



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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EPA-CASAC-08-010

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

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

Subject: Clean Air Scientific Advisory Committee (CASAC) Ambient Air Monitoring & Methods (AAMM) Subcommittee Consultation Concerning Ambient Air Monitoring Issues related to the Lead NAAQS

Dear Administrator Johnson:

EPA's Clean Air Scientific Advisory Committee (CASAC) Ambient Air Monitoring & Methods (AAMM) Subcommittee held a public advisory teleconference meeting on March 25, 2008, to conduct a consultation with staff from EPA's Office of Air Quality Planning and Standards (OAQPS), within the Office of Air and Radiation, on ambient air monitoring issues related to the National Ambient Air Quality Standards (NAAQS) for lead, including issues associated with alternative lead indicators.

The SAB Staff Office has developed the consultation as a mechanism to advise EPA on technical issues that should be considered in the development of regulations, guidelines, or technical guidance before the Agency has taken a position. A consultation is conducted under the normal requirements of the Federal Advisory Committee Act (FACA), as amended (5 U.S.C., App.), which include advance notice of the public meeting in the *Federal Register*.

As is our customary practice, there will be no consensus report from the CASAC as a result of this consultation, nor does the Committee expect any formal response from the Agency. The current CASAC AAMM Subcommittee roster is attached as Appendix A of this letter, Sub-

committee members' individual written comments are found in Appendix B, and the Agency's background and charge memorandum to the Subcommittee is provided in Appendix C.

Sincerely,

/Signed/

Dr. Armistead (Ted) Russell, Chair
CASAC AAMM Subcommittee

Attachments

cc: Marcus Peacock, Deputy Administrator
Robert Meyers, Acting Assistant Administrator, OAR
Dr. Rogene Henderson, CASAC Chair

Appendix A – Roster of the CASAC Ambient Air Monitoring & Methods (AAMM) Subcommittee

U.S. Environmental Protection Agency Clean Air Scientific Advisory Committee (CASAC) CASAC Ambient Air Monitoring & Methods (AAMM) Subcommittee

CASAC MEMBERS

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

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

Dr. Donna Kenski, Director of Data Analysis, Lake Michigan Air Directors Consortium (LADCO), Rosemont, IL

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, Emeritus, 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. Philip Hopke, Bayard D. Clarkson Distinguished Professor, Department of Chemical Engineering, Clarkson University, Potsdam, 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. Thomas Lumley, Associate Professor, Biostatistics, School of Public Health and Community Medicine, University of Washington, Seattle, WA

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

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

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

Dr. Jay Turner, Visiting Professor, Crocker Nuclear Laboratory, University of California - Davis, Davis, CA

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

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

Dr. Barbara Zielinska, Research Professor, Division of Atmospheric Science, Desert Research Institute, Reno, NV

SCIENCE ADVISORY BOARD STAFF

Mr. Fred Butterfield, 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)

*Dr. Demerjian and Dr. McMurry did not participate in this CASAC AAMM Subcommittee activity.

Appendix B – Comments from Individual CASAC AAMM Subcommittee Members

This appendix contains the preliminary and/or final written comments of individual members of the Clean Air Scientific Advisory Committee (CASAC) Ambient Air Monitoring & Methods (AAMM) Subcommittee. The comments are included here to provide both a full perspective and a range of individual views expressed by Subcommittee members during the consultation process. These comments do not represent the views of the CASAC AAMM Subcommittee, the CASAC, the EPA Science Advisory Board, or the EPA itself. Panelists providing written comments are listed on the next page, and their individual comments follow.

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Mr. George Allen

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

From: George Allen, AAMM subcommittee member, April 1, 2008

The following are written comments based on the Charge Questions in the EPA OAQPS memo to the SAB dated March 3, 2008. These comments also reflect discussion during the March 25 teleconference advisory meeting on a consultation for air monitoring issues related to the lead National Ambient Air Quality Standards. A copy of these comments is also being sent to Dr. Ted Russell, CASAC AAMM Subcommittee Chair.

Questions associated with Attachment 1: Options for Lead NAAQS Indicator: Monitoring Implications.

1. ...please describe the advantages and disadvantages of sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM10.
2. Is it appropriate to monitor for Pb-PM10 near Pb sources? And if so, under what conditions?
3. One indicator option suggests using scaling Pb-PM10 monitoring data up to an equivalent Pb-TSP level in lieu of Pb-TSP monitoring data. Under what circumstances would it be appropriate to scale data (e.g., non-source oriented sites, low concentration sites) and when would it not be appropriate to scale data?
4. We have limited data collocated Pb-PM10 and Pb-TSP monitoring data. What types and “scaling factors” are appropriate to create using this data (e.g., non-source oriented, source oriented)? What levels are appropriate for the types of scaling factors identified in the white paper?

Comments:

Assuming the Pb NAAQS is substantially tightened to the high end of the CASAC range ($0.2 \mu\text{g}/\text{m}^3$), I see no significant disadvantage in changing to PM10 as the routine indicator, and a wide range of advantages in not running Hi-Vol samplers. If we are changing the standard and network design to reflect current knowledge of lead sources and exposures, changing to a method that gives air agencies more flexibility can only be a good thing. If there are elevated levels of lead (relative to the new NAAQS), they are likely to be source oriented. A PM10 lead sample may (worst case) measure only half of what a Hi-Vol TSP sampler might, but one will still know there is a problem with fugitive lead emissions and a need for a control strategy. I am not in favor of any “scaling” approach when it comes to compliance lead monitoring. The connection between levels of lead measured in the air and actual dose of lead to sensitive populations is loose at best and random at worst, given the dominant exposure pathways. If there is concern about PM10 measuring somewhat less lead than TSP, have the standard reflect that by adding an additional margin of safety. If the lead NAAQS drops an order of magnitude, that is not much of an issue. However, if the revised lead NAAQS does not change, or is tightened only a modest amount or weakened by the form, then a scaling factor may be needed.

Questions associated with Attachment 2: Draft Federal Reference Method (FRM) and Federal Equivalent Method (FEM) Criteria for Lead in PM10 (Pb-PM10):

1. Is it appropriate to use the low-volume PM10-c FRM sampler as the Pb-PM10 FRM sampler?
2. What other PM10 samplers should be considered as either FRM or FEM for the Pb-PM10 FRM?
3. Is XRF an appropriate Pb-PM10 FRM analysis method?
4. What other analysis methods should be considered for FRM or FEM for the Pb-PM10 FRM?
5. Have we selected appropriate precision, bias, and method detection limit requirements for FEM evaluation?

Comments:

This attachment is very well written with only minor omissions. It is appropriate to use the low-volume PM10-c FRM sampler as the Pb-PM10 FRM sampler. Sequential PM10 samplers should also be allowed, either as FRM or FEM samplers. The dichotomous sampler is an obvious candidate for an FEM sampler for lead. While XRF may be appropriate for an FEM analytical method, ICPMS or GFAA should be used for the FRM analytical method since those methods do not have the potential for arsenic interference that XRF has. When properly done, using all three lead emission peaks to assess and correct for arsenic interference, XRF is suitable for routine lead analysis under an FEM designation. It should be noted that other elements may suffer from self-absorption errors with heavily loaded filters, so some caution may be needed if all reported XRF elements are used for other purposes. The bias and method detection limits in this draft are appropriate. I would suggest that the FEM precision be tightened from 15% to 10%.

Questions associated with Attachment 3: Lead NAAQS Ambient Air Monitoring Network: Network Design Options Under Consideration.

1. What types of monitoring sites should be emphasized in the network design (e.g., source oriented monitors, population monitors, near roadway monitors)?
2. We are considering proposing requirements for monitoring near sources exceeding an emissions threshold and discuss a number of options for determining this threshold in the white paper. What options should be considered in establishing an emissions threshold?
3. We are considering proposing requirements for non-source oriented monitoring in large urban areas to provide additional information on ambient air concentrations in urban areas. Considering other monitoring priorities and a potential requirement for Pb monitoring near sources, what size of a non-source oriented Pb network is appropriate?
4. What factors should we base non-source oriented monitoring requirements on (e.g., population, design value)?
5. We are considering proposing requirements for Pb monitoring near roadways and interstates. Is it appropriate to include separate monitoring requirements for near roadway monitoring, or should near roadway monitors be a part of the non-source oriented monitoring requirement?
6. Under what conditions would it be appropriate to waive the monitoring requirements for either source or non-source oriented monitors?

Comments:

First, not knowing what the final lead NAAQS will be (including the form, not just the concentration), it is very difficult to comment on network design. But assuming the final NAAQS will not be lower than $0.2 \mu\text{g}/\text{m}^3$, with a form that does not substantially weaken the effective stan-

dard, I would suggest the network focus on source and population oriented sites. For source oriented sites, assuming the emissions are reasonably well known one could model the near-field impact to determine if monitoring is necessary. Alternatively, if there is large uncertainty in emissions, limited preliminary monitoring could be deployed to determine if the ambient impact of the source requires additional or continued monitoring. Non-source ambient monitoring, e.g., neighborhood to urban scale siting, should consider both the design value and to a lesser extent, the population. We don't want to have a large (big-city) urban network of lead monitoring if all the sites are well below the NAAQS. For near-roadway monitoring, this also depends on the level and form of the NAAQS, but I would recommend only a limited monitoring (e.g., pilot) effort for this source at least initially until more is known about both the extent of elevated lead air concentrations near roadways as well as the value and form of the final lead NAAQS. As for waiving or modifying monitoring requirements, if it can be shown by historical data or other reasonable approaches that lead air levels are well below the NAAQS, then less monitoring should be done.

Questions associated with Attachment 4: Lead NAAQS Ambient Air Monitoring Network: Sampling Frequency Options Under Consideration.

1. What sampling frequency would be appropriate if the Pb NAAQS is based on a monthly average?
2. Is it appropriate to relax the sampling frequency in areas of low Pb concentration? If so, at what percent of the Pb NAAQS?
3. Is it appropriate to relax the sampling frequency in areas considerably higher than the NAAQS? If so, at what percent of the Pb NAAQS?

Comments:

First I want to clearly state that sampling frequency issues (and the level of public health protection) are highly dependent on not only the level of the NAAQS, but also the form of the NAAQS; it is essential that any discussion on this topic include the form whenever a value is mentioned. Sampling frequency for a simple monthly average NAAQS should be at least every other day if not daily for sites that are near or above the NAAQS. If the form is "3-year average of second highest month" (an option discussed in the staff paper), then every third day sampling may be sufficient for sites near or above the NAAQS. It is appropriate to reduce sample frequency at sites well below (50%?) the NAAQS, but again the sample frequency depends on the form of the NAAQS. I would suggest third-day for a simple monthly mean, and sixth-day for a "3-year mean of second highest month" form. I would also like to note that if a form similar to "3-year average of second highest month" is adopted for the lead NAAQS, this would be inconsistent with the health concerns leading us towards a 1-month metric. Additionally, for a given NAAQS value such as $0.2 \mu\text{g}/\text{m}^3$, a form as noted above results in a substantially weaker lead NAAQS than a simple 1-month form.

Dr. Judith Chow

From: Judith C. Chow, CASAC AAMM subcommittee member

Subject: Review of Ambient Monitoring Issues Related to Lead

This memo addresses the questions on which the Subcommittee members were asked to comment regarding Attachment 1 (“Options for Lead NAAQS Indicator: Monitoring Implications”), Attachment 2 [“Draft Federal Reference Method (FRM) and Federal Equivalent Method (FEM) Criteria for Lead in PM₁₀ (Pb-PM₁₀)”], Attachment 3 (“Lead NAAQS Ambient Air Monitoring Network: Network Design Options Under Consideration”), and Attachment 4 (“Lead NAAQS Ambient Air Monitoring Network: Sampling Frequency Options Under Consideration”).

Questions on Attachment 1 (Options for Lead NAAQS Indicator: Monitoring Implications)

Question 1: Considering issues such as sampler performance, size cuts, operator maintenance, integration with other measurement systems, and usefulness as the measurement system for the indicator, please describe the advantages and disadvantages of sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM₁₀.

The lead (Pb) national ambient air quality standard (NAAQS) was established in 1978 (U.S.EPA, 1978), when measurement technology for integrated samplers was limited to total suspended particulates (TSP). EPA should move toward Pb-PM₁₀, which is inhalable and can travel longer distances from emission sources.

Disadvantages: The TSP size fraction was defined by the dimensions of the high-volume (Hi-Vol) sampler as specified in the code of Federal Regulations (Federal Register, 1975). It is well known that HiVol TSP is non-size-specific, and EPA should consider phasing out this old technology (Chow, 1995). By the end of the 1970s, efforts using wind tunnels to characterize HiVol size-selection profiles showed that the 50% cut point of 30 – 50 μm depended on the orientation of the sampler with respect to the direction and velocity of the wind (Bruckman and Rubino, 1976; Chahal and Romano, 1976; Wedding et al., 1977; Blanchard and Romano, 1978; McFarland et al., 1980; Swinford, 1980). The large opening underneath the HiVol’s peak roof inlet allows dust to blow onto the filter before and after sampling between the every-sixth-day filter change. Given the non-size-specific nature of the TSP samples and considering the question of how well Pb-TSP can represent human exposure, this 1950s technology should be discontinued.

Advantages: The only advantage of keeping Pb-TSP is that a large body of Pb-TSP concentrations have been obtained since 1980 (U.S.EPA, 2007) and the highest levels of Pb are found near smelters and tailing piles (U.S.EPA, 2003). As shown in Figure 1, two areas in the U.S. are designated as non-attainment for the Pb NAAQS due to recorded high Pb concentrations (U.S.EPA, 2007). TSP data might be useful for long-term trend analysis and to keep continuity with historical data, but given the large reductions already seen, and the leveling of concentrations at most locations, this seems unnecessary.

The low-volume (16.7 L/min) PM₁₀ inlet is wind-tunnel tested with specified collocated precision over a wide range of wind speeds and directions (Watson and Chow, 1993; 2001). Low volume PM_{10c} FRMs (Appendix O to Part 50) provide more flow control, low background Teflon-membrane filters, and more precise mass determination. It is also similar to PM_{2.5} FRM (using the same PM₁₀ impactor inlet with the addition of WINS or sharp-cut cyclone inlets). The low-volume PM_{10c} FRM sampler is consistent with the EPA current proposed difference method for PM_{10-2.5}, which is similar (e.g., filter medium, sample collection, gravimetric analysis, quality assurance [QA]/quality control [QC]) to new or existing PM data set(s). Since low-volume PM₁₀ samplers have been widely deployed in many urban networks, they are commercially available and network operators are familiar with them, the cost for additional sampling and analysis should be reasonable. There is no need for a separate Pb-PM₁₀ network. The integrated air monitoring strategy (U.S.EPA, 2005) should be considered for Pb-PM₁₀ monitoring (Scheffe et al., 2007)



Figure 1. Non-attainment areas for lead (from <http://www.epa.gov/oar/oaqps/greenbk/maplead.html>).

Question 2: Is it appropriate to monitor for Pb-PM₁₀ near Pb sources? And if so, under what conditions?

Yes, Pb-PM₁₀ should be monitored near Pb sources, including roadways, mines (containing lead ore), smelters, and tailing piles. The current ~200 Pb-TSP sites are mostly located in urban areas, which may not represent near-source exposure. Since Pb additions to gasoline were decreased in the early 1970s (Kitman, 2000), Pb-TSP content has decreased drastically, especially at urban sampling sites near freeways (U.S.EPA, 2007). Exposure to Pb comes from multiple sources, including ingestion and inhalation, so important point sources such as Pb smelters or areas with suspendable Pb tailings need to be considered. Pb is still found in road dust, and decomposition of tire wheel weights has been suggested as a potential source (Root, 2000). In addition to blood level Pb, the relationship between air Pb and human exposure are critical (Bachmann, 2007). An evaluation of Pb emitters

in the NEI (Attachment 3) is a good start. PM₁₀ levels near Pb sources should be monitored under a variety of meteorological conditions and for extended periods, especially at downwind locations where the concentrations are expected to be the highest.

Question 3: One indicator option suggests using scaling Pb-PM₁₀ monitoring data up to an equivalent Pb-TSP level in lieu of Pb-TSP monitoring data. Under what circumstances would it be appropriate to scale data (e.g., non-source oriented sites, low concentration sites) and when would it not be appropriate to scale data?

Even though the analysis for measurements between 1993 and 2006 shows good correlations between Pb-TSP and PM₁₀ for 33 non-source-oriented sites, 40% of the Pb-TSP concentrations were underestimated using linear regression. As noted earlier, and well-documented in the scientific literature, the TSP fraction is ill-defined, not sampled consistently, has a large fraction that deposits near the source, and is not as amenable to Pb analysis as PM₁₀. A better question is: “What is the purpose for scaling Pb-PM₁₀ to an equivalent Pb-TSP level?” Such scaling is rarely applicable to all situations. Without adequate collocation under different meteorological conditions, scaling data always includes unaccountable uncertainties. This exercise may be acceptable if the PM₁₀ data can be used to set up new Pb-PM₁₀ NAAQS. The U.S. EPA should acquire Pb-PM₁₀ and analyze archived PM₁₀ low-volume FRM samples to fill the gaps in the existing database.

Scaling data for source-oriented sites is even more difficult, since meteorological phenomena may result in disproportional particle resuspension for TSP as compared to PM₁₀ and it is more difficult to establish Pb-PM₁₀ and Pb-TSP relationships under high wind speeds.

Question 4: We have limited data collocated Pb-PM₁₀ and Pb-TSP monitoring data. What types and “scaling factors” are appropriate to create using this data (e.g., non-source oriented, source oriented) ? What levels are appropriate for the types of scaling factors identified in the white paper?

At the very least, different statistical methods (e.g., weighted least squares, effective variance least squares, distribution of differences; (Watson and Chow, 2002; Mathai et al., 1984) should be used to create the “scaling factor.” Data should be aggregated by season and segregated by wind sectors and wind speed to relate Pb-TSP to Pb-PM₁₀ or vice-versa. It would be important to add a ± uncertainty to the scaling. Again, what is the purpose of scaling?

Questions on Attachment 2 [Draft Federal Reference Method (FRM) and Federal Equivalent Method (FEM) Criteria for Lead in PM₁₀ (Pb-PM₁₀)]

Question 1: Is it appropriate to use the low-volume PM_{10c} FRM sampler as the Pb-PM₁₀ FRM sampler?

Yes, as stated in the response to Question 1 of Attachment 1. A low-volume PM_{10c} FRM sampler as the Pb-PM₁₀ FRM sampler is the most cost-effective way. There shouldn't be any difference in low-volume PM_{10c} samplers for PM₁₀ mass or Pb.

Question 2: What other PM₁₀ samplers should be considered as either FRM or FEM for the Pb-PM₁₀ FRM?

Although there are medium-volume and HiVol PM₁₀ FRM samplers (see Table 2 of Chow, 1995, reproduced below) that can be considered as alternatives, many of them use 8" × 10" quartz-fiber filters. Since Pb is a stable compound, retrospective Pb analysis can be done on these samples by inductively coupled plasma (ICP), atomic absorption spectroscopy (AAS), or XRF. Since many of the PM₁₀ high- or medium-volume FRMs are not compatible with the existing PM_{2.5} networks, it creates more variability in those networks and is not as useful as low-volume PM_{10c} FRM samples.

Table 2. U.S. EPA designated reference and equivalent methods for PM₁₀

Reference/Equivalent Method ^a (Designation No.)	Sampler Description	Federal Register Citation (Notice Date)
1. Reference method (RFPS-1087-062)	Wedding & Associates PM ₁₀ Critical Flow High-Volume Sampler (using a cyclone-type inlet, critical flow device, and 20.3 cm x 25.4 cm filters).	Vol. 52, 37366 (10/06/87)
2. Reference method (RFPS-1287-063)	Sierra-Andersen (SA) or General Metal Works (GMW) Model 1200 PM ₁₀ High-Volume Air Sampler System (using a SA- or GMW-1200 PM ₁₀ impaction-type size-selective inlet and 20.3 cm x 25.4 cm filters).	Vol. 52, 45684 (12/01/87) Vol. 53, 1062 (01/15/88)
3. Reference method (RFPS-1287-064)	Sierra-Andersen or General Metal Works Model 321 B PM ₁₀ High-Volume Air Sampler System (using a SA- or GMW-321 B PM ₁₀ impaction-type size-selective inlet and 20.3 cm x 25.4 cm filters).	Vol. 52, 45684 (12/01/87) Vol. 53, 1062 (01/15/88)
4. Reference method (RFPS-1287-065)	Sierra-Andersen or General Metal Works Model 321 C PM ₁₀ High-Volume Air Sampler System (using a SA- or GMW-321 C PM ₁₀ impaction-type size-selective inlet and 20.3 cm x 25.4 cm filters).	Vol. 52, 45684 (12/01/87) Vol. 53, 1062 (01/15/88)
5. Reference method (RFPS-0389-071)	Oregon DEQ Medium-Volume Sequential Filter Sampler for PM ₁₀ (using a SA 254 impaction-type PM ₁₀ inlet and 47 mm Teflon-membrane and quartz-fiber filters. Samples are collected simultaneously onto two filter substrates, and device can be programmed for up to six days of unattended operation and allow automatic filter-sequencing as filter overloading occurs).	Vol. 54, 12273 (03/24/89)
6. Reference method (RFPS-0389-073)	Sierra-Andersen Models SA 241 and SA 241M or General Metal Works Models G 241 and GA 241M PM ₁₀ Low Volume Dichotomous Samplers (using a SA 246 B or G 246 impaction-type PM ₁₀ inlet, 2.5 µm virtual impactor assembly, and 37 mm PM _{2.5} and coarse [PM ₁₀ minus PM _{2.5}] filter holders).	Vol. 54, 31247 (07/27/89)
7. Equivalent method (EQPM-0990-076)	Andersen Instruments Model FH621-N PM ₁₀ Beta Attenuation Monitor (using a SA 246 B impaction-type PM ₁₀ inlet and 40 mm filter tape).	Vol. 55, 38387 (09/18/90)
8. Equivalent method (EQPM-1090-079)	Rupprecht & Patashnik TEOM Series 1400 and Series 1400a PM ₁₀ Monitor (using an impaction-type PM ₁₀ inlet, internal tapered element oscillating microbalance, and 12.7 mm diameter filter).	Vol. 55, 43406 (10/29/90)
9. Equivalent method (EQPM-0391-081)	Wedding & Associates PM ₁₀ Beta Gauge Automated Particle Sampler (using a cyclone-type PM ₁₀ inlet and 32 mm filter tape).	Vol. 56, 9216 (03/05/91)
10. Reference method (RFPS-0694-098)	Rupprecht & Patashnik Partisol Model 2000 Air Sampler (using an impaction-type PM ₁₀ inlet and 47 mm diameter filter).	Vol. 59, 35338 (07/11/94)

From Chow, 1995

Question 3: Is XRF an appropriate Pb-PM₁₀ FRM analysis method?

Yes, ringed Teflon-membrane filters are one of the best choices for XRF analysis of Pb, owing to the high X-ray energy of the Pb L- α lines (10.55 and 12.61 eV), penetration into the filter, and large-particle self-absorption aren't major issues. XRF is non-destructive, relatively inexpensive, and can obtain other elemental concentrations as a bonus. It usually has low blank levels for metals and is inert to adsorption of gases. The PM_{2.5} FRM network uses Whatman (Hillsboro, OR) PTFE (polytetra fluoroethylene) Teflon-membrane filters, which are 60% thicker than those from Pall Sciences (R2PJ047, 25 μ m thickness, Ann Arbor, MI), but this should not effect the minimum detectable limits (MDLs) of heavy elements such as Pb. In the early 1990s, a batch of Teflon-membrane filters were contaminated with Pb, and that compromised study results, therefore acceptance testing of low-volume PM₁₀ Teflon-membrane filters is essential before sampling (Chow, 1995). The acceptance test should be set as $3 \times$ MDL or 7 – 8 ng/cm². Pb analysis by XRF is highly sensitive, without much spectral interference. It can achieve MDLs of 1.5 – 2 ng/cm² (Note that the MDL in Table 1 of Attachment 2 is 1.5 ng/cm² and page 7 of Appendix Q to Part 50 shows 2.0 ng/cm². 3 ng/cm² is probably more reasonable.)

Question 4: What other analysis methods should be considered for FRM or FEM for the Pb-PM₁₀ FRM?

There are quite a few modern analytical methods that can be used to quantify Pb. It can be analyzed by XRF, proton-induced X-ray emission (PIXE), flame ionization or graphite furnace, AAS, ICP/atomic emission spectroscopy (ICP/AES), or ICP/mass spectrometry (ICP/MS) (Watson et al., 1999). Table 1 shows the difference in MDLs among the different methods. Switching from AAS to XRF is a good choice, since AAS is labor intensive, subject to contamination during extraction, can only acquire a single element for a given time, and requires lengthy acid extraction prior to chemical analysis.

Some XRF and PIXE instruments quantify elements with atomic numbers ranging from 11 (sodium) to 92 (uranium), although XRF usually acquires elements with lower MDLs as compared to PIXE. It is non-destructive and requires neither sample preparation nor extensive operator time after samples are loaded into the analyzer. To achieve the greatest benefit for the investment, EPA should consider acquiring all the elements listed in Table 1 using XRF (added costs will include acquiring a complete set of standards and to conduct spectral processing). If archived or other samples are acquired on quartz- or cellulose-fiber filters, other analytical technology such as AAS or ICP can be considered, though the equivalences needs to be achieved among different analytical methods.

Table 1. Minimum detectable limits (MDLs) among the different methods.

Species	Minimum Detectable Limit in ng/m ³ ^a						
	Flame ^{e,f} INAA ^{b,c}	XRF ^b	PIXE ^{b,d}	Graphite Furnace ^{e,f} AAS ^{e,g}		ICP ^{e,g}	ICP-MS ^h
Ag	0.12	6	NA ⁱ	4	0.005	1	0.000090
Al	24	5	12	30	0.01	20	0.004098
As	0.2	0.8	1	100	0.2	50	0.000081
Au	NA	2	NA	21	0.1	2.1	0.010000
Ba	6	25	NA	8 ^f	0.04	0.05	0.000261
Be	NA	NA	NA	2 ^f	0.05	0.06	0.000400
Br	0.4	0.5	1	NA	NA	NA	NA
Ca	94	2	4	1 ^f	0.05	0.04	0.012675
Cd	4	6	NA	1	0.003	0.4	0.000007
Ce	0.06	NA	NA	NA	NA	52	0.000003
Cl	5	5	8	NA	NA	NA	NA
Co	0.02	0.4	NA	6 ^f	0.02	1	0.000006
Cr	0.2	1	2	2	0.01	2	0.003906
Cs	0.03	NA	NA	NA	NA	NA	0.000015
Cu	30	0.5	1	4	0.02	0.3	0.001061
Eu	0.006	NA	NA	21	NA	0.08	0.000004
Fe	4	0.7	2	4	0.02	0.5	0.015601
Ga	0.5	0.9	1	52	NA	42	0.000039
Hf	0.01	NA	NA	2,000	NA	16	0.000010
Hg	NA	1	NA	500	21	26	0.010000
I	1	NA	NA	NA	NA	NA	NA
In	0.006	6	NA	31	NA	63	0.000009
K	24	3	5	2 ^f	0.02	NA	0.007467
La	0.05	30	NA	2,000	NA	10	0.000003
Mg	300	NA	20	0.3	0.004	0.02	0.001633
Mn	0.12	0.8	2	1	0.01	0.1	0.000102
Mo	NA	1	5	31	0.02	5	0.000190
Na	2	NA	60	0.2 ^f	< 0.05	NA	0.008134
Ni	NA	0.4	1	5	0.1	2	0.000301
P	NA	3	8	100,000	40	50	NA
Pb	NA	1	3	10	0.05	10	0.000069
Pd	NA	5	NA	10	NA	42	0.000024
Rb	6	0.5	2	NA	NA	NA	0.000049
S	6,000	2	8	NA	NA	10	0.002621
Sb	0.06	9	NA	31	0.2	31	0.000080
Sc	0.001	NA	NA	50	NA	0.06	NA
Se	0.06	0.6	1	100	0.5	25	0.000151
Si	NA	3	9	85	0.1	3	NA
Sm	0.01	NA	NA	2,000	NA	52	0.000006
Sn	NA	8	NA	31	0.2	21	0.000076
Sr	18	0.5	2	4	0.2	0.03	0.000035

Table 1. Continued.

Species	Minimum Detection Limit in ng/m ³ ^a						
	Flame ^{e,f} INAA ^{b,c}	XRF ^b	PIXE ^{b,d}	Graphite Furnace ^{e,f} AAS ^{e,g} AAS ^{e,g}		ICP ^{e,g}	ICP-MS ^j
Ta	0.02	NA	NA	2,000	NA	26	0.000576
Th	0.01	NA	NA	NA	NA	63	0.000004
Ti	65	2	3	95	NA	0.3	0.001016
Tl	NA	1	NA	21	0.1	42	0.000148
U	NA	1	NA	25,000	NA	21	0.000004
V	0.6	1	3	52	0.2	0.7	0.000030
W	0.2	NA	NA	1,000	NA	31	0.000187
Y	NA	0.6	NA	300	NA	0.1	0.000020
Zn	3	0.5	1	1	0.001	1	0.003051
Zr	NA	0.8	3	1,000	NA	0.6	0.000306

- ^a Minimum detection limit is three times the standard deviation of the blank for a filter of 1 mg/cm² areal density.
 ICP = Inductively Coupled Plasma Emission Spectroscopy.
 ICP-MS = Inductively Coupled Plasma - Mass Spectrometry
 AAS = Atomic Absorption Spectrophotometry.
 PIXE = Proton Induced X-ray Emissions Analysis.
 XRF = X-ray Fluorescence Analysis.
 INAA = Instrumental Neutron Activation Analysis.
- ^b Concentration is based on 13.8 cm² deposit area for a 47 mm filter substrate, with a nominal flow rate of 20 L/min for 24-hour samples.
- ^c Olmez, 1989.
- ^d Cahill, 1980.
- ^e Concentration is based on the extraction of 1/2 of a 47mm filter in 15 ml of deionized-distilled water, with a nominal flow rate of 20 L/min for 24-hour samples.
- ^f Fernandez, 1989.
- ^g Harman, 1989.
- ^h Concentration is based on the digestion of 1/2 of a 47mm filter in 50 ml of acid, with a nominal flow rate of 20 L/min for 24-hour samples.
- ⁱ Not available.

Question 5: Have we selected appropriate precision, bias, and method detection limit requirements for FEM evaluation?

Precision, bias, and MDLs for a FEM should be no different from FRM for Pb analysis. Since FEMs are usually installed at non-urban areas, MDLs for FEMs should be lower than those of FRMs. MDLs of one tenth of NAAQS are recommended in Attachment 2. Why should different MDLs be accepted for FRMs and FEMs? Five percent analytical accuracy, 15% precision, and 20% maximum difference as stated in Attachment 2 appear to be reasonable. Pb and other heavy elements have been shown to be quantifiable on filter tape deposits from FEM beta attenuation monitors (Watson et al., 2007).

Questions on Attachment 3 (Lead NAAQS Ambient Air Monitoring Network: Network Design Options Under Consideration)

Question 1: What types of monitoring sites should be emphasized in the network design (e.g., source oriented monitors, population monitors, near roadway monitors)?

Different types of sampling sites represent different receptor zones of representation based on EPA's Guidance on Network Design Principles (Watson et al., 1997). Pb-PM₁₀ monitoring should include both neighborhood-scale monitors (0.5 – 4 Km) for hot spots (e.g., smelters, tailing piles) and urban-scale (4 – 100 m) monitors for population exposure in an urban environment (Chow et al., 2002). If elevated PM₁₀ appears to raise concerns about public health near a specific source or sources, special studies should be conducted (with more intense frequency at multiple locations) to assess the source zone of influences and to address the receptor zone of representation (Chow et al., 1999)

Question 2: We are considering proposing requirements for monitoring near sources exceeding an emissions threshold and discuss a number of options for determining this threshold in the white paper. What options should be considered in establishing an emissions threshold?

Assuming the worst-case shown in Figure 2 of Attachment 1, Pb-TSP is 2.2 times Pb-PM₁₀ for Pb-PM₁₀ NAAQS. This translates current 1.5 µg Pb-TSP NAAQS to 0.68 µg/m³ of Pb-PM₁₀. This value corresponds to median and maximum values of 0.3 µg/m³ and 0.7 µg/m³ per tons per year (tpy) for Pb emissions, respectively. There are 271 facilities in the U.S. for a 1 tpy emission rate. As mentioned in Question 2 of Attachment 1, the NEI is a good starting point, as are the estimations shown in Table 5 of Attachment 3 (e.g., 379 sites for core-based statistical areas [CBSA] with populations > 100,000 people. Note that the second Table 5 is the number of CBSAs).

Question 3: We are considering proposing requirements for non-source oriented monitoring in large urban areas to provide additional information on ambient air concentrations in urban areas. Considering other monitoring priorities and a potential requirement for Pb monitoring near sources, what size of a non-source oriented Pb network is appropriate?

The relationship between estimated emissions and observed ambient concentrations should be established to determine an emissions threshold. The multi-layered network design for the Pb surveillance network is a good start. EPA should correlate locations of current Pb-TSP monitors (Figure 1 of Attachment 3) with those of Pb sources in NEI (Figure 2 of Attachment 3). For example, Figure 1 of Attachment 3 shows that there are no Pb monitoring sites in Arizona, where Figure 2 of Attachment 3 shows large (> 5 – 15 tpy) sources. Maybe the sources have been closed since the 2002 Inventory, but comparing existing point sources to monitoring sites provides good knowledge for network design.

According to the U.S. EPA (2007; see Figure 1 above), only Jefferson County, MO and East Helena Area (Lewis & Clark County), MT are designated as non-attainment areas for Pb, but Figure 1 of Attachment 3 doesn't show Pb-TSP monitoring near these sites. This type

of discrepancy should be resolved. Statistical analyses based on existing data should also be considered before sites are chosen.

Question 4: What factors should we base non-source oriented monitoring requirements on (e.g., population, design value) ?

Non-source oriented monitoring intends to represent human exposure in an urban scale (4 – 100 Km) or neighborhood scale (0.5 – 4 Km). CBSA is a good start for the basic number of sampling sites. Even though Pb is a primary pollutant, and it may be localized, downwind transport from large point sources needs to be considered at the regional scale (100 – 1,000 Km)

Question 5: We are considering proposing requirements for Pb monitoring near roadways and interstates. Is it appropriate to include separate monitoring requirements for near roadway monitoring, or should near roadway monitors be a part of the non-source oriented monitoring requirement?

As less Pb was added to gasoline between 1978 and 1986, Pb emissions decreased substantially (Bachmann, 2007). Even though mobile sources may contribute Pb from wheel weights (i.e., ground up as road dust), brake wear, petro-fuels (traceable amounts) and lube oil, Table 7 of Attachment 3 showed that maximum monthly Pb concentrations are below $0.05 \mu\text{g}/\text{m}^3$; it is not clear how close the five selected sites are to roadways or other Pb emitters. Unless EPA is considering a Pb-PM₁₀ NAAQS of $\leq 0.1 \mu\text{g}/\text{m}^3$, roadside measurements may not be a priority. Some roadside (hot spot) monitors should be part of the normal PM₁₀ and PM_{2.5} networks, but it should not be necessary to perform these measurements in every city, although special studies can be conducted at busy intersections to address the spatial and temporal variations of Pb-PM₁₀ along with ultrafine particles ($d_p < 0.1 \mu\text{m}$) measurements to address the issue of human exposure and potential health impacts (Biswas and Wu, 2005; Chow et al., 2005).

Question 6: Under what conditions would it be appropriate to waive the monitoring requirements for either source or non-source oriented monitors?

This is a decision of EPA and should be consistent with decisions for other criteria pollutants.

Questions on Attachment 4 (Lead NAAQS Ambient Air Monitoring Network: Sampling Frequency Options Under Consideration)

Question 1: What sampling frequency would be appropriate if the Pb NAAQS is based on a monthly average?

The original proposal from EPA during the mid-1970s considered monthly average Pb-TSP. Industry expressed a concern that the monthly maximum form of NAAQS would require longer-term average Pb-TSP as low as $0.41 \mu\text{g}/\text{m}^3$ to keep the maximum monthly below $1.5 \mu\text{g}/\text{m}^3$. The one-in-six day sampling schedule is not adequate to determine the monthly average (Supplemental Table 7 of Bachmann, 2007). If a monthly average is to

be used, EPA would need to have a minimum of every third day sampling (i.e., ten samples/month).

Question 2: Is it appropriate to relax the sampling frequency in areas of low Pb concentration? If so, at what percent of the Pb NAAQS?

It is reasonable to consider every sixth day sampling for areas with low Pb concentrations. The 30% Pb NAAQS proposed in Attachment 4 seems reasonable.

Question 3: Is it appropriate to relax the sampling frequency in areas considerably higher than the NAAQS? If so, at what percent of the Pb NAAQS?

No. Areas with high Pb concentrations should keep at least an every third day sampling schedule, and possibly a more frequent schedule. If facilities emit high concentrations of Pb sporadically, daily sampling may be considered. Since suspended toxic dust might be a large source, sampling and analysis should be more frequent during activities or meteorological conditions that enhance dust suspension.

References

- Bachmann, J.D. (2007). 2007 Critical review - Will the circle be unbroken: A history of the U.S. National Ambient Air Quality Standards. *J. Air Waste Manage. Assoc.*, **57**(6):652-697.
- Biswas, P.; and Wu, C.Y. (2005). 2005 Critical Review: Nanoparticles and the environment. *J. Air Waste Manage. Assoc.*, **55**(6):708-746.
- Blanchard, G.E.; and Romano, D.J. (1978). High volume sampling: Evaluation of an inverted sampler for ambient TSP measurement. *J. Air Poll. Control Assoc.*, **28**(11):1142-1145.
- Bruckman, L.; and Rubino, R.A. (1976). High volume sampling: errors incurred during passive deposition exposure periods. *J. Air Poll. Control Assoc.*, **26**(9):881-883.
- Cahill, T.A. (1980). Proton microprobes and particle-induced x-ray analytical systems. *Ann. Rev. Nucl. and Part. Sci.*, **30**:211-252.
- Chahal, H.S.; and Romano, D.J. (1976). High Volume Sampling: Evaluation of an Inverted Sampler for Ambient TSP Measurements. *J. Air Poll. Control Assoc.*, **26**:895.
- Chow, J.C. (1995). Critical review: Measurement methods to determine compliance with ambient air quality standards for suspended particles. *J. Air Waste Manage. Assoc.*, **45**(5):320-382.
- 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.; and Cates, W. (1999). Middle- and neighborhood-scale variations of PM₁₀ source contributions in Las Vegas, Nevada. *J. Air Waste Manage. Assoc.*, **49**(6):641-654.
- 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.; and Zhu, T. (2002). Chapter one: exposure measurements. *Chemosphere*, **49**(9):873-901.

- Chow, J.C.; Watson, J.G.; Savage, N.; Solomon, J.; Cheng, Y.S.; McMurry, P.H.; Corey, L.M.; Bruce, G.M.; Pleus, R.C.; Biswas, P.; and Wu, C.Y. (2005). 2005 Critical review discussion: Nanoparticles and the environment. *J. Air Waste Manage. Assoc.*, **55**(10):1411-1417.
- Federal Register, F.R. (1975). National Primary and Secondary Ambient Air Quality Standards. Appendix B - Reference Method for the Determination of Suspended. *CFR*, **40**(50):12-16.
- Fernandez, F.J. (1989). Atomic absorption spectroscopy. In *Methods of Air Sampling and Analysis*, 3 ed., J.P. Lodge, Jr., Ed. Lewis Publishers, Chelsea, MI, pp. 83-89.
- Harman, J.N. (1989). Inductively coupled plasma emission spectroscopy. In *Methods of Air Sampling and Analysis*, 3rd ed., J.P. Lodge, Ed. Lewis Publishers, Chelsea, MI, pp. 88-92.
- Kitman, J.L. (2000). The secret history of lead: Special report. *The Nation*, (March):11-45. <http://www.thenation.com/doc/20000320/kitman>.
- Mathai, C.V.; Rogers, C.F.; and Watson, J.G. (1984). Intercomparison of aerosol samplers used in the SCENES Program: test program protocols. Report No. AV-R-84/534. Prepared for Electric Power Research Institute, Palo Alto, CA, by AeroVironment, Inc., Pasadena, CA.
- McFarland, A.R.; Ortiz, C.A.; and Rodes, C.E. (1980). Characterization of sampling systems. In *Proceedings, The Technical Basis for A Size Specific Particulate Standard, Part I & II*, C. Cowherd, Ed. Air Pollution Control Association, Pittsburgh, PA, pp. 59-76.
- Olmez, I. (1989). Instrumental neutron activation analysis of atmospheric particulate matter. In *Methods of Air Sampling and Analysis*, 3rd ed., J.P. Lodge, Ed. Lewis Publishers, Chelsea, MI, pp. 143-150.
- Root, R.A. (2000). Lead loading of urban streets by motor vehicle wheel weights. *Environ. Health Perspect.*, **108**(10):937-940.
- Scheffe, R.; Hubbell, B.J.; Fox, T.D.; Rao, V.B.; and Pennell, W.R. (2007). The Rationale for a Multipollutant, Multimedia Air Quality Management Framework. *EM*, **May**:14-20.
- Swinford, R.L. (1980). The assessment of passive loading effects on TSP measurements in attainment areas. *J. Air Poll. Control Assoc.*, **30**(12):1322-1324.
- U.S.EPA (1978). National ambient air quality standard for lead. *Federal Register*, **143**(194):46246.
- U.S.EPA (2003). National air quality and emissions trends report: 2003 special studies edition. Report No. EPA 454/R-03-005. Prepared by U.S. Environmental Protection Agency, Research Triangle Park, NC. <http://www.epa.gov/air/airtrends/aqtrnd03/toc.html>.
- U.S.EPA (2005). U.S. EPA's Final Draft National Ambient Air Monitoring Strategy. Report No. EPA-SAB-CASAC-05-006. Prepared by U.S. Environmental Protection Agency, Research Triangle Park, NC. <http://www.epa.gov/ttn/amtic/monitor.html>.

- U.S.EPA (2007). Report on the environment: Science report. Report No. EPA/600/R-07/045. Prepared by U.S. Environmental Protection Agency Office of Research and Development, Research Triangle Park, NC.
- Watson, J.G.; and Chow, J.C. (1993). Ambient air sampling. In *Aerosol Measurement: Principles, Techniques and Applications*, K. Willeke and P.A. Baron, Eds. Van Nostrand, Reinhold, New York, NY, pp. 622-639.
- Watson, J.G.; Chow, J.C.; DuBois, D.W.; Green, M.C.; Frank, N.H.; and Pitchford, M.L. (1997). Guidance for network design and optimal site exposure for PM_{2.5} and PM₁₀. Report No. EPA-454/R-99-022. Prepared by U.S. Environmental Protection Agency, Research Triangle Park, NC. <http://www.epa.gov/ttn/amtic/pmstg.html>.
- Watson, J.G.; Chow, J.C.; and Frazier, C.A. (1999). X-ray fluorescence analysis of ambient air samples. In *Elemental Analysis of Airborne Particles, Vol. 1*, S. Landsberger and M. Creatchman, Eds. Gordon and Breach Science, Amsterdam, pp. 67-96.
- Watson, J.G.; and Chow, J.C. (2001). Ambient air sampling. In *Aerosol Measurement: Principles, Techniques, and Applications, Second Edition*, 2nd ed., P. Baron and K. Willeke, Eds. John Wiley & Sons, New York, NY, pp. 821-844.
- Watson, J.G.; and Chow, J.C. (2002). Comparison and evaluation of in-situ and filter carbon measurements at the Fresno Supersite. *J. Geophys. Res.*, **107**(D21):ICC 3-1-ICC 3-15.
- Watson, J.G.; Chow, J.C.; Chen, L.-W.A.; and Kohl, S.D. (2007). Non-Destructive XRF and SEM Analyses on Beta Attenuation Filters for Elemental Concentrations at the Craig Road Monitor. Prepared for Clark County Department of Air Quality and Environmental Management, Las Vegas, NV, by Desert Research Institute, Reno, NV.
- Wedding, J.B.; McFarland, A.R.; and Cermak, J.E. (1977). Large particle collection characteristics of ambient aerosol samplers. *Environ. Sci. Technol.*, **11**(4):387-390.

Dr. Ellis Cowling

Dr. Ellis Cowling
North Carolina State University
March 29, 2008

Individual Comments following the March 25, 2008 Teleconference Consultation by the Clean Air Scientific Advisory Committee (CASAC) CASAC Ambient Air Monitoring and Methods (AAMM) Subcommittee regarding Ambient Air Monitoring Issues related to the National Ambient Air Quality Standards (NAAQS) for Lead (Pb)

As indicated during earlier consultations after review of plans for formulation and implementation of the NAAQS for lead, several colleagues on the CASAC Lead Review Panel are much better prepared than I am by experience and scientific expertise to provide constructive comments on air quality monitoring methods that are appropriate for airborne lead.

Thus, my natural predilection as a member of CASAC is to focus on general rather than specific aspects of the challenges involved including:

- 1) The importance and apparent lack of timeliness in implementation of some of EPA's responsibilities for joining with other agencies of our federal and state governments in decreasing airborne lead pollution in our country; and,
- 2) The very substantial and remarkably positive responsiveness of staff in EPA's Office of Air Quality Planning and Standards to the several recommendations by CASAC with regard to implementation of future primary and secondary NAAQS standards for airborne Pb pollution including:
 - a) Switching from the current "Indicator" of airborne lead pollution [Pb in Total Suspended Particulate Matter (TSP)] to Pb in PM₁₀, and
 - b) Decreasing the air concentrations of Pb that would be allowed under very substantially more stringent NAAQS standards that appear to be necessary to protect public health and public welfare from adverse effects of airborne Pb in the future.

Importance and Apparent Insufficiency of Past Efforts:

What an inspiration it was to learn that several different agencies of our Federal government had committed themselves during the early 1990s to establishing a very worthy goal for environmental protection — "eliminating childhood lead poisoning [in the United States] by the year 2010!"

Prohibiting the use of Pb additives in gasoline and Pb-based pigments in house paints were very substantial steps forward toward this noble goal.

But what a disappointment it has been also to recognize that these two major steps forward have not been adequate to prevent the continuing adverse effects of airborne Pb on the IQ of children in American society.

The attached reference indicates that the currently proposed actions and reports regarding lead pollution and resulting childhood lead poisoning in the United States are long overdue.

Childhood lead poisoning prevention. Too little, too late. B P Lanphear. J Amer Med Assn. 2005 May, 293(18):2274-2276.

I commend the present administration of the USEPA for undertaking their apparently renewed interest and actions with regard to lead pollution and lead poisoning and hope that the USEPA will now do an even larger share of its important part — together with other agencies of government — and thus help our country make further progress toward achieving this very worthy national goal — if not by the year 2010 — then as soon thereafter as possible!

Responsiveness of OAQPS Staff to Recommendations by CASAC's Lead NAAQS Review Panel

During the recent CASAC Ambient Air Monitoring and Methods Subcommittee, Consultation, this Subcommittee was asked to review four important reports by staff within EPA Office of Air Quality Planning and Standards:

- 1) "Options for Lead NAAQS Indicator: Monitoring Implications" by Kevin Cavender.
- 2) "Draft Federal Reference Method (FRM) and Federal Equivalent Method (FEM Criteria for Lead in PM 10 (Pb-PM10)" by Joann Rice.
- 3) "Lead NAAQS Ambient Air Monitoring Network: Network Design Options Under Consideration" by Kevin Cavender.
- 4) "Lead NAAQS Ambient Air Monitoring Network: Sampling Frequency Options Under Consideration" by Mike Papp.

What a pleasure it was to see how very thoroughly each of these four reports gave earnest attention to the several recommendations of the CASAC Lead Review Panel in their earlier letter reports to the Administrator of EPA with regard to options for lead NAAQS indicator, federal reference and federal equivalence methods of analysis, and both network design and sampling frequency options under consideration!

The authors of each of these reports are to be commended for the thoroughness and clarity with which their analyses and recommendations have been completed and presented for evaluation by our CASAC Ambient Air Monitoring Subcommittee.

We hope this kind of thorough and positive responsiveness will be followed by similar consideration of CASAC's other recommendations during the progress that must be made by the USEPA in meeting the court-ordered deadlines for presentation of the:

Proposed Rule for lead NAAQS on May 1, 2008, and the

Final Rule for lead NAAQS on September 1, 2008 — both of which are now less than two months away, and less than six months away, from the date of this Ambient Air Monitoring and Methods Subcommittee Consultation on March 25, 2008.

Mr. Bart Croes

U.S. EPA's Pb NAAQS Review: Indicator and Monitoring Issues

March 25, 2008 Consultation Meeting

CASAC AAMM Subcommittee Review Comments, Bart Croes

Overall, the documents provided to the Subcommittee continue the impressive responsiveness by U.S. EPA staff to CASAC and our Subcommittee's comments. Staff should be commended for taking a systematic approach towards implementation of a likely revised lead (Pb) National Ambient Air Quality Standard (NAAQS). I appreciate the opportunity to comment during this intermediate stage of the process. The documents provide a good description of the issues and a reasonable rationale for changes to the Pb Federal Reference Method (FRM) and Federal Equivalent Method (FEM) process. I agree with the basic approach taken by U.S. EPA, and offer comments on several aspects that need further attention. My comments address the consultation questions posed by Lewis Weinstock in his March 3, 2008 memo to Fred Butterfield. These comments also reflect input from California Air Resources Board staff responsible for implementing U.S. EPA monitoring requirements and using the data in source apportionment and health studies.

Charge Questions:

Attachment 1 – Options for Lead NAAQS Indicator: Monitoring Implications

1. *Considering issues such as sampler performance, size cuts, operator maintenance, integration with other measurement systems, and usefulness as the measurement system for the indicator, please describe the advantages and disadvantages of sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM10.*

The primary advantages of a PM10 size cut for Pb monitoring are that these are inhalable particles (which are more relevant for human health effects from ambient air), the data is of better quality, and there is a large existing PM10 monitoring network that can be adapted for Pb monitoring.

However, the disadvantage is that super coarse particles that contribute to human health effects through ingestion by multi-media routes would be ignored. Also, there would be a disconnect with four decades of Pb-TSP data.

From a resources point of view, it makes most sense to build off of one of the existing networks (e.g., HiVol PM10, TSP Total Metals). The California Air Resources Board has a 20-site Toxics Network (12 lpm TSP, Teflon filter, ICP/MS analysis) that we would like to see considered as an option for meeting compliance requirements. By taking advantage of existing PM10 or TSP monitors, the need for additional monitors would be limited, which would make the program less costly for U.S. EPA and the SLT entities.

2. *Is it appropriate to monitor for Pb-PM10 near Pb sources? And if so, under what conditions?*

For large fugitive or stationary sources, TSP monitors capture all health-relevant Pb particles and seem to be a better choice than PM10 monitors. Specifically, from Figure 2, Pb-PM10 levels are about half of Pb-TSP levels.

3. *One indicator option suggests using scaling Pb-PM10 monitoring data up to an equivalent Pb-TSP level in lieu of Pb-TSP monitoring data. Under what circumstances would it be appropriate to scale data (e.g., non-source oriented sites, low concentration sites) and when would it not be appropriate to scale data?*

From Figures 1 and 2, Pb-PM10 to Pb-TSP correlations seem relatively high, but further collocated monitoring and analysis would strengthen the analysis.

4. *We have limited collocated Pb-PM10 and Pb-TSP monitoring data. What types and “scaling factors” are appropriate to create using this data (e.g., non-source oriented, source oriented)? What levels are appropriate for the types of scaling factors identified in the white paper?*

The data are limited and further collocated monitoring and analysis is needed, especially for the source-oriented monitoring that has the highest Pb levels.

Attachment 2 – Draft Federal Reference Method (FRM) and Federal Equivalent Method (FEM) Criteria for Lead in PM10 (Pb-PM10)

1. *Is it appropriate to use the low-volume PM10coarse FRM sampler as the Pb-PM10 FRM sampler?*

If the decision is to move away from total health risk (as represented by TSP) to inhalable risk (PM10), then the use of the low-volume PM10coarse FRM sampler is reasonable.

2. *What other PM10 samplers should be considered as either FRM or FEM for the Pb-PM10 FRM?*

SLT entities should be permitted to use the HiVol TSP and all existing FRM and FEM PM10 samplers. Even if the Pb NAAQS goes from TSP to PM10, TSP would be a conservative (i.e., health-protective) measurement.

3. *Is XRF an appropriate Pb-PM10 FRM analysis method?*

Yes. While it has problems with non-uniform deposits, XRF is a cost-effective technique.

4. *What other analysis methods should be considered for FRM or FEM for the Pb-PM10 FRM?*

AAS, ICP/MS, and PIXIE.

5. *Have we selected appropriate precision, bias, and method detection limit requirements for FEM evaluation?*

Yes. The current FEM requirements of 15% maximum precision and 5% accuracy seem reasonable, as well as the proposed requirement that the MDL must be equal to or less than 1/10th the level of the Pb NAAQS.

Attachment 3 – Lead NAAQS Ambient Air Monitoring Network: Network Design Options Under Consideration

1. *What types of monitoring sites should be emphasized in the network design (e.g., source oriented monitors, population monitors, near roadway monitors)?*

Source oriented monitoring should be emphasized as these are the areas likely to have the highest levels. If below the NAAQS, then no further monitoring is needed. Otherwise, population and near roadway monitors should be considered.

2. *We are considering proposing requirements for monitoring near sources exceeding an emissions threshold and discuss a number of options for determining this threshold in the white paper. What options should be considered in establishing an emissions threshold?*

The analysis is reasonable, but the issue of periodically emitting sources should be considered, which would lower the emissions threshold.

3. *We are considering proposing requirements for non-source oriented monitoring in large urban areas to provide additional information on ambient air concentrations in urban areas. Considering other monitoring priorities and a potential requirement for Pb monitoring near sources, what size of a non-source oriented Pb network is appropriate?*

Non-source oriented monitoring should only be considered if analysis of existing data (e.g., Pb-TSP data, PM_{2.5} speciation Pb data, special study data, reconstructed Pb levels using air quality modeling or interspecies correlations) show the potential to exceed the Pb NAAQS.

4. *What factors should we base non-source oriented monitoring requirements on (e.g., population, design value)?*

It should only be based on the potential to exceed the Pb NAAQS.

5. *We are considering proposing requirements for Pb monitoring near roadways and interstates. Is it appropriate to include separate monitoring requirements for near roadway monitoring, or should near roadway monitors be a part of the non-source oriented monitoring requirement?*

Unless the Pb NAAQS is very low, near roadway exposures should not be a problem, as shown in Table 7.

6. *Under what conditions would it be appropriate to waive the monitoring requirements for either source or non-source oriented monitors?*

These conditions should be consistent with decisions for other criteria pollutants.

Attachment 4 – Lead NAAQS Ambient Air Monitoring Network: Sampling Frequency Options Under Consideration

1. *What sampling frequency would be appropriate if the Pb NAAQS is based on a monthly average?*

The California Air Resources Board has had a monthly average Pb-TSP standard (not to be exceeded) of 1.5 $\mu\text{g}/\text{m}^3$ since 1970 and has always used one-in-six-day sampling. California has always met a monthly 75% completeness criteria as compared to the federal requirement of 75% across a quarter. One-in-three-day sampling should only be considered for sites that are near or exceed the standard.

2. *Is it appropriate to relax the sampling frequency in areas of low Pb concentration? If so, at what percent of the Pb NAAQS?*

If a one-in-six-day sampling frequency is chosen, then no. If a one-in-three-day sampling is selected, then the frequency should be relaxed if peak Pb levels are 30% or less of the NAAQS, as proposed by U.S. EPA staff.

3. *Is it appropriate to relax the sampling frequency in areas considerably higher than the NAAQS? If so, at what percent of the Pb NAAQS?*

No, as that would be unprecedented for criteria pollutant and not health protective for periodic sources.

Dr. Delbert Eatough

April 9, 2008

From: Delbert J. Eatough, CASAC AAMM subcommittee member

Subject: Review of Ambient Monitoring Issues Related to Lead

Options for Lead NAAQS Indicator: Monitoring Implications

As with others on the AAMM committee and in accord with the earlier statements of CASAC, I fully support the elimination of TSP-Pb as an indicator of either total Pb exposure or the determination of ambient atmospheric exposure. I have delayed my comments until I had a chance to review the 7-page memo describing the results of a November 1987 to April 1988 study conducted by the State of Montana -- "Co-located PM-10/Hi-Vol Monitoring Results for E. Helena," dated July 22, 1988 which was provided to AAMM members yesterday by Fred Butterfield. My comments will focus on that document and its implications for some of the charge questions. Specifically, I will address as a group the following charge questions.

Questions on Attachment 1 (Options for Lead NAAQS Indicator: Monitoring Implications)

Question 1: Considering issues such as sampler performance, size cuts, operator maintenance, integration with other measurement systems, and usefulness as the measurement system for the indicator, please describe the advantages and disadvantages of sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM₁₀.

Question 2: Is it appropriate to monitor for Pb-PM₁₀ near Pb sources? And if so, under what conditions?

Question 3: One indicator option suggests using scaling Pb-PM₁₀ monitoring data up to an equivalent Pb-TSP level in lieu of Pb-TSP monitoring data. Under what circumstances would it be appropriate to scale data (e.g., non-source oriented sites, low concentration sites) and when would it not be appropriate to scale data?

The advantages of using a Pb-PM₁₀ based monitoring system for the Pb ambient air quality standard lies in the greatly improved precision and better definition of what is being monitored. In contrast, the old Pb-TSP sampling protocols are fraught with many uncertainties which are well numerated in the material provided by EPA. The point however, has also been made that it is total exposure that is important, especially for children. A comparison of results obtained using these two monitoring methods was provided in Figures 1 and 2 of Attachment 1. Figure 1, based on non-source oriented data suggests that no significant underestimation of ambient air Pb exposure will occur by changing the sampling method used to determine attainment. However, Figure 2 suggests that significant under-determination of exposure can occur near major Pb sources based on results from two studies. One of the studies (202090020, as identified in Table 1) gives results which are within the range of the studies reported in Figure 1. The second study, the above referenced E. Helena study suggests that exposure will be under-measured using

the proposed Pb-PM₁₀ based protocol near a source by a factor of over 2. Since the driving force for not changing the sampling protocols are essentially all contained in the results of this study, the study deserves a closer look.

An examination of the document provided to the AAMM subcommittee by Fred Butterfield on April 8 suggests this is a very weak hat to hang the whole decision of changing from the Pb TSP measurement method or not. I have the following serious concerns with the study:

1. The study does not carry the weight of a peer reviewed publication.
2. The samples were collected about ½ mile from the fence line of the ASARCO smelter. At this distance, one would expect to see some variation in the mix of <10 and >10 micron particles present as a function of wind direction and wind speed as the import of large particle fugitive dust versus small particle emissions impacts varies. In fact, this is not the case, but the study is amazingly consistent for all collected data.
3. One would also expect to see a variation in the fraction of the particles present as Pb as the above factors change the relative amount of various sources from the smelter. In fact, this fraction is constant (as well as the ratio of PM₁₀ and TSP) for all data points.
4. No details are given on the filter media on which samples were collected, the methods of data analysis, blank corrections, etc.

In short, the study is not consistent with know and expected variations in large versus small particle concentrations and composition from a near-by smelter source. In addition, insufficient detail is given to determine whether this unexpected result is due to a most fortuitous combination of meteorological factors, or to a fundamental flaw in the study design and sample analysis. I therefore conclude that established something as important as the direction of the future Pb standard and the associated sampling protocol essentially on this study is folly. Outside this result there is no credible data which have presented in the EPA attachment which would argue that exposure to children can be significantly under measured if the Pb TSP method is abandoned.

Based on the above, I strongly support moving to a Pb-PM₁₀ protocol. Furthermore, I believe attempting to use factors in setting the standard would not be based on firm data. If it is believed that the TSP standard should be maintained, I would think additional data are needed to justify such a decision. Neither cost nor the current science justifies it in my opinion.

Mr. Dirk Felton

Dirk Felton: CASAC AAMM Individual Written Comments on Ambient Air Monitoring Options for Lead

(Prepared for the March 25th teleconference
Revised March 27th)

These comments have been made in spite of the broad range proposed for the primary and secondary Pb NAAQS. The level of the standard drives much of the network design, sampler technical specifications and analytical methods. More specific comments can be offered if the range for the standard is narrowed.

Part of the discussion during the teleconference centered around the desire to know the size of the Pb containing particles in ambient air. The NYSDEC has some Pb size data available from a PMcoarse evaluation that was performed in 2005. Samples were collected through calendar year 2005 on the EPA 1 in 6 day schedule. Filters were analyzed by XRF from low volume PM₁₀ and PM_{2.5} samplers in New York City and Niagara Falls, NY. The data for Pb is displayed in table 1 as ratios of PM₁₀ / PMcoarse.

Table 1

NYC	All Data	Cold Months	Warm Months
mean	0.47	0.41	0.53
median	0.47	0.43	0.61
25%ile	0.29	0.23	0.33
75%ile	0.66	0.61	0.71
min	0.00	0.00	0.00
max	1.00	0.93	1.00

Nia Falls	All Data	Cold Months	Warm Months
mean	0.31	0.27	0.34
median	0.27	0.29	0.24
25%ile	0.08	0.06	0.12
75%ile	0.47	0.46	0.53
min	0.00	0.00	0.00
max	1.00	0.58	1.00

The data shows that for the Pb containing particles smaller than PM₁₀, slightly more Pb is found in the PM_{2.5} fraction than in the PMc fraction at these locations in New York.

A presentation on the NYSDEC PMc evaluation was delivered at the 2006 National Monitoring Conference. The .ppt file can be found on the EPA AMTIC webpage:

<http://www.epa.gov/ttn/amtic/files/ambient/2006conference/felton.pdf>

• **Attachment 1 Options for Lead NAAQS Indicator: Monitoring Implications**

Charge Questions:

1. *Considering issues such as sampler performance, size cuts, operator maintenance, integration with other measurement systems, and usefulness as the measurement system for the indicator, please describe the advantages and disadvantages of sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM₁₀.*

The primary advantage of implementing the PM₁₀ size cut for the Pb standard is that the resulting data is more relevant for air pollution related health effect correlation and for source permitting and source control.

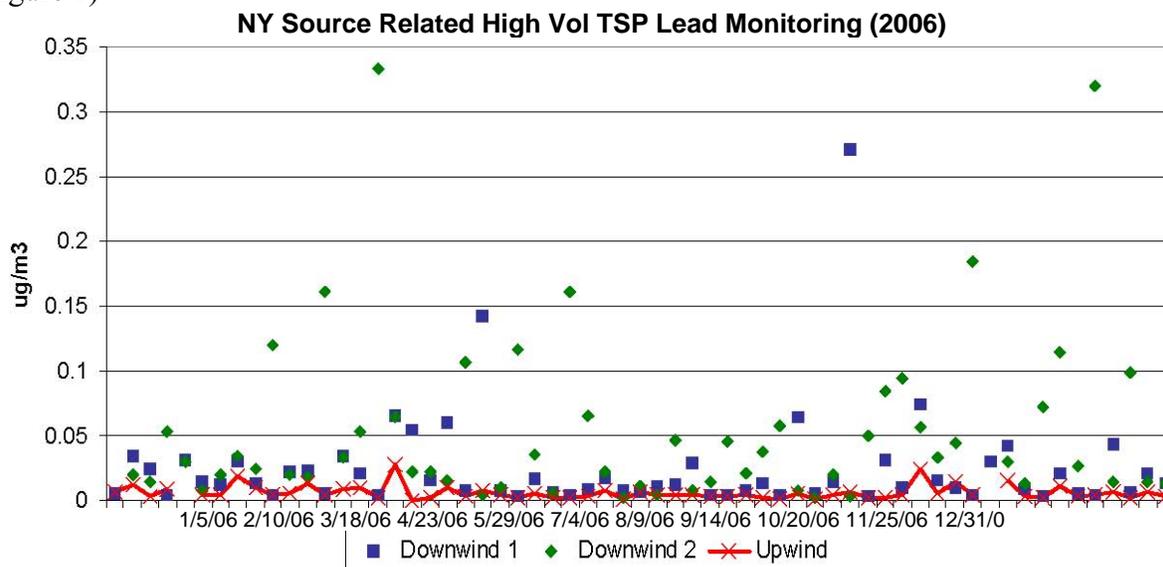
2. *Is it appropriate to monitor for Pb-PM₁₀ near Pb sources? And if so, under what conditions?*

It depends on the type of source. TSP is still the best choice for monitoring on-site and at the perimeter of large fugitive Pb sources. This would include primary smelters and other smaller sources where significant outdoor raw material handling is performed. It is acceptable to use PM₁₀ monitors at middle or neighborhood scale population exposure locations adjacent to source properties. The data from the PM₁₀ monitors is more consistent because in locations downwind of Pb sources, the data will be relatively unaffected by deposition losses. This makes the interpretation of data simpler because varying downwind concentrations can be more easily related to sources.

3. *One indicator option suggests using scaling Pb-PM₁₀ monitoring data up to an equivalent Pb-TSP level in lieu of Pb-TSP monitoring data. Under what circumstances would it be appropriate to scale data (e.g., non-source oriented sites, low concentration sites) and when would it not be appropriate to scale data?*

Scaling PM₁₀ data is not necessary. Sites that are distant from sources of Pb are not going to be significantly impacted by particles larger than PM₁₀. One way to determine if a monitoring location is likely to be impacted by large particles is to review the historical variation of the Pb TSP data. Since concentrations of large particles vary tremendously due to source variations such as work shift changes, material handling changes, deposition, and meteorology; datasets that exhibit little concentration variation are not likely to be impacted by large particles. (See the upwind site data in Figure1.)

(Figure 1)



• Attachment 2 Draft Federal Reference Method (FRM) and Federal Equivalent Method (FEM) Criteria for Lead in PM₁₀ (Pb- PM₁₀)

Charge Questions:

1. *Is it appropriate to use the low-volume PM₁₀ FRM sampler as the Pb-PM₁₀ FRM sampler?*

Yes, the sampler is well characterized and very familiar to State and Local air monitoring Agencies. The sequential versions of the samplers should also be designated as FRMs because future Pb PM₁₀ FEM evaluations should use the FRM samplers and protocols most predominantly utilized in the National network. Future FEM evaluations should be designed with the identical sample collection interval (midnight to midnight) and filter handling procedures as followed by the majority of the data providers for the national network.

2. *What other PM₁₀ samplers should be considered as either FRM or FEM for the Pb-PM₁₀ FRM?*

Monitoring Agencies should be permitted to use High Volume TSP and existing High Volume FRM and FEM PM₁₀ samplers if the data is approximately adjusted for Local Conditions and the data from the site is well below the ambient Pb standard (< 70% of the NAAQS). If TSP samplers are used, the resulting Pb concentrations should be compared to a new Pb-PM₁₀ standard. High Volume samplers would have to be considered FEMs.

3. *Is XRF an appropriate Pb-PM₁₀ FRM analysis method?*

Specifying XRF would make analytical problems stemming from non-uniform loading and non-ideal filter loading densities an inherent part of the FRM. ICPMS

should be the analysis method for the FRM and for the PEP audit samples. ICPMS is more accurate and it does not require the filter to be uniformly loaded. XRF should be designated as a cost effective FEM that is routinely compared to ICPMS through the periodic collocation of the PEP audit program.

4. What other analysis methods should be considered for FRM or FEM for the Pb-PM₁₀ FRM?

XRF and GFAA should be considered for FEM designation.

5. Have we selected appropriate precision, bias, and method detection limit requirements for FEM evaluation?

The precision requirement should be tightened to 10% for new methods with a provision for 15% to permit FEM designation for existing high volume samplers.

• Attachment 3 Lead NAAQS Ambient Air Monitoring Network: Network Design Options Under Consideration

Charge Questions:

1. What types of monitoring sites should be emphasized in the network design (e.g., source oriented monitors, population monitors, near roadway monitors)?

Source oriented monitoring should be emphasized.

2. We are considering proposing requirements for monitoring near sources exceeding an emissions threshold and discuss a number of options for determining this threshold in the white paper. What options should be considered in establishing an emissions threshold?

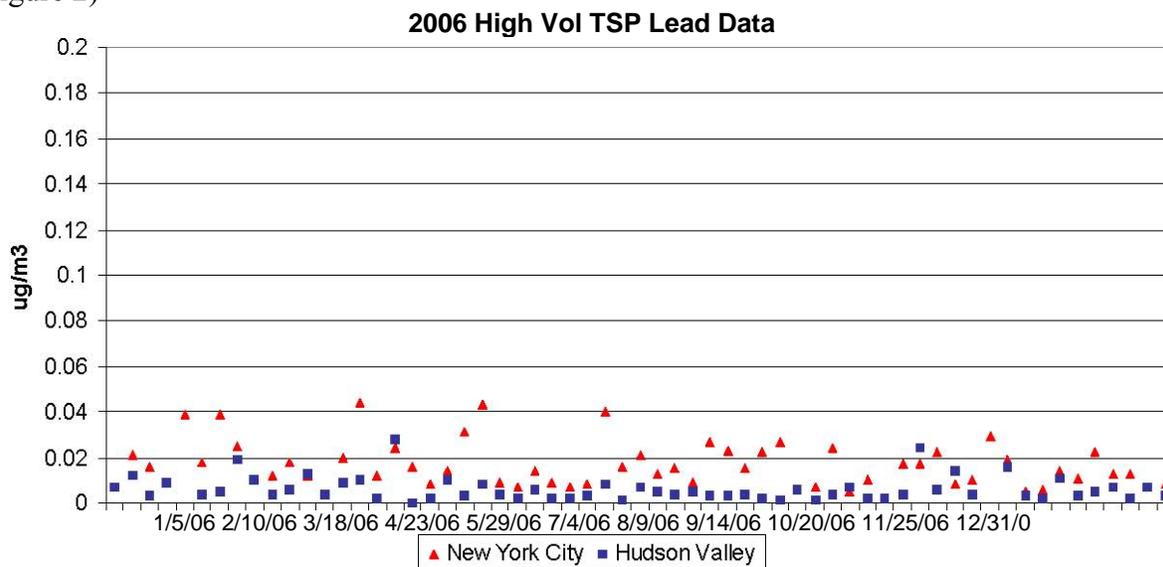
The analyses described in the white paper look at the amount of Pb emitted from a facility but there is no consideration of the type of emissions. Sources that handle large quantities of raw materials such as smelters and battery recyclers are likely to emit large plumes periodically. These sources will need downwind monitoring at a lower threshold than a source such as a ceramic manufacturer or a municipal incinerator that has a more consistent process output. The emissions threshold should be a range that provides for more intensive monitoring for sources that have relatively high Pb emissions or for sources that have the ability to release high concentrations of Pb if a process control were to malfunction.

3. We are considering proposing requirements for non-source oriented monitoring in large urban areas to provide additional information on ambient air concentrations in urban areas. Considering other monitoring priorities and a potential requirement for Pb monitoring near sources, what size of a non-source oriented Pb network is appropriate?

Urban areas are likely to show a small increment to the background Pb concentrations associated with known sources. Since these increments are not significant at

all but the lowest concentrations under consideration for the revised NAAQS, non-source oriented monitoring should not be emphasized in urban areas distant from Pb sources. Historic Pb data and current data from the NATTs network locations can be used to determine if urban areas are close enough to a source to warrant ambient monitoring. Figure 2 shows the Pb concentrations for an urban location in New York City and a regional site in the Hudson Valley.

(Figure 2)



4. What factors should we base non-source oriented monitoring requirements on (e.g., population, design value) ?

Population size is not well correlated with ambient Pb concentration and should not be used as a factor in Pb ambient monitoring network design. The design value is acceptable if one can be calculated from historical data or from data collected by other monitoring programs such as NATTs.

Urban areas are also sometimes located near known sources of Pb. In these cases, population exposure monitors are warranted in order to obtain a reasonable design value for the urban/populated area. These evaluation monitors should be easily discontinued if they demonstrate that the newly calculated design value is below 35% of the NAAQS.

5. We are considering proposing requirements for Pb monitoring near roadways and interstates. Is it appropriate to include separate monitoring requirements for near roadway monitoring, or should near roadway monitors be a part of the non-source oriented monitoring requirement?

Near roadway monitors will only be necessary if the NAAQS is chosen at the lowest of the levels currently under consideration. If the Pb NAAQS is set at a very low level, near roadway monitors should be considered source monitors. This may aid

in the development of emission factors for specific roadway attributes such as age, vehicle miles traveled and the ratio of heavy duty diesels to passenger cars.

6. Under what conditions would it be appropriate to waive the monitoring requirements for either source or non-source oriented monitors?

Source oriented monitoring could be waived if the source conducts routine supervised representative Pb monitoring and that monitoring data shows no short term concentration spikes and no incremental differences in the downwind Pb concentration.

Required non-source oriented monitors should be waived if the design value is below 35% of the NAAQS and there are no changes in the inventory of potentially significant sources. The non-source oriented sites that have design values below 70% of the NAAQS should be permitted to reduce their monitoring frequency to 50% of the required sampling frequency.

Single monitors can be assigned for non-source oriented population exposure monitoring as long as the design value is below 70% of the NAAQS. If the design value of the MSA/CBSA is greater than 70% of the NAAQS, multiple monitors may be required in order to accurately determine the possible extent of a non-attainment area.

• Attachment 4 Lead NAAQS Ambient Air Monitoring Network: Sampling Frequency Options Under Consideration

Charge Questions:

1. What sampling frequency would be appropriate if the Pb NAAQS is based on a monthly average?

One day in three represents a reasonable compromise between necessary accuracy and the effort and costs required to perform frequent filter based sample collection and chemical analysis.

2. Is it appropriate to relax the sampling frequency in areas of low Pb concentration? If so, at what percent of the Pb NAAQS?

Yes, the sampling frequency should be reduced by 50% when the design value is below 70% of the NAAQS. The sampling frequency should also be reduced when the ambient data is very consistent from sample to sample. This could be instituted by specifying a threshold coefficient of variation below which the sampling frequency could be reduced. The sampling frequency should not be reduced for sites near large sources.

3. Is it appropriate to relax the sampling frequency in areas considerably higher than the NAAQS? If so, at what percent of the Pb NAAQS?

No, Pb concentration data from areas above the NAAQS are necessary to adequately determine the potential health effects from specific Pb sources.

Dr. Philip Hopke

Comments by Philip K. Hopke on Pb Monitoring Issues

The documents provided for review were well written and provided reasonable approaches to the monitoring issues. However, there needs to be a clearer tie between the exposure pathways and the monitoring approaches. It seems incongruous that if we believe a wide range of particle sizes are important, we then only measure a fraction of the particles when it might be possible to obtain a measure of a wider size range of particles. There is not yet a clear enough definition of the exposure pathways and using those definitions to provide the basis for why, where and how monitoring should be done to produce data relevant to protect the public health. In the case of lead, there is a clearly defined susceptible subpopulation, children, and the design of the monitoring program needs to address this issue. Exposure to the population as a whole is much less important than exposure of children to lead and thus, monitoring must be targeted in those areas most likely to produce exposure to children.

Considering issues such as sampler performance, size cuts, operator maintenance, integration with other measurement systems, and usefulness as the measurement system for the indicator, what are the advantages and disadvantages of sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM₁₀?

The main advantage I can see is that the PM₁₀ would provide lower costs and ease of implementation. However, if there is real concern that large particle coarse particles are of concern, then it makes more sense to measure TSP. It is possible to measure TSP with much greater precision than is currently possible with the high volume sampler. One wants samplers that has good flow control, no wind speed and direction dependence and provides a filter that is appropriate for the analytical method of choice. It is certainly possible to do this with currently available technology that provides good flow control and insensitivity to wind direction. There remains a problem with wind speed, but I would suggest that this is of relatively limited concern since there would still be good sampler to sampler precision. Thus, I would suggest against switching to PM₁₀ as the inlet since I think it is better to try to directly measure the indicator rather than a surrogate and guess at how to “correct” the result to provide an indirect measure of the indicator. You should look at Kenny L, Beaumont G, Gudmundsson A, Thorpe A, Koch W Source: JOURNAL OF ENVIRONMENTAL MONITORING Volume: 7 Issue: 5 Pages: 481-487 Published: 2005

Is it appropriate to monitor for Pb-PM₁₀ near Pb sources? And if so, under what conditions?

Only if you are going to a PM₁₀-based standard. If TSP is of concern, then TSP is what should be measured as well as it possibly can be measured.

One indicator option suggests scaling Pb- PM₁₀ monitoring data up to an equivalent Pb-TSP level in lieu of Pb-TSP monitoring data. Under what circumstances would it be appropriate to scale data (e.g., non-source oriented sites, low concentration sites) and when would it not be appropriate to scale data?

It is always risky to “scale” data when it is possible to directly measure a quantity of interest.

We have limited collocated Pb-PM₁₀ and Pb-TSP monitoring data. What types and “scaling factors” are appropriate to create using this data (e.g., non-source oriented, source oriented)? What levels are appropriate for the types of scaling factors identified in the white paper?

If we set a stringent standard level, then the values will be so dominated by noise and the development of a scaling factor is then quite uncertain. Thus, I still believe it is best to monitor that which we think is the cause of the adverse health effects.

Is it appropriate to use the low-volume PM10c FRM sampler as the Pb-PM₁₀ FRM sampler? What other PM₁₀ samplers should be considered as either FRM or FEM for the Pb-PM₁₀ FRM?

Sure. The PM10c sampler provides good precision for mass collection and thus, will provide good precision for Pb in PM10. The current FEM rules for the PM10 head are quite lax because the acceptance interval was made too wide in 1987. If you want FEM precision to be good, the acceptance window for the PM10 inlet performance should be reduced from + 0.5 μm at 10 μm to something more like + 0.1 to 0.2 μm. Then FEMs would have good precision in side-by-side comparisons with the PM10c sampler.

Is XRF an appropriate Pb-PM₁₀ FRM analysis method?

Yes, there can be problems in areas with significant As concentrations since there is an overlap in the As Kα with one of the Pb l-lines.

What other analysis methods should be considered for FRM or FEM for the Pb-PM₁₀ FRM?

ICP/MS or GFAAS would both provide the sensitivity and precision. Electrochemical methods like anodic stripping voltammetry can be useful and should be considered.

Have we recommended appropriate precision, bias, and method detection limit requirements for FEM evaluation?

Yes

What types of monitoring sites should be emphasized in the network design (e.g., source oriented monitors, population monitors, near roadway monitors)?

What are the exposure pathways that are being looked at to provide protection to the public? The key is whether lead is being transported to playgrounds, urban gardens, etc where ingestion hazards might become important. Is the primary monitoring interest in population exposure, source identification and assessment, etc.? If it is population exposure, then the source areas are of less importance to monitor. Near minor roadways where children might play would be significant locations at which to make measurements.

We are considering proposing requirements for monitoring near sources exceeding an emissions threshold and discuss a number of options for determining this threshold in the white paper. What options should be considered in establishing an emissions threshold?

Emissions thresholds in what sizes? Ultra coarse particles will not be transported at significant distances whereas PM10 and smaller can be transported over sufficient distances to be important. Again, there is no simple answer here in the absence of a clearer definition of why the measurements are being made.

We are considering proposing requirements for non-source oriented monitoring in large urban areas to provide additional information on ambient air concentrations in urban areas. Considering other monitoring priorities and a potential requirement for Pb monitoring near sources, what size of a non-source oriented Pb network is appropriate?

The question here is how much ultra-coarse is likely to be present and how uniform or non-uniform are the sources of these larger particles. More heterogeneous source locations lead to the need for more samplers. One suggestion would be to make some measurements using the Leith and Wagner passive monitor where they are sufficient low cost that many samples could be obtained across an urban area and the variability assessed. One could even consider a requirement to make an initial assessment of the heterogeneity of exposures with low cost sampling and use those results to plan an effective monitoring network tailored to the individual urban area rather than a one size fits all philosophy.

What factors should we base non-source oriented monitoring requirements on (e.g., population, design value)?

The design needs to include both the inhalation risk and the ingestion risk. The target population has to be children over adults and thus, areas where there could be significant exposure like schools, playgrounds, ball parks, etc. should be a priority. If there are designated urban garden areas, then they should also be target areas. The key is that adults are not as affected by lead as children so the population at risk should drive the location plans.

We are considering proposing requirements for Pb monitoring near roadways and interstates. Is it appropriate to include separate monitoring requirements for near roadway monitoring, or should near roadway monitors be a part of the non-source oriented monitoring requirement?

Under what conditions would it be appropriate to waive the monitoring requirements for either source or non-source oriented monitors?

What sampling frequency would be appropriate if the Pb NAAQS is based on a monthly average?

You need enough points to provide a meaningful average. At 1 in 6 sampling, we would only have 5 points per month and that would provide a measurement with lower power and a higher probability of type 1 errors than a 1 in 3 schedule. I would suggest that 1 in 3 would need to be required.

Is it appropriate to relax the sampling frequency in areas of low Pb concentration? If so, at what percent of the Pb NAAQS?

Once there is a good data base to support the attainment with low risk exists, it is certainly possible to relax the sampling schedule unless some new facility is built that has the potential for lead emissions. There would need to be a trigger to increase sampling if there is significant new development in the area.

Is it appropriate to relax the sampling frequency in areas considerably higher than the NAAQS? If so, at what percent of the Pb NAAQS?

Shouldn't the local agency want high confidence data on the lead concentrations if they are in non-attainment and there is a SIP in place to force reductions. This question does not make a lot of sense to me since if the area is in substantial non-attainment, one would have thought there would be action on-going to reduce the concentrations and thus, a desire to assess the improvements being made. Thus, I cannot see any reason why one would want to reduce the measurement frequency.

Dr. Rudolf Husar

March 27, 2008

To: Fred Butterfield, Designated Federal Officer, Clean Air Scientific Advisory Committee (CASAC); Ted Russell, CASAC Ambient Air Monitoring and Methods (AAMM) Subcommittee Chair

From: Rudolf B. Husar, CASAC AAMM subcommittee member

Subject: Review of Ambient Monitoring Issues Related to Lead

Options for Lead NAAQS Indicator: Monitoring Implications

I fully support the elimination of TSP-Pb as an indicator of total Pb exposure. The use of coarse particle (PM_{2.5}-PM₁₀) Pb or PM₁₀ Pb is appropriate for estimating the ambient Pb concentrations. If indeed, most of the Pb exposure (of children) is due to the ingestion of soil material, then the relevant indicator should be the Pb in the soil, which may have vary poor relationship to the ambient Pb concentration in any size range.

Lead NAAQS Ambient Air Monitoring Network: Network Design Options Under Consideration

The section of the document describing the network design is well prepared and presented. The separation of source, population and roadway-oriented monitors is logical and well-suited as network design and implementation criteria. The emphasis of the Pb monitoring network should be placed on source monitoring since point sources now dominate the national emissions. Using the source emission rate as a scaler for the number of source-oriented monitoring sites makes sense. An alternative metric for scaling the number of monitors is the population-weighted exposure. This would require more monitors for those sources that result in higher population exposure.

Population-oriented monitors would require more consideration. In particular, it would be helpful to establish whether most of the population exposure is from known distant point sources or from less known local sources. In case of the latter, a strategically designed moving sampler would establish whether such unknown Pb sources exist.

I also support Donna Kenski's suggestion to make maximum utilization of the monitoring data from the Speciation Trends Network and the evolving NCore. I do not see any reason why the Pb-sampling frequency should be different from the STN/NCOR networks.

Dr. Kazuhiko Ito

Comments for the March 25, 2008 Clean Air Scientific Advisory Committee (CASAC) Ambient Air Monitoring & Methods (AAMM) Subcommittee Teleconference

Kazuhiko Ito, 3/21/08

General comment: The range of “candidate NAAQS level” shown in these tables (0.02 to the current $1.5 \mu\text{g}/\text{m}^3$) is quite wide (I understand that the Staff Paper recommends no higher than $0.2 \mu\text{g}/\text{m}^3$). It may be important to compare the extent of uncertainty associated with the reported exposure/health effects relationships and the estimated uncertainty associated with Pb monitoring network design.

• “Options for Lead NAAQS Indicator: Monitoring Implications”

Q1. Considering issues such as sampler performance, size cuts, operator maintenance, integration with other measurement systems, and usefulness as the measurement system for the indicator, please describe the advantages and disadvantages of sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM₁₀.

Advantages: The better precision and ability to accommodate sequential sampling in case more frequent sampling (i.e., every 3rd day) is required.

Disadvantages: Possible requirement for “scaling factor” to adjust for larger particles that the Pb-PM₁₀ sampler may miss.

Q2. Is it appropriate to monitor for Pb-PM₁₀ near Pb sources? And if so, under what conditions?

Figure 2 on page 7 indicates a good linear relationship. This suggests that Pb-PM₁₀ works in source-oriented situations, but I think more data (pilot studies?) are needed to more fully characterize the factors (e.g., size distribution, wind-direction dependency, etc.) that affect comparability between Pb-TSP and Pb-PM₁₀ samplers.

Q3. One indicator option suggests using scaling Pb-PM₁₀ monitoring data up to an equivalent Pb-TSP level in lieu of Pb-TSP monitoring data. Under what circumstances would it be appropriate to scale data (e.g., non-source oriented sites, low concentration sites) and when would it not be appropriate to scale data?

The source oriented sites’ data (Figure 2) support justification for scaling factor using the relatively good relationship. It is more difficult to tell what we should do for non-source monitoring unless we look at the data for any pattern by city, region, or period. I feel a bit uncomfortable using scaling factors based on data such as those shown in Figure 1. In Figure 1, it is not clear how much of the scatter is due to the imprecision of TSP. As I mentioned in the conference call, I think it would help if we can see the scatter plots of co-located Pb-TSP monitors and co-located Pb-PM₁₀ monitors.

Regarding Figure 2, since the data came from 1200 data pairs from 31 non source-oriented sites that collected data between the years 1993 and 2006, I imagine that the overall regression could be masking potentially important information such as variation in slope across sites, regions, and years. During the conference call, Mr. Kevin Cavender mentioned that the slope of individual sites varied between 1 and 1.4, which made me feel more comfortable, but I would still consider running a regression model that takes into consideration the fact that the data came from different sites (mixed effects model).

• **“Draft Federal Reference Method (FRM) and Federal Equivalent Method (FEM) Criteria for Lead in PM₁₀ (Pb- PM₁₀)”**

Q1. Is it appropriate to use the low-volume PM_{10c} FRM sampler as the Pb-PM₁₀ FRM sampler?

It seems reasonable given the better precision than the Pb-TSP sampler.

Q2. What other PM₁₀ samplers should be considered as either FRM or FEM for the Pb-PM₁₀ FRM?

I don't know.

Q3. Is XRF an appropriate Pb-PM₁₀ FRM analysis method?

It sounds reasonable based on the required characteristics. It is also comparable with the PM_{2.5} and PM_c speciation monitor data. During the conference call, Dr. Phil Hopke mentioned possibility of As-Pb spectral interference. I think the EPA can check how much of a problem this is by analyzing available data from various source types.

Q4. What other analysis methods should be considered for FRM or FEM for the Pb-PM₁₀ FRM?

I don't know.

Q5. Have we selected appropriate precision, bias, and method detection limit requirements for FEM evaluation?

Given the expected concentration range and the possible range of Pb NAAQS, the requirements seem appropriate.

• **“Lead NAAQS Ambient Air Monitoring Network: Network Design Options Under Consideration”**

Q1. What types of monitoring sites should be emphasized in the network design (e.g., source oriented monitors, population monitors, near roadway monitors)?

I get a mixed impression about the relative importance of source types from these documents. The statement on page 1, "...there is substantial uncertainty about ambient air Pb levels resulting from historic Pb deposits near roadways," suggests that, at least initially, we need near-roadway monitors. However, Table 7 (page 8) suggests that the Pb levels near roadways are not that high, though we don't have much data on this table.

In cities where densities of roadways are high, what is the distinction between "non-source oriented monitoring" and "near roadway monitoring"? Also, during the conference call, the issue of aviation gasoline being an important source came up. I imagine most airports are also surrounded with major roadways. Thus, many of the major city neighborhoods may be difficult to characterize as "non-source".

Source-oriented monitors are clearly important when populations living nearby are at risk, but it seems we do need more data to characterize spatial variation of Pb in "near roadway" and "non-source" areas. I found that the rationale to emphasize ozone and PM_{2.5} monitors in comparison to Pb a bit unconvincing - the levels of ozone and PM_{2.5} would be fairly uniform within a city because they are secondary formed pollutants. One can argue that we need more monitors for the pollutants that are spatially more variable because they are locally generated.

Q2. We are considering proposing requirements for monitoring near sources exceeding an emissions threshold and discuss a number of options for determining this threshold in the white paper. What options should be considered in establishing an emissions threshold?

This idea of using the ratio of the observed Pb levels to the emission rate to come up with an emission threshold seems reasonable. The tables prepared in this document are very useful in supporting this idea. The only obvious issue we see with this approach is that, when we get to Table 5 (page 6), it becomes clear that we may need to monitor at a large number of locations (> 1,000) if the Pb NAAQS is set at 0.2 µg/m³ or less. Given the range of variability in the concentration-to-emission ratios (Table 2), an initial site-specific surveillance may be required to determine if monitoring is needed in that location.

Q3. We are considering proposing requirements for non-source oriented monitoring in large urban areas to provide additional information on ambient air concentrations in urban areas. Considering other monitoring priorities and a potential requirement for Pb monitoring near sources, what size of a non-source oriented Pb network is appropriate?

It is difficult to figure out how many monitors we need unless we know the extent of spatial variation of Pb. We need some kind of pilot study to characterize the spatial variation.

Q4. What factors should we base non-source oriented monitoring requirements on (e.g., population, design value) ?

(1) Population size; (2) existing data indicating Pb concentrations higher than "background" levels.

Q5. We are considering proposing requirements for Pb monitoring near roadways and inter-

states. Is it appropriate to include separate monitoring requirements for near roadway monitoring, or should near roadway monitors be a part of the non-source oriented monitoring requirement?

Given the high density of roadways in many urban areas, I think there is no need to separate sampling requirements for these two monitoring types.

Q6. Under what conditions would it be appropriate to waive the monitoring requirements for either source or non-source oriented monitors?

(1) no population being impacted; (2) existing or initial monitoring suggests sufficiently low ambient Pb concentrations.

• “Lead NAAQS Ambient Air Monitoring Network: Sampling Frequency Options Under Consideration”

Q1. What sampling frequency would be appropriate if the Pb NAAQS is based on a monthly average?

Every-3rd-day sampling appears appropriate if the Pb-PM₁₀ low flow sampler is going to be used. I would also find out, from a pilot study, if this sampling frequency satisfies DQO. In addition, I would take the every-6th-day part of the every-3rd-day data in pilot study and check if the precision is sufficient for DQO. If it is, then allow the sampling frequency to be every-6th-day.

Q2. Is it appropriate to relax the sampling frequency in areas of low Pb concentration? If so, at what percent of the Pb NAAQS?

Again, this depends on the precision of the data and DQO.

Q3. Is it appropriate to relax the sampling frequency in areas considerably higher than the NAAQS? If so, at what percent of the Pb NAAQS?

It is hard to comment on this without actually looking at data.

Dr. Donna Kenski

Revised Preliminary Comments on Pb NAAQS Monitoring

Donna Kenski

For AAMM Consultation March 25, 2008

1. Charge questions, attachment 1, Options for Lead NAAQS Indicator: Monitoring Implications: *Considering issues such as sampler performance, size cuts, operator maintenance, integration with other measurement systems, and usefulness as the measurement system for the indicator, please describe the advantages and disadvantages of sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM10.*

As I commented in reviewing the Lead ANPR, I prefer changing the Pb NAAQS indicator to Pb-PM10. This option takes advantage of current technology to make a more precise measurement, it would allow states to make better use of existing monitors, and the technology allows sequential measurements to be made automatically. While it will not capture the fraction of Pb on very large (>10 um) particles, I believe that it is possible to account for this in a reasonable way by incorporating a scaling factor into the standard. The uncertainty or variability introduced with this scaling factor is probably not significantly greater than that introduced by the TSP monitor itself, by virtue of its varying size cut with wind speed and direction.

Is it appropriate to monitor for Pb-PM10 near Pb sources? And if so, under what conditions?

Yes, it is appropriate to monitor for Pb-PM10 near Pb sources. Elevated Pb will show up in PM10 if it shows up in TSP. I can't imagine a scenario where TSP could show levels of Pb at or near the standard and PM10 would not. As noted above, incorporating a scaling factor into the standard would provide an adequate margin of safety to account for possible PM-Pb distributions that were skewed toward the >10 um particles.

One indicator option suggests using scaling Pb-PM10 monitoring data up to an equivalent Pb-TSP level in lieu of Pb-TSP monitoring data. Under what circumstances would it be appropriate to scale data (e.g., non-source oriented sites, low concentration sites) and when would it not be appropriate to scale data?

I don't think the data should be scaled, I think the standard should be set for Pb-PM10 at a level that is sufficiently protective of human health to account for possible ultra-coarse particles not collected by the sampler. That is, the scaling factor should be built into a PM10 standard, not applied to adjust PM10 data for comparison with a TSP standard. While I would prefer to see additional data on Pb-PM10—Pb-TSP relationships, I think EPA has sufficient information at the moment to make a reasonable estimate of that relationship, as shown in the memorandum from Kevin Cavender.

We have limited data collocated Pb-PM10 and Pb-TSP monitoring data. What types and "scaling factors" are appropriate to create using this data (e.g., non-source oriented, source oriented) ? What levels are appropriate for the types of scaling factors identified in the white paper?

It would be helpful to see the Pb-PM10—Pb-TSP relationship for a variety of sources and monitor sites – smelters, mines, roadways, other industrial sites, etc. However, I know this type of data is very limited. If time permits, EPA might attempt to collect additional data to better characterize the relationship.

2. Charge questions, attachment 2, Draft FRM and FEM criteria (memo from Joann Rice):

Is it appropriate to use the low-volume PM10 FRM sampler as the Pb-PM10 FRM sampler?
Yes.

What other PM10 samplers should be considered as either FRM or FEM for the Pb-PM10 FRM?

EPA should consider allowing TSP monitors to be compared to the Pb-PM10 NAAQS when (unadjusted) values are below the new Pb-PM10 standard. This would be conservative – concentrations from the TSP would be biased high relative to PM10 – and would allow the states/locals some flexibility in turnover to the newer technology.

Is XRF an appropriate Pb-PM10 FRM analysis method?

Yes, it improves the detection limit and has acceptable costs and thus should be permitted. The fact that it is nondestructive is a bonus.

Have we selected appropriate precision, bias, and method detection limit requirements for FEM evaluation?

All the proposed changes to the FRM and FEM criteria were reasonable.

3. Charge questions, attachment 3, Ambient Monitoring Network: *What types of monitoring sites should be emphasized in the network design (e.g., source oriented monitors, population monitors, near roadway monitors)?*

Concentrations near sources are elevated so the initial focus should be there; the requirements for which sources, based on emission limits, will clearly depend on the level of the standard. The roadway data are pretty limited and I'm not sure we have adequate information to make a determination yet about the extent of monitoring needed there; this will also depend strongly on the level of the new standard. Population monitors seem the least critical. Presumably the NCore network will be making Pb-PM10 measurements; can those be designated as the Pb population monitors as well?

We are considering proposing requirements for monitoring near sources exceeding an emissions threshold and discuss a number of options for determining this threshold in the white paper.

What options should be considered in establishing an emissions threshold?

We are considering proposing requirements for non-source oriented monitoring in large urban areas to provide additional information on ambient air concentrations in urban areas. Considering other monitoring priorities and a potential requirement for Pb monitoring near sources, what size of a non-source oriented Pb network is appropriate?

What factors should we base non-source oriented monitoring requirements on (e.g., population, design value)?

I don't think non-source oriented monitoring needs to be a priority for this pollutant. It is clear that near-source exposures are the ones that are most relevant. I'd be content with measurements from NCore, if all ~75 sites make speciated PM10 measurements. Between these measurements and the PM2.5 speciation network, there would be a respectable national data set to assess typical non-source concentrations in urban and rural environments.

We are considering proposing requirements for Pb monitoring near roadways and interstates. Is it appropriate to include separate monitoring requirements for near roadway monitoring, or should near roadway monitors be a part of the non-source oriented monitoring requirement?

I haven't seen enough data on how Pb varies with roadway type, traffic counts, or other factors to make a recommendation on this. I really think we need to collect more data before making this a requirement.

Under what conditions would it be appropriate to waive the monitoring requirements for either source or non-source oriented monitors?

If several years of monitoring data (PM-10 or TSP) demonstrate compliance or if a comprehensive modeling analysis for a source shows no potential for exceedances. However, it seems like some kind of maintenance monitoring should be required for sources that have the potential for exceedances, even if their monitoring data show compliance for a particular period.

4. Charge questions, attachment 4: Sampling Frequency Options:

What sampling frequency would be appropriate if the Pb NAAQS is based on a monthly average?

Is it appropriate to relax the sampling frequency in areas of low Pb concentration? If so, at what percent of the Pb NAAQS?

Is it appropriate to relax the sampling frequency in areas considerably higher than the NAAQS? If so, at what percent of the Pb NAAQS?

I'm not totally convinced that monthly averages are a necessity, but if the averaging time does change to 1 month, then the sampling frequency does need to increase to 1/3 day. As above, if monitors show attainment with the standard it is definitely reasonable to relax the frequency requirement. The 30% figure proposed was fine. I'm not sure I see the rationale to relaxing frequency in areas above the NAAQS. Presumably there will be actions taken to reduce concentrations, which we would want to document with measured values, and particularly with improved precision as we approach the standard.

Dr. Armistead (Ted) Russell

CASAC AAMM Ambient Air Lead Monitoring Lead

Armistead Russell

(Prepared for the March 25th teleconference)

While generally supportive of using PM10 monitoring for lead, as opposed to TSP, this is particularly true if a tighter standard is chosen. The relative benefits of going to a PM10 monitor, and issues with TSP monitors, were well laid out by CASAC in their letters regarding the NAAQS lead standard, so they will not be repeated here, except to say that a tighter standard is less near-source oriented than our current one, suggesting a finer cut point. Further, the data do not suggest that there will be a significant difference between the two in most cases that, along with a tighter standard, would suggest that using PM10 would not be protective of public health and also provide more and more usable data, further helping to protect public health. My major concern is that the TSP monitoring is becoming significantly less extensive with time, and there are areas with major sources that are not monitored.

Options for Lead NAAQS Indicator: Monitoring Implications

1. Considering issues such as sampler performance, size cuts, operator maintenance, integration with other measurement systems, and usefulness as the measurement system for the indicator, please describe the advantages and disadvantages of sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM₁₀.

Primary advantages of PM10 monitors include that they are less subject to sampling variability (e.g., size cuts, etc.), the PM being measured is more relevant to area-wide exposures and that there is a broader coverage with the PM10 monitors.

2. Is it appropriate to monitor for Pb-PM₁₀ near Pb sources? And if so, under what conditions?

Yes. While TSP monitors will pick up higher levels on, or near the fence line of large sources that emit larger sized lead-containing particles, the samples collected will be highly variable, and it is not immediately evident how quickly the higher levels would drop due to deposition. The PM10 samples would be more consistent and relevant to exposures of the population. It is not apparent that one can get just as good of an estimate of area-wide lead deposition from PM10 monitors.

3. One indicator option suggests using scaling Pb-PM₁₀ monitoring data up to an equivalent Pb-TSP level in lieu of Pb-TSP monitoring data. Under what circumstances would it be appropriate to scale data (e.g., non-source oriented sites, low concentration sites) and when would it not be appropriate to scale data?

As noted above, along with a tighter standard, scaling is not needed. The data suggest that the TSP and PM10 levels tend to be quite close.

Draft Federal Reference Method (FRM) and Federal Equivalent Method (FEM) Criteria for Lead in PM₁₀ (Pb-PM₁₀)

1. Is it appropriate to use the low-volume PM_{10c} FRM sampler as the Pb-PM₁₀ FRM sampler?

Yes. This monitor is well tested and widely used. The various analysis methods for lead can directly use the substrates used in this sampler.

2. What other PM₁₀ samplers should be considered as either FRM or FEM for the Pb-PM₁₀ FRM?

3. Is XRF an appropriate Pb-PM₁₀ FRM analysis method?

While XRF can suffer from non-uniform loading, it is still a very effective approach, and is compatible with other metals analysis, and is thus very cost effective. It should be specified as either the FRM or FEM (and if the latter, ICPMS should be the FRM).

4. What other analysis methods should be considered for FRM or FEM for the Pb-PM₁₀ FRM?

As noted above, XRF, if not the FRM, should be FEM, along with AA.

5. Have we selected appropriate precision, bias, and method detection limit requirements for FEM evaluation?.

This depends, in part, on the form of the standard (the longer the averaging, the less precision is needed). The levels provided appear reasonable.

Lead NAAQS Ambient Air Monitoring Network: Network Design Options Under Consideration

1. What types of monitoring sites should be emphasized in the network design (e.g., source oriented monitors, population monitors, near roadway monitors)?

Much of the focus of the PM₁₀ monitoring should be placed on source oriented monitoring, which includes near roadways.

2. We are considering proposing requirements for monitoring near sources exceeding an emissions threshold and discuss a number of options for determining this threshold in the white paper. What options should be considered in establishing an emissions threshold?

The analysis looks reasonable and well thought out. After a standard is set, one can back out what level of emissions will lead to likely non-attainment.

3. *We are considering proposing requirements for non-source oriented monitoring in large urban areas to provide additional information on ambient air concentrations in urban areas. Considering other monitoring priorities and a potential requirement for Pb monitoring near sources, what size of a non-source oriented Pb network is appropriate?*

Use of the PM2.5 speciation network can provide much of the needed information as to identifying areas that have a significant potential to be in non-attainment of at PM10 lead standard. I would suggest keeping this aspect relatively small.

4. *What factors should we base non-source oriented monitoring requirements on (e.g., population, design value) ?*

I would let the design of the non-source/non-roadway aspects of the PM10 network be driven by results from the PM2.5 speciation network (and probably even the roadway-oriented aspects of the network).

5. *We are considering proposing requirements for Pb monitoring near roadways and interstates. Is it appropriate to include separate monitoring requirements for near roadway monitoring, or should near roadway monitors be a part of the non-source oriented monitoring requirement?*

6. *Under what conditions would it be appropriate to waive the monitoring requirements for either source or non-source oriented monitors?*

Lead NAAQS Ambient Air Monitoring Network: Sampling Frequency Options Under Consideration

1. *What sampling frequency would be appropriate if the Pb NAAQS is based on a monthly average?*

I would give areas the choice of one in three (or more frequent) and one in six.

2. *Is it appropriate to relax the sampling frequency in areas of low Pb concentration? If so, at what percent of the Pb NAAQS?*

If a one in three frequency is chosen, yes, if the monitor indicates Pb levels at 50% or less of the NAAQS. If a one in six is chosen, then no.

3. *Is it appropriate to relax the sampling frequency in areas considerably higher than the NAAQS? If so, at what percent of the Pb NAAQS?*

No.

Dr. Jay Turner

Draft Comments Submitted by Jay R. Turner (March 25, 2008)

Attachment 1: Options for Lead NAAQS Indicator: Monitoring Implications

Charge Questions

- *Considering issues such as sampler performance, size cuts, operator maintenance, integration with other measurement systems, and usefulness as the measurement system for the indicator, please describe the advantages and disadvantages of sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM₁₀.*
- *Is it appropriate to monitor for Pb-PM₁₀ near Pb sources? And if so, under what conditions?*
- *One indicator option suggests using scaling Pb-PM₁₀ monitoring data up to an equivalent Pb-TSP level in lieu of Pb-TSP monitoring data. Under what circumstances would it be appropriate to scale data (e.g., non-source oriented sites, low concentration sites) and when would it not be appropriate to scale data?*
- *We have limited data collocated Pb-PM₁₀ and Pb-TSP monitoring data. What types and “scaling factors” are appropriate to create using this data (e.g., non-source oriented, source oriented)? What levels are appropriate for the types of scaling factors identified in the white paper?*

Comments

Clearly Pb-PM₁₀ measurements would be more closely aligned with the current particle-related compliance monitoring network. That said, the issue is the extent to which the standard must/should be directly tethered to the properties responsible for adverse effects. Ideally the indicator would reflect the particle size range of concern. As noted in the memorandum, this is complicated for Pb because the routes of exposure include ingestion as well as inhalation, and thus larger particle sizes are also of interest. If Pb-TSP is most representative of the particle properties that should be regulated, then the indicator should reflect this size range either directly (e.g., a Pb-TSP standard) or indirectly using another indicator such as Pb-PM₁₀ indicator which could be used in combination with a conservative adjustment to the Pb-TSP threshold value to arrive at a standard. Note in this case the application of an adjustment would take place in setting the standard (indicator and threshold value) rather than in the implementation of the standard (using Pb-PM₁₀ with scaling factors to assess compliance with the Pb-TSP standard).

Role of Pb-PM₁₀ measurements if the indicator is Pb-TSP. Sites with Pb-PM₁₀ greater than the threshold value for the Pb-TSP indicator clearly violate the standard. Thus, Pb-PM₁₀ could be used as a screening tool to identify areas of violation with subsequent compliance measurements using a suitable FRM or FEM technology. The gray zone would be areas that with Pb-PM₁₀ less than the threshold value for the Pb-TSP indicator. In this case, perhaps very conservative scaling factors (perhaps even more so than the values highlighted in the memorandum) could be used to assess the likelihood of noncompliance and trigger the deployment of FRM/FEM measurements.

Development of Scaling Factors. This is an interesting approach and more information would be helpful in assessing the potential application of scaling factors. Concerning the analysis presented in the memorandum, the regression suggests negligible increase in Pb-TSP compared to

Pb-PM10 for the non source-oriented sites. Was this an ordinary least squares regression (OLS)? If so, do the regression coefficients significantly change if a Deming-type regression is used? A footnote states the “original regression gave a negative zero intercept”; the question is whether the intercept is statistically distinguishable from the origin and this can be determined from the regression coefficients confidence intervals. Indeed, it would help to have 95% confidence levels on the regression coefficients. While there were 31 sites, virtually all of the concentration values are below $0.05 \mu\text{g}/\text{m}^3$. How many of the high concentration values (e.g., greater than $0.1 \mu\text{g}/\text{m}^3$) came from a single site? This would clarify whether the regression is being strongly influenced by a single site. The data representation in Figure 1 is visually misleading since axis ranges are similar but the plot has a high aspect ratio; the figure should be remade as a square with identical axis range (e.g., 0-0.3 $\mu\text{g}/\text{m}^3$). This will provide a better visual representation of the relatively high Pb-TSP values observed at relatively low Pb-PM10 values. For the source-oriented analysis with only two sources, is the data above $0.5 \mu\text{g}/\text{m}^3$ from a single source?

Attachment 2: Draft Federal Reference Method (FRM) and Federal Equivalent Method (FEM) Criteria for Lead in PM10 (Pb-PM10)

Charge Questions

- *Is it appropriate to use the low-volume PM10c FRM sampler as the Pb-PM10 FRM sampler?*
- *What other PM₁₀ samplers should be considered as either FRM or FEM for the Pb-PM10 FRM?*
- *Is XRF an appropriate Pb-PM10 FRM analysis method?*
- *What other analysis methods should be considered for FRM or FEM for the Pb-PM10 FRM?*
- *Have we selected appropriate precision, bias, and method detection limit requirements for FEM evaluation?*

Comments

If a Pb-PM10 indicator is selected, the low-volume PM10c sampler should be a suitable Pb-PM10 FRM sampler if the threshold value is sufficiently high to permit adequate data quality with analysis by XRF. Using the lowest reported candidate NAAQS level in Table 3 of Attachment 3 ($0.02 \mu\text{g}/\text{m}^3$) and a 4:1 scaling factor for Pb-TSP compared to Pb-PM10 (conservatively high for the source-oriented scaling factors in Attachment 1), the standard would be about 5 times the estimated XRF MDL (Table 1). Thus, as long as the NAAQS level is in the upper portion of the candidate range ($0.02 - 1.5 \mu\text{g}/\text{m}^3$) the combination of a low-volume PMc sampler and analysis by XRF should be adequate.

XRF does not require sample digestion. Should other analysis methods be considered FEM designation, it will be important that the specifics of the extraction protocol be part of the method. Prior intercomparison studies have clearly demonstrated that equivalency can be achieved for Pb between XRF and ICP-MS, but such findings might be limited to certain extraction methods.

Attachment 3: Lead NAAQS Ambient Air Monitoring Network: Network Design Options Under Consideration

Charge Questions

- *What types of monitoring sites should be emphasized in the network design (e.g., source oriented monitors, population monitors, near roadway monitors)?*
- *We are considering proposing requirements for monitoring near sources exceeding an emissions threshold and discuss a number of options for determining this threshold in the white paper. What options should be considered in establishing an emissions threshold?*
- *We are considering proposing requirements for non-source oriented monitoring in large urban areas to provide additional information on ambient air concentrations in urban areas. Considering other monitoring priorities and a potential requirement for Pb monitoring near sources, what size of a non-source oriented Pb network is appropriate?*
- *What factors should we base non-source oriented monitoring requirements on (e.g., population, design value)?*
- *We are considering proposing requirements for Pb monitoring near roadways and interstates. Is it appropriate to include separate monitoring requirements for near roadway monitoring, or should near roadway monitors be a part of the non-source oriented monitoring requirement?*
- *Under what conditions would it be appropriate to waive the monitoring requirements for either source or non-source oriented monitors?*

Comments

Emphasis should be placed on population monitoring and source oriented monitoring. In the latter case, it is important to consider historical industrial activities and not rely solely on contemporary emission inventories. For example, in East St. Louis it appears that a significant source of Pb-PM10 is from resuspension of Pb that was deposited from smelting activities that took place over the past decades. The Pb sources include not only the currently operating Pb smelter in Herculaneum but also other Pb smelters that previously operated in the Metro east area but have been shuttered for decades. Indeed, resuspension of historically-deposited Pb from prior smelting operations might partially explain the high ratio of ambient Pb to NEI emissions for AQS ID #171190010 in Granite City, IL (Table 2).

Concerning the analysis of near roadway emissions, it is noted that AQS ID#291892003 in Clayton, MO (Table 7) is located in metropolitan St. Louis and is likely impacted by plumes from the Herculaneum Pb smelter and potentially the aforementioned resuspension issue (although this site is somewhat more removed from the zone of historical smelting activity which was concentrated in the Metro East area).

Attachment 4: Lead NAAQS Ambient Air Monitoring Network: Sampling Frequency Options Under Consideration

Charge Questions

- *What sampling frequency would be appropriate if the Pb NAAQS is based on a monthly average?*

- *Is it appropriate to relax the sampling frequency in areas of low Pb concentration? If so, at what percent of the Pb NAAQS?*
- *Is it appropriate to relax the sampling frequency in areas considerably higher than the NAAQS? If so, at what percent of the Pb NAAQS?*

Comments

It is likely that 1-in-3 day or higher frequency would be needed to obtain a stable monthly average values. Given that the Pb will often be associated with the coarse PM fraction and the sensitivity of coarse PM to environmental conditions, sampling frequencies greater than 1-in-6 days will most certainly be needed in most cases.

Any thoughts on how concentration values below MDL would be imputed?

Dr. Warren H. White

Comments on Monitoring for Pb NAAQS

Warren H. White

AAMM Consultation, 25 March 2008 Teleconference

The charge questions given the Subcommittee include the following general groupings.

1. Selection of sampling technology and siting:

... *sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM10.*

... *monitor for Pb-PM10 near Pb sources?*

... *“scaling factors”?*

... *appropriate to use the low-volume PM10 FRM sampler?*

Purely as sampling technology, the advantages of the lo-vol PM₁₀ sampler over hi-vol TSP should be decisive. The PM₁₀ FRM collects a well-characterized and replicable sample on a clean substrate that is well-suited to XRF analysis. As I noted during the call, the uniformity of the sample deposit collected by any sampler can affect the precision of XRF analyses and should be verified before a final commitment to this approach. The fact that the lo-vol sampler is automated and already widely deployed is no small additional virtue. As several CASAC and AAMM commenters have already observed, a TSP-PM₁₀ scaling factor is an unnecessary distraction to the consideration of an order-of-magnitude change in the level.

EPA hesitates to adopt a 10-micron particle-size cut for Pb because ingestion of larger particles is believed a significant exposure pathway for children, the most sensitive group. The relevance of air monitoring for assessing the ingestion of ultra-coarse Pb depends on the following specific questions:

- Are the ingested particles from ongoing or historical air emissions?
- Do they arrive by air or are they tracked in by tires and shoes?

These questions lie in the areas of exposure- and risk-assessment presumably represented and actively considered by members of the CASAC Pb panel. They lie outside the areas of special expertise for which I and other members of the AAMM subcommittee were selected, so I defer to CASAC's unambiguous recommendations on sampling technology and siting.

2. Selection of analysis methods:

... *XRF an appropriate Pb-PM10 FRM analysis method?*

... *appropriate precision, bias, and method detection limit requirements for FEM?*

As the documentation notes, XRF is a relatively inexpensive and reasonably sensitive method that would also provide information on other metals of potential concern. A paper* that is currently in review at ES&T reports that the routine Pb-PM_{2.5} measurements in the CSN/STN and IMPROVE networks demonstrate XRF detection limits of 5-7 ng/cm², corresponding to air levels of ~3 ng/m³ for a 24h sample at 16.7 lpm. The paper defined this as the actual Pb concentration at which 95% of the observations detect Pb and report it to be significantly above blank levels.

* N.P. Hyslop and W.H. White, An Empirical Approach to Estimating Detection Limits using Collocated Data.

3. Sampling frequency options:

... *if the Pb NAAQS is based on a monthly average?*

... *in areas of low Pb concentration?*

... *in areas considerably higher than the NAAQS?*

One-in-six-day sampling clearly will not produce a reliable estimate of the monthly average. Determining an appropriate sampling frequency will require specification of acceptable rates for Type I and Type II decision errors, along with careful statistical modeling, and all this will be part of the DQO process that is undertaken before any new monitoring plan is finalized. During the call I asked whether there was any reason to believe that a month of high concentrations, in a year of otherwise low concentrations, is more harmful to a child's development than the same number of high concentrations scattered throughout the year. I have subsequently waded through enough of the Criteria Document to understand the prudence of considering current as well as cumulative exposures. However ingestion, where the questions of current vs. historical emissions and atmospheric transport vs. surface tracking still seem open, may not track current air concentrations.

For a given analytical method, there is little value in frequent sampling if concentrations are only marginally detectable. However I would be inclined to maintain normal sampling frequencies in any location with routinely measurable levels. As other committee members noted, at concentrations much higher than NAAQS there is a need to verify the atmospheric effects of the control measures undertaken. At concentrations well below NAAQS, we should keep in mind the possibility that next decade's Pb CASAC panel may find itself reviewing new evidence of adverse effects at levels below today's contemplated NAAQS.

Dr. Yousheng Zeng

CASAC AAMM Subcommittee Review of Ambient Air Monitoring Options for Lead (Pb) NAAQS Comments from AAMM Subcommittee Member Yousheng Zeng

Options for Lead NAAQS Indicator: Monitoring Implications

I think that Pb-PM₁₀ is a better indicator than Pb-TSP. Although Pb-TSP includes the contribution from larger particles, it will not serve well as an indicator for NAAQS. The primary concern for the Pb NAAQS and its indicator is air quality which directly relates to the inhalation pathway. Ingestion is an important Pb pathway; however, measuring Pb-TSP neither offers a quantitative connection to the level of ingestion exposure nor measures the Pb deposition rate that may be more relevant to ingestion. Since Pb-TSP is not a good indicator for these pathways, it is unclear what benefit will be gained from measuring Pb-TSP. If we monitor Pb-PM₁₀, at least we get a good indicator for the inhalation pathway.

With leaded gasoline phased out, vehicle tailpipe emissions are no longer a significant source of Pb. Stationary Pb sources are regulated by MACT and other federal and state rules. With these regulatory controls, Pb emissions from stationary sources are likely associated with PM₁₀. Very little of the PM emissions from these sources resemble TSP. If the objective of measuring ambient Pb levels is to monitor impacts of freshly emitted Pb, using Pb-PM₁₀ is better than Pb-TSP even for monitors near stationary sources. Pb-TSP is most likely re-suspended PM. Because it is re-suspended, it does not represent net deposition. If we want to measure the dust that may cause ingestion risk, it would be much more direct and easier to measure the Pb concentration in soil or dust samples.

Using Pb-PM₁₀ is consistent with monitoring PM₁₀. It helps streamline our monitoring efforts.

Using Pb-PM₁₀ will also be consistent with the New Source Review (NSR) permitting program. As part of NSR Prevention of Significant Deterioration (PSD) modeling analyses, emissions from stationary sources will be modeled. The data from the facilities will likely be based on PM₁₀.

Because the above reasons, we should replace Pb-TSP with Pb-PM₁₀. There is no value in scaling Pb-PM₁₀ monitoring data to an equivalent Pb-TSP level.

A more high level comment – If the inhalation pathway is not a significant health concern for Pb, why not remove Pb from the NAAQS list and manage it as other metals such as mercury, cadmium, etc.? Pb had its place in NAAQS when leaded gasoline was widely used. Now, the sources and health impacts of Pb are comparable to other metals. EPA uses MACT to control Pb sources. EPA can use the residual risk management approach or the approach used in hazardous waste combustion to minimize the health risk. This approach can incorporate both direct and indirect exposure, which has the benefit of addressing inhalation and ingestion pathways explicitly and not causing the confusion discussed above.

Draft Federal Reference Method (FRM) and Federal Equivalent Method (FEM) Criteria for Lead in PM₁₀ (Pb-PM₁₀)

I like the idea proposed by Mr. Dirk Felton to use AA as FRM for sample analysis and use XRF as FEM. EPA should evaluate this approach.

Lead NAAQS Ambient Air Monitoring Network: Network Design Options under Consideration

The third analysis in this EPA memo used the SCREEN3 model to help establish source oriented monitoring thresholds. The SCREEN3 model was used without considering building downwash, yet the modeling results were referred to as worst cases. Consideration of building downwash could yield higher modeled impacts than the results in this memo. It would be better to use site-specific, more realistic modeling analyses and the final Pb NAAQS to determine whether or not ambient monitoring is required near stationary sources.

In the PSD program, there is a threshold for site-specific, pre-construction Pb monitoring. The threshold is $0.1 \mu\text{g}/\text{m}^3$ for the current Pb NAAQS of $1.5 \mu\text{g}/\text{m}^3$, i.e., approximately 7% of the NAAQS. Once the new Pb NAAQS is finalized, EPA may consider using a similar approach to set the near-source monitoring requirements. For example, if the new Pb NAAQS is $0.2 \mu\text{g}/\text{m}^3$, the monitoring threshold will be $0.014 \mu\text{g}/\text{m}^3$. If site-specific modeling (with building downwash considered) yields a result higher than $0.014 \mu\text{g}/\text{m}^3$ (corresponding emission rate in tons per year may change from site to site due to different dispersion conditions), then a monitor should be installed.

The monitoring requirements should be somewhat flexible. If the monitoring results are always well below the NAAQS for one or two years, then the monitoring requirements may be reduced or waved.

Lead NAAQS Ambient Air Monitoring Network: Sampling Frequency Options under Consideration

If the averaging period for the Pb NAAQS changes from quarterly to monthly, then the sampling frequency should be changed. The specific frequency should be determined based on EPA's DQO model. EPA may consider relaxing the sampling frequency if the monitoring results are low – as an example, if average monthly results are 75% of the new Pb NAAQS, then the frequency can be relaxed from 1-in-2 to 1-in-3. If the results are only 50% of the new NAAQS, then the frequency may be further relaxed to 1-in-6.

Dr. Barbara Zielinska

CASAC Ambient Air Monitoring & Methods Subcommittee Teleconference: Comments on the Lead NAAQS Indicator, Monitoring and Sampling Frequency

Barbara Zielinska

In the January 22, 2008 letter to the EPA Administrator, the CASAC Lead Panel unanimously recommended that the Agency revise the indicator for lead sampling from TSP to PM₁₀. I continue to support this recommendation. The letter said:

“The agency should seize this opportunity to transition from TSP to PM₁₀, since the current review indicates a need for a substantial lowering of the lead NAAQS. If a standard is lowered by a factor of 10 to 100, it is unimportant if the indicator measures 10% or 15% less than the indicator selected 30 years ago. <.. > Rather than needing to arduously establish a large series of site-specific PM₁₀-Pb to TSP-Pb ratios (which would, in essence, constitute “fitting good data to bad”), it would be well within the Agency’s range of discretionary options to accept a slight loss of ultra-coarse lead at some monitoring sites by selecting an appropriately conservative level for the revised Pb NAAQS. Conversely, it would be a mistake to hold up the old TSP metric as the “gold standard” and only allow newer, better technology if it can reproduce the old, and seriously-flawed, sampler performance.”

I do agree with this reasoning.

Charge questions, Attachment 1, Options for Lead NAAQS Indicator: Monitoring Implications:

1. *Considering issues such as sampler performance, size cuts, operator maintenance, integration with other measurement systems, and usefulness as the measurement system for the indicator, please describe the advantages and disadvantages of sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM₁₀.*

As depicted in the individual comments attached to the January 22, 2008, CASAC letter, the TSP monitor represents old, 1950s technology and its accuracy is questionable. Hi-Vol TSP is non-size specific and its 50% size cut point of 30 – 50 µm particles depends greatly on a wind speed and direction. Contrary to Pb-TSP, Pb-PM₁₀ is inhalable and can travel longer distances from emission sources. Currently, TSP monitors are used only for Pb-TSP measurements. It is time that the EPA abandons this old technology and moves towards more precise PM₁₀ measurements. The great advantage of this strategy is the existing PM₁₀ network and thus a possibility of integration with other measurement systems.

2. *Is it appropriate to monitor for Pb-PM₁₀ near Pb sources? And if so, under what conditions?*

Yes, it is. Pb-PM₁₀ should be monitored near the major Pb sources to get the idea about Pb concentrations in this inhalable particle size range. Since Pb-containing larger than 10 µm particles may be important in the vicinity of large Pb point sources, such as Pb smelters or areas with con-

siderable Pb tailings, Pb-TSP monitoring should be continued in these areas. However, since the present TSP monitors are not accurate, the deployment of new, low-volume TSP samplers should be encouraged in these areas. There is certainly a need for getting a better understanding of Pb emissions in various particle sizes near the major Pb sources.

3. *One indicator option suggests using scaling Pb-PM10 monitoring data up to an equivalent Pb-TSP level in lieu of Pb-TSP monitoring data. Under what circumstances would it be appropriate to scale data (e.g., non-source oriented sites, low concentration sites) and when would it not be appropriate to scale data?*

I don't think scaling is a good idea. As emphasized in the CASAC's January 22, 2008 letter, a scaling is equivalent to fitting "good data to bad". Also, see my answer to charge question #4 below.

4. *We have limited data collocated Pb-P10 and Pb-TSP monitoring data. What types and "scaling factors" are appropriate to create using this data (e.g., non-source oriented, source oriented)? What levels are appropriate for the types of scaling factors identified in the white paper?*

Kevin Cavender's memo from March 3, 2008 emphasizes that all size Pb particles contribute to exposures and associated health effects. This is true, but it does not necessary mean that the Pb-PM₁₀ standard has to be tied to Pb-TSP. As shown in this document, non-source oriented Pb-TSP and Pb-PM₁₀ monitor data (Figure 1) show strong linear relationship and the ratio of Pb-PM₁₀ to Pb-TSP close to unity. Rather than trying to decide if Pb-TSP = Pb-PM₁₀*1.014+0.028 or +0.017, the Pb-PM₁₀ standard can be set at a slightly more conservative level. For source-oriented monitor data, Figure 2 indicates that the relationship between Pb-TSP and Pb-PM₁₀ is driven by the highest Pb concentrations. If the standard is set at the level below 0.5 µg/m³, it is unimportant if 1 µg/m³ Pb-PM₁₀ concentration corresponds to 1.39 or 2.2 µg/m³ of Pb-TSP. These values are much above the standard anyway. Rather, the relationship for the concentrations in the range of expected Pb standard (below 0.5 µg/m³) should be examined. This hasn't been done in this document; however, low accuracy of hi-Vol TSP samplers in this low concentration range, may make such a comparison not reliable.

Charge questions, Attachment 2, Draft FRM and FEM Criteria:

1. *Is it appropriate to use the low-volume PM10 FRM sampler as the Pb-PM10 FRM sampler?*

Yes, it is.

2. *What other PM10 samplers should be considered as either FRM or FEM for the Pb-PM10 FRM?*

Low-volume, sequential PM₁₀ FRM sampler is the best candidate for the Pb₁₀ FRM.

3. *Is XRF an appropriate Pb-PM10 FRM analysis method?*

I believe, yes, it is. XRF has an adequate sensitivity, is relatively inexpensive, non-destructive and allows for simultaneous measurements of other elements.

4. *What other analysis methods should be considered for FRM or FEM for the Pb-PM10 FRM?*

Modern analytical methods that can be used to quantify Pb include graphite furnace AA, ICP/atomic emission spectroscopy (ICP/AES), or ICP/mass spectrometry (ICP/MS).

5. *Have we selected appropriate precision, bias, and method detection limit requirements for FEM evaluation?*

The selected levels seem reasonable.

Charge questions, Attachment 3, Ambient Monitoring Network:

1. *What types of monitoring sites should be emphasized in the network design (e.g., source oriented monitors, population monitors, near roadway monitors)?*

All three types are useful, but in my opinion source oriented monitors should have the highest priority.

2. *We are considering proposing requirements for monitoring near sources exceeding an emissions threshold and discuss a number of options for determining this threshold in the white paper. What options should be considered in establishing an emissions threshold?*

All three options considered in this document appear to be reasonable. I favor the second option, which is based on the measurements near Pb sources. The maximum impact of $0.7 \mu\text{g}/\text{m}^3$ per tpy is consistent with the results obtained by the screening model. After the Pb standard is established, it should be possible to estimate what level of Pb emissions may lead to non-attainment. As noted in the document, since these threshold estimates are on the conservative side, it would be appropriate to include an option for the monitoring agencies to request a waiver for monitoring requirements if it could be shown that the source is very unlikely to cause the ambient air Pb concentrations to exceed 70% of the NAAQ Pb standard.

3. *We are considering proposing requirements for non-source oriented monitoring in large urban areas to provide additional information on ambient air concentrations in urban areas. Considering other monitoring priorities and a potential requirement for Pb monitoring near sources, what size of a non-source oriented Pb network is appropriate?*

Presumably NCore sites will perform Pb measurements. I don't think there is a need for separate Pb monitors, if the existing PM_{10} monitoring network can be utilized for this purpose. The additional analysis cost for Pb is very reasonable, if XRF method is used. In addition, $\text{PM}_{2.5}$ monitoring network can provide some information regarding Pb concentrations in this PM size fraction.

4. *What factors should we base non-source oriented monitoring requirements on (e.g., population, design value)?*

I suspect that the proximity to Pb sources may be important. Pb is a primary pollutant and it can be transported significant distances if present in the inhalable PM fraction.

5. *We are considering proposing requirements for Pb monitoring near roadways and inter-states. Is it appropriate to include separate monitoring requirements for near roadway monitoring, or should near roadway monitors be a part of the non-source oriented monitoring requirement?*

From data presented in this document (Table 7) it is not clear that the proximity to the roadway results in a higher Pb ambient concentration. Unless the NAAQS is established at a very low level ($<0.1 \mu\text{g}/\text{m}^3$) these monitors should probably be part of the non-source oriented monitoring network.

6. *Under what conditions would it be appropriate to waive the monitoring requirements for either source or non-source oriented monitors?*

This subject is addressed in question #2 above and in charge questions for attachment 4.

Charge questions, Attachment 4: Sampling Frequency Options:

1. *What sampling frequency would be appropriate if the Pb NAAQS is based on a monthly average?*

I agree with the document that if the Pb NAAQS is based on a monthly average, the 1-in-6 day sampling schedule is not frequent enough. A 1-in-3 day sampling frequency would yield 10 samples at 100% completeness or 7 at 75%. If this is enough or not, it is difficult to say without having the actual data that would allow for the estimate of uncertainties associated with different sampling frequencies. According to the document, the EPA plans to evaluate every day, 1-in-3 day and 1-in-6 day sampling frequencies and provide a general margin of error about a mean monthly estimate, focusing on estimates close to the proposed NAAQS. After this task is completed, it would be more obvious which sampling frequency is sufficient. The appropriate sampling frequency depends also on the statistical form of the Pb standard.

2. *Is it appropriate to relax the sampling frequency in areas of low Pb concentration? If so, at what percent of the Pb NAAQS?*

I think yes, it is. The document proposes a reduction in sampling frequency to 1-in-6 day, if all 12 monthly averages in a calendar year are lower than 30% of the Pb NAAQS. This seems reasonable to me, although 50% is probably sufficient. If an area elects to stay with the higher sampling frequency, this should be allowed.

3. *Is it appropriate to relax the sampling frequency in areas considerably higher than the NAAQS? If so, at what percent of the Pb NAAQS?*

No, these data are important for an adequate evaluation of potential health effects. In addition, if a source emits larger quantities of Pb periodically, more frequent monitoring may be considered.

One minor comment on Attachment 4: Figure 1 did not translate well in the Adobe PDF version of this document.

Appendix C – Agency’s Background and Charge Memorandum to the CASAC AAMM Subcommittee



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

March 3, 2008

MEMORANDUM

SUBJECT: CASAC Review of Ambient Air Monitoring Options for Lead (Pb) National Ambient Air Quality Standards (NAAQS)

FROM: Lewis Weinstock /Signed/
Acting Group Leader
Ambient Air Monitoring Group
Office of Air Quality Planning and Standards (D243-02)

TO: Fred Butterfield
Designated Federal Officer
Clean Air Scientific Advisory Committee
EPA Science Advisory Board Staff Office (1400F)

Attached are materials for review by the Clean Air Scientific Advisory Committee’s (CASAC) Ambient Air Monitoring and Methods (AAMM) Subcommittee. These materials will be the subjects of a consultation by the AAMM Subcommittee, scheduled for a teleconference to be held on March 25, 2008. I am requesting that you forward these materials to the AAMM Subcommittee to prepare for the consultation.

This project, entitled *Lead National Ambient Air Quality Standards (NAAQS) Review: Indicator and Monitoring Issues*, has been requested by EPA’s Office of Air Quality Planning and Standards (OAQPS), within EPA’s Office of Air and Radiation, in anticipation of potential revisions to the Pb NAAQS. The consultation will cover the lead (Pb) National Ambient Air Quality Standards (NAAQS) indicator as well as several monitoring topics under consideration for the upcoming notice of proposed rulemaking.

The consultation on the Pb NAAQS indicator will solicit Subcommittee comments and advice on several options that have been identified that would low volume Pb in PM₁₀ (Pb-PM₁₀) monitors to be used in the NAAQS surveillance monitoring network. The consultation on the draft Pb in PM₁₀ Federal Reference Method (FRM) and Federal Equivalent Method (FEM) criteria will assist EPA in developing these methods for use in measuring Pb in PM₁₀. The consultation on network design options will provide Subcommittee comments and advice on how the Pb

surveillance monitoring network should be structured to ensure proper monitoring coverage in areas likely to exceed the Pb NAAQS as well as provide information on typical population exposures in large urban areas. Finally, the consultation on sampling frequency will solicit Subcommittee comments on the appropriate sampling frequency in the case that the NAAQS averaging time is reduced to a monthly average. Charge questions associated with each part of the consultation are provided below.

The upcoming consultation will support the EPA by providing scientific advice as the EPA Administrator considers potential revisions to the Pb NAAQS; a notice of proposed rule-making is to be signed by May 1, 2008. Although this consultation does not call for a consensus statement, we are requesting each of the members provide his or her individual written comments on an expedited schedule to assist EPA in meeting the May 1, 2008 deadline for proposing the Pb NAAQS.

Following consultation, the Agency will issue a notice of proposed rulemaking with regard to our review of the Pb NAAQS, together with proposed changes to the associated monitoring requirements and the draft FRM for Pb in PM₁₀. Note that due to a court order, any monitoring requirement changes needed to implement the revised NAAQS must be promulgated at the same time as the final NAAQS standard. A peer review by the Subcommittee of the final FRM for Pb in PM₁₀ may be appropriate for future consideration.

We appreciate the efforts of you and the Subcommittee to prepare for the upcoming meeting and look forward to discussing this project in detail on March 25, 2008. Questions regarding the enclosed materials should be directed to Mr. Kevin Cavender, EPA-OAQPS (phone: 919-541-2364; e-mail: cavender.kevin@epa.gov).

Documents Associated with Subcommittee's Consultation:

The purpose of the upcoming CASAC AAMM Subcommittee meeting is to provide consultation on several aspects of potential ambient air monitoring requirements for the Pb NAAQS. The attached documents summarize the aspects being considered and provide various options under consideration. The Agency requests that the Subcommittee focus on the associated charge questions as part of its review.

- **Attachment 1 – *Options for Lead NAAQS Indicator: Monitoring Implications***

Background and Summary: Lead in total suspended particulate (TSP) is the current indicator for the lead NAAQS. Concerns have been raised regarding the quality of the data generated by the high volume TSP sampler due to perceived poor precision and an upper particle cut size that varies widely as a function of wind speed and direction. CASAC has recommended that EPA move towards the use of Pb in PM₁₀ as the indicator for the Pb NAAQS. In response to CASAC's concerns and comments, the EPA is considering options which that would allow Pb in PM₁₀ to be used as the indicator or to allow Pb in PM₁₀ data to be used in lieu of Pb in TSP data while maintaining Pb in TSP as the indicator. The attached document discusses the options under consideration for the Pb NAAQS indicator.

Charge Questions:

Considering issues such as sampler performance, size cuts, operator maintenance, integration with other measurement systems, and usefulness as the measurement system for the indicator, please describe the advantages and disadvantages of sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM₁₀.

Is it appropriate to monitor for Pb-PM₁₀ near Pb sources? And if so, under what conditions?

One indicator option suggests using scaling Pb-PM₁₀ monitoring data up to an equivalent Pb-TSP level in lieu of Pb-TSP monitoring data. Under what circumstances would it be appropriate to scale data (e.g., non-source oriented sites, low concentration sites) and when would it not be appropriate to scale data?

We have limited data collocated Pb-PM₁₀ and Pb-TSP monitoring data. What types and “scaling factors” are appropriate to create using this data (e.g., non-source oriented, source oriented)? What levels are appropriate for the types of scaling factors identified in the white paper?

- **Attachment 2 – Draft Federal Reference Method (FRM) and Federal Equivalent Method (FEM) Criteria for Lead in PM₁₀ (Pb-PM₁₀)**

Background and Summary: In order for monitoring data to be used in determination of attainment with the NAAQS, the data must be collected with a FRM or FEM. A number of options under consideration for the Pb NAAQS indicator would require the EPA to develop a FRM and FEM criteria for the measurement of Pb in PM₁₀. The EPA has drafted language for a FRM for Pb in PM₁₀ based on the existing FRM sampler for low volume PM_{10c} in Appendix O to Part 50 of the Code of Federal Regulations (CFR) coupled with analysis by x-ray fluorescence (XRF). In addition, minor changes to the FEM criteria for Pb methods have been drafted to make these requirements consistent with the draft FRM for Pb in PM₁₀. The attached document summarizes the rationale for the proposed changes and includes a draft of the FRM and FEM CFR text.

Charge Questions:

Is it appropriate to use the low-volume PM_{10c} FRM sampler as the Pb-PM₁₀ FRM sampler?

What other PM₁₀ samplers should be considered as either FRM or FEM for the Pb-PM₁₀ FRM?

Is XRF an appropriate Pb-PM₁₀ FRM analysis method?

What other analysis methods should be considered for FRM or FEM for the Pb-PM₁₀ FRM?

Have we selected appropriate precision, bias, and method detection limit requirements for FEM evaluation?

- **Attachment 3 – Lead NAAQS Ambient Air Monitoring Network: Network Design Options Under Consideration**

Background and Summary: The existing Pb-TSP network has decreased substantially over the last few decades. In 1980 there were over 900 Pb-TSP sites; this number has been reduced to approximately 200 sites. Several states have no Pb-TSP samplers resulting in large portions of the country with no data on current ambient Pb-TSP concentrations. In addition, many of the largest Pb-emitting sources in the country do not have nearby samplers, and there is substantial uncertainty about ambient air Pb levels resulting from historic Pb deposits near roadways. As a result, the existing network and network requirements may not be adequate to support a lower Pb NAAQS. The attached document identifies a number of network design options under consideration.

Charge Questions:

What types of monitoring sites should be emphasized in the network design (e.g., source oriented monitors, population monitors, near roadway monitors)?

We are considering proposing requirements for monitoring near sources exceeding an emissions threshold and discuss a number of options for determining this threshold in the white paper. What options should be considered in establishing an emissions threshold?

We are considering proposing requirements for non-source oriented monitoring in large urban areas to provide additional information on ambient air concentrations in urban areas. Considering other monitoring priorities and a potential requirement for Pb monitoring near sources, what size of a non-source oriented Pb network is appropriate?

What factors should we base non-source oriented monitoring requirements on (e.g., population, design value)?

We are considering proposing requirements for Pb monitoring near roadways and interstates. Is it appropriate to include separate monitoring requirements for near roadway monitoring, or should near roadway monitors be a part of the non-source oriented monitoring requirement?

Under what conditions would it be appropriate to waive the monitoring requirements for either source or non-source oriented monitors?

- **Attachment 4 – Lead NAAQS Ambient Air Monitoring Network: Sampling Frequency Options Under Consideration**

Background and Summary: The current Pb sampling frequency requirement is for one 24-hour sample every six days. For the current NAAQS, which is based on a quarterly average, the 1-in-6 sampling schedule yields 15 samples per quarter on average with 100% completeness, or 12 samples with 75% completeness. A change to a monthly averaging period would result in between 4 and 6 samples per month at the current sampling frequency with 100%

completeness, or between 3 and 5 samples with 75% completeness. If we change the averaging time to a monthly average, we may need to increase the sampling frequency to better reflect ambient Pb concentrations during the averaging period. The attached document describes several options we are considering which would increase the sampling frequency.

Charge Questions:

What sampling frequency would be appropriate if the Pb NAAQS is based on a monthly average?

Is it appropriate to relax the sampling frequency in areas of low Pb concentration? If so, at what percent of the Pb NAAQS?

Is it appropriate to relax the sampling frequency in areas considerably higher than the NAAQS? If so, at what percent of the Pb NAAQS?

Attachments

cc: Richard Wayland, OAQPS/AQAD
Bill Lamason, OAQPS/AQAD
Deirdre Murphy, OAQPS/HEID
Karen Martin, OAQPS/HEID
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