Lead (Pb) Monitoring Methods
Lead (Pb) Monitoring Methods

- **TSP is the indicator for Pb**
  - Required for determining whether an area attains the NAAQS
  - Data reported at local conditions
- **Pb in PM$_{10}$**
  - Use of Pb-PM$_{10}$ can be approved by the Regional Administrator in certain cases
  - See 40 CFR Part 58, Appendix C (Section 2.10) for more detail
  - Data also reported at local conditions
Sampling Technique for Pb-TSP

- High volume sampler already approved as an Federal Reference Method (FRM)
  - 40 CFR Part 50, Appendix B
- Includes ultra-coarse particles that might be missed by PM$_{10}$ sampling
- Sampling efficiency known to vary according to wind speed and direction
- Acceptable precision and bias
  - Precision 15%; Bias 5%
- Low volume TSP alternatives have not been fully characterized
Sampling Technique for Pb-PM$_{10}$

- Low-volume PM$_{10}$ samplers already approved as FRMs.

- **Low-volume PM$_{10}$** samplers that meet the requirements described in Appendix O of Part 50 are approved for monitoring to meet NAAQS comparison objectives.

- Advantages include:
  - Omni-directional inlet
  - Supports sequential operation
  - Sample data can also support PM$_{10}$ NAAQS (standard conditions) and PM$_{10-2.5}$ (local conditions)

- If it’s an approved FRM for PM$_{2.5}$ then you can use it for Pb-PM$_{10}$.

- **High-volume PM$_{10}$** samplers are not approved for Pb-PM$_{10}$ in support of NAAQS.
Analysis Methods, Lead in TSP and PM$_{10}$
Pb Analysis Methods, TSP (Pb-TSP)

- FRM based on Flame Atomic Absorption (AA) as described in 40 CFR part 50, Appendix G (1978)
- Existing Federal Equivalent Methods (FEMs) approved for Pb-TSP
  - Any of the existing FEMs can be used
- Advances in measurement technology warrant development of new FRMs and FEMs
  - EPA is planning to develop a new FRM for Pb-TSP
    - FRM development process is beginning now
    - Rule making is required
    - Expect CASAC peer review and proposed rule in 2010
New Pb-TSP FEMs

• A new FEM for Pb-TSP has been submitted to ORD for review
  – Inductively-coupled plasma mass spectrometry (ICP-MS)

• EPA plans to pursue submittal of additional FEMs
  – Inductively-coupled plasma atomic emission spectrometry (ICP-AES)

• Moving towards universally-applicable or “generic” FEMs

• GSA Task Order Option – ICP-MS
  – In place January/February 2010
  – Does not include reporting to AQS
Pb Analysis Methods, PM\textsubscript{10} (Pb-PM\textsubscript{10})

- FRM based on Energy Dispersive X-ray Fluorescence (XRF) as described in 40 CFR Part 50, Appendix Q
- FEMs (none yet approved)
- EPA working on new FEMs for Pb-PM\textsubscript{10}
  - Inductively-coupled plasma mass spectrometry (ICP-MS)
  - Inductively-coupled plasma atomic emission spectrometry (ICP-AES)
    - May be available in 2010
    - Field sampling by Missouri DEP
- GSA Task Order Option – XRF
  - In place January/February 2010
  - Does not include reporting to AQS
# Preliminary MDLs for Pb in TSP and PM$_{10}$

MDL Requirement is 5% of NAAQS or 0.0075 µg/m$^3$ (7.5 ng/m$^3$)

<table>
<thead>
<tr>
<th>Filter: MDL (ng/m$^3$)</th>
<th>Sample Analysis Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSP: 0.060$^U$; 0.030$^H$</td>
<td>Graphite Furnace Atomic Absorption (GFAA)</td>
</tr>
<tr>
<td>PM$_{10}$: 0.7$^a$</td>
<td>Energy-dispersive X-Ray Fluorescence (EDXRF)</td>
</tr>
</tbody>
</table>
| PM$_{10}$: 0.19$^U$; 0.18$^H$  
TSP: 0.037$^U$; 0.015$^H$ | Inductively Coupled Plasma Mass Spectrometry (ICP-MS)       |
| PM$_{10}$: 2.2$^U$; 4.6$^H$  
TSP: 0.57$^U$; 0.34$^H$ | Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES) |

$^U$ Heated Ultrasonic  
$^H$ Hot Block  
$^a$ 40 CFR Part 50, Appendix Q
Need More Information on Pb?

• Technical (Q&A) Notes Available
  – Network Design
  – Modeling of Pb Sources
  – Emissions Inventories
  – Sampling Methods
  – Analysis Methods
  – Quality Assurance
  – Reporting Data to AQS

• [www.epa.gov/ttn/amtic/pb-monitoring.html](http://www.epa.gov/ttn/amtic/pb-monitoring.html)
Particulate Matter (PM) Monitoring Update
Current PM NAAQS Review

Monitoring Section 7.0
Integrated Review Plan for the National Ambient Air Quality Standards for Particulate Matter
Integrated Review Plan
Final – March 2008

Monitoring Section 3.4
Integrated Science Assessment
2nd Draft – July 2009
Final – Dec 2009
Integrated Science Assessment
First External Review Draft

Monitoring Section 4.1
Urban Visibility Assessment
Preliminary Draft - Sept 2009
2nd Draft & Final – 2010
Urban Visibility Assessment
Draft – Sept 2009
Final – Dec 2009

Monitoring Sections 2.3 & 2.4
Policy Assessment for the Review of the Particulate Matter National Ambient Air Quality Standards
Preliminary Draft
September 2009

Proposed Rule – 2010
Final Rule – 2011

More information: www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html
Urban-Focused Visibility Assessment

• Supports PM Secondary NAAQS

• Potential Indicators
  – Total light extinction (light scattering and light absorption)
  – Hourly PM$_{2.5}$ Mass

• Potential Monitoring for the Indicator
  – Direct measure of light extinction
    • Examples: Nephelometer and Aethalometer™
    • Engaging ORD on measurement methods
      – Cleveland Multiple Air Pollutant Study (CMAPS)
  – Measurement of hourly PM$_{2.5}$ mass
    • Continuous PM$_{2.5}$ mass FEMs already available
  – CASAC Advisory on methods – early 2010
### Types of PM Monitoring Networks

*P = Primary purpose, S = Secondary purpose*

<table>
<thead>
<tr>
<th>PM Indicator</th>
<th>Network Element</th>
<th>Compare to Standards</th>
<th>Public Reporting - AQI</th>
<th>Develop control strategies</th>
<th>Assess progress/trends</th>
<th>Health/Exposure</th>
<th>Assess Visibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{2.5}$</td>
<td>FRM Mass</td>
<td>P</td>
<td></td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>Continuous Mass</td>
<td><strong>Now Available</strong></td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>Chemical Speciation Network</td>
<td></td>
<td></td>
<td>P</td>
<td>P</td>
<td>S</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>IMPROVE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S</td>
<td>P</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>FRM Mass</td>
<td>P</td>
<td></td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>FEM Continuous</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>PM$_{10-2.5}$</td>
<td>FRM/FEM Mass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P</td>
<td>P</td>
</tr>
</tbody>
</table>
Approximately 700 stations in 2008
Expect some increase as FEMs are now available
Implementation of Continuous PM$_{2.5}$ FEMs

• First approved continuous PM$_{2.5}$ FEM designated - March 2008
  – Five FEMs now approved

• Memo issued July 2008 on the use of continuous FEM data at SLAMS

• Memo covered several issues:
  – Implementation and method evaluation
  – Reporting of data to AQS
  – Use of data for the NAAQS

• More information posted at:
  – [www.epa.gov/ttn/amtic/datamang.html](http://www.epa.gov/ttn/amtic/datamang.html)
Approximately 940 sites in 2008
Expect some decrease as continuous FEMs implemented
• Approximately 868 sites in 2008
• PM$_{10}$ still reported at STP (Standard Temperature and Pressure)
• Some areas operating more sites than required
• Approximately 190 IMPROVE and 200 CSN sites in 2008
• Networks relatively stable at this time
CSN Carbon Method Implementation

- EPA and monitoring agencies have implemented changes to the carbon method
  - Sampling and analysis protocols both changed
- **Needed for consistency** in organic and elemental carbon measurements between the CSN and IMPROVE
- Sampling with URG3000N Carbon Sampler
- Analysis performed using IMPROVE_A TOR analysis method
- Field blanks and backup filters collected at all sites
- Blank correction protocol to be determined
- 3 Phase implementation – completed October 2009
- Detailed Information: [www.epa.gov/ttn/amtic/specurg3000.html](http://www.epa.gov/ttn/amtic/specurg3000.html)
Old CSN (SASS) and IMPROVE
Birmingham, AL (Jan 1 – Dec 31, 2006)

Collocated Old CSN TOT and IMPROVE_A TOT 2006

CSN data adjusted with average field/trip blank value for period
1.08 ug/m³ OC
0.01 ug/m³ EC

IMPROVE EC = 1.31 CSN EC + 0.07
R² = 0.89
n = 118

IMPROVE OC = 0.72 CSN OC + 0.03
R² = 0.89
n = 119
New CSN (3000N) and IMPROVE
Birmingham, AL (May 1 – Dec 31, 2007)

Collocated New CSN and IMPROVE_A TOR 2007

CSN 3000N data adjusted with monthly backup filter for period
0.33 to 0.67 ug/m³ OC
0.01 to 0.03 ug/m³ EC

IMPROVE EC = 1.00 CSN EC - 0.05
R² = 0.95
n = 78

IMPROVE OC = 1.00 CSN OC + 0.11
R² = 0.97
n = 78
New PM$_{2.5}$ CSN Laboratory Contract

- New Contract Awarded January 2009
- Changes...
  - Reduced XRF target list
    - Removed 15 elements rarely detected and mercury
    - Retained 24 elements measured by IMPROVE
  - Addition of optical light absorption measurements
  - Ability to order line items separately
  - Addition of tabular metadata reports
    - Chronological documentation of changes to lab and field procedures
    - Chronological documentation of measurement issues identified, data affected, and resolutions implemented
## Recently Approved FRMs/FEMs for PM

<table>
<thead>
<tr>
<th>PM$_{2.5}$</th>
<th>PM$_{10-2.5}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met One BAM 1020 Measurement System</td>
<td>BGI Model PQ200 Sampler Pair</td>
</tr>
<tr>
<td>Thermo TEOM® 1400a Monitor with Series 8500C FDMS®</td>
<td>Met One BAM 1020 Measurement System</td>
</tr>
<tr>
<td>Thermo TEOM® 1405-DF Dichotomous Monitor with FDMS®</td>
<td>Thermo Dichotomous Partisol® -Plus Model 2025-D Sequential</td>
</tr>
<tr>
<td>Thermo Partisol® 2000-D Dichotomous Sampler</td>
<td>Thermo Partisol® 2000-D Dichotomous Sampler</td>
</tr>
<tr>
<td>Thermo Dichotomous Partisol® -Plus Model 2025-D Sequential</td>
<td>Thermo Partisol® Model 2000 Sampler Pair</td>
</tr>
<tr>
<td>Thermo FH62C14-DHS Continuous Ambient Particle Monitor</td>
<td>Thermo Partisol® -Plus Model 2025 Sequential Sampler Pair</td>
</tr>
<tr>
<td>Thermo Model 5030 SHARP Monitor</td>
<td></td>
</tr>
</tbody>
</table>

PM_{10-2.5} Monitoring

- NCore requirements finalized in 2006 as part of the last revision to the PM NAAQS and monitoring regulations
- Although PM_{10} was retained as the indicator, the PM_{10-2.5} requirements were finalized to initiate characterization
- PM_{10-2.5} FEMs have been approved
- **PM_{10-2.5} mass monitoring required as part of NCore**
  - Monitoring plans were due by July 1, 2009
  - Full network deployment by January 1, 2011
- Primary objective for PM_{10-2.5} speciation data is to support further research in understanding the chemical composition and sources
- **EPA will not be requiring deployment of PM_{10-2.5} speciation sampling by January 2011 at NCore stations**
**PM$_{10-2.5}$ Speciation Monitoring Pilot**

- Some measurement issues not yet resolved
- Prior to future implementation, a small pilot project will occur in 2010 at two locations
  - Primarily using PM$_{10-2.5}$ FRMs and dichot FEMs
  - Goal to identify key target species
  - Further development of analysis methods
  - Develop Standard Operating Procedures (SOPs)
- CASAC consultation on pilot February 2009
  - Supported pilot monitoring effort
  - Strongly recommended use of dichot samplers
  - Recommended analysis of pilot data prior to network deployment…“move slowly”
Questions?