The Lead (Pb)-PEP R EVOLUTION—
Where we’ve been
Where we are
Where we’re going

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A special thanks to all the Pb-PEP participants who have helped launch this program!

All data presented are preliminary and have not undergone final EPA review and validation.
The Lead (Pb)-PEP REVOLUTION—
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• Preview:
  – Recent regulatory history
  – The QA requirements for Pb-PEP
  – TSP, airport sites, NCore, and low volume PM-10 Pb sampling
  – The early challenges with TSP Pb
  – Tools and remedies
  – The TSP results 2010 through 2011 and partially in 2012
The Lead (Pb)-PEP REVOLUTION—
Where we’ve been

Regulatory History

- November 12, 2008 Primary NAAQS revised
  - From 1.5 micrograms per cubic meter (µg/m³) to 0.15 µg/m³,
  - measured as total suspended particles (TSP)
  - Secondary (welfare-based) standard identical

- December 10, 2010
  - Monitoring threshold at proximity of source lowered from 1 tpy to 0.5 tpy
  - Deploy low-volume PM-10 monitoring at NCORE sites at CBSAs with a population of 500,000 people
  - 15 Airports monitored for TSP-Pb for one year
§ 58.16 Data submittal and archiving requirements.

(a) The State, or where appropriate, local agency, shall report ... all ambient air quality data and associated quality assurance data for ...; Pb–TSP mass concentration; Pb– PM$_{10}$ mass concentration;...
Pb-PEP Independent Audit Frequencies

- **15% of all sites audited per year;** all sites in 6 years
- **If 5 sites or fewer → 5 Audits per year**
  - 1 with an Independent PEP sampler
  - 4 filters collected from network precision samplers and sent to EPA’s Independent lab
- **If 5 sites or more → 8 audits per year**
  - 2 collocations with a PEP Sampler
§ 58 Appendix D 4.5(a)iii State and, where appropriate, local agencies are required to conduct ambient air Pb monitoring near each of the airports listed in Table D–3A for a period of 12 consecutive months .... Data collected shall be submitted to the Air Quality System database according to the requirements of 40 CFR part 58.16.
§ 58.20(b) Any SPM data collected by an air monitoring agency using a Federal reference method (FRM), Federal equivalent method (FEM), or approved regional method (ARM) must meet the requirements of §58.11, §58.12, and appendix A to this part or an approved alternative to appendix A to this part.
## Required Collocation and PEP Audit Summary

<table>
<thead>
<tr>
<th>Pb Sampler in network</th>
<th>Host PQAO</th>
<th>No. Collocation sites.</th>
<th>No. Independent PEP Audits</th>
<th>No. SLT Site-Colloc. filters to EPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSP</td>
<td>SLT</td>
<td>15% or at least one</td>
<td>1 or 2; all in 6 yrs</td>
<td>4 or 6 spread across sites and qtrs.</td>
</tr>
<tr>
<td>TSP NCore</td>
<td>SLT</td>
<td>If only SLT TSP site, “0”</td>
<td>Include in SLT PQAO</td>
<td>Covered by SLT PQAO Requirements</td>
</tr>
<tr>
<td>TSP Airport</td>
<td>SLT</td>
<td>Optional-part of PQAO</td>
<td>Include in SLT PQAO</td>
<td>Optional unless only SLT PQAO Site</td>
</tr>
<tr>
<td>PM-10 Low Vol</td>
<td>SLT</td>
<td>15% or at least one</td>
<td>Include with respective Region’s NCore PQAO Rotation</td>
<td>1 filter per site per qtr.</td>
</tr>
<tr>
<td>PM-10 Low Vol NCore</td>
<td>NCore</td>
<td>15% --3 based on current site count</td>
<td>Every Region with site conducts 1 per year; all in 6 yrs</td>
<td>Covered by 5 NCore Colloc. sites</td>
</tr>
<tr>
<td>PM-10 Low Vol NCore Collocated</td>
<td>NCore</td>
<td>5 sites have been approved as of Jan 2012</td>
<td>First year and in the Regional 6 yr Rotation thereafter</td>
<td>1 filter per site per qtr.</td>
</tr>
</tbody>
</table>
The Lead (Pb)-PEP REVOLUTION—Where we are

QA Goals

- Collocated sampler precision
  - Coefficient of variation 20% at the 90% confidence limit
- Overall absolute bias
  - Upper bound goal of 15%
- Goals assessed on 3 years of data at the PQAO level of aggregation.
- SLT Site collocated PEP data will be evaluated separately
- 100% Completeness!!!
The Lead (Pb)-PEP REVOLUTION—Where we’ve been—Where we’re going

Challenges in the TSP Pb PEP

• Finding a suitable “Gold Standard” sampler
  – Evolving from Mass-Flow Controlled back to Volume-Flow controlled
  – Still have some questions about high altitude sampling
  – Measuring fleet precision is a logistical challenge
The Lead (Pb)-PEP REVOLUTION—
Where we’ve been—Where we’re going

Challenges in the TSP Pb PEP

- **Sampler Issues**
  - Temperature probe hysteresis and lethargic response
  - Pressure transducers
  - Calibration drift
  - Data acquisition software and hardware connections
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Where we’ve been—Where we’re going

Challenges in the TSP Pb PEP Data

- Complicated Data Flow
  - EPA or Independent Audits
  - SLT Site-Collocated Audits
- Missing field data
- Data quality issues
- Data matching issues
- Bias data loss
Data Flow for EPA or Independent Audits

COC originates with Auditor

SLT Routine

Filter

Field Data

SLT Analysis Lab

EPA or Independent

Filter

Field Data

EPA Analysis Lab

RTI

http://AirQA.RTI.ORG

SLT Reporting Agency

Lab Data

AQS

Lab Data

PEP Audit Matched to SLT Routine

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Data Flow for SLT Site-Collocated Audits

COC originates with Auditor

SLT Routine

SLT Site-Collocated

SLT Analysis Lab

EPA Analysis Lab

RTI

http://AirQA.RTI.ORG

SLT Reporting Agency

AQS

PEP Data Matched to SLT Routine
Incomplete and/or Incorrect Data Contribute to Data Matching and Validation Problems

Comparison of Field and Lab Record Counts

Missing some field data. Differences could be attributed to:

- SLTs may be submitting field and trip blanks (these can’t be entered on the website).
- Filters used and sent to lab but no field data entered (likely scenario).

![Bar chart comparing field and lab records](chart.png)

- More lab results than field data!
- Includes EPA field blanks and parking lot study filters
Both Field and Lab Results are Required for a Complete Audit.

Filters with Matched Field and Lab Data

- 348 records matched
- 71 blanks
- 88 parking lot
- 36 EPA
- 153 SLT
- 189 (54%) PEP Audits
Missing COC/FDS Information

- Problems with entering data from scanned forms:
  - Difficult and time consuming for RTI to enter.
  - No contact info (needed to resolve questions).

HELP! We need the SLTs to register and enter their own data.
Missing COC/FDS data led to reliance on scanned images (often difficult to read)

Pb-PEP Collocated Hi Volume Sample Field Data Sheet and Chain-of-Custody Form
(*Red- Required Field)

### PART I - SAMPLING EVENT INFORMATION

<table>
<thead>
<tr>
<th>AQS Site ID*</th>
<th>17-119-0040</th>
<th>Filter ID Number*</th>
<th>03512076</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Name*</td>
<td>Granite City, IL &amp; Madison</td>
<td>Collocated Sampler POC</td>
<td>1</td>
</tr>
<tr>
<td>Site Operator*</td>
<td>Dave Huffman</td>
<td>Primary Sampler Serial No.</td>
<td></td>
</tr>
<tr>
<td>Other Operators or Observers</td>
<td></td>
<td>Collocated Sampler Serial No.</td>
<td>A22209</td>
</tr>
</tbody>
</table>

### PART II - SAMPLING EVENT FILTER AND EXPOSURE DATA

<table>
<thead>
<tr>
<th>Sample Date (HMDD-MM-YY)</th>
<th>01/19/11</th>
<th>Sample Collection Date</th>
<th>01/03/11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elapsed Time (ET) (Hr)</td>
<td>34</td>
<td>Total Volume Ambient (m³)</td>
<td>1.350</td>
</tr>
<tr>
<td>Start Date/Time</td>
<td>01/03/11 10:00</td>
<td>Initial Flow Rate Ambient (m³/min)</td>
<td>1.350</td>
</tr>
<tr>
<td>Stop Date/Time</td>
<td>01/03/11 14:20</td>
<td>Flag Flow Rate Ambient (m³/min)</td>
<td>1.350</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flow Rate Ambient (m³/min)</th>
<th>Max: 1.350</th>
<th>Min: 1.260</th>
<th>Avg:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>Max:</td>
<td>Min: 1.260</td>
<td>Avg:</td>
</tr>
<tr>
<td>Barometric Pressure (mm Hg)</td>
<td>Max:</td>
<td>Min:</td>
<td>Avg:</td>
</tr>
</tbody>
</table>

Sampler Flags: Field Flags:

<table>
<thead>
<tr>
<th>Shipment Date</th>
<th>01/03/11</th>
<th>*Shipped Via</th>
<th>UPS</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affiliation of Shipper</td>
<td>UPS Real Day Air</td>
<td>*Address</td>
<td>CA 940 9-04</td>
<td></td>
</tr>
<tr>
<td>*Ship by (Signature)</td>
<td>Michelle Hudson</td>
<td>*Hazardous</td>
<td>CA 940 9-04</td>
<td></td>
</tr>
</tbody>
</table>

Do you want a portion of the filter sent back to the POAO? Y or N | Y

### PART VI - NATIONAL Pb-PEP LABORATORY RECEIVING INFORMATION

*Date Received* 01/19/11 10:30 | Received by Signature: [Signature] | Integrity Flag: OK

Notes:
Pb-PEP Audits in 2010

6/5/2012  U.S. Environmental Protection Agency  20
Pb-PEP Audits in 2011

- ▲ SLT Site-Collocated Audits
- ▲ EPA or Independent Audits

6/5/2012 U.S. Environmental Protection Agency
Hi-Vol PEP Audits by Year
(filters with field and lab data matched up)

<table>
<thead>
<tr>
<th>Year</th>
<th>EPA or Independent Audits</th>
<th>SLT Site-Collocated Audits</th>
<th>Total Audits</th>
<th>EPA matched to Routine</th>
<th>SLT matched to Routine</th>
<th>Total matched to Routine</th>
<th>Data Loss (% of Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>6</td>
<td>88</td>
<td>94</td>
<td>4</td>
<td>62</td>
<td>66</td>
<td>30%</td>
</tr>
<tr>
<td>2011</td>
<td>29 (42% of goal*)</td>
<td>60</td>
<td>89</td>
<td>17 (25% of goal*)</td>
<td>37</td>
<td>54</td>
<td>39%</td>
</tr>
<tr>
<td>2012</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>67%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>36</td>
<td>153</td>
<td>189</td>
<td>21</td>
<td>101</td>
<td>122</td>
<td>35%</td>
</tr>
</tbody>
</table>

* Annual EPA goal is ~69 audits per year

- 43 PEP audits match to invalid routine data in AQS
- 8 PEP audits have invalid AQS Site IDs (not 9 character site codes)
### Reasons Routine Values were Invalidated

#### AQS Null Data Codes

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Null Data Code</th>
<th>Description</th>
<th>Number of Audits</th>
</tr>
</thead>
<tbody>
<tr>
<td>14129</td>
<td>AM</td>
<td>MISCELLANEOUS VOID</td>
<td>10</td>
</tr>
<tr>
<td>14129</td>
<td>AL</td>
<td>VOIDED BY OPERATOR</td>
<td>8</td>
</tr>
<tr>
<td>14129</td>
<td>AZ</td>
<td>Q C AUDIT (AUDT)</td>
<td>7</td>
</tr>
<tr>
<td>14129</td>
<td>AR</td>
<td>LAB ERROR</td>
<td>5</td>
</tr>
<tr>
<td>14129</td>
<td>AU</td>
<td>MONITORING WAIVED</td>
<td>3</td>
</tr>
<tr>
<td>14129</td>
<td>AQ</td>
<td>COLLECTION ERROR</td>
<td>3</td>
</tr>
<tr>
<td>14129</td>
<td>AN</td>
<td>MACHINE MALFUNCTION</td>
<td>3</td>
</tr>
<tr>
<td>14129</td>
<td>AV</td>
<td>POWER FAILURE (POWR)</td>
<td>2</td>
</tr>
<tr>
<td>14129</td>
<td>AI</td>
<td>INSUFFICIENT DATA (CAN'T CALCULATE)</td>
<td>2</td>
</tr>
<tr>
<td>14129</td>
<td>AH</td>
<td>SAMPLE FLOW RATE OUT OF LIMITS</td>
<td>2</td>
</tr>
<tr>
<td>14129</td>
<td>BL</td>
<td>CODE NOT DEFINED</td>
<td>1</td>
</tr>
</tbody>
</table>
Critical Data Reporting Issues

- **Incomplete AQS_Site_ID** – Need all 9 digits, including leading zeros for state code
- **Incorrect AQS_Site_ID** – Some IDs do NOT match ANY known site for lead
- **Incorrect filter numbers** – Fundamental need for matching field with lab results!
- **No matching site value in AQS** – Wrong site, wrong date, site did not submit results, etc.
- **Flow or volume data in incorrect units** – e.g. submitted values in cubic feet but specified as cubic meters
- **Incomplete field data** – Prohibits validation
Examine PEP vs. Routine Concentrations (Log Scale to View Outliers)

120 Audits Total
EPA: 21 (4 in 2010, 17 in 2011)
SLT: 95 (58 in 2010, 37 in 2011)
SLT Outliers: 4 in 2010

Pb-PEP Audits

Routine Sample (µg/m³) vs. PEP Audit (µg/m³)
Examine PEP vs. Routine Concentrations (Linear Regression)

**2010-2011 Pb-PEP Audits**

- **EPA or Independent Audits**
- **SLT Site-Collocated Audits**
- Linear (SLT Site-Collocated Audits)
- Linear (EPA or Independent Audits)

**Equations:**
- $y = 0.9671x + 0.0008$, $R^2 = 0.9835$
- $y = 0.9325x + 0.0012$, $R^2 = 0.9942$

**120 Audits Total**
- EPA: 21 (4 in 2010, 17 in 2011)
- SLT: 95 (58 in 2010, 37 in 2011)
- SLT Outliers: 4 in 2010

*Note: SLT outliers not included in linear regression.*
Examine PEP vs. Routine Bias Estimates

d_i = (Routine - PEP)/PEP * 100%

Pb-PEP Hi-Vol Bias Estimates (2010-2011)

10 EPA audits and 43 SLT audits excluded due to low concentration (i.e., <0.02 µg/m³).

\[
y = -12.477x + 4.6469 \quad R^2 = 0.0307
\]

\[
y = -0.1904x - 2.758 \quad R^2 = 6E-06
\]
Revisit Audit Counts with Bias Data Loss

<table>
<thead>
<tr>
<th>Year</th>
<th>PEP Audits</th>
<th>Matched to Routine</th>
<th>Results &gt;= 0.02 µg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EPA</td>
<td>SLT</td>
<td>Total</td>
</tr>
<tr>
<td>2010</td>
<td>6</td>
<td>88</td>
<td>94</td>
</tr>
<tr>
<td>2011</td>
<td>29</td>
<td>60</td>
<td>89</td>
</tr>
<tr>
<td>2012</td>
<td>1</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>153</td>
<td>189</td>
</tr>
</tbody>
</table>

* Annual EPA goal is ~69 audits per year

For bias estimates, exclude Pb audit concentrations < 0.02 µg/m³

- 1 EPA and 27 SLT excluded 2010
- 9 EPA and 16 SLT excluded 2011

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The Lead (Pb)-PEP REVOLUTION—Where we are—Where we’re going

Tools and Remedies

• Website
  – COC/FDS redesigned and expanded for critical validation data and PM-10 enabled
  – Will become the site for Regions and SLTs to participate in the validation process
  – Will ultimately provide the PEP data to generate the bias values until the AQS QA transaction area is re-engineered.
Welcome to the QA Website

The purpose of this website is to facilitate the transmission and processing of field data collected as part of EPA’s PM2.5 and Lead (Pb) National Monitoring Networks QA programs. In addition the site will be used to provide program managers with summary reports to aid in their QA review of program data.

Click here to view the Terms of Use for this site.

Click here to log into the site. If you do not have an account, click here to register.

<table>
<thead>
<tr>
<th>CSN Audit Repository</th>
<th>Auditor Certifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM2.5 - Performance Evaluation Program</td>
<td>Pb - Performance Evaluation Program</td>
</tr>
<tr>
<td>AA-PGVP - Ambient Air Protocol Gas Verification Program</td>
<td></td>
</tr>
</tbody>
</table>

6/5/2012

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Conclusions

• Collocated SLT sites are established
• Auditors need to **complete** digital COC/FDS forms using the AirQA.rti.org Website
• EPA is making data available to QA managers via the Website
• Bias data loss due to low concentrations is an inherent issue
• Correlation of data we have been able to match up is encouraging
Pb-PEP Contacts

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https://AirQA.RTI.ORG