NCore Technical Issues
Selected Topics

✓*$PM_{10-2.5}$ mass sampling options*

✓*Status of $PM_{10-2.5}$ speciation requirement*

✓*Emerging Issue – Future measurements of Pb at NCore*

✓*Calibration challenges for trace-level gases*

(Dirk Felton – NY DEC)

Disclaimer:

Mention of trade names or commercial products during this training session does not constitute endorsement or recommendation for use.

$PM_{10-2.5}$ Requirements - A Closer Look

- NCore requirements for $PM_{10-2.5}$ were finalized in 2006 as part of the last revision to the PM NAAQS and monitoring regulations
- Although PM_{10} was retained as the indicator for coarse particles in that review, the $PM_{10-2.5}$ requirement was finalized to initiate characterization across the country
- Current NCore requirements include measurement of (total) mass and speciated components
- We will focus on $PM_{10-2.5}$ total mass options today

$PM_{10\text{-}2.5}$ Methods

- New Federal reference method was finalized in 2006
  - Appendix O to Part 50
  - Reference Method for the Determination of Coarse Particulate Matter as $PM_{10–2.5}$ in the Atmosphere
  - Measured as the arithmetic difference between separate but concurrent, collocated measurements of low-volume PM_{10} and $PM_{2.5}$ samplers
- Criteria for approving Federal equivalent methods for $PM_{10\text{-}2.5}$ were also finalized in 2006
  - Additional options approved this year

$PM_{10} – PM_{2.5} = PM_{10\text{-}2.5}$

BGI PM_{10} FRM

BGI $PM_{2.5}$ FRM

Thermo PM_{10} FRM Sequential Sampler

Thermo $PM_{2.5}$ FRM Sequential Sampler

Examples of the $PM_{10\text{-}2.5}$ FRM Difference Method

Comparing $PM_{10-2.5}$ Options*

FRM Difference Method

**Lew's opinion – not a policy recommendation*

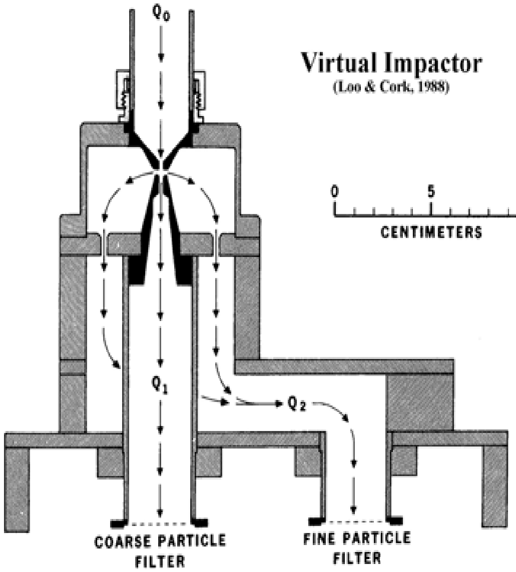
Advantages	Disadvantages
Leverages existing FRM $PM_{2.5}$ sampler that is already present at site	Footprint requires two positions on shelter roof or platform where space may be scarce
Utilizes familiar sampling technology – spare $PM_{2.5}$ samplers can be easily be converted to PM_{10}	Could be less cost-effective if additional samplers must be purchased
Teflon filters can be used for additional analyses (e.g., metals including lead)	Doubled opportunity for operator error or equipment failure compared with single-sampler options
Provides direct FRM measurement of PM_{10}* if NAAQS monitoring is important option * PM_{10} data must be recalculated as STP for PM_{10} NAAQS	Extra filters to weigh, equilibrate, and transport

Manufacturer	Model	Method
BGI, Inc	PQ200 Sampler Pair	Manual Reference Method: RFPS-1208-173
Thermo-Fisher, Inc.	Model 2000 PM10-2.5 Sampler Pair	Manual Reference Method: RFPS-0509-175
Thermo-Fisher, Inc.	Model 2025 PM10-2.5 Sequential Air Sampler Pair	Manual Reference Method: RFPS-0509-177

Comparing $PM_{10-2.5}$ Options *

Dichotomous Sampler

Advantages	Disadvantages
Provides a measurement of $PM_{10-2.5}$ without subtraction	Coarse particle sample includes ~10 % fine particle intrusion – needs correction, so data analysis more complicated
Single sampler design conserves roof or platform space	Recent models not approved as FRMs for PM_{10} if NAAQS comparison important objective
Teflon filters can be used for additional analyses (e.g., metals including lead) including collection of the $PM_{10-2.5}$ fraction	Does not provide a direct collection of PM_{10} if that objective is needed for additional analyses (e.g., Pb-PM_{10} for NAAQS or NATTS)
Dichotomous method is also approved as FEM for $PM_{2.5}$	
Option may be cost-effective to procure and operate compared with Difference method FRM	



Manufacturer	Model	Method
Thermo-Fisher, Inc.	2000-D Dichotomous Air Sampler	Manual Equivalent Method: EQPS-0509-178
Thermo-Fisher, Inc.	2025-D Dichotomous Air Sampler	Manual Equivalent Method: EQPS-0509-180

Comparing $PM_{10-2.5}$ Options *

Paired BAM Monitors

Advantages	Disadvantages
Provides a semi-continuous measurement of $PM_{10-2.5}$ without need for manual filter changes, filter conditioning, and pre/post sample weighing	Requires two positions on shelter roof or platform where space may be scarce
Leverages existing FEM $PM_{2.5}$ sampler that may already be present at site to meet continuous $PM_{2.5}$ requirement	Could be less cost-effective since agencies rarely have extra continuous monitors in inventory
Provides direct FEM semi-continuous measurement of PM_{10}* if NAAQS monitoring is important option * PM_{10} data must be recalculated as STP for PM_{10} NAAQS	Doubled opportunity for operator error or equipment failure compared with single-sampler options
	Not as advantageous for applications where Teflon filters are needed for additional analyses (e.g., metals including lead)

Manufacturer	Model	Method
Met One, Inc.	BAM-1020 PM10-2.5 Measurement System	Automated Equivalent Method: EQPM-0709-185

Other $PM_{10-2.5}$ Options

- Dichotomous FDMS TEOM – $PM_{10-2.5}$ channel could be approved at a later date
- Difference methods (PM_{10} - $PM_{2.5}$) using non-identical filter based samplers – not EPA approved - not recommended – (e.g., Hi-vol PM_{10} – Lo-vol $PM_{2.5}$)
- Difference methods among other continuous monitors that have not be submitted for EPA approval as a $PM_{10-2.5}$ method
  - E.g., older TEOMS

$PM_{10-2.5}$ Speciation Update

(Joann Rice is lead on this effort)

- $PM_{10-2.5}$ Speciation monitoring important for improved characterization of coarse particles
- Some measurement issues not yet resolved
- CASAC/AAMMS consultation in February 2009
  - Supported pilot monitoring to further develop methods
  - Recommendation to analyze pilot data prior to deployment
- Prior to future implementation, a small pilot monitoring project will be operated in 2010 at two locations
  - Primarily using $PM_{10-2.5}$ FRMs and dichotomous FEMs
  - Goal to identify key target species and develop analysis methods
  - Standard operating procedures (SOPs) will be developed
- **EPA will not be requiring deployment of $PM_{10-2.5}$ speciation sampling by January 2011 at NCore stations**

Potential Pb Measurements at NCore

- EPA is in the process of finalizing revisions to Pb monitoring requirements - signature expected this fall with final rule next spring/summer
- One potential outcome:
  - Re-proposal of non-source requirements
    - Current NAAQS monitoring requirement - one site per CBSA with $\geq$ 500,000 population – due by January 1, 2011
    - Under consideration – re-propose to instead require Pb monitoring at all NCore stations (or urban subset) – presumptively as $Pb\text{-}PM_{10}$
    - Revoke current NCore requirement for Pb monitoring in most populated MSA in each EPA region
  - Monitors would still need to be operational no later than January 1, 2011 per NCore deadline
- This potential Pb requirement may influence your consideration of options for $PM_{10\text{-}2.5}$ mass measurement (unless you plan on adding a hi-vol for Pb-TSP)

NCore Calibration Challenges

- Required trace-level monitors operate on lower ranges so calibration and audit points must reach these lower concentrations
  - Old CO range 0 – 50 ppm for NAAQS compliance
  - Typical NCore CO range 0 – 5 ppm for urban sites and 0 – 2 ppm for rural
- More frequent QC checks highly advised so calibration automation is important
- Integration of data systems and calibrators important for QC validation and timely reporting of problems
- Zero air purity is more critical than ever
- **Reviewing your calibrator capabilities and potentially upgrading hardware may be the most important part of designing and implementing a successful NCore gas monitoring system**

Calibrator Critical Specifications

- Gas Flow – options for multiple gas standard flow controllers important (e.g., 0 to 50 cc/min, 0 to 100 cc/min)
- Air Flow – 0 to 20 L/min for greater dilution
- Multiple Gas ports – useful for different stds
- Built in traceable ozone generator
- Accuracy +/- 1% Full Scale
- Precision +/- 1% Full Scale
- Linearity +/- 1% Full Scale
- Programmability to store multiple calibration sequences

Example Flow Calculation with a Dual Gas MFC Calibrator

- Example – Calibrator with 0 – 20 LPM dilution MFC and Gas MFC's of 0 – 50 ccm and 0 – 100 ccm; CO cylinder with 250 ppm
  - Lowest achievable CO concentration*

$$\left[\frac{5cc * 250\,ppm}{18{,}000cc + 5cc}\right] = 0.069\,ppm$$

  - Highest achievable CO Concentration*

$$\left[\frac{90cc * 250\,ppm}{2{,}000cc + 90cc}\right] = 10.77\,ppm$$

**keeping flows within 10 – 90% of MFC full range*

Expanded Dilution Capability Also Needed to Reach Audit Points per Appendix A

- Low levels added to accommodate Trace Level Instruments
- At Least three consecutive audit levels
- The audit levels selected should represent or bracket 80 percent of ambient concentrations

Audit level	Concentration range, ppm			
	O_3	SO_2,	NO_2	CO
1......	0.02-0.05	0.0003-0.005	0.0002-0.002	0.08-0.10
2......	0.06-0.10	0.006-0.01	0.003-0.005	0.50-1.00
3......	0.11-0.20	0.02-0.10	0.006-0.10	1.50-4.00
4......	0.21-0.30	0.11-0.40	0.11-0.30	5-15
5......	0.31-0.90	0.41-0.90	0.31-0.60	20-50

Calibrator presentation:

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Questions