Mercury CEMS and Sorbent Trap System Certification Under New Rules



EMC Measurement Technology Workshop

Robin Segall
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
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Topics

- Mercury Measurement Requirements in New Rules
- Mercury Monitoring Specifications
  - Performance Specification 12A
  - Performance Specification 12B
  - MATS, Appendix A
- Ongoing QA Criteria for Mercury Monitoring
  - Procedure 5
  - MATS, Appendix A

Key New Rules w/ Mercury Measurement Requirements

- Mercury Air Toxics Standards (MATS) for Utility Boilers (Subpart UUUUU)
  - Compliance date 4/16/2015
- Portland Cement MACT
  - Compliance date 9/9/2015
- Commercial/Industrial Incinerator MACT (CISWI)
  - Compliance date 8/7/2013
- Boiler MACT
  - Compliance date 1/31/2016
- Sewage Sludge Incinerator MACT (SSI)
  - Earliest compliance date 3/21/2016

Mercury Air Toxics Standards (MATS)

- Solid fuel/IGCC units
  - Must use Hg CEMS or sorbent trap monitoring systems
    - Appendix A contains mercury monitoring requirements
      - All Hg CEMS requirements
      - References Performance Specification 12B for sorbent trap monitoring system installation, maintenance and operation
      - Reference Method (RM) options: Methods 29, 30A, 30B or ASTM D6784-02
      - Ongoing QA requirements

Portland Cement MACT

- New and existing kilns
  - Must use Hg CEMS or sorbent trap monitoring systems
    - Performance Specification 12A (PS 12A) for Hg CEMS
    - Performance Specification12B (PS 12B) for sorbent trap monitoring systems
    - Procedure 5 for ongoing QA of Hg CEMS and sorbent trap monitoring systems
    - RM options: Method 29, 30A, 30B or ASTM D6784-02

Commercial/Industrial Solid Waste Incinerators

- New Waste-burning Kilns
  - Must use Hg CEMS or sorbent trap monitoring systems (Table 7); option for other affected units (60.2165(j))
    - PS12A for Hg CEMS
    - PS12B for sorbent trap monitoring systems
    - Procedure 5 for ongoing QA
    - RM options: Method 29, 30A, 30B or ASTM D6784-02

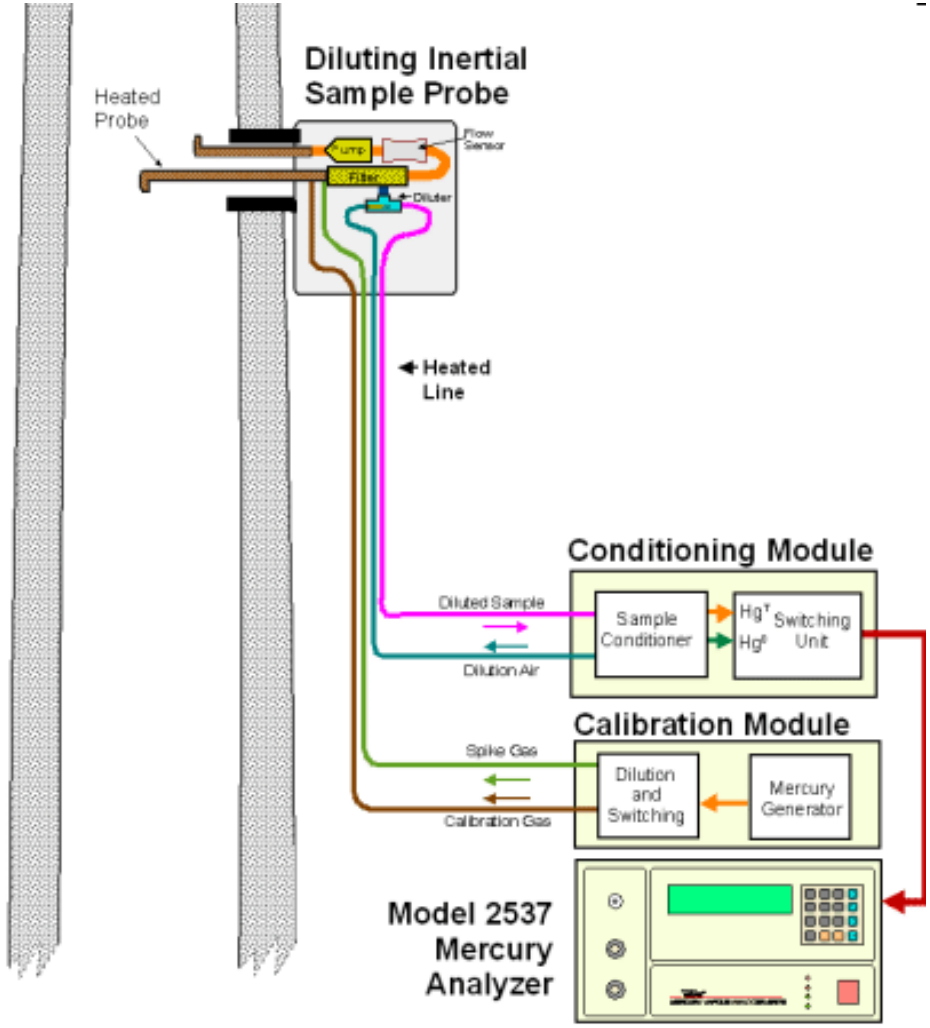
Boiler MACT

- Large coal-, oil-, and biomass-fired units
  - Optional use of Hg CEMS or sorbent trap monitoring system
    - PS 12A for Hg CEMS
    - PS12B for sorbent trap monitoring systems
    - Procedure 5 for ongoing QA of Hg CEMS and sorbent trap monitoring systems
    - RM options: Method 29, 30A, 30B or ASTM D6784-02

Sewage Sludge Incinerators

- All affected units
  - Optional use of Hg CEMS or sorbent trap monitoring system
    - PS 12A for CEMS
    - Procedure 5 for CEMS
    - RM options: Method 29, 30B or ASTM D 6784
    - PS12B for sorbent trap monitoring systems not specified, but would be an appropriate alternative that we could approve should a source request

Hg CEMS



- Measure gaseous Hg
  - Elemental (Hg^0)
  - Oxidized (Hg^{2+})
- Almost all convert oxidized Hg to elemental Hg for measurement of total gaseous Hg
- Calibrate using NIST-traceable mercury gas generators or cylinders

Performance Specification 12A for Hg CEMS

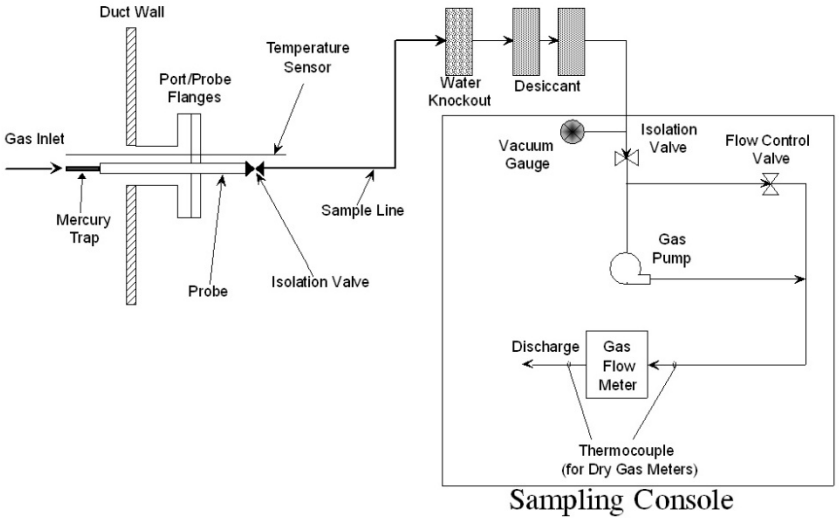
- Certification Testing Requirements
  - 7-day calibration drift test -- with Hg^0 or Hg^{2+}
  - Measurement error test -- 3 levels with Hg^0 and Hg^2
  - Relative accuracy against a RM

Performance Specification 12A Performance Criteria

Certification Test	Acceptance Criteria
Calibration Drift	$\leq$ 5% of span
Measurement Error	For Hg^0 $\leq$ 5% of span For Hg^{2+} $\leq$ 10% of span
Relative Accuracy	$\leq$ 20% or $\lvert RM_{avg} - C \rvert \leq$ 1 ug/scm if RM is $\leq$ 0.5 ug/scm

Sorbent Trap Monitoring System Background

- Integrated sample measures total gaseous Hg
- For post-PM control locations
- Paired traps, in-stack w/ 3 sections
- Proportional sampling



Performance Specification 12B for Sorbent Trap Monitoring Systems

- Sampling/analytical requirements
  - Sampling train and operations
  - Sampling/sample QA
- Certification testing requirements
  - Spike recovery study
    - Sorbent capture capability
    - Analytical capability
  - Relative accuracy against a RM

Performance Specification 12B Performance Criteria

Certification Test	Acceptance Criteria
Spike Recovery Study	85% $\leq$ %R_{avg} $\leq$ 115%
Relative Accuracy	$\leq$ 20% or $\lvert RM_{avg} - C \rvert \leq$ 1 ug/scm if RM is $\leq$ 0.5 ug/scm
Pre- and Post- Leak Checks	$\leq$ 4% of target (avg) sampling rate
Stack Gas Flow Ratio	95% of hourly ratios within 25% of reference ratio
Trap Section 2 Breakthrough	$\leq$ 5% of Section 1 mass; $\leq$ 20% RD or difference $\leq$ 0.03 ug/scm when conc $\leq$ 1.0 ug/scm
Paired Trap Agreement	$\leq$ 10% RD; $\leq$ 20% RD or difference $\leq$ 0.03 ug/scm when conc $\leq$ 1.0 ug/scm
Calibration	
Trap Section 3 Spike Recovery	75 to 125% of spike amount
Gas Meter Calibration	Measured Y $\pm$5% of initial Y
Temperature Sensor Calibration	$\pm$1.5% of reference sensor
Barometer Calibration	$\pm$10 mm of NIST-traceable barometer

Appendix F, Procedure 5 for Ongoing QA

- For Hg CEMS
  - Daily calibrations -- with Hg^0 or Hg^{2+}
  - Weekly system integrity check with Hg^{2+}
  - Quarterly s test run RAA or 3-level gas audit with Hg^0 and Hg^{2+}
  - Annual relative accuracy test audit (RATA)
- For sorbent trap monitoring systems
  - Annual RATA
  - PS12B, not Procedure 5, specifies routine QA/QC (leak checks, calibrations, paired train agreement, spike recovery, breakthrough)

Procedure 5 Performance Criteria

Certification Test	Acceptance Criteria
Calibration Drift (Daily)	≤ 5% of span
System Integrity Check (Weekly)	None
Gas Audit (3 Quarters)	±15% of avg audit value or ± 0.5 ug/m^3
3-Run RAA (3 Quarters)	±20% of 3-run avg or ±10% of applicable standard
RATA (Yearly)* *CEMS and Sorbent Trap Systems	Same as PS12A

MATS, Appendix A

- Certification Testing Requirements
  - 7-day calibration error test -- with Hg^0 or Hg^{2+}
  - Linearity check at 3 levels -- with Hg^0
  - System integrity check at 3 levels -- with Hg^{2+}
    - Not required if no converter
  - Cycle time test
  - Relative accuracy against a RM

MATS, Appendix A
Certification Performance Criteria

Certification Test	Acceptance Criteria
Calibration Drift	≤ 5% of span or absolute value ≤1.0 ug/scm
Linearity Check System Integrity Check (3-level)	±10% of reference gas value or absolute value ≤0.8 ug/scm
Cycle Time Test	15 minutes
Relative Accuracy* *CEMS and Sorbent Trap Systems	≤ 20% or $\lvert RM_{avg} - C \rvert \leq 1.0$ ug/scm if RM is ≤ 0.5 ug/scm

MATS, Appendix A
QA Performance Criteria

Certification Test	**cceptance Criteria**
Calibration Error (Daily)	≤ 5% of span or absolute value ≤1.0 ug/scm
Single-level System Integrity Check (Weekly)	±10% of reference gas value or absolute value ≤0.8 ug/scm
Linearity Check or 3-level System Integrity Check (Quarterly)	±10% of reference gas value or absolute value ≤0.8 ug/scm
RATA (Yearly) * *CEMS and Sorbent Trap Systems	≤ 20% or $\|RM_{avg} - C\| \leq 1.0$ ug/scm if RM is ≤ 0.5 ug/scm

Key Differences Between PS 12A and MATS Certification Criteria

- Calibration Drift (Error)
  - MATS has alternate absolute value criterion
- Measurement Error (Linearity) with Hg^0
  - MATS has alternate absolute value criterion
- Measurement Error (System Integrity) with Hg^{2+}
  - MATS has alternate absolute value criterion
  - PS 12A has less strict sole criterion
- Cycle Time Test
  - PS 12A has no cycle time test

Key Differences Between PS 12A and MATS Ongoing QA Criteria

- Daily Calibration Drift (Error)
  - MATS has alternate absolute value criterion
- Quarterly Gas Audits (3-level Linearity or System Integrity) with Hg^0 and/or Hg^{2+}
  - MATS only requires use of Hg^0 or Hg^{2+} while PS 12A requires both
  - PS 12A has less strict % of reference gas criterion while MATS has less strict alternate absolute value criterion

Summary

- Most mercury monitoring system certifications will be occurring at coal-fired utility boilers and Portland cement plants
- Some differences between MATS and Portland cement certification and QA requirements, but not terribly significant
- Look for proposed adjustments in MATS requirements soon
  - No longer allow sole use of Hg^{2+} gas standard
  - Tighten up RATA criterion
- Future
  - Finalize Hg calibration gas traceability protocols and procedures

Questions?