

Update on Hg CEMS

They're here to stay ...

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Overview

- Regulatory Update
- Hg CEMS
- Sorbent trap monitoring
- Hg Emissions monitoring performance and related issues
- NIST Traceability
- Take home messages ...
- Questions



Regulatory Update

- EPA Part 60 compliance monitoring procedures promulgated as part of Portland Cement MACT amendments (75 FR 54970 9/9/2010)
 - PS12A
<http://www.epa.gov/ttn/emc/perfspec/ps-12A.pdf>
 - Appendix F Procedure 5 (Hg CEMS continued QA/QC)
<http://www.epa.gov/ttn/emc/perfspec/AppFProc5.pdf>
 - PS12B (Sorbent traps initial certification and continued QA/QC)
<http://www.epa.gov/ttn/emc/perfspec/ps-12B.pdf>
- Hg CEMS and sorbent trap monitoring procedures now formally exist



Monitoring Requirements

- PS12A: Hg CEMS - Performance specifications for initial certification
 - Measurement Error Test (linearity) with Hg⁰ and HgCl₂
 - 7-Day Calibration Drift Test with zero and mid-level Hg⁰
 - Relative Accuracy Test
- Appendix F Procedure 5: Continued QC/QA requirements
 - Daily Calibration Drift Assessment
 - Weekly System Integrity Check
 - Data Accuracy Assessment
 - Relative Accuracy Test Audit
 - Quarterly Gas Audit
 - Relative Accuracy Audit (alternative)
- PS12B: Sorbent Traps – Performance specifications for initial certification and continued QC/QA requirements



Hg Emissions Monitoring

- Hg CEMS
- Sorbent Traps



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Tekran

- 50 lpm sample extraction
- Inertial filter
- Dilution-based
- Thermal-catalytic converter located in the rack
- Pre-concentration CVAFS
- 0.001 ug/wm³ resolution
- 150 second cycle time
- Fully automated



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Thermo-Scientific

- 50 lpm sample extraction
- Inertial filter
- Dilution-based
- Thermal converter located in the probe
- Real-time CVAFS
- 0.01 ug/wm³ resolution
- Fully automated



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CEMTREX



- 10 lpm sample extraction
- Standard filter
- Dilution-based
- Thermal converter located in the probe
- Pre-concentration CVAAS
- 0.01 ug/wm³ resolution
- 180–360 second cycle time
- Fully automated



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Hg CEMS: Where we're at ...

- ~600 sold to utilities
 - At least half installed/certified
(see NESCAUM Report for breakdown)
http://www.nescaum.org/documents/hg-control-and-measurement-techs-at-us-pps_201007.pdf
 - How many implementing NIST traceability program?
- Trend towards low level measurements ($< 1 \mu\text{g}/\text{m}^3$)
- Hg CEMS now considered for other source categories



Sorbent Trap Hg Emission Monitoring Systems

- Multiple providers and systems
 - Manual and automated
- >200 sold to utilities
 - Many installed/certified
 - Many as “backups” to Hg CEMS
- Suitable for low and high level Hg measurements
- More vulnerable to data loss (due to length of monitoring)



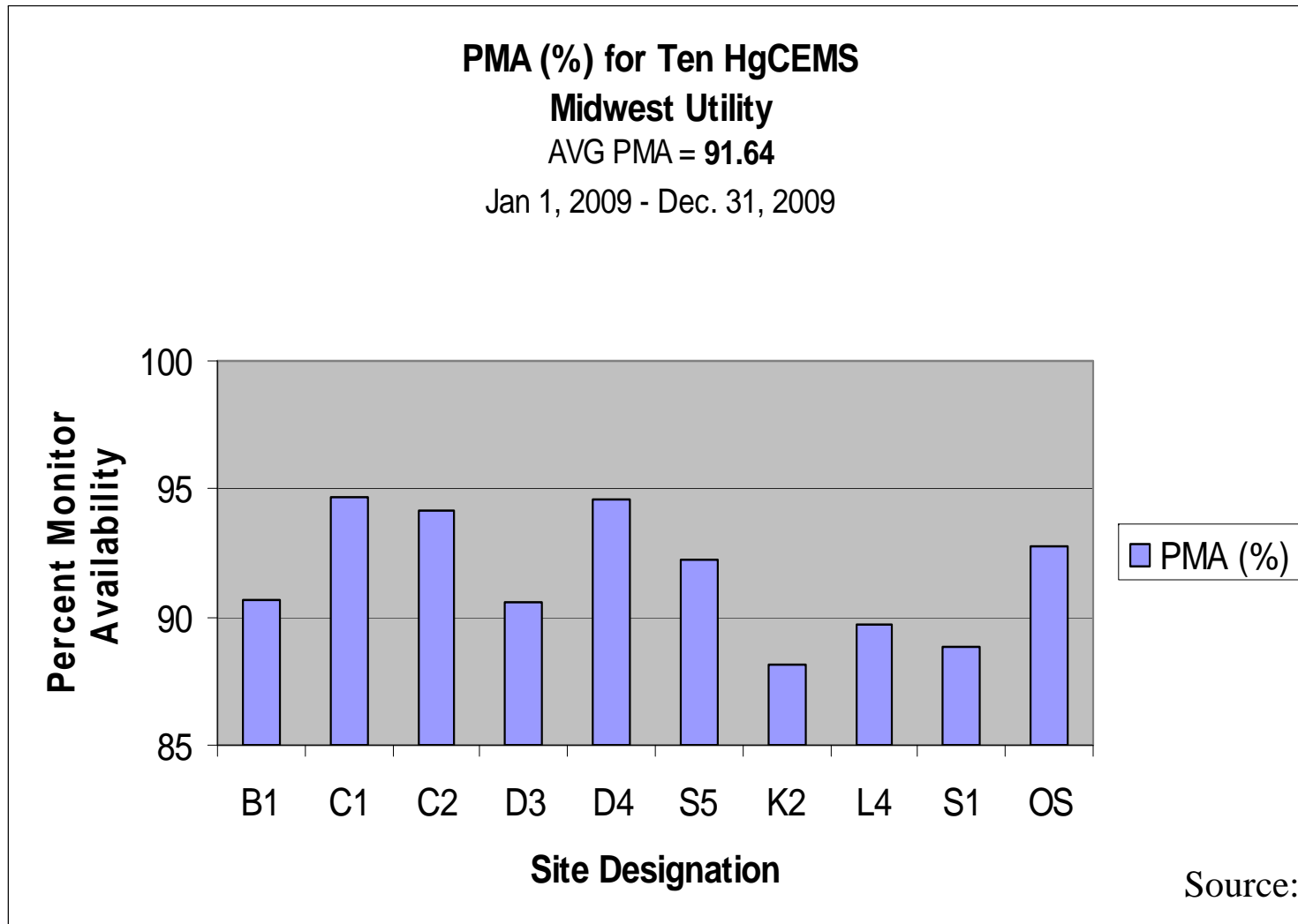
Hg CEMS Emission Monitoring Issues ...

- Reliability
- Low Hg concentrations
- Other source categories
 - Measurement environment
 - Dynamic range of emissions
- Status of NIST traceability
- Range of available Hg calibration gas concentrations



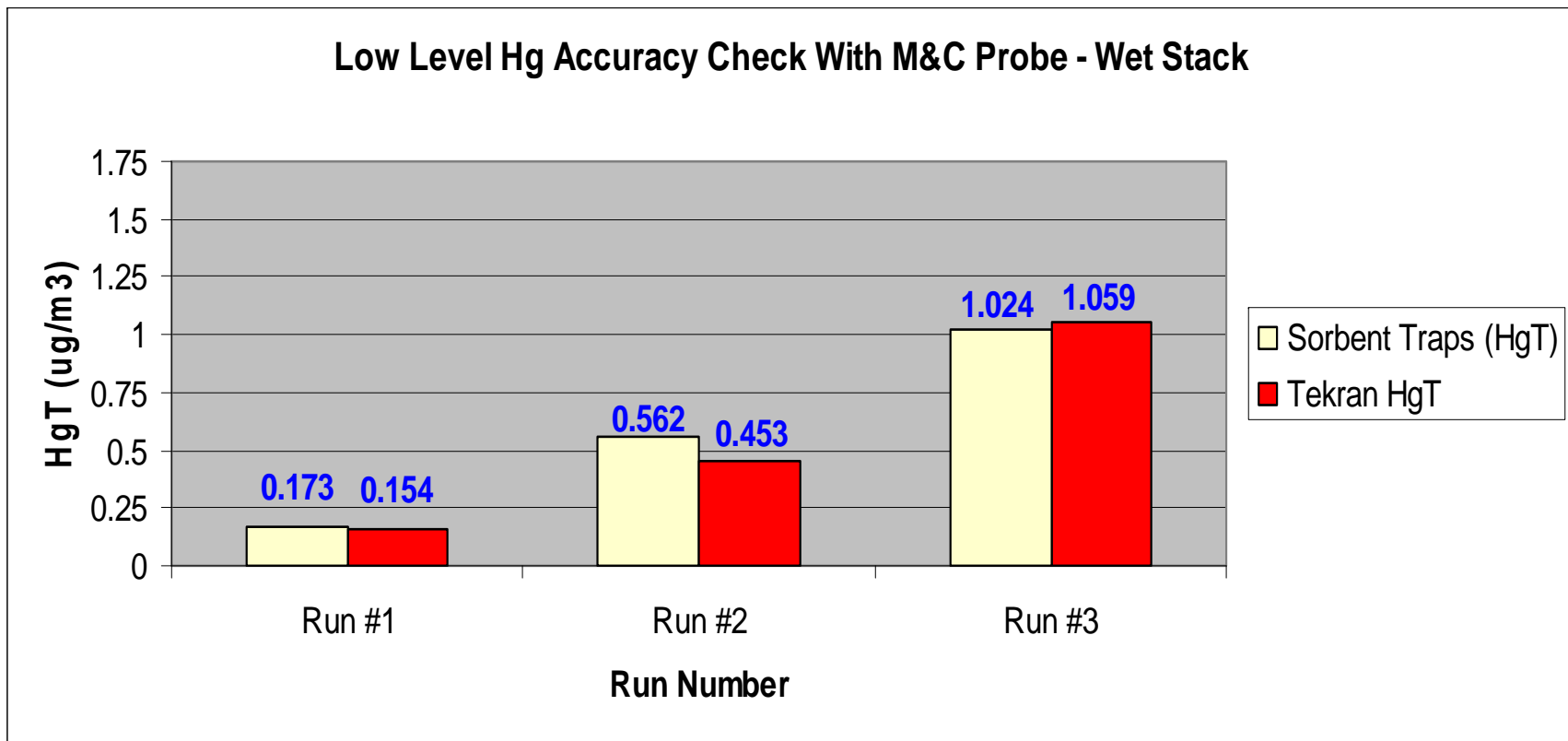
Percent Monitor Availability for HgCEMS

Full Year Results 2009



Power Plant - Hg CEMS RATA Results

Low-Level Emissions Tests



Source: Tekran

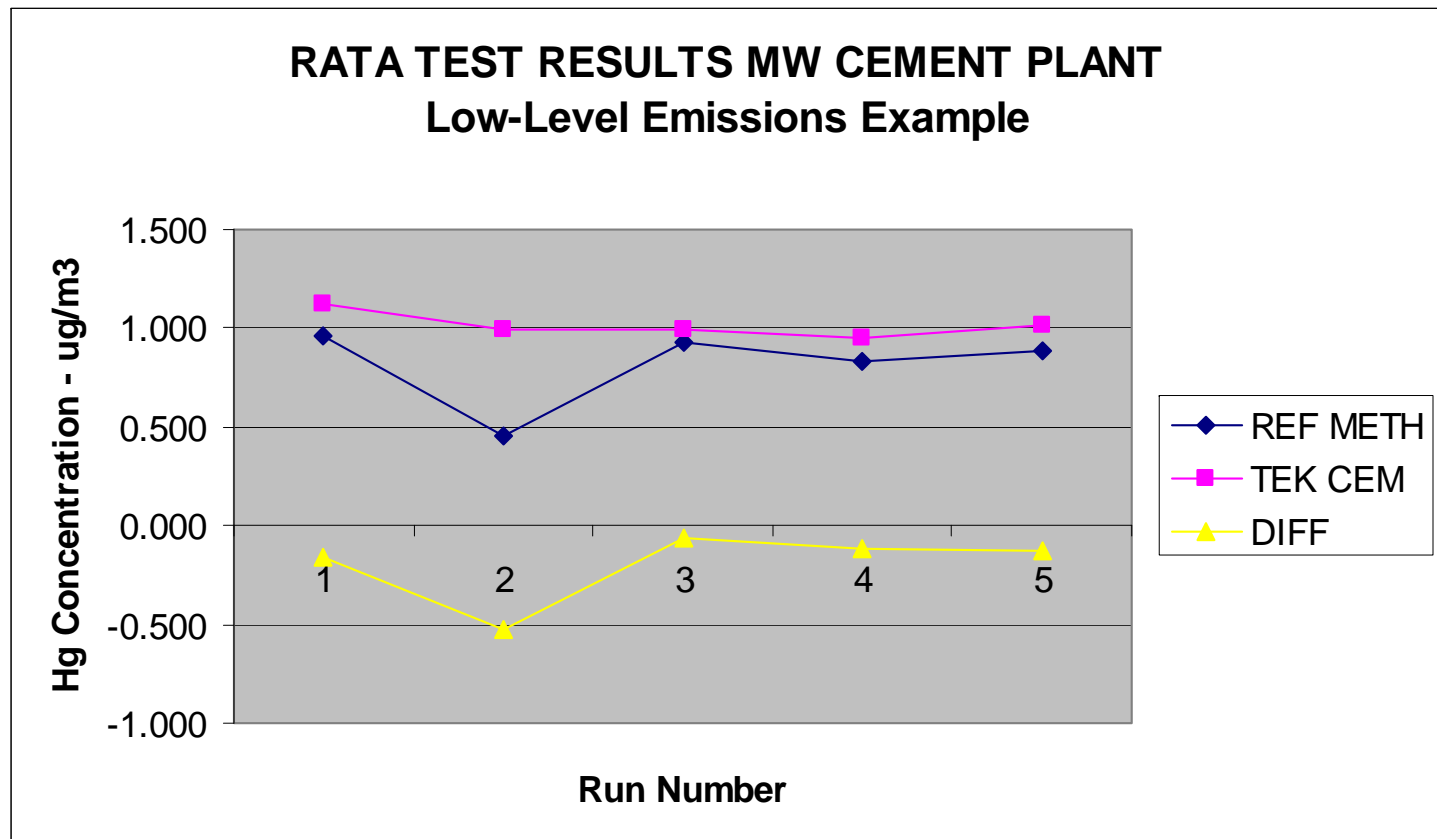


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Cement Plant - Hg CEMS RATA Results

Low-Level Emissions Tests



Source: Tekran

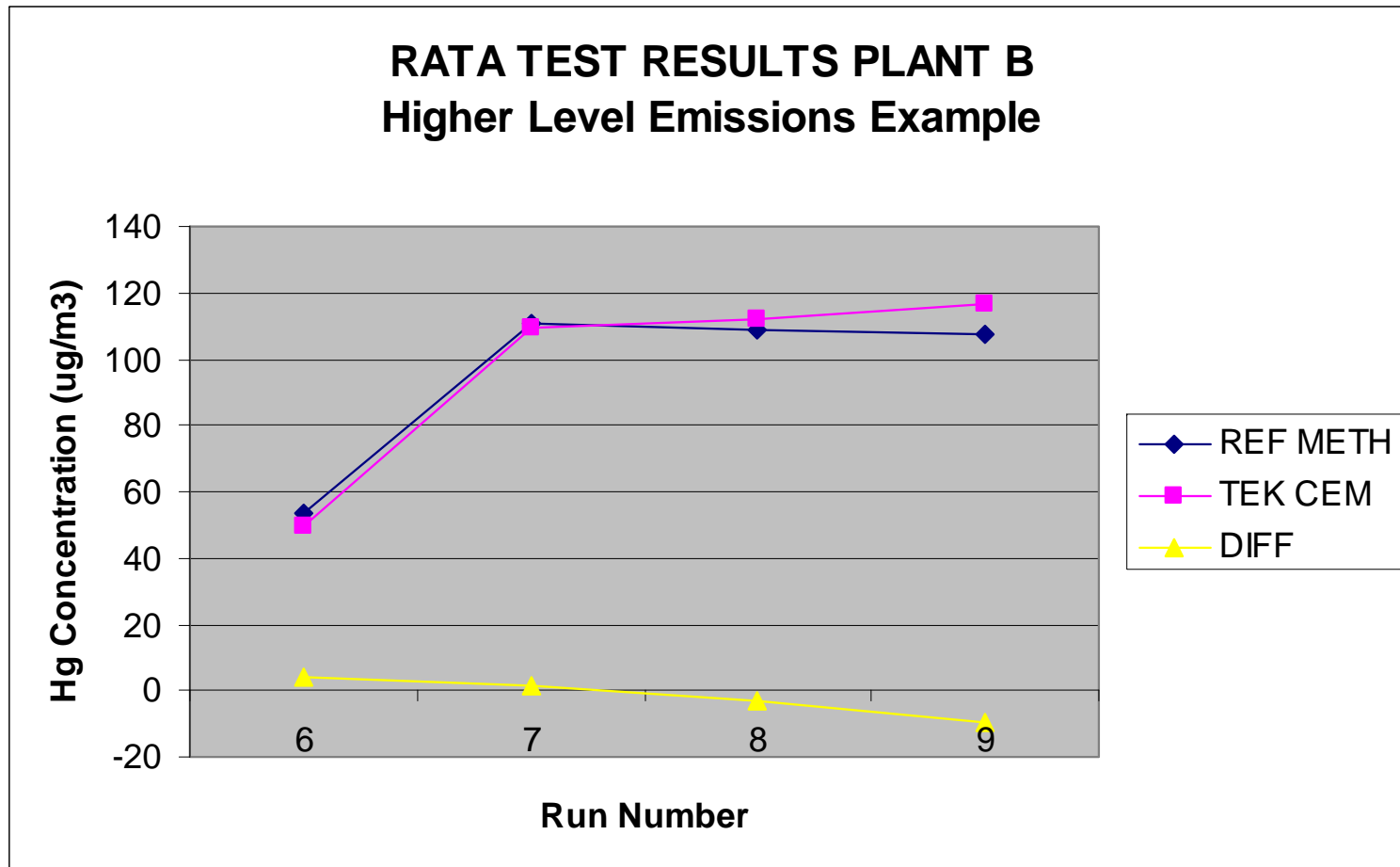


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Cement Plant - Hg CEMS RATA Results

Low-Level Emissions Tests



Source: Tekran



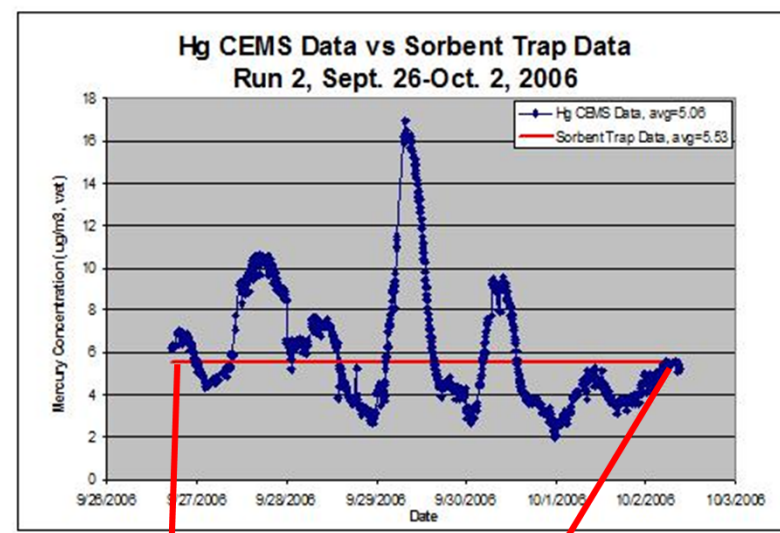
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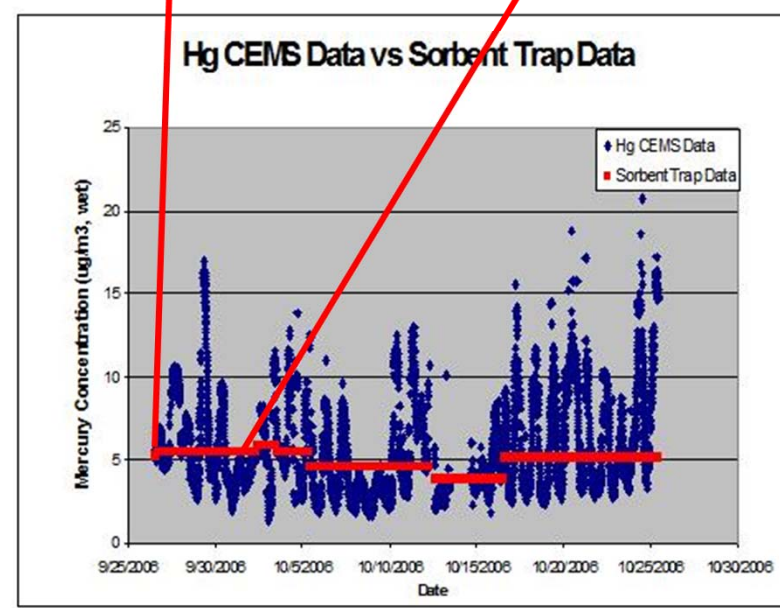
Hg Emissions Data

Hg CEMS vs. Sorbent Traps

- See what you're missing ...
 - Process characterization
 - Data variability



(a)



(b) Source: NESCAUM 2010

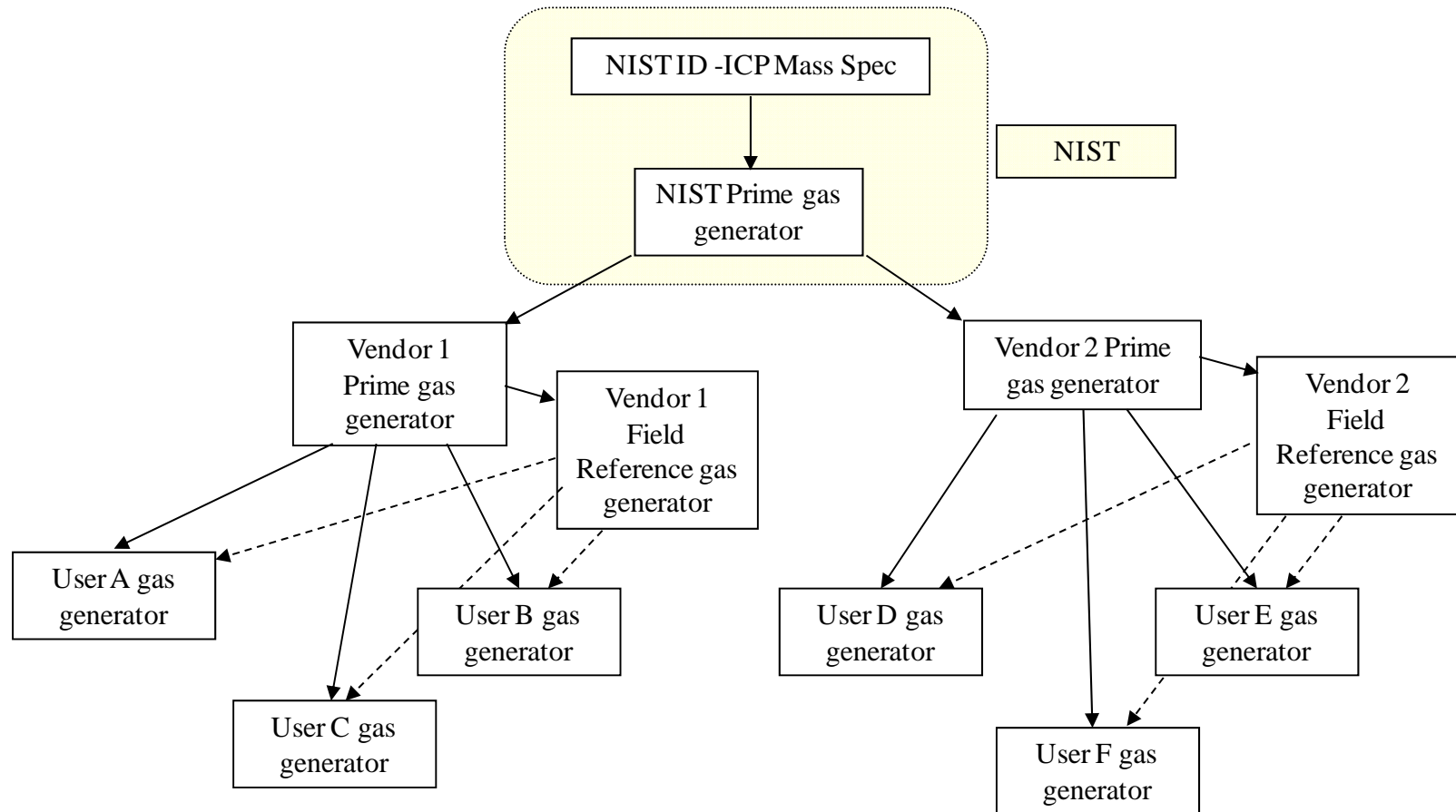


NIST Traceability

- Certified “NIST Traceable” gas standards are needed to support regulatory applications
- EPA defines NIST Traceability
- Where possible, the certified concentration is derived from an unbroken chain of direct comparisons linked to a primary reference originating from NIST
- With collaboration from the utility industry, Hg CEM vendors and NIST, EPA has developed Interim Protocols to establish certification and continuing QA procedures for Hg⁰ and HgCl₂ gas standards



How NIST Traceability Works



Hg Calibration Gases

- NIST-traceable Hg⁰ and Hg⁺² calibration gases now available
- Hg⁰ and Hg⁺² Interim Protocols used to establish traceability
<http://www.epa.gov/ttn/emc/metals/ElemHgProtocol.pdf>
<http://www.epa.gov/ttn/emc/metals/OxHgProtocol.pdf>
- Final NIST traceability protocols expected in the next 12-18 months
- Nominal NIST-traceable Hg⁰ concentrations of 0.5 µg/m³ to 300 µg/m³ now available
(NIST recently extended upper end from 45 µg/m³)
- Fundamental bias (7-10%) exists between Hg⁰ and evaporative Hg⁺² standards
 - Reason unknown (but we're still working on it)
 - Does not limit NIST traceability or regulatory use of Hg CEMs



Take Home Messages ...

- Hg CEMS are indeed ready for “prime time”
- Now being used on multiple source categories
 - Cement plants, HWIs, steel plants, power plants
- Promulgated monitoring procedures for Hg CEMS and sorbent traps now available
- NIST traceability available and functional for Hg⁰ and Hg⁺² calibration gases
- NIST traceable Hg⁰ gases available from ~0.5 µg/m³ to 300 µg/m³
- Don't underestimate the benefit of using Hg CEMS for process characterization.



Questions?



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