Clean Air Mercury Rule (CAMR) – Hg Monitoring and Test Methods




2007 Measurement Technology Workshop

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OAQPS/AQAD/MTG

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Outline

- **Background**
  - **CAMR Status**
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  - **Key Elements of CAMR**
  - **Mercury Standards**
- **Mercury Monitoring and Testing Requirements**
  - **Monitoring Options**
  - **Testing Requirements**
  - **New Alternative Mercury Reference Test Methods Rulemaking**
  - **Hg Gas Standard Traceability**



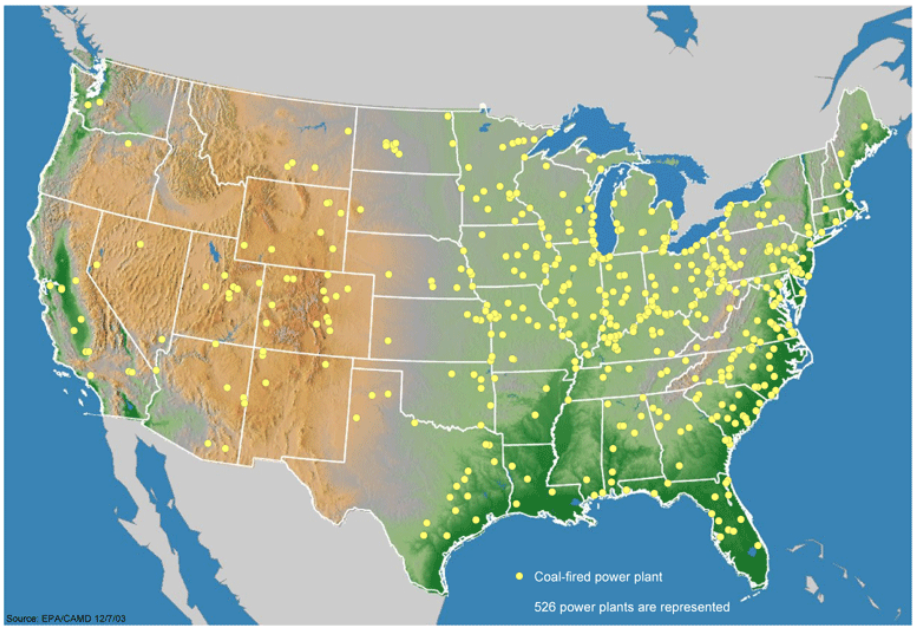

Status of CAMR

- **CAMR proposed on January 30, 2004 (69 FR 4652)**
- **Section 112(n) Revision promulgated on March 29, 2005 (70 FR 15994)**
- **CAMR promulgated on May 18, 2005 (70 FR 28606)**
- **Final reconsideration notice published on June 9, 2006 (71 FR 33388)**

Legal and Administrative Challenges – Section 112(n) Revision and CAMR

- **Petitions for Judicial Review**
  - States/City
  - Environmental Groups
  - Industry Groups
  - Also intervenors on both sides
- **Petitions for Administrative Review**
  - States
  - Environmental Groups
  - Native American Groups
  - Integrated Waste Services Assoc
  - Jamestown Board of Public Utilities
- **Reconsideration process has been completed**
- **All briefs have been filed with Court; awaiting schedule for oral arguments**

Coal-Fired Power Plants in the U.S.

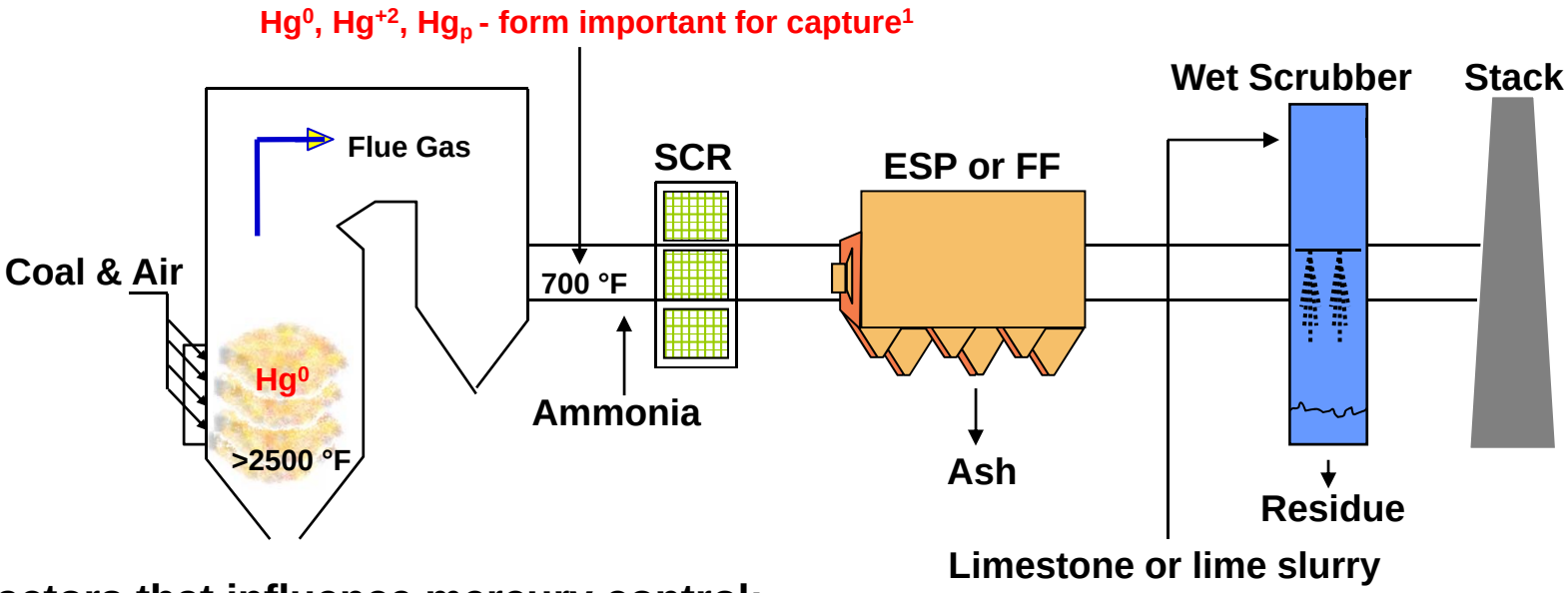


U.S. Coal-Fired Power Plants

- **Affected Facilities:**
  - About 1,300 coal-fired generation units (~ 500 coal-fired power plants) with about 305 GW of generation capacity

- **Existing Controls:**
  - Almost all units have PM control devices
  - About one-third have SO_2 scrubbers
  - Most have initial NO_x controls (e.g., low-NO_x burners)
  - About one-third (primarily in the east) will have advanced NO_x control (SCR) when NO_x SIP-call is fully implemented
- **Future Controls:**
  - About two-thirds (primarily in the east) will have SO_2 scrubbers when CAIR is fully implemented
  - About one-half (primarily in the east) will have advanced NO_x control (SCR) when CAIR is fully implemented

Power Plant Equipment and Mercury



Factors that influence mercury control:

- **Coal type**
- **Time/temperature profile**
- **Flue gas composition (chlorine) and fly ash characteristics (carbon, calcium, iron, porosity)**
- **Air pollution controls already in place**

[1] **Hg^0 = elemental Hg, Hg^{+2} = oxidized Hg, Hg_p = particulate Hg**

Key Elements of CAMR

- Market-Based Cap-and-Trade Program that will reduce nationwide emissions of mercury from new and existing coal-fired power plants in two phases:
  - First phase (2010)
    - Cap is 38 tons
    - Taking advantage of "co-benefit" reduction of mercury achieved by reducing SO_2 and NO_x under CAIR
  - Second phase (2018)
    - Cap is 15 tons
- New Source Emission Standards for mercury from coal-fired units under 40 CFR Part 60, Subpart Da

Subpart Da Mercury Standards

- **Subpart Da revised to require coal-fired units constructed after 1/30/04 to meet output-based NSPS in addition to being subject to caps**
- **Compliance determined on a 12-month rolling average basis, using Hg monitoring data**
- **Performance Specification 12A for certifying Hg monitoring systems (promulgated w/ CAMR)**

New Source NSPS Limits:

Subcategory	Hg (10^{-6} lb/MWh)
Bituminous-fired	20
Sub-bituminous-fired: - "Wet" geography - "Arid" geography	 66 97
Lignite-fired	175
IGCC	20
Coal refuse-fired	16

CAMR Hg Monitoring Requirements – Cap and Trade Program

- Units have option to use Hg CEMS or sorbent trap monitoring
  - 12-month average
- Low-emitting units ($\leq$ 29 lb/yr) may qualify for a third option
  - Annual stack testing if Hg emissions are $\leq$ 9 lb/yr
  - Biannual testing if Hg emissions are $\geq$ 9 lb/yr, but $\leq$ 29 lb/yr
- Revisions to Parts 72, Part 75, and Appendices A, B, and F of Part 75, as well as addition of Appendix K and Subpart I to Part 75 provide the detailed provisions for implementation of Hg monitoring
- Reference method for relative accuracy test audits (RATAs) of monitoring systems
  - ASTM D6784-02 ('Ontario Hydro Method')
  - Administrator approved instrumental test method

CAMR Hg Monitoring Requirements – 40 CFR 60, Subpart Da

- Units have option to use Hg CEMS or sorbent trap monitoring
  - Compliance determined on a 12-month rolling average basis
- Performance Specification 12A specified for Hg CEMS relative accuracy test audits (RATAs)
  - Part 75 performance specifications are an option for units subject to cap and trade program
- Reference method for relative accuracy test audits (RATAs) of monitoring systems
  - ASTM D6784-02 (‘Ontario Hydro Method’)
  - Method 29

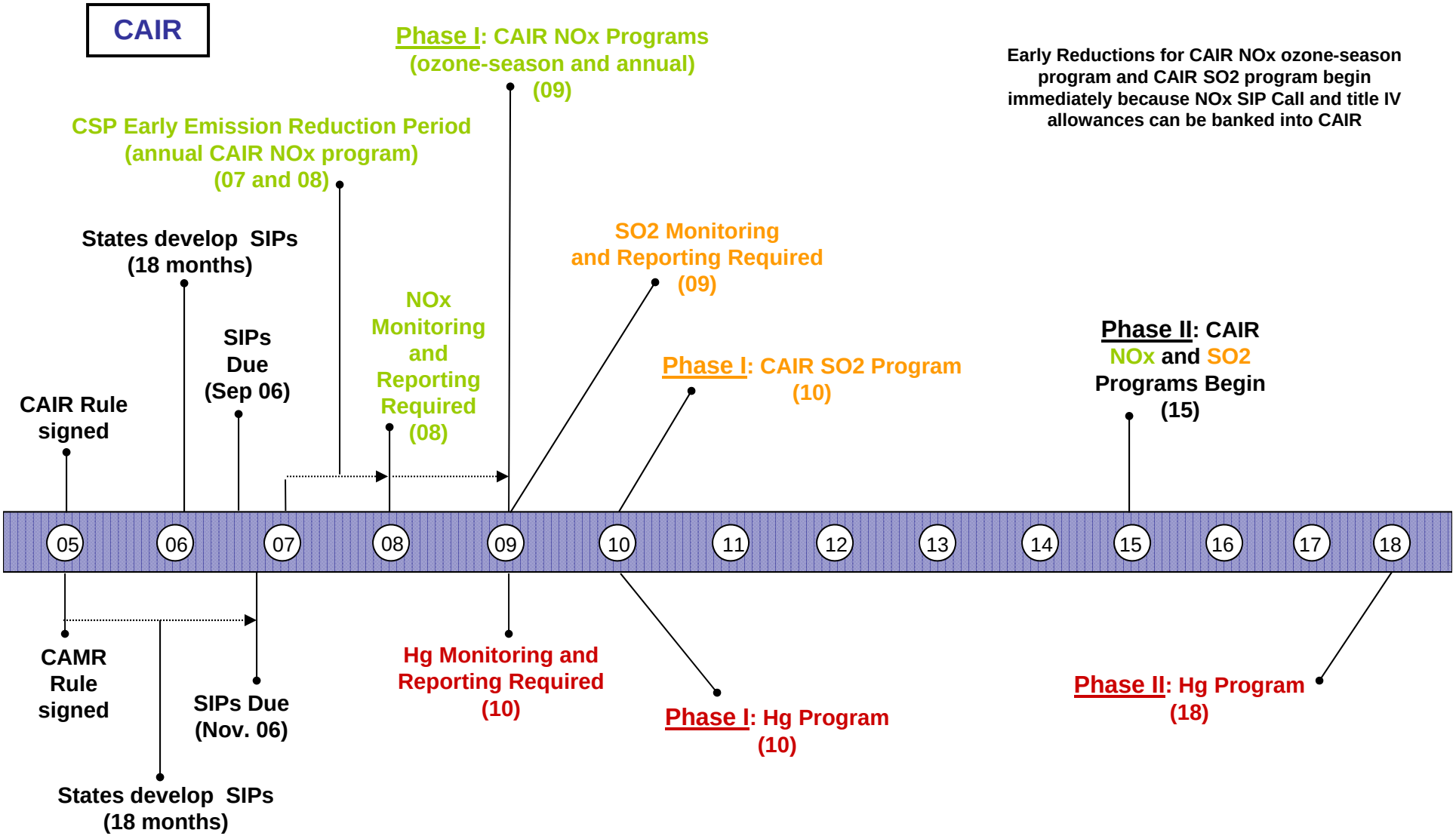
Certification Testing Requirements

- Hg CEMS
  - 7-day calibration error test---with Hg^0 or Hg^{2+}
  - System integrity check at 3-levels, with Hg^{2+}, if the CEMS has a converter
  - Linearity check with Hg^0
  - Cycle time test
  - RATA with using a reference method
  - Bias test

Certification Test Requirements (cont.)

- Sorbent Trap Systems
  - RATA and bias test
  - Applicable QA/QC procedures in Appendix K
- Low-Emitting Units
  - Hg testing using Ontario Hydro method (ASTM D6784-02) or an approved instrumental test method
- Certification deadlines
  - For existing units --- January 1, 2009
  - For new units---90 operating days or 180 calendar days after commencement of commercial operation

CAIR and CAMR Implementation Timeline



On-Going QA Requirements

- Hg CEMS
  - Daily calibrations---with Hg^0 or Hg^{2+}
  - Weekly system integrity check, if the CEMS has a converter (not required if Hg^{2+} is used for daily calibrations)
  - Quarterly linearity check with Hg^0 or system integrity check with Hg^{2+}
  - Annual RATA and bias test

On-Going QA Requirements (cont.)

- Sorbent Trap Systems
  - Annual RATA and bias test
  - QA/QC procedures in Appendix K
- Low-Emitting Units
  - Semiannual or annual Hg emission testing

Alternative Hg Reference Methods - Background

- Stakeholders very concerned that OH reference method difficult and, more importantly, not timely (2 to 3 week turnaround)
- We committed in CAMR promulgation to develop instrumental reference method (IRM) for Hg; later recognized that sorbent trap-based reference method also viable
- Development/evaluation had to be rapid
  - Over 800 Hg monitoring systems will need RATAs in 2008 to meet 1/1/09 deadline
  - Many utilities are planning RATAs for late 2007

Hg Methods Rulemaking

- Two Additional Reference Method Options for Measurement of Mercury
  - Method 30A - Instrumental reference method (IRM)
  - Method 30B - Sorbent trap reference method
- Direct Final Approach
  - Allows for timely promulgation of methods
  - Adverse comment, however, would result in reversion to a proposal

Hg Methods Rulemaking Schedule

- Rulemaking was signed by Administrator on August 17
- Should be published in the Federal Register by first week in September
- If no adverse comment, would become final in early November

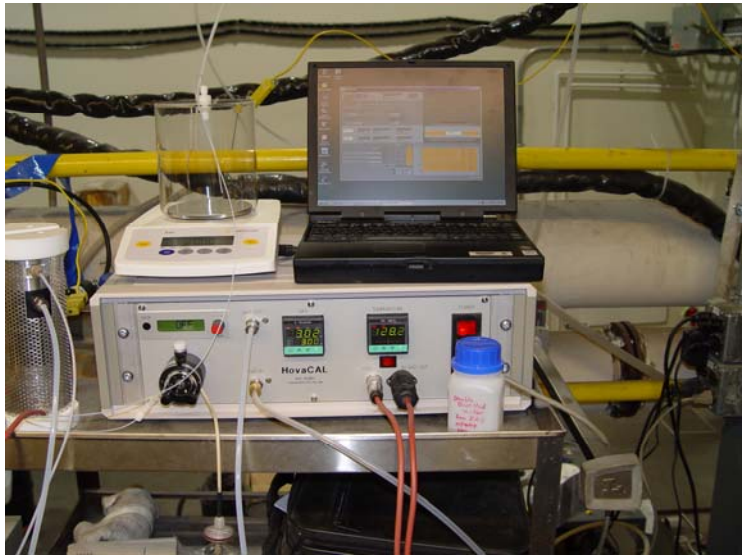
IRM for Mercury – Method 30A

- Real-time
- Performance-based
  - Amenable to new technologies
  - Test program-specific verification of data quality
  - FR Notice of Intent (October 6, 1997)
- Consistent w/ SOx & NOx instrumental methods
- Key elements
  - Calibration error/linearity
  - System integrity/conversion efficiency
  - System response time
  - Interference test
  - Dynamic spiking (gaseous method of standard additions)

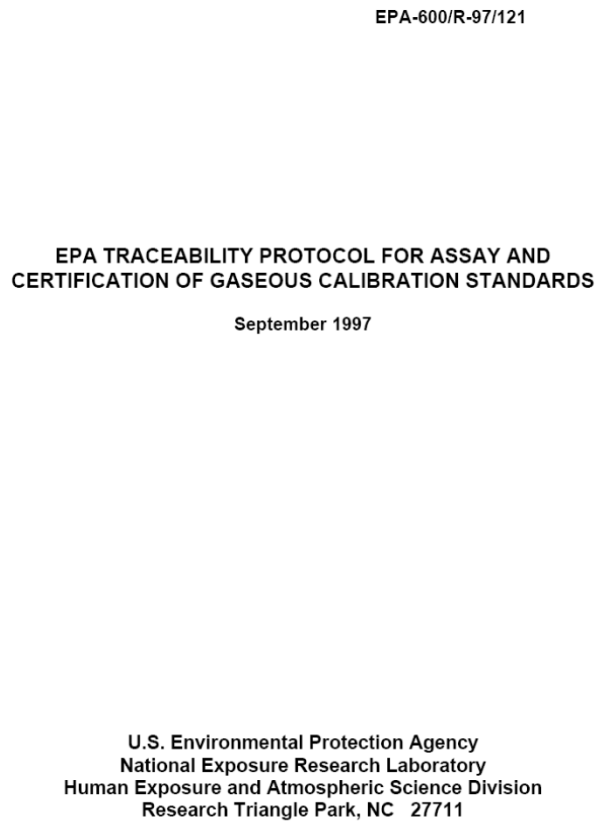
Sorbent Trap Method for Mercury – Method 30B

- Performance-based
  - Amenable to new sorbents, equipment, and analytical technologies
    - Lab verification of sobent performace and analysis
    - Test program-specific verification of data quality
- Capability for on-site analysis (timely)
- Description
  - Known volume of stack gas is sampled through paired, in-stack 2-section sorbent traps (e.g., iodated carbon)
  - Analysis by any suitable system that can meet performance criteria (e.g., leaching, digestion, thermal desorption/direct combustion coupled with UV AF, UV AA, XRF)

Hg Gas Standards



Hg Gas Standard Traceability


EPA-600/R-97/121

EPA TRACEABILITY PROTOCOL FOR ASSAY AND CERTIFICATION OF GASEOUS CALIBRATION STANDARDS

September 1997

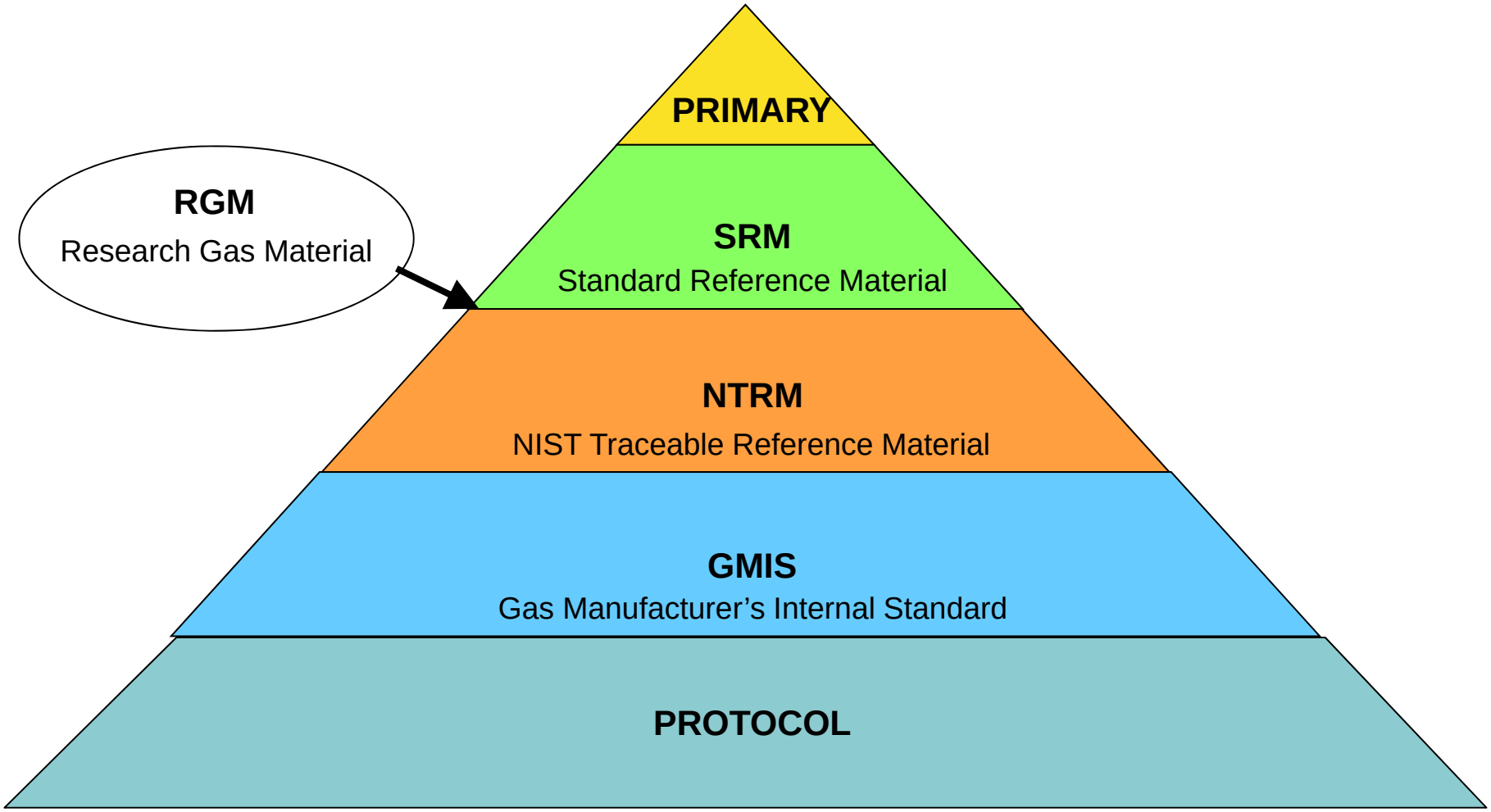
U.S. Environmental Protection Agency
National Exposure Research Laboratory
Human Exposure and Atmospheric Science Division
Research Triangle Park, NC 27711

- CAMR and Method 30A require "NIST Traceable" Hg gas standards
- NIST Traceability is defined by EPA
- Documented in EPA-600/R-97/121 "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards"
- Traceable to a measured concentration, not theoretical

How Traceability Protocol Works

- NIST SRMs and NTRMs are gas standards used by vendors to generate the “protocol” gas standards used by industry and its test contractors
- SRMs and NTRMs are used to calibrate instrumentation that measure the concentration of the “protocol” gases sold
- EPA Traceability Protocol provides guidance on how to establish the uncertainty of the “protocol” gases sold, traceable to the NIST RMs

How Traceability Protocol Works (cont.)



Status for Hg Gas Standard Traceability

- Gas Generators
  - EPA has a working draft of traceability protocol for certifying elemental Hg gas generators
    - Includes approach for certifying elemental Hg gas generators that are already in the field
  - NIST has certified its 'NIST prime' elemental Hg gas generator and is now working on certification of 'vendor prime' elemental Hg generators
  - EPA is drafting traceability protocol for certifying oxidized Hg gas generators
    - EPA/ORD is working on independent gravimetric technique
- Gas Cylinders
  - EPA is adding elemental Hg gas cylinder traceability procedures to the existing traceability protocol for SO_2 and NO_x cylinders
  - Shelf life and stability will be assessed

Next Steps

- Finalization of Methods 30A and 30B
- Additional evaluation of Methods 30A and 30B to allow for further SOP development and potential adjustments to stratification testing requirements
- Completion of Hg calibration gas traceability protocols and procedures
- Development of training materials and conduct of training for EPA Regions, state agencies, and sources