Utility Working Group

- Working group charge
- Roles
- EPA expectations
- Suggested ground rules

Sally Shaver

Emission Standards Division

Working group *charge*...

- *CHARGE* to the working group
  - Provide input to the EPA regarding Federal MACT regulations for coal-fired electric utility steam generating units that will maximize environmental and public health benefits in a flexible framework at a reasonable cost of compliance and within the constraints of the Clean Air Act

The central challenges in addressing the *charge* are...

- Obtaining active participation from all stakeholders
- Determining the most effective ways to address environmental issues
- Considering strategies for simplifying the regulations and allowing compliance flexibility while maintaining full environmental benefits

Questions that may be considered under the *charge*

- Are the available data adequate?
- How should the subcategories/floors be determined?
- What regulatory alternatives, including beyond-the-floor options, should be considered?
- What are the impacts of each alternative?
- What regulatory recommendations should be considered?

What is NOT part of the *charge*?

- This working group will not
  - Reconsider the basis for the Administration's finding that regulation of coal-fired electric utility steam generating units under section 112 of the CAA is necessary and appropriate
  - Discuss litigation issues
  - Make recommendations regarding any three-pollutant legislation or other non-CAA alternatives to regulation

Roles -- EPA

- EPA's role is to
  - Provide a forum in which all stakeholders may brainstorm
  - Encourage group to stay focused on the issues at hand so as to maximize the use of the available time
  - Provide support to working group by drafting and distributing materials
  - Provide feedback on policy issues/questions

Roles -- Stakeholders

- Each stakeholder's role is to
  - Provide feedback to EPA on the working group's charge
  - Come prepared to analyze and address issues in a productive manner
  - Respect the views of others

EPA's expectations

- Working group needs to
  - Make recommendations for a MACT standard for coal-fired electric utility units
  - Focus on relevant issues
  - Think outside the box...but inside the CAA
- Working group does not have to
  - Reach consensus -- desired but not required
  - Make decisions

Suggested ground rules

- Test assumptions and inferences
- Share all relevant information
- Be specific - use examples
- Agree on what important words mean
- Explain the reasons behind your statements, questions, and actions
- Make statements, then invite questions
- Keep the discussion focused

More ground rules

- Technical presentations by EPA and stakeholder groups to working group
- Working group discussion leading to a consensus recommendation, or a separate recommendation
- No venue for public participation during meetings
  - Positions may be made through members

How we'll proceed

- Today
  - Three background presentations on MACT process and utility background, current mercury control knowledge, and three-pollutant legislation activities
  - Discussion of future meetings
  - General discussion of how process will be structured and future schedule

Utility Working Group

Utility MACT background

MACT process

Bill Maxwell

Combustion Group/ESD

Purpose

- To provide background on utility MACT project
- To provide background on MACT process
  - Section 112 requirements
  - Issues
  - Timing
  - Process

Background -- Mandate

- Section 112(n)(1)(A) of CAA: EPA must perform study of, and report to Congress on, the hazards to the public health of HAP emissions from fossil fuel-fired electric utility steam generating units
- Based on the results of the study, Administrator must determine whether HAP regulations for such units are necessary and appropriate

Background -- Study

- Report to Congress issued in February 1998
  - HAP of greatest concern -- mercury from coal-fired units
  - Some concern from other HAP from coal-fired units and from oil-fired units

Background -- ICR

- Information collection request
  - Intended to inform electric utility regulatory determination along with health studies (e.g., NAS report), control option analyses, etc.
  - Intended to improve overall estimate of the amount and species of mercury being emitted from coal-fired utility units

Background -- ICR (conc.)

- Identified all coal-fired units meeting CAA definition and their control configuration
- Required all coal-fired units to analyze coal mercury content during calendar year 1999
- Required ~85 coal-fired units to test for speciated mercury emissions

Background -- Determination

- EPA announced finding on 12/14/2000
  - Regulation necessary for oil- and coal-fired boilers
  - Regulation not necessary for gas-fired boilers
  - Based on
    - Public health concerns
    - Mercury emissions from power plants
    - Information that mercury from power plants can be controlled

Section 112 rule

- “Best of the best” for new sources
- Average of the top performing 12 percent (e.g., top 6 percent) for existing sources
  - Recent court decisions will be examined
- Allows for subcategorization
- Listing decision triggers section 112(g) case-by-case MACT determinations for new coal- and oil-fired sources

Format of section 112 rule

- Emissions standard applicable to each source
- Trading not allowed in any consideration of the level(s) of control at the floor
  - Trading among units at given facility allowed

Section 112 focus

- Most of attention has been on mercury from coal-fired units
- Also concerned about
  - Other HAP from coal-fired units
  - Nickel from oil-fired units

Timing

- Settlement agreement provides for
  - Proposal of section 112 regulations by 12/15/2003
  - Promulgation of section 112 regulations by 12/15/2004
- Compliance date of 12/15/2007

Current activities

- Data analyses
- Coordination activities
- Additional activities

Data analyses

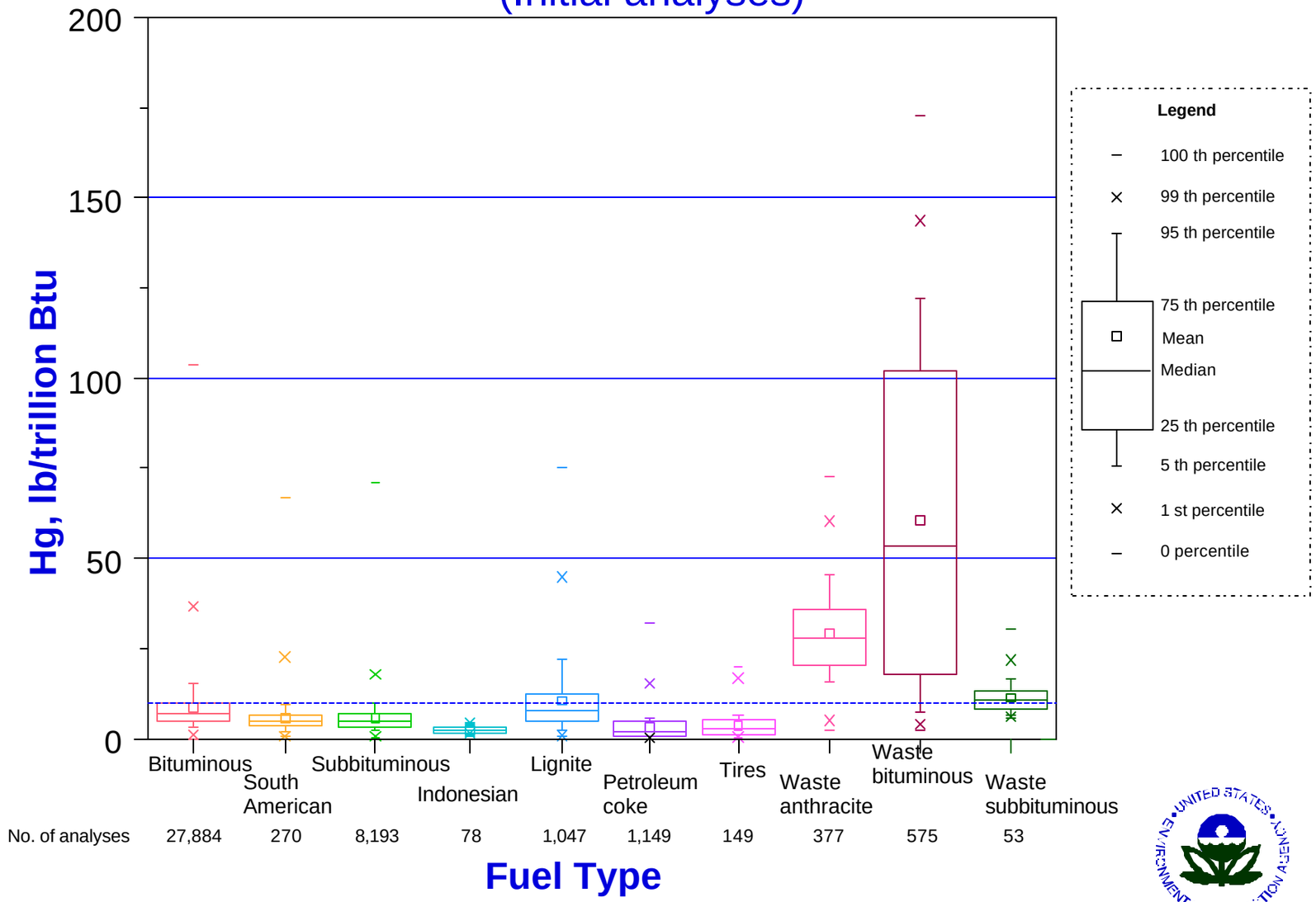
- Further analyze data for the purpose of establishing section 112 standards
  - Subcategories
  - Floor
  - Best performing
  - Adequacy of data
    - No data officially “thrown out” yet

Preliminary results

- Mercury content of coal is not an indicator of level of mercury emissions in all cases
- Mercury control on subbituminous and lignite coals is more problematic than on bituminous and waste coals
- NO_x control may enhance mercury control for some coals

1999 ICR Data Analyses - Mercury in Fuels

(Initial analyses)



Preliminary subcategory options

- Fuel type
  - All coal
  - Individual coals
    - Bituminous
    - Subbituminous
    - Lignite
    - Waste
- Boiler type
- Control device type
- Others - ?

Coordination activities

- Continue coordination with ORD, DOE, EPRI, UNDEERC, et al. on on-going mercury control research
  - More testing on existing control devices and enhancements
  - More testing on SCR/SNCR installations
  - Fly ash issues
  - Control device cost analyses

Additional activities

- More sophisticated deposition analyses using REMSAD and new mercury emissions data
- Analyses using IPM looking at the costs and market impacts of a variety of potential levels of mercury control

CONTROL OF MERCURY EMISSIONS FROM COAL-FIRED UTILITY BOILERS

James D. Kilgroe
Office of Research and Development
National Risk Management Research Laboratory
Air Pollution Prevention and Control Division
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MACT Working Group Meeting
August 1, 2001

GLOSSARY

- APCD - Air pollution control device
- CEMs - Continuous emission monitors
- CFBA - Circulating fluidized bed absorber
- ESP - Electrostatic precipitator for particulate control (CS-ESP = cold-side ESP, HS-ESP = hot-side ESP)
- FF - Fabric filter baghouse for particulate control
- FGD - Flue gas desulfurization
- GC - Cooling of flue gas

cont'd

GLOSSARY

- Hg or Hg(T) - Total mercury in coal or flue gas
- Hg° - Elemental mercury
- Hg^{2+} - Ionic mercury
- Hg(p) - Particulate bound mercury
- ICR - Information collection request
- LNB - Low NOx burner
- PAC - Powdered activated carbon

cont'd

GLOSSARY

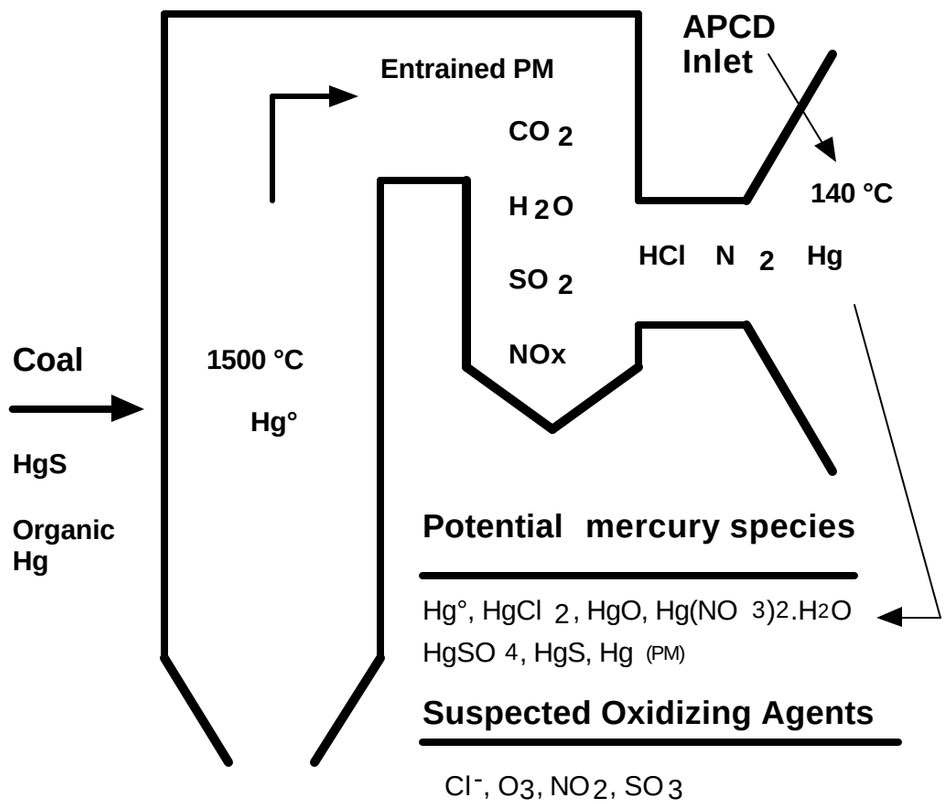
- PC - Pulverized coal
- PM - Particulate matter
- SCR - Selective catalytic reduction for NOx control
- SDA - Spray dryer absorber for SOx control
- SI - Sorbent injection*
- SNCR -Selective non-catalytic reduction for NOx control

* Sorbent injection may include flue gas cooling and increased duct lengths for increased residence times.

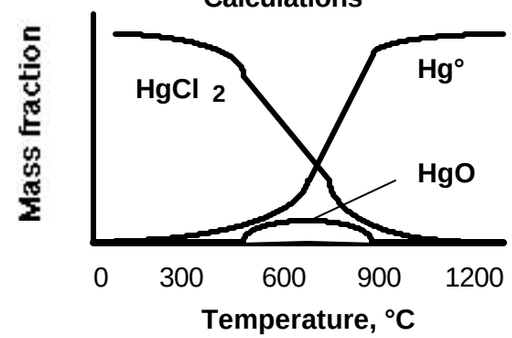
ORD MERCURY CONTROL TECHNOLOGY PROGRAM STRATEGY

- Support OAR/OAQPS development of regulations
- Evaluate Hg measurement methods and Hg CEMs
- Characterize factors that effect mercury speciation and capture
- Work jointly with DOE, EPRI and the utility industry to develop cost-effective control technologies
- Characterize and control the stability of Hg in coal combustion residues and residue by-products
- Conduct performance, economic and control trade-off studies

BEHAVIOR OF MERCURY IN COAL-FIRED BOILERS



Thermochemical Equilibrium Calculations



Factors Affecting Speciation

- Type and properties of coal
- Time/temperature profile
- Composition of flue gas
- Fly ash and sorbent properties
- Flue gas cleaning conditions

MERCURY MEASUREMENTS

- **Manual measurement methods for Hg(T): Method 101A and Method 29**
- **Ontario-Hydro measurement method for mercury speciation**
  - Sampling probe
  - Sample filter to collect Hg(p)
  - Series of impingers to separate and collect Hg^{2+} and Hg°
- **CEMs for Hg(T) used in Europe and Japan on incinerators**
- **Speciating CEMs being developed for U.S. market**
  - Measures only gas-phase mercury
  - Measures Hg° and Hg(T)
  - Determines Hg^{2+} by difference

MERCURY CAPTURE

- Hg(p) easily captured by ESPs and FFs
- Hg^{2+} exhibits high to low solubility and can generally be captured in scrubbers
- Hg° is insoluble and must be adsorbed on to solids or converted to Hg^{2+} for capture by scrubbing
- Hg^{2+} is generally easier to adsorb than Hg°
- Adsorption is highly dependent on flue gas composition and temperature
- Typical Hg^{2+} to Hg° ratio in flue gas: bituminous coal > subbituminous coal > lignite

RESULTS OF DETERMINATION STUDY BOILER AND APCD INFORMATION

- **Types of Boilers (1140 units)**
  - **Pulverized coal-fired: 979 units**
  - **Cyclone-fired: 87 units**
  - **Fluidized-bed combustors: 42 units**
  - **Stoker-fired: 32**
- **Flue gas cleaning methods***
  - **ESPs only: 787 units**
  - **FFs only: 79 units**
  - **Dry scrubbers: 43**
  - **Wet FGD scrubbers: 143**
  - **Other: 88 units**

*38 units with SNCR and 6 units with SCR

MAJOR CONCLUSIONS OF DETERMINATION STUDIES

- 48 tons of Hg emitted from coal-fired units in 1999
- Capture by existing equipment ranges from 0 to > 90%
- Moderate to good capture for bituminous coals
- Poor capture for subbituminous coal and lignite
- Best capture for dry and wet FGD scrubbers
- Capture associated with PM controls:
  FF > ESPs > PM scrubbers & mechanical collectors
- NOx controls may enhance ability to capture Hg

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MEAN MERCURY EMISSION REDUCTIONS FOR EXISTING PC-FIRED UNITS[a], %

Add-onControls	Type of Coal[b]		
	Bituminous	Subbituminous	Lignite
PM Only			
CS-ESP	36	3	0
HS-ESP	11	12	NT
CS-FF	89	73	NT
PM Scrubber	12	0	33
Dry FGD Scrubbers			
SDA+ESP	NT	50	NT
SDA+FF	98	23	2
Wet FGD Scrubbers			
CS-ESP+Wet FGD	81	0	34
HS-ESP+Wet FGD	42	38	NT
CS-FF+Wet FGD	97	NT	NT

a. Based on OH train data. NT= not tested
b. Revised April 24

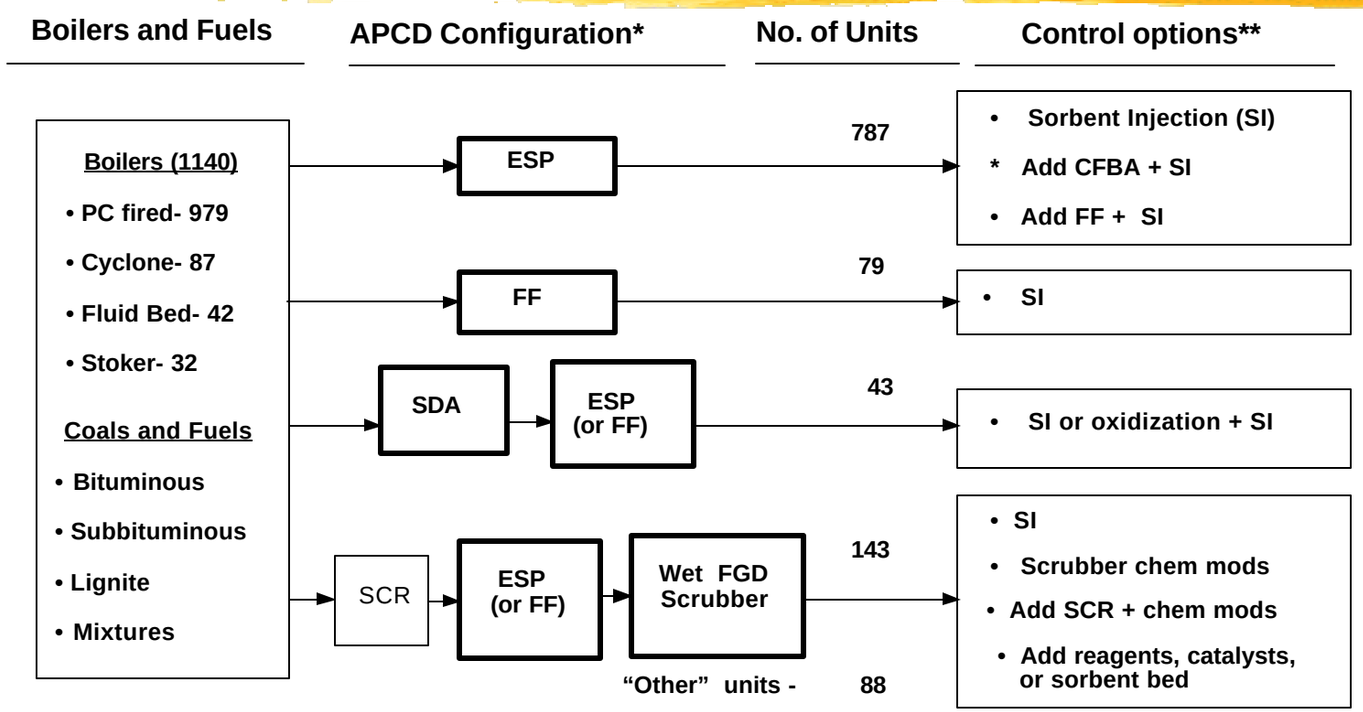
STABILITY OF MERCURY IN COAL COMBUSTION RESIDUES

- No evidence that the mercury in residues pose a leaching problem
- Insufficient information to determine whether mercury will volatilize from normal disposal practices
- Major concern is the stability of mercury during the manufacturing, use, and disposal of residue by-products
- Residue research will be conducted in conjunction with mercury control technology development efforts

CURRENT CONTROL TECHNOLOGY RESEARCH PRIOITIES

- Develop controls for air toxics MACT regulations
- Develop Hg controls for NOx SIP call units
- Develop combined Hg, NOx, and SO2 controls
- Coordinate Hg and fine PM control research

MERCURY CONTROL RETROFIT OPTIONS

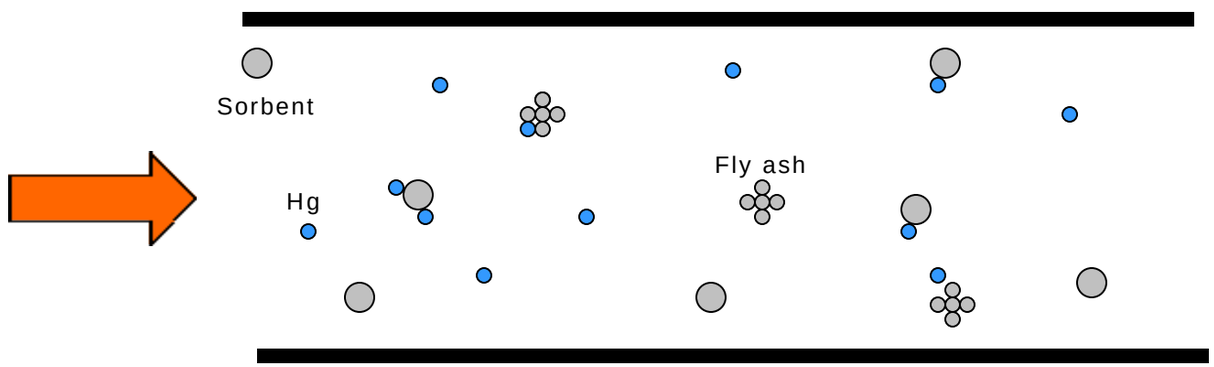


* ESP= electrostatic precipitator, FF=fabric filter, CFBA=circulating fluidized-bed absorber, SCR=selective catalytic reduction (6 units), SDA=Spray dry adsorber

** Selected control options--other options possible. Flue gas cooling and additional ducting may be used with sorbent injection (SI)

MERCURY CONTROL TECHNOLOGY
ESP RETROFIT PROBLEMS

- Low flue gas concentrations of Hg° and Hg^{2+}
- Hg° is relatively inert and difficult to capture
- High flue gas flow rates and poor sorbent utilization
- Competition for surface active sites with other flue gas constituents

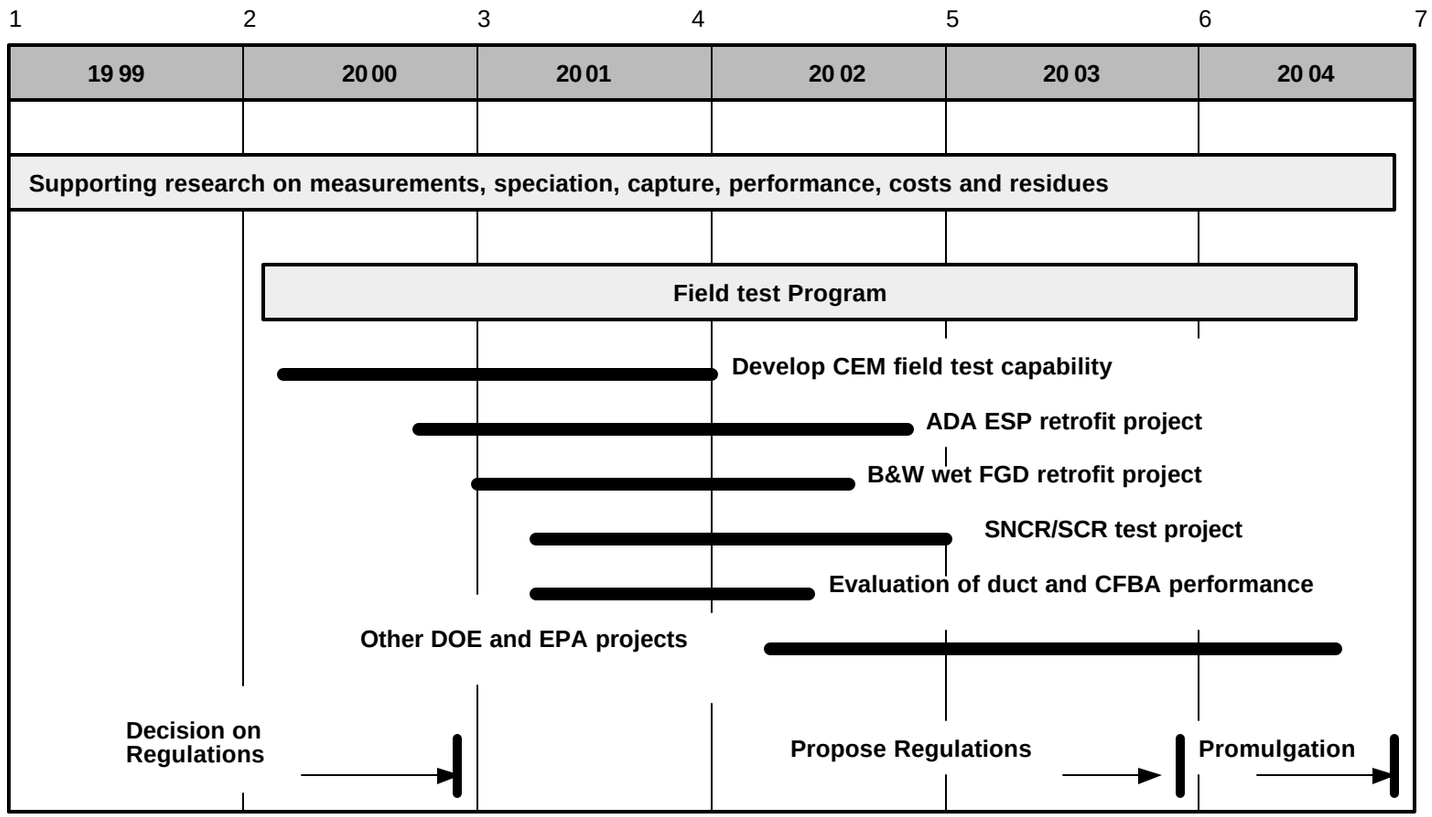


CONTROL TECHNOLOGY CHALLENGES FOR MERCURY MACT REQUIREMENTS

- **Control of emissions for units with ESPs**
  - Poor carbon utilization
  - High carbon costs
  - Lowering flue gas temperatures to increase Hg capture results in corrosion problems
  - Excessive carbon in collected fly ash results in disposal/utilization problems
- **Control of Hg emissions from subbituminous coals and lignite**
- **Development of Hg° oxidizing methods for wet FGD systems**
- **Optimization of NOx controls for mercury control**
- **Evaluation of controls for non-PC fired units**
- **Use and evaluation of mercury CEMs**

EPA

TIME-LINE FOR MERCURY CONTROL TECHNOLOGY PROGRAM



STATUS OF CURRENT DOE-EPA-EPRI MERCURY CONTROL RESEARCH

- Full-scale ESP sorbent injection projects at 4 sites
- One full-scale wet FGD project
- Project on effects of SCR/SNCR - 5 sites
- Six new pilot-scale DOE projects announced this May
- Evaluation and use of mercury CEMs
- On-going speciation and capture research
- DOE, EPRI, and EPA to commit additional resources for mercury, multi-pollutant control and residue research in FY2002 and FY2003

ESTIMATED FEASIBLE LEVELS OF NEAR- AND LONG-TERM CONTROL*

PERCENT REDUCTION FROM INLET CONCENTRATON

Existing Technology	Current Bitum.	Current Subb.		Near-Term Bitum.	Near-Term Subb.
ESP		**36**	**3**		**70**
45					
FF	**89**	**73**		**90**	**85**
SDA + ESP	**70**	**50**		**80**	**70**
SDA + FF	**95**	**25**		**90**	**80**
ESP + wet FGD	**80**	**0**		**90**	**50**
FF + Wet FGD	**90**	**75**		**90**	**85**

Long-term control ranges from 85 to 95 % depending on coal and control technologies

*** Mercury control for pulverized coal-fired boilers and units with cold-side ESPs or FFs. Current control from ICR data; Near-term control (2007-2008) is base on use of PAC; Long term control for technologies available in 2012-2015**

Utility Working Group

Meeting procedures

Proposed schedule

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Emission Standards Division

Proposed schedule

- Overall schedule
  - Completion of technical analyses - 06/02
  - Completion of impacts analyses - 08/02
  - Draft proposal package - 06/03
  - Proposal - 12/03
  - Promulgation - 12/04

Proposed schedule

- Intermediate schedule
  - Quarterly meetings in conjunction with (preceding) CAAAC meetings
  - Other
    - Teleconferences
      - Frequency - ?
    - Periodic, as-needed, face-to-face meetings