ICR Data Available

- Part 1 - General power plant information for all coal plants
- Part II - Coal analyses (Hg, Cl, S) for all coal plants
  - Monthly coal consumption
- Part III - Flue gas measurements at 84 plants
  - Control device inlet/outlet
  - Coal analyses (Hg, S, Cl)
Objective and Approach

Estimate 1999 total and speciated Hg emissions for all US coal power plants

- Using coal data, estimate total mercury entering power plants
- Using stack data, develop predictive correlations, relationships
- Using plant and coal data - and using correlations, estimate Hg emissions for all plants
Develop correlation based on “available” parameters
- Data measured in ICR test report
- Data available for all coal power plants

Possible factors that impact Hg, but not incorporated
- LOI, unburn carbon
- Flue gas temperature
- Flue gas residence time
- Metal concentrations in coal, ash
- Effect of SCR, SNCR, NH3
## Divided Industry into 12 Control Technology Categories

<table>
<thead>
<tr>
<th>Controls</th>
<th>Test Sites</th>
<th>US Sites</th>
<th>Tons Hg Entering</th>
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</thead>
<tbody>
<tr>
<td><strong>Across Particulate Controls</strong></td>
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<tr>
<td>ESP cold</td>
<td>18</td>
<td>674</td>
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<tr>
<td>ESP hot</td>
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<td>120</td>
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<td>Fabric Filter</td>
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<td>58</td>
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<tr>
<td>FBC FF</td>
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<td>39</td>
<td>3.4</td>
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<tr>
<td>Vent. Scrubber</td>
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<td><strong>Across FGD Systems</strong></td>
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<td>ESPh FGDw</td>
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<tr>
<td>FGDd ESPc</td>
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<td>5</td>
<td>0.3</td>
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</table>
Effect of NOx, SO2, Hg on Hg Removal ESPs (cold) Category

- Fraction Hg Remove vs Log. (SO2 lb/mil)
- Fraction Hg Remove vs Log. (Hg lb/tril)
- Fraction Hg Remove vs Log. (NOx lb/mil)

- $R^2 = 0.15$
- $R^2 = 0.021$
- $R^2 = 0.056$
Effect of Cl and HHV (coal type) on Hg Removal - ESPs (cold) Category

- $R^2 = 0.3$
- $R^2 = 0.2$

Fraction Hg Removed

Cl ppm
HHV
Log. (Cl ppm)
Log. (HHV)
ESP (cold) - Correlations for Hg Removal, Speciation (% Elemental)

- % Elemental: $R^2 = 0.51$
- % Removal: $R^2 = 0.43$

Mercury Removal or % Elemental

Cl/SO2 for Removal vs. Coal Chlorine (ppm) for Elemental %
Effect of Firing Configuration

Mercury Removal

CI/SO2 Ratio

Low NOx Burners
Cyclone Boilers
Cold ESPs: Hg in Particulates
Employ average particulate Hg

R^2 = 0.23
Calculation Methodology for Industry Estimate

- Calculate Hg entering power plant (ICR Part II)
- Calculate % Hg removal based on mean Cl and S in the coal (ICR Part II)
- Calculate % elemental Hg based on mean Cl
- Particulate Hg is an average of the data
- % Oxidized = 100 - Elemental Hg - Particulate Hg
Methodology - Constraints

- Limitations - more variables? not directly correlated, e.g. temperature, LOI, ash, etc.
- Coal analyses defines mercury entering boiler
- Assume no mercury in bottom ash
- Did not extrapolate the correlation beyond the existing data
- No negative or >100% of input emissions (possible with correlations)
EPRI Mercury Emission Estimates

- 1999 Hg emissions from coal plants = 45 tons
  - Estimate 75 tons entering plants
  - Average 40% removal from existing controls tech.
- Large uncertainty in EPRI correlations for some of the less populated categories
  - Sufficient data for the key categories (ESPc, ESPc/FGDw)
- Variability, uncertainty - primarily plant-specific
  - Other independent variables not incorporated such as LOI, flue gas temperature, others?
- Effect of SCR, SNCR?
  - Estimate >55% (MW) will install by 2010