# DOE Mercury Control Research

*Air Quality III:*
*Mercury, Trace Elements, and Particulate Matter*

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www.netl.doe.gov

# Potential Mercury Regulations

**MACT Standards**

- Likely high levels of Hg reduction
- Compliance: 2007

**Clean Power Act of 2001**

- 4-contaminant control
- 90% Hg reduction by 2007

***President Bush Announcing Clear Skies Initiative February 14, 2002***

**Clear Skies Act of 2002**

- 3-contaminant control
- 46% Hg reduction by 2010
- 70% Hg reduction by 2018
- Hg emission trading

# Uncertainties
## *Mercury Control Technologies*

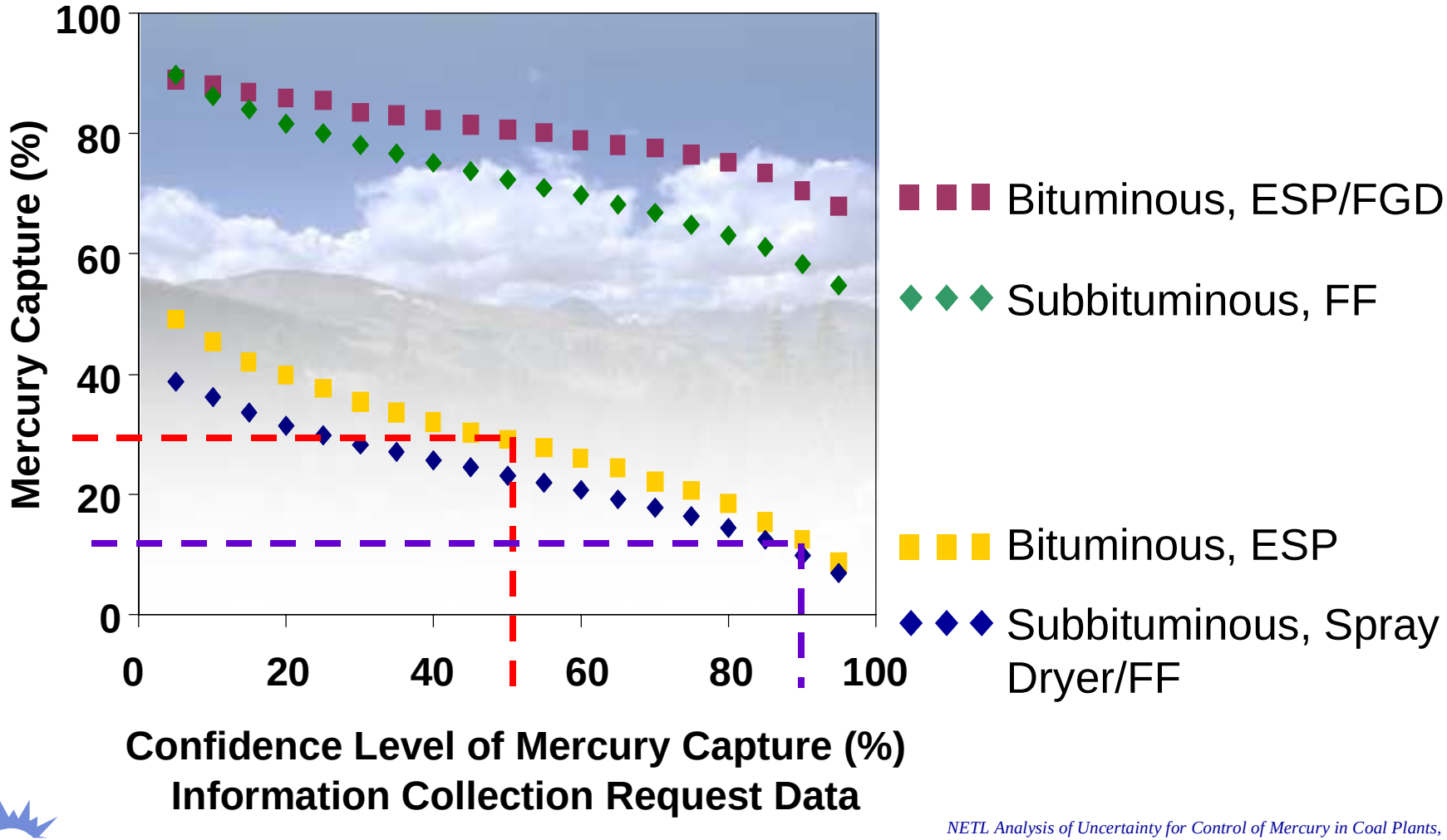
- **Balance-of-plant impacts**
- **By-product use and disposal**
- **Capture effectiveness with low-rank coals**
- **Confidence of performance**

# SCR + FGD Not Necessarily the Solution

- **Plant 1 – Bituminous coal**
  - 25% Hg oxidation across SCR
  - 98% total oxidized Hg
- **Plant 2 – Bituminous coal**
  - 31% Hg oxidation across SCR
  - 88% total oxidized Hg
- **Plant 3 – Subbituminous coal**
  - 5% Hg oxidation across SCR
  - 10% total oxidized Hg

# ICR Data Uncertainty

## *Confidence of Performance for Mercury Control*



# Capturing Mercury Difficult!

*Houston Astrodome*

## *A Hypothetical Example*

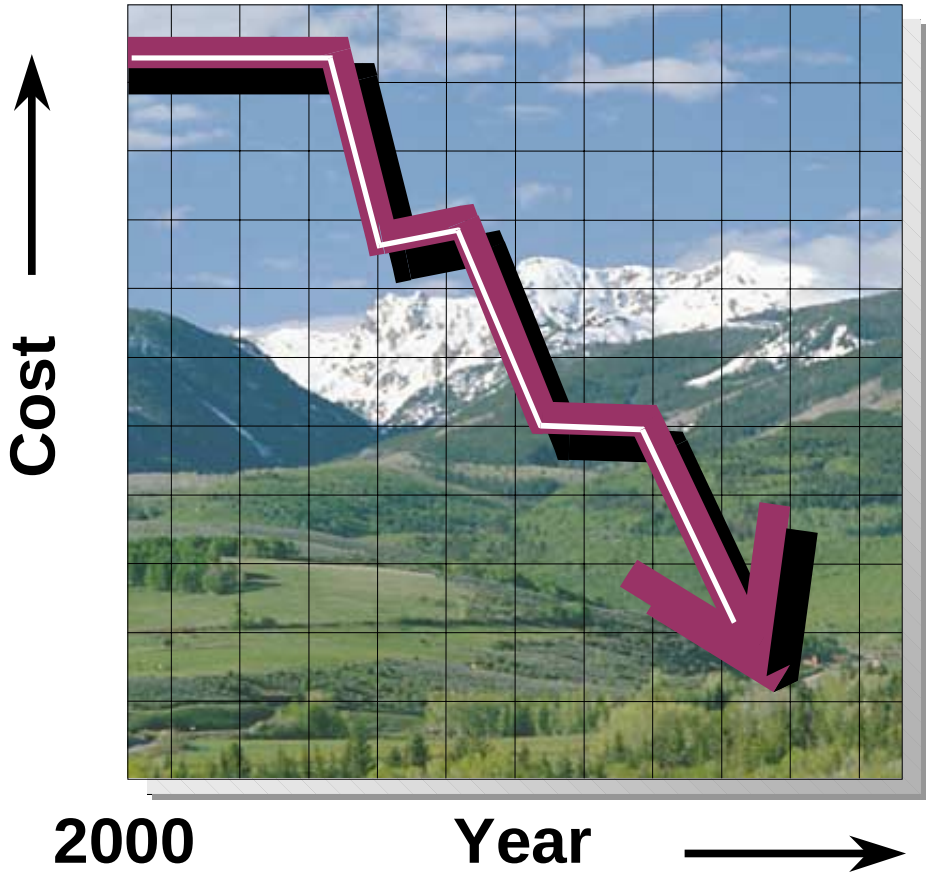
- **Dome filled with 30 billion ping-pong balls**
- **30 mercury balls**
- **Remove 27 balls for 90% Hg capture**

# R&D Goals

## *DOE Mercury Control Program*

**Have technologies ready for commercial demonstration:**

- **By 2005, reduce emissions 50-70%**
- **By 2010, reduce emissions by 90%**
- **Cost 25-50% less than current estimates**




**Baseline Costs: $30,000 - $70,000 / lb Hg Removed**

# Six Mercury Control Field Tests

| Technology / Utility Plant | Start Date |
|---|---|
| **ADA-ES – Sorbent Injection** | |
| Alabama Power – Gaston | March 2001 |
| We Energies – Pleasant Prairie | September 2001 |
| PG&E – Brayton Point | June 2002 |
| PG&E – Salem Harbor | September 2002 |
| **McDermott-B&W – Enhanced Scrubbing** | |
| Michigan South Central Power – Endicott | May 2001 |
| Cinergy – Zimmer | October 2001 |

# ADA-ES Field Test Sites

## Alabama Power – Gaston

- 135 MW
- Low-sulfur bituminous coal
- ESP
- COHPAC fabric filter

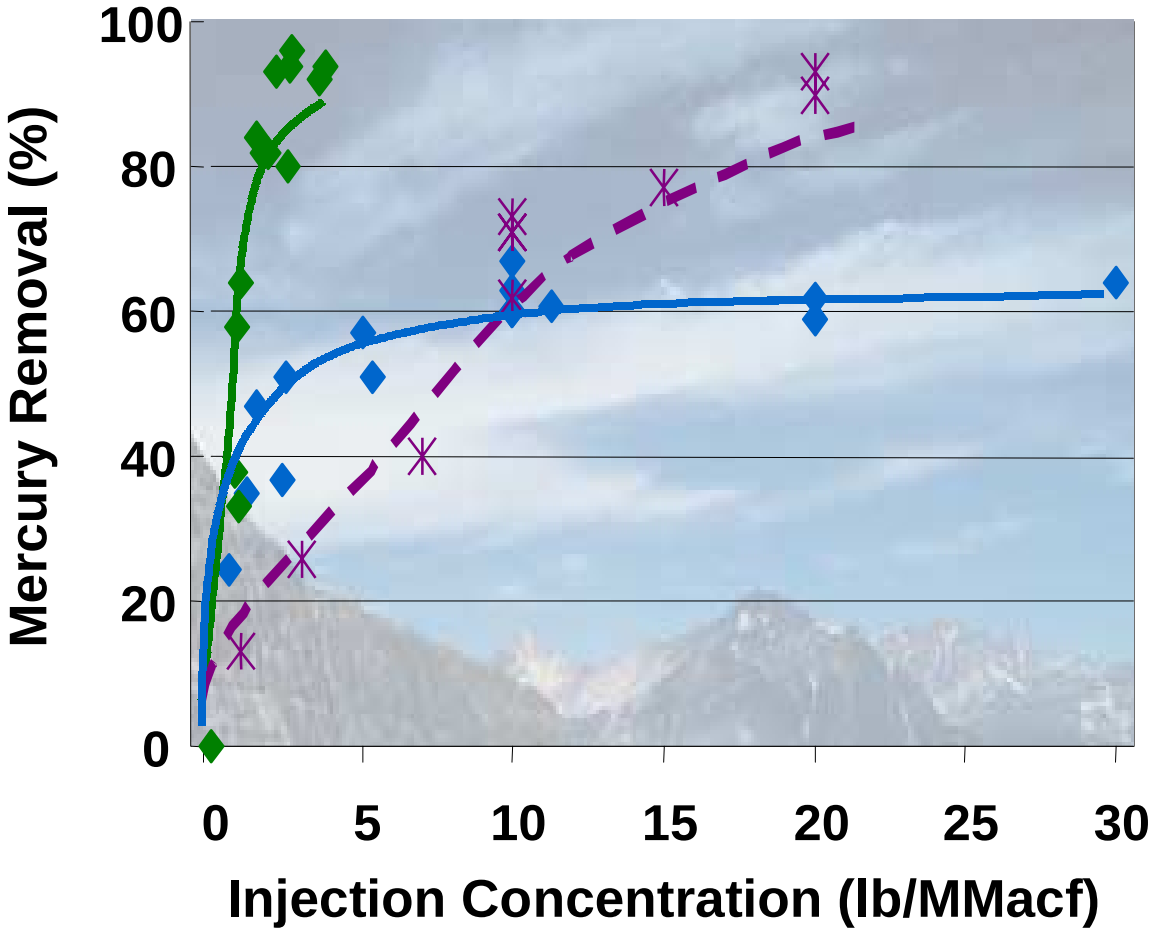
## We Energies – Pleasant Prairie

- 150 MW
- Subbituminous coal
- ESP

## PG&E – Brayton Point

- 122 MW
- Low-sulfur bituminous coal
- Low-$NO_X$ burners
- Two ESPs in series

# Mercury Removal Trends
## *Activated Carbon Injection*




***Gaston:*** **Bit., ESP**

***Brayton Point:*** **Bit., ESP**

***Pleasant Prairie:***
**SubB., ESP**

# Observations from Field Tests

- **Activated carbon removes Hg**
  - Range of effectiveness depends on coal type and plant configuration
- **Many uncertainties remain**
  - Low-rank coals
  - Sorbent costs
  - Units equipped with ESPs
  - Downtime for startup
  - By-product use and disposal

# Impact on By-Products Could Be Significant

## Fly Ash

- 63M tons/yr generated
- 32% used
- Utilization loss for concrete ≤ $390M impact

## FGD By-product

- 25M tons/yr generated
- 19% used
- Utilization loss for wallboard ≤ $135M impact

Fly Ash

FGD Byproduct

**Hazardous Designation of All By-products Would Cost $11 Billion / Year**

# Long-Term Field Testing Key Research Need

- **Competitive solicitation in FY 03**
- **Seeking stakeholder input:**
  - Coal types
  - Plant size and configuration
  - Testing duration
  - Application of CEMs

# Other Research Needs

- Implications of global Hg emissions on U.S.
- Improvements in CEMs
- Investigation of Hg impacts on coal by-product use and disposal
- Continued development of advanced Hg control concepts

# Advanced Mercury Control Concepts

- **Apogee Scientific**
  - –Advanced Hg sorbents
- **CONSOL**
  - –Multi-pollutant control for Hg, $SO_2$, acid gases
- **EERC**
  - –Hybrid particulate control system
- **Powerspan**
  - –Multi-pollutant control for Hg, $SO_2$, $NO_x$, particulates, acid gases
- **Southern Research Institute**
  - –Calcium-based additives to control Hg
- **URS Group**
  - –Catalyst to convert elemental to oxidized Hg

**Designed to Achieve ≥ 90% Hg Removal**

# We Live in One World

# Proposed Emissions Reductions
## *Electric Power Plants (Tons / Year)*

| | | | Clear Skies | | Jeffords |
|---|---|---|---|---|---|
| *Emission* | *Actual 2001* | *Baseline* | *2008/2010 Cap* | *2018 Cap* | *2007 Cap* |
| $SO_2$ | 10.6 M | 8.9 M | 4.5 M | 3.0 M | 2.2 M |
| $NO_x$ | 4.7 M | 4.0 M | 2.1 M | 1.7 M | 1.5 M |
| Mercury | 48 | 48 | 26 | 15 | 4.8 |

# Partnership Is Key to Success!

*Jim Kilgroe – EPA*
*Scott Renninger – NETL*
*George Offen – EPRI*
*Larry Monroe – SCS*

**Discussing Mercury Control Field Testing Plans**