

# Reinhold Environmental Ltd.



2008 APC Round Table  
& Expo Presentation

*July 13-15, 2008, in Savannah, GA*

One  
**GREAT**  
Team

Southern Company Generation

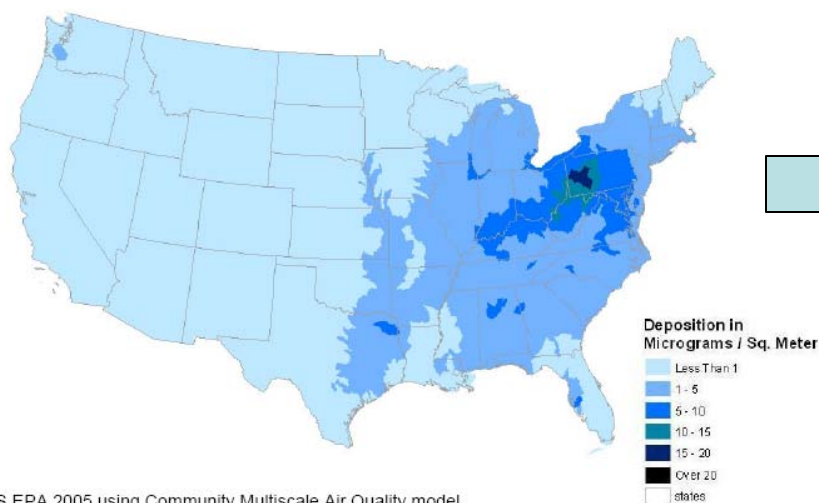
## New Approaches to Hg Control

Brandon Looney  
2008 APC/PCUG Conference

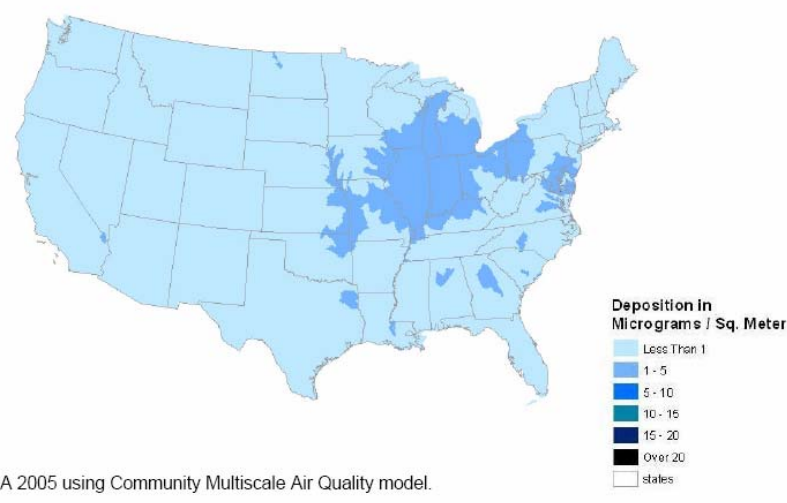
 **Once upon a time...**

## Clean Air Mercury Rule

- Phase 1: 38 Ton Emission Cap
- Phase 2: 15 Ton Emission Cap
- Total Reduction of Nearly 70%
- Market Based Cap-and-Trade



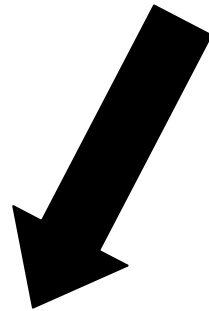
Source: US EPA 2005 using Community Multiscale Air Quality model.



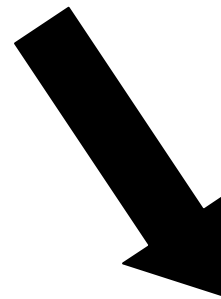
Source: US EPA 2005 using Community Multiscale Air Quality model.

*As the dust settled...*

CAMR Compliance



Activated Carbon  
Injection



FGD  
Co-Benefit

*...And the Industry lived happily ever after*

U  
ntil...



*“Because coal-fired EGUs are listed sources under section 112, regulation of existing coal fired EGUs’ mercury emissions under section 111 is prohibited, effectively invalidating CAMR’s regulatory approach. Accordingly, the court grants the petition and vacates both rules.”*

United States Court of Appeals

# Maximum Achievable Control Technology

## 2004 Hg MACT Proposal

Subcategory	Emission Limit (lb/TBtu)	Emission Limit (10 <sup>-6</sup> lb/MWh)
Bituminous-fired	2.0	21
Subbituminous-fired	5.8	61
Lignite-fired	9.2	98
IGCC unit	19	200
Coal refuse-fired	0.38	4.1

Note: Heat rate correlation between input-based and output-based limit is 10,667 Btu/kWh

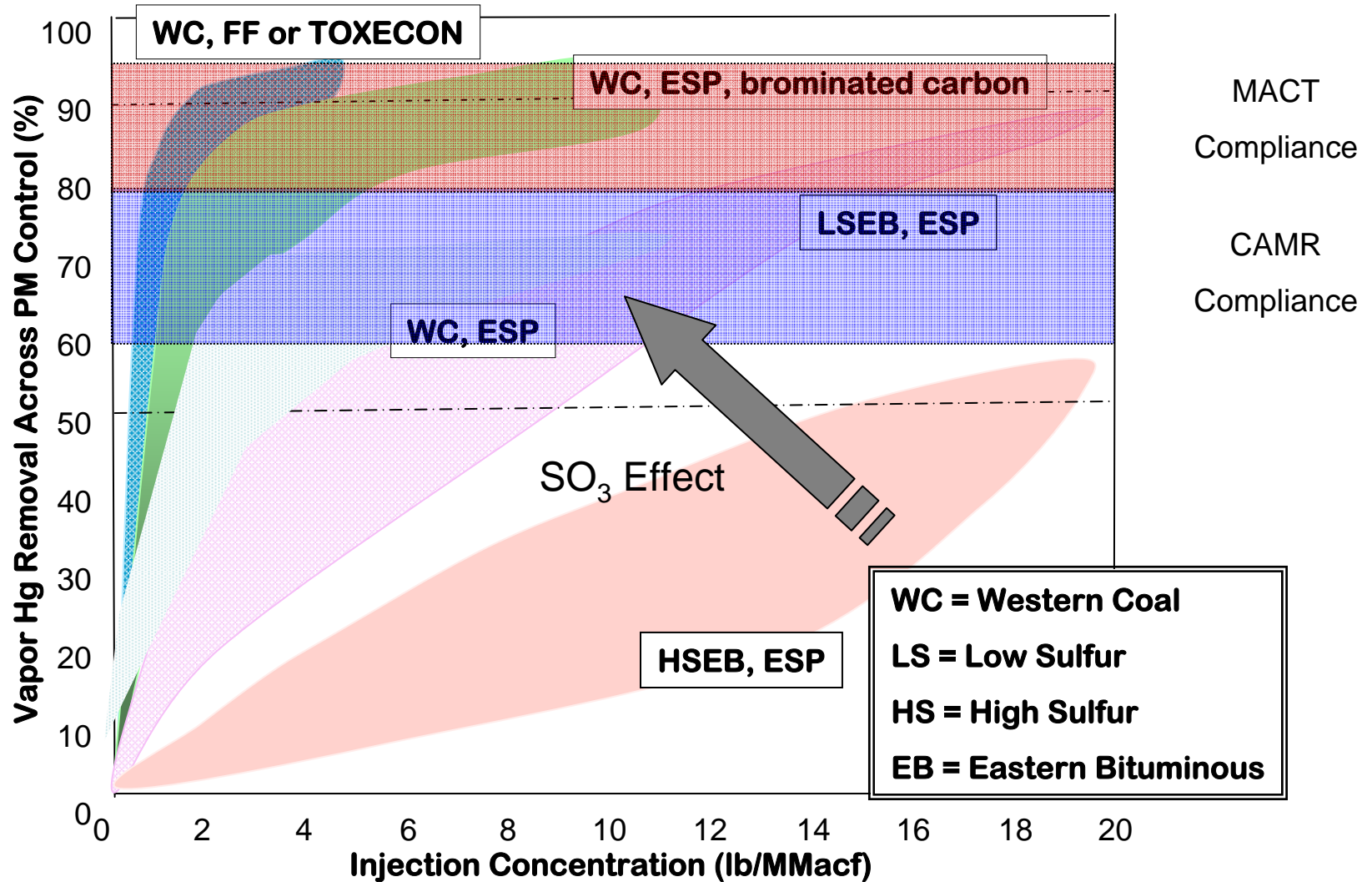
## What does this mean for technology?

Coal Percentile	Bituminous		Subbituminous	
	Coal (lb/10 <sup>12</sup> Btu)	Removal (%)	Coal (lb/10 <sup>12</sup> Btu)	Removal (%)
50 <sup>th</sup>	7.1	71.8	5.0	-16.0
90 <sup>th</sup>	15.2	86.8	9.9	41.4
95 <sup>th</sup>	20.6	90.3	12.5	53.6
97.5 <sup>th</sup>	26.7	92.5	15.0	61.3
99 <sup>th</sup>	36.6	94.5	18.0	67.8

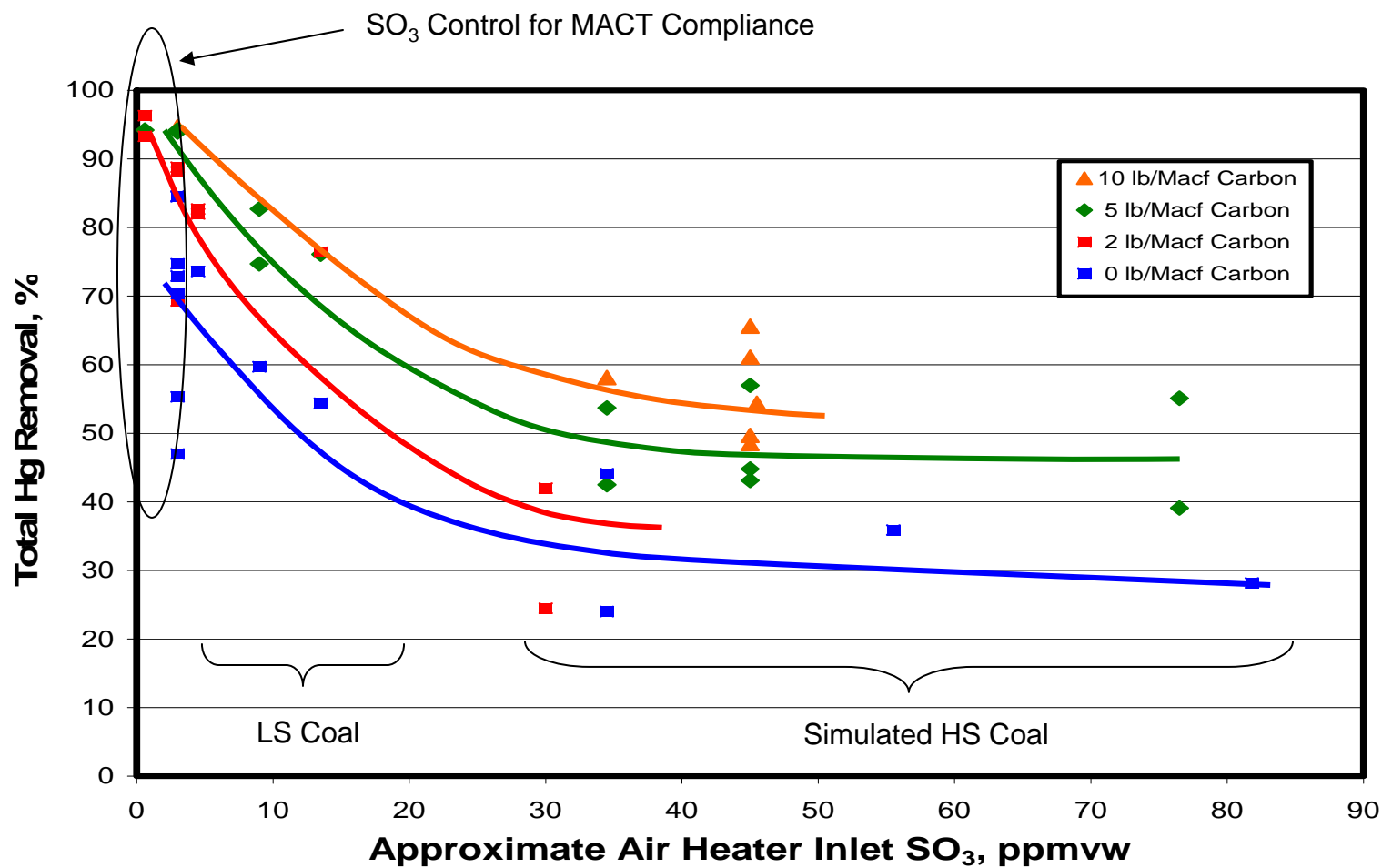
Analysis prepared by RMB Consulting & Research, Inc. for Utility Air Regulatory Group

Is your old CAMR Compliance Strategy going to be good enough?

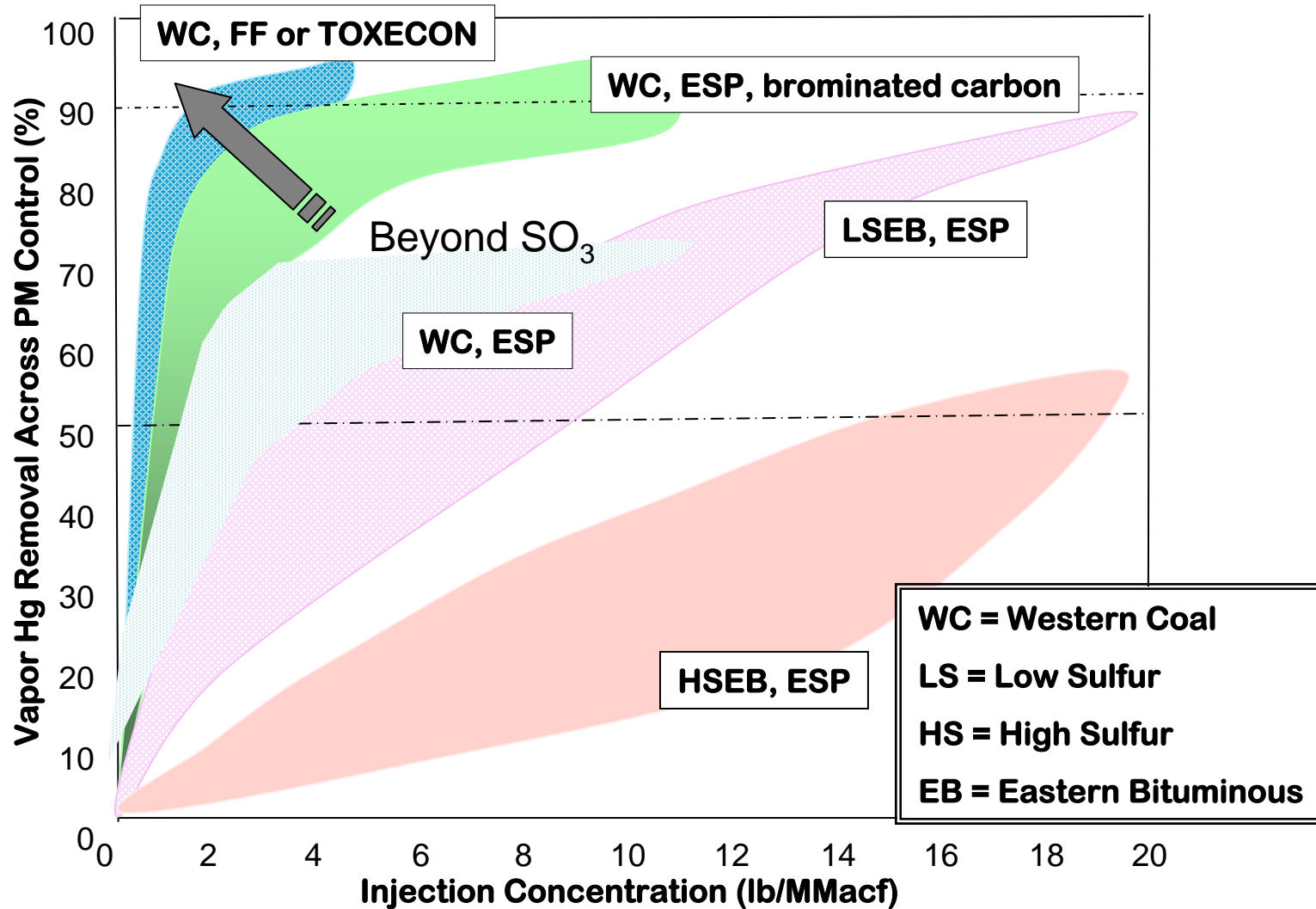
# Activated Carbon Injection



# SO<sub>3</sub> vs. Hg Competition



# Activated Carbon Injection



# Improvement Beyond SO<sub>3</sub> Removal

## Particle Size Enhancement

- What is the right particle size for PAC?
- Onsite Milling
- Onsite De-agglomeration

## Other Important PAC Criteria

### Fixed Structures

- TOXECON removal levels without Baghouse?
- Fixed Structure Life?
- EPRI MercScreen
- Other Adsorption Catalyst

# ACI Specification Development

PAC Properties for Consideration	
Bulk density	Volatile matter
Moisture, ash, fixed C	Ignition temperature
Particle size distribution	Auto ignition tendency
BET surface area	Trace chemicals (Br, metals)
Abrasion resistance	Foam index
Iodine number	Concrete impact
Molasses number	Corrosivity
Pore size distribution	Reducing capacity
Flowability	capacity and reactivity

# EPRI MercScreen



Goal: 90% Hg Removal

Limitation: Adsorption Capacity and  
Pressure Drop

Stage of Development: Pilot Scale Test

Similar  
Technologies  
Needed



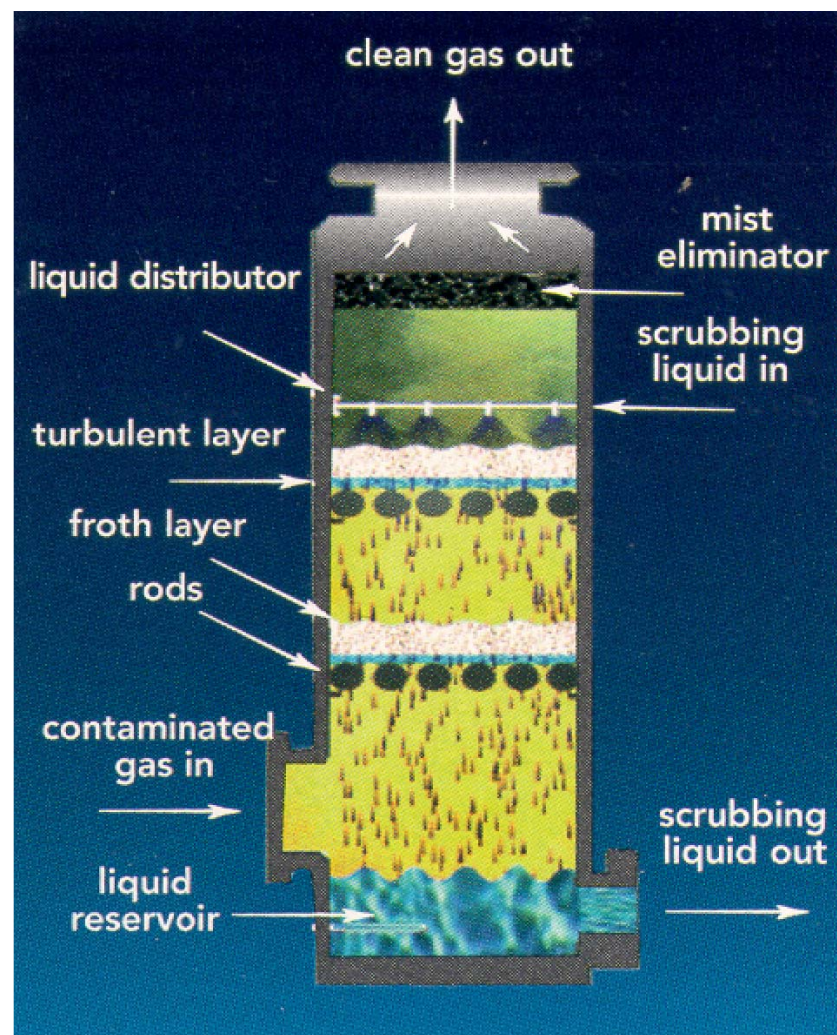
## FGD Co-Benefit

### Enhanced Hg Oxidation

- Chlorine Injection
- Bromine Injection
- Plasma Enhanced Oxidation
- Oxidation Catalyst

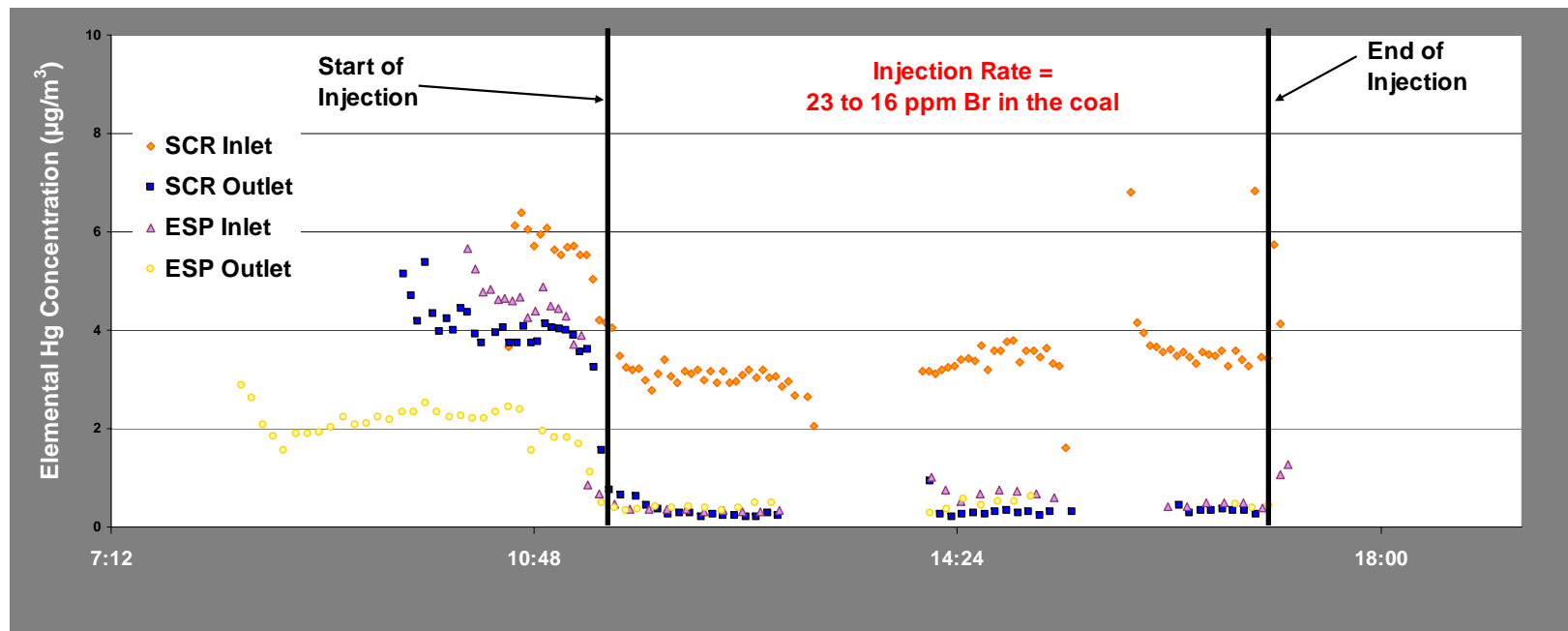
### Hg Re-Emission Reduction

- FGD Additives
- Oxidation Reduction Potential (ORP) Control
- ACI in FGD



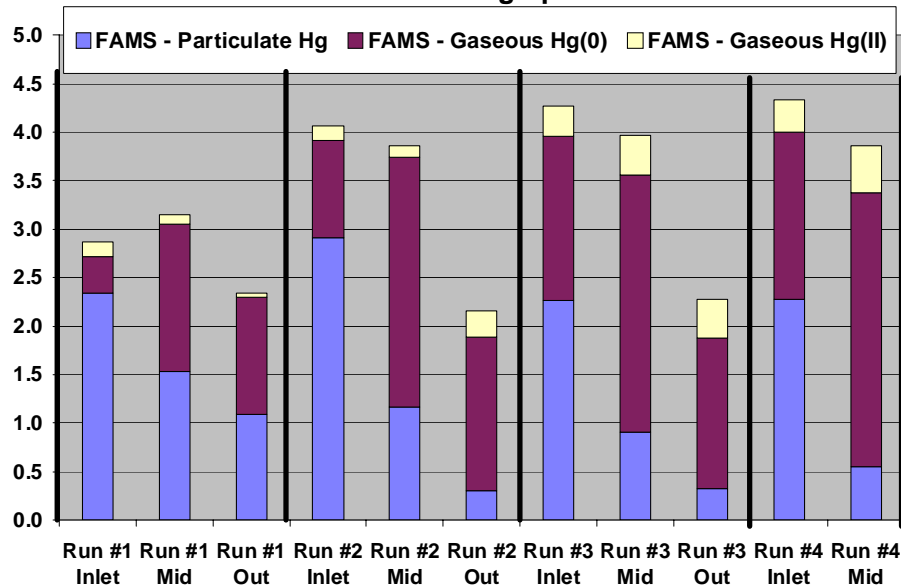
# Oxidation Enhancement

- Bromine Injection very effective on low halogen fuels
- Can Cl Injection work as well?
- Halogen injection not effective on higher Cl fuels



# Plasma Enhanced Oxidation

Pilot Results - Hg Speciation

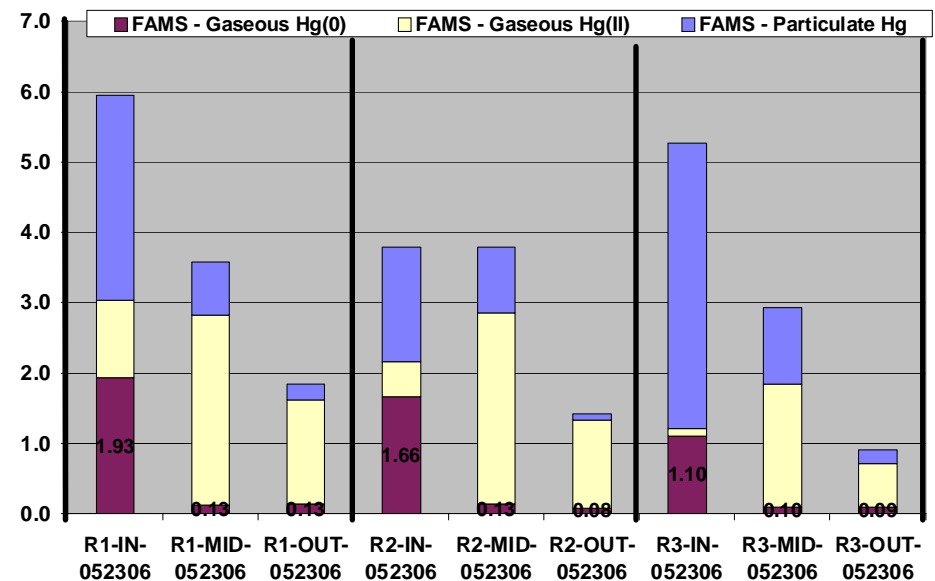


Mercury is oxidized by injecting a highly reactive reagent gas into the corona region of an electrode.

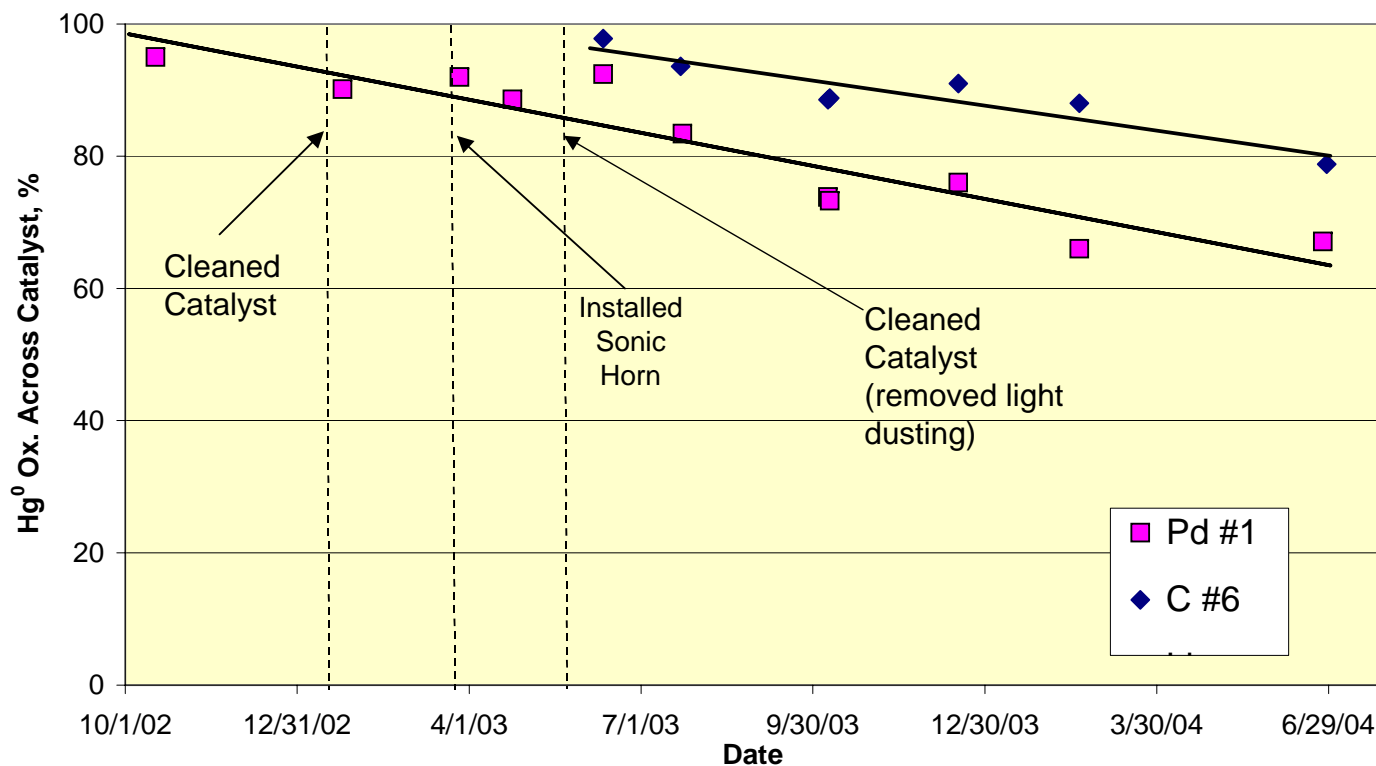
Technology has been successfully demonstrated on pilot scale however, further optimization is being pursued by technology provider, Siemens.

Day #8: Hg Speciation Results

Runs 1-3 : 05/23/06

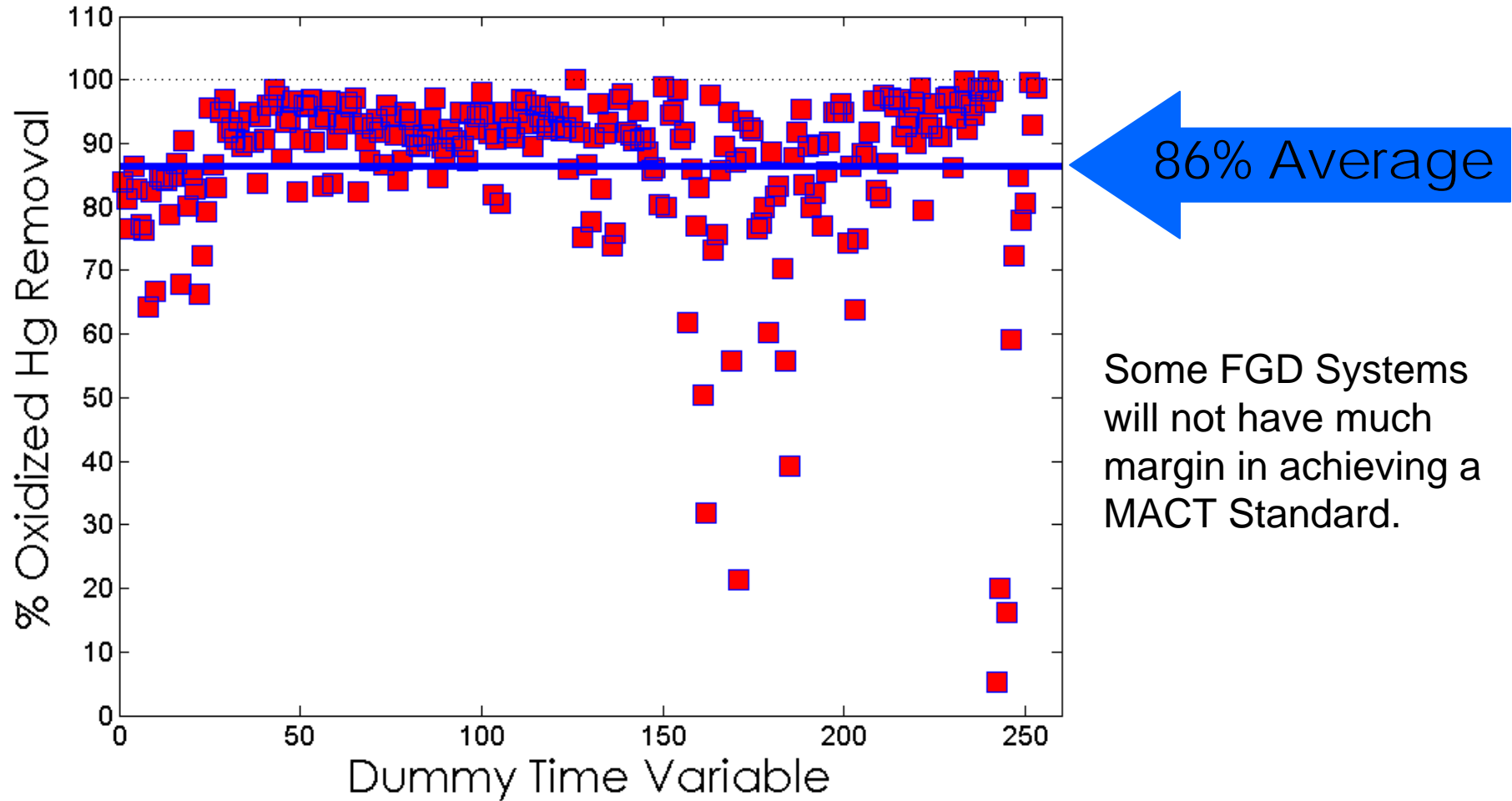


# Hg Oxidation Catalyst

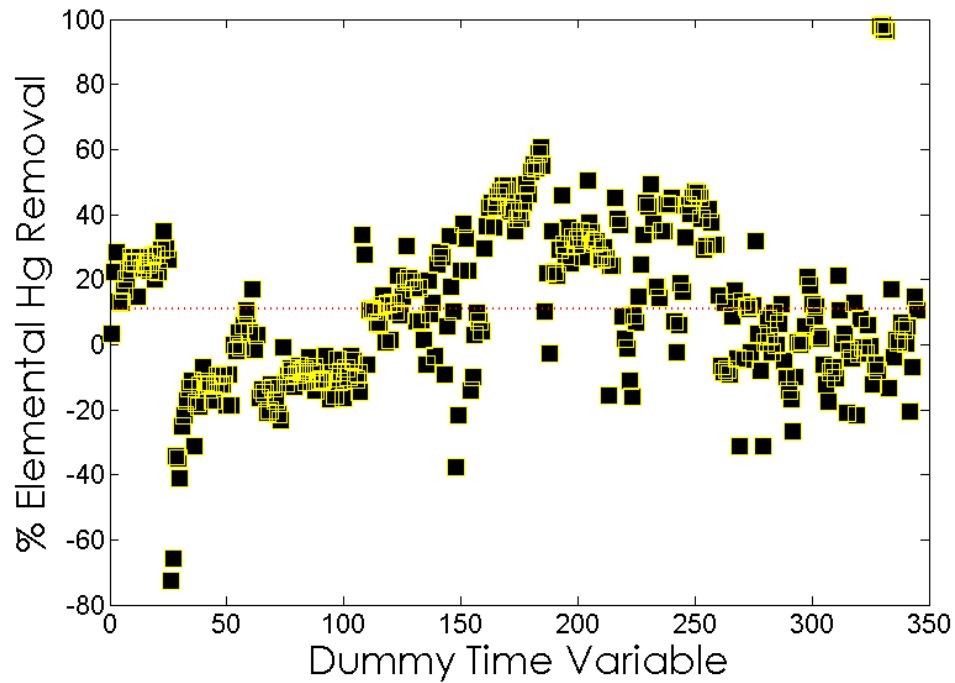


No full scale data available.

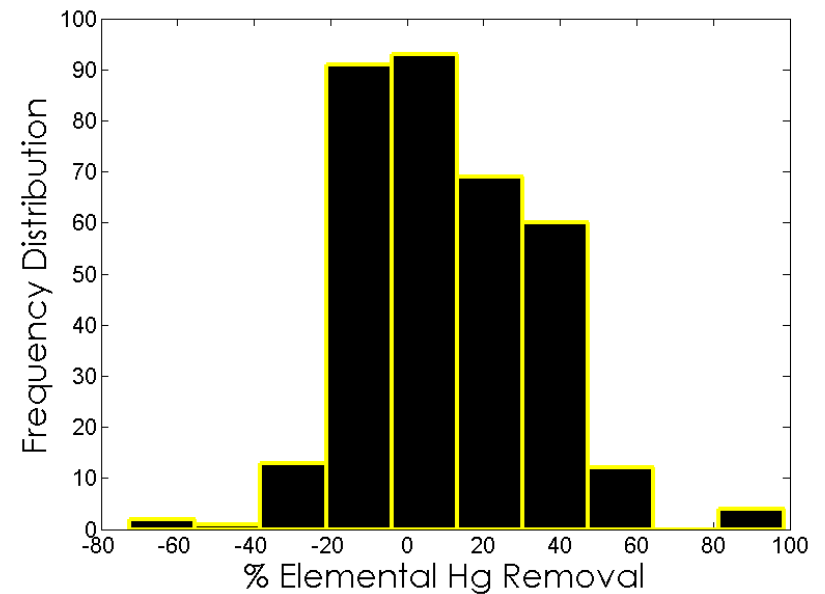
# Hg Re-Emission Concern



# Hg Re-Emission Concern



Commercial Solution is Needed!



# Summary

## Activated Carbon Injection

- Will not meet MACT Standard without BH or other enhancement
- Focus should be on SO<sub>3</sub> Removal and carbon properties
- Low Capital TOXECON replacement needed

## FGD Co-Benefit

- Near 100% oxidation is needed
- No commercial oxidation enhancement for high CI fuels
- No commercial solution for Hg Re-emission

What about other HAPS?

**Sb**

**Se**

**As**

**Cr**

**HCl**

**Hg**

**HF**

**Co**

**Pb**

**Ni**

**Be**

**VOC**

**Mn**

**Cd**



# QUESTIONS