



***“Combined Hg and SO<sub>3</sub>  
Removal Using a  
Single Sorbent”***

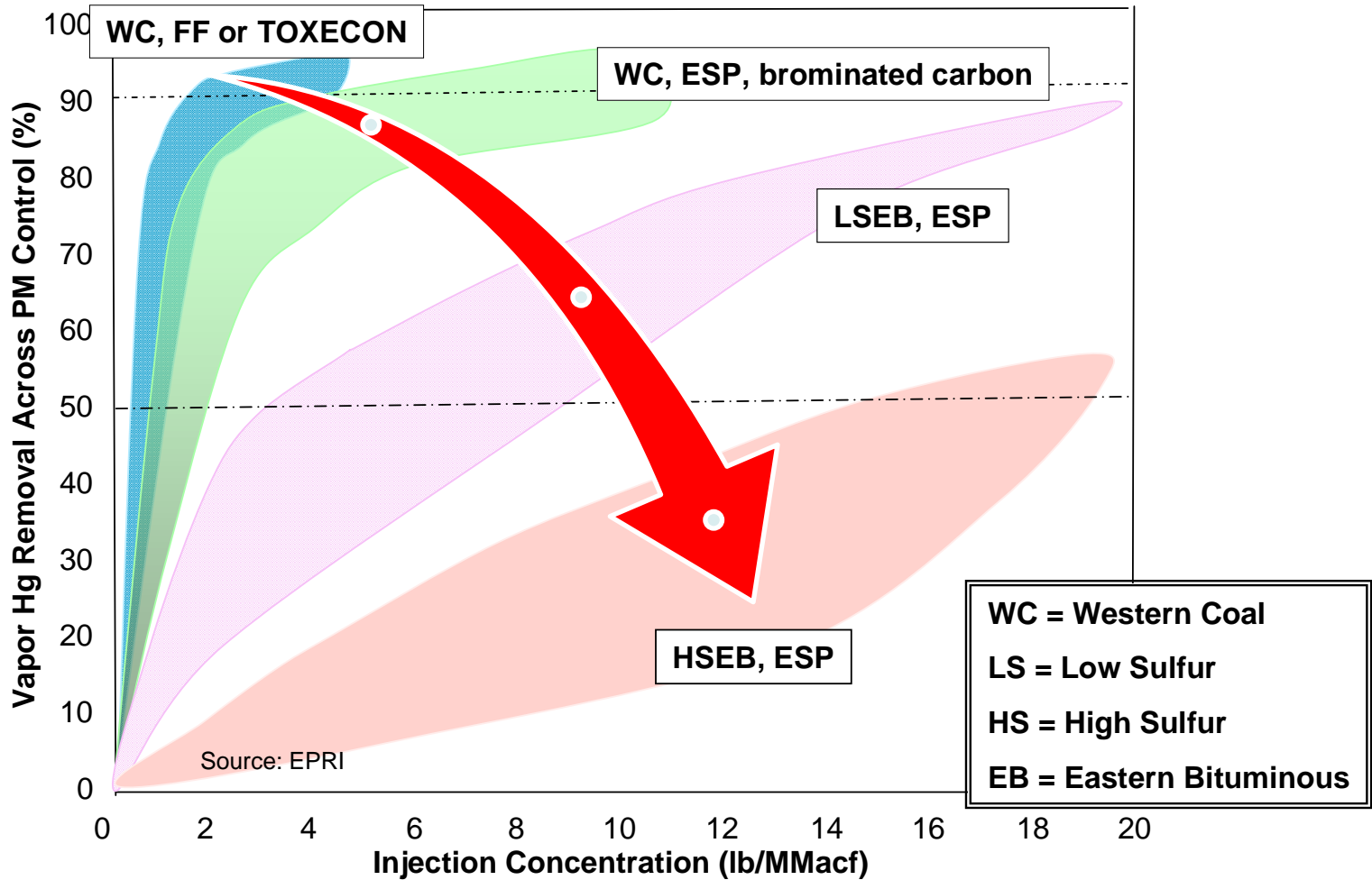
Sterling Gray, URS Corporation

McIlvaine Hot Topic  
September 27, 2012

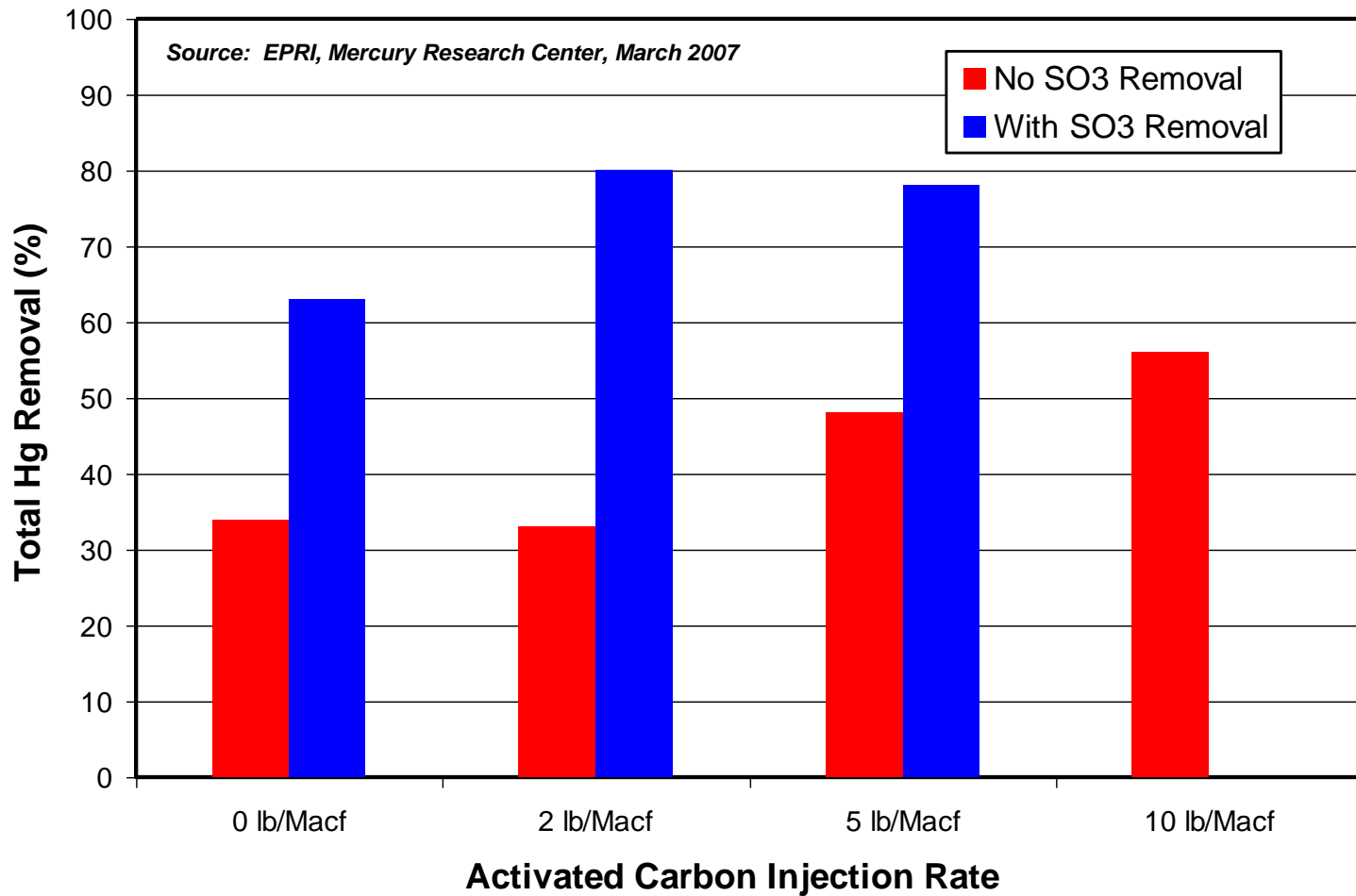
# Overview

- MATS regulations requires significant reductions in Hg emissions from coal-fired plants
- Activated Carbon Injection (ACI) is the most widely demonstrated and applied control technology
- ACI performance is adversely affected by elevated flue gas SO<sub>3</sub> concentrations and temperatures
- SBS Injection is very effective for SO<sub>3</sub> removal and allows a reduction in APH operating temperatures
- Native unburned carbon (LOI) can be very effective for Hg capture under very low SO<sub>3</sub> and low flue gas temperature conditions

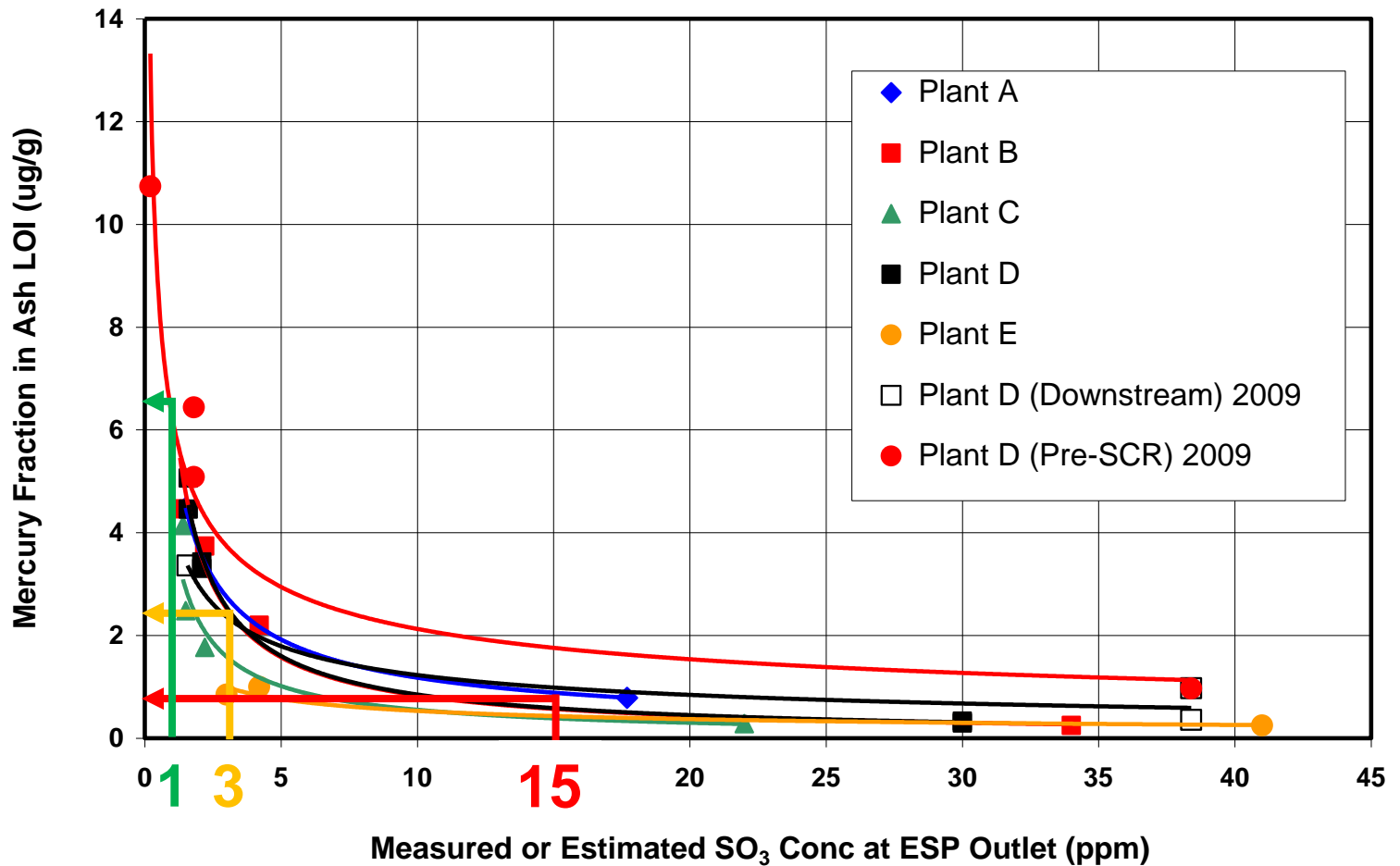
# Impact of SO<sub>3</sub> on ACI Performance



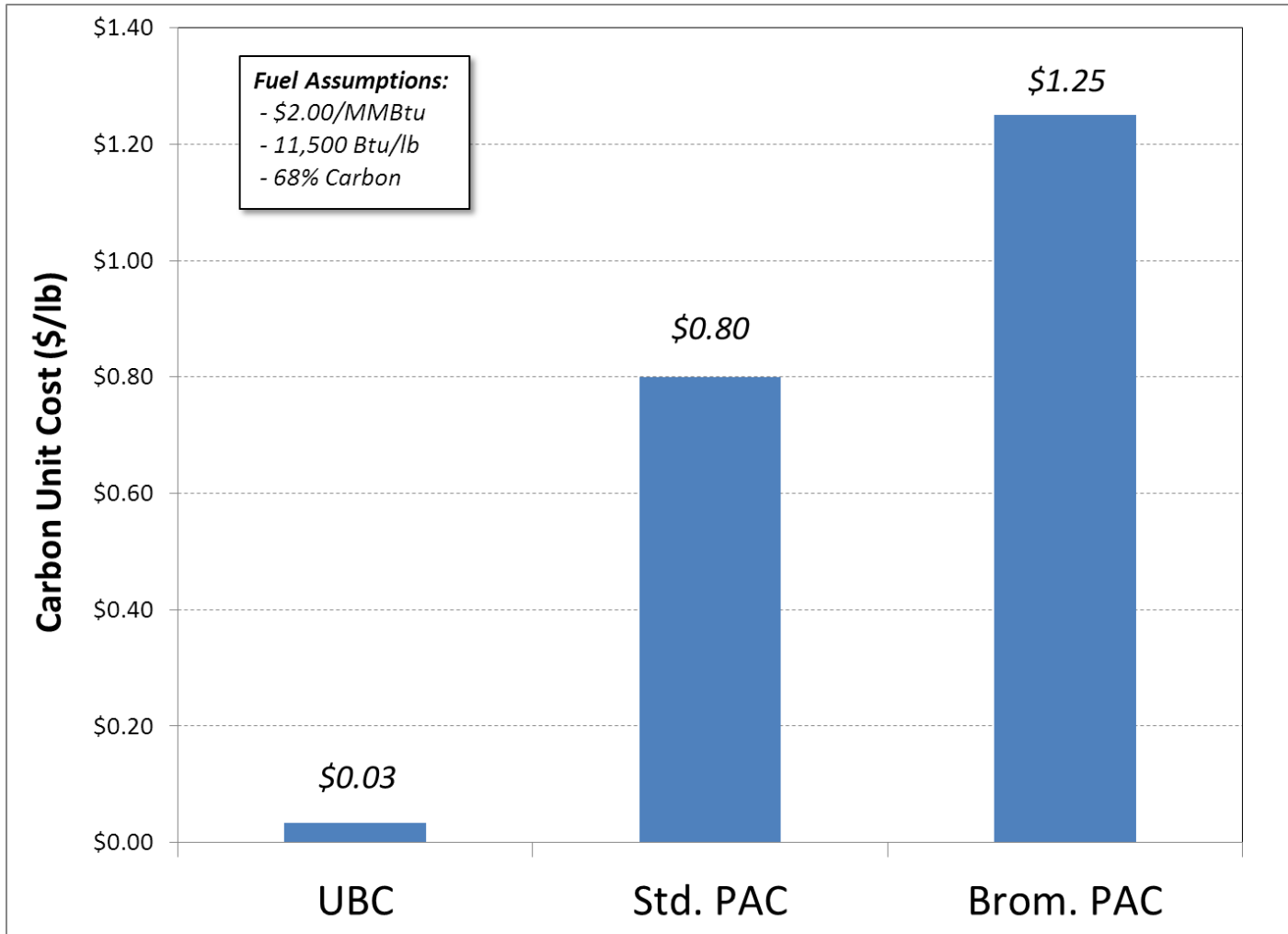
# Impact on Hg Removal with ACI



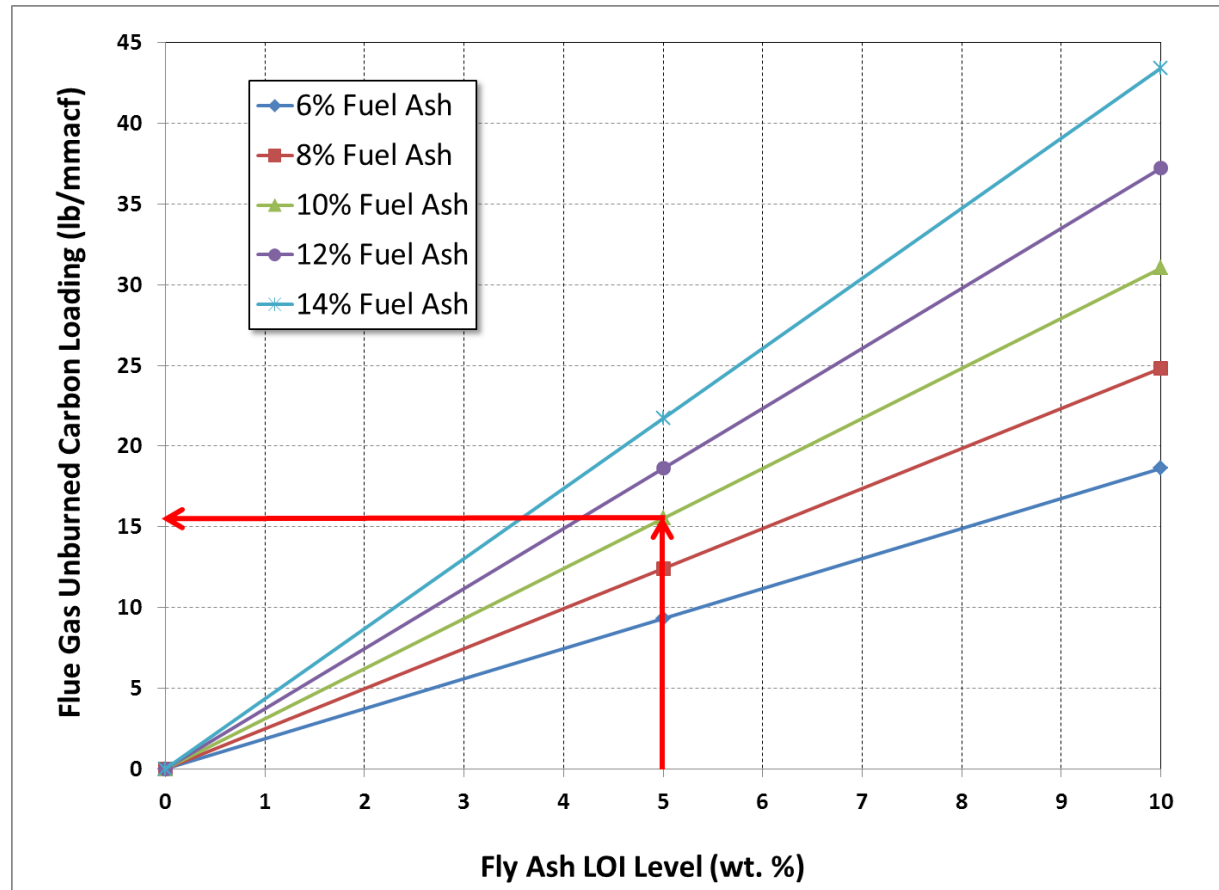
# SO<sub>3</sub> Impact on Ash Hg Capture



# Cost of Carbon Sources



# UBC Loading vs Fly Ash LOI



*UBC Loading ~ 3 x Fly Ash LOI (for 10% fuel ash)*

# SBS Injection Installations

- Installation List
  - 24 Boilers
  - 11 Plants
  - 15,000 MW
- Since 2005...
  - All “upstream” of APH
  - Some “downstream” systems relocated
- “Pre-SCR” Injection
  - 4 Plants
  - 5600 MW
  - 4+ yrs Op experience

Utility	Plant	State	MW	Design SO <sub>2</sub>	Injection Location	Reagent	Startup Date
FirstEnergy	Mansfield 1-3	PA	3 x 860	80	Air Heater Inlet	Sodium Sulfite	2003
TVA	Widows Creek 7	AL	550	54	Air Heater Inlet	Sodium Sulfite	2003
NIPSCO	Bally 8	IN	365	59	Air Heater Outlet	Sodium Carbonate	2004
Vectren	Culley 3	IN	287	48	SCR Outlet	Sodium Carbonate	2004
PPL	Montour 1-2	PA	2 x 765	42	Air Heater Outlet	Sodium Carbonate	2004
Duke Energy	Gibson 1-5	IN	5 x 650	110	Air Heater Outlet	Sodium Carbonate	2005
DP&L	Killen 2	OH	635	34 / 36	Econ Outlet / SCR Outlet	Sodium Carbonate	2007
IP&L	Harding St 7	IN	465	58	SCR Outlet	Sodium Carbonate	2007
NIPSCO	Bally 7	IN	180	59	SCR Outlet	Sodium Carbonate	2008
DP&L	Stuart 1-4	OH	4 x 620	90	SCR Inlet	Sodium Carbonate	2008
Duke Energy	Gibson 1-3, 5	IN	4 x 650	110	SCR Inlet	Sodium Carbonate	2009-2011
Allegheny Energy	Pleasants 1-2	WV	2 x 700	74	SCR Outlet	Sodium Carbonate	2012
Hoosier Energy	Merom 1-2	IN	2 x 540	100	SCR Inlet	Sodium Carbonate	2012

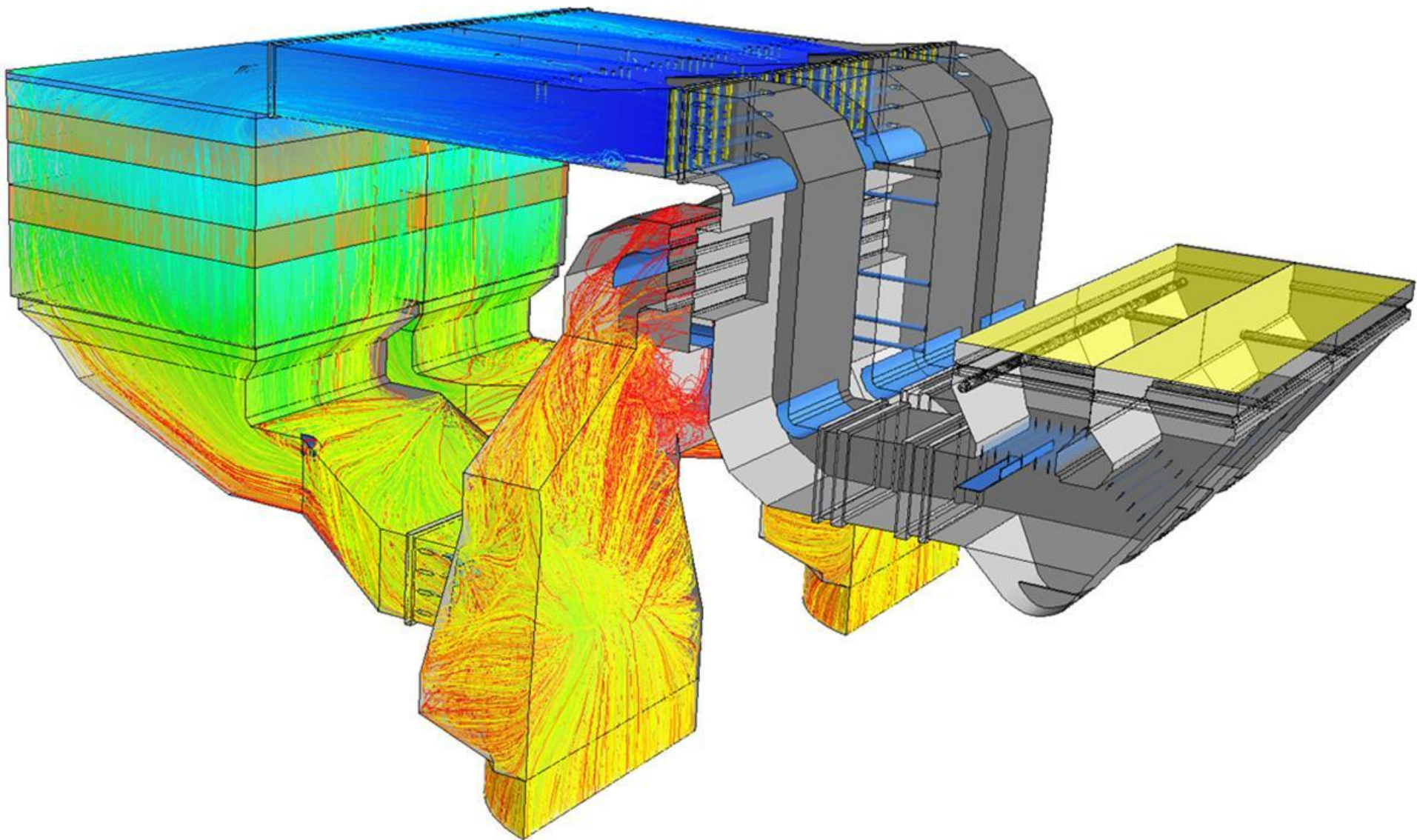




# Midwestern SBS Installation

- 2 x 500 MW
- SCR-APH-ESP-WFGD
- 5 lb SO<sub>2</sub> Fuel
- 100 ppm design SO<sub>3</sub>
- 70 ppm actual SO<sub>3</sub>
- SCR inlet injection



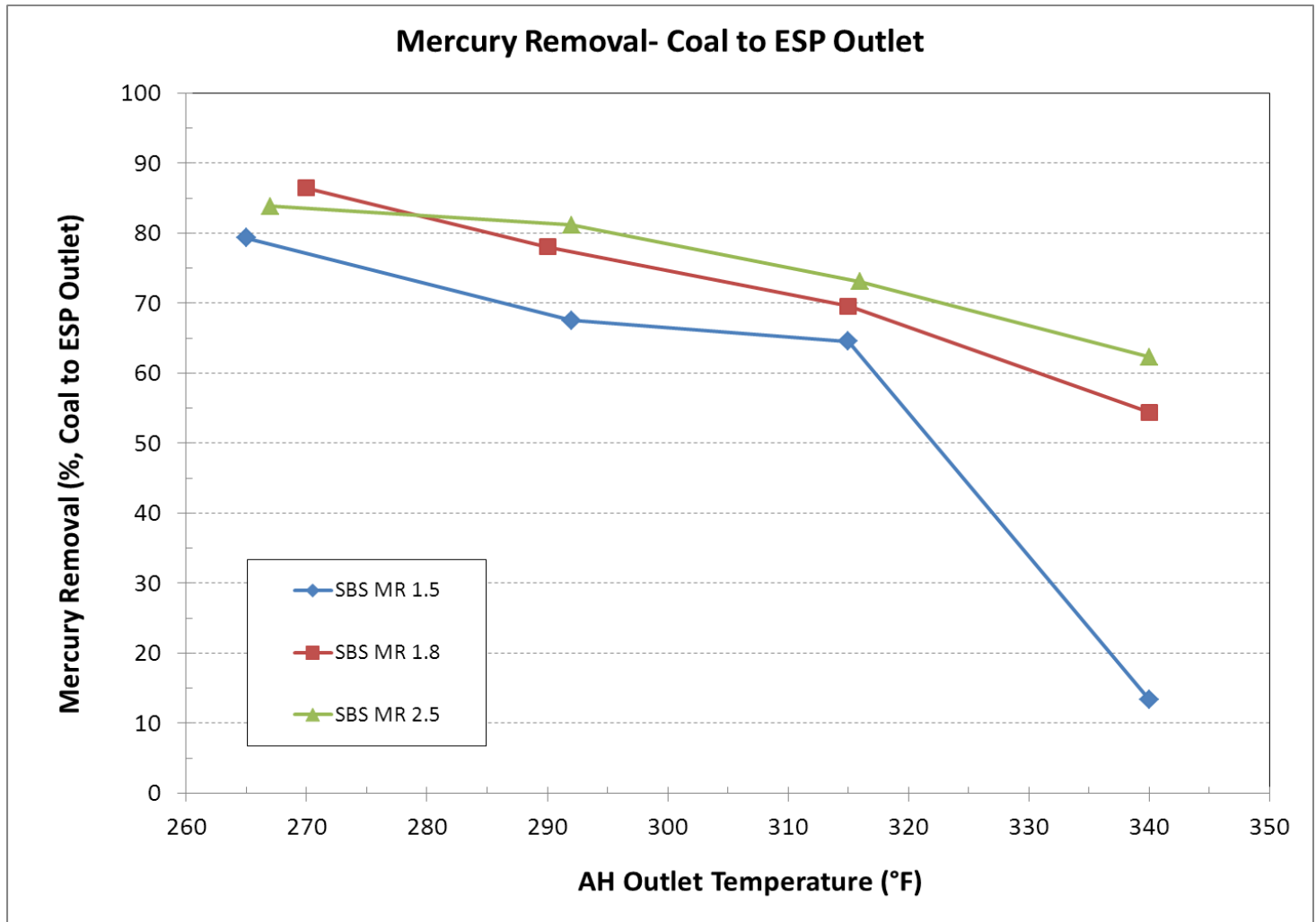


Injection Location – SCR Inlet

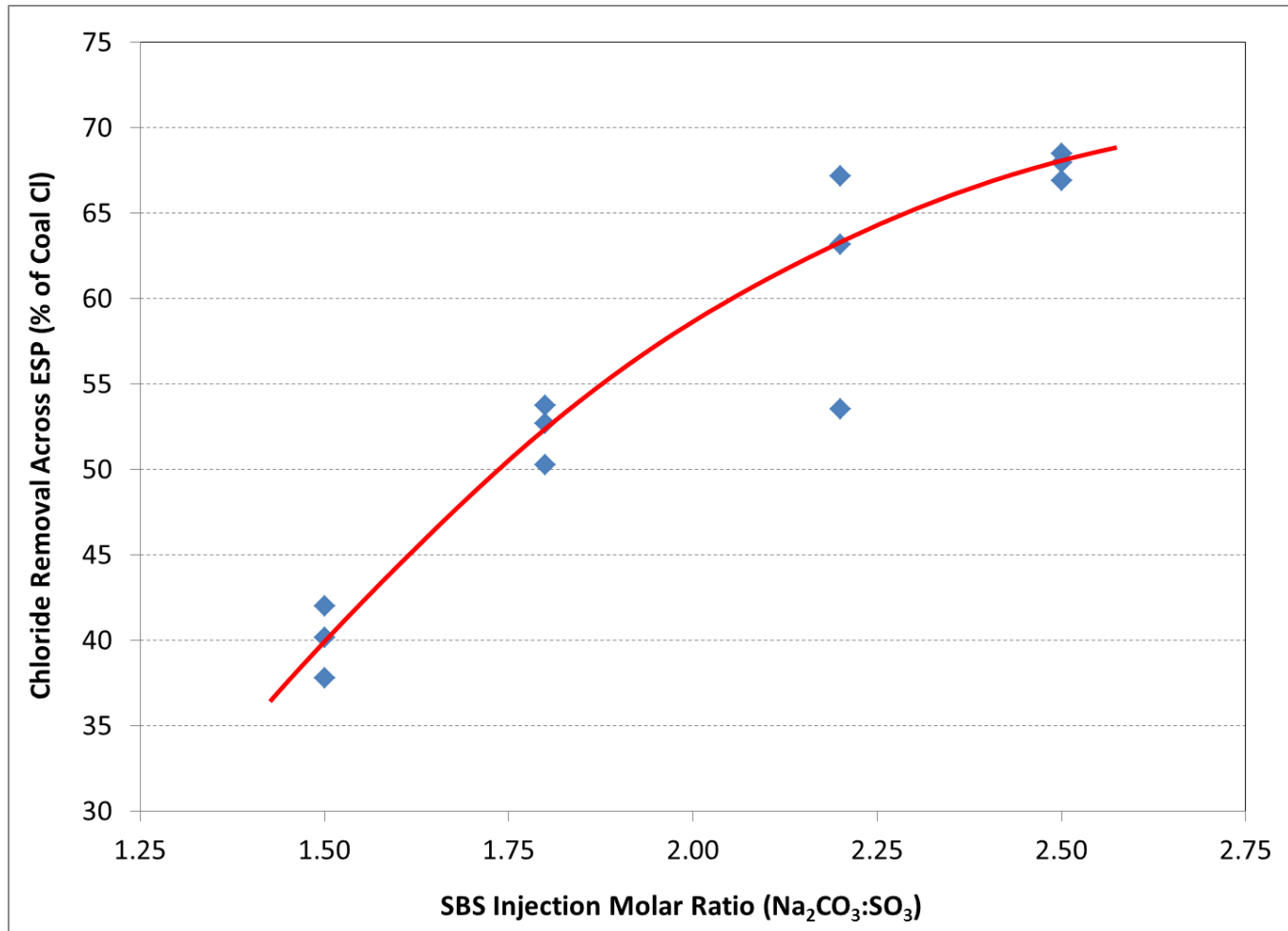
# Hg/SO<sub>3</sub> Test Program\*

- Primary Test Variables:
  - SBS Injection Rate: 1.5 - 2.5 MR
  - APH Outlet Gas Temp: 340 - 265°F
- Measurements:
  - Hg: Coal, SCR outlet, ESP outlet gas (SCEM)
  - SO<sub>3</sub>: ESP outlet gas (CCS)
  - Ash LOI: ESP fly ash
  - Chloride: Coal, Fly Ash, ESP outlet gas (M26)
  - Selenium: Coal, Fly Ash, ESP outlet gas (M29)
- Results:
  - Hg: ~ 7-8 lb/TBtu; ~ 20-50% oxid at SCR outlet
  - SO<sub>3</sub>: ~ 0.8 – 1.2 ppm at ESP outlet
  - Ash LOI: ~ 3 - 5 wt %

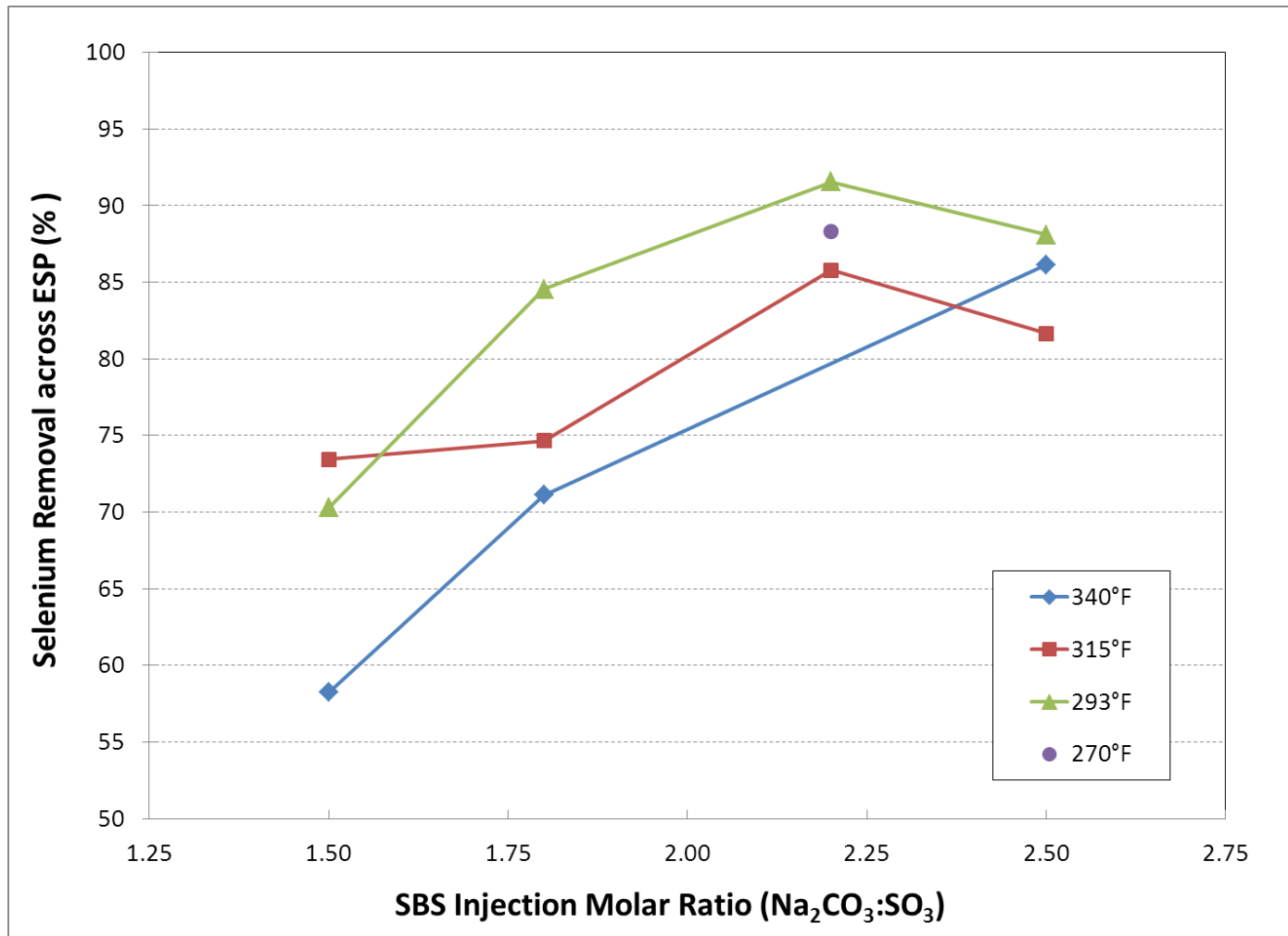
# Mercury Test Results



# Chloride Removal



# Selenium Removal



# Summary

- MATS regulations requires significant reductions in Hg emissions from coal-fired plants
- Activated Carbon Injection (ACI) is a conventional technology for Hg control, but performance is adversely affected by elevated SO<sub>3</sub> and temperature
- SBS Injection can reduce SO<sub>3</sub> levels to <1 ppm and allow APH operation at flue gas temperatures < 250°F
- Hg capture rates of 50-90% can be achieved prior to the wet scrubber using the native UBC in the fly ash, reducing potential for mercury re-emissions and need for wastewater treatment
- Co-removal of HCl and Se with the ash can greatly reduce wet scrubber concentrations and wastewater treatment requirements

# Questions?



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