



Full Scale Evaluations of Mercury Control Technologies with PRB Coals

EUEC
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Sharon Sjostrom, ADA-ES Inc.



Co-Authors

- ADA-ES: Travis Starns, Michael Durham, Jean Bustard
- Sunflower Electric: Wayne Penrod, Corey Linville
- AmerenUE: Rich Phillips, Tom Hart
- DOE/NETL: Andrew O’Palko
- EPRI: Ramsay Chang



Hg Removal with Existing Equipment

ICR Data

Controls

Bituminous

Subbituminous (PRB)

CSESP

46%

16%

FF

83%

72%

SDA + FF

98%

25%

**Example: Sunflower Electric Holcomb Station
PRB Coal SDA/FF**

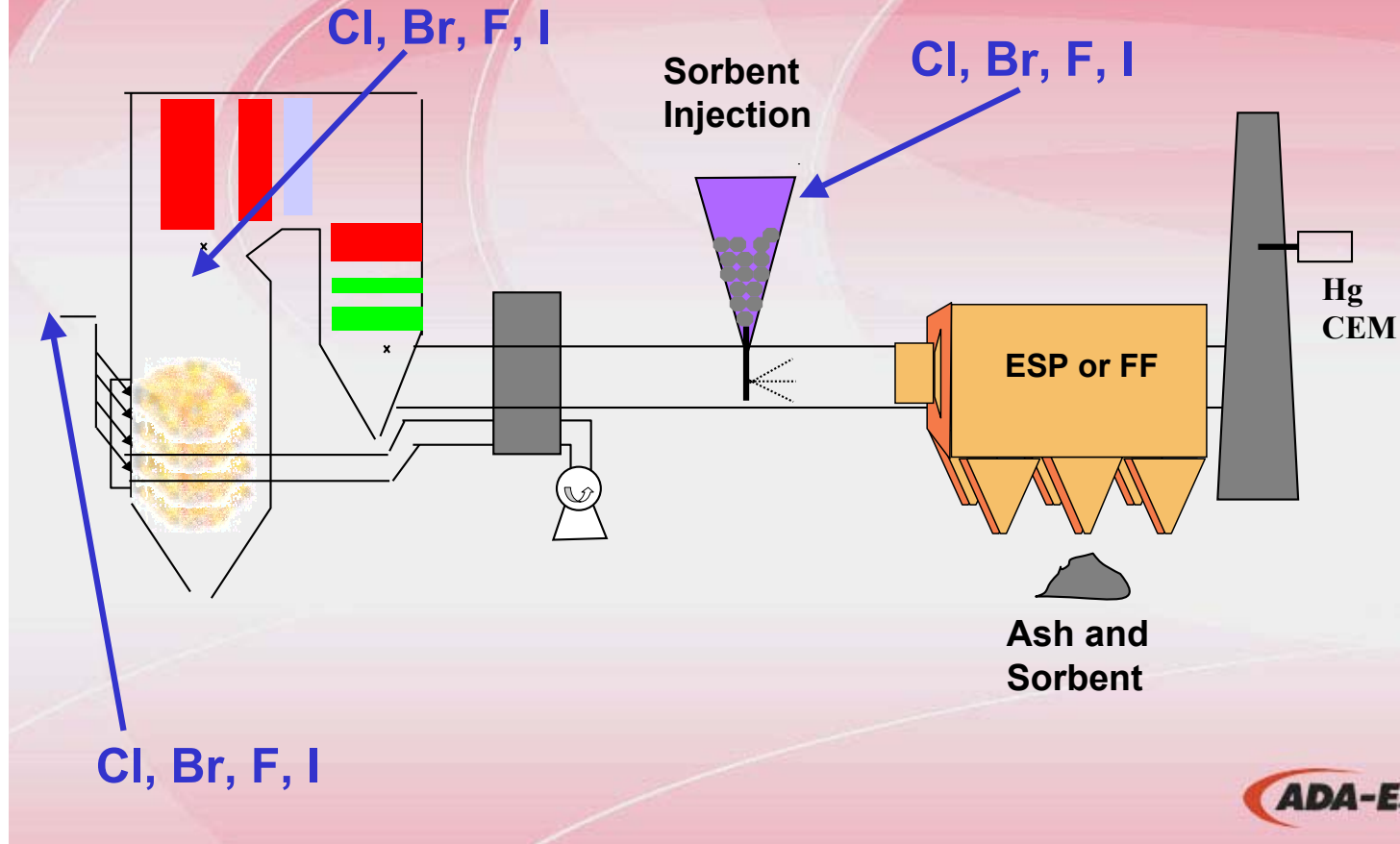
Inlet Hg: 10.5 $\mu\text{g}/\text{dn}\text{cm}$

Outlet Hg: 11.2 $\mu\text{g}/\text{dn}\text{cm}$

Hg Removal: 0%



Enhancing Mercury Removal for Western Coals



Coal Blending to Improve Mercury Control

Sunflower Electric, Holcomb Station

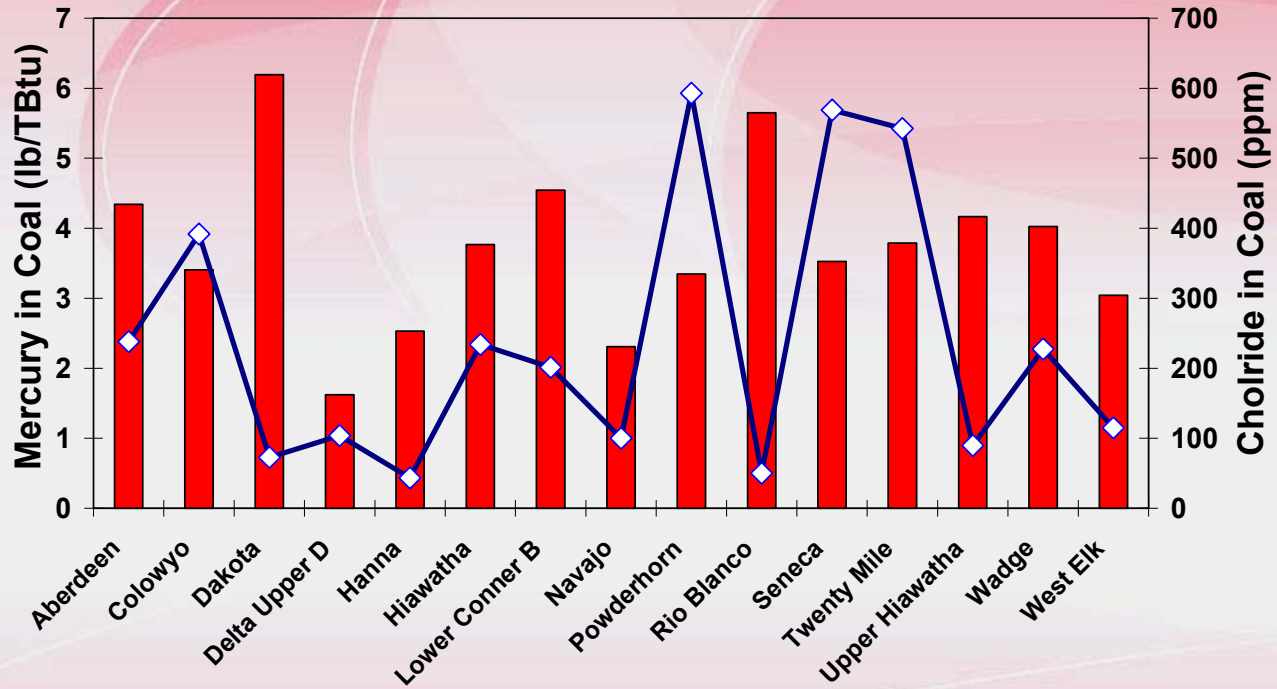
Completed 2004

Detroit Edison, Monroe Station

2005



Mercury and Chlorine in Western Bituminous Coals

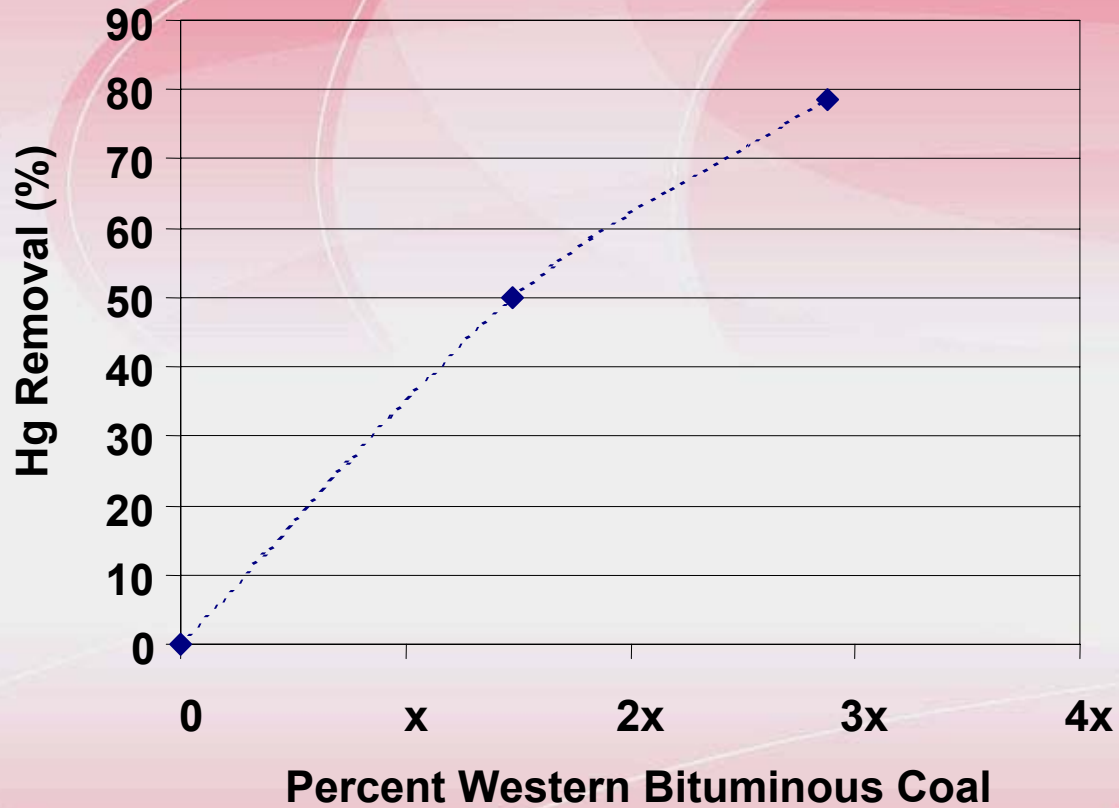


Native Mercury Removal by Western Bituminous Coals

Plant	APC	Coal	Mercury Removal
Cherokee 3	FF	Colowyo	98%
Intermountain	FGD	Utah Bit	74%
Valmont	FF	20 Mile Colowyo	86%



Coal Blending Results - Holcomb



Coal Blending at Holcomb



Activated Carbon Injection to Improve Mercury Control

Sunflower Electric, Holcomb Station	Completed 2004
AmerenUE, Meramec Station	Completed 2004
Great River Energy, Coal Creek Station	Completed 2003
We Energies, Presque Isle	2005-2007
Detroit Edison, Monroe Station	2005
Entergy, Independence Station	2005



ACI Required Equipment



Testing at Holcomb Station

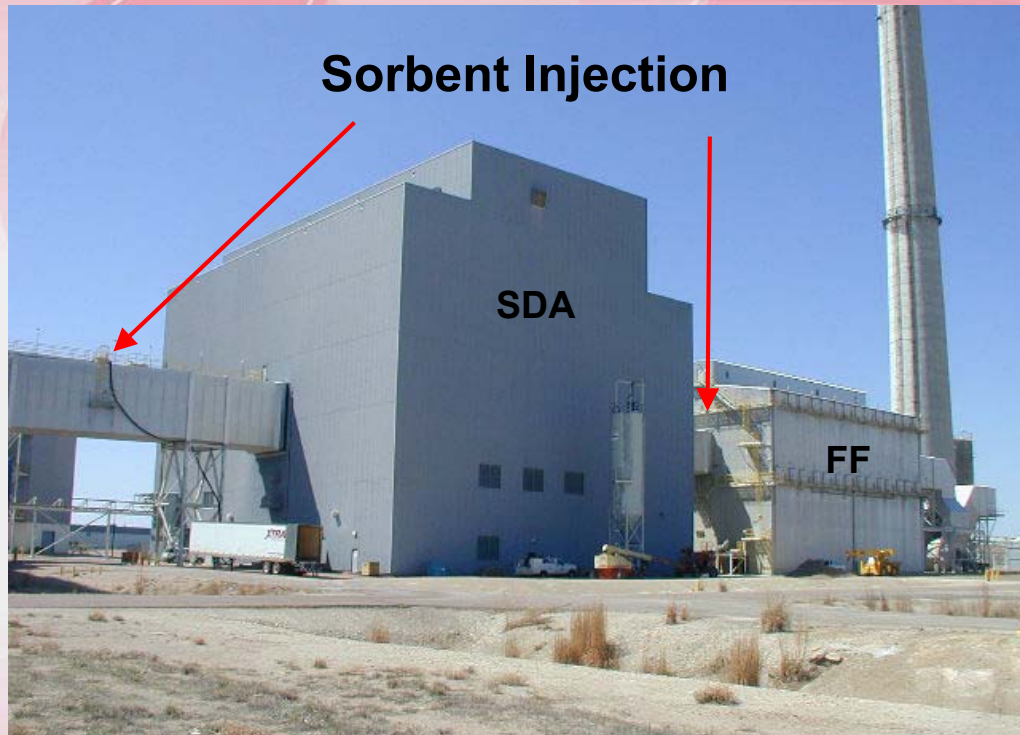
- Unit Capacity
 - 360 MW
- Coal
 - PRB
 - Hg Content:
0.04 – 0.1 ppm-dry
 - Cl Content:
7-35 ppm-dry
- SO₂ Control – SDA
- Particulate Control – FF



DOE Cooperative Agreement DE-FC26-03NT41986

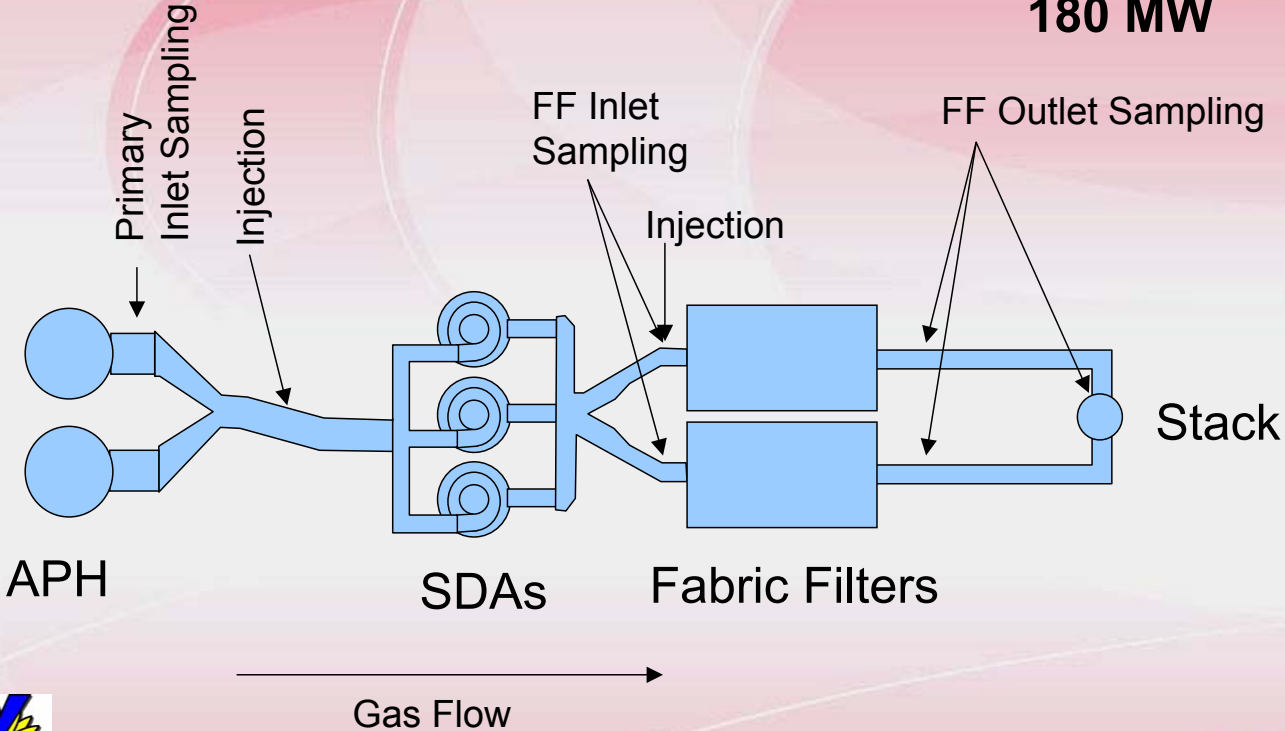


Plant Layout

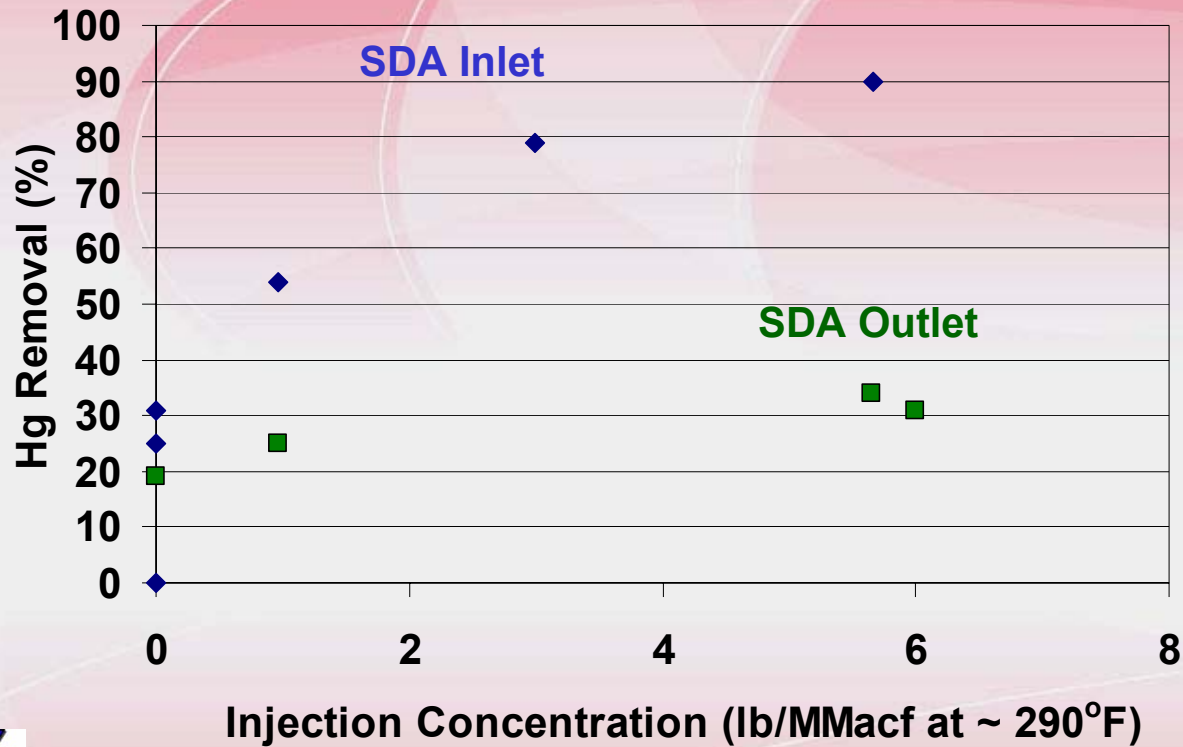


Holcomb Overall Layout

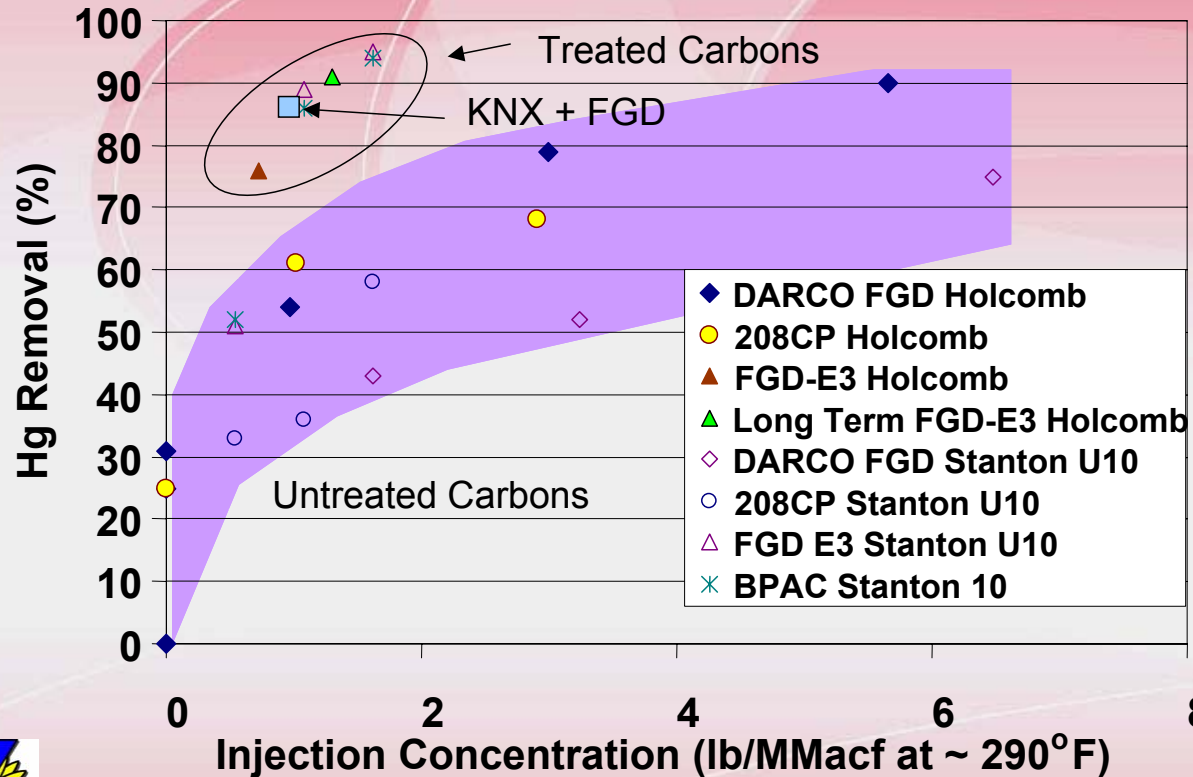
360 MW
180 MW



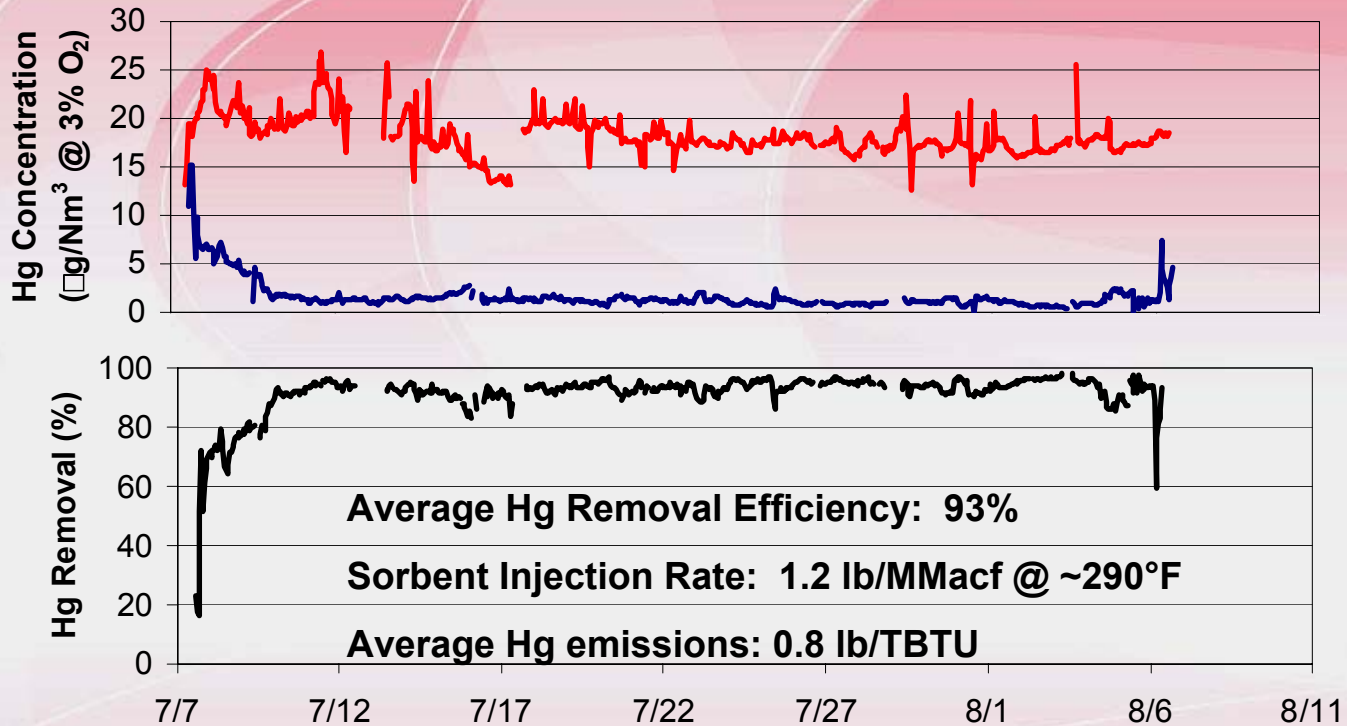
Effect of Injection Location on Hg Removal: DARCO FGD, Holcomb



SDA Results, PRB and Lignite Fuels



Holcomb – 30-day Long Term Results FGD-E3 Injection



AmerenUE Meramec Plant

Unit Capacity
140 MW

Coal

PRB

Mercury Content:

0.04 – 0.1 ppm-dry

Chlorine Content:

7-35 ppm-dry

NO_x Control – SOFA, LNB

SO₂ Control – Compliance Coal

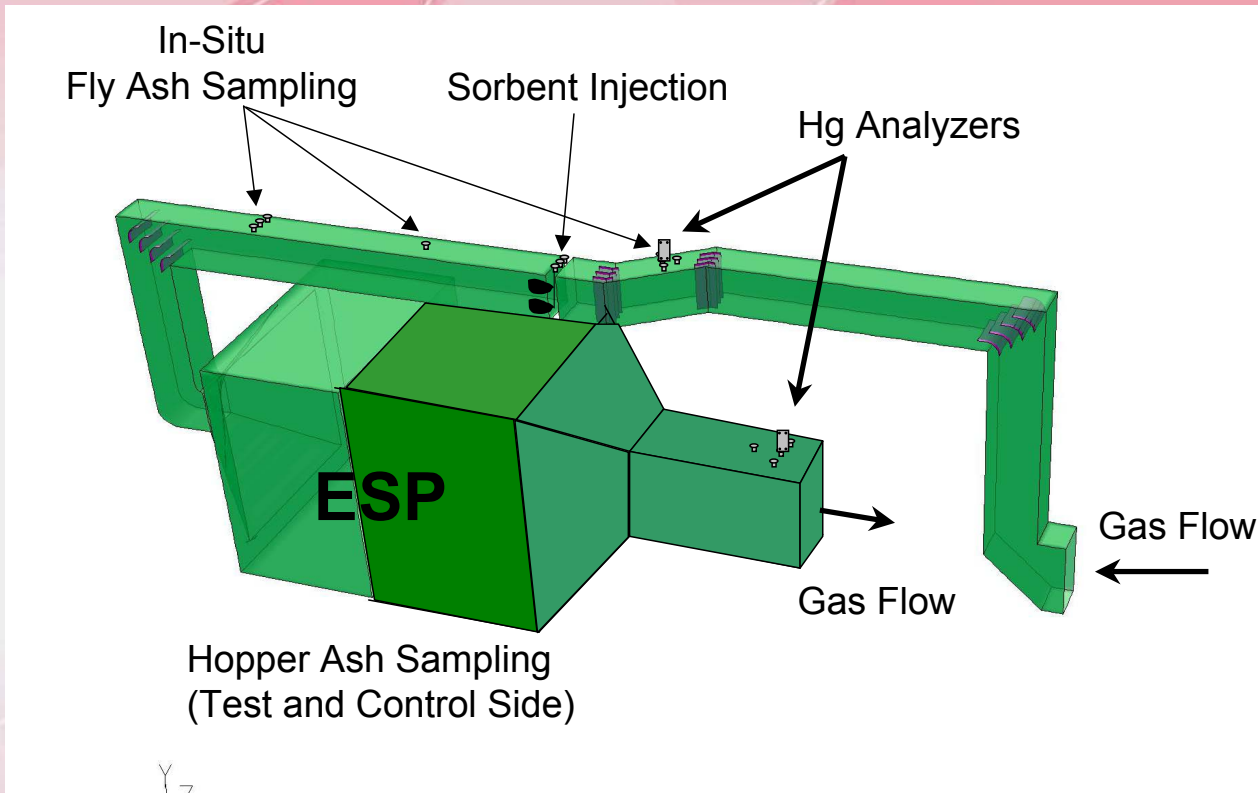
Particulate Control – CSESP



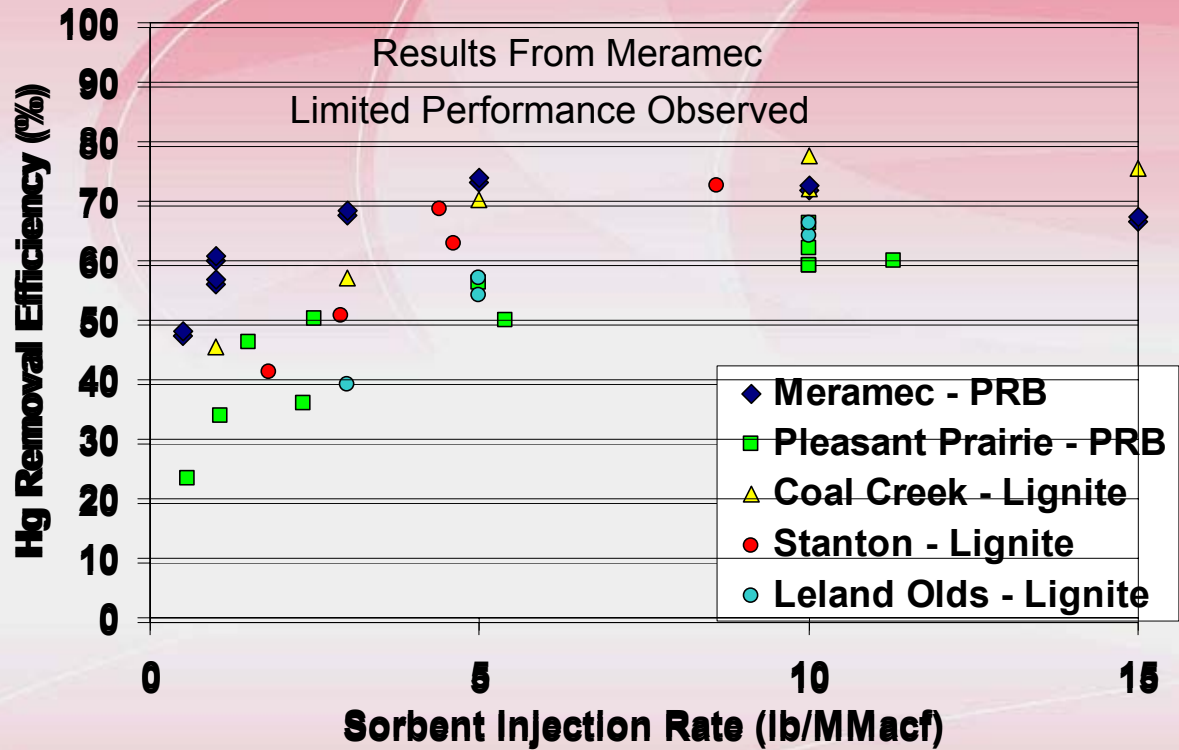
DOE Cooperative Agreement DE-FC26-03NT41986



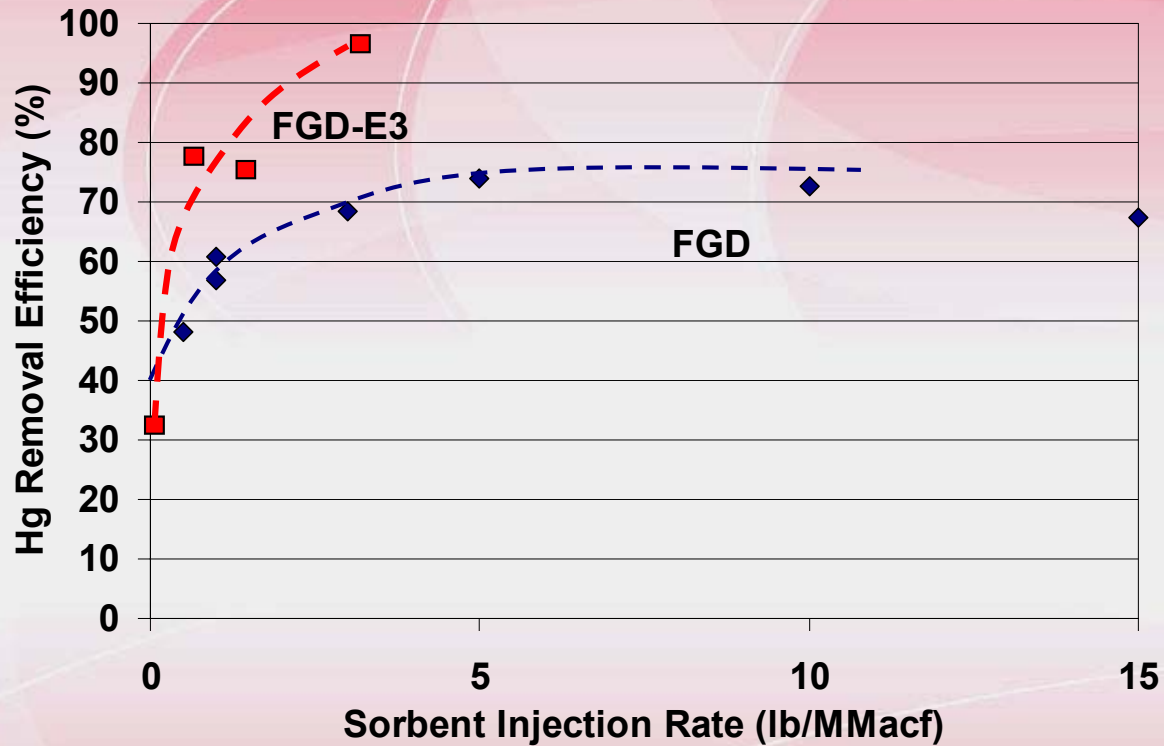
Flue Gas Flow – 1/2 of Unit 2



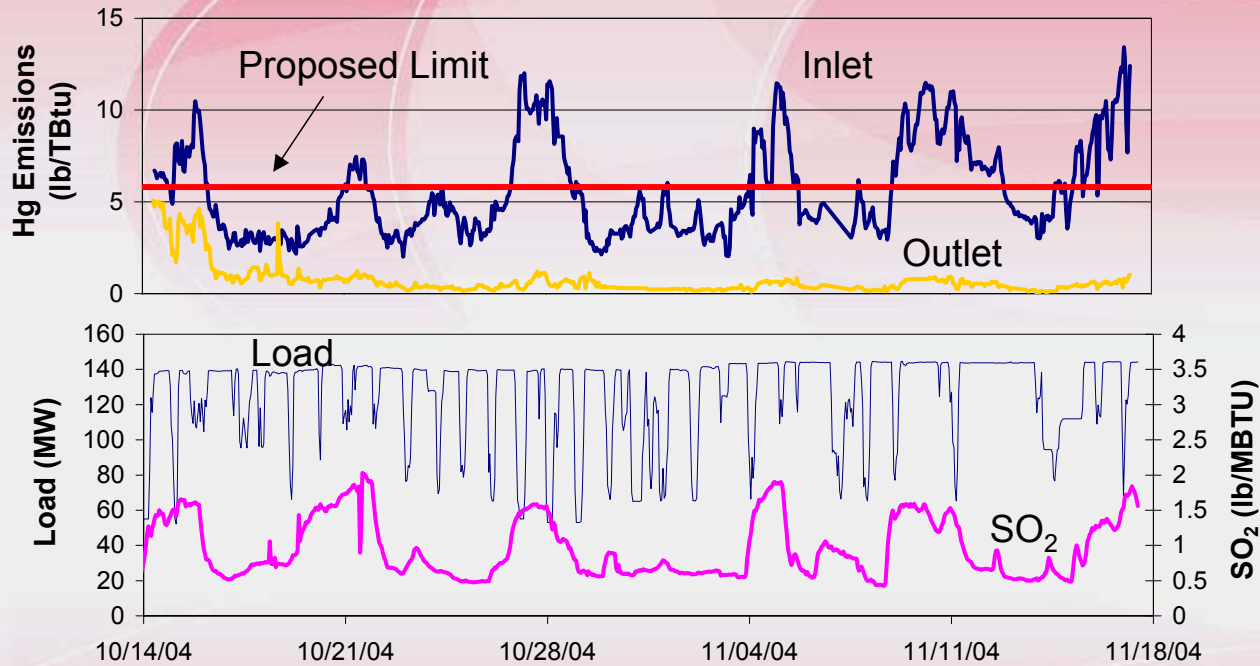
Untreated PAC Injection into ESP PRB and Lignite Coals



Parametric Results – Treated Carbon



Preliminary Long-Term Results



Coal Additives at Meramec

- KNX (Alstom Power) and SEA2 (EERC)
 - >80% mercury removal measured with additive injection during high LOI periods



Is Meramec “Typical”?

- Tubular Air Preheater
 - Data from Salem Harbor (Phase I program) and Meramec indicate higher than expected Hg removal. Both have tubular APH. Both had high LOI during testing.
- Large fraction of particulate-phase mercury
 - Large carbonaceous ash particles were present in ash and have very high Hg (~ 4 ppm)



Secondary Emissions from Coal Additives or Treated Carbon

- Holcomb:
 - Halogen emissions decreased across SDA + FF during FGD-E3 testing
 - No increase in halogen concentrations during coal additive tests
- Meramec:
 - Halogen emissions were slightly higher during FGD-E3 testing but remained within range expected from PRB coal
 - No M26 results available from coal additive tests



Plant Operation and Effects on Ash

- Plant Operation
 - *No adverse effects on ESP power, SDA operation or FF cleaning frequency, or opacity during longer-term tests*
- Landfill Concerns: leaching (mercury or halogens) from ash
 - *Initial tests indicate ash does not leach significant halides or measurable mercury*
- Ash Sales - Meramec
 - *Fly ash may require additional AEA due to fly ash contamination from ACI injection*



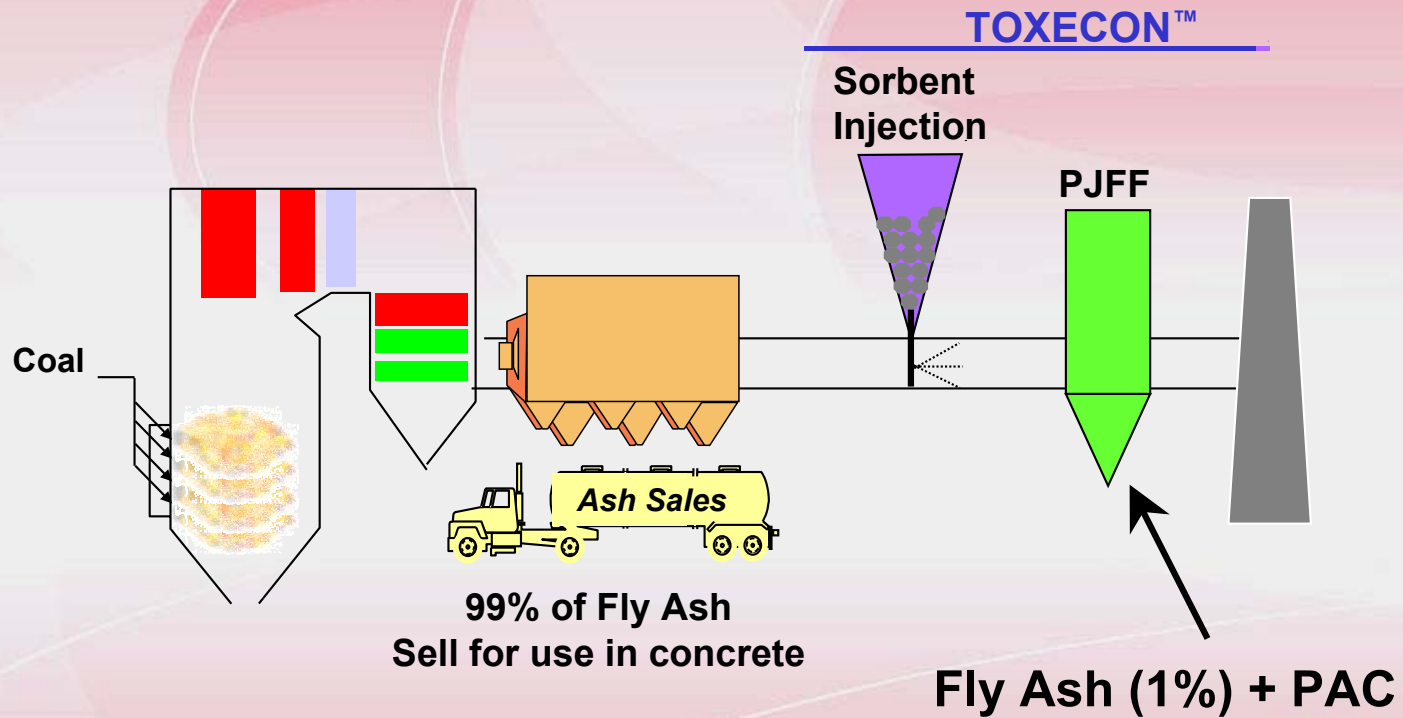
Additional Testing

Monroe Unit 4

- Fires blend of PRB and E. Bituminous (60/40)
- 750 MW, Wall-Fired Unit
 - Test size $\frac{1}{4}$ of unit
- Low NOx burners (B&W)
- Cold-Side ESP, Small SCA (280 ft²/kacfm)
- SCR in-service during ozone season



EPRI TOXECON™ Configuration



First TOXECON Hg Control System at We Energies Presque Isle Power Plant

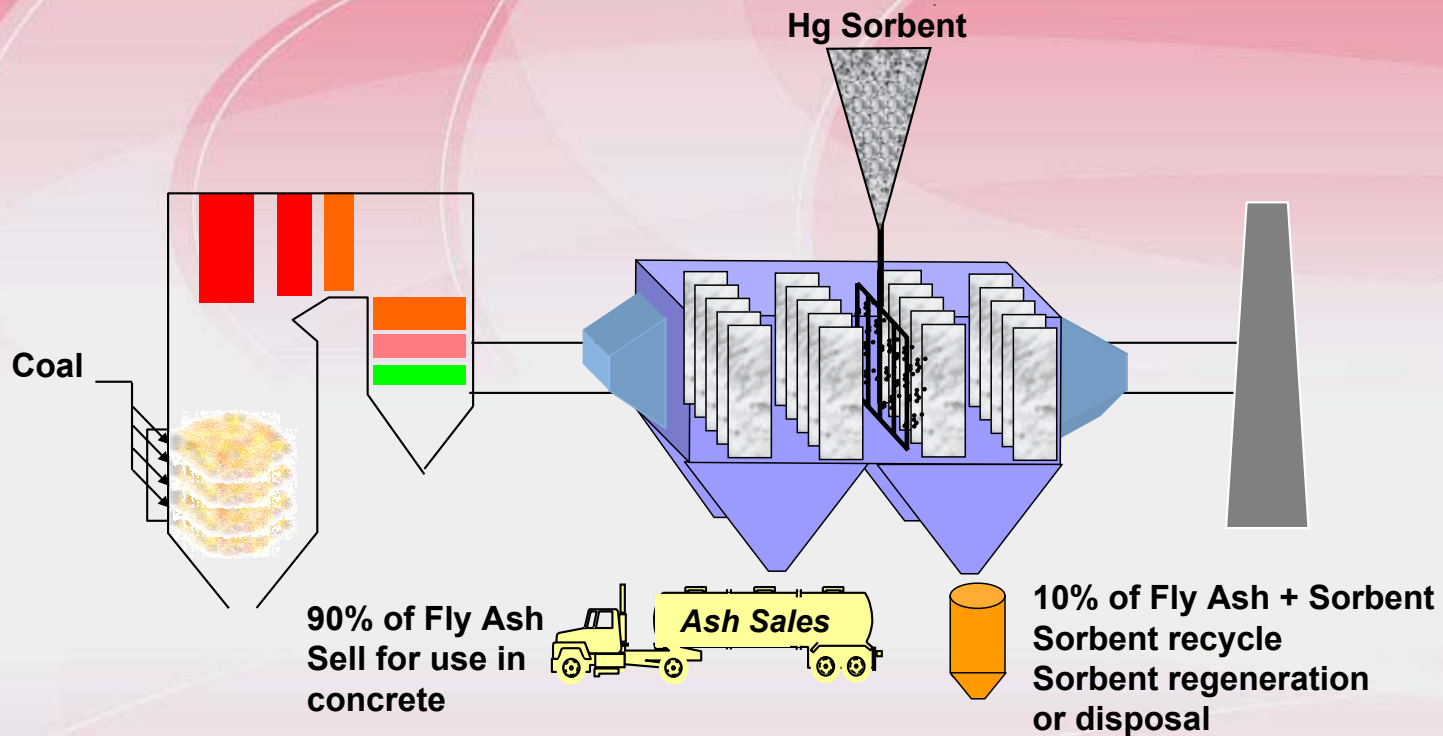
- Units 7 – 9 on PRB Coal
- 270 MW
- System designed for 90% Hg control



DOE Clean Coal Power Initiative



EPRI TOXECON II™ Configuration



TOXECON II™ at Coal Creek Station

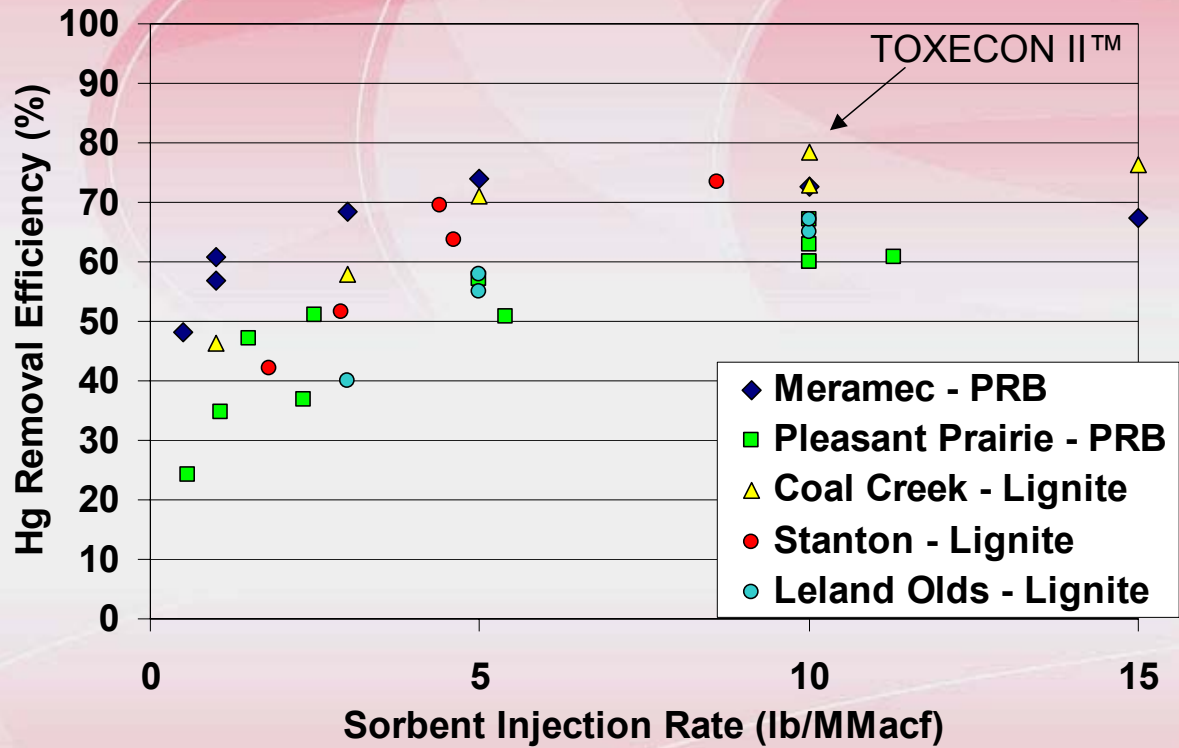
- Unit Capacity
 - 590 MW
- Coal
 - North Dakota Lignite (Falkirk Mine)
 - Mercury Content: 0.096 ppm-dry
 - Chlorine Content: 0.009 %-dry
- NO_x Control – OFA
- SO₂ Control – WFGD
- Particulate Collection Device – CESP
 - SCA = 599 ft²/1000cfm
 - ESP Inlet Temperatures: 340-360°F



Tests Funded by EPRI and Great River Energy



Comparison of ESP and TOXECON II™



DOE/NETL Full-Scale Field Test of TOXECON II in 2005

- Host Site:
Entergy Independence Station (842 MW)
 - PRB Coal, CS ESP
- Goals
 - Document mercury capture performance
 - Evaluate possible improvements with treated carbons
 - Identify impacts on ESP
- Participation by other utilities encouraged



Options for Western Fuels: Summary

- Treated Activated Carbon Injection
 - High removal achieved at Holcomb and Meramec
 - No adverse balance-of-plant impacts noted
- Coal Additives
 - >80% removal achieved at Meramec without ACI (*plant configuration and high LOI may have contributed to removal*)
 - ACI required at Holcomb for high removal



Options for Western Fuels: Summary

- Coal Blending
 - Up to 80% mercury removal achieved during short-term test at Holcomb
 - Additional tests required to confirm this result

