



Cooperative Agreement DE-FC26-01NT41180

Assessment of Low Cost Novel Sorbents for Coal- Fired Power Plant Mercury Control

**U.S. Department of Energy
National Energy Technology Laboratory**

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Objective

To identify and assess novel sorbents projected to cost at least 25% less than commercial activated carbons and have the potential for greater than 90% mercury removal



Request for Sorbents

The initial request for sorbents was sent out to vendors during the last quarter of 2001 (~15 vendors)

- Describe the sorbent in non-proprietary terms
- Provide evidence that the cost will be at least 25% less than that of FGD carbon
- Provide evidence that sufficient quantities will be available (100,000 tons per year) by year 2010

Plant Descriptions

	Powerton	Valley
Owner	Midwest Generation (EME)	We Energies
Unit Size	893 MW	650,000 lb/hr steam
Coal Type	PRB	85% Bituminous and 15% Petcoke
Coal Chloride	20- 200 ppm	50 – 1500 ppm
Coal Mercury	0.05 ug/g	0.011 –0.11 ug/g

Sorbent Evaluations

Laboratory Fixed-Bed Evaluations (URS Group)

- Equilibrium Adsorption Capacity On simulated PRB and Low-Sulfur Bituminous Coal Flue Gas at temperatures of 275° and 325° F

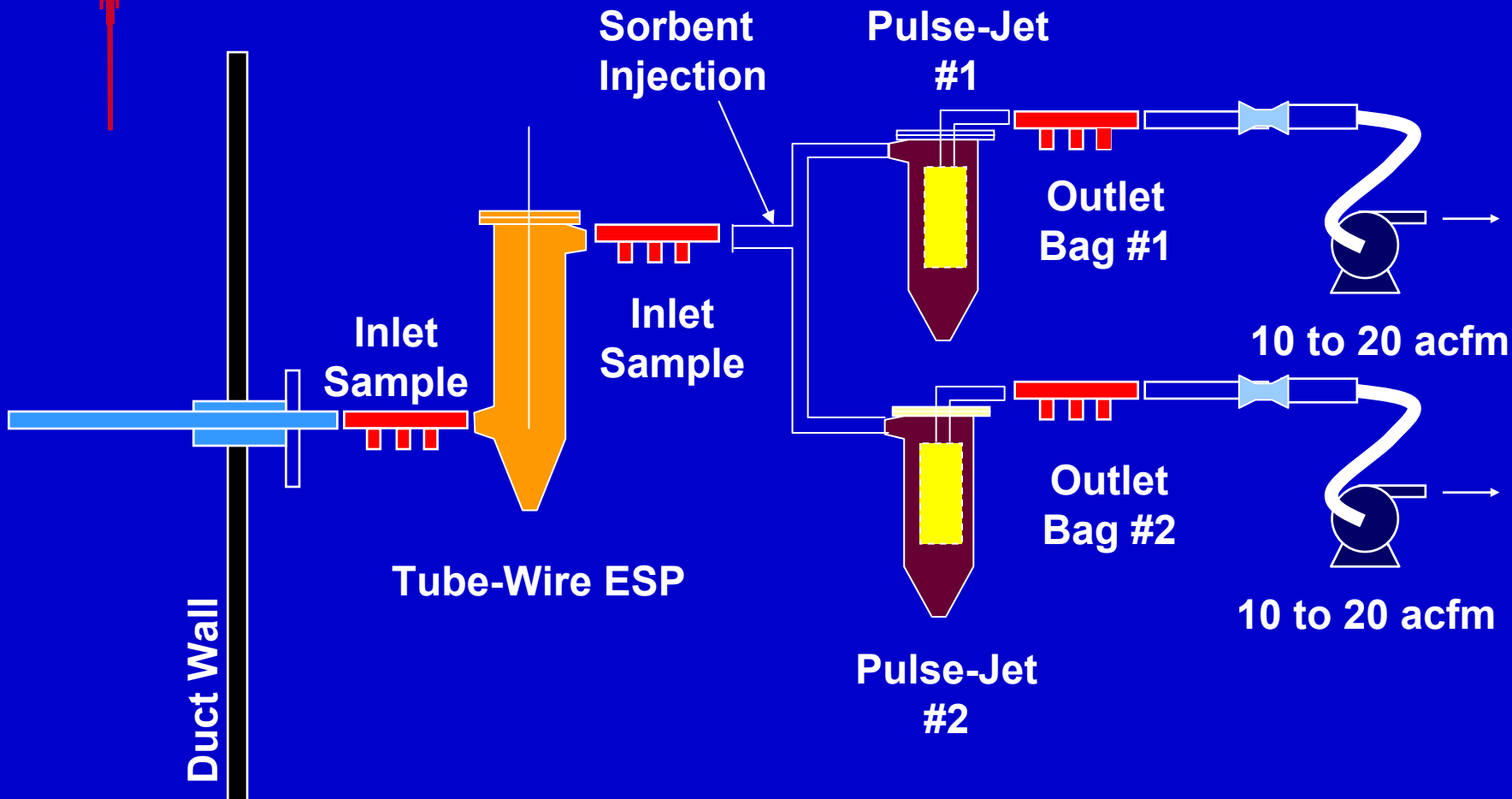
Field Fixed-Bed Evaluations (URS Group)

- Valley and Powerton (March 2002)

Field Pilot-Scale Evaluation (Apogee)

- Powerton (Summer 2002) and Valley (Spring 2003)

Pollution Control Test System



PoCT System in COHPAC Configuration

Pulse-Jet Baghouse
Modules

Tube-Wire ESP

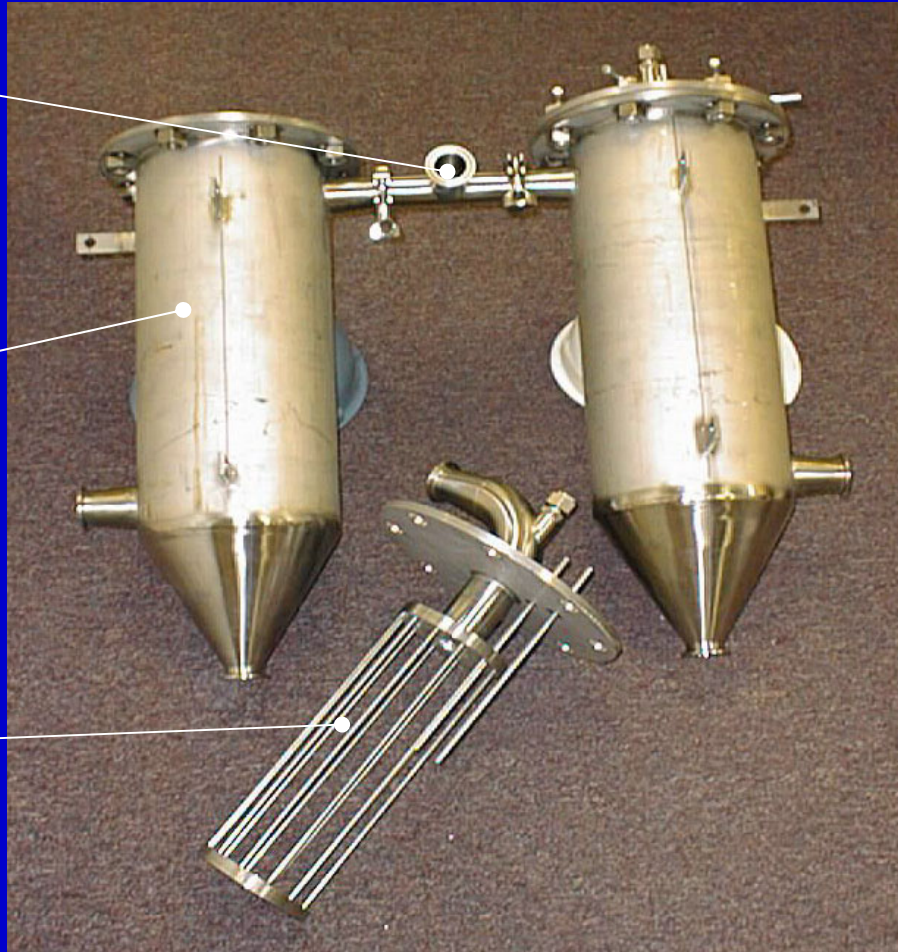


PoCT Pulse-Jet Modules

Flue Gas Inlet

Single - Bag Can

Cage - Outlet Plenum
Assembly



PoCT System Specifications

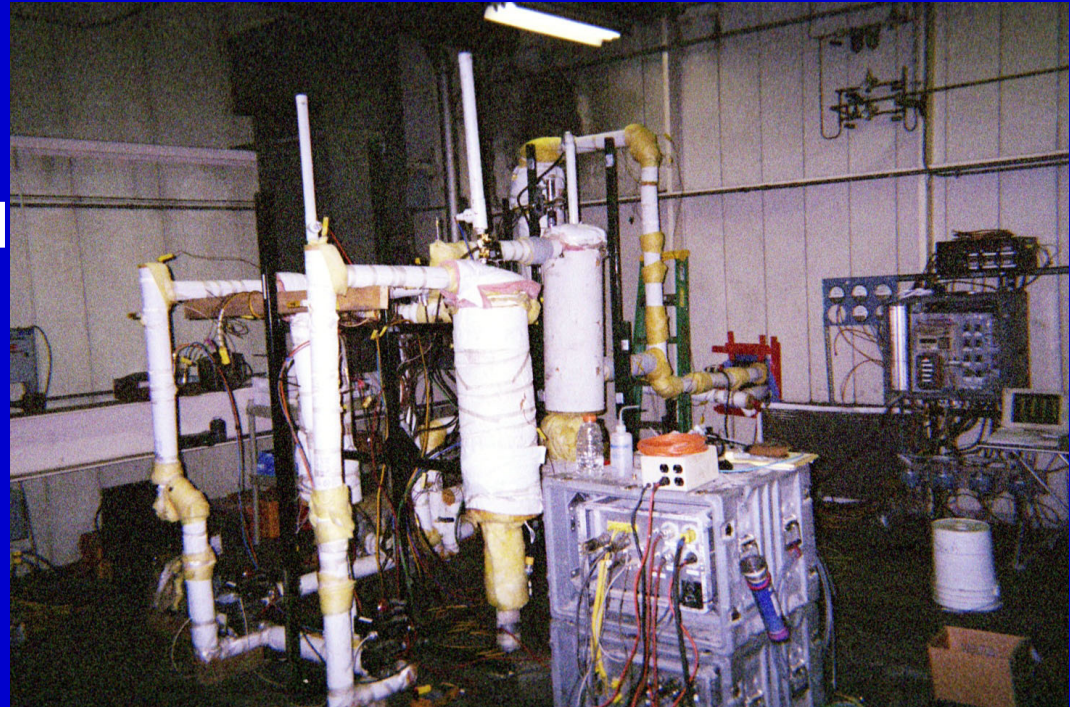
Portable System

Temperature Controlled

10 - 20 acfm

Modules:

- Tube-Wire ESP
- Pulse-Jet Baghouse
- Fixed Sorbent or Catalyst Section



Novel Sorbents for Hg Control

Powerton = P Valley = V

Sorbent	Plant
Darco FGD™	P and V
Tire-Derived Activated Carbon	P and V
Corn Char	P and V
Experimental Carbon from Oil	P and V
DESOREX HOK	P and V
Type CB	P and V

Sorbent	Plant
Zeolite-Based	V
Flyash Sorbent Mixture	V
Activated Carbon	V
Separated and Treated Flyash	P and V
Lignite Activated Carbon	V

Test Plan

Screening

- Sorbents evaluated at an injection rate of 1.5 to 2.0 lb/MMacf

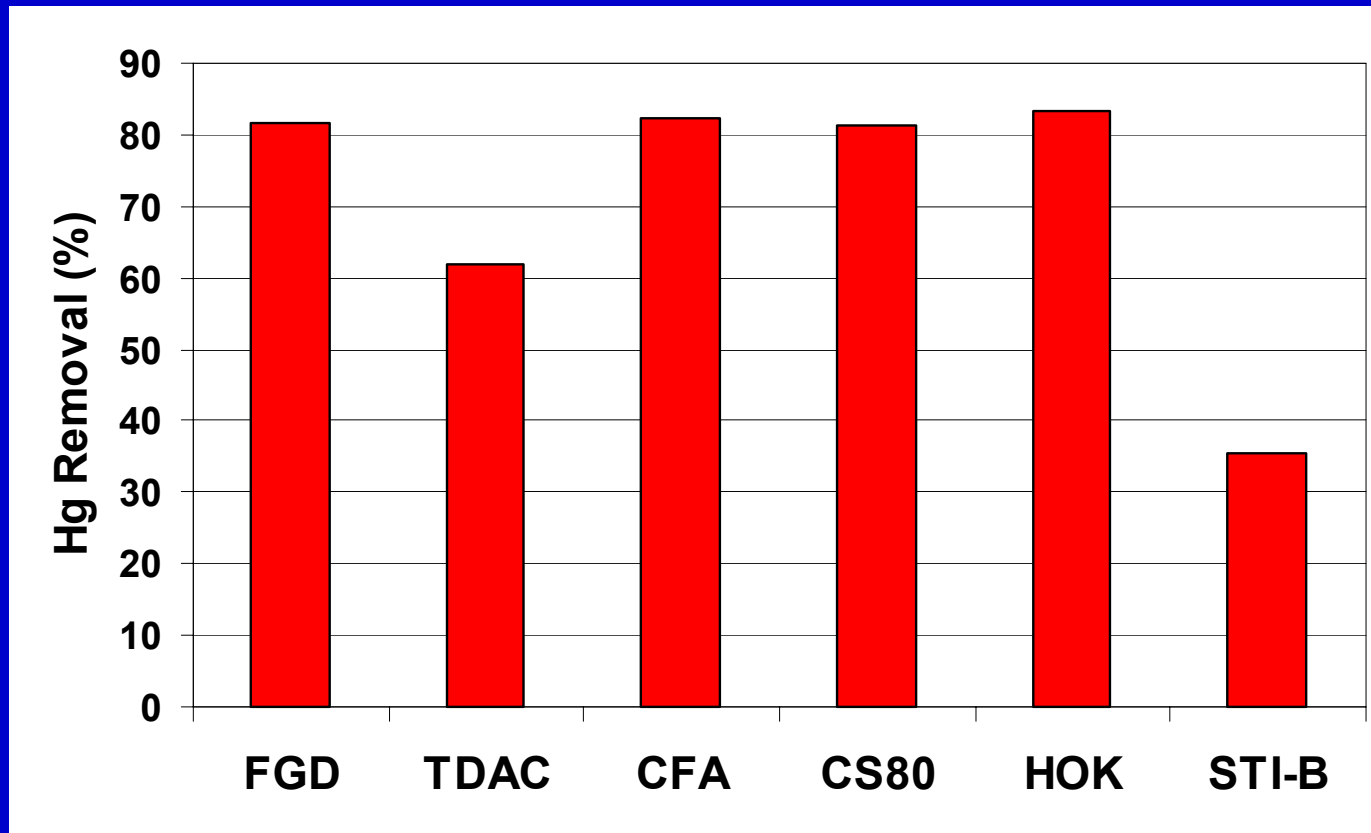
Parametric (2 most promising sorbents & FGD)

- Three injection rates (0.5 to 2 lb/MMacf)
- Two different bag fabrics
- Residence Chamber (in flight removal, 2 and 4 seconds, 3 different injection rates, 2 temperatures)
- Long-term tests (8 to 12 hours injection)

Sorbent Screening Results

Midwest Generation Powerton

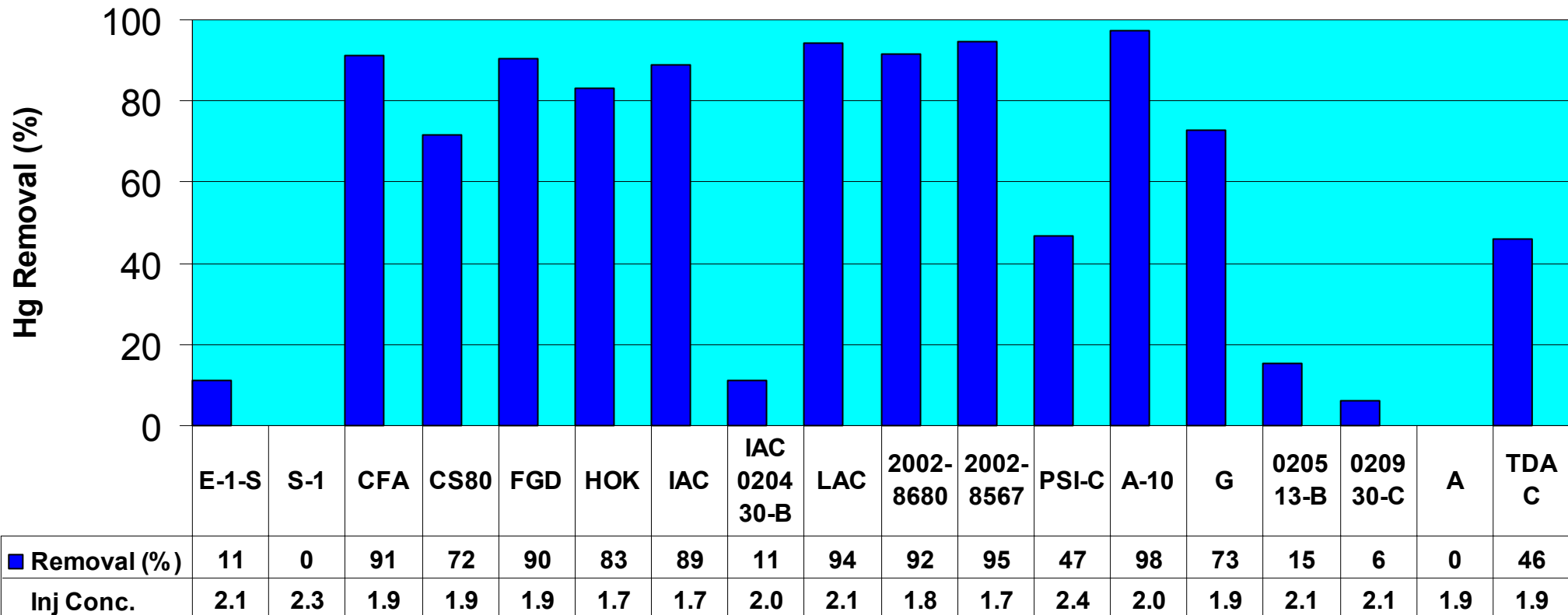
Sorbent Injection rate 1.5 lb/MMacf, Temp 300°F



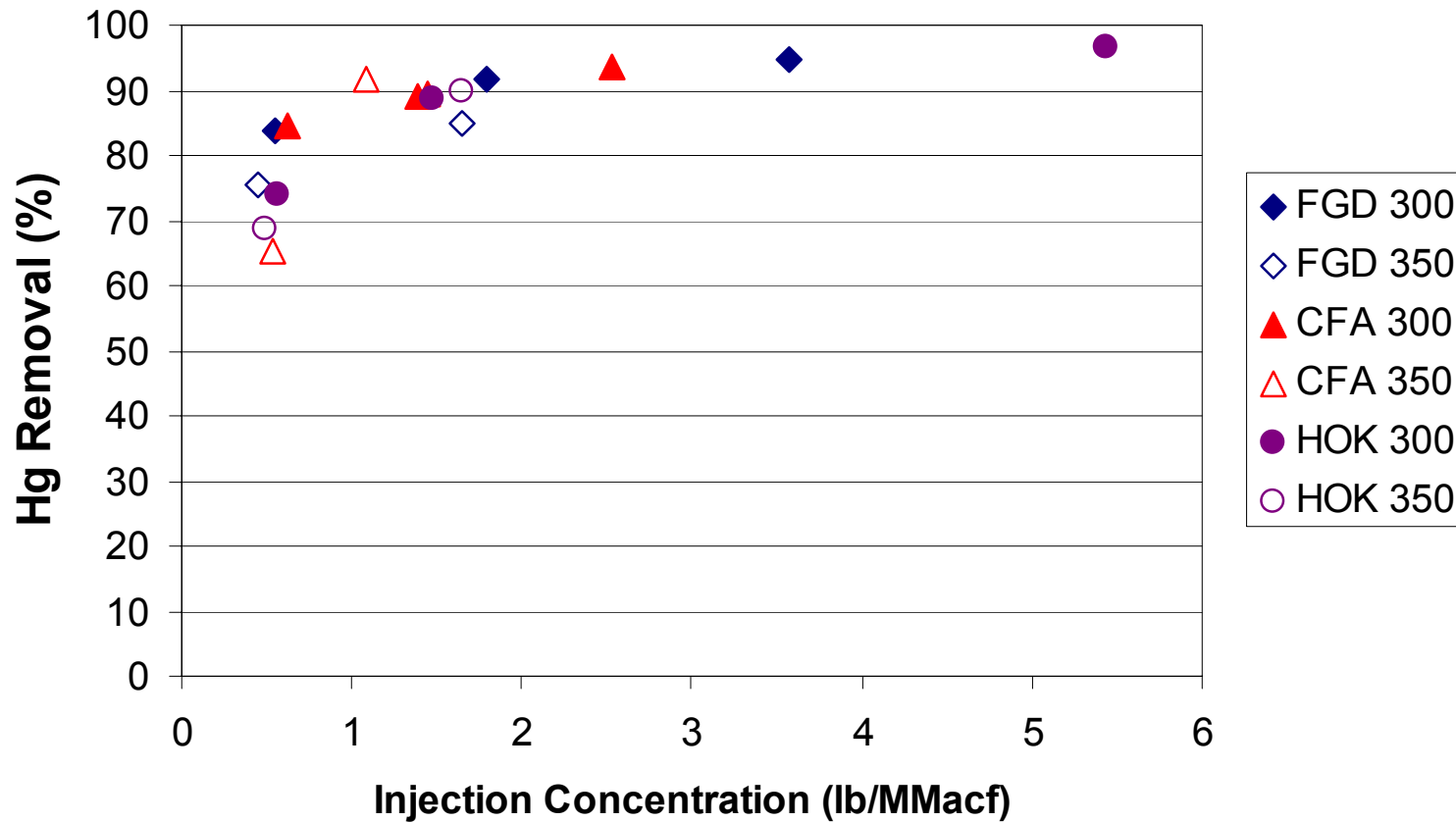
Sorbent Screening Results

We Energies' Valley

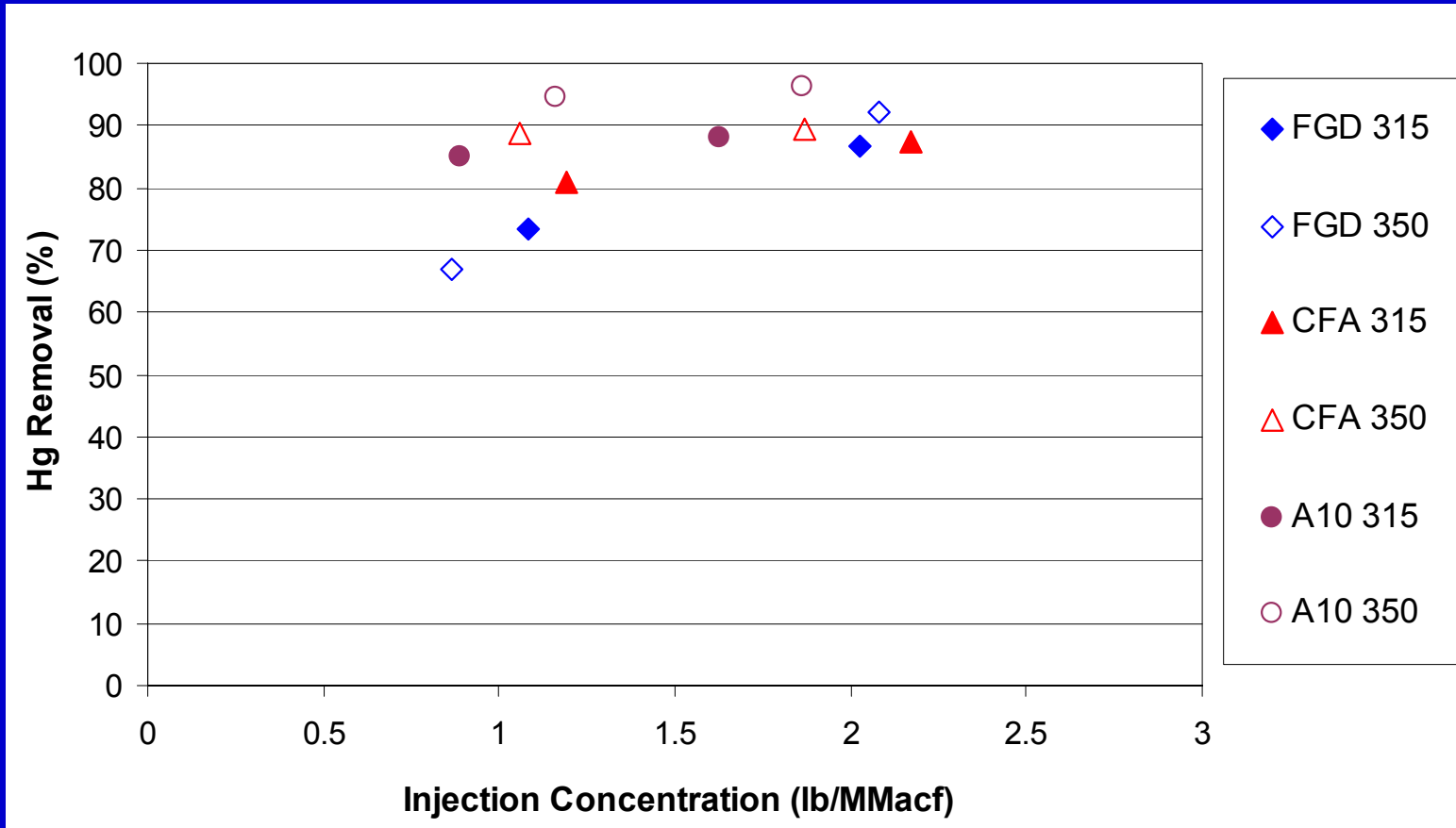
Sorbent Injection rate 2.0 lb/MMacf, Temp° 315 F



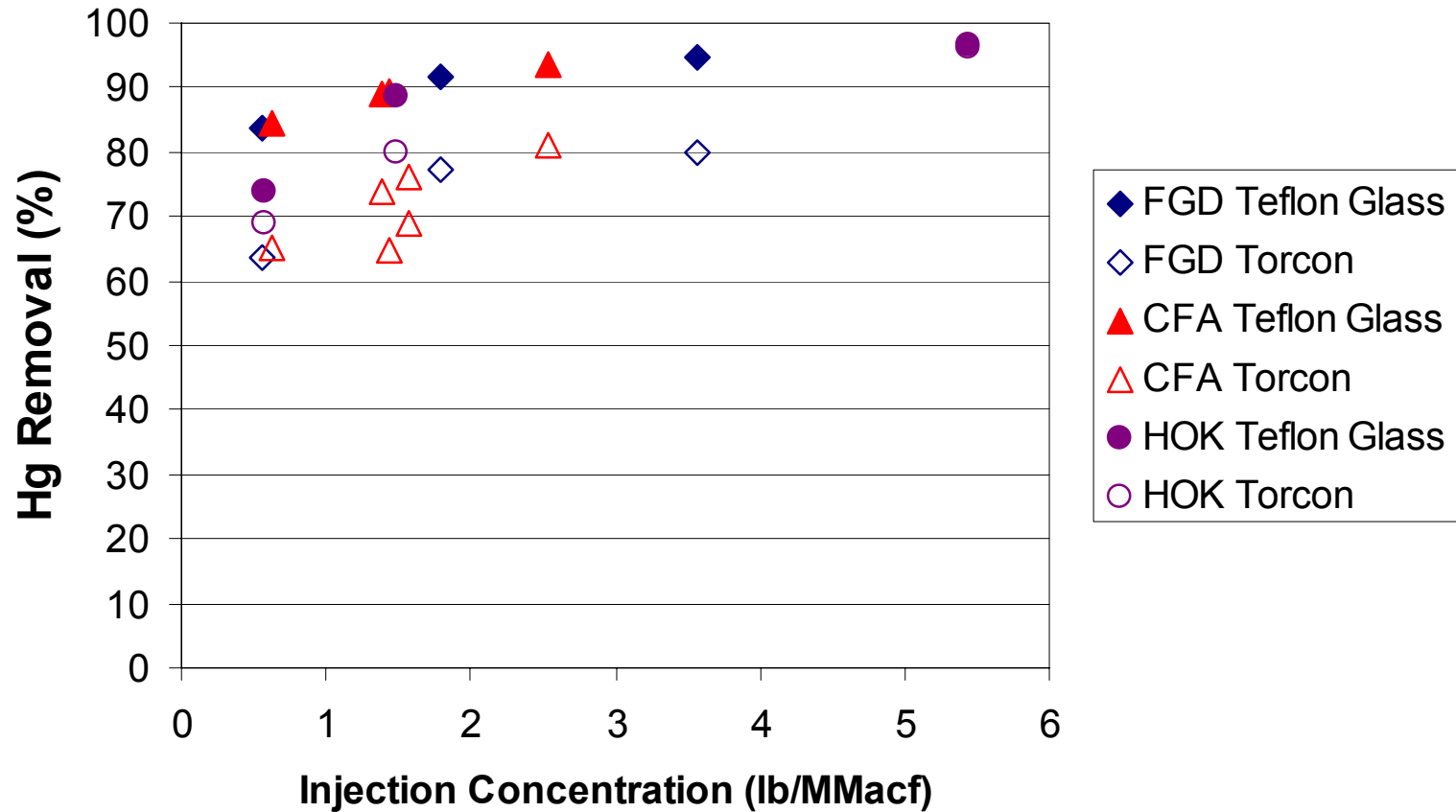
Parametric Results (Powerton)



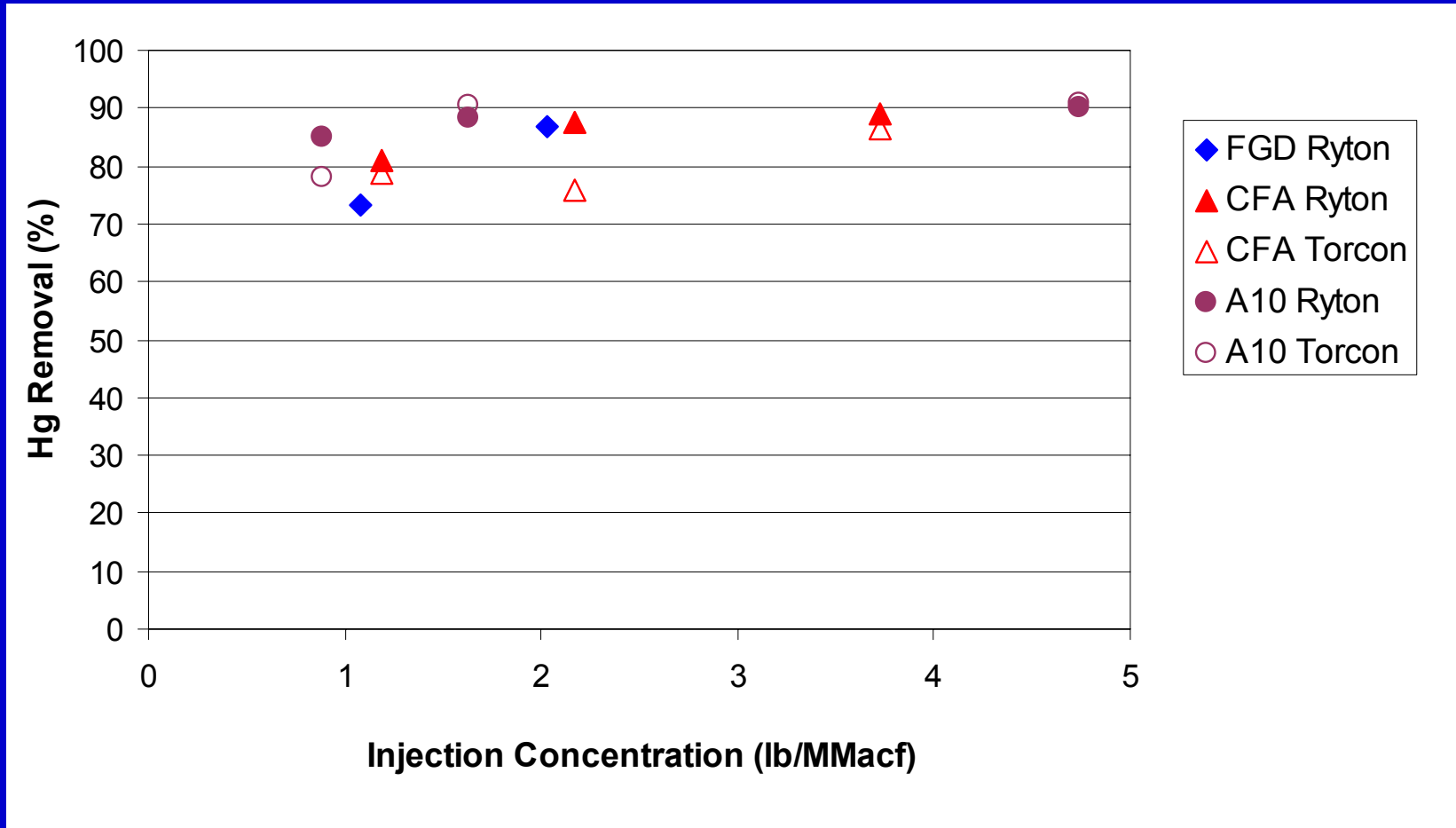
Parametric Results (Valley)



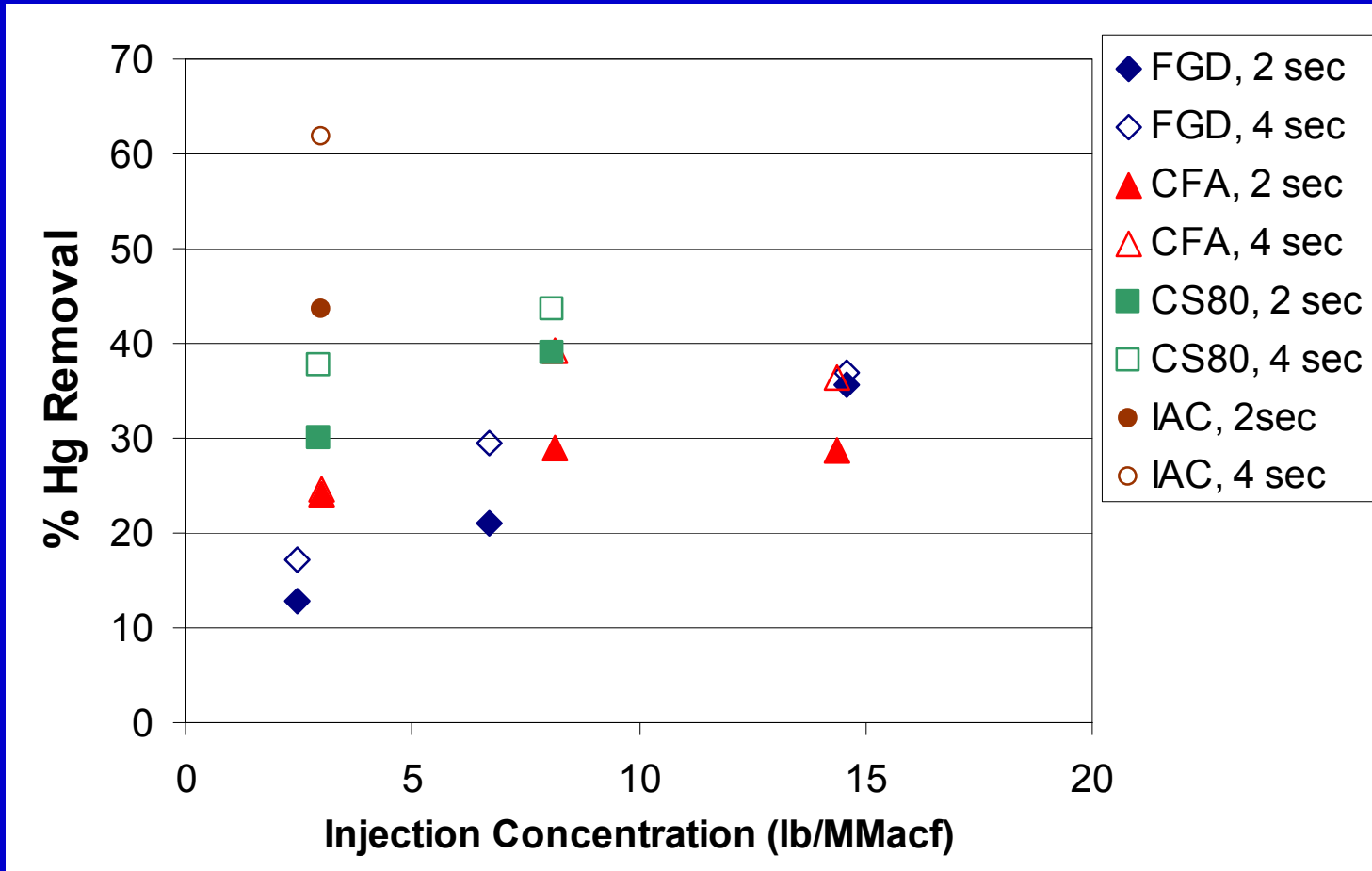
Parametric Results (Powerton)



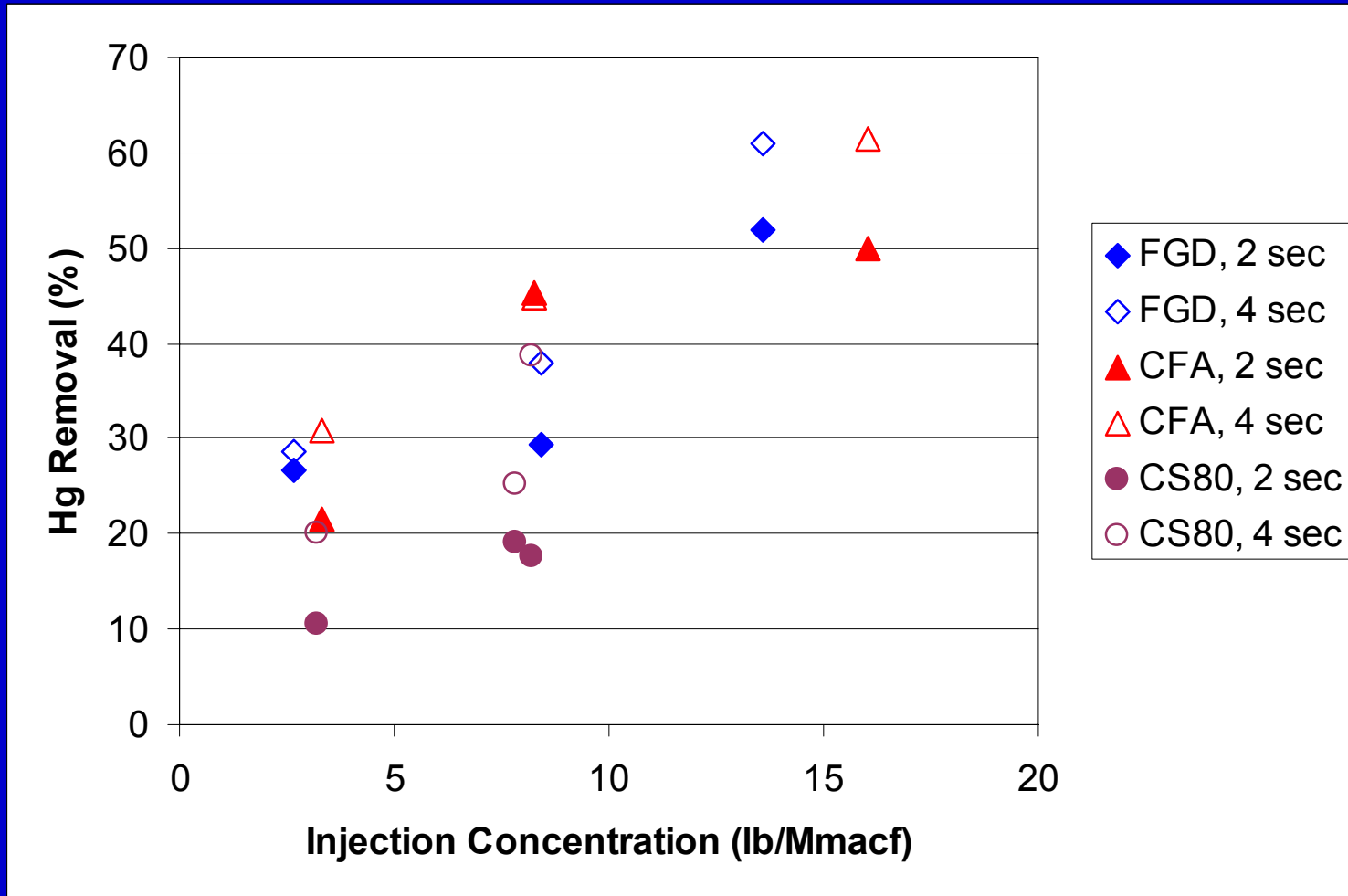
Parametric Results (Valley)



Residence Tube Results (Powerton)



Residence Tube Results (Valley)



Waste Characterization (Powerton)

Sorbent	Bag Type	Hg in Sample $\mu\text{gHg/g}$	% LOI	Ash:Sorbent
FGD	Teflon	5.5	5.8	3.2
FGD	Torcon	6.0	6.3	3.2
CFA	Torcon	11.7	15.2	1.5
CFA	Teflon	15.3	20.6	2.4
HOK	Torcon	10.1	7.2	3.6
HOK	Teflon	8.9	12.0	5.2

Waste Characterization

SGLP

- No significant mercury loss observed for all Powerton ash samples

Air Landfill Simulations

- Room temperature tests were run on Powerton ash samples for 8 weeks and showed no mercury loss
- TGA-style tests are continuing on the Powerton ash samples
- Analysis on Valley ash samples are continuing

Conclusions

Powerton

- Similar performance for all but one untreated carbon based sorbents
- IAC showed comparable performance to that of FGD in COHPAC
- IAC performance was better than FGD in residence tube
- CS80 performed better than FGD or CFA in the residence chamber, which may be attributable to the smaller size of CS80
- Torcon bag fabric consistently showed lower mercury removals for all sorbent types
- Temperature did not significantly affect sorbent performance in COHPAC or residence chamber configurations for FGD, HOK, or CFA
- Mercury removal improved with residence time for all four sorbents

Conclusions

Valley

- During screening, six sorbents demonstrated similar performance (> 90% removal)
 - Three sorbents removed > 70% but less than 90%
 - Six sorbents removed less than 50% (two sorbents at 0%)
- For parametric evaluations, all three sorbents performed comparable.
 - Removal across the Ryton bag was slightly better
 - Temperature had a slight affect on performance for CFA and A10.
 - Mercury removal improved with residence time for all three sorbents.

Key Personnel

PERSON	ORGANIZATION
Bob Patton	DOE/NETL Project Manager
Trevor Ley	Apogee Project Director
Tim Ebner & Rick Slye	Apogee Engineers
Kent Wanninger	Midwest Generation
Tom Platt	Midwest Generation (Powerton)
Dick Johnson	We Energies
Robert Meidl / Doug Goebel	We Energies (Valley)
Ramsay Chang	EPRI
Carl Richardson & Mandi Richardson	URS Group
Sharon Sjostrom	ADA ES