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Field Testing of Activated Carbon Injection Options for Mercury Control at TXU's Big Brown Station

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Project Participants

Acid Gas Solutions

A *Lhoist Group Company*

Big Brown Power Station, Fairfield, Texas

Big Brown Unit Information

Big Brown Station, Freestone County, near Fairfield, Texas

- Plant capacity: Approximately 1200 MW total capacity with two 600-MW units
- Test unit: Tested one-quarter of BB Unit 2, baghouse Module 2-4 (FF 2-4)
- Boiler type: Tangentially fired with eight coal feeders per unit
- Typical fuel: 70% Texas lignite–30% PRB blend

- SO_2 control: None
- NO_x control: Low-NO_x burners
- Particulate control: COHPAC™ configuration

Field Testing Objectives

70% Lignite–30% Powder River Basin (PRB)

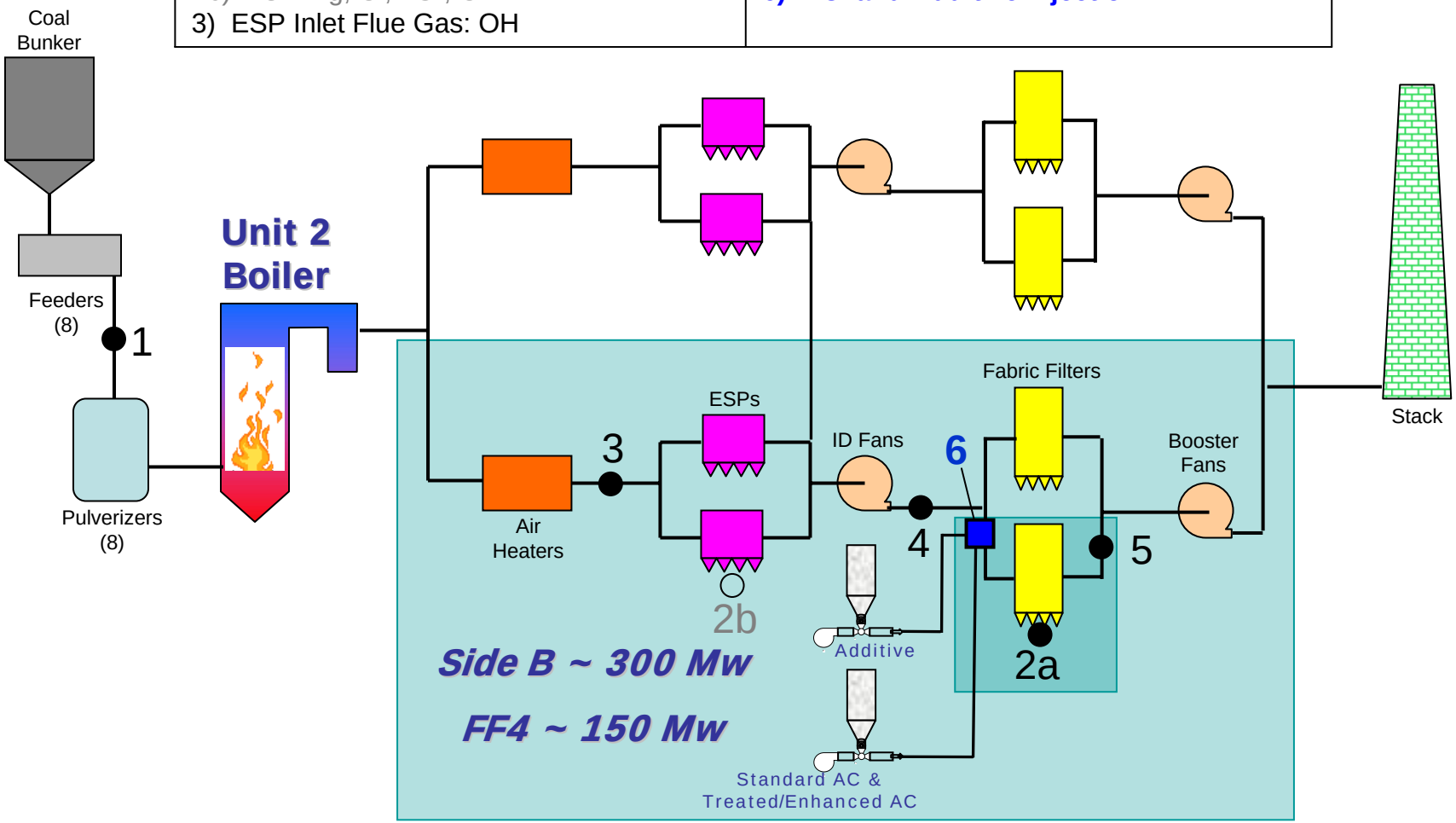
- Establish baseline Hg concentrations and speciation across FF 2-4.
- Screen control technologies with short-duration parametric tests, including ACI-only, enhanced ACI, and ACI plus SEA4.
- Perform a monthlong test with the most promising technology, and evaluate long-term Hg capture and balance-of-plant (BOP) issues.

100% PRB (under separate project)

- Establish baseline Hg concentrations and speciation across FF 2-4.
- Parametric tests, including ACI-only and enhanced ACI.

Mercury Control Options for TXU Big Brown Configuration

TXU's Big Brown Unit – Sampling Locations	
1) Coal: Hg, Cl, Prox./Ult., Heating Value 2a) Ash: Hg, Cl, LOI, C 2b) Ash: Hg, Cl, LOI, C 3) ESP Inlet Flue Gas: OH	4) Baghouse Inlet Flue Gas: OH, Hg CEM 5) Baghouse Outlet Flue Gas: OH, Hg CEM **6) ACI and Additive Injection**



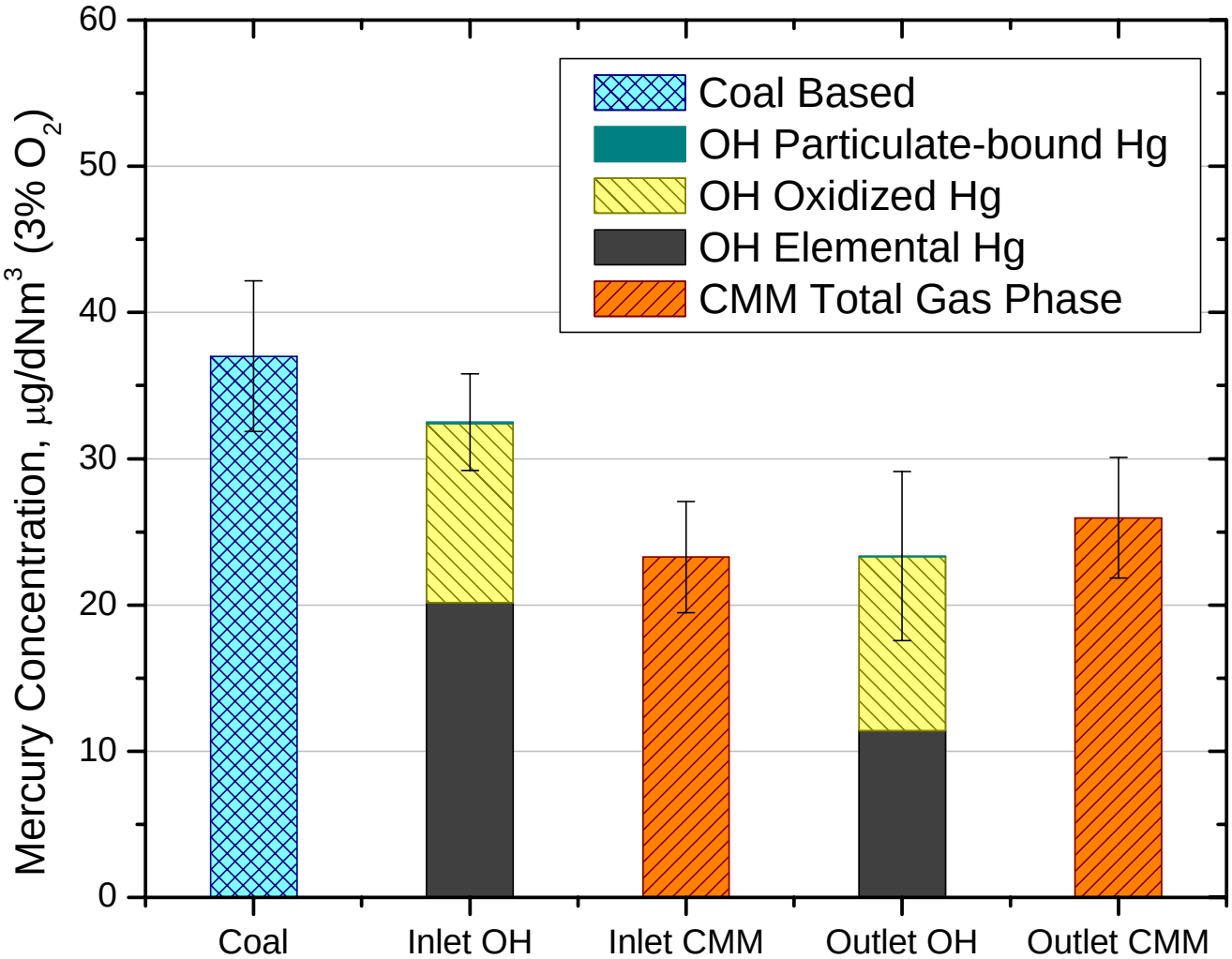
Baseline Coal Comparison
70–30 Blend and 100% PRB Averages

	Nominal 70–30 Blend *	100% PRB *
Hg, ppm (dry)	0.287	0.102
Cl, ppm (dry)	17**	8**
Moisture, %	31.17	31.17
Ash, %	9.91	4.94
Sulfur, %	0.68	0.39
Heating Value, Btu/lb	7531	8101
Fd, dscf/10^6 Btu	9729	9294
Hg, μg/dNm^3, 3% O_2	37.01	12.80

All values on an as-received basis unless otherwise noted.
* Assumed ratio based on plant information.
** Single value.

Baseline* Hg Speciation for 70–30 Blend

Average of 1/18/06, 1/19/06, and 1/20/06



* Measurement taken at inlet and outlet of FF2-4.

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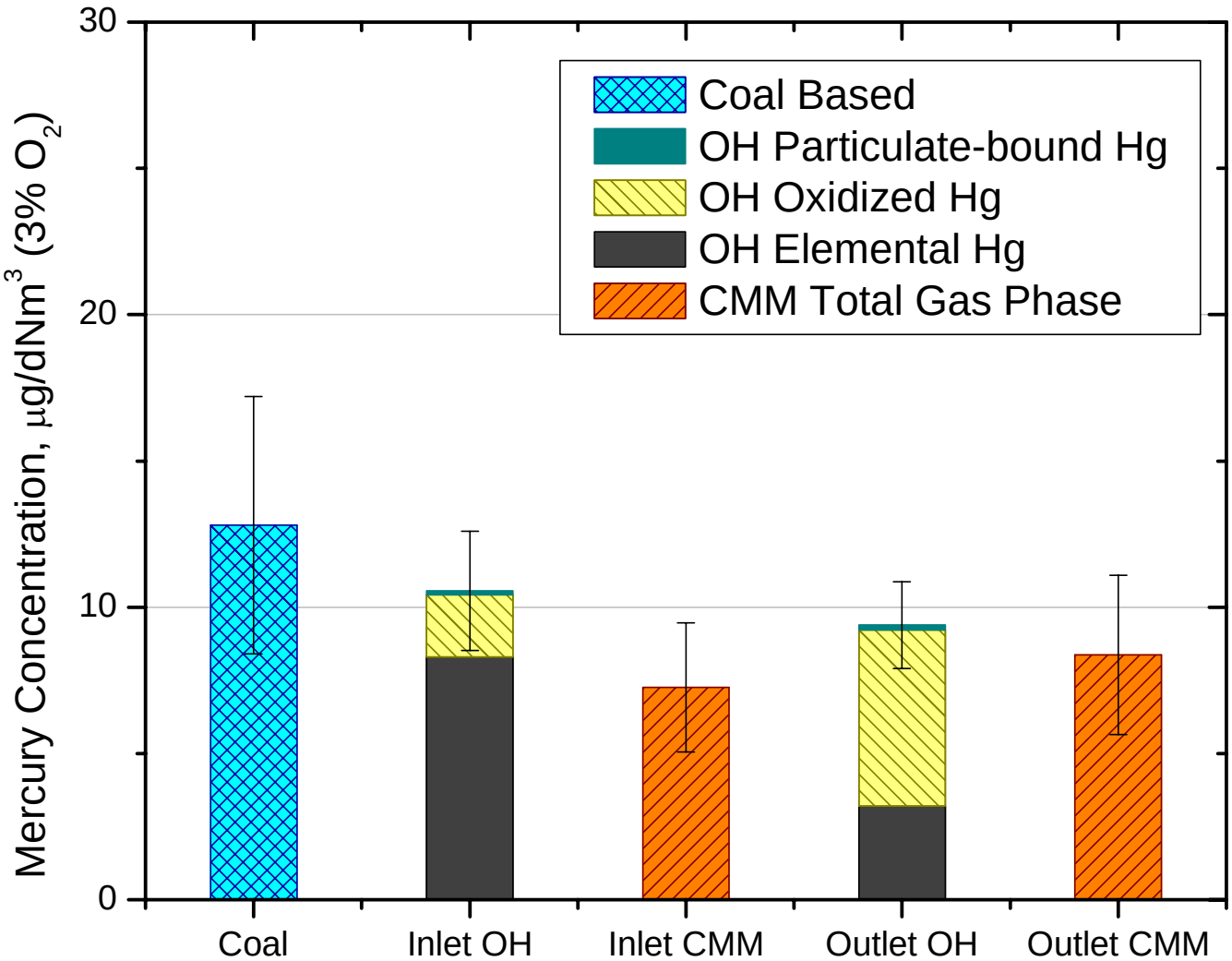
Baseline* Hg Speciation for 100% PRB

Average of 3/30/06, 3/31/06, and 4/1/06



* Measurement taken at inlet and outlet of FF2-4.

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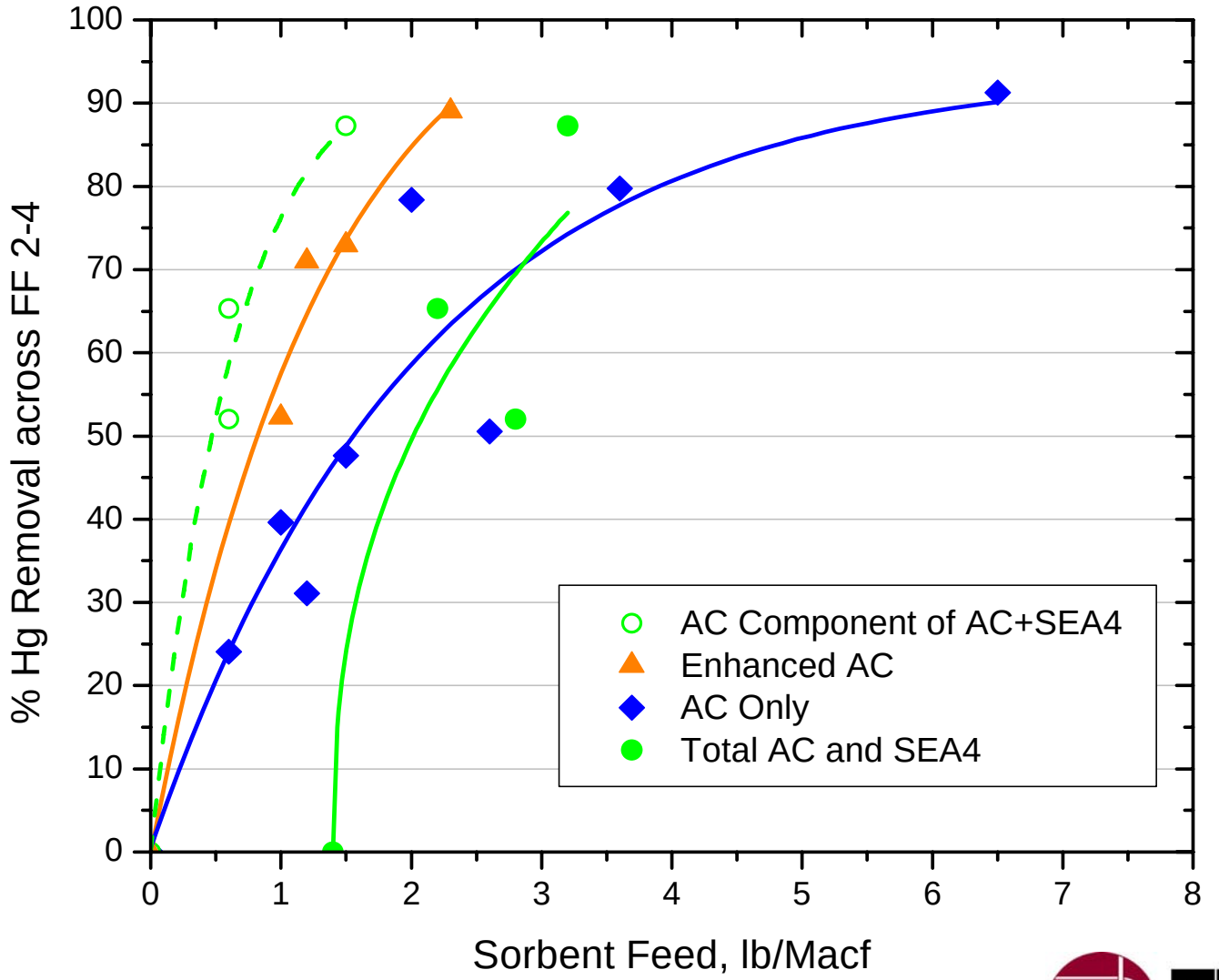
Parametric Results Summary
70–30 Blend



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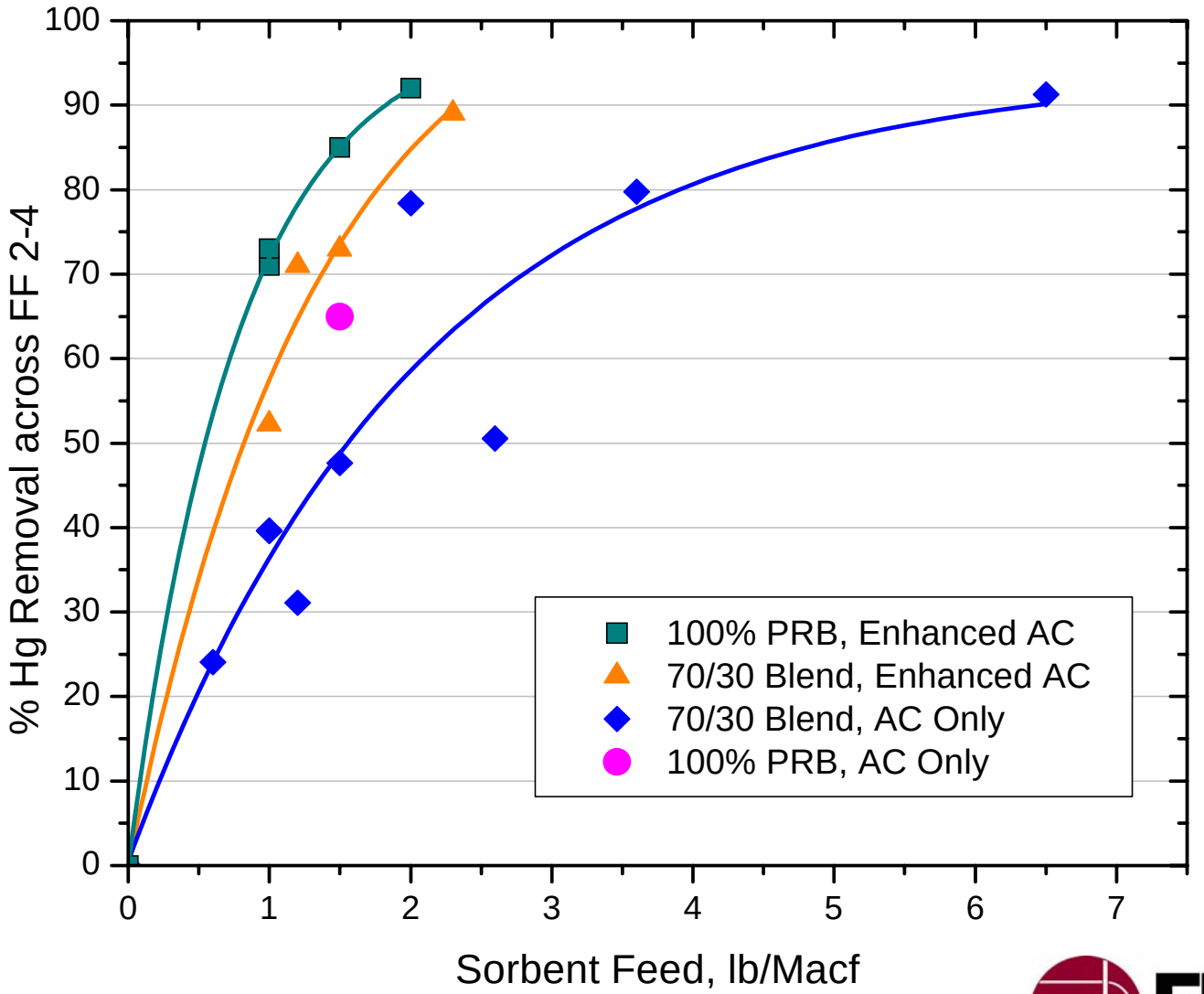
Comparison of Parametric Testing 70–30 Blend and 100% PRB



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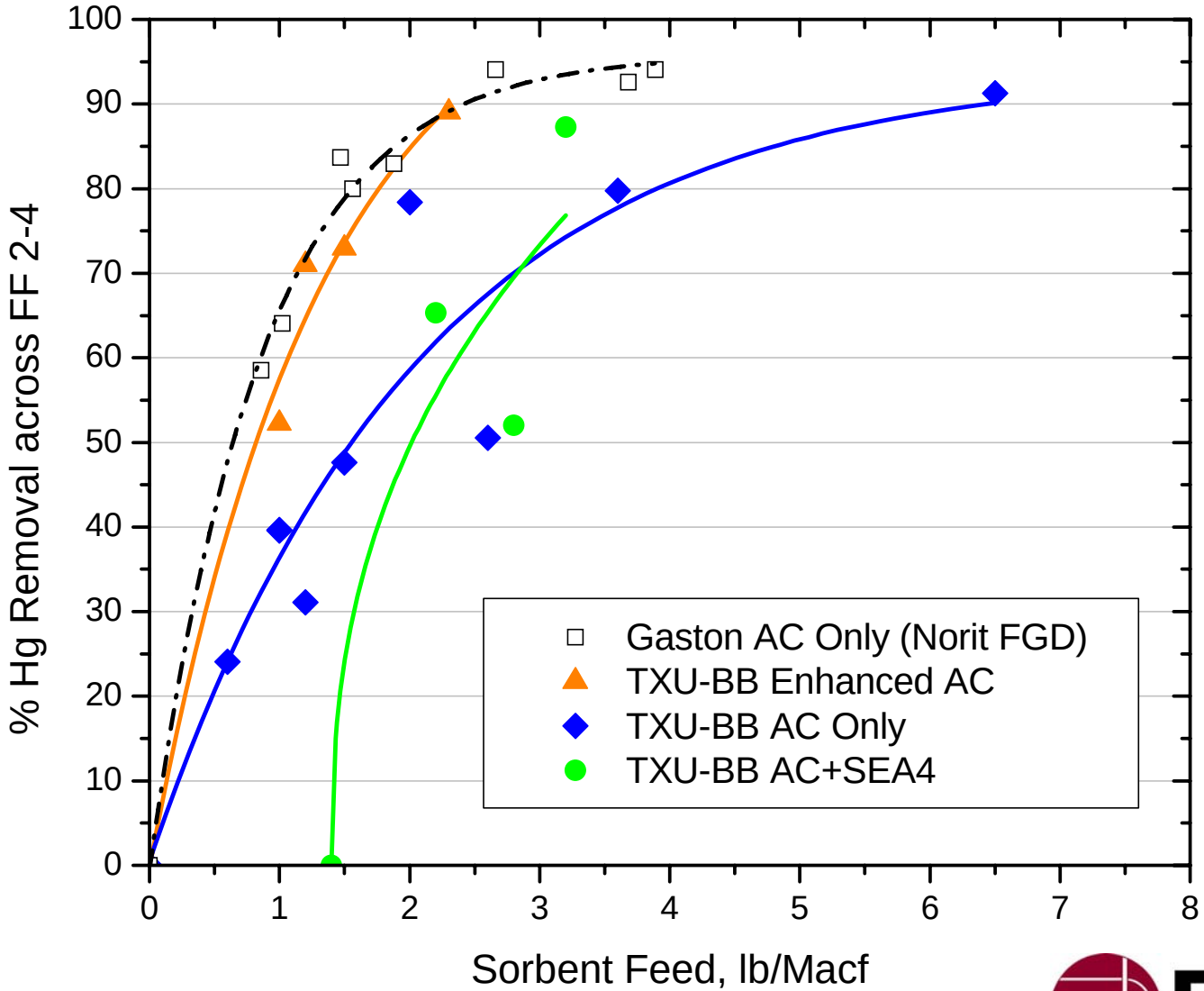
Comparison of Blend and PRB Hg Emissions

(based on CMM data)

	FF 2-4 Inlet µg/dNm³, 3% O_2	FF 2-4 Outlet µg/dNm³, 3% O_2	FF 2-4 Removal, %	FF 2-4 Outlet Emissions, lb/TBtu
Blend Baseline	23.3	26.0	0	18.4
PRB Baseline	7.2	8.4	0	5.7
Blend with Enhanced AC*	18.1	5.1	75	3.2
PRB with Enhanced AC*	8.5	1.6	81	0.9

* Enhanced AC rate was 1.5 lb/Macf

Comparison of Blend Parametric Data to Gaston Results



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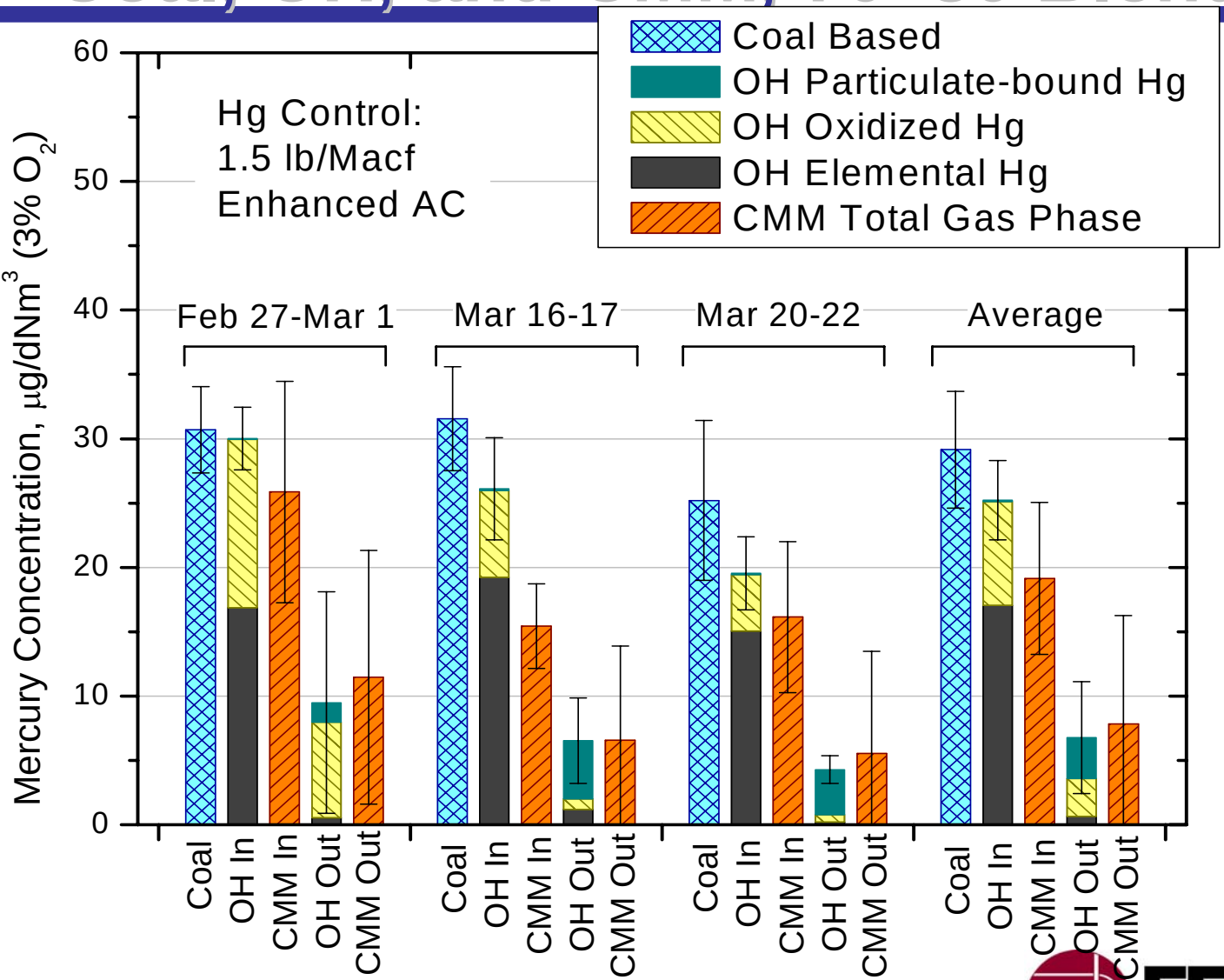
Monthlong Test Rationale

Enhanced ACI at a target rate of 1.5 lb/Macf (load-following) was selected for the monthlong testing because it had a favorable balance among the following factors:

- Hg removal goals, parametric testing indicated >55% capture was possible.
- Preliminary economics based on sorbent consumption and equipment needs.
- Reducing plant impacts by minimizing the quantity of injected sorbent. Could inject only when dP was below 10 in. W.G.

Hg Sampling Throughout Monthlong Test Coal, OH, and CMM, 70–30 Blend



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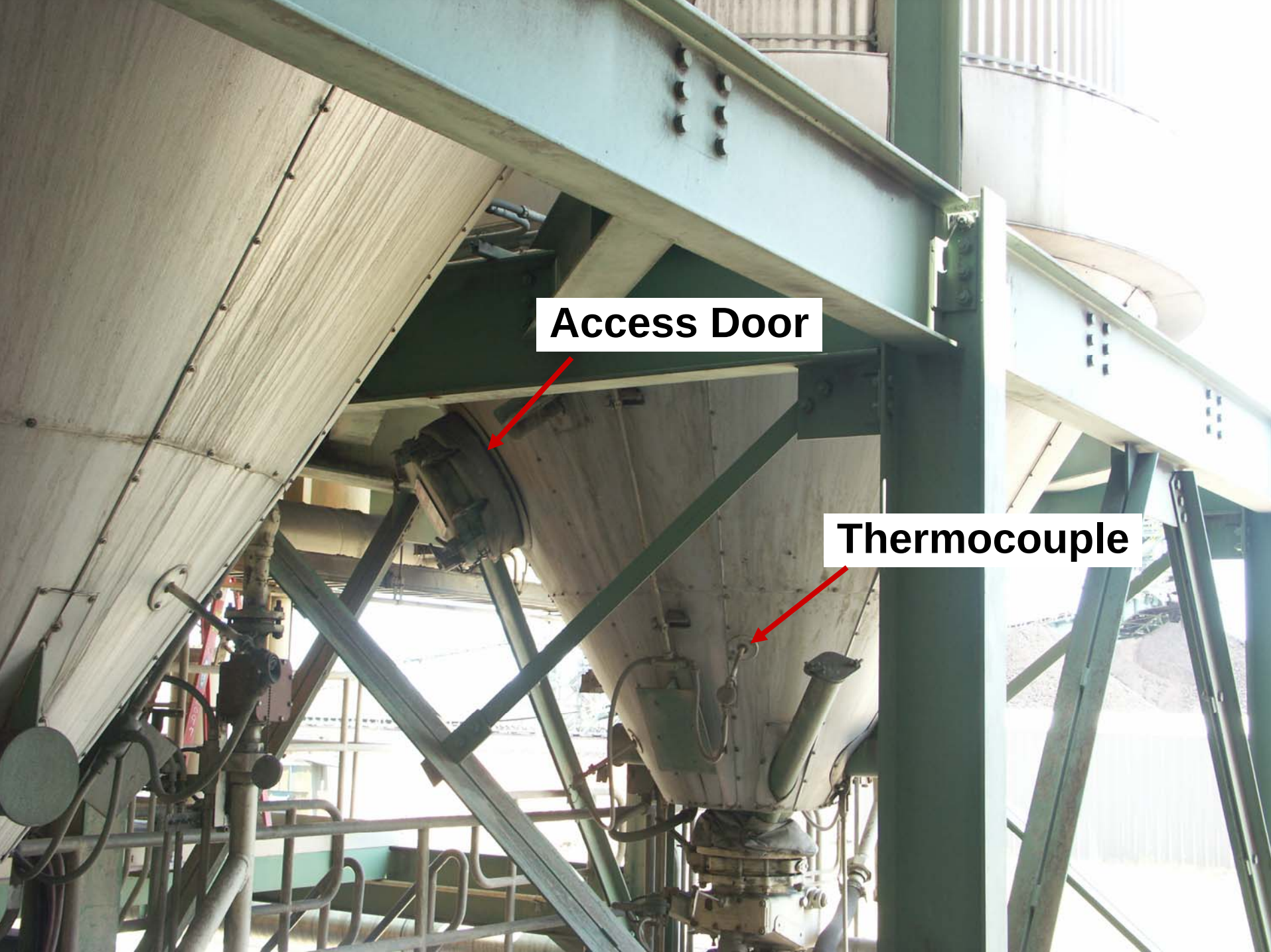
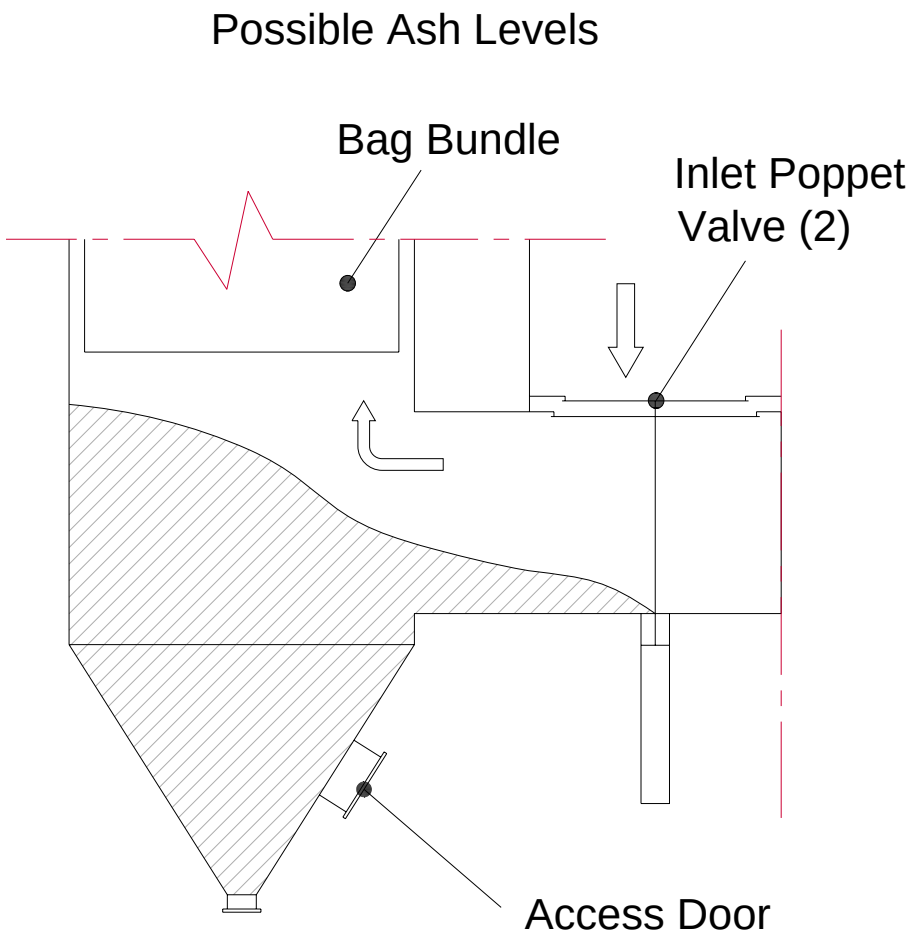
Big Brown Field Testing
Balance-of-Plant (BOP) Issues

- **Bag Blinding**—Following Hg field testing, the residual drag across FF 2-4 had reached a point where TXU was not confident in its performance for the upcoming summer season; therefore, the plant initiated a full bag replacement of FF 2-4 in May 2006. Because of many confounding factors, the exact cause is still under investigation.
- **Plugged Hoppers/Deposits**—During the bag change, it was discovered that two of the eight hoppers (Hoppers C and H) on FF 2-4 were plugged and filled with ash. In these two hoppers, unusual deposits were found mixed with the loose ash, which was reported to be very hot and smoldering.


Access Door
Thermocouple

Hoppers C and H – Ash Level

- When opened for the bag change, both Hoppers C and H were completely full of ash to a height above the access door.
- The operators did note that ash had collected in the inlet duct and was probably at least to that level and, therefore, completely filling the bottom cone.
- They did not think ash contacted the bags since that would require the entire inlet duct to become blocked.



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Conclusions
Big Brown Hg Field Testing

- Under baseline test conditions, mercury capture across the baghouse is effectively zero for both the 70–30 blend and 100% PRB.
- Both the AC+SEA4 and enhanced AC options performed better than AC alone. Testing showed that >70% capture could be achieved with rates lower than 2 lb/Macf.
- Hg removal efficiencies were similar for the 70–30 blend and 100% PRB, but emissions were much lower with the PRB because of the lower Hg-in-coal content.
- Month-long testing with the enhanced AC showed an average removal greater than 70%, however, there were fluctuations due to interruptions in the ACI feed and the ACI equipment settings. At steady state conditions with the target ACI rate of 1.5 lb/Macf, average removals were greater than 80%.
- The narrow and limited operating margin of the COHPAC differential pressure proved to be the limiting factor for applying sorbent injection at Big Brown. Short term tests were successful, but for long-term sustainable ACI operation, substantial modifications to the plant are required to provide a greater operating margin.

Conclusions
Big Brown Balance of Plant Effects

- The residual drag across FF 2-4 appears to have increased by an amount that was unexpected based on past experience. The investigation into the root cause is still underway and includes plant operating conditions as well as the effects of sorbent injection.
- The plugged hoppers and the associated deposits appear to be a result of the hopper heaters being off for compartments C and H. The heaters being off likely led to formation of deposits that eventually grew to a size large enough and strong enough to plug hopper C and H discharge. Subsequently, this led to accumulation of ash and AC of adequate quantity to promote self heating and eventual ignition. The deposits are a mix of hydration products, heated to varying degrees, and ash sintered with heat from the smoldering ash-AC mixture. More work is needed to determine exact mechanism of self ignition and conditions under which it can occur.