

Evaluation of Fuel Samples and Process Byproducts from Full-Scale Mercury Control Evaluations Conducted on Coal-Fired Boilers Burning PRB Fuel

Air Quality V

September 21, 2005

Travis Starns
ADA-ES, Inc.



Co-Authors

- ADA-ES, Inc.
 - Sharon Sjostrom, Jerry Amrhein, Chad Sapp, Cody Wilson, Erik Zipp
- Reaction Engineering International
 - Connie Senior

- **DOE/NETL Project Manager: Andrew O’Palko**
- **ADA-ES Project Manager: Sharon Sjostrom**
- **ADA-ES Site Manager: Travis Starns**

Test Sites

<u>Test Site</u>	<u>Coal</u>	<u>Pollution Control</u>
Sunflower Electric	PRB	SDA + FF
Holcomb	<i>PRB/Bit Blend</i>	
AmerenUE	PRB	Cold-Side ESP
Meramec		
Missouri Basin PP	PRB	SDA + ESP
Laramie River	<i>PRB/Bit Blend</i>	

Meramec, Monroe, and Conesville Co-Funders

AmerenUE*

American Electric Power*

DTE Energy*

Dynegy Generation

MidAmerican

Ontario Power Generation

Southern Company

TVA

ADA-ES

ALSTOM

Arch Coal

EPCOR

EPRI

Babcock & Wilcox

NORIT Americas

** Host Sites*



Holcomb and Laramie River Co-Funders

- Associated Electric Coop
- City of Sikeston
- Empire District Electric Company
- Kansas City Board of Public Utilities
- Kansas City Power and Light
- **Missouri Basin Power Project***
- Nebraska Public Power District
- PacifiCorp
- Southern Minnesota Municipal Power Agency
- **Sunflower Electric Power Corporation***
- Tri-State
- TransAlta
- Westar Energy
- Wisconsin Public Service
- ADA-ES, Inc.
- ALSTOM
- Arch Coal
- EPRI
- Kennecott Coal
- NORIT Americas
- Peabody Coal
- Western Fuels Association

** Host Sites*

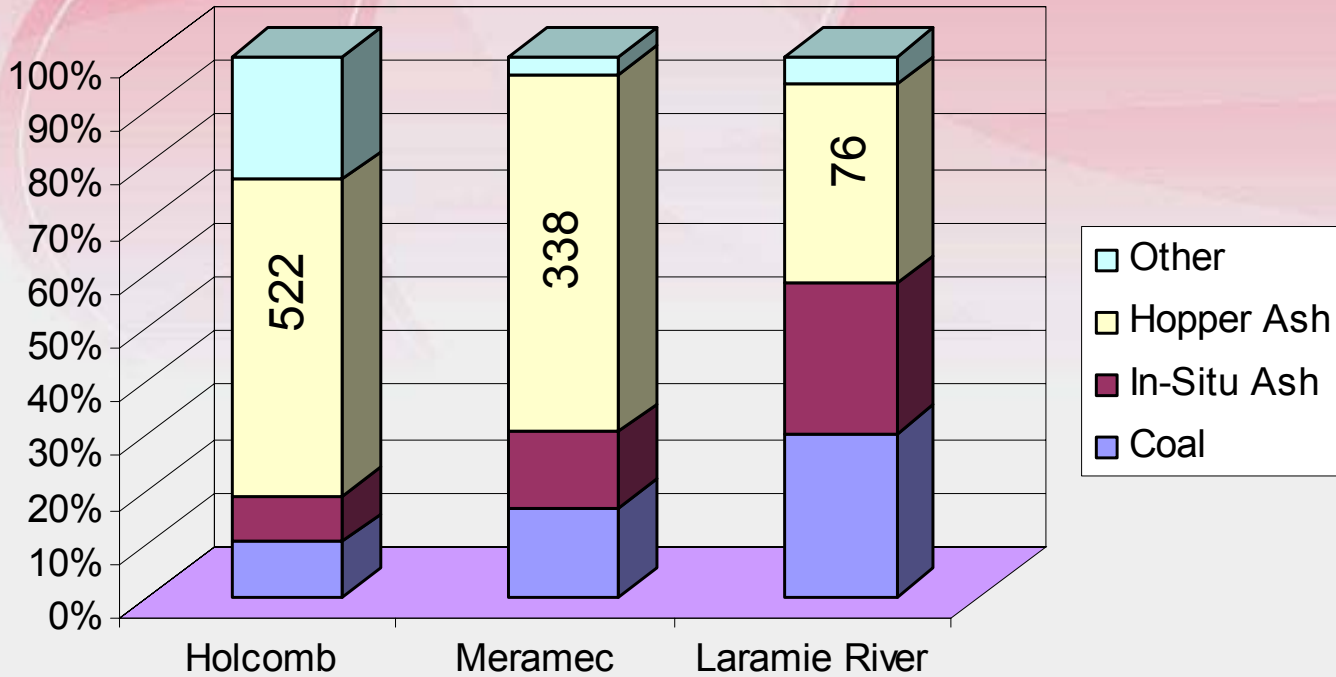


Collecting and Analyzing Samples

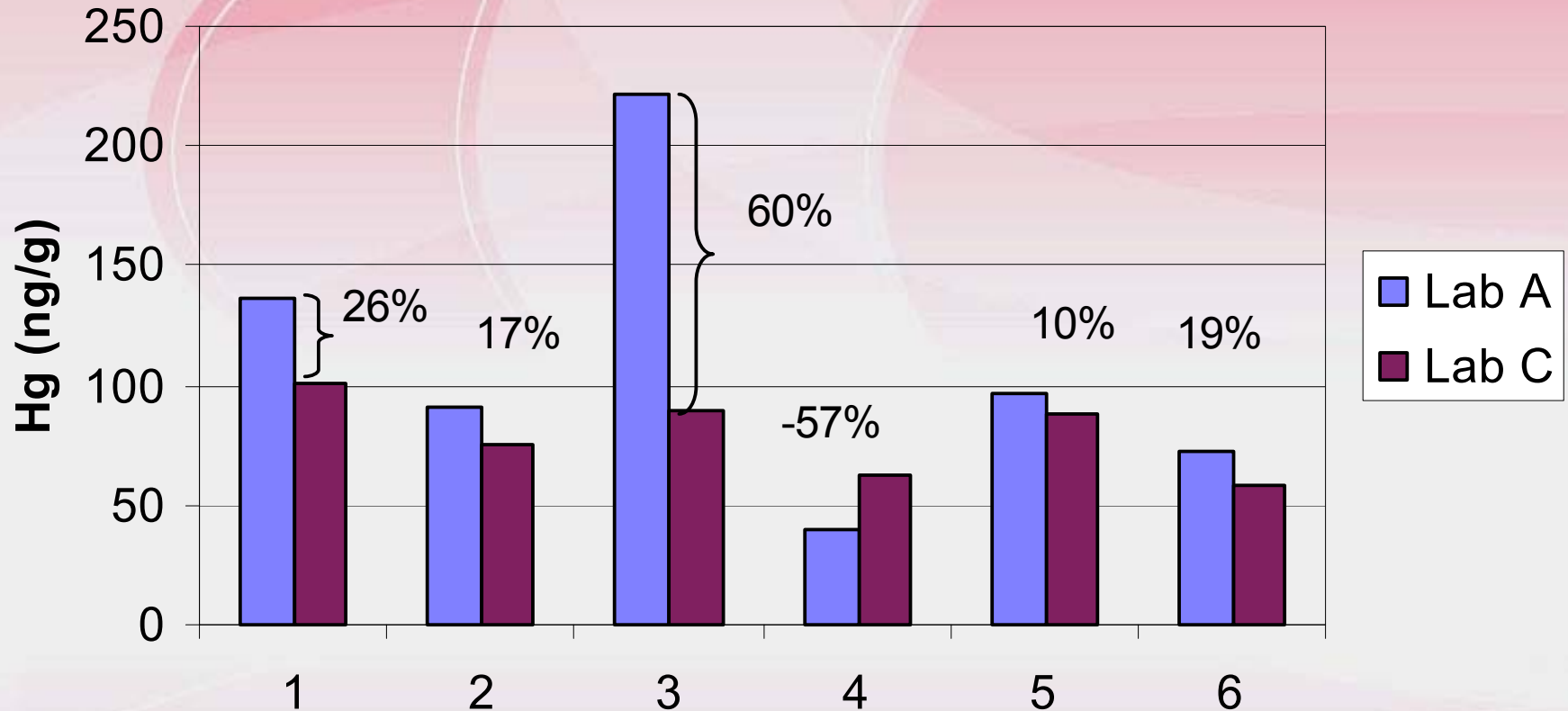
QA/QC

- Careful sample collection, handling, and analysis are critical to obtaining quality results.
- Samples should be homogenized prior to analysis and quality control procedures should be in place in the field and lab.

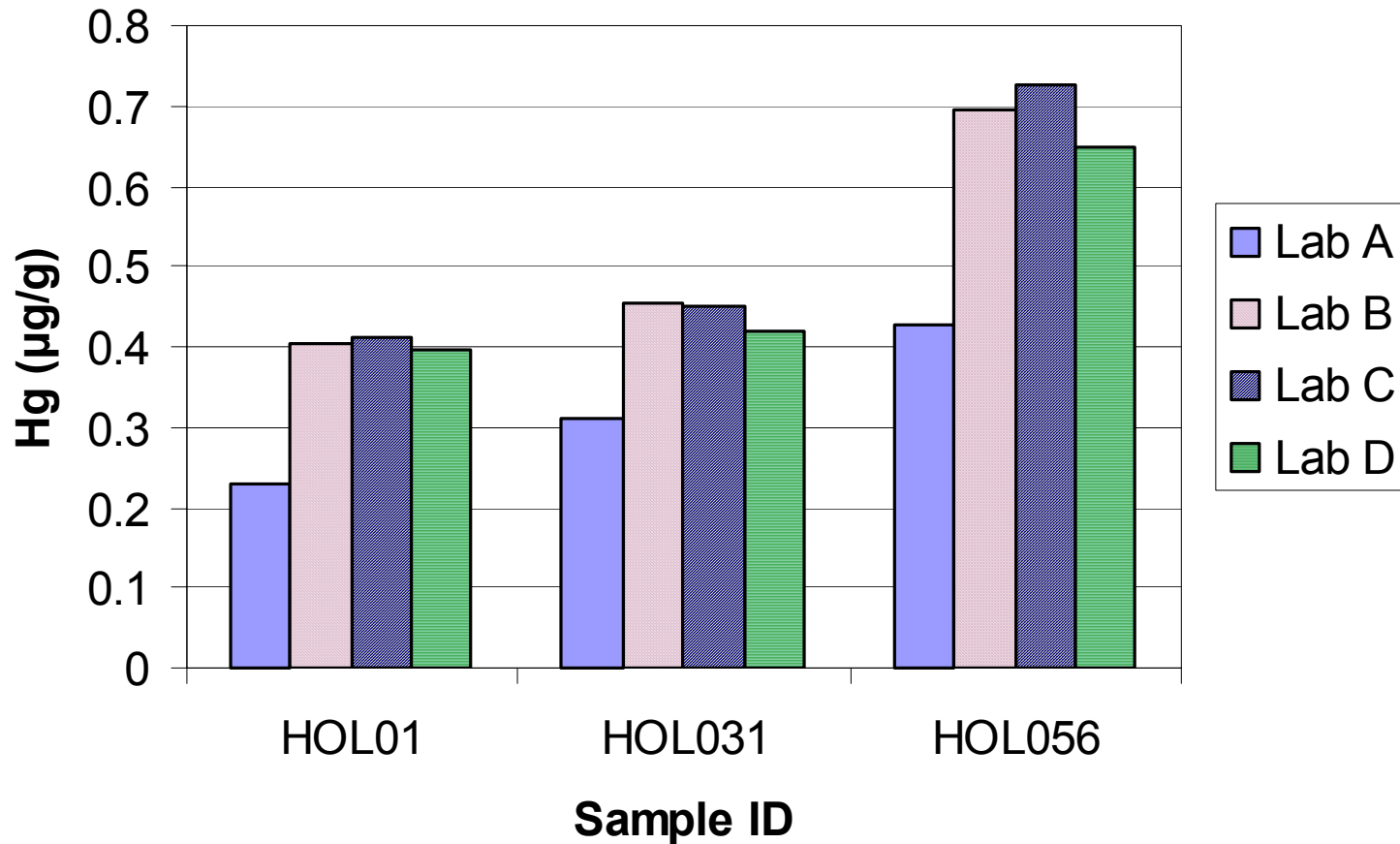
Samples Collected



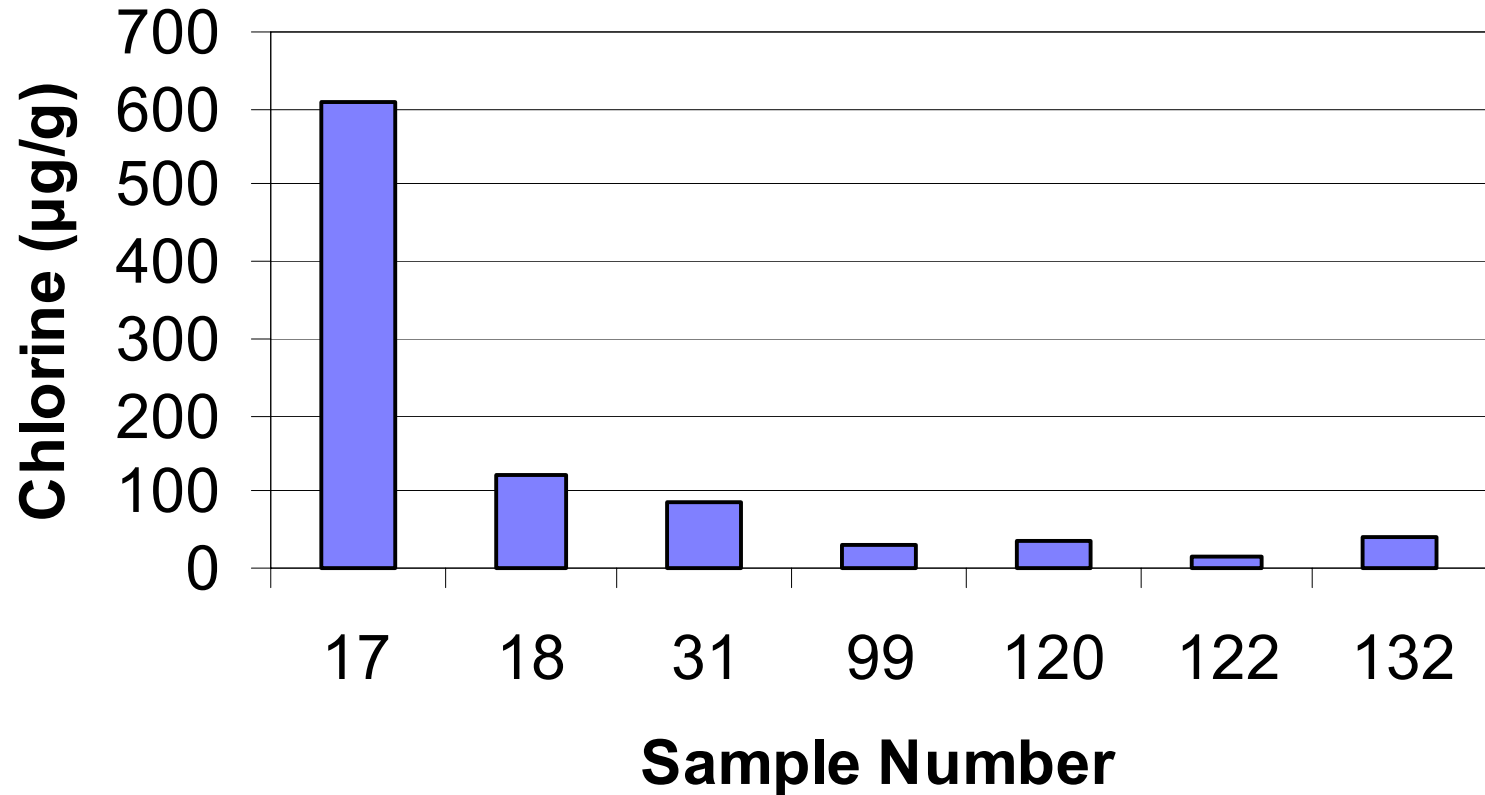
Coal Mercury: Laboratory Variability



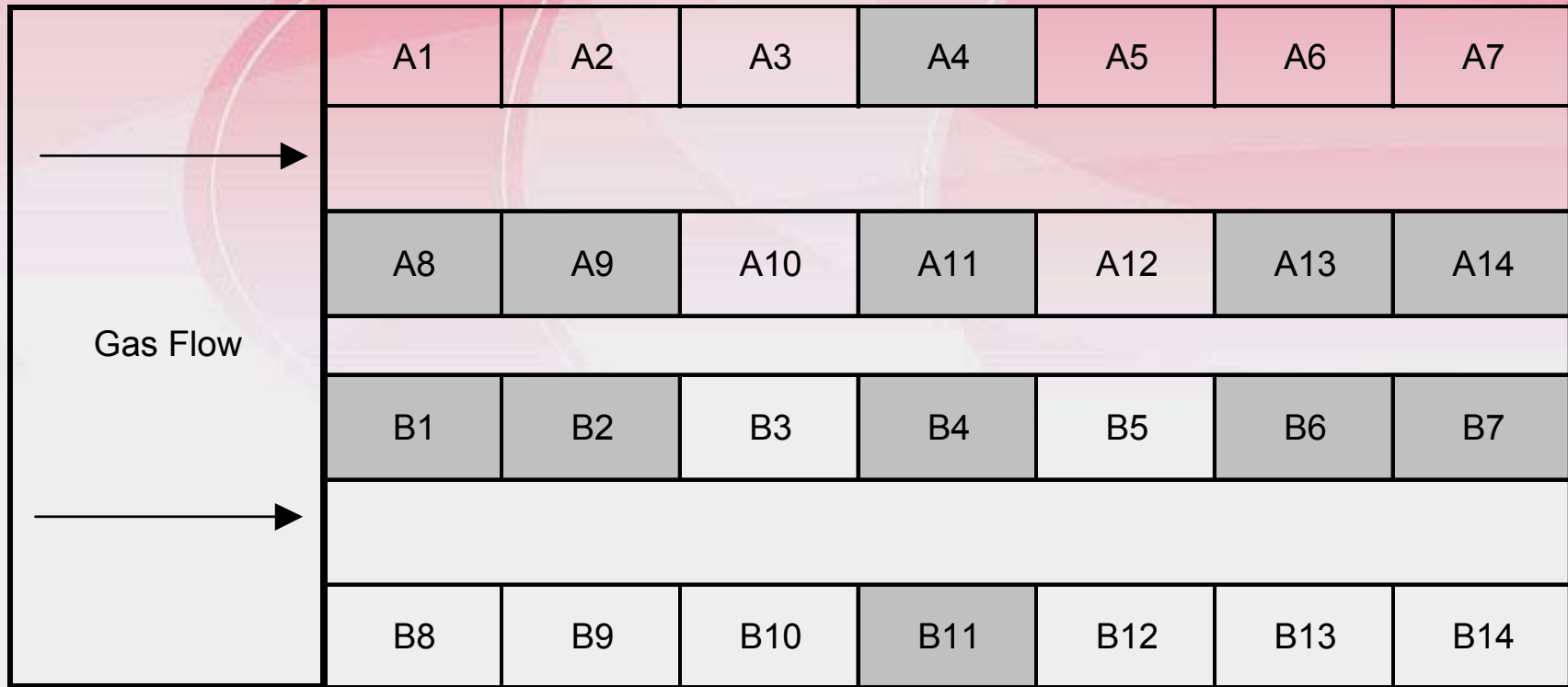
Ash Mercury: Laboratory Variability



Chlorine: Possible Contamination

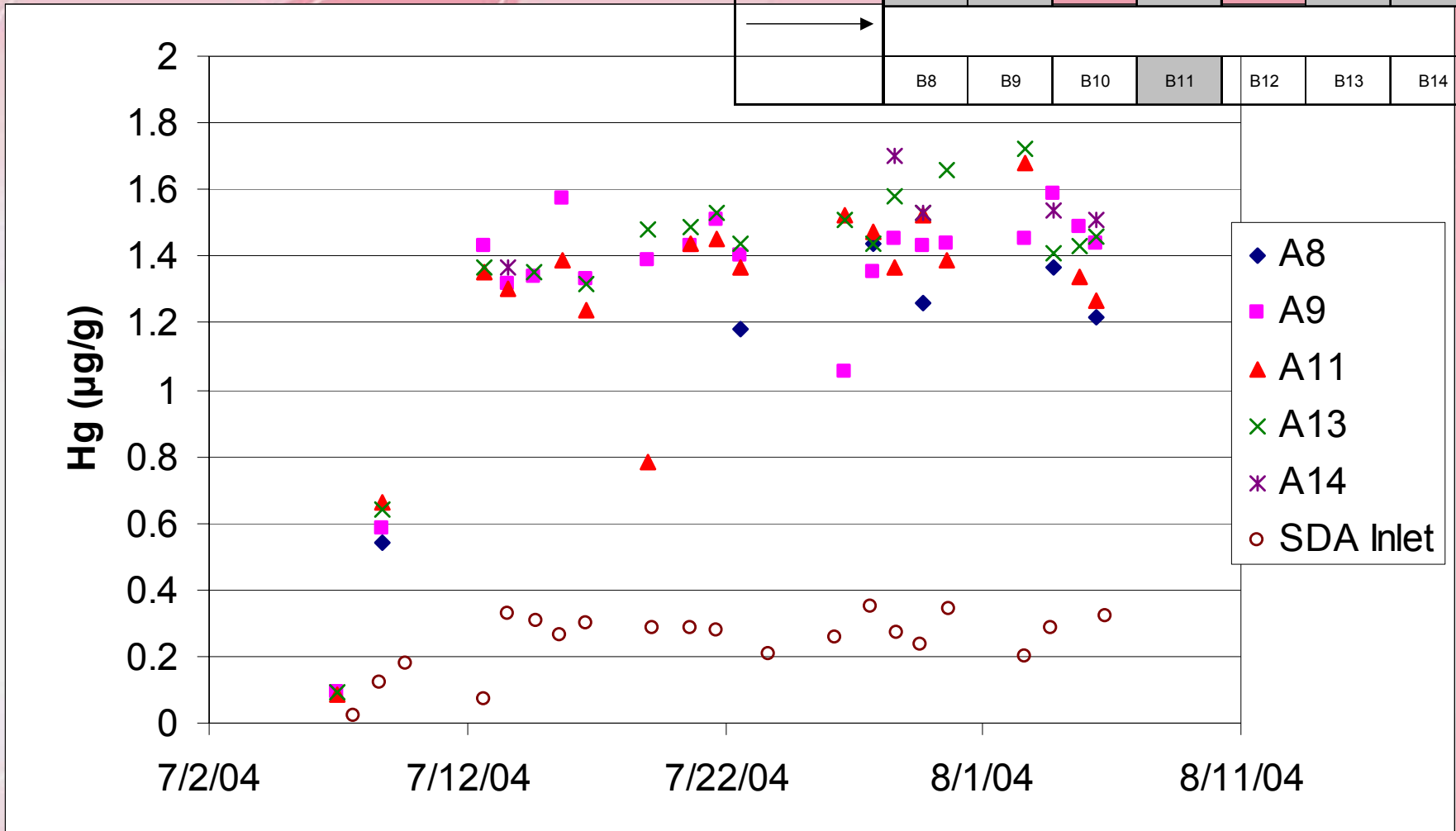
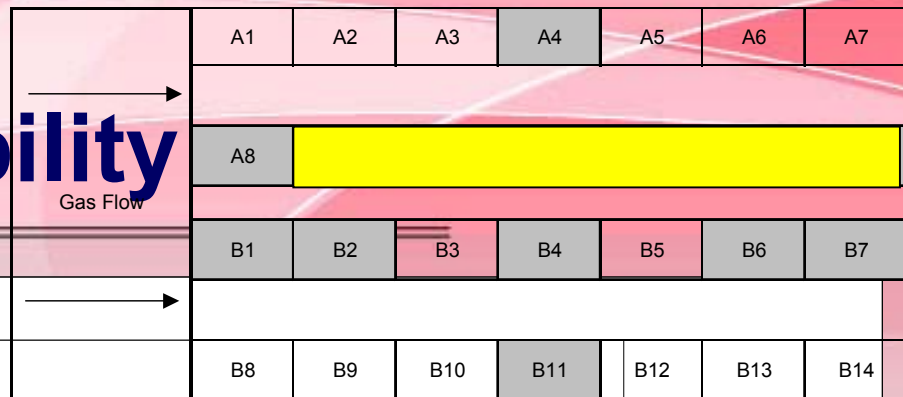


Baghouse Hopper Sketch

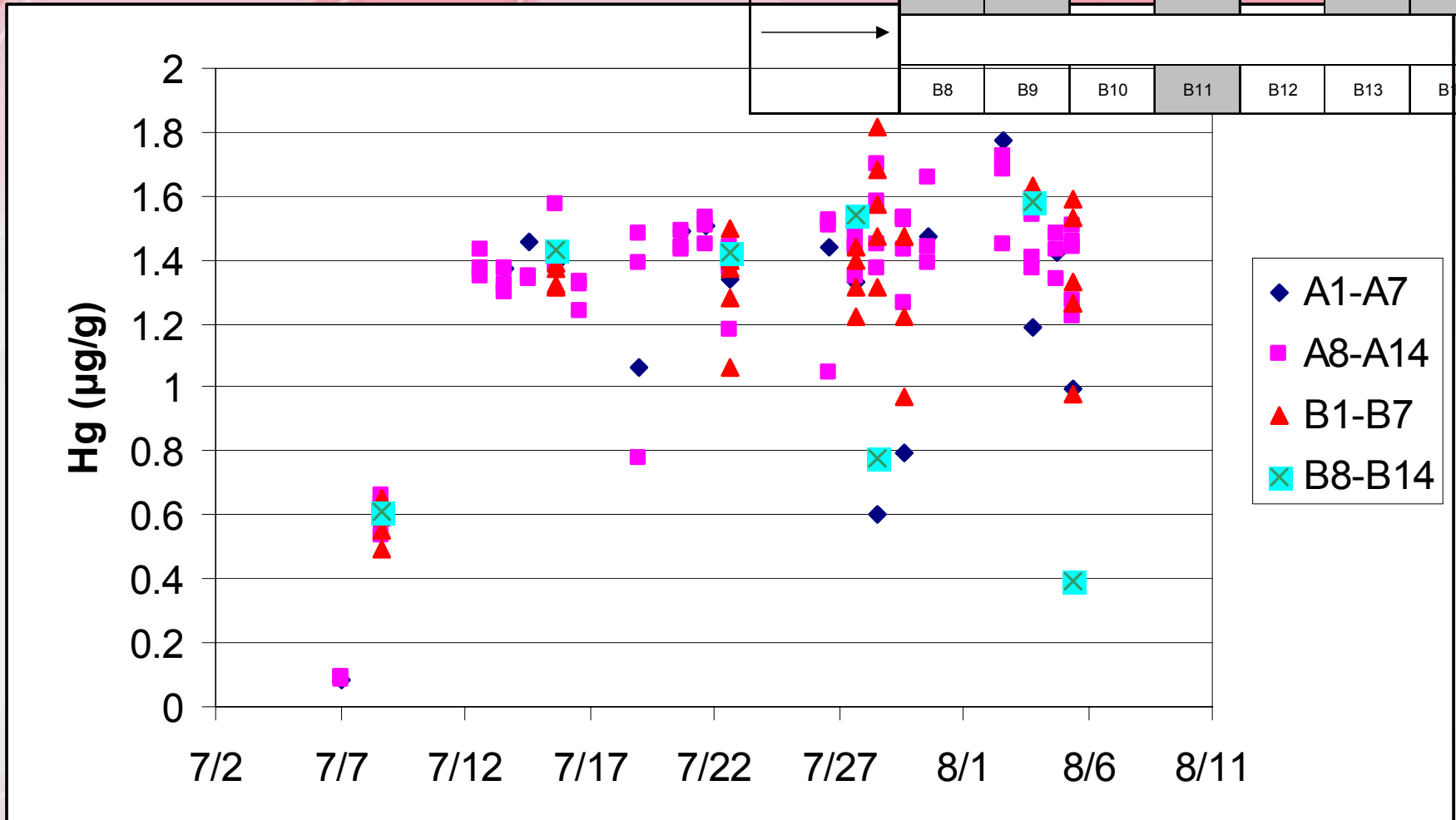


* - 1 Liter Samples Collected Daily

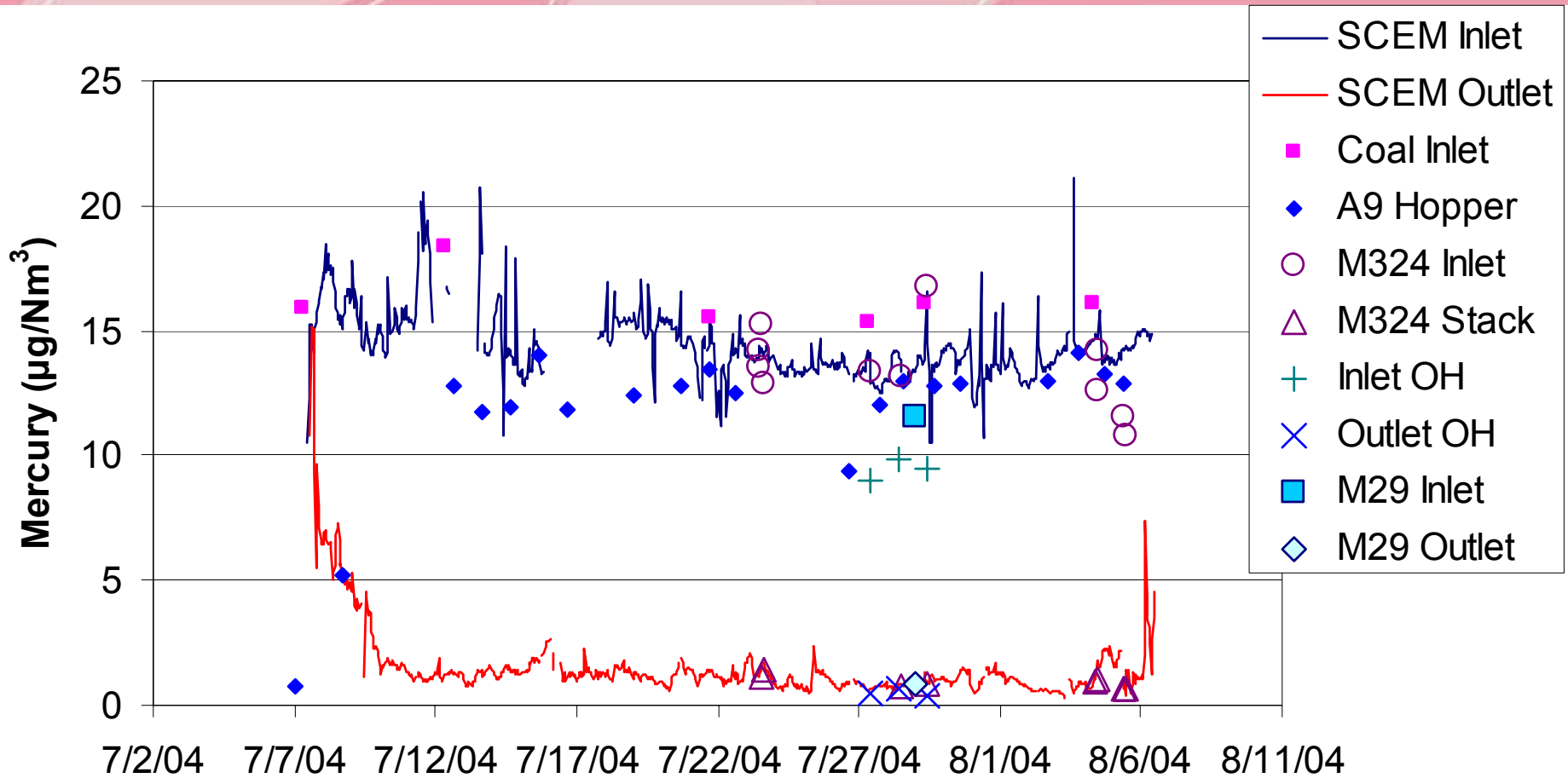
Hg in Ash – Variability



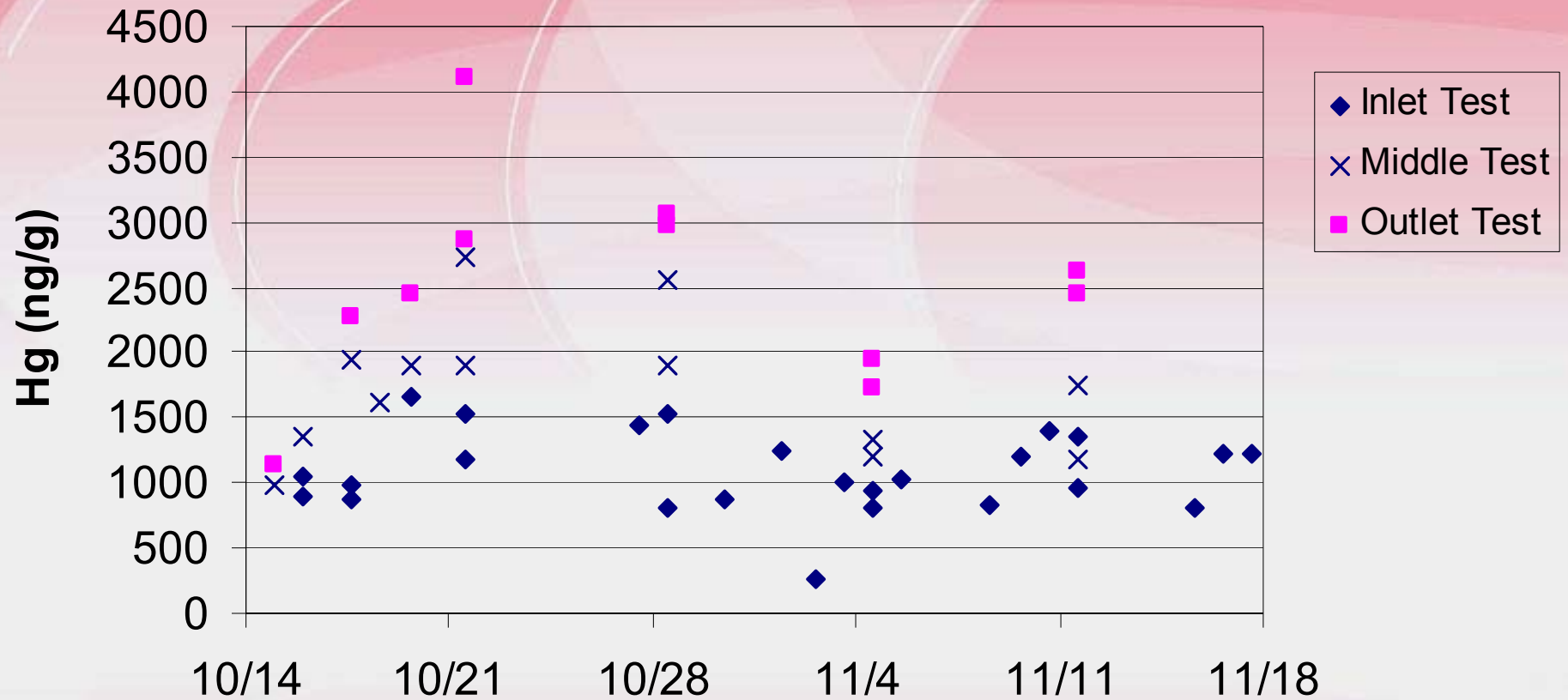
Hg in Ash – Variability



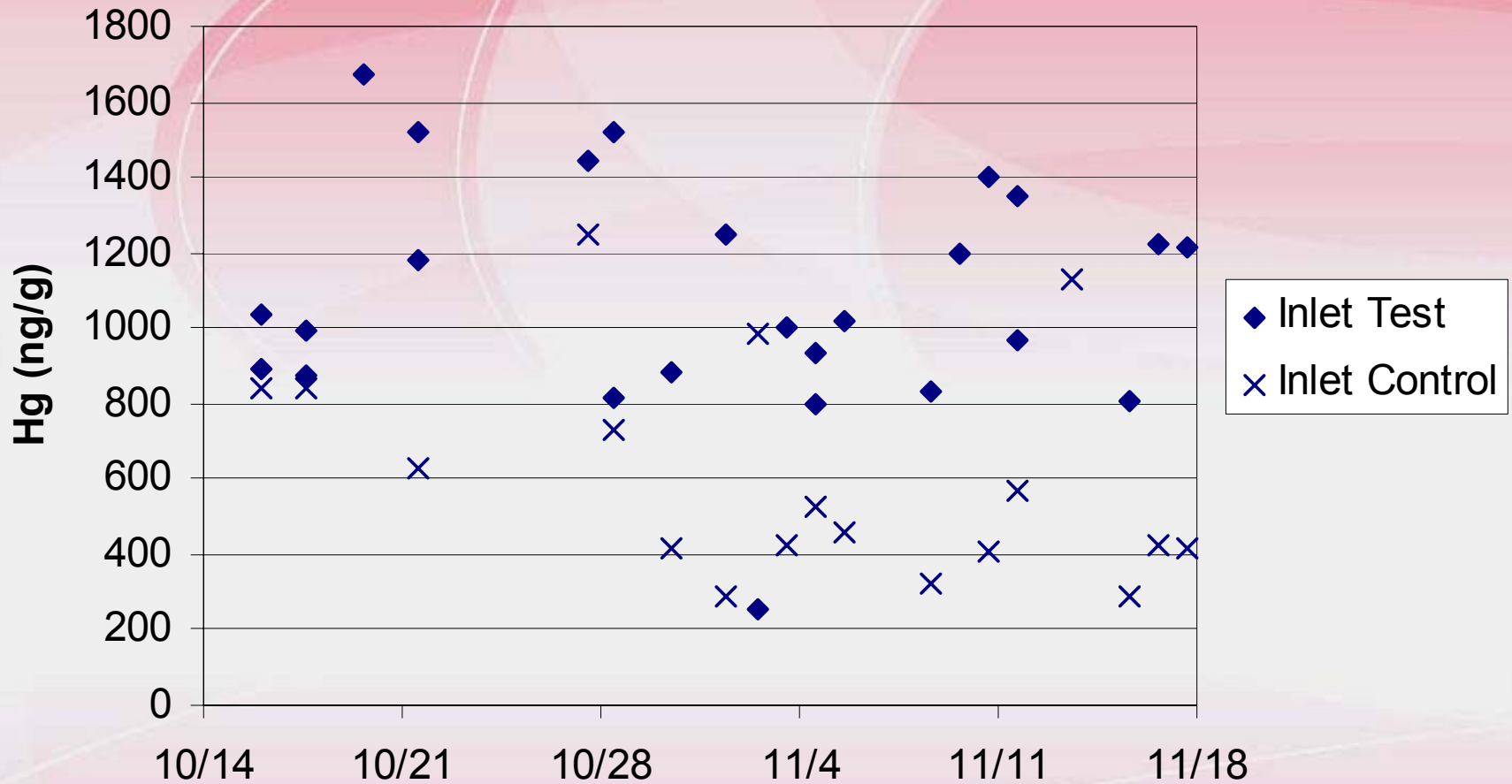
Mercury Measurements at Holcomb



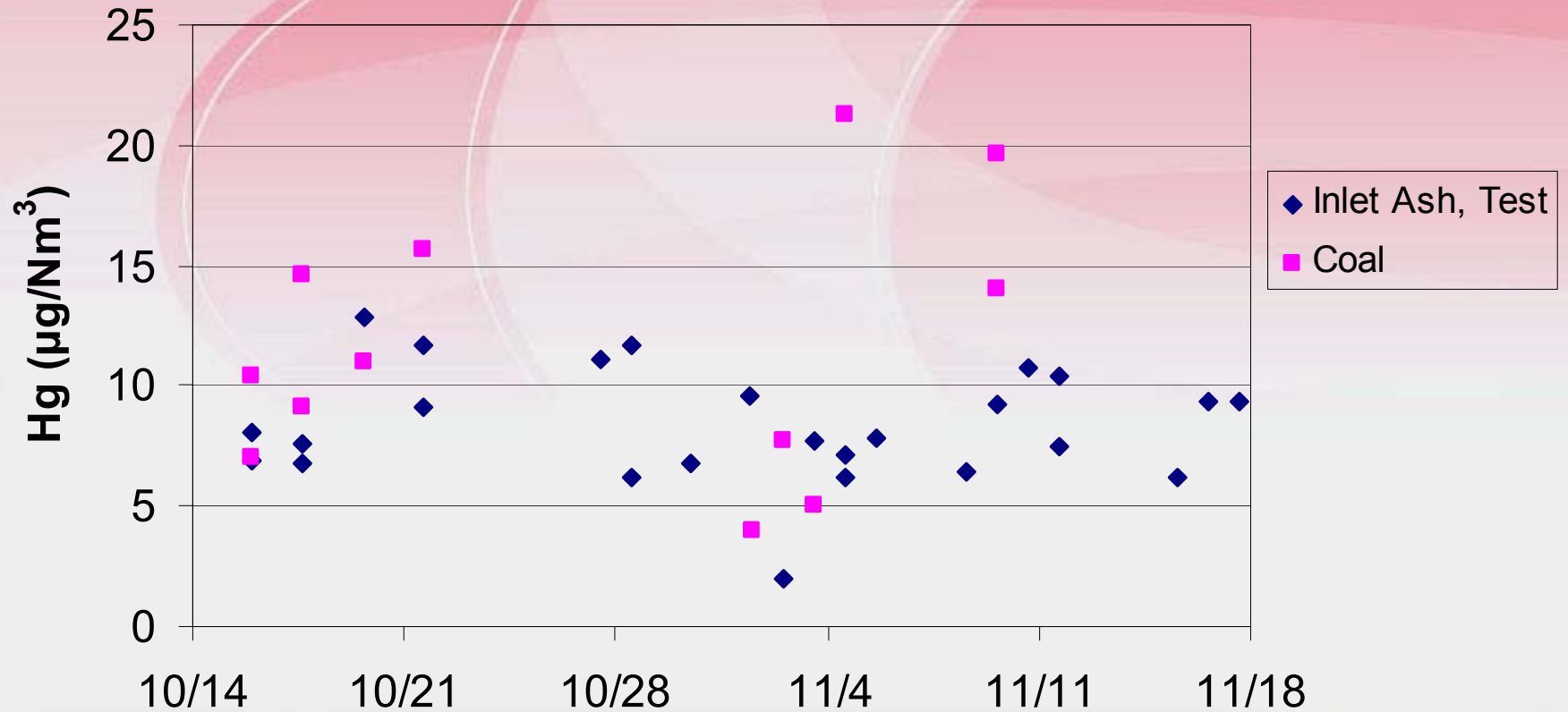
Mercury in ESP Ash



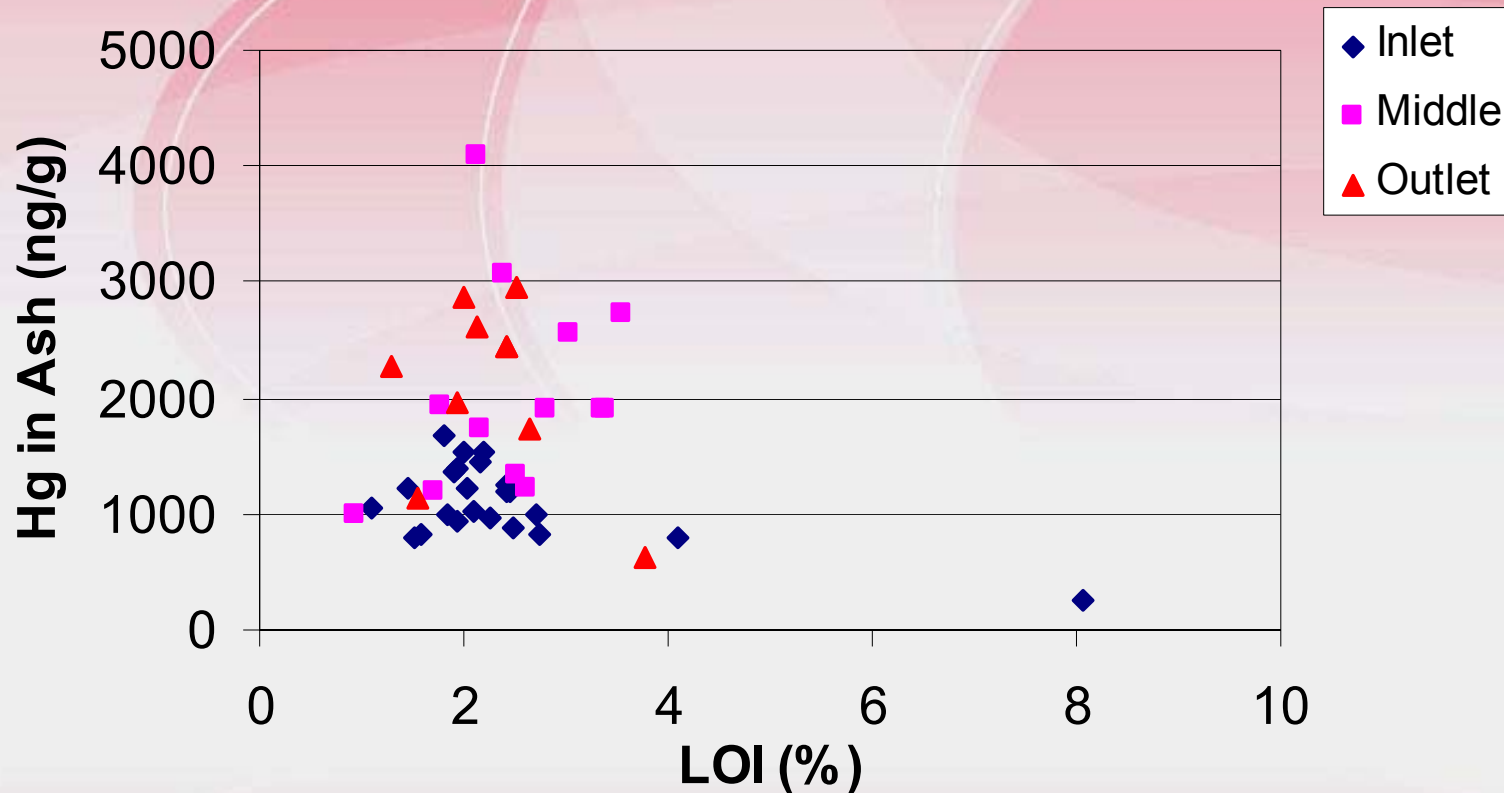
Mercury in ESP Ash



Mercury in Ash and Coal

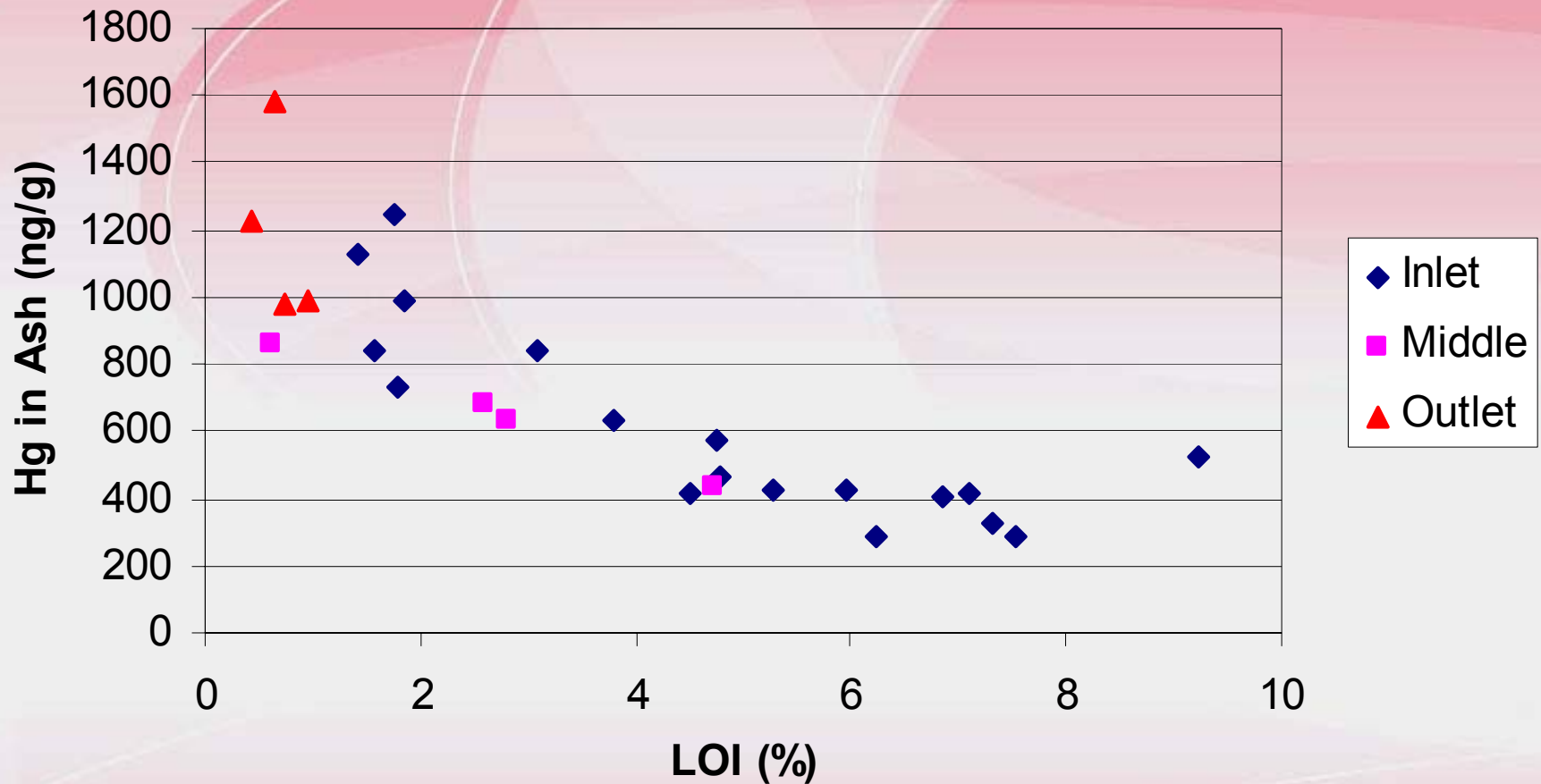


Hg and LOI: Test-Side



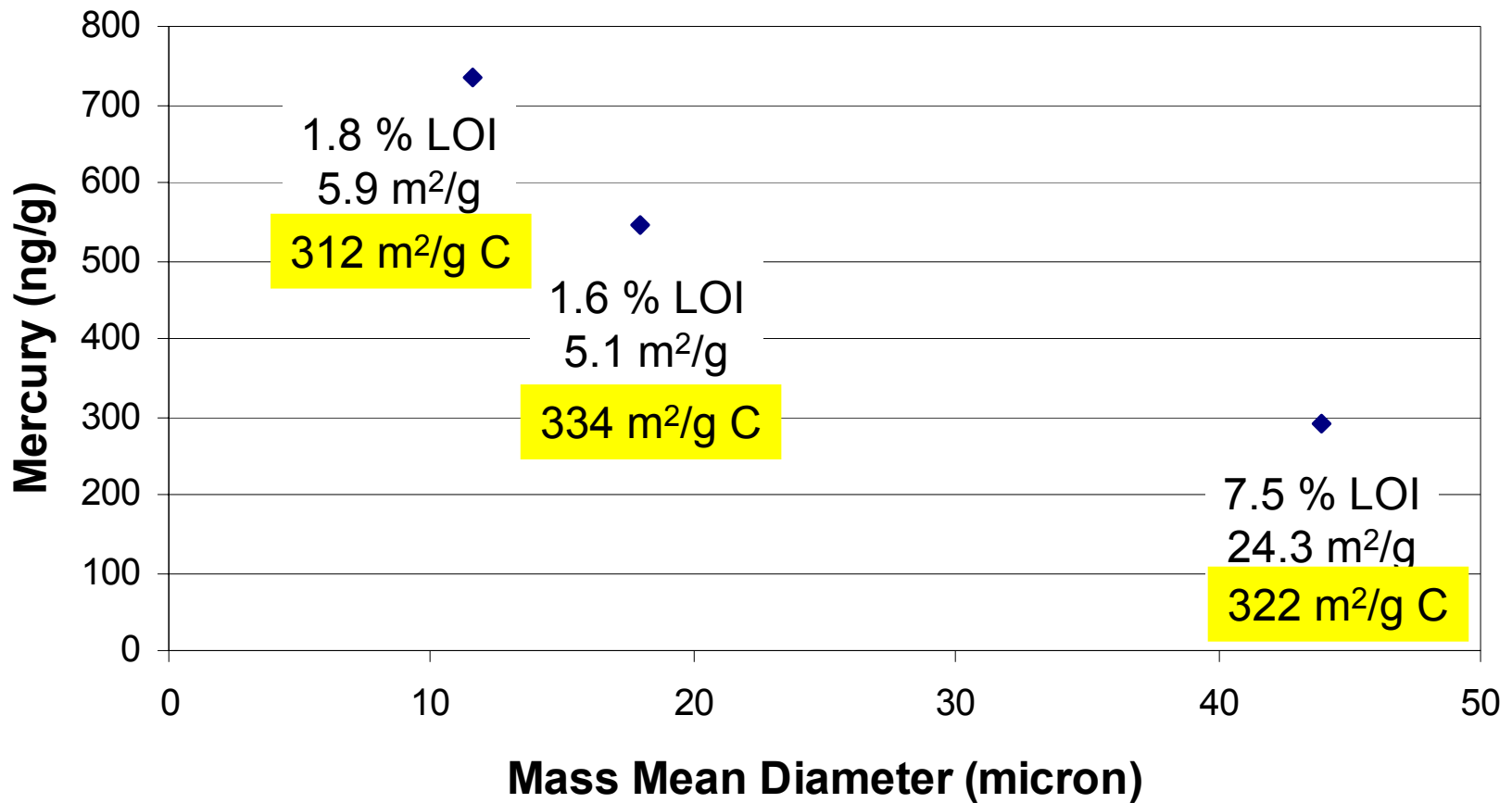
No correlation between mercury in the ash and LOI in samples with PAC

Hg and LOI: Control-Side

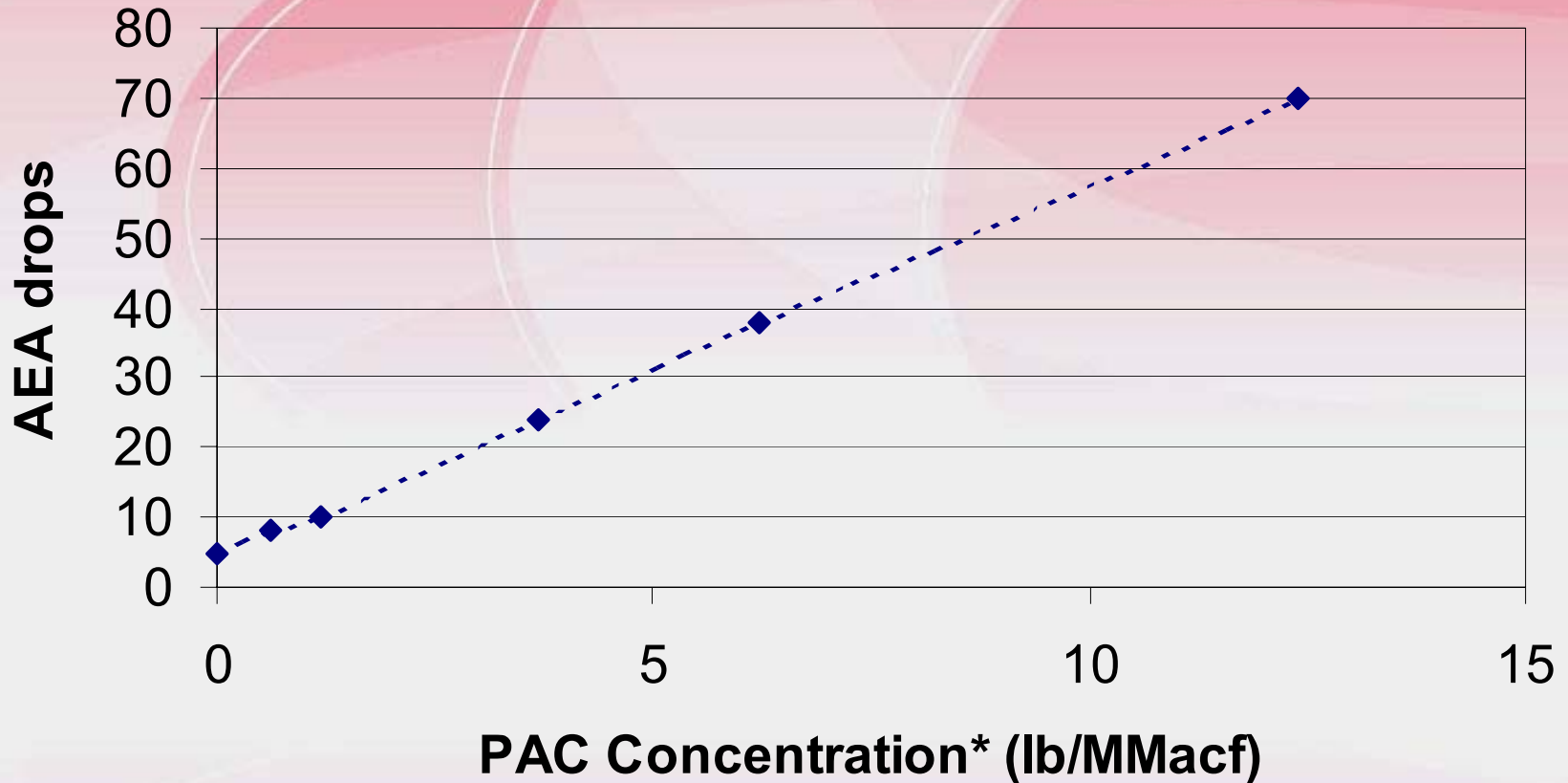


Mercury in the native ash
inversely proportional to LOI

Ash Size and Surface Area Control-Side



Foam Index Test Results



*Estimated concentration. PAC mixed with sample of baseline ash.

Leaching

- SGLP Results:
 - Mercury below detection limit in all leachate solutions
 - Some bromine leached from the ash/
DARCO[®] Hg-LH sorbent mixtures

Additional testing and analysis should be conducted to quantify the impact of bromine leaching from fly ash/sorbent mixtures.

SGLP Results

		Baseline (mg/L)		Long-Term Testing (mg/L)	
		SGLP 18-hr	SGLP 30-day	SGLP 18-hr	SGLP 30-day
Holcomb	Br*	1.48	1.55	10.10	10.40
Meramec	Br	0.115	0.056	9	16
Holcomb	Hg	<0.0002	<0.0002	<0.0002	<0.0002
Meramec	Hg	<0.0002	<0.0002	<0.0002	<0.0002

**Bromine-based water treatment chemical used at Holcomb*

Thermal Stability

The thermal stability of mercury in ash increases when DARCO[®] Hg-LH activated carbon is present.

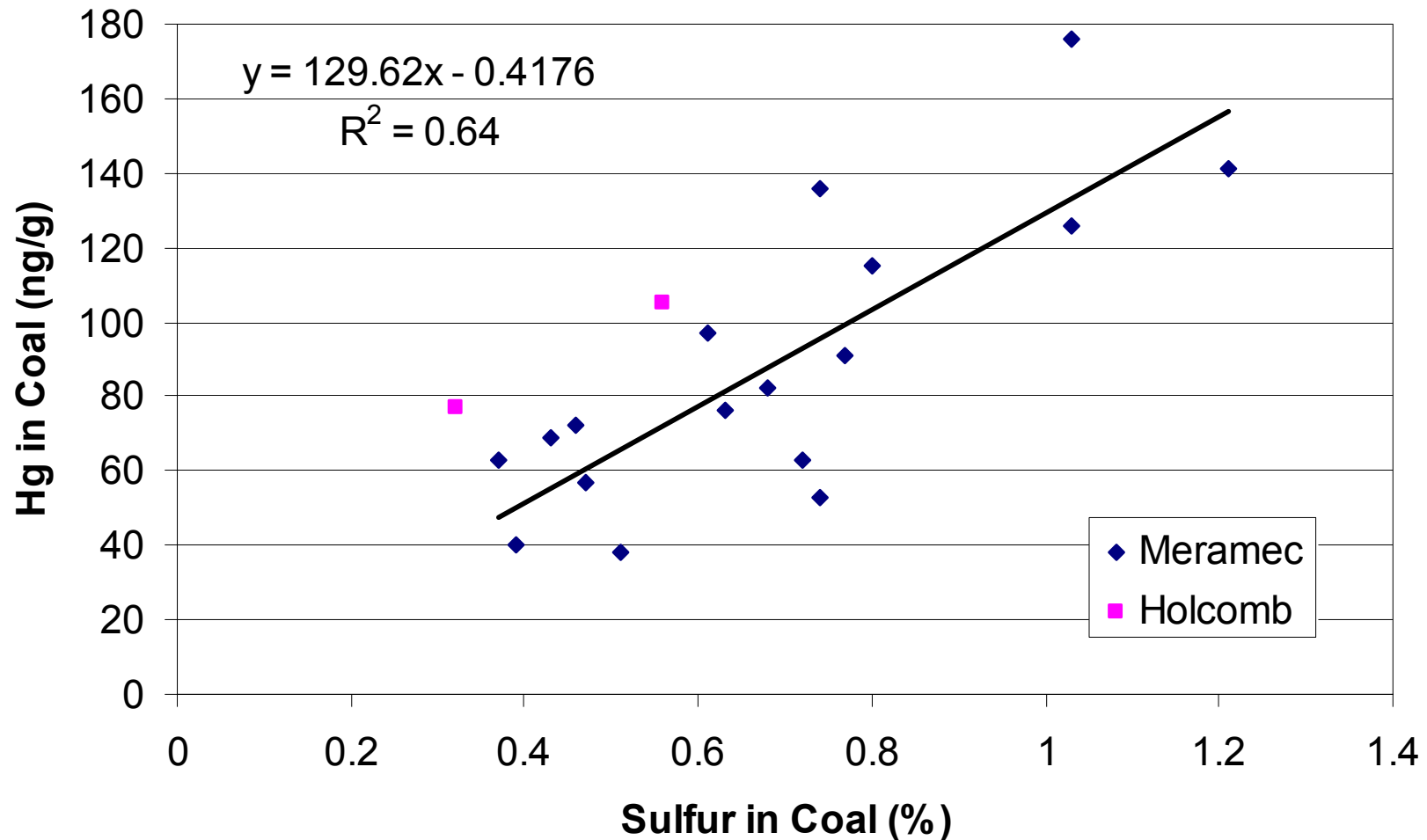
– Holcomb:

- 240°C (baseline)
- 315°C (with PAC)

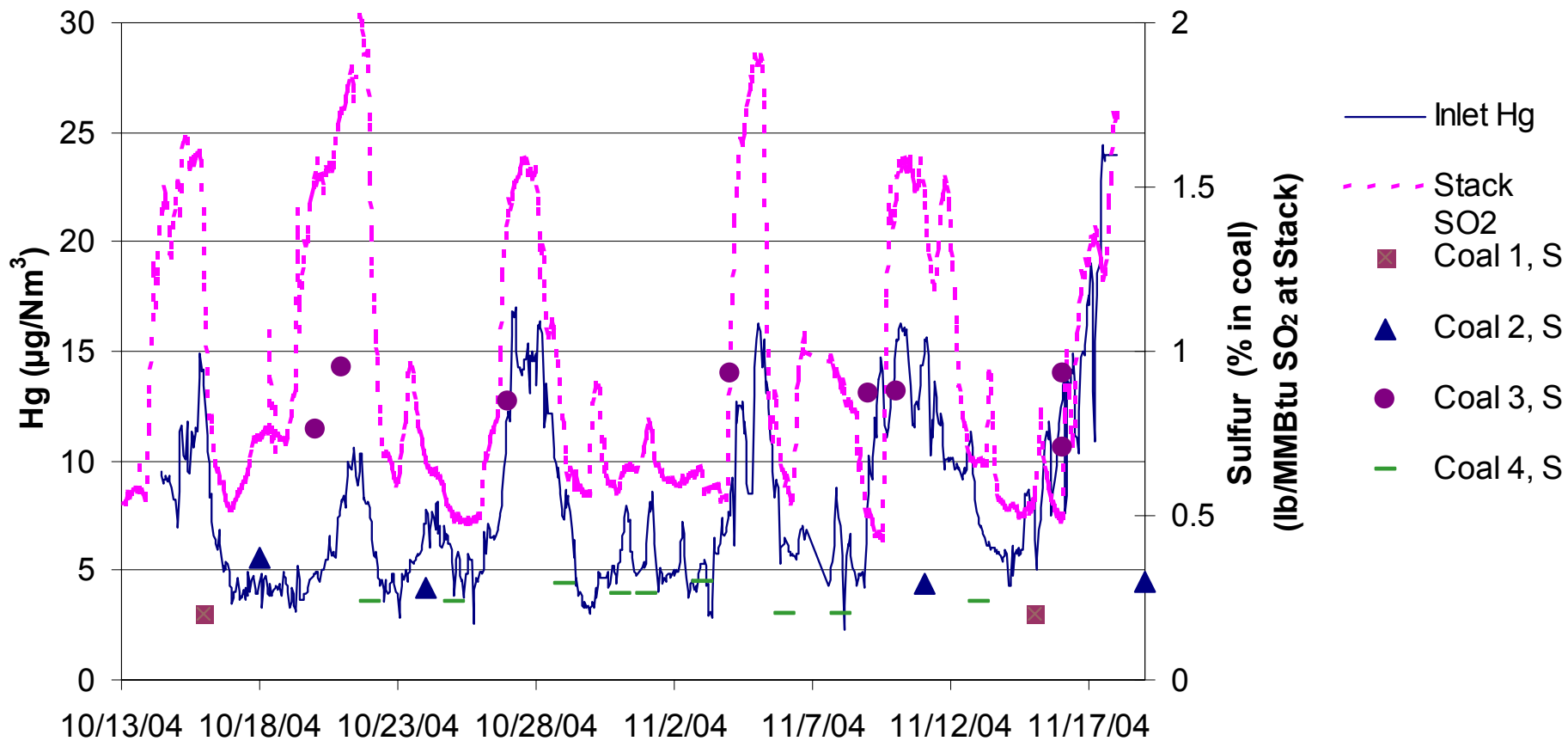
– Meramec:

- 358°C (baseline)
- 419°C (with PAC)

Comparison of Coal Sulfur and Mercury – PRB Coals



Sulfur and Mercury Correlations



Summary

- Careful sample collection, handling, and analysis are critical
- Mercury leaching from collected ash samples is near the detection limit for most methods
- Some bromine leached from the ash/DARCO[®] Hg-LH sorbent mixtures
- Mercury in the native ash at Meramec was inversely proportional to LOI
- Thermal stability of mercury in ash increases when DARCO[®] Hg-LH is present
- Correlation noted between sulfur and mercury in PRB coals