

# Mercury Control Evaluation of Furnace Halogen Injection at TXU's Monticello U3

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# Project Acknowledgments

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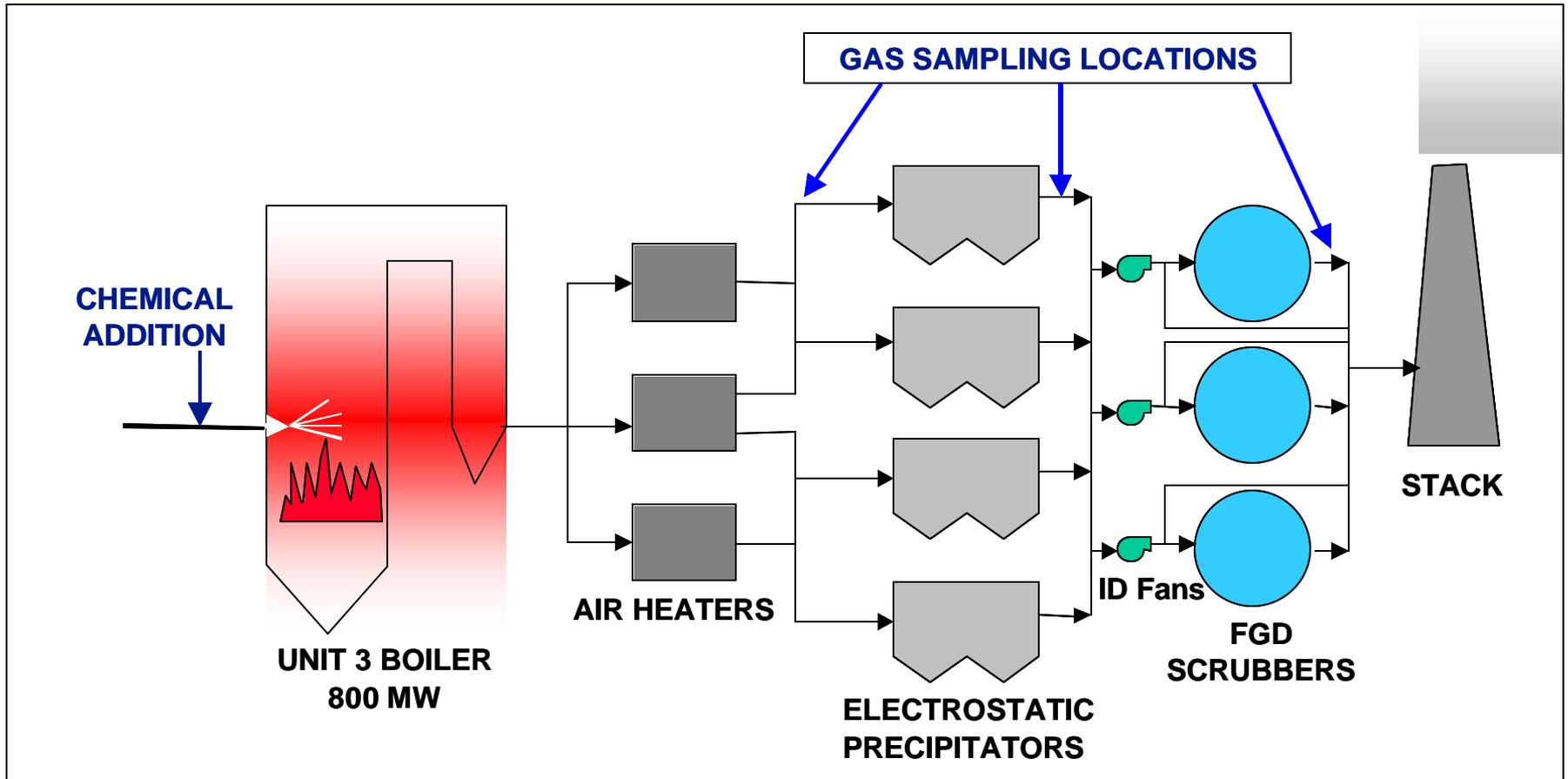
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- **Co-funded by**
  - EPRI
  - TXU Power (also provided host site)
  - NRG
- **Acknowledgments**
  - Monticello engineers, operators, subcontractors
  - Tested under a grant from Vosteen Consulting GmbH, in co-operation with Dr. Vosteen

# Project Objectives

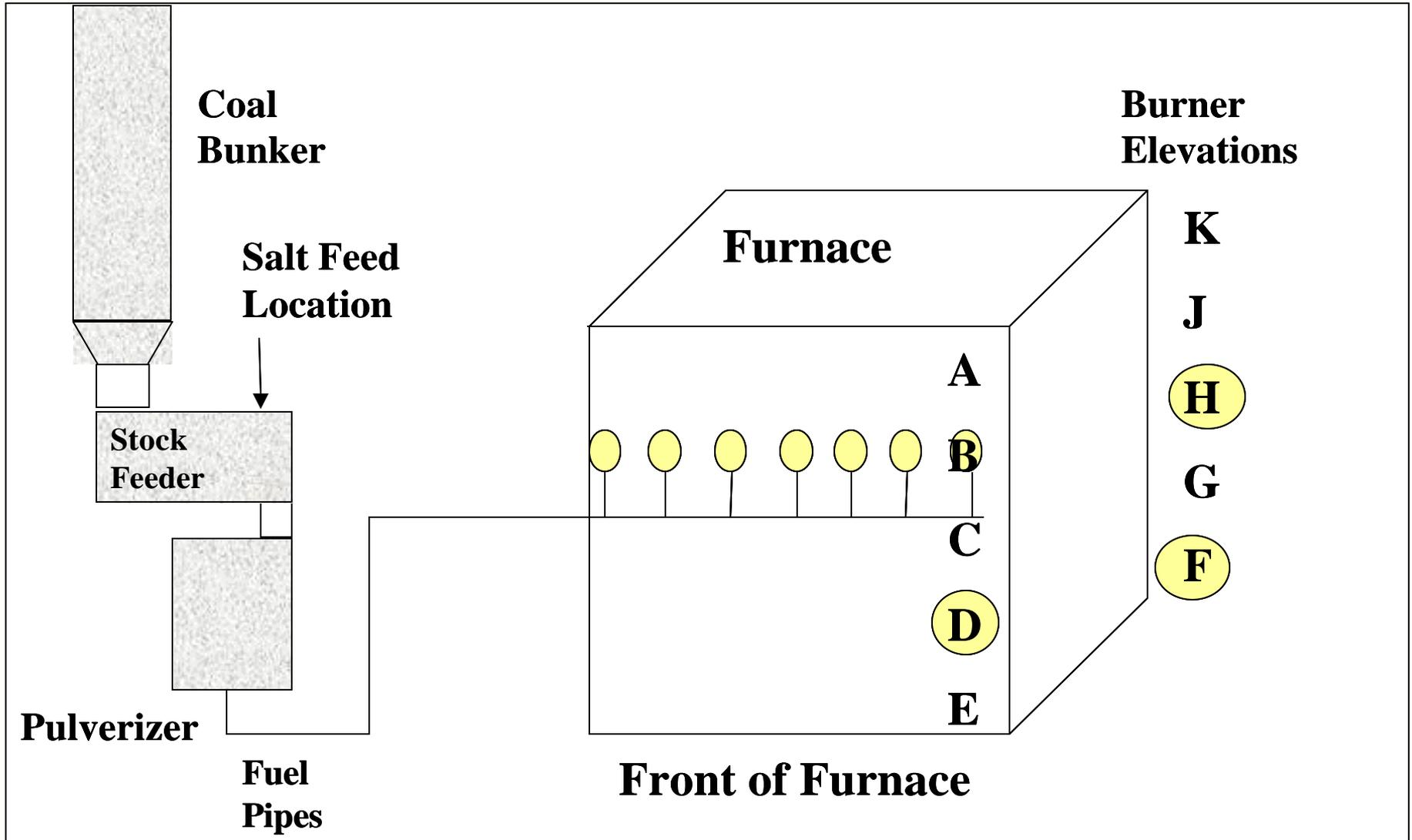
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- **Evaluate the ability of furnace injection of halogen salts to:**
  - Increase mercury oxidation in flue gas
  - Enhance mercury removal across wet scrubber
- **Project performed on Monticello Unit 3**
  - 793 MW
  - Fires a blend of Texas lignite and PRB coals
  - Equipped with cold-side ESP
  - Equipped with wet FGD scrubber
    - Limestone forced oxidation
    - Spray tower

# Monticello Unit 3



# Method of Salt Addition



# Method of Salt Addition

- Add liquid salt to the coal
  - spray on belt upstream of pulverizer

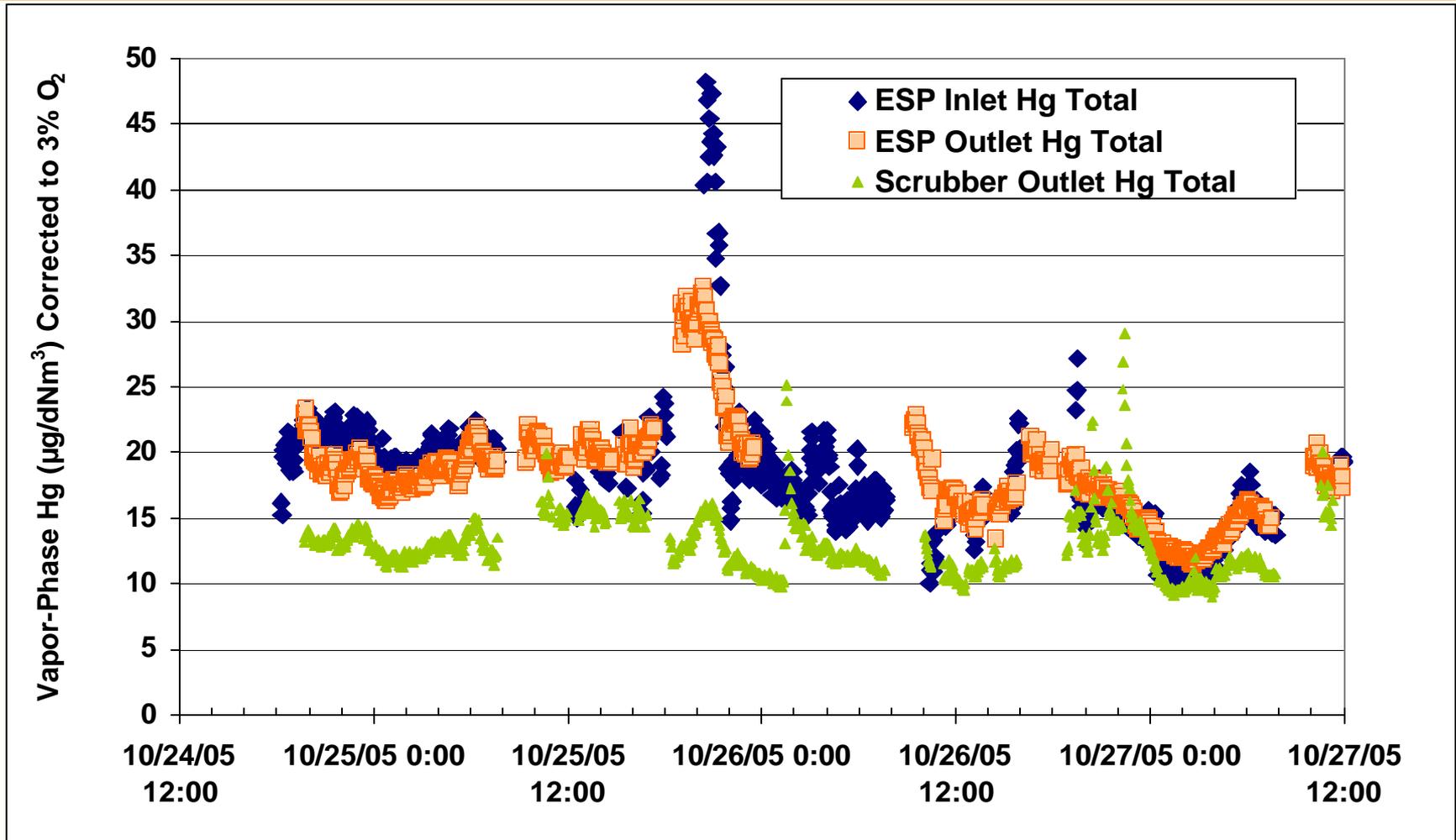


# Baseline Hg Concentrations

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- Coal Hg Concentrations
  - PRB: 0.05 – 0.10 ppm, dry
  - TxL: 0.15 – 0.35 ppm, dry
- ESP Inlet Hg
  - 10 – 30  $\mu\text{g}/\text{dNm}^3$
  - 10 – 40% oxidation
- Less than 20% Hg removal by fly ash
- FGD Outlet Hg
  - 10 – 18  $\mu\text{g}/\text{dNm}^3$
- Removal across ESP/FGD: 10 – 40%

# Typical BL Hg Concentrations



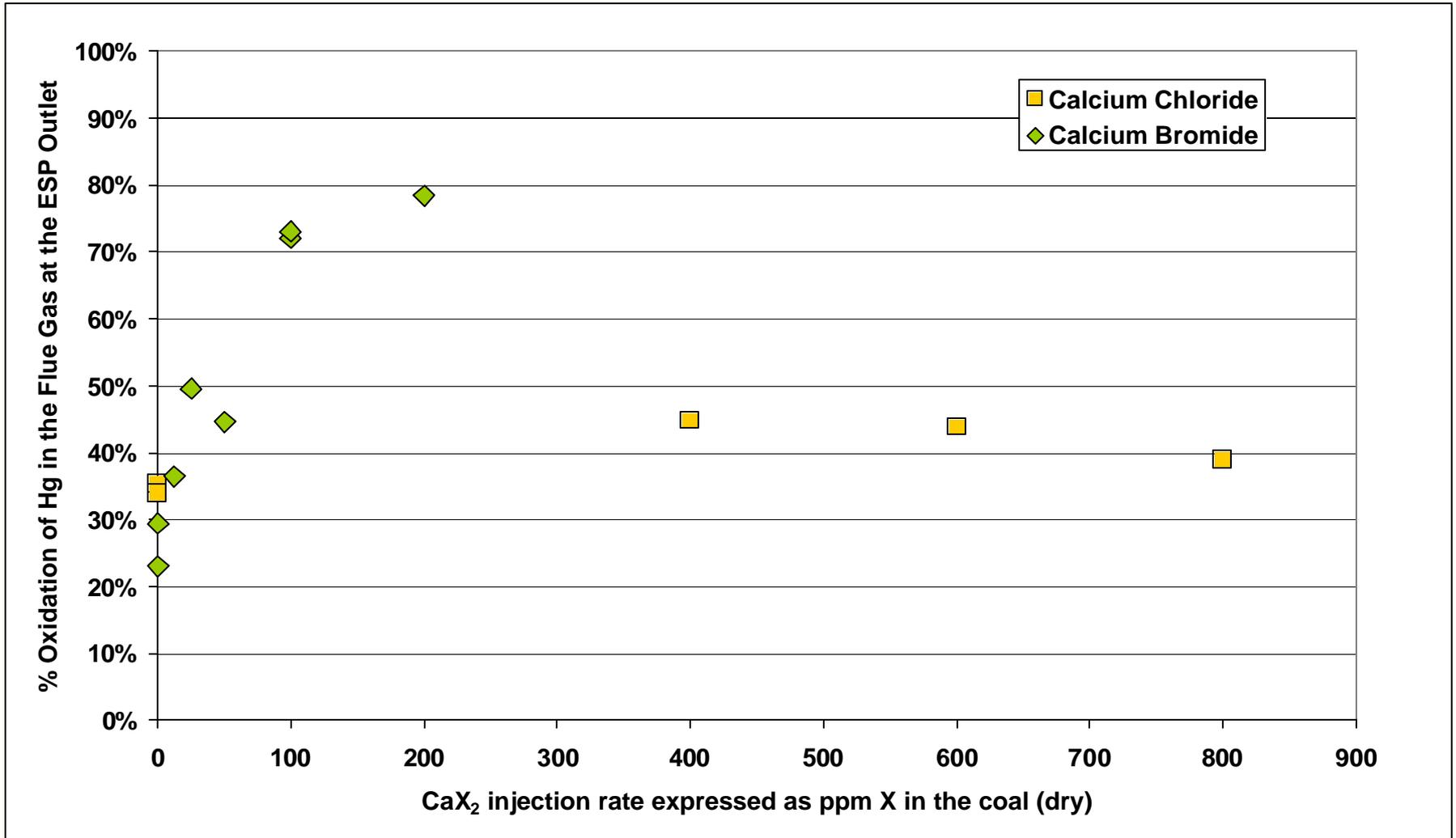
# Parametric Test Plan

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- Compare performance of two salts
- Measure Hg oxidation vs. injection rate
- $\text{CaCl}_2$ 
  - Cost is \$ 0.31/lb Cl
  - Tested at rates of 400, 600, 800 ppm Cl in the coal
- $\text{CaBr}_2$ 
  - Cost is \$ 1.76/ lb Br
  - Br more reactive with Hg
  - Tested at rates of 12, 50, 100, 200 ppm Br in the coal

# Parametric Test Results

## Hg Oxidation vs Injection Rate



# Long-term Test Plan

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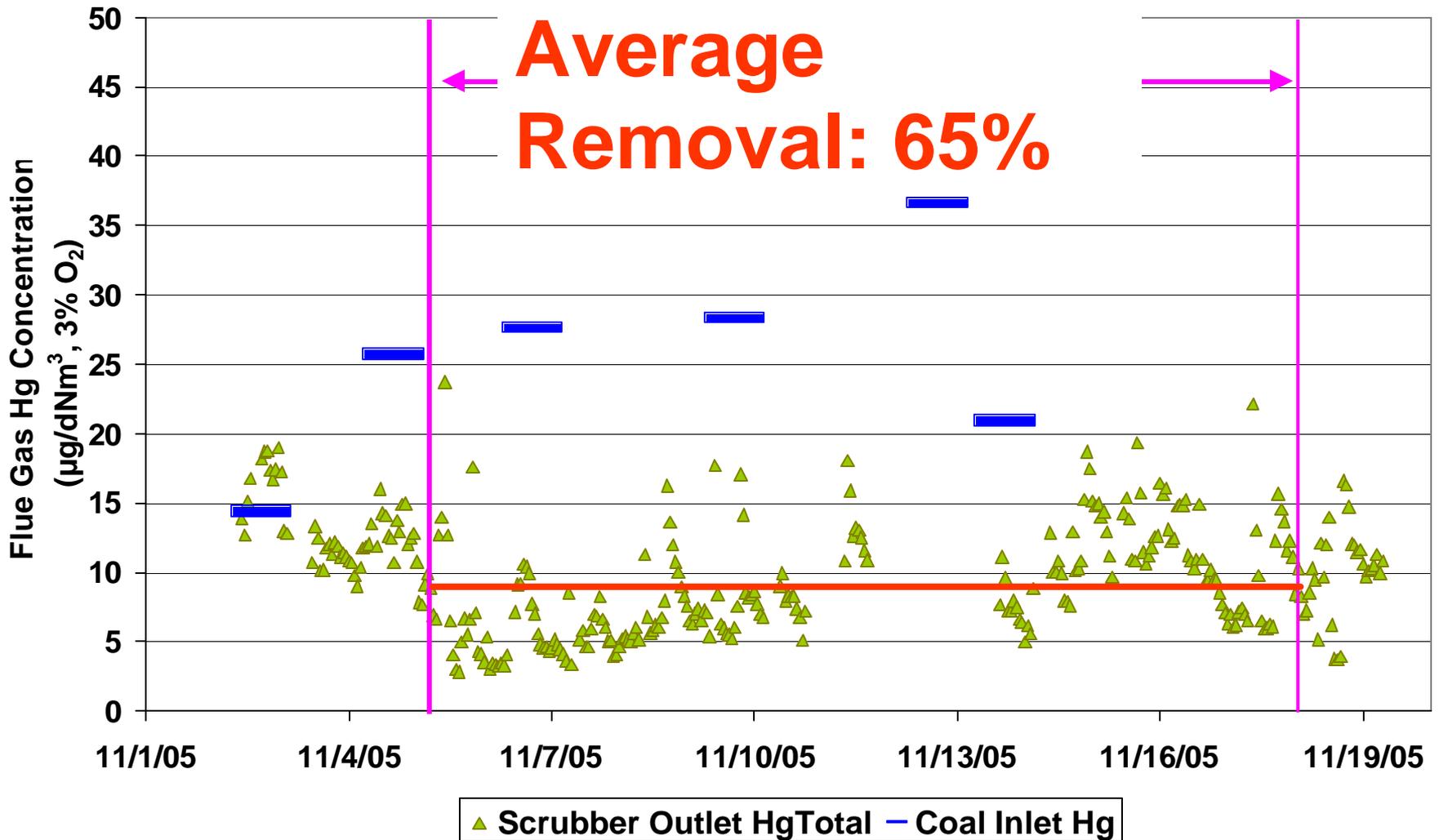
- Evaluate salt's ability to maintain high level of Hg oxidation
- Evaluate balance of plant impacts
- First two-week test of  $\text{CaBr}_2$  at 55 ppm Br in coal
- Second two-week test of  $\text{CaBr}_2$  at 113 ppm Br in the coal

# **% Hg Oxidation: 55 ppm Br in the coal**

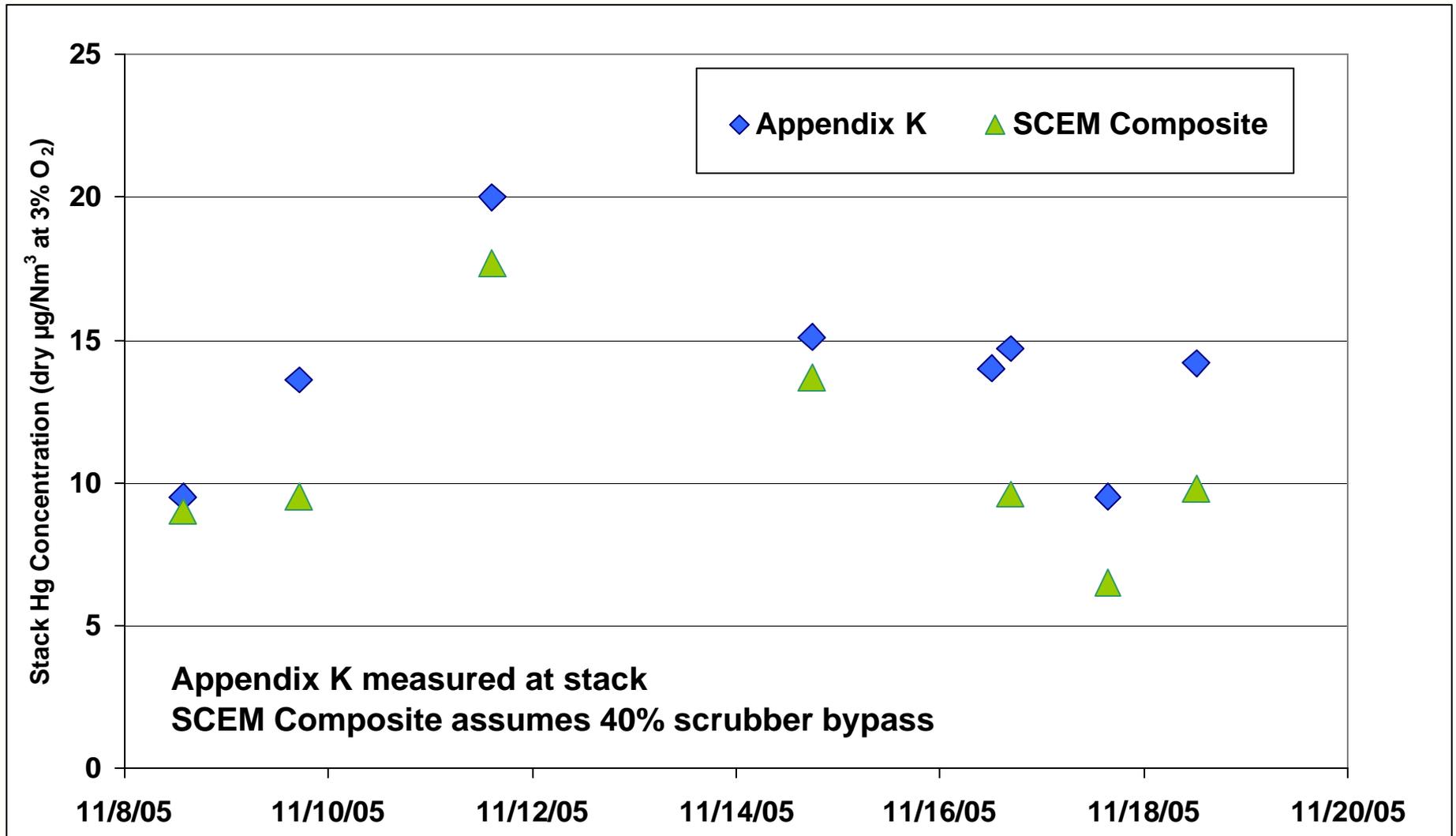
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- Compare Average Coal Inlet Hg to Average SCEM Hg<sup>0</sup> at FGD inlet
- 67% oxidation of mercury at 55 ppm Br in coal

# Coal Inlet vs FGD Outlet: 55 ppm Br in the coal



# Appendix K Verifies SCEM trends at Scrubber Outlet



# **% Hg Oxidation: 2<sup>nd</sup> Long Term Test**

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- Compare Average Coal Inlet Hg to Average SCEM Hg<sup>0</sup> at FGD Inlet
  - 113 ppm Br: 85%
  - 193 ppm Br: 91%
  - 330 ppm Br: 93%

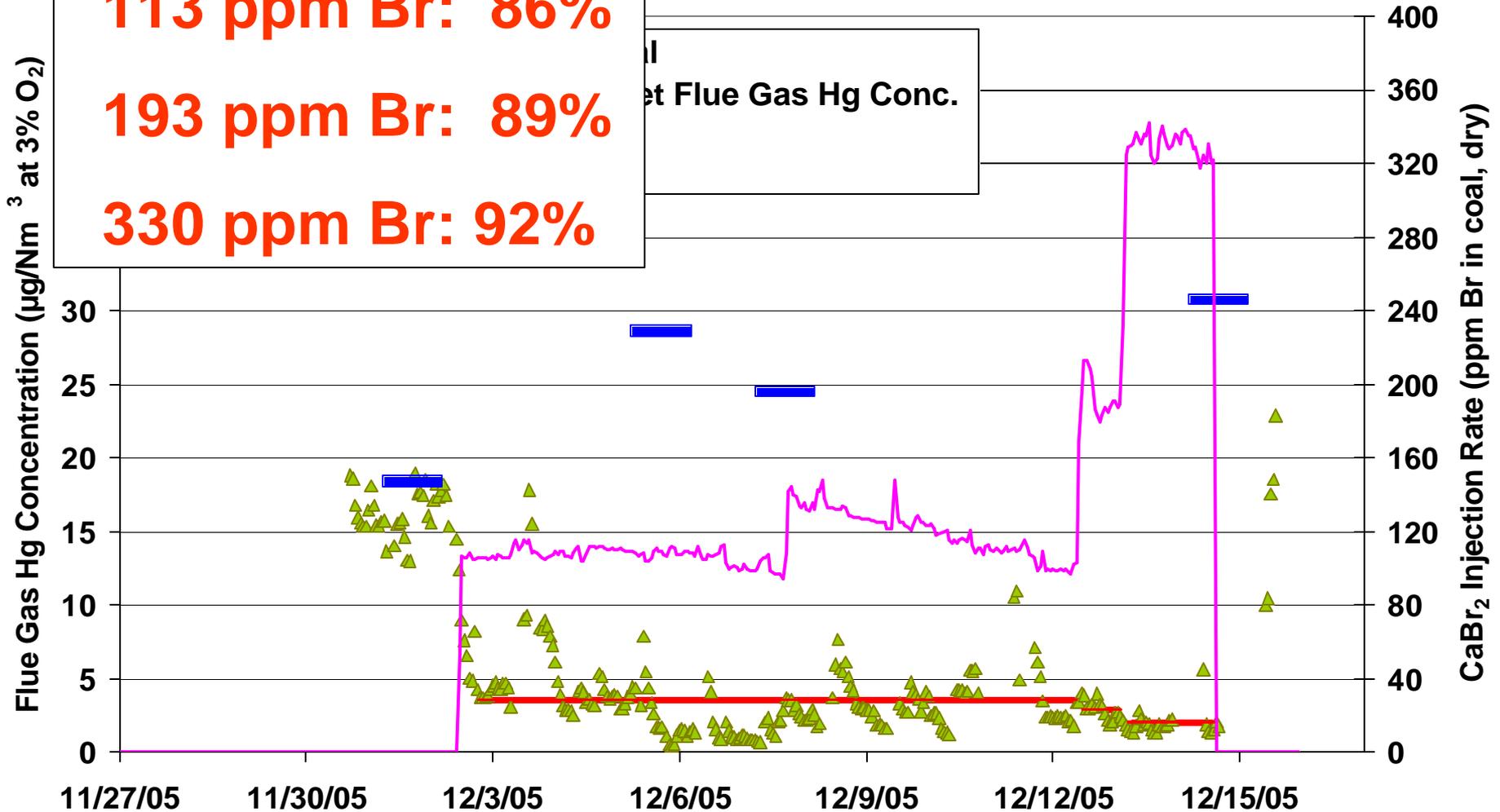
# Coal Inlet vs FGD Outlet: Br in the coal

**Average Removal:**

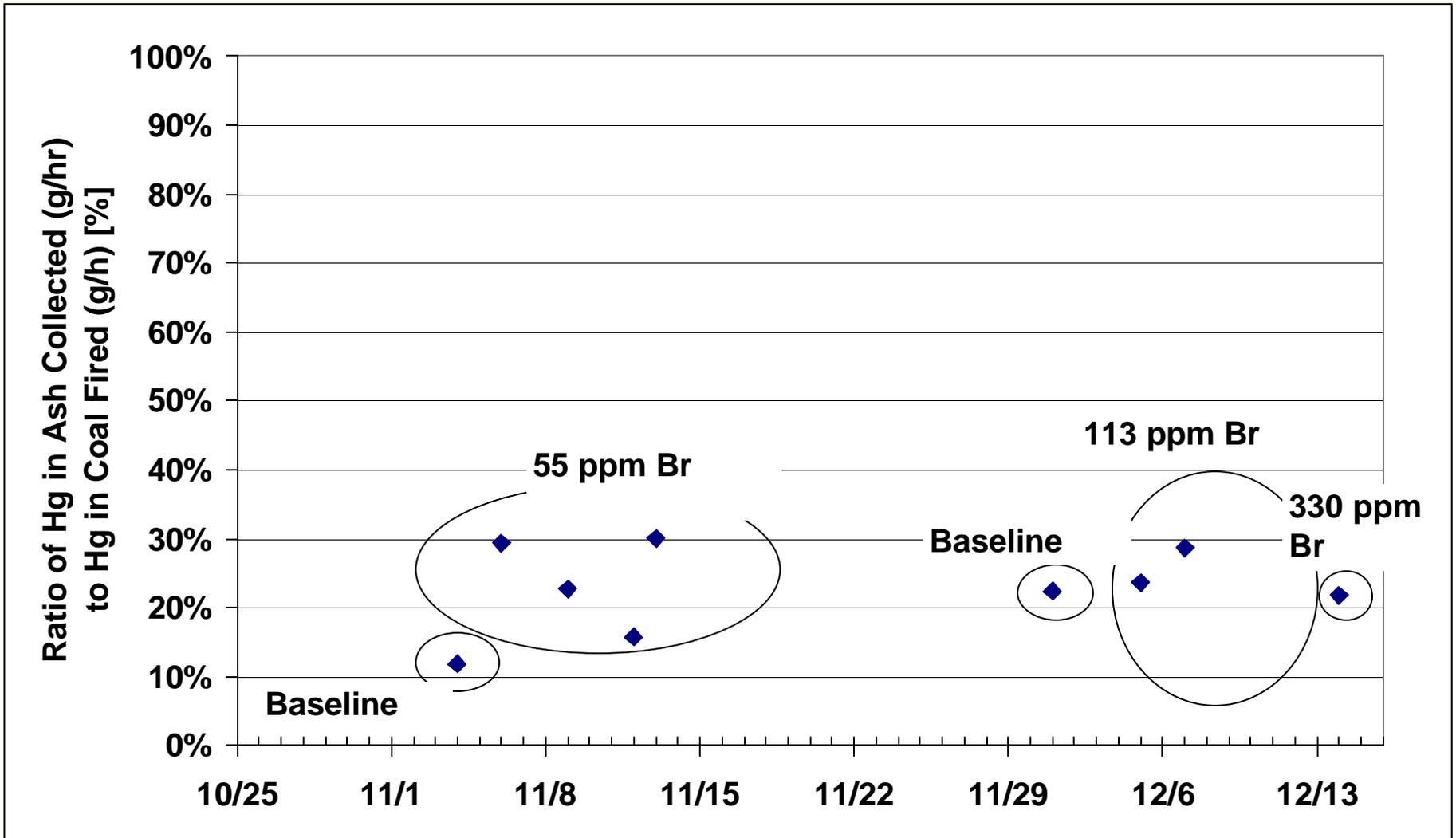
**113 ppm Br: 86%**

**193 ppm Br: 89%**

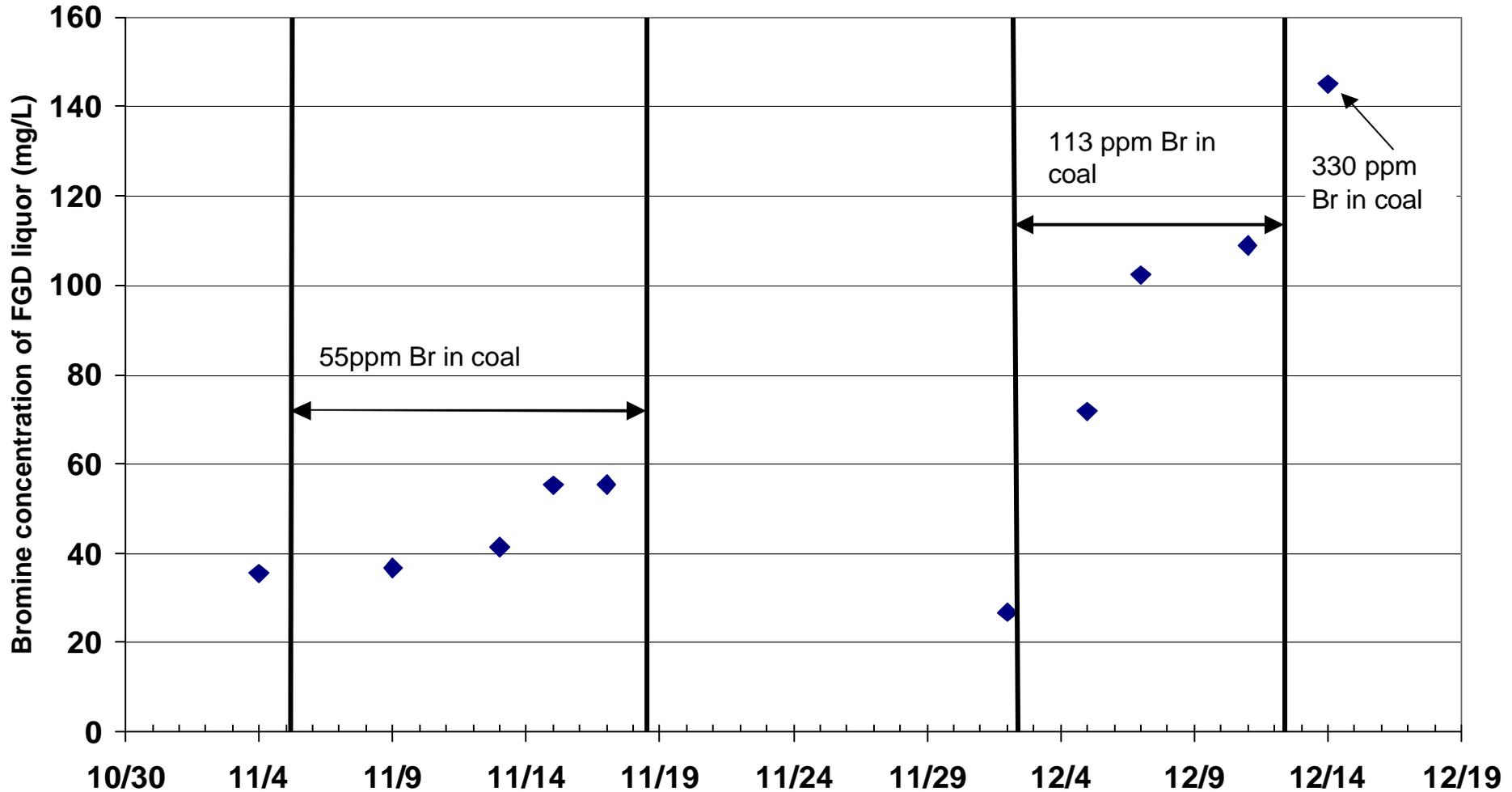
**330 ppm Br: 92%**



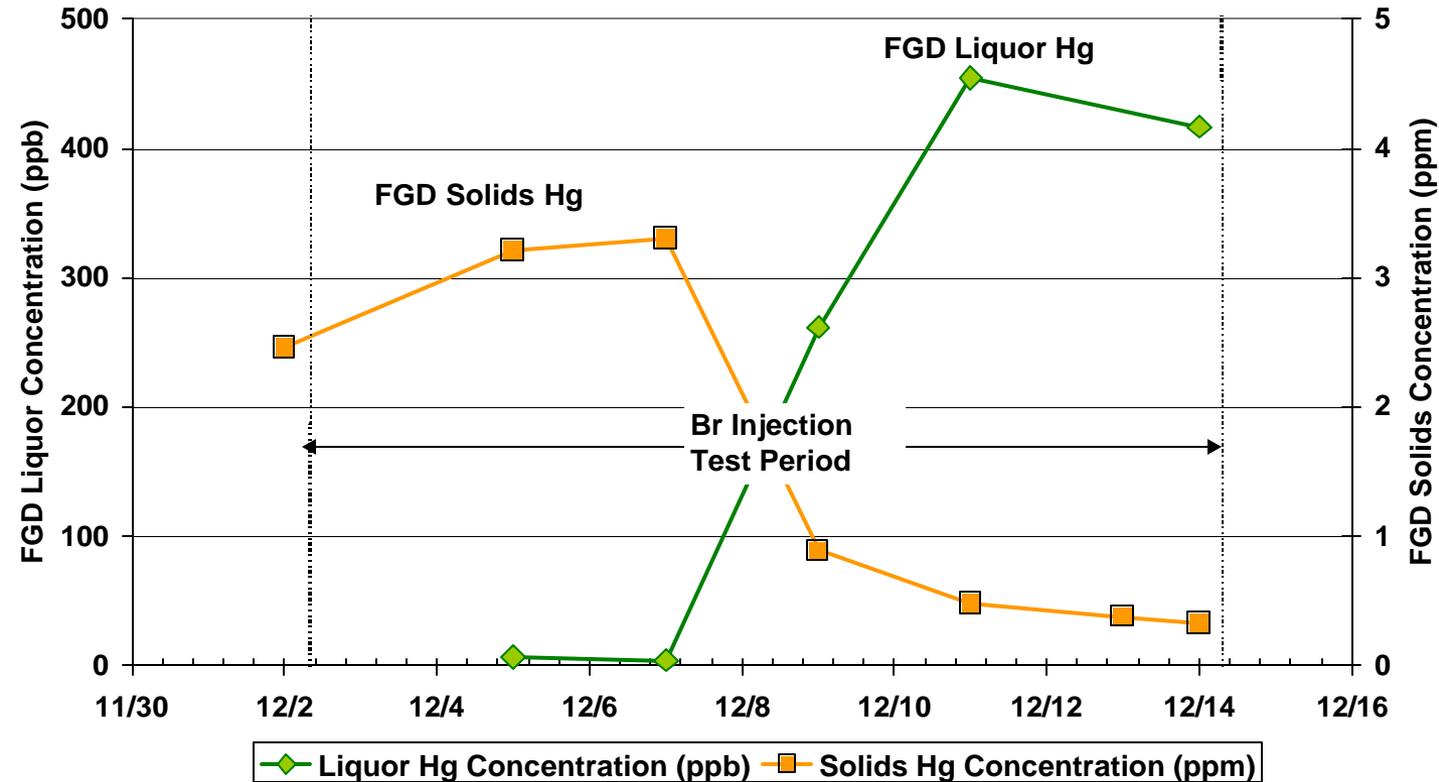
# Br did not cause significant increase in Hg removal by fly ash



# Increase in Br content of FGD liquor



# Increase in Hg Content of FGD Liquor



- At baseline, <2% of FGD Hg is in liquor

- In presence of Br, Hg partitions to liquor

- With Br injection, >90% of FGD Hg is in liquor

# Summary

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- Oxidation of flue gas mercury was increased with  $\text{CaCl}_2$  and  $\text{CaBr}_2$  salts
- Removal of Hg across wet scrubber correlated well with oxidation of Hg
- Results of Long-Term Test (FGD outlet vs. average coal Hg)
  - Baseline: 10 – 40% removal
  - 55 ppm Br in coal: 65% removal
  - 113 ppm Br in coal: 86% removal
  - 330 ppm Br in coal: 92% removal

# Further Testing Needed

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- Evaluate long-term operation
- Characterization of potential balance-of-plant impacts of chemical injection
  - Corrosion
  - Air heater plugging
  - FGD performance
  - FGD materials of construction
  - Effects on byproducts not well understood
    - Ability to sell ash or gypsum