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UCC Dry Sorbent Injection
Multi-Pollutant Removal with DSI

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Need for Simultaneous SO_2, SO_3, Hg, HCl Removal

- **MATS**
  - Hg limit of 1.2 lb/TBTU
  - HCL limit of 0.002 lb/MMBTU for most units
  - Both readily attainable with DSI
- **SO_2 Removal**
  - MATS Alternative Limit
  - CAIR/Future CSAPR?
  - BART
  - State Rules
  - Consent Orders, etc.

SO_2, SO_3, Hg, and HCl Removal with DSI

SORBENT CHOICE AND INJECTION LOCATIONS

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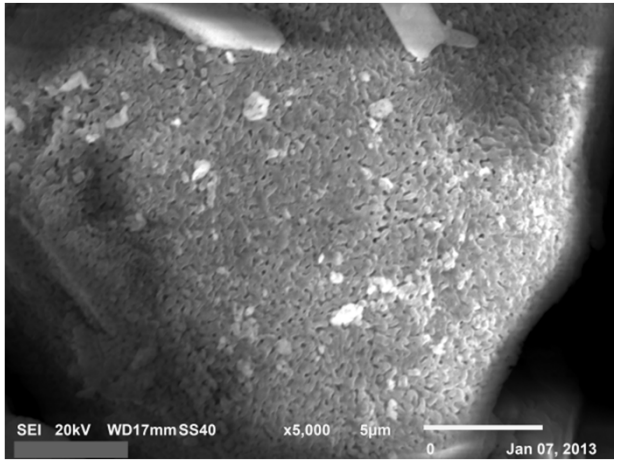
SO_2 and HCl Removal – Sorbent Choice

Trona

- Use when:
  - Moderate SO_2 removal needed (approx. 80% or less)
  - Need very high HCl removal



Sodium Bicarbonate

- Use when:
  - High SO2 removals needed (> 80%)
  - Want to minimize loading to ESP and/or ash removal systems
  - Want to inject at air heater outlet on PRB units to allow PAC injection air heater inlet

Hydrated Lime

- Use when:
  - Only require HCl Removal or only need low SO2 removal
  - Want to preserve ash sales
  - Possibly to avoid NO_2 plume (when have fabric filter)

Hg Removal – Sorbent Choice

PAC

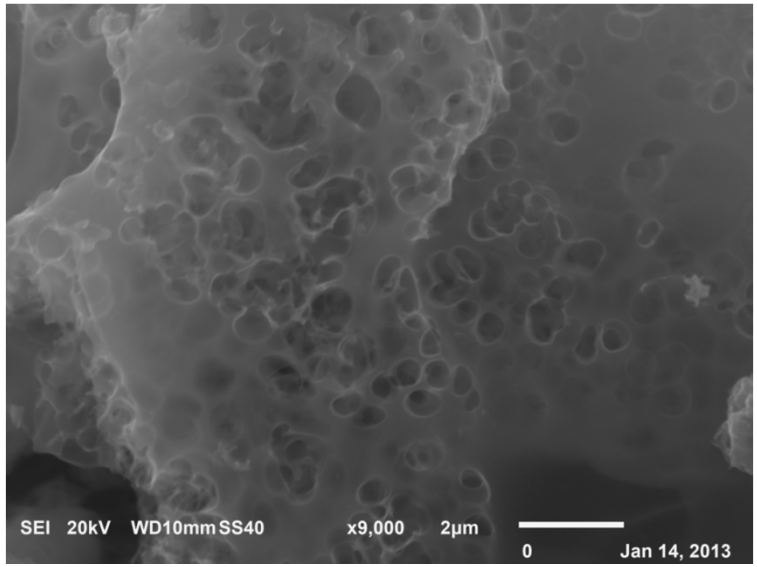
- Use for:
  - High Cl E. Bituminous coals
  - Use in combination with CaBr2 fuel additive for PRB

Brominated PAC

- Use for:
  - PRB coals
  - Want to inject alkali sorbent at air heater inlet and therefore can't use fuel additive

Non-Carbon/Low Carbon Sorbents

- Use when:
  - Want to retain ash sales
  - ESP cannot accommodate carbon



SO_2 and HCl Removal – Injection Locations

Trona

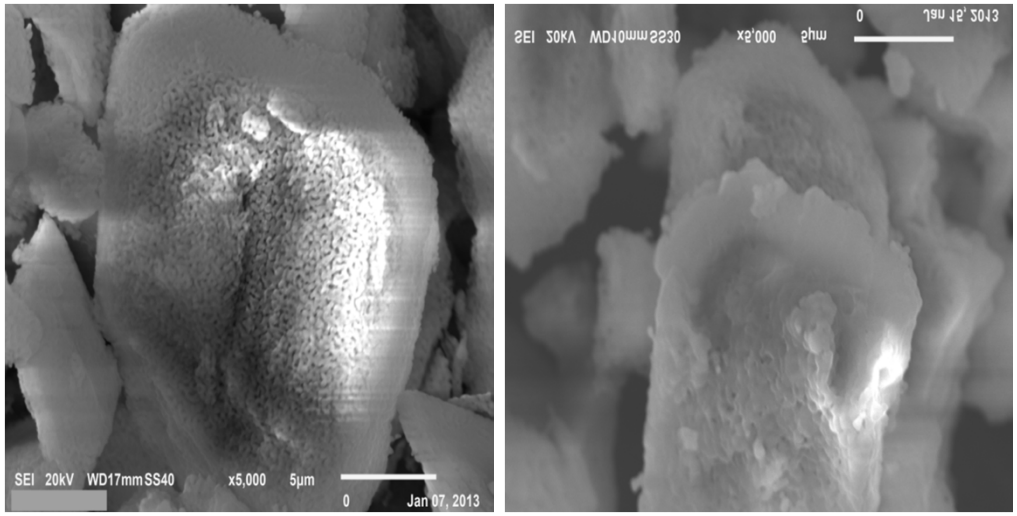
- Economizer Inlet
  - If < 1000^o F
- AH Inlet
  - Often the best choice
- AH Outlet
  - Performance decreases below 250^o F

Sodium Bicarbonate

- AH Inlet
  - If < 660^o F
- AH Outlet
  - Performance decreases below 250^o F

Hydrated Lime

- Effective at both Air Heater inlet and outlet
- Generally use less at Air Heater Outlet for HCl removal



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Hg Removal – Injection Locations

Air Heater Inlet

- Generally has shown better performance for PRB coals than air heater outlet since Hg is removed in air heater

Air Heater Outlet

- Typically used for E. Bituminous coals when alkali sorbents are used at air heater inlet to remove SO_3

SO_2, Hg, and HCl Removal with DSI

TEST RESULTS

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SO_2, Hg, HCl Removal Results from DSI Demonstration Tests

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SO_2, Hg, HCl Removal Results from DSI Demonstration Tests

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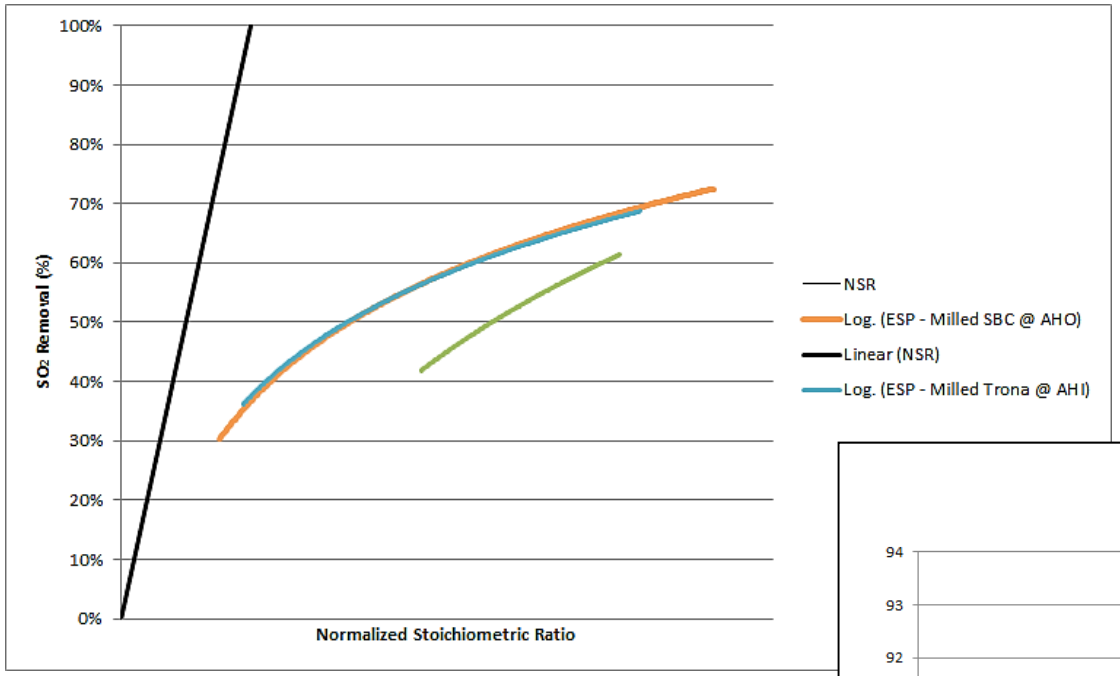
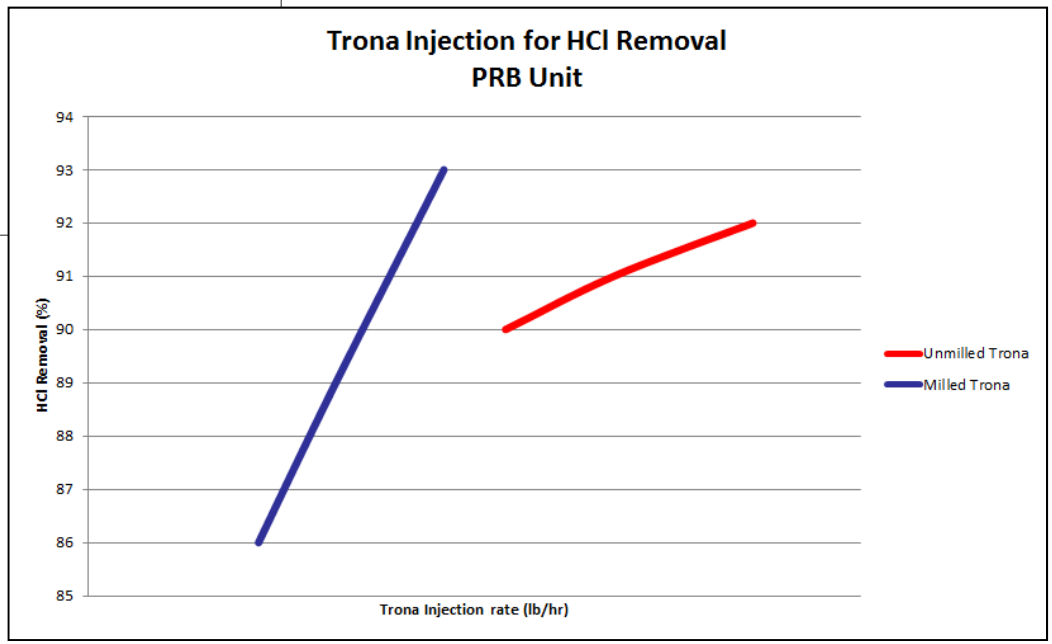
Typical Multipollutant Removal for PRB Unit - ESP



SO_2 Removal

HCl Removal



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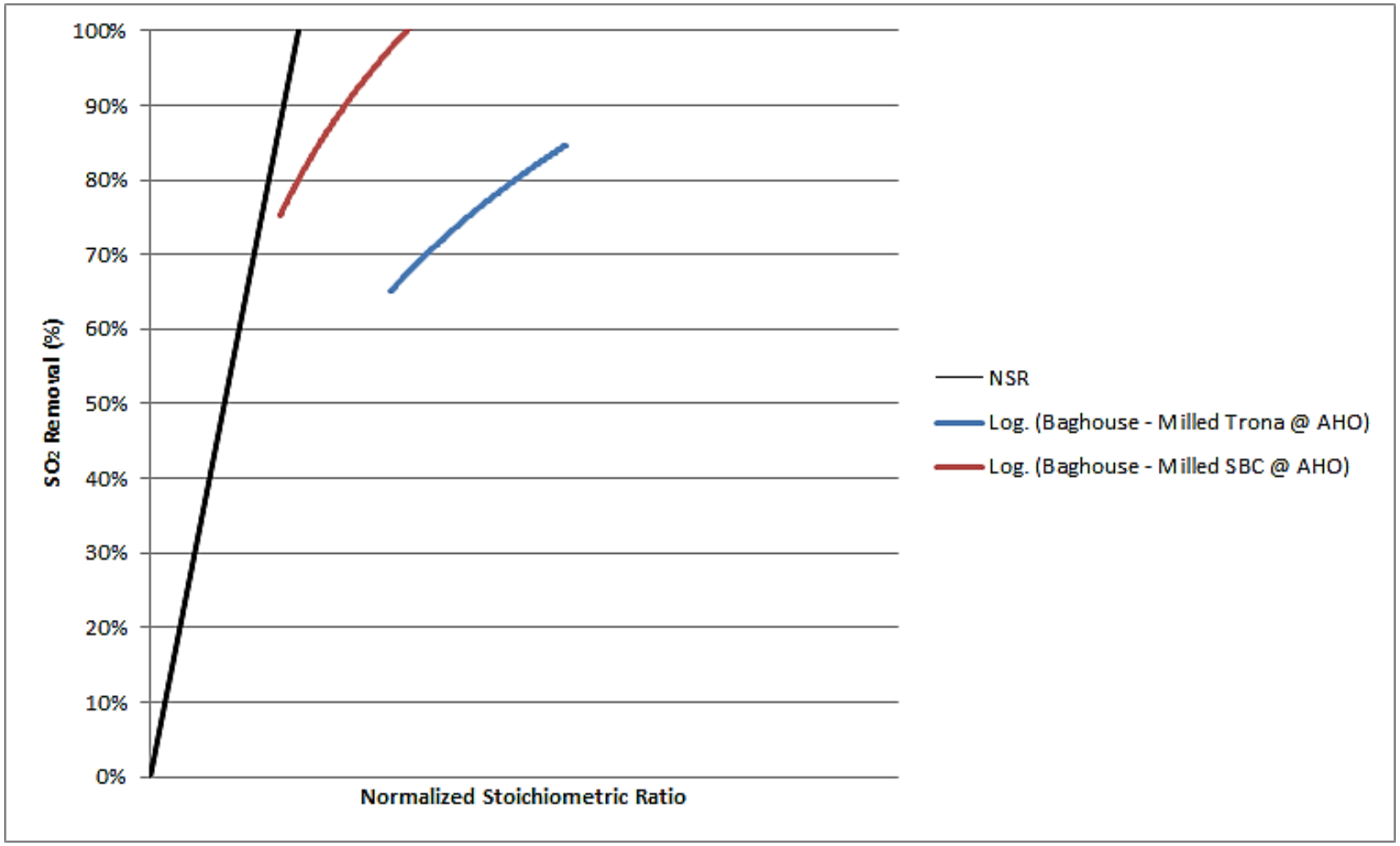
Typical Multipollutant Removal for PRB Unit Fabric Filter



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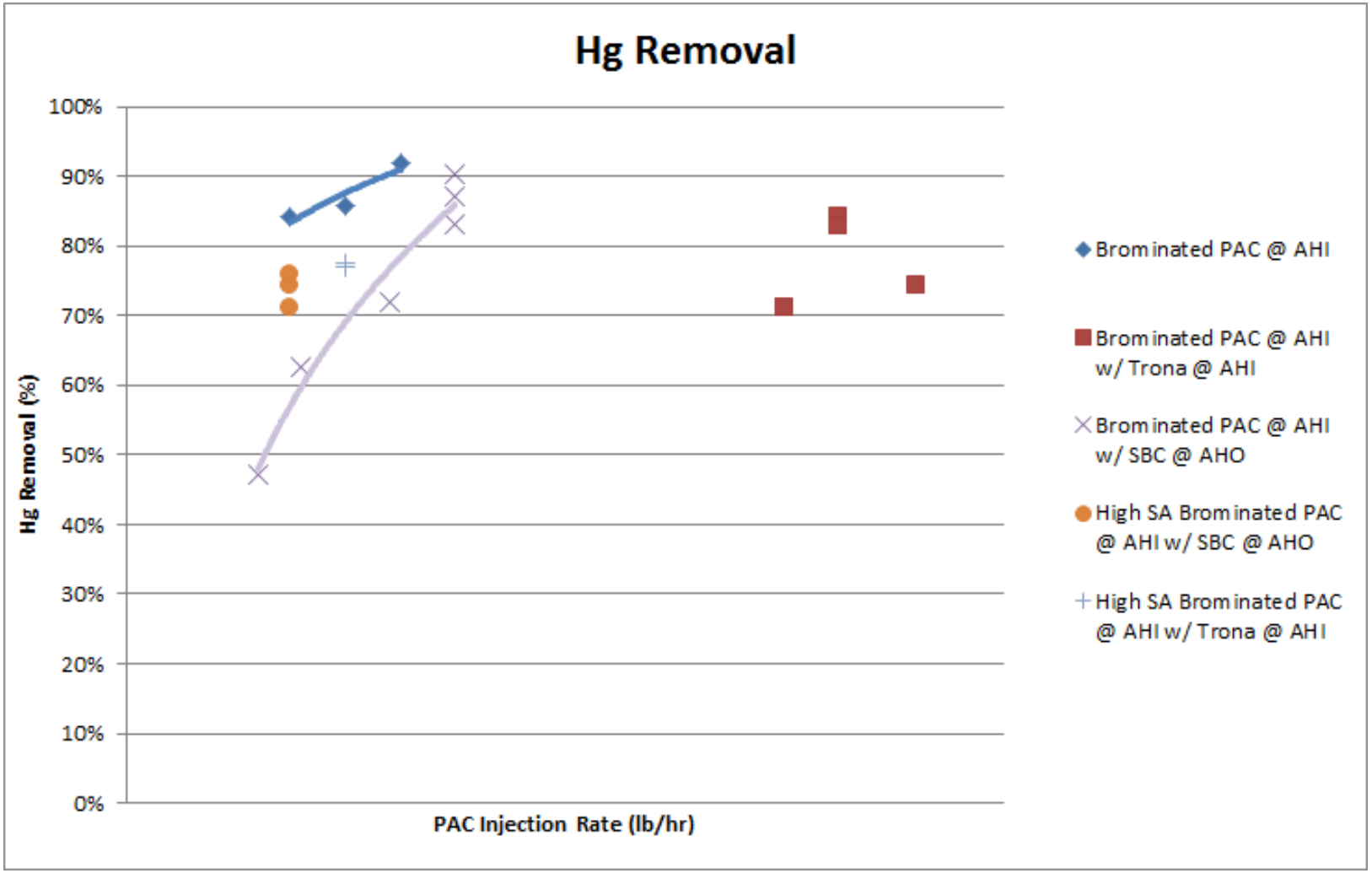
Typical Multipollutant Removal for PRB Unit - ESP



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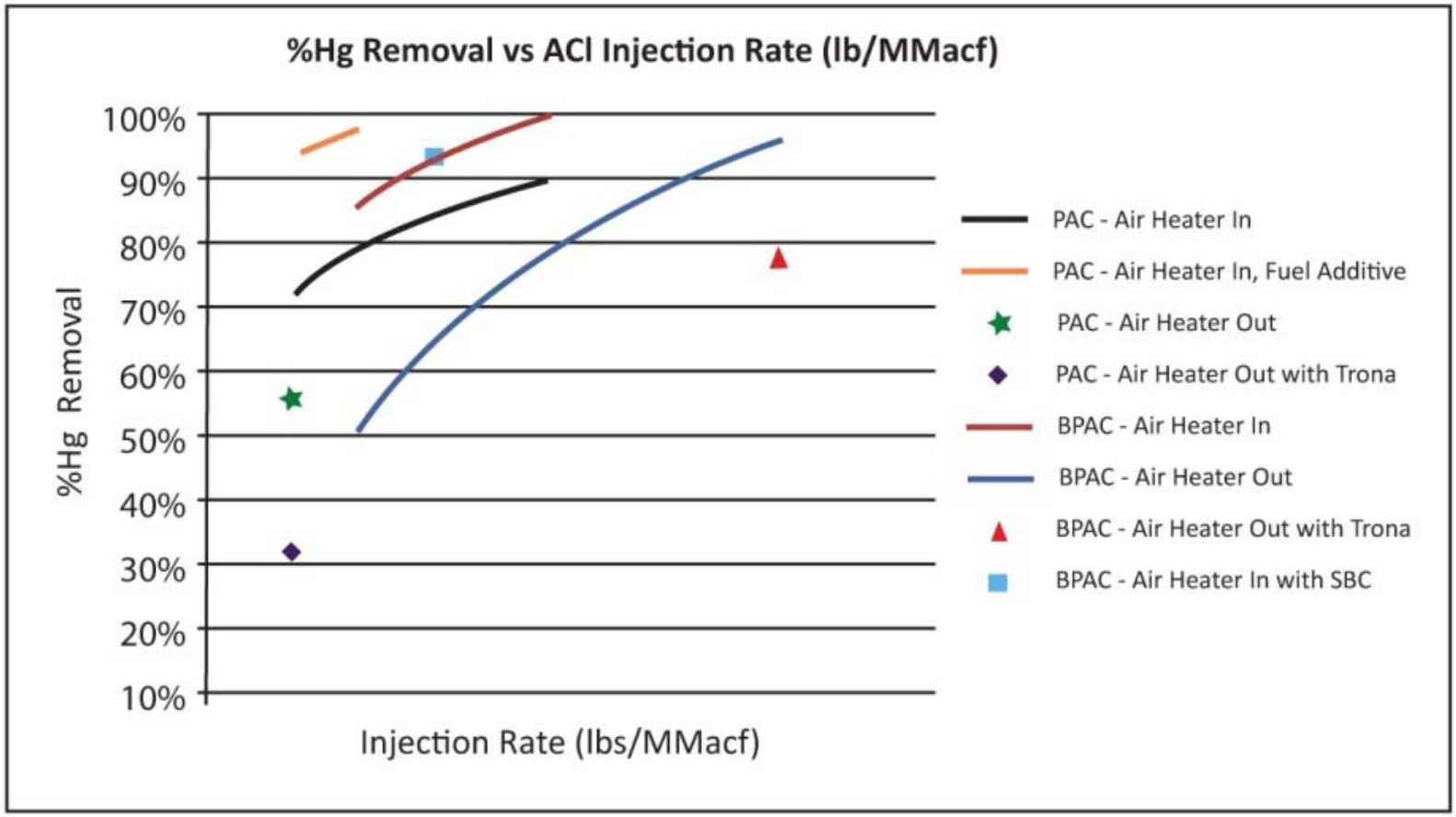
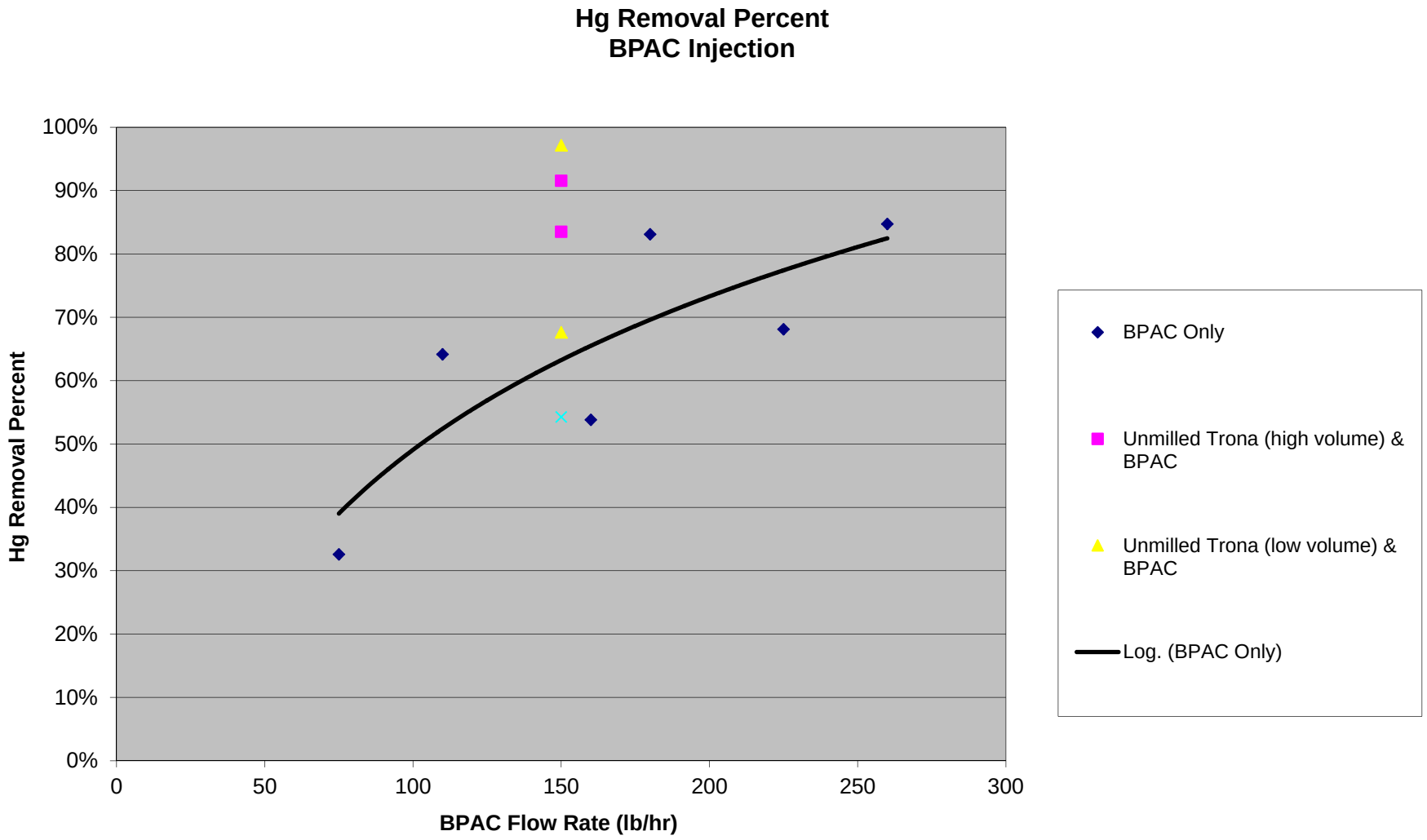
Typical Multipollutant Removal for PRB Unit - ESP

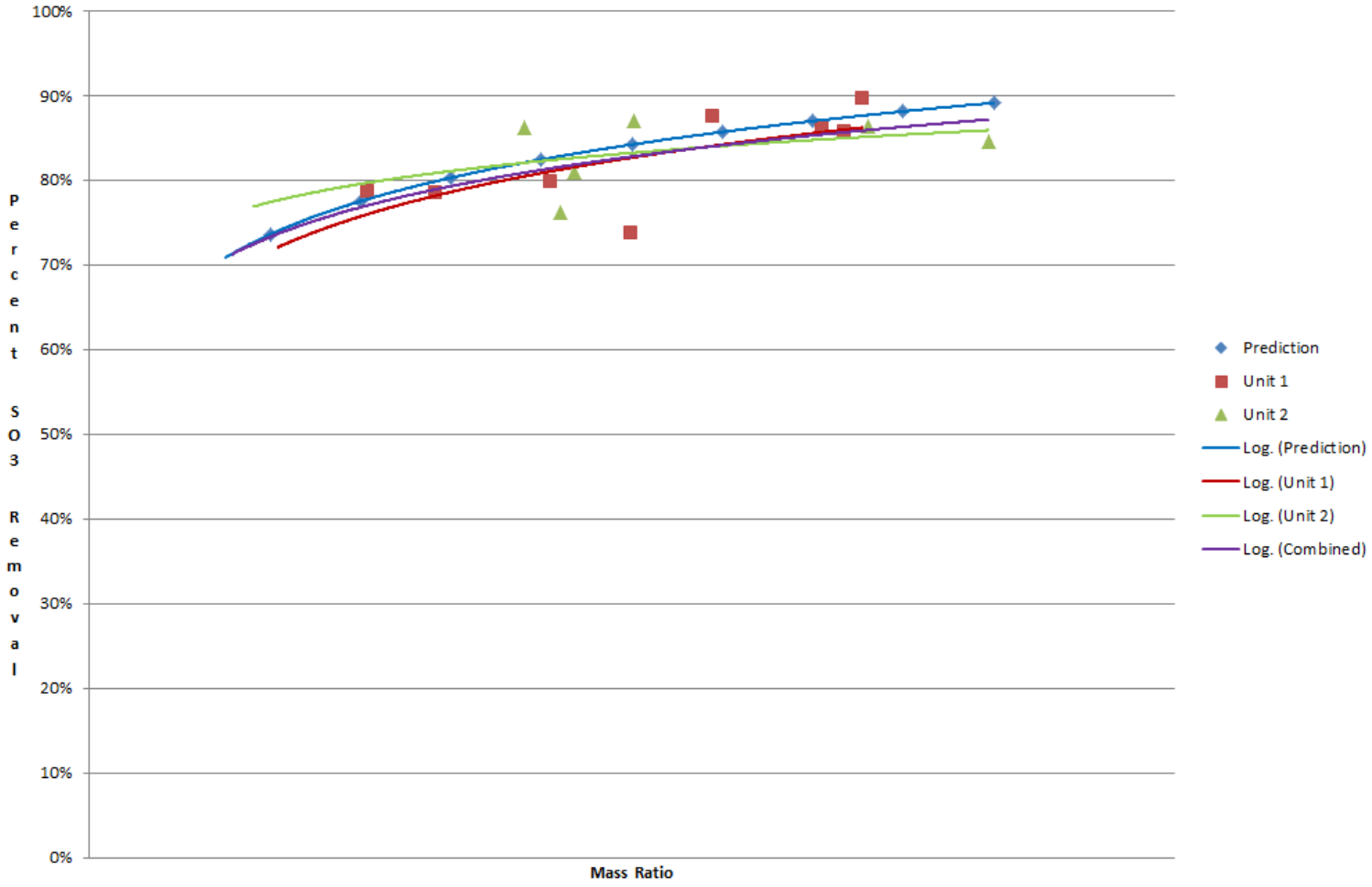


Mercury Removal on E. Bituminous Unit



SO_3 Removal

Hydrated Lime with ESP



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SO_3 Removal

Unmilled Trona vs. Milled Trona

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SO_2, Hg, HCl Removal with DSI

CONCLUSIONS

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Conclusions for E. Bituminous Fuels

- Trona and sodium bicarbonate demonstrated as effective sorbents for SO_2 and HCl removal
- Hydrated lime effective for HCl removal, but less so for SO_2 removal
- Simultaneous high Hg removals for E. Bituminous coals usually requires SO_3 Removal
  - PAC or Brominated PAC typically used at AH outlet, with hydrated lime or trona at AH inlet for SO_3 removal
- Over 90% SO_2 removal, up to 99% HCl removal, and over 90% Hg removal

Conclusions for PRB Fuels

- Fuel additive and PAC upstream of AH performs the best, but any trona/SBC injection must be at AH outlet
  - Otherwise, trona/SBC will react with halogen from fuel additive
- Brominated PAC at AH inlet with trona/SBC at AH outlet performs very well
  - Trona/SBC at AH inlet would remove HCl/SO_2 needed to oxidize Hg in AH
- Trona/SBC at AH inlet with Brominated PAC injection at AH outlet is effective, but more Brominated PAC needed
  - May be due to NO_2 formation and/or HCl removal upstream of BPAC

Questions

Questions ?

For Further Information on
Dry Sorbent Injection Systems for SO_2, SO_3, Hg and HCl Reduction

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