REINHOLD ENVIRONMENTAL Ltd.

2011 APC Round Table
& Expo Presentation

July 11-12, 2011, in Cleveland, OH / Hosted by FirstEnergy

URS

"Strategy to Improve Air Preheater Performance via SO_3 Mitigation"

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Reinhold Environmental APC Conference
Cleveland, OH - July 11, 2011

Workshop Outline

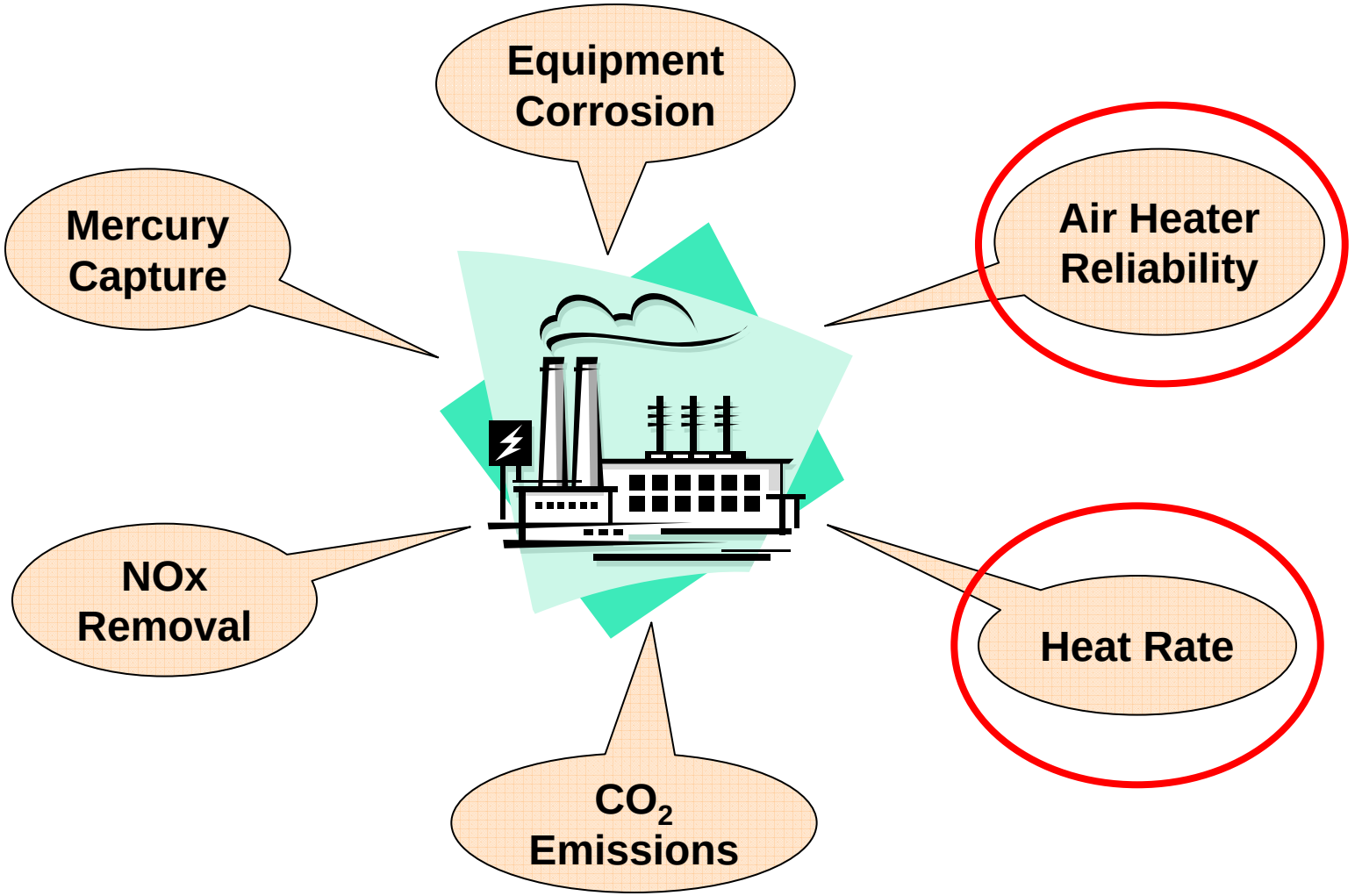
- SO_3 Impacts
- Air Heater Operation Strategy
- SO_3 Controls
- Full-Scale Application (SBS Injection)

I

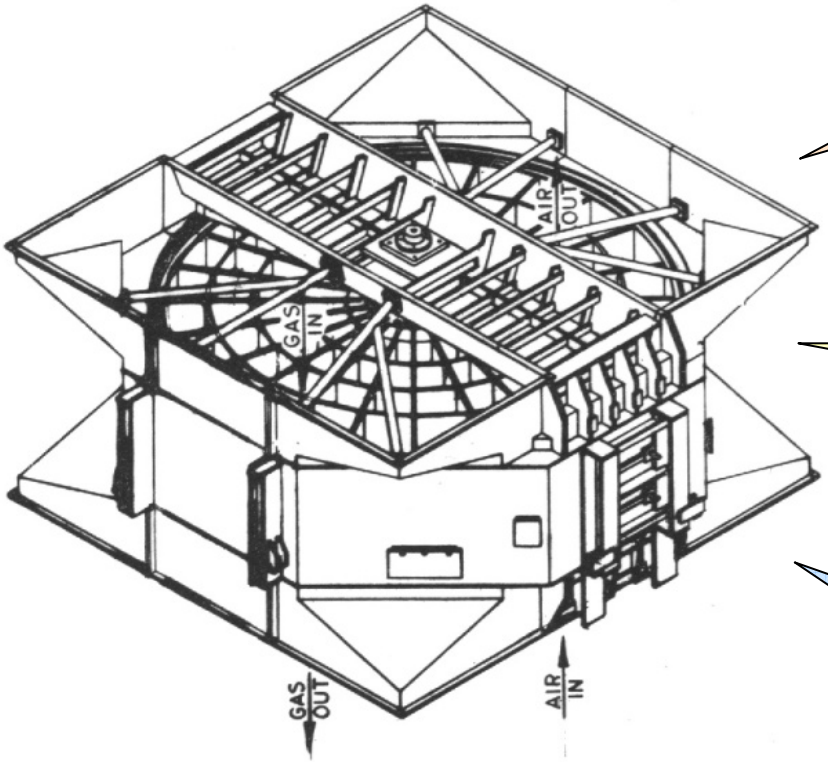
- Alstom APH Research Program
- Bench/Pilot APH Test Results
- Full-Scale APH Demonstration
- Air Heater Performance Upgrades
- Summary

II

SO_3 Adversely Impacts …



Air Heater Fouling Agents



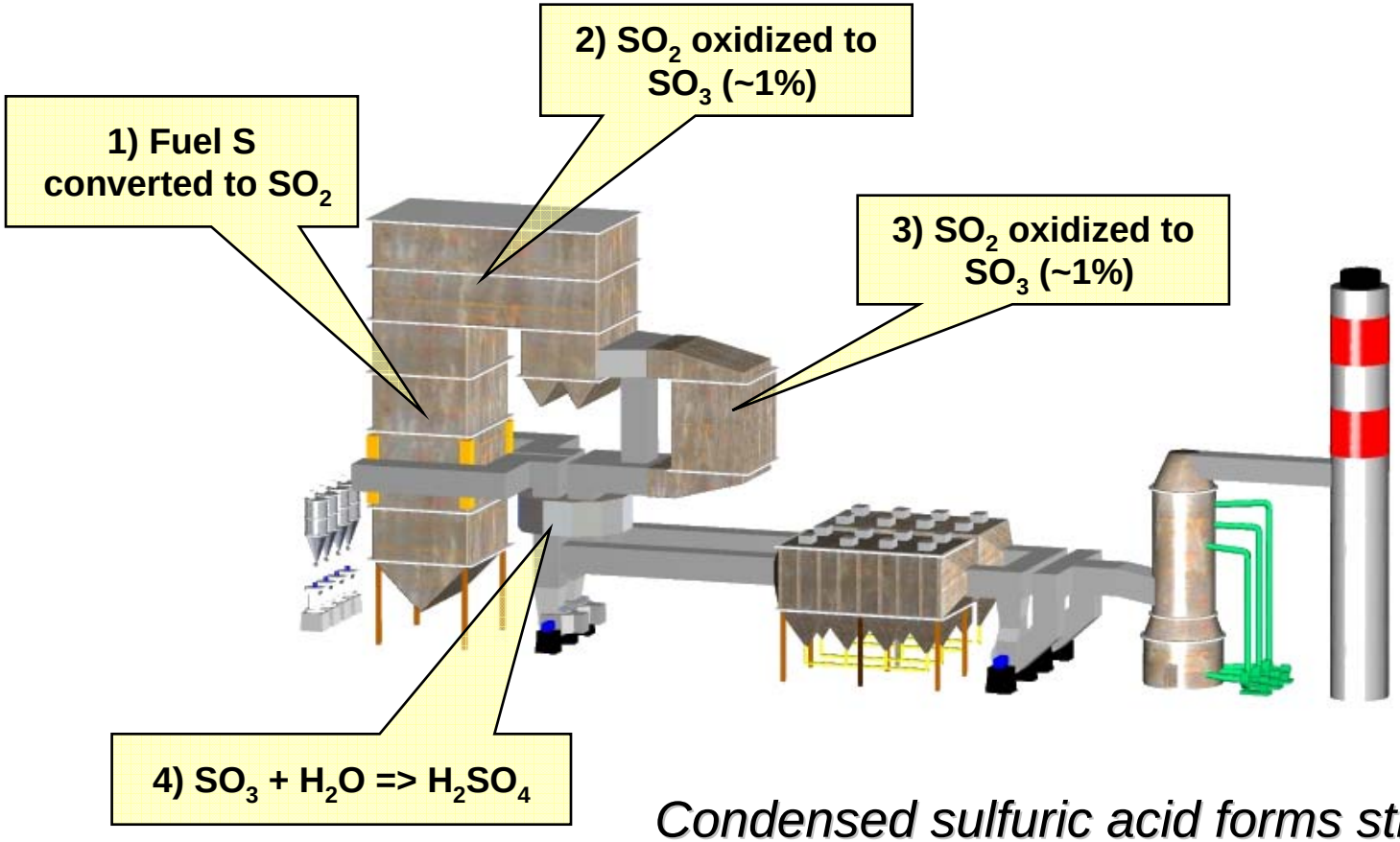
Source: Alstom Air Preheater Company

Ash

Sulfuric Acid

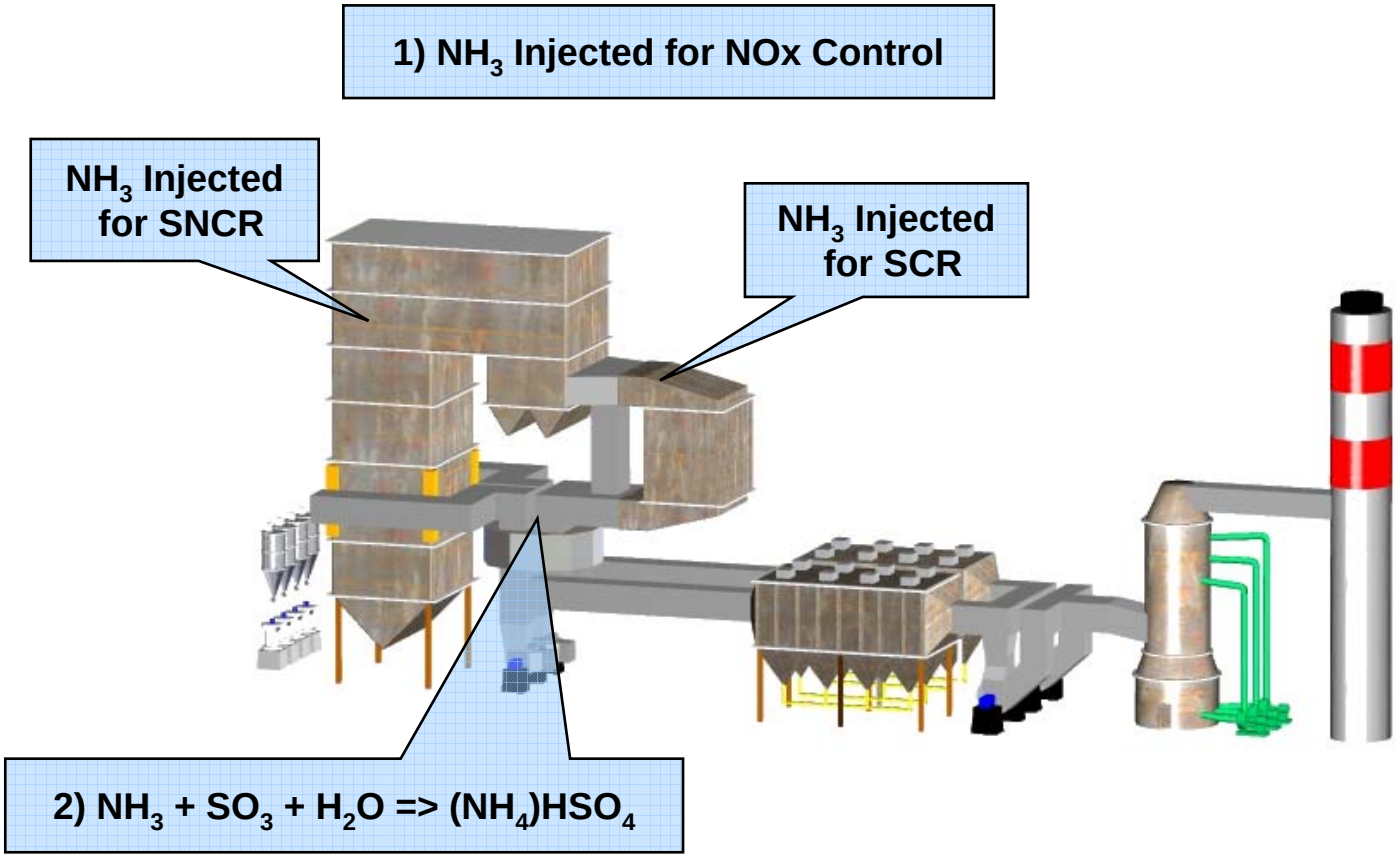
Ammonium Bisulfate

Sulfuric Acid Formation



Condensed sulfuric acid forms sticky, corrosive deposits in "cold-end" of APH

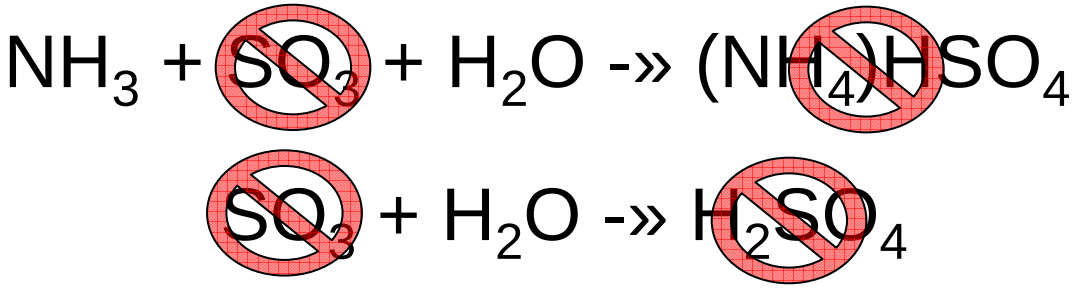
Ammonium Bisulfate (ABS)



Condensed Ammonium Bisulfate forms sticky, corrosive deposits in "middle" of APH

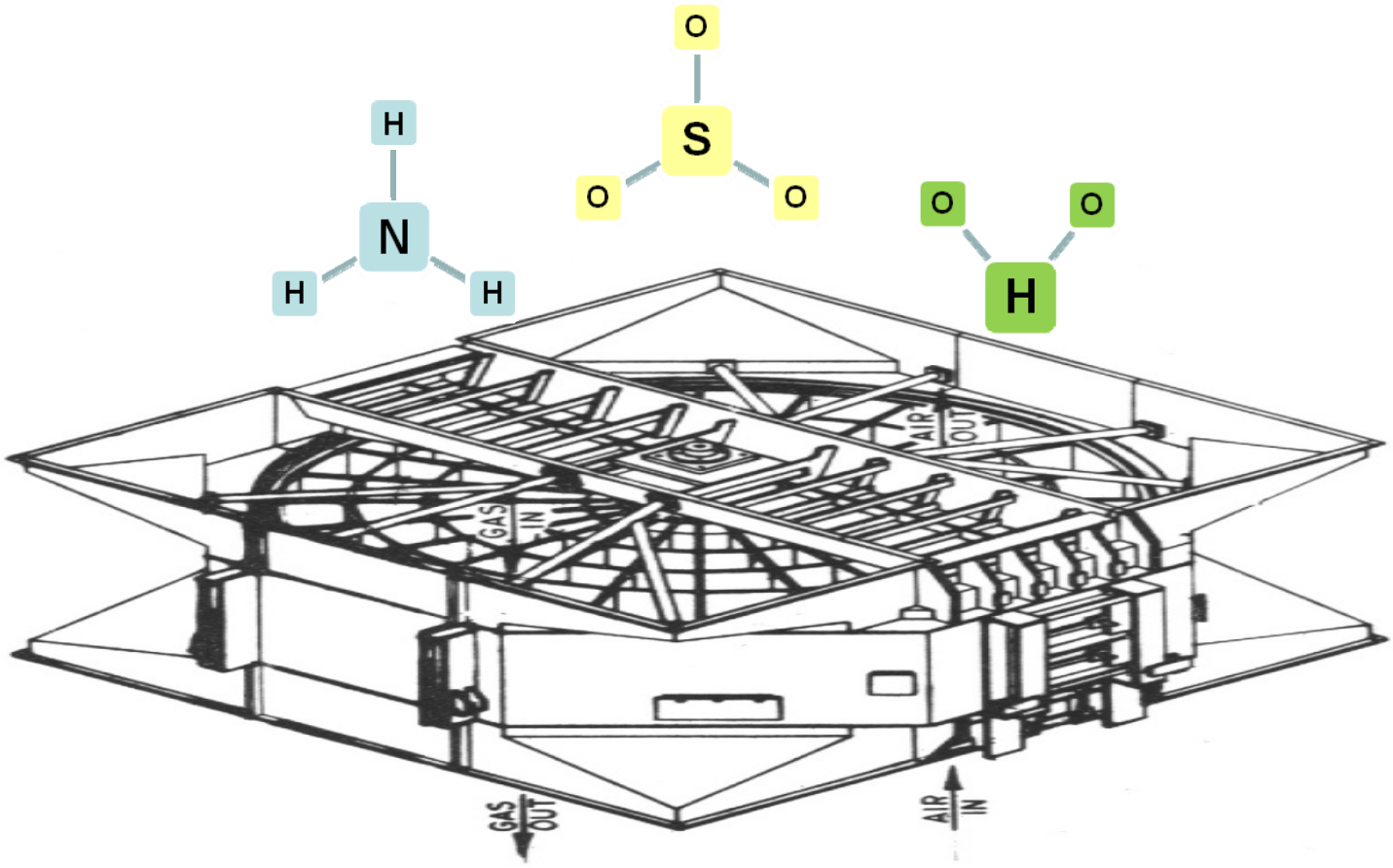
Strategy: APH Performance

1) Inject Sorbent to Remove SO_3 Prior to Air Heater



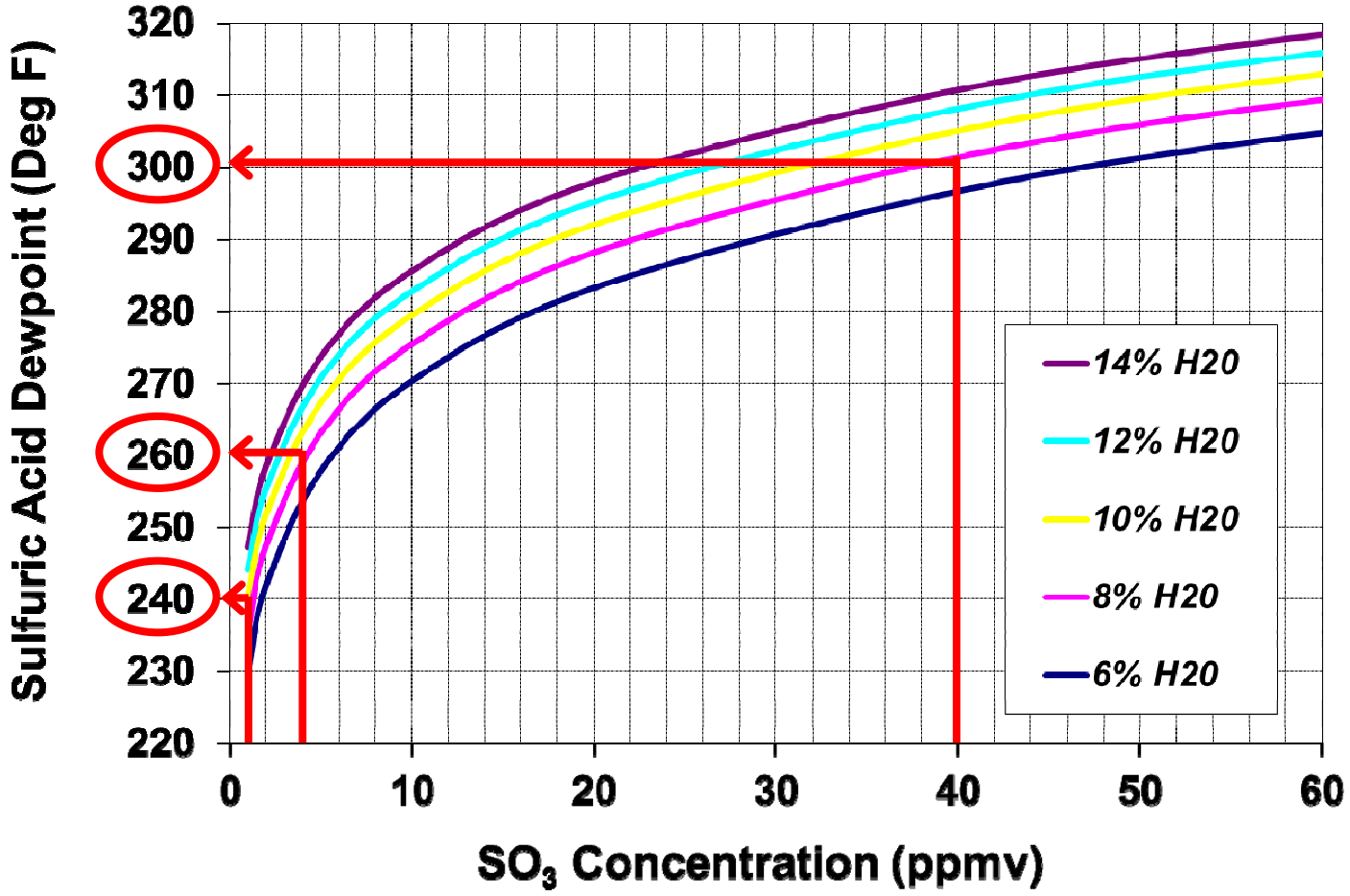
2) Reduce Exit Gas Temp from Air Heater
(Part II of Workshop)

Strategy: Step 1

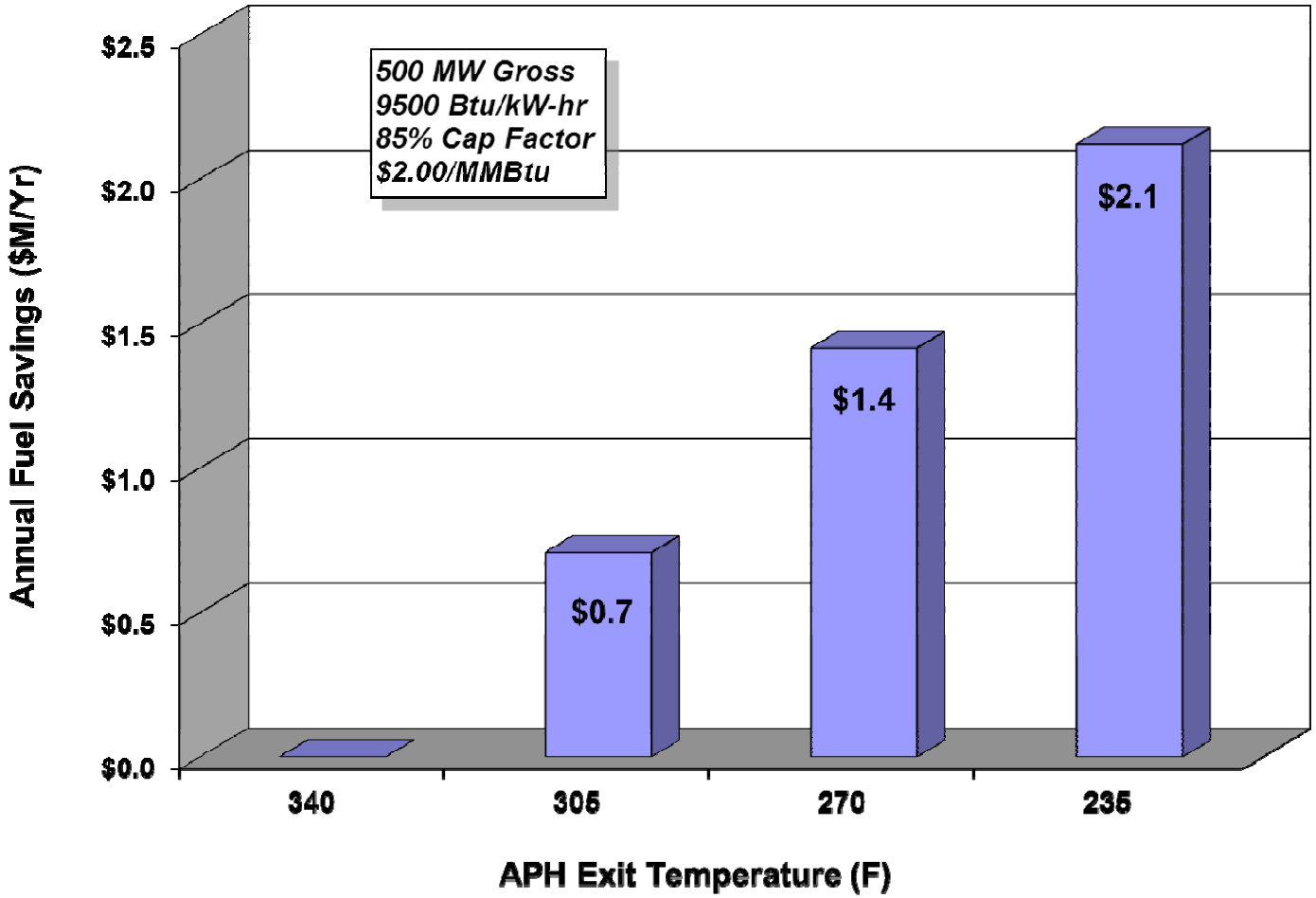


Result: No Fouling of Air Heater

Strategy: Step 2



Strategy: Heat Rate Benefit



Strategy: Other Co-Benefits

- Reduced CO_2 Emissions
  - higher unit energy efficiency
- Enhanced Mercury Capture
  - greater carbon absorption capacity
  - less SO_3 interference
- Enhanced ESP Performance
  - lower gas volumetric flow (higher SCA)
  - lower ash resistivity (temp and SO_3 effect)
- Reduced Gas Path Pressure Drop

Comparison of SO_3 Controls

	SBS Injection	Mag Hydroxide	Hydrated Lime	Trona	Ammonia
Typical Injection Location					
Boiler		√			
Before SCR	√				
Before AH	√				
Before ESP			√	√	√
Before FGD			√		
Typical SO3 Removal	90 - 98%	50 - 90%	50 - 80%	70 - 90%	80 - 95%
Typical Injection NSR	1 - 1.5	2 - 4	3 - 5	2 - 3	1 - 2

SBS Injection™ Technology

Features

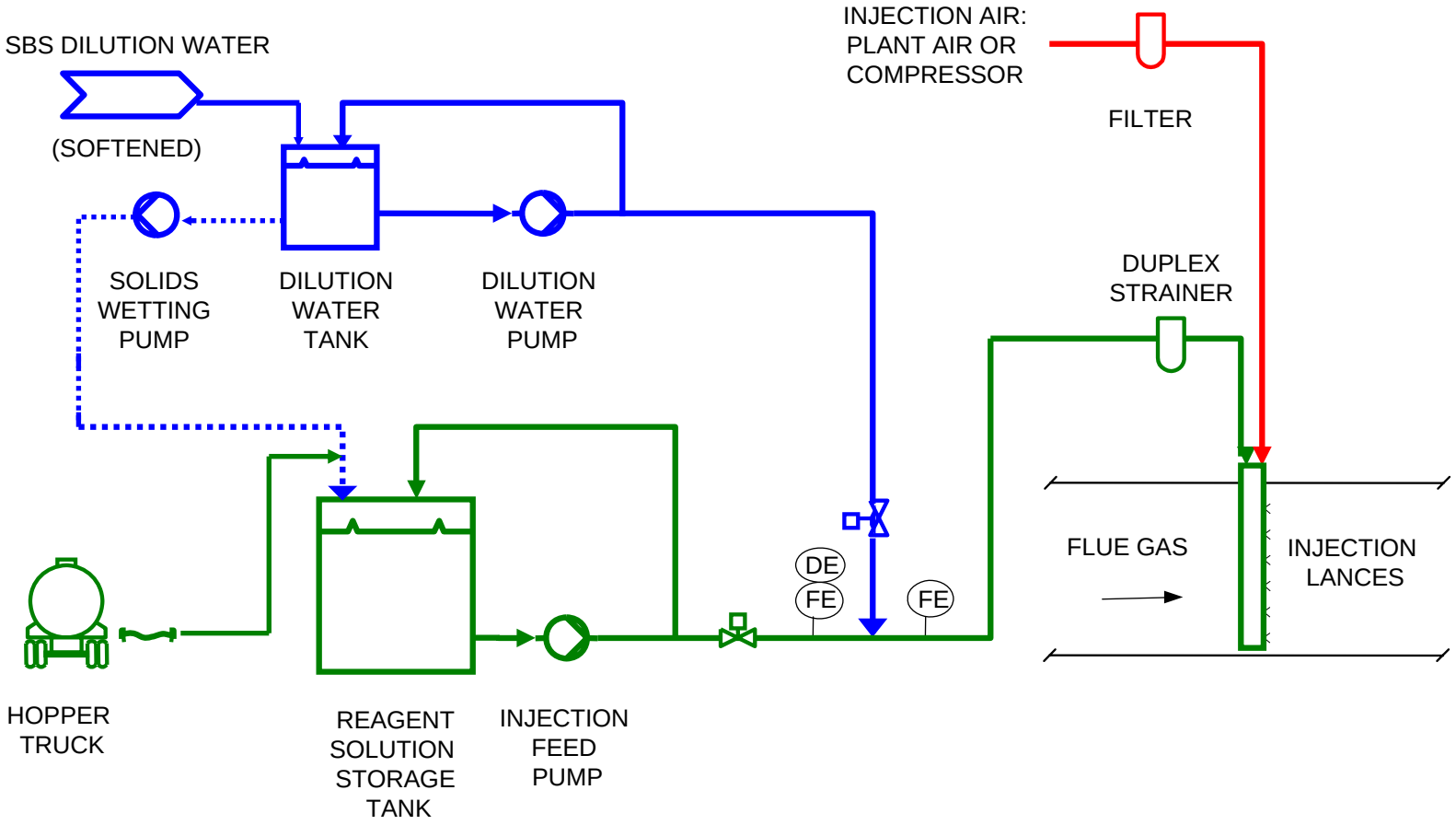
- Patented Technology
- Simple Solution Injection
- Sodium-Based Reagent
- Dual-Fluid Atomization
- Selective Reactions
- High SO_3 Removal
- Low Injection Rate
- Product Collected with Ash

Benefits

- Opacity Elimination
- Corrosion Reduction
- ESP Enhancement
- HCl and Se Removal
- Potential Heat Recovery
- SCR/SNCR Flexibility
- Hg Capture Enhancement
- CO_2 Reduction

Maximum Benefits with "Upstream" Injection

Simplified SBS Flow Diagram



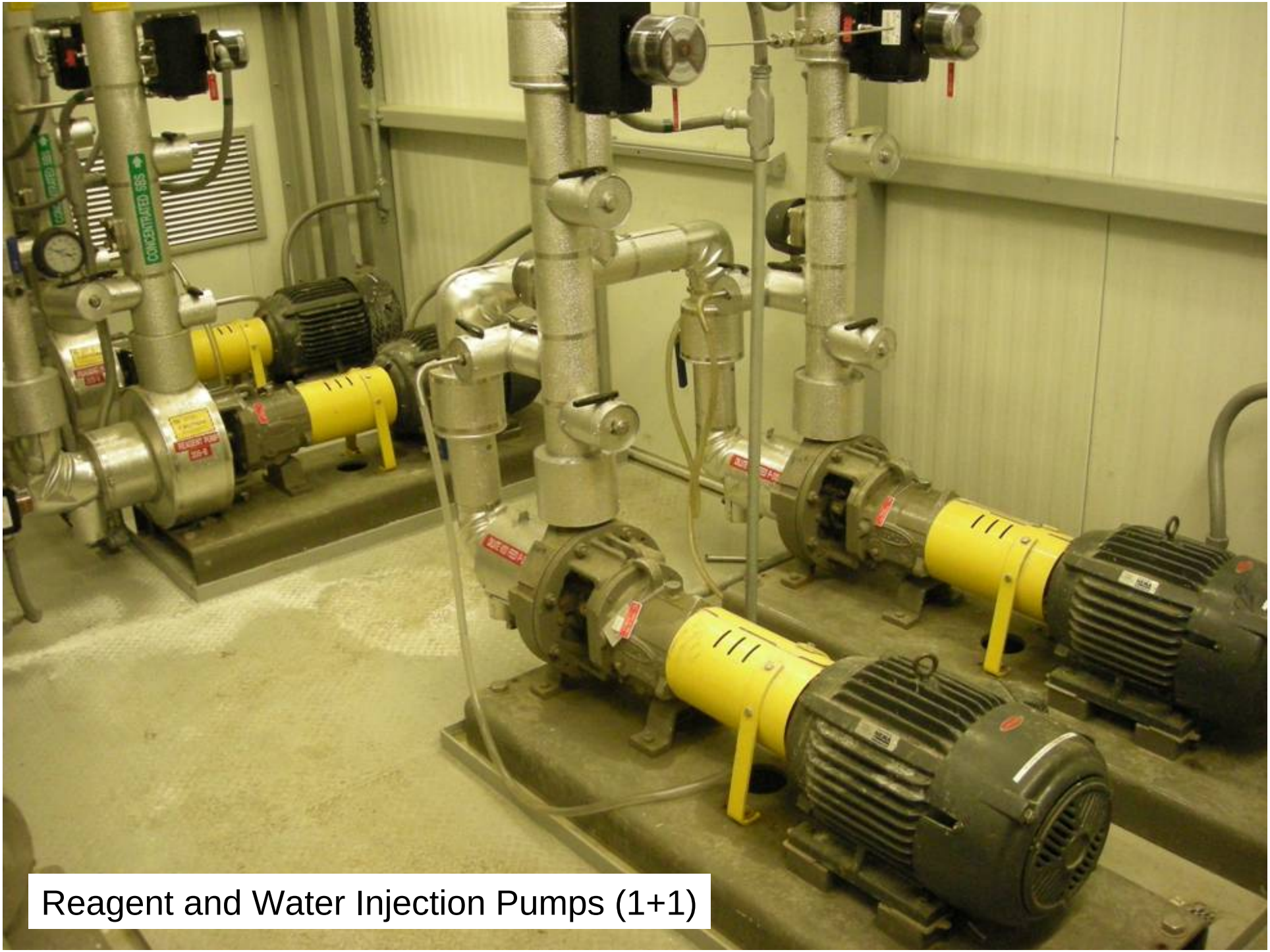
Full-Scale Application (SBS)

- Midwestern Utility
- 500 MW (nominal)
- SCR / APH / ESP / WFGD
- 4-5 lb SO_2/MMBtu Fuel
- 40-50 ppm SO_3
- SBS Injection
  - SCR outlet; <1 sec to APH

Solution Storage Tank and Injection Skid

Injection Skid

Injection Skid PLC and Electrical Gear



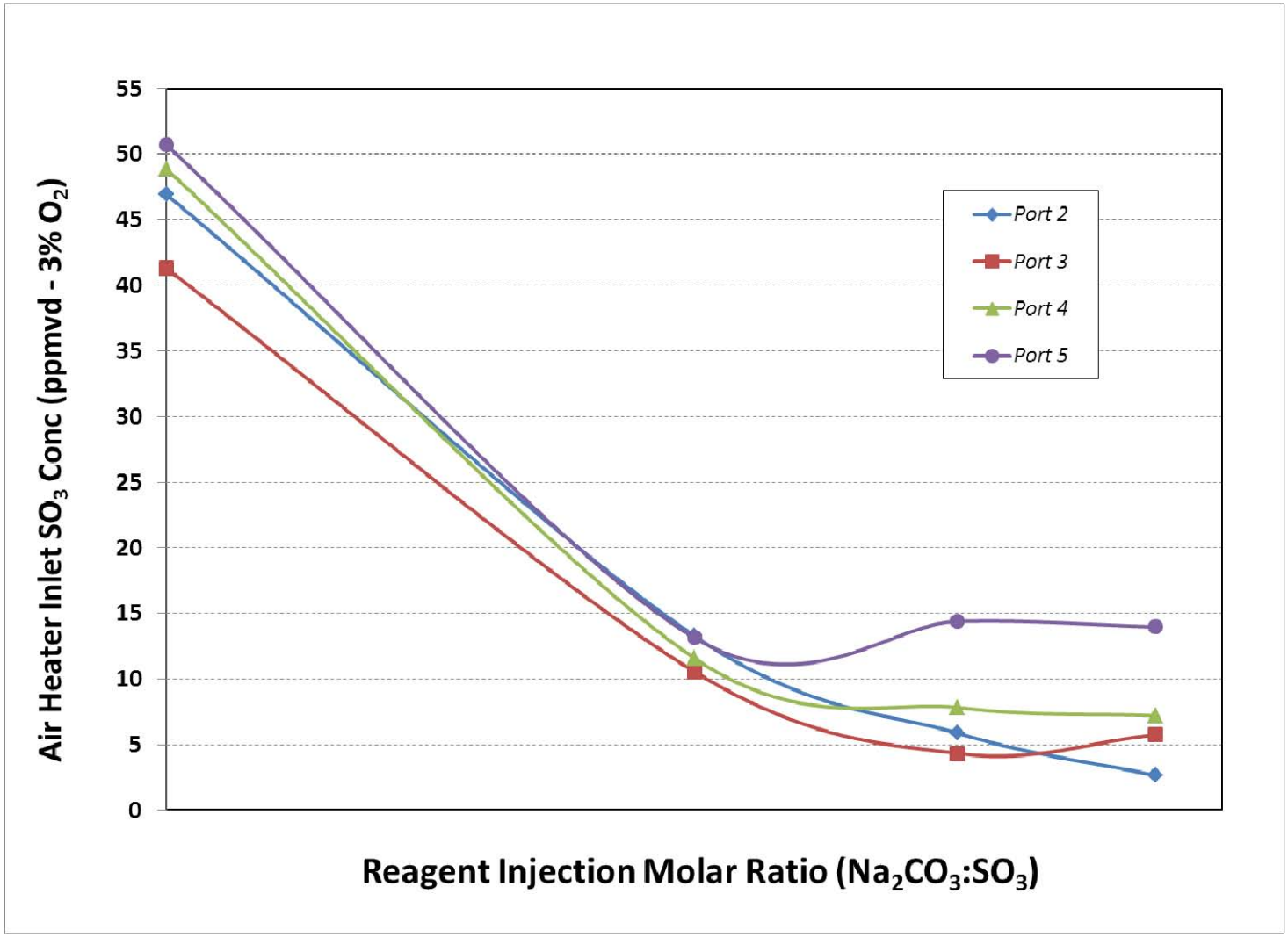
Reagent and Water Injection Pumps (1+1)

Solids Wetting Pump (1+0)

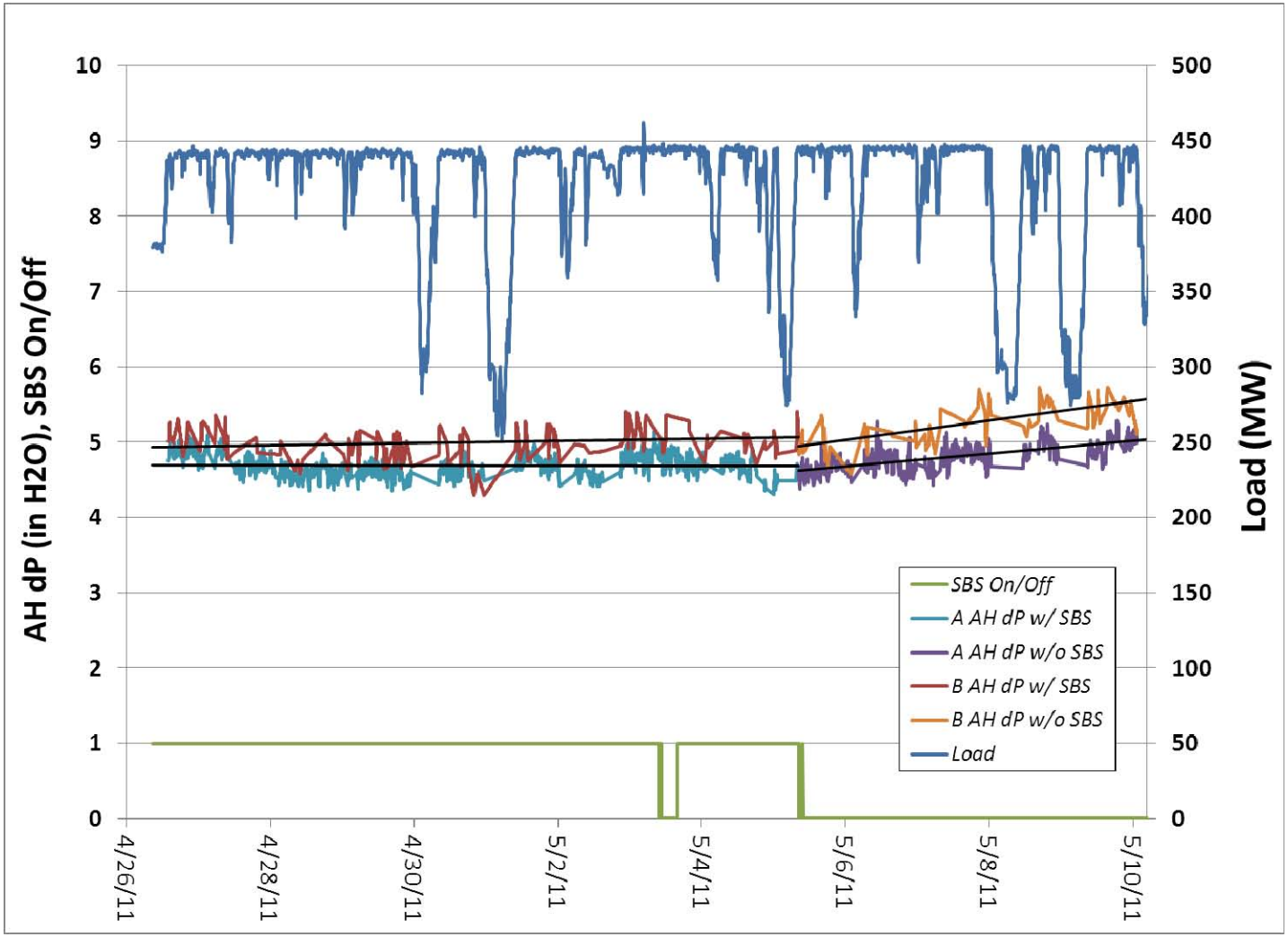
Injection Duct – Fall 2010; after 8 months of operation

Injection Manifold and Injection Lances

Air Heater Inlet SO_3 Results



Impact of SBS on APH dP



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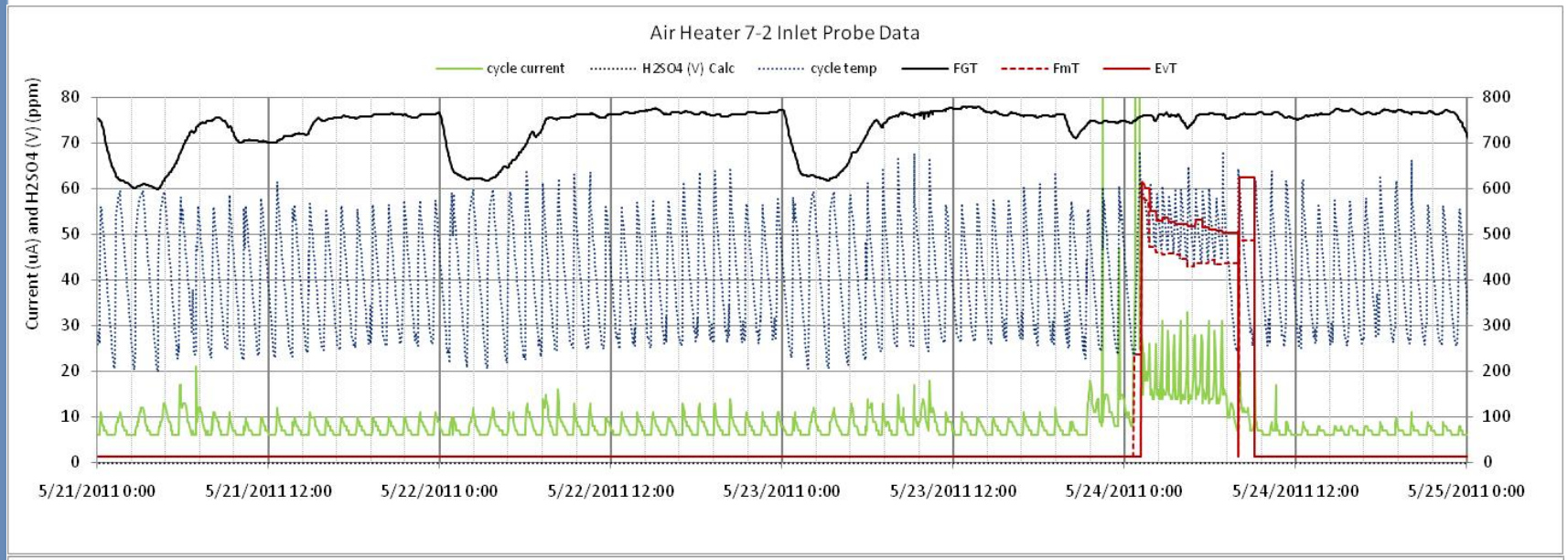
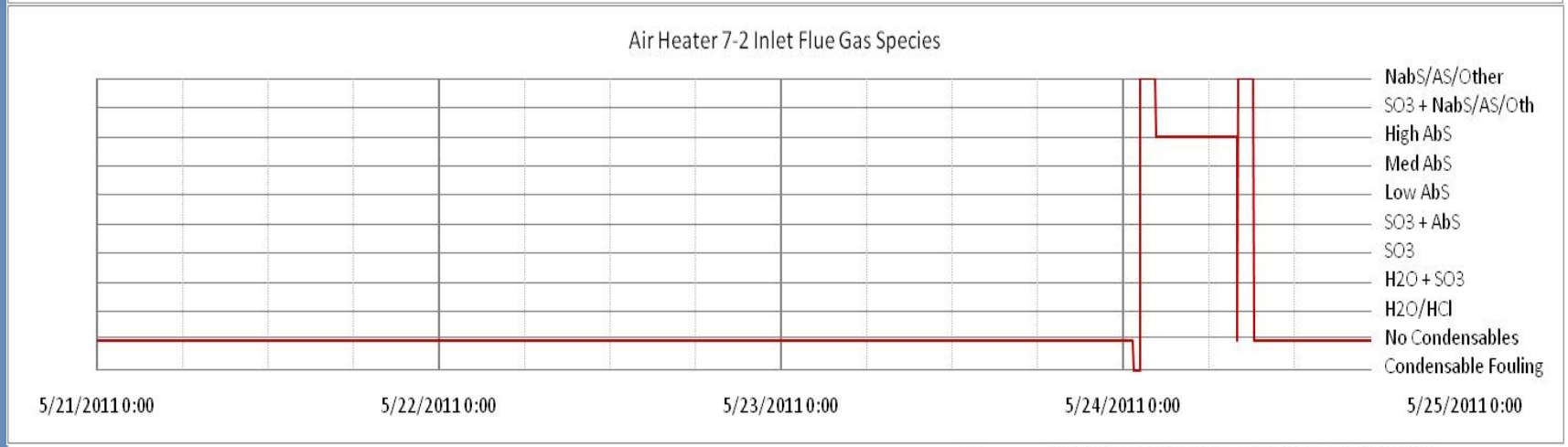
Breen "Condensables" Results





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