THE McILVAINE COMPANY

The Benefits of High Reactivity Hydrated Lime for Air Pollution Control

MISSISSIPPI® LIME

Discovering what's possible with calcium

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Improve Hydrated Lime Performance

Allow higher SO_3 / HCl removal rates

- Meet tighter sulfuric acid mist requirements
- Meet HCl MATS for Utility and Industrial boilers

Better in-flight capture of SO_3 / HCl

- Attain benefits of hot side injection of hydrate
  - APH cleanliness
  - Residence time improvement
- Help meet Hg MATS by removing more SO_3 in-flight

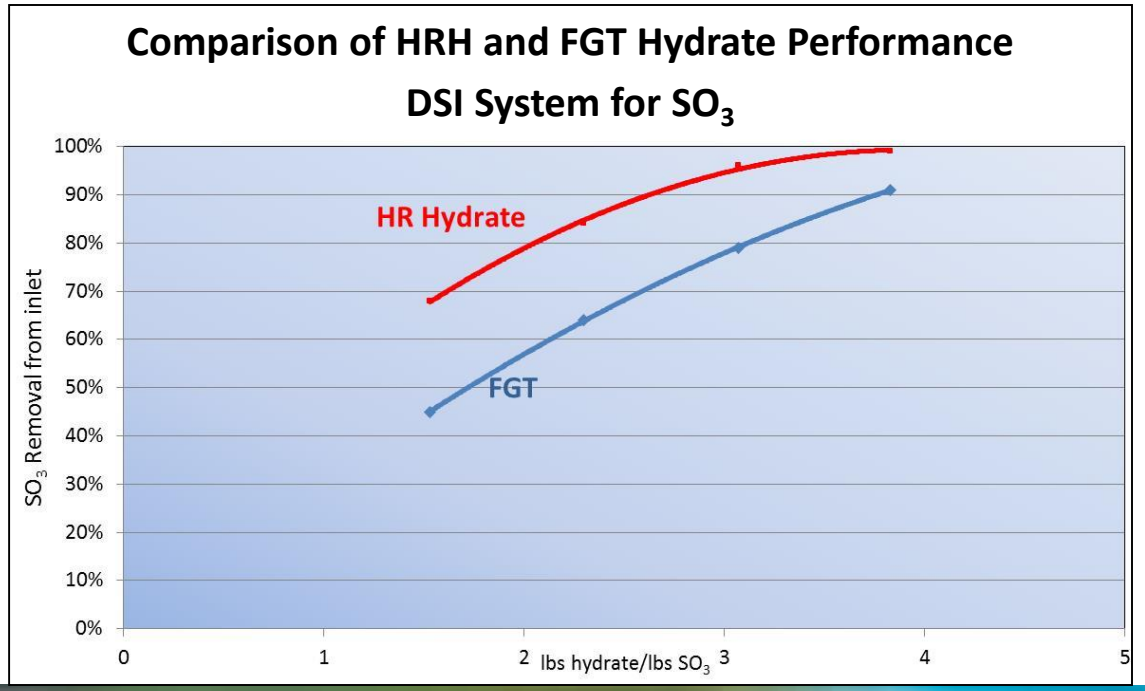
→ High Reactivity Hydrated Lime

What is High Reactivity Hydrated Lime?

New product from Mississippi Lime aimed at Dry Sorbent Injection industry for SO_3 and HCl mitigation

- Extensive site testing shows 25-50% benefit over FGT-grade hydrated lime
- Aimed at improved in-flight pollutant capture
- Fast reactivity

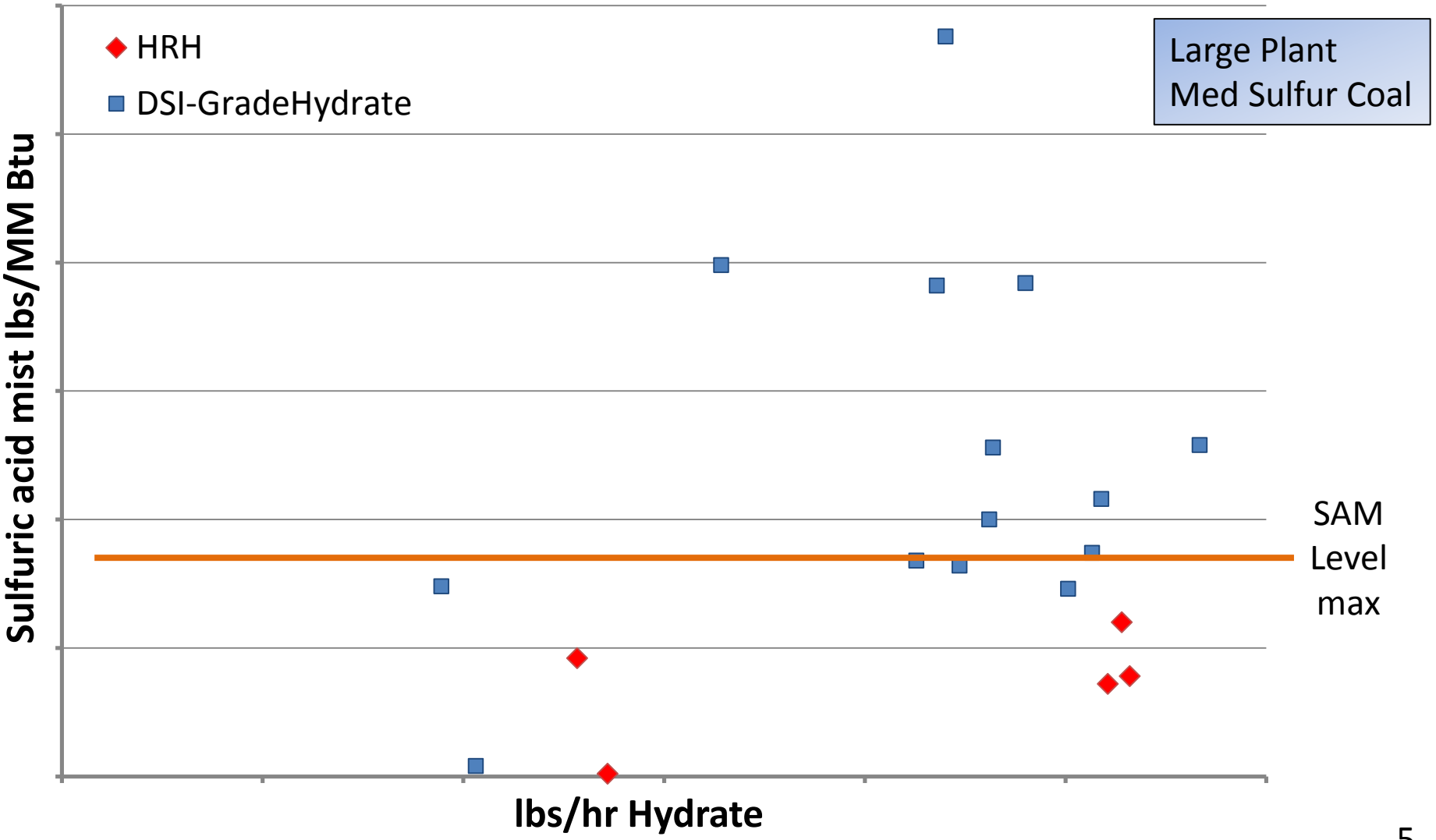
- Supporting papers and presentations available
- Full scale availability began in December 2013



Regulatory Benefits of HRH

- Tighter regulations on Sulfuric Acid Mist
- Need for in-flight capture of SO_3 to improve activated carbon utilization
- High removal rate of HCl for MATS

HRH Allows a Plant to Meet SAM Requirements



In conjunction with Activated Carbon

Full scale test in advance of 2015 MATS

- Using FGT grade hydrate
  - Unit unable to meet mercury reduction limits regardless of amount of hydrate and carbon fed

- Using HR hydrate
  - Unit easily able to meet mercury reduction targets

HR Hydrated Lime – HCl Mitigation

Hydrated lime is most economical option for HCl mitigation to meet MATS requirements.

Examples from Testing Programs

Coal type	Particulate Collection	HCl reduction	Hydrate: Total Acid NSR	Comment
Western/PRB	BH	>95%	~ 0.80	Easily achieved MATS
App. Coal	BH	>99%	3.0 – 4.0	Easily met MATS **Also 40-50% SO_2 reduction**
Western/PRB	ESP	>80%	~ 0.50	Easily achieved MATS
Waste	BH	>97%	0.7 – 1.2	MATS achieved
High Cl	ESP	90%	~ 0.7	MATS achieved Very marginal ESP with < 1.5 sec residence time
Western/PRB	Marg ESP	>95%	~ 0.80	Challenging system, also targeting Hg reduction with AS

Cost Benefits of HRH

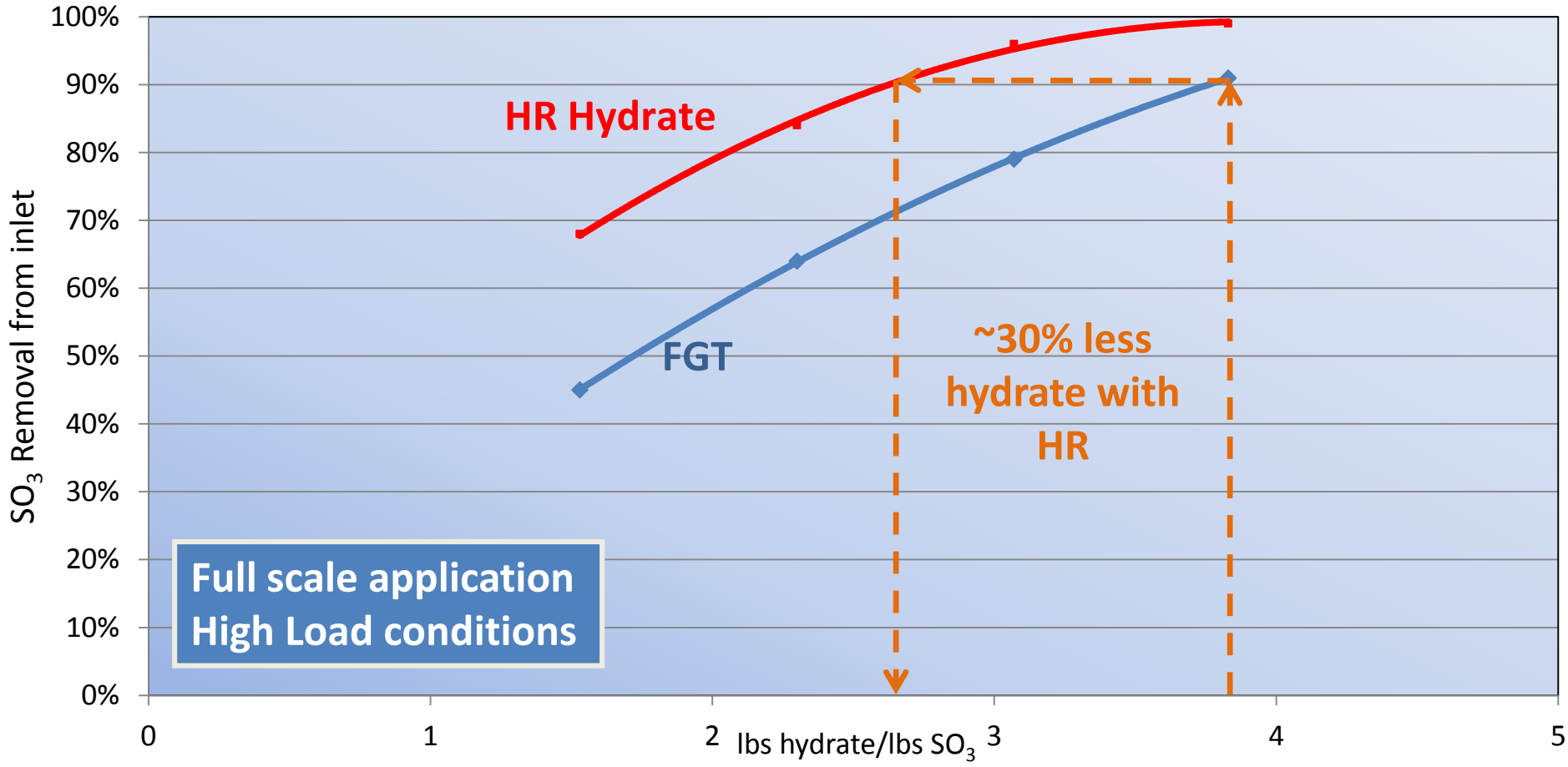
- Use less hydrate = reduced freight costs
  - Freight typically 25-30% of delivered cost

Example: 10,000 tpy with FGT

30% HRH benefit -> 7,000 tpy HRH

- 125 fewer shipments per year with HRH
- Freight savings offset product price premium
- Utility recognizes cost savings

Full Scale Evaluation – SO_3 Removal - HR vs. FGT

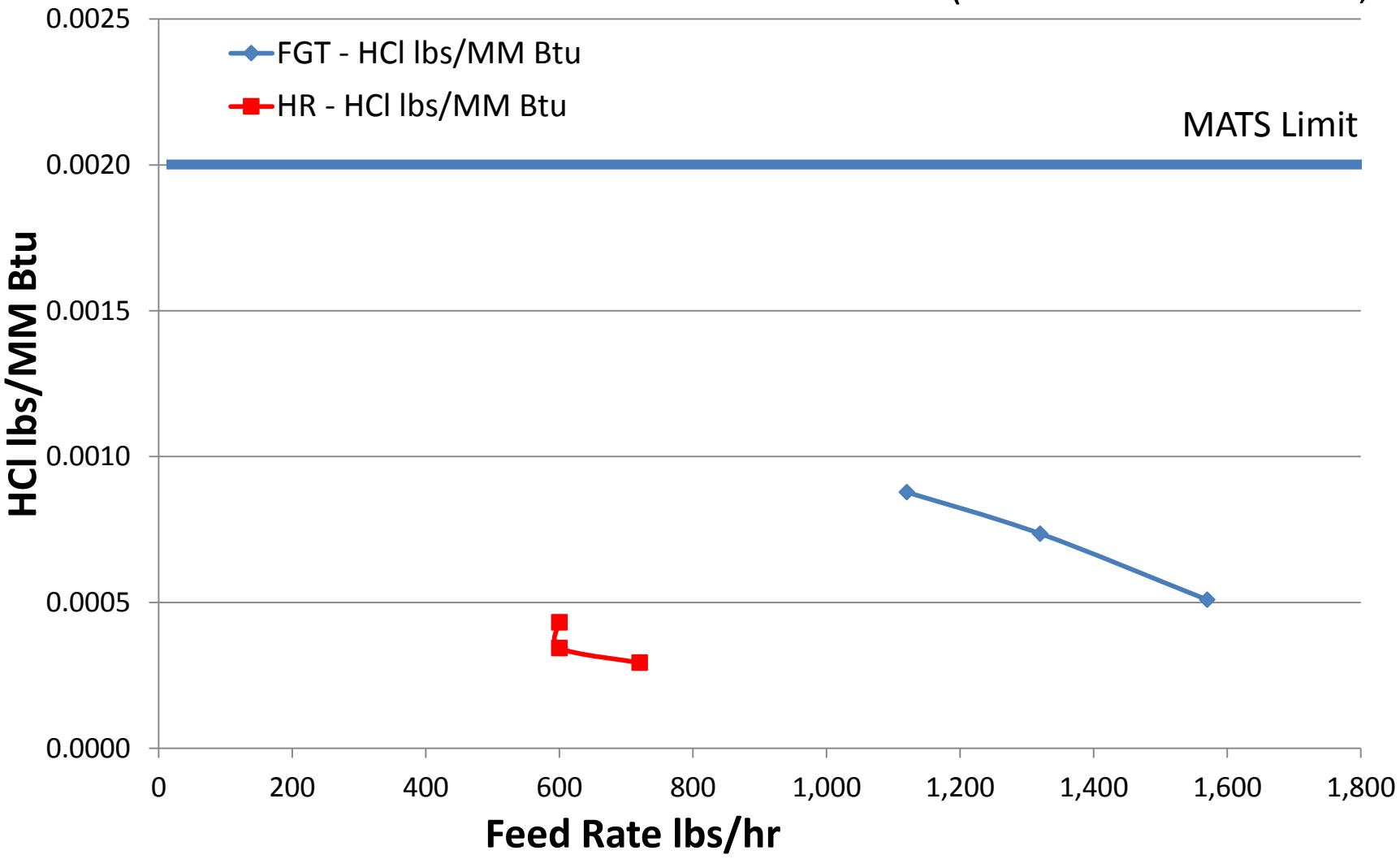


FGT hydrate gives good removal

HR Hydrate offers better utilization or high level removal capabilities

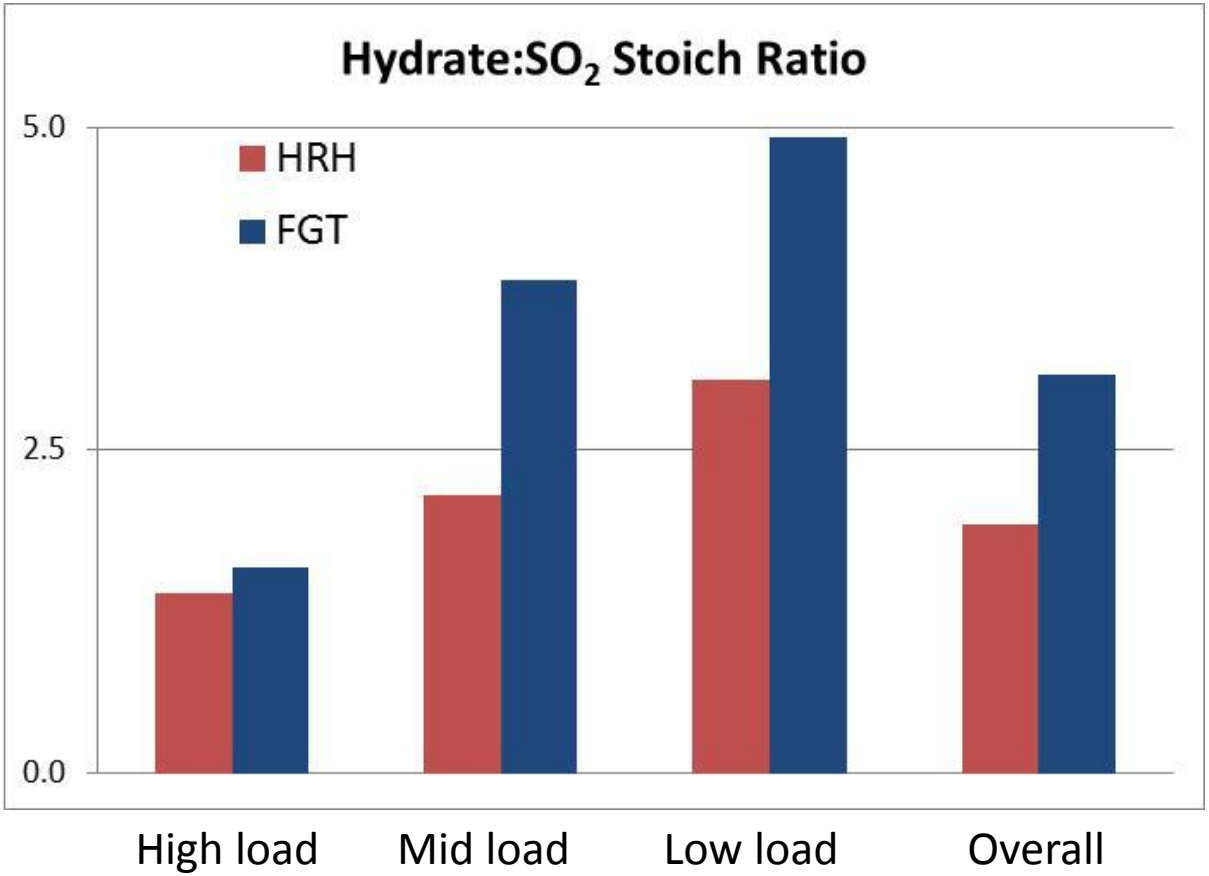
Meeting 2015 Utility MATS Limits for HCl

(smaller unit < 300 MW, IBC)



Evaluation of HRH in CDS

- Overall, HRH provides significant improvement vs FGT
- Most benefit at mid and low load conditions



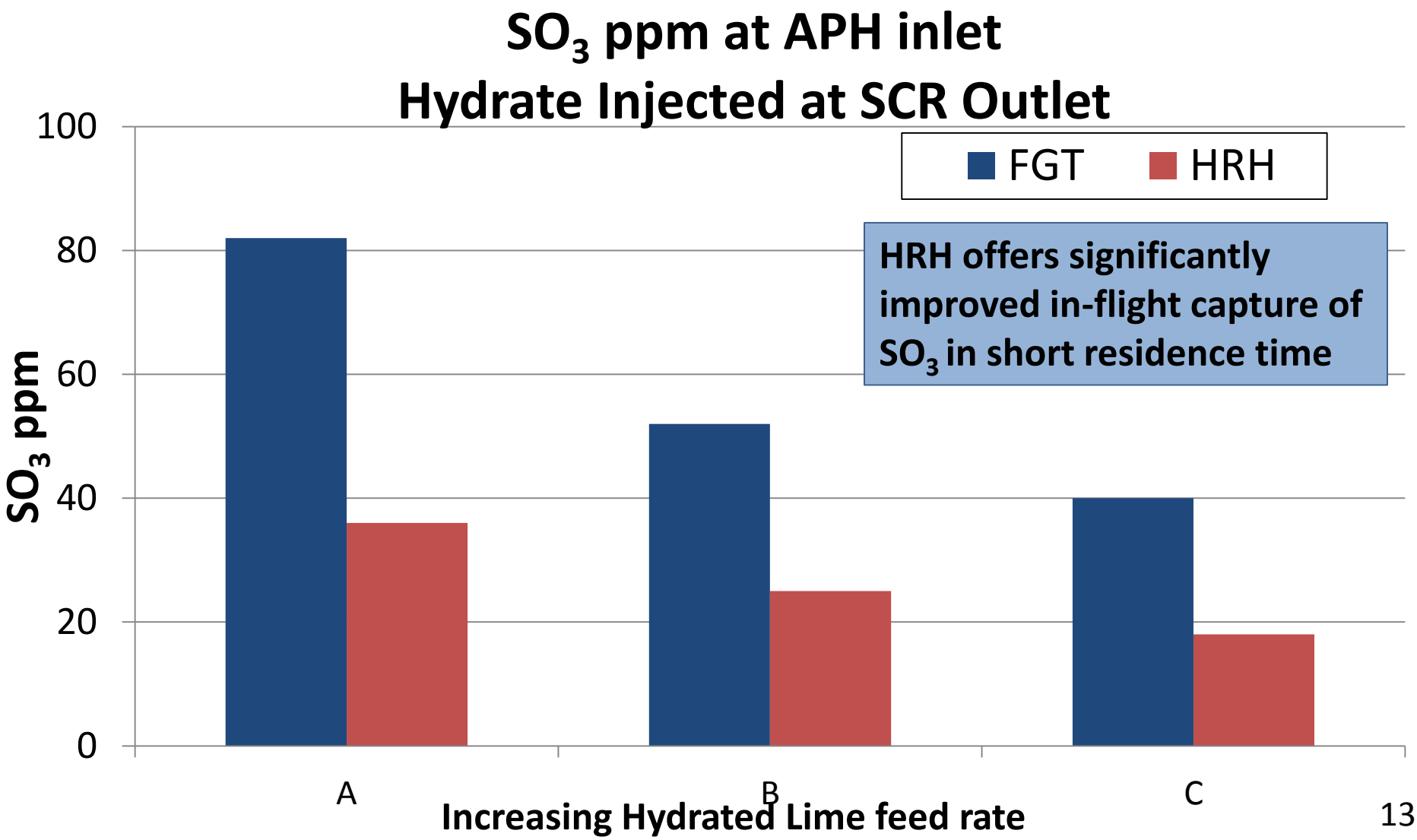
Full scale test on existing Circ Dry Scrubber
Identical length test periods
Averaged data at respective load groupings

Operational Benefits

- Pre-Air Preheater injection of hydrated lime
  - Maintain APH cleanliness while controlling SO_3 emissions
  - More efficient SO_3 removal reduces ABS formation and deposition in APH

- Simple systems
  - Mills not required
  - Dilution system or complex lances not required

SO_3 Reduction at APH Inlet



Ash Benefits

- More efficient sorbent = less ash

  Example: 10,000 tpy with FGT

  30% HRH benefit -> 7,000 tpy HRH

  Ash disposal = 3,000 tpy * $20/ton disp = $60,000/year savings

- Lower feed rates with HRH reduce particulate loading on ESP
- Benefits of calcium in ash
  - Hydrated lime-based ash leaches the least toxic metals of Se, As, V, and Mo
  - Calcium stabilizes heavy metals in ash
  - Calcium precipitation critical in minimizing As/Se leaching

Summary

HR Hydrate offers many potential benefits to customers:

- Regulatory
- Cost improvement
- Operational benefits
- Ash reduction and quality

Questions

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