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McIlvaine Company Hot Topic Hour

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Dry Sorbent Injection Options and Issues

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Presentation Overview

- Lhoist Overview
- Dry Sorbent Injection (DSI)
- Hydrated Lime Sorbents
- DSI Case Studies
- Lhoist Field Trial Capabilities
- Conclusions
- Summary

Lhoist Overview

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- Sounds like ‘Luh-wost’
- **Chemical Lime** and **Franklin Industrial Minerals** merged to form Lhoist North America (LNA)
  - ✓ Suppliers of high quality chemical grade calcium products including Limestone, Quicklime, Slurry, and Hydrate (Sorbacal®)
- Part of Lhoist Group
  - ✓ World’s largest lime company
  - ✓ In lime business for more than 125 years
  - ✓ 6,000 employees, 30 nationalities
  - ✓ 90 plants in 25 countries

Ste. Genevieve, MO Plant

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Why Dry Sorbent Injection (DSI)?

Why Dry Sorbent Injection (DSI)?

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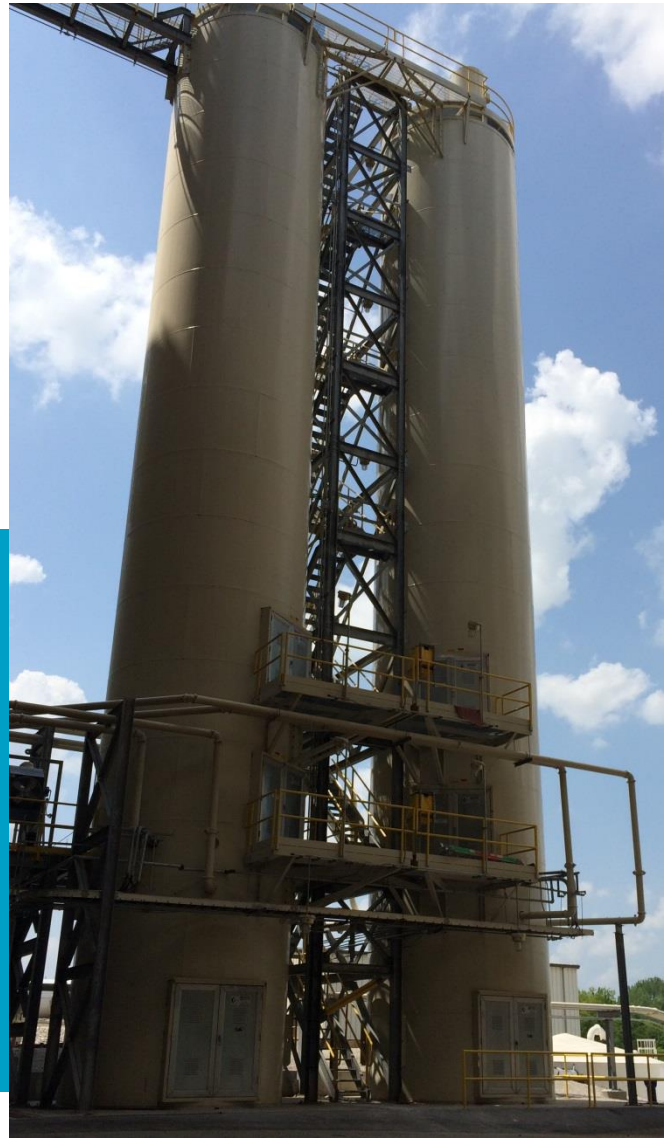

- Simple equipment with a small footprint
- Mature Technology
  - ✓ In use for over 30 years
  - ✓ Injection equipment continues to evolve
  - ✓ Sorbent improvements
- Low CapEx
- ~12 month schedule (award to installation)

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Hydrated Lime Sorbents

Lhoist Hydrate Introduction

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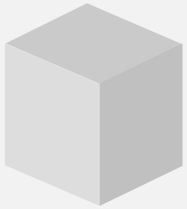
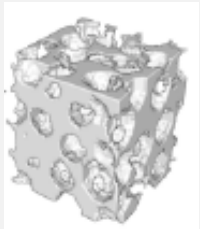
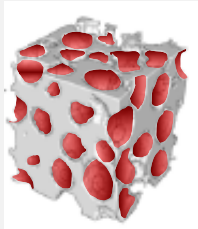
Sorbent	Standard Hydrated Lime	Sorbacal® H	Sorbacal® SP	Sorbacal® SPS
Figure				
Typical Available $Ca(OH)_2$ [%]	92 – 95	93	93	93
Typical Surface Area [m^2/g]	14 – 18	> 20	~40	~40
Typical Pore Volume [cm^3/g]	~0.07	0.08	~0.20	~0.20

Why Enhanced Sorbents?

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- Reduced sorbent consumption vs. “standard” hydrated lime sorbents
- Achieve higher removal performance
- Potential operating cost savings associated with lower sorbent consumption
- Potential capital cost savings on equipment if designed based on enhanced hydrated lime
- Lower mass loading on particulate control device and ash handling systems
- Fewer deliveries
- Less fly ash / spent sorbent required for disposal

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DSI Case Studies

DSI Case Study #1

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- Application → Industrial Manufacturing Process
- Goal → ~70% HCl Removal Efficiency (baseline 35-40 ppm)
- Why → Meet Future Regulations
- Boiler → AH → DSI → CS-ESP → Stack
- Flue gas temperature at DSI location 300-350°F
- DSI → Eight (8) Injection Lance @ AH Outlet
- Sorbent → Sorbacal® SP

DSI Case Study #1

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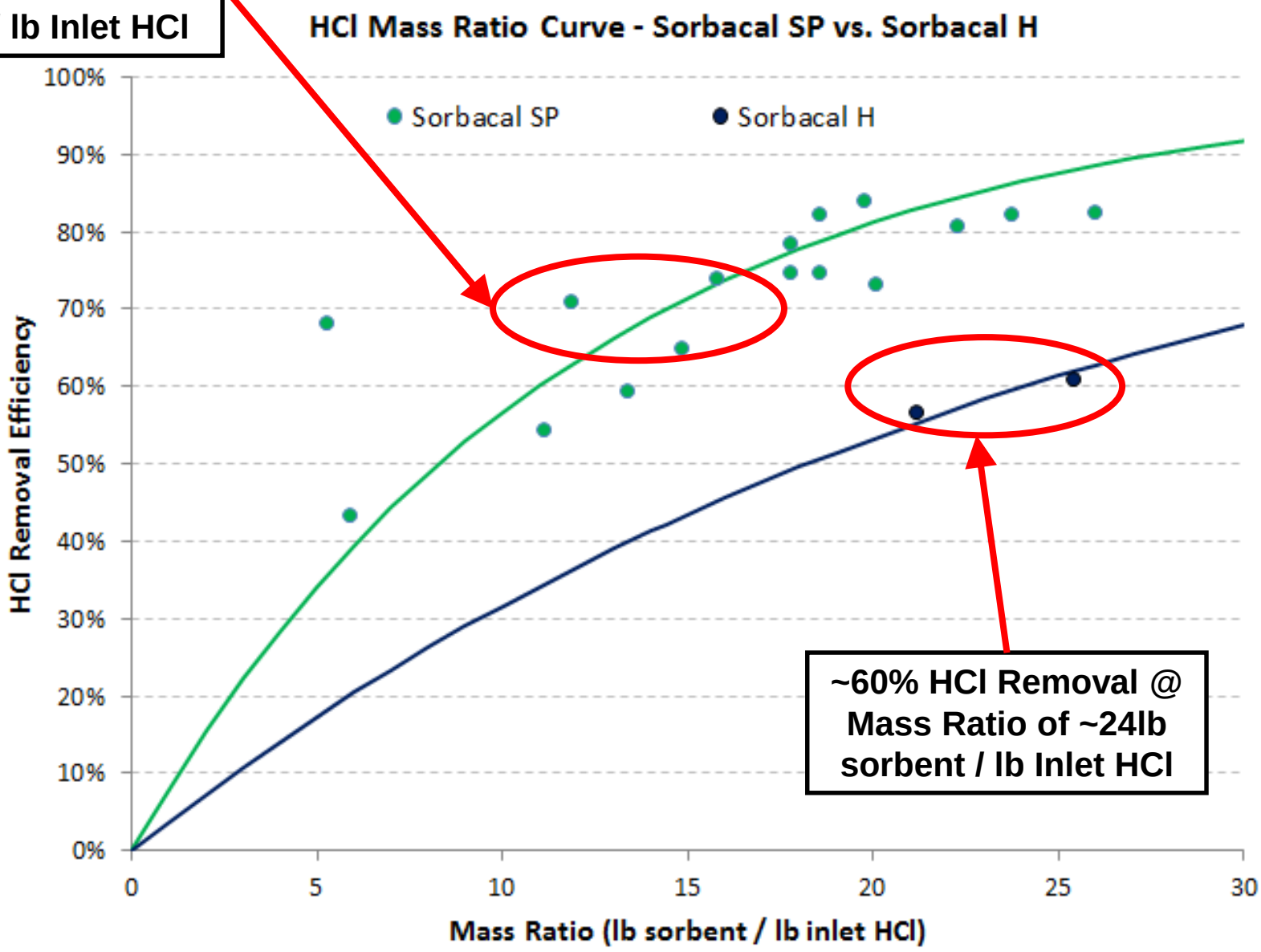
70% HCl Removal @ Mass Ratio of ~14 lb sorbent / lb Inlet HCl



~60% HCl Removal @ Mass Ratio of ~24lb sorbent / lb Inlet HCl

DSI Case Study #2

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- Application → 500 MW Electric Utility
- Goal → Increase Overall SO_2 Reduction to ~70%
- Why → Meet Future SO_2 Regulations
- Low Sulfur Coal → Boiler → AH → DSI → SDA → FF
- Process Conditions,
  - ✓ Flue gas moisture ~20% relative humidity at stack
  - ✓ Baseline concentration ~225-250 ppmv SO_2
  - ✓ Flue gas temperature at DSI location 275-300°F
- DSI → Five (5) Injection Ports @ DSI Location
- Sorbent → Sorbacal® SPS

DSI Case Study #2

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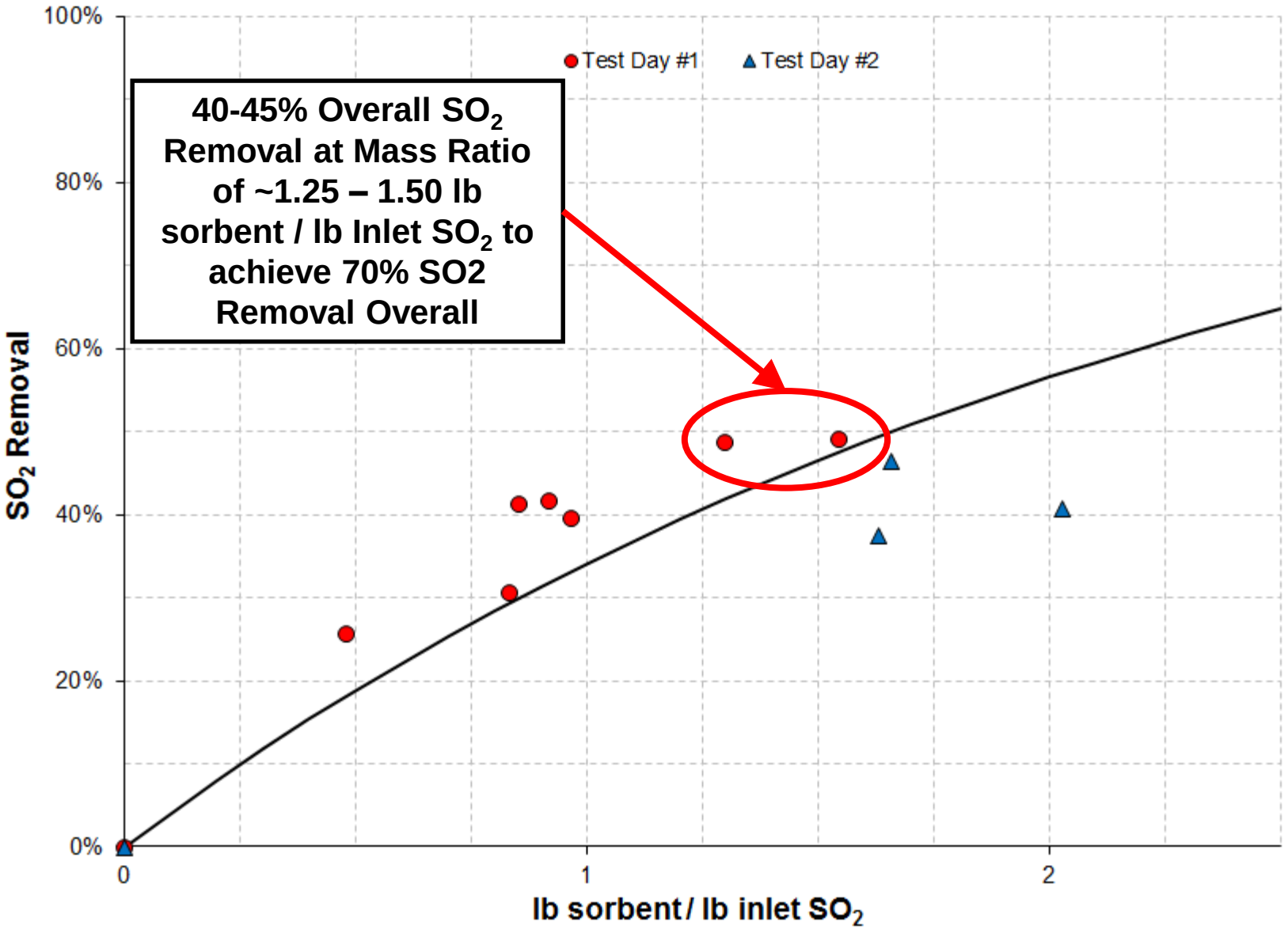

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Lhoist Trial Capabilities

Field Trial Capabilities

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Example Test Data

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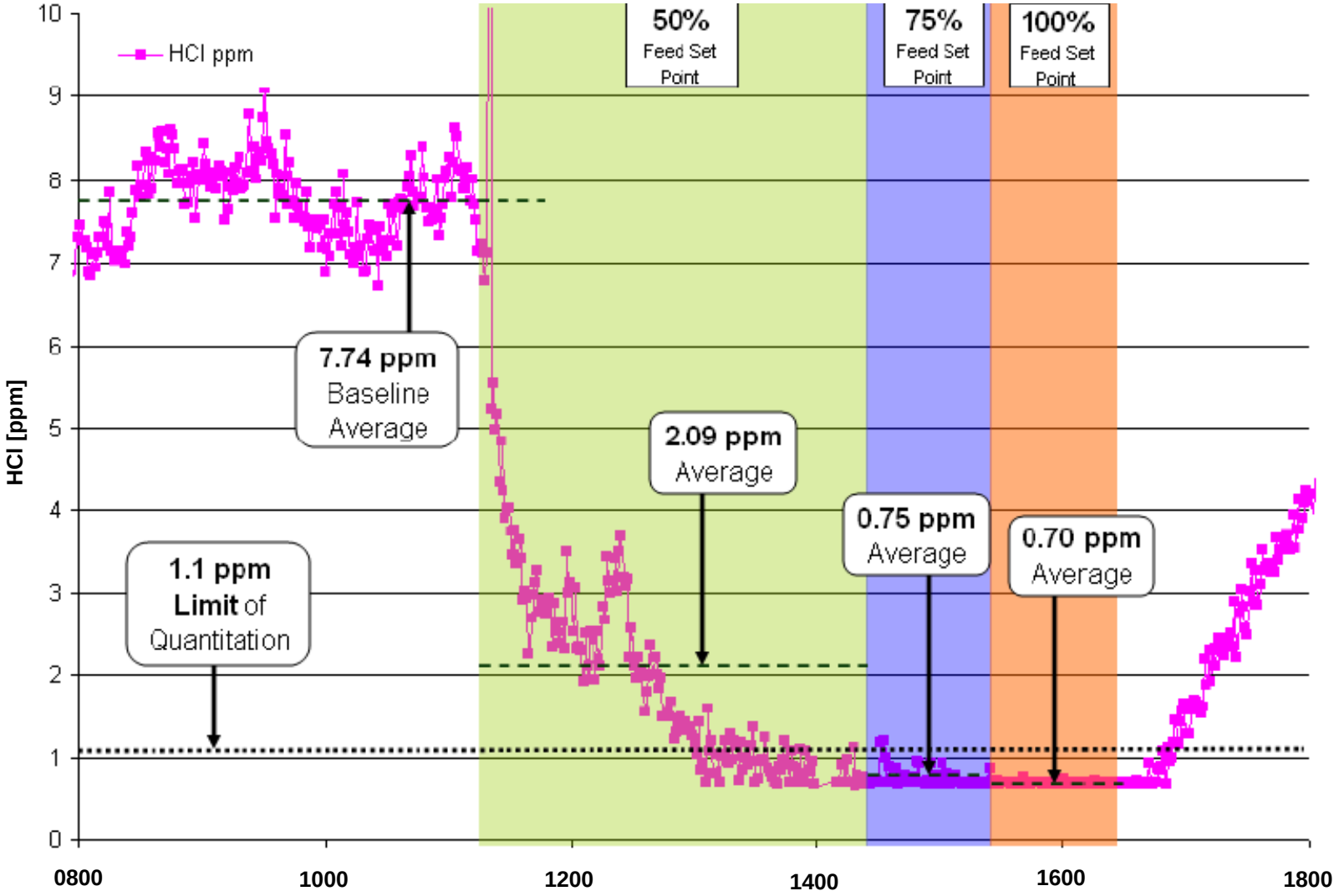

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Conclusions / Discussion

Conclusions

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- Both cases were successful in achieving required removal efficiency using DSI technology with hydrated lime sorbent
- Case 1
  - ✓ DSI using Sorbacal® SP able to achieve high HCl removal efficiencies (> 80%)
- Case 2
  - ✓ DSI using Sorbacal® SPS effective solution for utility scale SO_2 control.

Summary

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- Hydrated Lime sorbents are a viable reagent for acid gas compliance requirements (SO_3, HCl, HF **& SO_2**)
- Sorbent properties also important
  - ✓ Standard lime vs. enhanced hydrated limes
- Path Forward:
  - ✓ Additional SO_2 trials to understand how different parameters impact performance
  - ✓ Improve flue gas to sorbent mixing
  - ✓ Improve understanding of impacts of competitive reactions, flue gas temperature, flue gas moisture, sorbents, etc. impact SO_2 removal

Contact Information

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