



McIlvaine Company Hot Topic Hour

April 9, 2015

Dry Sorbent Injection Options and Issues

**Marty Dillon
Flue Gas Treatment Specialist
Lhoist North America**

Presentation Overview

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



- 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
 - ✓ Over 6,000 employees, 30 nationalities
 - ✓ 88 plants in 25 countries



Ste. Genevieve, MO Plant

Why Dry Sorbent Injection (DSI)?

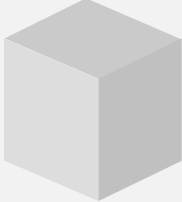

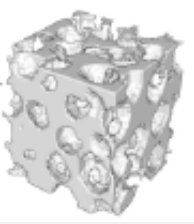
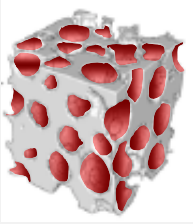




- Simple equipment with a small footprint
- Mature Technology
 - ✓ In use for over 30 years
 - ✓ Injection equipment continues to evolve
 - ✓ Sorbent improvements
- Low CapEx
- ~12 month schedule (award to installation)

Hydrated Lime Sorbents



| 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 |



- 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



DSI Case Studies



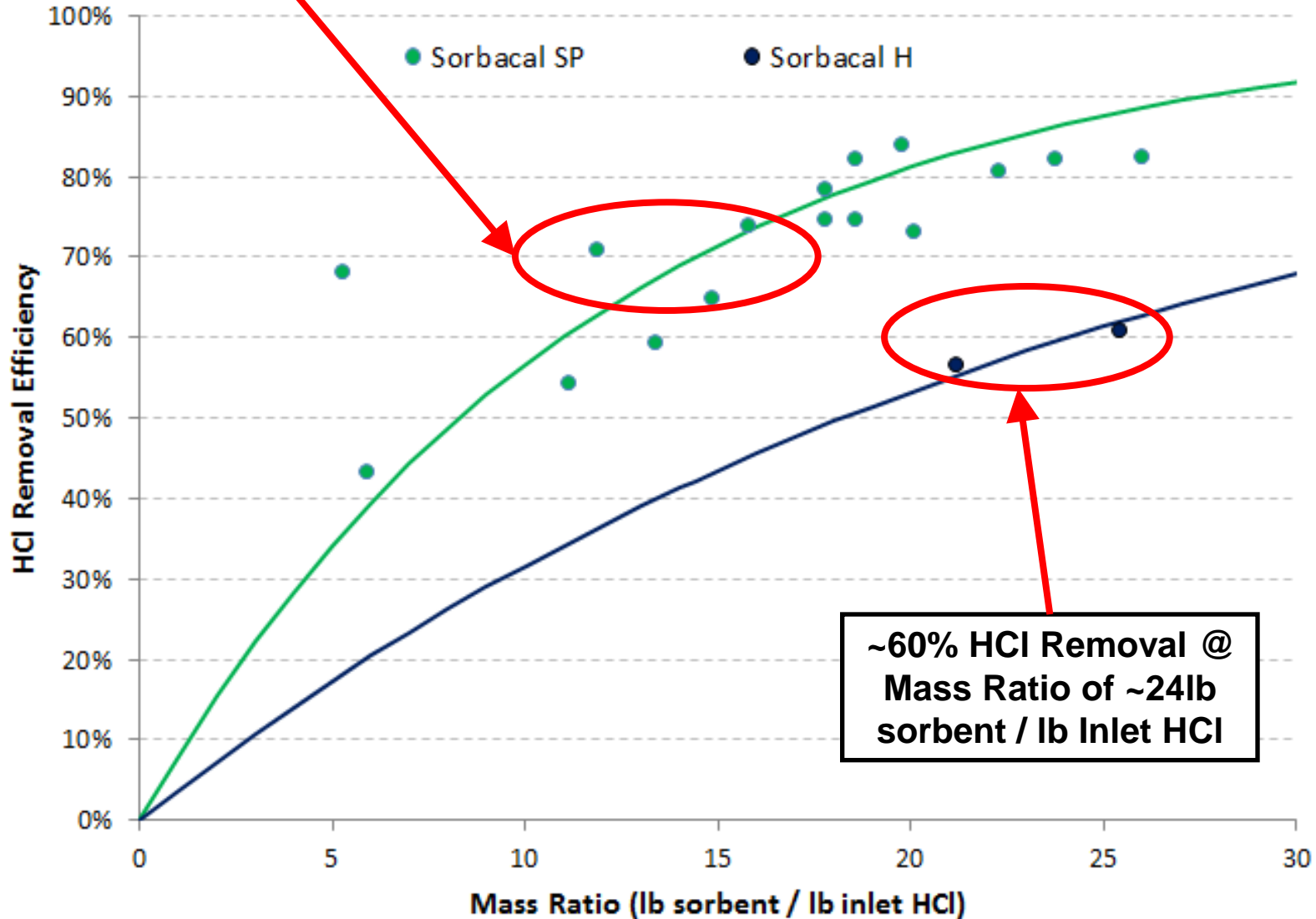
- Application → Industrial Manufacturing Process
- Goal → ~70% HCl Removal Efficiency (baseline 35-40 ppm)
- Why → Meet Future Regulations
- Boiler → AH → DSI → CS-ESP → Stack
- Flue gas temperature at DSI location 300-350°F
- DSI → One (1) Injection Lance @ AH Outlet
- Sorbent → Sorbacal[®] SP



DSI Case Study #1

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

HCl Mass Ratio Curve - Sorbacal SP vs. Sorbacal H



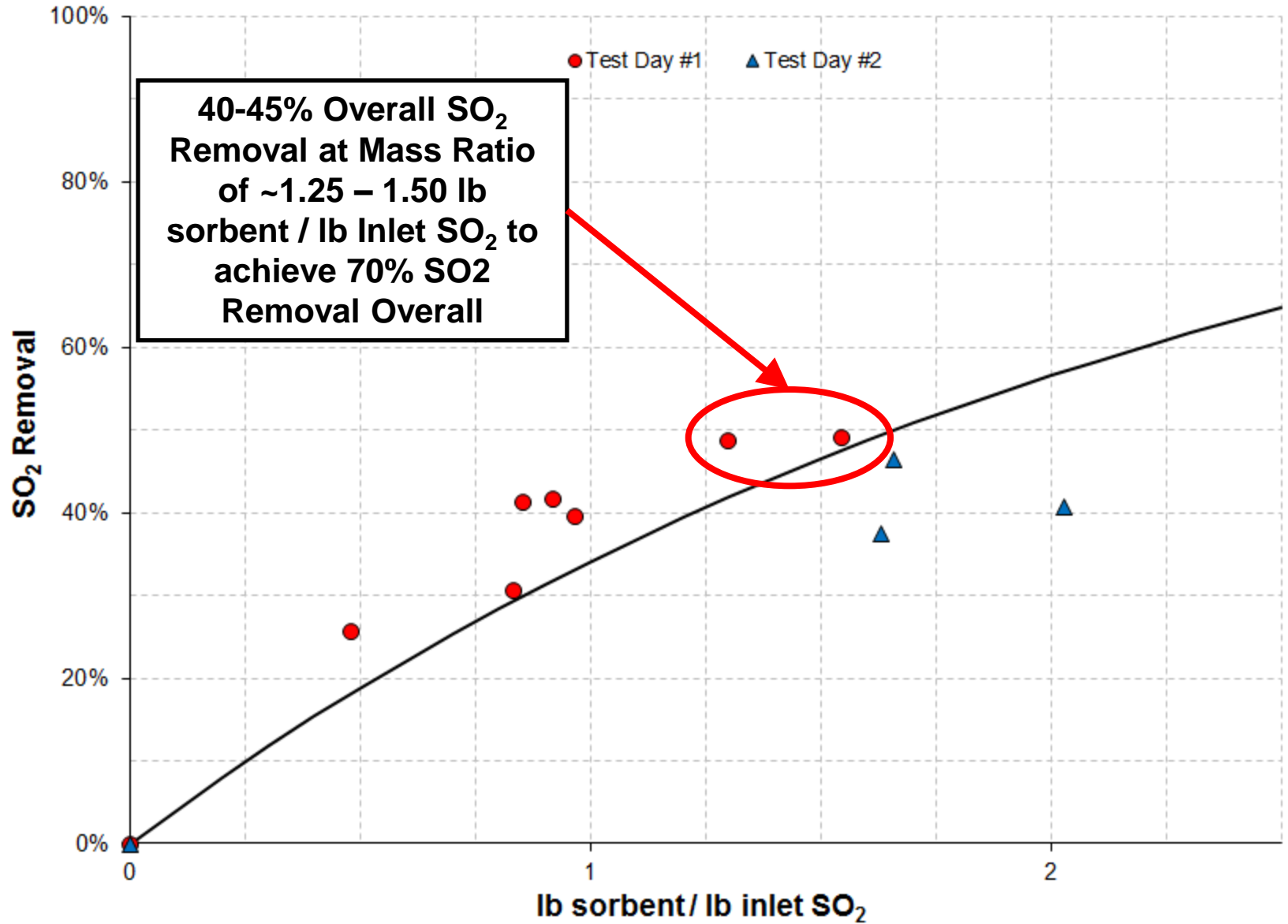
**~60% HCl Removal @
Mass Ratio of ~24lb
sorbent / lb Inlet HCl**



- Application → 500 MW Electric Utility
- Goal → Increase Overall SO₂ Reduction to ~70%
- Why → Meet Future SO₂ Regulations
- Low Sulfur Coal → Boiler → AH → DSI → SDA → FF
- Process Conditions,
 - ✓ Flue gas moisture ~20% relative humidity at stack
 - ✓ Baseline concentration ~225-250 ppmv SO₂
 - ✓ Flue gas temperature at DSI location 275-300°F
- DSI → Five (5) Injection Ports @ DSI Location
- Sorbent → Sorbacal[®] SPS



DSI Case Study #2



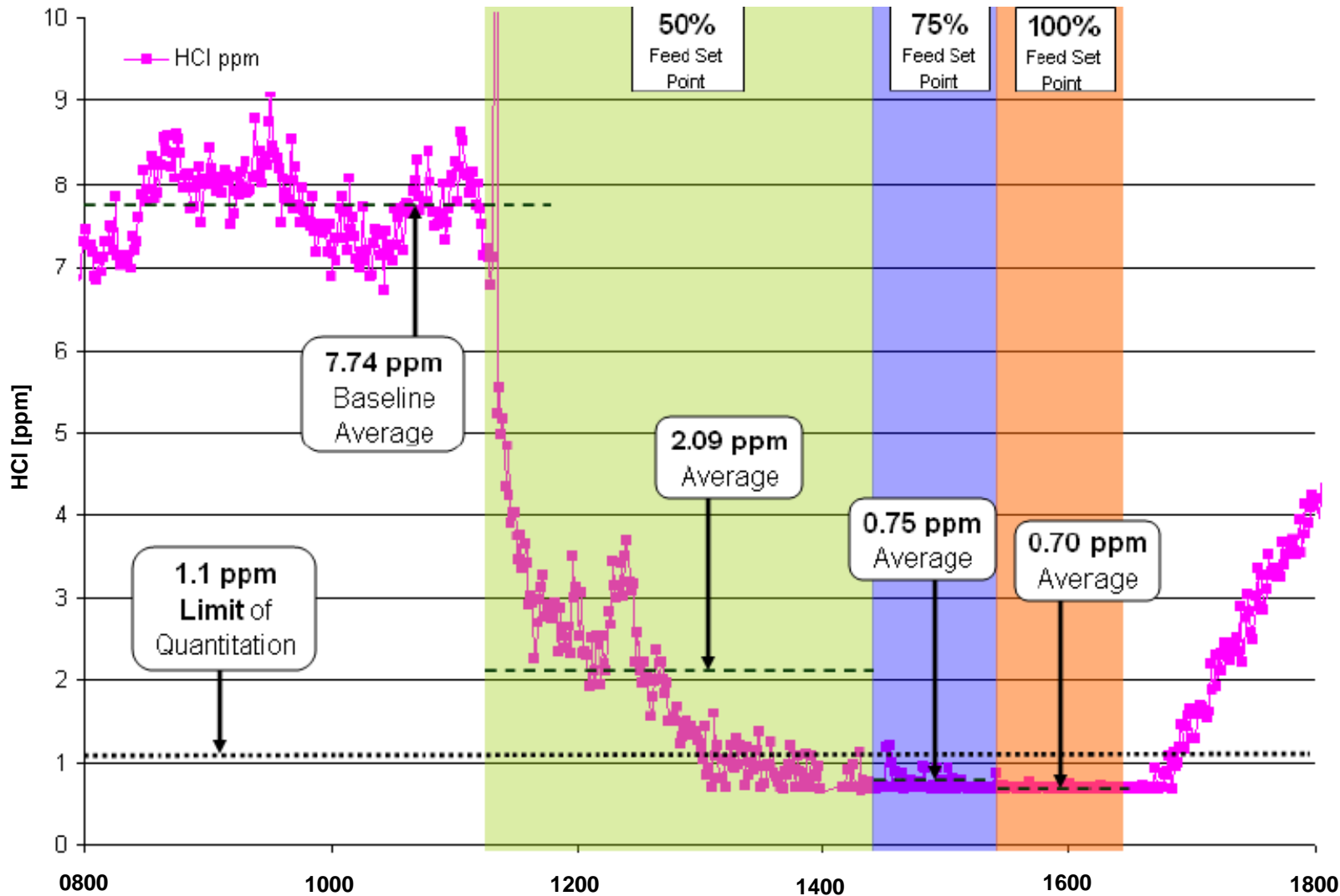
Lhoist Trial Capabilities



Trial Equipment & Residue Analysis



Example Test Data



Conclusions / Discussion



- 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 SO₂ trim control.



- DSI technology using hydrated lime sorbents 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. on SO_2 removal



Please feel free to contact me at:

Martin Dillon, P.E.
Lhoist North America
Flue Gas Treatment (FGT) Specialist
(720) 509-9484
Marty.Dillon@Lhoist.com

