


MACT Update
McIlvaine Hot Topic Hour

May 7, 2015

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How has industry been preparing for MACT success?

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- Performance and Versatility
  - ✓ Improvements in DSI Technology and Process Tools
    - Demonstration and optimization
    - Sorbent injection, distribution and mixing tools coupled with tools such as CFD modeling, reaction models
    - Improved understanding/design around material handling; better system reliability, flue gas constituents (temp, other acids, moisture)
  - ✓ Improvements in Sorbents (calcium based)
    - Standard hydrates
      - "FGT grade" hydrates
    - Enhanced hydrates
      - Small particles
      - High surface area/pore volume
        - Sorbacal® SP/SPS

Why Consider Enhanced Sorbents?

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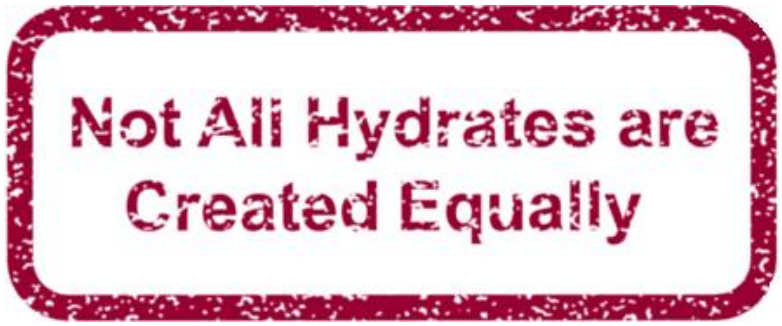
- Performance
  - ✓ Higher removal performance
  - ✓ Less mass loading into the particulate control device
- Operational Cost Savings
  - ✓ Lower Sorbent Consumption
  - ✓ Capital Equipment
  - ✓ Fewer Deliveries
  - ✓ Less waste
- Different sorbents will likely behave differently, testing is important!



Lhoist Sorbent Information

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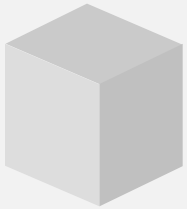
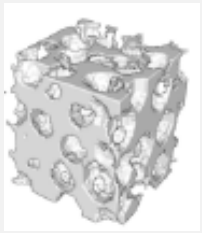
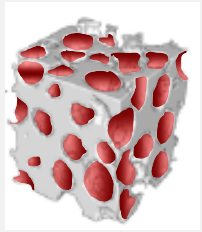
Sorbent	Standard Hydrated Limes	FGT Grade Sorbacal® H	Sorbacal® SP	Sorbacal® SPS
Figure				
Typical Available $Ca(OH)_2$ [%]	92 – 95	93	93	93
Typical Surface Area [m^2/g]	14 – 18	> 20	~40	~40
Typical Pore Volume [cm^3/g]	~0.07	0.08	~0.20	~0.20

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DSI Trial Experience

Trial Equipment & Residue Analysis

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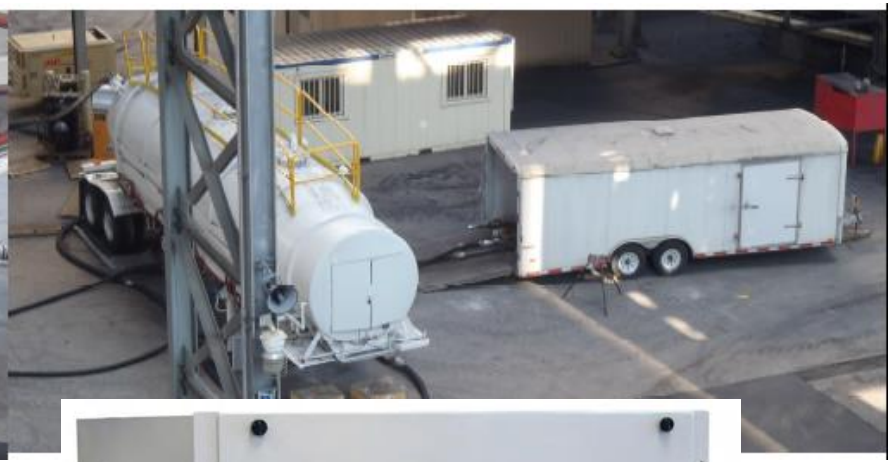

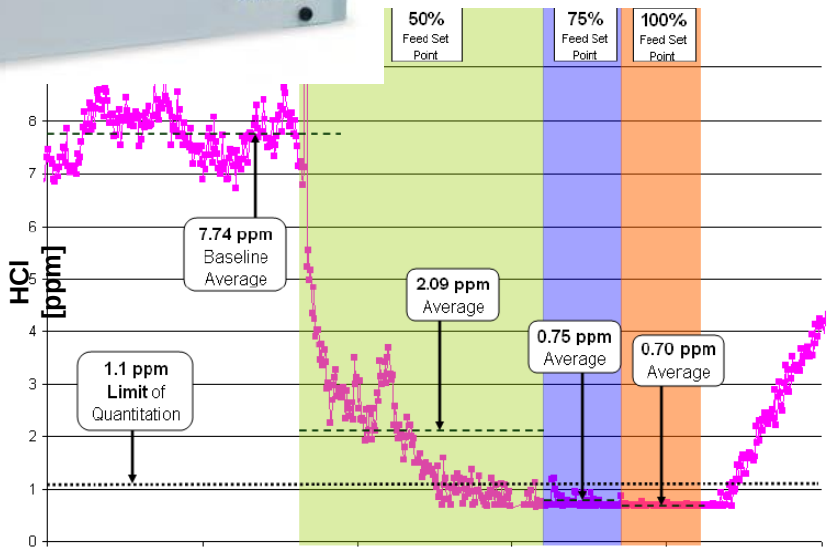

Lhoist Experience

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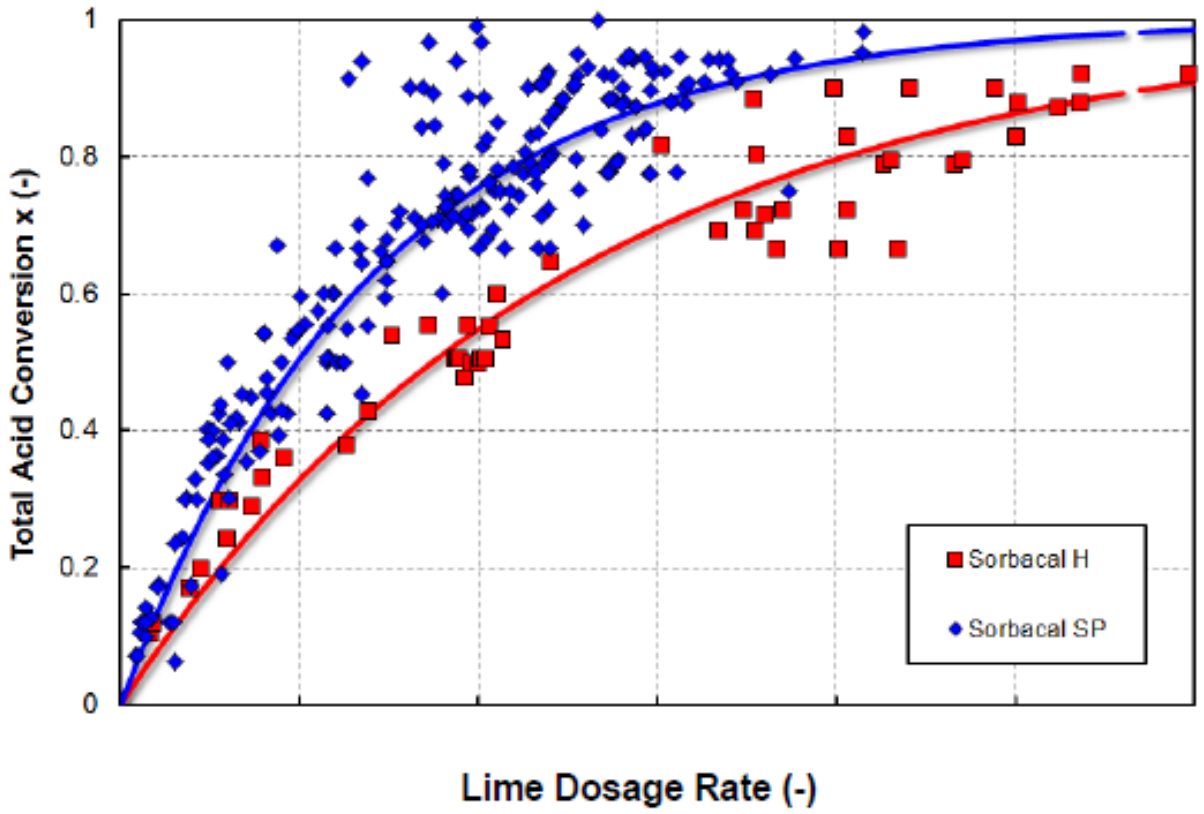
- Commercial Trial Library
  - ✓ Example: SO_2 removal in baghouse applications
  - ✓ Wide range of process conditions, applications
  - ✓ Sorbacal® SP twice as active as Sorbacal H (FGT type)



Case Study Development- TRIALS!

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- LNA has been active in more than 30 trials in the last 18 months
  - ✓ Utility & Industrial
  - ✓ BMACT, MATS, Permit
  - ✓ HCl, SO_3, SO_2, and HF
  - ✓ Trials important to confirm performance
    - Various injection configurations
    - Fuels
    - Sorbents
    - Changes in load/process
    - Site specific equipment needs

					LNA Scope			New or Existing
No.	Driver	Pollutant(s)	Sorbents	Application	Sorbent	FTIRs	DSI	LNA Customer
1	Consent	SO2	SP & SPS	Chemical Manufacture	X			New
2	IB MACT	HCl	H & SP	Pulp & Paper	X			New
3	IB MACT	HCl	H & SP	University	X			New
4	IB MACT	HCl	H	Industrial	X			New
5	Existing	HCl	H & SP	EGU	X	X		Existing
6	MATS	HCl, SO2	SP	EGU	X			New
7	Consent	HCl, SO2	SPS	EGU	X			New
8	IB MACT	HCl	H & SP	Paper	X	X		Existing
9	Permit	SO2	SPS	Steel	X		X	New
10	Permit	SO2	SPS	Steel	X		X	New
11	Consent	SO2	SPS	Chemical Manufacture	X			New
12	MATS	HCl & Hg	SPAC	EGU	X	X	X	New
13	Existing	SO2	SP	EGU	X	X		Existing
14	Permit	HCl, HF, SO2	SPS	Tile	X	X	X	Existing
15	NAAQS	SO2	SP & SPS	University	X			New
16	MATS	SO3	SP	EGU	X			Existing
17		SO2	SPS	Pilot	X	X		-
18	Consent	SO3	SP	EGU	X			New
19	HISWI	HCl	SP	Medical Waste	X			New
20	Permit	HCl, HF, SO2	SPS	Tile	X	X	X	Existing
21	IB MACT	HCl	SP	Glass	X			Existing
22	Permit	SO2	LKD, Std HL & SPS	Lime	X	X	X	-
23	IB MACT	HCl	Std HL & SP	Biomass	X	X	X	New
24	Consent	SO2	SPS	Cement	X		X	New
25	Consent	SO2	H	Cement	X		X	New
26	Permit	SO2 & Hg	SPAC	Paper	X		X	Existing
27	Permit	HCl, HF, SO2	SPS	Tile	X			New
28	Permit	HCl, HF, SO2	SPS	Brick	X			New
29	Permit	HCl	SP	Paper	X			New
30	Permit	SO2	H & SP	University	X			Existing

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DSI Case Studies

Case Study - Summary

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1. Utility MATS multi-pollutant compliance for HCl and Hg using Sorbacal® SPAC
2. Conversion from sodium bicarbonate (SBC) to Sorbacal® SPS

Case Study - Utility Multi-Pollutant

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- Application → 60 MW Coal Fired Power Plant
- Goal → ~50% HCl & ~65% Hg Removal Efficiency
- Why → Meet Hg + HCl MATS Limit
- Boiler → Air Heater →ESP → DSI → FF
- Process Conditions
  - ✓ Flue gas flow rate ~265,000 ACFM
  - ✓ Flue gas moisture ~11-12% by volume
  - ✓ Baseline concentrations ~2 ppmv HCl / 3-3.5 lb/TBtu Hg
  - ✓ Flue gas temperature at DSI location ~315 degrees F
- DSI → One (1) Injection Lance @ DSI Location
- Sorbent → Sorbacal® SP / BPAC Blended Sorbent
- Challenges → Simultaneous HCl + Hg Compliance with Single Sorbent

Case Study - Utility Multi-Pollutant

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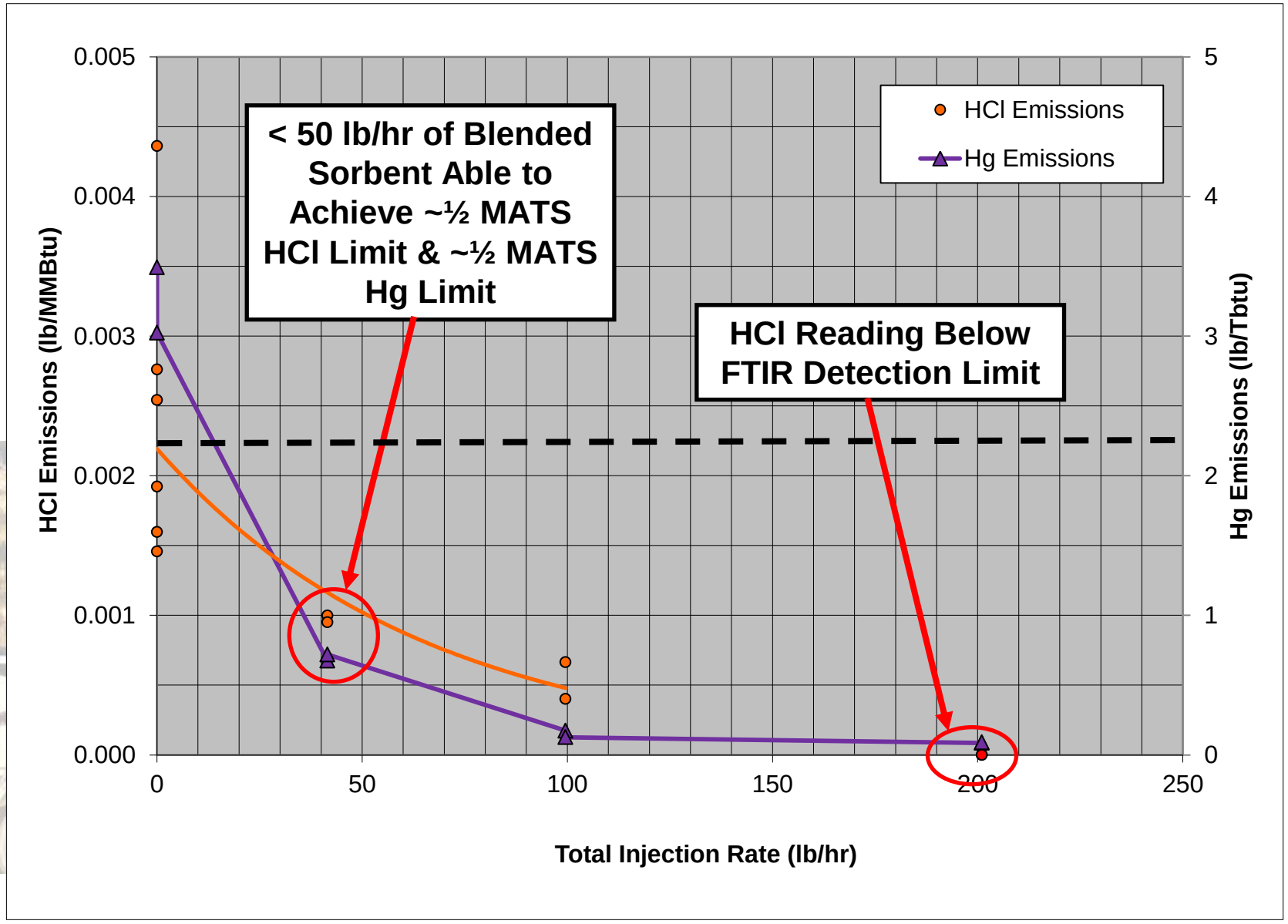

Case Study - Tile

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- Plant used sodium bicarbonate (SBC) and Sorbacal® SP
- SBC used for SO_2 and HCl control but HF over permitted levels; 2nd system was installed to inject Sorbacal® SP for HF

  System #1 Goal → 90% HCl, 85% HF & 60% SO_2 Reduction
  System #2 Goal → 95% HCl & 65% HF Reduction

- Residue could not pass TCLP (selenium and chromium)
  - classified as hazardous waste: $550/ton to landfill
- Sorbacal® SPS able to achieve SO_2, HCl and HF limits and passed TCLP test; reduced landfill costs by $480/ton
- Continue to work with customer to optimize Sorbacal® SPS performance for all acid gases
  - ✓ Humidification, mixing, injection lances

Case Study - Tile

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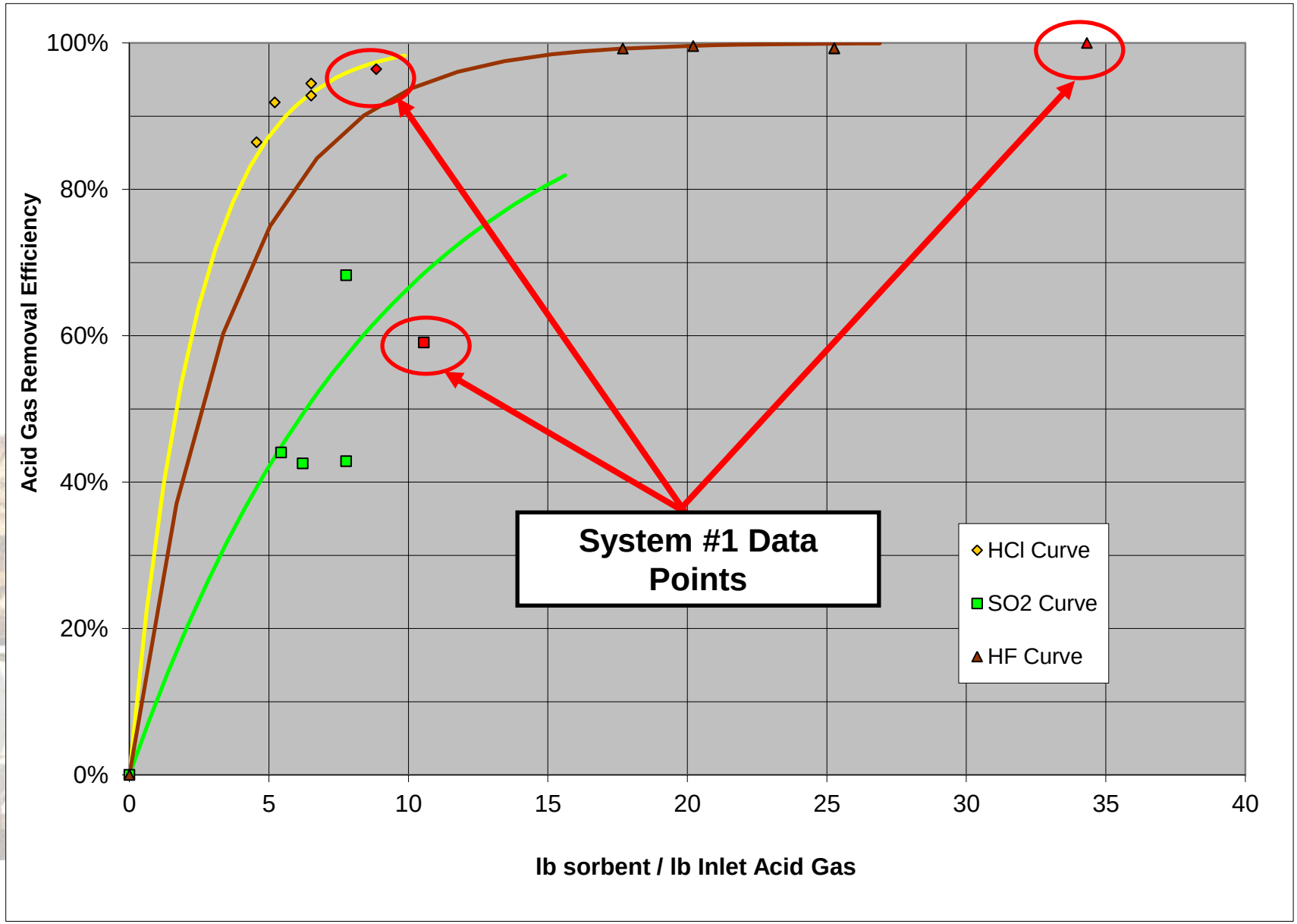
- Kiln → Heat Exchanger → DSI → FF
- Process Conditions
  - ✓ Flue gas flow rate ~25,000 ACFM (system #1) & ~16,000 ACFM (system #2)
  - ✓ Flue gas moisture ~10-11% by volume
  - ✓ Baseline concentrations ~50 ppmv HCl / ~25 ppmv SO_2 / ~25 ppmv HF
  - ✓ Flue gas temperature at DSI location 300-350 degrees F
- DSI → One (1) Injection Port @ DSI Location
- Sorbent → Sorbacal® SPS
- Challenges → Simultaneous Multi-Acid Gas Control

Case Study - Tile



Summary

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- DSI is mature and viable control technology
- Sorbent properties are important
  - ✓ Standard limes vs. Enhanced hydrated limes
- Calcium DSI sorbents are capable at achieving high removals for a variety of pollutants
  - ✓ SO_3, HCl, and HF
  - ✓ SO_2
- Case studies and prior trial experience help predict performance and compliance options
  - ✓ Testing is the most reliable way to verify.

Contact Information

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Please feel free to contact me at:

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