MACT Compliance Options
Dry Sorbent Injection Options for MACT

- DSI with FGT grade hydrated lime has proven effective at capturing SO$_2$ & HCl in both conventional boiler systems & cement plants.
- In challenging applications a High Reactivity or fast reacting hydrated lime may be required or desired.
# Hydrated Lime Types and Expectations

<table>
<thead>
<tr>
<th>Hydrate</th>
<th>Target Mkt</th>
<th>Description</th>
<th>Annual tonnage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td>• WWT</td>
<td>• Low surface area</td>
<td>1.2 X</td>
</tr>
<tr>
<td></td>
<td>• Construction</td>
<td>• Low purity</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>• Water treatment</td>
<td>• Moderate surface area</td>
<td>1.1 X</td>
</tr>
<tr>
<td></td>
<td>• Chemical</td>
<td>• High purity</td>
<td></td>
</tr>
<tr>
<td>Flue Gas</td>
<td>• Dry sorbent injection</td>
<td>• High purity</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>• Dry scrubbers</td>
<td>• High (&gt;20) surface area</td>
<td></td>
</tr>
<tr>
<td>High React</td>
<td>• Next generation for DSI and CDS</td>
<td>• High purity and surface area</td>
<td>0.7 X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fast reactivity</td>
<td></td>
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</tbody>
</table>
HCl Reduction – CFB w/ Bag House

- FGT - HCl lbs/MM Btu
- HR - HCl lbs/MM Btu

MATS Limit

Feed Rate lbs/hr

HCl lbs/MM Btu
HCl Mitigation – Industrial Boiler

- 135,000 lbs/hr stoker boiler; KY washed coal
- Fed ~ 40 ft before the bag house

HCl control to below MACT levels with High Reactivity Hydrate
Addition of a small amount of Hydrate allowed substantially more \( \text{SO}_2 \) reduction without the addition of more stone or fuel.
DSI In Cement Manufacturing
Cement Plant for HCl

Ca based sorbent (hydrate) outperformed Na based sorbent (Bicarb) on HCl removal.
Typical Scrubber System in Cement

- Hydrated lime is mixed on site into a slurry
- Slurry fed through nozzles into the SO$_2$ scrubber
- In many systems the nozzles eroded &/or plugged - causing high maintenance costs.
- In the Midwest liquid systems froze, making compliance difficult & inconsistent (especially during the “Polar Vortex” in early 2014)

Could we get the same removal rates using **Dry** Sorbent Injection – and eliminate the challenges with handling a liquid slurry??
Evaluation of Dry Sorbent Injection

- MLC supplied a temporary DSI feed system to a large US cement manufacture.
- 2 feed locations were tested: the bucket elevator (before scrubber tower) & the ID fan (after the scrubber tower).
- Bucket Elevator location was more effective on SO\textsubscript{2} removal, ID Fan location was more effective on HCl.
Results: $\text{SO}_2$ Removal at Bucket Elevator

![Graph showing SO2 Baseline, Hydrate Feed Start Up, 45% Reduction, Hydrate Feed Dose #1, 60% Reduction, and Hydrate Feed Dose #2.]
**Results: HCl Removal at ID Fan**

- **HCl Baseline**
- **Hydrate Feed Dose #1**
- **Hydrate Feed Dose #2**
- **79% Reduction**
- **78% Reduction**

**Graph Details:**
- **y-axis:** lbs/hr hydrate
- **x-axis:** ppm HCl
- **Timeline:** 13:28:59 to 15:32:02

**Key Points:**
- **Hydrate Feed Start Up**
- **Effectiveness:** Reductions noted after dosing events.
Results: FGT vs High Reactivity

At a given feedrate, the High Reactivity Hydrate achieved more SO$_2$ reduction than the FGT grade. This allows the plant to achieve compliance with lower targets, or use less reagent to accomplish the same removal.
Conclusions:

• DSI with hydrated lime can allow SO2 & HCl reduction for both industrial boilers and cement manufacturers.

• Depending on the application and the facilities goals, a High Reactivity Hydrate may allow better removal or lower costs.

• In cement scrubber towers, DSI gave comparable removal rates to feeding a liquid slurry of hydrated lime directly to the scrubber tower.
Questions

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