The Benefits of High Reactivity Hydrated Lime for Air Pollution Control

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Improve Hydrated Lime Performance

Allow higher $\text{SO}_3 / \text{HCl}$ removal rates
- Meet tighter sulfuric acid mist requirements
- Meet HCl MATS for Utility and Industrial boilers

Better in-flight capture of $\text{SO}_3 / \text{HCl}$
- Attain benefits of hot side injection of hydrate
  - APH cleanliness
  - Residence time improvement
- Help meet Hg MATS by removing more $\text{SO}_3$ in-flight

High Reactivity Hydrated Lime
What is High Reactivity Hydrated Lime?

New product from Mississippi Lime aimed at Dry Sorbent Injection industry for $\text{SO}_3$ 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

- **HRH**
- **DSI-GradeHydrate**

[Graph showing Sulfuric acid mist (lbs/MM Btu) vs. lbs/hr Hydrate for different SAM levels]
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**

<table>
<thead>
<tr>
<th>Coal Type</th>
<th>Particulate Collection</th>
<th>HCl Reduction</th>
<th>Hydrate: Total Acid NSR</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western/PRB</td>
<td>BH</td>
<td>&gt;95%</td>
<td>~ 0.80</td>
<td>Easily achieved MATS</td>
</tr>
<tr>
<td>App. Coal</td>
<td>BH</td>
<td>&gt;99%</td>
<td>3.0 – 4.0</td>
<td>Easily met MATS&lt;br&gt;Also 40-50% SO₂ reduction</td>
</tr>
<tr>
<td>Western/PRB</td>
<td>ESP</td>
<td>&gt;80%</td>
<td>~ 0.50</td>
<td>Easily achieved MATS</td>
</tr>
<tr>
<td>Waste</td>
<td>BH</td>
<td>&gt;97%</td>
<td>0.7 – 1.2</td>
<td>MATS achieved</td>
</tr>
<tr>
<td>High Cl</td>
<td>ESP</td>
<td>90%</td>
<td>~ 0.7</td>
<td>MATS achieved&lt;br&gt;Very marginal ESP with &lt; 1.5 sec residence time</td>
</tr>
<tr>
<td>Western/PRB</td>
<td>Marg ESP</td>
<td>&gt;95%</td>
<td>~ 0.80</td>
<td>Challenging system, also targeting Hg reduction with AS</td>
</tr>
</tbody>
</table>
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 – SO₃ Removal - HR vs. FGT**

- **FGT hydrate** gives good removal.
- **HR Hydrate** offers better utilization or high level removal capabilities.

Additional notes:
- Full scale application:
  - High Load conditions

Graph highlights:
- **HR Hydrate** outperforms **FGT** in SO₃ removal.
- ~30% less hydrate with **HR** compared to **FGT**.
Meeting 2015 Utility MATS Limits for HCl

(smaller unit < 300 MW, IBC)

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

MATS Limit

Feed Rate lbs/hr

HCl lbs/MM Btu

0.0000
0.0005
0.0010
0.0015
0.0020
0.0025
0 200 400 600 800 1,000 1,200 1,400 1,600 1,800

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

MATS Limit
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 $\text{SO}_3$ emissions
  – More efficient $\text{SO}_3$ 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

SO$_3$ ppm at APH inlet
Hydrate Injected at SCR Outlet

HRH offers significantly improved in-flight capture of SO$_3$ in short residence time
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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