Proven Solutions to Traditional Problems:

Comparing Lime Slaking, Traditional Low Density Lime, and High Density Lime Systems

Nathan Teeters
MERRICK CONSECO
Discussion Topics

- Introduction to Lime types and Slurry preparation
- Design considerations for storing, feeding, and flow promotion of dry lime
- Discussion on the type of equipment used in each type of system
- The problems of Lime systems
Lime Types

- **Calcium Oxide (CaO)**
  - AKA Pebble Lime or Quicklime
  - Bulk Density 55-60 lbs/ft³
  - Must be slaked: \( \text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 \)
  - Must have grit removed

- **Calcium Hydroxide (Ca(OH)_2)**
  - AKA Slaked Lime or Hydrated Lime
  - Bulk Density 25-35 lbs/ft³
Slurry Preparation

- **Calcium Oxide**
  - Slaking
  - Grit Removal
  - Holding/Aging
  - Recirculation

- **Calcium Hydroxide**
  - Low Density Hydrated Lime Slurry
    - Recirculation
  - High Density Hydrated Lime Slurry
    - 30-40% Concentration by weight
Slurry Preparation
**Design Considerations**

- **Storage Silo**
  - Proper Filling
  - Dust Collection
  - Promote Mass Flow

- **Lime Feeding Equipment**
  - Prevent material segregation
  - Promote consistent flow
  - Do not use compressed air
Types of Equipment

- Calcium Oxide
  - Slaker
  - Grit Removal
  - Holding/Aging Tank
  - Recirculation Pumps
  - Control Valves

- Low Density Hydrated Lime System
  - Mixing/Batch Tank
  - Recirculation Pumps
  - Control Valves
Types of Equipment

- High Density Hydrated Lime System
  - Mixing/Batch Tank
  - Metering Pumps
## Problems with Lime Systems: Maintenance

<table>
<thead>
<tr>
<th>Slaking System</th>
<th>Low Density Lime System</th>
<th>High Density Lime System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scaling of the pipe lines, troughs, slakers, etc.</td>
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<td>N/A HDLS Systems do not scale</td>
</tr>
<tr>
<td>Acid cleaning</td>
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<tr>
<td>Manual cleaning, pigging, etc.</td>
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<td>N/A HDLS Systems do not scale</td>
</tr>
<tr>
<td>Replacement of pipes &amp; valves due to scaling</td>
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<td>N/A HDLS Systems do not scale</td>
</tr>
<tr>
<td>Cleaning the slaker &amp; grit remover</td>
<td>N/A LDLS Systems do not require grit removal</td>
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</tr>
<tr>
<td>Removal/Disposal of grit</td>
<td>N/A LDLS Systems do not have grit; only a very minimal amount of impurities in the hydrate, maybe a few lbs/month</td>
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## Problems with Lime Systems: Housekeeping

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<tr>
<td>Slaking systems are never dust tight</td>
<td>LDLS Systems can be made dust &amp; water tight</td>
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</tr>
<tr>
<td>Dust &amp; Vapor remover must be cleaned regularly</td>
<td>Breather/filter bag &amp; nozzle cleaned once per week: 5 minutes</td>
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</tr>
<tr>
<td>Slaking equipment must be cleaned routinely. Material is usually not re-usable</td>
<td>Slurry batch tanks must be cleaned routinely. Material is usually not re-usable</td>
<td>Slurry batch tanks require a 5 minute wash down once a week but the material is kept inside the slurry tank; a very clean procedure</td>
</tr>
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Problems with Lime Systems: Pumping System

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<tr>
<td>Slurry must be pumped at a minimum of 2.5 ft/sec</td>
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<td>30 to 40% by weight slurries do not settle; pipeline velocity is a moot point</td>
</tr>
<tr>
<td>Recirculation loop required</td>
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<td>HDLS slurries do not settle and can be pumped to the use points, stopped and restarted without flushing of the pipelines</td>
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<td>Pumps for dilute slurries must be sized to pump the amount of slurry plus the excess required for recirculation; requires automatic dosing valve at point of application</td>
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<td>Pumps for HDLs are always smaller as the amount of slurry required can be up to 7 times less due to the high density</td>
</tr>
</tbody>
</table>
Thank you for your time, we hope that this presentation has been helpful.

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