Worldwide Pollution Control Association

WPCA-Duke Energy FGD Wastewater Treatment Seminar

March 7, 2013

Visit our website at www.wpca.info

Conversion from Slaked Quicklime to High Density Hydrated Lime Slurry

MISSISSIPPI® LIME

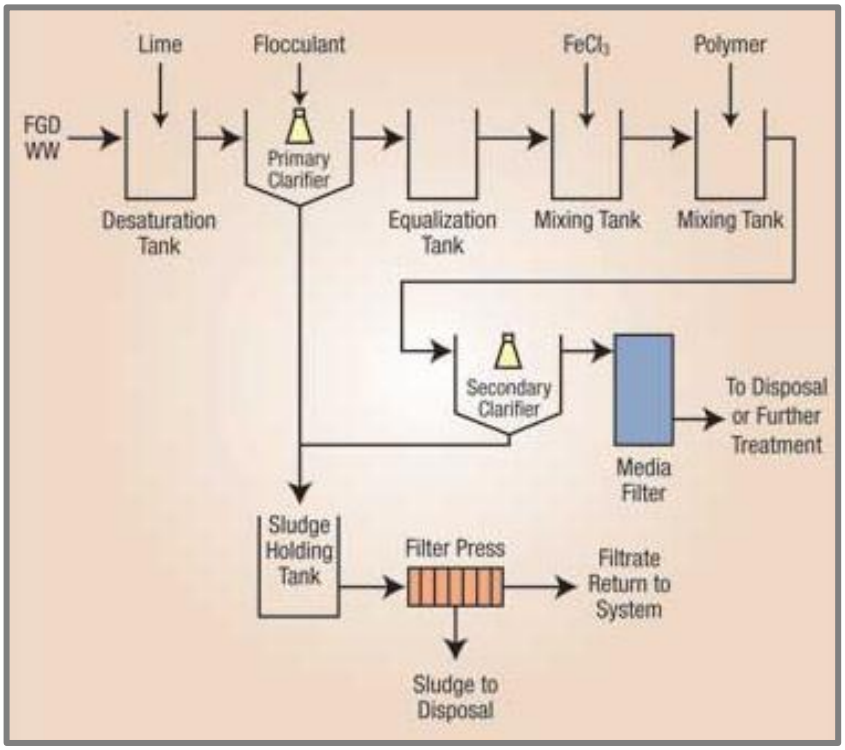
Discovering what's possible with calcium

Curt Biehn
WPCA – Duke WWT
March 7, 2013

FGD Wastewater Treatment

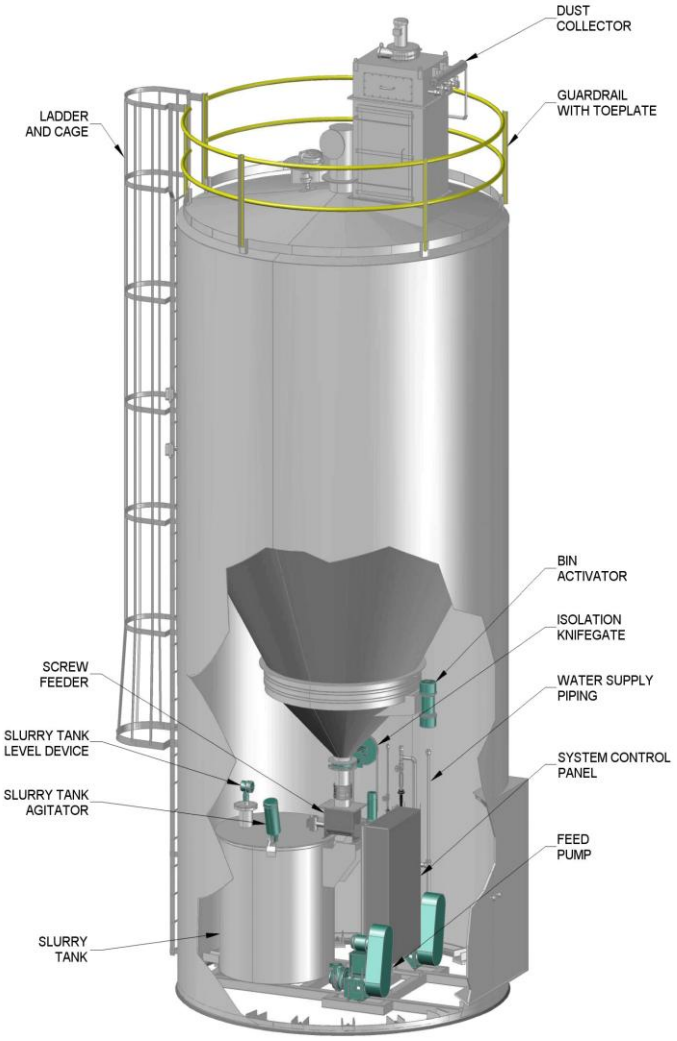
- First step in FGD WW is treatment with an alkali solution
  - Generally an aqueous solution of $Ca(OH)_2$
- Hydrated lime precipitates sulfate ions as gypsum
- Excess hydrate also serves to precipitate some metals as hydroxides

- Two pathways to generate hydrated lime solution
  - Slaking quicklime (CaO)
  - High Density hydrated lime system



Buecker & Clarke, Power Engineering, *Sep 1, 2011*

Slaking vs. High Density Systems



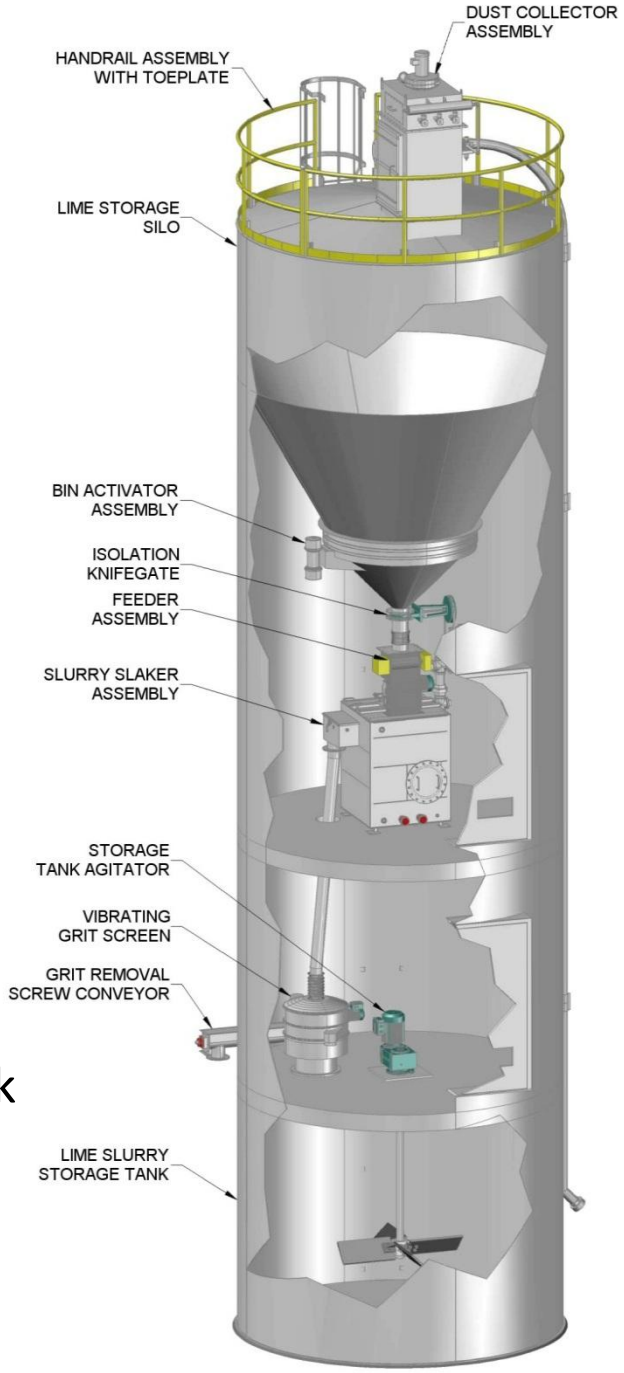
TYPICAL HYDRATED LIME SYSTEM

Slaker (right)

- Quicklime storage
- Feeder
- Slaker assembly
- Grit removal
- Slurry storage tank

High Density System (left)

- Hydrated lime storage
- Feeder
- Slurry mix & storage tank



TYPICAL QUICKLIME SLAKING SYSTEM

Diagrams courtesy of Chemco systems

Slaking Problems – Safety & Operational

Safety

- Reaction of Lime and Water is highly exothermic
  - There have been instances where life threatening injuries have been sustained due to slaker malfunctions

Operational

- Max benefit achieved at slaking temperatures *consistently* > 190˚F
  - Lower temperatures: more grit, larger lime particles and less reactive lime
  - Raw material and process variation make temperature control challenging
- Low solids slurry leads to scale formation
- Water quality is important
  - Low sulfates

Slaking Problems – Process Control

- Grit removal & disposal
  - Some quicklime grades contain significant grit
  - High grit -> more washing of slakers -> excess thinning of slurry
- Non-uniformity of chemical concentration in slaked lime slurry
  - Thin, low % solids slurry
    - Poor suspension
    - Extreme mixing required to achieve homogeneous mixture
  - Slaker upsets
    - Variability in the solids content of finished slurry
- Clarifier sludge due to non-uniform reaction

Why Use High Density Hydrate Slurries?

Calcium hydroxide slurries above 30% (by weight) should not settle

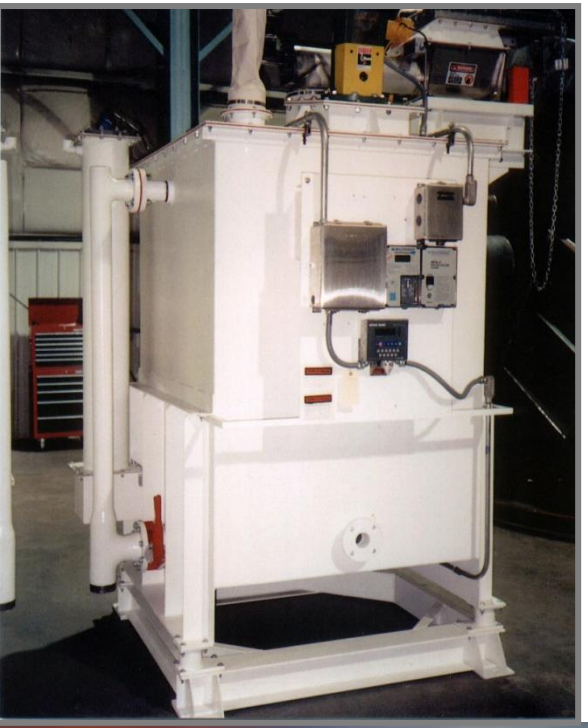
Benefits:

1. Up to 50:1 turn down ratios using the same size piping systems and controls
2. Low potential for line pluggage
3. Ageing of high density slurries increases surface area due to de-agglomeration.
4. Less water required for make-up of slurries.
5. Lack of scaling offers the opportunity to use inline mass flow/density meters to monitor the slurry flow streams.

High Density Hydrate Slurry - Operational Advantages

- Reduced maintenance costs
  - High density hydrate lime systems have reported up to 90% reduction in maintenance costs*
- Reduced equipment expense

Photos courtesy of Merrick



- Less manpower requirements
- Scaling
  - High density slurry contains precipitation within itself and <u>will not scale</u> on tank, mixer or in pipes
    - No chemical de-scaling or mechanical pigging of lines will be necessary

* Getting Hydrated – Ron Plank, Merrick ConSeCo, January 2011

Summary

High Density Hydrated Lime Systems:

- Provide a safe and convenient alternative to slaked lime
- Eliminate grit removal and waste disposal costs
- Provide cost benefits
  - Equipment, Maintenance, and Labor
- Eliminate scaling problems
- Provide greatly improved process control
  - Uniform, consistent flow of chemical into the WWT process
  - Requires substantially less mixing while maintaining a homogeneous mixture throughout the storage tank

Questions

Curt Biehn
Manager, Marketing and Technical Services
crbiehn@mississippilime.com

Mississippi Lime Company
3870 S. Lindbergh Blvd.
Suite 200
St. Louis, MO 63127
www.mississippilime.com

MISSISSIPPI LIME™

Discovering what's possible with calcium™