

Eliminating Large Particle Carryover – Improving Milk of Lime Reactivity

INTRODUCTION

VERTIMILL® slakers have been utilized as a premium lime slaker that eliminates the grit handling requirements and also produces a superior quality, more reactive, lime slurry.

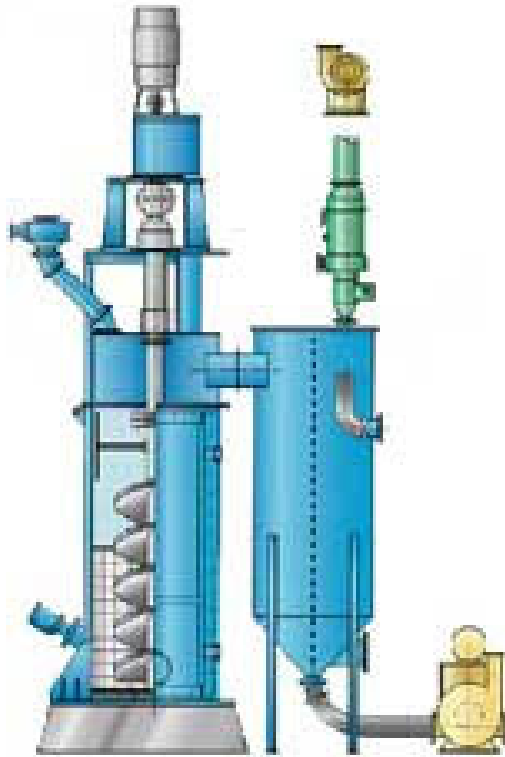
A typical VERTIMILL® slaker, as supplied from the factory, may allow short-circuiting of the fresh feed, resulting in large particle carry-over downstream. A small, but meaningful, percentage of the fresh feed will pass directly from the top of the slaking/grinding chamber directly into the Separating Chamber before effective slaking or grinding of the grit has occurred.

ISSUES

The VERTIMILL® is a stirred vertical regrind mill partially filled with 1” steel grinding media. Quicklime & water are fed into the top of the VERTIMILL® and the slaking reaction begins. At the top of the slaking chamber there are two mixer/scrapper arms to promote mixing; at the bottom of the slaking chamber the grit and large quicklime particles are intensely agitated and attrition grinding further reduces particle size. Lime slurry overflows into the Separating Chamber and a large percentage is recycled back into the VERTIMILL® for further processing. Large particles that pass directly from the top of the VERTIMILL® into the Separating Chamber have a chance to carry through with the viscous lime slurry into the downstream process.

In addition due to the severe short circuiting and large particle carryover, the design throughput capacity could not be maintained. In one case only 62% of design could be reached and even at that reduced capacity lower quality lime slurry resulted.

DESIGN OF OEM SUPPLIED VERTIMILL®



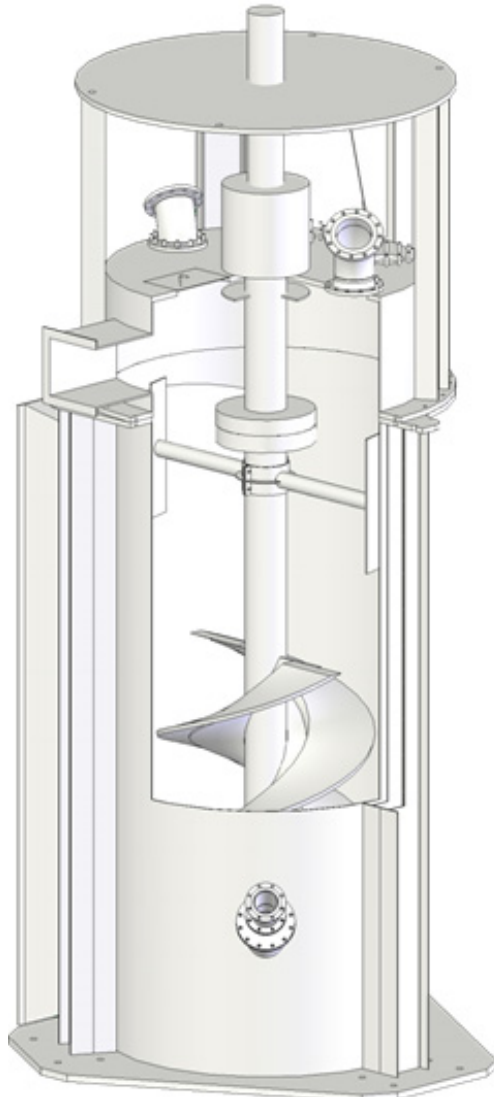
With the lime / water feed chute being so close to and at the same level as the rectangular overflow chute, it was very easy for lime to bypass the VERTIMILL® completely. As the Separating Chamber inlet inspection hatch was opened, un-slaked quicklime splashed through the opening. Some lime slurry even overshot the Separating Chamber dividing weir and went straight to the product pump tank. A poor quality, low reactivity lime slurry resulted.

Issues summarized as supplied by OEM:

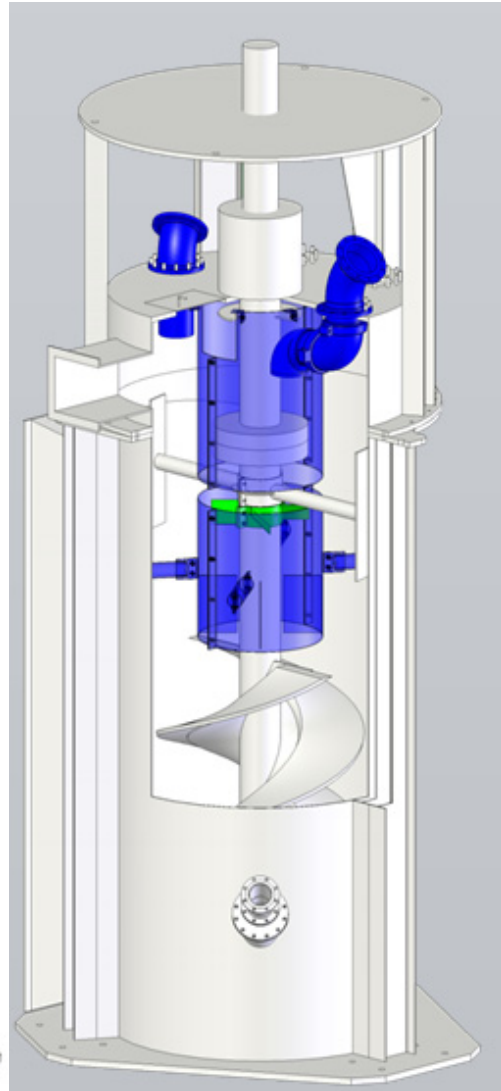
- Large particle carry-over
- Severe surface splashing
- Settling of large particles downstream in tanks and pipes causing plugs and process upsets
- Loss of throughput capacity
- Lower quality lime slurry produced
- Higher lime consumption resulted

T-001 – TECHNICAL BULLETIN
Lime Slaking VERTIMILL® Improvements

OEM Supplied VERTIMILL®



STT Improved VERTIMILL®



DESIGN OF STT IMPROVED VERTIMILL®

From observation and data collected at operating sites key solutions were developed. Observations included severe splashing and surging at the surface, accumulations of large particles, settling out or sanding out downstream, excessive maintenance and housekeeping requirements.

The areas of engineered improvement for the VERTIMILL® are highlighted by the blue additions and include:

- Piping and a split 2 tiered center feed well to direct water and quicklime mixture to the grinding zone at bottom of VERTIMILL®.
- Down pumping impeller to promote flow downwards.
- Vortex breakers.
- Ball charge addition extension chute.
- Elimination of upper scraper arm.

CONCLUSION

The first full scale Feed Retrofit Kit was installed on a VTM-400-LS in July, 2014.

It has exceeded performance expectations. In comparing the pre and post installation performance, the following conclusions can be drawn.

After 8 months of operations:

- Elimination of large particle carry-over.
- 16% reduction in lime consumption per ton of SO₂ removed.
- Higher scrubbing efficiency was achieved (less SO₂ discharged to the environment).
- Maintenance intervals and tank cleanout frequencies have been improved due to reduced large particle carry-over.

This is a 'Patent Pending' improvement suitable for all sizes of Lime Slaking VERTIMILL® in lime slaking duty. This improvement is ready for implementation.

This improvement may also be applicable to VERTIMILL® designated WB, as used in limestone grinding applications, but this would require further testing. These WB VERTIMILL® have a crude underflow weir as part of their design already.

T-001 – TECHNICAL BULLETIN
Lime Slaking VERTIMILL® Improvements



REFERENCE

1. STT Patent Title: Vertical Ball Mill with Internal Materials Flow Conduit, Serial No. 14/323149, Filing date: July 3rd, 2014, Case No. P38814, Owner: STT Enviro Corp, Inventors: BORGES, Tyler; FANG, Xiaoqi (Stephen); NG, Chien-Ee; SARBAN, Calin
2. Minnkota Power Cooperative, Contact: Kevin Thomas, Center, North Dakota
3. Fraser Bringeland, STT Enviro Corp, Richmond, BC