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Simply taking the lid off of the lime bulk storage tank caused injuries to operators at a sanitary district in Mineral Ridge, Ohio.

Lime Chemical Bridging, Sticking, and Flow Problems Solved

The Mahoning Valley Sanitary District in Mineral Ridge, Ohio, uses lime to soften its water. The lime is stored in four concrete bulk storage bins that were built in 1929–31 using 2- × 10-in. wood forms. Each bin stores 200,000 lb of lime, and the plant uses approximately 20,000 lb/d on average.

STORAGE PROBLEMS LEAD TO OPERATOR INJURIES

Temperature changes throughout the year caused the lime to bond with the concrete and to bridge or arch within the bins. In addition, rat holes formed in the lime, and erratic flow became a daily problem. The result—flow problems to the main hopper that feeds the lime slurry machines. This problem became so bad that operators would spend more than an hour each shift hoeing the lime from bulk bins to hopper openings. Operators used a 40-ft, 75-lb pole with a shovel at the end to move the lime that had attached to the bins' concrete walls. A secondary problem was creation of large amounts of airborne lime dust; the dust could not be controlled because the vacuum systems were inadequate.

Opening the lime bin access cover and maneuvering the pole was putting a huge amount of stress on the operators' shoulders, backs, and legs. Depending on water demand, an operator used the pole a mini-

It's no surprise that operators experienced shoulder, back, and leg injuries while moving lime from bulk bins to hopper openings.

mum of 60 minutes per shift (84 times per week; 4,368 times per year). Not surprisingly, the operators were experiencing lower back, shoulder, and knee injuries as well as injuries related to inhalation of lime dust. These injuries increased the plant's workers' compensation costs and resulted in missed work days.

From 2003–05, 25% of injuries were experienced by operators working in this area of the plant. Several first-aid injuries and even an employee resignation during this two-year span can be connected to operations within the lime softening portion of the plant.

The cost from the injuries and illnesses sustained during this period was $32,912; this amount does not include wage or indemnity payout. The plant has paid out a deductible minimum of $1,000 per injury, plus the resulting increases in premiums. Indirect costs from retraining, overtime, and administrative cost were approximately $131,648. In summary, the total cost of these injuries and illnesses during the two-year period was $164,560.

The two most common injuries that operators experienced were lower back strains and lung disorders. The cost for all injuries in these areas was expected to increase over several years because of an increased demand for water. Potential costs over the two years could be as high as $197,472. In turn, treating more water would generate a greater need for more lime and require more lime to be moved to the hopper opening. More maintenance would also need to be performed.

Employee turnover during the two-year reporting period was relatively low. A major reason for this low rate is management's commitment to safety and employee well-being. However, when compared with other parts of the plant, employee turnover at this specific operation is high—11% during the past two years.

PROBLEM SOLVED WITH LINING SYSTEM

The goal was to keep the lime flowing to the hopper opening and to keep the lime dust within the vacuum system. Possible solutions included adding a vibrator to the bins and painting them.

A $40,000 safety grant from the State of Ohio Bureau of Workers' Compensation was used to fund system modifications. The final solution involved lining the concrete bins with a high-performance, ¼-in.-thick, blue polyethylene lining system.[1] This liner was made from plastic with an ultrahigh molecular weight and an extremely low friction coefficient.

The 40-ft, 75-lb pole used to move the lime was difficult to use and contributed to personnel injuries and operations inefficiencies.

The plastic lining prevents the lime from adhering to the walls and bridging the material, allowing the material to fall freely into the hopper opening. The lining also eliminates the need to hoe because the lime cannot adhere to the plastic.

The lining was delivered and installed by trained installers, who cut and formed the liner to fit the bin. The edges were terminated to the concrete, and sheets were fastened to the sloping floor; all seams were welded to create a complete unit.

A 99.9% efficient air-filtering system[2] was the other part of the solution. This system maintains a constant 4,000 cfm during vacuum delivery, and rock lime is kept in its rock form thus eliminating lime dust and keeping work areas clean and free from airborne dust particles. No training was required for this system; the liner does all the work, and the air filter system only has an on–off button.

BENEFITS OF THE NEW SYSTEM

Productivity and overall safety were greatly improved with addition of the liner and air-filtering system. In addition, morale has increased because operators no longer spend time hoeing and can be given other tasks including working on plant machinery. Approximately 4,368 staff-hours have been saved over the past two-year period; at an operator' salary, this translates to approximately $93,912 gained in wages and increased productivity.

Proper lime flow and product consistency have led to longer filter runs and lower turbidity thus improving water quality. An overall operational savings of $73,000 was achieved by decreasing the number of filter washes.

The total cost over a two-year period is $12,440/month. With a total project cost of $86,996, the return on investment will be reached in approximately seven months.

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FOOTNOTES

[1] TIVAR® 88 liner, Quadrant EPP System, Reading, Pa.
[2] Pulsatron, Chardon, Ohio