

Case history | New elbows fix pneumatic conveying lines

A water reclamation plant switched the elbow joints in its pneumatic conveying lines to prevent messy, dangerous blowouts.

The Upper Occoquan Water Reclamation Plant in Centreville, VA, reclaims more than 30 million gallons of water per day, providing a source of potable water for a population of more than 300,000 across portions of Fairfax and Prince William Counties. The plant's chemical treatment system uses a steady supply of pebble lime to raise pH levels to a point where phosphorus can be removed. The lime is pneumatically conveyed to six indoor silos during off-loading to adequately supply the treatment plant.

Due to high conveying velocities and the pebble lime's 3 to 4 percent grit content, the pneumatic conveying line's elbow walls experienced frequent failures. During a failure, the plant's workers needed to clean up pebble lime spillage and dust that escaped from a failed elbow. Even a small hole in an elbow would spray abrasive powder into the building, presenting a slip-and-fall risk and threatening indoor air

quality. The required system shutdown to clean up the lime and mitigate risks to workers also put the plant behind schedule.

Inspecting elbows became a frequent task, and maintenance personnel became experts at replacing elbows to keep the silos in service. Meanwhile, operations personnel were being diverted from their formal responsibilities to help with the cleanups.

"It's very difficult for us to replace an elbow," says Robert Forgiione, director of the operations and maintenance division for the Upper Occoquan Service Authority (UOSA). "The elbows at ground level aren't easily accessed and the ones on top of the silos are four stories up. It's a safety concern as well as a cost concern."

With elbow failures occurring approximately every 6 months, Forgiione needed to find a more permanent fix for the problem. Pneumatically conveying high volumes of the abrasive material proved difficult



The Upper Occoquan Water Reclamation Plant supplies more than 30 million gallons of potable water per day. The water treatment process requires the use of pebble lime, a highly abrasive material, to raise the water's pH level.



The plant has gone 16 years without an elbow failure after installing short radius deflection elbows on its pneumatic conveying lines.

for every elbow type that plant personnel tested. Iron elbows lasted nearly a year, and longer, 10-foot-radius long-sweep elbows were able to last 18 months. The plant also tried wear-back elbows, which allow users to replace just the outer radius portion that's made thicker than the elbow itself. However, wear-back elbows eventually wore down and the plant wanted something that would last as long as the straight pipe lengths.

"We hit a brick wall," Forgi-one says. "We needed to make the elbows last longer and we needed it done fast."

Forgione learned about a deflection elbow from HammerTek, a pneumatic conveying elbow supplier, that had been installed at a nearby wastewater treatment plant to solve an identical lime handling problem. A UOSA process control engineer and the mechanical manager toured the other facility and found that the plant hadn't had a single elbow blowout since installing the manufacturer's Smart Elbows. The team also noted the cleanliness of the facility, highlighting the potential benefit of stopping the blowouts and leaks for good.

The proprietary elbow has a spherical chamber that protrudes slightly beyond the desired 90- or 45-degree flow path, causing a loose ball of material to rotate slowly in the same direction as the airstream that propels it, gently deflecting incoming material around the bend. Self-renewing, the ball gradually releases material in a first-in first-out progression, promoting directional change without affecting system pressure.

Forgione tested the deflection elbow for more than a year and, after finding no signs of wear, replaced all pebble lime elbows at the facility. Five 45-degree, 4-inch-diameter elbows were installed where the trucks off-loaded their lime and 12 90-degree, 4-inch-diameter elbows were installed at the tops of the silos. A custom alloy for the elbows was specified based on characteristics of the pebble lime and the length and velocity of the pneumatic conveying system.

"With new deflection elbows, we've eliminated the primary source of lime dust along with the hazardous conditions it creates," says Forgi-one. "The delivery was fast and our mechanics were able to

install them quickly without complaints. If we ever get wear in an elbow anywhere in the plant, we'll replace it with one of these elbows."

In more than 16 years since the installation of the deflection elbows, UOSA's facilities have yet to have a blowout. Maintenance and labor costs have been reduced, safety and air quality have been upgraded, and the buildings are visibly cleaner.

"We haven't changed out any of the elbows since installing them," says Forgi-one. "We checked the metal thicknesses of the elbows some years ago and found no reduction, so we believe we're good for a very long time." **PBE**

For further reading

Find more information on this topic in articles listed under "Pneumatic conveying" in the article archive on *PBE's* website, www.powderbulk.com.

HammerTek
Bethlehem, PA

610-814-2273

www.hammertek.com