

Engineering solution | Making bulk bag unloading systems portable

A water utility adds a portable system to unload fluoride powder into its silos.

A public water utility in Colorado needed to change the way it had been handling sodium fluorosilicate, also known as fluoride. The powder is often added to municipal drinking water for the purpose of maintaining good dental health. The additive enhances tooth strength by forming fluorapatite, a naturally occurring component of tooth enamel. The US Department of Health and Human Services sets optimum fluoride levels for preventing tooth decay at 0.7 parts per million, or 0.7 milligrams, in every liter of water.

At the Colorado utility, fluoride powder had been being delivered in self-unloading, pressure-differential trucks, which delivered the material directly into the utility's silos. That option, however, became unavailable, so the utility had to make a change. The alternatives were receiving the powder in bulk bags or in 50-pound paper sacks. The plant temporarily opted for the individual 50-pound sacks, but that method made for a messy, difficult, and potentially dangerous unloading task. While fluoride powder can safely be consumed in drinking water, the material is considered a HAZMAT Class 6 Toxic Substance if inhaled. Employees dealing with the sacks needed personal protective gear, and trying to physically handle the bags was a cumbersome, potentially injury-causing task.

Eventually, the utility found an overseas fluoride source that would ship the powder in bulk bags, but this would require a new method to transfer the shipped powder from the 2,200-pound bags into existing storage silos at the utility's two water treatment facilities.

To inquire about designing a new transfer method, the utility contacted Greg Black, owner of Golden Eagle Technologies in Golden, CO, and a local representative for Vibra Screw, a Totawa, NJ-based bulk solids handling equipment supplier. He visited the utility's two locations to assess the existing bins and pneumatic conveying lines. Working on behalf of Vibra Screw, Black proposed a portable skid-mounted bulk bag unloader that discharged into a venturi eductor to convey the fluoride powder into silos through the existing truck delivery lines. He sent the design concept, along with details on the bin sizes, existing conveying line lengths, and number of pneumatic conveying line fittings, to the supplier for development.

In operation, the system needed to be able to quickly — within 45 minutes — and efficiently discharge the material from the bulk bags, whose contents could possibly have compacted during overseas shipment.

"The system needed to be portable for placement on a flatbed work truck for transport between two locations," explains Ed Giacobbe, Vibra Screw regional sales manager. "The equipment also needed to be stored in the facility garage with a door that had 12 feet of headroom."

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The utility wound up with a two-skid bag unloading system that could be used at two different facilities.

shipment. The system also needed to prevent the hazardous fluorosilicate powder from leaking during unloading to protect operators and other personnel.

The supplier recommended a model I-VHD bulk bag unloader as the best solution for the project due to its low profile. To load the fluoride into the system, a forklift picks up the bulk bag and places it onto the unloader support pan and frame, which holds the bag in position until the emptying process is complete. With the bag in place, the operator opens the bag spout access door, unties the bag spout, cuts open the inner plastic liner, and closes the access door, preventing leaks and limiting operator exposure to the hazardous dust.

As the bulk bag rests on the support pan, it vibrates to facilitate material flow into a 4-inch eductor with a 25-horsepower positive-displacement rotary blower. The eductor conveys the material approximately 100 feet at a rate of 2,000 to 3,000 lb/h. All material contact surfaces are passivated stainless steel with polished welds.



The bulk bag unloader is connected to a 4-inch eductor and uses a positive-displacement rotary blower to move material at a rate of 2,000 to 3,000 lb/h.

A review of the capacity of the utility's existing silo bin vent dust collectors and fans revealed that the system could handle the conveying air volumes, and the dust collectors and fans were deemed as more than adequate to handle the dilute-phase pneumatic conveying system's eductor blower volume.

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The supplier designed the system to sit on two interlocking skids, one for the bulk bag unloader and eductor and one for the PD blower. Placing the system on two skids makes transporting it and moving it into place much easier. Once in place, the two skids are temporarily linked together for stability during operation. The 4-inch blower hose is then connected to the venturi eductor, and the discharge hose is connected to the silo's pneumatic conveying line.



The new portable, two-skid system connects to the utility's existing pneumatic conveying lines at each facility.

The dual-skid system design made power connections somewhat challenging. To allow for easier system connect and disconnect, the supplier provided UL-approved control panels to be installed at each facility, along with power and signal cables and equipment to connect the skids to the control panels.

“Bulk bag unloaders and eductor systems aren't new, but building a portable one was a first for us,” Giacobbe says. **PBE**

For further reading

Find more information on this topic in articles listed under “Bags” and “Loading, unloading” in the article archive on PBE's website, www.powderbulk.com.

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