Bag dump conveying system contains TiO2 dust in PVC plant

Ameron International, a manufacturer of protective PVC lining products for large concrete sewer pipes, turned to a system from Flexicon to deal with dust arising with handling of bags of titanium dioxide.

At the Ameron plant, titanium dioxide (TiO2) is weighed and blended with PVC resin prior to extrusion of the compound, to impart UV resistance and a translucent white colour. With the company's previous mixing process it was difficult to contain dust. Plant personnel cut open bags of titanium dioxide (TiO2), which has a bulk density of 721kg/cu m, and shovelled the powder into a bucket on a scale. When the net weight of TiO2 reached 2.7kg, it was dumped into a blender containing 137kg of PVC (a 2 per cent concentration).

Handling the powder in an open environment produced dust. "If you open a bag of titanium dioxide and dump it, the powder can become airborne," explained James Gross, a product engineer at the Ameron plant.

He researched enclosed systems but had trouble finding one able to handle the powder, which is cohesive and compressible, tending to pack, cake, bridge, and otherwise resist flow. "It’s a powder that acts almost like a paste, so it’s problematic to move," Gross said.

He ultimately decided on a system from Flexicon consisting of a bag dump station with an integral flexible screw conveyor.

Bag dump station collects dust

Pallets of 11kg bags of titanium dioxide are stacked next to the bag dump station on an elevated dock. The station is equipped with a waist-high bag tray support that provides a work surface for operators to stage, clean and open bags prior to dumping.

The bag dump station’s dust collection unit is mounted directly on the 0.16cu m floor hopper. The operator opens the hopper lid, activating a high velocity vacuum fan, and dumps TiO2 through a screen that keeps foreign objects out of the system. The fan draws airborne dust onto two filter cartridges rated at 99.99 per cent collection efficiency for materials with a particle size of one micron or greater. At the same time, an automatic reverse-pulse filter cleaning system employs timer-activated solenoid valves to direct short blasts of compressed plant air at the cartridge filters, causing dust build-up on the outer filter surfaces to fall into the hopper.

Measuring 762mm square x 118mm high, the hopper is a "high-flow" configuration that causes titanium dioxide to topple and flow toward and down the unit’s steep back wall, preventing the powder from bridging between the unit’s sidewalls. Additionally, it is equipped with a pneumatic vibrator and an agitator to promote flow toward the conveyor’s inlet. "For most materials, neither of these devices is required, but they are needed to move titanium dioxide," Gross noted.

The bag dump station’s support tray provides a work surface to open bags prior to dumping. A vacuum fan pulls dust onto the filter cartridges while a pneumatic vibrator and agitator promote flow of the difficult-to-move powder toward the flexible screw conveyor’s inlet at bottom.
Flexible screw conveyor moves difficult material

The hopper directs powder into the intake adapter of a 7.6m-long, 67mm-diameter flexible screw conveyor inclined to 45 degrees. The conveyor employs a flexible, stainless steel screw with a specialised geometry engineered by Flexicon to handle materials with difficult properties such as TiO2.

A 1.5kw electric motor at the discharge end of the conveyor rotates the screw, propelling titanium dioxide through the plastic tube and through a discharge spout connected to a 1.2m-long, 152mm-diameter wire-reinforced PVC downspout. The powder falls into a bucket enclosed in a dust-containment box, which sits on an electronic scale above the blender.

When the blender calls for titanium dioxide an operator activates the conveyor, as well as the vibrator and agitator in the hopper. The controller automatically stops the conveyor when the weight of the material in the bucket reaches 2.5kg. At this point, the remaining powder in the downspouting trickles into the bucket, bringing the final weight close to the required 2.7kg. “We’re achieving batch weight accuracy of approximately ±0.01 kg, which is many times more accurate than the old system,” Gross reported.

Gross’s initial estimates allowed up to three minutes to deposit the required 2.7kg, given the variable flow characteristics of titanium dioxide, but the task is now accomplished in 30 to 45 seconds.

Conveying process ends in dust-containment box

Since the filled bucket empties into the blender without removing it from the dust-containment box, titanium dioxide is contained throughout the system.

“The system has effectively contained dust,” Gross reports. In addition to protecting workers and keeping the surrounding plant area clean, the system reduces material waste and eliminates the need to clean a remote dust-collection site.

As for maintenance, Gross cleans the equipment every three or four months, noting, “It’s basically a no-maintenance item.”

Contact: sales@flexicon.com.au