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Pipeline Technology

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Restoring the Ganga River

Powder-handling equipment improves filtration at desalination plant

The 2800 m² Tampa Bay Seawater Desalination Plant produces up to 95 million liters of drinking water per day, making it the largest seawater desalination plant in North America. Since March 2007, the plant has desalinated more than 11 billion liters of drinking water from the Tampa Bay and provides the area with 10 percent of its drinking water when operating at full capacity. The plant shut down in 2005, however, because it could not meet the expected operational sustainability.

Tampa Bay Water, the government agency responsible for the plant, assigned remediation work to American Water and Acciona Agua, through their operating partnership American Water-Pridesa, a group that has designed and built more than 50 desalination plants worldwide. Among many improvements made during this period is the addition of

DE is a silica powder (hydrated silicon dioxide) comprised of the cell walls of phytoplankton called diatoms. Applied to the pressure side of filter elements, DE traps micron-size particles that would otherwise pass through ordinary filter media. DE powder is added to seawater upstream of the filter, forming a cloud of DE particles that coats the filter medium and, in turn, traps solid contaminants as water passes through the DE coating. When contaminants build up, indicated by pressure increases, the filter is backwashed, after which another dose of DE is added to the water to re-coat the filter medium.

The Tampa Bay plant consumes 1800 to 2725 kg per day of DE, which arrives in 400 kg bulk bags that are stored in a temperature- and humidity-controlled area to prevent compaction of the material. When the RO process calls for DE, a crane moves a bag from storage to



At the flexible screw conveyor's discharge end, DE flows through a transition adapter into the 1136 L tank where the DE is put in suspension with water.

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Precoat Filtration using a bulk handling system for diatomaceous earth.

Desalination plants rely on reverse osmosis (RO), which uses high pressure to force water through semi-permeable membranes that remove salt from seawater. Seawater must be pretreated to remove particulates. During remediation at the Tampa plant, American Water Acciona Agua improved pretreatment by adding coagulation and flocculation, improving the operation of the existing sand filters, and installing a diatomaceous earth (DE) filtration system to eliminate microscopic materials from the water prior to RO.

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either of two bulk bag weigh batching systems that feed the DE to a 1140-litre tank where it is put into suspension with water to a 5-percent concentration. The suspension is then metered into the saltwater upstream of the filter by peristaltic pumps.

System moves DE dust-free

The DE bulk handling equipment, produced by Flexicon Corp. of Bethlehem, Pennsylvania, USA, consists of two identical systems, allowing cleaning and maintenance of either system with no interruption in the movement of DE from the bulk bags to the dilution tank where it is used. Each system consists of a bulk bag unloader with loss-in-weight batching controls and an integral flexible screw conveyor.

The bulk bag unloaders measure

1.5 square meters. Four vertical extension posts are adjustable in overall height from 4.3 m to 5.8 m to accommodate bulk bags from 600 mm to 2000 mm in height.

The unloaders are equipped with Flow-Flexer™ bag activators that raise and lower opposite bottom edges of the bulk bag at timed intervals, improving material flow into the bag's discharge spout. As the bag lightens, the stroke of the pneumatic bag activators lengthens, producing a steep "V" bag shape to promote evacuation of material.

Also promoting flow are a Spout-Lock® clamp ring that creates a high-integrity, sealed connection with the bag spout, and a Tele-Tube® telescoping tube that applies continual downward tension on the bag as it empties and elongates. Above the clamp ring is a Power-Cincher® flow-control valve whose curved, articulated rods cinch the bag spout concentrically, allowing the operator to control the flow of material through the spout after releasing the bag spout drawstring, as well as to close and re-tie the spout of partially empty bags with no leakage or dusting.

DE flows from the bulk bag through the bag spout into a 1.8-m³ capacity surge bin able to hold the entire contents of one bulk bag, effectively doubling the unattended run time of dischargers having small surge hoppers.

The sealed system is vented through a port in the hopper lid to a dust collector that vacuums displaced air and dust, and collapses empty bags dust-free prior to tie-off and removal, eliminating manual flattening and associated dusting. Reverse-jet filter cleaning allows the vacuum system to operate at high efficiency, while extending filter life.

The hopper discharges into an intake adapter that charges a Model



A Bag-Vac® dust collector, mounted on the bulk bag unloader frame, vacuums displaced air and dust, and collapses empty bags dust-free prior to tie-off and removal. The bulk bag is supported in a lifting frame.

1250 flexible screw conveyor with DE. A cantilevered arm on the bulk bag unloading frame supports the discharge end of the 4.6 m long conveyor tube which is inclined at 30-degrees. At the discharge end, a gear-drive assembly with a 0.75-kw motor rotates the flexible screw, propelling DE through the 67-mm OD plastic tube.

When the DE dilution tank has discharged its contents, a level indicator signals the PLC that controls the weigh batching system to initiate a weigh batching cycle by running one of the flexible screw conveyors. Load cells supporting the bulk bag unloader frame with

integral conveyor, transmit weight loss information to the PLC which reduces the conveyor speed immediately before stopping the conveyor, achieving an accurate batch weight. Based on the amount of weight lost, the PLC also indicates when the operator needs to load a full bag of DE into the unloader.

Weight loss information is shown on an LCD, part of a control centre that includes a keypad, custom-engineered software, and an A/C inverter with adjustable speed control and a reversing feature for the conveyor drive.

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