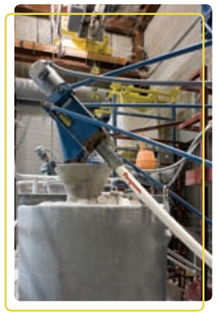

By David Boger

full-capacity filtration

The 30,000-sq-ft Tampa Bay Seawater Desalination Plant produces up to 25 million gal of drinking water per day, making it the largest seawater desalination plant in North America. Since March 2007, the plant has desalinated more than 3 billion gal of drinking water from the Tampa Bay.

Powder-handling equipment improves operations at a Florida desalination plant

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In 2005, however, the plant was shut down 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 the firm's many improvements is the addition of precoat filtration using a bulk handling system for diatomaceous earth (DE). This has proven to be instrumental in re-establishing the plant as a major source of drinking water for the Tampa Bay region.

RO Converts Seawater

Desalination plants rely on reverse osmosis (RO), which uses high pressure to force water through semipermeable membranes that remove salt from seawater. To ensure efficient RO, seawater must be pretreated to remove particulates. During remediation at the Tampa plant, American Water and Acciona Agua improved pretreatment by adding coagulation and flocculation, improving the operation of the existing sand filters and installing a DE filtration system to eliminate microscopic materials from the water prior to RO, according to Nacho Lopez, construction manager of the Tampa project.

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 recoat the filter medium.

The Tampa Bay plant consumes 4,000 to 6,000 lb per day of DE, which arrives in 900-lb 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 either of two bulk bag-weigh batching systems that feed the DE to a 300-gal tank, where it is put in suspension with water to a 5% concentration. The suspension is then metered into the saltwater upstream of the filter by peristaltic pumps.

Dust-Free DE Movement

The DE bulk handling equipment, produced by Flexicon Corp., 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 utilized. Each system consists of a bulk bag unloader with loss-of-weight batching controls and an integral flexible screw conveyor.

The bulk bag unloaders measure 5 sq ft. Four vertical extension posts are adjustable in overall height from 14.5 to 19 ft to accommodate bulk bags from 36 to 84 in. tall. 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,

which 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; it has curved, articulated rods that 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 retie the spout of partially empty bags with no leakage or dusting.

DE flows from the bulk bag through the bag spout into a 63-cu-ft-capacity surge bin able to hold the entire contents of one bulk bag, effectively doubling the unattended run time of dischargers with 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 1250 flexible screw conveyor with DE. A cantilevered arm on the bulk bag unloading frame supports the discharge end of the 15-ft-long conveyor tube, which is inclined at 30°F. At the discharge end, a gear-drive assembly with a 1-hp (0.75-kW) motor rotates the flexible screw, propelling DE through the 2.625-in. OD plastic tube.

Accurate DE Dosing

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," said Lopez.

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

When operating at full capacity, the plant provides the Tampa Bay region with approximately 10% of its drinking water. WWD

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