

Powder handling equipment improves filtration at desal plant

The Tampa Bay Seawater Desalination Plant produces up to 94.6 million litres of drinking water per day (up to 10% of Tampa, Florida's drinking water), making it the largest seawater desalination plant in North America. Since March 2007, the plant has desalinated over 13.6 billion litres of drinking water from the Tampa Bay.

In 2005, however, the plant was shut down, as 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 its 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 proved to be instrumental in re-establishing the plant as a major source of drinking water for the Tampa Bay region.

Desalination plants rely on reverse osmosis (RO), which uses high pressure to force water through semi-permeable 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 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.

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-sized 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 1814 to 2722 kg per day of DE, which arrives in 408 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 either of two bulk bag weigh batching systems that feed the DE to a 1136 litre tank where it is put in suspension with water to a 5% concentration. The suspension is then fed into the saltwater upstream of the filter by peristaltic pumps.

The DE bulk handling equipment, produced by Flexicon Corporation, consists of two identical systems, allowing cleaning and maintenance of either system with no interruption in the supply of DE to the process. 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 1.5 m². Four vertical extension posts are adjustable in overall height from 4.35 to 5.8 m to accommodate bulk bags from 914 to 2134 mm 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 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, 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 1.8 m³ capacity surge bin able to hold the entire contents of one bulk bag. 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, powered by a gear-drive assembly with a 0.75 kW motor.

When the DE dilution tank has discharged its contents, a level indicator signals the PLC to initiate a weigh batching cycle by running one of the flexible screw conveyors. Load cells supporting the bulk bag unloader frame transmit weight loss information to the PLC, which reduces the conveyor speed immediately before stopping the conveyor, achieving an accurate batch weight. Weight loss information is shown on an LCD, part of a control centre that includes a keypad, custom-engineered software, an AC inverter with adjustable speed control and a reversing feature for the conveyor drive.

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