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A desalination innovation

The Tampa Bay Seawater Desalination Plant is the largest seawater desalination plant in North America producing up to 95 million litres of drinking water per day. Since March 2007, the plant has desalinated over 11 billion litres of drinking water thanks in part to a Precoat Filtration using a bulk handling system for diatomaceous earth from **Flexicon Corp**

In 2005, the Tampa Bay 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 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. This has proven to be instrumental in re-establishing the plant as a major source of drinking water for the region.

Reverse osmosis

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 diatomaceous earth (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 1,800 to 2,725 kg per day of DE, which arrives in 400 kg bulk bags stored in a temperature and humidity-controlled area to prevent compaction of the material. A crane moves a DE bag to either of two bulk bag weigh batching systems feeding the DE to a 1,140 litre tank where it is put into suspension with water to a five per cent concentration. The suspension is metered into the saltwater upstream of the filter by peristaltic pumps.

A Bag-Vac dust collector vacuums displaced air and dust, and collapses empty bags dust-free prior to tie-off and removal.

Right: 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

One of two hoppers holds a 408kg bag of diatomaceous earth (DE) allowing the DE to transfer through the flexible screw conveyor to the tank

System moves DE dust-free

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 utilised. Each system has a bulk bag unloader with loss-in-weight batching controls and an integral flexible screw conveyor.

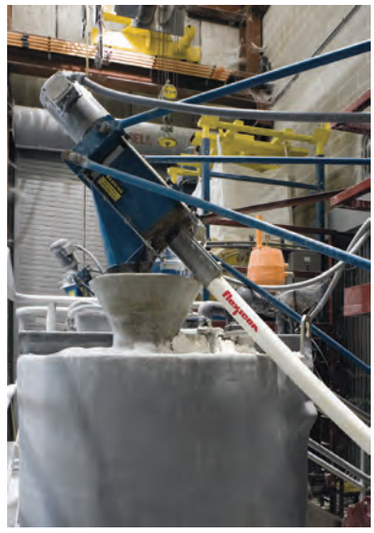
The bulk bag unloaders are equipped with Flow-Flexer bag activators that raise and lower opposite bottom edges of the bulk bag at timed intervals, improving material flow into the bag's discharge spout. As the bag lightens, the stroke of the pneumatic bag activators lengthens, producing a steep "V" bag shape to promote evacuation of material. Also promoting flow is 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 1.8m^3 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 1250 flexible screw conveyor with DE. A cantilevered arm on the bulk bag unloading frame supports the discharge end of the 4.6m long conveyor tube which is inclined at 30 degrees. At the discharge end, a gear-drive assembly with a 0.75kw motor rotates the flexible screw, propelling DE through the 67 mm OD plastic tube.



Loss-in weight batching

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 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.

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

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