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SCREENING AND CLASSIFYING

Case history

Batch weighing and dosing system hits pay dirt

A seawater desalination plant installs a batch weighing and dosing system in its pretreatment facility to improve water filtering capabilities.

Owned by Tampa Bay Water, the Tampa Bay Seawater Desalination Plant in Tampa, Fla., uses a single-pass seawater reverse osmosis (SWRO) system to remove salt and other minerals from seawater, producing more than 25 million gallons of clean, drinkable water every day for area residents. When the 30,000-square-foot desalination plant began operating in 1998, it struggled to achieve optimum operating efficiency because of various problems with the SWRO system's design, including the pretreatment system responsible for preparing the seawater for desalination. So to improve the plant's operation, Tampa Bay Water temporarily closed the plant and formed a public-private partnership with American Water–Acciona Agua in 2004. The latter company was to remedy the desalination process and then operate and manage the plant. American Water–Acciona Agua LLC is a joint venture formed in 2004 by American Water Co., Voorhees, N.J., and Acciona Agua, Madrid, Spain. The company has experience designing and building more than 50 desalination plants around the world.

Desalinating seawater

Desalination is a process that removes salt and other minerals from seawater, converting it to fresh water suitable for human consumption or irrigation. At the Tampa Bay plant, seawater is pumped from Tampa Bay to the plant's pretreatment facility, where it's sent through a multistep screening and settling process that removes shells and other large solid debris from the water. Next, various chemicals are added to the water before it's sent through a two-stage sand filter system that removes smaller organic and inorganic debris particles. The water is then pumped to the desalination facility, where it passes through a cartridge filter assembly that filters

The two independently operated batch weighing and dosing systems can feed diatomaceous earth from bulk bags into a filter tank at up to 10 ft³/h.

out microscopic particles before the water is transferred to the reverse osmosis desalination process. It was in the pretreatment steps that the plant was experiencing problems.

The remediation project

After reviewing the Tampa Bay plant's desalination process, American Water–Acciona Agua found several problems with the pretreatment system. According to Ignacio López, the company's construction manager, the pretreatment facility's sand filter system wasn't effectively filtering all of the necessary sediment particles from the water. The excess particles that passed through to the desalination facility led to the SWRO system's costly reverse-osmosis filter membranes becoming clogged too quickly and having to be replaced too often, which increased operating costs and limited water production.

To fix this problem, the company decided to install a new filter system between the sand filter system and desalination facility. "We implemented an additional filtering step by adding a diatomaceous earth (DE) filter system with a three-hundred-gallon filter tank to the pretreatment facility," says López.

DE is a silica powder composed of the cell walls of phytoplankton called diatoms. It's an extremely effective filtering agent for micron-size particles. When put into a water-filled tank that has a pretreatment filter, it coats the filter media and traps extremely fine

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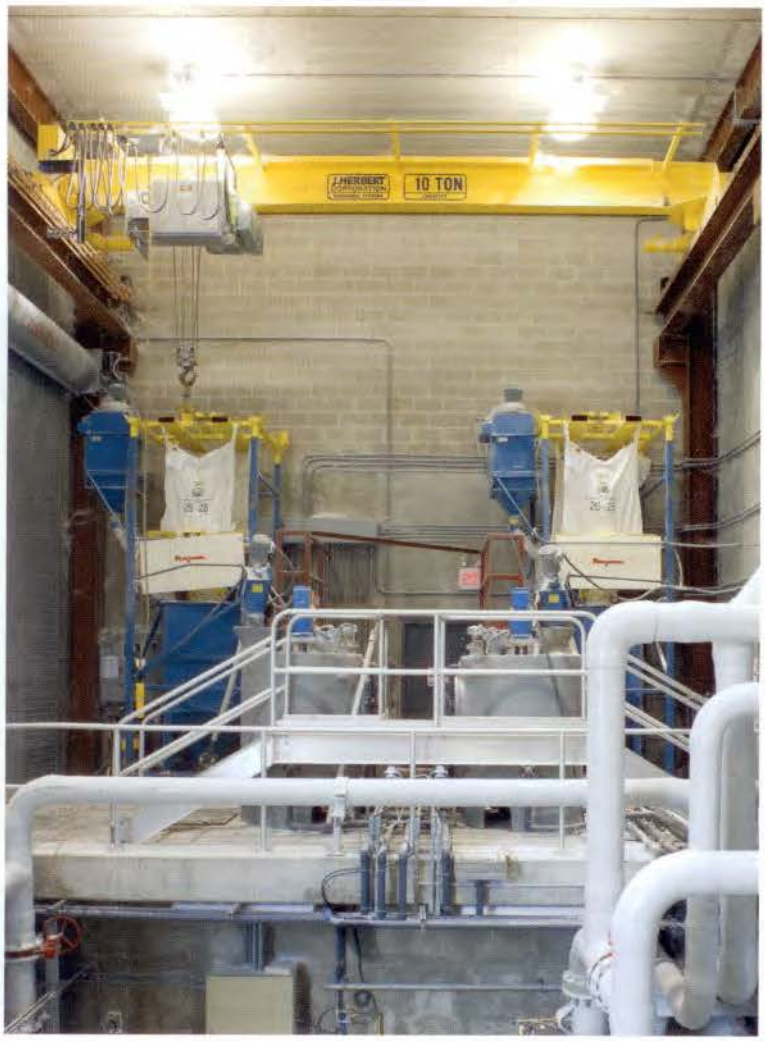

The bridge crane (top yellow beam) and movable hoist allow an operator to easily lift and seat a 900-pound-capacity bulk bag in either discharger.

particles, vastly improving the water quality going to the desalination facility. When the DE in the tank reaches its filtering capacity, the pretreatment filter is backwashed and another dose of DE is added to the tank.

For the DE filter system to be effective, the company needed a way to transfer the DE from 900-pound-capacity bulk bags to the filter tank at various feedrates. "We needed an automated batch weighing and dosing system that was flexible and within our budget," says López. "And the system had to be able to operate on demand according to our specifications for feeding a proper dose of DE into the tank. So we started looking for equipment that would meet our requirements."

The company's policy is to use equipment manufactured by suppliers in the country in which it's working to make transporting, installing, operating, and maintaining the equipment easier. "For this remediation project, our technical team looked for equipment suppliers in the American market," says López. "During our search, one of the many suppliers we investigated was Flexicon. We evaluated their weighing and dosing system, and their equipment performed so well that we chose it to integrate into the pretreatment system."

Flexicon, Bethlehem, Pa., manufactures bulk bag dischargers, flexible screw conveyors, bulk bag fillers, pneumatic conveying systems, drum dumpers, weighbatching and blending systems, and bulk handling systems with automated controls.

The automated batch weighing and dosing system

The DE filter system's automated batch weighing and dosing system consists of two identical, independently operated systems, which allows the company to clean and maintain either system without interrupting the DE transfer to the filter tank. Each system consists of a model BFF bulk bag discharger installed on load cells, a programmable loss-in-weight (LIW) controller, a bulk bag lifting frame, a 63-cubic-foot-capacity hopper, and a model 1250 flexible screw conveyor with a hollow-core screw. The two systems are installed next to each other, and a bridge crane with a movable hoist is installed directly above them. Using the crane's hoist, an operator maneuvers the lifting frame and bulk bag into the discharger frame and then lowers the lifting frame to seat the bag in the discharger.

The discharger uses the supplier's TELE-TUBE telescoping-tube system and SPOUT-LOCK clamp ring to promote flow from a bag and prevent fugitive dust. After seating the bag in the discharger, the operator accesses the bag's spout and, while the spout is still tied, wraps the spout bottom over the telescoping-tube inlet. The operator engages the clamp ring, sealing the bag's spout to the tube's top to create a dust-tight seal. The operator then unties the discharge spout, and the tube lowers down toward the hopper, removing any slack from the bag and creating an open pathway for the material to flow through to the hopper. To promote material flow, the discharger's FLOW-FLEXER pneumatic bag activators operate at timed intervals to raise and lower the bag's opposite bottom edges. And a POWER-CINCHER flow-control valve installed above the clamp ring allows the operator to regulate the material flow from the bag and retie the spout of partially full bags without leakage or dusting.

When a bag is empty, the operator manually activates the model BV-CBOT single-cartridge dust collector attached to the discharger frame to pull in air and dust from the bag, collapsing it and preventing fugitive dust when disconnecting it from the telescoping tube. At timed intervals during operation, the dust collector's reverse-pulse filter cleaning system knocks dust off the cartridge filter into the hopper to maximize material use.

The flexible screw conveyor, which extends at a 45-degree angle from the hopper bottom, moves the DE 15 feet

from the hopper to the filter tank. The conveyor's 1-horsepower variable-speed drive can transfer the DE to the tank at up to 10 ft^3/h.

The plant can handle more than 44 million gallons of seawater per day, with the DE filter system transferring up to 6,000 pounds of DE per day to the filter tank.

Since the amount of DE and the rate at which it's transferred to the filter tank depends on the water's initial quality, the operator regularly accesses the LIW controller to regulate the system's dosing parameters. "If the water is good and doesn't need much filtering, the operator will decrease the DE amount put in the tank," says López. "And if the water is bad, the DE amount is increased. The system operates on demand and easily adapts to the different conditions that can be required for each batch. This ensures that we can control the water quality sent to the desalination process."

Cool, clear, desalinated water

Since beginning operation in winter 2007, the remediated Tampa Bay Seawater Desalination Plant has produced more than 6 billion gallons of clean drinking water. When operating at full capacity, the plant can handle more than 44 million gallons of seawater per day, with the DE filter system transferring up to 6,000 pounds of DE per day to the filter tank without any problems.

"We're happy with how the batch weighing and dosing system has been functioning," says López. "The desalination plant is running well and producing the quality and quantity of water that Tampa Bay Water demands, and the supplier's system has contributed to this success. The supplier has been good to work with for finding the right equipment for our application, and whenever there was a problem during installation and startup, we were able to solve it with the help of their technical team. In fact, since we also work with wastewater and water treatment plants for various industries, we continue to evaluate the supplier's equipment for projects we work on." **PBE**

Note: Find more information on this topic in articles listed under "Bagging and packaging," "Weighing and batching," and "Mechanical conveying" in *Powder and Bulk Engineering*'s comprehensive Article Index in the December 2009 issue and at *PBE*'s Web site, www.powderbulk.com, and in books available through the Web site in the *PBE* Bookstore. You can also purchase copies of past *PBE* articles at www.powderbulk.com.

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