PC Pumps Handle Tough Wastewater Jobs

CASE STUDY

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Tight land usage requirements, coupled with increased customer demand, prompted one Southern California wastewater department to design and build a state-of-the-art sludge processing plant, from the ground up, that incorporates several new high-performance dewatering and thickening centrifuges. Before the changeover, as its volume steadily increased, the district had begun incurring high pump maintenance costs in two critical areas: polymer injection and pumping sludge into and out of the centrifuges. By installing new progressive cavity (PC) pumps at each key location, the facility has now eliminated the dual pumping problems, and cut its routine repair time in half.

With a capacity of 190 million gallons a day (mgd), the City of San Diego Metropolitan Wastewater Department's $200 million Metro Biosolids Center (MBC) serves almost two million customers that generate more than 132 tons of dewatered sludge per day. By 2050, estimates put the facility's customer base at 2.9 million people, producing a wastewater flow of 340 mgd and yielding about 235 tons of dewatered sludge per day.

In 1991 the city and the California Coastal Commission agreed that the district's existing Fiesta Island Sludge Processing Center would be relocated, and by 1995 ground was broken for the MBC on a 39-acre tract adjacent to the city's Miramar Landfill. Siting required construction of a 17-mile pipeline from the District's Point Loma Wastewater Treatment Plant, which transfers 1.1 mgd of digested sludge to the MBC. In addition, the plant receives another 1.1 mgd of raw solids from the primary and secondary treatment processes of nearby North City Water Reclamation Plant (NCWRP). The MBC went into full production in early 1998, operating 24 hours a day, 365 days a year.

At Fiesta Island, digested sludge used to be pumped to the processing facility, where it was originally dewatered by means of drying beds and decant boxes during the 1980s. By the early 1990s, the District had begun using belt filter presses and injecting polymer, but the island facility was restricted from installing any buildings or equipment on a permanent basis by terms of its agreement with the City's Department of Parks and Recreation, which owns the island. The facility, in fact, had to operate with portable generator-powered electricity and limited water supply, The non-availability of coastal land around the Point Loma Plant precluded its expansion and the fully automated, computer-controlled Metro Biosolids Center was born.

Photo 1. Progressive cavity sludge pumps feed thickening centrifuges at up to 1,000 gpm.

Since the new MBC has greater access to electricity and water, the plant, to improve the quality of its product (that is, make a drier sludge cake), installed eight 225-gpm capacity dewatering centrifuges and five thickening centrifuges. The facility provides two treatment operations: thickening and digestion or raw sewage from the North City Reclamation Plant and dewatering of the blended sludge from both the Point Loma Plant and the North City facility. The MBC produces final dewatered sludge that is about 30% solids.

When planning the new facility, the City's design team, working with a regional consulting engineering firm, wanted to eliminate the high maintenance costs of the pumps used to inject polymer and transfer sludge through the centrifuges. At Fiesta Island, the District had been using different model PC pumps to handle these two functions. In meeting the design specifications, the MBC team turned to Cortech Engineering Co., an Anaheim, CA-based fluids handling firm, which supplied the facility with 19 PC pumps for sludge transfer and 13 PC

pumps for polymer metering, all Type BN models manufactured by seepex, Inc.

The sludge pumps have cast iron housings, hardened tool steel rotors and Buna stators. The polymer units have 316 stainless steel housings and rotors and Viton stators. The sludge pumps range in capacity from 90 to 1,000 gpm; the polymer units from 10 to 40 gpm.

In operation, the positive displacement pump's external helix rotor turns within an internal helix stator to form progressively moving cavities creating the pumping action. The pump's output is directly proportional to its speed, and its customized stator ensures an identical compression ratio along the entire length of the rotor/stator interface.

The new polymer-injection sludge-pumping operation at the Center now proceeds smoothly and efficiently. Untreated .5% to 1% solids wastewater from the North City Plant is transferred to the receiving tanks at the MBS, where they next pass through degritters to the seepex sludge-thickening pumps, which feed the product to one of five thickening centrifuges. The seepex metering pumps, in turn, inject polymer into the wastewater flow at variable points on the discharge side of the sludge pumps.

The resulting 5 to 5.5% solids thickened sludge is pumped by seepex units through a screening system to blending tanks prior to transfer to anaerobic digesters. The thickened-sludge PC pumps are used to produce a clear centrate, which is returned to the municipal sewer system, lightening the wastewater-processing load downstream.

The now 2.4%-solids sludge from the digesters is transferred to one of two one-million gallon holding tanks, which also receive 2.4%-solids digested sludge from the Point Loma Plant. Another set of seepex sludge pumps feed the eight dewatering centrifuges, with seepex metering pumps injecting polymer in the same manner as is used with the thickening centrifuges. The digested sludge is dewatered using the DS 706 high-performance centrifuges, with the final 28 to 32% solids sludge cake being stored in one of eight 217-ton capacity silos, which hold three-day's (one weekend's) supply, before being trucked offsite.

The MBC has experienced several benefits as a result of installing the new PC pumps for sludge pumping and polymer injection. First, the new 32 PC pumps have performed consistently and reliably for more than three years. Only minimal repair and maintenance has been required, and only two or three pumps have needed stator replacements. When repair or maintenance is required, the seepex pumps, overall, take 50% less time to service because the plug-in shaft connection between the pump and drive enables a quick replacement of the pump's working rotating parts. For example, it now takes just one day to take apart and reassemble the pumps. Before, it required one-and-a-half to two days for the same task with the previous pumps, which had gear-type universal joints.

Photo 2. Author Ernie Molas inspects progressive cavity polymer feed pumps (foreground) used to transfer to thickening centrifuges. Additional PC units (rear) move thickened sludge through a screening system to blending tanks.

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The MBC also has better control over its polymer injection pumps, with the capability of monitoring dosage rates up to three decimal points, which leads to increased efficiency in polymer use. The seepex units also provide a consistent, uninterrupted flow of polymer and sludge to the centrifuges, which now produce a 10% drier cake than was produced by the filter presses at Fiesta Island. This improved product quality has enabled the facility to cut its truck-hauling costs by 10%. The final cake can be land applied for beneficial uses or sent to landfills. The Fiesta Island site has now been turned into a recreational park for public use.

Treating wastewater generated by 16 area cities and districts, the City of San Diego Wastewater Department manages all of the resources to operate the San Diego Metropolitan Sewerage System and was the first publicly-owned wastewater organization to receive ISO 14001 certification.

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