



Equipment Upgrades, Maintenance Efforts Yield Solid Success for Phoenix WWTP

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Few regions in the country today can rival the growth occurring in Phoenix and its surrounding areas. A combination of warm, dry climate and unfettered economic opportunity has resulted in a population that more than doubled between 1970 and 2004 and has positioned Phoenix as the sixth most populous city in the U.S. While that growth has understandably strained the city’s infrastructure, its wastewater treatment effort has kept pace through a combination of results-driven equipment upgrades — particularly its solids pumping function — and a renewed focus on equipment maintenance. On a daily basis, the 91st Avenue Wastewater Treatment Facility handles better than 150 million gallons of sewage, processes over two million gallons of sludge, and removes 100 dry tons of processed “cake” for sanitary landfill disposal.



No More Lagoons

On a complex that spans better than a square mile, the solids processing area at the 91st Avenue facility represents the final stop in wastewater's journey from source to disposal. According to Cecil Chandler, the site's Operations and Management Technician, the plant's approach to handling solids has come a long way since coming online.

"By treatment plant standards, this part of the plant is not that old," he says. "Up until 1996, we were taking waste directly from the digesters out to more than 100 lagoons we had in the desert and drying it for disposal. In '96 we made the switch to the process we use today: taking sludge — both primary and Waste Activated Sludge (WAS) — routing it to digesters, dewatering it, running it through a centrifuge and sending it to cake pumps for movement to a hopper and subsequent disposal in a sanitary landfill."

Chandler notes that, until several years ago, that same material from the hoppers that is landfilled today was used as a soil additive on non-food crops such as alfalfa and cotton.

"It was really an ideal use for that material," he says. "But current laws have been tightened to eliminate any risk to area groundwater, so now it is simply spread out at a sanitary landfill and covered on a daily basis."



Cecil Chandler, the site's Operations and Management Technician with the Pipeline Lubrication System

Having Your Cake . . .

The cake pumps to which Chandler refers — currently five Schwing Bioset Model KSP-45 units — have proven an integral part of the process, meeting demanding needs in a round-the-clock operation at 91st Avenue.

"Those cake pumps run 24/7 year in and year out," says Chandler. "The maximum stroke we have them running at is 9 1/2 strokes per minute with each stroke pushing out 11 gallons of sludge. On average we will run three of the five pumps, but in winter, when 'Snowbirds' boost the local population, we often have to run all five. The initial installation in 1996 utilized 6-inch diameter pipe for the system; about two years ago that was upgraded to 9-inch diameter piping to increase efficiency. In both situations, they have been extremely productive and reliable for us."



Schwing Bioset Model KSP-45, unit #3 inside the 91st Ave WWTP in Phoenix, AZ

Chandler feels the hydraulic design of the cake pumps lends itself particularly well to their type of application: one in which the flow rate can vary greatly. As part of the normal procurement process, however, his department looked into alternative pump technology and in doing so, confirmed that the pumps they have in place are best-suited for the job.

“We experimented with a progressive cavity (PC) pump, but it didn’t fit our application,” he says. “When we would dry our cake to anything more than 18% moisture content, pump pressures got too high and the pump couldn’t push the material. With a hydraulic unit, pressures are at a 2.35:1 ratio, so if we are putting 2,100 lbs. of hydraulic pressure on it, the pressure on the material will be 700 lbs. Since the pumps are capable of operating at up to 5,000 p.s.i. of hydraulic pressure, there is more than enough available pressure to pump even the driest cake.”

He notes that the PC pump worked reasonably well when the line was kept full and the pump was continuously running. However, when forced to operate from a “full-stop” position, that was not the case.

“When you start drying out the cake and the level in the hopper goes down, the pump has to stop until the hopper level gets high enough to start up again, leaving the pipe from the hopper down to the discharge end of the pump full of material. Unfortunately, when the PC pump would have to get that material moving again it simply couldn’t do it. It’s a lot like a freight train: in full motion it’s efficient but once it stops it’s tough to get going again — that just wouldn’t work for us. We also saw unusually high wear on the stators of the PC pump, due again to the higher pressures. By going to hydraulic units we’ve essentially eliminated the pressure limitations and pressure-related wear issues we saw with the rotary PC pump.”

Maintaining an Edge

While the hydraulic cake pumps have answered the needs for Chandler and his group, since coming onboard in 2000, he has instituted some maintenance-based changes to maximize pump productivity and minimize the risk of downtime. In addition, he has made some changes to components on the pumps themselves which have resulted in a measurable cost savings.

“When I first came onboard seven years ago, maintenance in this department was high due to the lack of training the maintenance crew had at the time. The general rule back then was, if a problem was detected, the crew went through a process replacing all the major pump components until the problem was fixed. The first thing I did was establish a comprehensive maintenance training program. Today, everyone in this department knows how to troubleshoot a problem and when an issue is detected, address it quickly and efficiently. That’s really turned things around.”

Before instituting his changes, Chandler says pump cylinders were regularly replaced; in his seven years at 91st Avenue, they’ve yet to change out a cylinder.

“It’s all about achieving a skill level with your workforce and today we have an excellent crew that takes a lot of pride in what they do. Anyone in our crew can now change out a set of rams in a couple hours by himself; much faster than in the past. It’s made a huge difference in performance and brought down maintenance-related costs for this department.”



Pump configured in horizontal plane to minimize floor space required

Chandler also worked with Schwing Bioset to have each cake pump retrofitted to include a “slip ring,” or pipeline lubrication system. This feature injects a thin film of water that separates viscous and sticky materials from the inner wall of the pipeline. Doing so reduces friction loss in the pipeline and lowers pipeline operating pressure — in some cases by more than 50%.



Pipeline lubrication system shown with integrated slip injection ring in pipeline

“It might seem contradictory to add water during a drying operation, but this process only adds about 12 gallons per hour — a very small amount,” he says. “The benefits far outweigh that. Since the pump and hydraulic unit don’t have to work as hard, we have seen a nice savings in energy. In addition, we have greatly reduced wear in the piping since it no longer cakes up. This is definitely a nice feature for us.”



Screw feeder drain allows centrate to be diverted during centrifuge start-up

Looking Ahead at 91st Avenue

With no letup in site for Phoenix area growth, the 91st Avenue facility is poised for growth of its own and, in fact, has several expansion projects underway. According to Chandler, his area is making changes to meet the challenges ahead.

“We are currently a 200 million gallon per day plant and, when all is said and done we will easily be at double that capacity. In our department, we originally

had four Schwing Bioset cake pumps but we added a fifth one when we converted one of our thickeners to a dewatering machine and added two thickeners. We are currently in the process of doing the same thing to two more, bringing our total of thickeners to seven. This is a challenging application, but through it all we have seen excellent performance from the cake pumps — we’re confident that this is the best equipment available for that type of work.”

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