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SEPTEMBER 2012

Tech Talk:
Advantages of
large-blade mixers

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Steven Hardeman
Utilities superintendent
Norman, Okla.

On a *Mission*

THE TEAM IN NORMAN, OKLA., THRIVES ON
COMMUNICATION, SHARED RESPONSIBILITY,
AND A CLEAR, SIMPLE GOAL

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Giant microbes in
Coeur d'Alene, Idaho

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- PlantScapes: Recreation and birding in Muskegon, Mich.
- Greening the Plant: Energy efficiency in Wausau, Wis.

on the cover

Utilities superintendent Steven Hardeman says the Norman (Okla.) Water Reclamation Facility runs like a business, with a mission statement everyone embraces, job descriptions stated clearly in just three words, an uncompromising commitment to product quality and customer service, and a makes-sense management style. (Photography by David Cobb)



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let's be clear

Credit Where it's Due

THE CLEAN-WATER PROFESSION IS FILLED WITH FACILITY LEADERS WHO NEVER FORGET THEY ARE ONLY AS GOOD AS THE MEMBERS OF THE TEAMS THEY LEAD

By Ted J. Rulseh, Editor

In my experience, clean-water plant managers and superintendents have one important thing in common: They are not interested in taking all the credit for their plants' performance.

When we ask about possibly interviewing them for feature stories in *TPO*, we often hear: "Can I include some members of my staff?" Or some variation on that theme.

They have learned an important principle of leadership: That as leaders they are only as good as their teams.

What brought this to light for me was a note from a reader and U.S. Air Force veteran, responding to an article I wrote for another magazine about military officers and their leadership methods. "I will tell you that officers don't get the job done — non-commissioned officers (NCOs) do," he wrote. "These people are the front-line leaders in any unit, be it a combat team or a maintenance unit."

"For all that is said about the military academy graduates, they owe it all to those wearing stripes."



Oddly enough, most in the officer corps think it is their grand ideas and actions that get things done. It would never happen, and mistakes are often undone and put right by those with stripes.

"All good officers will credit NCOs for their success. And those NCOs will in turn credit the troops who work with them. Too many officers never seem to get around to mentioning the outstanding performance of those who serve under them."

OUT OF THE WAY

Now, this may be just one person's opinion — perhaps only a minority of high military officers think and act as described. At the same time, in the private sector, one can argue that high-profile CEOs get all the credit for their companies' fortunes, while no one mentions the brilliant inventors, the tireless sales managers, the incredibly efficient shop floor workers, and others whose roles were essential.



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Be all that as it may; we seem not to have this issue in the clean-water business. In fact, if one can draw conclusions from articles in this magazine, the number one leadership skill among plant managers and supervisors is knowing enough to get out of the way and let highly capable people do their jobs. And then — no small matter — making sure those same people get recognized, if not in splashy public displays, then at least among their industry peers.

That's why team pictures are important components of feature stories we publish. It's never just one or two people who are responsible for a plant's excellent performance, or even for an individual operator's success. Clean water is truly and always a team sport.

It's never just one or two people who are responsible for a plant's excellent performance, or even for an individual operator's success. Clean water is truly and always a team sport.

FROM THE GROUND UP

For an excellent example of teamwork, see the July issue's profile on the Rock Falls (Ill.) Water Reclamation Facility. They went a step further: Plant personnel worked hand-in-glove with the engineers to design a brand-new facility. Now that plant and process stand as monuments to professional respect and collaboration.

If the plant should ever win an award for its design, you can bet the engineers from Willett Hofmann & Associates won't be hogging the spotlight. And if the plant should win an award for operating performance, it's easy to envision both engineers' and operators' hands holding up the trophy.

There's a popular saying that has been attributed to everyone from Harry Truman to John Wooden to Ralph Waldo Emerson: "It's amazing how much can be accomplished if no one cares who gets the credit."

Perhaps a corollary would be: "It's amazing how productive a workplace can be when everyone shares the credit." That seems to be the way things work at clean-water plants around the country. **tpo**

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Sized Just Right

A 2.3 MW SINGLE-AXIS TRACKING SOLAR SYSTEM HELPS AN ARIZONA TOWN CUT ELECTRICITY COSTS AND ENABLES PROCESS CHANGES THAT WILL SAVE EVEN MORE

By Doug Day

The Neely Wastewater Reclamation Plant in Gilbert, Ariz., now gets 44 percent of its electricity from photovoltaic solar arrays it didn't have to pay for, doesn't have to operate, and doesn't maintain. Over the term of the deal, it's expected to save the town of 215,000 people about \$2 million.

Wastewater Division manager Mark Horn says the deal came about because SPG Solar (SPG), of Novato, Calif., was marketing solar opportunities for municipal facilities in Arizona. "They approached me, and over the next month or so I had a lot of conversations with them about the concept," says Horn. "I was looking for a reason why we shouldn't pursue it, and I couldn't find one. It seemed to be a no-brainer."

Sealing the deal was a renewable energy incentive from the local utility, Arizona Public Service (APS), who purchases the renewable attributes of the power generated from the approximately \$10 million, 2.3 MW-DC project. "Instantly, that made this project very attractive in everyone's eyes," says Horn. "It made the whole project come together."

With production expected to be around 4.8 million kWh per year, the solar installation will make enough electricity to power about 440 homes for a year while preventing the emission of 86 million pounds of carbon dioxide over the next 20 years.



The photovoltaic array at the Neely wastewater plant uses a single-axis tracking system to follow the sun across the sky, increasing output by about 20 percent over a non-tracking installation. When the groundwater recharging basins are filled with water, the panels will provide shade to reduce evaporation losses.

"We looked at the past 12 months of the plant's power demands because we wanted to make sure the system was sized accordingly. We wanted it to produce just enough power for us during our peak demand. We didn't want to oversize the solar system."

MARK HORN

SPACE CONSIDERATIONS

The 11 mgd (design) Neely plant's Class A+ reclaimed water is used in parks, golf courses and homeowner association neighborhoods for irrigation, and about 65 percent is put back into the aquifer through groundwater recharge basins.

That offered plenty of land for the 8,000 solar panels. "Gilbert has three separate recharge facilities," says Horn. "The Neely Recharge Facility where the solar arrays were constructed has 11 basins that are each 3 to 4 acres in size. The recharge facilities also serve as a wildlife habitat. So they really serve multiple purposes."

The Neely Recharge Facility is right next to the wastewater plant, making it a prime location for the SPG Solar SunSeeker single-axis tracking array.

The area gets plenty of fuel for the solar panels, averaging 310 days of sunshine a year. By shading the recharge basins, the solar panels will also reduce evaporation.

The solar plant is owned by Gilbert Solar Facility I LLC, a wholly owned subsidiary of Integrys Energy Services Inc. Gilbert Solar Facil-



The 8,000 solar panels on the SPG Solar SunSeeker system at the Neely Wastewater Reclamation Plant are mounted on 6.5-foot-tall beams. The system will generate about 44 percent of the plant's electricity.

PHOTOS COURTESY OF TOWN OF GILBERT WASTEWATER DIVISION

ity I contracted with SPG for the design, construction and operation of the facility, choosing a single-axis tracking system that follows the sun as it travels across the sky. "Single-axis panels are 20 percent more efficient than a fixed array that doesn't follow the sun," says Horn. Dual-axis systems that also adjust for the height of sun from the horizon provide more power, but they are more expensive to build and require much more maintenance.

"We looked at the past 12 months of the plant's power demands because we wanted to make sure the system was sized accordingly," Horn says. "We wanted it to produce just enough power for us during our peak demand. We didn't want to oversize the solar system."

While it is possible to earn credit for excess electricity put back onto the power company's grid, Horn says it was more important to make sure the solar project was sized right to fit the financial picture.

COLLABORATION NEEDED

Public-private partnerships to develop renewable energy are becoming common in light of declining local government budgets and increasing renewable energy incentives and requirements. "Without the incentive, it would have been more difficult for the project to move forward," says Town of Gilbert Wastewater Division manager Mark Horn.

The power purchase agreement was reached in less than six months. Other agreements included a land license contract since the installation is owned by a third party but located on the Town's property.

It also took time to finalize the agreements necessary to interconnect the solar plant to the main power grid. "We really got down to it, but we had to," says Horn. "The renewable energy incentive had a deadline. From the time we started talking about an initial concept to the time the plant was operating was only about 15 months."

The Town of Gilbert will save money over the term and will have 44 percent of its power for the Neely Wastewater Reclamation Plant come from the solar facility, enabling the generation of clean renewable energy. Gilbert Solar Facility I LLC will realize a return on its investment by selling the electricity to the town and the renewable attributes to the utility. Arizona Public Service benefits by counting the renewable attributes toward the state's requirement that 15 percent of its power come from renewable sources by 2025.

"That was one of the things that was somewhat rewarding through the course of this project," adds Horn. "Everybody who is involved in one way or another is going to benefit."

FINDING MORE SAVINGS

A local, inexpensive supply of electricity has allowed the treatment plant, one of two in the town, to make operational changes to save money. Since the Neely plant has no solids handling facility, it pumps all waste activated sludge to a regional treatment plant in nearby Phoenix. "It used to be cheaper to do that at night when we had reduced time-of-use rates from the power company," Horn says. It is now done during the day, powered by the less-expensive electricity from the solar plant.

There are also three backup generators at the plant that used to be tested during the day for an hour once a week. During testing, the generators provide the plant's electricity. "We don't do that during the day anymore because that's when our solar panels are producing power," Horn says.

(continued)



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Horn says such tweaking will continue as the plant staff learns more about optimizing its operations to match up with the new source of power.

DUE DILIGENCE

It took about 15 months to go from the initial discussions to full solar power operation. SPG approached Gilbert in June 2010, the renewable energy incentive was approved by APS in September, and the town council accepted the long-term power purchase agreement (PPA) with SPG in November. Project design started in December, and construction began in February 2011. The solar plant began operating in September 2011.

The Town of Gilbert provides only the land for the solar panels and buys the electricity at a set rate. "That's where the savings come from," says Horn. "Eventually, the amount we pay for utility power is going to be much higher than what we pay for the solar power."

Gilbert pays just under the current utility rate for the electricity, and the PPA includes a fixed price escalator that's lower than the utility's past rate increases. "Looking at the last ten years, the power company had raised rates an average of 5.5 percent per year," says Horn. "We used a projection of 4 percent per year over the term of the agreement."

Most of the savings will come in the later years of the PPA. Horn says the annual savings for the treatment plant will initially be about \$15,000, but that will increase to about \$200,000 annually toward the end of the term.

What's Your Story?

TPO welcomes news about environmental improvements at your facility for future articles in the Greening the Plant column. Send your ideas to editor@tpomag.com or call 877/953-3301.

Town manager Patrick Banger called it "ingenuity at its best" during a tour for elected officials from across the country in November 2011. He added, "This facility also clearly demonstrates all of the possibilities for the town in the clean and renewable industry." **tpo**

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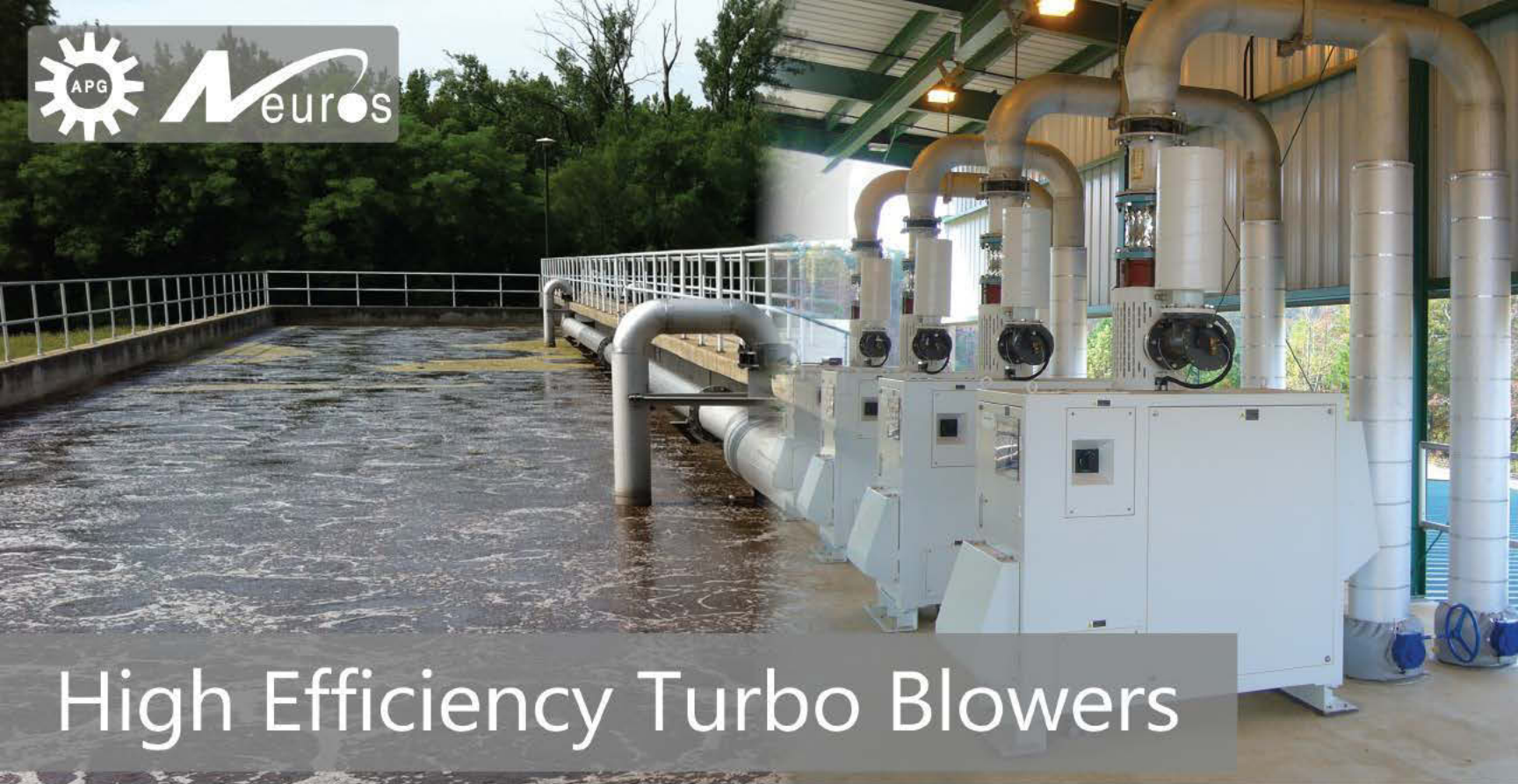


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NEW BRIGHTWATER PLANT IN KING COUNTY, WASH., COMBINES EFFICIENT TREATMENT WITH ODOR CONTROL TECHNOLOGIES THAT MAKE THE PLANT A GOOD NEIGHBOR

By Doug Day

"There are virtually no odors even inside the plant. That's one thing that really stood out to me as an operator. It's just really clean — it's amazing."

ANGELO ARCHULETA





The Brightwater facility, seen from the tallest landform within the 72 acres of public open space outside the facility site. (Photography by Patrick Lennox Wright)

AFTER MORE THAN A DECADE OF PLANNING AND ABOUT FIVE YEARS OF CONSTRUCTION, the 36 mgd (design) Brightwater Treatment Plant began operating in September 2011. It was the largest capital improvement in the history of King County, Wash., and the largest expansion of the regional wastewater system since the two original plants were built in the 1960s.

"It's a really significant project, and one we're really proud of," says communication specialist Annie Kolb-Nelson. The final \$1.85 billion cost includes an on-site environmental education/community center and over 70 acres of public open space and restored habitat. The treatment plant includes a technologically advanced odor control system to address King County's commitment to odor-free operation.

While Brightwater can make a claim to be one of the world's largest membrane bioreactor plants, a plant under construction in Dubai, due to come online in a year or two, will be larger. Still, it was a major project for the county Wastewater Treatment Division.

Brightwater joins the West Point plant in Seattle and the South plant in Renton in serving a total of 1.5 million people in 34 cities and sewer districts in King County and parts of Snohomish and Pierce Counties in the Seattle area. Brightwater itself will serve about 189,000 people in northern King and southern Snohomish Counties.

King County and their engineering consultant team of CH2M HILL and Brown and Caldwell, selected the ZeeWeed hollow-fiber membrane bioreactor (MBR) from GE Water & Process Technologies. It combines clarification, aeration and filtration in a single process, saving capital and operating costs.

"Hollow-fiber ultrafiltration is very applicable to wastewater treatment because the microscopic particles have biological components like viruses and bacteria," explains plant manager Ron Kohler. "The membranes filter out pollutants to the bacterial level, achieving high-quality water suitable for landscape irrigation and reducing pollutant loading into Puget Sound substantially compared to conventional secondary treatment. We get very low turbidity and zero coliform."

Plant operator Angelo Archuleta, who has been working in wastewater plants for about 20 years, adds, "The dynamics of an MBR are very interesting and different."

TWO-STAGE SCREENING

One of the keys to membrane filtration is proper screening of wastewater to protect the membranes from damage by debris and to prevent accumulation of solids on the fibers. Improper screening can also void membrane warranties.



profile

Brightwater Clean-Water Treatment Facility, King County, Wash.



BUILT:	2011
POPULATION SERVED:	189,000
FLOWS:	36 mgd design, 130 mgd peak
TREATMENT LEVEL:	Tertiary (Class A reclaimed water)
TREATMENT PROCESS:	Activated sludge, membrane bioreactor
BIOSOLIDS:	Anaerobic digestion, land application (farms and forestry)
EMPLOYEES:	27 (6 operators)
ANNUAL BUDGET:	\$10 million
WEBSITE:	www.kingcounty.gov/environment/brightwater-center.aspx
GPS COORDINATES:	Latitude: 47°47'30.53"N; Longitude: 122°8'26.63"W

“Coming into the headworks, we have four 9 mm punch plate screens (WasteTech, a Division of Kusters Water) followed by aerated grit channels and five primary sedimentation tanks for chemically enhanced primary clarification,” says Kohler. “Before it gets to secondary treatment, we have 2 mm traveling band screens (Ovivo).”

Two screening stages were selected to prevent having fine screens prior to primary treatment, which carried the risk of blinding the screens, although some other MBRs use single-stage screening. “We didn’t want to take that risk,” Kohler says. After screening, the influent goes to three standard activated sludge secondary aeration tanks with anoxic zones up front.

“With the nitrification-denitrification process available with membranes, you sometimes get low alkalinity,” Kohler says. “A 1 mgd recycle pump (Fairbanks Morse) sends the flow from the ends of the tanks back to the beginning for alkalinity recovery.”

The Brightwater operations and maintenance group includes, from left, electrician Josh Li, industrial master mechanic Terry Dixon, operator Angelo Archuleta, senior operator Gary Fletcher, operator Keith Roraback, instrument technician Kevin Moore, process analyst II Carol Nelson and instrument technician Joe Karl. (Photo by Joe Karl)

The wastewater is then pumped to the membranes to remove remaining suspended solids. When the flow leaves secondary treatment, it is at about 8,000 mg/L mixed liquor suspended solids (MLSS).

“We withdraw so much clean water through the hollow tubes that MLSS in the membrane basins goes up to 11,000 or 12,000,” says Kohler. “That is starting to act as a solid.” To combat that, the plant uses a 5Q recycle flow rate: For every 5 million gallons pumped to the membranes, 1 million gallons of clean water comes out and 4 million gallons is needed to carry the mixed liquor back to the front of the aeration tanks.

SMALLER FOOTPRINT

There are 10 membrane basins, each 21 feet deep, 70 feet long and 28 feet wide. Each has 13 hollow-fiber cassettes 5 feet square and 13 feet tall. “The advantage of hollow-fiber membranes is that for the same treatment throughput, you get a significantly smaller footprint, which means much less expense,” says Kohler. Because of the split-flow treatment process, which processes peak wet-weather flows through chemically enhanced primary clarification, the MBR requires about 40 percent less space than a traditional secondary clarifier installation.

The membranes remove 80 to 90 percent of viruses, which are too large to get through the pores. Bacteria are also filtered along with other suspended solids. “That physical barrier gives you better effluent, and it improves efficiency of disinfection through lower dosing,” says Kohler. “So membranes do improve effluent quality.”

The clean water flows from the membranes to chlorine disinfection with liquid sodium hypochlorite dosed at 1.7 ppm for 30 minutes. Programmable logic controllers (PLCs) monitor reclaimed water production to make sure it meets a limit of 1 ppm residual chlorine; it is normally about 0.5 ppm. “If it doesn’t meet that quality, it is automatically diverted back to the influent pump station,” says Kohler. “The control strategies assure us that out-of-spec water doesn’t get to our reclaimed water customers.”

(continued)

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Final effluent flows to an outfall with a two-tiered weir that directs the water to meet the demand of the reclaim system first. Whatever is left flows 13 miles to Puget Sound. For the time being, all effluent goes to the Sound, as the plant team wanted a year to refine operations while the 10-mile reclaimed water system is finished (2013). “We will be able to ultimately deliver up to 21 mgd to the Class A reclaimed water system,” says Kohler.

Biosolids are treated in fixed-cover modified silo anaerobic digesters to create Class B biosolids used as an agriculture and forestry soil amendment. Some material is available to the public through a vendor that treats biosolids to create Class A compost.

MEMBRANE MAINTENANCE

Discharge permit compliance is assured with the highly automated MBR process. The membranes have three operating modes: Filtering, relaxed and backflushing. Membrane cassettes go into a relaxed period for 30 minutes about every eight hours, during which time no water flows through them and they are allowed to rest. They are backflushed every few days to clean out the pores and wash off the fibers.

A PLC runs that process. “The computers are looking at things like the membrane pressure and amount of energy required to get negative



A Brightwater educator conducts a school-day tour with students in the public open space at Brightwater.



AWARD WINNING PROJECT

The Brightwater Clean-Water Treatment Facility earned two Engineering Excellence Awards in January from the American Council of Engineering Companies (ACEC) of Washington. Designed by CH2M HILL, it received a gold award in the Waste and Stormwater category and was named a finalist for ACEC national competition.

The award was based on a “highly collaborative partnership in designing a treatment plant that would protect public health and the environment, meet stringent seismic design codes, produce reclaimed water, improve habitat, and eliminate odors while

incorporating sustainable design features and community amenities such as trails and a community center.” It was also recognized for completing design deliverables on schedule and within budget.

Brightwater’s East Tunnel project received ACEC’s Best-in-State Silver Award. The 2.7-mile tunnel, designed by MWH/Jacobs Associates, is 16 feet 8 inches in diameter and holds pipes that convey untreated wastewater, treated wastewater and reclaimed water. The work also received a prestigious international tunneling award presented in Hong Kong in December 2011.

(continued)

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ABOVE: Pumps for membrane bioreactor backflushing (Fairbanks Morse). LEFT: Operator Pam Restovic monitors high-efficiency turbo blowers (APG-Neuros).

BUILT FOR SUSTAINABILITY

Sustainability was a key objective in design of the Brightwater Clean-Water Treatment Facility. Its notable features include:

- 50 percent reduction in impervious surface on the 114-acre site versus typical plant construction, using more landscaping and islands in traffic areas.
- Innovative stormwater treatment system (designed by CH2M HILL), with multiple-stage filtration through four stormwater ponds and wetlands before release to Little Bear Creek, a sensitive salmon spawning ground.
- Use of recycled or green building and construction materials, such as flyash concrete.
- Building designs that maximize use of natural light.
- Use of excavated soil to create landforms and buffers.
- Substantial native landscaping around buildings.
- 70 acres of open space for public use, walking trails, and wildlife habitat including 22,000 native plants and 5,000 seedling trees.
- Recycling of 15,000 cubic feet of compost material.
- LEED Platinum certification for the Brightwater Environmental Education and Community Center.



Sample section of the 9 mm punch plate screen design (WasteTech, a Division of Kusters Water) in the plant headworks.

pressure in the hollow fibers," says Kohler. "They have very high-level algorithms that control when the fibers need to be relaxed and when they are backflushed."

Archuleta says it is highly automated, so operators only need to monitor the system. "We have trending to help us, and everything is working really well on its own."

Operators need to understand the membrane operating cycle, Kohler observes: "If you're planning on a 15 mgd effluent flow rate hour after hour, you do not get that with membranes. When they go through

a relaxed period or backflush, there's about 20 minutes when your effluent drops until the other basins pick up the flow. It's an important element you have to plan for when you're delivering reclaimed water."

The Brightwater plant usually has one basin either in the relaxed mode or backflushing at any given time, which means nine basins are in full operation.

Besides backflushing, periodic chemical cleaning is needed to remove biofouling and dissolve lime and calcium buildup on the membranes. For those processes, the basin is filled with clean effluent and receives a light dose of hypochlorite for four hours for biofouling removal, or citric acid for lime and calcium removal.

"The advantage of hollow-fiber membranes is that for the same treatment throughput, you get a significantly smaller footprint, which means much less expense."

RON KOHLER

The Brightwater team does not yet know how often citric acid will be needed — the area has very soft water. Another MBR facility in the area has operated for about three years without needing chemical cleaning, although it has been done anyway to comply with warranty requirements.

ENERGY-EFFICIENT DESIGN

Besides high treatment efficiency, the plant is designed for excellent energy performance. High-efficiency turbo blowers with air bearings supply air for the aeration system. "We originally specified a very sophisticated single-stage blower," says Kohler. "During design, APG-Neuros provided one of their turbo blowers for testing at another of our plants. We documented 3 to 5 percent less energy use to deliver the same amount of air at the same pressure compared to other high-efficiency blowers."

The local electric utility, Snohomish County Public Utility District, installed monitoring equipment on the blowers and documented the savings, resulting in a \$265,000 rebate. "We're going to see that reduction in electrical use for as long as those blowers are in operation, and that's a great value for our ratepayers," says Kohler.

An added benefit is that they are much quieter: the blower room is at

(continued)

A black and white photograph of Don Bennett, a man with short, dark hair, looking directly at the camera with a serious expression. He is wearing a light-colored, high-visibility work jacket over a dark shirt. The background is slightly out of focus, showing what appears to be the interior of a vehicle or a piece of machinery.

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Plant manager Ron Kohler introduces operators from the National Parks Service to Brightwater.

about 85 decibels, compared to 130 decibels in most blower rooms. The rooms are also cooler because the blowers recapture their own heat instead of expelling it into the room. “I’ve worked with different types of blowers and these are a lot quieter and more efficient,” says Archuleta. “It’s refreshing to see technology at work.”

The air-handling system was also optimized to reduce air requirements and that is expected to lower power consumption by about 50 percent. “The membranes use a lot of air injected right under the cassettes to keep them moving so they don’t stick together,” says Kohler. “We worked with GE to modify that system to reduce airflow significantly.”

GOOD NEIGHBOR

While creating a cost-effective treatment system, the plant invested heavily — to the tune of \$65 million — in being a good neighbor. During design, a promise was made to the public: You will not smell Brightwater. “That was the biggest concern people had,” says Kolb-Nelson. “We committed to no detectable odors past the fence line.”

The plant neighborhood is low-density housing with some light industry and is likely to develop in the future. “The county conditional use permit places specific performance criteria on our odor control system,” says Kohler. “All process areas are covered or inside buildings under negative pressure. All air that comes in contact with wastewater is scrubbed in three odor control phases before it is exhausted.”

The plant has ten trains of Siemens odor control equipment in operation

Brightwater Clean-Water Treatment Facility PERMIT AND PERFORMANCE

	INFLUENT	EFFLUENT	PERMIT
BOD	296 mg/L	1.3 mg/L	30 mg/L monthly avg. 45 mg/L weekly avg.
TSS	278 mg/L	<2.0 mg/L	30 mg/L monthly avg. 45 mg/L weekly avg.
Coliform (MPN/100 ml)	N/A	<1.0	2.2 7-day median 23 sample maximum

at all times, and three more serve as backups. Each train treats about 350,000 cfm. The process starts with a biological scrubber, followed by chemical scrubbing and finally treatment in carbon absorption beds containing 90,000 pounds of activated carbon.

The biological scrubber is a relatively new technique that uses organisms that feed on hydrogen sulfide. “It’s a low-cost, passive system that is guaranteed to remove 60 to 80 percent of H₂S,” says Kohler. “That results in a direct reduction of sodium hydroxide and sodium hypochlorite in the chemical scrubbers by one to three tankers a week.”

Brightwater can document that it is meeting its promise to neighbors. The conditional use permit limits H₂S to 0.08 parts per billion (ppb) at the property boundary. That’s below the detection limit, but mathematical calculations show it is equal to 20 ppb at the stack when dispersion is taken into account. Monitors show that the actual stack level is typically less than 3 ppb.

“There are no odors even inside the plant,” adds Archuleta. “That’s one thing that really stood out to me as an operator. It’s just really clean — it’s amazing.”

MEETING EXPECTATIONS

Kohler accepts the modern reality that people expect sustainable operation and effective wastewater treatment, but they don’t want hassles, especially with greenfield construction projects like Brightwater. “Neighbors are going to insist you cover the entire facility and scrub all of the air so you don’t become a nuisance,” Kohler says.

The education center is also helpful, adds Archuleta. “We’re open to the public and it’s a great educational experience to teach children and the public about our environment, wastewater treatment and reuse.”

The biggest compliment Kohler has heard came at the grand opening, to which all neighbors received a personal invitation. “Two of our closest neighbors asked me when we were going to start operating. I laughed and told them we’d been operating for a month.” Then he heard something all wastewater operators want to hear: “They told me they trusted us.” **tpo**

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Shift operator Veon Richmond, maintenance relief operator Angel Perez and utilities supervisor Ryan Bart check on the operation of Allen-Bradley variable-frequency drives (Rockwell Automation) for the reclaimed water system at the Norman Water Reclamation Facility. (Photography by David Cobb)



On a Mission

THE TEAM IN NORMAN, OKLA., THRIVES ON COMMUNICATION, SHARED RESPONSIBILITY, AND A CLEAR, SIMPLE GOAL TO DELIVER SAFE WATER AT LOW COST TO THE COMMUNITY

By Jim Force

UTILITIES SUPERINTENDENT STEVEN HARDEMAN says the Norman (Okla.) Water Reclamation Facility runs like a business. In truth, most businesses could learn a thing or two from the plant. Its operating platform includes:

- A mission statement everybody embraces.
- Job descriptions stated clearly in just three words.
- Uncompromising commitment to product quality and customer service.
- A makes-sense management style that puts operations at the hub of the communications and decision-making process.

“We have a product, stakeholders, customers, employees and a budget given to us by our customers,” says Hardeman. “Our mission statement is simple: Produce safe water for the environment, at the lowest cost to our ratepayers.”

It’s more than words on a plaque. The facility produces effluent clean enough for recycle and reuse at the University of Oklahoma’s golf course and for several in-plant processes. And the 24-member operating team has instituted energy-saving measures that have already lowered the plant’s power consumption dramatically.

Teamwork, starting with the operators, is instrumental. “It used to be that communications centered around administration,” recalls Hardeman, who has 25 years of experience as a clean-water professional. At Norman, ideas and recommendations emanate from anybody and are communicated throughout the team.

All ideas are considered based on the mission, and operators play a critical role in decision-making. “They are the ones who know what’s going on; they listen, they hear, they see,” says Hardeman. “They’re in the center, with the support staffs around the outside, like a wheel. It’s a different mindset.”

HIGH-POWERED SECONDARY

The Norman facility may be one of the best-performing secondary treatment plants in the field. It has no disinfection requirement and uses no tertiary filters, yet it records typical effluent values of 0.1 mg/L for ammonia, 2.4 mg/L for suspended solids, and 4.0 mg/L for BOD.

Treatment starts with fine screens and vortex grit removal (both from WasteTech, a Division of Kusters Water). The flow then passes through a Parshall flume and splits on its way to two sets of primary clarifiers (Siemens

Senior operator Lonny Larson samples the secondary clarifiers (WesTech Engineering); (CorePRO sludge sampler, USABlueBook).



profile



Norman Water Reclamation Facility, Norman, Okla.

BUILT:
1943, expanded 2000

POPULATION SERVED:
112,000 plus University of Oklahoma

FLOW:
12 mgd

TREATMENT LEVEL:
Advanced secondary

TREATMENT PROCESS:
Activated sludge

RECEIVING WATER:
South Canadian River

BIOSOLIDS:
Anaerobic digestion, dewatering, cake to land application

EMPLOYEES:
24

AWARDS:
2011 Oklahoma Water and Pollution Control Association Large Treatment Plant of the Year

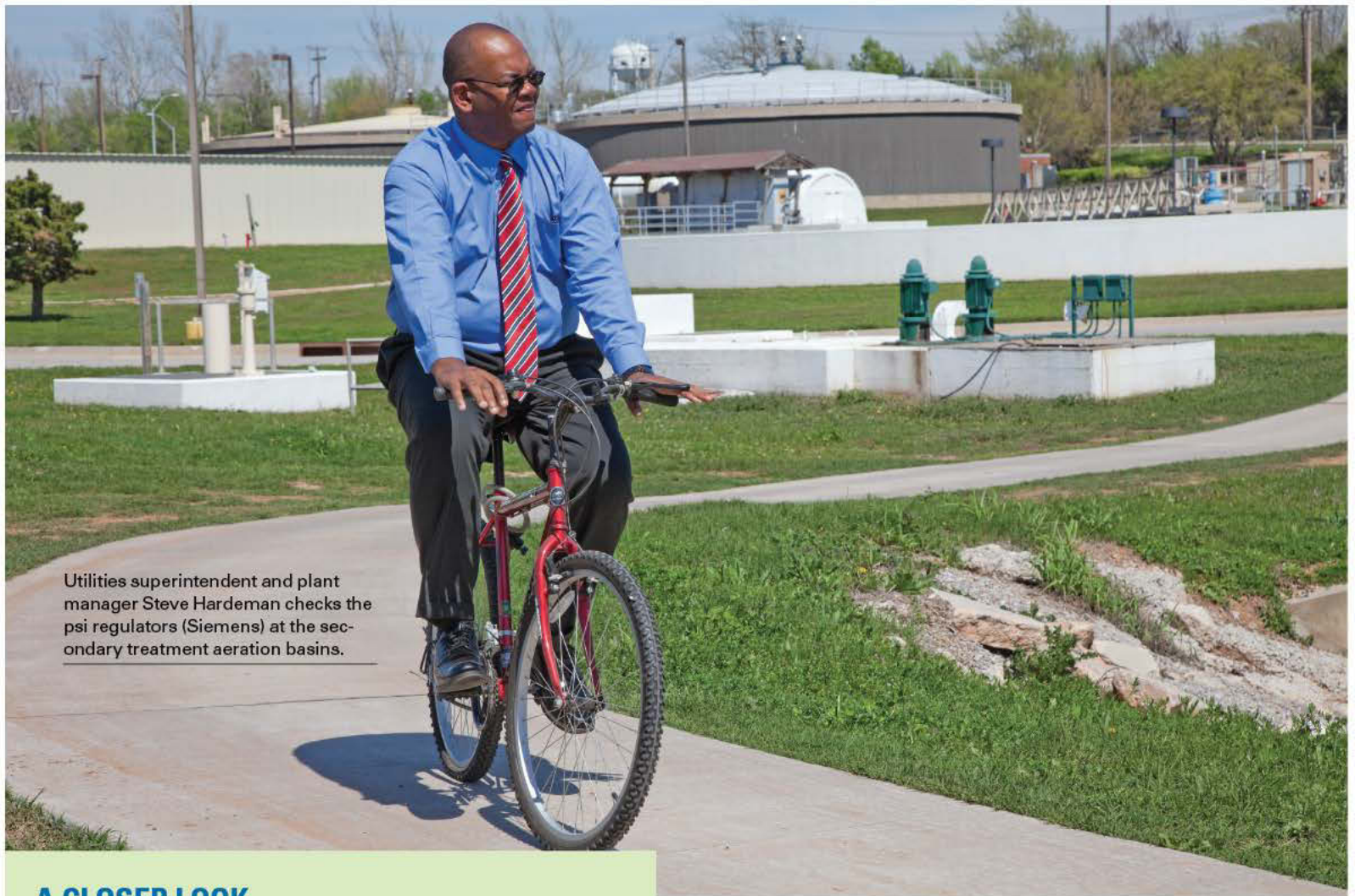
ANNUAL BUDGET:
\$9 million

WEBSITE:
www.ci.norman.ok.us

GPS COORDINATES:
Latitude: 35°10'31.14"N;
Longitude: 97°26'34.94"W

"Operators are the ones who know what's going on; they listen, they hear, they see. They're in the center, with the support staffs around the outside, like a wheel. It's a different mindset."

STEVEN HARDEMAN



Utilities superintendent and plant manager Steve Hardeman checks the psi regulators (Siemens) at the secondary treatment aeration basins.

A CLOSER LOOK

How many times have you heard someone say, “The answer’s right in front of you”?

It’s good advice, and it’s the way the Norman Water Reclamation Facility runs and fine-tunes its operation. “We look very closely at our microorganisms,” says utilities superintendent Steven Hardeman, “and we watch them every day.”

Hardeman’s team started paying extra attention to microbes about 10 years ago. “We trained ourselves as to what our microbes looked like and what they were affected by,” he says. “We researched the kind of indicator organisms we needed to see in order to produce the best water we could. We watch how they swim and try to determine if anything’s wrong or if we should be doing anything different.”

Such close observation has often helped spot problems in the collection system. In one case, a change in the microbes’ activity was traced back to illegal dumping. “The bugs weren’t acting right that day, and our environmental services division discovered a septic hauler illegally midnight dumping near the university,” Hardeman says.

In another case, a change in bug behavior signaled a toxic surfactant being used by a firm contracted to control roots in the sewer system. The chemical was changed. Hardeman gives a lot of credit to his laboratory staff: “Our QA-QC is vitally important. When the state regulatory people come in, the first thing they do is go to the lab to make sure our QA-QC is correct.”

Water Technologies and Hi-Tech, a Division of Kusters Water). The north plant handles about 40 percent of the flow, while the south plant takes the remaining 60 percent.

The clarified water is merged again and passes to the activated sludge system, operated in the plug flow mode and equipped with anoxic selector zones for nitrification-denitrification.

“We have seen a significant drop in electrical cost this year. We’ll have to wait and see what the next few monthly bills look like before we have a celebration.”

STEVEN HARDEMAN

The plant was one of the first to incorporate such zones, back in 2000. “I’m amazed at how well they perform,” Hardeman says. “The zones enable us to nitrify and denitrify, as well as control filamentous growth. We keep the dissolved oxygen low in the selector zones ahead of oxidation, and increase it to 3.0 parts per million in the oxidation zones.”

Three trains are designed for 900,000 gallons each. Blowers are Gardner Denver, and Sanitaire (Xylem) supplied the aeration system. The design calls for mixed liquor suspended solids (MLSS) of 3,500 mg/L, but the Norman team likes to keep the levels around 3,000 mg/L. “We were higher during our sludge processing improvement project in 2008, getting up around 8,000 mg/L,” Hardeman notes.

Norman Water Reclamation Facility PERMIT AND PERFORMANCE

	INFLUENT	EFFLUENT	PERMIT
CBOD	240 mg/L	2.62 mg/L	13 mg/L Jun-Oct 25 mg/L Nov-Mar
TSS	169 mg/L	11.24 mg/L	30 mg/L
Ammonia	25.2 mg/L	0.158 mg/L	4.1 mg/L
DO	0.9 mg/L	5.3 mg/L	5.0 mg/L

InsiteIG probes monitor mixed liquor and DO. The Norman staff has made adjustments to promote nitrification-denitrification during the colder winter months. "Our ammonia-reducing microorganisms don't like the cold, so we've had to add more microorganisms in the winter to sustain the desired levels of biological activity," Hardeman says.

After settling in a quartet of secondary clarifiers (WesTech and Conjet AB/National Hydro), the clear water passes through another Parshall flume, and some of the water is diverted for reclamation and reuse. The remainder is discharged to the South Canadian River.

EMERGENCY COGEN

Future plans include a disinfection and filtration station, followed by post-aeration, to improve effluent quality even further and meet a 2013 limit on fecal coliform. The plant will operate under an interim permit until 2013 while the new system is being installed.

Solids wasted from the system are pumped to gravity thickeners and then moved to anaerobic digesters by double disc pumps (Penn Valley Pump). Digester heat recovered via heat exchangers is used to bring feed solids up to proper temperatures. Most of the system components were furnished by Siemens.

While digester gas is normally flared, the plant maintains a cogeneration system (Waukesha Engine/GE Energy) to supply power during emergencies. There are plans to add more cogeneration capability in the future.

After digestion, solids are further thickened, then dewatered on Siemens centrifuges. A nearby 430-acre farm field accepts the dewatered cake at about 21 percent solids. In the winter, the material can be stored at the plant.

Return activated sludge is routed to an RAS/WAS station and then pumped back to the aeration basins. A new iFIX system (GE Intelligent Platforms) automates and controls plant processes, and enables remote monitoring. One SCADA node will be set up in the utility manager's office in city hall. Control of the city's 17 lift stations will be incorporated into the SCADA system in the near future.

WATER FOR THE FUTURE

Like many areas in the Southwest, Oklahoma has seen its share of droughts in recent years, and the Norman treatment plant is doing its best to make sure the community has an adequate supply of fresh water in the future.


"We have been practicing water reuse here since 1995," says Hardeman. "But we've had major droughts in 2005-06 and again in 2009-10. We're asking our-

selves how we can help save our citizens water that comes from the lake (Lake Thunderbird, the city's main source of drinking water)."

So, since 2009, the Norman plant has been using effluent water wherever practical for in-plant purposes, like washdown of headworks equipment and seal water for pumps and motors. "We've been brainstorming and looking at other treatment plants to find new ways to use our water," Hardeman says. He estimates that the university uses 2 million gallons a month, and up to 7 million gallons a month during summer. At the plant, between 9 million and 10 million gallons are recycled each month, increasing to 14 million gallons in summer.

"That's water that we don't have to get from our water treatment plant, and it's water that's available for others to use," Hardeman observes. Meanwhile, the Oklahoma state legislature is working on new legislation that will encourage reclamation and reuse of water. Expect more reuse ideas from the team at Norman.

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Lab technician Richard Squirrel does CBOD/BOD testing in the lab.



SAVING ENERGY

While water reuse represents economy at the Norman facility, energy reduction presents even more opportunities for the plant to live up to its mission of reducing operating costs and saving ratepayers money. Like many other water and wastewater operations across the country, Norman has been closely examining its electricity bills, searching for areas to cut costs.

“Normally, our electricity bills were running between \$34,000 and \$38,000 a month, and \$28,000 to \$34,000 of that total went to our aeration tank blowers,” Hardeman reports. He and his staff looked into the situation and consulted with a local expert on power usage. They determined that their motors were running at peak kilowatt usage on a 4,160-volt system, irrespec-

“I went on rounds with the operators, talking with them and gathering input; they pointed to issues not even on the radar, and their suggestions made it into the final design.”

STEVE RICE

tive of the air output. “We were squeezing down the air use, but the motors were running at 100 percent,” Hardeman says.

The solution was to install variable-frequency drives. “We changed out motors and switchgear and converted everything to Square D [Schneider Electric] 480-volt VFDs,” says Hardeman. “Now our air demand is based on the motor, not the valve.”

Funding for the modifications came from the U.S. government stimulus program via a \$1.1 million grant from the Department of Energy, and already the move is paying off. “We have seen a significant drop in electrical cost this year,” says Hardeman. “We’ll have to wait and see what the next few monthly bills look like before we have a celebration.”



The Norman team includes, from left, front row, utilities supervisor Ryan Bart, shift operator Veon Richmond, administration technician III Loretta Saunders, utilities superintendent/plant manager Steve Hardeman; second row, plant mechanic John Baze, maintenance relief operator Angel Perez, senior operator Lonny Larson, pollution prevention specialist Paul Wright; third row, maintenance worker I Blake Carter, maintenance worker II Joe Robertson, assistant environmental services coordinator Lyle Milby, environmental services coordinator Debbie Smith, crew chief Mike Bates; fourth row, shift operator George Holmes. Not shown: Darrel Schwartz, James Sterling, Gary Todd, Chris Serrano, Robert Daniels, Richard Squirrel.

The Norman facility also looks for other ways to save energy. Sensor-based lighting has been installed throughout the facility so that lights go off when rooms are not occupied. In addition, modifications are being made to the digester gas and cogeneration system to further reduce the plant’s energy bill.

SELF-IMPROVEMENT

Like many other improvements around the Norman plant, the energy savings modifications are often driven by the facility staff. “We’re always looking for ways to make things better,” Hardeman says. “And we do most of it ourselves.” The utility had budgeted about \$50,000 for new chopper pumps in the clarifiers, but the plant halved that cost by installing the pumps with in-house labor. In another cost-saving measure, crew chief Mike Bates got online and found vendors that specialized in 4,160-volt equipment. “We sold the 4,160-volt motors and associated equipment to them for \$26,500,” says Hardeman. “We’re proactive in what we do.”

With the central role that teamwork plays here, staff communications are critical. “We’ve actually trained ourselves to communicate with one another,” Hardeman says. “We have weekly, monthly and mini meetings. Our operators communicate with maintenance. When we do that, we can prevent breakdowns and fix something before it burns up and we have to replace it.”

Communications at Norman extend beyond just the internal staff. Steve Rice, project manager for Garver, the engineering firm designing the next expansion of the Norman facility, spent several days at the plant. “It was extremely valuable,” he says. “I went on rounds with the operators, talking with them and gathering input; they pointed to issues not even on the radar, and their suggestions made it into the final design.”



Shift operator George Holmes samples effluent from the Parshall flume.

An example involved new biosolids dewatering centrifuges proposed in the expansion.

"There were issues with the pumps that take the drainage from the centrifuges back to the head of the plant," says Rice. The meetings with operators pinpointed the problem, and the new design now includes an upgrade to the pumping station.

"We value their input," Rice says. "We don't want a situation where plant designers are identifying solutions without input from the guys who actually make the equipment work."

And what about those three-word job descriptions? "They're designed to provide each group with a simple way to remember their mission at the Water Reclamation Facility," explains Hardeman. For operators, it's Monitor, Collect, Input.

For the maintenance staff: Prevent, Repair, Maintain.

"We all do other things within our organization, but these are the core duties and responsibilities of each person," Hardeman explains.

And for him? Plan, Procure, Oversee. **tpo**

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Plant Pride

TREATMENT PLANT STAFF MEMBERS IN GREELEY, COLO., ARE PROUD OF THE IMPRESSION THEY MAKE ON YOUNG ENVIRONMENTALISTS

By Briana Jones

Making an impression on the youth in Greeley, Colo., has been easy for industrial pretreatment specialist Eddie Treviño. “I told my five-year-old granddaughter that when she goes to the bathroom and flushes, that comes to my job to get cleaned up, so only clean water goes into the river,” he says. “So after she goes to the bathroom, she’ll tell me, ‘Grandpa, I just sent a sample. Will you call the plant and tell them it’s on the way?’”

Greeley’s 14.7 mgd (design) Water Pollution Control Facility serves about 97,000 people. The wastewater treatment division leads a number of public education efforts. Plant staff members use a mixed bag of methods to convey the importance of clean water to the public.

“This education and outreach effort is conducted by plant employees, who take a lot of pride in working with students, government officials, retirees and community leaders,” says division manager Tom Dingeman. “We inform them of the innovative projects that are ongoing at the local wastewater treatment facility, help them understand the importance of clean water, and show them what we are doing to be good environmental stewards for the entire community.”

WATER MONITORING

Treviño and other plant staff members take part in World Water Monitoring Day (WWMD), an international education and outreach pro-



Kids from the City of Greeley’s Summer Parks Program collect invertebrates in a park stream using a sieve net. They identify the creatures with a picture guide and use the information to assess water quality.



PHOTOS COURTESY OF GREELEY WPCF

What’s Your Story?

TPO welcomes news about your public education and community outreach efforts for future articles in the Hearts and Minds column. Send your ideas to editor@tpo-mag.com or call 877/953-3301.

Eddie Treviño, industrial pretreatment specialist and program leader, assists a Brownie troop member with a water sample while Brownie troop leader Debbie Nix looks on.

gram that builds public awareness of protecting water resources.

“We provide lab kits to the Poudre Learning Center (PLC), which is designed for students and teachers to get educated on the environment,” says Treviño. PLC is funded by several school districts, including Greeley School District 6.

Treviño and Bob Alexander, another pretreatment specialist, run tests with the kids to check for temperature, pH, total dissolved oxygen and turbidity.

In the process, kids learn about clean water and the digital aspect of collecting information. “They have started compiling the data every year,” says Treviño. “They upload the data to the national WWMD website. We encourage the kids to get involved because it gives them an opportunity to see what happens in their own local community, and also at the state, national and international levels.”

WATER WISE

Plant staff members are also involved in various water festivals and local career fairs, and in the Stockholm Junior Water Prize (SJWP) competition, a Water Environment Federation youth award program for water-related science projects created by high school students.

“For almost 10 years, a team of plant personnel here at Greeley has been judging at the state annual science and engineering fair leading up to the SJWP,” says Dingeman. “We select the nominee who will represent Colorado at the national competition.”

Plant tours and large-group conferences are ways for plant staff to discuss career opportunities with students. “This is a tremendous field where a student virtually can go anywhere and find a job,” explains Dingeman.

“There’s always going to be a need for wastewater treatment professionals, especially when it is predicted that 40 percent of the



“This education and outreach effort is conducted by plant employees, who take a lot of pride in working with students, government officials, retirees and community leaders.”

TOM DINGEMAN



Children look at their catch of critters from a stream next to Bittersweet Park in west Greeley.



Kids from the Rodarte Cultural Center are shown after completing a tour at the Greeley Water Pollution Control Facility.

water/wastewater workforce is set to retire within the next 10 years. We have a passion to get the word out there and make it known to the younger generation that this is a good field to pursue.”

WASTEWATER FOR THE SOUL

Providing public education outlets for students and adults in Greeley gives the operations staff a sense of pride. “Our staff members appreciate the responsibility we have been entrusted with — to be service-oriented professionals and environmental stewards who provide quality, safe, and cost-effective wastewater treatment for the citizens of Greeley,” says Dingeman.

“Plant employees work hard to promote a good public image through an excellent environmental compliance record, customer service, and proactive public education and outreach programs.”

Treviño boasts a strong connection to the community where he grew up. “Public education means giving back to the community,” he says. “It means a lot to me to go to schools and educate kids and go to Rotary clubs and educate adults so they see what they’ve been missing and how they can help contribute to future generations.” **tpo**

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Giant Microbes

The statues of wastewater treatment microbes are made from 3/8-inch thick flame-cut steel with a naturally rusting finish. The 12-foot-tall "Totem to the Water of Life" sculpture (far right in the photo above) is carved from basalt.

SCULPTURES AT THE COEUR D'ALENE WASTEWATER TREATMENT PLANT
PAY PROPER TRIBUTE TO THE TINY HEROES OF THE ACTIVATED SLUDGE PROCESS



PHOTOS COURTESY OF CITY OF COEUR D'ALENE

By Jeff Smith

It isn't often that community residents can visit their local wastewater treatment plant to view creative public art, but in the City of Coeur d'Alene, Idaho, it's part of the experience.

Six steel statues reaching nearly 8 feet tall display the shape and form of the protozoa and metazoa that work behind the scenes in the plant. They immortalize the tiny agents that do the transforming work as wastewater makes its way through this 6 mgd (design) advanced treatment facility, based on the activated sludge process.

Named "Frolicking Creatures" by their creator, Coeur d'Alene artist Allen Dodge, the 3/8-inch-thick flame-cut statues of ciliates, filamentous and rotifers have a naturally rusting finish. They are post-mounted on concrete bases and stand near the plant's main entrance. A freestanding ceramic plaque mounted near each piece describes the characteristics of the microorganism.

LIKE A CAMPUS

Another local artist, Dale Young, created a 12-foot-tall sculpture, "Totem to the Water of life." Carved from basalt, the totem presents images that depict land, water and sky. It stands near the main entrance to the recently completed administration/laboratory building.

"The public art complements our efforts toward developing an architectural style," says wastewater superintendent Sid Fredrickson. He says recent plant upgrades have included projects to improve the plant's facade and give it a campus-like appearance.

In part that's because a consortium of colleges and universities plans to build a corridor of higher education facilities next to the plant. It's also because a popular paved hiking and bicycling trail passes in front of the plant. "Certainly this art will have an impact on the general public," Fredrickson says.

ARTIST INSPIRED

Fredrickson served on the selection committee that reviewed the entries from more than 20 artists who answered the city Arts Commission's call for hands-on and interpretive art pieces. The winning artist completely changed his offering after he had a tour of the secondary treatment facility, which included a new digester. "He was completely enraptured with the microorganisms and their function in the wastewater treatment process," says Fredrickson.

"We realize that in such a sensitive setting we can no longer appear as an industrial tank farm to our neighbors."

SID FREDRICKSON

The \$50,000 needed for the public art project came through funding from a city ordinance that designates 1.33 percent of the total cost of all aboveground projects for the Arts Commission. Since 1982, the plant has invested more than \$64 million in upgrades.

Fredrickson says architectural aesthetics will continue to be an important part of all future plant upgrades: "We realize that in such a sensitive setting we can no longer appear as an industrial tank farm to our neighbors." **tpo**

Share Your Ideas

TPO welcomes news about interesting features of your facility's grounds, signage or buildings for future articles in the PlantScapes column. Send your ideas to editor @tpomag.com or call 877/953-3301.

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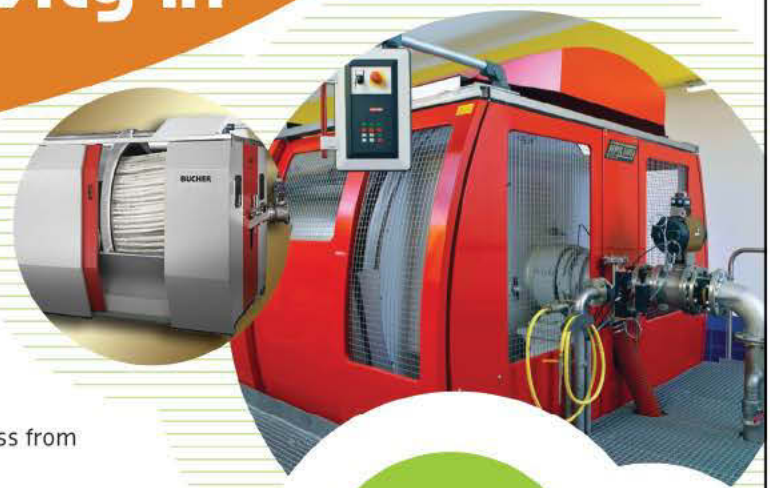
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PRIVATE PERSPECTIVE FOR PUBLIC GOOD

RAYMOND VERMETTE JR. CONTINUES TO STREAMLINE HIS FACILITY, RELYING ON THE LATEST TECHNOLOGIES, A KNOWLEDGEABLE TEAM, AND SUPPORT FROM HIS CITY OFFICIALS

By L.K. Williams

THE 4.7 MGD DOVER (N.H.) WASTEWATER TREATMENT FACILITY OPERATES under facility supervisor Ray Vermette — who also serves as chief operator. “It makes me have a busy day,” Vermette acknowledges.

With this last promotion, he earned more responsibility, more pay, and a home-based laptop computer connected to the facility SCADA system. By summer, the SCADA connection was to be streamed to his Android phone, enabling him to address emergencies quickly even while on the move.

Adopting the “latest and greatest” technology has helped the city pare its facility staff to seven team members — fewer than half the number employed 20 years ago when Vermette began working at Dover. By his side now are lab supervisor Arnold Powers, who also oversees the industrial pretreatment program, lab technician Tammy Bougie, operators Allan Johnstone and Steve Rogers, electrical technician Raymond McNeil, and maintenance mechanic Earl Friede.

“Every person here is both feet, 100 percent committed to the facility,” Vermette says. Vermette, Powers, Friede and Johnstone have worked at the plant both as city employees and as employees of OMI, the contract operations division of CH2M HILL, which ran the facility for seven years. They have used their skill and experience, along with insights from both in-house and contract operations, to the substantial benefit of the city.

EARLY COMMITMENT

Vermette’s interest in the clean-water professions goes back to his teen years when he attended a summer program at the Somersworth wastewater treatment plant. “Just seeing how the environment was taken care of — you



Ray Vermette, supervisor, Dover Wastewater Treatment Facility, with the plant’s Huber Q800 incline screw press (Huber Technology). (Photography by Jeff Dachowski)

didn’t realize when you ran the water or flushed, where it went and what happened,” he says. “It just gave me a tremendous interest.”

He started at Dover as a laborer in 1991 and worked on several improvements and upgrades while moving up the ranks. He was retained by OMI as it took control of operations in 1992. When the facility returned to public operation in 1999, the city kept and soon promoted him. “The city was smart — they used the contractors to get policies and procedures in place and get the facility running,” recalls Vermette. “It only ran under the municipality for six months before it was contracted out, so OMI did all the initial startup work.”

Vermette says his experience is unique because he has been at the same facility for two decades. “My heart was always here,” he says. “I’ve had the opportunity to be at one facility and use the benefits of both public and private operations models. I’ve been very fortunate.”

CONTRACT OPS MINDSET

“Working for the city for more than a year, at a newly constructed facility before contract operations, gave me just enough time to see how the municipality was structured,” Vermette says. “Through the seven-and-a-half years of contract operations, I learned a tremendous amount about streamlining, structure, policy and procedures. That experience gave me the mindset to think and act like an owner and do more with less.”

The plant now runs in a manner very similar to the way it did through contract operations. For example, Vermette and his team continue to perform quarterly walk-throughs, writing up what needs to be addressed. “That’s something that was brought to me working for OMI,” says Vermette. “Policies



Ray Vermette, shown running an effluent turbidity test, gives back to the industry by serving in leadership positions in state and local associations.

profile

The Dover team includes, from left, operator 1 Allan Johnstone, lab supervisor Arnie Powers, lab technician Tammy Bougie, facility supervisor Ray Vermette, electrical technician Ray McNeil, maintenance mechanic 2 Earl Friede, and operator 1 Steve Roger.



Ray Vermette, Dover Wastewater Treatment Facility, Dover, N.H.



POSITION
Facility supervisor

EXPERIENCE:
20+ years

DUTIES:
Manage 7 employees and a 4.7 mgd treatment facility

EDUCATION:
Associate degree in Water and Wastewater Technology from New Hampshire Technical College, 1999

CERTIFICATIONS:
New Hampshire Grade 4 Wastewater Operator's license, Grade 1 Water Treatment Operator's license, NEWEA Grade 4 Collection Systems Operator certification, NEWEA Grade 1 Lab Analysis certification, University of New Hampshire supervisory skills certification

PROFESSIONAL GOALS:
See the next facility upgrade, meet and comply with the next 20 years of challenges, become president of NEWEA

GPS COORDINATES:
Latitude: 43°9'40.36"N; longitude: 70°50'12.60"W



HYDROTURBINE POWER

Everyone knows wastewater treatment plants are big energy users, and these days everyone wants to harness green power and cut costs. Perhaps ahead of the curve, the Dover Wastewater Treatment Plant is on its way to doing that with the help of Walker Wellington.

Company principals Henry Russell and Richard Russell collaborated with inventor Benjamin Brickett to develop a turbine generator known as W4e to capture kinetic energy from wastewater effluent.

"The challenge is low head and fluctuating flows, but the W4e modulating turbine adjusts to those parameters," says Vermette. "As the flows go down, the vanes can close, and as flows go up, the vanes open."

Last fall, Walker Wellington installed a custom W4e generator into a manhole at the plant. Effluent flows through the pipes, eventually passing through a transition structure at the end with about 60 feet of head drop. "The company has tailored this revolutionary generator that goes into one of our manholes and was scavenging about 5,550 continuous watts of power," Vermette says.

The generator's variable force and pitch control automatically regulate head and flow rate changes. The company has been testing and fine-tuning the technology while Dover reaps cost savings estimated at \$12,000 to \$15,000 per year. The device is the first of its kind. "When this is all said and done, we'll have a unit at no charge to the city," Vermette says.

The project was funded through Green Launching Pad, a New Hampshire program supported by U.S. Department of Energy stimulus funding. The city recently applied for a DOE grant, hoping to build a full-scale inline direct-drive hydrokinetic turbine generator.

LEFT: Ray Vermette works on one of the "latest and greatest" technologies at the Dover plant — an effluent turbine from W4e (Water for Energy) that turns the flow into electric power. BELOW: Vermette checks the controls on one of the turbo blowers (HSI) for the aeration process.



"My heart was always here. I've had the opportunity to be at one facility and use the benefits of both public and private operations models. I've been very fortunate."

RAY VERMETTE

and procedures was something OMI was very big into, and that was something I got to bring to the city."

Operating through a municipality, especially in the current economy, has not been easy. The city has faced budget cuts every year, and in fact his hourly workers drive snowplows when the streets need clearing. That thinking of his crew sometimes makes operations challenging.

Working under contract operations has its issues, too: It requires the private company to regularly re-bid for the job. "Every three years, you had that uncertainty," Vermette says. "Who's going to get the project? We worked hard to make sure that OMI kept it." Vermette describes the current publicly run structure as a great fit. He says the best parts of his job are:

- Being employed by a proactive organization that is always working to improve itself
- Having a city council, city manager and a community services director involved in and supportive of the operation and progression of the facility
- Being able to operate and manage the facility as if it were his own
- Having a team of dedicated co-workers who have helped make more than 20 years of operations "an unforgettable experience."

IMPROVING THE PROCESS

The city's conventional activated sludge facility accepts wastewater from about 100 miles of sewer lines and 21 pumping stations. From a 36-inch force main, the flow passes to two chain-and-flight primary clarifiers (US Filter/Siemens Water Technologies) and then to four aeration basins with fine-bubble diffusers (Sanitaire – a xylem brand). Three 150 hp turbo blowers (HSI) supply the air.

Treatment continues in two secondary clarifiers (Ovivo). After the flow is measured through a Parshall flume, a TrojanUV3000Plus UV system disinfects the effluent, which discharges to the Great Bay Estuary through a

diffuser system (Red Valve Co./Tideflex Technologies). A Rotamix system (Vaughan) mixes blended primary and secondary sludges in the storage tanks before dewatering. Two new Huber Q800 incline screw presses (Huber Technology) dewater biosolids.

Before replacing the facility's belt filter presses and gravity thickeners with screw presses last March, the wastewater facility composted about 5,600 wet tons of biosolids per year at 15 percent solids. The new system is expected to cut production to about 3,000 wet tons per year at 30 percent solids. "That will drastically reduce our solids costs," Vermette says.

The decision to use the screw press technology was not made lightly. The facility staff compared centrifuges, rotary presses and incline screw presses. "We did a pilot test — this wasn't just something we were sold on," says Vermette. "We looked at the 20-year life-cycle cost."

AECOM helped the city with pilot testing three years ago and has continued to support the dewatering upgrade through design and construction. The volume reduction will allow the facility to close its compost operation and put its biosolids out to bid for offsite composting or landfilling at a facility that produces methane gas for energy. According to Vermette, the new system starts on its own, cleans itself, and takes one-quarter of the time to do the job.

The city dedicated \$4 million to the biosolids equipment upgrade, but the screw presses cost only \$2 million. Vermette plans to ask to use some of the balance to add feed pumps and apply epoxy coating to the facility's 20-year-old sludge storage tanks. He sold the old belt presses on the used equipment market.

ASSOCIATIONS AND NETWORKING

Vermette's work has not gone unnoticed: He won the New England Water Environment Association (NEWEA) Operator of the Year Award in 2011 and the NEWEA Alfred E. Pelonquin Award in 2003. The Dover plant won Wastewater Treatment Facility of the Year in 2003 from the New Hampshire Water Pollution Control Association (NHWPACA).

Fred McNeill, chief engineer in Manchester, N.H., nominated Vermette for Operator of the Year. The nomination letter commended Vermette for making significant operational contributions through participation in NHWPACA/NEWEA, for managing a state-of-the-art facility, and adapting to a changing regulatory environment over the last 10 years.

Vermette has served on the NHWPACA certification and safety committees and as the 40th president. He also has worked on the plant operations committee of NEWEA, is in his third year as a state director with the group, and hopes ultimately to be its president.

"I've always been encouraged by my boss [community service director Doug Steele] and the city manager [Michael Joyal] to get involved," he says. "It gets Dover in front, all this networking." His involvement included providing real-world experience for a Wastewater Management Candidate School, co-hosted by NHWPACA and the state Department of Environmental Services in 2011.

REAL-WORLD EXPERIENCE

While he was operations supervisor under OMI, the plant installed a new flat cover and biofiltration system. As facility supervisor for the city, he has overseen the retrofit of the outfall diffuser with duckbill valves and installation of the UV disinfection system,

"Through the seven-and-a-half years of contract operations, I learned a tremendous amount about streamlining, structure, policy and procedures. This experience gave me the mindset to think and act like an owner and do more with less."

RAY VERMETTE

SCADA system, high-speed turbo blowers, and the screw presses.

Looking ahead, Vermette sees new nitrogen limits on the horizon. The U.S. EPA has developed a draft permit of 3 mg/L, and a coalition of neighboring communities has spoken against it at a public hearing. *(continued)*

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"The city is committed to doing what's right to protect the Great Bay Estuary," says Vermette, whose home is next to the bay. "We want to make sure the science is good." Plant upgrades to meet the new limit are estimated at \$25 million to \$30 million. Vermette notes that an 8 mg/L limit would reduce nitrogen feeding the estuary's eel grass by 70 percent, and the facility could meet that limit for about \$10 million. "If we don't get it right and spend all that money, it's not good for the ratepayers," he says.

Come what may, Vermette and his team will continue to apply their knowledge and professional experience on behalf of Dover residents. **tpo**

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Mixing Things Up

LARGE-BLADE, SLOW-SPEED WASTEWATER MIXING TECHNOLOGIES GAIN RECOGNITION FOR PROVIDING SOLID PERFORMANCE WITH LOW-ENERGY USAGE

By Jared Wray, P.E., and Daniel Alper

To appreciate the importance of mixing, it helps to consider the array of products that require mixing as they are made or refined. Stirring with a stick may seem crude, but for an application like cooking, it is still a state-of-the-art mixing technology. As increasing volumes of material need mixing, larger and more automated mixing technologies are required.

From a simple blender to large truck-mounted concrete mixers, mixing has evolved rapidly. In particular, with changing environmental regulations and legislation, new products are constantly being created to supply energy-efficient mixing for water and wastewater applications. Throughout this evolution, submersible mixers have maintained market stability and have proven reliable in varied applications.

The first submersible mixers were manufactured in the early 1960s and were quickly implemented in wastewater treatment. They were soon used in the original step-feed nitrification/denitrification activated sludge process, introduced in the late 1970s.

This mixing technology has been used ever since because it is



highly effective and offers a simple means of mixing for all of the aerobic, anoxic, and anaerobic reactors required by the biological treatment process. With increasing energy costs in Europe in the 1980s, highly efficient large-blade/slow-speed mixers came to the market, and by the mid-1990s they became the European standard for mixing activated sludge processes. The technology was slow to catch on in the United States, where energy costs were lower. However, it is becoming much more prevalent here with constantly rising energy prices and growing sustainability awareness over the last 10 years.

STARTING SMALL

In the water and wastewater industry, the original preferred mixing technology was small-blade/high-speed mixers. These submersible mixers use a direct-drive motor to produce turbulent flows at submergence typically about 10 feet. The technology is used for tasks such as thickening, nitrification and denitrification stages, biological phosphorus elimination, and stormwater basin solids suspension.

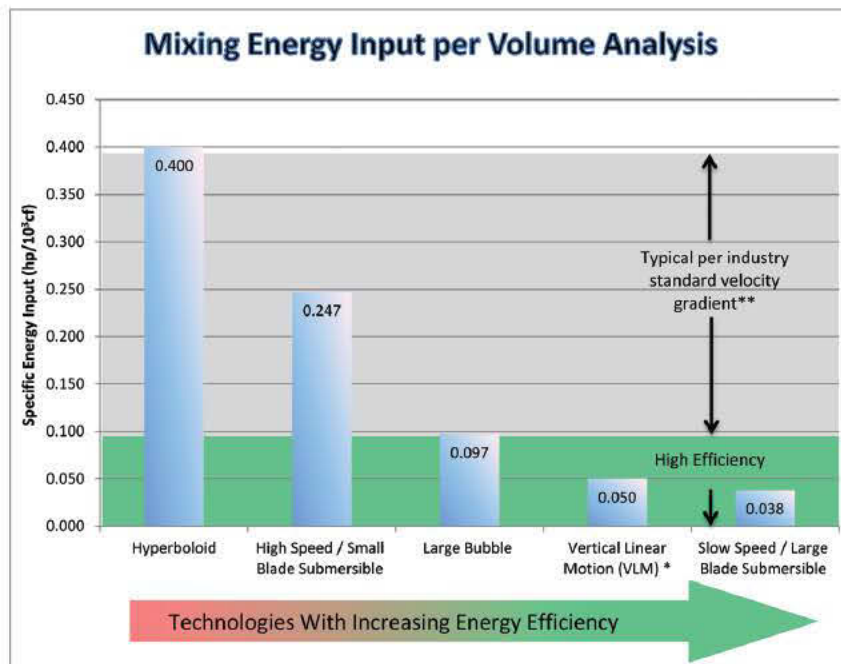
With an output range from 20 to 40 hp at speeds up to 1,750 rpm (depending on the manufacturer) small-blade mixers have many benefits and have proven highly reliable over the last half of the century. Multiple shaft seals enable long operating life by providing extra safety against leakage. One manufacturer even offers as standard, three levels of up-front shaft sealing, including a lip seal and two totally independent mechanical seals.

Leading manufacturers also use a backward-swept self-cleaning propeller design, hydraulically optimized for reliable mixing with the lowest possible energy costs. In addition, these mixers have a robust shaft with sealed-for-life bearings for high reliability at low maintenance and service costs.

Along with these other features, some manufacturers have perfected the power and control cable by fully sealing its cross section and offering a simple plug-and-play connection that further improves reliability and ease of installation. All these benefits help make small-blade mixers a popular choice for engineers and operators when selecting agitation technology.

TOWARD LARGER BLADES

As energy costs rise and treatment processes become increasingly intensive to meet U.S. EPA and state regulations, mixing technology has rapidly evolved. A U.S. EPA report, Evaluation of Energy Conservation Measures (ECMs) for Wastewater Treatment Facilities, touches on some newer technologies being developed to meet those demands. However, because the report focuses on emerging ECM technologies, it does not remind Americans of the large-blade sub-



Note: except as noted values are for typical anoxic/anaerobic reactor with TSS < 1% and complete mix target

*Anaerobic digester application with TSS ~ 1.8%. Negligible impact to specific energy input.

**Metcalf & Eddy Wastewater Engineering Treatment & Reuse, 4th Ed. Values from table 5-10, Typical flocculation process used in wastewater treatment ($\mu = 0.001$).

mersible mixers that have been the European standard for more than two decades.

On average, a large-blade submersible mixer provides the same mixing results as a small-blade mixer while requiring only one-fourth the power. For example, computational fluid dynamics (CFD) shows almost identical mixing from an 8-foot-diameter (large-blade) propeller turning at 30 rpm and a 2-foot-diameter propeller (small-blade) turning at 600 rpm.

This can be simply explained because both mixing devices generate approximately the same thrust. However, at the same time, the large-blade mixer requires only 3.5 hp as opposed to the small-blade mixer requiring 15 hp.

The evolution from small-blade to large-blade agitators has occurred as a way to provide higher-efficiency mixing. With typical speeds up to 100 rpm and power output of less than 10 hp, large-blade mixers deliver substantial power savings, while including all the long-life and low-maintenance benefits of small-blade mixers.

In order to analyze efficiency, the energy requirements of the mixing equipment must be standardized on a per volume basis (in accordance with the industry standard VDMA 24656). The resulting Mixing Energy Input per Volume Analysis can then be utilized to compare operational costs because it is directly correlated to energy bills (see accompanying chart). This analysis reveals that the large-blade mixer efficiency compares favorably in studies with other mixing technologies, including hyperboloids, large-bubble systems, and vertical linear motion equipment.

CASE IN POINT

The benefits of large-blade mixing technology were demonstrated by animal protein processor JBS USA. The company was discharging anaerobically treated wastewater from its packing plant in Grand Island, Neb., directly into the city's wastewater treatment plant.

Due to the high strength of the wastewater, the food facility was incurring high treatment surcharges from the city, and the city had proposed significant capital upgrades at the municipal plant to address ammonia loading. As a remedy, the company designed and built its own biological pretreatment system, which included two aeration and two anoxic reactors.

Because of the energy costs associated with the new facility, the company decided to solicit bids for various mixing technologies to help achieve the most efficient solution. After examining the technical details, the company chose large-blade submersible mixers.

While providing equivalent mixing results, the large-blade mixers supplied large energy savings over small-blade and jet mixing alternatives the company considered. The plant installed 12 large-blade mixers requiring a combined 36 hp, saving more than 200 hp over the small-blade mixer array that would have been needed to accomplish the same mixing.

Since startup in September 2011, the large-blade mixers have performed to expectations. JSB USA environmental director Mark Retsema stated, "The low-energy mixing system was exactly what we were seeking, as it provides both effective mixing and high-oxygen-transfer efficiency at minimal energy demand."

While new mixing energy conservation measures continue to be developed, submersible mixing

Large-blade mixing technology was slow to catch on in the United States. However, it is becoming much more prevalent with constantly rising energy prices and growing sustainability awareness over the last 10 years.

technology will continue to evolve while building on the credibility it has maintained since the 1960s.

ABOUT THE AUTHOR

Jared Wray, P.E., is product manager of submerged propeller devices and Daniel Alper is marketing assistant with KSB, a pump and mixer manufacturer based in Richmond, Va. They can be reached at jwray@ksbusa.com and dalper@ksbusa.com. **tpo**



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Scrubbing Bubbles

A PULSED HYDRAULIC MIXING SYSTEM HELPS AN OHIO TREATMENT PLANT RESOLVE OPERATING ISSUES AND HOMOGENIZE GREASE FOR INCINERATION

By Scottie Dayton

Pumping concentrated brown grease at 180 degrees F into a heated 10,000-gallon storage tank at the Easterly Wastewater Treatment Plant in Cleveland, Ohio, occasionally tricked the ultrasonic level sensor when steam affected the return signal to the transducer. Overflows looked like liquid peanut butter oozing down the sides of the tank and pooling on the floor.

Water in the grease seeped behind the external electric heating jacket on the tank, shorting out elements, corroding the metal, and causing leaks. As the pads lost heating capacity, the oil cooled enough to cake on the tank walls and conical bottom.

Mixing was done by recirculating the grease through pumps and grinders, but suspended water settled out when levels were low. “The liquid also has a considerable amount of chopped plastics,” says maintenance supervisor Morris Taylor.

“If they aren’t kept in suspension, the bits coagulate and block suction ports.”

During an upgrade of the tank, plant engineers chose the PHi-300 mixing system from Pulsed Hydraulics. Combining it with other components solved the problems.

LABOR INTENSIVE

Cleaning an average spill took three operators eight hours. “Cold grease has the consistency of wax and is difficult to remove,” says Taylor. “The guys would shovel up as much as they could, then transport it in a wheelbarrow to a grease sump. To wash the area, they used powerful degreasers and a gas-fired steam cleaner [Jenny Products].” Dirty water collected in the sump.

Operators pumped the sump to one of two flotation tanks, which also received grease from the plant’s primary settling tanks and chlorine contact tanks. Air injected into the flotation tanks from a 50 hp compressor with water separator made the grease rise to the surface with the denser water below.



Overflows from the heated 10,000-gallon grease storage tank resembled liquid peanut butter but had the consistency of wax when cooled.

PHOTO COURTESY OF KRIS DREWRY



Shift supervisor Rich Bluemel at the Easterly Wastewater Treatment Plant adjusts the PHi mixing controller (Allen-Bradley PanelView Plus 700 terminal from Rockwell Automation).

PHOTO COURTESY OF FRED MONAGO

Arms in the flotation tanks skimmed the grease and plastic floatables to an inline Muffin Monster grinder (JWC Environmental) and a macerator (NOV Monoflo Pipeline Grinders) in series. “From there, we pumped to our 5,000-gallon day tanks, labeled A and B, or to C tank, the storage tank,” says Taylor. “Grease rendered in this plant goes to the day tanks for heating to 180 degrees.”

Just before operators incinerate a batch, they subcant or draw off as much water as possible. Then a gun injects the oil into a Dorr Oliver fluidized sand bed furnace. The sand, heated to 1,300 degrees F, is suspended 12 inches above the floor by a pneumatic force. The resulting turbulent mixing, much bubbling fluid, incinerates the oil.

The Southerly and Westerly treatment plants each ship 5,000 gallons of concentrated, hot brown grease to Easterly monthly. Their product goes into C tank, a conical vessel 14 feet 8 inches in diameter and 17 feet 6 inches high. Grease is transferred to A and B tanks as needed. Easterly incinerates 15,000 gallons of grease per month.

THROUGH THE ROOF

The plant’s Engineering Department hired Bay Mechanical and Electrical Corp. to remove the flat roof on the processing building, extract the old tank, set the new one, and reinstate the roof. The upgrade took a month; plumbing the pre-engineered 10,000-gallon Tenco Hydro Thermix heated batch process tank took two weeks.



The bubble formed by the inverted Hydro-Pulse plate (Pulsed Hydraulics) powers liquid and sediment off the bottom of the tank and forces them upward.

PHOTO COURTESY OF CRAIG JOHNSTON COMMUNICATION

“Besides connecting grease lines at the bottom of the tank, they also plumbed the overflow line running to the sump,” says Taylor. Bay also plumbed the Chromalox 50 kW electric heater boiler supplying water to the tank’s heating jacket.

The mixing system from Pulsed Hydraulics has a Hydro-Pulse bubble-forming plate inverted in the center of the tank inches above the bottom. Bay tapped into the plant’s air supply line and attached it to the unit at an easily accessible location.

A computer controls the bubble-pulse intensity, duration and intervals. Operators program it using an Allen-Bradley PanelView Plus 700 terminal (Rockwell Automation). Every 30 seconds, a valve releases a 100 psi burst of air beneath the plate.

The resulting massive bubble powers liquid and sediment off the bottom of the tank and forces them upward. When the bubble breaks the surface, liquid and solids move tangentially to the walls and down the sides to the bottom, completing the mix cycle. After 10 minutes, the kinetic energy decreases, then achieves steady-state mixing for 30 minutes.

To prevent overflows, the tank has SITRANS radar level measurement transmitters (Siemens Water Technologies) that use a low-energy electromagnetic pulse guided along a probe. When the pulse reaches the surface of the grease, the energy is reflected up the probe to the circuitry that calculates the fluid level from the time difference between the pulse sent and the pulse reflected.

SPILL-PROOF

The tank has automatic mixing and temperature controls. Sensors turn them on and off based on the liquid level in the tank. “The hot-water heating system, pulsed-air mixer, and radar level sensor work like a dream,” says Taylor. “With no spills to clean up, the upgrade is maintenance free.”



The air supply line to the Hydro-Pulse bubble-forming plate in the 10,000-gallon grease storage tank is easy to access.

“The hot-water heating system, pulsed-air mixer, and radar level sensor work like a dream. With no spills to clean up, the upgrade is maintenance free.”

MORRIS TAYLOR

On previous plant improvements, operators had to follow behind vendors to debug and modify products after installation, says Taylor. “This was the first time we didn’t have to tweak anything. That speaks volumes.” *tpo*

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Real-World Practice

A PILOT TREATMENT PLANT AT SOUTHERN ILLINOIS UNIVERSITY-EDWARDSVILLE GIVES OPERATOR CANDIDATES THE ULTIMATE IN HANDS-ON INSTRUCTION

By Ted J. Rulseh

Imagine showing up at your treatment plant in the morning and finding your process completely out of kilter. It's no way to start your day, but it can happen, and knowing how to react when it does is part of being a quality operator.

Prospective and experienced operators at the Southern Illinois University – Edwardsville (SIUE) Environmental Resources Training Center (ERTC) get to experience genuine plant upsets as part of their training. That's because the Water Quality Control operator training program there includes use of a training-scale activated sludge treatment plant. It gives operators the ultimate in hands-on practice in a controlled environment where a plant upset poses no risk to receiving waters.

Paul Shetley directs the ERTC, and Rick Lallish directs the water pollution control program. Lallish is a Class 1 (highest) Illinois wastewater operator and is also operator in charge of the 0.4 mgd SIUE campus wastewater treatment plant, which for 2011 won the Treatment Plant of the Year Award for activated sludge plants under 1 mgd from Illinois Association of Water Pollution Control Operators.

Shetley and Lallish talked about their training program and the pilot plant in an interview with *Treatment Plant Operator*.

tpo: What's the history of the ERTC?

Shetley: Before the training center existed, professors in our School of Engineering trained wastewater operators. Federal money became available in about 1975 to establish a training center in each state. The university had the foresight to pursue those funds and establish a training center here. The building was in place by 1979, and they were doing training for operators in the field and getting the faculty lined up. In fall 1981, they started the one-year training course that is now the backbone of our program.

tpo: Is this training center solely for wastewater operations?

Shetley: It's 50-50 between wastewater and drinking water. Another important part of our mission is cross-connection control with backflow devices. We are the only ones in Illinois who can certify a licensed plumber or water operator to perform cross-connection control device inspections.

tpo: How is the center staffed?

Shetley: We have five full-time instructors and several adjunct instructors — people who work or have worked in the field and teach classes for us. We have a program director for drinking water, who is Barb Woods, director of operations Kim Bateman, and lab director Dave Wesselmann. Rick Lallish is our director on the wastewater side, and Kurt Neuhaus is the hands-on



Paul Shetley, left, director of ERTC, and Rick Lallish, director of the water pollution control program.

“The students aren't in attendance on Mondays, so while they're gone I like to introduce some kind of upset, so that on Tuesday when they come in, they have to figure out what is wrong with the plant.”

RICK LALLISH

instructor for the treatment plant. Our coordinator for student registration is Marci Webb.

tpo: What does the wastewater course curriculum look like?

Lallish: Our primary offering is the one-year operators' course, in which we teach 25 to 30 students each year. It's a two-semester course that starts with basic wastewater and progresses through lagoons, fixed-film and activated sludge treatment. We also teach sludge handling, biosolids land application, collection systems, confined-space safety, and wastewater math. The course prepares students for Class 4 Illinois and Class D Missouri wastewater certification.

tpo: How does the center serve operators already working in the field?

Lallish: We provide training to help them earn higher levels of licensing and provide any further education they need, whether water or wastewater. We set up one- and two-day courses, and we also offer two five-day short schools, one in the northern part of the state and one here at Edwardsville.

(continued)

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For the five-day courses, we bring in operators from all over the state and have breakout classes. We hold separate sessions for Class 1, Class 2, Class 3 and Class 4 operators, directed toward their licensing needs.

tpo: Tell us about the pilot wastewater treatment plant.

Lallish: It's a 30,000 gpd activated sludge aeration plant inside our building. We also maintain a four-cell rotating biological contactor fixed-film system. We can operate the two in series or in parallel, or operate them completely separate from each other. The students set up the piping for each system as needed. If we want to change the piping from one tank to another, we teach the students how to do it. They do all the work. We also have two secondary clarifiers, holding tanks, and a pilot-size UV system where we train for disinfection. We operate it with training bulbs — we're not actually doing full disinfection for safety reasons.

tpo: How exactly do you use the plant for instruction?

Lallish: During the first semester I bring the plant up online, start the bugs, get it running, and show the students how to do the day-to-day operation. At the end of the first semester, we take the plant completely down. When the students return for second semester I oversee them and they bring it back up on their own.

tpo: Where does the influent for this plant come from?

Shetley: When they designed this building, they located it about 200 yards and uphill from SIUE's own wastewater treatment plant. We have two sump pumps at the plant, and two 6-inch PVC lines supply our influent. We get water as it comes out of the plant's primary clarifiers, and we can also get water as it comes out of the secondary clarifiers before it goes to the tertiary filters.

Lallish: We pump the wastewater up here, run it through the pilot plant, and discharge the effluent right back down to the headworks of the SIUE plant.

tpo: What sort of aeration process is used in the pilot plant?

Lallish: We have both a centrifugal blower and a positive displacement blower, which we operate alternately. In the basin we run both coarse- and fine-bubble diffusers. I train the operators how to work with each one, how to recognize which one is in operation, and which one gives better dissolved oxygen. For pumping return activated sludge (RAS) out of the clarifiers, we run both a positive displacement pump and a diaphragm pump, and we alternate between those, as well.

tpo: Does the pilot plant have a solids process?

Lallish: We run the solids through an aerobic digester. We don't have the capability for any other solids treatment at this time. One of the goals we have is to acquire a centrifuge or a gravity belt thickener for training purposes. We show the students how aerobic digestion works, and when they start seeing solids reduction, we release the material back to the SIUE plant. We also take them to the SIUE plant and show them the anaerobic digester there, so they get a bit of insight on how that's run.

tpo: What about instrumentation and laboratory facilities?

Lallish: We have inline DO meters, but otherwise we do most measurements manually. We hope in the future to have a SCADA system, but we're not there yet. We have an incredible wastewater lab fully set up for DO, BOD, TSS, fecal coliform, nitrogen, phosphorus and COD. For microscopic examination, we have that set up to display on a flat-screen TV monitor. One student can be looking in the microscope and everybody else can see what's going on. That's really a great teaching tool. For any typical lab analysis that a wastewater operator would do out in the field, we have the facilities here. Students spend about one four-hour class a week strictly on lab work.

tpo: How do you acquire the equipment for the pilot operation?

Lallish: Most of it we have purchased with our own funds. We try to buy

what we can afford and what is best on the market. The UV system was donated to us from a state park that was renovating its wastewater treatment plant and didn't need it anymore. We cleaned it up and fixed what needed to be repaired.

tpo: Are the students required to make the plant comply with any specific effluent limits?

Lallish: Because we discharge to the SIUE treatment plant, we don't need an actual NPDES permit, but I have the students run off a permit I created based on the Illinois EPA's model. I took the permit for the SIUE plant and used the same parameters for the pilot plant. They submit a Daily Monitoring Report based off that permit. The effluent limits are 12 mg/L monthly average and 24 mg/L daily maximum for TSS, 10/20 for BOD, 3/6 for nitrogen, pH 6-9, and DO a minimum of 6 mg/L. They also have to maintain a 0.5 mg/L daily maximum chlorine residual.

"We're proud of the training center. We think it's a unique place. Anyone who has ever taken training here, if they had the chance to come and work here, there is no way they would turn it down."

PAUL SHETLEY

tpo: What kinds of things do you do to make plant operation challenging?

Lallish: The students aren't in attendance on Mondays, so while they're gone I like to introduce some kind of upset, so that on Tuesday when they come in, they have to figure out what is wrong with the plant. If they operate a plant that's running perfectly all the time, they're not going to learn as much. This way they see a plant that has some kind of abnormal condition, and they learn to troubleshoot it and get it back to running properly. I might turn off the RAS pumps for the weekend, or turn the RAS pumps up to double what they're normally set it. That has a major effect on the mixed liquor suspended solids. I might turn the aerators down to almost the minimum and upset the plant that way. Whatever I can come up with that's a nice way to challenge them.

tpo: What career path led you to your current position?

Lallish: I've been in the wastewater business since 1994, and I've maintained my Class 1 license since 2000. I came here to the ERTC to take night courses, short schools and correspondence courses. I worked for the City of Greenville (Ill.) for 14 years, operating their 1.5 mgd Class 1 plant. I came here for the challenge of caring for the operators and meeting their training needs, and as a way to improve myself and become a better operator. I firmly believe that if you're teaching people, you're training yourself. I love what I do. I've got a great plant to run and a great network of operators and friends all over the state and beyond. I tell the operators who attend my workshops and classes that I work for them. I make it clear that my phone is always available, my door is always open, and I'm more than happy to help them anytime, anyplace.

tpo: What does the future hold for the ERTC wastewater program?

Lallish: We've looked into the possibility of online training. We have a really good correspondence setup, and we're looking to make that better. We're always looking for different courses that we could offer around the state.

Shetley: We want to get deeper into the industrial side of wastewater. Illinois has a separate industrial wastewater license, and there's a lot to do in industrial pretreatment. We're trying to satisfy that need for training with some new adjunct instructors. We're proud of the training center. We think it's a unique place. Anyone who has ever taken training here, if they had the chance to come and work here, there is no way they would turn it down. Most of the people who work here are past students. It's a heck of a nice place to work. **tpo**

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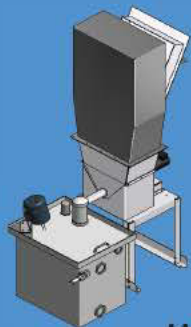
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By Scottie Dayton

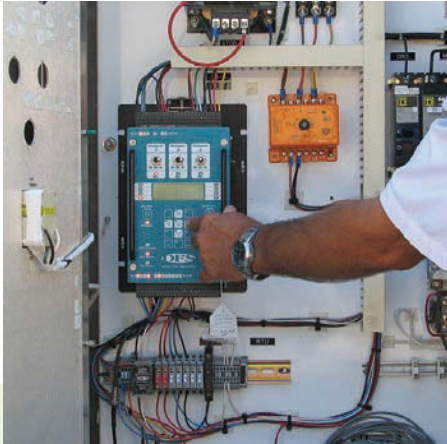
SCADA solves pressure spikes

Problem

Pumping conflicts in 16 lift stations on a major force main in Winter Park, Fla., were causing pressure flow spikes. City officials, preferring not to install a larger pipe, looked for options.

Solution

Operators used the **TAC II SCADA system with Symphony from Data Flow Systems**. The harmonious pump and flow management software synchronized pumping minute-by-minute on all stations and leveled flow by managing the force main's diurnal curve over 24 hours.



RESULT

Lower pressure spikes resulted in a 42 percent energy savings and a 34 percent reduction of pump run times. **321/259-5009; www.dataflowsys.com. tpo**

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Digital Technology

By Briana Jones

PANELBOARD

The PowerPlex panelboard from Appleton Electric transfers its flamepath protection from the enclosure to individual circuit breaker housings. The component-level protection allows it to deliver installation flexibility and simple maintenance, while eliminating external conduit or cable seals. Each circuit breaker housing connects to the panelboard through increased safety terminal connections. The terminations provide wiring access and are molded into the housing. The board uses standard circuit breakers that are readily field replaceable. Its modular design and flexible mounting footprint provide almost endless breaker configurations.

Units are available in three- to 48-circuit configurations, with main breakers available up to 150 amps. Voltages are available in ranges of 120/240, 240, 277/480, 480, 347/600 and 600 VAC. Branch circuit breakers are available in 1-, 2- and 3-pole combinations with a 10 to 150 amp range that can be locked in the on or off position with no breaker tripping interference. **800/621-1506; www.appletonelec.com.**



PowerPlex panelboard from Appleton Electric



AquaProbe insertion electromagnetic flowmeter from ABB Inc.

INSERTION FLOWMETER

The AquaProbe insertion electromagnetic flowmeter from ABB Inc. is designed to work with both WaterMaster and AquaMaster 3 transmitters and

features a choice of power options, including main, battery and renewable, which can draw power from a solar or wind source. The probe is fully submersible and has no moving parts. **800/829-6001; www.abb.us/instrumentation.**

DURABLE ENCLOSURES

Polyguard enclosures from AC/DC Equipment Co. are available in 6 by 4 by 3.5 inches and 8 by 6 by 4 inches. All enclosures are made in the USA, UL listed and carry NEMA type ratings of 2, 3, 3R, 4, 4X, 5, 6, 6P, 12 and 13. The durable, UV-resistant polycarbonate construction makes the units well suited for control panels or other indoor or outdoor electrical applications. They are available hinged or non-hinged with opaque or clear lids and offer optional lockable stainless steel latches, adjustable aluminum back plates, and aluminum dead-front doors. All units can be custom drilled or custom color molded. **419/281-9120; www.acdcequipment.com.**



Polyguard enclosures from AC/DC Equipment Co.

DATA MANAGEMENT

Antero version 5 from AllMax Software is a user-friendly maintenance data management program that bridges the needs of performance, security and data governance with focus on accountability and reducing maintenance costs and downtime. It helps plants comply with strict industry and regulatory requirements. The software includes a Microsoft SQL database engine, which is scalable and can handle more records and data than previous versions.

Other benefits include the ability to share information among multiple facilities, Windows login for automatic user validation, and group security. A work order section allows data associated with work orders and multiple equipment/task combinations to be generated at one time. The work order builder enables improved data flow from setup to creation. Features include a gallery for storing images and attached documents, newly redesigned reports, and an in/out of service history section for better tracking of maintenance and related data. **800/670-1867; www.allmaxsoftware.com.**



Antero version 5 from AllMax Software



Level Mate III system from AMETEK PMT Products

COMPLETE LEVEL MEASUREMENT

The Level Mate III system from AMETEK PMT Products provides versatile and complete level measurement for water and wastewater applications. The system consists of a stainless steel submersible hydrostatic sensor with cable and a fully calibrated microprocessor-controlled digital meter within a NEMA 4X enclosure. Installation requires minimal time and effort. All programming is done at the factory so that users only

need to supply AC power and place the sensor in water.

The unit features a two-line LED display meter with configurable function keys, engineering units, programmable 3A Form C relays, analog output, alternating pump control, and 32-point linearization programs. Installed desiccants are included for moisture control. Options include AC and DC power, lightning and surge protection, additional relays, stainless steel support cable, and choice of multiple sensors based on applications. **215/355-6900; www.ametekusg.com.**

CHEMISTRY MODULES

ATI gas-phase chemistry modules from Analytical Technology Inc. are online monitoring systems that use air-stripping methodology designed for sample streams that are highly contaminated with solids or biological activity. Modules for dissolved oxidants use iodometric chemistry to prepare the sample stream for measurement. Modules for non-oxidizing chemicals use pH adjustment of the sample before measurement.

After chemical addition, the integral air pump provides a continuous stream of ambient air to the reactor assembly to release the analyte from the water phase and into the gas phase. A special gas-phase sensor detects the chemical concentration in the air stream. By using air-stripping technology, the sensor is removed from the liquid phase, preventing fouling. The low-maintenance technology lowers operating costs. The modules are available with total residual chlorine, residual sulfite, dissolved sulfide, and potassium permanganate monitors. **800/959-0299; www.analyticaltechnology.com.**



ATI gas-phase chemistry modules from Analytical Technology Inc.

DIGITAL PRESSURE GAUGE

The PG10 digital pressure gauge from Automation Products Group (APG) for indoor/outdoor use is IP65 rated. The unit features a 5.5-inch display casing, a full five-digit display with 0.68-inch-tall characters, and a 270-degree digital dial or radial bar graph that shows a user-selectable pressure range from 0 to 100 percent. Four large setup buttons provide at-a-glance readability. Standard features include tare, peak hold, and max-min readings, and user-selectable units of measure and an auto-off timer.



PG10 digital pressure gauge from Automation Products Group (APG)

Options include two solid-state relays or SPDT mechanical relay outputs for basic to semi-advanced automation. With an operating temperature range from 0 to 160 degrees F, the unit offers ± 0.25 percent accuracy of full scale, and features pressure ranges from vacuum to 500 psi, or 0 to 10,000 psi. Outputs are 0-2 VDC for battery-powered units, 4-20 mA for loop-powered units, and 0-5 VDC for externally powered units. Data logging provides local access to the latest 60 readings. **888/525-7300; www.apgsensors.com.**



Dynasonics DXN portable clamp-on ultrasonic meter from Badger Meter

CLAMP-ON METER

The Dynasonics DXN portable clamp-on ultrasonic meter from Badger Meter allows users to verify flow rate before pump or meter repair. The hybrid instrument can automatically switch between transit time and Doppler measurement. The compact design fits into one convenient over-the-shoulder bag. An advanced touchscreen interface, full-color graphing,

and wizard-based startup configuration make the unit suited for a variety of job sites.

The meter provides user-customizable, site-specific parameters with an expandable 1 GB data logger and USB connectivity. Built with high-quality measurement processing speed, the unit takes more than 100 flow readings per second. Applications include clean, solids-bearing or gaseous liquids in closed full 1/2-inch and larger pipes. **262/639-6770; www.badgermeter.com.**

PH AND TEMPERATURE PEN

The ULTRAPEN PT1 pH and temperature pen from Myron L Company features one-button operation with dip or scoop sampling for measurements in standing bodies of water and vertical streams. Other features include the ability to choose between snapshot and continuous measure modes; one-, two- and three-point calibration for high-quality accuracy; automatic temperature compensation; fully encapsulated electronics; proprietary sensor construction; highly stable microprocessor-based circuitry; and waterproof housing.

The conductivity/TDS/salinity tester features the accuracy and stability of benchtop lab equipment with the convenience of a pen. The pen allows users to select from three commonly used solution standards: KCl, NaCl, and the company's 442 proprietary standard for Natural Water. An Ultrameter III 9P titration kit allows users to do water-quality testing in the field. The unit features fast, one-touch measurements for conductivity, resistivity, TDS, ORP, free chlorine, pH and temperature, and performs in-cell conductometric titrations for alkalinity, hardness and LSI. **760/438-2021; www.myronl.com.**



ULTRAPEN PT1 pH and temperature pen from Myron L Company

MAGNETIC FLOWMETERS

ABB ProcessMaster magnetic flowmeters from Cole-Parmer deliver accurate flow measurement in diverse sectors and process applications. They provide accuracy of ± 0.4 percent of measured value. With intelligent design, state-of-the-art technology, and advanced features, the units deliver reliable and accurate measuring values. Self-cleaning, double-sealed electrodes enhance reliability and performance.



ABB ProcessMaster magnetic flowmeters from Cole-Parmer

Using a high excitation frequency combined with advanced filtering, the meter improves measurement accuracy by reducing fluid and electrode noise. Flowmeters are designed for high-temperature use, and in combination with a reinforced PFA liner, improve vacuum stability and prevent potential liner deformation. **800/323-4340; www.coleparmer.com.**



V-2000 photometer from CHEMetrics

WATER-QUALITY TESTING

The V-2000 photometer from CHEMetrics offers advanced water testing technology with pushbutton ease. Lightweight and field-portable, the microprocessor-based LED colorimeter features pre-programmed methods to measure 13 mm, 16 mm or 1-inch cells in concentration, percent transmittance (%T) or absorbance (abs) modes. Updates and new programs are available via the website, and the unit can store up to 10 custom programs.

The instrument can log 100 data points and download them to a printer or PC. The company's self-filling Vacu-vial reagent ampoules minimize personal contact with chemicals and provide reliable, accurate and safe water-quality tests in over 50 pre-loaded parameters, including ammonia, peroxide and phosphate. Intuitive operation reduces training time. **800/356-3072; www.chemetrics.com.**

ELECTROMAGNETIC SYSTEMS

Dynamatic electromagnetic variable-speed pump and centrifugal blower drive systems from DSI Dynamatic employ eddy current technology, consisting of a constant-speed AC induction motor and magnetic clutch governed by a small digital controller. The amount of power available is determined by the motor size (1/4 to 2,000 hp). A rotating drum is connected to the motor shaft, and an electromagnetic coupling is used to vary the speed of output. The only wear parts are bearings, as the motor and drive are separated by an air gap.



Dynamatic variable-speed pump and centrifugal blower drive systems from DSI Dynamatic

A clutch coil, tachometer, and output bearing complete the internal components in standard drives. A digital clutch controller that typically uses less than 1 percent of the total system power governs the voltage sent to the clutch coil. The AC motor runs at optimum rated speed. By regulating voltage to the clutch coil, a magnetic flux field is created, and distortion of the field creates torque. The greater the power to the coil, the greater the strength of the field and output torque. A tachometer provides output feedback to the digital controller, making this a closed-loop system. **800/548-2169; www.dynamatic.com.**

(continued)

SHAFT SLOWDOWN PREVENTION

Electro-Sensors provides a system consisting of the LRB1000 shaft speed switch, a 906 shaft speed sensor, and a split-collar pulser wrap with magnetic targets that can provide an early warning of shaft slowdown or stoppage, preventing downtime and repairs. The LRB1000 receives a frequency from the 906 as it reads the magnets on the pulser wrap that is clamped around the flocculator shaft. The LRB1000 compares this frequency to the preset programmable setpoint and provides an early warning if the shaft slows down below the setpoint due to motor failure, shaft breakage, or some other event. **952/930-0100; www.electro-sensors.com.**



Electro-Sensors



ST100 series thermal mass air/gas flowmeter from FCI – Fluid Components International

AIR/GAS FLOWMETER

The ST100 series thermal mass air/gas flowmeter from FCI – Fluid Components International is available in a remote-mountable configuration for applications in hazardous areas or hard-to-reach locations. The remote-mount transmitter, with optional digital display, can be mounted up to 1,000 feet away from the flow sensor using interconnecting cable. The flowmeter continuously measures, displays and transmits an array of parameters. It is available with 4-20 mA analog, frequency/pulse, alarm relays or digital bus communications such as HART, Fieldbus, Profibus or Modbus. The unit adapts to plants' needs for upgrades with a plug-in card replacement that can be changed out by operators in the field. The flowmeter is designed for rugged industrial process and plant environments, including service up to 850 degrees F. It is agency-approved for hazardous environments, including the entire instrument, transmitter and NEMA 4X/IP67-rated enclosure. **800/854-1993; www.fluidcomponents.com.**

ION-SELECTIVE ELECTRODE

The ISEmax CAS40D from Endress+Hauser is an ion-selective electrode system for real-time control of nitrification and denitrification with ammonium and nitrate measurement. It makes the nitrification and denitrification processes transparent and reduces costs for power used in aeration systems.

The sensor consists of ion-selective electrodes and a pH reference, which is installed in an immersion assembly. The sensor is mounted on the basin rim with a suitable retaining unit and immersed into the process. Up to three ion-selective electrodes measure ammonium, nitrate and other variables simultaneously. An integrated compressed air cleaning system keeps the electrodes free from fouling and contamination. **888/363-7377; www.us.endress.com.**



ISEmax CAS40D from Endress+Hauser

FOUR-WIRE MULTI-PARAMETER

The Rosemount Analytical multi-parameter 56 four-wire liquid analytical instrument from Emerson Process Management serves municipal applications with a wide range of measurement inputs available. The unit features a high-resolution color LCD screen for easily viewed process measurements and on-screen data trend graphs. It supports SMART-enabled

pH sensors, eliminating field calibration of pH probes through automatic upload of calibration data.

Troubleshooting of most problems can be done with a complete easy-to-read on-screen user manual and detailed descriptions of faults, warnings and diagnostics. Step-by-step Quick Start prompts make commissioning easy. Wireless network compatibility is available using the wireless THUM adapter on HART-enabled units; a standard USB port to enable easy export of process data and events, and user-friendly WAVE 0.5 AMS Intelligent Device Manager screens. The unit also comes host-ready for network commissioning with HART 5 and 7 (selectable) or Profibus DP communication protocols. **800/854-8257; www.rosemountanalytical.com.**



Rosemount Analytical multi-parameter instrument from Emerson Process Management



G460 multi-gas detector from GfG Instrumentation

MULTI-GAS DETECTOR

The G460 compact data logger from GfG Instrumentation is designed for simultaneous detection of up to six gases. Installed sensor options include infrared (NDIR) for CO₂ and PID for VOC measurements. The unit offers completely automatic calibration, one-button operation, top-mounted display and interchangeable battery packs for up to 25 hours of continuous operation. The rechargeable NiMH battery pack can be equipped with optional flashlight LEDs.

The large, high-resolution top display can be flipped 180 degrees by pressing two buttons. Its watertight design incorporates an impact-proof, rubberized housing to meet tough requirements. The data logger records over 1,800 gas concentrations and alarms. The data can be downloaded to a PC for viewing, storage and evaluation. A detachable, self-powered pump is available for sampling confined spaces before entry. It allows operation of the instrument in diffusion or sample-draw mode. **800/959-0329; www.gfg-inc.com.**

LDO PROBE

The LDO (luminescent dissolved oxygen) probe from Hach Company requires no calibration for the entire two-year life of the sensor cap. With an added 3D calibration procedure that is conducted prior to shipping, the probe will not drift and is very accurate. **800/227-4224; www.hach.com.**



LDO (luminescent dissolved oxygen) probe from Hach Company



SS bare flex conduit from Calbrite Stainless Steel Conduit Systems

FLEX CONDUIT

SS bare flex conduit from Calbrite Stainless Steel Conduit Systems is designed for applications involving routing conduit around turns and at different angles. Flex conduit is flexible with a smooth interior to protect electronic/electrical wires and cables, while still being durable and strong enough to maintain integrity.

Available in 316 stainless steel and polished with a standard bright finish for increased corrosion resistance, the product absorbs motion and vibrations and is compatible with stainless steel flex connectors and 90-degree elbows. The conduit is manufactured in interlock and double buckle styles in 25-foot coils and comes in standard sizes from 1/2 to 2 inches. It complies with UL514B standards, suitable for corrosive environments. **800/536-6800; www.calbrite.com.**

DO PROBE

The RDO PRO probe from In-Situ Inc. is designed for continuous dissolved oxygen (DO) monitoring and process control. The probe uses optical technology that does not require sample flow or hydration. The sensor cap withstands abrasion, high sediment loads, and rapid flow rates. The cap is unaffected by interferences such as grease, oils, sulfides, chloride and ammonia. The unit has EPA approval.

The probe includes built-in Modbus/RS485, SDI-12 and 4-20 mA and can interface with SCADA and PLC systems. Long-lasting calibration and a robust sensor reduce maintenance. Once a year, operators snap on a new sensor cap that is pre-loaded with calibration coefficients, expiration clock and serial number. **800/446-7488; www.in-situ.com.**



RDO PRO probe from In-Situ Inc.

LEVEL TRANSMITTERS

Submersible level transmitters from Keller America include the LevelGage and the Acculevel. The units are equipped with internal lightning protection and are in full compliance with the "buy American" provision of the ARRA section 1605. **877/253-5537; www.kelleramerica.com.**



Submersible level transmitters from Keller America



REDUCERS AND GEARMOTORS

Cyclo BBB4 series of speed reducers and gearmotors from Sumitomo Drive Technologies

The Cyclo BBB4 series of right-angle spiral bevel speed reducers and gearmotors from Sumitomo Drive Technologies feature all-steel internal construction with Cyclo or planetary inputs. The ductile iron housing allows for high radial loads in a compact design. A splined connection ensures durable and dependable power transmission.

A single oil bath lubrication system provides high ratings and easy maintenance. Double output seals prevent leaks and exclude contaminants. Keyed hollow, shrink-disc, solid-shaft, and keyless Taper-Grip bushing shaft options, along with flange, foot, shaft and universal housing mounting options enable configurations to fit almost any requirements. Standard specifications include a ratio range of 11:1 to 26,000:1 and greater, 1/8 to 100 hp, and torque capacity of 1,000 to 160,000 lb-in. **800/762-9256; www.sumitomodrive.com.**

(continued)



WS Series control panels from SEewater

PUMPING CONTROL PANELS

WS Series control panels from SEewater are advanced simplex and duplex systems controlled by the company's Smart Board, designed for wastewater and sewage pump applications. The panels come standard with: NEMA 4X enclosure, upgraded pump protection, pump fault indicators and auxiliary contacts for accessing building management systems (SCADA). Custom options are available

upon request. All panels are ARRA Certified (made in the USA). **888/733-9283; www.seewaterinc.com.**

UPCOMING TRAINING & EVENTS

Inspector Training & Certification:

September 7-8, 2012 - Arlington, TX

TAREI, RETS & SoS

Contact: Andrea Barnard at andrea@tarei.com

September 20-21, 2012 - Ruidoso, NM

N-MOWA - NAWT, Contact: Jace Ensor

at 575-937-8304 or nmowa.president@gmail.com

November 15-16, 2012 - Lakewood, CO

CHURCH Onsite Wastewater Consultants, Contact:

Kim Seipp (303) 622-4126 or highplains@tds.net

Installer Workshops

October 15, 2012 - Dover, DE

DOWRA Conference Contact Hollis Warren at

(302) 284-9070 or htwarren430@aol.com

October 25-26, 2012 - Lakewood, CO

CHURCH Onsite Wastewater Consultants

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highplains@tds.net

Operation & Maintenance

Training Certification:

September 12-13, 2012 - Mill Valley, California

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Kit Rosefield - Go to www.COWA.org

November, 2012 - (TBA) California

Operation & Maintenance, Level 2

Instructors: Nick Weigel or Kit Rosefield

Go to www.COWA.org

CEU's for NAWT Recertification

October, 2012 - Northern (TBA), CA

COWA & NAWT Science of Soils

Go to www.COWA.org.

October 8-9, 2012 - Tucson, AZ

Univ. of AZ Soil & Site Evaluation

for Onsite Wastewater Systems

NAWT Vacuum Truck Technician

September 17 & 18, 2012 - Albuquerque, NM

POWRANM - NAWT, Contact: Bill McKinstry at

(505) 989-7676 or admin@powranm.org

September 19, 2012 - Ruidoso, NM

N-MOWA - NAWT, Contact: Jace Ensor at

575-937-8304 or nmowa.president@gmail.com

January 7-8, 2013 - East Lansing, MI

MI & NAWT - Contact Mark Scott at (989) 275-5011

or msscott@i2k.com

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PORTABLE FLOWMETER

The OPTISONIC 6400 portable ultrasonic flowmeter for liquids from KROHNE measures flow velocity, current volumetric flow and a variety of diagnostic values. The flowmeter consists of a compact evaluation unit and one or two rails, each equipped with two ultrasonic sensors. Rails are available in a variety of sizes to accommodate different tube diameters, from 1/2 to 160 inches. The flowmeter is powered by an integrated battery with 14 hours running time or line powered with supplied adapter. Readings are displayed on a color graphic LCD screen. **800/356-9464; www.us.krohne.com.**



OPTISONIC 6400 portable ultrasonic flowmeter for liquids from KROHNE

PLUG-AND-PLAY ANALYZER

The plug-and-play Krypton K analyzer from Kuntze Instruments uses automatic sensor cleaning (ASR) electrode technology that is effective against iron, manganese oxide and fats. Maintenance and cost are minimal with no reagents, membranes, electrolytes or moving parts. The unit is available for free chlorine, chlorine dioxide, ozone and hydrogen peroxide analysis. **724/339-8510; www.kuntzeinstruments.com.**



Krypton K analyzer from Kuntze Instruments

PACKAGED WATER SYSTEMS

Metro-IsoPac packaged protected water systems from Metropolitan Industries Inc. eliminate contamination of city water supplies with a physical air gap. The systems come complete with all equipment including pumps, controls and tanks. A modulated float-operated fill valve maintains break tank level and reduces water hammer by matching demand. Several pump options are available to meet any flow and pressure application.

Tank materials include high-density crosslinked polyethylene stainless steel, epoxy-coated steel, galvanized steel, glass-lined or custom-lined. Systems can be configured to include the company's MetroTech II controller and touchscreen operator interface, which incorporates a control strategy that saves energy, reduces water hammer and proves accurate setpoint control even under demanding conditions. Custom control options include remote monitoring, flow monitoring and Intellipump constant speed control. **815/886-9200; www.metropolitanind.com.**



Metro-IsoPac packaged protected water systems from Metropolitan Industries Inc.

SUSPENDED SOLIDS METER

The Model 502 suspended solids meter from Markland Specialty Engineering allows users to measure the concentration of sludges or slurries without the reading being affected by color. In wastewater treatment plants it is used to measure primary, secondary and return activated sludges. The meter can be used in drinking water plants to measure the concentration of backwash sludge from sand or membrane filters before it is sent for further processing.



Model 502 suspended solids meter from Markland Specialty Engineering

The meter uses the attenuation of ultrasound to read the concentration. It can be mounted in open-top tanks or pipelines. It measures slurries that are too thick for optical methods. Ultrasound requires no permits or regulatory approvals to operate. **905/873-7791; www.sludgecontrols.com.**

ULTRASONIC FLOWMETER

The OCM Pro CF ultrasonic flowmeter from NIVUS GmbH is a permanent system for continuous flow measurement, flow control and storage of recorded data in a range from slight to heavily polluted media of various consistencies. It is designed for use in part-filled and full pipes, channels and flumes with different shapes and dimensions. The unit offers fast processors and Internet access, ensuring reliable and economic operation.



OCM Pro CF ultrasonic flowmeter from NIVUS GmbH

A complete system consists of a transmitter and appropriate active sensors. Flow velocity sensors are available with or without integrated flow level measurements, and air-ultrasonic flow level sensors are available for direct connection to the unit. Various constructions can be used depending on the application. Wedge sensors are available for channels and open flumes, and pipe sensors are available for steel, concrete and plastic pipes. **www.nivus.com.**

DIFFERENTIAL PROBES



Aquametrix differential pH/ORP probes from Water Analytics

Aquametrix differential pH/ORP probes from Water Analytics consist of two identical circuits with an electrode and a common ground rod. One electrode sits in pH 7 reference solution and the other sits in the process. The voltage difference between the two electrodes generates a current proportional to the true pH. A buffer amplifier converts the high-impedance current to a low-impedance current.

The arrangement offers a reference solution that can be easily replaced when it becomes contaminated. The double-junction salt bridge can also be easily replaced. The ground rod is common to both circuits so ground loops are eliminated. The embedded amplifier allows transmission of the signal at distances up to 3,000 feet. Another version transmits a direct 4-20 mA signal over a two-wire loop. The probes also include an embedded temperature element for automatic temperature compensation. **978/749-9949; www.aquametrix.com.**

COST-EFFECTIVE PANEL

The TCOM control panel from Orenco Systems is a low-cost/high-value SCADA system. It is a modular, programmable remote telemetry control panel that can be used to regulate booster stations, reservoirs and community wells. User-friendly features include color touch screens with built-in programming and real-time data acquisition and control over an Internet, cell or phone line connection.

The panel combines the functions of relays, timers, alternators, elapsed-time meters, and cycle counters, resulting in a compact panel design and increased reliability. The unit has built-in communication protocols supported by widely used software already installed on, or easily added to, most computers. The panel's Viewer software is free and works on Windows PC computers. The software provides an easy-to-understand user interface with remote access and control, plus the ability to retrieve, sort and graph data. **800/348-9843; www.orencococontrols.com.**



TCOM control panel from Orenco Systems

ADVANCED MONITORING

The M800 system from MISSION Communications provides real-time, advanced monitoring and managed SCADA for water and wastewater systems. The system uses cellular communications for reliability and fast deployment. Versatile scheduling options are included for efficient notification to staff. Alarm notifications are delivered by any combination of voice phone calls, text messages, emails, faxes and pagers.

Users can access, analyze and download data through secure Web portals, accessible on any computer, tablet or mobile device. Streaming data provides trends as levels change and pumps turn on and off. Reports are optimized for CMOM, state and EPA regulatory compliance, and water and wastewater professionals. Data can be integrated with HMI software via an industry standard optional OPC data link. No software updates, no maintenance and no programming are necessary. **877/993-1911; www.123mc.com.**



M800 system from MISSION Communications



AquaShock IP67 meters from Sper Scientific

WATERPROOF, SHOCKPROOF METERS

Handheld AquaShock IP67 waterproof meters from Sper Scientific feature replaceable BNC-connected probes with a screw-down, waterproof housing. When a waterproof connection is not needed, any BNC-connected probe can be used. The shockproof meters have a soft-grip surface to prevent accidental drops.

Other features include a large, backlit LCD display, 99-memory review, min/max/avg settings, internal clock and calendar, C and F automatic temperature compensation and auto-

ranging. Available in three models, meters measure pH, mV, ORP, conductivity and TDS. **480/348-0278; www.sperdirect.com.**

RAPID ANALYZER

The ChemScan mini LowAm Ammonia Analyzer from ASA Analytics is designed for rapid and automatic batch analysis of ammonia in wastewater effluent. The low-cost units are designed from the ground up for reliable, accurate operation in real-world environments of wastewater treatment plants. Requiring minimal maintenance with quarterly reagent changes, the analyzer helps reduce energy costs of aeration and provides verification of the process. **800/665-7133; www.asaanalytics.com.**



ChemScan Analyzer from ASA Analytics

ENCLOSURE AIR CONDITIONERS

Closed-loop enclosure air conditioners from Thermal Edge control the internal temperature and keep dirt, dust and contaminants out of electrical enclosures. The units provide controls to keep sensitive systems operating within required parameters. The systems are available from 1,000 to 24,000 Btu/hr. They include a programmable digital controller and condensate evaporation. The units fit on enclosures 8 inches deep and larger. An optional integrated heat package is available. Coils can be coated and stainless steel is available for harsh environments. The units are available in 120, 230 and 480 VAC and are UL Listed for NEMA types 12, 4 and 4X. **888/580-0202; www.thermal-edge.com.**



Closed-loop enclosure air conditioners from Thermal Edge

MATCHBOX-SIZE DATA LOGGER

The matchbox-size HOB0 UX90 motor on/off data logger from Onset Computer has an LCD display for monitoring the run times of motors, pumps, compressors and other equipment. The logger records up to 340,000 equipment on/off cycle changes and uses analysis software (runs on PC or Mac) to convert recorded data into time- and date-stamped graphs. The logger attaches to motor housings via built-in magnets and without wiring. The display confirms operation, while a signal strength indicator ensures proper placement. **800/564-4377; www.onsetcomp.com.**



HOB0 UX90 motor on/off data logger from Onset Computer



MCP-TP control panel from Singer Valve

MULTI-PROCESS PANEL

The MCP-TP control panel from Singer Valve can monitor multiple processes and remotely control the dual solenoid control valve based on system conditions. The panel can function as a simple single-loop control (pressure reducing, flow control, level control) or as a multiple-loop controller (flow and pressure, or reducing and sustaining).

The unit reads transmitted signals and energizes the dual solenoid pilots on the control valve. It can react to any change in conditions by monitoring the system continuously and comparing actual process values to desired setpoint values. The multi-process control panel incorporates a high-performance PLC-based control with P.I.D. optimization. The program can be customized to meet specific applications. Optional alarm outputs for SCADA are available. **800/663-7266; www.singervalve.com. tpo**

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Buckley joins UV Pure Technologies

Steve Buckley joined UV Pure Technologies and will be responsible for a sales territory and business development in the U.S. Engineered Solutions market. He has a bachelor's degree in civil engineering, master's degree in environmental engineering and achieved the highest level of wastewater certification in Massachusetts and California.

Xylem produces technical handbooks

Xylem produced two technical handbooks on sludge pumping and wastewater treatment mixing. The *Flygt Handbook of Sludge Pumping* includes details on the advantages of different pump types for transporting sludge, how to estimate the required pump head pressure in a sludge transportation system, as well as case studies. The *Flygt Handbook of Mixing* combines theoretical background, application guidelines and recommendations for submersible, jet and top-entry mixers.

Natural Systems acquires assets of Connexus Waterways

Natural Systems Utilities, formerly EcoCheck, acquired the assets of Connexus Waterways, a division of Connexus Energy. The transition includes the transfer of 11 Minnesota wastewater treatment systems. NSU is a private utility that designs, builds, owns, finances and operates decentralized municipal and industrial wastewater treatment systems throughout Minnesota.

IST names VP of sales and marketing

Industrial Safety Technologies named Kevin McKeique vice president of sales and marketing. He will oversee sales and marketing efforts for IST companies Detcon and Gas Measurement Instruments. McKeique has 20 years experience in developing, marketing and selling gas detection products, sensors and control systems.



Jeff Helm

NETZSCH Pumps hires regional sales manager

NETZSCH Pumps North America named Jeff Helm regional sales manager for the western region. He is responsible for supporting industrial and municipal distributors in California, Arizona, Alaska, Colorado, Hawaii, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington and Wyoming. Based in Bremer, Wash., he has 30 years experience in the pump industry.

Headworks BIO signs option agreement with Texas A&M

Headworks BIO signed an option agreement with the Texas A&M University System (TAMUS). The agreement provides Headworks with the right to negotiate an exclusive license for TAMUS's electron beam (E-Beam) technology for use in municipal wastewater treatment options.

Dixon opens specialty products manufacturing facility

Dixon opened a dedicated manufacturing facility in Chestertown, Md., for its renamed and expanded specialty products division. The 44,000-square-foot facility will be the home for Dixon Specialty Products, previously known as Dixon Specialty Hose. The division engineers, develops and manufactures ball joint armor and other armored hose products, PTFE hose and fitting components and King Safety cables. Taylor Goodall is divisional manager for DSP.

Purafil marks 25 years of CCCs analysis

Purafil marks 25 years of its Corrosion Classification Coupons analysis. Originally intended for monitoring control rooms in industrial settings, more than 75 percent of CCCs analyzed come from industrialized settings, including oil and gas refineries, as well as municipal facilities. Reports detail the types of contaminants in the environment and the severity of corrosion in the room as defined by the Instrumentation, Systems and Automation Society (ISA) Standard 71.04-1985.

Calgon Carbon chairman, president, CEO retires

John S. Stanik, Calgon Carbon chairman, president and chief executive officer will retire after 21 years. The board of directors expects to fill the position by the third quarter of 2012. Stanik will remain with the company until a replacement is hired.

Moyno launches interactive website

Moyno launched an interactive website at www.moyno.com. The site features a pump selector tool, product information, technology innovations and case studies.

InduSoft offers online training series

InduSoft is offering an online training series for its InduSoft Web Studio 7.1 HMI/SCADA software. The first module provides users instruction on installation, tags, drivers and screen groups. The second module covers instruction for active objects, animations, trends and alarms. The videos can be streamed or downloaded with iPads and Android tablets that have Flash or MP4 support from www.indusoft.com.

Lechler publishes spray product catalog

The Lechler Catalog 500 features spray products and accessories as well as information on spray system design, material options, conversion tables, product differentiation and a new section on lances and nozzle headers. The catalog can be downloaded at www.lechlerusa.com.

ABB offers product brochure

The *Flow Measurement Solutions* publication from ABB Measurement Products can be downloaded at <http://goo.gl/A3kqC>. The brochure features a range of flow measurement products and discussion on a common HMI (human-machine interface) platform that enables users to configure, integrate and maintain ABB flow products. **tpo**

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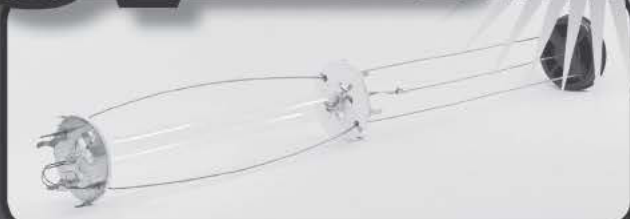


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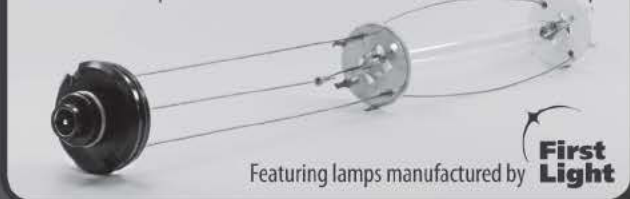
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1. RIG-A-LITE MAR2 LED LIGHTING FIXTURE

The MAR2 LED lighting fixture from Rig-A-Lite is designed for hazardous and severe environments. Featuring a copper-free extruded aluminum housing, the unit is suitable for land drilling rigs, oil and gas production, refineries, wastewater treatment plants and wherever hazardous gases might be present. Available with an 80-watt LED system tested at 90.1 lumens per watt in 2-foot or 4-foot lengths, the light offers 60,000 hours of maintenance-free production. **713/943-0340; www.rigalite.com.**

2. KSB SEWATEC VOLUTE CASING PUMP

The Sewatec dry-installed volute casing pump from KSB is designed for wastewater transport and treatment, sludge handling and stormwater applications. Features include a flexible hydraulic design, two mechanical seals to protect against failure, even during extended use and fluctuating conditions. The pump line has a diameter of 2 to 28 inches, maximum flow rate of 15,000 gpm, heads to 320 feet and liquid temperature limit of 158 degrees F. Cleanout openings in the pump volute are standard beginning with 4-inch models. **804/222-1818; www.ksbusa.com.**

3. SURCOTECH SCATTER ODOR CONTROL GRANULES

Scatter Odor Counteractant Granules from SurcoTech contain Metazene odor destroying additives. Formulated to handle odors from restaurant, institutional, commercial and municipal waste, granules can be applied in and around sewage treatment plants, roll-off containers, trash compactors and landfills. **800/556-0110; www.surcotech.com.**

4. DANFOSS EV245B STEAM VALVE

The updated EV245B steam valve from Danfoss has a longer stroke for applications where rapid heating is critical. Three compact polymer coil types clip to the valve. The BB dc coil is designed for temperatures up to 284 degrees F while the BB ac and BN dc coil is designed for temperatures up to 320 degrees F. The high-temperature BQ ac coil is made for temperatures up to 365 degrees F. Other features include double-guided piston and extra closing spring to prevent leakage. **410/931-8250; www.danfoss.us/ia.**

5. SHARPE MIXERS INLINE SLUDGE CONCENTRATOR

The Simfloc 5.0 inline sludge concentrator from Sharpe Mixers reduces polymer usage and decreases hauling and disposal costs. Designed for 24/7 service, all wetted parts are fabricated from 300 Series stainless steel for durability and corrosion resistance. Features include washdown inverter-duty motor with leak-free mechanical seal and 6-inch, 150-pound flanged access window to inspect the mixing chamber and impeller. The concentrator can be mounted in any orientation and the mixing chamber can be rotated to meet piping requirements. **800/237-8815; www.sharpemixers.com.**

6. HAMMOND DUAL-ACCESS CABINETS

Eclipse dual access wall-mounted cabinets from Hammond Manufac-

Wastewater Disinfectant Offers Alternative to Bleach

By Ed Wodalski

Proxitane WW-12 disinfectant from **Solvay Chemicals** is based on environmentally compatible peracetic acid (PAA) and hydrogen peroxide for biological control in municipal wastewater. "It can be used like sodium hypochlorite (bleach), but without the chlorinated byproducts," says John Maziuk, technical marketing manager. "Instead, you'll get small amounts of acetic acid, water and oxygen."

The ready-to-use liquid controls fecal coliforms, fecal streptococci, total coliforms and *E. coli*. It has no adverse effects on TDS, TSS and pH. It also can be used to increase the capacity of undersized UV systems and does not require a dechlorination step. The EPA-registered disinfectant, an alternative to halogenated disinfectants, also can have synergistic effects on existing UV disinfection systems.

"I'm a chemical engineer and I like to see minor improvements put together to make the whole process much better than before," Maziuk says. "Quite a bit of work has been done in a number of UV systems in Europe, and now we're starting to do studies in the United States."

The microbiocide can be used for wet-weather disinfection at CSOs, SSOs and secondary bypasses, as well as to control wastewater odors. Stable under ambient conditions, the disinfectant has a shelf life of about six months. "It also is very stable over wide temperature ranges," Maziuk says.

The Proxitane WW-12 injection system can be used as the primary disinfection system or as a low-energy-demand backup during high flows or peak power demand periods. "The more information we can provide to people who are considering alternatives to chlorine disinfection, the more it helps," Maziuk says. "All we're saying is that there aren't just one or two alternatives — there may be three or four. Not everything is perfect for every particular type of wastewater." 713/525-6800; www.solvaychemicals.us.

turing offer a strong enclosure for high-density LAN cabling and 19-inch patch panels, as well as for any 19-inch electronic equipment. The unit consists of a heavy-duty, wall-mounting rear and base, main body and a solid or window lockable front door. The body and door are independently hinged with 120-degree opening. All sections are constructed from 14-gauge steel. Seamless, poured-in gaskets provide protection against dust, oil and water to NEMA type 3R, 12, 4 and IP66. Sizes range from 16 inches high by 24 inches wide and 15 inches deep to 48 inches by 24 inches by 24 inches. 519/822-2960; www.hammondmg.com.

7. WATSON-MARLOW SODIUM HYPOCHLORITE PUMP

The 620 series sodium hypochlorite pump from Watson-Marlow is designed for water and wastewater applications. Features include off-gassing to prevent vapor lock while maintaining ± 0.1 percent accuracy in hypo metering. The pump handles harsh chemicals, including ferric chloride, sodium bisulfate, aluminum, fluoride, carbon and lime slurries, polymers, aqueous ammonia, potassium permanganate and caustic slurries. With no valves or seals to clog, the pump requires minimal maintenance. 800/282-8823; www.wmpg.com.

8. PARKSON MAINTENANCE-FREE ROTATING DRUM SCREENS

Rotoshear EZ-Care rotating drum screens from Parkson require no lubrication or maintenance, incorporating non-metallic components in the wheel bearings and other key areas. Screens are available in more than a dozen configurations with many application-specific custom features for use in municipal wastewater treatment and various industrial applications. 888/727-5766; www.parkson.com.

9. HAYWARD FLOW T-SERIES PUMPS

T-Series Webster thermoplastic pumps from Hayward Flow Control, available in 1/3 hp to 1 1/2 hp models, feature a single, non-coupled motor/impeller shaft (303 stainless steel), PTFE shaft seal design, extended shaft sleeve with standard and washdown motors in voltages of 115/230 and 208-230/460. Options include GFPP or PVDF pump head and impeller assembly, inlet screen, in-tank filtration, impeller trim variations, explosion-proof motors, 575-volt motors and S-J type electrical cord. 888/429-4635; www.haywardflowcontrol.com.

10. VAL-MATIC DUAL DISC CHECK VALVE

The Dual Disc check valve from Val-Matic features non-slam, spring-assisted closing, a pressure-sensitive vulcanized seat for tight closure at both low and high pressures and lift and pivot action to reduce seat wear. The valve is available in sizes from 2 to 60 inches for pressure up to 500 psi in Wafer (ANSI 125, ISO PN10, ISO PN16), Lug and Grooved End connections. 630/941-7600; www.valmatic.com. tpo

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people/awards

The **City of Rolla Wastewater Treatment Division** received the Outstanding Safety Performance Award for Large Wastewater Treatment Plants from the Missouri Water Environment Association.

The **Virginia Institute of Marine Science** received a Diamond Excellence Award from the Hampton Roads Sanitation District for 12 consecutive years of perfect compliance with its wastewater permit. The institute manages wastewater on its 40-acre shoreline campus in Gloucester Point.

TPO welcomes your contribution to this listing. To recognize members of your team, please send notices of new hires, promotions, service milestones, certifications or achievements to editor@tpomag.com.

education

Florida

The University of Florida's TREEO Center is offering these classes at its training site in Gainesville:

- Oct. 9-11 – Process Control of Advanced Waste Treatment Plants
 - Oct. 30-Nov. 1 – Activated Sludge Process Control and Troubleshooting
- Email swest@treeo.ufl.edu or call 352/392-9570 ext. 216 for course details.

Georgia

The Georgia Association of Water Professionals has a Fall Conference & Expo and Laboratory Symposium on Nov. 13 in Dalton. Visit www.gawp.org.

Illinois

The Illinois Water Environment Association has a Nutrient Removal and Recovery Workshop on Sept. 13 in Sandwich. Visit www.iweasite.org.

Kentucky

The Kentucky Water and Wastewater Operators Association is offering the following courses:

- Sept. 19-20 – Central Fall Wastewater Training Conference, Falls of the Rough
 - Oct. 16-17 – Wastewater Training, Madisonville
- Visit www.kwwoa.org.

Massachusetts

The New England Water Environment Association has a Collection Systems Seminar and Exhibit on Sept. 11 in Westford. Visit www.newea.org.

Michigan

The Michigan Water Environment Association is offering the following courses:

- Sept. 6 – Collection Systems Seminar, East Lansing
- Oct. 30 – Health and Safety Seminar, East Lansing
- Nov. 7 – Process Seminar, East Lansing

Visit www.mi-wea.org.

Missouri

The Missouri Water Environment Association has a Fall Conference on Nov. 1 in Columbia. Visit www.mwea.org.

Nebraska

The Nebraska Water Environment Association is offering the following courses:

- Oct. 11 – Wastewater Training, Sidney
 - Nov. 13-15 – Wastewater Certification Training, Lincoln
- Visit www.ne-wea.org.

TPO invites your national, state, or local association to post notices and news items in the Worth Noting column. Send contributions to editor@tpomag.com.

CALENDAR OF EVENTS

Sept. 9-12

Rocky Mountain Water Environment Association Annual Conference, Copper Mountain, Colo. Visit www.rmwea.org.

Sept. 12-14

South Dakota Water and Wastewater Association Annual Conference, Ramkota Convention Center, Rapid City. Visit www.sdwwa.org.

Sept. 13-14

New York Water Environment Association Science and Technical Conference, Hotel Thayer, West Point. Visit www.nywea.org.

Sept. 19-20

Kentucky Water and Wastewater Operators Association Fall Wastewater Training Conference, Falls of the Rough. Visit www.kwwoa.org.

Sept. 29-Oct. 3

Water Environment Federation Technical Exhibition and Conference, New Orleans Morial Convention Center. Visit www.weftec.org.

Oct. 9-12

Wisconsin Wastewater Operators Association Annual Conference, Kalahari Resort, Wisconsin Dells. Visit www.wwoa.org.

Oct. 14-16

Atlantic Canada Water & Wastewater Association Annual Conference, Charlottetown, Prince Edward Island. Visit www.acwwa.ca.

Oct. 21-24

Pacific Northwest Clean Water Association Annual Conference and Exhibition, Boise (Idaho) Centre. Visit www.pncwa.org.

Oct. 23-24

New England Water Environment Association Northeast Residuals, Biosolids and Energy Conference, Amherst, Mass. Visit www.newea.org.

Nov. 14-16

Indiana Water Environment Association Annual Conference, Westin Hotel, Indianapolis. Visit www.indianawea.org.

North Carolina

The North Carolina-AWWA-WEA is offering the following courses:

- Sept. 11 – Advanced Topics in Wastewater Seminar, Lexington
 - Sept. 27 – Collection and Distribution Seminar, Greensboro
- Visit www.ncsafewater.org.

New York

The New York Water Environment Association is offering the following courses:

- Sept. 12 – Nutrient Removal Technology and Process Optimization, Williamsville
 - Oct. 3 – Nitrification/Denitrification, Rochester
 - Oct. 24 – Nutrient Removal Technology and Process Optimization, Monticello
 - Nov. 7 – Nutrient Removal Technology and Process Optimization, Lyons
 - Nov. 28 – Pump Hydraulics, Selection, Sizing and Controls, Sawyer
 - Nov. 29 – Sustainability, Williamsville
- Visit www.nywea.org.

Ohio

The Ohio Water Environment Association is offering the following courses:

- Oct. 24-25 – Plant Operations and Laboratory Analysts Workshop, Lewis Center
 - Nov. 15 – Plant Operations, Cincinnati
- Visit www.ohiowea.org.

Wisconsin

The Wisconsin Department of Natural Resources is offering the following courses:

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Neighborhood Waste Water is looking for acquisitions! Massachusetts preferred, but will consider all New England. Contact Todd at mcmahon@arrayfs.com, or leave message 781-829-0014. (P11)

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- Sept. 5-6 – Disinfection Intro and Advanced, Chippewa Falls
 - Sept. 11 – Collection Systems, Mount Horeb
 - Sept. 12-13 – Phosphorus Removal Intro and Advanced, Chippewa Falls
 - Sept. 13 – Utility Management Training, Dodgeville
 - Sept. 17-21 – General Wastewater Treatment Intro and Advanced, Stevens Point
 - Sept. 18 – Control of Hazardous Energy, Shawano
 - Sept. 25-27 – Lab Introduction, Janesville
 - Sept. 27 – Control of Hazardous Energy, Elk Mound
 - Oct. 1-5 – General Wastewater Treatment Intro and Advanced, Oconomowoc
 - Oct. 15-16 – Tertiary Filtration Intro and Advanced, Oconomowoc
 - Oct. 16 – Competent Person Safety, Madison
 - Oct. 17-18 – Laboratory Advanced, Oconomowoc
 - Oct. 22-23 – Activated Sludge Intro, Green Bay
 - Oct. 24-25 – Activated Sludge Advanced, Green Bay
 - Oct. 29-30 – Primary Treatment Intro and Advanced, Stevens Point
 - Oct. 31-Nov. 1 – Ponds and Lagoons Intro and Advanced, Madison
 - Nov. 5 – General Wastewater Treatment Intro and Advanced, Stevens Point
 - Nov. 6 – General Wastewater Treatment Intro and Advanced, Oconomowoc
 - Nov. 6 – Personal Protective Equipment, Baraboo
- Visit www.dnr.wi.gov. **tpo**

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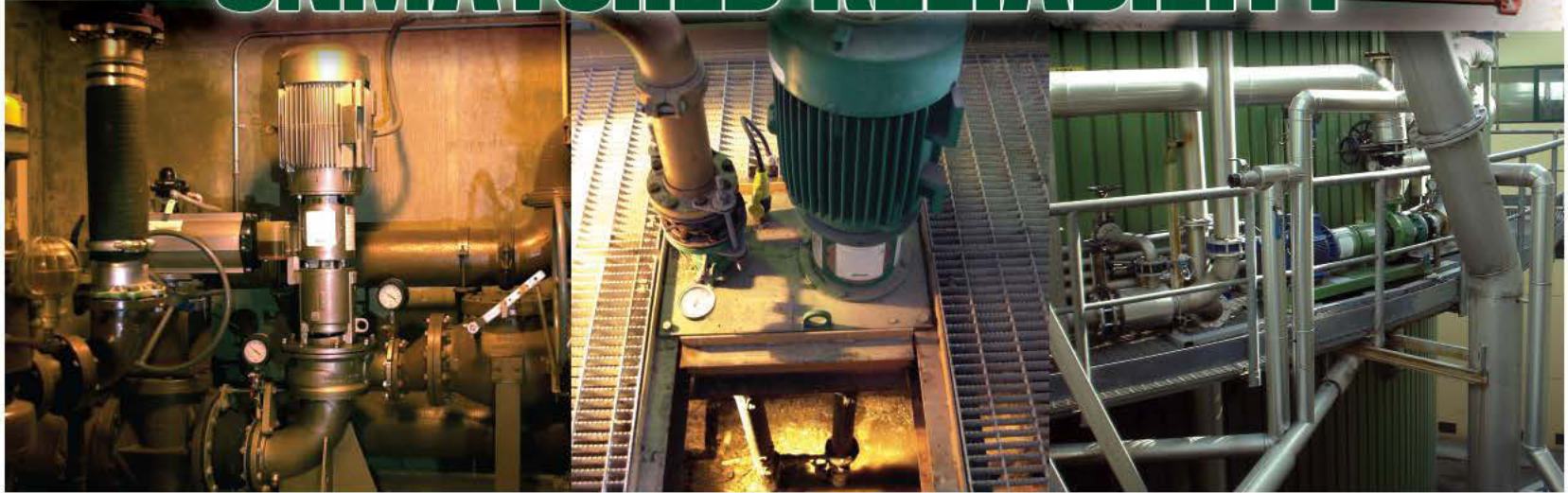
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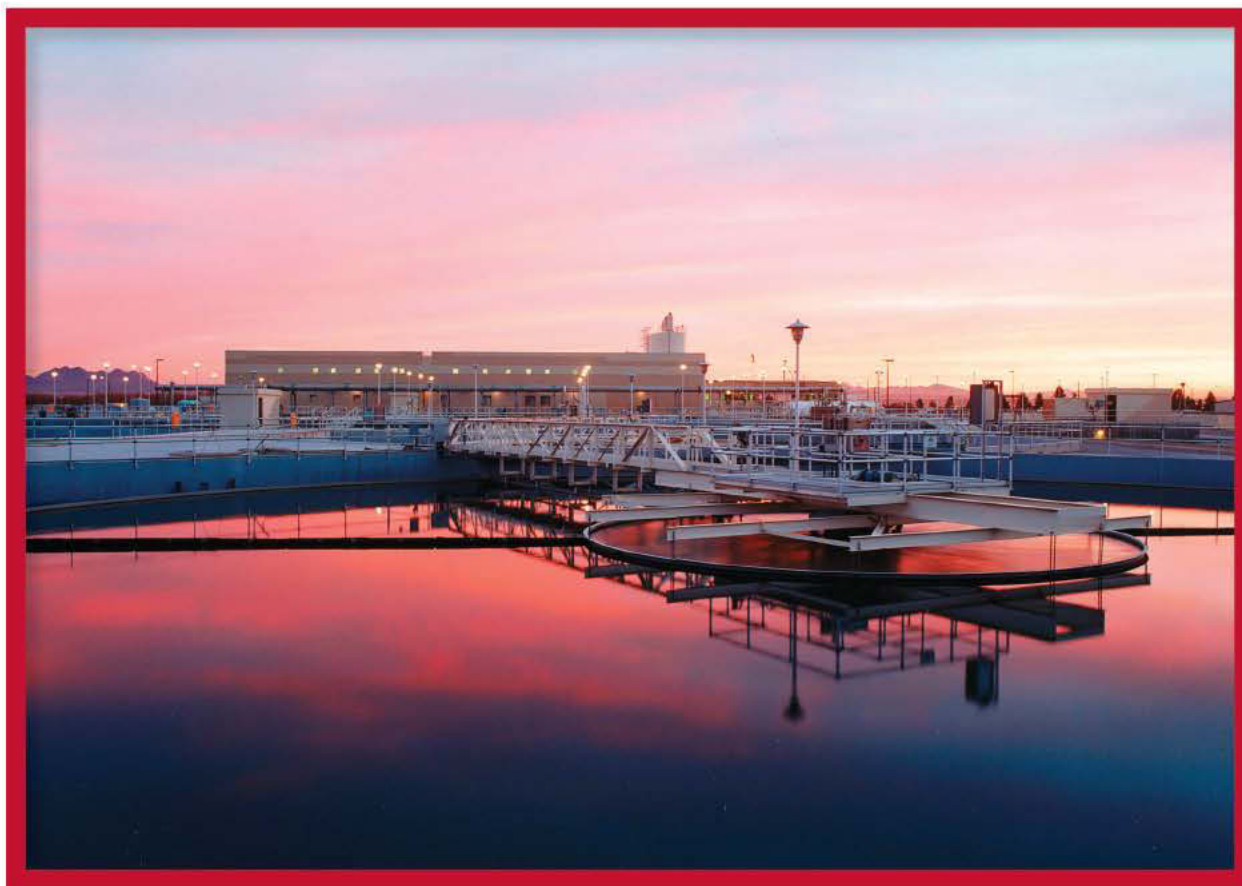
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