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Civic Asset

Stanley Shaffer
Chief Operator
Oneonta, N.Y.

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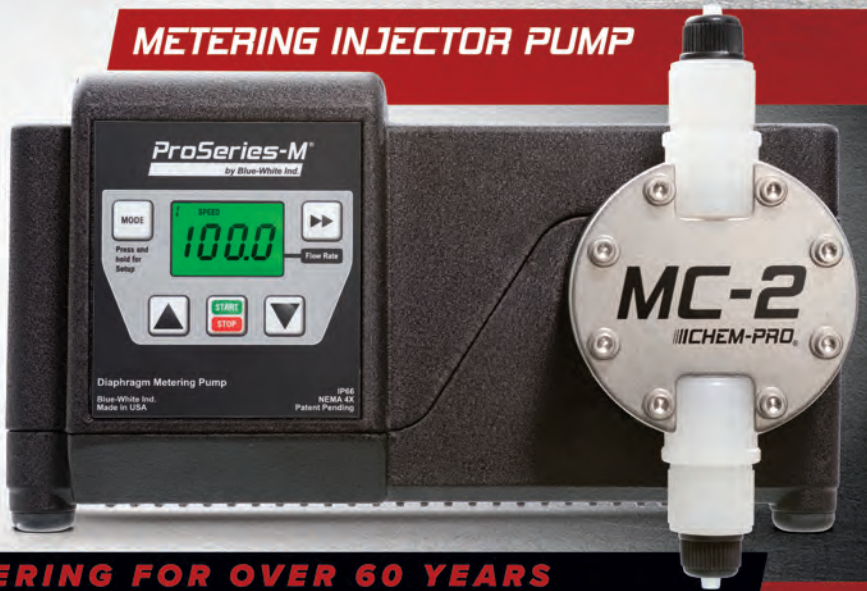

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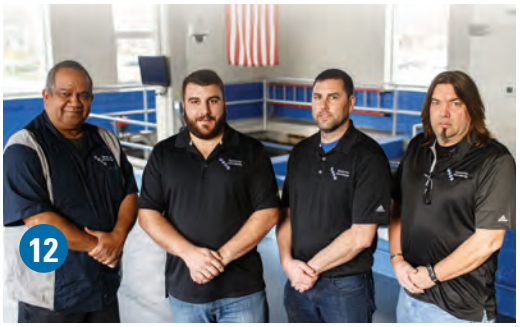

on the cover

To the customers of the Oneonta Water Treatment Plant, Stanley Shaffer is more than the lead operator. In 38 years there, driven by a commitment to provide the safest and cleanest water possible, Shaffer has become a resource vital to the city's health and well-being. (Photography by James Robinson)

top performers:

coming next month: November 2017

FOCUS: Treatment and Filtration

- Let's Be Clear: Understanding news professionals
- Top Performers:
  - Wastewater Operator: Tim Mills, Town of Bethel, Vermont
  - Water Plant: Water distribution excellence, Centerville, Utah
  - Water Operator: Earl Stewman, Anchorage, Alaska
  - Wastewater Operator: Lab director Jody Flannery, Rhinelander, Wisconsin
- How We Do It: Sequencing batch reactor in Moore County, Tennessee
- Sustainable Operations: LED lighting and power management in Santa Cruz, California
- In My Words: An innovative approach to phosphorus management
- PlantScapes: Ponds and manmade wetlands at Indian River County (Florida) Utilities
- Hearts and Minds: Water Professionals Appreciation Day in Virginia.
- Technology Deep Dive: Reverse engineering for pump restoration

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let's be clear

Missing Link Found

ELECTRICAL ENERGY STORAGE HAS POTENTIAL TO FILL A CRITICAL GAP IN THE EMISSIONS-REDUCING AND MONEY-SAVING ATTRIBUTES OF RENEWABLE POWER RESOURCES

By Ted J. Rulseh, Editor

There has always been one problem with solar and wind energy. It boils down to two words: darkness and calm.

Solar panels are great electricity sources, so long as the sun shines. The same is true of wind turbines, so long as the wind blows. But at night and when the air is still, those renewable sources go dead, and conventional power plants have to take over.

Renewable energy advocates have long said: If only the electricity solar and wind systems produce could be stored and saved for later. For years, there have been ways to store energy from generated electricity. One way is to use the electricity to spin a heavy flywheel, which becomes an energy source when the electricity is shut off. Another is to use an electric chiller to make ice at night and then use the ice to cool water for air conditioning during the day.

Unfortunately, those methods have limited applications, and they're not especially cost-effective; they require large capital investments that can take a long time to pay back. But now, as evidenced by the Sustainable Operations feature in this issue of *Treatment Plant Operator,* there's a third option.

JUST COMMON SENSE?

In one word — batteries. One might reasonably ask: Why didn't someone think of this before? Well, many people did think of it. It's just that batteries weren't sophisticated or cheap enough to store electric energy affordably and in meaningful amounts. Now, that appears to be changing.

The Napa (California) Sanitation District is using banks of lithium-ion batteries designed and built by Tesla to make more efficient use of electricity from the wastewater treatment plant's cogeneration system and an array of solar panels. Simply stated, the batteries store energy generated at times when utility power is cheap and discharge it when utility power is expensive.

Batteries still have a fairly long way to go, but the technology keeps advancing. Lithium-ion batteries aren't the

only game in town for large-scale energy systems. For example, flow batteries store and deliver energy not by way of solid electrodes, but through two chemical components dissolved in liquids. Iron-air rechargeable batteries produce electricity through the interaction of iron oxide (rust) and air.

COMPLETING THE PICTURE

Now, consider the possibilities at a wastewater treatment plant where cost-effective, battery-based storage is combined with digester-gas-fueled cogeneration, a gas- or diesel-driven standby generator, solar and wind power (for which treatment plants often have ample space), and sophisticated software that can deploy each resource to maximum economic advantage.

At times of low utility rates, the generating sources could charge the batteries. At times of high utility rates, the batteries could discharge, saving expensive purchased kilowatt-hours. Further, with battery storage, solar and wind power essentially cease to be intermittent energy sources; the power they generate can be used all day long.

Why didn't someone think of batteries before? Well, many people did think of it. It's just that batteries weren't sophisticated or cheap enough to store electric energy affordably and in meaningful amounts. Now, that appears to be changing.

And that's not all. Imagine a setting where the local utility allows interconnections with major customers and pays a feed-in tariff, and where market power prices fluctuate by the hour based on demand. Now the energy management software, communicating with the power markets, can follow the market prices.

Suppose a standby generator can produce electricity for 6 cents per kilowatt-hour, but the market will buy the power for 12 cents. It then becomes profitable to start that generator and feed power to the utility grid. The right software and systems can enable it all to happen automatically.

EXPLORING ALL OPTIONS

A system like this adds meaning to the phrase "water resource recovery facility." Now to this mix of resources, add co-digestion, feeding food waste or FOG to the digesters. Suddenly, status as a net-zero energy facility seems well within reach, and cost-effective at that. These are exciting times for plant managers and operators looking to get the most from their facilities. Battery-based storage is another tool in the progressive energy manager's kit. **tpo**

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TAP WATER DATABASE

Analyzing water

By now, most water utility operators have likely heard that the Environmental Working Group has released its national Tap Water Database, which allows Americans to enter their zip codes to see the levels of potentially harmful chemicals in their city's drinking water. As more citizens become informed and take an active interest in water quality, what will it mean for treatment plant operators?

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OVERHEARD ONLINE

"People think that because they're flushable, they're not going to affect the system, so they do it regularly without thought."

Utility Tackles Chronic Lift Station Issues With Public Education

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ENVIRONMENTAL STEWARDS

Honeybee project

You have to look closely to notice the activity atop DC Water's Blue Plains wastewater treatment facility, but an otherwise plain rooftop has been transformed into a miniature ecosystem. DC Water recently partnered with the DC Beekeepers Alliance to provide a healthy home for honeybees. Currently, the utility has four hives on the roof of the plant's central maintenance facility.

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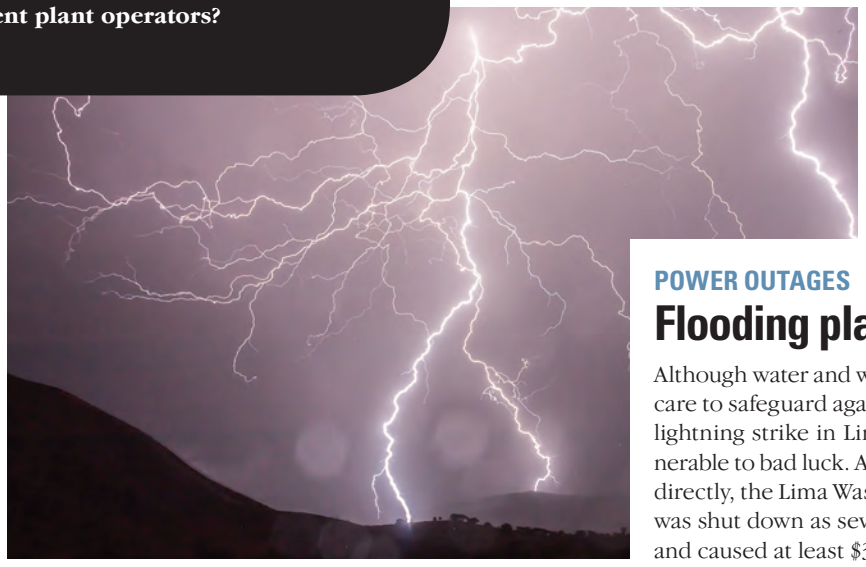

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POWER OUTAGES

Flooding plants

Although water and wastewater treatment facilities take great care to safeguard against storms and power outages, a recent lightning strike in Lima, Ohio, proves that no plant is invulnerable to bad luck. After lightning struck its main switchgear directly, the Lima Wastewater Treatment Plant lost power and was shut down as several feet of stormwater flooded the city and caused at least $3 million in damage.

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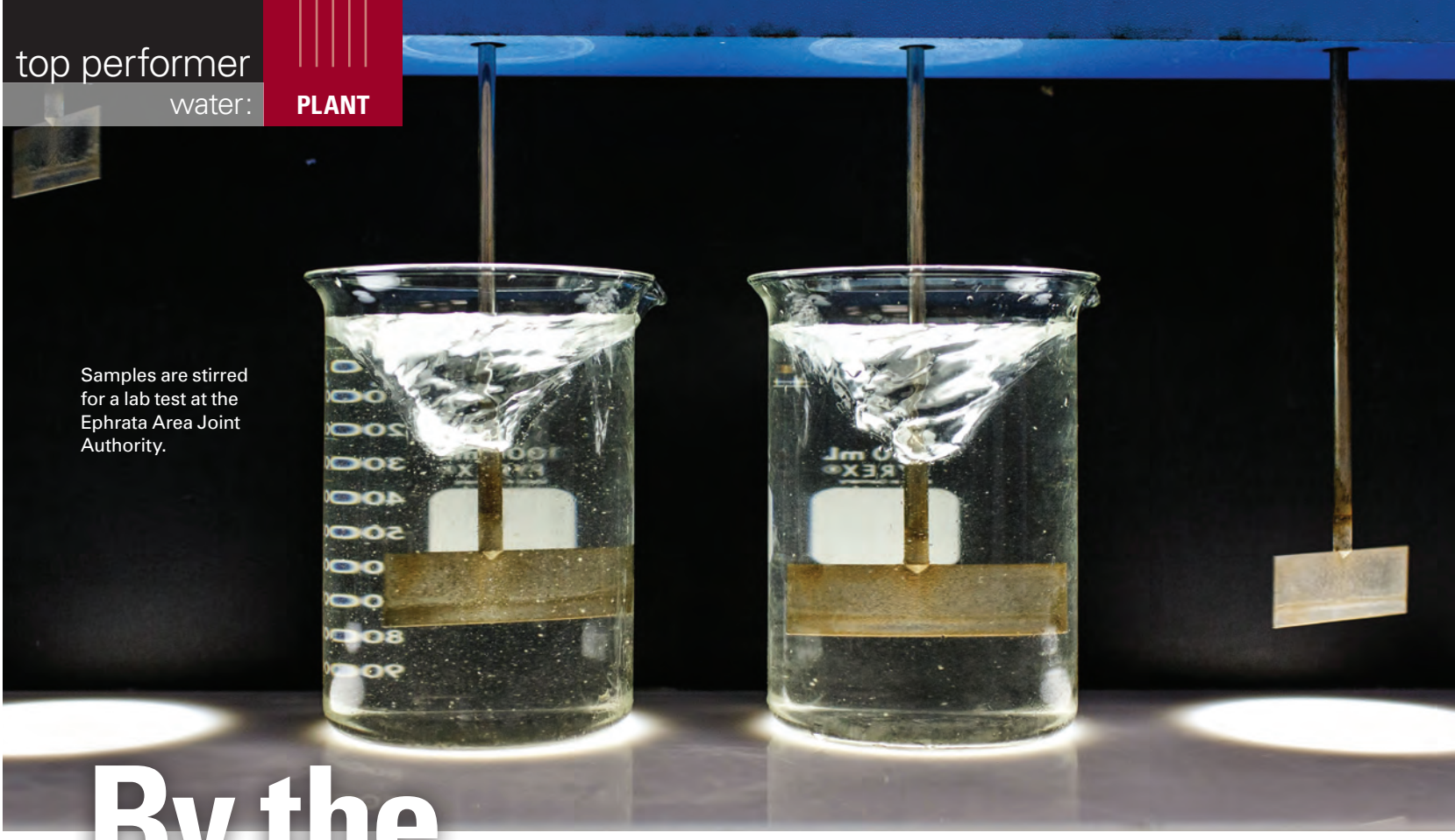

Samples are stirred for a lab test at the Ephrata Area Joint Authority.

By the Numbers

PRESIDENTS AWARD-WINNING EPHRATA AREA JOINT AUTHORITY PLANT USES DATA TO FINE-TUNE PROCESSES AND PRODUCE CONSISTENTLY HIGH-QUALITY WATER

STORY: **David Steinkraus**
PHOTOGRAPHY: **James Robinson**

THE PENNSYLVANIA AMISH COUNTRY CELEBRATES old ways, but the Ephrata Area Joint Authority's Church Avenue Filter Plant isn't tied to the past. The staff has pushed the plant's performance well beyond state permit requirements.

The authority manages the water needs of 24,500 residents in Clay Township, Ephrata Township and Ephrata Borough. The filtration plant was a winner of a 2016 Presidents Award from the Partnership for Safe Water.

DUAL SOURCES

The authority draws from three wells and from Cocalico Creek, which runs through the borough and not too far from the filtration plant. Well water flows to a building that provides corrosion control, air stripping and disinfection. Well 1 produces 1,000 gpm, and Well 2 adds 200 gpm. Well 4 has nanofiltration equipment because the aquifer it taps is high in sulfates and total dissolved solids. Well 3 has been drilled but not developed; it is being held in reserve for growth.

> "After we consider water quality, the first thing we look for is what levels we want our resources to be at during any given season. Then we look at the lowest cost to achieve that."
> **JOE PEZZINO**

"The borough itself is old, but Ephrata and Clay townships are not, and both have a lot of development potential," says Joe Pezzino, the authority's chief operator. "We're only 10 minutes from the turnpike, and we're beginning to see more businesses and satellite offices in the area." The service territory lies about 70 miles northwest of Philadelphia.

Cocalico Creek brings all the challenges of a surface water source that is influenced by rains upstream. At some times it is high in nitrates washing

(continued)

off farm fields. During winter, road salt washes into the creek. "We can treat the water no matter what's in the creek," Pezzino says. "But because we can draw water from multiple sources, we shut the filtration plant down during rains and use only the wells until the creek water improves, or we reduce the inflow from the creek to give us an edge on treatment. There's no point in using a lot of chemicals to treat creek water if we don't have to."

It's always a balancing task to combine the sources. Water quality trumps everything, but there are also issues of cost and managing resources.

PARTNERING FOR CHANGE

Well 4 is the most costly source because of the nanofiltration equipment. It's drilled in sandstone and pulls from a large area, but because of its depth it brings up sulfates and TDS, as does Well 2. Water from those wells is blended with water from Well 1, which taps an aquifer flowing from the nearby hills to Cocalico Creek. "After we consider water quality, the first thing we look for is what levels we want our resources to be at during any given season," Pezzino says. "Then we look at the lowest cost to achieve that."

The authority draws on extensive data on the historical levels of its wells. "We don't stress our wells, and we have plans for contingencies so when problems come up it's not a crisis but just another day in the office," Pezzino says. With that history of collecting and using information, it was a natural step for the authority to join the Partnership for Safe Water.

"What the Partnership taught us is to gather information and look at what it tells you," Pezzino says. For example, technicians know that ammonia will be high at certain times of year, and they understand how that will affect the plant. It's the same with nitrates. "In the past, our system definitely was not optimized although it met all regulations and permit requirements," says Pezzino. "With the help of the Partnership we've improved on that."

SMALL STAFF, BIG IMPACT

Joining the Partnership and using its resources was the idea of Jeff Iezzi, the authority's water quality and compliance operator, who had worked with the Partnership before. In 2014, the authority was granted the Partnership's Phase III award for its filtration plant. Last year, the authority received the Presidents Award for reaching Phase IV, the second highest level of recognition. In 2014 and 2015, the authority also received awards for area optimization from the Pennsylvania Department of Environmental Protection.

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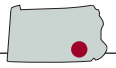
Ephrata Area Joint Authority Church Avenue Filter Plant, Ephrata Borough, Pennsylvania



BUILT: | **1932, expanded 1985**

POPULATION SERVED: | **24,500**

SERVICE AREA: | **Clay Township, Ephrata Township, Ephrata Borough**

EMPLOYEES: | **4**

CAPACITY: | **2 mgd**

SOURCE WATER: | **Cocalico Creek**

SYSTEM STORAGE: | **4.75 million gallons**

DISTRIBUTION: | **92 miles of water mains**

ANNUAL BUDGET: | **$2.8 million (operations)**

KEY CHALLENGE: | **Achieve Partnership for Safe Water Phase II for the distribution system**

WEBSITE: | **www.ephrataboro.org/2146/Ephrata-Area-Joint-Authority**

GPS COORDINATES: | **Latitude: 40°11'08.3"N; longitude: 76°10'18.1"W**

Operator Jai Howard and team members at the Ephrata Area Joint Authority pay close attention to source water quality in their quest to achieve consistently low turbidity in finished product.

"If it wasn't for the work with the Partnership and making our organization better, we'd never be able to do everything we do with four people," Pezzino says. "There's more to what we achieved. If you look at rates, we're actually the lowest-cost provider among our peers, and the Partnership work helps us keep costs down. It also helps that we don't have huge capital needs."

One way the authority avoided large new capital expenditures was by not building a new filtration plant. Instead, the old building on Church Avenue underwent a significant renovation.

THE OLD RENEWED

"We cleaned it up, fixed it up, automated it, brought it back to life," Pezzino says. During the past six years, the authority has replaced the filter system, added an Aries air scour system (Roberts Filter Group), repaired the sedimentation basins, put a new roof on the building, repainted the building inside and out, and improved the piping, electrical system, automation and valves. People who visit comment on how clean the building is, Pezzino says.

"We also have a DEP-approved source plan in place, so we don't look at just treating the water coming in, but we also look at what can we do to make the water better in our area," he says.

Two 16-inch mains under one of the borough's streets bring water from Cocalico Creek into the Church Avenue plant. A flowmeter (Master Meter) measures the incoming water and an inline static mix plate (Westfall Manufacturing Co.) feeds coagulants. Next, the water flows past a 24-nozzle aerator, receives prechlorination, and flows into one of two sedimentation and flocculation basins equipped with mixers (Philadelphia Mixing Solutions).

Post-chlorination comes just before water enters filters equipped with the Aries air scour system. Next is a clearwell where a Seaquest orthopolyphosphate blend (Aqua Smart Inc.) is added to inhibit corrosion. Two 75 hp/1,000 gpm pumps move water into the distribution system. The authority has standardized on Peerless pumps (Grundfos Pumps) driven by motors from U.S. Motors (Nidec Motor Corporation). Chemicals are introduced with Proseries-M Model M-2 peristaltic pumps (Blue-White Industries). That standardization makes repairs and parts inventories much easier to manage.

Mario Asencio and other members of the plant's small staff have benefited greatly from participation in the Partnership for Safe Water.

(continued)

> "If it wasn't for the work with the Partnership and making our organization better, we'd never be able to do everything we do with four people."
>
> **JOE PEZZINO**

The team at the Ephrata Area Joint Authority Church Avenue Filter Plant includes Mario Asencio, Operator II; Joe Pezzino, chief operator; Jai Howard, Operator III; and Jeff Iezzi, water quality and compliance operator.

A SCADA system (being monitored here by Jeff Iezzi, water quality and compliance operator), enables close control of plant functions.

MORE TO COME

Besides Pezzino and Iezzi, the operations team includes Mario Asencio, Operator II, and Jai Howard, Operator III. In 2015, Pezzino was named Operator of the Year by the Pennsylvania Rural Water Association. In 2016, he was named Employee of the Year by the Pennsylvania Municipal Authorities Association.

Utility superintendent Paul Swangren, borough manager Bob Thompson, and operations director Tom Natarian have made a concerted effort to assemble a quality operations team and keep building it. "When Bob brought me in, it was because they wanted a younger person who would be here in the future," Pezzino says. "Mario was brought in because of his knowledge of chemicals and polymers."

Iezzi plans to retire in about five years, and managers are looking at Howard as his replacement. Howard is extremely organized and helps out by taking on data management and other administrative tasks, Pezzino says. Team members find their own niches as they discover what they like to do best. Howard and Asencio do fieldwork, and Iezzi runs the testing program and scheduled maintenance. Pezzino works with the DEP, does budgeting and purchasing, and handles the SCADA system and its upgrades.

The Ephrata team members have learned a lot and achieved a lot, on their own and with help from the Partnership. They reached the highest level of recognition but will not rest on their laurels. They're working on Partnership Phase III recognition for the distribution system. tpo

GOING TO THE SOURCE

While the Ephrata Area Joint Authority is busy making its treatment operations better through its work with the Partnership for Safe Water, the staffs hope to take advantage of another partnership to improve its source.

In 2015, the state approved the authority's plan to become part of the Pennsylvania watershed protection program. Run by the state Department of Environmental Protection, the program can provide money for public education, installing riparian buffers, building wetlands that mitigate stormwater surges, and repairing stream banks, among other activities. In fiscal 2015, the state awarded $3.26 million in U.S. EPA grants to manage nonpoint source pollution in 11 counties.

The first step, as in the safe water program, is to gather information, says Joe Pezzino, chief operator: "It takes a bunch of years to evaluate everything in an area." That will include gathering information on gas stations with underground storage tanks that may leak, on agricultural runoff sources, and on companies that work with hazardous materials. "It's basically pulling together all the facts so we can do a full assessment of what in the area could harm our water sources, and from that point figuring out what our best actions would be," Pezzino says.

The authority is starting small. The first project will be to post signs around the watershed advising people to dial 911 if they see a contaminant spill. Another option is to join the Ephrata Borough program to educate people against putting grass clippings in the street because of their potential to contribute nitrogen and phosphorus to waterways, and about being careful with detergents used to wash cars. More complicated actions will require more thought.

"If we wanted to restore the banks of streams that feed into Cocalico Creek, you're talking big-dollar items to put in riparian buffers," says Pezzino. For other projects, a partnership would make sense. For example, if the authority wanted to work with farmers to reduce nutrient loading in runoff, it would make more sense to partner with the Natural Resources Conservation Service, whose experts work with that issue all the time and know the people.

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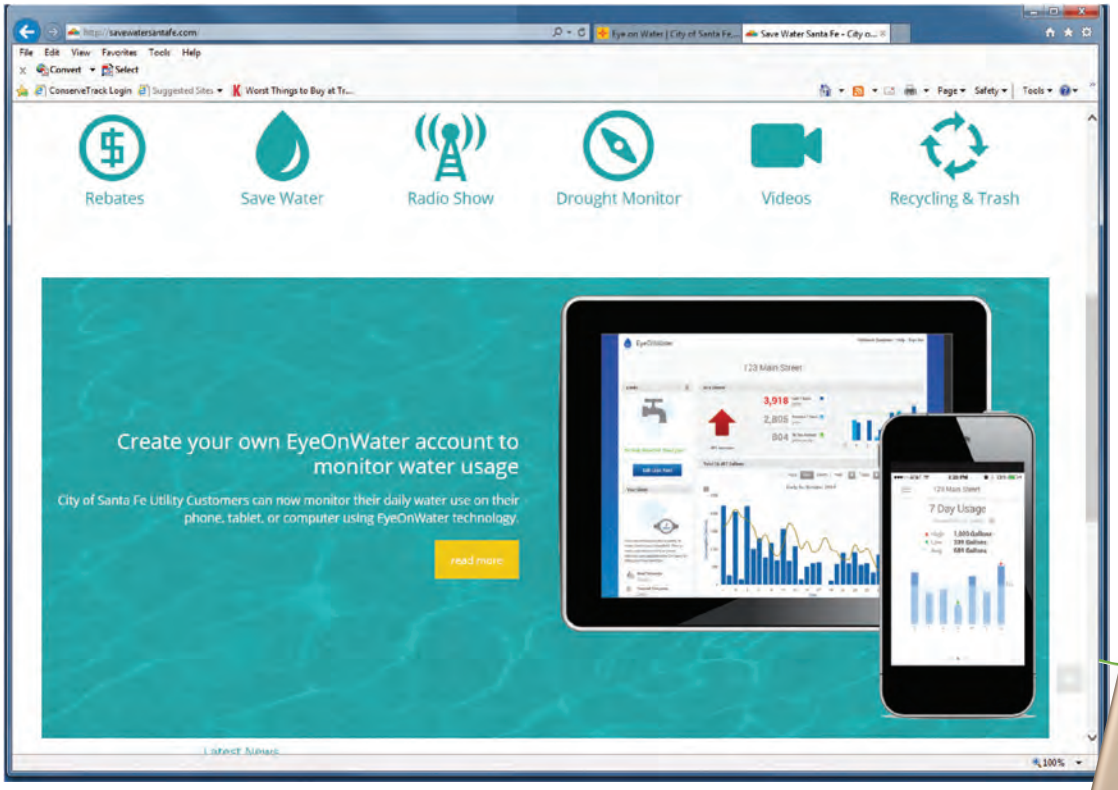


LEFT: To create an EyeOnWater account, customers go to the website, type in their account number and download the app. It takes about five minutes to set up. BELOW: The Santa Fe Water Division sent inserts with customers' water bills in January and July encouraging them to sign up for the EyeOnWater app.

GRAPHICS COURTESY OF THE CITY OF SANTA FE WATER DIVISION

There's a (Water) App for That

THE SANTA FE WATER DIVISION UNVEILS SMARTPHONE APP TO HELP CUSTOMERS IDENTIFY LEAKS, UNDERSTAND THEIR WATER USAGE, AND ADOPT CONSERVATION HABITS

By Craig Mandli

We live in a connected world. Nearly everyone has a pocket device that can feed them any information they desire.

Knowing this, the Santa Fe (New Mexico) Water Division has leveraged the "smart" remote-read water meters in residents' homes to offer a program that encourages buy-in to water conservation.

The remote-read meters (Badger Meter) were installed throughout the city in 2016. Besides making meter reading easy, they enable customers to track their water usage and even pinpoint problems on their property using the EyeOnWater smartphone app. Program organizers say customers are taking a big interest.

WATCHFUL EYE

"We've had more than 2,200 people so far sign up for the app," says Caryn Grosse, senior water conservation specialist. "Our whole goal is to get people to see beyond the dollar amount on their bills."

Available through Badger Meter's BEACON advanced metering analytics, EyeOnWater lets customers view and understand their usage through simple graphs. It also lets them establish alerts to better manage their usage. It's designed to promote conservation by offering hourly, daily, monthly and yearly data directly from the metering system.

The city receives a notification from the system when water leaks are indicated. "The system designers determined there should be at least one hour in the day where a home isn't running any water," Grosse says. "If the system detects running water at such times, we are notified, and we then notify the homeowner."

RECRUITING BY MAIL

The division sent inserts with customers' water bills last January and July. The insert asked customers to sign up for the EyeOnWater app.

"All customers need to do is go to the website, type in their account number and download the app," says Grosse. "It only takes about five minutes to set up."

> "People have a lot of fun following the app. They use it to pinpoint where they are using water and make changes as a result. Not only is it saving them money on their bill, but it is also helping us conserve water as a community."
> **CARYN GROSSE**

If water runs continuously for a whole day, the system alerts the user by email or text. Grosse tracks water usage for her own home through her web browser, which provides more detailed information than the smartphone app. She says many app users were surprised at how much water they used in a day and where that water was used.

"People who have drip irrigation systems were astounded by how much water they actually use," she says. "Those systems can also spring leaks very easily, often without the homeowner knowing." Many customers downloaded the EyeOnWater app after receiving a letter notifying them of a leak. Many continue to monitor their usage even after making the needed repairs.

"When people see anomalies, they often call to ask us about it," says Grosse. "We use that first contact as a jumping-off point for conservation education."

CONTINUING CONVERSATIONS

By analyzing data from the EyeOnWater app, division staff members can quickly determine the cause of excess water usage and then remedy the issue. They can also use the data to discuss with citizens how to avoid usage issues in the future.

"EyeOnWater actually lets us break down where there's a problem in the water delivery system," says Grosse. "When you really drill it down, it can determine if the problem is over-irrigation, leaks or other water usage. The goal is to help people better understand how they use their water."

The utility takes a multifaceted approach in teaching customers to use the app. Staff members have appeared at community events and in local media to highlight it. They've found that people of different ages need different approaches.

"The younger people who are tech savvy are downloading the app and using it, but with others, there is definitely more education involved," says Grosse. "We have walked a lot of people through how to use the app on their phones and have taught them how to download it on their computer if they don't have a smartphone."

COMMUNITY BENEFIT

Grosse says that once people download and learn the app, they often open it regularly. It's making a difference, as data indicates those using the app use less water: "That has been an interesting process. People have a lot of fun following the app. They use it to pinpoint where they are using water and make changes as a result. Not only is it saving them money on their bill, but it is also helping us conserve water as a community."

Grosse suggests communities looking at remote-read meters consider those with programs that allow customers to keep tabs on their water: "The more aware you can make your customers, the better handle you can keep on the system. If your customers are educated, there's more accountability in the choices they make." tpo

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@tpomag.com or call 877/953-3301.**

Brian Ovitt, assistant operator at Enosburg Falls, cleans the bar rack beside a Channel Monster grinder pump (JWC Environmental).

Rainy Day *People*

THE ENOSBURG FALLS TEAM ACTS TO LIMIT OVERFLOWS FROM WET-WEATHER EVENTS AND LAYS ASIDE FUNDS TO MAKE REGULAR PLANT PROCESS IMPROVEMENTS

STORY: **Jim Force**
PHOTOGRAPHY: **Oliver Parini**

Aeration basins at the Enosburg Falls Wastewater Treatment Facility.

RAINY DAYS USED TO SPELL TROUBLE FOR THE Enosburg Falls (Vermont) Wastewater Treatment Facility in the form of combined sewer overflows. That led to a major upgrade in 2012, including a 30,000-gallon offline storage tank to contain excess flows for later treatment.

Meanwhile, Rodney Allen, chief operator, with assistant Brian Ovitt, created a rainy day fund to make repairs and replacements that keep the day-to-day operations running smoothly. The fund is supported by sewer allocation fees and a $10,000 annual operating budget set-aside. "We identify projects and make needed improvements every year," he says. "This year we'll install a new drive mechanism for the anaerobic selector tank mixers and replace one of our pumps."

OUT WITH CSOS

The Enosburg Falls facility dates to 1977, when it replaced septic tanks that risked leakage to Vermont's Missisquoi River, a tributary to Lake Champlain and the plant's receiving stream. Designed by the DuBois & King engineering firm, the plant included headworks, extended aeration activated sludge treatment, clarification and chlorine disinfection.

> "We don't need big money for these projects. Every year, we keep the plant looking good and working well. We set this fund up when I first started working here. The state liked it. It's worked out really well for us."
> **RODNEY ALLEN**

The village began separating storm sewers and roof drains from the sanitary sewer system in 1995. Phosphorus reduction programs were completed in 1995-96 with the addition of an anaerobic selector process for biological phosphorus removal. The aeration systems were upgraded in 2005 with fine-bubble diffusers (Sanitaire - a Xylem Brand).

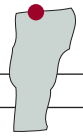
The 2012 upgrade responded to a state order to control CSOs and included the 30,000-gallon cast-in-place concrete tank to store excess influent when rainfall exceeded 2.5 inches in 24 hours. Since then the village has had no CSO violations. "It has been needed on a few occasions but has always performed to design," Allen says.

During the same upgrade, the village installed a new influent screening structure and grit removal system, added another chlorine contact tank, and

Enosburg Falls Wastewater Treatment Facility PERMIT AND PERFORMANCE			
	INFLUENT	EFFLUENT	PERMIT
BOD	421 mg/L	3.4 mg/L	30 mg/L
TSS	169 mg/L	5.4 mg/L	30 mg/L
Phosphorus	4.24 mg/L	0.18 mg/L	0.8 mg/L

Brian Ovitt, left, assistant operator, and Rodney Allen, chief operator.

Enosburg Falls (Vermont) Wastewater Treatment Facility



BUILT: | **1977 (CSO upgrade 2012)**

POPULATION SERVED: | **1,300**

AREA SERVED: | **Village of Enosburg Falls**

FLOWS: | **450,000 gpd design, 250,000 gpd average**

TREATMENT LEVEL: | **Secondary**

TREATMENT PROCESS: | **Extended aeration activated**

RECEIVING STREAM: | **Missisquoi River (tributary to Lake Champlain)**

BIOSOLIDS: | **Hauled off site for processing**

ANNUAL BUDGET: | **$600,000 (operations)**

WEBSITE: | **www.villageofenosburgfalls.org**

GPS COORDINATES: | **Latitude: 44°54'9.88"N; longitude: 72°48'31.62"W**

installed a double disc pump (Penn Valley Pump Co.) to drain that and other tanks as needed. The work also included improvements to the blowers, including variable-frequency drives for the existing aeration systems. Design engineer was Aldrich + Elliott, and NECCO was the general contractor.

EFFECTIVE BIO-P

Today, the plant handles an average flow of 250,000 gpd. Wastewater first passes through an influent structure that includes two coarse bar racks for screening. The headworks includes a vortex grit removal system with grit collector, grit pumps and grit cyclone (all from Envirodyne Systems).

The anaerobic selector tanks, funded entirely by a state grant, provide conditions to enhance biological phosphorus removal. The contents are maintained at zero dissolved oxygen and are mixed by Flygt - a Xylem Brand, Sulzer Pumps Solutions and Hydromatic submersible mixers. Retention time is about two hours. Although the plant has capability to add alum for phosphorus precipitation, that is seldom used.

"We piloted the selector system back around 1999-2000," says Allen. "We proved to the state that we could operate it and biologically remove phosphorus." After biological treatment, the flow passes to the aeration basins and on into dual rectangular clarifiers. The effluent is then chlorinated and flows through two contact tanks that provide about four hours' detention time.

Biosolids are aerobically digested, again using fine-bubble aerators. The liquid material at about 3 percent solids is hauled by a contractor to the Plattsburgh (New York) Wastewater Treatment Plant about an hour away for dewatering followed by landfilling or composting.

READY SOURCE OF FUNDS

The rainy day fund has performed well. Allen calls it his sewer equipment replacement fund. At present, the fund totals about $260,000, not a big number to midsized and large wastewater authorities, but a goodly sum for a plant as small as Enosburg Falls.

"Every year we make a list of in-house projects that need doing." Allen says. "This year, we'll put new vertical-shaft drives on the mixers in our selector tank. We'll assist in the installation and hope to achieve better mixing, greater efficiency and easier access for maintenance. Allen and Ovitt also installed a new replacement pump (Gorman-Rupp Company) at one lift station and will widen the plant's access gate to allow large vehicles like biosolids trucks to enter and leave more easily. All these projects will cost an estimated $30,000.

"We don't need big money for these projects," says Allen. "Every year, we keep the plant looking good and working well. We set this fund up when I first started working here. The state liked it. It's worked out really well for us. We know how long things will last; we don't wait for them to fail. We're refurbishing the plant for the future."

STRONG STAFF

The do-it-yourself approach is not surprising at Enosburg Falls. Allen and Ovitt are combat veterans, and answering the call is nothing new to them. Allen, who started as an assistant at the plant in 1978, served in Vietnam, where he was a mess hall sergeant for three years. Ovitt, who has a degree in environmental and civil engineering, served in the U.S. Army from 1989-95 as part of an air assault unit.

> "We piloted the selector system back around 1999-2000. We proved to the state that we could operate it and biologically remove phosphorus."
>
> **RODNEY ALLEN**

The two staff the plant each weekday, then alternate on-call duties on weekends and holidays, including three-hour shifts on Saturdays and Sundays. They use beepers and smartphones to maintain contact during off-hours.

Computer-driven data and manual recordkeeping enable Allen and Ovitt to keep track of maintenance requirements. "We keep a record on every piece of equipment in the plant," says Allen. "We update it every month. We keep a regular book. If something goes down, we have a backup. Good recordkeeping over the years has allowed us to plan for the future." *(continued)*

PLAQUES APLENTY

The Enosburg Falls Wastewater Facility and its staff members have earned several major awards for excellence. They include:

- Plant Excellence Award, Green Mountain Water Environment Association — second place, 1981-83; first place, 1984, 1987, 1990, 2016
- Rodney Allen, Operator of the Year, New England WEA, 1991; Outstanding Service in Water Pollution Control, Green Mountain WEA, 2010
- Brian Ovitt, Andrew D. Fish Laboratory Excellence, Green Mountain WEA, 2015

Allen notes that the awards in the 1980s were received when the late Sam Gates was chief operator: "He set a high standard for operation and commitment that is evidenced in the staff today. All employees past and present have taken great pride in operating this plant and receive support from all other departments as well as local government."

ABOVE: Brian Ovitt adjusts the double disc pump (Penn Valley Pump). RIGHT: Rodney Allen takes a dissolved oxygen meter reading of the process tanks. BELOW: Allen records data from the plant's main control center.

STAYING SAFE

The plant maintains an excellent safety program. "We have regular safety meetings," says Ovitt, who has completed OSHA safety training. The Vermont Rural Water Association provides additional safety training.

"With a small operation like this, we have a lot of responsibilities, including process control of the plant, state reports, maintenance, lab analysis, outside sewer lines and pump stations," says Allen. "We're also involved in the annual budget process and sewer allocations. But it works out well for us. We're cross-trained in everything. We keep the ball rolling."

In the nomination for Enosburg Falls' 2016 Plant Excellence Award from the Green Mountain Water Environment Association, the reviewer complimented the operators for their dedication and proactive approach: "They have an excellent preventive maintenance program and are innovative and mechanically skilled. They take great pride in their work."

The plant has an excellent compliance record. BOD removal is 99 percent, and TSS removal is 96 percent. Effluent phosphorus is typically about 0.2 mg/L, well within the permit. With the treatment provided, the effluent is crystal clear and nearly free of pollutants. Rain or shine. **tpo**

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FEEDING FERRIC CHLORIDE TO DIGESTED BIOSOLIDS PAID BIG DIVIDENDS IN DRIER MATERIAL, LOWER HAULING COSTS AND REDUCED ODOR COMPLAINTS IN FORT WORTH, TEXAS

By Scottie Dayton

For some two decades, Renda Environmental has applied more than 40,000 dry tons of Class A exceptional quality lime-stabilized and dewatered biosolids on agricultural sites for the city of Fort Worth, Texas.

"We had some odor complaints throughout the years, but nothing serious until they spiked in spring 2013," says Ben Davis, environmental program manager for the dewatering facility. "That's when operators noticed a change in the characteristics of the anaerobically digested biosolids in response to a significant drop in iron concentration. The material became wetter and visually unattractive."

Davis, who was familiar with Kemira Chemicals, a global chemistry company, called applications manager Tafadzwa "Tee" Mariga, who analyzed the material and then ran a trial mixing it with ferric sulfate. Results were encouraging, but not the solution. To reduce odors further, Mariga switched to feeding PIX-111, a ferric chloride based on trivalent iron (Fe3+).

Although a six-month trial was necessary to customize the flow-based equipment, operators saw the biosolids characteristics change within hours of feeding the primary coagulant. "The material went from sloppy to granular and was more aesthetically pleasing," says Davis. "Previously, we were fortunate if the belt presses achieved 14 percent solids. With the addition of ferric chloride, 16 to 18 percent solids became the norm." More good news lay ahead.

An operator at the Renda facility adjusts the polymer feed levels at the local control panel. The plant lowered polymer usage by about 30 percent, helping to reduce odor complaints.

Finished material from Renda's biosolids storage pad is loaded onto a transport truck headed to Wise County.

INJECTION POINT

The 166 mgd (design) Village Creek Water Reclamation Facility averages 100 mgd from 900,000 city residents and 22 communities. Pumps in a wet well at the plant send digested biosolids through a mile-long, 12-inch pipe to a 500,000-gallon storage tank at the dewatering facility.

Five 2-meter belt filter presses (Andritz Separation) keep up with demand. The facility's dump trucks make numerous weekly trips to application sites 40 to 70 miles away. Mechanical spreaders disperse the material. Renda Environmental staffs the entire operation.

"Because of the distance between the treatment plant and dewatering facility, the trial's biggest factor was selecting the appropriate injection point for the chemical," says Davis. "The treatment plant had an ideal location."

Kemira technicians fabricated a dosing point to increase surface area for maximum mixing of the ferric chloride and sludge. Proprietary KemConnect software monitors the process and adjusts doses based on flow meter readings. It also monitors the tank level, creates daily reports on the process, creates alarms and alerts, and initiates chemical delivery to ensure product availability.

Chlorine dioxide tanks (blue) stand in front of the liquid storage tanks (tan).

MAXIMUM BENEFITS

"Tee had calculated the startup feed rate," says Davis. "Operators then increased it incrementally based on orthophosphate levels in the filtrate. The city checks it five days a week. Initially, we had readings of 120 ppm to 130 ppm. When they dropped to the single digits, we knew we had the correct dosage. At the time, it was 2 gallons of chemical per 1,000 gallons of digested biosolids."

The 90 percent reduction in orthophosphate ended the formation of struvite. Previously, operators had noticed struvite accumulating in the piping and grinder pumps, blinding the belts and perforated rollers on the presses.

Biosolids are moved through a belt filter press at the Renda facility (Andritz Separation).

> "If we didn't have ferric chloride to turn to, we would be in big trouble. Application costs would have gone up exponentially because we would have had more truckloads hauling greater distances to more isolated application sites."
> **BEN DAVIS**

They worked overtime breaking down the equipment, chipping off the mineral and restoring the presses' efficiency. Today, the facility has no struvite issues.

While drier cake reduced the number of weekly truckloads, it's difficult to determine monetary savings. Crews dredge the settling ponds occasionally, and that volume spikes the hauling numbers. "If we didn't have ferric chloride to turn to, we would be in big trouble," says Davis. "Application costs would have gone up exponentially because we would have had more truckloads hauling greater distances to more isolated application sites."

DOWN WITH POLYMER

Because ferric chloride acts as a coagulant, as soon as the first batch of biosolids hit the belt presses, operators could reduce polymer usage by about 30 percent. "According to a study paid for by the city, polymer is an odor-contributing agent," says Davis. "Complaints did die off tremendously after we began adding ferric chloride, but we still had changes in product chemistry that lasted a day or two and could have generated legitimate odor complaints."

In a March 2016 trial study, Renda Environmental fed chlorine dioxide (Water Solutions, a division of Azure Water Services) to its biosolids storage tank. The oxidizer, dosed at 100 ppm, was implemented full time in December 2016. Davis says, "This additional treatment step has greatly diminished the likelihood of odor events." **tpo**

exam STUDY GUIDE

By Ron Trygar

Licensing exams can be challenging. Our **Exam Study Guide** helps you prepare by presenting questions similar to those on an actual exam. You can find many more sample questions on the *TPO* website at www.tpomag.com/study.

WASTEWATER:

The operator of an extended-aeration activated sludge treatment facility running at a 10-day solids retention time (SRT) completes a monthly microscopic examination of a sample of mixed liquor suspended solids (MLSS) from the effluent end of the last aeration tank before the clarifiers. He looks at three slides and documents the data in the table below. Based on all the information provided, what is the best assumption about the current plant operating condition?

ORGANISM	Slide 1	Slide 2	Slide 3	Total	Average
Amoeba, blobs	15	18	27	60	20
Amoeba, shelled	1	0	1	2	0.7
Flagellates	21	18	23	62	21
Free-swimming ciliates	15	14	10	39	13
Stalked ciliates	3	4	1	8	2.7
Rotifers	0	2	0	2	0.7
Worms	0	0	0	0	0
Other	0	0	0	0	0

A. The facility is running optimally and no changes need to be made.
B. The MLSS and SRT are too high and the waste rate should be increased.
C. The food/microorganism (F/M) ratio is too low and the waste rate should be increased.
D. The MLSS and SRT are too low and the waste rate should be decreased.

ANSWER: D. Remember that the question asks you to base your answer on all the information described, including the stem of the question, which states that the extended aeration plant is operating at a 10-day SRT. This is on the low side of the normal operating range for extended aeration, which is 20 to 30 days with an F/M ratio from 0.05 to 0.15 pounds of BOD per pound of mixed liquor volatile suspended solids (MLVSS) per day. Typical MLSS values range from 2,000 to 6,000 mg/L.

A microscopic examination of typical extended aeration MLSS will normally reveal a predominance of rotifers, nematodes (roundworms) and stalked ciliates, with some free-swimming ciliates, but few (if any) flagellates and blob (proteus) amoeba. There may be many shelled (testate) amoeba observed, and they resemble brown doughnuts. The sample results shown are more representative of a young sludge age commonly found in conventional or contact-stabilization activated sludge facilities. The operator will need to decrease the waste rate to build MLSS up, which raises the SRT and decreases the F/M ratio. On a side note, a microscopic exam of MLSS is recommended more often than once per month. A few times per week is more acceptable.

WATER:

An 18-inch water transmission main is 1 mile long. If the velocity in the main is 4 feet per second, what is the flow rate in gallons per minute (gpm)? Select the closest answer.
A. 52.9 gpm
B. 708.0 gpm
C. 3,177.6 gpm
D. 5,296.4 gpm

ANSWER: C. Before reviewing the steps used to arrive at the answer, it is important to understand a few things about solving math questions. There is usually more than one method to arrive at a correct answer. In solving this word problem, we used the standard rounding method: for anything over 5, round the preceding digit to next highest value, and round out to the hundredth digit (two values to the right of the decimal place — x.xx). It is also valuable to identify how the distractors ("fake answers") are generated in many exam situations. As you work the math, you might recognize some of the numbers used to make the incorrect choices, but also recognize that the units shown with those choices are not correct. For example, answer B, 708.0 gpm, is actually the flow rate as cubic feet per second with the decimal in the wrong space. Watch out for traps along the way to solving the question that might draw you into picking an incorrect answer.

Calculation steps:

Use the formula shown, as adapted from State of Florida Drinking Water Operator and Water Distribution System Operator Math Formula Sheets:

Flow Rate, gpm = (Area, sq. ft.)(Velocity, ft/sec)(7.48 gal/cu ft)(60 sec/min) or Q = V x A x 7.48 x 60

- Convert diameter (D) inches to feet: 18-inch pipe opening ÷ 12 inches/ft = 1.5 ft.
- Calculate the cross-section area, in square feet, of the pipe: A = 0.785 x D x D. A = 0.785 x 1.5 x 1.5. Area = 1.77 sq. ft.

Next, calculate the cubic foot volume of just the 4-foot length given as velocity, ft/sec. The total pipe length of 1 mile is not needed. This question is about the how fast the 4-foot section of water in the pipe is moving, not the total gallons.

Volume, V = A x length. V = 1.77 sq. ft. x 4 . Volume = 7.08 cu ft. *Note that this is actually 7.08 cubic feet per second (cfs) because the 4-foot number used was the velocity as 4 feet per second. The second units remain with the value as 7.08 cfs.*

Now, calculate the flow rate in gallons per second (gps) using the conversion value of 7.48 gal/cu.ft. Gallons/second = 7.08 cfs x 7.48 gal/cu.ft. Flow rate = 52.96 gps.

Lastly, convert to gpm by multiplying the gps by 60 seconds per minute: 52.96 gps x 60 sec/min = 3,177.6 gpm.

That's a lot of steps for one answer that may be only worth one point on an exam — but it may be the one extra point that rewards you with a 70 percent passing score. If you struggle with math, the best advice is to practice, practice, and practice some more. Use the steps above, but change the initial numbers a bit to make it a new question (pipe diameter, velocity, etc.) and then work it out again. State exams usually have math formula sheets, so practice with them to help you gain confidence in your math skills. You can do it!

ABOUT THE AUTHOR

Ron Trygar, a certified environmental trainer, is the senior training specialist for water and wastewater programs at the University of Florida's TREEO Center. He has worked in the wastewater industry for more than 30 years in a variety of locations and positions. He holds a Florida Class A wastewater treatment operator license and a Florida Class B drinking water operator license. tpo

CIVIC ASSET

STANLEY SHAFFER APPLIES LONG EXPERIENCE, PEOPLE SKILLS AND A NONSTOP LEARNING QUEST TO BUILD AN AWARD-WINNING CAREER AS CHIEF WATER PLANT OPERATOR IN ONEONTA, NEW YORK

STORY: **Jack Powell** | PHOTOGRAPHY: **James Robinson**

TO THE 16,000 CUSTOMERS OF THE ONEONTA (NEW YORK) WATER Treatment Plant, Stanley Shaffer is more than the lead operator. In 38 years there, driven by a commitment to provide the safest and cleanest water possible, Shaffer has become a resource vital to the city's health and well-being.

City leaders and officials with the New York State Department of Health (NYSDOH) call Shaffer "extremely knowledgeable," "forward-looking," and "an incredible asset." Oneonta Mayor Gary Herzig, in a local newspaper column, observed, "One big reason that we can take healthy water for granted is a man named Stan Shaffer. If you spend time with Stan in our water treatment plant, you will quickly learn that he has a passion for producing healthy, good-tasting water."

HONORED FOR DEDICATION

Officials praise Shaffer's desire to learn new technologies and treatment techniques, his ability to manage and motivate operators, and his determination to generate positive interactions with the community through meetings, internships and school tours.

Those good feelings culminated last April when Shaffer received the 2017 Operator's Meritorious Service Award from the New York Section AWWA. The group cited his "dedication to researching new technology and process improvements, which has allowed Oneonta to continuously improve its water quality while maintaining a low cost to the end user. Even during many storm and flood events, including the 500-year flood of 2006, the city, due to Stan's leadership and diligence, has had zero U.S. EPA and NYSDOH water-quality violations to date."

Stanley Shaffer, lead operator, Oneonta Water Treatment Plant

Despite such accolades, Shaffer remains humble. "I was more than shocked when I learned I'd won," he says. He mentions his nomination by Greg Mattice, city engineer, and his endorsement by Shane Finch, the city's NYSDOH representative. "Even my wife, Karen, filled in some of the blanks in the nomination form. Everyone played a role, including the great team of operators I supervise."

FROM DAIRY FARM TO WATER PLANT

A self-effacing style has been Shaffer's trademark since he joined the water plant team in 1979. Growing up on his family's dairy farm, he showed a strong interest in natural sciences. He earned an associate degree in laboratory techniques from the State University of New York Cobleskill and then, in 1972, a bachelor's degree in biology from SUNY Oneonta, where he also took chemistry and environmental science courses. Needing a job, he worked at a factory in Walton, a village of 3,100, and then spent a year and a half as an operator at that community's wastewater treatment plant.

Seeing an ad in the Oneonta newspaper for a civil service exam for wastewater and water treatment plant operators, he took the test but heard nothing. A year and a half later, while working at the Walton plant, he interviewed for a job at the Oneonta wastewater plant. He didn't get it, but the chief operator told him there would soon be an opening at the water treatment plant and laboratory. He was hired in 1979 and was promoted to chief operator in 1990. He earned a Grade II-A Community Water Operator license in 1981 and Grade I-A license 10 years later.

> “Stan is a great guy and a great employee. He’s dedicated to his job and so interested in all aspects of water treatment. ... He’s always looking for new ways to improve the plant, to make the best and safest water he can make.”
> **GREG MATTICE**

The Oneonta plant team includes, from left, Steven Schaefer, Karen Shaffer, Stanley Shaffer, Scott Kellogg, Thomas House and Paul Thayer.

Stanley H. Shaffer, City of Oneonta, New York

POSITION:	**Chief operator, water treatment plant**
EXPERIENCE:	**38 years in water industry**
DUTIES:	**Oversee 4.5 mgd plant and state-certified laboratory**
EDUCATION:	**Bachelor’s degree in chemistry, State University of New York Oneonta; associate degree in laboratory techniques, SUNY Cobleskill**
CERTIFICATIONS:	**Grade I-A Water Operator**
MEMBERSHIPS:	**AWWA New York Section**
BUDGET:	**$1.1 million (Treatment and distribution operations)**
GOAL:	**Remain on the job serving the people of Oneonta**

The Lower Reservoir at the Oneonta Water Treatment Plant.

Final sedimentation at the Oneonta treatment facility.

MANAGING AN AGING WATER PLANT

Once on board, Shaffer dedicated himself to providing excellent drinking water by helping the plant operate as efficiently as possible. Designed by New York City engineer Thomas Riddick, whom Shaffer calls "a genius," the 4.5 mgd plant came online in 1957. Oneonta, once a big railroad town, became smaller as the Delaware & Hudson Line offices and repair shops closed or moved away. When Shaffer arrived, the plant was treating about 3 mgd; at present, it averages about 1.6 mgd.

City water comes from two reservoirs, Wilber Lake and Oneonta Creek, and a supplemental well. Water is piped through a conventional treatment process and pumped to a booster station, then into six Aquastore fiberglass-lined steel storage tanks (CST Industries) before being fed through 66 miles of distribution mains. During his career, Shaffer has led a variety of upgrades and initiatives. These include:

- A preventive maintenance program that involved scraping and painting of the filter gallery floor and installing a new access catwalk to the low-service/sludge pumps.
- Installing SolarBee solar-powered mixers (Medora Corporation - SolarBee / GridBee) in several of the water storage tanks.
- A switch from dry chemical feeder units to metered liquid dosing pumps (ProMinent Fluid Controls) that proved more accurate and more cost-effective.
- A 2003 conversion from gaseous chlorine to a two-stage mixed-oxidant disinfection system (MIOX Corporation) and a subsequent system upgrade in 2011.
- A new SCADA system (Dell computer, GE software, Bristol-Babcock controls) installed in 2015-16 that incorporates inline analyzers for chlorine, pH, turbidity, ORP and UV transmittance. (The facility uses a UV254 analyzer to fine-tune the coagulation process for organics removal.)

City engineer Mattice observes, "Stan is a great guy and a great employee. He's dedicated to his job and so interested in all aspects of water treatment. He has taken just about every treatment course he can, and he's always pleased to share his knowledge with younger people. He's always looking for new ways to improve the plant, to make the best and safest water he can make."

EMPATHETIC STYLE

Technical skills aside, Shaffer earns high marks as a boss. He supervises six team members:.

- Karen Shaffer (his wife), operator and laboratory chemist (Grade I-A license)
- Paul Thayer, senior plant operator and lab technical director (Grade I-A)
- Thomas House, operator II (Grade II-A)
- Steven Schaefer, operator (Grade II-A)
- Terry Harkenreader, part-time maintenance
- Scott Kellogg, part-time student worker

One operator comes in at 5 o'clock every morning and gets the plant going. Other staff members work from 7:30 a.m. to 4 p.m., taking samples from the distribution system for analysis in the Environmental Laboratory Accreditation Program-certified lab and doing maintenance on pumps, mixed-media filters and other equipment.

PREPPING THE NEXT GENERATION

Stanley Shaffer has a strong commitment to continuing education that includes developing himself and his team of operators and promoting water as a career option. He seeks ways to expand operators' knowledge beyond the Oneonta Water Treatment Plant. For example, he coordinated the inclusion of two operators in the operation and maintenance of the city's outdoor public swimming pool, helping the Parks Department provide a valuable service.

In 1985, Shaffer launched an internship program for college students majoring in the environmental sciences, biology, chemistry and water resources. Interns help research treatment technologies and laboratory techniques. Through a partnership with his alma mater, SUNY Oneonta, he has introduced bright, young people to various water-quality issues.

"The value of the program cannot be understated," says Greg Mattice, city engineer. "Over the years, we've had scores of interns and probably hired 40 or 50 college students. Stan directly contributes to the education of the younger generation in a field that is of utmost importance to the public." Shaffer constantly recommends water careers when he gives plant tours to students from second grade to college. He points to the variety of well-paid positions in the industry: maintenance, operations, laboratory work, construction and others.

"I tell the younger ones to stay in school and learn as much as they can," he says. "For the college kids, I point out that water and wastewater is a great field. A lot of people don't go into it, so there's less competition for jobs. We have an aging workforce, so we need young people to replace those who are retiring. And there are many more men than women in the field, which means more women should get involved. There are opportunities for everyone, and I want them to know what's available."

While Shaffer considers communication important to leadership, he rates empathy even higher: "You have to get the job done, but you also have to think about the person and what they're dealing with inside and outside the plant. For example, we have an operator who has children, so it's important for him to have some flexibility on the weekends. You have to understand the people working for you and what's important to them on a day-to-day basis."

Operator Schaefer gladly attests to Shaffer's supervisory capabilities. On the job for a year and a half and the plant's newest Grade II-A operator, he observes, "Stan has been like a father I've never had. He's been very accepting of me and is eager to show me the water trade and explain how everything works. When I came to work here, I had no experience in water treatment, and he has taught me just about everything I know. He's a nice guy and a great boss, caring about his employees' needs and at the same time making sure things get done right."

TARGETED UPGRADES

Looking to the future, Shaffer and Mattice have put in place a five-year plan to upgrade the treatment plant and reservoirs, and the distribution system, which dates back to 1872. In addition, the plant faces ever-tightening federal and state regulations, including surface water treatment rules that require water systems to filter and disinfect water.

> "You have to understand the people working for you and what's important to them on a day-to-day basis."
> **STANLEY SHAFFER**

Shaffer makes sure the plant is always in compliance. For example, water coming in from the reservoirs can have turbidity anywhere from 1 to 600 NTU, while water leaving the plant must be under 1 NTU. The Oneonta plant produces water at no more than 0.04 NTU 99.9 percent of the time.

Such strong water quality merits praise from Finch of the NYSDOH Oneonta office: "Stan is always looking to optimize treatment techniques and take them to the next level. Although pretty old, the plant always produces good water. Stan is very knowledgeable, and a lot of times when a new rule comes out he'll know better than I how it will affect the plant, because he's always looking ahead."

RELISHING CHALLENGES

Shaffer is constantly on the lookout for the next project, treatment course or plant upgrade. That includes everything from more SCADA system upgrades to changing the disinfection system from chlorine to ozone, to rehabilitating the flocculation and sedimentation basins. He also spends a lot of time as a husband and father. His wife worked as a hydrogeologist for the Putnam County (New York) Department of Health and as a project manager for the New York City Department of Environmental Protection before joining the Oneonta team six years ago. Son Cole recently graduated from high school, and daughter Kayla is a high school junior.

In his spare time, Shaffer enjoys hiking and fishing and riding his motorcycle. When talk about retiring comes up, he just shakes his head: "I'm well past retirement age, but I keep having projects I'd like to see through, and I've always really liked my job. So I'm not looking to leave anytime soon." **tpo**

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The battery system supplied by Tesla is rated at 1 MW/2 MWh and so could discharge 1 MW for two hours or a smaller amount for more time. The project cost $3.2 million.

Batteries Included

A CALIFORNIA DISTRICT INSTALLS AN ENERGY STORAGE SYSTEM TO HELP MAKE MORE EFFICIENT USE OF ELECTRICITY FROM COGENERATION AND SOLAR POWER

By Steve Lund

Sustainable energy is a high priority for the Napa (California) Sanitation District. That leads the operators of the district's 15.4 mgd wastewater treatment plant to some innovative projects.

One of those projects is the installation of batteries designed and manufactured by Tesla. The batteries help the district make more efficient use of electric power from the wastewater treatment plant's cogeneration system and its array of solar panels.

"We use a fairly large amount of electricity," says Jeff Tucker, chief financial officer. "At any given time, we use 500 kW to 1.6 MW. Electricity is expensive, so we try to reduce the energy we consume and produce our own energy. Part of that package and way of thinking is the batteries. They allow us to take some of the energy we create when electricity is less expensive and use it when electricity is more expensive."

SUBSTANTIAL SAVINGS

Founded in 1945, the Napa Sanitation District collects and treats wastewater for some 82,000 residents in its city and surrounding unincorporated areas. The district's energy demand is relatively high because it recycles about 2,000 acre-feet of water each summer and pumps it to farms, vineyards, parks, cemeteries and other sites.

The batteries are expected to save about $110,000 per year in electric utility charges, to be split between the district and Tesla. "So far, it's looking very positive," Tucker says.

Napa Mayor Jill Techel, who also chairs the sanitation district, considers the project a great success. Long-range planning helped put the district in position to capture the opportunity. "It's just great to be producing green energy and using it at peak times," she says.

The five white metal cabinets containing lithium-ion batteries stand on a concrete slab. Each cabinet is 8 feet tall, 8 feet wide and 6 feet deep. The batteries reduce energy charges by discharging at times of day when utility rates are highest. They can also reduce the district's peak demand on the utility grid and thus limit demand charges.

"The battery system is either charging, discharging or waiting," says Tucker. "If we have a high load, it knows not to charge. It's constantly sensing our meter and determining what to do." The battery pack is rated at 1 MW/2 MWh, which means the batteries could discharge 1 MW for two hours or a lesser amount for a longer time.

OPERATING PARTNERSHIP

The battery project cost $3.2 million, offset by a $1.9 million Self-Generation Incentive Program grant from Pacific Gas & Electric. Tesla paid the rest and handles operations and maintenance. "It's fairly passive and automated," says Tucker. "Tesla's programmers and monitors are all remote. They have telemetry directly into our system. If anything is going on with the batteries, they can tell right away. If it's something small, they ask us to fix it. If it's something larger, then they come out. We see them only if there is a problem, and there haven't been many problems."

> "The battery system is either charging, discharging or waiting. If we have a high load, it knows not to charge. It's constantly sensing our meter and determining what to do."
> **JEFF TUCKER**

Most electricity generated at the district comes from biogas produced in its 1.2-million-gallon, egg-shaped anaerobic digester, which rises 80 feet above ground and extends 40 feet below ground. At first, the biogas provided

about 25 percent of the district's energy. That increased to 40 percent with the addition of fats, oils and grease from restaurants. The 1 MW, 4-acre solar energy system (SunPower) installed in 2016 boosted the total to 60 percent.

The battery system helps the district manage the self-generated electricity. Typically, it's charged using electricity from a 415 kW engine-generator, which runs around the clock. "But it could be charging from the solar as well," says Tucker. "It doesn't see that distinction." tpo

MORE OPPORTUNITIES

As part of its application for a grant to fund the Tesla battery project, the Napa Sanitation District and Pacific Gas & Electric performed an energy audit that revealed some other potential energy- and cost-saving projects. They include the following opportunities:

- **Better dissolved oxygen control.** The audit found the district was putting more air than necessary into its aeration process.
- **Increased variable-frequency drives.** The audit recommended adding VFDs to water pumps and air-exchange pumps. The VFDs are expected to pay for themselves in about eight years.
- **Chemically enhanced primary treatment.** The audit revealed ferric chloride could be added at the headworks to enhance solids settling. This would capture more solids for conversion to biogas and reduce the secondary treatment load. The district already uses ferric chloride, but would add it at a different process stage.

STAR STILL RISING

WILLIAM D. HATFIELD AWARD-WINNER SUE BAERT SUCCEEDS WITH HARD WORK, A WINNING MANAGEMENT STYLE, AND EXTENSIVE SERVICE TO INDUSTRY ASSOCIATIONS

STORY: **Trude Witham** | PHOTOGRAPHY: **Rob Hart**

SUE BAERT CREDITS HER HUSBAND, DAN, FOR GETTING HER into the wastewater treatment industry.

"I grew up on a Wisconsin farm, got my biology degree and worked in the lab at a cheese plant," says Baert. "Then I met my future husband, who was from Illinois." He showed her an ad for a lab technician at the Wheaton (Illinois) Sanitary District.

That was 27 years ago. She got the job, worked in the lab for 18 years, and worked up to wastewater treatment plant superintendent, a position she has held for seven years. Her experience and management skills served her well as she met challenges head on, from plant upgrades and staff training to learning the financial side of the business. She's eager to share information with those who seek her advice.

Sue Baert, plant superintendent, Wheaton Sanitary District

WELL-DESERVED RECOGNITION

Baert is grateful to her mentors, including lab manager Danette Stout, former plant superintendent Steve Bollweg, and executive director Steve Maney. Her biggest mentor, though, was former plant manager Bob Clavel. "He exposed me to many outside organizations by suggesting that I check out what they were doing in the wastewater field. He encouraged me to become involved with state and federal regulations by reviewing and submitting comments. But all my mentors let me grow and encouraged me to think outside the box."

Baert received the 2016 William D. Hatfield Award from the Central States Water Environment Association (CSWEA); she was named Operator of the Year by the Illinois Association of Water Pollution Control Operators in 2014. She credits the plant's solid compliance history, made possible by good design and a talented, proactive staff. She also credits her volunteer work as an executive board member of CSWEA and the DuPage River Salt Creek Workgroup.

IMPRESSIVE PERFORMANCE

The district's activated sludge plant (8.9 mgd design/6.19 mgd average) serves about 63,000 customers in Illinois including Wheaton, southern Carol Stream, small portions of Glen Ellyn and Winfield, and unincorporated areas of DuPage County.

Archimedes screws carry the influent through 4 mm fine screens (Headworks International), followed by aerated grit chambers. Raptor units (Lakeside Equipment) wash and compact the screenings and grit. The flow moves on to four primary settling tanks and then to five aeration tanks with fine-bubble diffusers (Environmental Dynamics International) fed by a 200 hp blower (APG-Neuros).

After settling in four secondary clarifiers (Walker Process Equipment, A Div. of McNish Corp.), the water flows by gravity to eight Hydro-Clear sand filters (Evoqua Water Technologies), and is then pumped to a contact tank for sodium hypochlorite disinfection. The water is dechlorinated with sulfur dioxide gas and discharged to Spring Brook Creek. Effluent averages 1.9 mg/L BOD, 2.5 mg/L TSS and 0.42 mg/L ammonia nitrogen.

About 1 mgd of effluent is reused for pump and plant maintenance and for watering nearby golf courses. The waste activated and primary sludges are anaerobically digested. The resulting Class B biosolids are processed

Sue Baert, Wheaton (Illinois) Sanitary District

POSITION: | **Plant superintendent**

EXPERIENCE: | **27 years**

EDUCATION: | **Bachelor's degree, biology, University of Wisconsin-La Crosse**

AWARDS: | **2016 William D. Hatfield Award, Central States WEA; 2014 Operator of the Year, Illinois Association of Water Pollution Control Operators**

CERTIFICATION: | **Class I Wastewater Operator**

GOAL: | **Attain a higher management position**

GPS COORDINATES: | **Latitude 41°50'38.46"N; Longitude: 88°8'44.51"W**

"I have a lot of young staff. We hire people with no certification, and the more experienced employees train them."

SUE BAERT

RIGHT: The Wheaton district's activated sludge plant (8.9 mgd design flow) serves about 63,000 customers. BELOW: Sue Baert is a mentor to team members like operator Angelo Mistretta.

through centrifuges (Alfa Laval), stored on site and removed quarterly by contractor Stewart Spreading for application on farms.

SMOOTH OPERATION

The plant has been upgraded several times to meet environmental and water-quality standards. The most recent upgrade, in 2010, included new intermediate pumps (Lakeside Equipment) to convey flow seamlessly to the activated sludge process. LED lights (LED Rite) were installed throughout the plant, the aeration system was upgraded, and two backup diesel generators (500 kw Caterpillar and 350 kw Cummins) were added.

A staff of 24 keeps things running smoothly; 15 report to Baert, who manages operations, maintenance, and the lab. She also handles written and oral reports to the board of trustees, operational reports for process control, and U.S. EPA and Illinois EPA (IEPA) reporting. She ensures permit compliance and plant security and is the point person for keeping the district current with emerging technologies and best management practices.

Plant staff members are a mix of longtimers and recent hires. "I have a lot of young staff," Baert says. "We hire people with no certification, and the more experienced employees train them." A detailed document tells new hires what they need to know. Once they are comfortable with the procedures, they and their trainer sign off on it. New employees also use the California State University, Sacramento books and other study guides; they take classes at the Southern Illinois University Edwardsville Environmental Resources Training Center.

"We've had five retirements in the last six years and could have another five in the next five years," Baert says. "So, we give tours and hire summer interns in the hopes that we will attract new staff as people retire."

RESILIENT TEAM

The operations staff covers the plant around the clock. An operator is at the plant from 6 a.m. to 6:30 p.m., and night watch is on duty in the remain-

LEISURE TIME

When Sue Baert goes on vacation, it's a real one with no TV and limited cellphone access. "Every year, we go to the Upper Peninsula of Michigan at a lake resort," says Baert. "The whole family goes — Dan, my husband of 27 years; my 17-year-old daughter; and my 20-, 21- and 23-year-old sons. We do a lot of swimming, boating, and various yard games during the day, and play board and card games in the evenings or if it rains." Her husband's family has been vacationing at the resort for more than 70 years.

Baert also enjoys movies, books and playing the dice game Bunco. "Once a month, I play bunco with seven ladies in their 70s, 80s and 90s. It keeps me connected with the community because they know who's in town and what's going on."

She also volunteers at her church, counting the collections and cleaning. She admits to an obsession with the sudoku puzzle game and enjoys an occasional crossword puzzle. "It relaxes me, and I feel that I'm giving my brain some good exercise."

Sue Baert with her team in Wheaton. Front row, from left, Charles Black and Jon Rusch, operations; Dan Rogers, information technology; Zach Billings and Bob Vogel, maintenance; Baert; Danette Stout, lab manager; and Shelley Jenks, lab tech. Back row, Rick Romani, maintenance; Exectuvie Director Steve Maney; Angelo Mistretta, operations; Jason Ackmann, maintenance; Svetlana Denisov, accountant specialist; Maintenance Supervisor Dave Bullard; Michele Salemi, billing specialist; and Administrative Services Director Diana Soltess.

(continued)

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Baert's duties include supervising a lab team that includes lab technician Shelly Jenks.

ing hours. Watch duties include sample collection, and buildings and grounds inspection and cleaning. The on-call operator can access the plant's SCADA system via tablet.

"My staff is dedicated," says Baert. "They are dependable, trustworthy and resilient. They work during rain events or failure issues and will still come back the next day for their regular shift." Besides Baert, the plant's staff includes:

- Operators Jeffrey Johnson, Philip Knight, Charles Black and Angelo Mistretta
- Watchman Terry Leggett and part-time watchmen Michael Heinz, Gary Almeroth and Jon Rusch
- Sewer inspector Stephen Beach
- Maintenance manager Dave Bullard and team members Rick Romani, Robert Vogel, Jason Ackmann and Zach Billings
- Lab manager Danette Stout and technician Shelley Jenks
- Administration: Steve Maney, executive director; Diana Soltess, manager; Michele Salami, billing specialist; Svetlana Denisov, accounting specialist; Scott Bobek, financial specialist; and Dan Rogers, IT.

PEOPLE FIRST

The team has weathered some serious storms. In April 2013, Wheaton was declared a federal natural disaster area from excessive rain. Baert recalls, "The area lost power, as everything was underwater. We still have the 4-foot-high watermarks left on several of our buildings as a reminder. We rented generators to run the plant and within four hours had everything up and running again."

Baert takes pride in delivering good-quality effluent and is especially proud of one project: "The district asked me to write a Quality Assurance Project Plan (QAPP) for stream sampling. This sampling was to be conducted upstream and several locations downstream, and included continuous dissolved oxygen monitoring. We were the second plant in the state to receive an IEPA-approved QAPP." The plant team sampled from 2002 to 2008 and submitted a report every year to the IEPA before handing over the sampling sites to the Salt Creek Workgroup.

Managing people can be a challenge. "I've had to overcome the idea that everyone works at the same intensity that I do," Baert says. "I have a Type A personality, and most of my staff is laid-back. I push buttons and change pumping rates and levels, and the staff can be a bit leery of doing something that I would naturally do. But I believe this gives us a good balance overall."

It helps to have a sense of humor: "I can work well with difficult people. I was the youngest of seven kids, so I'm bolder and more accepting because of that." She is pleased that her peers seek her out for advice. "I've received calls from people outside the plant asking my opinion on various equipment and standard operating procedures. I think it's because I get exposure to other people's issues through shared experiences at outside meetings."

Her volunteer work with the CSWEA and the Salt Creek Workgroup has been rewarding. CSWEA includes water and wastewater professionals, consultants and students from Wisconsin, Illinois and Minnesota. The Salt Creek Workgroup was founded by wastewater professionals, environmental activists, scientists, regulators, city managers and consultants to improve water quality and stream morphology in the DuPage River watershed.

Baert spends about six hours a month working with the boards of both organizations to determine meeting agendas, budgets, and watershed remediation projects, and to stay current with U.S. EPA and IEPA regulations.

LIKE FAMILY

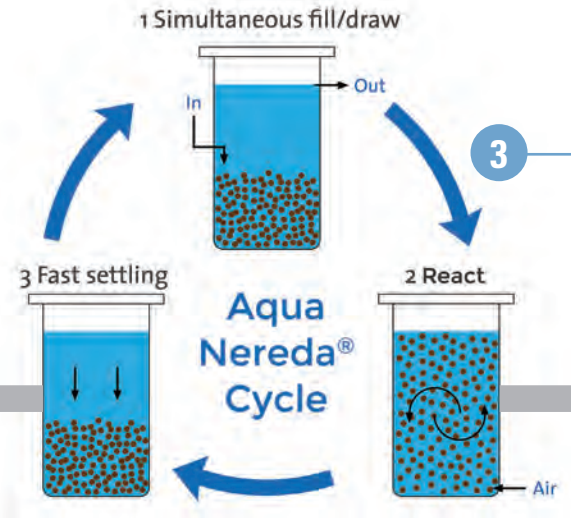
Baert is excited about upcoming plant upgrades. "We're currently working on plans to replace the sand filters with disc filters and convert from sodium hypochlorite to UV," she says. The disc filters will improve treatment capacity and reduce solids, fecal coliform and phosphorus loadings. She would like to stop using chlorine and SO2 and thus reduce chemical byproducts entering the creek. The disc filters will be online by 2019 and the UV system by 2020. "This is new technology for us, and learning the ins and outs should be exciting. Shortly after that, we will be evaluating biological nutrient removal processes."

She also looks forward to learning more about the financial side of the business. "My boss, Steve Maney, has me doing more financial work, like state revolving loan applications and preparing the plant's budget-setting rates and loan funding."

Baert would welcome the challenge if a higher management position were to become available. In the meantime, she is content to "mother" her staff: "I consider them to be like family. One of my staff is retiring soon. He told me, 'I'll return if you need help, because you've had my back all these years, and I've got yours.'" tpo

> "I can work well with difficult people. I was the youngest of seven kids, so I'm bolder and more accepting because of that."
> **SUE BAERT**

1. The first full-scale municipal Nereda aerobic granular sludge technology was installed in Epe, Netherlands. The technology is contained in the circular tanks.
2. A comparison shows the rapid settling of aerobic granular sludge (left) versus conventional activated sludge. Settling time in this example was five minutes.
3. A simple schematic of the Nereda process.



Defying the Conventional

AN INNOVATIVE SECONDARY TREATMENT TECHNOLOGY USES AEROBIC GRANULAR BIOMASS FOR EFFECTIVE NUTRIENT REMOVAL IN A COMPACT FOOTPRINT WITH LOW ENERGY CONSUMPTION

By Ted J. Rulseh

Companies continue to develop new approaches to basic wastewater treatment processes, always in search of more effective pollutant and nutrient removal with lower costs for energy and other inputs as well as in smaller packages.

Among the latest offerings is the AquaNereda Aerobic Granular Sludge technology, which in commercial application in Europe is under the name Nereda. Aqua-Aerobic Systems is the exclusive provider of Nereda technology developed by Royal HaskoningDHV in the U.S.

The technology consists of a three-phase batch process completed in a single tank. Durable granules composed entirely of biomass do the work of treatment, performing simultaneous nitrification and denitrification for nitrogen removal while also biologically removing phosphorus to low levels without chemical addition. It accomplishes this without mechanical mixing and with closely controlled introduction of air.

Brian Bates, product channel manager for the AquaNereda process, talked about the technology in an interview with *Treatment Plant Operator*.

tpo: Is this an alternative to conventional activated sludge?

Bates: Yes. The microbiology is very similar to that found in an activated sludge system. However, the biology is primarily found in granules. Rather than relying on a flocculated sludge, which is a loosely mixed microbial community, the granules are layered microbial communities. Within each granule, you have aerobic, anoxic and anaerobic zones. Basically, each granule is a miniature treatment plant. The granules are created automatically by the conditions created in the AquaNereda reactor.

tpo: Is this process preceded by primary treatment?

Bates: It doesn't have to be, but it can be — similar to conventional activated sludge. We have some applications that follow primary treatment, but most plants thus far are fed with raw influent. The process stream has grit removal and screening, just as it would in a conventional system. Sometimes, depending on the plant design, we need a buffer tank.

> "Within each granule, you have aerobic, anoxic and anaerobic zones. Basically, each granule is a miniature treatment plant."
>
> **BRIAN BATES**

tpo: After the preliminary steps, how does the process begin?

Bates: Everything is done in one tank. The first step is a simultaneous fill from the bottom of the tank and a draw from the top. The raw wastewater is a rich carbon source, and at the granules there is a high food-to-mass ratio. Phosphorus release occurs because of the anaerobic conditions there,

and the clean effluent is displaced up through the top. No air is introduced in this step; the granules remain settled at the tank bottom.

tpo: What happens after this step?

Bates: The process moves to the react phase. The influent flow is shut off. Air is then added intermittently through fine-bubble diffusers, controlled based on dissolved oxygen, ammonia concentration, or both. Simultaneous nitrification and denitrification occur because of the different discrete zones within the granules.

tpo: At this point, are the granules held in suspension?

Bates: Yes. However, the level of mixing varies throughout the cycle. Sometimes, we achieve a complete mix of the granules, but this is not necessary throughout the entire reaction phase. The aim is to move the bulk liquid around the granules.

tpo: What happens after the react phase?

Bates: The process advances to the settle phase. The granules separate from the treated water. Rapid settling allows more time to be spent in the react phase, and that enables the use of small reactor volumes while achieving ultralow enhanced biological nutrient removal. During the settle phase, a small amount of sludge is wasted out of the system. After that, the process reverts to the first step.

tpo: What effluent conditions can this system produce?

Bates: We typically guarantee 10 mg/L for BOD and TSS. We can achieve as low as 3 mg/L total nitrogen and less than 1 mg/L total phosphorus with no chemical addition. With chemical addition, we can get phosphorus down to approximately 0.5 mg/L, and with tertiary filtration, we can go lower.

tpo: Is this process typically followed by tertiary filtration?

Bates: Not necessarily. The need for filters is based on the effluent requirements. If effluent TSS of less than 10 mg/L is needed, a filter would be required.

tpo: What is the nature of the granules used in this process?

Bates: The granules in aerobic granular sludge are truly a biomass — there is no carrier in them. Everything is formed by the biology we select to create extracellular polymeric substances. These EPSs act as the glue, creating extremely robust granules that can handle many adverse conditions in the system. There has never been a case of de-granulation in an operating facility.

tpo: What specific advantages does this process have over conventional activated sludge?

Bates: It has a 75 percent smaller footprint compared to a five-stage biological nutrient removal process. It roughly doubles the mixed liquor suspended solids, to about 8,000 mg/L. Due to the batch nature of the process, you save on final clarifiers. The energy savings are also significant: energy savings of 30 to 50 percent compared to conventional systems have been achieved.

tpo: Can this process be retrofitted to an existing plant?

Bates: It's great in retrofit applications. We can retrofit to essentially any basin geometry. Since all processes occur in a single tank, plants that have secondary clarifiers can have their aeration tanks retrofitted with the AquaNereda process and their clarifiers can be converted to other purposes, such as equalization basins or sludge basins. In the process, the MLSS is increased significantly, enabling more flow through the same system while saving on chemicals and energy. As an added bonus, nutrient removal is typically improved.

tpo: Is there a sweet spot in terms of system size?

Bates: We typically look for flows greater than 100,000 gpd. Above that, the sky is the limit. One plant in Ireland has a maximum flow of 314 mgd.

tpo: What is the status of installations of this technology?

Bates: There are around 40 installations worldwide that are in operation or under construction design with flows ranging from 100,000 gpd to over 300 mgd. In the United States, we have many plants under design with some in the detailed design stage. In addition, Aqua-Aerobic Systems is currently constructing an AquaNereda plant at the wastewater treatment plant in Rockford, Illinois, that will serve as a site for customers who would like to see the technology. It's also for research and development to help determine how far we can push this process and possibly come up with novel ways to use it. **tpo**

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Where Science and Operations Meet

WASTEWATER TREATMENT THAT USES ANAMMOX BACTERIA IS AN EXAMPLE OF HOW LAB EXPERIMENTATION AND REAL-WORLD TRIAL AND ERROR CAN WORK TOGETHER TO PROMOTE PROGRESS

By Ted J. Rulseh

One fascinating thing about wastewater treatment is that while plants are filled with big tanks, motors, pumps, mixers, blowers and valves, the real work gets done at the microscopic level — by the bacteria that consume the waste.

In recent years, a new family of microorganisms has come into focus: anammox bacteria, which can turn ammonium into nitrogen gas anaerobically. The obvious advantage over conventional treatment is that anammox bacteria require far less aeration and thus far less energy to remove nitrogen from the wastewater.

So theoretically, that's great. The question is how to make the anammox bacteria function most efficiently in the real-world treatment plant environment. It turns out that they grow slowly, and their effectiveness requires close control over oxygen and temperature. This is where science comes in. Researchers at the University of Wisconsin-Madison are studying how anammox bacteria interact with conventional nitrifying bacteria in the wastewater treatment ecosystem. It's a project that's funded in part by the National Science Foundation, the UW-Madison Microbiome Initiative, and a training fellowship from the Natural Sciences and Engineering Research Council of Canada.

The research may provide clues to unlocking the full potential of the anammox organisms, first discovered in the 1990s. Then comes the work of deploying and testing the anammox-based processes in the field, and that's the province of operators. Supervising the UW-Madison research are Katherine "Trina" McMahon and Daniel Noguera, professors of civil and environmental engineering. Executing the day-to-day work is Christopher Lawson, a graduate student in civil and environmental engineering. McMahon talked about the research in an interview with *Treatment Plant Operator*.

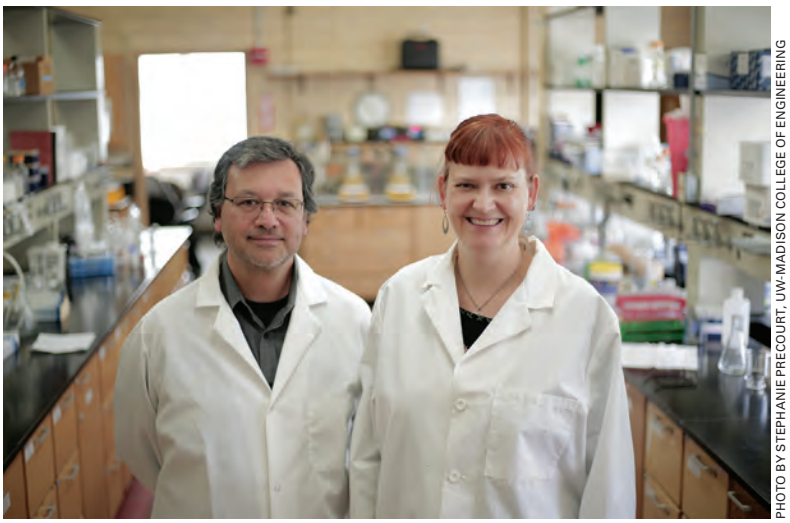

PHOTO BY STEPHANIE PRECOURT, UW-MADISON COLLEGE OF ENGINEERING

Civil and environmental engineering professors Daniel Noguera and Trina McMahon study how anammox bacteria may improve conventional wastewater treatment methods.

TPO: How is your research team connected to the wastewater treatment industry?

McMahon: I studied wastewater treatment as a Ph.D. student before I came here 14 years ago. I focused on phosphorus cycling in wastewater. I am really interested in how microorganisms interact and how those interactions lead to positive things for humans, like treating wastewater and keeping lakes clean. Noguera has studied nitrogen cycling for almost all of the 20 years he has been here, and I've collaborated with him on this work for the past five years. Lawson did his undergraduate and master's degrees in civil and environmental engineering at the University of British Columbia. For his master's thesis he worked on phosphorus removal, but he got hooked on microbiology and the principles of interactions between types of bacteria.

> "The benefit of anammox bacteria is that they can take ammonia and oxidize it to nitrogen gas using nitrite, and do it without oxygen. That means you're able to get more conversion of ammonia to harmless nitrogen gas with less aeration, so you save money".
> **TRINA McMAHON**

TPO: What is it that makes anammox bacteria so intriguing?

McMahon: Plant operators know about nitrification — the conversion of ammonia into nitrate. That's critical in wastewater treatment, and the organisms that are really important for that in most systems are traditional nitrifiers, which are aerobic. Oxygen is a huge part of BOD removal; estimates are that aeration accounts for about 50 percent of the energy use at many activated sludge treatment plants. The benefit of anammox bacteria is that they can take ammonia and oxidize it to nitrogen gas using nitrite, and do it without oxygen. That means you're able to get more conversion of ammonia to harmless nitrogen gas with less aeration, so you save money.

TPO: In working with the anammox bacteria, why is it important to understand the interactions they have with other organisms?

McMahon: Anammox organisms are autotrophs, which means they

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Summary - The Hyundai Approach: Hyundai requires that every single motor produced does not exceed 80°C so they set their internal target at 7-8% less. This assures that **every motor** produced meets the requirement. Hyundai uses this same philosophy for many other critical attributes such as efficiency, noise level, vibration, full load speed, locked rotor and breakdown torques.

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Summary - Hyundai motors run cooler and provide a larger buffer of protection for the insulation system which results in long life. An additional benefit of this design allows you to apply a stock motor in higher ambient conditions and still provide a good buffer.

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Vibration leads to premature bearing failure and can damage the coupled equipment.

Hyundai's approach to a low vibration motor ... **Shoot for less than half of the NEMA requirement**, don't cut cost with lighter weight end bells, machine all motors with a precise foot flatness and use only the best bearings.

NEMA requires a finished motor to have a vibration level that does not exceed **.15 inch/second peak**. **Hyundai's conservative approach** sets the target at **~.07 inch/second peak**. All motors are precision balanced, feet are machined to a flatness of ~0.005", end bells are heavily ribbed and only premium bearings such as NSK, SKF or FAG are used.

Summary - heavy cast iron frames, precision balance rotors and precise foot flatness leads to lower vibration and thus longer bearing life and less damage to other equipment.

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take carbon dioxide in order to make their cells, like plants do. It's a very difficult way to make a living. It's easier to take organic matter, such as the carbon compounds that are in the wastewater, in order to grow. And so Lawson was interested in interactions between the anammox and heterotrophic bacteria, the ones that use the organic carbon that's already there. He had ideas about how these heterotrophs could be providing the anammox bacteria with important molecules that allow them to grow more efficiently or in a more stable way.

Many researchers are so laser-focused on the anammox bacteria that they neglect the principle of ecology that says organisms never live in isolation and always depend on other organisms. If you respect that and use it as a principle to design a system in a way that leverages those interactions, then you can come up with much better designs for wastewater treatment. What we learn about the interactions can help us better engineer systems that use anammox bacteria.

TPO: What is the challenge around making the use of anammox bacteria more widespread?

McMahon: On paper, these organisms look like magic. They do this job for us that we used to have to coax the traditional nitrifiers into doing, but they do it with less oxygen. However, we haven't figured out the best way to grow the anammox organisms in a wastewater treatment plant in a stable way and in a way that integrates into existing plant infrastructure.

> "We have activated sludge plants that are not going away anytime soon, and modifying them to include anammox for the whole stream is not easy. The key is finding creative ways to modify existing infrastructure. Often that involves sidestream treatment."
> **TRINA McMAHON**

TPO: How are anammox bacteria being applied today in actual plant operations?

McMahon: We have activated sludge plants that are not going away anytime soon, and modifying them to include anammox for the whole stream is not easy. The key is finding creative ways to modify existing infrastructure. Often that involves sidestream treatment. Someday, if we get a whole lot of money to rebuild our wastewater treatment infrastructure, then maybe we can imagine designing an anammox system from scratch. But right now, it seems the major focus is on sidestreams.

With sidestreams, you're able to get more nitrification in systems that you can control independently from the main activated sludge treatment train. A sidestream gives more bang for the buck in terms of the ability to control it. A lot of research still needs to be done to make it as easy as it should be to justify any treatment plant installing these kinds of systems.

TPO: What is an example of a sidestream that can be treated with anammox organisms?

McMahon: There is a great deal of ammonia in digestate from anaerobic digesters, and that's where a lot of people have focused their early work. Anammox treatment greatly reduces the ammonia load at the headworks; it's ammonia that has gone through the full process already. It's kind of a futile cycle in that during aeration the organisms turn some of the nitrogen into proteins that end up in the digester and turn back into ammonia, which then has to be converted back again into proteins. If you divert that ammonia from the digester to a sidestream where you can turn it into nitrogen gas using less oxygen, you're greatly reducing the total oxygen load on the plant.

TPO: From the operators' perspective, is there some resistance to or hesitancy about treatment processes using anammox bacteria?

McMahon: I think there is still a perception that they're fussy and tricky to work with. Researchers need to come up with strategies to make the systems less fussy. Lawson is working on exactly that. If you can engineer an interdependency of the organisms, you can make the system more stable and robust. That way if something happens, like a toxic shock or some process operations failure, the organisms can recover quickly.

TPO: Are there challenges to culturing and growing the anammox bacteria?

McMahon: Yes, and that is one of the barriers to wider adoption. The companies that install anammox systems have to provide the biomass because you can't just enrich for anammox bacteria from regular activated sludge. You have to get a pretty dense culture of the organisms and use them to inoculate and jump-start the system. There are only a few of those cultures in the world.

I see a lot of opportunity for someone who is entrepreneurial to go out and find other cultures of these organisms from the environment and enrich them. It could be that if we found slightly different versions of the organisms, they might be more robust and have better interactions with the local bacteria.

TPO: What needs to be done to improve anammox processes?

McMahon: I believe having more innovative designs of the reactors they grow in, the recirculation systems, and the process controls could get them to perform even better. Production of nitrous oxide is something people need to focus on. Nitrous oxide is a very potent greenhouse gas and is something nitrogen-cycling bacteria produce when they're not working 100 percent efficiently. You have to get them really humming to avoid production of that gas. That's another research opportunity. If we can get the system to be more stable and operate exactly how we want it to operate, we can avoid nitrous oxide production.

TPO: What research approaches are being used to help make progress toward more widespread uses of anammox organisms?

McMahon: The research and practitioner communities are going to come at it from different angles. There will be people doing more empirical work — "I'm going to try a new reactor configuration and see if that helps." Then people like Lawson will say, "I'm going to understand the biology of the organisms, and that's going to tell me what kind of reactor to design."

Both of those approaches are valuable, and the history of wastewater treatment research is all about that: trying the empirical, practical approach, but also the basic science. Somewhere along the way they meet, and we get great advances in how we treat wastewater. tpo

A decorative fence blends with the grand entrance to the Saginaw Water Treatment Plant.

PHOTOGRAPHY BY MIKE SONNENBERG

Thing of Beauty

AN INNOVATIVE FENCE DESIGN PROVIDES SECURITY WHILE MAINTAINING THE ARCHITECTURAL INTEGRITY OF A HISTORIC WATER TREATMENT PLANT BUILDING IN SAGINAW, MICHIGAN

By Jeff Smith

The goal in building a fence around the City of Saginaw Water Treatment Plant was not only to improve security, but also to preserve the iconic building's architectural beauty.

"I believe we were not only successful, but actually improved the look of the facility with the fence," says Paul Reinsch, superintendent of water treatment and field operations for Saginaw, located in east-central Michigan.

PHASED CONSTRUCTION

The 52 mgd plant stands in a historic district called The Grove that is near the heavily used Frank N. Andersen Celebration Park. Both destinations provide an open view to the Gothic-style building, which was constructed in 1929 and is a source of community pride. The solution was to install a classic knee-wall design, picket-style fence with decorative columns and top caps. The brick knee-wall and columns are accented with a precast concrete coping feature that matches the building's design. The steel picket fence portion is painted black.

The fence was built in phases. The knee-wall portion, which protects the massive front of the building, was completed in 2009 with funding through a Department of Homeland Security grant. A grant and part of a previously approved bond issue funded the second phase. Completed two years later, the fence encloses nearly the entire 21-acre plant property.

Tetra Tech did the engineering and architectural design. J.R. Heineman & Sons was the first-phase general contractor, and the masonry was done by McMath Masonry. The second-phase general contractor was J. R. Electric, and Pumford Construction did the masonry. Future Fence Co. installed the metal fence.

"The initial fencing project was done by our water treatment plant staff," says Reinsch. "It was a chain-link fence installed to secure our chemical delivery area in the back of the plant. The area has limited visibility and really did not affect the overall appearance of the plant."

ATTRACTIVE INSIDE

The city is proud of its historic buildings. Because federal funds were used for the fencing, the Michigan State Historical Preservation Office had to review the project. An architectural dig confirmed that Native American mounds at the site were nonburial locations and contained no artifacts.

> "I believe we were not only successful, but actually improved the look of the facility with the fence."
> **PAUL REINSCH**

Attractiveness is not limited to the exterior of the treatment plant. Inside, modern equipment and plant operators function amid high ceilings, balconies, pointed arches and the openness of long corridors with pillars. Several oil and acrylic paintings by noted artists dominate high arches of the foyer in the plant's central tower of the plant.

A painting entitled "The Treaty" was donated by artist William John Von Schipmann to commemorate the 157th anniversary of the signing of a treaty with Native American tribes in 1819 at Saginaw. Von Schipmann also donated "The Lodge," representing the poem "Evangeline" in which Henry Wadsworth

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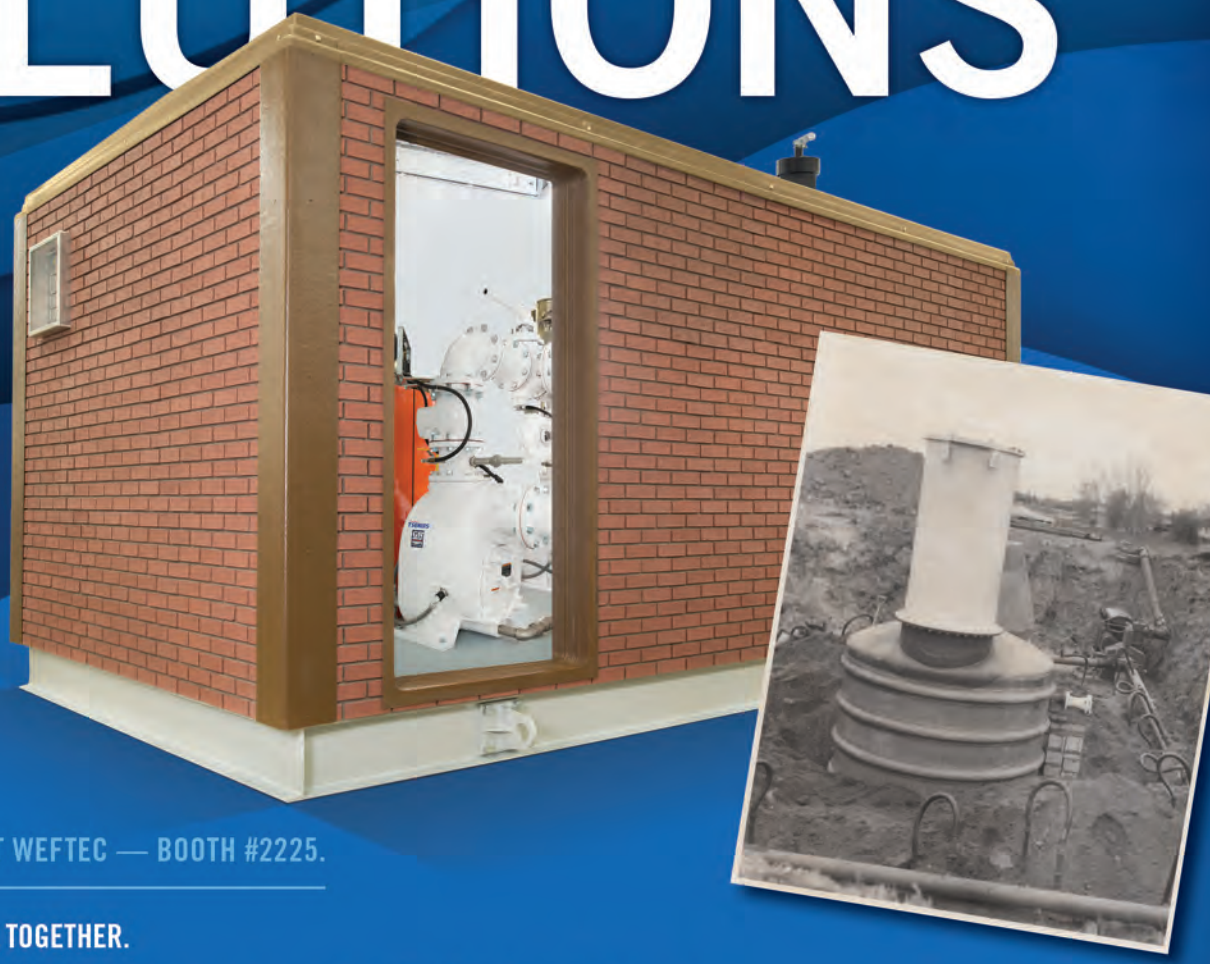

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The project included a classic knee-wall picket-style fence.

The plant grand entrance is shown before the decorative fence was installed.

Longfellow immortalized the Saginaw River. Another painting titled "The Approach of Winter" is the work of Saginaw artist Harker W. Jackson, who was inspired by watching construction of the plant in the late 1920s.

HOLIDAY FEATURE

Although there are many notable buildings and architectural landmarks in Saginaw, Reinsch has heard people refer to the water plant as "the jewel of the city." That civic pride is on display each winter when the plant and its landscape trees are decorated with wreaths and colored lights. A traditional public lighting ceremony in late November marks the start of the Christmas season.

Reinsch says the main driver of the fence project was a vulnerability assessment done in compliance with the 2002 Bioterrorism Act. Many citizens were concerned that a fence would obstruct and destroy the plant's beauty, but in fact it is functional and beautiful. "I am pleased that the fence was done so as not to detract from the appearance of the plant," says Reinsch. "The fencing looks like it is original to the facility." **tpo**

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By Craig Mandli

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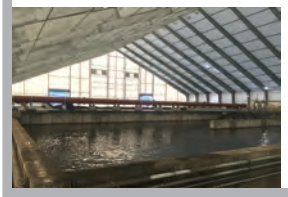

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Waste Blaster three-in-one shovel/squeegee/scrapers from Way Cool Product Co. can be used to clear tank floors prior to inspection, oil removal, sludge removal, silt removal, environmental spills cleanup and oil barge cleanout. To operate, the user pulls to move and scrape down surfaces with the metal side or pushes to move and squeegee liquids and viscous materials without breakage or getting splashed. Its usage adds efficiency and cuts labor costs, perfoming three functions at once. It has a no-snag design for smooth pushing. It comes with either 24- or 30-inch stainless steel or aluminum blades, or 36-, 48- or 72-inch MAGNUM blades. The unit is constructed from 12-gauge aluminum or stainless steel and has a 72-inch fiberglass handle, stainless steel hardware, and 1/4-inch three-ply rubber blades. **315/569-9974; www.waycoolproduct.com**

Coatings and Linings

AKZONOBEL POLIBRID 705E

Polibrid 705E, distributed by AkzoNobel, is an odorless, zero VOC, two-component coating designed to protect concrete and steel in severe service environments.

Polibrid 705E coating distributed by AkzoNobel

The coating has been sold in the U.S. since the 1980s. The ultrahigh-build, solvent-free elastomeric polyurethane cures fast and dries into a dense, crack-resistant elastic membrane that can withstand the expansion and contraction of concrete while providing protection to rivets, bolts, edges and other surface imperfections. Geotextile fabric may also be embedded within the coating to produce reinforced, bonded geomembrane linings. **440/234-2900; www.akzonobel.com**

AMTECH TANK LINING & REPAIR AMERICAN FIBERGLASS TANK REPAIR

Tank repair services from American Fiberglass Tank Repair, a division of AmTech Tank Lining & Repair

American Fiberglass Tank Repair, a division of AmTech Tank Lining & Repair, provides scheduled and emergency tank inspection and repair services for fiberglass tanks throughout North America. Using its precast nozzles, manways and replacement components, technicians can repair or modify any fiberglass vessel or structure in the field with minimum downtime. All resins are blended to match the original tank system, ensuring complete compatibility. Field crews can repair and reline the bottom pan or the entire interior corrosion layer of an FRP vessel to add service life to existing tanks. Field techs can also repair or install integral tank heating systems and insulation wraps. Services are offered for composite tanks used for potable water, wastewater, chemicals/petrochemicals, fuels, food processing, and other domestic and industrial applications. **877/427-0090; www.americanfiberglasstank.com**

CORTEC CORPORATION CORRVERTER

CorrVerter from Cortec Corporation is a water-based primer formulated to penetrate and eliminate rust on poorly prepared steel surfaces. It modifies surface rust into a hydrophobic passive layer and coats it with a film-forming latex that is combined with thickeners and dispersant for protection against rerusting. The water-based primer is environmentally friendly and nontoxic with a very low VOC. It can be covered with water- and solvent-based topcoats and is recommended for use on all ferrous metal surfaces when proper cleaning or sandblasting is difficult. The coating can be applied to dry or damp surfaces and should be allowed to air-dry 12 to 24 hours before applying the topcoat or putting it into the environment. It passes 1,000-hour salt spray testing (ASTM B 117) at 3 to 5 wet mils application. It is available in black or green. **800/426-7832; www.cortecvci.com**

CorrVerter primer from Cortec Corporation

SHERWIN-WILLIAMS POLY-COTE

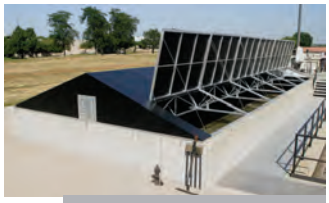
Poly-Cote polyurethanes from Sherwin-Williams

Fast-drying, high-build, solvent-free Poly-Cote polyurethanes from Sherwin-Williams' protective and marine coatings division deliver fast throughput corrosion protection for water conveyance piping. The chemical- and abrasion-resistant products provide a smooth, glossy finish and offer the hydrophobic properties of an epoxy while maintaining the durability, flexibility and fast cure times of a urethane. All are NSF certified up to 250 mils. They exceed the minimum requirements of AWWA C222-08 Polyurethane Coatings for the Interior and Exterior of Steel

Water Pipe and Fittings. They provide optimal film build and aesthetic properties, and they have a wide range of acceptable dry film thicknesses for potable and nonpotable water applications. **800/524-5979; www.sherwin.com/protective**

Covers/Domes

ENVIRONETICS DEFENDER TANK COVERS



Defender Tank Covers from Environetics

Defender Tank Covers from Environetics are custom manufactured from industrial-grade materials to fit the profile of new or existing wastewater treatment or potable water tanks. The low-profile, structurally supported covers minimize emission treatment volume to reduce the cost of air filtration equipment. They can help eliminate the ongoing expense of applying costly odor control chemicals through atomizers and misters. **815/838-8331; www.environeticsinc.com**

Grating/Handrails/Ladders

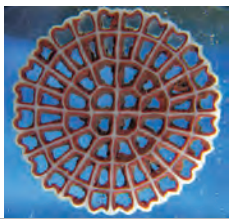
DynaRound system from Fibergrate Composite Structures

FIBERGRATE COMPOSITE STRUCTURES DYNAROUND

The DynaRound modular round-rail component system from Fibergrate Composite Structures consists of 1.9-inch O.D. pultruded tube railings and connectors, and it's easy to specify, order and install. It provides extreme durability and corrosion resistance with the ability to withstand conditions where aluminum or metallic round-rail systems will not last. This further expands the Dynarail square-tube railing system. Round-rail systems can be used in water treatment applications where safety and ergonomics are a concern. **800/527-4043; www.fibergrate.com**

Media

KRUGER USA ANOXKALDNES K5 MEDIA



AnoxKaldnes K5 Media carriers from Kruger USA

ANITA Mox sidestream deammonification technology consists of AnoxKaldnes K5 Media engineered polyethylene carriers from Kruger USA to provide ample protected surface area for biofilm to thrive. The media (approximately the diameter of a quarter) hosts two types of bacteria in the same reactor. The outer layer consists primarily of ammonia-oxidizing bacteria, which converts about half of the ammonia to nitrite. The inner layer consists mainly of anammox (anaerobic autotrophic ammonia oxidizer) bacteria. These bacteria use the resulting nitrite and much of the remaining residual ammonia and convert them to nitrogen gas, which is released harmlessly to the atmosphere. **919/677-8310; www.veoliawatertech.com**

Mixers

4320 submersible mixer from Flygt - a Xylem Brand

FLYGT - A XYLEM BRAND 4320 LOW-SPEED MIXER

The 4320 high-efficiency, low-speed submersible mixer from Flygt - a Xylem Brand couples a high-efficiency mixer with an integrated variable-frequency drive. It simplifies variable-speed mixing and eliminates the need for an external VFD. A variety of ratings and propeller options meet a range of thrust requirements. With motor efficiency comparable to Super Premium Efficiency IE4 levels and fully adjustable speed, it delivers low life cycle mixing energy costs. **855/995-4261; www.xylem.com/treatment**

JDV EQUIPMENT CORPORATION NOZZLE MIX SYSTEM

Nozzle Mix System from JDV Equipment Corporation

The Nozzle Mix System from JDV Equipment Corporation is a dual-zone mixing system that provides uniform mixing patterns, producing even distribution and a stable environment. The system is designed with pumps installed outside the tanks to facilitate maintenance. The pumps are typically chopper pumps or pumps incorporating inline grinders that prevent fibrous materials from accumulating and causing plugging problems. The application dictates which type(s) of the many varied pump options can be used. High-velocity nozzles are mounted inside the tank and oriented to discharge in a flow pattern that completely mixes the tank contents. **973/366-6556; www.jdvequipment.com**

KSB SUBMERSIBLE MIXERS

Submersible mixers from KSB

Submersible mixers from KSB have propellers that have been optimized to transfer the maximum amount of energy to the fluid while consuming the least amount of power. Their tandem mechanical sealing arrangement provides a 100 percent backup system to seal the shaft, while the leak-proof cable entry prevents water from wicking inside the motor. Their cable plug allows for easy installation and removal of the mixer. Just plug it in or unplug it without the assistance of an electrician. The design provides reliable service for demanding applications, which allows users to focus on plant operations instead of mixer maintenance. **804/222-1818; www.ksbusa.com**

NEPTUNE CHEMICAL PUMP CO. INDUSTRIAL PORTABLE MIXER

Industrial portable mixers from Neptune Chemical Pump Co.

Industrial portable mixers from Neptune Chemical Pump Co. provide long life and trouble-free service for a wide variety of blending and mixing operations. They are ideal for waste treatment, water treatment and chemical applications with viscosities ranging from 1 to more than 25,000 cPs that need to be mixed or blended in pails, drums, totes or tanks up to 5,000 gallons. They include steel helical gears, high-quality bearings and high-grade lubricant. Recent design upgrades help lower noise levels. The changes also meet the tenets within the ISO 9001:2008 quality management system standard. **215/699-8700; www.neptune1.com**

Skimmers

SkimPro floating skimmer from Park Process

PARK PROCESS SKIMPRO

The SkimPro floating skimmer from Park Process is designed to be used in backwash receiving tanks to skim clear water and recycle it back to the clean water flow. The unit is constructed of 316 stainless steel with a skimmer head that is designed to handle whatever flow is required for the particular application. **855/511-7275; www.parkprocess.com**

Storage Tanks/Components

AMERICAN STRUCTURES BOLTED, STAINLESS STEEL STORAGE TANKS

Storage tanks from American Structures

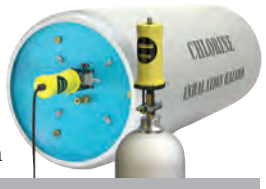
Bolted, stainless steel storage tanks from American Structures can be used for potable and nonpotable water as well as process and dry storage applications in the municipal, agricultural, industrial and commercial sectors. Stainless steel is widely accepted as a building material in many industries, and is commonly used because it can meet FDA standards and is NSF 61 approved. It creates a high-quality, maintenance-free storage facility. Bolted, stainless steel tanks are strong, watertight and resistant to cold weather. They can be formed to meet individual preferences. **715/235-4225; www.ameristruc.com**

Full Drain Outlet assemblies from Assmann Corporation of America

ASSMANN CORPORATION OF AMERICA FULL DRAIN OUTLET

Molded-in Full Drain Outlet assemblies from Assmann Corporation of America are available for tanks 2,500 gallons and larger. This outlet provides the ability to drain the tank without the need for mechanically installed nozzles, and it can be utilized where heavy solids or salts may accumulate in the bottom of the tank. It can help eliminate difficult maintenance work and stand up to virtually any service condition; it is available with multiple expansion joint options. The outlet is available in 3 and 4 inches and in material variations of 316 stainless steel, titanium and Hastelloy. A replaceable polyethylene flange adapter allows the adapter to be removed for tank installation. The flange can also be replaced in case of chemical or mechanical damage without needing to replace the entire vessel. **888/357-3181; www.assmann-usa.com**

HALOGEN VALVE SYSTEMS TERMINATOR ACTUATOR



Terminator Actuator from Halogen Valve Systems

The Terminator Actuator from Halogen Valve Systems can be used on chlorine ton containers as well 150-pound cylinders to instantly stop the flow of chlorine in case of an emergency. Emergency chlorine shut-off is initiated when the controller receives a close-contact signal from a leak detector or when the included emergency shut-off switch and a relay output provide remote indication that an emergency close sequence has been performed. **949/261-5030; www.halogenvalve.com**

CORE filter from Philadelphia Gear – A Timken Brand

PHILADELPHIA GEAR – A TIMKEN BRAND CONTINUOUS OIL RESCUE EQUIPMENT (CORE)

The CORE filter from Philadelphia Gear – A Timken Brand can remove particles as small as 1 micron. At the center is a series of annular magnets shrouded by steel plates. When the oil is filtered through these plates, it is subjected to a high magnetic flux gradient caused by the focusing of the magnetic field at the tips of the plates. The result is that contaminants are drawn into collection areas between the plates and out of the oil flow. This filtering process results in a negligible pressure drop, while at the same time helping to prevent "wash off" since the contaminant is isolated and cannot wash back into the oil. **800/766-5120; www.philagear.com**

Dechlorinating Overflow Security Assembly from Red Valve Co.

RED VALVE CO. DECHLORINATING OVERFLOW SECURITY ASSEMBLY (DOSA)

The nonclogging DOSA from Red Valve Co. automatically removes chlorine residuals during discharges from water tanks. It also increases tank security and prevents intrusion of birds, rodents, insects and cold air drafts. It is constructed of dual Tideflex nozzles and an internal adjustable dechlorination tube, completely encased in an epoxy-coated steel or stainless steel body. During an overflow event, the upper nozzle discharges an elliptically shaped jet down into a dechlorination tube. A calculated portion of water passes through the tube. The rest of the water deflects around the tube. The water is then completely blended to ensure that it is thoroughly mixed and dechlorinated before being discharged out of the DOSA through the lower nozzle. **412/279-0044; www.redvalve.com**

Tanks

Wastewater treatment tanks from Highland Tank & Manufacturing Co.

HIGHLAND TANK & MANUFACTURING CO. WASTEWATER TREATMENT TANKS

Wastewater treatment tanks from Highland Tank & Manufacturing Co. include oil/water separators, oil/sand interceptors, elevator sump pump interceptors and advanced hydrocarbon filtration systems. Oil/water separators include Corelle coalescers. Grease removal systems include hydromechanical grease interceptors as well as passive grease interceptors. The water storage tank and pressure vessel division include water storage tanks for a variety of applications, such as fire protection, rainwater harvesting and code-compliant ASME pressure vessels. **814/893-5701; www.highlandtank.com**

PARKER BOILER CO. ASME HOT-WATER STORAGE TANKS

Hot-water storage tanks for hot or cold water, glycol mixtures,

or thermal fluids from Parker Boiler Co. can be used for all types of volume water heating applications. The tanks are commonly used for circulating systems — hot-water storage or thermal expansion and air separation — or as distribution tanks for thermal fluid systems. ASME hot-water storage tanks are manufactured in sizes from 4.6- to 2,950-gallon capacities. Tanks are used for storage, expansion and air separation. Glass-lined storage tanks are available in 119 to 5,695 gallons; stainless steel tanks are offered in 91 to 12,818 gallons. **323/727-9800; www.parkerboiler.com**

Hot-water storage tanks from Parker Boiler Co.

PEABODY ENGINEERING AND SUPPLY INDUSTRIAL CHEMICAL TANKS

Industrial chemical tanks from Peabody Engineering and Supply

Peabody Engineering and Supply designs and manufactures a full line of single- and double-walled industrial chemical tanks in a large variety of sizes and applications. They are made to solve many of the issues facing companies that need to store liquids safely. Industrial chemical tank systems are available in durable industrial FDA-grade polyethylene. ProChem single-walled tanks are available from 5 to 20,000 gallons, and Gemini Dual-Containment tanks are available from 5 to 500 gallons, with DCSII up to 10,500 gallons. They meet EPA and UFC regulations pertaining to secondary containment. Systems are unaffected by UV rays and other environmental conditions. **800/473-2263; www.4peabody.com** tpo

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- ❒ Lakeside Equipment Corporation Spiraflo clarifier
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Clarifier/Digester/Tank Cleaning
- ❒ Deep Trekker DT640 Utility Crawler
- ❒ Way Cool Product Co. Waste Blaster shovel/squeegee/scrapers

Coatings and Linings
- ❒ AkzoNobel (distributor) Polibrid 705E coating
- ❒ American Fiberglass Tank Repair, a division of AmTech Tank Lining & Repair, tank repair services
- ❒ Cortec Corporation CorrVerter primer
- ❒ Sherwin-Williams Poly-Cote polyurethanes

Covers/Domes
- ❒ Environetics Defender Tank Covers

Grating/Handrails/Ladders
- ❒ Fibergrate Composite Structures DynaRound system

Media
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Mixers
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- ❒ JDV Equipment Corporation Nozzle Mix System
- ❒ KSB submersible mixers
- ❒ Neptune Chemical Pump Company industrial portable mixer

Skimmers
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Storage Tanks/Components
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- ❒ Assmann Corporation of America Full Drain Outlet
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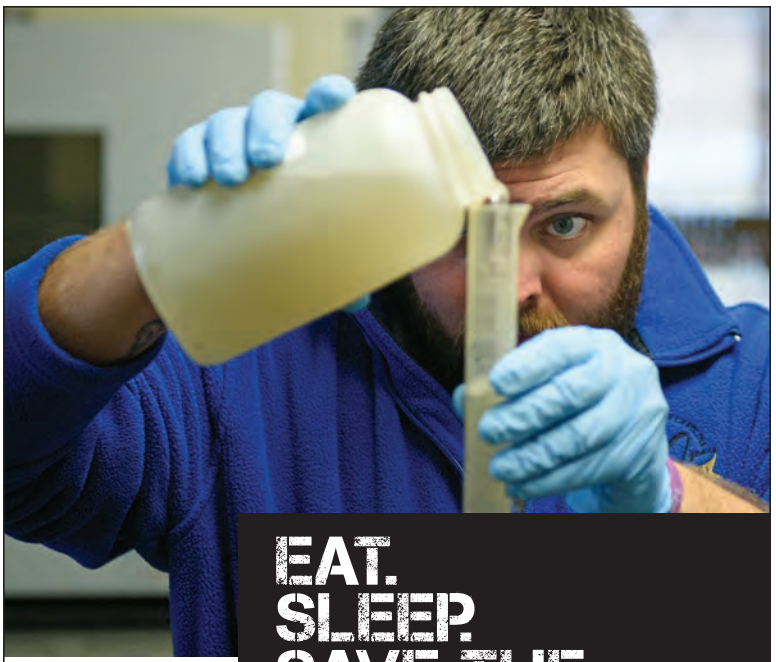

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By Craig Mandli

Sliding-frame silos help plant produce more fertilizer

Problem

The Ocean County (New Jersey) Utilities Authority in New Jersey produces OCEANGRO fertilizer with biosolids from the central treatment plant for sale to the community. Leadership looked to increase production to meet demand by also using biosolids from the north treatment plant. Challenges included getting the biosolids into the trucks at the north plant, unloading at the central plant, and blending the two biosolids streams.

Solution

Schwing Bioset manufactured a custom-designed **storage silo** with a sliding-frame feeder at the north plant to load trucks. It stores the biosolids and rapidly feeds it into the trucks. At the central plant, two sliding-frame silos receive biosolids from the north plant. The silos have covers to contain odors, and each can accommodate a 25-ton truckload of cake. The silos provide ample capacity, allowing operators at the central plant to meter the feeds from both plants.

RESULT

The silos enabled processing of the biosolids from the north plant at the rate needed to keep production running smoothly at the central plant, increasing the amount of biosolids beneficially reused as OCEANGRO fertilizer. **715/247-3433; www.schwingbioset.com**

Cover system keeps odors from affecting home development

Problem

A home development in North Carolina close to a wastewater treatment plant raised concern about odors. Plant management wanted to cover the equalization chamber.

Solution

Geomembrane Technologies designed, fabricated and supplied a structurally supported **cover,** designed with truncated arches to accommodate the tank's unique shape, ensuring a perfect fit.

RESULT

The cover keeps odors from wafting into the neighborhood. It also helps simplify operations, as it can be easily rolled open when needed to access the chamber for maintenance and cleaning. **855/484-4630; www.gticovers.com**

Mixing system helps eliminate temperature stratification

Problem

The city of Reading, Pennsylvania, sought to refurbish its 16-million-gallon drinking water tank that had been experiencing temperature stratification, unequal chlorine distribution and significant chlorine loss.

Solution

The utility installed a **Pulsed Hydraulics PHi** NSF-compliant **large bubble mixing system.** Sixteen 8-inch-diameter stainless steel forming plates on the floor of the 220-foot-diameter tank mix the entire contents, bottom to top. Large bubble-forming pulses of compressed air are controlled by two PHi 500 four-valve mixing controllers that have an environmental enclosure housing all components. Two 15 hp compressors with receiver tanks supply high-pressure air.

RESULT

The mixing system is connected to the plant's SCADA system to allow remote monitoring and control. It has eliminated the temperature stratification and chlorine distribution issues. **800/641-1726; www.phiwater.com**

Facility uses fabric structures to keep biosolids dry

Problem

The Northern Moraine Wastewater Reclamation District in Illinois had been storing treated and dried biosolids outside; the material got wet from rain or snow, causing odors and raising hauling costs.

Solution

The facility purchased two 65- by 70-foot **Hercules Truss Arch Buildings** from **ClearSpan Fabric Structures.** They have high clearances and spacious interiors without support posts. The frames are constructed from triple-galvanized structural steel designed to hold up in corrosive environments.

RESULT

The structures have been effective, and the utility was happy with the construction timeline. Both structures are keeping biosolids dry; the utility may find more uses for similar buildings. **866/643-1010; www.clearspan.com** tpo

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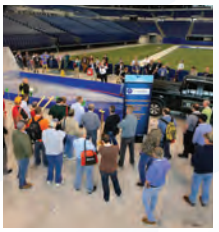

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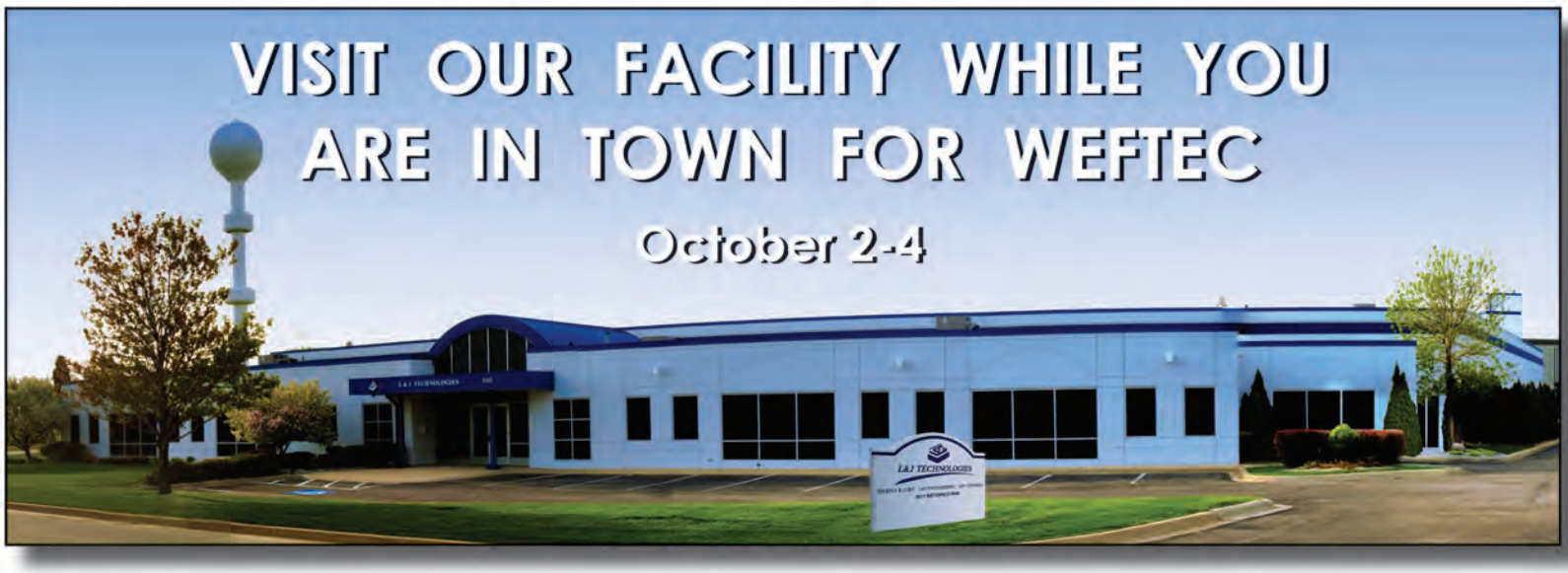

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1. BADGER METER BLANCETT B3100 SERIES FLOW MONITOR

The Blancett B3100 Series flow monitor from Badger Meter is a flexible, durable and easy-to-use digital signal-processing platform for flow metering applications. It is explosion-proof for harsh surroundings and has a rugged 1-inch thread for mounting. The large, backlit LED display provides a seven-digit flow rate/total and an 11-digit accumulated total. Each log contains flow rate, flow total, accumulated total, log number, and time and date stamp. Remote data access and programming are available without opening the enclosure and the log data can be downloaded as a .csv file. **800/876-3837; www.badgermeter.com**

2. HAYWARD FLOW CONTROL TBH SERIES BALL VALVE

The Hayward TBH Series True Union Ball Valve with System2 Sealing Technology delivers extended lifetime performance versus conventional valves. The System2 technology incorporates a floating seat design, utilizing the valve's upstream seat as a backup to the downstream seat while enhancing the sealing of the downstream seat. **888/429-4635; www.haywardflowcontrol.com**

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The SEL-2411P Pump Automation Controller from Schweitzer Engineering Laboratories is a preconfigured, SCADA-ready device built for unforgiving water and wastewater environments. Terminal labeling makes installation easy. The controller provides secure, user-accessible programming to facilitate system upgrades and to expand functionality. It can monitor and control liquid levels for simplex, duplex or triplex applications in lift stations or wells and reservoirs. It can also control constant-speed, variable-speed and alternating pumps and is compatible with analog level sensors, floats, or a combination of both. **509/336-2527; www.selinc.com/p258**

5. PARKSON CORP. AQUA CAIMAN ARTICULATING RAKE SCREEN

The Aqua Caiman articulating rake screen from Parkson Corp. has a flexible belt assembly that handles large solids with ease and eliminates the need for bottom bearings. Teardrop-shaped bars are designed for low headloss. Full rake engagement is achieved with True-Engage bar fastening design and the True-Track chain positioner allows for rake engagement adjustment without a hoist. The rake screen is designed to fit various applications for plants seeking low maintenance screening. **888/727-5766; www.parkson.com**

6. FCI - FLUID COMPONENTS INTERNATIONAL FLT93 FLOW SWITCH SERIES

The FLT93 Flow Switch Series from FCI - Fluid Components International verifies chemicals or additives are being injected and ensures

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wastewater:
product spotlight

A valve and flowmeter in one

By Craig Mandli

In most wastewater treatment plants, space is at a premium. Equipment that can perform multiple duties is valuable. With that idea in mind, **Singer** and **McCrometer** have teamed up to provide a solution for in-valve flow measurement — the **SPI-MV single-point-insertion electromagnetic flowmeter.**

Using McCrometer's single-insertion meter technology along with the reliability of a Singer valve, it allows users to have both a flowmeter solution along with the functionality of a control valve.

"Having these two components joined as one means you now only require three pipe diameters upstream of your SPI-MV package, and there is no required downstream straight lengths," says Ryan Spooner, instrumentation and automation manager for Singer. "This significantly reduces the amount of vault size you need for confined space installation, which saves money on construction costs."

The unit is designed to provide an accurate flow rate that can be utilized with the metering valve built into a pilot system to provide complete flow-based valve control. The compact insertion design fits in confined spaces and offers complete accessibility. It can be removed for easy inspection and cleaning.

"The ideal application is anywhere a control valve is needed along with the need to measure flow," says Spooner. "This could be for flow data monitoring or for the use of flow control. As it fits into most common Singer-offered control valves, it can be an add-on for just about any application."

It is available for valve sizes from 3 to 36 inches. The flow sensor comes precalibrated, with no moving parts and a single-piece design, it contains nothing to wear or break, and is generally immune to clogging. It is also available in a battery-operated model that measures accurate flow rate when power is not available. That version can run independently of an external power source for three to five years, and a small solar panel can be added to extend the lifetime to 10 to 15 years. It can also be paired with an external AC or DC power source so the battery becomes a backup for power outages.

SPI-MV flowmeter from Singer

"There was already a great reputation established for the product by McCrometer, but now having it offered with the Singer valve as a package gives it even more advantages," says Spooner. "Combined with the automation control panel, the control package has become a standard for many users to control their system." **888/764-7858; www.singervalve.com**

injection pumps and feeders continue to operate. It is suitable for flow detection of liquids and gases, and is available in several wetted materials for compatibility with almost any fluid. Dual 6A relay outputs are standard and are assignable to flow or temperature. It can be specified in either insertion or inline styles for installation in pipe or tube diameters .25 of an inch or larger. **800/854-1993; www.fluidcomponents.com**

7. BIONOMIC INDUSTRIES SERIES 6500 JET EJECTOR VENTURI SCRUBBER

The Bionomic Industries Series 6500 Jet Ejector Venturi Scrubber offers a multispray zone staging configuration that gives about a 50 percent boost in collection efficiency performance. It features a simple, rugged design that utilizes a high-velocity spray and scrubbing liquid flow to achieve simultaneous removal of gaseous contaminants and particulate down to .75 micron size. The high scrubbing liquid-to-gas ratio design rapidly reduces the temperature of high exothermic reactive gases. It creates its own draft to eliminate the need for a fan in most cases, and gas capacity sizes from 5 through 60,000 acfm are standard. **800/311-6767; www. bionomicind.com**

8. VICTAULIC STYLE W257 DYNAMIC MOVEMENT JOINT

The Style W257 dynamic movement joint from Victaulic is preassembled and reduces installation complexity to threaded rod installations of the AWWA M11 harness and C219 bolted sleeve-type joints. It can accommodate differential settlement and seismic movement in large-diameter piping systems and is comprised of Victaulic's AGS Flexible Coupling Style W77. The couplings are self-aligning and provide a visual confirmation of proper assembly from the metal-to-metal bold pad contact. The joint is available in 14- to 78-inch DN350 to DN1950 sizes and is designed to be direct buried, utilizing epoxy coating compliant with NSF61 and AWWA C210 as well as stainless steel hardware. **610/559-3300; www.victaulic.com**

OR-TEC GEMINI SERIES BELT PRESS

The 7.2-foot-wide Gemini Series Belt Press from OR-TEC is the largest made by the company and is ideal for the medium- to large-size wastewater treatment plant. The double-belt system is constructed of stainless steel and combines a gravity drainage zone, a squeezing zone, and high-pressure shear zone to provide a large dry solids throughput of up to 1,500 pounds per hour. The unit has a large flocculation tank with a variable-speed mixer, which allows the biosolids and polymer solution to be thoroughly mixed. A single control panel is used, and the system also features electric actuation, so no hydraulics or pneumatics are needed. **216/475-5225; www.or-tec.com** tpo

(continued)

water:
product spotlight

Providing multiparameter control

By Craig Mandli

You need to keep accurate tabs on the chemical elements added in the water and wastewater treatment process. As regulations and limits are adjusted on a constant basis, the ability to adjust on the fly is paramount. The **Capital Controls MicroChem3** from **De Nora Water Technologies** is designed to do just that.

The multiparameter water analysis system offers both measurement and control of chlorine-based compounds and other critical elements in one instrument that can be specifically tailored to individual applications. According to Ray Mahoney, a product engineer for De Nora, the unit is a fit anywhere that chlorine needs to be measured and controlled for water disinfection.

"The system is used to measure and/or control the primary chlorination system in a municipal water treatment plant as well as monitor conditions in the distribution system," he says. "In municipal wastewater applications, it monitors or controls disinfection portions of the treatment process. It is also a solution for measurement and control in non-municipal process water systems, including applications like pulp and paper plants, and food and beverage operations."

Features include a color touch-screen display, menu-driven software for setup and operation, and a USB interface for software updates and data log downloads. It was specifically designed to ease and improve the user experience, starting with the simplicity of one single solution for chlorine management that functions as both analyzer and controller. It can be used in conjunction with De Nora's range of wet ends to measure and control any combination of chlorine, chlorine dioxide, pH, ORP, conductivity and 4-20mA flow.

Capital Controls MicroChem3 from De Nora Water Technologies

"This unit is the result of direct market feedback, particularly from customers who wanted an instrument that would be easy and very user-friendly for operators," says Mahoney. "Customer feedback also indicated the need for a modular system with true customization to measure and control chlorine levels. And they wanted to be able to choose from multiple parameters."

Additional channels are easily added and field sensors can be changed to achieve new measurements, making it very versatile and customizable. Customer feedback has indicated that the MicroChem3 is easy to set up and use, and that using the instrument as either a controller or an analyzer with multiple parameters that can be selected and changed is ideal.

"We feel that makes this a very comprehensive system that will transition customers into future needs," says Mahoney. **215/997-4000; www.denora.com**

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- ❒ **5.** Parkson Corp. Aqua Caiman articulating rake screen
- ❒ **6.** FCI - Fluid Components International FLT93 Flow Switch Series
- ❒ **7.** Bionomic Industries Series 6500 Jet Ejector Venturi Scrubber
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industry news

Industrial Scientific meets restriction of hazardous substances standard

Industrial Scientific announced that all of the company's products will be manufactured to European Union Directive 2011/65/EU RoHS Standard. The standard prohibits the sale of electronics with certain hazardous materials to member countries. The materials include lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls and polybrominated diphenyl ethers.

Grundfos enters into partnership with ADRA International

Grundfos entered into a new partnership with ADRA International in an initiative to provide access to clean water to 1.5 million people in Africa, Asia, Central and South America and the South Pacific over the next five years. Utilizing Grundfos' solar-powered technology, ADRA created a water kiosk model offering clean water, hygiene supplies and other basic household items.

Lystek wins wastewater technology and Company of the Year awards

At the sixth annual Water's Next Award ceremony held in Toronto, Lystek International was presented with both the Company of the Year and Project/Technology – Wastewater awards. The awards were presented to the company in recognition of its technical solutions, customer satisfaction and achievements in the sustainable management of biosolids and organics. **tpo**

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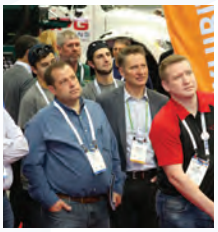
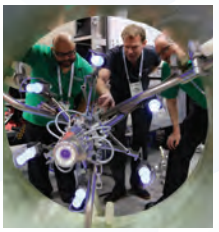
Looking for professional development? The education sessions at WWETT Show 2018 are just what you need. 110 sessions over three days will cover a wide array of industry and business topics. You can choose certification classes, and new for 2018 - technical tours to area facilities. And be sure and look at the lists of available CEU credits. WWETT Show education - it's a great way to up your game.





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people/awards

The **Carnation Wastewater Treatment Plant** operated by King County (Washington) earned a Platinum Peak Performance Award from the National Association of Clean Water Agencies, for five consecutive years' compliance with environmental permits.

Joe Kelley received an award for 25 years' outstanding service with the city of La Junta, Colorado. Kelley recently retired but still does consulting.

The town of **Sandwich, Massachusetts,** received a $34,500 state grant to evaluate how the town communicates with its residents and how to use those communication tools to inform taxpayers about big upcoming capital improvement projects. Specifically, the town hopes to use the grant to raise awareness among its populace about the need to improve water quality and develop one or more wastewater treatment systems.

Terry Wright, founder of ClearCove Systems, received the Distinguished Inventor of the Year award from the Rochester (New York) Intellectual Property Law Association. Wright pioneered a number of improvements in wastewater treatment, including design of systems that reduce the energy used in the process and recapture gas. In addition to municipal applications, his wastewater treatment systems are being used by food and beverage companies.

Nick Mulick has been hired as the in-house attorney for the Key Largo (Florida) Wastewater Treatment District.

The **Salida (Colorado) Wastewater Treatment Plant** received a Gold Safety Award from the AWWA/Rocky Mountain Water Environment Association Joint Committee of Emergency Preparedness.

Jason Riegel was hired as wastewater superintendent for the city of Hays, Kansas.

Ken Helton of Dalton Utilities was named the District 1 Wastewater Collection System Operator of the Year by the Georgia Association of Water Professionals.

The **Mill Creek Wastewater Treatment Plant** was named Best Operated Water Reclamation Plant of the Year (less than 1 mgd advanced treatment) by the Georgia Association of Water Professionals.

The **Loopers Wastewater Treatment Plant** was named the Best Operated Water Reclamation Plant of the Year (greater than 10 mgd nondischarging) by the Georgia Association of Water Professionals.

Prudential Uniforms, a supplier of work apparel and textile services, received a 2017 Encina Wastewater Authority Gold Award for 100 percent compliance with industrial wastewater regulations. The company also received a Certificate of Partnership from the U.S. EPA for its use of green power.

The Washington County (Virginia) Board of Supervisors in Virginia appointed **Kenneth Nurre** to a four-year term on the Washington County Service Authority Board of Commissioners.

For the 19th consecutive year, the **Noman M. Cole Jr. Pollution Control Plant** in Lorton, Virginia, earned a Platinum Peak Performance Award from the National Association of Clean Water Agencies.

The Prince William County (Virginia) Service Authority's **H.L. Mooney Advanced Water Reclamation Facility** won a Platinum Peak Performance Award from the National Association of Clean Water Agencies for the fourth consecutive year.

Rachel Chang and **Ryan Thorpe,** both of Manhasset, New York, won the Water Environment Federation's 2017 U.S. Stockholm Junior Water Prize.

events

Sept. 30-Oct. 4
Water Environment Federation WEFTEC, McCormick Place, Chicago. Visit www.weftec.org.

Oct. 4-6
WaterSmart Innovations Conference and Exposition, South Point Hotel and Conference Center, Las Vegas. Visit www.watersmartinnovations.com.

Oct. 10-12
Iowa Section AWWA Annual Conference, Mid-America Center, Council Bluffs. Visit www.awwa-ia.org.

Oct. 11-13
Intermountain Section AWWA Annual Conference, Sun Valley Resort, Sun Valley, Idaho. Visit www.ims-awwa.org.

Oct. 12
Indiana Water Environment Association Collection Systems Specialty Conference, West Lafayette. Visit www.indianawea.org.

Oct. 15-17
Alabama-Mississippi Section AWWA Annual Conference, Grand Hotel Marriott Resort Golf Club and Spa, Point Clear, Alabama. Visit www.almsawwa.org.

Oct. 15-17
Southwest Section AWWA Annual Conference, Renaissance City Convention Center Hotel, Oklahoma City. Visit www.swawwa.org.

Oct. 15-18
Atlantic Canada Water and Wastewater Association 2017 Annual Conference, Prince Edward Island Conference Center, Charlottetown. Visit www.acwwa.ca.

Oct. 17-19
North Dakota Section AWWA Annual Conference, Fargo. Visit www.awwand.org.

Oct. 23-26
California/Nevada Section AWWA Annual Conference, Atlantis Resort, Reno. Visit www.ca-nv-awwa.org.

Oct. 24-26
Kentucky Water and Wastewater Operators Association North Central/Eastern Fall Wastewater Conference, Four Points By Sheraton Hotel, Lexington. Visit www.kwwoa.org.

Oct. 25-27
New England Water Environment Association Northeast Residuals and Biosolids Conference, Hilton Hotel, Burlington, Vermont. Visit www.newea.org.

Oct. 30-Nov. 2
Alaska Rural Water Association Annual Training Conference, Sheraton Hotel & Spa, Anchorage. Call 907/841-2800 or visit www.arwa.org.

Oct. 30-Nov. 2
AWWA Water Infrastructure Conference and Exposition, Westin Galleria Houston, Texas. Visit www.awwa.org.

The students designed a process to detect and purify water contaminated by bacteria, earning the top prize of $10,000 and an all-expense paid trip to Stockholm, Sweden, to represent the U.S. at the international competition.

The **Illinois American Water Cairo District** received the AWWA Wendell R. LaDue Utility Safety Award. The district has been free of safety incidents for 17 years.

The **Illinois American Water Granite City Water Treatment Plant** received the Directors Award of Recognition from the Partnership for Safe Water for maintaining Phase III certification for 15 years.

For the second year, **Mount Pleasant Waterworks** was named one of the Best Places to Work in South Carolina in a program created by SC Biz News with the South Carolina Chamber of Commerce and Best Companies Group.

A new totem pole at Northwest Hospital in Seattle was created to honor **Cindy James,** an accountant who was a longtime staff member at Ronald Wastewater District in Shoreline. James died of cancer in fall 2016 at age 52.

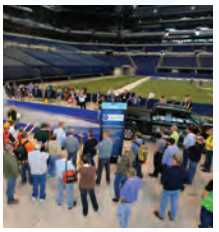
For the second straight year, the **Madison water filtration plant** received a 2016 Area Wide Optimization Award from the North Carolina Division of Water Resources for surpassing federal and state drinking standards.

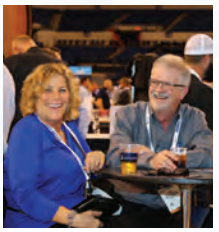
The **Henry County Water Authority Walnut Creek Water Reclamation Facility** was named Plant of the Year by the Georgia Association of Water Professionals.

TPO *welcomes your contributions to Worth Noting. To recognize members of your team, please send notices of new hires, promotions, service milestones, certifications or achievements as well as event notices to editor@tpomag.com.* tpo

LIVE DEMOS AT THE WWETT SHOW

Want to see how a piece of equipment works? The WWETT Show is the place to go for live demonstrations. Hammerhead, I.S.T. Services, Picote Solutions and others are having demos in the Marketplace Expo Hall, perfect for getting up-close and hands-on. Or join companies that include Gradall, Nozzteq, and Vactor as they show off the heavy equipment at WWETT Live! at Lucas Oil Stadium.





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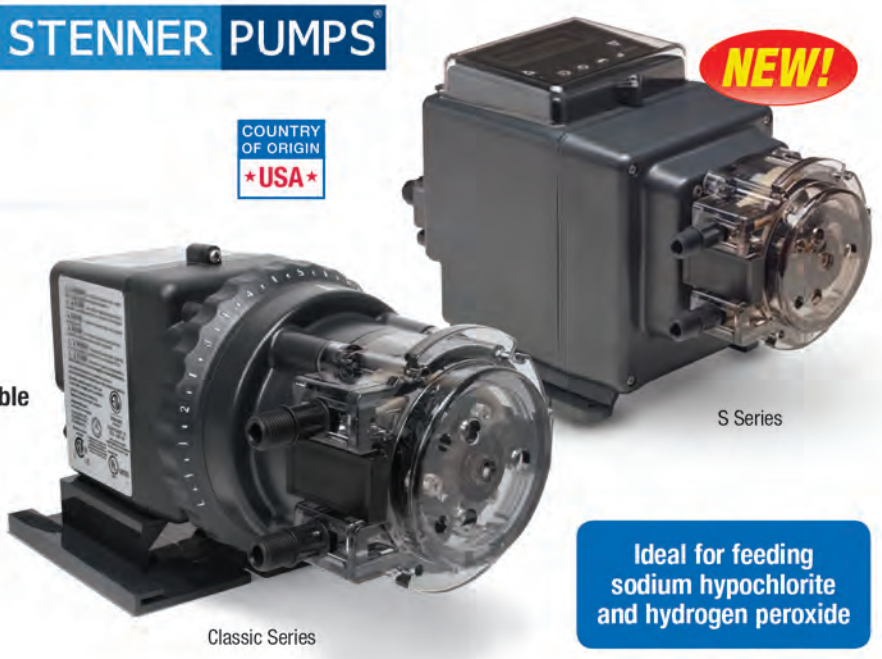

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