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Jerry Atkinson
Water district general manager
Killeen, Texas

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on the cover

The City of Killeen, Texas, and the Bell County Water Control & Improvement District No. 1 have turned biosolids from three wastewater treatment plants into a source of revenue with a composting facility that opened last summer. Jerry Atkinson, general manager of the water district, is shown with the facility's Wildcat TR521 trommel screen from Vermeer. (Photography by Kay Taylor)

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Published monthly by COLE Publishing, Inc.
1720 Maple Lake Dam Rd., PO Box 220, Three Lakes, WI 54562

Call toll free 800-257-7222
Outside of U.S. or Canada call 715-546-3346
Mon.-Fri., 7:30 a.m.-5 p.m. CST

Website: www.tpomag.com / Email: info@tpomag.com / Fax: 715-546-3786

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ADDRESS CHANGES: Submit to *TPO,* P.O. Box 220, Three Lakes, WI, 54562; call 800-257-7222 (715-546-3346); fax to 715-546-3786; or email nicolel@colepublishing.com. Include both old and new addresses.

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EDITORIAL CORRESPONDENCE: Address to Editor, *TPO,* P.O. Box 220, Three Lakes, WI, 54562 or email editor@tpomag.com.

REPRINTS AND BACK ISSUES: Visit www.tpomag.com for options and pricing. To order reprints, call Jeff Lane at 800-257-7222 (715-546-3346) or email jeffl@colepublishing.com. To order back issues, call Nicole at 800-257-7222 (715-546-3346) or email nicolel@colepublishing.com.

CIRCULATION: 77,431 copies per month.

It's Everyone's Job

NUTRIENT LIMITS ARE GETTING TIGHTER. IT'S TIME TO START PLACING MORE EMPHASIS ON CONTROL UPSTREAM, INSTEAD OF AT THE END OF THE PIPE.

By Ted J. Rulseh, Editor

Back in the late 1980s when I was working on an assignment with the Milwaukee Metropolitan Sewerage District, the executive director went public with a proposal to involve upstream communities in the watersheds of the city's three rivers in efforts to control pollution that ultimately affected the city and Lake Michigan.

Well, judging from the reaction, it's lucky for him the pillory had passed out of existence a couple of centuries earlier. A headline on a Milwaukee newspaper editorial pretty well summed it up the reaction: "City Hall Can't Run the Region." (The paper ascribed the proposal to city hall because the mayor had power to appoint seven of the district commission's 11 members.)

Whether the paper's editors knew it or not, that headline cut straight to the root of the problem: A provincial attitude among municipalities, townships and counties that tends to discourage large-scale, cooperative solutions to regional problems.

In reality, the director's proposal made excellent sense. After all, pollution in a river, most notably nutrients in the form of nitrogen and phosphorus, comes not from the city at the river's mouth but from the entire watershed — from upstream cities and villages, from farms and lawns, from all manner of rural and urban runoff. Why should wastewater agencies and their sewer users bear all the cost of controlling those nutrients?

BIGGER PICTURE

Clearly more visionary people understand this. The Chesapeake Bay Initiative, for example, takes an entire-watershed approach to helping clean up the bay. The program looks not only at wastewater treatment plants, septic systems and urban and rural runoff but also at deposition of pollutants from the air.

We are also beginning to see innovations like nutrient trading and adaptive, watershed-based approaches in other states and localities. In this month's "In My Words" article about reducing phosphorus in effluent from lagoon treat-

ment systems, the interviewee specifically mentions the phosphorus rule in my home state of Wisconsin.

It allows wastewater agencies facing newly strict phosphorus limits to look upstream for part of the solution, generally involving management programs that help curtail nutrient-rich runoff. Such remedies tend to be both sensible and more cost-effective than trying to do the whole job with treatment technology.

THE LIMITING FACTOR

The impact of phosphorus on waterways became elegantly clear to me when I read a wonderful book, *For Love of Lakes*, by Darby Nelson, an aquatic ecologist, former community college instructor, and former state legislator in Minnesota.

Nelson first describes all the ingredients in his wife's blueberry muffins and explains how, if she happens to have only two teaspoons of baking powder, she can only make one batch of muffins — no matter how much flour and sugar and how many eggs she may have on hand. Then:

"In lakes, except in unique circumstances, the 'tin' of phosphorus usually empties first. Compared to demand, it is phosphorus that is available in least supply, the bottleneck to alchemy. Little phosphorus in lake water begets few cyanobacteria, algae and aquatic plants. Lots of phosphorus begets lots of blue-green (algae) or aquatic plants or both." (Blue-green algae is the worst consequence of phosphorus pollution.)

> Pollution in a river, most notably nitrogen and phosphorus, comes not from the city at the river's mouth but from the entire watershed — from upstream cities and villages, from farms and lawns, from all manner of rural and urban runoff. Why should wastewater agencies and their sewer users bear all the cost of controlling those nutrients?

If not just wastewater operators but citizens in general understood this simple yet powerful concept — that phosphorus is the key ingredient in a biological process that is fouling our waters — then it might be easier to get people to cooperate with phosphorus control initiatives.

Presumably that would include getting people, first to be willing to spend money and change their behaviors to do their part, and second to look beyond parochial interests and accept that here is a case where what on the surface may look like Big Brother and "big government" is really the only approach to a serious problem that can actually work.

Strangely enough, I see more discussion about watershed-based approaches in my work involving onsite wastewater treatment — septic systems — than I do in the big-pipe community. I would not swear that this perception of mine is accurate; I simply offer it as something I observe.

TIME FOR TEACHING

So here's a salute to those wastewater agencies that are doing what they can to educate their customers and their communities about nutrients, their effects, and the remedies with which each of us can lend a hand. And here's an extra note of congratulations for agencies that are taking bigger-picture, collaborative, watershed-based approaches to help deal with nutrient enrichment issues in the waterways we all love and depend upon.

In a time when political cooperation at the state and national levels is harder to achieve than at any time in memory, perhaps there is room to believe, or hope, that local cooperation and personal involvement on this issue is possible. If so, it will do more good than almost any state or federal nutrient legislation that may come out of the pipeline. **tpo**

Shifting Gear

A QUICK DESIGN CHANGE FOR ENERGY EFFICIENCY HELPS A LONG ISLAND TOWN EARN REBATES FOR A NEW PUMP STATION NEEDED TO MEET GROWING DEMAND

By Doug Day

When the New York Town of Riverhead needed to expand one of its 12 pump stations, local officials decided on a brand new facility that would meet demand for many years. Little did they know it would bring in a sizable rebate check, as well.

Town officials were in talks with the Long Island Power Authority (LIPA) about a possible wind turbine when sewer district superintendent Mike Reichel learned about the authority's Reduced Energy Design program, which provides rebates based on the cost of equipment that saves energy.

"We were already in construction of the pump station when we found out about the rebates," notes Reichel. The New York design firm H2M quickly came up with a plan to qualify for the rebate.

H2M suggested adding a larger force main so that smaller pumps could be used. "It was because of good design and good thinking that we were able to qualify," says Reichel. LIPA ultimately granted rebates and incentives worth $46,225 that helped pay off some debt incurred in the $2.9 million project.

Reichel says the result shows the importance of having a relationship with the utility and staying on top of changes and additions to rebate and incentive programs.

THE DESIGN

Replacing the 1936-era pump station had been in the town's plans. "We needed the capacity because we extended our sewer district several years ago," says Reichel. "It was part of the planning back in 1994 that the pump station would have to be upgraded to accommodate additional flows."

Planning began in 2008, and bids were awarded in October 2010. The station went online in July 2011. The old pump station site was too small for the new one, so the town acquired the neighboring 0.6 acre for $150,000. H2M had determined the new station would require 75 hp pumps to move wastewater through a 10-inch cast iron force main. After learning of the rebate program, the engineers recommended starting with a new, larger main so that 35 hp pumps could be used.

PHOTOS COURTESY OF TOWN OF RIVERHEAD

The variable-speed drives on four Flygt pumps are run from this motor control center. Improved energy efficiency will save nearly $70,000 a year.

The 1,200-foot, 14-inch polyethylene pipe was installed with directional boring. The plastic will last longer and reduce flow resistance, making pumping more efficient. The new pipe is also large enough for future growth in the station's area. "We'll never have to change out that pipe again," says Reichel.

The four Flygt pumps (Xylem) have variable-speed drives with soft-starters. That reduces the electrical demand on startup and saves energy in operations. By using the larger pipe and smaller pumps, the town will reduce pump station energy costs by about 370,000 kWh a year, saving $68,000 a year.

"I didn't realize it was going to take so much electricity in the first place, so the savings are substantial," says Reichel. "You're talking about savings over the life of the pump station, 40 or 50 years." The previous pump station had a capacity of 400,000 gpd, and the new one was quickly handling 450,000 gpd.

This $2.9 million pump station was necessary to meet demand for a growing section of the Town of Riverhead, N.Y. Outside funding helped offset part of the cost, but only because quick design changes qualified the project for rebates and incentives.

What's Your Story?

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

WIND POWER ON THE WAY?

The Town of Riverhead is investigating a wind turbine to help provide electricity for its wastewater treatment plant. Sewer district superintendent Mike Reichel says the town has been working with Long Island Power Authority (LIPA), the New York Power Authority, and consulting groups to site a wind turbine expected to provide about 41 percent of the facility's needs.

A feasibility study by DHL Neutral Power has recommended a 275-foot-tall, 750 kW turbine costing $1.6 million. Reichel hopes for LIPA rebates and other funding to help pay for the project, which is still uncertain.

The 2010 feasibility report on wind power was followed by a year-long anemometer study of wind speed and direction at the plant. "The wind resource is there," Reichel says. "There's a lot to look at — the escalation of electricity cost, and the cost to purchase, install and maintain the wind tower. The town board isn't 100 percent sold on it. They like the idea, but they want to continue to look at it."

The town also looked at adding solar energy but found it unattractive. "It was going to cost about $11 million," says Reichel. "The payback would have been 28 years, and the life expectancy of the solar panels is 30 years."

Its rated capacity is 800,000 gpd.

"The area served by the pump station ends with the developed areas of the town, about half residential and half commercial, including the downtown," says Reichel. With a population of 50,000 Riverhead is the largest agricultural town in Suffolk County, the state's largest agricultural producer per capita.

PLANT UPGRADE COMING

With the new pump station in place, upgrades to the wastewater treatment plant are planned. The original 1937 primary treatment plant was upgraded to secondary treatment in 1959 with the addition of trickling filters and upgraded to tertiary treatment in 2000 with sequencing batch reactors, nitrogen removal, and UV disinfection.

The 1.2 mgd (design) plant is to be upgraded again soon to meet new effluent regulations. The plant will be converted to a membrane bioreactor in 2013. "We're trying to reduce the nitrogen loading going into the Peconic Estuary," says Reichel. "We discharge into a pretty sensitive area. It is protected by the federal government and is one of 19 nationally recognized estuaries."

MBR technology will enable water reclamation. "Reducing nitrogen will allow us to provide irrigation water for a county golf course next door," Reichel says. "It's a beneficial reuse and provides an extra step of filtration before the treated water goes back to the Peconic."

The estimated $18.5 million upgrade will also improve biosolids handling. The plant produces about 1,500 dry metric tons a year, shipped to landfills in Ohio at a cost of $250,000 a year. Class B biosolids from the improved facility will be applied to sod farms on Long Island.

"We'll get a beneficial reuse," says Reichel. "The sod farmer can reduce the amount of fertilizer used and maybe extend the life of the property by adding biosolids as a soil conditioner. We may also offer it for purposes like nurseries and landscaping."

He expects up to $200,000 in rebates as part of the next plant upgrade for energy-efficient blowers, pumps, and mixers that meet LIPA rebate program requirements. Using what he has already learned, Reichel will talk to the utility often to stay up to date on program changes that provide even more financial benefits. **tpo**

Waste Stream to Revenue Stream

A REGIONAL COMPOSTING FACILITY HELPS A TEXAS CITY AND WATER DISTRICT DEAL WITH WASTE MANAGEMENT ISSUES AND CREATE HIGHLY SUCCESSFUL COMMERCIAL PRODUCTS

By Pete Litterski

profile

Bell County (Texas) Water Control & Improvement District No. 1

SERVICE AREA:	City of Killeen and U.S. Army Fort Hood, population about 30,000
POPULATION SERVED:	158,000
FACILITIES:	Three wastewater treatment plants
FLOWS:	Total 30 mgd design, 11.5 mgd average
BIOSOLIDS PROCESS:	Belt press dewatering, aerobic digestion
BIOSOLIDS VOLUME:	190,000 cubic yards per year
BIOSOLIDS USE:	Composting for commercial and retail sales
WEBSITE:	www.wcid1.org
GPS COORDINATES:	Latitude: 31°6'36.74"N; Longitude: 97°42'10.74"W

Two on-site catch ponds collect rainwater for reuse as moisture for the composting rows. (Photography by Kay Taylor)

THE CITY OF KILLEEN, TEXAS, AND THE BELL COUNTY Water Control & Improvement District No. 1 have turned biosolids from three wastewater treatment plants into a source of revenue with a composting facility that opened last summer.

The district's Regional Compost Facility went into operation in August 2011 after navigating the state's rigorous permitting process. Water district general manager Jerry Atkinson foresees a market that will consume all of the composted material produced out of biosolids from Killeen (population 128,000) and the U.S. Army's Fort Hood (30,000). "We anticipate we'll sell every bit of the product we have," he says.

Most will be sold to contractors for seeding on Texas Department of Transportation highway rights-of-way after construction projects. Local landscaping contractors are also included in the marketing plan, and the district will reserve about 20 percent of the material for sale to local residents, who will have their choice of compost ($10 per cubic yard), chipped brush for mulch ($8), or a custom blend of compost with sand, clay and silt branded BioLoam ($13).

The district will also sell compost to wholesalers under a request for proposal (RFP) process. Wholesalers will be allowed to set up operations to package the material on site.

BIG STEP FORWARD

Composting is a major advance from the district's previous practice of land-applying Class B biosolids on cropland and ranchland. Composting helped solve two problems: The district needed a new beneficial use for its biosolids after a land application agreement fell through, and Killeen was spending about $150,000 a year stacking and hauling brush to landfills.

In 2006, the Bell County WCID No. 1 began research on building a compost site to turn the biosolids and brush piles into a rich soil supplement — and ease the pressure on both entities' budgets. Atkinson estimated that the two could save more than $200,000 per year.

After initiating talks with the city, the district in 2007 leased 20 acres of land Killeen had available at its waste transfer station, where brush was being stacked before being hauled to landfills. The key was to develop the compost facility without adding debt.

"We were worried about whether we had enough available funds to do this without borrowing any money," Atkinson says. When the recession hit in 2008, he noticed that as large private building projects slowed and public entities began to tighten their belts, the demand for new construction dipped and costs began falling.

"I told the board, 'Why don't we go out for bids and see what we get back?'" he recalls. With a design from the Lockwood, Andrews & Newman engineering firm in hand, the district put the project out for bids.

The board was pleased when the low bids came in at $2 million for a 1,600-square-foot administration building, site preparation, and the primary composting area – a 13-acre concrete pad where biosolids would be mixed with wood chips and yard waste and windrowed. The composting equipment added $1.6 million, for a total of $3.6 million, well within budget.

Shredded brush flies off the conveyor belt of the chipper (Vermeer.)

Lab technician Kelly Brown collects a biosolids sample.

MOISTURE: KEY TO QUALITY

Moisture control is important in biosolids composting. Bell County Water Control & Improvement District No. 1 general manager Jerry Atkinson says that begins with the Enviroquip Series 518 belt presses (Ovivo) at the district's three wastewater treatment plants. "We can make them run at whatever moisture level we want," he says.

The second step in moisture control comes at the composting site, where operators can pump water from three retention ponds into the facility's International 4,000-gallon capacity water truck to hydrate the rows of biosolids and plant waste.

"The third way to control moisture," Atkinson says, "is to add green product to the mix."

"We anticipate we'll sell every bit of the product we have."

JERRY ATKINSON

HEAVY VOLUME

Site preparation was an important part of construction. The district contracted for tests to make sure the soil could support the compost facility and the product that would be piled on it. Planners also had to slope the site so that all runoff could be steered to three retention ponds on the property. A 1-acre pond at the front of the facility enhances its appearance, as does a functional windmill used to aerate the pond. Besides protecting the surrounding watershed from runoff, the ponds supply water for hydrating the windrows when needed.

The compost facility handles all biosolids from the district's treatment plants. Two (the 38th Street Plants) are conventional aeration facilities built side by side and permitted for 18 mgd and 6 mgd maximum flow. The newest plant, commissioned in 2007, is a 6 mgd facility that serves the southern part of Killeen and is one of the state's largest sequencing batch reactors. In recent years, in a prolonged drought, the three plants have generated an average of 190,000 cubic yards per year of Class B biosolids. "In wetter years, it will be more," says Atkinson.

CERTIFIED QUALITY

The district took steps to ensure acceptance of its product. After it was certified bacteria-free, the district was listed on the state DOT website as an approved compost vendor. The district also joined the U.S. Composting Council (USCC), and its compost has received the organization's Seal of Testing Assurance (STA) certification.

Certification requires the district to have its products analyzed at least every 60 days at an approved testing facility. Samples must be tested for pH, soluble salts, nutrient content (total N, P_2O_5, K_2O, calcium and magnesium), moisture content, organic matter content, bioassay, stability, particle size, pathogens, and trace metals.

The district also must certify that the biosolids going into the compost process comply with all applicable local, state, and federal regulations. The biosolids must maintain a Class B certification from the Texas Commission on Environmental Quality to comply with the STA program. "We've maintained that for years," says Atkinson.

The quality of the biosolids coming out of the district's treatment plants has presented minimal challenges. There is minimal heavy industry in the district and no food or animal processing facilities.

After the composting process, the material is rated as a Class A product. Besides STA certification, the district is sending its final product to another lab to evaluate its nutritive value. That information is important to commercial and residential customers. "We want to inform them of the nutrient content so they understand the application rates they need with our product," Atkinson says.

PROCESS CONTROL

Dewatered biosolids are collected in 25-cubic-yard roll-off containers at

(continued)

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The Bell County Regional Compost Facility team on the Vermeer windrow turner includes, from left, supervisor Matt Atkinson, office worker Tammy Coleman, operator Isaac Mercado, and operator Anthony Robinson.

the wastewater treatment plants and hauled to the compost site by district employees. The plants produce an average of about 76 tons of material per day at 14 percent solids. Wayne Lovett, district wastewater superintendent, says the compost facility easily keeps up with the plants' output: "Just as fast as we haul it, they can windrow it."

At the site, the compost starts as a ratio of one part biosolids to one and a half parts brush. The brush is run through an HG 6000 horizontal grinder (Vermeer) to prepare it for composting. The building of a windrow starts with a bed of chipped brush 18 feet wide and 200 feet long. The first layer is slightly hollowed in the middle to help contain a layer of biosolids.

> "We can load all types of equipment. And if someone comes in and just wants to get a couple buckets of material, we have a bin where they can fill those."
>
> **WAYNE LOVETT**

An operator drives over the two layers with a Wildcat CT718 windrow turner (Vermeer) to mix the two materials. The process continues with alternating layers of brush and biosolids until the windrow reaches a height of seven feet. The rows are seven feet wide at the top. There is enough room in the processing area of the site to build 21 windrows about 15 to 18 feet apart. Lovett estimates the facility will process 100 windrows per year.

Once a new windrow is fully stacked and mixed, it takes about four days for the material to come to a temperature of 130 degrees F as decomposition begins. The optimal temperature range for composting is 130 to 160 degrees F. District employees use probes to take and record the temperatures in all of the active windrows. This is important, Lovett says, because "it has to hold the temperature for 15 days" to eliminate any harmful bacteria.

After the compost has "cooked" for 15 days, it is fed through a Wildcat TR521 trommel screen (Vermeer) to remove pieces larger than 3/8 inch. Finished material is then piled in the curing area of the concrete pad to cool as the decomposition process winds down. Oversize material is returned to the raw brush and processed again to complete its decomposition.

The district estimates it will produce about 26,000 to 30,000 cubic yards of compost per year. After curing, a portion of the compost will be blended with sand, clay and silt from the site to create the BioLoam product.

COMPOST TEAM

The site manager at the compost facility is Matt Atkinson. His staff includes two heavy equipment operators, Isaac Mercado and Anthony Robinson, as well as office worker Tammy Coleman. If business at the compost site gets hectic, two people from the district office have been trained to help with customer service. Jerry Atkinson and Lovett are also available to supplement the crew during busy times.

The facility is open to the public from 8 a.m. to 5 p.m. on Monday, Tuesday, Thursday and Friday and from 8 to noon on Saturday. Commercial trucks that come for loads of compost or BioLoam can drive to a loading area next to the windrows, where the district staff loads them with one of two Volvo front-end loaders, also used to move raw materials and finished product around the site.

Customers with trailers have room to pull in, turn around and back their trailers into the loading area. "We can load all types of equipment," Lovett says. "And if someone comes in and just wants to get a couple buckets of material, we have a bin where they can fill those."

The compost facility's office can take payment by check, credit card or debit card. There is a minimum of $13 per transaction. Although a customer buying compost or BioLoam by the bucket may not take home a full cubic yard, "Compared to buying a bag in the store, they're still going to save all kinds of money," Lovett says.

"It's been a win-win situation for the district and the city, and the public is impressed at two government entities working so well together."

JERRY ATKINSON

COMPOST SHOWCASE

After several months of operation in fall 2011, the compost facility attracted a small crowd of residents to a chilly open house and tour in early December 2011. The facility has been well received, and workers have noted big interest in the BioLoam and regular compost. "It's been looked at very favorably," says Atkinson. "It's been a win-win situation for the district and the city, and the public is impressed at two government entities working so well together." **tpo**

Wastewater operator Cruz Solis evens out the biosolids in a 25-cubic-yard roll-off container (MAC).

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A NEBRASKA TREATMENT PLANT SUPERINTENDENT PARTNERS WITH THE LOCAL EXTENSION AGRICULTURE EDUCATOR TO ADVANCE HIS CITY'S BIOSOLIDS LAND APPLICATION PROGRAM

By Ted J. Rulseh

KEITH KONTOR AND HIS TEAM KNOW HOW TO PRODUCE HIGH-QUALITY biosolids. Dave Varner knows how to explain the product's benefits to farmers. Together they have built a highly successful biosolids land application program around Fremont, Neb.

The program supplies both Class B dewatered biosolids and a Class A composted product to corn and soybean growers within about 30 miles of Fremont in Dodge County. The materials are applied at agronomic rates on about 450 to 500 acres per year.

In his 11 years with Fremont, Kontor has worked hard to improve both farmers' and neighbors' perceptions of biosolids. He gives considerable credit to his team at the treatment plant and to Varner, Dodge County Extension educator.

"I don't have an agriculture background," says Kontor. "If I went to farmers and asked them to put biosolids on their land instead of the fertilizer they had been using for years, what are they going to tell me? That's why I chose to work with Dave. He has the knowledge, and he has the trust of the producers. It really works out well."

The respect goes both ways: Earlier this year Varner presented Kontor with an Award for Outstanding Contributions to Dodge County Extension Agriculture Education Programming, on behalf of the University of Nebraska-Lincoln Extension.

Keith Kontor, superintendent of the Fremont Wastewater Treatment Facility. (Photography by Chris Machian)

MARKS OF SUCCESS

Kontor looks with pride on a variety of achievements in the biosolids program. He says the city has never received a complaint from the public about odor or other issues at application sites.

Demand is strong, helped by field test data showing the products' effect on crop yields. In 2011, for the first time, the city charged farmers for the materials — $7 per ton plus $1 for each 10-mile increment in delivery distance. As a result, the program generated $42,000 in revenue, recouping about two-thirds of the city's costs for hauling and application of Class B material at 25 percent solids and compost at 50 percent solids.

All told, the program saves the city about $200,000 per year over the pre-2001 practice of land-applying liquid material at 1.5 percent solids.

"The program is recognized as one of the best in Nebraska," says Varner. "The growers love it because it's one-stop shopping — we deliver and apply the product, and we take care of all soil testing. The farmers collectively benefit from $75,000 in savings on commercial fertilizer, plus any yield enhancements from the product.

"We couldn't ask for a better partner than Keith. He has been willing to learn the needs of the farming community, and he has concentrated on making quality products that are easy to market. In 2001 when Keith came here, we were lucky to find two farmers willing to accept the material. Now we have a list of growers who want it. Since we began charging for it last year, demand has not dropped off a bit."

DEEP EXPERIENCE

Kontor came to Fremont (about 25 miles northwest of Omaha) with strong experience in wastewater treatment and biosolids. He began his career as a utility worker in Wilber, Neb., a community of about 1,700, and received a promotion to wastewater treatment operator in 1988.

profile

Keith Kontor, Fremont (Neb.) Wastewater Treatment Facility

POSITION:	Plant superintendent
EXPERIENCE:	23 years in industry
DUTIES:	Plant operations and maintenance, regulatory, biosolids management
EDUCATION:	Wastewater operator training, State of Nebraska
CERTIFICATIONS:	Grade 4 wastewater, Grade 2 water
GOALS:	Maintain plant operations to professional standards, continue a compliant and cost-effective biosolids program
GPS COORDINATES:	Latitude: 41°25'13.11"N; Longitude: 96°24'48.16"W

Keith Kontor, shown taking a biosolids sample, is proud of a land application program that operates free of public complaints.

In 2004, Kontor and his team began composting biosolids on a 300-foot-square permitted site on the treatment plant property. Windrows of biosolids and yard waste are mixed by a Wildcat windrow turner (Vermeer).

The Fremont team includes, from left, operators Allan Williams and Gerald Indra, maintenance mechanic Gary Cooper, operators Korey Perry and Ted Pratt, lab technician Derril Meiners, operator Russ Kirchmann, maintenance mechanics Tom Vacha and Bob Smutz, and plant superintendent Keith Kontor.

TEAM EFFORT

The partnership in the City of Fremont's biosolids program is not limited to the connection between the treatment plant and the county Extension Program. It begins much closer to home, with the treatment plant staff.

"There are 10 of us here, counting myself, including five operators, three mechanics and a lab technician," says Keith Kontor, plant superintendent. "All of them play a part. They do all the legwork — the centrifuging, the composting, the on-site product testing, the equipment repairs. Without them, things wouldn't happen." The plant team members are:

- Derril Meiners, lab technician, 38 years with Fremont, Grade 4 wastewater/Grade 3 water licenses
- Gary Cooper, maintenance mechanic 2, 37 years, Grade 4 wastewater
- Bob Smutz, maintenance mechanic 2, 27 years, Grade 2 wastewater
- Tom Vacha, maintenance mechanic 2, 10 years, Grade 1 wastewater
- Ted Pratt, wastewater operator 2, 37 years, Grade 2 wastewater
- Allan Williams, wastewater operator 2, 36 years, Grade 4 wastewater
- Gerald Indra, wastewater operator 2, 36 years, Grade 4 wastewater
- Russ Kirchmann, wastewater operator 1, 4 years, Grade 1 wastewater
- Korey Perry, wastewater operator 1, 1 year, in training

After eight years there, he worked four years at a pork processing plant as a wastewater operator. When he arrived in Fremont (population 25,000), the city was completing a $20 million upgrade to the wastewater treatment plant, including major improvements to the biosolids process.

Today the plant has an 11 mgd design flow and 4.5 mgd daily average flow. The headworks is followed by a diffused air flotation process to remove grease from a local meat processor. Next come primary clarifiers, trickling filters to reduce BOD, and extended aeration activated sludge secondary treatment. Final effluent is UV disinfected before discharge to the Elkhorn River.

The heart of the solids process is an egg-shaped digester with mechanical mixing, supplied by CB&I. It provides thorough mixing that keeps the material in contact with microorganisms to maximize biogas production. The methane feeds boilers that heat the digester complex.

Upstream of the digester, primary and waste activated sludges pass through a thickening centrifuge from GEA Westfalia Separator. After digestion, another GEA Westfalia centrifuge dewaters the material to about 25 percent solids. In total, the plant processes 80,000 to 100,000 gallons of sludges per day and produces 2,500 to 3,000 dry tons per year.

DRAMATIC CHANGES

Taking over Fremont's program in January 2001, Kontor drew on his experience in Wilber, where he had worked successfully with the local Extension educator to market a liquid biosolids product. At the time, Fremont was applying liquid material on just one farmer's land.

Kontor got permission from Fremont Utilities general manager Derril Marshall to seek a similar arrangement with the Dodge County Extension office. Varner embraced the idea. By August 2001, the new digester and centrifuges were online. Kontor and his team mixed the dewatered biosolids

Dodge County extension educator Dave Varner, left, and plant superintendent Keith Kontor have built a highly successful biosolids land application program around Fremont.

"I don't have an agriculture background. If I went to farmers and asked them to put biosolids on their land instead of the fertilizer they had been using for years, what are they going to tell me? That's why I chose to work with Dave."

KEITH KONTOR

with yard waste from the local recycling station to reduce the concentration of molybdenum, which at the time slightly exceeded EPA 503 regulations.

Meanwhile, Varner went to work recruiting farmers. Initially, he sought to show growers that biosolids would meet their crop nitrogen requirements and deliver the yields they expected. He helped them conduct replicated on-farm research tests comparing commercial fertilizer with biosolids.

"We would calculate their nitrogen requirement based on soil tests and apply the product at the appropriate rates," he says. "The growers met or exceeded their expected yields in almost every instance." Data from those tests has helped the city's marketing program significantly.

In 2004, Kontor and his team began composting biosolids on a 300-foot-square permitted site on the treatment plant property. Windrows of biosolids and yard waste are mixed by a Wildcat windrow turner (Vermeer).

"Probably 60 percent of our biosolids is now composted," says Kontor. "It's a seasonal operation, usually from about April until we get frozen out in November." Farmers have come to prefer the compost product because it spreads more uniformly, Kontor observes.

RUNNING SMOOTHLY

Today, the program runs with barely a hitch. The Class B biosolids product contains about 5.2 percent nitrogen and 4.3 percent phosphorus; the Class A product is somewhat lower in nitrogen and higher in phosphorus. Both products contain other essential crop nutrients, including zinc, sulfur and iron, that add fertilizer value.

Varner acts as the point man in the field. "He works with these producers day to day on how they can increase yields and what types of fertilizer to use," says Kontor. "We have so many different kinds of ground here — sandy soils, gypsum soils, clay soils. That is Dave's profession — helping the producers grow the best crops they can."

In recent years, Varner's outreach efforts have focused on land with soils low in phosphorus. Other selection criteria include suitable distance from residential developments and from floodplains, and farmers willing to be patient, as wet weather can cause delays in product delivery and application.

Dodge County extension educator Dave Varner, left, observes, "We couldn't ask for a better partner than Keith."

"The first thing Dave does is sample the ground," says Kontor. "If he finds a site that's low in phosphorus, he meets with the farmer to further explore the prospect of applying biosolids. Producers who are willing must apply to Dodge for a permit. As part of the process, notices are sent to all the neighbors within 1,000 feet of where we're going to apply the material."

Neighbors are invited to a public hearing; if they raise legitimate concerns, the permit application may be withdrawn. "We don't want to fight a battle over public perception," says Kontor. "There is always other ground we can go to."

If all goes well, the county issues a permit that lasts five years, and the farmer is signed up to receive product the following year. Kontor and Varner try to permit 500 to 750 acres per year. "I feel it's good public relations to let as many farmers as possible use the products and receive the benefits," says Kontor.

SCIENTIFIC PROCESS

The actual application is a rigid process designed to deliver nutrient value to match the needs of the crop. The products are stored at the treatment plant site, or on recipients' farms if they have space available, until after harvest in fall. A contractor handles hauling and application.

Both the Class A compost and the Class B biosolids are applied using a tractor-drawn manure spreader with a vertical beater bar. "We have to weigh the spreader before we start to make sure we know how many tons we have on board," says Kontor. "Then we calculate the necessary ground speed based on how much we need to put on per acre.

"The contractor has a GPS setup that tells exactly where he has hauled, so he won't haul over the same ground twice. We use the same equipment to spread both materials. To change from one to another, all they have to do is re-weigh the machine and re-calculate the speed to make sure we're applying at an agronomic rate."

"We couldn't ask for a better partner than Keith. He has been willing to learn the needs of the farming community, and he has concentrated on making quality products that are easy to market."

DAVE VARNER

Over the years, the program built such credibility that it wasn't difficult to transition to charging for the products. "Budgets of cities around the country are getting tighter and tighter, and we were asked how we could recoup or eliminate some of our costs," says Kontor.

"We held a meeting with Dave and the producers — some with new land and some with land we had hauled to previously, and explained that we wanted to begin charging. We had 25 landowners at the meeting, and all 25 signed up."

It's all a credit to a good production, marketing and delivery process, and good teamwork. Varner observes, "Keith has maintained excellent quality control of the biosolids products and has done everything Extension has asked of him and more to accommodate area farmers. He has been instrumental in the program's success." **tpo**

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Stars of the Show

PLANT OPERATORS AT NARRAGANSETT BAY COMMISSION ARE ON THE FRONT LINE WHEN IT COMES TO TEACHING THE PUBLIC ABOUT KEEPING WATER CLEAN

By Briana Jones

Plant operators are integral to the education program at Narragansett Bay Commission (NBC) in Rhode Island on multiple levels — and one became the star of the show.

"One of the elementary classes was so impressed by the work of one of our operators, Joe LaPlante, that they wrote a musical about their wastewater treatment experience," says Jamie Samons, public affairs manager at NBC. "The main character was Joe, so one of the little kids played him.

"It was hilarious! They met him and liked him, and they were so psyched about the whole activated sludge process."

LaPlante, now the operations and maintenance support supervisor, recently won an Alfred E. Peloquin Award from the New England Water Environment Association, recognizing personal service contributing to excellence in plant operations.

NBC runs education programs for elementary, middle and high school students and for adults, as well. Operators take part in classroom sessions and lead tours and learning activities at treatment plant sites.

WATERSHED SCIENTISTS

NBC operates two wastewater treatment plants, Field's Point (50-55 mgd average) and Bucklin Point (25-30 mgd average), that jointly serve 350,000 people in 10 cities and towns. The commission's education programs make sure children and adults understand what those plants do and help them to appreciate the environment the plants protect.

PHOTOS COURTESY OF NARRAGANSETT BAY COMMISSION

Students from SD Barnes School in Johnston, R.I., get a plant tour at the Bucklin Point wastewater treatment facility.

The Woon Watershed Explorers (WWE) program for grades 2-5 began as a pilot program in 2004 and has taken off since then.

Mariama Gonscalves from the MET School in Providence with the toilet seat she decorated for the World Toilet Day observance at the Narragansett Bay Commission.

"WWE is a full watershed curriculum," says Cynthia Morissette, environmental education coordinator. "We integrate water-quality testing so kids learn about all the parameters, like dissolved oxygen, pH, and nitrates and phosphates. They do river testing at local sites."

The nine-month program educates students through monthly in-class lessons, field trips to local rivers, and a culminating environmental education symposium at the end of the school year. "Toward the end of the program, we incorporate macroinvertebrate studies so the kids get to know how water quality affects life in their rivers and ponds," says Morissette.

The NBC staff and plant operators take the program to the classrooms. "The way we figured would be most equitable was to include one school from each of the 10 service communities," says Samons.

The program supplements state and federal curriculum standards. "WWE is added into the school's curriculum, so it's something extra they get on top of the science they're already getting," explains Morissette. "A lot of the schools have cut back on science, so the program allows the students to get out into the community and see their local water resources as well as work with our operators. Sometimes it actually helps because their curriculum is so limited."

CURRICULUM CULMINATION

An end-of-the-year symposium brings the young scientists together from all the schools that took part in WWE to apply what they learned. "At the year-end Environmental Education Symposium

For the past two years on World Toilet Day, students and adults have been artistically enhancing toilet seats with messages about clean water.

in Goddard Park, we bring in a lot of outside organizations," says Morissette. "The operators help the students do water-quality testing, and they teach the kids about the different species in the bay. The operators bring in activities to talk about wastewater and show how the treatment plant is involved with what we do."

Organizing 500 rambunctious kids is not always easy with a small staff. "The operators help the children complete their activities, and they get the kids from place to place," says Samons.

MOVING ON UP

Older students are not overlooked. "We have a six-week program for high school students," says Samons. "It looks at the environmental as well as economic and policy implications of having or not having clean water on a local and global level."

NBC staff members go out to the schools, but they also bring the students to the wastewater treatment facilities to tour the plants and specifically the laboratories. This gives the students a more scientific look at plant operations.

"We've also done job shadowing for high school students interested in technical careers," adds Samons.

Adults get involved in education, too. For the past two years on Nov. 19, World Toilet Day, students and adults have been artistically enhancing toilet seats with a message about clean water.

"The response was fantastic!" says Samons. "We mounted the toilet seats at a local gallery."

Established about 10 years ago by the United Nations, World Toilet Day is just one way NBC brings awareness that about half the people on the planet don't have access to adequate sanitation.

> "The operators are the ones on the front line. They've got the rubber to the road every day. They have done more to improve the quality of the water in Narragansett Bay than anyone in this state. It's the folks at the plant who have done the lion's share of the environmental improvement in this state."
>
> **JAMIE SAMONS**

LEADING THE PACK

"We consider the folks who work here at NBC the real environmentalists," says Samons. "The operators are the ones on the front line. They've got the rubber to the road every day. They have done more to improve the quality of the water in Narragansett Bay than anyone. It's the folks at the plant who have done the lion's share of the environmental improvement in this state."

With recognition like this, NBC has schools knocking on the door to get into the education programs. "It's important to educate the young about the dangers of bad water and keeping water clean," says LaPlante. "Older people are stuck in their ways and it's very difficult to change bad habits." **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.

True Partnership

IN LEONI TOWNSHIP, A PRIVATE COMPANY OPERATES THE TREATMENT PLANT, WHILE MUNICIPAL WORKERS HANDLE THE MAINTENANCE. THE ARRANGEMENT SERVES EVERYONE WELL.

By Jim Force

Jared Driscoll, left, operations specialist with Infrastructure Alternatives, and Tom Prescott, Public Works employee, work on the Alfa Laval centrifuge. (Photography by Bob Foran)

CLOSE COOPERATION BETWEEN THE MUNICIPALITY and plant management makes public-private partnerships successful. Few places prove that axiom better than Leoni Township, a small community in Michigan's south central lake country.

The treatment plant is managed by Infrastructure Alternatives, a private firm, but staff duties are shared by both company and township employees. Chris Crenshaw and Jared Driscoll are operations specialists with Infrastructure Alternatives, while Leoni Township team members Tom Prescott and Marty Keyser handle maintenance.

It's a relationship that works well, according to plant manager Tom High, a 40-plus-year veteran of wastewater treatment. "It's a unique situation," he says. "We do a lot of cross-training, and it has worked out very nicely."

The teamwork has been doubly important as the township upgraded treatment to membrane bioreactor (MBR) technology. That change came after subpar results and numerous violations with the older plant, using lagoons and fixed-film systems. It was made more urgent by new tighter standards for phosphorus removal.

CORRECTING ISSUES

Treatment at Leoni dates to 1971 when the township installed a 0.9 mgd aerated lagoon, coupled with spray irrigation of the treated water. In 1987, the facility was upgraded to surface water discharge with a capacity of 1.3 mgd, using packed towers for ammonia removal. Then, in 1999, the capacity of the lagoon system was doubled to 2.6 mgd.

But even with the improvements, the plant had issues meeting Michigan Department of Environmental Quality requirements, and with an average daily flow pushing 1.8 mgd and new phosphorus limits on the horizon, the township began looking for new technology. In 2005, the township hired Infrastructure Alternatives, based in Rockford, Mich., to manage the plant and help it through the transition.

"They contacted us around November 1 and wanted us to be in place by the end of the month," remembers High. "It was a quick turnaround."

The township had looked at an MBR plant in Georgia and decided on that technology, even though the cost of the new plant added up to $32 million. "We were hired to assist with the construction project and the startup of the new system," says High. "After that, we entered a three-year extension of our operations contract." The new treatment facility was designed by OMM Engineering of Grand Rapids, and O'Harrow Construction Management of Jackson, Mich., handled the building process.

The township wanted to keep the treatment plant maintenance staff on its payroll, even though they would be supervised by Infrastructure Alterna-

profile Leoni Township (Mich.) Sewer Treatment Plant

BUILT:	1971, upgraded 2009-2010
SERVICE AREA:	13 communities, 51.2 square miles
POPULATION SERVED:	14,000
FLOWS:	3.0 mgd design, 2.0 mgd average
TREATMENT PROCESS:	Membrane bioreactor
TREATMENT LEVEL:	Tertiary
RECEIVING WATER:	Grand River
BIOSOLIDS:	Centrifuge dewatering, cake to landfill
STAFFING:	Tom High, manager; Chris Crenshaw and Jared Driscoll, operations; Marty Keyser and Tom Prescott, maintenance
ANNUAL BUDGET:	$1.6 million (operations)
WEBSITE:	www.leonitownship.com
GPS COORDINATES:	Latitude: 42°13'45.40"N; Longitude: 84°15'40.45"W

"We have no jealousies here — no restraints that would keep guys from working together. If I teach the township people how to run the centrifuge, there's no worry that it will take away someone's job."

TOM HIGH

Leoni staff members include, from left, Tom High, plant manager; Jared Driscoll, operations specialist with Infrastructure Alternatives; Marty Keyser and Tom Prescott, Public Works employees; and Chris Crenshaw, operations specialist with Infrastructure Alternatives.

A GOOD WORK ENVIRONMENT

While everyone is happy with the new treatment technology at Leoni Township — including the state Department of Environmental Quality — the cooperation between the township and the operating company, Infrastructure Alternatives, gets high marks, as well.

"It works great," says operator Chris Crenshaw, an employee of the company. "For one thing, it gives us a direct connection with the township — our customer. We have good rapport. And team members all have skills and knowledge they readily share."

He's impressed with the town employees who still do the plant maintenance: "They know quite a bit. We're able to take advantage of their experience. If we need something, they can go across the road and get it. They know what to look for in terms of maintenance, and they are constantly teaching us about the township that we work for."

From the township's point of view, maintenance specialist Tom Prescott is equally complimentary. "Marty Keyser and I have a lot of experience with pumps, and the electrical and mechanical systems, and it was more cost-effective for the township to let us take care of maintenance at the plant," he says.

He describes plant manager Tom High as "an excellent person" and has been pleased with Infrastructure Alternatives as a whole.

Township clerk Michele Manke was instrumental in bringing the company and the township together, and she couldn't be happier with the result. "We visit other townships," she says. "When we were having difficulties with our old plant, we visited Brighton Township and saw how they were using Infrastructure Alternatives with good results. The company gave us a bid, and they've been very friendly, easy to work with."

Manke credits the company with repairing the township's relationship with the DEQ and says its team members were hands-on right from the design phase of the new treatment system. "Tom High is very knowledgeable about wastewater treatment," she says. "Communication has been excellent, and our employees work well with the company. We're a happy family."

Leoni Township Sewer Treatment Plant PERMIT AND PERFORMANCE			
	INFLUENT	EFFLUENT	PERMIT
BOD	235 mg/L	2.1 mg/L	4.0 mg/L
TSS	183 mg/L	2.1 mg/L	20.0 mg/L
Phosphorus	3.25 mg/L	0.10 mg/L	0.33 mg/L
Ammonia	25.9 mg/L	0.13 mg/L	0.50 mg/L

tives. That's not the normal model in the business, "but we agreed that it could work — and it has," High observes.

At first, as "an old activated sludge guy," High was not convinced about MBR technology. He is a believer now: "It just makes sense; we don't have any clarifiers, and therefore keeping solids in the system is not an issue. We can run at incredibly high sludge ages. Performance has been fantastic. I've been converted."

REPLACING SEPTICS

The upgraded Leoni Sewer Treatment Plant serves 13 small communities with many homes situated around the area's lakes. Sewers and force mains have replaced septic systems to help prevent eutrophication of the lakes.

Treatment starts with grit removal in a Waste Tech vortex-type system (Kusters Water), followed by 1/8-inch fine screens (Huber Technology). High says it's important to remove as much sand and grit as possible ahead of the MBR membranes to protect them from damage.

The wastewater then moves into the triple-train biological treatment portion of the MBR process (Ovivo). In the first section, contents receive anaerobic treatment in small tanks designed to promote luxury phosphorus uptake by the microorganisms. The second set of tanks provides anoxic treatment, which facilitates denitrification. From there, pumps from ABS USA lift the water to a second deck containing the aerobic treatment basins, equipped with Sanitaire fine-bubble diffusers (Xylem) for carbonaceous removal.

After that, the water passes to the KUBOTA membranes (Ovivo), flat-plate units with a 0.4-micron pore size. There are five membrane tanks in all, each containing 13 cassettes. Each cassette houses 400 membrane cartridges, for a total of 26,000 cartridges.

Treated water flows through the membranes by gravity; permeate pumps (Gorman-Rupp Co.) are available to assist as needed. The permeate moves on to UV disinfection (TrojanUV), and then to cascade reaeration steps before pumps (Goulds Water Technology) transport it to an outfall in the upper reaches of the Grand River, about five miles from the plant. "This is the headwaters region of the Grand, which flows west across the state to Lake Michigan," High says. "That's the reason for the phosphorus limits."

Solids are stored in two tanks with a JetMix mixing system (Siemens Water Technologies) and then dewatered in a centrifuge (Alfa Laval). Cake is hauled to a local landfill.

A PLC-based SCADA and monitoring system controls plant processes. High says it would be difficult to manage the system by hand, given the membrane operation and cleaning procedures. Ovivo supplied the automation, matched precisely to its MBR technology. High and his staff can access the plant remotely and see and control all the treatment processes.

"It's a nice system," High says. "I can log in through the Internet and run a good part of the plant while I'm sitting at home." Remote access to plant operations through the SCADA system eliminates the need for around-the-clock staffing.

A HAPPY STAFF

Initially, High's firm proposed a four-member operations staff. "Most times we bring in our own crew, but the township preferred to have its own employees do the maintenance," High says. "We're a small firm and we can respond. I do the timesheets and evaluations for the full staff, but the township pays its two employees. They're like my own staff, except I don't pay them."

"It just makes sense; we don't have any clarifiers, and therefore keeping solids in the system is not an issue. We can run at incredibly high sludge ages. Performance has been fantastic. I've been converted."

TOM HIGH

The arrangement has its benefits — mainly cross-training. "Just today, we were out in the plant doing some changeouts of pump seals," says High. "One of the township maintenance specialists took the lead, and I assigned one of my operators to be the second person, forming a team that worked together. We have no jealousies here — no restraints that would keep guys from working together. If I teach the township people how to run the centrifuge, there's no worry that it will take away someone's job."

Certification is another area of common interest. High, who has developed online training courses for operators during his long career, has been working with the township staffers and his company's personnel to obtain or upgrade their Michigan certifications. "They're very interested in certification," he says. "And we encourage people to upgrade their skills."

SOLVING PROBLEMS

The startup of the new MBR system gave High and the Leoni staff plenty of opportunities to learn about state-of-the-art technology. "Our membranes go into a relax cycle every 11 minutes, allowing the solids to be dislodged," says High. "When it becomes more difficult for the water to move through the membrane, indicated by pressure readings on both sides of the membrane, we'll do a clean-in-place."

In that process, operators take one of the membrane tanks out of service and use a chemical, usually bleach, to clean the membranes and remove any organic fouling. Iron scale can also form on the membrane surfaces, and that calls for various cleaning acids. The Leoni team is working closely with Ovivo to find the right acid for cleaning.

Operators recently pulled a membrane cartridge out of a cassette and applied different types of acid to remove the scale. "We have tried hydrochloric acid and citric acid, but with little results," High says. "We may have to go with an oxalic acid to get the desired results."

At Leoni, the natural flow to the membranes is by gravity, but pumps are used when the membranes begin to foul. "When the membranes aren't clean, we can lose capacity," High says. "When they're clean, we can return to gravity flow."

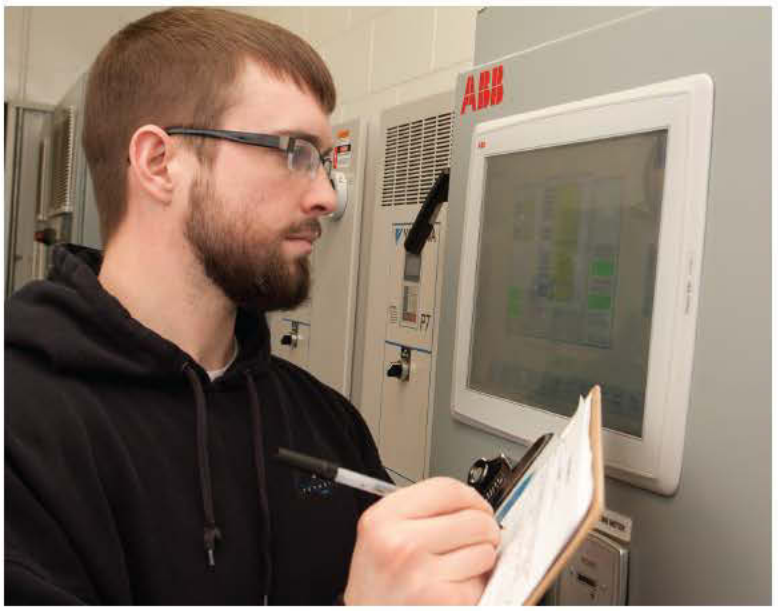
LOTS OF SUPPORT

The Leoni staff is pleased with the operation of the biological system and the responsiveness of the various manufacturers. High says the biological system performed well right from the start. "BioTech Agronomics hauled in about 570,000 gallons of mixed liquor from the Lansing plant — a good, acclimated sludge — rather than trying to build up our mixed liquor from scratch," he says.

The ammonia and carbonaceous removals "took off right from the start." It took three or four months to achieve the desired biological phosphorus removal levels, hampered at times by colder weather. "We can add ferric for phosphorus removal if necessary," says High.

At steady-state operation, the staff runs the plant with a relatively long sludge age. "We run at 10,000 to 15,000 mg/L mixed liquor concentration, never dropping below 10,000," High says. "It encourages the growth of our nitrifying bacteria, and our ammonia levels are stable at around 0.1 mg/L in the effluent."

The staff also maintains dissolved oxygen in the aeration basins at 0.3 to 0.8 mg/L, again to promote nitrification and denitrification. Overall, High says, the startup went about as expected, with some maintenance issues cropping up here and there. "We had some significant issues with our blowers, but the manufacturer (Dresser Roots [GE Water]) stayed with us, and we



Jared Driscoll, operations specialist with Infrastructure Alternatives, takes readings from the centrifuge control panel (ABB).

Public Works employee Marty Keyser, left, and Jared Driscoll work on a permeate pump (Gorman-Rupp).

(continued)

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>
> **TOM HIGH**

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Stirring the Pot

EFFECTIVE MIXING DESIGN HELPS ENSURE UNIFORM MATERIAL CONCENTRATION AND PROPER PERFORMANCE IN DIGESTER SYSTEMS

By Argun Olcayto Erdogan, Ph.D.

For tanks at wastewater treatment plants that contain solids slurries, either for anaerobic digestion or sludge storage, mixing is a key factor in the proper design, operation and maintenance of the system.

Correct mixing is one of the most important control parameters for the reactors used in every biological treatment step in a plant. It is also critical to maintaining uniform solids concentration in the digester, ensuring that concentrations in any sample taken, at any time, will not vary by more than 10 percent from the average of all samples taken, except for deposits on the tank bottom and floating scum[1].

Anaerobic digesters routinely operate with solids concentration from 3 to 5 percent. Sludge storage tanks can have solids concentrations exceeding 5 percent dry solids and, in some extreme cases, settled solids at the bottom can be as high as 10 to 12 percent dry solids.

PREVENTING SETTLING

Municipal wastewater consists of both biodegradable and non-biodegradable solids, including inert material like grit and silt. These dense materials tend to settle in areas where there is less turbulence. Where the solids concentrations are elevated and grit and inert solids are present, special considerations must be given to a mixing system[2].

When mixing is not carefully considered, inefficient mixing can take place, hindering performance of biological reactors and leading to operational problems.

A well-designed mixing system must be used in anaerobic sludge digesters to ensure proper biological reactions for optimum digester performance, as measured by volatile solids reduction and gas production, and to reduce maintenance made necessary by solids deposition in the digester tanks.

Some commonly used mixing technologies include mechanical, gas (biogas injection alone or with recirculation sludge), draft tube and hydraulic. All can help eliminate settling while keeping digester contents homogeneous.

SELECTING THE RIGHT SYSTEM

Each mixing system is used for certain applications according to digester shape. The accompanying table[3] outlines the pros and cons of each mixing technology that should be considered, along with energy consumption rates, in system selection.

PHOTO COURTESY OF SIEMENS

Hydraulic mixing technologies include the JetMix system (Siemens Water Technologies) which uses a vortex mixing pattern created by nozzles that can be rotated 360 degrees, preventing deadspots. The system maintains mixing efficiency regardless of liquid levels in the tank.

GAS INJECTION

Gas injection systems used in cylindrical tanks can be classified as unconfined or confined. In unconfined applications, biogas is collected at the top of the digester and cleaned with a coarse gravel filter and a fine cartridge filter. It is then compressed and sent back to the digester via a diffuser system at the bottom of the reactor or through lances at the vertical top perimeter of the digester. Injected biogas rises to the top of the digester and creates bottom-to-top circulation that mixes and homogenizes the contents.

In confined gas injection applications, biogas is collected at the top of the digester, then treated and compressed in the same way as in the unconfined method. The major difference is that in confined applications, the biogas is released or discharged through a pipe or tube at the center of the digester. The compressed gas is then released from the pipe and gas bubbles rise to the surface, creating an airlift effect.

MECHANICAL MIXING

In mechanical mixing systems, vertical-shaft, low-speed turbines or vortex fans are used. Mechanical systems can be unconfined (mixer directly positioned in the center of the digester) or confined (mixer in a pipe or tube positioned vertically at the center of the reactor). Since the motor and gearbox of the mixer are located at the top of the digester, mechanical mixers are mostly used for fixed-cover or floating-cover digesters.

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TYPE OF MIXER	ADVANTAGES	DISADVANTAGES
All systems	Increased rate of biosolids stabilization.	Corrosion and wear of ferrous-metal piping and supports; equipment wear by grit; equipment plugging and operational interference by rags.
Gas injection, unconfined:		
Cover-mounted lances	Lower maintenance and less hindrance to cleaning than bottom-mounted diffusers. Effective against scum buildup.	Corrosion of gas piping and equipment; high maintenance for compressor; potential gas seal problem. Compressor problems if foam gets inside; solids deposition; plugging of gas lances. When not properly designed, entire tank contents are not mixed.
Bottom-mounted diffusers	Better movement of bottom deposits than cover-mounted lances.	Corrosion of gas piping and equipment; high compressor maintenance; potential gas seal problem. Foaming and incomplete mixing, scum formation, diffuser plugging. Bottom deposits can alter mixing patterns; requires digester dewatering for maintenance.
Gas injection, confined:		
Gas lifters	Better mixing and gas production, better movement of bottom deposits than cover-mounted lances. Lower power requirements.	Corrosion of gas piping and equipment; high maintenance for compressor; potential gas seal problem. Corrosion of gas lifter; lifter interferes with digester cleaning. Scum buildup; does not provide good top mixing; requires digester dewatering for maintenance if bottom-mounted.
Gas pistons	Good mixing efficiency.	Corrosion of gas piping equipment; high maintenance for compressor; potential gas seal problem. Equipment internally mounted; pistons interfere with digester cleaning. Requires digester dewatering for maintenance.
Mechanical stirring:		
Low-speed turbines	Good mixing efficiency.	Wear of impellers and shafts; bearing failures; interference of impellers with rags. Requires oversized gearboxes; gas leaks at shaft seal; long overhung loads.
Low-speed mixers	Breaks up scum layers.	Not designed to mix entire tank contents. Bearing and gearbox failures; impeller wear; interference of impellers by rags.
Mechanical pumping:		
Internal draft tubes	Good top-to-bottom mixing.	Sensitive to liquid level; corrosion and wear of impeller; bearing and gearbox failures. Requires oversized gearbox.
External draft tubes	Same as internal draft tube. Draft-tube maintenance easier than internal type.	Same as internal draft tube.
Pumps	Better mixing control. Scum layer and sludge deposits can be recirculated. Pumps easier to maintain than compressor.	Impeller wear; plugging of pumps by rags; bearing failures.

Sources: Adapted from WEF (1987b) and Metcalf & Eddy (1984a).

The shaft in a mechanical mixer consists of two or more turbines — as opposed to vortex-type mixers that have only one turbine — to ensure proper mixing at various depths. Provided that the mixing pattern is similar to that of a gas injection system, the rotating turbine or vortex fan generates downward or upward movement on the bulk of the material. The pipe or tube used for the confined version is similar to a case on a pump, while the mixer acts as a propeller, causing movement in only one direction.

HYDRAULIC MIXING

A variety of hydraulic mixing systems are on the market that use a pump to recirculate flow from the tank through nozzles strategically located inside the digester. Properly designed systems provide effective mixing and help to improve anaerobic digester efficiency and the re-suspension of solids in applications such as sludge storage tanks that are allowed to sit idle for months at a time.

When this technology is properly designed, it addresses common issues that can arise in mixing digesters and storage tanks. Tanks containing solids slurries are notorious for having fibrous material re-weave that creates ragging issues in pumps and on impeller blades. Hydraulic mixing helps to overcome this, as well as dead spots in the tank where solids tend to accumulate, and accumulation of scum and foam. All these conditions can contribute to operational issues, requiring labor to maintain the mixing system and clean out the tank.

CASE IN POINT

In 2006, the Wheaton (Ill.) Sanitary District installed a hydraulic mixing system at its wastewater treatment plant after its former gas mixing system was destroyed when the tank cover was taken out of service. The 1,350 gpm hydraulic mixing system used a 25 hp chop-

(continued)

per pump to agitate sludge within the anaerobic digestion process, optimizing digestion and methane production. The system provided efficient mixing that kept the tank floor clean and broke up the scum layer. The solids concentration was 4 to 5 percent.

The district chose a hydraulic mixing system because it was sized efficiently, with only two nozzles and a 25 hp motor. The circular digestion tank re-suspended settled solids when the system was turned on. Plant operators were able to schedule mixing times, reducing power usage by about 90 percent without decreasing methane gas production or negatively affecting volatile solids reduction.

Hydraulic mixing uses moving parts that are outside the system and readily accessible. After installing the system, the Wheaton facility experienced minimum scum blanket buildup, improved volatile solids destruction, and better overall digestion.

The plant continued to optimize by consistently reducing the mixing period until it could maintain anaerobic digestion performance by operating one four-hour period, once a week. This allowed the plant to maintain high gas production with an average of only 0.6 hp per day. The district uses the methane produced for heating digesters in the support buildings.

ABOUT THE AUTHOR

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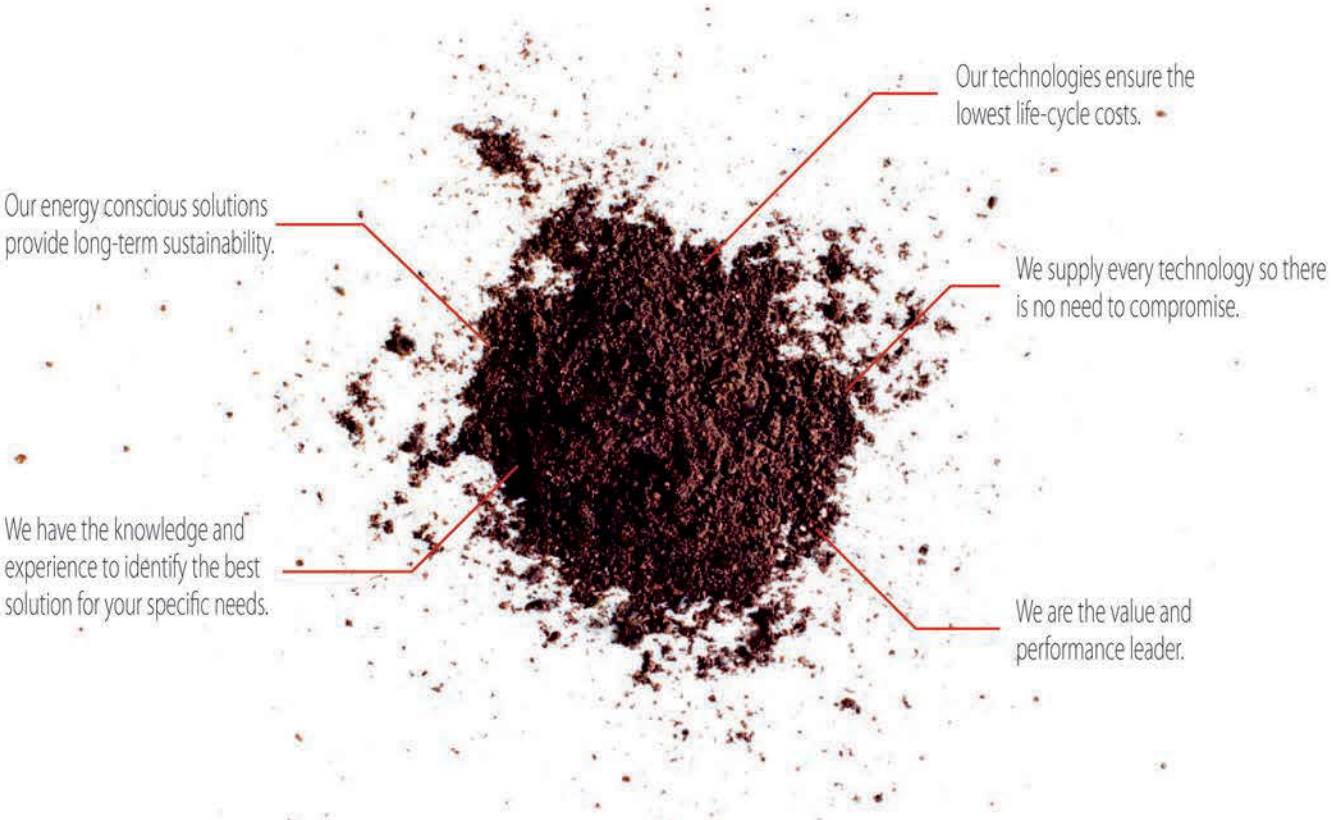
[2] Roehl, Marc. ***Water & Wastes Digest,*** Getting the Right Mix. August 2011.

[3] Tchobanoglous, G., Burton, Franklin L., Stensel, H. Davis. *Wastewater Engineering Treatment and Reuse.* 2004 Fourth Edition, McGraw-Hill.



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A PROBLEM WITH SLIME BULKING AT A WASTEWATER TREATMENT PLANT TURNED OUT TO HAVE ITS ORIGINS ON THE POTABLE WATER UTILITY SIDE

By Ron Trygar, CET

Wastewater operators encounter a wide range of conditions that affect their plants on a weekly or even daily basis. Flow surges from rain events, power outages, severe storms, and illegal dumping of oil, grease and other nasty fluids are just a few of the problems.

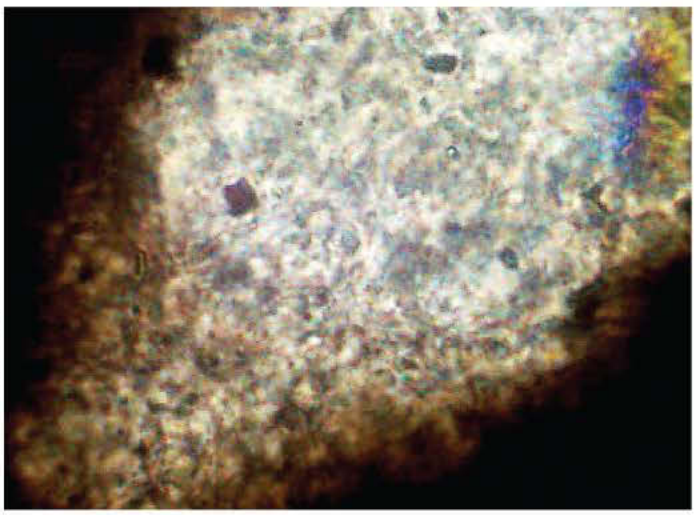
Personally, I have found it's these varying conditions that make wastewater treatment so challenging and, in some ways, enjoyable. Don't get me wrong, I like the days when the plant is running smoothly. But I also enjoy the days when I get to put my trouble-shooting skills to work. This is a story of one of those days.

HANDLING SMALLER FLOWS

Running package treatment plants allows an operator to use many skills learned over time. A small package plant serving a highway rest area, campground or small mobile home community can quickly humble even the most seasoned operator.

These small units might treat flows less than 100,000 gpd but can be very difficult to control. In fact, many veteran operators will admit that running a small package-type plant is more challenging than operating a plant with more than 1 mgd flow. Things happen much faster at a small plant, and when things go wrong, they usually do so quickly, without warning.

The lab detective responded to a call from a fellow professional who operates and maintains a 24,000 gpd extended aeration activated sludge plant that serves a small mobile home community. The operator met the detective at the gate and described the situation: the mixed liquor suspended solids (MLSS) had a very light, yellowish brown color.



PHOTOCOURTESY OF RON TRYGAR

The lab detective ran a reverse India ink stain test on a wet-mount slide of the MLSS. The test proved that the MLSS had excessive slime, as the India ink could not penetrate the floc on the slide.

What's Your Lab Story?

The Lab Detective feature in *TPO* will help operators learn analytical techniques that help diagnose and solve treatment problems. Are you struggling with a process issue?

Send a note to editor@tpomag.com. Your question may become the topic of a future column.

It settled very poorly in the clarifier and in the settleability test container, but the most interesting symptom was the consistency of the MLSS: It appeared to be slimy, almost gel-like. When the operator used a core sampler to determine the sludge blanket depth, the MLSS would cling to the sampler and slowly ooze off the clear plastic tube.

SEEKING CLUES

The MLSS acted similarly in the settleability container, settling slowly with an appearance like cotton candy. The lab detective was perplexed to say the least. He left the treatment plant with many notes, photos, and a small MLSS sample for microscopic diagnosis.

Back at his office, he collected his favorite reference manuals (note references at the end of this article), got a cup of coffee, and went to work.

He suspected a condition called slime bulking, but that condition is uncommon at plants that treat domestic wastewater. Slime bulking occurs frequently at industrial treatment plants where influent nutrient loadings are unbalanced or pH values are low. So what could be causing a slime bulking condition at this small package plant?

The lab detective ran a reverse India ink stain test on a wet-mount slide of the MLSS. The test proved that the MLSS had excessive slime, as the India ink could not penetrate the floc on the slide (see photo). The references offered several clues to the causes of slime bulking. Nutrient-deficient wastewater can be a cause of excessive slime coating on bacterial cell walls.

Just like human beings, bacteria need nutrients for proper cell growth. When bacteria receive proper amounts of vital nutrients like carbon, nitrogen, phosphorus and sulfur, they develop a thin slime coating around their cells that aids in floc formation.

But if one or more of these elements are lacking, the slime layer does not form properly, resulting in a much thicker slime coating. The floc-forming bacteria then cannot clump tightly together, and instead form a loose mass with a jelly-like slime that resists the water surrounding it. In the settleometer, it has a fluffy, cotton-candy appearance and consistency.

INTO THE RECORDS

Armed with this information, the detective reviewed the treatment plant's daily logs, lab results and state discharge reports. One thing stood out: the plant was receiving just under 19,000 gpd of flow, but had a very low influent BOD, at 80 to 85 mg/L. The state did not require influent nutrient testing but did require effluent nitrate nitrogen reporting; the limit was 12 mg/L.

The facility seemed to meet that limit well, with an annual average nitrate nitrogen of 4 mg/L. But, the detective thought, does that mean everything is all right? Perhaps the facility is not nitrifying at all? He needed more information to confirm his hypothesis.

Slime bulking occurs frequently at industrial treatment plants where influent nutrient loadings are unbalanced or pH values are low. So what could be causing a slime bulking condition at this small package plant?

Back at the treatment plant, the detective and the operator collected additional samples from the influent lift station, aeration tanks and clarifier. The detective's hunch proved correct: the influent wastewater contained very little nutrient and was much diluted.

After the detective shared the diagnosis with the plant operator, who also ran the small water system for the community, the operator described the water system operation and water usage. The residents pay a flat monthly rate for their water, rather than pay for the water they actually use, which would be measured by a water meter.

TOO MUCH WATER

The residential services had no water meters — the only meter was at the water plant, measuring daily usage. The local water management district was concerned about the high usage at the utility and required the utility owner to begin a water audit to measure the usage.

With this new information, the lab detective had several 24-hour composite samples of the influent wastewater tested for total Kjeldahl nitrogen (TKN), orthophosphate, ferrous iron, and CBOD. For wastewater to be considered nutrient-balanced, the ratio of carbon:nitrogen:phosphorus:iron should be roughly 100:10:1:0.5 mg/L.

The wastewater entering this treatment plant certainly appeared unbalanced, with readings of 74 mg/L CBOD; 30 mg/L TKN; 2 mg/L PO_4; and 10 mg/L Fe. Why so much TKN and iron? The detective learned that people who cleaned the community recreation building used large amounts of ammonia, and that the drinking water supply contained high soluble iron.

The water system was planning to build an actual water plant to lessen the iron from the water supply, using greensand filters. In addition, water meters were to be purchased for residential metering. The current water plant simply disinfected the source groundwater.

Water systems that do not meter individual residences and use flat-rate monthly billing seem to promote excessive water consumption: The residents do not see the need to conserve water when they do not pay by the gallon.

When residents don't mind their water usage, leaking toilet flapper valves cause toilets to run continuously, and leaking sink fixtures and excessive yard irrigation contribute to excessive usage. All this water running down the drains dilutes the wastewater, creating a high influent flow with low nutrient content.

TOWARD A SOLUTION

The lab detective and the plant operator worked with the utility owner and engineer to educate the residents on the value of water and ways to conserve, especially since the water would soon be billed based on consumption.

The new water plant went into operation shortly thereafter, much to the residents' delight. The water was much more palatable and contained less hardness, and the chlorine demand and dosage decreased, as well.

The effects of the water system upgrades affected the wastewater greatly, too. With the influent flow decreasing, the dilution factor decreased. Nutrient levels approached a near-perfect ratio, and the slime bulking became a thing of the past.

This story is just one example of how connected water and wastewater utilities can be. The condition of the drinking water distribution system and the operation and maintenance of the water utility greatly affect the wastewater collection system and the treatment plant. By communicating more effectively, operators on both sides of a utility can learn from each other and make their jobs easier at the end of the day.

ABOUT THE AUTHOR

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Headworks and Biosolids

By Briana Jones

BIOFILTRATION SYSTEM

Monafil biofiltration system from Anua

The Monafil biofiltration system from Anua uses peat media as a capture and support medium that offers high removal efficiencies for odors, VOCs, sulfur and nitrogen-based compounds. The granular high-density media can achieve high removal via high porosity, good water retention, high cation exchange capacity and large surface area.

The system achieves greater than 99 percent removal of H_2S and greater than 95 percent OU/m³ depending on the application. It resists breakdown with media life up to 10 years. The deeper media (up to 10 feet) allows for a reduced footprint. No chemical or nutrient addition necessary. The media can be graded at the time of replacement and up to 50 percent can be recycled and reused. **800/787-2356; www.anua-us.com.**

Klampress belt filter press technology from Ashbrook Simon-Hartley

FILTER PRESS TECHNOLOGY

Klampress belt filter press technology from Ashbrook Simon-Hartley is adaptable to the full range of sludge types. The technology incorporates multi-zone dewatering, including a conditioning zone, gravity dewatering zone, adjustable wedge zone (also adjustable during operation), radial dewatering zone, and full pressure zone. Depending on sludge characteristics, the press is configured with expanded pressure zones, with an integral gravity belt thickener, as a high solids unit or with a combination of these options.

The unit can also be configured as a vertical belt press incorporating a horizontal gravity belt thickener. The presses are available in 1-, 1.5-, 2-, 2.5- and 3-meter width to support the full range of process flows. Frame components are optimized using finite element analysis to ensure rigidity and accurate, permanent alignment. Units are available in hot-dipped-galvanized carbon steel or stainless steel and as skid-mounted units when a package system is needed. **800/362-9041; www.as-h.com.**

CYLINDRICAL CONTAINERS

TITANTube technology from Flint Industries

TITANTube technology from Flint Industries is a simple and low-cost solution for dewatering biosolids and water treatment sludge. The technology works as a stand-alone treatment or in conjunction with other mechanical dewatering devices.

The units are large cylindrical containers constructed of high-performance woven fabrics. Wet waste is pumped in, trapping the solids and allowing the filtrate to pass through the porous fabric. Once consolidated, the dewatered solids can be disposed of in a landfill or used for beneficial use. When dewatering biosolids or water treatment sludge with a high percentage of fines, a polymer is often injected into the sludge prior to entering the tube. The polymer causes the sludge to flocculate, increasing the efficiency of the dewatering process. **912/685-3375; www.flintusa.net.**

HEAVY-DUTY COMPACTOR

ScrewpactorHD from Headworks Inc.

The ScrewpactorHD from Headworks Inc. is an upgraded, heavy-duty shafted spiral compactor. Features include robust spiral, high-torque and sealed double-thrust bearings. The unit compacts inorganic solids and pieces of the system itself that break down and get caught.

The low-profile conveyor/compactor is about 6 feet long and 3 feet wide, handles about 105 cubic feet per hour, and is easily retrofitted to existing systems. The unit is manufactured from grade 304 or 316 stainless steel, and the shafted spiral is made of alloy steel. Options include a screenings washing system that loosens and emulsifies organic material on the screenings and a continuous bagging module that collects screenings. **713/647-6667; www.headworksusa.com.**

Dimminutor channel disintegrator from Franklin Miller

CHANNEL DISINTEGRATOR

The Dimminutor channel disintegrator from Franklin Miller provides effective automatic screening and grinding of wastewater solids in straight-through channels and wet wells. The unit reduces plastics, wood, rags and other solids to fine bits, enhancing plant operation and improving the reliability of pumps and other downstream equipment.

The unit employs a smooth, continuously rotating design with high torque. As its three bidirectional rotary cutters intermesh at close clearance with stationary cutters, solids are finely reduced to a size small enough to pass through a sizing screen. With no gaps or openings between the screen and cutters, output is controlled. An open design allows it to handle high flow rates with low headloss. The unit is easy to maintain and features individually replaceable cutters, oil lubrication, and a simple rotary design requiring no auxiliary diverter screens. A cantilevered design eliminates seals or bearings near the gritty channel floor. **973/535-9200; www.franklinmiller.com.**

INCLINED SCREW PRESS

RoS3Q inclined screw press from Huber Technology

The RoS3Q inclined screw press from Huber Technology offers fully automatic operation. The press uses minimal energy to dewater municipal and industrial sludge and biosolids, resulting in optimal cake solids, low polymer consumption and high capture rates. It generates minimal noise and wear due to the low speed of the compacting screw. The rotating auger and wide gap between the screw conveyor and sieve make the unit insensitive to coarse material. **704/949-1010; www.huber-technology.com.**

PRESSURIZED SCREENING

Hydro-Sludge screen from Hydro International

The Hydro-Sludge screen from Hydro International is a durable pressurized screen that separates material from sludge and dewaters screened materials for landfill in one operation. The horizontal, inline coarse material separator has an inlet screening zone and a pressing (compaction) zone. The enclosed system reduces odors and has no wash-water requirements. Sludge passes through the perforated stainless steel screen while material larger than 5 mm is captured and conveyed to the compaction zone.

Coarse materials are compacted in the regulating cone, and screenings are discharged for disposal. The unit can be used for pumped feed or on direct discharge from a septage truck and can be used in primary, secondary or combined sludges. It is fully automatic for continuous or intermittent screening. **503/615-8130; www.hydro-int.com.**

IPT from In-Pipe Technology

BACTERIAL FORMULATION

IPT from In-Pipe Technology is a formulation of select, facultative, symbiotic, spore-forming, naturally occurring, non-pathogenic bacteria. The formulation is regularly added in high concentrations to strategic locations through the collection system, enhancing the microbial community so that more reactions occur in the sewer biofilm. This contributes to increased metabolism of wastewater compounds within the sewer.

IPT bacteria are facultative anaerobes that grow quickly in anoxic conditions (using nitrate as a final electron acceptor), aerobically (using oxygen as the final electron acceptor), and at stages in between (using fermentation). The bacteria convert insoluble solids into a soluble format that is more bioavailable, allowing conversion of the soluble organic compounds into carbon dioxide and nitrogen gas. The processing of organic matter in the collection system reduces the biological load to the wastewater treatment plant. As the bacteria enter the plant, they continue to reduce the solids inventory. The combination of reduced influent load, lower solids inventory, and increased biological activity results in decreased sludge production. **630/871-5844; www.in-pipe.com.**

SOLIDS PROTECTION

LEVEL LODOR from JDV Equipment

The LEVEL LODOR from JDV Equipment is a user-friendly, low-maintenance way to protect solids from the environment while containing odors and providing even solids distribution. The system allows for easy swap out of dump containers without taking up more floor space than necessary. The unit sits on top of the container and pivots up to allow the container to be swapped out in minutes and without requiring equipment to be hauled down highways. The built-in leveling device allows even distribution without moving the container, reducing the overall footprint. The unit is fully enclosed. Different versions are available depending on material conveyed and output required. **973/366-6556; www.jdvequipment.com.**

ADVANCED SLUDGE DEWATERING

The Dehydris Twist advanced sludge dewatering process from Infilco Degremont employs the Bucher Unipektin hydraulic piston press technology. The process accepts drinking water and wastewater sludge. The automated process consists of a rotating cylinder and moving piston that continuously squeezes the sludge, allowing the water to pass through flexible drainage elements made of porous woven cloth material. After the sludge enters the cylinder, it is continuously rotated and squeezed by the piston, reaching the limit of mechanical dewatering. The sludge cake is retained inside the cylindrical shell and automatically discharged.

Dehydris Twist advanced sludge dewatering process from Infilco Degremont

Digested sludge can be dewatered to autothermal conditions before incineration. Maximum dry substance content is achieved for chemically treated and denatured sludge. The high level of automation and self-optimizing controls maximize operational safety and performance, allowing for increased productivity in non-stop operation (24/7) with a minimum amount of operator input. **804/756-7696; www.degremont-technologies.com.**

Silo discharger from Sodimate

SILO DISCHARGER

The silo discharger from Sodimate features a vertical spindle fitted with flexible blades to ensure the mechanical discharge of dry solid materials from silos, rigid bins or hoppers. It rotates within the container bottom cone to prevent non-flowing material from jamming, bridging, compacting or rat holing. The mechanical unloader is designed for difficult dry chemicals such as lime and soda ash.

The mechanical bin activator gently and efficiently discharges dry solids and integrates one, two, three and four precise volumetric screw feeders. Each screw feeder is independent and can feed up to 15,000 pounds per hour with different lengths and throughput variations. **773/665-8800; www.sodimate-inc.com.**

DEEP-CHANNEL SCREEN

Fine Screen Type MC from Schreiber

The Fine Screen Type MC from Schreiber is a continuous filter belt deep-channel screen with depths up to 50 feet and widths up to 14 feet including slot spacing to 1 mm. The screen requires little maintenance and is easy to work on without dewatering due to the block design and the absence of underwater moving parts.

The block design consists of two elements, straight or hook, that are interchangeable. The individual filter elements are mounted on two stainless steel support shafts with end caps making up separate blocks. Units can be custom configured and are completely assembled then bolted into place. Each block is mounted on a heavy-duty drive chain with no interconnection to adjacent blocks, eliminating wear. Since the filter belt design is not interconnecting, the blocks can be removed in three steps for inspection and maintenance. **205/655-7466; www.schreiberwater.com.**

(continued)

ENCLOSED THICKENER

The GSCE Gravalbelt from Komline-Sanderson is an enclosed gravity belt thickener that meets requirements for thickening and odor control. The unit uses the company's RotoKone high-rate drainage system. **800/225-5457; www.komline.com.**

GSCE Gravalbelt from Komline-Sanderson

Raptor septage plants from Lakeside Equipment Corp.

ALL-IN-ONE PLANT

The Raptor septage acceptance plant and Raptor septage complete plant from Lakeside Equipment Corp. remove debris and inorganic solids from municipal, industrial and septic tank sludges. The heavy-duty machines incorporate the Raptor fine screen for screening, dewatering and compaction. Accessories include grit and rock removal, and security access, and automated accounting systems. With the addition of aerated grit removal, the acceptance plant is offered as a complete plant. **630/837-5640; www.lakeside-equipment.com.**

POSITIVE DISPLACEMENT PUMPS

NEMO BF/SF positive displacement pumps from NETZSCH Pumps North America are designed for conveying dewatered sludge from a filter press or centrifuge. The customizable rectangular hopper and force feed chamber provide easy entry of the product into the rotor and stator. The coupling rod incorporates a feed screw that extends over the joints and is always positioned opposite the open cavity of the stator. Sludge cake is pushed directly into the open cavity in the shortest possible route, improving chamber filling.

NEMO BF/SF positive displacement pumps from NETZSCH Pumps North America

A friction loss reduction (FLR) system reduces pressure, lowers operating costs and extends the system life. The pumps can handle pressures over 1,000 psi. The company's Ring Nozzle within the FLR system provides a continuous 360-degree even layer of water or polymer within the pipeline for friction loss reduction and pressure reduction. **610/363-8010; www.netzschusa.com.**

Duet Screen from Ovivo

TWO SCREENS IN ONE

The Duet Screen from Ovivo combines a 3 mm fine screen with a finer mesh screen of 500 to 1,800 microns. By adding the second stage screen to a common drum with the first stage fine screen, the unit provides the benefits of two screens. The second stage can remove a substantial amount of fibrous waste, keeping the downstream processes free of as much membrane-fouling waste as possible. The unit is a flow-through screen with low headloss. It can work in a channel with gravity flow or in its own box for gravity or pumped flow applications. **801/931-3000; www.ovivowater.com.**

COMPACT FAN PRESS

The Rotary Fan Press from Prime Solution simplifies dewatering for sludges/slurries by using continuous pressure differential technology. Features includes slow rotational speed (less than 1 rpm), semi-automated operation, self-cleaning, low maintenance, long service life, energy efficiency, portability, minimal footprint, and expandability.

Rotary Fan Press from Prime Solution

Few mechanical parts combined with slow revolution reduces noise and vibration, increases functionality, minimizes maintenance and improves life-cycle costs. Several capacities are available. The simple, compact design allows for easy installation. Skid-mounted systems include a central operator control panel, feed pump, polymer system and inline mixing as standard; plant integrated controls are available. The unit can be tailored for portability and is available as a trailer-mounted mobile system. The system requires minimal supervision. **269/694-6666; www.psirotary.com.**

CheckMate inline check valve from Red Valve Co./Tideflex Technologies

INLINE CHECK VALVE

The CheckMate inline check valve from Red Valve Co./Tideflex Technologies is designed for backflow prevention and odor mitigation. In outfalls, stormwater, CSO and SSO applications, the custom-engineered, all-rubber unibody design eliminates backflow from oceans, rivers and interceptors.

The unit has a low headloss and can open to a near full pipe diameter, maximizing the flow capacity of the outfall, which is beneficial in low-lying areas where limited driving head is available. The valves are available in 4- to 72-inch sizes and are built to suit site-specific and flow needs. The elastomer fabric-reinforced construction eliminates corrosion problems. There are no mechanical components to catch debris, corrode or fail. **412/279-0044; www.tideflex.com.**

HYDRAULIC MIXING

The Rotamix system from Vaughan Company for mechanical hydraulic mixing consists of an engineered arrangement of floor-mounted nozzles fed by the company's Chopper pump. Using custom software, the company analyzes and sizes each application to achieve the desired mixing effect. The unit can be applied in circular, rectangular and oval tanks and basins. **888/249-2467; www.chopperpumps.com.**

Rotamix system from Vaughan Company

CAKE PUMP SYSTEM

BTH cake pump from seepex

The BTH cake pump from seepex allows flow rates up to 220 gpm at pressures up to 540 psi. An auger pushes the cake into the pumping element. The pitch, diameter and speed of the auger can be adjusted to match the application. A customizable open hopper along with system controls results in a non-intrusive cake pump solution. Dry-running protection, load cell sensors, pressure gauge and boundary layer injection complete the system. **937/864-7150; www.seepex.com.**

DEWATERING CONTAINERS

Dewatering containers from Wastequip

Wastequip dewatering containers reduce the cost of waste disposal by separating liquids from solids. Gasketed doors and hydro testing ensure that containers will not leak.

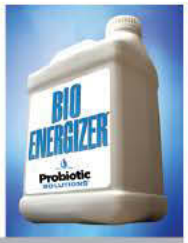
For easy clean up, containers come with easy-to-remove shells that feature a perforated 7-gauge floor. The shells can be removed from the container by removing a few bolts, allowing it to be used as a sludge container. Liners are available to aid in cleanup and disposal. The units can be custom configured for specific applications. For durability, the containers have 1/4-inch floors and 7-gauge sides. Additional features include an outside rail understructure and continuous welds. Lid options include side-to-side roll tarps or single piece, side-to-side plastic or aluminum lids. The units are available in round-bottom or rectangular designs in 20- or 25-cubic-yard sizes. **877/468-9278; www.wastequip.com.**

SELF-CLEANING SCREEN

CleanFlo Monoscreen from WesTech Engineering

The CleanFlo Monoscreen from WesTech Engineering is a high-efficiency, self-cleaning fine screen for a variety of wastewater and process water treatment applications. Using a blade and drive system, the screen creates a progressive step motion that allows the screenings to be evenly distributed while minimizing water level surges. The result is a screenings capture ratio of 82.5 percent. When paired with the company's CleanWash SWP/CPS dewatering unit, the combination maximizes solids capture while minimizing the amount of solids for disposal. **801/265-1000; www.westech-inc.com.**

BIOCHEMICAL OXIDATION



BIO ENERGIZER from Probiotic Solutions

BIO ENERGIZER from Probiotic Solutions is a specialized micro carbon complex that is used in municipal and industrial systems to reduce sludge, odor, BOD/COD, FOG and costs in wastewater treatment plants and lagoons. The formula biochemically oxidizes sludge in lagoons while remaining online and continuing to work, and reduces the lagoon sludge blanket without the need for draining, drying, dredging, handling or hauling.

When used in activated sludge plants, the formula increases volatile solids destruction and improves decant volume and settleability for greater digester and reactor capacity, allowing for more capacity to waste solids. This is important during winter months when land applying is not an option. The formula uses the Micro Carbon Technology as the base ingredient for maximum microbial stimulation to increase the production efficiency of treatment plants by reducing biosolids quickly, improving settleability and raising dissolved oxygen levels. **800/961-1220; www.probiotic.com.** tpo

By Scottie Dayton

Collector chain resists corrosion

Problem

A microbiological attack on the 403 stainless steel collector chains at the Deer Island Sewage Treatment Plant in Winthrop, Mass., reduced their expected life and increased the probability of failure in the clarifiers.

Solution

The Massachusetts Water Resources Authority replaced more than 300,000 feet of original chain with **SS713P 304 stainless steel collector chain from Allied-Locke Industries.** The passivated chain protects against the corrosive environment.

RESULT

Coordination between the system supplier, general contractor, and the authority allowed the manufacture, delivery, and installation of equipment to be completed ahead of schedule and within budget, and allowed continual plant operation. **815/288-1471; www.alliedlocke.com.**

Dewatering doubles handling capacity

Problem

The drying beds that dewatered biosolids at the Groesbeck (Texas) Wastewater Treatment Plant were too small to meet demand. Public Works director Keith Tilley looked for an economical solution.

Solution

The city purchased two 20-cubic-yard tipping stand-mounted **Sludge Mate dewatering containers with Poly-Mate polymer make down system from Flo Trend Systems.** Each container dewaters 15,000 gallons, producing cake at 14 to 16 percent solids for hauling to landfill.

RESULT

The equipment enabled Tilley to double the plant's wasting program and handle future requirements. **713/699-0152; www.flotrend.com.**

Design/build/operate plan improves biosolids program

Problem

The Mebane Bridge Wastewater Treatment Plant in Eden, N.C., operated a pair of 2-million-gallon liquid biosolids storage lagoons for a land application program. The 13.5 mgd plant, which produces 700 to 800 dry tons annually, needed a more sustainable solution for managing the biosolids.

Solution

The plant team chose **Synagro for a design/build/operate procurement process** that allowed lower-cost installation, proven technology, and timely completion. The company provided a dewatering facility with a 2-meter BDP 3DP polymer pump belt filter press with Vogelsang sludge feed, along with a biosolids storage pad.

Synagro staff operates the facility with the plant staff and provides land application of the biosolids cake when weather and crop schedules permit. The design/build/operate process enabled the city to obtain the newest technology.

RESULT

The plant has a sustainable biosolids program of beneficial reuse that also provides flexibility for other options. **800/370-0035; www.synagro.com.**

Bio-augmentation reduces sludge

Problem

The 100,000 gpd sequencing batch reactor at the Henderson (La.) Wastewater Treatment Plant handles 250 to 300 mg/L BOD influent load. Biosolids dewatering and hauling costs were $1,000 per month. Interim mayor Ray Robin looked for products to reduce operating expenses.

Solution

At a Louisiana Rural Water Association meeting, Robin learned about **Sewper Rx bacteria formulation from Reliant Water Technologies.** Representative Jim Dartez trained the treatment plant operators on how to add the ecologically safe, granulated mix. After inoculating the plant with it, they added the product once a month to the upstream sewer lines. Allowing the bacteria to settle throughout the system eliminated odors and grease buildup. When the bacteria eventually reached the plant, it provided the same level of treatment as dosing it directly into the facility.

RESULT

Six months passed before the plant hauled a load of biosolids for $1,350, saving the town more than $4,500. **504/400-1239; www.reliantwater.us.com.** tpo

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Lighting the Way

MICROWAVE UV DISINFECTION TECHNOLOGY ENABLES A TREATMENT PLANT IN SOUTHERN LOUISIANA TO REDUCE LABOR HOURS AND ELIMINATE CONTRACTOR EXPENSES

By Scottie Dayton

An upgrade to the Mandeville (La.) Wastewater Treatment Plant from 2 to 4 mgd included replacement of an aging UV disinfection system that used electrode lamps with receptacle plugs and ground fault circuit interrupters.

The facility had two banks of UV lights in one channel and one bank in the second channel, for a total of 264 bulbs. Burning continuously, the horizontal bulbs heated to 160 to 180 degrees F, hot enough to bake debris onto the sleeves and shorten lamp life. Operators watched for rising bacteria numbers to tell them when bulbs had burned out, but they still didn't know which ones had failed.

After researching replacement options, director of Public Works David deGeneres chose the MicroDynamics microwave UV disinfection system from Severn Trent Services. "We gambled a little because the technology, although successful overseas, isn't well known in this country," he says. "However, the bulbs have self-cleaning wipers and require no maintenance. We'll save $300,000 in the first three years of operation and 416 labor hours annually."

Henry Evans, assistant superintendent at the Mandeville Wastewater Treatment Plant, uses the touch screen to program a MicroDynamics microwave UV disinfection module from Severn Trent Services.

The eight OCS 660 UV units with 16 bulbs each were installed in two trains of four. With 136 fewer bulbs, the facility also will save electricity.

PHOTOS COURTESY OF DAVID WITTNER

The Mandeville plant has eight OCS 660 microwave UV modules with 16 bulbs each installed in two trains of four. The third channel is for future expansion.

REDUCING MAINTENANCE

Before the replacement, the city was paying a contractor $100,000 a year to replace sleeves and bulbs in the UV system rather than divert operators from their duties. "Properly seating and sealing the sleeves and O-rings is a delicate operation," says deGeneres. "If done incorrectly, a leaking seal might short out the entire rack." About 85 percent of the contractor's expense was parts.

Cleaning the bulbs was the biggest issue, requiring eight hours per week. "The racks weren't easy to extract," says deGeneres. "After hanging them up, the operators would scrub the bulbs with a light acid. Frequent removal and replacement damaged the lamps and broke sleeves." The operators also pressure washed the channels weekly.

The 1.5 mgd (average) treatment plant uses three gravity-fed aeration ponds in series to treat the wastewater before disinfection and discharge to a wetland. The upgrade by Gilmore & Son Construction Corp. of Baton Rouge included three new disinfection channels 49 inches deep.

"One UV module treats 1 mgd, but the engineers designed for redundancy," says deGeneres. "By putting four modules in each channel, we can divert our entire flow to one channel if the other goes offline."

Based on flow, automatic gates on the channels open or close to maintain water levels. The third channel, for future expansion, will probably receive UV units in 2013.

The technology uses microwaves to energize gases in the bulbs and generate consistent-strength UV disinfection. The modular, open-channel design allows the tops of the vertical bulbs to remain above the water.

Each assembly, driven by a magnetron powered by a dedicated power unit, has four UV bulbs with waveguides contained in a quartz sleeve. If a bulb needs replacing, the operator removes the cover and three bolts, lifts out the assembly without touching the sleeve, and snaps the bulb out. "Every component is modular with quick-connect plugs," says deGeneres. "Repairs are simple and take minimal time."

Switching to the new UV system involved closing one valve and opening another. "We were probably offline for eight hours for piping and installs," says deGeneres. "The modules arrived on a pallet, and all the contractor did was lower them into the channels."

AUTOMATED OPERATION

A Severn Trent technician programmed the software, set the parameters, and trained the operators for two days. The modules use MicroPace flow-pacing technology, which measures the transmittance of the water and the flow. An external flowmeter signals the computer to reduce power to the magnetrons or turns them off as flows decline, then reactivates them as flows increase.

At full power, the quartz sleeves reach 115 degrees F, making them less susceptible to fouling. The team programmed the wipers to activate every eight hours, sending stainless steel brushes up and down the length of the sleeves to clean them.

Although the UV software isn't tied to the plant SCADA system yet, it is connected to a central computer in the rear of the plant. Operators receive alerts to problems and their locations. For example, if a probe on the outside of the sleeve doesn't sense enough light, it sends a low-intensity output warning for a specific bulb.

"The first thing we do is hit the manual override button on the wiper to see if it's working," says deGeneres. "If it is, we have a different issue, but troubleshooting is as simple as following a recipe in a cookbook."

Although the new system costs 15 to 20 percent more than the original UV system, the savings from reduced maintenance make up the difference: "The system has many benefits and my guys love it," deGeneres says. **tpo**

> "One UV module treats 1 mgd, but the engineers designed for redundancy. By putting four modules in each channel, we can divert our entire flow to one channel if the other goes offline."
>
> **DAVID deGENERES**

Share Your Idea

TPO welcomes news about interesting methods or uses of technology at your facility for future articles in the How We Do It column.

Send your ideas to editor@tpomag.com or call 877/953-3301.

To aid the viewing experience, the city built a wooden walkway with rails that reaches more than 730 feet over the pond and shoreline. There are also three 10-foot-square observation decks and a 26-foot-tall observation tower.

PHOTOS COURTESY OF NUECES COUNTY

Nothing But Benefit

A POND-WETLAND COMPLEX IN PORT ARANSAS, TEXAS, ATTRACTS BIRDERS AND NATURE LOVERS AND HELPS CLEAN TREATMENT PLANT EFFLUENT IN THE BARGAIN

By Jeff Smith

Officials in the Texas gulf coast City of Port Aransas will tell you that locating an avian center adjacent to the wastewater treatment plant has been nothing but a benefit.

"It brings in a lot of tourists and presents the plant as a good neighbor — which it is," says Mark Young, district manager of the Nueces County Water Control & Improvement District No. 4, which owns and operates the plant.

Occupying nearly 10 acres of wetlands that include an 8-acre pond, the Leonabelle Turnbull Birding Center is a major tourist attraction to this city of nearly 3,500 full-time residents. Winter Texans swell that population to around 12,000.

CLOSE COLLABORATION

The center was created in 1994 from a vision of Young's predecessor, Nona Sherrill. The effort coincided with a requirement of the Texas Parks and Wildlife Department that the city provide mitigation and remedy for alterations made to a roadway at a separate city park project.

Once the city council approved the project, it took collaboration to ensure success. Key players included the U.S. Army Corp of Engineers, the USDA/Soil Conservation Service, the U.S. Fish & Wildlife Service, the Port Aransas Independent School District, and the Texas Parks and Wildlife Department. The first goal was to secure a long-term lease from the Nueces County district for the land.

"The discharge of freshwater from the plant is the reason the pond is there," says Young. And the pond anchors the wetland that birding enthusiasts say attracts vast numbers of waterfowl and other seasonal birds year-round. To aid the viewing experience, the city built a wooden walkway with rails that reaches more than 730 feet over the pond and shoreline. There are also three 10-foot-square observation decks and a 26-foot-tall observation tower.

> "It serves as a real good outreach to the community. And we also get several school groups each year."
> **JOHN MCKINNEY**

GREETED BY A MURAL

Visitors to the birding center park in a paved lot directly in front of the 1.88 mgd (design) activated sludge plant. Young says that to be a good neighbor, the plant team painted a 150- by 11-foot mural on the oxidation tank that faces the lot. The mural depicts water scenes with migrating birds and wildlife often seen in the area.

The project involved substantial community support, including business and civic leaders. Even the local garden club decorated the entrance and 300-foot gravel walkway that leads to the wooden walkway with native plants and grasses, such as seacoast bluestem and other primary vegetation. "Without the cooperation of a lot of people, the project would not have happened," Young says.

DOWN WITH NUTRIENTS

Chief operator John McKinney says visitors to the birding center often include a tour of the plant. "It serves as a real good outreach to the community," McKinney says. "And we also get several school groups each year." The

Occupying nearly 10 acres of wetlands that include an 8-acre pond, the Leonabelle Turnbull Birding Center is a major tourist attraction to this city of nearly 3,500.

The plant team painted a 150- by 11-foot mural on the oxidation tank that faces the parking lot. The mural depicts water scenes with migrating birds and wildlife often seen in the area.

City of Port Aransas operates and maintains the birding center, and the land leased by the district must be held in perpetuity and be managed as an open space and natural area to maintain habitat for wildlife.

Young says effluent from the plant is even cleaner when it empties into the Corpus Christie Bay because of its flow through the birding center. For example, tests show a drop in phosphates from 4.8 to 1.1 mg/L, and nitrogen drops from 32.2 to 9.8 mg/L.

"It's really just using an available resource," says Young. "You have taken something in the worst part of town that no one wants to be around and made it into a valuable resource." **tpo**

Share Your Ideas

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

Driving Down P

A RESEARCH PROJECT HELPS ESTABLISH THE COST-BENEFIT PICTURE FOR CHEMICALLY REMOVING PHOSPHORUS IN LAGOON TREATMENT SYSTEMS

By Ted J. Rulseh

Pat Morrow

State regulatory agencies are ratcheting down nutrient limits for wastewater treatment plants, notably limits on phosphorus. Reaching extremely low phosphorus limits is especially challenging for lagoon systems.

To help demonstrate the levels to which phosphorus can be removed cost-effectively, Pat Morrow, P.E., of MSA Professional Services, headquartered in Baraboo, Wis., conducted a pilot study of treatment by alum addition at the O'Dell's Bay (Wis.) Wastewater Treatment Facility, a 30,000 gpd (average) covered lagoon facility.

Morrow, who is a certified Wisconsin wastewater operator (Grade 2 activated sludge, disinfection, and Special K-Recirculating Sand Filters) talked about his study design and results in an interview with *Treatment Plant Operator*.

tpo: What was the impetus for this pilot study?

Morrow: In Wisconsin, there are new water-quality-based phosphorus limits, enacted in 2010. We are the contract operators for the O'Dell's Bay treatment facility, and we designed an upgrade for it in 2007. So we were in a position to pilot-test alum addition to remove phosphorus. We did that with the permission of the client, who paid for the sampling costs.

"The Department of Natural Resources has clearly stated that the phosphorus variance is not a get-out-of-jail-free card. It appears that, eventually, lagoons will be required to do whatever is economically feasible to remove as much phosphorus as they can."

PAT MORROW, P.E.

tpo: How would you describe the objective of this project?

Morrow: Our aim was to measure how low we could cost-effectively go with chemical phosphorus removal. What happens with chemical treatment for phosphorus is that to achieve lower levels, you have to add more and more chemical. It's not a linear relationship — those last few pounds of phosphorus you take out at very low concentrations become really expensive.

Wisconsin used to have an effluent limit of 1.0 mg/L for phosphorus. This facility's discharge ends up in Castle Rock Lake, an impoundment of the Wisconsin River that is an impaired waterway. Under the new water-quality-based rules, they are eventually looking at a 0.03 mg/L phosphorus limit.

Our purpose wasn't to see if the lagoon system could meet that limit. The purpose was to take as much out as we could and document the cost. Wisconsin allows other avenues such as watershed-based approaches, where you remove phosphorus as best you can, then go out into the watershed and offset the remaining contribution.

tpo: Does this approach have applications for different types of lagoons?

Morrow: All lagoons can remove some phosphorus by addition of alum or ferric chloride. It has been done in multiple types of lagoons with a variety of methods.

tpo: What exactly is O'Dell's Bay facing with regard to phosphorus limits now and in the future?

Morrow: O'Dell's Bay is a small sanitary district in central Wisconsin where winter flows are about 20,000 gpd and summer flows can be up to 90,000 gpd because a lot of people have second homes in the area.

They are not required to remove phosphorus now, but they will be. When their next WPDES permit is issued, we expect there will be a requirement to do a feasibility study of whether they can remove phosphorus to meet a future limit of 0.03 mg/L. They will not be able to, but the Wisconsin Administrative Code allows for lagoons to receive an economic variance. To qualify, you need to demonstrate economic hardship.

The Department of Natural Resources has clearly stated that the phosphorus variance is not a get-out-of-jail-free card. It appears that, eventually, lagoons will be required to do whatever is economically feasible to remove as much phosphorus as they can. And they can make a big improvement because the initial pounds of phosphorus at higher concentrations can be removed somewhat readily — you can get a lot of bang for the buck as opposed to doing nothing.

tpo: What is the basic nature of the O'Dell's Bay treatment system?

Morrow: This district has what textbooks would consider a high-performance aerated lagoon system. There are three lagoon cells in series. In the complete mix cell, enough energy is introduced through aeration to maintain a completely mixed reactor. In the partial mix cell, aeration is supplied for remaining BOD degradation and solids stabilization, but not enough for complete mixing.

The final effluent clarifies in the settling cell, which is followed by

UV disinfection. There is an insulated floating cover on the lagoons with hatches to access the fine-bubble diffusers for cleaning or maintenance. They also have influent and effluent flow metering.

tpo: For the pilot project, how was the chemical feed system designed?

Morrow: We fed the alum between the complete mix and partial mix ponds. It was a very simple and inexpensive setup. Next to an existing building we installed storage and delivery tanks for the alum. Inside we mounted a chemical feed pump to a wall. We ran a tube out to a manhole between the two lagoon cells. Finally, we created an alum injection apparatus to ensure effective mixing, thus maximizing contact with the wastewater, so that the alum would grab onto as much of the phosphorus as possible. The aluminum ions from the alum react with phosphate to form an insoluble precipitate.

tpo: How was the actual pilot testing conducted?

Morrow: We completed three discrete pilot runs from July 2010 to September 2011 and in each case collected effluent phosphorus samples on a weekly basis. The theoretical dosing for alum treatment is one mole of aluminum per mole of phosphorus to be treated, but lagoons often need elevated aluminum/phosphorus ratios, and the ratio increases with decreased phosphorus concentration. Our goal was to feed between 3.5:1 and 1.5:1 molar ratios and document removal and associated costs.

tpo: What were the results of the three pilot test runs?

Morrow: We measured influent phosphorus at the outlet of the complete mix lagoon, since some of the phosphorus gets taken up by bacteria in that cell. For the first pilot run, our influent phosphorus was 3.6 mg/L, and we averaged an alum dosage of 3.6:1. At that concentration we were able to get the phosphorus down to 0.43 mg/L. The overall chemical cost per pound of phosphorus removed was $10.88.

For the second test run, we averaged a 1.7 molar ratio. Our influent phosphorus was higher at 6.0 mg/L. Effluent phosphorus was 2.05 mg/L, and the overall chemical cost per pound of phosphorus removed was $5.14.

For the third test run, we chose a middle-of-the-road dosage of 2.2:1, shooting to hit an effluent phosphorus level of about 1.0 mg/L. The influent phosphorus was 4.92 mg/L, the effluent level averaged 0.91 mg/L, and the overall chemical cost per pound removed was $6.65.

Summary of Pilot Tests

	Alum:P Ratio	Influent P	Effluent P	Overall Chemical Cost/Pound of P Removed
Pilot Test 1	3.6:1	3.6 mg/L	0.43 mg/L	$10.88
Pilot Test 2	1.7:1	6.0 mg/L	2.05 mg/L	$5.14
Pilot Test 3	2.2:1	4.92 mg/L	0.91 mg/L	$6.65

tpo: What does this exercise demonstrate?

Morrow: It shows that with phosphorus treatment by addition of alum, the cost goes up exponentially as you try to take the effluent phosphorus lower (Figure 1). It goes exponential because you're talking about diminishing returns. As you keep pumping more alum in, you get less and less proportional benefit out. You get more and more cost, but less and less benefit.

It's fairly easy and relatively inexpensive to get after phosphorus in the range of 5.0 mg/L to 2.0 mg/L. You don't have to add a ton of chemical to do that. But as you remove more phosphorus, the *incremental* cost per pound increases dramatically (Figure 2). Incremental costs represent the additional degree of chemical "effort" needed as you remove phosphorus at lower and lower concentration ranges.

If you're a fisherman, think about a full minnow bucket. It's pretty easy to scoop those minnows out with a small net. That's like going from 6.0 mg/L to a 0.9 mg/L phosphorus concentration. Now think of three guys and one big net in a lake with hardly any minnows in it. That's like going from a 0.9 mg/L to 0.4 mg/L.

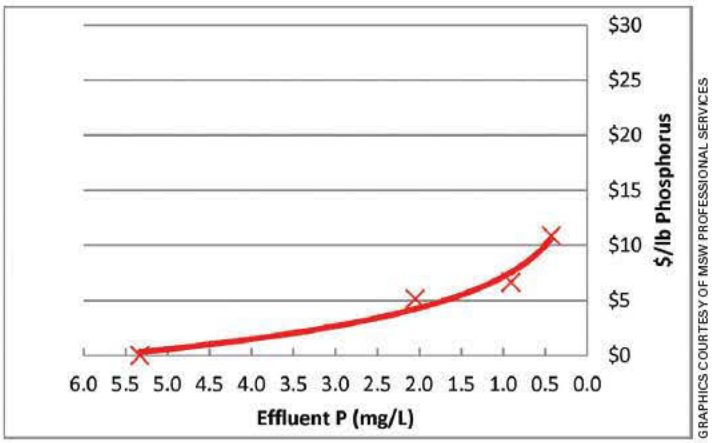

FIGURE 1 – With phosphorus treatment by addition of alum, the cost goes up exponentially as the effluent phosphorus is driven lower.

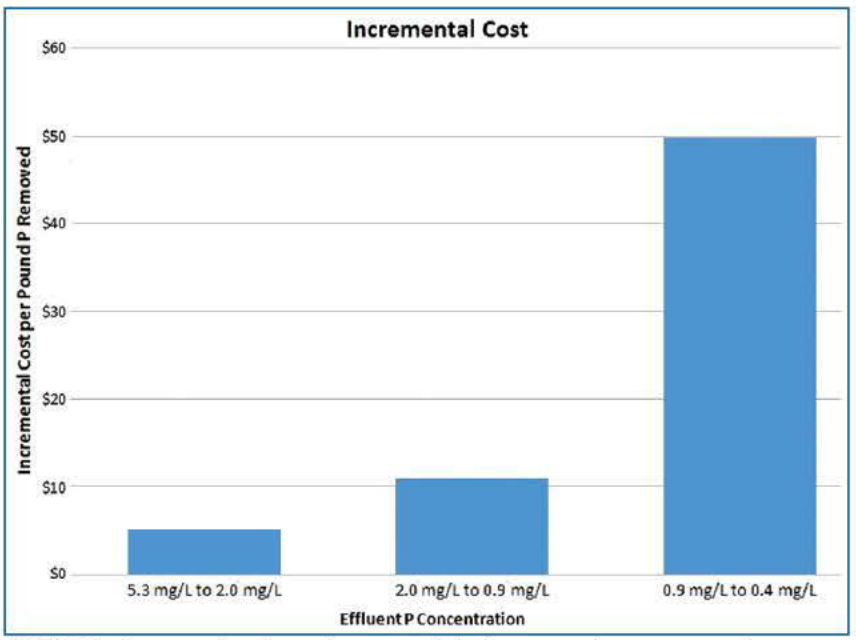

FIGURE 2 – As more phosphorus is removed, the incremental cost per pound increases dramatically. Incremental costs represent the additional degree of chemical "effort" needed as phosphorus is reduced to lower and lower concentrations.

tpo: So, where does the real point of diminishing returns kick in?

Morrow: I would say the diminishing returns really start around 0.8 mg/L, but what's cost-prohibitive to one community may not be to another. A bigger treatment plant with a lot of users to spread the costs over might see things differently than a small facility that serves perhaps 200 residents. Then again, as treatment plant size increases, the total pounds of phosphorus and associated cost of removal increases.

tpo: Does the type of lagoon affect the performance of alum treatment for phosphorus removal?

Morrow: Covered lagoons have a better chance of reaching low levels of phosphorus. That's because with a covered lagoon you have much lower effluent TSS. The TSS is very algae-dependent, and you have more algae in an uncovered system. There is phosphorus in the algae itself, and phosphorus also clings to solids particles, so if you have high TSS, you will have a hard time getting low phosphorus. **tpo**

Peerless Electronics launches eCommerce stores

Peerless Electronics, distributor of electromechanical and interconnect products, launched six vertical market eCommerce stores. Accessed from www.peerlesselectronics.com, the stores offer switches, relays, circuit breakers, contactors, connectors, terminal blocks, splices, heat shrink and indicator lights and fuses.

TB Wood's publishes eCatalog

TB Wood's expanded its eCatalog, www.tbwoods.com, to include its Sure-Flex, Dura-Flex and Form-Flex couplings. The site enables users to select the correct coupling for a specific application.

ITC becomes authorized IACET provider

The Infrared Training Center has received authorized provider status from the International Association for Continuing Education and Training to provide IACET continuing education units. The recognition period extends for five years and includes all programs offered or created during that time.

Westfall static mixer receives NSF certification

Westfall Manufacturing Co.'s Model 2800 static mixer has been evaluated and certified by NSF International. The mixer is a fixed plate that mounts inline, can inject up to four chemicals simultaneously and features an internal orifice with angle tabs for mixing with minimal headloss.

EOSi names director of supply chain management

Rob Keeling joined EOSi as director of supply chain management. He has 10 years experience in supply chain management, purchasing and operations. In addition to managing raw materials procurement, manufacturing, packaging and inbound/outbound logistics for EOSi's 10 production facilities, Keeling will be responsible for identifying new materials for use in future products.

Thompson hosts 2012 Pumpology school

Thompson Pump & Manufacturing Co. held its 22nd annual Pumpology school at its corporate facilities in Port Orange, Fla. A total of 50 attendees from 19 states and three foreign counties participated in the three-day workshop that included training sessions for sales and service professionals in pumping fundamentals, dewatering and bypass applications, selecting the correct equipment, designing, installing and maintaining pumping systems and troubleshooting.

FCI ST100 air/gas flowmeter receives FM, FMc approval

The ST100 Series thermal mass air/gas flowmeter from Fluid Components International received FM and FMc approval from FM Global, certifying the meter conforms to the highest national and international safety standards. The meter received approvals for Class 1, Division 1 hazardous locations, Groups B, C, D; Class II and III, Division 1, Groups E, F, G; nonincendive Class I, Division 2, Groups A, B, C, D; nonincendive Class II, Division 2, Groups E, F, G.

Oldham's OLCT IR receives IP67 certification

Oldham's OLCT IR infrared fixed gas detector, tested according to IEC/EN 60529, was awarded IP67 protection degrees. Tests were conducted by INERIS, one of two IECEx certification bodies in France. The design protects the OLCT IR against dust and the effect of immersion in up to one meter of water.

MWH meets UCMR3 proficiency testing requirements

MWH Laboratories, a division of MWH Global, has met all proficiency testing requirements by the U.S. Environmental Protection Agency for the third round of the Unregulated Containment Monitoring Regulation. Beginning in January, water utilities serving a retail population of more than 10,000 are required to conduct one year of monitoring for 28 contaminants being considered for future regulation. Only laboratories approved by the EPA specifically for the UCMR3 monitoring program are allowed to report results.

Copperwing adds media planner, buyer

Natalie Panciera

Copperwing Design hired Natalie Panciera as media planner and buyer. She is responsible for the development of multimedia plans, strategies and campaigns in support of client goals and objectives. Company clients include the water and wastewater industry.

Parkson names Hurley president, CEO

Parkson Corp. named Shamus M. Hurley president and chief executive officer. He replaces Zain Mahmood who stepped down after five years as CEO.

Grundfos opens business development center

Grundfos opened its business development "competency center," approximately 40 miles west of Chicago. The center serves all of North America and is devoted exclusively to the municipal wastewater industry. It is housed in the 105,000-square-foot, pump-manufacturing facility of the former Yeomans Chicago Corp., which Grundfos acquired in 2008.

American Water completes acquisitions

American Water Works Company, a publicly traded U.S. water and wastewater utility company, completed its acquisition of seven water systems in New York and the sale of its regulated operations in Ohio. The agreement for the transactions with Aqua America was announced in 2011. The completion was contingent upon regulatory approval in New York and Ohio.

Xylem names VP of sales, managing director

Mike Delzingaro

Grant Salstrom

Xylem named Mike Delzingaro vice president and director of sales for dewatering solutions. He has 14 years experience and was regional manager for the Northeast region. The company also named Grant Salstrom managing director, Godwin. He will be responsible for the growth and development of the Godwin and Flygt brands.

Environmental Dynamics International adds extrusion line

Environmental Dynamics International added an extrusion line to support the production of elastomeric membranes. The line complements a 2009 expansion into perforation technology. tpo

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T420 and T440 thermal imagers from FLIR Systems feature a thermal resolution of 76,800 pixels (320 x 240) for accurate diagnostics, even from a distance, and MSX Multi-Spectral Dynamic Imaging. MSX adds the detail of real-time visible spectrum images captured by the built-in digital camera to thermal spectrum images to instantly highlight problem areas. **866/477-3687; www.flir.com.**

2. ABB VIDEOGRAPHIC DATA RECORDER SOFTWARE

DataManagerPRO videographic data recorder software from ABB Inc. enables users to collect data from multiple recorders either manually from memory cards or automatically via a network. Functions include the ability to compile graphical cards from the data, which display a range of different parameters that can be readily compared and contrasted. Other features include a dual cursor function and marker function that shows normal conditions for the process, enabling operators to spot deviations. **800/752-0696; www.abb.com.**

3. BLUE-WHITE CHEM-PRO METERING PUMPS

Chem-Pro C2 and C3 metering pumps from Blue-White Industries have a 1/2-inch ball check valve in the PVDF pump head for pumping viscous fluids. Other features include DC gear motor in a chemical-resistant polyester-coated metal housing for washdown applications, built-in controller with remote speed control, built-in leak detection system that senses chemicals in the pump head, alarm output and flow verification system. Maximum output is 42 gph and maximum pressure is 175 psi. **714/893-8529; www.blue-white.com.**

4. HAMMOND STAINLESS STEEL ENCLOSURES

Floor-mounted and freestanding stainless steel enclosures from Hammond Manufacturing Co. are designed to house electrical, electronic, hydraulic or pneumatic controls and instruments. The 1418, 1422 and HN4SS series are manufactured from 304 or 316 grade stainless steel with a smooth brushed finish. All seams are continuously welded, ground smooth and sealed to NEMA 4X rating. Units include heavy-duty lifting eyes. Doors are mounted on continuous hinges and sealed with a seamless, poured-in-place gasket. **519/822-2960; www.hammondmfg.com.**

5. XYLEM APP 800 PUMP CONTROLLER

The Flygt APP 800 pump controller from Xylem is engineered to control water and wastewater transport systems, showing the volume of liquid that's being pumped and the amount of energy being consumed. An embedded Web server gives operators access to data from anywhere, enabling them to monitor equipment, troubleshoot and identify trends, diagnose and resolve issues from a remote location. The controller is pre-engineered and pre-packaged for instant use and can be connected to a SCADA system for seamless integration. Other features include color touch screen, intuitive graphical interface and full telemetry and alarm handling distribution, data logging and data storage. **704/409-9700; www.flygtus.com.**

6. ENECON 100-PERCENT SOLIDS PROTECTIVE COATING

CHEMCLAD SC from ENECON Corporation is a two-component, 100-percent solids, polymer system used for creating a high-quality corrosion- and chemical-resistant protective coating on all types of equipment and structures. The product mixes easily and can be applied by brush or roller. It is available in safety yellow and other colors to simplify overcoating. The high-gloss coating yields a surface that is functional and aesthetically pleasing. **888/436-3266; www.enecon.com.**

7. ULTRA ELECTRONICS MX-SERIES MULTIPLEXERS

MX-Series multiplexers from Ultra Electronics transmit up to 16 channels of bidirectional electrical information over a pair of fiber optic cables. Features include input/output module selections that include 4-20 mA, 0-10 VDC, contact closure and RS232/485. The MX base unit connects directly to the fiber optic cable and provides a visual indication of the link status. Power is supplied through an external 24 VDC supply. Each base unit has a duplex optical port configured for use with 1300 nm wavelength and single- or multi-mode optical fiber. **800/880-9333; www.ultra-nspi.com.**

8. OPTO 22 ZERO-CONFIGURATION ANDROID APP

The zero-configuration Android application for automated control systems from Opto 22 monitors and manages the company's SNAP PAC system using mobile devices with Android operating systems. The aPAC provides real-time control system access and information to authorized automation professionals, enabling them to discover SNAP PAC controllers and I/O systems, view, debug and fine-tune them. The app requires no initial configuration. **800/321-6786; www.opto22.com.**

9. HACH BOD TESTING PACKAGES

HQd series meters and IntelliCAL LBOD probe from Hach are designed to simplify BOD testing. Calibrations and measurements can be performed without pre- programming. The probe has no membranes to replace. Features include backlit meter display for easy reading, even in sunlight glare, internal data storage and ability to enter user IDs and sample IDs to ensure data integrity. A USB port enables data transfer. Meters and probe can be ordered separately or as a bundled kit. **800/227-4224; www.hach.com.**

10. SJE-RHOMBUS ENGINEERED FILTRATION SYSTEM

The engineered filtration system from the Ceramic Filtration Solutions group at SJE-Rhombus is fully automated and includes the option for remote monitoring. Applications include membrane bioreactor, tertiary treatment (wastewater polishing), industrial process wastewater treatment, pre-filtration to reverse osmosis, groundwater treatment and oil/gas produced water filtration. Features include flat-sheet membranes and pre-assembled filtration components. **888/342-5753; www.sjerhombus.com. tpo**

product spotlight

WS Series control panels from SEEwater

Simplex, duplex control panels provide total pump protection

By Ed Wodalski

Single- and three-phase WS Series wastewater/sewage simplex and duplex control panels from SEEwater include Smart Board pump protection for longer pump life and performance.

"The duplex system provides high-demand, two-pump operation for above-normal volumes by allowing both pumps to run simultaneously," says Michael Johnson, vice president. "It also provides standby capacity if one unit fails." Applications include sewage pump chambers, sump pump basins and lift stations. The panels can be used with grinder pumps.

"We offer a complete line of pre-engineered control panels that are specific for single- and three-phase wastewater and sewage pump applications," Johnson says. "The panels come standard with complete pump status monitoring and protection, including visual indicators and adjustable overload protection. They also come with seal failure and thermal cutout/heat sensor circuits and dry contacts (high liquid, pump run and pump fault) for remote alarms, auto dialers or building automation systems."

Duplex control panels are available in three, four-float models (WD1P-3-4, WD3P-5-4, WD3P-10-4). Model WD1P-3-4 is a 120/208/240 VAC single-phase control that operates pumps up to 1 hp at 120 volts or 2 hp at 208/240 volts. Model WD3P-5-4 is a 120/208/240 VAC three-phase control that operates pumps up to 3 hp at 208/240 volts. Model WD3P-10-4 is a 480 VAC three-phase control that operates pumps up to 7.5 hp at 480 volts and includes through-door main disconnect. Three-float models for two-pump operation and high-liquid alarm are available.

Simplex control panel models include WS1P-TP (120/208/240 VAC single-phase), WS3P-TP (120/208/240 VAC three-phase) and WS3P-TP-B (480 VAC three-phase).

The NEMA 4X polycarbonate panels have visible pump-run LED indicators, hand-off-auto (HOA) switches, green pump-run and red pump-fault lights with reset button, and power-on light. Visible-mounted alarm features include high red-beacon alarm light, alarm test, silence buttons and high 85-decibel audible alarm.

The control system includes three or four narrow-angle float switches with 20-foot cords and mounting hardware. Panels and controls are UL listed for the United States and Canada and CSA certified. Custom options are available. **888/733-9283; www.seewaterinc.com.**

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people/awards

Cliffs Natural Resources Inc.'s United Taconite Mine received the Wastewater Treatment Facility Operational Award from the Minnesota Pollution Control Agency. The award is given for outstanding operation, maintenance and management of wastewater treatment systems.

The **Vernon (Conn.) Water Pollution Control Facility** received a Congressional Record Statement from U.S. Rep. Joseph Courtney for winning a Wastewater Utility of the Year Award from the New England Water Environment Association.

Clean's plant in O'Fallon, Mo., received the 2011 Gold Award for Outstanding Practices in Wastewater Pretreatment from the Missouri Water and Environmental Association.

The **Whitewater (Wis.) Wastewater Treatment Plant Laboratory** was named the best large certified lab in the state by the Department of Natural Resources.

The **Minnesota Pollution Control Agency** recognized the following people and facilities for maintaining a perfect record of compliance with their wastewater treatment permits during 2011:

- **Jerry Vogt,** City of Worthington-Worthington Industrial
- **Scot Spranger,** Alexandria Lake Area Sanitary District
- **Henning Wastewater Treatment Facility**

Paula Byers, laboratory supervisor with the Town of Culpepper (Va.) Wastewater Treatment Plant, received the Laboratory Technician of the Year Award from the Virginia Rural Water Association.

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

education

Illinois

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

Kansas

The Kansas Water Environment Association has an Electrical Motors and Drives seminar Aug. 8-9 in Emporia. Visit www.kwea.net.

Kentucky

The Kentucky Water & Wastewater Operators Association has a Confined Space Training workshop on Aug. 16 in London: Visit www.kwwoa.org.

Michigan

The Michigan Water Environment Association is offering the following courses:

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

Visit www.mi-wea.org.

Massachusetts

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

North Carolina

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

- Aug. 6-10 – Collection and Distribution School, Morganton
- Sept. 11 – Advanced Topics in Wastewater Seminar, Lexington
- Sept. 27 – Collection and Distribution Seminar, Greensboro

Visit www.ncsafewater.org.

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

CALENDAR OF EVENTS

Aug. 7-9
International Society of Automation Water/Wastewater and Automatic Controls Symposium, Holiday Inn Castle Resort, Orlando, Fla. Visit www.wef.org.

Aug. 26-29
American Public Works Association Expo, Anaheim (Calif.) Convention Center. Visit www.apwa.net/congress.

Aug. 28-30
Kansas Water Environment Association Annual Conference, Topeka. Visit www.kwea.net.

Sept. 9-12
Rocky Mountain Water Environment Association Annual Conference, Copper Mountain, Colo. Visit www.rmwea.org.

Sept. 12-14
South Dakota Water and Wastewater Association Annual Conference, Ramkota Convention Center, Rapid City. Visit www.sdwwa.org.

Sept. 13-14
New York Water Environment Association Science and Technical Conference, Hotel Thayer, West Point. Visit www.nywea.org.

Sept. 19-20
Kentucky Water & Wastewater Operators Association Fall Wastewater Training Conference, Falls of the Rough. Visit www.kwwoa.org.

Sept. 29-Oct. 3
Water Environment Federation Technical Exhibition and Conference, New Orleans Morial Convention Center. Visit www.weftec.org.

Oct. 9-12
Wisconsin Wastewater Operators Association Annual Conference, Kalahari Resort, Wisconsin Dells. Visit www.wwoa.org.

Oct. 14-16
Atlantic Canada Water & Wastewater Association Annual Conference, Charlottetown, Prince Edward Island. Visit www.acwwa.ca.

Oct. 21-24
Pacific Northwest Clean Water Association Annual Conference and Exhibition, Boise Centre, Boise, Idaho. Visit www.pncwa.org.

Oct. 23-24
New England Water Environment Association Northeast Residuals, Biosolids and Energy Conference, Amherst, Mass. Visit www.newea.org.

New York

The New York Water Environment Association has a Fundamentals of Wastewater Asset Management seminar on Aug. 29 in Potsdam. Visit www.nywea.org.

Wisconsin

The Wisconsin Wastewater Operators Association has a Microscopic Examination of Activated Sludge seminar on Aug. 13 in Birnamwood. Visit www.wwoa.org.

The University of Wisconsin Department of Engineering-Professional Development has a Processes, Design and Operation seminar Sept. 25-27 in Madison. Visit www.epdweb.engr.wisc.edu. **tpo**

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