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**Hearts and Minds:
Art and poetry contest
in New York City**

PAGE 16

Pride in the Products

**A CALIFORNIA AGENCY CREATES A BRAND
FOR ITS RECYCLED WATER, BIOGAS ENERGY,
AND PELLETIZED BIOSOLIDS**

PAGE 18

**Let's Be Clear:
It's not "human waste"**

PAGE 8

**How We Do It:
Magnetite ballast for
phosphorus removal**

PAGE 26



Octavio Navarrete
Operations Manager
Carlsbad, Calif.





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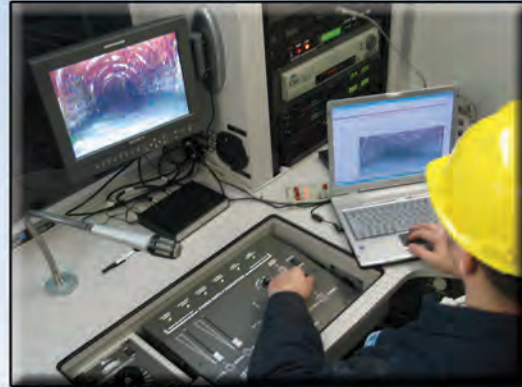
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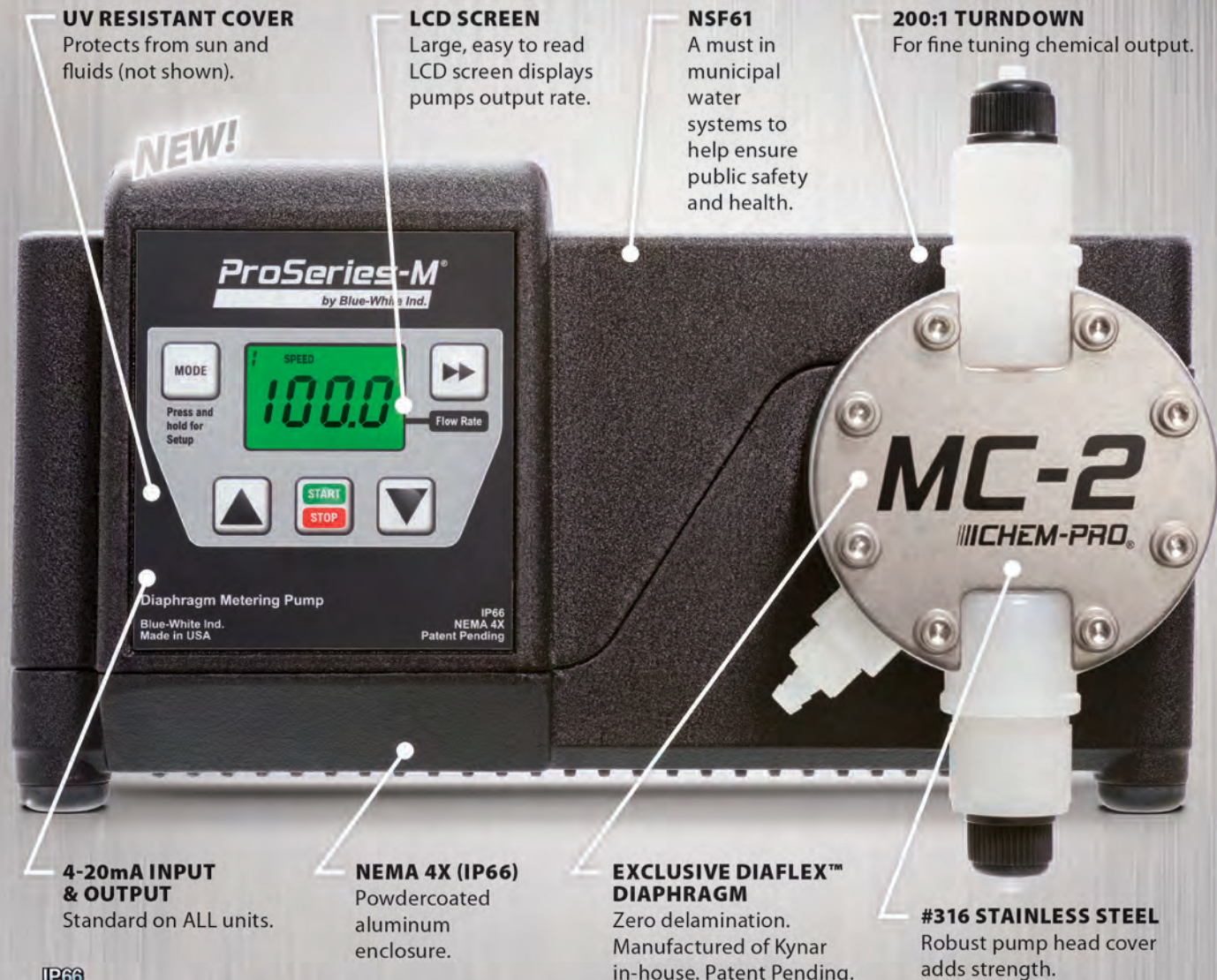
DECEMBER 2014

	Aerzen USA	13	Hurst Boiler & Welding Company, Inc.	45	
	AIMax Software, Inc.	44	INFILCO INFILCO DEGREMONT	17	
	Blue-White Industries	5		JDV Equipment Corporation	43
	Carylon Corporation	3		Keller America Inc.	2
	Centrisys Corporation	23		Komline-Sanderson	66
	Data Flow Systems, Inc.	23	McNish Corporation	43	
	Environmental Dynamics International	37	Noxon North America, Inc.	8	
	Gardner Denver	4	Pollardwater Pollardwater	68	
	Hoffman & Lamson, Gardner Denver Products	39		Vaughan Company, Inc.	67
	Huber Technology, Inc.	7	Walker Process Equipment, A Div. of McNish Corp.	31	
			CLASSIFIEDS	66	

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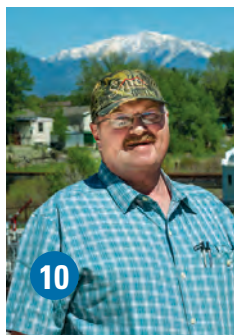
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on the cover

Many clean-water plants create brand names for their biosolids. The Encina Wastewater Authority takes the concept further. Its Class A biosolids pellets go to market under the PureGreen brand; its electric power and heat from biogas: PureEnergy; and its recycled water: PureWater. Octavio Navarrete, operations manager, is shown in the facility's biosolids heat dryer building. (Photography by Collin Chappelle)

LET'S BE CLEAR Page 8

Dumping 'Human Waste'? No, They're Not.

Ill-informed reporters often grossly mischaracterize biosolids. It's time for clean-water agencies to step up with education and end this harmful practice.

By Ted J. Rulseh, Editor

THE FIRE CHIEF PROJECT Page 9

Keeping It in the River

The Rocky Mountain City of Aspen partners with a conservancy group on a drinking water plant tour to promote awareness and conservation.

By Ted J. Rulseh

@TPOMAG.COM Page 15

Visit daily for exclusive news, features and blogs.

HEARTS AND MINDS Page 16

With Pen and Brush

An annual poetry and art contest helps teach students in New York City and surroundings about the value of water and the city's water and wastewater processes.

By Linda J. Edmondson

SUSTAINABLE OPERATIONS Page 24

Finding Better Ways

Pilot projects at Delta Diablo test technologies with potential to save energy, enhance resource utilization and improve treatment.

By Doug Day

HOW WE DO IT: WASTEWATER Page 26

It's All Settled

A phosphorus reduction process using magnetite ballast helps a Massachusetts treatment plant consistently meet strict effluent permit limits.

By Scottie Dayton

top performers:

WATER: OPERATOR Page 28

Seriously Dedicated

Whether supervising a major plant upgrade or handling daily operations, Brian Bishop takes no shortcuts in serving his Vermont community.

By Jack Powell

WATER: PLANT Page 32

Excellence Recognized

Water treatment personnel in a North Carolina city earn their fair share of the community's annual awards for innovation.

By Scottie Dayton

WASTEWATER: PLANT Page 10

Surprise Recognition

A small but experienced team in Colorado produces sparkling effluent using an innovative process that combines mixed liquor with fixed-film media.

By Jim Force

WASTEWATER: PLANT Page 18

Pride in the Products

A California agency creates a brand for its recycled water, biogas energy and pelletized biosolids, building community connections and winning support for future investments.

By Ted J. Rulseh

TECHNOLOGY DEEP DIVE Page 38

Dosing With Precision

A peristaltic metering pump from Watson-Marlow is designed to cut chemical costs in common water and wastewater applications.

By Ted J. Rulseh

PRODUCT FOCUS Page 40

Energy Management and Sustainability

By Craig Mandli

CASE STUDIES Page 46

Energy Management and Sustainability

By Craig Mandli

INDUSTRY NEWS Page 49

PRODUCT NEWS Page 54

Product Spotlights: Intelligent sensors provide multiple measurements / Field-adjustable butterfly valve designed for easy maintenance

By Ed Wodalski

PLANTSCAPES Page 56

Ring of Beauty

Palo Alto's clean-water plant is surrounded by a landscape of trees, shrubs and plants selected by a committee with advice from community stakeholders.

By Jeff Smith

TECH TALK: WASTEWATER Page 58

Pumping Savings Realized

When applied correctly, variable-speed pumps can enhance pump station reliability and performance while delivering on the promise of lower energy usage.

By Stefan M. Abelin

IN MY WORDS Page 60

DDoS: What You Don't Know Can Hurt You

Water and wastewater facilities are increasingly threatened by an insidious form of cyberattack. Here's some advice on how to prepare for and fight off the threat.

By Ted J. Rulseh

HOW WE DO IT: WASTEWATER Page 62

The Optimum Blend

Effective mixing of polymer to a homogeneous and fully activated solution reduces polymer consumption at California treatment plant by 23 percent.

By J.J. Miller and Dave Mullaney

WORTH NOTING Page 64

People/Awards; Education; Events

coming next month: January 2015

Process Chemistry and Laboratory Analysis

» Let's Be Clear: The power of public participation

» Top Performers:

Water Operator: Susan Butts, Augusta, Ky.

Wastewater Plant: Team environment at Bucklin Point, R.I.

Wastewater Plant: Experience pays in Gorham, N.H.

Water Plant: Raw-water challenges in Medicine Park, Okla.

» How We Do It: Enhancing grit removal in Augusta, Ga.

» How We Do It: A ragging remedy in Vancouver, Wash.

» Hearts and Minds: Wisconsin's Water Wagon

» Sustainable Operations: Partnering for watershed protection in North Carolina

» In My Words: Community involvement in water plant design in Yankton, S.D.

» Technology Deep Dive: Combined ozone and biologically active filtration

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let's be clear

Dumping 'Human Waste'? No, They're Not.

ILL-INFORMED REPORTERS OFTEN GROSSLY MISCHARACTERIZE BIOSOLIDS. IT'S TIME FOR CLEAN-WATER AGENCIES TO STEP UP WITH EDUCATION AND END THIS HARMFUL PRACTICE.

By Ted J. Rulseh, Editor



I subscribe to various Google alerts, and it seems every week I get links to news articles about a clean-water agency spreading “human waste” on farmland.

This needs to stop. The stories are really about land application of biosolids which, despite its source, is something altogether different from “human waste.” A quick Internet search around that offensive term brings links to multiple articles with a variety of characterizations:

- Treated human waste
- Concentrated human waste
- Processed human waste
- Human manure
- Composted human waste

And of course, just plain “human waste.” This is incredibly wrong and unfair. The reporters might as well go ahead and use the four-letter word that starts with S. No matter what adjectives come before those two words, and no matter what (usually half-baked) technical explanations follow, the damage is done. There is no way to unring the bell.

MULTIPLE REPERCUSSIONS

To put it bluntly, these news stories make it sound as if cities are essentially having a very large and long bowel movement on their rural neighbors' land.

The words “human waste” are part of the reason that despite decades of evidence that biosolids are safe and effective when used responsibly, we still see counties and townships proposing ordinances to ban land application. They're part of the reason some natural foods retailers have banned foods grown with biosolids from their stores. And they're part of the reason why negative perceptions of wastewater treatment and treatment plants persist.

So how can we stop this gross example of untruth in labeling? The time to act is not after the newspaper carries the headline article about “human waste” being spread. The time is before that reporter touches fingers to keyboard.

FIRST, DO NO HARM

Of course, the best prevention of this form of bad publicity is a quality beneficial-use operation. Sometimes (not always), controversies about biosolids start because the clean-water

agency was less than fastidious about its field operations or didn't do proper public outreach up front.

The next best prevention is outreach to news reporters and editors. Newspaper people, except for some environmental reporters, are generalists, often lacking in science training and almost certainly lacking in knowledge of wastewater treatment. Fortunately, almost every newspaper has built-in wastewater educators in its community. And they, of course, are the local clean-water operators. Many if not most operators make it a point to get elected officials familiar with their facilities. Is it not equally important to have the local newspaper staff on board?

Have you visited a reporter or editor lately? If you're doing the job of outreach properly, you should be on a first-name basis with the local news editor and with the beat reporter who covers your city government or utility commission.

PAY A VISIT

So the question is: Have you visited a reporter or editor lately? If you're doing the job of outreach properly, you should be on a first-name basis with the local news editor and with the beat reporter who covers your city government or utility commission. At the bare minimum, those people should know enough to call you anytime an issue or question arises about anything that has to do with your plant.

It's generally not hard to make a connection. It may be challenging to get access if your local paper is the *Chicago Tribune* or the *Boston Globe*, although on the plus side those papers are likely to have environmental reporters with at least some knowledge of the industry.

If your local paper is the weekly or daily *Any City Gazette*, you should have no trouble getting an audience with the right person or people. This doesn't need to be a big production. Reporters and editors are busy people and wouldn't likely sit down for an hour's presentation even if you decided to prepare one.

For starters, about all you have to do is make a call and get permission to stop by for five minutes sometime well away from the paper's deadline. Introduce yourself, drop off a small packet of information and a business card, have a get-acquainted chat and invite the person to call you anytime. If you want to be a little bold, offer a plant tour.

ACROSS THE BOARD

There's no reason you shouldn't also do this for your local news radio station and even for the TV stations that cover your area.

Once you have made the introduction, pass your new contacts a note now and then about things happening at your place — compliance milestones, staff promotions, new equipment installed and anything else of interest. Don't make a pest of yourself, but let the news people know you're there to help them.

The more clean-water operators have personal connections with their local reporters and editors, the less often we'll have to read about "human waste" being spread out in the country. And in general, the more connections, the more positive treatment we'll see for the clean-water profession in our news media. **tpo**

Keeping It in the River

THE ROCKY MOUNTAIN CITY OF ASPEN PARTNERS WITH A CONSERVANCY GROUP ON A DRINKING WATER PLANT TOUR TO PROMOTE AWARENESS AND CONSERVATION

By Ted J. Rulseh

Communities don't come much more environmentally aware than Aspen, Colo. The city is a leader in renewable energy and aspires to draw all its energy from solar, wind and hydro power.

So residents of Aspen and surrounding resort communities are receptive to messages about conserving water. About two dozen of them toured the city's two drinking water treatment plants last September in an event arranged with the Roaring Fork Conservancy, named for the river that flows through Aspen.

Charlie Bailey, treatment supervisor in the Water Department, invited the *Aspen Daily News* to cover the event and so multiplied the reach of the education and conservation messages he gave to the tour group.



TIGHT SUPPLIES

Conserving water in Colorado is critical. "Right now water sources are dwindling," says Bailey. "Conservation is pretty much the only way to create new water sources, because there isn't enough water out there to go around."

Aspen draws its drinking water from Castle Creek and treats it using a conventional process. The water plants have a combined 20 mgd capacity. During the tour, Bailey and Laura Taylor, the city's A Operator, described the treatment process and the steps the department takes to minimize chemical additions and limit withdrawals from local streams.

The tour included a visit to the 10-acre Leonard Thomas Reservoir, which provides initial settling before treatment. The process in the plants is meticulous. "We monitor everything every day and night — our incoming NTUs, our chemical dosages, hardness alkalinity, pH," Bailey says.

“We have to be stewards and watch what’s coming in, what we’re using and what’s going out. We try to nail that down to minimum intakes and minimum discharges and keep as much water in the river as possible.”

CHARLIE BAILEY

WATER FOR ALL

Bailey notes that water awareness in western states is especially important because water rights are at issue. "The water belongs to somebody — it belongs to all of us," he says. "The City of Aspen has senior rights on Castle Creek, Maroon Creek and the Roaring Fork going back to the 1880s, but the water still belongs to someone else on down the line. We have to be stewards and watch what's coming in, what we're using and what's going out. We try to nail that down to minimum intakes and minimum discharges and keep as much water in the river as possible."

He urges tour visitors to learn about their water no matter where they live — where it comes from, how it's treated and what the local water utility does for conservation. He also emphasizes Aspen's close cooperation with the area communities of Snowmass Village, Basalt, Carbondale and Glenwood Springs.

"We know all the ladies and gentlemen in those water departments and we all have the same philosophy," he says. "We all help each other. Collectively, we want to conserve the resource and use only what we need. We're all on the same page up here." **tpo**

top performer
wastewater:

PLANT

Surprise Recognition

STORY: Jim Force
PHOTOGRAPHY: Carl Scofield



Salida operator Bryan MacNiven draws a sample for lab testing.

A SMALL BUT EXPERIENCED TEAM IN COLORADO PRODUCES SPARKLING EFFLUENT USING AN INNOVATIVE PROCESS THAT COMBINES MIXED LIQUOR WITH FIXED-FILM MEDIA



DEEP IN THE ROCKY MOUNTAINS, RANDY SACK and his three operators quietly treat wastewater and septage and discharge sparkling effluent to the Arkansas River.

Nothing seems to faze the team at the Salida (Colo.) Wastewater Treatment Facility. Together they have nearly 90 years of experience, all at the 2.7 mgd (design) Salida plant. Few seem to notice or appreciate what they do.

That's why the 2013 Plant of the Year Award from the Colorado Rural Water Association was such a surprise. "We were unaware of it until we got a call from the association, asking if someone from our plant was going to be at the award dinner," recalls Sack, plant manager. In fact, they hadn't planned to attend and had never received any honors in the past.

"We really appreciate the award," he says now. "It makes us proud that our hard work has been recognized. The crew really deserves this recognition."

NEW PROCESSES

While the Salida crew has been around for a while, the treatment processes are relatively new — the plant was upgraded during 2010-2012. "We were having issues with ammonia and BOD," Sack says. "We weren't in violation, but it was real close." The original plant was built in 1956; old trickling filters were replaced with rotating bio-contactors in 1985.

Salida hired the engineering firm of SGM of Glenwood Springs to perform a study and make treatment process recommendations. "We considered sidestream treatment, then decided to scrap everything and start new," Sack says. "It came down to an oxidation ditch versus the IFAS [Integrated Fixed-Film Activated Sludge] process from Kruger."

After reviewing processes at other plants, Salida chose the IFAS process, which adds polyethylene carrier elements to the aeration basins. The media provides a large surface area for beneficial microorganisms to attach, forming a biofilm that supplements the activity of the suspended microorgan-

City of Salida (Colo.) Wastewater Treatment Facility

BUILT: | 1956, upgraded 1985, 2012

POPULATION SERVED: | 7,000

EMPLOYEES: | 4

SERVICE AREA: | City of Salida, Town of Poncha Springs

FLOWS: | 2.7 mgd design, 0.8 mgd average

TREATMENT LEVEL: | Secondary

TREATMENT PROCESS: | IFAS biological system

RECEIVING WATER: | Arkansas River

BIOSOLIDS: | Composting, Class A material given away to public

ANNUAL BUDGET: | \$2.5 million

WEBSITE: | www.cityofsalida.com

GPS COORDINATES: | Latitude: 38°30'59.96" N; longitude: 105°58'29.29" W



The team at the Salida treatment facility includes, from left, Bryan MacNiven, operator; Randy Sack, plant manager; and Dan Poole and Bob Cannon, operators.



**Salida Wastewater Treatment Facility
PERMIT AND PERFORMANCE**

	INFLUENT	EFFLUENT	PERMIT
BOD	280 mg/L	< 5 mg/L	30 mg/L
TSS	300 mg/L	< 5 mg/L	30 mg/L
Ammonia	19 mg/L	< 1 mg/L	Report

separate anoxic zones, and then to two aerated IFAS tanks, where the polyethylene media augments biological treatment, including nitrification. Turblex blowers (Evoqua) supply the air. The media is held in the activated sludge tank by retaining screens, while the mixed liquor flows on to two secondary clarifiers. A portion of the nitrified stream is recycled to the anoxic

isms. As a result, the process provides enhanced treatment in the same volume of tankage.

The new plant takes flow from the City of Salida as well as wastewater from nearby Poncha Springs. Average daily flow at present is about 0.88 mgd. Influent flows by gravity over a bridge across the Arkansas River to the plant, where it enters the preliminary treatment facility for screening and grit removal (Vulcan screening washer). An air ionization odor control system from TransTech Energy and Environmental is positioned in the same area.

A pair of primary clarifiers (Evoqua) follow; the overflow is sent to two

“We do 95 percent of our maintenance in-house. ... When we face an issue, we simply go out and make things right.”

RANDY SACK

zone to achieve denitrification and partial BOD reduction upstream of the aerobic IFAS zones.

Clarifier overflow passes through a disc filter (WesTech Engineering) and then is disinfected in an Aqua Ray 40 HO UV system (Ozonix) before discharge to the Arkansas River, which flows eastward out of the Rockies.

FIXED-FILM TECHNOLOGY

The AnoxKaldnes IFAS (Integrated Fixed-Film Activated Sludge) system, developed and marketed by Kruger, a subsidiary of Veolia Water Solutions & Technologies, uses non-clogging biofilm carriers positioned with activated sludge mixed liquor in an aerobic reactor.

According to the Kruger website, the carrier media, made of high-density polyethylene, does not require backwashing and provides a large surface area for biofilm. Since nitrification capacity increases without an increase in solids loading, a plant can maintain nitrifying biomass in a smaller footprint than would be possible with a conventional activated sludge system.

An engineered aeration system mixes the media and mixed

liquor in the reactor. Stainless steel screens retain the media within the reactor, allowing the mixed liquor to pass through and settle out in the secondary clarifiers. The pre-denitrification zone combines nitrified internal recirculation, raw influent and return activated sludge to achieve total nitrogen removal and partial BOD reduction upstream of the aerobic IFAS zones.

“Kruger sent out some of their top people to teach our staff about the system,” says Randy Sack, plant manager. “John He conducted the training with staff. He taught us about trying different things with the system, like changing the internal recycle and trying a thicker sludge blanket to help with some of the removals.”

Solids withdrawn from the system pass through a drum thickener and are pumped to an anaerobic digester. A centrifuge (Westfalia) dewateres the material. The resulting cake is composted on a drying pad and turned once or twice a day. Finished material is given away to the public after about a year of curing to a Class A quality.

AUTOMATED CONTROL

A SCADA system (Browns Hill Engineering & Controls) monitors and controls the entire treatment process. The project included a pump station designed for a 500-year flood that would enable the plant to force-feed wastewater out to the river in case of extremely high water.

The plant also features a large septage receiving area. “We receive septage from several counties — southern Park, Chaffee, Custer and Fremont, as well as ski resorts and the U.S. Forest Service station in southern Colorado,” says Sack. “The receiving area is completely computerized. Truckers put in their code numbers, then discharge their loads.”

Any shock ammonia loads are easily handled by the new IFAS system. The Salida plant has one more project on the list: “We want to put treated city water in here as our potable supply,” Sack says. “Right now, we’re on wells and they’re getting pretty old. The last one was drilled 15 years ago.”

The city water line will cross the Arkansas River to the plant and will ensure a continuous supply. While most of the plant is new, Salida was able to keep and use the existing anaerobic digesters, adding a new cover to the secondary digester. The preliminary treatment building was retained, although the screening system is more compact than its predecessor. The grit removal system is the same except for new pumps.

STAYING AHEAD

If the old plant came close to permit limits on BOD and ammonia, that’s no longer a concern. After nearly two years of operating full-bore, the plant is averaging below 5 mg/L on BOD, considerably under the permitted level of 30 mg/L. Nitrogen is well below 1 mg/L.

Sack believes that if phosphorus removal requirements lie ahead, the plant will be able to meet them: “We’re testing for the state right now, trying to determine what we can do in terms of nitrogen and phosphorus.”

The upgrade was the largest capital project in the history of the city — about \$18 million all told. The city creatively financed the project, prepurchasing some of the equipment and obtaining a \$14.7 million loan from the U.S. Department of Agriculture, supplemented by a \$1.4 million grant from the U.S. Department of Local Affairs.

Sack and his team have also been aggressive where lab work is concerned, performing their own analyses while also taking in samples from a number of small entities in the area, including ski areas, resorts and camps like the Young Life Ranch and Mount Princeton Hot Springs. “We can handle everything except bio-monitoring and metals, which we farm out,” Sack says.

“If I had to describe our plant in a few words, I’d say ‘extremely clean.’ Sure it’s a wastewater facility, but our housekeeping is immaculate.”

RANDY SACK

IN-HOUSE MAINTENANCE

The Salida team can handle just about everything where maintenance is concerned.

“We do 95 percent of our maintenance in-house,” says Sack. “We don’t do major electrical work, but

we handle minor wiring especially on our pumps, and we have experience rebuilding all our pumps — including changing out packing to mechanical seals — and rebuilding our primary clarifiers.

“When we face an issue, we simply go out and make things right. We had a primary clarifier that got all bent out of shape. We drained the tank. Dan Poole started measuring and ordered the metal, and in two days a new clarifier scraper mechanism was welded, painted and installed. That’s the type of team I have.”

(continued)

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Operator Bob Cannon takes a dissolved oxygen reading (analyzer from InsiteIG).



ABOVE: Windrowed compost piles are turned as necessary. LEFT: Deep in the Rocky Mountains, the Salida Wastewater Treatment Facility received the 2013 Plant of the Year Award from the Colorado Rural Water Association.



“You don’t often see this kind of longevity in this business. I think it shows you that we like what we do.”

RANDY SACK

Then there’s the lawn. “If I had to describe our plant in a few words, I’d say ‘extremely clean,’” Sack says. “Sure it’s a wastewater facility, but our housekeeping is immaculate. Our lawn is mowed, the trees and shrubs trimmed. Nothing is overgrown. It’s a good way to keep sand and dirt from blowing around and dirtying up the place. When our council members come for a visit, they sometimes get mad because the landscaping here is nicer than anyplace else in town.” And who does the yard work? “We all do,” says Sack.

Sack, who was born and raised and played high school football in Salida, never thought wastewater treatment would be his profession when he started at the plant 36 years ago. “I was on the road a lot and needed something that would let me be at home,” he says.

The longevity of his career has rubbed off on the operators: 29 years for Bob Cannon, 19 years for Poole and four years for Bryan MacNiven. “I really appreciate the job these guys do,” says Sack. “You don’t often see this kind of longevity in this business. I think it shows you that we like what we do.”

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COMMUNICATION TIPS
Put It In Writing

Email, online calendars, Google docs and other programs have taken over our daily world, often replacing the simple act of writing a note or logging a task. However, there is still a place for written communication. Find out how to effectively use it at your wastewater treatment plant. After all, forms, logs and even the occasional sticky note are a critical component of a well-run facility.
tpomag.com/featured

WATER SHUT-OFFS

UN Experts Criticize Detroit

Is access to water a human right? In Detroit, where water shut-offs have received international attention, United Nations representatives have answered that question with a resounding “yes.” So where does the right to water begin and end? Does the human right to water include treated water? Read this online exclusive and let us know what you think.

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OVERHEARD ONLINE

“In the case of an emergency, the team can craft a message and — with a click of a button — the message can be texted, emailed or phoned to all affected customers to let them know about a problem.”

Ingenuity Winner: Solve a Wastewater Crisis With Reverse 911
tpomag.com/featured

PRODUCT SPOTLIGHT

24 Most Innovative Technologies



Innovation was a big theme at WEFTEC 2014, the clean-water industry’s flagship exhibition and conference. Take a look at some of the newer and better technologies that were featured at the exhibit hall at the Morial Convention Center in New Orleans. This product roundup features everything from nutrient-recovery technology to water-reduction apps.

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With Pen and Brush

AN ANNUAL POETRY AND ART CONTEST HELPS TEACH STUDENTS IN NEW YORK CITY AND SURROUNDINGS ABOUT THE VALUE OF WATER AND THE CITY'S WATER AND WASTEWATER PROCESSES

By Linda J. Edmondson

With more than 8 million people living in New York City, another million in the surrounding communities and more than 50 million visiting the Big Apple each year, it's safe to say there's tremendous demand for water.

Through 19 reservoirs and three controlled lakes in three watersheds covering some 2,000 square miles, the city Department of Environmental Protection (DEP) delivers about 1 billion gallons of drinking water daily through 7,000 miles of water mains, tunnels and aqueducts.

Add 1.3 billion gallons of wastewater daily traveling through 7,400 miles of sewers and 96 pump stations to 14 treatment plants, and it adds up to a huge job. With it goes an obligation to bring attention to the value of water and importance of conservation. And in that, art and poetry have roles to play.

WORDS AND PICTURES

DEP programs teach students about the importance of water, the city's water and wastewater systems, combined sewer overflows, green infrastructure, water conservation and more. Many programs support partnerships between the city and classrooms within the watershed.

Four staff members help create and deliver watershed education, professional development opportunities, environmental education curricula and other resources for school teachers and nonformal educators across the city's five boroughs and upstate watersheds. Among the most effective programs is an annual Water Resources Art and Poetry Contest.

"This year, students in grades two through 12 submitted nearly 600 original pieces of artwork and poetry, reflecting an appreciation for New York's water resources and wastewater treatment systems, and the importance of water conservation," says Kim Estes-Fradis, DEP director of education.

That's a lot of entries, but after running the program for 28 years, the department has the logistics down to a science. "For the first 25 years, teachers would physically submit entries, which were then also used for displays," says Estes-Fradis. "But in the last several years, with two to three times more schools and entries, we've moved to electronic submissions, especially to facilitate online judging."

Entries are uploaded to the contest website in any of several specified file formats. A few teachers are still allowed to mail submissions, which



TOP PHOTO: Winning art contest entry by Armando Fuentes. LOWER PHOTO: Award-winning submission from Melanie Rojas.

DEP staff members scan and upload. Estes-Fradis credits the staff for making sure it all works smoothly, from entries to judging.

INTEGRATING CURRICULUM

The department develops four major entry themes each year. "We also create a resource guide so teachers can dig deep into these topics for their in-class teaching," Estes-Fradis says. "The guide enables teachers to think creatively about how the contest fits into their curriculum and to incorporate the most appropriate water themes. The contest then becomes the culmination of a yearlong study about water in the classroom."

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New York City DEP judges review entries in the annual art and poetry contest.

In addition, judges selected 39 participants as this year's Water Champions, who were called by name to come up on stage."

WORKING WITH PARTNERS

The DEP Education Office has a small budget but conducts the event by soliciting partners to help defray costs. The ceremony is held in a professional theater venue that holds 900 people.

Each student also receives a drawstring bag with an imprint of an actual art entry, a journal with another student entry on the cover, a thumb drive on a key ring and the DEP's traditional promotional materials, such as branded water bottles and pencils.

A number of partners support the program. Donations range from guest passes for students to the New York Hall of Science and the Museum of the City of New York, to \$3,000 from Con Edison for snack bags, entertainers and sign language interpretation.

"This year, our entertainment included two fabulous slam poets who performed five poetry submissions, with the awestruck winning students standing alongside them," Estes-Fradis says.

The program is also aligned with the New York State and the Common Core Learning Standards.

For more information, visit www.nyc.gov/html/dep/html/environmental_education/artpoetry.shtml. **tpo**

Judges are selected each year from among professionals who do environmental education work outside the agency. Several hundred of the agency's 6,000 employees, chosen at random, also take part. After judging, the department hosts an awards ceremony to which all participating students and teachers are invited. Everyone who submits an entry is recognized.

"This year, 675 students from 68 schools submitted more than 580 art-work and poetry entries," says Estes-Fradis. "All students were honored as DEP Water Ambassadors with a certificate recognizing their contributions.



The Encina Wastewater Authority maintains a garden on site as an example of the effectiveness of the plant's PureGreen fertilizer.

Pride in the Products

A CALIFORNIA AGENCY CREATES A BRAND FOR ITS RECYCLED WATER, BIOGAS ENERGY AND PELLETIZED BIOSOLIDS, BUILDING COMMUNITY CONNECTIONS AND WINNING SUPPORT FOR FUTURE INVESTMENTS

STORY: **Ted J. Rulseh**

PHOTOGRAPHY: **Collin Chappelle**

MANY CLEAN-WATER PLANTS CREATE BRAND NAMES for their biosolids. The Encina Wastewater Authority takes the concept further.

Its Class A biosolids pellets go to market under the PureGreen brand. Its electric power and heat from biogas, PureEnergy. Its recycled water, PureWater. Even staff resources and information get a brand name: PureKnowledge.

For the agency, headquartered in Carlsbad, Calif., the brands emphasize that its 67 team members are devoted to more than protecting the Pacific Ocean from pollution. The 40.5 mgd (design) Encina Water Pollution Control Facility recycles, in one way or another, nearly half its 23 mgd average flow.

It generates 76 percent of its own electricity and much of its heat, and is on its way to energy self-sufficiency. Its biosolids are in growing demand in regional fertilizer markets, and selling prices and revenue are rising.

The brand names alone don't make that happen, but Kevin Hardy, general manager, says they're important to forging connections with the community. "You look and see that communities have internalized the benefits of the facilities we operate, but have not internalized the costs because the federal government subsidized their construction," he says.

"People like me are concerned that we'll have difficulty securing the necessary investment to operate these facilities and get good environmental outcomes in perpetuity. We feel a consistent identity for our products provides a much needed platform for communication."

UPGRADING TREATMENT

The Encina Wastewater Authority serves 358,000 residents in northwestern San Diego County. The authority is owned by six public agencies under a joint powers agreement in which the agencies share costs in order to get

Encina Water Pollution Control Facility, Carlsbad, Calif.

BUILT: | 1965; five expansions, latest 2009

POPULATION SERVED: | 358,000

FLOWS: | 40.5 mgd design, 23 mgd average

TREATMENT LEVEL: | Secondary/tertiary

TREATMENT PROCESS: | Activated sludge, sand filtration

RECEIVING STREAM: | Pacific Ocean/reuse

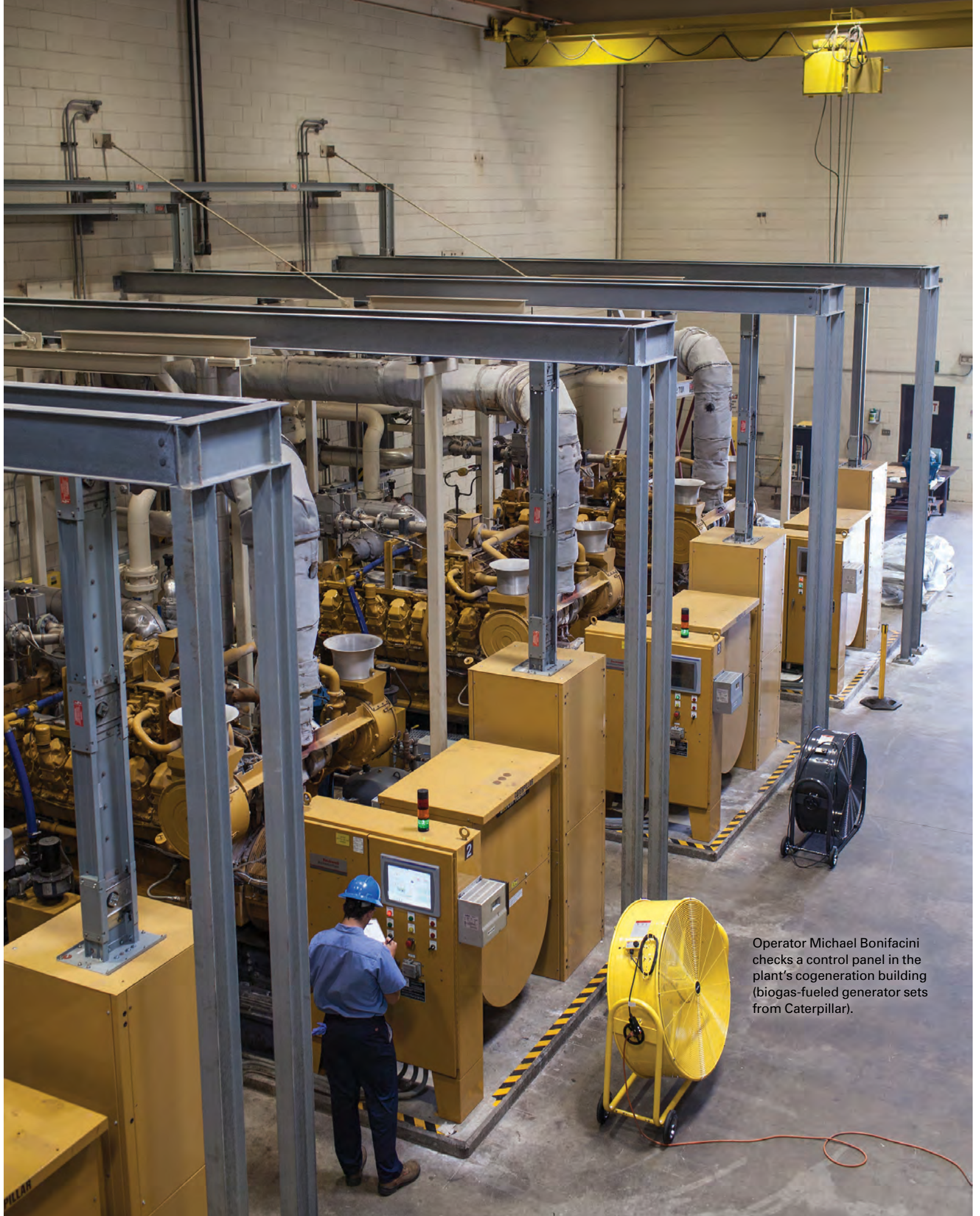
BIOSOLIDS: | Heat-dried Class A pellets

ANNUAL BUDGET: | \$14.2 million (operations)

WEBSITE: | www.encinajpa.com

GPS COORDINATES: | Latitude: 33°06'59.47" N; longitude: 117°19'17.65" W





Operator Michael Bonifacini checks a control panel in the plant's cogeneration building (biogas-fueled generator sets from Caterpillar).



GETTING NOTICED

The Encina Wastewater Authority is gaining recognition from many quarters for its general excellence and its resource recovery initiatives. The authority is a member of the U.S. EPA Green Power Partnership Leadership Club for on-site renewable power generation.

In two of the past three years, the California Water Environment Association has honored the Encina Water Pollution Control Facility as its Large Plant of the Year. In 2009, the PureGreen program earned a Spotlight on Excellence Award from the California Public Employees Retirement System.

In 2013, PureGreen marketing earned the California Association of Sanitation Agencies' Public Outreach and Education Award and received a Green California Leadership Award from *Green Technology Magazine* for its waste management practices, notably the diversion of material from landfills and return of nutrients to the soil through beneficial use of biosolids.

The Encina Water Pollution Control Facility staff includes Debbie Biggs, director of operations; Octavio Navarrete, operations manager; Joe Cipollini, Fran Deleonardis, Scott Allan and Irek Wenske, shift supervisors; and Luis Campos, Eugene Casados, Michael Bonifacini, Miguel Gutierrez, Larry Martinez, Teva Miller, Davey Riedesel, Mike Sumner and Brad Wichman, operators.

Biosolids processing and drying staff includes James Mattern, heat dryer supervisor; and Bill Bonghi, Scott Johnson, Nick Lalonde and Xavier Pearson, operators. Alan Manges is supervisor of biogas and energy production. Joe Sallay, remote facilities supervisor, and Chris Scibilia and Mazi Yazdani, operators, are responsible for remote facilities, water recycling and four pump stations.

The team at the Encina Wastewater Authority includes, from left, Bill Bonghi, operator I; Michael Cripe and Chris Scibilia, operator II; Santiago Resendiz, operator; Octavio Navarrete, operations manager; Brian Samoska, mechanic; James Mattern, heat dryer supervisor; Alan Manges, biogas and energy production supervisor; Irek Wenske, operations shift supervisor; and Davey Riedesel, operator.

more economical, technically advanced facilities than they could afford on their own. The owners are the cities of Carlsbad, Vista and Encinitas, the Vallecitos Water District, the Buena Sanitation District and the Leucadia Wastewater District.

The Encina Water Pollution Control Facility has seen steady upgrades since it was built in 1965. Biosolids drying and a new biogas-fueled cogeneration system were among the latest additions, in 2009.

The basic primary treatment process starts with a screenings building that includes four bar screens (INFILCO DEGREMONT), recently rebuilt by plant staff using in-house fabricated parts; a rotary screen (Richards of Rockford) that removes smaller objects; and a Hycor dewatering press (Parkson Corp.). The headworks also includes three concrete grit basins, each with a volume of 100,600 gallons (two are in use at any given time). Grit removed is pumped to a dewatering system in the screenings building.

Wastewater then flows to 10 215,000-gallon sedimentation tanks (five or six are in use at any time), where a chemically enhanced primary treatment process takes place. "It's an engineered process that consists of addition of ferric chloride after the bar screens, and polymer just after the grit tanks," says Octavio Navarrete, operations manager. "Coagulation of particles aids in settling and enhances removal of BOD and TSS."

Primary effluent passes through a conduit to four 2.3-million-gallon aeration basins (two at a time in operation). Aeration is controlled by way of six dissolved oxygen probes. Air is delivered by three 500 hp blowers (two Hoffman & Lamson, one Dresser-Roots from GE Water & Process Technologies) and one 350 hp (Gardner Denver) through Envirex membrane fine-bubble

Irek Wenske (foreground) and Davey Riedesel evaluate a sample of the plant's microbiology, checking for common indicator organisms such as amoeboids, flagellates and free-swimming ciliates.

diffusers (Evoqua Water Technologies). The treated water flows to seven secondary clarifiers (five normally in operation). An eighth clarifier tank now functions as an equalization basin.

"Flow through the entire plant is normally by gravity, all the way to the ocean outfall," says Navarrete. "There is no lift station at the head of the plant or anywhere else in the process." The only exception to gravity flow is during peak-flow periods at high tide. In that event, the plant team can call on four 200 hp effluent pumps to send the treated water the last 2 miles through land and ocean outfalls to a 136-port, 800-foot-long effluent diffuser submerged 150 feet below the surface of the Pacific Ocean.

RECYCLING BEGINS

Of course, not all effluent ends up in the ocean. About 4-5 mgd of secondary effluent is diverted to the Carlsbad Water Reclamation Facility next door, and another 1 mgd goes to the Leucadia Wastewater District. "In both cases, their facilities finish the water reclamation process," says Kevin Hardy, Encina general manager. "The

“ People like me are concerned that we'll have difficulty securing the necessary investment to operate these facilities and get good environmental outcomes in perpetuity. We feel a consistent identity for our products provides a much needed platform for communication.”

KEVIN HARDY

water from CWRF is put into the Carlsbad Municipal Water District's recycled water distribution system, and the water from Leucadia is delivered to the La Costa Golf Course. These recycling efforts help minimize discharges to the ocean."

Some secondary-treated water is also recycled and used throughout the Encina plant processes. About 4.75 mgd is used for many in-plant needs, including equipment washdown, tank cleaning, cogeneration engine cooling, solids thickening and dewatering, odor reduction facilities and site landscape irrigation. An additional 0.25 mgd is treated in a DynaSand upflow sand filter (Parkson) and used for chemical batching, pump seals and a chemical scrubber.

On the solids side, primary and secondary sludges are pumped to two of the plant's three 2.3-million-gallon anaerobic digesters — another digester tank now serves as a solids holding tank.



Michael Bonifacini samples biosolids from the plant's heat dryer.

Three centrifuges (Alfa Laval Ashbrook Simon-Hartley) dewater the digested material to cake at 21 to 22 percent solids — and so begins the process of creating PureGreen fertilizer.

"The cake is sent to a screw conveyor, which delivers it to one of two bins," says James Mattern, heat dryer supervisor. "From there, it is delivered by a Moyno progressive cavity pump to a mixer to be blended with material that has already gone through the dryer but is either oversized or too fine to meet our standards for final pellet size. We mix about 60 percent cake to 40 percent dry solids in the mixer, which has tines inside it, like a rototiller."

The blended material enters a rotary drum dryer (Andritz DDS 40 process) and is heated to about 200 degrees F by a mixed gas furnace. Through direct and indirect application of hot air, the material is dried to about 94 percent solids. Resulting pellets drop from a hopper into a shaker screen for

Kevin Hardy, Encina Wastewater Authority general manager.



sizing. Those of the correct size go through a pellet cooler and into storage silos. The pellets are sprayed with a dust control agent and loaded into trucks or bags for transport.

On the way from the digesters to the dryer, the biosolids generate energy in the form of biogas. The plant's biogas-to-energy initiative dates back to 1983 with an upgrade in 1995. That older system included five biogas-fueled engines, three driving electric generators and two directly driving aeration blowers.

In 2009, the authority replaced those units with four 750 kW Caterpillar G3516 gas engine-generators that can operate on digester gas, natural gas or a blend. Heat captured from engine exhaust and coolant feeds the digestion process by way of plate-and-frame heat exchangers (Alfa Laval Ashbrook Simon-Hartley). The electricity fulfills about 76 percent of the plant's demand.

POWER IN BRANDING

The Encina authority continues striving to improve its position, and branding is essential to that effort. "The PureWater program is about supporting our member agencies in water recycling and engaging with the community to talk about the quality of the water we're putting in the ocean and the overall health of the local marine environment," says Hardy.

PureEnergy, meanwhile, aligns with the authority board's goal to achieve energy independence in a financially prudent way and with an energy management strategic plan adopted in 2011. The energy management plan has unfolded in three phases: First an energy audit undertaken with help from local utility San Diego Gas & Electric, next execution of that audit's recommendations, including replacement of aging pumps with new high-efficiency units and finally a project to increase biogas production by taking brown grease into the digesters.

The biogas project involves a public-private partnership in which a design-build team of the HDR engineering firm and Filanc Construction will build a grease receiving station. Liquid Environmental Services (LES) will collect brown grease from area food service businesses' grease traps, deliver it to the facility and pay a tipping fee. The facility is to be online in early 2015.

LES will pay 4.5 cents per gallon initially and, under an eight-year contract, will contribute \$300,000 toward the capital expense for the receiving station. "The reason we signed a longer-term contract is that LES made a commitment to help us develop a market here in North County, which has been somewhat underserved by grease haulers," says Hardy.

“The cost of hauling and land-applying biosolids doubled, and doubled again, in five years. As we stared at that \$2.2 million operating cost, we resolved to explore whether we could instead make a capital investment to better serve our communities and reduce the volume of material we manage.”

KEVIN HARDY

"This program also provides our member agencies with a solution they can offer to the businesses in their communities that has added value. It helps achieve their maintenance goals by keeping grease out of the system, and also results in some green power being produced in the region. That's a good win for them." The system will be designed with capability to accept other organic wastes in the future, including some forms of food waste. Ultimately, says Hardy, the authority hopes to produce enough biogas both to fuel the cogeneration engines and to replace the natural gas now fed to the biosolids dryer.

A PROVEN PRODUCT

While returns from the biogas project are speculative for now, the Pure-Green fertilizer is gaining strength in the local market.

Until 2009 when the heat dryer came online, the authority shipped biosolids at about 16 percent solids to a farm near Yuma, Ariz., more than 200 miles away, at a cost of \$2.2 million a year. The move to Arizona became necessary when two California counties took steps to effectively ban the importation and land application of biosolids.

"We were sending five truckloads a day, seven days a week," says Hardy. "The cost of hauling and land-applying biosolids doubled, and doubled again, in five years. As we stared at that \$2.2 million operating cost, we resolved to explore whether we could instead make a capital investment to better serve our communities and reduce the volume of material we manage."

"Today, we ship one truckload per day, four or five days a week. The dryer also creates a Class A exceptional quality product that has no restrictions on its use. It can be used in a wide variety of fertilizer applications — not just in the narrow land application or landfill concepts that many biosolids programs are built around."

Encina Water Pollution Control Facility PERMIT AND PERFORMANCE

	INFLUENT	EFFLUENT	PERMIT
CBOD	205 mg/L	7.1 mg/L	25 mg/L monthly avg.
TSS	270 mg/L	7.6 mg/L	30 mg/L monthly avg.
Ammonia	N/A	34.0 mg/L	350 mg/L daily max.
Total nitrogen	N/A	0.2 mg/L	1.2 mg/L daily max.
Phosphorus	N/A	N/A	None

At first, the authority sold its 6,000 tons per year of biosolids pellets to a nearby cement kiln as fuel, largely to ensure a reliable outlet. In the past three years, however, the majority of the PureGreen branded product has been shifted to the fertilizer market, mainly to nurseries, golf courses and fertilizer blenders who appreciate its 5-6-0 NPK analysis, high organic matter content and low salt index. A share of the credit belongs to Eric Have, a wastewater operator who had sales experience and applied it to developing the PureGreen market.

Doug Campbell, director of environmental compliance for the authority, observes, "We're registered in five states as a commercial fertilizer, and we're looking to acquire a specialty fertilizer license in California."

PureGreen revenue reached nearly \$80,000 in 2013, and it's primed to increase. Recent marketing innovations include bagging material in 1,400-pound tote sacks for sale to wholesale distributors. Totes have sold for as high as \$135 — or \$193 per ton. "Not surprisingly, as we take the size of the packaging down, the price per ton goes up," Hardy says.

GOING SOCIAL

Today, the value of the branding for PureGreen, PureEnergy and PureWater is as critical to the program's development as the sales revenue. "All of us who have made a career in wastewater have experienced a conversation stopping as soon as we described where we work," Hardy says. "That's not a judgment, but it is reality. We needed a platform to create good engagement — a way to sustain a conversation with our public. We started by talking about what we do: We protect the Pacific Ocean, we produce and use renewable resources, and we practice fiscal responsibility.

"As we started talking in those terms with our elected officials and staff and began experimenting out in the public, we found that all of a sudden people wanted to ask, 'How do you do those things?'"

"A natural next step was to extend the conversation into the social media world and compete for the attention of the millennial generation — the Facebook and Twitter demographic. We felt that having a consistent, hashtagable identity for these products would provide a platform for communication. So far it seems to be resonating.

"Social media is a low-risk place to learn lessons about how we can brand our operations in a way that encourages good communication that the community can understand, and that provides a compelling argument for investing in facilities. It's about being transparent in what we do and the standards we strive for, and talking about the people who work to make it all happen." tpo

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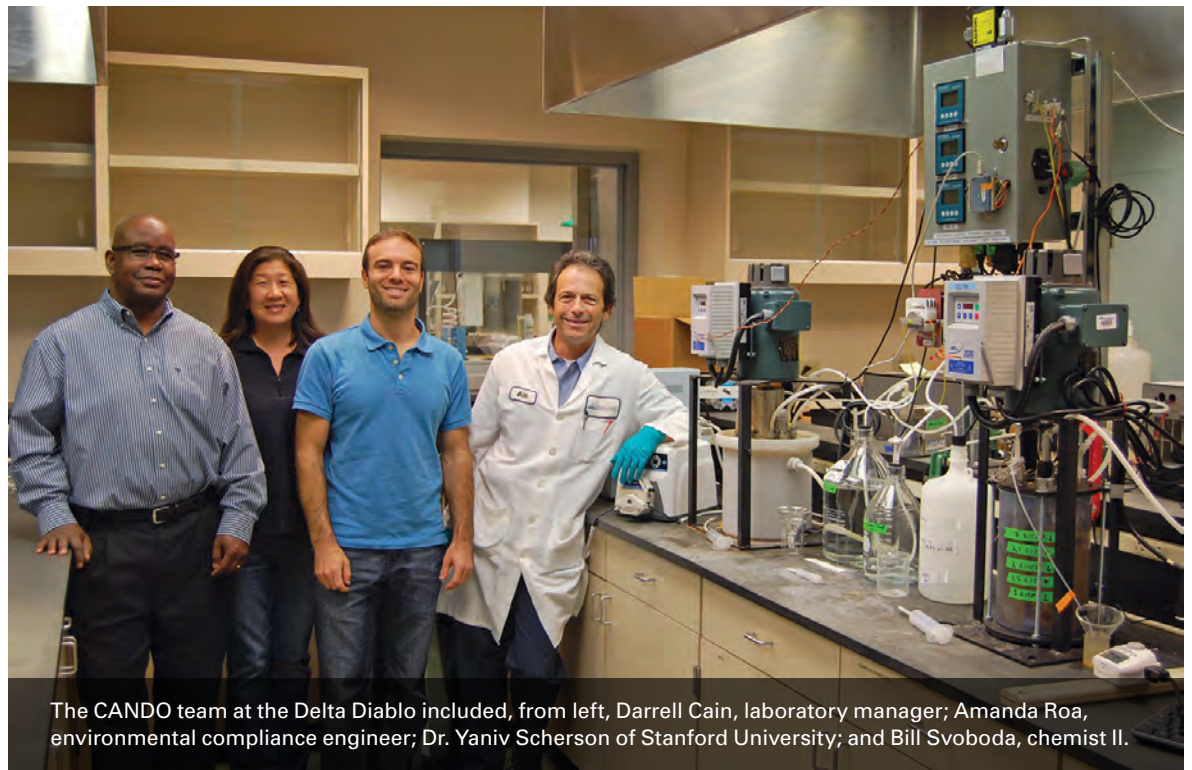
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Finding Better Ways



The CANDO team at the Delta Diablo included, from left, Darrell Cain, laboratory manager; Amanda Roa, environmental compliance engineer; Dr. Yaniv Scherson of Stanford University; and Bill Svoboda, chemist II.

PILOT PROJECTS AT DELTA DIABLO TEST TECHNOLOGIES WITH POTENTIAL TO SAVE ENERGY, ENHANCE RESOURCE UTILIZATION AND IMPROVE TREATMENT

By Doug Day

The wastewater industry is changing, and Gary Darling is excited about the shift from merely treating water to creating new resources.

“There’s a significant amount of energy in wastewater,” says Darling, general manager of Delta Diablo Sanitation District, a resource recovery district in Antioch, Calif., 45 miles east of San Francisco. “Figuring out ways to get at that energy is very intriguing.”

He notes that capturing that energy could solve 16 percent of the nation’s electrical needs, according to the National Association of Clean Water Agencies.

The 16.5 mgd Delta Diablo treatment facility is involved in several partnerships exploring new technologies that include producing energy from biosolids, capturing nitrous oxide from wastewater for fuel and a new way to clean effluent that may also help desalinate brackish waters.

“It takes a lot of effort and cooperation to get new equipment to the market,” says Darling. “Our industry is conservative when it comes to that. We’re all managing public dollars, and we take our public trust responsibilities very seriously.”

One answer is to share the effort and risk, he says: “We’ve formed a couple of coalitions in our region to invite new technology into the San Francisco Bay Area. The overarching interest is to see new technology come to market.”

AN ENERGY GROUP

The Bay Area Biosolids to Energy Coalition was formed in 2006 to create sustainable energy sources. Delta Diablo is hosting a demonstration of a technology, developed by Chemergy, that converts biosolids to hydrogen. It is conducted through a partnership with Lawrence Livermore National Laboratory and Chemergy.

The \$1.75 million project is funded by the California Energy Commission and Chemergy. It uses reduction-oxidation thermoelectrochemistry to produce renewable hydrogen gas from wet biosolids. The hydrogen will be used to make electricity using a fuel cell provided by the U.S. Department of Energy Fuel Cell Technologies Office and the U.S. Department of Defense Construction Engineering Research Laboratory.

Chemergy will process about 1 ton of biosolids per day to produce up to 30 kW of electricity for use in the plant. Excess process heat can be used for local heating, while the hydrogen is converted to energy in a vehicle or stationary generator.

NO LAUGHING MATTER

Another pilot at Delta Diablo uses bacteria to create nitrous oxide from ammonia in wastewater. Better known as laughing gas, nitrous oxide is a fuel used in rockets and some race cars that can be used in cogeneration engines.

“It’s a new nitrogen removal process that will give engines more power with the same amount of fuel,” says Amanda Roa, environmental compliance engineer. “Nitrogen removal is very energy-intensive. When we were approached with a new process that may require less energy, or possibly even produce energy, we were very interested.”

CANDO was developed by Dr. Yaniv Scherson of Stanford University. “A lot of processes use the anammox bacteria to convert ammonia to nitrogen gas,” says Roa. “CANDO adds a twist by converting ammonia to nitrous oxide. The pilot will determine how much ammonia can be removed and how much nitrous oxide can be recovered.”

Bench-scale studies conducted by Stanford and Delta Diablo showed close to 95 percent ammonia removal and 80 percent conversion to nitrous oxide. This year’s six-month test is the first time the technology has been used in a real-life setting.

The TomKat Center for Sustainable Energy at Stanford is funding the equipment. Other support is coming from the National Science Foundation Engineering Research Center for Reinventing the Nation’s Urban Water Infrastructure (ReNUWI), along with grants from the National Science Foundation and Veolia Water.

FORWARD AND REVERSE

In another project, with Porifera, Delta Diablo is helping develop a new method of treating effluent using a combination of forward osmosis and



Secondary clarifiers at Delta Diablo, which serves 42 square miles with a population of 200,000 in Antioch, Bay Point, and Pittsburg. The sanitation district was formed in 1976, and the plant went online in 1980.



The pilot-scale demonstration of the CANDO process for converting ammonia to nitrous oxide for energy recovery.

reverse osmosis technology. “The technology has recently reached commercial stage,” says Darling. It could cost 30 percent less than conventional reverse osmosis through reduced chemical use, less maintenance and lower energy consumption.

The same technology could be used to desalt brackish water for irrigation, potentially cutting energy use by 90 percent. Other configurations of the technology can generate electricity using treated wastewater and high-salinity waste streams.

“It’s a potential game changer if it works,” adds Darling. “2013 was the driest year on record in California, so we’re in a significant multiyear drought. That in combination with sea level rise is making our water supply more salty. If somebody can come up with a new way, it has great potential worldwide.”

Darling says such cooperative efforts help new ideas survive the “valley of death” that exists between an idea and getting it to market. “In the past, private industry may have assisted new technologies to market. Now the trend is that they sit back and watch. If it’s successful, they will buy it. Public agencies don’t typically have a research and development budget but we can invite these new technologies to use our facilities in a careful and deliberate manner.” **tpo**

What’s Your Story?

TPO welcomes news about environmental improvements at your facility for the Sustainable Operations column. Send your ideas to editor@tpomag.com or call 715/277-4094.

“Public agencies don’t typically have a research and development budget but we can invite these new technologies to use our facilities in a careful and deliberate manner.”

GARY DARLING

WHERE REUSE IS CRITICAL

Since 2000, Delta Diablo has been using reclaimed water at two power plants, two golf courses and 12 city parks in Antioch and Pittsburg. “In this day and age, especially in the drier regions, there is no logic in treating water and using it only one time when it has many uses,” says Gary Darling, general manager.

The resource recovery district is the lead agency for the Western Recycled Water Coalition, a 22-member group of agencies and utilities that are planning 21 recycling projects to reduce the pumping of freshwater from the San Joaquin-Sacramento River Delta and local aquifers, and to provide 120,000 acre-feet of new sustainable, drought-resistant water supply.

The 16.5 mgd Delta Diablo plant produces an average of 6 mgd of reclaimed water. About 90 percent of it goes to cool two combined-cycle natural-gas-fired electric power plants. The rest goes to the golf courses and parks for irrigation. “There are hot summer days, when the power plants are cranked up, that all of our effluent is being recycled,” says Darling.

A 2013 national survey identified 92 entities developing recycled water projects in 14 states. Sixty-five projects in California accounted for nearly 1 million acre-feet of water over the next 10 years. The total cost of the projects is estimated at \$6.4 billion.

“More than a third of these projects need financial assistance,” says Darling. “We need state and federal partnerships. There is also an effort to study direct potable reuse, including a \$6 million program to look at the science, public acceptance and regulatory aspects of treating water to the next level and sending it directly into the water supply.”

Angela Lowrey, public information manager for Delta Diablo, says people are more likely to support direct use of treated water when they hear about it personally. “When I talk about putting drinking water on landscaping or golf courses or for cooling power plants, I receive a resounding ‘No,’” she says. “It opens the door to talk about recycled water as a viable alternative.”

It's All Settled

A PHOSPHORUS REDUCTION PROCESS USING MAGNETITE BALLAST HELPS A MASSACHUSETTS TREATMENT PLANT CONSISTENTLY MEET STRICT EFFLUENT PERMIT LIMITS

By **Scottie Dayton**

From April through October (in-season), effluent from the Billerica (Mass.) Wastewater Treatment Plant averaged 0.80 mg/L total phosphorus. From November through March (off-season), it averaged 1.55 mg/L. In 2008, the U.S. EPA lowered the plant's total phosphorus limit to 0.20 mg/L in-season and 0.75 mg/L off-season.

To comply, operators added sodium aluminate at the head of the treatment train and polyaluminum chloride solution (USALCO) at the end. "That lowered our in-season total phosphorus to 0.50 mg/L," says Jeff Kalmes, plant supervisor. "We couldn't use sodium aluminate in winter because it froze, so our off-season total phosphorus averaged 1.29 mg/L."

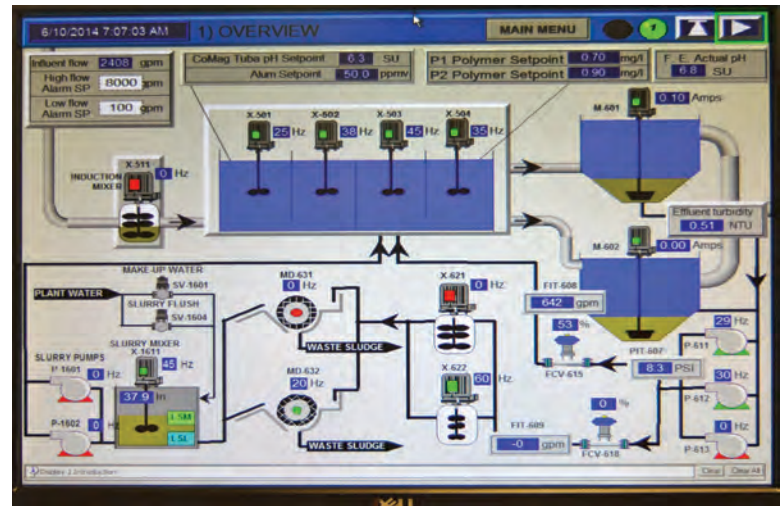
As a remedy, the Woodard & Curran Engineering firm recommended the CoMag phosphorus reduction system (Evoqua Water Technologies) for its economical operation and small footprint to accommodate a retrofit. The plant was the nation's first to receive a full-size CoMag system installation.

PREPARING THE PLANT

With 80 percent of the town's 40,000 residents connected to the sewer system, the 5.4 mgd (design) activated sludge plant treats 3.83 mgd on average. Operators wasted secondary sludge to one of two diffused air flotation thickeners (DAFT), then stored it in a 70,000-gallon tank. A second identical tank held primary sludge, and a third mixed the contents of the first two



Dave Garabedian, operations and maintenance specialist, checks the shear mixer after the chemical bond between the floc and magnetite has been broken.



A schematic of the CoMag system (Evoqua Water Technologies). Note low effluent turbidity reading on the right side.

before a Fournier rotary press dewatered the solids. Effluent was chlorinated, dechlorinated and discharged to the Concord River.

A two-month pilot study familiarized Evoqua Water Technologies engineers with the plant's secondary effluent as it ran through the phosphorus removal system in a portable trailer. "Whenever they took a sample to test for phosphorus, we split it," says Kalmes. "I ran my own test and sent a sample to a third-party laboratory. Our results always came in lower, which convinced us the system worked. However, we all used different EPA-approved tests, and that could account for the variances."

In late 2008 the DAFT units were replaced with gravity thickeners (settling tanks), five 3 mgd tertiary pumps in the basement, and a storage area for the alum, caustic and polymer used to condition the secondary effluent. Workers also installed two magnetic drums to collect and recycle magnetite (Fe_3O_4), the mineral in the CoMag system that helps remove particulate containing phosphorus.

With the gravity thickeners online, operators routed sludges to them without stopping operations. As the holding tanks emptied, workers converted them to two 24-foot-diameter tertiary settling tanks and a pump room for the CoMag return activated sludge pumps. They installed the phosphorus removal system — four 11-foot-square by 11-foot-deep reaction tanks — alongside the former holding tanks. The workhorse of the system is magnetite, a mineral resembling black talcum powder but five times heavier than sand.

MINERAL WITH A MISSION

Operators condition secondary effluent (CoMag influent) in the first two



Jeff Kalmes, plant supervisor, swaps out the shear mixers that separate magnetite from floc before the CoMag influent enters the magnetic recovery drum.



Operators Jim Lucas (left) and Ken Richard position a container of Kemira Superfloc polymer for dewatering biosolids.

“During the four years we’ve run the system, we’ve learned that conditioning effluent to 6.3 pH maximizes settling of phosphorus, aluminum and magnetite.”

JEFF KALMES

tanks to remove small amounts of TSS. The liquid then flows to the third (reaction) tank, where it mixes with fresh and recirculated magnetite.

Operators add 50 pounds of magnetite per day to a slurry tank; a 30 gpm on-demand pump then sends the mixture to reaction tank 3. Recirculated magnetite comes from the tertiary tanks. Operators add a small dose of Superfloc polymer (Kemira) per day to reaction tank 4 to create floc and enhance the capture rate of fine particulates.

The mixture then flows to the tertiary settling tanks. The high specific gravity of the ballasted floc produces rapid, reliable settling. The increase in solids density improves the capture of contaminants, enhances plant stability and enables the system to withstand high fluctuations in loads and flows.

Sludge wasted from the tertiary tanks flows through a shear mixer that breaks the chemical bond between the floc and magnetite. As the freed liquid rises, it hits a spinning magnetic drum that captures the mineral and returns it to the slurry tank for recirculation. The separated sludge flows back to the gravity thickener.

SURPASSING EXPECTATIONS

“Initially, Evoqua Water Technologies said we’d probably lose 30 pounds of magnetite per day,” says Kalmes. “During the four years we’ve run the system, we’ve learned that conditioning effluent to 6.3 pH maximizes settling of phosphorus, aluminum and magnetite. The result is a loss of 1 to 6 pounds of mineral per day.”

Daily, two operators manually test the pH in the reaction tanks, and Kalmes collects a sample of CoMag waste activated sludge to ensure that it has a 6.3 pH. “Operators must be diligent and at the top of their game,” he says. “For example, by looking at our chemical usage every morning, they can identify a problem within five minutes.”

And therein lay the rub. The retrofit switched the plant from manual operation to automation. After Evoqua Water Technologies trained personnel on SCADA operation, the biggest challenge was getting them to use it. Kalmes made daily checklists to help operators familiarize themselves with the SCADA screens by cycling through them.

“Automation was a big move on many levels,” says Kalmes. “For example, we’re still running three shifts, but we’re going to one shortly. We’ll keep the off-shift operators, enabling us to tackle more projects and have backup personnel to cover vacations or illness.”

TINKERING WITH TREATMENT

Billerica is unique in that the CoMag system is at the end of the treatment train, enabling operators to split the flow or bypass the reaction tanks and go directly to chlorination. The arrangement allows Kalmes and Dave Garabedian, operations and maintenance specialist, to experiment. During the off-season, they run 1 mgd through the CoMag system, testing ways to optimize performance by varying alum, polymer or magnesium volumes.

“Making small changes to the tertiary sludge wasting schedule taught us that we’ll have the best result if we waste for nine minutes on and 45 minutes off,” says Kalmes. “If we adjust the time a minute either way, we notice differences in the phosphorus and aluminum levels.”

The numbers speak for themselves. In-season effluent total phosphorus dropped to between 0.07 and 0.14 mg/L, and off-season went to 0.50 mg/L. “Our in-season influent has 196 mg/L BOD and the final effluent has 2 mg/L BOD and TSS,” says Kalmes. “In winter when we co-blend effluents from straight treatment and CoMag, we have 12 mg/L BOD and 9 mg/L TSS.” The permit is 30 mg/L for both.

A meter downstream of the tertiary settling tank but before chlorination measures turbidity. “It averages 0.51 NTU, but I’ve seen it as low as 0.20 NTU,” says Kalmes. “We can see a coin on the bottom of our 8-foot-deep chlorine tanks.” Nevertheless, he believes the team can work the system even harder to achieve still better results.

“As far as chemical and mineral usage, we’re exceeding anything projected by the technology providers,” says Kalmes. “They’re here often to see what we do and they use what they learn in future

installations. Operators and engineers who have heard of our success come from China, Russia, Poland, Cyprus and across the U.S. At the end of the day, we know what we’ve done equals quality going out and we’re mighty proud of it.” **tpo**

Share Your Ideas

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Send your ideas to editor@tpomag.com or call 715/277-4094.



SERIOUSLY DEDICATED

WHETHER SUPERVISING A MAJOR PLANT UPGRADE OR HANDLING DAILY OPERATIONS, BRIAN BISHOP TAKES NO SHORTCUTS IN SERVING HIS VERMONT COMMUNITY

STORY: **Jack Powell**
PHOTOGRAPHY: **Oliver Parini**

IF THERE'S ONE WORD THAT DESCRIBES BRIAN BISHOP IT'S "serious." Ask his boss, his mentor or the engineers who worked with him on a major upgrade to the Swanton (Vt.) Water Treatment Plant, and they'll say the same thing: When it comes to his job, Bishop is one serious guy.

With good reason: He's sole operator of Swanton's 1 mgd water plant, which in 2011-2012 underwent a \$5 million upgrade that came in \$800,000 under budget and enabled this village of 3,000 on the shores of Lake Champlain to invest in improving its distribution system. Even more impressive is that during the project, Bishop kept the water flowing, sometimes working around the clock.

Such dedication earned Bishop the 2013 Michael J. Garofano Water Operator of the Year Award from the Green Mountain Water Environment Association, "for outstanding performance in system maintenance, protecting public health and achievement beyond normal responsibilities." The award is named for a water treatment plant supervisor who died, along with his son, during Tropical Storm Irene in August 2011 while inspecting a reservoir. In announcing the award, the association called Garofano, "a stubborn perfectionist."

That easily could describe Bishop, who has devoted the past 15 years to ensuring quality water for residents of Swanton, a picturesque community in northwestern Vermont. Not that Bishop sees himself as especially award-worthy — for him it's just part of a job he took to heart from the moment he started.

"Frankly, I was surprised I won the award," Bishop says in a quiet voice. "I don't like being singled out, but I think it's good for folks in the field to see that when people put in extra effort they can get positive recognition. For me, 2012 was a very strenuous year. I logged many, many hours making sure things got done right."



Brian Bishop, chief operator at the Swanton (Vt.) Water Treatment Plant.

BUILDING A CAREER

A native of Franklin, Vt., Bishop graduated from Missisquoi Valley Union High School in Swanton and, after working for a while, joined the Navy in 1984. After basic training and classes, he was stationed at Kaneohe Marine Corps base on Oahu, Hawaii, for 3 1/2 years. On his return he got a job as assistant operator at the Sheldon Hydroelectric Plant, then joined the village's Orman Croft Hydroelectric Plant as an operator in 1994.

When the chief water operator position opened up in 1999, he took it, learned the treatment processes and made water his career. Bishop holds a Class 4-C water license and a Grade 3-D wastewater license, "so the guys in the wastewater plant and I can back each other up."

He earned his stripes dealing with challenges that arose at the plant, built in 1977. These included maintaining the original raw-water and high-lift pumps and two Neptune Microfloc filtration units (Aquarius Technologies). Because there was no automation, he had to run the treatment system manually. That meant constantly adjusting chemical dosages (aluminum sulfate, chlorine), backwash cycles and other functions as he strived to produce

the best-quality water possible from an older plant.

One major obstacle was the lack of state-mandated redundancy in the filtration system: Each filter had a capacity of 450,000 gpd, so both had to be operated at times to meet maximum day demands. Fortunately, he was able to optimize the filtration process through enhanced coagulation so that the village could comply with the state's Stage 2 disinfection byproducts regulations.

'WONDERFUL OPERATOR'

A pumping station on Lake Champlain pumps raw water across the road

Bishop's accomplishments include leading his team through a major plant rehabilitation project.



“ I sometimes find the responsibility overwhelming, but I have great support from my co-workers, which really helps. I took my responsibilities very seriously right from the get-go. I've worked hard and I think I've gained a lot of respect from village and state officials, which I find gratifying.” **BRIAN BISHOP**



The team at the Swanton water plant includes, from left, James Hull, wastewater operator; Reg Beliveau, village manager; Jim Irish, chief wastewater plant operator; Joe Letourneau, maintenance technician; and Brian Bishop, chief operator.

Brian Bishop, Swanton Village (Vt.) Water Treatment Plant

POSITION: | **Chief Operator**

EXPERIENCE: | **15 years**

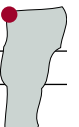
CERTIFICATIONS: | **Class 4-C Water, Grade 3-D Wastewater**


EDUCATION: | **Graduate of Missisquoi Valley Union High School; U.S. Navy**

MEMBERSHIPS: | **Green Mountain Water Environment Association**

GOALS: | **Complete a long career serving village residents**

GPS COORDINATES: | **Latitude: 44°54'10.85" N; Longitude: 73°09'52.93" W**





Brian Bishop's serious approach to his work has earned him praise from village officials and state regulators alike.

LETTING GO

Once in a while a problem comes along that's tough to leave, no matter how long you've been at it. That happened to Brian Bishop during the 2011-2012 upgrade of the Swanton Water Treatment Plant. One night after a pump change-out, Bishop and the construction crew couldn't get the new pump to prime because the Lake Champlain water level was so low.

"We had to use the water in the clearwell and the backwash tank to refill the pump," Bishop recalls. "And we worried about keeping the plant running, because the longer you go without lake water, the lower your reservoir goes, which means there's that much less pressure for the folks in town. So we had to get it working. As far as I know there were no complaints."

Reginald Beliveau, village manager, who worked for IBM as a maintenance/manufacturing manager and as part of an environmental team responsible for recycling, waste and chemical storage compliance, remembers Bishop's wife, Debbie, coming to the plant to get him for dinner. He was going on a 20-hour day and hadn't stopped for lunch. It was at the same time low water levels were making it difficult to siphon water out of the lake to feed the plant.

Beliveau told her, "You go down to the pump station and grab him and say that I'm ordering him to leave." He adds, "From that point forward, I made dictates to him, saying 'I know the plant is important, and I know it's like your own baby, but your health comes first and you have to take some time, and don't put your wife through such duress.' That's how dedicated Brian is."

In his letter supporting Bishop for the Michael J. Garofano Operator of the Year Award, Beliveau concluded, "Even with a new facility and simpler operation, Brian still continues to ensure that this facility produces the best-quality water possible!"

to the Swanton plant. Bishop adds aluminum sulfate (alum) as his main coagulant before sending the water through a two-stage filtration process, where it first goes through a bed of floating plastic beads and then through sand filters. The processed water then flows into a clearwell and from there it is pumped up to a storage tank in town at the end of the distribution system.

"I sometimes find the responsibility overwhelming, but I have great support from my co-workers which really helps," says Bishop, who lives next door to the plant. "I took my responsibilities very seriously right from the get-go. I've worked hard and I think I've gained a lot of respect from village and state officials, which I find gratifying."

One of those boosters is Ray Solomon, an environmental scientist for the State of Vermont who served as Bishop's mentor during his early days at the water plant. Now a part-time consultant for the state, Solomon calls Bishop, "a wonderful water treatment plant operator. He knew what he didn't know, and he asked and made sure what he was doing was correct. I was helping him quite a bit when he started, but over the years, he became very competent in terms of treatment processes.

"Brian stands out as someone who goes the extra mile. He's extremely conscientious, and he's always looking out for the best interest of his customers, especially from a public-health standpoint. We have a lot of good operators, but Brian is one of the best."

MAJOR UPGRADE

Bishop's commitment really came to the fore during the plant upgrade, a wholesale renovation that included:

- Two 1-million-gallon sand-and-anthracite filters (WesTech Engineering) for redundancy.
- New variable-speed raw-water pumps, backwash pumps, high-lift pumps and low-lift pumps (Sulzer).
- A two-stage disinfection system using sodium hypochlorite and UV light.

- A SCADA system (LCS Controls) that lets Bishop monitor and control pH levels, turbidity and other parameters from his office.

In addition, the entire facility, which looks like a big house on the 120-mile-long lake, was rehabilitated. General contractor NECCO and several sub-contractors replaced the electrical and HVAC system, renovated the offices, installed stainless steel piping, painted the facility and put in new landscaping. And, at Bishop's suggestion, they replaced the two sludge lagoons that handled the backwash with a three-lagoon system. This enables freeze-drying of the built-up alum residuals, reducing the village's sludge disposal costs.

In the freeze-and-drying process, residuals break down from a pudding-like material (after dewatering) from about 3 feet of sludge to less than a foot of powder, reducing the amount of material taken to the landfill. Moreover, the sludge does not have to be mechanically dewatered first — another cost saver — and the lagoons can be rotated several years before cleaning instead of being cleaned every year.

Despite the often-chaotic environment, Bishop kept the plant operating without a hitch — and helped bring the project in under budget — through sheer determination. “Brian was at times close to being overzealous in his supervising of the upgrade,” observes Reginald Beliveau, village manager and 26-year IBM veteran, who supported Bishop's award nomination with a letter to the WEA. “He sweated the details and got results. The plant work was approved by voters for \$5 million, and we came in at \$4.2 million, which gave us extra funds to spend on repairing our water mains and transmission lines.”

VITAL INTERACTION

Though the project was well-orchestrated, Bishop would stop the work if something bothered him. “He wasn't afraid to say, ‘I don't like this — you can't do it this way,’” Beliveau says. “While that might have caused the engineers a little consternation, in the end the village never lost water and the quality remained at the same high standard. In fact, things are even better now because of the new system. Brian was over-and-above cautious, but it's nice to have someone who cares about what they do.”

“Brian stands out as someone who goes the extra mile. He's extremely conscientious, and he's always looking out for the best interest of his customers, especially from a public-health standpoint.”

RAY SOLOMON

Bishop admits, “During the upgrade, I lay awake many nights trying to figure out how to keep the customers from knowing that anything was happening down here, whether it was water pressure or quality. Yes, I put in a lot of hours — probably enough to take a long vacation — but I wanted everything to be right for the residents.”

Another who can attest to Bishop's single-mindedness is Brad Aldrich, P.E., a principal at the Aldrich + Elliott water resources engineering firm, which designed the plant upgrade and oversaw its construction. He calls Bishop “great to work with — fun and very engaged throughout the renovation process.” In fact, the A+E team nominated Bishop for the Garofano award based on his drive and leadership.

Working with Bishop, Aldrich's engineers overcame many hurdles, chief among them building and installing the new filters and upgrading the pumps while maintaining existing water treatment processes. That meant taking out the old filter and putting another one in, then doing the same with the other filter. The same care applied to the pumps: Each had to be removed and a spare kept running so that water operations would be unaffected. That required daily coordination with Bishop, A+E's field representative and the contractor.

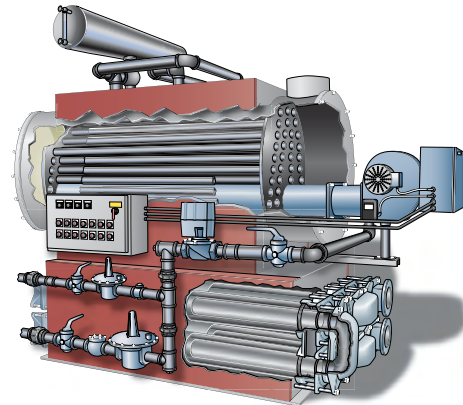
TOP PRIORITY

Accolades aside, Bishop remains sober in his outlook. He walks to the plant about 7:30 every morning and does his regular daily process sampling, plus the regulatory sampling required by the state and the U.S. EPA. After



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adjusting the chemical dosing, he heads into the village, takes a chlorine residual sample and checks out the system, including the 1.5-million-gallon enclosed reservoir. He also handles all the paperwork and interfaces with state inspectors, calling on Beliveau when he needs help.

Beyond the plant, Bishop has been married for 29 years. He has a daughter who is married to a U.S.

Army Afghanistan veteran stationed at Fort Lewis in the state of Washington, and a son “heavy into politics,” living in Washington, D.C. Although he might not miss being called at 2 a.m. to deal with a broken water main or malfunctioning filter, he still considers water a good career. That includes taking continuing education courses every year to keep up his certification. At most classes he is one of the younger attendees, a reminder that the industry needs to attract young people to become water plant operators.

“I have 20 years in with the Village of Swanton,” Bishop says. “When I'm 59 I'll have 30 years and can start thinking about retirement. I have a pretty good resume because of the upgrade, but I have no intention of leaving. There's no reason to go, seriously.” tpo

Excellence Recognized

WATER TREATMENT PERSONNEL IN A NORTH CAROLINA CITY EARN THEIR FAIR SHARE OF THE COMMUNITY'S ANNUAL AWARDS FOR INNOVATION

STORY: **Scottie Dayton**

PHOTOGRAPHY: **Al Drago**

THE INNOVATION AWARDS PROGRAM MAY BE UNIQUE to Hillsborough, N.C. Eric Peterson, town manager, started it in 2009 to recognize employees for exceptional contributions, ideas and efforts resulting in superior service or cost savings to citizens.

Anyone can nominate full- and part-time town employees throughout the fiscal year. A review committee selects the finalists, who receive Gold (\$500 and one day's vacation), Silver (\$250) and Bronze (\$100) awards or honorable mentions. The 2013 Silver award winners included six team members at the Hillsborough Water Treatment Facility.

- Russell Bateman, plant superintendent (27 years with the town)
- Howard Hobson, acting plant superintendent and chief operator (25 years)
- Larry Williams (19 years), Steve Baker (16 years), Malcolm Hester (16 years) and Randall Lloyd (seven years), operators

Bateman and Hobson also won Bronze awards. All have Grade 3 (highest) water treatment operator certification. Williams, Baker and Lloyd are also certified laboratory technicians, and Williams and Lloyd were former superintendents at other plants.

"Eric came from a town that didn't have a water or wastewater treatment plant," says Hobson. "We're a small town with both, so it was challenging for him to understand how everything worked." In June and July 2013, the water division faced multiple obstacles during a dredging project at the Lake Ben Johnston reservoir. Assisted by the utilities division, operators provided quality service to customers through innovative plant management and operation.

CONVENTIONAL TREATMENT

The 3 mgd (design) water plant, built in 1972, was upgraded in 2005 with

new raw-water and finished-water pump stations, a 1-million-gallon clearwell and three dual-media filters with air source. Finished water is delivered through 123 miles of mains to 14,700 customers.

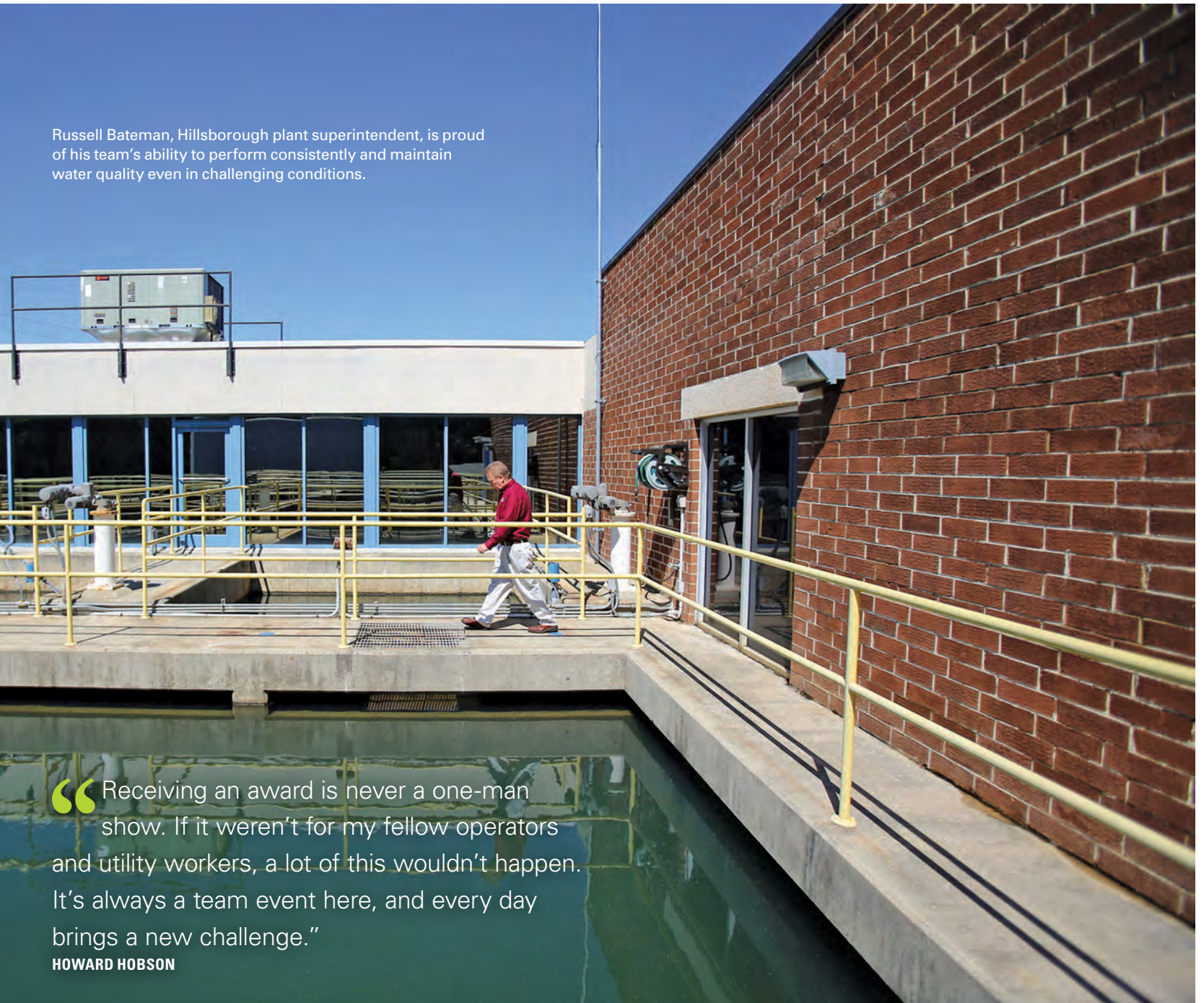
The plant draws raw water into a 20-inch main via two vertical screened 24-inch intakes on the Lake Ben Johnston reservoir on the Eno River. After treating the water with 0.5 ppm sodium permanganate, two 44 hp pumps (all Floway pumps from Weir Minerals) deliver it 2,500 feet to the static flash mixer (Philadelphia Mixing Solutions), which feeds liquid alum and pre-caustic if needed.

Water flows from the mixer through three flocculation tanks (total 100,000 gallons) with Anco mixers (Enviropax) before entering two 250,000-gallon sedimentation basins. It then flows to three FilterWorx dual-media filters (Leopold – a Xylem Brand). The liquid drips through anthracite coal over sand with a Leopold IMS cap porous plate support instead of gravel.

Post-caustic, AQUA MAG blended phosphate (Alexander, a Carus company) and fluoride are fed to the finished water as two 100 hp/1,050 gpm pumps and a 200 hp/2,600 gpm pump send it from the 200,000-gallon pump well. Ammonium sulfate is added at 85 pounds per day as the water leaves the plant for four storage tanks totaling 6.45 million gallons. Except for Accumet pH meters from Cole-Parmer, monitoring sensors are from Hach. Operators make chemical adjustments manually.



Russell Bateman, Hillsborough plant superintendent, is proud of his team's ability to perform consistently and maintain water quality even in challenging conditions.



“Receiving an award is never a one-man show. If it weren't for my fellow operators and utility workers, a lot of this wouldn't happen. It's always a team event here, and every day brings a new challenge.”

HOWARD HOBSON

FLUCTUATING LEVELS

Controlling turbidity is a key operations challenge. Water from the 4-mile-long, 16-foot-deep Lake Ben Johnston averages 20 NTU in summer. Complicating matters, an “island” of sediment, vegetation and logs formed around the raw water intake 24 feet from shore. “We could see the entire island shift when we blew the intakes once or twice a month,” says Hobson. Within a day or two, mud was back on the screens.

As sediment increased in the lake, the plant's ability to remove TOC decreased, enabling trihalomethane levels to rise above the average 0.057 mg/L. This was not the operators' first brush with fluctuating THM levels. Shortly after the 1-million-gallon clearwell came online, its THM levels reached 0.087 mg/L. “We normally keep the clearwell less than half full,” says Hobson. “Nevertheless, the water just cooked until it was pumped to the system.”

At the time, operators fed chlorine at 2 ppm before the filters, then post chlorine after them. State consultants Mike Hicks and J.D. Monroe intro-

Hillsborough (N.C.) Water Treatment Facility

BUILT: | 1972 (upgraded 2005)

POPULATION SERVED: | 14,700

SERVICE AREA: | Town of Hillsborough

CAPACITY: | 3 mgd design

TREATMENT PROCESS: | Conventional

SOURCE WATER: | Eno River

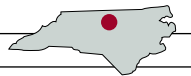
INFRASTRUCTURE: | 123 miles of water mains, 4 water towers, 2 pump stations

KEY CHALLENGE: | Turbidity

ANNUAL BUDGET: | \$1 million (operations)

WEBSITE: | www.ci.hillsborough.nc.us

GPS COORDINATES: | Latitude: 36°04'02.77" N; longitude: 79°07'28.29" W





INNOVATORS OF DISTINCTION

Howard Hobson, chief operator at the Hillsborough Water Treatment Facility, and Malcolm Hester, Grade III operator, received the city's 2012 Innovation Silver Awards for developing an alternate carbon feed system.

"After trying different treatment points and types of carbon to lower TOC removal, we wondered if we could make our own liquid carbon mixture," says Hobson. Through experimentation on weekends, they hit upon filling a 150-gallon tank with 100 gallons of water, adding dry carbon, mixing it for 10 minutes, then adding the remaining water and turning on the carbon feed pump.

They added a second carbon feed point to help meet this year's Stage 2 U.S. EPA disinfection byproducts rule. The solution has a projected annual savings of \$20,346.

Russell Bateman (left) goes over the water level numbers from the previous evening's heavy rain with Howard Hobson, chief operator.

duced a program to calculate chlorine contact times at different locations throughout the plant. They also moved the chlorine contact point from after the filters to between the clearwell and the pump well. The modifications lowered THM levels in the clearwell to 0.047 mg/L.

ALTERNATIVE ACTION

Dredging behind the dam was the only solution to the sediment problem, but the lowest bid was more than \$100,000 over budget, prompting town officials to delay the project for six months. This increased the difficulty for operators in controlling THM levels.

To buy time until the dredging contractor arrived in June 2013, William Baker, assistant utilities director, suggested using the town's trailer-mounted 40 gpm/2,000 psi Mongoose 402 water jetter to blast sediment away from the

hose and pulled himself hand over hand to the intake. Meanwhile, Dunevant stood on the bank and fed out the hose. Once in position, Baker signaled to Bryant Bailey, maintenance technician I, to start the jetter parked on the hill. For their actions, the team won Bronze Innovation Awards.

According to Kenneth Keel, engineer/utilities director, flushing the screens in April and May was the most significant factor in reducing THM levels at the plant. Other factors in reducing THM levels were dredging and moving the finished-water chlorine feed to after the clearwell.

“We already monitor our water every two hours instead of the required four hours. Once dredging began, we'd have to do it every 15 minutes and add a third operator to cope with the changes.”

HOWARD HOBSON

intake. To reach the pipe, Baker purchased and assembled two 8-foot-square floating dock sections to form a stable work platform. Then, as Sam Dunevant, utilities maintenance technician II, rowed a jon boat, Baker fed out 65 feet of rope and anchored it to trees on either side of the lake.

After hooking the line to the platform, Baker boarded it with the jetter

MAINTAINING CAPACITY

As the dredging date approached, plant operators anticipated purchasing water for two months from the City of Durham and the Orange Water and Sewer Authority. However, recent changes to both systems made them incompatible

with Hillsborough's. That meant turbidity would have to be controlled via numerous manual chemical adjustments.

“We already monitor our water every two hours instead of the required four hours,” says Hobson. “Once dredging began, we'd have to do it every 15 minutes and add a third operator to cope with the changes.”

Williams and Lloyd proposed another option: Why not fill the storage tanks and clearwell at night when turbidity was lowest, then shut down the plant when the night shift quit at 7 a.m. and pump from the clearwell during the nine hours of dredging? The solution lasted through the first week of May.

“Normally, we have drought in May, June and July, but 2013 was one of the wettest years on record,” says Hobson. “Every week for a month we had an inch or two of rain, interspersed with cloudbursts dumping 4 and 5 inches over three days.”

Controlling turbidity is a key operations challenge at the facility.



The rain overwhelmed the contractor's two dewatering pumps set upstream of the dam to lower the lake level and expose more sediment. The only way to maintain the level below the spillway was if the plant drew water during the day. A half-hour after dredging began, operators watched turbidity levels shoot from 20 NTU to 400 to 700 NTU.

“We used as much chemicals for flocculation in two weeks as we normally use in a month,” says Hobson. “We were feeding pre-caustic at \$4,800 per tank to boost alkalinity, then adding more alum at \$4,500 per tank to optimize coagulation.” The normal alum feed rate of 32 to 36 mg/L occasionally reached 123 mg/L.

Throughout the dredging project, utilities personnel played key supportive roles for water operators. Earning Silver Innovation Awards were:

- Nathan Cates, utilities inspector
- Joel Lashley, utility maintenance technician III
- Lacy Painter, utility maintenance technician II

Cates monitored turbidity in the river. He also met with the dredging contractor every morning and shared the daily agenda with the operators. “Everyone worked as a unit, enabling the contractor to meet the landowner's July 31 deadline to remove the bypass pumps,” says Hobson. Throughout the project, the plant met the monthly average water demands of 1.5 to 1.6 mgd without imposing restrictions.

The dredging contractor removed 3,600 cubic yards of sediment from behind the dam. To accommodate the volume of mud reaching the plant, the 100-foot-circumference sludge drying bed needed a facelift. “It's nothing but a big pond dug on a peninsula jutting into the river,” says Hobson. “After 23 years of neglect, the pond was full of sediment, vegetation and trees with 6-inch-diameter trunks.”

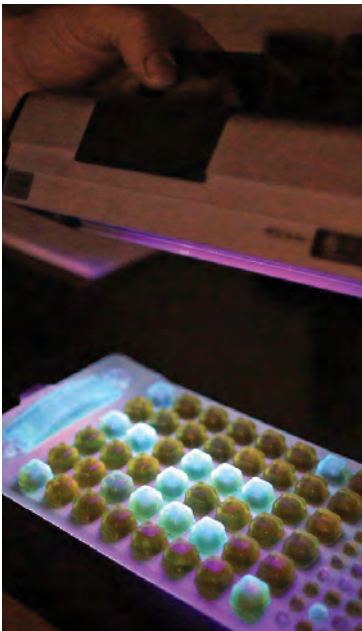
After a contractor cut down the trees, Lashley and Painter cleared the vegetation. They also searched for the two vertical 6-inch drains that discharged the pond's decanted water to the river but never found them. Consequently, they excavated 12 feet down to the bed's original depth and installed two new 6-inch drains.

“When the mud hit the plant, we ran the main and backup alum pumps simultaneously to keep up with it,” says Hobson. “That's odd for us and a little scary. If one of them went down, it would mean a huge price tag to overnight a replacement – and that would be our best case scenario.”

Anticipating such events, the city replaces a pump every three years, usually the oldest one. Operators rebuild it for emergencies, but the spares aren't

The team at the Hillsborough Water Treatment Facility includes, from left, Russell Bateman, plant superintendent; Steve Baker, operator; Malcolm Hesler, operator; Randall Lloyd, operator; Howard Hobson, chief operator; and Nathan Cates, utilities inspector.





A coliform test is performed using an IDEXX Colilert Quanti-Tray placed in an incubator.

always available on site. “More than once, we’ve had to borrow a pump from another department during a tense moment,” says Hobson.

KEEPING IT SAFE

Bateman and Hobson also received Bronze awards after David Moore, safety director, nominated them for introducing a new ammonia product. “We were using ammonium hydroxide,” says Hobson. “To enter the chemical feed room, we had to pass an annual physical and wear a self-contained breathing apparatus. In the last few years, only two people could pass the physical.”

Their research revealed many water plants preferring ammonium sulfate (Univar) because it is safe enough to use as a food additive and is almost odorless. The team tested a sample and received Moore’s approval to change the system. When it went online in spring 2013, operators found it effective and easy to use.

Although the product costs about as much as the original chemical, operators use more because it is less concentrated. They save money by no longer calibrating detection instruments and being able to dispense with safety gear.

“Receiving an award is never a one-man show,” says Hobson. “If it weren’t for my fellow operators and utility workers, a lot of this wouldn’t happen. It’s always a team event here, and every day brings a new challenge.” **tpo**



Malcolm Hesler tests the turbidity of a water sample after a hard rainstorm the night before.

**WATCH THEM
IN ACTION**

To learn more about the Hillsborough Water Treatment Facility, view the video at tpomag.com.

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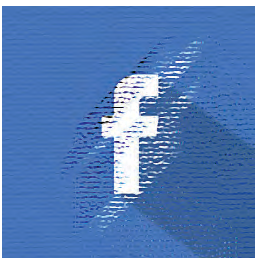
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1



2

- 1) Qdos peristaltic pumps offer a small footprint with flow rates from 0.001 to 15 gph at 100 psi.
- 2) ReNu pump head technology maximizes uptime with no-tools maintenance for quick, safe and easy pump head replacement.
- 3) Operators can easily see data such as flow rate, speed, current input and alarm status on the 3.5-inch TFT color display.



3

Dosing With Precision

A PERISTALTIC METERING PUMP FROM WATSON-MARLOW IS DESIGNED TO CUT CHEMICAL COSTS IN COMMON WATER AND WASTEWATER APPLICATIONS

By Ted J. Rulseh

In a time of tight budgets, no utility can afford to waste chemicals. A new chemical metering pump from Watson-Marlow Pumps Group is designed to enhance metering accuracy for applications like disinfection, pH adjustment and flocculation in drinking water, wastewater and industrial process water treatment systems.

The Qdos 60 peristaltic metering pump, along with the previously introduced Qdos 30 model, extends the capacity range of the company's peristaltic pump line to incorporate flows from 0.001 to 15 gallons per hour. The Qdos 60 is best suited for larger treatment plants.

The pump is designed to cut chemical waste with accurate, linear and repeatable metering. The manufacturer says it helps reduce chemical costs even when metering difficult fluids or when pressure, viscosity and solids content vary.

Peristaltic technology enables precise, continuous, smooth flow for optimal fluid mixing. The pump needs no ancillaries and is simple to install and maintain. Russell Merritt, marketing manager with Watson-Marlow, described the technology to *Treatment Plant Operator*.

tpo: What did you observe that water and wastewater customers were looking for in chemical metering pumps?

Merritt: Customers were asking for a metering pump with a relatively low cost that would be highly accurate, be able to maintain its accuracy over varying process conditions and be simple and inexpensive to maintain. We designed the Qdos 60 as a drop-in replacement unit that comes with our expertise in building fundamentally robust peristaltic pumps.

tpo: Why is this pump model especially suited for water and wastewater applications?

“Operators can easily see data such as flow rate, speed, current input and alarm status. It's a straight push-button interface and requires a minimal number of key presses. The keys are large enough so operators wearing gloves can still operate it easily.”

RUSSELL MERRITT

Merritt: It's a good choice partly because of its peristaltic technology, which has been proven extraordinarily accurate for metering. It offers in a very small footprint a pump capable of metering chemicals against the high pressures common in the environmental market, typically up to about 100 psi. It also delivers chemicals such as ferric chloride and caustic that are very aggressive in nature, while containing them within the pumping mechanism, so that when maintenance has to happen, operators aren't at risk of being exposed.

tpo: How do operators control the output of the pump?

Merritt: We combined the pump with a display that provides a lot of control flexibility. It is a 3.5-inch thin film transistor full-color display, which has excellent contrast in varying light conditions. Operators can easily see data such as flow rate, speed, current input and alarm status. It's a straight push-button interface and requires a minimal number of key presses. The keys are large enough so operators wearing gloves can still operate it easily.

TWO WAYS TO SAVE ENERGY & MONEY



Revolution High Speed Blower
Offers a **40% reduction** in energy usage[†]

Now Offering **10 Models!**

[†]When compared to multistage blowers



Next Generation Control with VFD
Offers a **20% savings** in energy usage*

* When compared to inlet throttling

www.HoffmanAndLamson.com

The system has advanced control features that include fluid level monitoring, fluid recovery, line priming and intuitive flow calibration.

tpo: In simple terms, how does a peristaltic pump work?

Merritt: In concept it is very similar to the way the esophagus works in our bodies. A rhythmic compression-decompression motion moves the product forward. The pump has a tube contained inside a pump header that has a rotor pressing on it at two pinch points. It draws a vacuum that pulls product in on one side and it rotates to push product out on the other side.

tpo: Why is this method of pumping highly accurate?

Merritt: A peristaltic pump is not subject to inaccuracies that result from varying pressure conditions. As a positive displacement pump, it will always put out the same amount of product per revolution, regardless of the pressure on the discharge side, and regardless whether the inlet conditions change. So even if pulling from a tank where the level may change, the pump will still be accurate. And if the product is likely to produce gas, as with sodium hypochlorite, the pump will not lose its accuracy, nor will it vapor lock and fail.

“Maintenance is incredibly simple. A pump can be fully rebuilt in less than one minute, and that is a boon for any facility that has multiple metering pumps.”

RUSSELL MERRITT

tpo: How does this type of pump help utilities save on chemicals?

Merritt: The calibration does not change with variation in discharge or duty conditions. If that were to happen, operators could find themselves discharging more chemical than needed, or potentially less, which would

create a worst-case scenario where treatment is not up to standards and corrections would have to be made. The lack of wastage, and the fact that operators know they're metering and dispensing the exact amount of chemical needed at all times, will definitely save utilities money.

tpo: What does maintenance on this pump model include?

Merritt: Maintenance is incredibly simple. A pump can be fully rebuilt in less than one minute, and that is a boon for any facility that has multiple metering pumps. In a peristaltic pump, the tube inside the pump head is the only wearing part – nothing else inside the pump mechanism actually contacts the product.

When the tubing fatigues, the control system will alarm the pump and tell the operator that the pump head needs to be replaced. The operator simply removes what we call the ReNu pump head – there is no need for special tools. He puts on a new pump head and re-enables it, and it's ready to go. There are no seals and diaphragms to change out and there are no ancillaries like backpressure valves, degassing valves or pulsation dampeners.

The ReNu pump head, which is essentially the entirety of the pump, is a very simple spare part to deal with. It doesn't require any specialized training to install.

tpo: What is involved in retrofitting this pump to an existing pump installation?

Merritt: That is also simple. The pump is similar in footprint and general size to any of the other metering pumps on the market. The interface is accomplished through standard quick-disconnect fittings, so connecting it to existing piping is also very straightforward. **tpo**

Energy Management and Sustainability

By Craig Mandli

Asset Management

PRESSURE TRANSIENT LOGGER

The Pressure Transient Data Logger from Fluid Conservation Systems monitors networks for damaging pressure transients, combating water hammering. With a five-year battery life, fast data sampling and large memory, it is suitable for long-term surveys and rapid troubleshooting. It has 4 GB of flash memory and uses advanced data compression algorithms to store up to 8 billion readings. It can operate effectively in the field for long periods. Reduction or elimination of pressure transients can significantly improve asset life and reduce burst frequency. The device comes with an aluminum case containing the data logger, pressure transducer with quick-fit connector, download lead, software and full documentation. **800/531-5465; www.fluidconservation.com.**



Pressure Transient Data Logger from Fluid Conservation Systems

REMOTE I/O SYSTEM

The u-remote distributed I/O platform from Weidmuller offers a streamlined design and hot-swappable slices, an integrated self-configuring Web server interface and simple plug-in connections. The advanced IP20 platform is built for fast installation and setup and is designed to improve machine performance and productivity. Using Push-In wire technology, each point is clearly visible with LED status indication. Hot-swappable card slices can be installed, updated and removed without tools. An integrated Web server helps speed installation and provides real-time network access to the slices/cards connected to a single fieldbus coupler. **800/849-9343; www.weidmuller.com.**



U-remote I/O platform from Weidmuller

Automation/Optimization

SCADA-ENABLED PUMP CONTROLLER

The TCU pump controller from Data Flow Systems combines automated pump control with SCADA communications for fixed-speed and variable-frequency drive applications. It can automate up to three pumps or can be linked in series to accommodate any number of pumps. It has an intuitive operator interface and expandable I/O interface; no PLC knowledge is required. The HOA switches are fail-safe and remain functional even with loss of power. The unit is SCADA-ready with open Modbus RTU and ASCII protocols and is available with integrated radio, networking, auto-dialer or Verizon cellular communications. It comes with a backup battery and charger and configuration software. **321/259-5009; www.dataflowsys.com.**



TCU pump controller from Data Flow Systems



LED linear luminaires from Dialight

LOW-PROFILE LED LINEAR LUMINAIRES

Low-profile LED linear luminaires from Dialight suit applications requiring greater clearance. They deliver up to 7,000 lumens at 106 lumens per watt. With Class I, Div. 2 and Class II certifications, the units have temperature ratings that enable use throughout a facility. A lifetime of more than 100,000 hours cuts maintenance and the risks of changing lamps in difficult-to-reach places. The luminaires are available in 33- and 66-watt options. They are IP 66 rated and suitable for wet locations. **732/919-3119; www.dialight.com.**

CORROSION-RESISTANT CONTROL PANEL

Corrosion-resistant OLS Series control panels from Orenco Controls contain integrated variable-frequency drives to optimize system operation, reduce energy usage and decrease hard starts and water hammer. Panels are customized to the application and setup needs. Multiple drives can be configured through one interface. Engineers pre-program the user interfaces to site-specific needs. Maintenance staff can easily adjust settings and monitor the system remotely. They are housed in a corrosion-resistant, weatherproof enclosure that also offers circuit protection, heat dissipation systems (fan or A/C), phase and voltage protection and level controls. **877/257-8712; www.orencocontrols.com.**



OLS Series control panels from Orenco Controls

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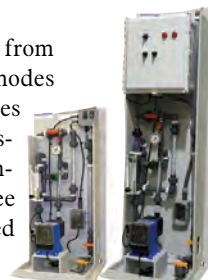


ECO SMART STATION control systems from PRIMEX Controls

ECO SMART STATION control systems from PRIMEX Controls provide a safe, energy-efficient solution for pump control using the latest in variable-frequency drive technology. The EnergyView Controller with kW Logix software uses an efficiency auto-tune algorithm that searches for the pump speed (Hz) that consumes the least energy per gallon of liquid pumped. Pump motor power is monitored by the VFDs and transmitted to the controller. No power meters are required. The auto-tune program accounts for the reduction in flow and head characteristics of the pump resulting from speed reductions to determine the best efficiency frequency (BEF). When the BEF is found, the pumps operate at that speed during every cycle. This ECO mode of operation is efficient during low and normal inflows to the pump station. **844/477-4639; www.primexcontrols.com.**

POLYMER MAKEDOWN SYSTEM

The PULSAblend polymer makedown system from Pulsafeeder in automatic, manual or dry contact modes has a three-step static blending system that provides dilution without harming the polymer chains. Systems include a fabricated assembly and turnkey simplicity, offering a wide range of dilution using three water flow rates. The static blending system is sized to provide activation of all types of polymers, while five polymer pump flow rates ensure correct makedown. The system includes an auto-fill calibration column, adjustable flowmeter and polymer backpressure regulator to maintain a consistent final product. **800/333-6677; www.pulsatron.com.**



PULSAblend polymer makedown system from Pulsafeeder



SYSTEM CONTROL

QUICKSMART PLC-based pump system controllers from Smith & Loveless have screen function buttons and a status bar accessible from each screen. A digital maintenance log displays periodic recommended operation and maintenance instructions and makes lubrication suggestions based on actual pump run times.

QUICKSMART pump system controllers from Smith & Loveless

The unit also offers alarm management, wet well level simulation, pump on/off levels, prime-mode selection, environmental system setpoints and optional STATIONCOMM integration. The 7-inch 65K-Color TFT LCD touch-screen HMI controller has surge protection. **800/898-9122; www.smithandloveless.com.**

Biogas

BIOGAS HOLDER

The Double Membrane Biogas Holder from JDV Equipment Corporation allows variable biogas storage within the inner membrane at constant pressure during gas production and usage, while the air-inflated outer membrane provides gas pressure and protection. The outer membrane is constructed of a high-tech cross-woven fabric, coated with PVC and UV protection. Sensors monitor gas volume, allowing operators to optimize the use of biogas to feed generators or heating systems. **973/366-6556; www.jdvequipment.com.**



Double Membrane Biogas Holder from JDV Equipment Corporation



EXELYS continuous thermal hydrolysis process from Kruger USA

CONTINUOUS THERMAL HYDROLYSIS SYSTEM

The EXELYS continuous thermal hydrolysis process for biosolids treatment from Kruger USA offers effective anaerobic digestion pretreatment with energy balance and solids reduction. In a typical LD (lysis-digestion) configuration, dewatered cake is continuously fed to it. As the cake enters the system, steam is injected, raising the temperature

to that required for hydrolysis to occur. After at least 20 minutes at temperature, the hydrolyzed material is cooled via heat exchangers and pumped to anaerobic digesters. The solids concentration into the digesters can be as high as 8 to 10 percent, increasing capacity. **919/677-8310; www.krugersusa.com.**

DIGESTER MIXING SYSTEM

The externally mounted GasMix digester mixing system from Landia reduces maintenance, as there is no need to open the digester. It can agitate the entire digester tank, preventing a crust from forming on top. Chopper pumps and a self-aspirating system reduce solids to produce more methane in less time. The system is easy to regulate and saves significant energy.

In the first mixing stage, the liquid is injected into the tank's upper half under high pressure, while new biogas is drawn from the top of the tank and mixed. In the second stage, the liquid is injected into the tank's lower half under high pressure, causing vigorous mixing. **919/466-0603; www.landiainc.com.**



GasMix digester mixing system from Landia



BioCNG biogas conditioning system from Unison Solutions

BIOGAS CONDITIONING SYSTEM

The BioCNG biogas conditioning system from Unison Solutions economically converts biogas to fuel for vehicles designed for compressed natural gas (CNG). The system removes hydrogen sulfide, moisture, siloxanes,

volatile organic compounds and carbon dioxide. The fuel is then routed to a CNG fueling station and compressed. The fuel meets or exceeds SAE J1616 criteria. Systems can produce up to 1,100 gasoline gallon equivalent per day. Depending on the chemistry of the biogas, the production cost is \$0.65 to \$1.15 per gasoline gallon equivalent. **563/585-0967; www.unisonsolutions.com.**

Boilers

FOUR-PASS PACKAGED SCOTCH BOILER

The Series 500 four-pass wetback Scotch marine boiler from Hurst Boiler & Welding Company is designed for optimum fuel efficiency with no heavy refractory back doors or baffles to replace or maintain. It has independent tube sheets with uniform temperatures, eliminating premature tube failure and cracks in the tube sheet. It has capacities from 30 to 2,000 hp, with 15 psi steam and 30 psi water (60 psi water optional). No field assembly is required. UL Listed boiler/burner packages come with fully assembled, prepiped, prewired and pressure-tested gas trains. **800/666-6414; www.hurstboiler.com.**



Series 500 boiler from Hurst Boiler & Welding Company



TC Series boiler from Parker Boiler Co.

CONDENSING HOT-WATER BOILER

The TC Series condensing hot-water boiler from Parker Boiler Co. is available in 399,000 to 5,443,000 Btu input, with stainless steel construction for corrosion resistance at low operating temperatures. It offers efficiencies to 99.7 percent as witnessed and verified by a Nationally Recognized

Test Lab. Units are available with conventional gas burners or low NOx power-type burners. **323/727-9800; www.parkerboiler.com.**

Drives

NEXT-GENERATION CONTROLS

Next-generation controls and variable-frequency drives from Hoffman & Lamson, Gardner Denver Products, optimize the efficiency of new or existing blowers. The controls are engineered with new technologies, yielding cost-effective, flexible and robust systems. Benefits include SCADA-ready panels, meterless flow control, pre-engineered design packages that reduce electrical installation costs and automated monitoring. Horsepower consumption is lower, as only the blower output decreases while the optimal efficiency remains the same as at full speed. **724/239-1500; www.hoffmanandlamson.com.**



Controls and drives from Hoffman & Lamson, Gardner Denver Products

(continued)



Integrated vector drives from seepex

INTEGRATED VECTOR DRIVE

Integrated vector drives for metering and general transfer progressive cavity pumps from seepex have a digital display that helps integrate pumps with a single-reduction gearbox, a four-pole TEFC inverter-rated electric induction motor and a vector-type variable-frequency drive in a NEMA 4 enclosure. The vector capability has an internal sensorless feedback system for accurate speed control and stability. The display shows operating speed, drive status and settings during drive programming and setup. The keypad allows customized settings and for some factory-set parameters to be adjusted in the field. Alphanumeric codes aid in determining the cause of a fault trip from an overload condition or an inhibit signal from one of the external instruments for sensing a run-dry, high-pressure or low-flow condition. **937/864-7150; www.seepex.com.**

MEDIUM-VOLTAGE AC DRIVE

MV1000 medium-voltage AC drives from Yaskawa America combine compact modular design, high efficiency, low harmonics and high mean time between failures in a drive compatible with 1000 Series low-voltage AC drive products. Smart Harmonics reduces input total harmonic distortion (THD) to less than 2.5 percent without filters. They also provide galvanic isolation between power input and output. They use two 5-volt step bridges per phase to generate a 17-level line-to-line voltage output delivered to the motor. The near sinusoidal waveform results in low THD voltage, low torque ripple and ideal low-speed torque without output filters. They are available in 2.4 kV models with outputs from 200 to 2,750 hp, and 4.16 kV models with outputs from 300 to 5,000 hp. **414/856-2496; www.yaskawa.com.**



MV1000 AC drives from Yaskawa America



Generator sets from Cummins Power Generation

Generators

TIER 2 GENERATOR SET

High-horsepower diesel generator sets from Cummins Power Generation meet EPA Tier 2 emissions regulations. The units are designed for emergency response, steady-state performance, reliability and versatility for standby power applications at water and wastewater treatment facilities. Models operating at 60 Hz meet EPA Tier 2 emissions regulations and are rated from 1,250 to 2,250 kW. They are seismic-certified and are preapproved by California's OSHPD agency for ground and rooftop installations. The units accept a full-rated load in a single step as required by NFPA for Level 1 systems. **877/769-7669; www.cumminspower.com.**

Heat Exchangers/ Recovery Systems

WIDE-GAP NON-PLUG HEAT EXCHANGER

Wide-gap non-plug heat exchangers from DDI Heat Exchangers have a rectangular



Heat exchangers from DDI Heat Exchangers

channel structure with large gaps of more than 6 inches, allowing for a double layer between sewage and potable water. Recovered energy can be used for heating in winter and cooling in summer. **514/696-7961; www.ddi-heatexchangers.com.**



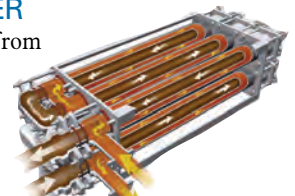
APV plate heat exchangers from SPX

PLATE HEAT EXCHANGER

APV plate heat exchangers from SPX include gasketed, semi-welded and welded options to suit applications from high-capacity, heavy-duty operation to small, space-saving units. A variety of plate materials, corrugation patterns, plate heights, gasket types and connection options provide design flexibility to match the application. Optimized plate designs enhance thermal efficiency and reduce energy consumption. Plate-alignment systems provide plate pack stability and ensure the safe use of thinner and thermally efficient plates. Easy gasket mounting and plate alignment systems simplify operation and maintenance. Long run times and easy access for cleaning and inspection reduce maintenance costs. **800/252-5200; www.spx.com.**

TUBE-IN-TUBE HEAT EXCHANGER

The Sludge-to-Sludge Heat Exchanger from Walker Process Equipment, A Div. of McNish Corp., is a concentric tube-in-tube design that uses counter-flow circulation of heated thermophilic sludge and raw influent sludge. The arrangement allows cooling of thermophilic sludge and reduces the energy required to heat raw sludge. Sludge tubes' end castings are removable for cleaning, and end castings include built-in water back-flushing connections. Controls include non-flow-restrictive temperature sensors and glass tube or dial thermometers to measure inlet and outlet temperatures. **630/892-7921; www.walker-process.com.**



Sludge-to-Sludge Heat Exchanger from Walker Process Equipment, A Div. of McNish Corp.

High-Efficiency Motors/Pumps/Blowers



AEGIS Shaft Grounding Ring Motor Repair Handbook from Electro Static Technology

SHAFT GROUNDING RING HANDBOOK

The 36-page AEGIS Shaft Grounding Ring Motor Repair Handbook from Electro Static Technology describes best practices for protecting motor bearings from electrical damage. It explains how to diagnose bearing damage caused by variable-frequency drives and explains in detail best practices for preventing such damage to motors of various sizes and horsepower ratings. It is available in PDF format for downloading at www.est-aegis.com/bearing. **866/738-1857; www.est-aegis.com.**

PROGRESSIVE CAVITY PUMP

The Flowrox progressive cavity pump is designed for industrial slurry and paste pumping applications, especially with high-viscous or shear-sensitive liquids and sludges. It delivers up to 150 psi per single stage with a spiral stator that forms the heart of the pump. The 2/3-spiral technology offers more pressure with less strain, resulting in less backflow and increased flow per revolution. **410/636-2250; www.flowrox.us.**



Progressive cavity pump from Flowrox

WASTEWATER PUMPING SYSTEM



The Exporior wastewater pumping system from Flygt – a Xylem Brand offers energy savings in a package that is easy to install and operate. Adaptive N-technology allows the impeller to move axially upward when necessary to permit bulky or tough debris to pass through, reducing stress on the shaft, seals and bearings. It is available with efficient motors optimized for wastewater pumping. SmartRun intelligent controls enable programming to optimize energy use. **704/409-9700; www.flygtus.com.**

Exporior wastewater pumping system from Flygt – a Xylem Brand

REGENERATIVE BLOWER

Regenerative blowers from FPZ have high-efficiency impeller construction with no belts and require no lubrication. They offer quiet operation for use in treatment plants in residential areas. Inverter duty motors can be tied to oxygen sensors that allow the blower to operate at various speeds to maximize efficiency. **262/268-0180; www.fpz.com.**



Regenerative blowers from FPZ

BACKUP PUMPING SYSTEM

The Reliaprime emergency bypass station from Gorman-Rupp Company has a 6-inch Super T Series pump capable of passing 3-inch spherical solids. A sound-proof lightweight aluminum enclosure has lockable door panels that can be removed for maintenance. The unit is a complete backup package, ready for hook-up. **419/755-1011; www.grpumps.com.**



Reliaprime emergency bypass station from Gorman-Rupp Company

FUME HOOD BLOWER

Belt and direct drive exhaust blowers from HEMCO Corporation are chemical resistant and available in standard and explosion-proof models. They efficiently remove hazardous fumes from within the fume hood. Epoxy-coated steel belt or direct drive units from 250 to 2,000 cfm have adjustable discharge and weather covers. PVC belt or direct drive blowers range from 230 to 1,600 cfm. Ventilation accessories including ducting, filters and components are available. **800/779-4362; www.hemcocorp.com.**



Exhaust blowers from HEMCO Corporation

ROTARY SCREW BLOWER PACKAGE

FBS rotary screw blower packages from Kaeser Compressors combine an energy-efficient Sigma Profile rotary screw air end with a blower package. The integrated package provides flows from 565 to 2,366 cfm. Units arrive ready for use and include a premium-efficiency



FBS rotary screw blower packages from Kaeser Compressors

TEFC motor with automatic V-belt drive tensioning device, inlet/outlet silencers, full sound enclosure, a full complement of sensors and an onboard controller. Units are available with wye-delta start or variable-speed drive. They include Sigma Control 2, which mon-

(continued)



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itors all pressure, temperature and other sensors, and includes expanded communication features. The Ethernet port and built-in Web server enable remote access and seamless integration into plant control and monitoring systems. **866/516-6888; www.kaeser.com.**

EFFICIENT REVERSE OSMOSIS SYSTEM

The efficient SALINO Pressure Center from KSB combines four components into a single, compact reverse osmosis system — a high-pressure pump, energy recovery device, booster pump and electric motor. This 4-in-1 technology, with space-saving design, makes it suited for decentralized use in small- and medium-sized containerized systems. Few components keep investment and maintenance expenses low. Integrated energy recovery reduces operating costs. Plug-and-desalt design allows fast installation and operation. **804/222-1818; www.ksbusa.com.**



SALINO Pressure Center from KSB



Moyno 2000 HS feeder system

TWIN-SCREW FEEDER SYSTEM

The Moyno 2000 HS system has a twin-screw feeder that supplies a constant, pressurized feed rate to the pump, resulting in a 100 percent pump cavity fill rate. Its integral hopper with twin-

screw auger feeder and progressive cavity pump efficiently handle dewatered municipal biosolids to over 50 percent solids. The Ultra-Feed pump rotor provides high volumetric efficiency. It is available in varying twin-screw feeder and hopper lengths to match wide feed areas from centrifuges and 1- through 3-meter length belt filter presses. Concentric auger rotation in a close-tolerance pressure tube allows the twin-screw feeder to generate positive stuffing pressure to the pump inlet. The intermeshing augers provide self-cleaning action. The twin-screw feeder can be run at a separate speed from the pump rotation, allowing control over stuffing pressure. **877/486-6966; www.moyno.com.**

MULTIPHASE PUMP

Multiphase Pumps from NETZSCH Pumps North America mitigate the costs of installing and operating separation equipment and the multiple pipelines that would be needed at the well site. They can handle various mixtures of oil, gas, solids and water. The progressive cavity pump is designed for untreated well flow applications that can provide flow rates up to 2,600 gpm and handle pressures up to 900 psi. They provide almost pulsation-free pumping, low shear rates, high overall efficiencies and low operating and maintenance costs. **610/363-8010; www.netzschusa.com.**



Multiphase Pumps from NETZSCH Pumps North America

INVERTER-DUTY MOTOR



WPI Inverter Duty motors from Nidec Motor Corporation

WPI Inverter Duty motors from Nidec Motor Corporation meet NEMA premium efficiency levels. The 15 to 30 hp vertical high-thrust motors protect against harmful effects when the motors are used with a variable-frequency drive, including a shaft grounding ring to discharge shaft current without harming the bearing, and winding thermostats to protect the motor from incidental overheating when operated at low speeds

for extended periods. **888/637-7333; www.usmotors.com.**

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AquaCritox system from SCFI Group

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Don Gariepy
 Water Treatment Plant Mechanic
 Charlotte-Mecklenburg (N.C.) Utility Department



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Oil-free screw blowers provide compressed air to process effluent

Problem

Operators of the wastewater treatment plant in Versmold, Germany, sought an updated energy source to process effluent. The 2.2 mgd plant treats 60 percent high-strength wastewater from meat processors containing above-average quantities of phosphate. The treatment and measurement technology, process controls and compressed air technology had to quickly measure the influent contents and respond accordingly.

Solution

Two **Atlas Copco ZS 55+ oil-free screw blowers** with variable-speed drives supply energy-efficient compressed air to process effluent. Nitrification and denitrification take place simultaneously in two aeration tanks. The aerobic process is first supplied with oxygen via the plate aerators. During the subsequent anaerobic phase, the tank contents are mixed together.



RESULT

The plant has cut energy costs by 10 percent. The two blowers supply compressed air at about 900 to 2,100 cfm. The volume of flow is automatically adjusted to the exact air demand using the variable-speed drives. “The blowers are compact, and it is not necessary to make many modifications,” says plant manager Khosrow Ghobadi. “The machines are simply linked to the process control system, which we did without any problems.” 866/546-3588; www.encyclopedia.com.

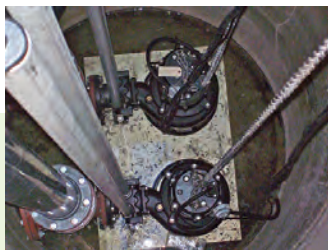
Submersible shredding pumps solve clogging issues

Problem

Regency in the Forest, a 400-unit, upscale adult-living apartment complex north of The Woodlands, Texas, uses a lift station to move raw sewage and runoff for the final processing. The lift station has two non-clog pumps in a duplex setup. When the pumps stopped working soon after their installation, service personnel found them clogged with fishing line, burlap bags and other debris. The crew repaired the pumps and reinstalled them, only to be called back weekly for several months for the same failures. Someone apparently was dumping things into a manhole on the property.

Solution

Pumps of Houston replaced the non-clog pumps with two 5 hp **SK 37C electric submersible pumps from BJM Pumps**. They have a tungsten carbide shredding impeller. Shredded pieces pass through the pump and into the wastewater stream.



RESULT

The pumps have worked almost flawlessly. One pump jammed when it could not digest an entire prom dress and several yards of thick nylon rope. Otherwise, both pumps have run without failure. 877/256-7867; www.bjmpumps.com.

Heat exchangers used to overcome dimensional restrictions and increase energy production

Problem

Cory Environmental’s plant in Weston-super-Mare, United Kingdom, burns biogas from anaerobic digesters to reduce energy costs and improve efficiency and uses biosolids as fertilizer. Three heat exchangers were required for digester heating, waste pasteurization and heating of a fat tank. The available footprint was small.

Solution

HRS Heat Exchangers designed and built three units mounted on a common boxed stainless steel frame. The units have stainless steel cladding over the frame and connections for each unit protruding from the cladding. The corrugated tube design helped keep the footprint to a minimum. The high turbulence and increased heat transfer rate significantly reduced the footprint.



RESULT

The compact solution fit the site and helped with pipe work connections. 623/915-4328; www.hrs-heatexchangers.com.

Grinder eliminates wipes problem

Problem

In 2012, the Santa Margarita Water District in California saw a change in the influent at its reclaimed water facility. Disposable wipes were degrading pump performance, requiring all four pumps to run continuously, instead of cycling two pumps at a time. When the pumps could no longer keep up, the plant staff had to derag them by hand, forcing a plant shutdown about every four weeks for two hours and exposing workers to potential injuries from sharps in the rag balls. The labor and the loss of an acre-foot of reclaimed water per month cost \$15,000 per year.

Solution

The facility upgraded its Channel Monster from **JWC Environmental** to a new perforated drum configuration designed to combat wipes and other materials. The upgraded drums are made of durable perforated metal that better traps wipes and forces them into the cutter stack, essentially eliminating clogs.



RESULT

Since the upgrade, the district has had zero pump clogging issues and has returned to using two pumps at a time. Energy costs decreased by \$78,000 per year and manual pump clean-out was eliminated. 800/331-2277; www.jwce.com.

Blowers decrease energy consumption and reduce noise, heat and maintenance costs

Problem

King County, Wash., wanted more energy efficient blowers at the South Plant in Renton. With the support of Puget Sound Energy and the Washington State Public Works Board, the plant secured incentives and a low-interest loan toward the retrofit. The county also needed to improve working conditions, increase operational reliability and reduce scheduled maintenance expenses.

Solution

The county replaced its blowers with **APG-Neuros turbo blowers**. The retrofit aligned with ongoing strategic efforts to protect water quality and decrease energy consumption in all county facilities by 20 percent by 2020.

RESULT

The county estimates the two new blowers will save \$55,000 a year and reduce energy consumption by 782,268 kWh per year. **866/592-9482; www.apg-neuros.com.**

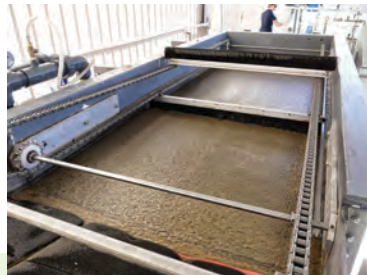
Separation technology system recycles frac water

Problem

Industrial Systems Inc., a hydraulic fracturing operation on the western slope of Colorado, experienced up to 30 percent flowback rate from water pumped into the ground. In addition, eight barrels of high-saline produced water surfaced with every barrel of crude. Operators needed a cost-effective way to manage the water. Trucking and disposal cost \$3 to \$12 per barrel and posed environmental risks.

Solution

OriginOil's Electro Water Separation technology offers a high-speed, chemical-free process that efficiently extracts oils, suspended solids, insoluble organics and bacteria from frac flowback and produced water for reuse. By circulating wastewater through reactor tubes, the system applies low-voltage electro-pulses that coagulate the oil and suspended solids. The oil and solids are then lifted to the surface by a cloud of micro-bubbles generated by a second surge of pulses in the flotation chamber. The process, integrated with a downstream polishing technology into a CLEAN-FRAC system, allows operators to clean and reuse water on site.



RESULT

OriginOil successfully demonstrated a 1,000-barrel-per-day commercial-capacity system with frac flowback and produced water for a disposal site in Delta, Colo. The technology, coupled with an infiltration membrane system from TriSep Corporation, removed 99.8 percent of turbidity, 100 percent of suspended solids and 99.2 percent of oil from the water. The results were verified by Lizard Analytical Laboratories, an independent lab in Grand Junction, Colo. **877/999-6645; www.originoil.com.**

Gas cogeneration system uses digester gas to create power

Problem

The Downers Grove (Ill.) Sanitary District sought a solution for generating electricity from biogas from its 11 mgd treatment facility.

Solution

Tech 3 Solutions supplied a 280 kW cogeneration system that can burn up to 100,000 cubic feet per day of digester gas. The district also purchased a digester gas cleaning system from Unison Solutions.



RESULT

The district uses all the electric power from the unit and will use captured heat for two of its five anaerobic digesters. From startup in June to mid-August 2014, the plant had produced over 160,000 kWh. The district estimates the system will cut power costs by 25 to 40 percent annually. **305/666-1910; www.tech3solutions.net.**

Orthophosphate analyzer helps plant meet effluent limit

Problem

The Hartford (Wis.) Wastewater Treatment Plant faced a an effluent phosphorus limit of 0.075 mg/L. Chemical coagulant is added to the oxidation ditch to bind dissolved phosphorus (orthophosphate). Plant Superintendent Dave Piquett and his staff sought ways to add sufficient chemicals to meet treatment requirements without overdosing.

Solution

The **P700 IQ ortho-phosphate analyzer** from **YSI, a Xylem brand**, draws samples from the effluent channel, and the measurement is used in a feedback loop to control chemical feed upstream through analog outputs from a 2020XT controller included with the analyzer. The controller can manage and display up to 20 measurements, allowing staff to add measurements to optimize treatment.



RESULT

Besides controlling chemical addition, the unit has demonstrated low reagent consumption. Auto calibration ensures the accuracy of the online phosphate measurement. Measurements closely agree with results from numerous grab samples. Continuous monitoring provides the information needed to evaluate the effect of changes to treatment processes. **800/765-4974; www.ysi.com.**

(continued)

Piston pump used to convey biosolids in tight quarters

Problem

The 420 mgd (design) Village Creek Wastewater Treatment Plant in Birmingham, Ala., was challenged in transporting biosolids from dewatering to truck loading in a constrained space. While the transport distance was short, the layout precluded the use of screw or belt conveyors.

Solution

Operators installed a **KSP50V(HD)L piston pump and piping system** from **Schwing Bioset** to convey dewatered biosolids. The system includes a sliding-frame silo with 940 cubic feet of storage as buffering capacity. The pumps now transport the biosolids to a lime treatment process for land application.



RESULT

This solution enables the beneficial reuse of about 500,000 pounds of biosolids weekly for strip mine reclamation. **715/247-3433; www.schwingbioset.com.**

Village looks to wind to power wastewater plant

Problem

Faced with rising power costs and a volatile energy future, the Village of Cascade, Wis., wanted an alternative energy source.

Solution

Two community-friendly **NPS 100-21 wind turbines** from **Northern Power Systems** generate all the energy for the wastewater treatment facility's aeration system, making it the first net-zero energy wastewater plant in Wisconsin.



RESULT

The village saves \$30,000 a year, a significant amount for a community with an annual budget of \$330,000. **800/906-6784; www.northernpower.com.**

Position transducers used to monitor drainage door position

Problem

The operator of the 676 mgd Stickney Water Reclamation Plant, in Cicero, Ill., needed accurate control of the position of valves that regulate drainage doors during treatment and integrate the information with the plant control system. The slidewires in use were unreliable and needed frequent replacement. Since each drainage door had different opening characteristics, the plant team had to be able to modify the analog output signal for the unit in the field. The unit had to be small enough to install in the valve actuator housing in a high-temperature, challenging environment.

Solution

Several field-programmable **Camille-Bauer Kinax 2W2 position transducers** from **Absolute Process Instruments** give an accurate and repeatable linear 4-20 mA signal for the valve position that can be interfaced with plant controls. At 1.95 inches in diameter and 1.10 inches deep, they fit in the actuator housing. They have temperature stability and cause no drag on the valve gearing. They are field-programmable and easily tailored to each door.

RESULT

The position transducers provided excellent accuracy and reliability to improve control of drainage door position. **800/942-0315; www.apicb.com.**

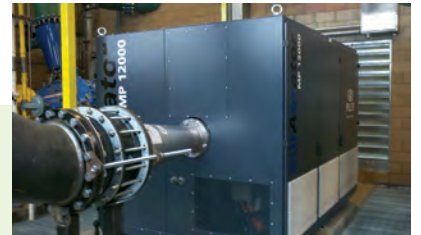
Energy-efficient blower unit leads to big savings

Problem

The Victor Valley (Calif.) Wastewater Reclamation Authority's 13 mgd treatment plant was being expanded to 18 mgd to account for growth, and the authority needed to upgrade its inefficient blower unit.

Solution

The authority received incentives through Southern California Edison's Customized Solutions program for replacing its blower with a new unit from **Piller TSC Blower Corporation**. The company provides free pump testing to measure pumping plant efficiency and calculate the annual energy savings.



RESULT

The unit increased overall plant efficiency, lowered electricity costs and reduced the carbon footprint. It will save a projected 928,500 kWh annually, saving up to \$98,000. **518/372-2496; www.piller-tsc.com.**



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Recarbonation system reduces filter loading

Problem

A water treatment plant in Omaha, Neb., saw potential to minimize operation costs and reduce filter loadings with a different side stream recarbonation system. The existing system, installed in 2012, used over 2,000 gpm of finished water for its carrier stream and had no power turndown when operating at reduced rates.

Solution

The city tested and ultimately purchased a full-scale **CDOX carbon dioxide injection system** from **BlueInGreen** that delivered precise, automatic control of process pH using a 200 gpm carrier stream.



RESULT

The 1,800 gpm difference in carrier water significantly reduced pumping power usage and helped operators by directly reducing filter loading. The system also used significantly less carbon dioxide and 90 percent less power than the previous system. The plant team expects operation cost savings to pay for the system in just over 2 1/2 years. **479/527-6378; www.blueingreen.com. tpo**

Yaskawa acquires Solectria Renewables

Yaskawa Electric Corp. acquired Solectria Renewables through its U.S. subsidiary, Yaskawa America. Headquartered in Lawrence, Mass., Solectria manufactures high-performance photovoltaic inverters. It will continue to operate as a wholly owned subsidiary.

Franklin acquires pump, fueling operations in India

Franklin Electric acquired Plugra Pumps and Motors in Vadodara, Gujarat, India, and Franklin Fueling Systems acquired Wadcorpp India in Mumbai, Maharashtra, India. Plugra designs, manufactures and distributes groundwater motor and pumping equipment through 11 branch offices in India. Wadcorpp distributes fueling equipment throughout India.

CNP acquires worldwide patent licenses

CNP-Technology Water and Biosolids Corp., a newly formed wastewater treatment technologies provider, acquired worldwide patent licensing for AirPrex from P.C.S. GmbH in Hamburg, Germany. CNP's flagship technology, AirPrex, is a sludge optimization process that recovers the high-phosphate mineral struvite after anaerobic digestion but before the dewatering process. Based in Racine, Wis., CNP North America also has locations in Germany and China.

SWAN Analytical introduces drinking water service program

SWAN Analytical USA introduced a service program for drinking water facilities and clarified or filtered wastewater applications. The program includes startup training, scheduled maintenance and retrofit services for online analytical water-quality monitors and controllers.

McLanahan reaches 1 million hours without lost-time injury

McLanahan achieved 1 million hours without a lost-work-time injury. A lost-time accident is measured as an incident where an employee is required to miss a day of work due to an injury other than the day of the accident. This is the second time the company has achieved the safety milestone. **tpo**



“The team members are the greatest resource at this plant. They do the work. I'm support staff. I coordinate what they do, and the best way for me to do that is to listen to what they have to say.**”**

**Nate Tillis, Operations and Maintenance Supervisor
Beloit (Wis.) Water Pollution Control Treatment Facility**

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Education Day kicks off the show, with presenters from the industry's top manufacturers and associations leading a wide variety of classes. Learning opportunities extend throughout the week, with educational seminars also slated for Tuesday and Wednesday. You will gain valuable industry-specific knowledge, and WWETT education courses also count toward continuing education credits in many states.

While the educational opportunities are valuable and popular, the show really ramps up on Tuesday when the exhibit hall opens. Every year, products introduced at the show become important components in many industry professionals' toolboxes and equipment fleets. More than 8,700 people representing 3,800 companies attended the 2014 show, with 529 exhibitors nearly spilling out of the exhibit hall.

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Education Day Sessions

Monday, February 23, 2015

NAWT

National Association of Wastewater Technicians
Room 234-236

- 8 a.m. | Pre-Trip Inspections
- 9:30 a.m. | Hours of Service (HOS) Overview
- 11 a.m. | Roadside Inspections
- 1:30 p.m. | Environmental Impact Study: Effects of Water Softener on Septic Tank Performance
- 3 p.m. | A Study of Microbiological Induced Corrosion
- 4:30 p.m. | Ask the Expert Q & A

WJTA-IMCA

Water Jet Technology Association
Industrial Municipal Cleaning Association
Room 140-142

- 8 a.m. | Hydroexcavation — Tools to Stay Current in a Changing Marketplace
- 9:30 a.m. | Maximizing Productivity on Vacuum/Air Mover Projects
- 11 a.m. | Waterblast Safety Can Enhance Productivity, Quality and Profits!

SSCSC

Southern Section Collection Systems Committee
Room 231-233

- 8 a.m. | Combination Vacuum Unit Operation Overview
- 9:30 a.m. | Been There, Done That, Got The T-Shirt (Small Business From a Hands-on Perspective)
- 11 a.m. | So You Think You Are the Best? CCTV Inspection In Its Highest Form
- 1:30 p.m. | Avoid the Pitfalls — Trenchless Pipeline Repair and Renewal
- 3 p.m. | NOZZLES, NOZZLES, NOZZLES!
- 4:30 p.m. | Ask the Experts Q & A

SSPMA

Sump and Sewage Pump Manufacturers Association
Room 243-245

- 1:30 p.m. | Sizing Guidelines for New or Replacement Sewage Pumps
- 3 p.m. | Backup Battery and Combination Pump Systems Evaluation and Installation
- 4:30 p.m. | Specifying Pumps: Why Do Pumps Fail?

NASSCO

National Association of Sewer Service Companies
Room 130-132

- 8 a.m. | Overview of Manhole Rehabilitation Technologies
- 9:30 a.m. | When, Why and How to Defeat Infiltration Cost Effectively
- 11 a.m. | New Opportunities in Small-Pipe Relining and Reinstatement
- 1:30 p.m. | Pipeline cleaning Best Practices
- 3 p.m. | Large-Diameter Pipe and Drain Rehabilitation Technologies
- 4:30 p.m. | Ask the Experts Q & A

NEHA

National Environmental Health Association
Room 237-239

- 8 a.m. | New Technologies for Non-Potable Water Use
- 9:30 a.m. | Rules & Regulations with New Technologies and Working with Regulators
- 11 a.m. | New Technologies for Non-Potable Water Use Part 2
- 1:30 p.m. | OSHA Regulations and Smart Business
- 3 p.m. | Sales & Marketing with New Technologies
- 4:30 p.m. | Ask the Experts Q & A

NOWRA

National Onsite Wastewater Recycling Association
Room 240-242

- 8 a.m. | Lobbying
- 9:30 a.m. | Field Inspections Part One
- 11 a.m. | Field Inspections Part Two
- 1:30 p.m. | Septic Tank Safety — Lethal Lids
- 3 p.m. | Time Dosing
- 4:30 p.m. | Ask the Experts Q & A

Portable Restroom Track

Beverly Lewis
Room 243-245

- 8 a.m. | Mastering the Busy Season
- 9:30 a.m. | A Great Customer Experience
- 11 a.m. | Employee Retention and Recruitment

Business Track

Kelly Newcomb, Ellen Rohr, Women's Roundtable
Room 136-138

- 8 a.m. | Grow or Go! Why Most Companies Fail to Grow Effectively and What You Can Do to Keep Your Company From Failing
- 9:30 a.m. | Target Marketing: How to Effectively and Efficiently Grow Your Sales
- 11 a.m. | Effective Branding and How it Can Help Your Business
- 1:30 p.m. | Business Basics 101
- 3 p.m. | Build the Business You REALLY Want
- 4:30 p.m. | Women in Wastewater Roundtable Discussion

Gil Longwell
Room 140-142

- 1:30 p.m. | Protecting Private Enterprise

Marketing Track

Susan Chin
Room 133-135

- 8 a.m. | Ladies and Gentleman: Create Your Personal Brand and Strategic Network for Success in 5 Easy Steps
- 9:30 a.m. | Effective Website Design and Engaging Customers in the Digital Age
- 11 a.m. | Tapping into the Power of Social Media and Content Marketing

Road Rules & Safety Track

John Conley
Room 133-135

- 1:30 p.m. | A Trucker's Guide to Washington Speak
- 3 p.m. | Cargo Tank Safety and Regulatory Report
- 4:30 p.m. | Compliance with Part 180 and Preparing for a Tank Truck CT Shop Audit

You can view the complete schedule of events along with an exhibitor list, floor plan, travel information and everything else you'll need to plan your trip to Indy at wwett.com



Tuesday Sessions

Detailed session information available at: wwett.com

February 24, 2015

NAWT Track

Room 234-236

- 8 a.m. | Septage Processing Introduction:
Working with an Engineer
- 9:30 a.m. | Analyzing Your Resources:
What Goes on Around You is Important!
- 11 a.m. | Introduction to Odor Control

Onsite Installer Track

Room 231-233

- 8 a.m. | Soils, Design, O&M: What Every Installer
Should Know
- 9:30 a.m. | Best Installation Practices for
Trouble-Free Pump Controls
- 11 a.m. | Introduction to Effluent Filters

*MSW Track

Room 237-239

- 8 a.m. | Mapping Solutions for Repair and
Maintenance of Water Distribution Systems
- 9:30 a.m. | The Shift from Reactive to Proactive
Wastewater Management Best Practices
- 11 a.m. | Why Hasn't Your Sewer System Evaluation
Survey Testing Worked?

*MSW - Municipal Sewer & Water

Treatment Plant Operator Track

Room 240-242

- 8 a.m. | An Emerging Technology for Lagoon-Based
Nutrient Removal
- 9:30 a.m. | The New Wastewater: Collection System
Challenges Caused by Today's Modern Trash
- 11 a.m. | Wastewater Microbiology

Industry Safety Track

Room 243-245

- 8 a.m. | New Trends and Technology in Equipment
for Excavation Safety
- 9:30 a.m. | Best Practices: Use, Care and Repair of
High-Pressure Sewer Cleaning Hose
- 11 a.m. | Development and Execution of a Cross-Bore
Prevention Program

Business Track

Room 130-132

- 8 a.m. | How to Position Your Company in the Market Today
- 9:30 a.m. | Six Proven Tactics to Generate Leads and
Turn Them Into Revenue
- 11 a.m. | Growth by Acquisition or Exiting Gracefully:
Buying or Selling a Septic or Sewer Business

Drain Cleaning Track

Room 133-135

- 8 a.m. | Drain Cleaning Methods - Then and Now
- 9:30 a.m. | The Physics of Pipe Cleaning Tools and
How I Make it Work for Me
- 11 a.m. | Lateral Lining - Are You Using the Right Tool?

Industry Technology Track

Room 136-138

- 8 a.m. | How to Manage Septic Systems
using Remote Monitoring
- 9:30 a.m. | GPS Tracking: Hype Vs. Reality
- 11 a.m. | Wireless Controls in the Waterjet Industry:
Sacrificing Safety for Convenience

Septic Series Track

Room 140-142

- 8 a.m. | True Crime Scene Stories: How to Inspect
and Troubleshoot Suspect Onsite Systems
- 9:30 a.m. | One Man's Waste is Another Man's Treasure
- 11 a.m. | Dewatering Options for Roll-Off Containers



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February 25, 2015

Septic Series Track

Room 140-142

- 8 a.m. Considerations in Building Your Next Vacuum Truck
- 9:30 a.m. Grease Collection and Treatment:
Raising the Bar Via Resource Recovery
- 11 a.m. Analyzing Common Onsite Septic System
Malfunctions and Options for Prevention & Correction

*MSW Case Study Track

Room 231-233

- 8 a.m. Retrofit of the Lansdowne Sanitary P/S
- 9:30 a.m. Huntington Beach Successfully Navigates
Emergency Repair of Fragile Storm Drain
Collection System Rehabilitation –
Alternative Technology
- 11 a.m.

*MSW Technology Track

Room 237-239

- 8 a.m. Implementation of Acoustic Inspection Technology
at the City of Augusta
- 9:30 a.m. Highlights from the 7th Edition of Operation
and Maintenance of Wastewater Collection
Systems Manual
- 11 a.m. Technological Advancements Fulfill the
Promise of Zoom Survey Paradigm

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Portable Sanitation Track

Room 136-138

- 8 a.m. Portable Sanitation - Special Events
- 9:30 a.m. Making Your Portable Restroom Business Lean
and Mean – How to Boost Productivity and
Increase Your Bottom Line
- 11 a.m. Building and Coaching Your Portable Sanitation Team

Treatment Plant Operator Track

Room 240-242

- 8 a.m. Utility Regulation Basics for Grease Haulers
- 9:30 a.m. The Waste in Our Wastewater
- 11 a.m. Security Issues and Best Practices for Water/
Wastewater Facilities

Pipe Rehab Track

Room 243-245

- 8 a.m. Integrating Temperature Sensor Technology
within Lateral Pipeline CIPP Installations
- 9:30 a.m. CIPP Calibration and Vacuuming
- 11 a.m. Extending Life Expectancies with Corrosion-
Resistant Coatings and Linings

Business Track

Room 133-135

- 8 a.m. Team Building for Profit
- 9:30 a.m. Ten Commonsense Ways to Grow and
Improve Your Business
- 11 a.m. Setting Expectations – The Key to Sales
and Customer Satisfaction

Advanced Onsite Installer Course

Room 234-236

8 a.m. - 5 p.m.

- Introduction and Site Evaluation
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1. AGRU AMERICA CONCRETE LINERS

Sure-Grip concrete liners from Agru America are designed for aggressive and abrasive media inside tanks, pipes and other structures. When combined with distance sheets, the protective liners meet requirements for storing environmentally hazardous media. Joined by ultrasonic welding, the space between the two sheets permits monitoring for leakage detection. The surface pattern also facilitates self-cleaning for reduced sedimentation. **800/373-2478; www.agruamerica.com.**

2. LARSON ELECTRONICS LED PORTABLE TANK LIGHT

The EPL-18C-150LED-RT explosion-proof tank light from Larson Electronics mounts to a portable wheelbarrow cart. The light, rated Class 1 and 2, Division 1 and 2, provides 10,000 square feet of coverage, producing 12,000 lumens from 150 watts. The portable LED has a removable 16-inch wide by 14-inch tall light head, enabling it to fit through standard-sized manholes or entry passages. **800/369-6671; www.magnalight.com.**

3. BRENTWOOD STORMWATER MANAGEMENT SYSTEM

The StormTank Pack stormwater management system from Brentwood is designed for non-load-bearing, subsurface applications. Designed for infiltration and integration in bioretention and rainwater harvesting applications, the system yields a 95 percent void space and utilizes a crossflow media, evenly distributing stormwater runoff to the base. The system can accommodate layout variations. It can be cut to any length and does not require assembly. **610/374-5109; www.brentwoodindustries.com.**

4. BLUE-WHITE MULTI-CHANNEL PUMP TUBE ASSEMBLY

The Flex-A-Prene heavy-duty, multi-channel pump tube assembly from Blue-White Industries is designed for use with Flex-Pro and Proseries-M peristaltic metering pumps. Engineered for up to 110 psi, tubing features permanently printed model numbers that can be viewed through the pump

head cover while the pump is operating for easy reordering. The clamp-less tube fitting is available with 1/2-inch M/NPT, barb fitting and 3/8-inch tube compression, tri-clamp and quick disconnect. The pump tubes retrofit Flex-Pro A2 and A3 and Proseries-M, M2 and M3 model pumps. **714/893-8529; www.blue-white.com.**

5. ADS FLOW MONITORING SYSTEM

The Triton+ advanced technology wastewater flowmeter from ADS Environmental Services can be configured as a single sensor monitor or expanded to include six measurement inputs. When combined with the ADS XIO system, the Triton+ provides options for digital and analog I/O and SCADA integration. **800/633-7246; www.adsenv.com.**

6. GATEWAY SAFETY EYEWEAR

Parallax protective eyewear from Gateway Safety features a temple design for all-day comfort. The eyewear has a single, wrap-around lens for protective coverage. An integrated brow guard protects against debris from above. The soft gel nosepiece works with the temples to ensure the glasses stay securely in place. The glasses meet ANSI Z87+, CSA Z94.3, as well as the ballistic impact resistance requirements for eyewear as per U.S. military performance specification MIL PRF-31013. **800/822-5347; www.gatewayssafety.com.**

7. SEL COMPACT AUTOMATION CONTROLLER

The SEL-3505-3 real-time automation controller from Schweitzer Engineering Laboratories provides a fully programmable IEC 61131-3 logic engine with built-in function blocks, including PID. The 6.96- by 5.54- by 2.25-inch controller can be cabinet or DIN rail mounted. It is designed for data concentration, protocol conversion and control applications. Security features include centralized authentication via lightweight directory access protocol, logging of all user access, port control, intrusion detection and alarming. **509/332-1890; www.selinc.com.**



8. SHERWIN-WILLIAMS POLYURETHANE PIPE COATINGS

Chemical and abrasion-resistant Poly-Cote 110 Fast Set, Poly-Cote 110 Rapid Set, Poly-Cote 115 and Poly-Cote 115FR from Sherwin-Williams Protective and Marine Coatings are NSF certified up to 250 mils. The performance characteristics of the Poly-Cote line exceed the minimum requirements of AWWA C222-08, polyurethane coatings for the interior and exterior of steel water pipe fittings. Poly-Cote 110 Fast Set is formulated for exterior pipe applications and has a drying time of five to 10 minutes. Poly-Cote 110 Rapids Set is designed for interior pipe applications and provides a dry-to-handle time of 20 to 25 minutes. Poly-Cote 115 is a flexible coating developed for small fittings, elbows, valves and other tight work spaces. Poly-Cote 115FR comes in a kit for coating welds and damage repairs. **800/524-5979; www.sherwin.com/protective.**

9. BAYCO MULTIFUNCTION LED FLASHLIGHTS

Nightstick multifunctional MT-200 Series Mini-TAC pro flashlights from BAYCO Products are 4 to 5.5 inches long and weigh 1.9 to 3.2 ounces. Made of blue anodized aircraft-grade 6061-T6 aluminum, the flashlight (models MT-200, MT-210, MT-220, MT-230) have a drop rating of 2 meters and waterproof rating of IPX7. All lights feature CREE LEDs with a deep parabolic reflector for a tight, long-throw beam. The flashlight body and tail switches provide momentary or constant-on functionality with high, medium or low settings, as well as strobe. **800/233-2155; www.baycoproducts.com.** **tpo**

wastewater: product spotlight

Intelligent sensors provide multiple measurements with single transmitter

By Ed Wodalski

The **T80 universal transmitter** and **S80 intelligent sensors** from **Electro-Chemical** measure pH, ORP, specific ion, dissolved oxygen, turbidity, conductivity and resistivity in municipal and industrial wastewater.

Specific ions include ammonium, bromide, cadmium, calcium, chloride, cyanide, cupric, fluoride, lead, nitrate, nitrite, potassium, sodium, sulfide and silver. The newest sensor measures the activity of free copper ions in concentrations from 1.0 ppb to 6,300 ppm.

“When you plug a sensor in, it automatically configures the analyzer,” says Steve Rupert, senior product manager. “The sensors have an identity, but the analyzer allows the user to program the sensor. If you had a copper sensor and you needed a nitrate sensor, you could switch out the electrode in the sensor, go to the transmitter with the sensor attached and tell it to analyze nitrate.”

The sensors are available in insertion/submersion or valve retractable designs. Standard models have a 3/4-inch O.D. 316 stainless steel body with 10-foot cable or optional detachable cable assembly for easy assembly.

The insertion/submersion design uses a 3/4-inch MNPT compression fitting as the process connection to accommodate installation in pipe tees, flow cells or through tank walls.

The valve retractable sensor uses a 1-inch ball valve with 1-inch process connection. Loosening the rear compression fitting allows the sensor to slide through the valve for either insertion into the process or retrac-



T80 universal transmitter and S80 intelligent sensors from Electro-Chemical

tion. Once retracted, the ball valve can be closed and the sensor removed for maintenance or replacement without shutting down the process line.

The transmitter features an intuitive menu and LCD display to provide graphical and numerical information, as well as 4-20 mA output with Modbus RTU and alarm relays. Hart communication is available.

Displays include data, millivolt and graphical screens. The data screen displays measurement type, measured value with units, percentage of milliamp output of the 4-20 mA channel and temperature.

The mV screen displays measurement type, raw millivolt signal from the sensor, percentage of milliamp output of the 4-20 mA channel and temperature.

Graphical screens display measurement type, measured value with units and graphical display of the milliamp output.

“You can switch between a single channel and dual channel with a single button,” Rupert says.

The analyzer also can be configured for alarm (setpoint) relays, time-activated relays or fault relays.

“The expiration timer is a nice safety feature,” he says. “If you add sulfuric acid to a system and the pH doesn’t change, something is wrong. The expiration timer shuts down the relay and signals a soft fault alarm telling you the relay is not working.” **800/729-1333; www.ecdi.com.**

(Continued on page 57)



Ring of Beauty

PALO ALTO'S CLEAN-WATER PLANT IS SURROUNDED BY A LANDSCAPE OF TREES, SHRUBS AND PLANTS SELECTED BY A COMMITTEE WITH ADVICE FROM COMMUNITY STAKEHOLDERS

By Jeff Smith

Despite being 2 miles from the city and beyond the view of its 225,000 residents, the 20 mgd (average) Palo Alto Regional Water Quality Control Plant has extensive landscaping around its 25-acre property.

Plantings screen the facility from its neighbors, including a nearby airport and thousands of visitors to the Palo Alto Baylands Nature Preserve. “It was the primary goal of the landscaping project committee,” says Julie Weiss, environmental specialist, who led the plant’s involvement in a three-year landscape renovation of the facility, 35 miles south of San Francisco.

The work was also a requirement of the Baylands Master Plan, a long-range city plan for preserving the Palo Alto Baylands. Nearly 50 species of plants, trees and shrubs, selected by an eight-member committee, adorn the facility’s fence line and the plant interior, which includes a drop-off area for household hazardous waste. Siegfried Engineering designed the landscape and contractor QLM did the installation.

ADVICE FROM THE COMMUNITY

Because limited information was available about various species’ suitability for the site’s soils, the committee received advice from the Audubon Society, the city arborist, the city Open Space, Parks and Golf Department, nonprofit organizations with expertise in native plants and urban forestry, and local residents.

To keep the trees and shrubs thriving, reclaimed water is distributed through more than 2 miles of 2-inch pipe to provide drip irrigation. Grasses and large areas of groundcover are sprayed. A maintenance plan guides workers on what to do if certain plant selections fail.

“There is a lot more to the project than just adding new plants and trees,” Weiss says. A half-mile-long, 5-foot-wide asphalt path meanders through the project site and a wooden interpretive sign illustrates the treatment facility’s processes. Mounted on recycled utility poles and anchored in a cement base, the vandal-proof sign describes how the facility helps protect the Baylands from pollution.

Six rest areas with benches provide areas for tour groups to gather and for staff to enjoy during meetings or at lunchtime. Two areas totaling 1,380



Besides landscape plantings, the Palo Alto plant includes ornamental signage and structures and a mural painted on the recycled water tank.

square feet are set aside for employees to plant vegetable and fruit gardens. They are irrigated with potable water.

DECORATIVE ARTWORKS

“The exterior pathway is really about safety, too,” says Weiss. “Since we are far from town and can’t go to a restaurant for lunch, it gives everyone a place to relax. The paths also provide a safe passageway for walkers and bikers who in the past had to use the roadway.”

Public art is part of the project. A sculpture by artist Martin Webb stands at the entrance. Made from reclaimed wooden highway guardrails, it bears a design entitled “Riding the Currents,” created by carving, painting and fastening stainless steel details. The square-sided guardrails, in a group of eight, are mounted vertically on a 3- by 8-foot concrete base.

Webb also painted a 20- by 30-foot mural with the same title and theme on the recycled water tank. Webb’s works were inspired by the Baylands

environment, one the largest tracts of undisturbed marshlands in the San Francisco Bay Area. The art was funded under a city policy to designate 1 percent of the value of each public project to public art.

BIG IMPROVEMENT

Before the landscape renovation, some mature trees and plants screened the facility, but expansion and improvement projects over the last 40 years caused it to deteriorate, and much of it had died or was in poor health. Many areas had become overgrown, and the irrigation system was no longer functional.

“We met our goal of screening the plant and vastly improving aesthetics, while also demonstrating how recycled water is beneficial and is becoming essential in commercial landscape, given our changing climate and pressures on potable water use.”

JULIE WEISS

“We met our goal of screening the plant and vastly improving aesthetics, while also demonstrating how recycled water is beneficial and is becoming essential in commercial landscape, given our changing climate and pressures on potable water use,” says Weiss.

James Allen, plant manager, agrees. Even though operators were not active in the project, they provided input to the design, helping to ensure that it had a beneficial impact on the Baylands. “We tried to improve the experience and safety for our visitors,” says Allen. “We just really wanted to be a good neighbor.” tpo

product news

(Continued from page 55)

water: product spotlight



Field-adjustable butterfly valves designed for easy maintenance

American butterfly valve from Val-Matic Valve & Mfg. Corp.

By Ed Wodalski

The **American butterfly valve** from **Val-Matic Valve & Mfg. Corp.** is designed to provide long life and trouble-free performance. Features include 360-degree uninterrupted seating, Tri-Loc seat retention system, traveling nut actuator with external adjustable stops, ductile iron disc, stainless steel seat retention hardware, shafts and body seats. All valves include two-part epoxy interior. Options include stainless steel and other materials, rubber linings and fusion-bonded epoxy coatings.

“The Val-Matic butterfly valve is manufactured with the end user in mind,” says David Scott, national sales manager for Val-Matic Valve & Mfg. Corp. “The resilient seat can be adjusted or replaced by the operator in the field simply by using a wrench.”

Stainless steel tangential tapered pins lock the valve shaft to the ductile iron disc using stainless steel nuts to prevent vibration.

“Vibration will wear a valve out prematurely,” Scott says. “With a tangential pin, because it’s on the side, you have undisturbed shaft material; you retain the integrity of the shaft. You’re not putting a pin or a hole through the center so the shaft material is much thicker, producing a stronger and tighter connection.”

The tapered pin design is also user friendly.

“You loosen the nut and tap out the pin with a soft-blow hammer,” he says. “Because it’s tapered it drops right out. It’s a nice feature, especially for performing maintenance.”

Suitable for water and non-solids wastewater, applications include shut-off service, modulating service, SCADA systems, buried/plant service, pump control and flow control. The valve fully complies with AWWA C504 and C516. It is NSF/ANSI 61 certified for drinking water and is NSF/ANSI 372 certified lead-free.

The valves are available in 150B and 250B AWWA classes with flanged end connections in sizes 3 to 144 inches and mechanical joint end connections in 4 to 48 inches. Wafer-style butterfly valves are designed with ANSI 125 flanges or ISO PN10 and PN16 flanges in sizes 4 to 24 inches.

While no special maintenance is required, a visual inspection is recommended whenever a filter is shut down. Scott suggests inspecting the disc edges to ensure they’re within tolerance and functioning properly. **630/941-7600; www.valmatic.com.**

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Pumping Savings Realized

WHEN APPLIED CORRECTLY, VARIABLE-SPEED PUMPS CAN ENHANCE PUMP STATION RELIABILITY AND PERFORMANCE WHILE DELIVERING ON THE PROMISE OF LOWER ENERGY USAGE

By Stefan M. Abelin

Pumping with variable-speed pumps can improve process control, save energy, smooth out operation and reduce maintenance for wastewater pump station operators.

However, some users of variable-speed pumps report little or no energy savings, or even increased energy usage. More frequent pump clogging is also common. The solution lies in intelligent control algorithms and a holistic pump system approach. By correctly applying variable-speed pumps, it is possible to maximize the benefits of variable-speed technology while avoiding pitfalls.

PUMP AND PUMP SYSTEM ASPECTS

Performance optimization depends in part on proper care of the pump and related systems.

Pump sumps. It is important to keep the pump sump clean to prevent sedimentation of organic and inorganic material. Variable-speed controls can be programmed to perform regular sump cleaning cycles to reduce buildup of sediment and accumulation of floating debris.

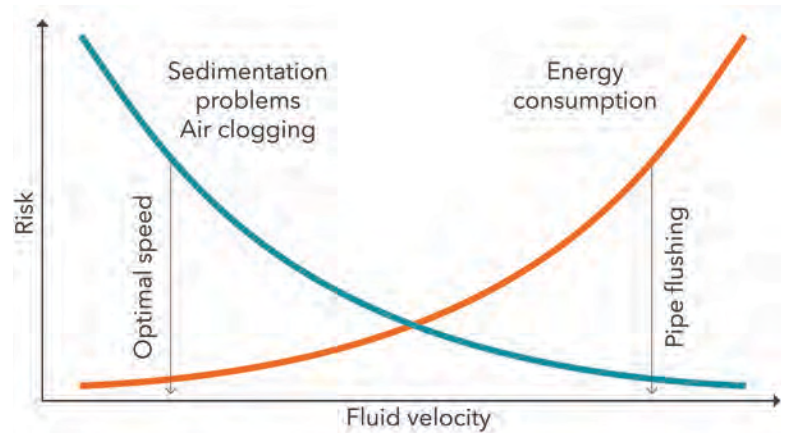
Pump suction and discharge piping. With variable-speed pumping, it is possible to reduce fluid velocity below the normally recommended 2.5 feet per second for extended periods because variable-speed technology enables flushing of the discharge line by temporarily increasing the fluid velocity. A variable-speed-controlled pump station increases flexibility to clean the force main by flushing.

Today's intelligent pump controls have algorithms that automatically optimize speed for minimum energy usage. The algorithms determine the optimal speed and adapt for system changes such as reduced pump performance or increased sedimentation in the force main.

Check valves. In applications with variable-speed pumps, the liquid velocity will be lower than normal in the pipe system. Swing check valves have lower friction losses at low velocities than ball check valves and therefore increase energy savings.

Water hammer. Variable-speed pumps have the capability to soft-start and soft-stop by gradually increasing and decreasing pump speed. By changing the water velocity slowly in the discharge line, water hammer and slamming of check valves can be minimized or eliminated.

Minimum speed. Certain pump designs may have limitations on the lowest allowable pump speed. The minimum speed depends on proper operation of the cooling system, shaft resonance frequencies and other issues.



When flushing the discharge line regularly, it is possible to reduce the minimum fluid velocity below 2.5 feet per second without having sedimentation problems.

PUMP CONTROLS AND VARIABLE-SPEED DRIVE ASPECTS

An efficient system must exert control over each pump and over the pump station as a whole.

Controlling pumps. Variable-speed drives must be controlled by software to control individual pumps, while the pump station must have a master controller to properly sequence and control all pumps. The most modern controllers for wastewater pumps are hosted inside variable-speed drives.

Drive starting current and starting torque. A wastewater pump must be equipped with a variable-speed drive that can deliver nominal torque at startup and sustain twice the nominal torque at full operating speed for at least one second. Using

the feedback data from the motor, the starting current can be reduced while the starting torque can be increased.

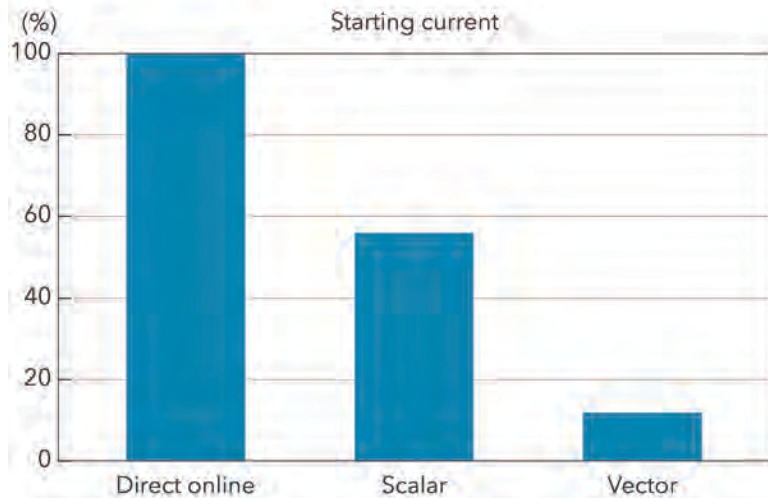
PROCESS CONTROL ASPECTS

Daily inflow to a wastewater pump station varies considerably – it is typically low during the night and peaks in the morning and evening. To minimize energy consumption, operators should focus on two areas.

Reducing the total pumping head. Total head is the sum of static head and losses. As a wastewater pump is normally sized to handle maximum inflow to the pump station, it is possible to reduce the pumped flow during normal operation and thereby reduce the total head.

Maximizing pump efficiency. To achieve maximum pump efficiency, it is important to select pumps that deliver sustained efficiency (self-cleaning pumps) and that operate as close to the best efficiency point as possible. To achieve maximum efficiency, a pump operated at reduced speeds should be selected well to the right of the best efficiency point at full speed.

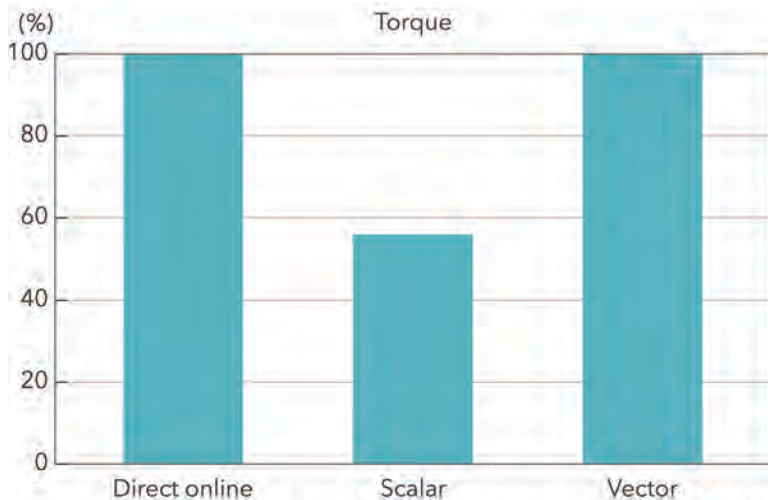
Today's intelligent pump controls have algorithms that automatically optimize speed for minimum energy usage. The algorithms determine the optimal speed and adapt for system changes such as reduced pump performance or increased sedimentation in the force main.



When starting a pump using a VFD with vector control, the starting current is considerably lower than when starting the pump directly online.

PUMP SUMP LEVEL CONTROL

Two-speed pumps and variable-speed-operated pumps allow the station to operate at flows closer to actual inflows as opposed to design flows. Correctly implemented variable-speed operation can lead to lower energy consumption. There are four basic methods of level control.



When starting a pump at zero speed, the torque of a pump motor controlled by a variable-frequency drive with vector control is the same as that of a pump motor with a direct online starter.

Traditional constant-level control. In this scenario, pumps often operate outside their preferred operating range, reducing life expectancy. This happens when the pump is run at lower than the energy-optimal speed (the speed at which the pump's specific energy consumption is at a minimum). Partial pump clogging is also more likely with non-self-cleaning pumps,

such as traditional closed-impeller and vortex pumps.

Optimal constant-level control. Using a combination of reduced speed and intermittent draw-fill operation is the most energy efficient method of controlling variable-speed pumps and is recommended for wastewater pump stations.

Variable-level control. The advantage of this common control method is that the inflow can be buffered in the sump, resulting in a smoother pumped flow. Compared to constant-level control, variable-level control is a softer control strategy that helps smooth out shorter inflow peaks.

Minimum flow control. To be energy efficient in this scenario, the pump speed must not fall below the optimal speed, even if the liquid level decreases at a slower rate.

THE HYDRAULIC END

For pumps with self-cleaning hydraulics, which have been on the market for more than 10 years, the risk of debris accumulation is low. This is due to a hydraulic impeller design with extremely "swept back" leading edges, a relief groove and sometimes other hydraulic augmentations. The self-cleaning mechanism remains constant regardless of flow and speed. Therefore, as long as the duty point remains within the pump's allowable operating range, a self-cleaning pump can handle reduced speeds, to as low as 50 percent of full speed, without increased risk of clogging.

CONCLUSION

To pump reliably and efficiently at variable speed, it is necessary to consider the pumped media, the pump type, the control method and the process requirements. Use of a standard drive for variable-speed wastewater pumping requires substantial engineering and investigations and implementation of the right control algorithm. Some drives are preprogrammed for controlling pumps with algorithms for various pumping applications. These drives must still be configured and engineered for the specific application.

Intelligent wastewater controls that are preprogrammed with advanced algorithms and preconfigured to ensure reliable wastewater pumping and ease of commissioning are just now entering the market. These devices will increase the pump station reliability and ensure that calculated energy savings are realized. In addition, engineering hours will not be wasted finding a custom control algorithm to suit a common application challenge.

ABOUT THE AUTHOR

Stefan M. Abelin is director of project execution for the Flygt branded wastewater pumping business of Xylem. He can be reached at stefan.abelin@xylem.com. An extended version of this paper was first presented at the Singapore International Water Week 2014. **tpo**

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DDoS: What You Don't Know Can Hurt You

WATER AND WASTEWATER FACILITIES ARE INCREASINGLY THREATENED BY AN INSIDIOUS FORM OF CYBERATTACK. HERE'S SOME ADVICE ON HOW TO PREPARE FOR AND FIGHT OFF THE THREAT.

By Ted J. Rulseh

Malicious computer hackers are everywhere and any entity with a network exposed to the Internet can be vulnerable. That includes water and wastewater facilities.

Recent years have seen growth in distributed denial of service (DDoS) attacks on networks. In the simplest terms, a DDoS attack floods an organization's network with extraneous data so that it can no longer perform its functions. As a result, essential services can be shut down.

Should you consider DDoS attacks a serious threat? Well, the U.S. EPA includes such attacks in its list of cyberattacks to which water and wastewater systems can be susceptible. And data from the Repository for Industrial Security Incidents shows that such systems face a growing number of cyberattacks: the industry has seen a 60 percent increase in cyber incidents in recent years. These can include attacks on SCADA systems that control water and wastewater treatment and other utility functions.

Michael Bennett of the Security Compass information security firm believes DDoS attacks are a significant threat for which water and wastewater facilities must prepare. Bennett is lead developer for the company's DDoS Strike, a simulation service that tests network and Web application vulnerability to DDoS attacks. He talked about the threat in an interview with *Treatment Plant Operator*.

tpo: What exactly is a DDoS attack?

Bennett: A DDoS attack occurs when a malicious user employs botnets of virus-infected computers or other means to generate huge volumes of traffic to a targeted computer network. The goal is to exhaust the resources of the network, overwhelming it with so much data that it can't process legitimate data.

“The main goal of a DDoS attack is to force an infrastructure to shut down. It would cause a disruption in the internal network so that devices can't communicate as they should. It could disrupt control systems like SCADA and PLCs.”

MICHAEL BENNETT

tpo: Is there a simple analogy that helps explain how these attacks work?

Bennett: You could think in terms of a water filtration system. Water comes in, the filter removes particles and chemicals, and out comes clean water at the end. If you suddenly flood that filter with an excess of clean water, it won't be able to process the flow. The filter becomes overwhelmed and can't process the water it should be processing. In this case the excess clean water represents the bogus network traffic sent by a malicious user in a DDoS attack.



Michael Bennett

tpo: What is the effect of such an attack?

Bennett: The main goal of a DDoS attack is to force an infrastructure to shut down. It would cause a disruption in the internal network so that devices can't communicate as they should. It could disrupt control systems like SCADA and PLCs. This could render a water or wastewater treatment facility unable to perform its essential functions.

tpo: Why is this threat a timely concern for water and wastewater facilities?

Bennett: Treatment facilities used to have closed systems and there was no access to their networks from the outside. In recent years, more such facilities have been connecting their internal networks to external networks, such as the Internet. They typically require authentication for access, so some security is in place. But if a malicious user can send traffic to the network, that network still needs to process it in some way.

tpo: Are there examples of DDoS attacks happening to facilities in the water sector?

Bennett: A utility in the southeastern U.S. has an online payment system. A DDoS attack basically brought that system down, so customers were not able to pay their bills. That would cause a lot of panic for customers who may need to pay their bills to keep their service going. The entire networking staff was overwhelmed trying to mitigate the attack. [The utility suspended shut-offs for nonpayment during the attack.]

tpo: Who actually launches these kinds of attacks?

Bennett: They range from lone hackers who operate out of malice or

to prove a point, to organized crime figures who may participate for some personal gain, to activist groups who may institute attacks as a sort of patriotic act. Activist groups from foreign countries who want to disrupt U.S. services might target treatment facilities just because they know that's part of our country's core infrastructure. Recently we've seen cases of extortion, where a malicious group tries to extract money by threatening to take down or disrupt an organization's service.

One issue with DDoS attacks is that the barrier to entry is very low. There are toolkits people can purchase on the black market that give them access to botnets that can contain millions of zombie servers, all infected with a virus. Those servers connect back to a command and control server that can issue commands to them to launch an attack. Hackers have created toolkits that can interface with command and control servers, allowing people with very little knowledge of computers to perform a DDoS attack. They can basically enter a target, click a button and launch an attack. This is all done for \$50 to \$100.

tpo: What are the remedies for DDoS attacks? What should water and wastewater agencies be doing to protect themselves?

Bennett: One of the main things they should do is plan. Water and wastewater facilities are being targeted more and more in recent years. It's easier for hackers to launch a successful attack against an organization that has never experienced it before and has not planned for it. If you've never experienced a DDoS attack and you're worried that you might be a target, setting up defenses beforehand will definitely help reduce the time it takes to mitigate an attack.

tpo: What exactly is involved in planning against an attack?

Bennett: It depends on what kind of network operations the organization currently has. A good strategy is always to be prepared — to know who to contact when an attack happens, who should be alerted and what actions they should take during the attack to mitigate it.

tpo: What remedies are available to smaller organizations, like water and wastewater utilities, that may not have substantial IT resources and staff?

Bennett: An organization that lacks the resources to mitigate an attack on its own can reach out to a cloud-based service. Several companies specialize in mitigating DDoS attacks and provide emergency DDoS services. The service provider will help the facility's employees reroute network traffic to its servers, which will scrub all the data so that only legitimate traffic is sent to the client's systems.

tpo: How can a utility tell if it is under a DDoS attack?

Bennett: An organization should have some type of network monitoring in place and should record baselines of what normal network traffic looks like. If an organization is used to seeing 100 to 1,000 connections per day and suddenly gets 100,000 per second, that's a huge sign. We see network throughput in some attacks averaging one to 50 gigabytes per second, which is more data than many organizations' networks can handle.

tpo: What is the role of DDoS attack simulation testing?

Bennett: Organizations will contact a company like ours and say they want to verify whether their network configuration can withstand a DDoS attack. We do a "black box" reconnaissance of their network. That means we don't use any inside knowledge of their network — we approach it with the same tools and knowledge any attacker would have. It really gives us and the client a complete view of what is public facing on their network and what could potentially be attacked.

We identify the more susceptible targets and then arrange a test, on a weekend or overnight to avoid disrupting normal traffic. We actually perform a controlled DDoS attack on their system. We can vary the strength of the attack and the frequency, and we can stop it at any time.

tpo: What is done with the information collected through testing?

Bennett: We gather statistics on the attack and our observations of the network — whether things were taken down or slowed down and how effective our attack actually was. We generate a report and walk the client through it in detail. Usually, we set up a meeting with their network engineers, go over what they saw on their side and compare it with our data to see if things match up. From there we come up with an action plan with remediations based on weaknesses we discovered and suggestions for how to improve network security and strength. We'll also help the network engineers implement the remediation steps.

“A good strategy is always to be prepared — to know who to contact when an attack happens, who should be alerted and what actions they should take during the attack to mitigate it.”

MICHAEL BENNETT

tpo: What can a utility do to protect itself, short of relying on outside services?

Bennett: An important step we see many organizations taking is to establish policies and processes for their people to follow. That includes making people aware of the threat, showing them what to look for so they can identify an attack when it's happening, and having a clear process for responding.

It's also important to know the parts of their systems that are exposed to the Internet and to have a good, transparent overview of how the entire network is connected. This helps avoid undesirable side effects of a DDoS attack. For example, a system that isn't directly connected to the Internet may be affected when another system that is Internet-connected is taken down.

tpo: What priority should a water or wastewater utility assign to building defenses against these attacks?

Bennett: It's not to be taken lightly. It's something a company needs to allocate a budget to for training staff, preparing for an attack, for making sure that there are policies and defenses in place, and for testing, because it's important to verify that defenses deployed will work as designed. Cybersecurity needs to be made a priority, especially in terms of DDoS attacks. **tpo**

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EFFECTIVE MIXING OF POLYMER TO A HOMOGENEOUS AND FULLY ACTIVATED SOLUTION REDUCES POLYMER CONSUMPTION AT CALIFORNIA TREATMENT PLANT BY 23 PERCENT

By J.J. Miller and Dave Mullaney

The water reclamation facility for the Mountain House planned community in California was having difficulty with excessive consumption of polymer used to dewater and thicken biosolids.

The 3 mgd sequencing batch reactor (SBR) facility serves a population of about 12,000 on 4,784 acres in San Joaquin County, about 150 miles east of Oakland. In 2013, the plant underwent changes in its polymer use as part of a comprehensive process initiated because management determined that the plant was attaining inadequate solids capture, and that large amounts of solids in centrate from the dewatering centrifuge were being returned to the headworks.

The facility staff resolved the problem by installing a new polymer feed and mixing system, instituting a three-stage mixing process and optimizing the polymer formulation. The improvements reduced polymer consumption by 23 percent, achieving projected payback on the equipment investment in about two years based on polymer savings alone.

GROWTH EXPECTED

The Mountain House Water Reclamation Facility, designed for 3 mgd, is underloaded at an average flow of about 0.7 mgd. The first homes in the Mountain House development were built in early 2003; growth stopped in 2008 as the economy and the housing market fell into recession. Since 2011, development has accelerated and 15,500 households and 40,000 people are expected at full build-out.

The water reclamation facility in its current design is expected to accommodate Mountain House residents and businesses until about 75 percent build-out. The SBR plant, operated by Severn Trent Services, has a footprint of less than 2 acres. SBR is designed as a cost-effective treatment alternative for small and medium-sized plants that require nutrient removal or have hydraulic or organic influent fluctuations.

The SBR process incorporates all stages of activated sludge treatment in the same basin. At the Mountain House facility, each SBR cycle includes an anoxic selector stage, aeration stages, a clarification stage and a decant stage. At decant, the top 4 feet of clear water is released to the plant's surge basin, then pumped through cloth-media tertiary filters, followed by UV disinfection before discharge. (The facility was among the first in the nation to use a UV disinfection system certified to meet California Title 22 requirements.)

Dave Mullaney (left) and J.J. Miller of Severn Trent Environmental Services manage the Mountain House Water Reclamation Facility.



Thickened sludge from the plant's digester is pumped to a high-speed decanting centrifuge from Noxon (shown) for dewatering. Polymer aids in liquid/solid separation.

POLYMER EFFICACY

Waste activated sludge from the SBR process is pumped to two aerobic digesters. Typically, sludge is thickened in a drum thickener after leaving one digester. From there it goes to the second digester and then is pumped into a high-speed decanting centrifuge (Noxon) for dewatering. Dewatered biosolids are sent to a compost facility in nearby Merced County.

In efforts to improve the facility's polymer efficacy, management first looked closely at the polymer preparation and feed systems. Polymer is fed to

The mixing unit provides a multi-zone mixing chamber that delivers a tapered energy profile for proper polymer activation. The engineered profile effectively hydrates and mixes the polymer to a homogenous and fully activated solution, providing only light agitation in the mixing tank to allow full extension of polymer chains.

One ProMinent ProMix-S polymer mixing system is dedicated to the plant's drum thickener and the other to the decanting centrifuge.



Waste activated sludge is pumped to two aerobic digesters. It is then typically thickened through a drum thickener and from there goes into the second digester before dewatering.

the waste activated sludge before thickening and dewatering to aid in liquid-solid separation. The Mountain House plant was using conventional mixing and feed systems to prepare its polymer. Although polymer was prepared and fed automatically, the process was characterized by wasted polymer.

Insufficient initial mixing energy generated by the polymer mixing systems created large quantities of fisheyes (entrapped, undissolved polymer masses) that did not contribute to sludge conditioning. High shear after initial wetting of the polymer solution broke numerous polymetric chains, hindering liquid-solid separation. As a result, excessive polymer was being consumed.

FEED SYSTEM TRIAL

In March 2013, the facility began a 60-day trial of a ProMix-S TA Series polymer feed system from ProMinent Fluid Controls to control feedwater and polymer and combine them. The system is designed

to receive emulsion polymer while mixing it with feedwater to produce and discharge a quality solution.

The mixing unit provides a multi-zone mixing chamber that delivers a tapered energy profile for proper polymer activation. The engineered profile effectively hydrates and mixes the polymer to a homogenous and fully activated solution, providing only light agitation in the mixing tank to allow full extension of polymer chains.

During the trial, the plant team recorded a number of variables, including digested sludge flow rate, reclaimed water flow rate (polymer dilution water), polymer neat pump flow rate and polymer use (in inches). From this data the team calculated the percent polymer concentration daily while operating the drum thickener and decanting centrifuge.

Because only one feed system was used during the trial, only one of the dewatering systems (drum thickener or centrifuge) could be used at a time with the unit. Based on a ProMinent representative's recommendation, the operators started the polymer feeder at a 5 percent polymer solution setpoint and ended with a setpoint just below 3 percent.

IMPROVEMENTS EVIDENT

Dewatering characteristics before and after the trial were significantly different in thickened sludge quality and a reduction in solids recycle from the centrifuge concentrate. Polymer usage was reduced by about 23 percent at an average polymer solution concentration of 0.293 percent.

Based on improvements in the sludge thickening process, significant polymer savings and reductions in solids recycle, the plant team purchased two ProMix-S polymer feeders, one dedicated to the drum thickener and the other to the centrifuge. Each new polymer feed system provides an LCD display (including primary and secondary flow display) with touchpad control, remote start/stop and programmable auto-flush. The unit maintains desired concentration based on primary and secondary dilution water flow.

Gaining optimum polymer activation through a three-stage mixing regimen played a key role in optimizing dewatering. A second major improvement followed the installation of the new mixing units. Although plant managers were pleased with the improved polymer performance, they remained less than satisfied with solids capture in the centrifuge.

Noxon representative Peter Gagne, after observing centrifuge operations and performing jar tests, recommended that the plant team consult polymer vendor Polydyne to determine an alternative. Polydyne adjusted the polymer formulation as the major final key in optimizing dewatering.

ONE-TWO PUNCH

An adjustment in polymer formulation, combined with a three-stage mixing regimen to enable full use of the polymer being fed, helped the Mountain House treatment plant gain full control of its solids management program. The plant reduced annual polymer expenditures by about \$10,000. In addition, the much lower water content of biosolids reduced the cost of transport to the compost facility.

ABOUT THE AUTHOR

J.J. Miller and Dave Mullaney are California-certified operations staff members with Severn Trent Services, which operates the Mountain House Water Reclamation Facility. **tpo**

Share Your Ideas

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 715/277-4094.

people/awards

The Champlain Water District's **Peter L. Jacob Water Treatment Facility** in South Burlington, Vt., received the Phase IV 15-year Excellence in Water Treatment Award from the Partnership for Safe Water.

The **Claypool Hill/Wardell Water Treatment Plant** in Tazewell County, Va., received a Gold Performance Award from the Virginia Department of Health Office of Drinking Water. It is one among 25 plants across Virginia that produce water three times cleaner than required by the U.S. EPA.

The **Southwestern Pennsylvania Water Authority** received the Area-Wide Optimization Program Award from the Water Works Operators Association of Pennsylvania for its success in optimizing its water treatment plant's performance.

The **Savannah (Ga.) Industrial and Domestic Water Plant** took first place in the Best of the Best Taste statewide taste test sponsored by the Georgia Section AWWA.

Brian R. Pickett, chief treatment plant operator for the Mobile Area Water and Sewer System, received the 2014 Charles White Award from the Alabama Water and Pollution Control Association.

Norman Patrick, wastewater lab technician for the City of Northport Wastewater Treatment Plant, received the 2014 Bolton, Crockett, Beck Award from the Alabama Water and Pollution Control Association.

The **City of Wilsonville (Ore.) Wastewater Treatment Plant** received a 2014 National Merit Award from the Design-Build Institute of America. Working with CH2M HILL, Wilsonville embarked on an improvement project to address population growth, aging infrastructure and more stringent discharge regulations.

Several companies in Kent, Wash., were honored for helping protect regional water quality. Facilities that outperformed wastewater discharge permit requirements in 2013 earned environmental awards from the King County Industrial Waste Program. Gold awards (compliance with wastewater discharge regulations every month in 2013 with no violations) went to **Aramark Uniform & Career Apparel, Exotic Metals Forming Co., Protective Coatings** and the **Seattle Public Utilities Kent Highlands Landfill**. Silver awards (no King County monitoring discharge violations in 2013) went to **Davis Wire Corp., Esterline Hytek Finishes Co., King's Command Foods, Ralcorp Frozen Bakery Products, Vectra Fitness, B.S.B. Diversified Co.,** and **Qualawash Holdings**.

The **San Jose-Santa Clara Regional Wastewater Facility** received a Gold Peak Performance Award from the National Association of Clean Water Agencies for 100 percent compliance with federal permit requirements in 2013. It was the facility's 12th Peak Performance Award.

The **City of Woodland** received the 2013 Wastewater Treatment Plant Outstanding Performance Award from the Washington State Department of Ecology.

Jennings County received a \$550,000 grant from the Wastewater and Drinking Water Program, managed by Indiana's Office of Community and Rural Affairs. The grant will help with the updating of a wastewater treatment facility near Hayden.

The Economic Development Administration of New York awarded a grant to the **Village of Westfield** for improvements to its wastewater treatment plant. The grant awards \$2,116,400 to fund upgrades and increase capacity and support expansion of the region's grape farming industry.

The **Wayne County (Mich.) Downriver Wastewater Treatment Facility** earned a Platinum Peak Performance Award from the National Association of Clean Water Agencies for the third consecutive year. The award recognizes 100 percent permit compliance five or more consecutive years.

Jon Foley of the Coldwater (Mich.) Board of Public Utilities received his Municipal Wastewater Treatment Plant Operator Class B certification.

The **Bowling Green (Ky.) Municipal Utilities Wastewater Treatment Plant** received a 2013 Operational Excellence Award from the Kentucky/Tennessee Water Environment Association for the sixth consecutive year.

Pima County's **Tres Rios Water Reclamation Facility** won a 2014 Project of the Year Award from the Arizona Chapter of the American Public Works Association in the category of Environment/More Than \$75 Million. It's the largest construction project completed in Pima County history.

St. Peter's **John Hank** won the 2014 Operator of the Year Award in Class C from the Minnesota Wastewater Operators Association.

Alan Bush, PE, BCEE, senior wastewater engineer, joined the Sheboygan, Wis., office of Short Elliott Hendrickson, an employee-owned engineering and architecture company.

TPO welcomes your contributions 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

AWWA

The American Water Works Association is offering a Regulatory Update Webinar Dec. 10. Visit www.awwa.org.

Alaska

The Alaska Section of AWWA is offering an Elected Officials Management for Rural Utilities course Dec. 8-12 in Anchorage. Visit www.dec.alaska.gov.

Arkansas

The Arkansas Environmental Training Academy is offering these courses in Camden:

- Dec. 2-4 – Backflow Assembly Repair (Large Series)
- Dec. 3 – Backflow Assembly Tester Recertification

Visit www.sautech.edu/aeta.

The Arkansas Rural Water Association is offering these courses:

- Dec. 3 – Water Exam Review, Lonoke
- Dec. 9 – Basic Math, Lonoke
- Dec. 10 – Water Exam Review, Trumann
- Dec. 11 – Applied Math, Lonoke
- Dec. 16 – Advanced Distribution, Lonoke

Visit www.arkansasruralwater.org.

California

The California-Nevada Section of AWWA is offering these courses in Rancho Cucamonga:

- Dec. 3 – Water Use Efficiency Grade I Workshop

- Dec. 15 – Intermediate Water Distribution Course
Visit www.ca-nv-awwa.org.

Colorado

The Rocky Mountain Water Environment Association is offering a Supervisor Certificate Program Class Dec. 9 in Parker. Visit www.rmwea.org.

Illinois

The Southern Illinois University Environment Resources Training Center is offering these courses:

- Dec. 9-12 – Cross Connection Control, Naperville
 - Dec. 15 – Class A Water Operations 1, Geneva
 - Dec. 16 – Class A Water Operations 2, Geneva
- Visit www.siu.edu/ertc.

Kansas

The Kansas Water Environment Association is offering these courses:

- Dec. 5 – Special Topics: Introduction to Water and Wastewater Chemistry, Hays
 - Dec. 9 – An Examination of Your Ethics, Pratt
 - Dec. 12 – An Examination of Your Safety, Pratt
 - Dec. 17 – Introduction to Water and Wastewater Conveyance, Garden City
 - Dec. 29 – Small Wastewater Systems, Dodge City
- Visit www.kwea.net.

Michigan

The Michigan Section of AWWA is offering a Safe Water in Ecuador Contribution Form online course Dec. 31. Visit www.mi-water.org.

The Michigan Water Environment Association is offering a Fundamentals of Solids Handling Seminar Dec. 4 in Grand Rapids. Visit www.mi-wea.org.

Ohio

The Ohio Water Environment Association is offering a Biosolids Workshop Dec. 11 in Lewis Center. Visit www.ohiowea.org.

New Jersey

The New Jersey Agricultural Experiment Station Office of Continuing Professional Education is offering these courses in New Brunswick:

- Dec. 3-5 – Operation and Maintenance of Pumps
 - Dec. 9 – Operation and Maintenance of Water Treatment Filters
 - Dec. 17 – Water Management and Drainage
- Visit www.cpe.rutgers.edu.

New York

The New York Section of AWWA is offering these courses:

- Dec. 8 – Basic Laboratory Skills, Poughkeepsie
 - Dec. 10 – Hydrant and Water Main O&M, Woodbury
- Visit www.nysawwa.org.

North Carolina

The North Carolina Section of AWWA is offering a Contemporary Topics in Water/Wastewater Construction course Dec. 9 in Greenville. Visit www.ncsafewater.org.

Oklahoma

The Rose State College Oklahoma Environmental Training Center is offering these courses in Midwest City:

- Dec. 1-2 – D-Water Operator
- Dec. 3-4 – D-Wastewater Operator
- Dec. 8-11 – C-Wastewater Lab Operator

Visit www.rose.edu/oklahoma-environmental-training-center.

events

Nov. 30 - Dec. 4

Florida AWWA Section Fall Conference, Davenport. Visit www.fsawwa.org.

Dec. 3

Illinois AWWA Section South Suburban Water Works Association Meeting, Champaign. Visit www.isawwa.org.

Dec. 3

North Carolina AWWA Water Environment Association Industrial Seminar. Visit www.ncsafewater.org.

Dec. 11

Illinois AWWA County Water Supply Operators Association Meeting, Champaign. Visit www.isawwa.org.

Dec. 11

Ohio Water Environment Association Biosolids Workshop, Lewis Center. Visit www.ohiowea.org.

Dec. 18

Illinois AWWA Section Kane County Water Association Meeting, Champaign. Visit www.isawwa.org.

Dec. 19

Rocky Mountain Water Environment Association Water Treatment Committee Conference, Denver. Visit www.rmwea.org.

Accurate Environmental in Oklahoma is offering these courses:

- Dec. 2-4 – D Water and Wastewater Operator, Stillwater
 - Dec. 8 – General Refresher for Water Operators, Stillwater
 - Dec. 8-9 – C Water Operator, Stillwater
 - Dec. 10-11 – C Wastewater Operator, Tulsa
 - Dec. 15-18 – C Wastewater Laboratory, Stillwater
 - Dec. 16-18 – D Water and Wastewater Operator, Tulsa
- Visit www.accuratelabs.com/classschedule.php.

Texas

The Texas Water Utilities Association is offering these courses:

- Dec. 1-3 – Utilities Management, El Paso
 - Dec. 2-4 – Water Distribution, Longview
 - Dec. 9-11 – Distribution, Carrollton
- Visit www.twua.org.

Wisconsin:

The Wisconsin Rural Water Association is offering these courses:

- Dec. 9 – General Safety, Plover
 - Dec. 11 – Regional Utility Management, Watertown
- Visit www.wrwa.org.

The Wisconsin Department of Natural Resources is offering these courses:

- Dec. 3-5 – Sanitary Sewer and Collection System Engineering, Madison
- Dec. 9-11 – Fundamentals of Modern Wastewater Treatment, Milwaukee
- Dec. 15-17 – Key Processes of Wastewater Transport and Control, Milwaukee
- Dec. 17-19 – Safe and Efficient Fresh Water Transport and Distribution, Milwaukee

Visit <http://dnr.wi.gov.tpo>

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EDUCATION

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POSITIONS AVAILABLE

The City of Pierre is accepting qualified applications for the Wastewater Treatment Plant Superintendent position. The Superin-

tendent is responsible for directing & supervising the operation, maintenance & repair of the wastewater treatment facilities and lift stations and is responsible for meeting South Dakota DENR and EPA rules & regulations and for compliance monitoring. Must possess a valid Wastewater Treatment Class IV Certificate issued by South Dakota DENR or obtain certification within 1 year. Salary range: \$49,000 - \$62,000 and is FLSA Exempt. The capital city of Pierre is a premier destination for outdoor recreation and was recently highlighted as the Nation's Second Best Capital City to live in and the best place to live in South Dakota. Job description and application available at: City of Pierre, Attn: Human Resources, 222 East Dakota, PO Box 1253, Pierre, South Dakota, 57501. E-mail: laurie.gronlund@ci.pierre.sd.us. Application and job description available online at www.pierre.sd.gov. Open until filled. (o12)

Gainesville Regional Utilities in Gainesville, Florida is currently seeking qualified candidates to fill the Water Distribution & Wastewater Collection System Director position and also the Wastewater Facilities Operations Director position. For further information and/or to apply, visit: www.cityofgainesville.jobs EOE/AA/DFWP/VP. An application must be submitted for each position of interest. (o12)

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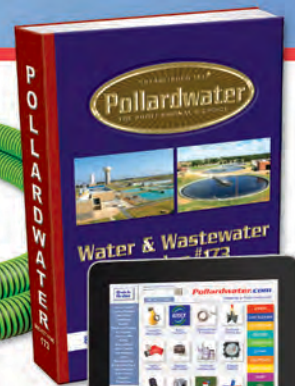


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