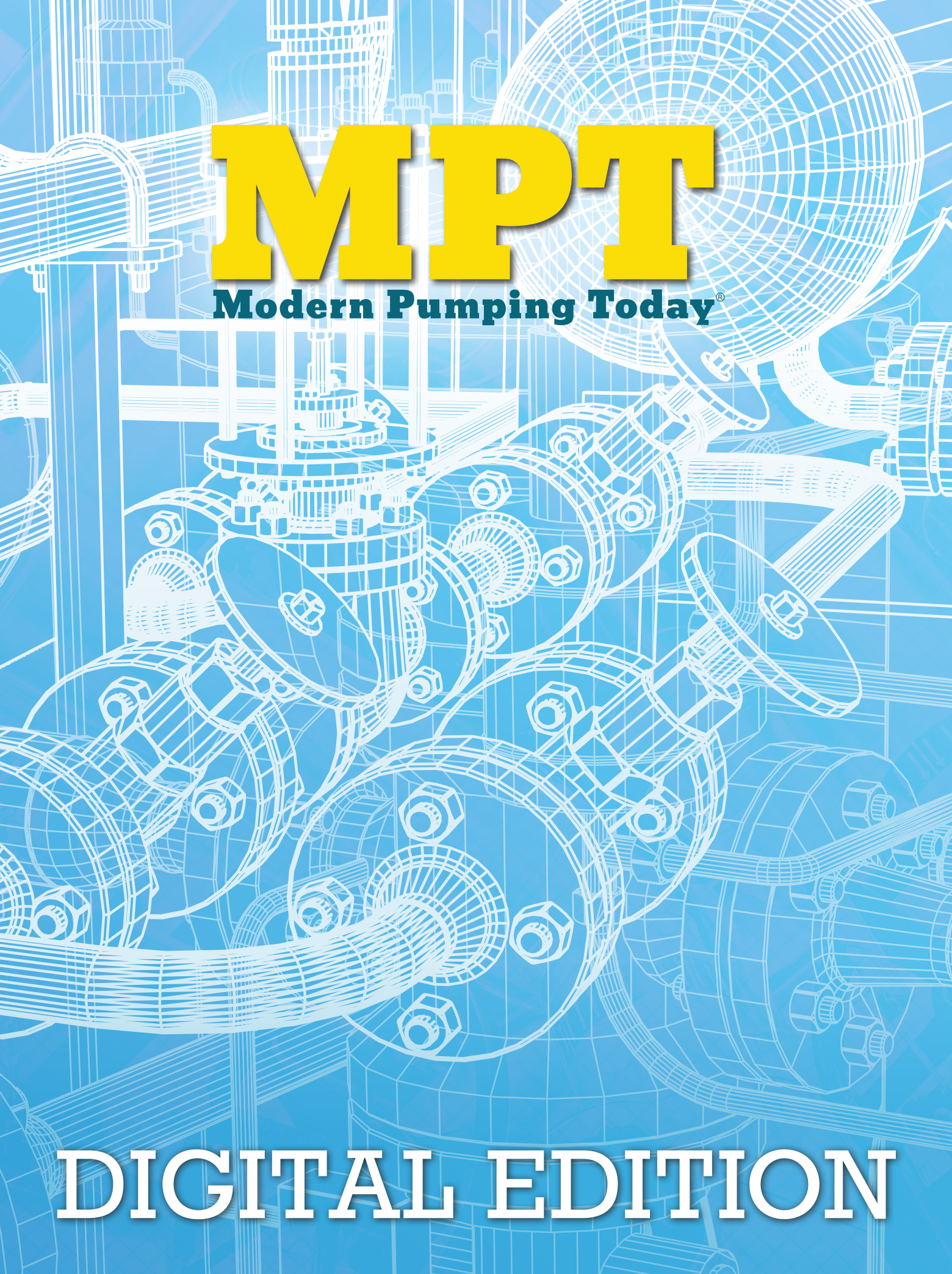
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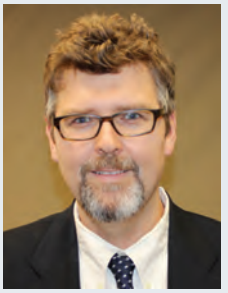

J. Campbell, Editor
Modern Pumping Today

Readers, welcome to a new year and a new issue of MPT! In our Maintenance & Reliability section, we share a timely piece, "When and How to Upgrade Your Vertical Pumps" (pg. 22). Pump expert and long-time MPT contributor Heinz Bloch provides real-world tips from best-in-class performers to maximize your return on investment.

Most news from the previous year wasn't good, so we're happy to share a positive story in this issue's Pump Solutions section (pg. 26). Finding potable water is not always as simple as turning on the tap, and Xylem's Joe Vesey shows how his company partnered with the Chris Long Foundation to overcome distance, salination, and a pandemic to give one family the water they need.

Demanding material requirements in life sciences applications are nothing new. On one hand, manufacturers must choose materials that will ensure safety, quality, and reliability across a wide range of use cases. On the other, they must also choose materials that are both nonreactive and can withstand harsh sterilization. Mathew Griffin and Ray Daugherty of Greene Tweed show how their products strike this balance in our Sealing Solutions section (pg. 36).

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MERGER CREATES ONE-STOP SHOP FOR NATURAL GAS COMPRESSOR PARTS AND SERVICES

H&S Valve, Ignition Systems and Controls (ISC), Global Compressor, and Potemkin have combined to form a new organization, Global Compression Services, a solutions provider and one-stop shop for natural gas compressor equipment parts and services for operations across the globe.

All four of the legacy companies bring unique expertise and experience to Global Compression Services, combining to form an industry-leading portfolio of products and services. Global Compressor Parts is recognized for its outstanding customer service, extensive inventory, and worldwide shipping capabilities. H&S Valve is renowned for providing quick turnarounds, high quality compressor part repairs, and manufactured replacement parts. ISC is respected as an industry-leading service provider of engine instrumentation and serves as the largest Altronic distributorship in the world. Finally, Potemkin Industries underpins Global Compression Services' in-house design, engineering, and manufacturing capabilities.

Anthony Speer, president, Global Compression Services, says, "Combining the talent and expertise of these great organizations allows us to provide exceptional products and services to the gas compression market. As a result, the scope of our product and service offerings will allow us to be a one-stop-shop for much of our customers' gas compression needs."

WESCORP UNVEILS NEW DIGITAL BRANDING WITH RELAUNCHED WEBSITE

WESCorp (White Engineering Surfaces Corporation) has launched a new website at www.wescorp.us. The newly launched website features an intuitive solution-based approach, reflective of the spirited innovation and expanded capabilities that WESCorp offers critical manufacturers in need of high-performance components.

Colby Nyland-Elliott, Wescorp's vice president, states, "Our new website reflects our strategic corporate expansion through new branding, new logo, corporate identity, and tagline 'Mission-Grade Coatings.' We've worked in partnership with our trusted creative agency partner, the Borenstein Group, a top B2B technology marketing agency, to usher in a new brand that reflects who we are as a trusted leader in the thermal coatings industry."

WESCorp is a proud made-in-America, third-generation, woman-owned-and-operated, family business. It offers industrial customers a single-source solution with precision machining, precision finishing, and thermal spray coating (HVOF, plasma, and wire arc) capabilities all under one roof in their 40,000-square-foot building. A comprehensive single source solution enables WESCorp to bring complete quality control and efficiency to any product line.

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TEKSCAN, INC. APPOINTS NEW PRESIDENT AND CEO

The board of directors of Tekscan, Inc. has appointed Jeff Ames as president and CEO, effective immediately. Ames will lead all strategic and operational initiatives to position Tekscan for successful growth and value creation. Tekscan was acquired by Artemis Capital Partners (Artemis) in 2020.

Ames brings over twenty-five years of experience in engineered product businesses, with past roles spanning commercial, technical, and operational responsibilities. Before joining Tekscan, he led the industrial automation business unit of Kaman Distribution Group, a leading integrator and distributor of automation and motion control solutions. Ames previously held roles of increasing responsibility at Eaton Corporation, including leading Eaton's Notification and Wright Line businesses and directing Eaton's uninterruptible power supply offerings.

Peter A. Hunter, managing director for Artemis and chairman of Tekscan's board of directors, says, ''We are thrilled to bring Jeff onto the Tekscan team and are confident that his skills will help Tekscan build on their leadership position in the tactile force and pressure sensing market space. Jeff shares Artemis's passion for leading companies with highly differentiated product offerings in growing niche markets.''

UNIVAR SOLUTIONS AND DOW COATING MATERIALS ANNOUNCE NEW DISTRIBUTION AGREEMENT

Dow Coating Materials has authorized Univar Solutions as its distributor in the United Kingdom and Ireland for all coatings applications and in Turkey for industrial coatings applications. The company's portfolio of acrylic binders, styrene acrylic binders, rheology modifiers, and dispersants is produced in Europe and provides solutions across architectural, industrial, and wood coating applications.

"We are excited to deepen our distribution relationship with the Dow Coating Materials business from Dow. Univar Solutions is a global leader in the distribution of specialty chemicals for the coatings industry and our continued collaboration with Dow will provide our customers in the United Kingdom, Ireland, and Turkey with an even more comprehensive product portfolio," says Joshua Hicks, vice president of global industrial solutions at Univar Solutions. "By bringing together a best-in-class product portfolio with industry leading service and market knowledge, we believe coatings manufacturers in the region will be able to further accelerate their growth."

The distribution agreement began January 1, 2021, and expands Univar Solutions specialty portfolio including industry-leading silicones, pigments, fillers, and other resins used in various architectural, industrial, and wood coating applications.

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PINNACLE ACQUIRES SPECIALTY RISK-BASED INSPECTION FIRM TRINITY BRIDGE

Pinnacle has acquired Houston-based Trinity Bridge, LLC, a consulting company specializing in risk-based inspection programs for the refining and petrochemical industries. This comes on the heels of Pinnacle's announced rebrand and reinvestment into technology and systems to create next generation reliability solutions for the industry.

"Reliability will be the key to sustainability for industries like oil and gas refining, chemicals, mining, and water treatment, and Trinity Bridge brings a great team of people to accelerate that advancement," says Ryan Sitton, founder and CEO, Pinnacle and author of "Crucial Decisions." "Lynne Kaley and I have worked alongside each other as competitors and collaborators for nearly twenty years, and I have always respected and admired her. She was a pioneer in the early days of risk-based inspection technology development, and we are excited to have her and her team join us in building next generation of solutions to optimize reliability."

Lynne Kaley, principal owner of Trinity Bridge, will be joining Pinnacle as vice president of research and development. In this role, she will lead Pinnacle's investment into the development of new technology, processes, and solutions to advance industrial reliability.

NAI APPOINTS NEW DIRECTOR OF OPERATIONAL EXCELLENCE

NAI announces the appointment of Delice Javalera to fill the new position of director of operational excellence. In this new role, Javalera will be responsible for supplier quality and operations planning, and she also will act as the primary operations interface with customers.

To meet NAI global supplier quality requirements, Javalera will enhance the company's current proactive measures of supplier performance. As an initial priority for operations planning, she will focus on formalizing the process to provide dual capacity across NAI's current and expanding global manufacturing locations and ensure seamless on-time delivery and quality performance. In addition, Javalera will coordinate and institute best practices among these various operations.

Jon Jensen, president and CEO at NAI, states, "We established this new position as we continue to take our operations to the next level and leverage the strengths of each location for the benefit of the others. Delice is highly qualified to drive this charge at NAI, and we look forward to her success in advancing our continuous improvement efforts."

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BADGER METER ACQUIRES ANALYTICAL TECHNOLOGY, INC.

Badger Meter has acquired Analytical Technology, Inc. (ATi), a leading global provider of water quality monitoring systems headquartered in Collegeville, Pennsylvania. This acquisition, along with the recent acquisition of s::can GmbH in November 2020, provides Badger Meter with a robust and scalable water quality monitoring offering that delivers real-time data on demand to its utility and industrial customers worldwide. The combination results in one of the most comprehensive water quality solutions available.

ATi specializes in the design, manufacture, and distribution of water quality instruments based on electrochemical and optical sensors. In addition to water quality parameters, its technology can detect toxic gasses used in water treatment and other applications.

Badger Meter continues to grow its smart water offerings through both research and development and acquisition of advanced technologies in instrumentation, including flow measurement, temperature, pressure, and water quality parameters. Our goal is to create robust digital solutions that enable our customers to operationalize real-time data into actionable insights—which, in turn, will help them drive better results, optimize operations, reduce costs, and create outstanding customer experiences.

ADVANCED TECHNOLOGY SERVICES, INC. CEO RECEIVES NATIONAL SAFETY COUNCIL AWARD

Advanced Technology Services, Inc. (ATS) announces its chief executive officer, Jeff Owens, was named to the prestigious 2021 list of "CEOs Who 'Get It'" by the National Safety Council, along with seven other leaders nationwide.

The annual award recognizes executive leaders who go above and beyond to protect employees both on and off the job through four key components: risk reduction, performance measurement, safety management solutions, and leadership and employee engagement.

Owens began his career with ATS in 1988, rising through the ranks over the next three decades to his current role as CEO. He committed himself to embedding safety in the company's overall philosophy and core values by implementing a Live Safety/Beyond Zero culture, Safety Dashboard, and programs such as the President's Award for Safety Excellence. That commitment is reflected in ATS's safety performance as measured by the OSHA Recordable Incident Rate (RIR) and OSHA Lost Time Rate (LTR).

The National Safety Council, America's leading nonprofit safety advocate for over 100 years, is a mission-based organization that works to eliminate the leading causes of preventable death and injury in and beyond the workplace. ◆

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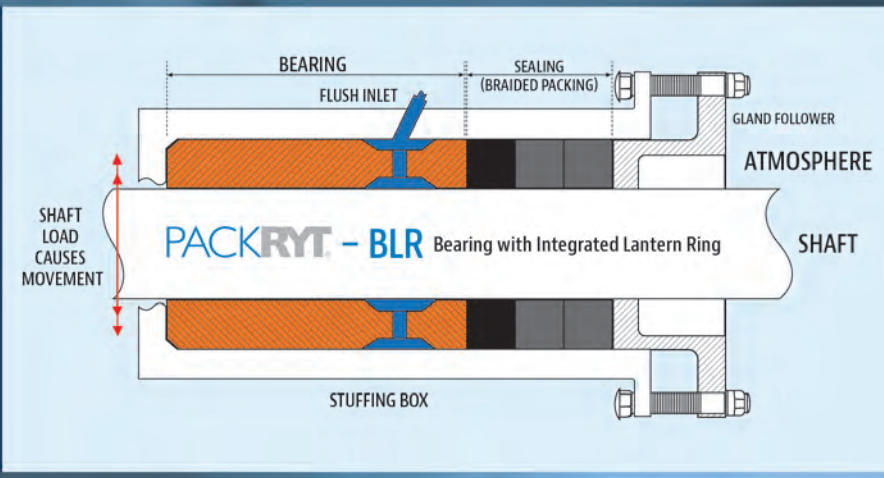

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2021 ASHRAE Virtual Winter Conference

In response to safety concerns related to the ongoing COVID-19 pandemic, ASHRAE has created a safe alternative to the organization's annual conference and exposition. Originally scheduled to be held in January 2021 at McCormick Place in Chicago, the 2021 ASHRAE Expo has been replaced with an innovative and interactive online event. The 2021 ASHRAE Virtual Winter Conference will take place in a convenient, online format February 9 through 11. Attendees can join live discussions with top experts, learn the latest industry updates, and have access to over ninety technical sessions, which will be archived for viewing after the event for up to eighteen months.

NEW CHALLENGES MEAN NEW OPPORTUNITIES

Although in-person meetings may be gone for the 2021 event, the video conferencing technology of the ASHRAE Virtual Winter Conference provides an expanded opportunity for greater numbers to be face to face with the industry's latest innovations in real time. Seizing the moment, ASHRAE has added Sponsor Technology Demonstrations to this year's event. Technology Demonstrations will be hosted by sponsoring companies and will provide the opportunity for attendees to join a thirty-minute interactive session via Zoom to learn more about conference sponsors' technology. Attendees will be able to interact with and ask questions throughout the session with leading companies such as GPS: Global Plasma Solutions, Honeywell, Mitsubishi Electric, and Armstrong Ceilings.

EIGHT TRACKS FOR CONTINUOUS LEARNING

What hasn't changed is ASHRAE's commitment to furthering the professional development and education of its event's attendees. The 2021 ASHRAE Winter Conference technical program is comprised of eight tracks, selected to represent areas of focus common among ASHRAE membership.

HVAC&R Fundamentals and Applications

Fundamentals are the foundation for understanding applications in engineering. Key components of ASHRAE fundamentals include thermodynamics, psychrometrics, fluid flow, and mass flow. This track provides opportunities for papers and presentations of varying levels across a large topic base. Concepts, design elements, and shared experiences for theoretical and applied concepts of HVAC&R design are included.

Systems and Equipment

HVAC&R systems and equipment are constantly evolving to address the changing requirements of the built environment. Papers and programs in this track will focus on the development of new systems and equipment, improvements to existing systems and equipment and the proper application and operation of systems and equipment.

Refrigeration and Refrigerants

Refrigeration is a critical element of modern life, from preserving food and medicine to maintaining comfort. With significant changes on the horizon for refrigerant regulations, along with new applications for refrigeration systems being frequently applied, there is more need than ever to understand both the fundamental and advanced concepts and issues related to refrigeration. Papers and programs in this track will focus on refrigerants, refrigerant regulation, refrigeration cycles, and refrigeration applications.

Environmental Health through IEQ

HVAC&R systems play a significant role in maintaining indoor environmental conditions. As people spend increasingly more time in the built environment, health concerns are becoming paramount to design. This track will seek papers and programs on developing, evaluating, and predicting optimal indoor environmental conditions, especially as they pertain to environmental health.

Building Performance and Commissioning for Operation and Management

Modern HVAC&R systems are complicated and designed for high efficiencies. In order to optimize their use and provide

proper operation, commissioning is recommended. This track provides an opportunity to provide papers and presentations surrounding building operation and commissioning practices as well as case studies in performance and commissioning.

Energy Conservation
Whether it is new construction, renovation, routine maintenance, or energy audits, there is a major concern over the use of energy in the built environment. Designs are using more techniques to reduce energy with the use of energy wheels and pipes, solar energy, photo voltaic, and more efficient equipment and new concepts that are pushing to be standard design practice. In addition, modeling is being used to generate more cost decisions for the design and value-engineering decisions beyond standard HVAC practice. This track will highlight case studies and research that expand on the simple to the complex energy savings measures being implemented in today's and tomorrow's designs.

International Design
Design for various environmental elements, geography, and culture demand that new and innovative strategies be developed. As an international organization, ASHRAE strives to meet the needs of a global membership. HVAC&R systems vary globally and this track provides an opportunity to share innovative and necessary design elements that can be shared internationally.

Standards, Guidelines, and Codes
ASHRAE is known for its standards and design guidelines—and they are constantly evolving with the intent on improving the built environment and its systems. Designers, contractors, architects, and owners must be able to keep up with the continuing changes in the current cycle but to also be prepared for the future changes. In addition, there is a large interaction of ASHRAE with the code authorities and government to incorporate these standards and guidelines. The series of sessions in this track highlight the changes to the standards and guidelines, their projected path, and optimum design techniques to meet or exceed the standards.

STUDENT PROGRAM

As part of the 2021 ASHRAE Virtual Winter Conference, the Student Program will feature three sessions presented live for students around the globe to join starting on the morning of February 9. Registration is open for students looking to enter the profession and ASHRAE Student Members and Student Branch Advisors receive a discounted rate to attend. The Student Program sessions are included in the registration rate as well as the full virtual program for the 2021 ASHRAE Virtual Winter Conference,

Registration is open now. For more information, visit **www.ashrae.org.** ◆

Saft Batteries Break the Ice

Batteries provide critical engine starting and backup power for Azov Sea icebreakers

By Karen Hollington, Saft

Saft batteries are providing critical engine starting and backup power for icebreakers that protect year-round navigation for Russia's ports in the Azov Sea. Port operator Federal State Unitary Enterprise Rosmorport has turned to Saft to supply replacement batteries for eight ice breaking vessels after the original batteries supplied by Saft delivered more than thirty years of service.

SSPH nickel battery solutions recover their voltage instantaneously, making them the ideal choice for starting applications off-shore.

NEW-GENERATION BATTERY FOR NEW CHALLENGES

The new Saft nickel technology batteries include SPH models to deliver cranking power for diesel engine starting, as well as SBM batteries to provide backup power for communication, navigation, and emergency lighting systems. They are the new-generation battery types that have replaced the original H and M Nife batteries installed between 1983 and 1986 for Finnish shipbuilder Wärtsilä on behalf of the Soviet Union.

Saft block batteries function in a wide range of temperatures, resist electrical abuse, shock, and vibrations, and need only basic maintenance.

Reliable power is essential to help icebreakers protect year-round navigation to Azov, Rostov-on-Don, and Taganrog. These ports are important gateways between industrial regions in Russia, the Black Sea, and the Mediterranean Sea. Rosmorport's thirty-five icebreakers cut routes through the ice and escort caravans of vessels over distances of up to 210 nautical miles between November and April. The enterprise

icebreaker fleet is the largest in the world, performing 10,000 ice escorts each year.

FACING UP TO TOUGH CONDITIONS

As the lead vessels in the caravans, performance of safety equipment such as backup batteries on board icebreakers is vital. Wind chill means that the temperatures drop below -22 degrees Fahrenheit (-30 degrees Celsius) and ice thicknesses can reach 15 to 30 inches due to the shallowness and low salinity of the Azov Sea.

Therefore, the batteries must withstand extremely low temperatures, as well as the shock and vibration of icebreaking and storm conditions. The long life achieved by the original Saft nickel batteries was mainly due to their tough industrial construction but also to the professionalism of the icebreaker crews, who followed the battery operating schedules and standards to the letter.

LONG LASTING PERFORMANCE, EASY INSTALLATION

One challenge overcome during installation was due to limited space available on board the icebreakers. While the duty of the new nickel batteries is a close match with the originals, the size and shape of the new units differs slightly. To ensure smooth and straightforward installation, experts from Saft's Moscow office worked closely with the technicians on the icebreakers at an early stage to identify new locations for batteries.

Sergey Varnavskiy, Saft's key account manager based in Moscow, adds, "The batteries on board the Azov Sea icebreakers are an excellent example of how Saft's nickel batteries technology stand the test of time in the toughest industrial environments and make a meaningful contribution to strategically important operations."

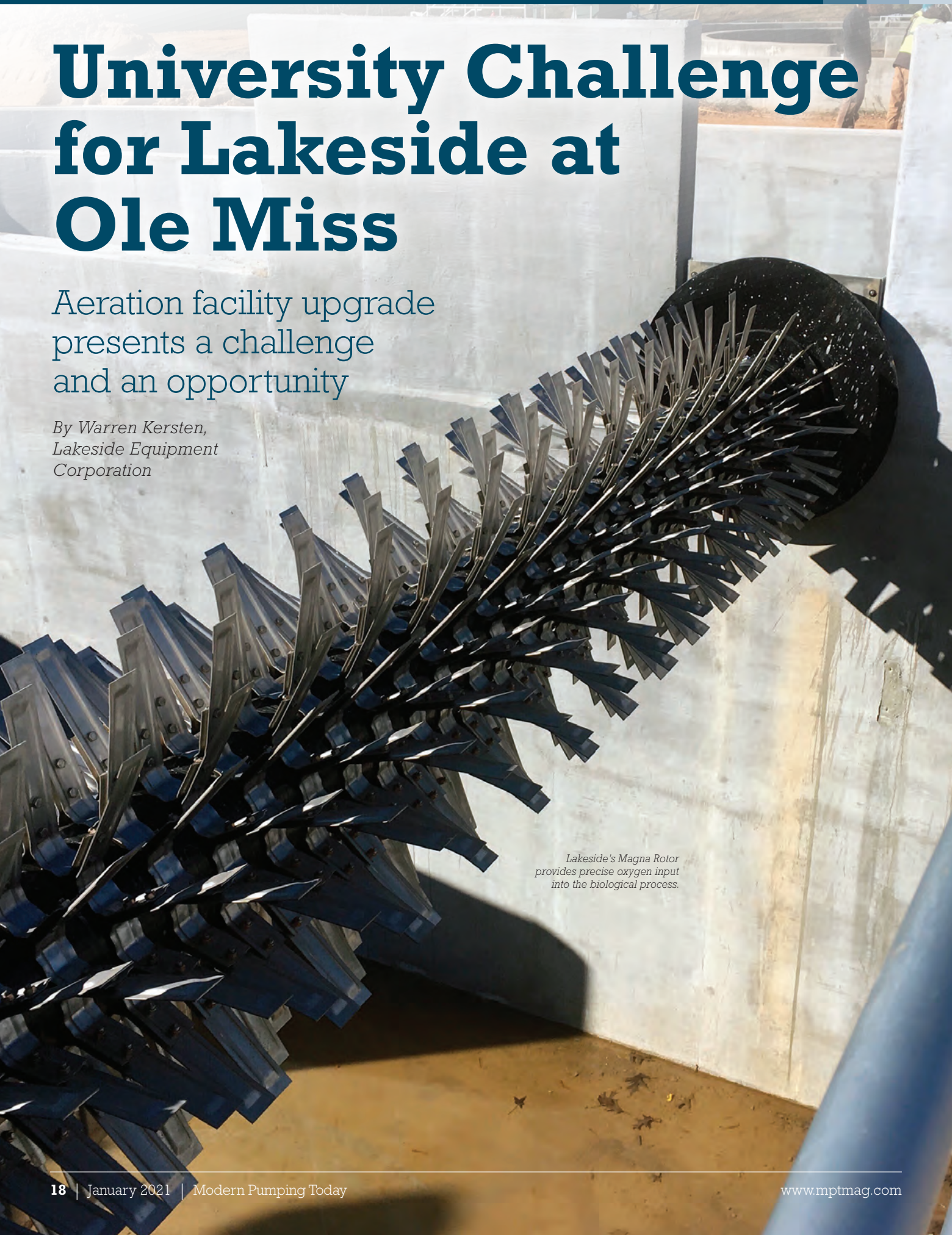
Saft manufactures SPH batteries in Bordeaux, France, and SBM batteries in Oskarshamn, Sweden. ◆

Saft specializes in advanced technology battery solutions for industry, from the design and development to the production, customization, and service provision. For 100 years, Saft's longer-lasting batteries and systems have provided critical safety applications, back-up power, and propulsion for their customers. Saft's innovative, safe, and reliable technology delivers high performance on land, at sea, in the air, and in space. Saft is powering industry and smarter cities, while providing critical back-up functionality in remote and harsh environments from the Arctic Circle to the Sahara Desert. For more information, visit **www.saftbatteries.com.**

University Challenge for Lakeside at Ole Miss

Aeration facility upgrade presents a challenge and an opportunity

By Warren Kersten, Lakeside Equipment Corporation



Lakeside's Magna Rotor provides precise oxygen input into the biological process.

The phrase "significant operational challenges" is something of a major understatement when bringing about wastewater treatment enhancements at a preeminent public international research university, that 170 years on from its establishment, continues to expand.

Known affectionately by alumni, students, and its passionate sports fans as Ole Miss, the University of Mississippi first approached Engineering Solutions Inc. (ESI) in 2010, seeking guidance on an upgrade to its wastewater facility built in 1972 as a a dual basin extended aeration plant.

Building of the Lakeside CLR (Closed Loop Reactor)

EXPANSION AND CONVERSION

ESI (based in Pontotoc, Mississippi) designed a project to convert one of the basins to a 0.75 million gallon per day Lakeside oxidation ditch, replacing the existing clarifier equipment and recirculation pumping, as well as upgrading the headworks and converting the other aeration basin to flow equalization.

Lakeside's oxidation ditch, the Closed Loop Reactor (CLR) Process, consists of reactors with a single feed point for raw wastewater and return sludge. The basic design uses a simple racetrack configuration that provides a straight-line flow pattern for wastewater between the headworks and the final clarifiers. At the core of the CLR Process is the horizontal Magna Rotor, which sustains a high population of micro-organisms in the reactor to provide simple process control. The Magna Rotor provides precise oxygen input into the biological process through adjustment of rotor immersion by raising or lowering the level control weir and by adjusting the rotational speed.

FLEXIBLE TO ADAPT

As ESI's Mike Falkner, civil engineer–principal, explains, the wastewater facility at the University of Mississippi is different in several ways.

"First," he says, "there are very wide swings in on-campus population, depending on the school calendar. This can range from almost no campus population at all during the Christmas break—to normal student loading—and then to home football games—for which the much-loved Ole Miss Rebels attract sell-out crowds in excess of 60,000 to every home game."

TRYING TO MAINTAIN A STABLE POPULATION OF BIOMASS

Falkner adds, "Influent flows at the wastewater treatment facility can therefore range from a low of 0.3 or 0.4 million gallons per day to an average of 0.6 or 0.7 million gallons per day to a high of 1.2 million gallons per day. This creates those significant operational challenges in trying to maintain a stable population of biomass within the treatment reactor, which is a biological treatment process.

"Also, due to a campus-wide push to convert to low-flow plumbing fixtures, the net wastewater flow rates were not increasing as a linear function of population; however, the concentrations of contaminants (such as ammonia) in the waste stream were continuing to rise—often to levels which are difficult to effectively treat using normal municipal-type treatment processes. This rising trend in ammonia levels was not identified in pre-design sampling prior to the 2010 plant rehab project. The source has been confirmed by on-campus sampling conducted as an independent study."

GROWTH RATE A PRIORITY

As the campus population continued its rapid growth, the Physical Plant Department at the university (PPD) then tasked ESI in 2013 with investigating options for future wastewater treatment. At that time, the university owned and operated a single oxidation ditch separate wastewater treatment facility, permitted for 0.95 million gallons per day, which would be upgraded in the 2015 project to the dual-basin configuration with nutrient removal capability.

Faced with a growth rate that would overwhelm existing wastewater facilities as early as 2017—and experience periods of overload prior to that, the university sought the most feasible approach—from economic, environmental and social perspectives, for the next twenty years.

ESI saw that while the existing system's water conservation effort had been beneficial in many respects, it had placed higher demands on the wastewater treatment facility, especially when trying to consistently meet the discharge limit for ammonia nitrogen of 2 micrograms per liter.

Lakeside's original CLR (Closed Loop Reactor) on the left, with the new CLR at Ole Miss on the right.

At this time, the resident population had grown from approximately 7,500 to 8,400—and with the addition of 2,500 employees, the university's daytime population was almost 20,000.

ENVIRONMENTAL CONCERNS ADDRESSED

ESI looked hard at the surface waters potentially affected by the project, including an unnamed tributary of Burney Branch, along with Burney Branch itself, which flows generally southeast into Burney Branch and thence southward to the Yocona River—which had capacity for larger drainage, but was already impacted by the City of Oxford POTW. The city had adequate available capacity to treat the anticipated flows from the university, but it would have been necessary to construct some 12,500 feet of 24 inches gravity sewer to make the connection, including a bore under Mississippi Highway 278.

The potential benefits included lower initial capital cost, elimination of the need for ongoing operational and maintenance expenses, and reduction of environmental liability. Also, it would allow the abandonment of the university wastewater treatment facility, which is located on a prime site adjacent to Vaught-Hemingway Stadium, home to the hugely popular Ole Miss Rebels football team. Not only is this a valuable site, but there are social impacts of treating wastewater, including visual impacts and occasional odor issues, in what has become a high traffic and highly visible area—although there would still be a need for a sewer metering station in the vicinity of the current wastewater treatment facility, so that the entire site could not be converted to other uses.

However, the negative impacts related to this alternative were considered far greater—particularly the City of Oxford's commercial usage rates for treating wastewater—but the fact that it would leave the University vulnerable to future rate increases. Charges would also apply to maintenance, expansion and replacement of its existing collection system components.

INCREASING CAPACITY

After lengthy consideration, ESI recommended iincreasing the capacity at the university's existing wastewater treatment facility, maintaining an adequate level of wastewater treatment capacity while maximizing current assets. ESI proposed the introduction of a second Lakeside oxidation ditch, as well as the addition of anoxic tanks upstream of both ditches for enhanced biological nutrient removal (BNR) to help maintain compliance with more stringent National Pollutant Discharge Elimination System (NPDES) discharge limits. The proposed new process train would have to be slightly higher in capacity than the existing ditch, and new headworks would be constructed to optimize the flow balance between the two. Other components would also have to be modified to handle pumping, sludge treatment and chemical treatment.

The most beneficial aspect of this alternative is that the university retains full control of wastewater treatment/disposal activities. Any decisions that would increase operational costs would be made by the university instead of the city, where the university has no vested representation. Also, the annual debt service plus operational cost of this expansion would be substantially lower over the life of the facility than either option involving off-campus treatment. The initial capital cost was higher than the other options and the wastewater treatment facilty would still be located next to the prestigious stadium—but the visual and odor related social impacts would be attenuated by the use of covers and air scrubbers.

VERY EASY TO MAINTAIN

Falkner continues, ''The most recent project added a third clarifier, new screening and grit removal systems, a headworks odor control scrubbing system, and an aerobic sludge digestor as well as an ultraviolet disinfection system. This included Lakeside's Grit Removal system, the

SpiraGrit, which has no submerged bearings, so is very easy to maintain.''

Compact in design, this system consistently removes inorganic grit from the treatment plant in a mechanically induced vortex environment. The efficiently removes grit over a wide range of daily flow rates. Rotating paddles maintain the flow velocity in the vortex chamber, keeping organics in suspension while allowing heavier grit to settle on the chamber floor. The settled grit moves across the floor and falls into the lower grit hopper.

Lakeside also supplied its Raptor® Micro Strainer, which captures small debris that passes through other screens. The captured screenings are washed, compacted, and dewatered to a dry solids content of 40 percent as they are transported up the inclined screw for disposal. This step reduces the volume by 50 percent and weight by 67 percent, ultimately reducing disposal costs.

''Again, this is a simple yet very effective design with a single drive that keeps maintenance costs low for the university,'' says Falkner.

The university's popularity and growth was underlined in the fall of 2016 when enrolment reached an all-time high of 24,250 students. Overall, enrolment has grown by a massive 40.5 percent over the past decade, and by 13.1 percent in the past five years alone—so putting all of these futureproof measures in place has been crucial.

MUCH MORE ENERGY-EFFICIENT

''The current configuration now has a flow capacity of 1.5 million gallons per day with a peak of 2 million gallons per day. It is designed to be highly energy efficient because the aerators in the ditches are controlled based on dissolved oxygen levels in the mixed liquor using variable frequency drives. This means that they only inject as much oxygen and mixing as necessary to maintain high quality effluent. This is much more energy-efficient that timers or other mixing schemes since it is based on real time operational conditions.''

He concludes, ''Investing in Lakeside's robust engineering was very much part of our commitment to the long-term wellbeing of the University of Mississippi's wastewater treatment facility. It is tough, reliable equipment, which requires only basic maintenance.'' ◆

Warren Kersten is vice president of Lakeside Equipment Corporation. Lakeside Equipment Corporation is an engineering and manufacturing company concentrating on helping to improve the quality of our water resources. Lakeside started in the spring of 1928 to engineer, develop, and provide water purification systems to municipalities and companies throughout North America. For more information, visit **www.lakeside-equipment.com**.

When and How to Upgrade Your Vertical Pumps

Learning from best-in-class performers to achieve real savings

By Heinz P. Bloch

High asset reliability should be our priority, because the illusory "savings" derived from forever repairing cheap equipment have vanished with the first major repair. That repair, of course, was often decades ago. But suppose that not only is your plant old but the EPC (engineering/procurement/construction) contractor received a bonus for coming in under budget. In that case, some of your equipment is almost certain to have come from the lowest bidder and the average MTBR (mean time between repairs) of your vertical pumps is probably well below today's industry average of around 4.5 years.

Back pull-out style vertical inline pump (see reference 2).

IMITATE BEST-IN-CLASS PERFORMERS

If moving towards the ranks of best-in-class performers ("BiCs") is in your plans, consider viewing the next repair event as an opportunity to go beyond the usual repair. Work with a competent shop facility, one that will assist you in combining the repair with some judicious upgrading. While improvements to hydraulic efficiency and extending the safe head/flow range are often feasible, upgrading equipment also implies imparting extended life expectancy or greater run lengths before the asset requires repairs. That type of upgrading usually involves the mechanical end of a vertical pump.

Experience shows that proven upgrades will move vertical pumps out of the failure-prone side of the MTBR data base and to the more reliable side of a facility's MTBR tabulation (see reference 1). The reasonable incremental cost of proven upgrades will often surprise the plant's reliability staff and their managers. Where no in-plant statistics exist, interested parties can select time-tested ways to perform straightforward, yet relatively accurate cost justifications for upgrades to either the widely used back pull-out vertical inline pumps in figure 1, or the column-style deep-well pumps shown in figure 2 (see reference 2).

SINGLE-STAGE IN-LINE PUMPS

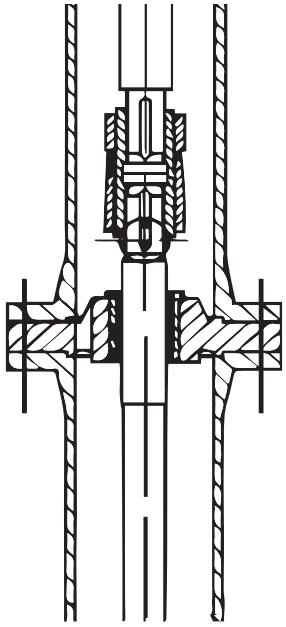
A widely used version of a single-stage in-line back pull-out pump is shown in figure 1. Contrary to

occasional assumptions, these pumps fail no more often than their traditional horizontal shaft counterparts. A major refinery with over 1,000 horizontal and hundreds of vertical API-compliant single stage back pull-out pumps (Style OH5) recorded its failure statistics over a five-year period. With a mean-time-between repairs (MTBR) of 7.4 years for one and 7.6 years for the other style, there was no meaningful difference. However, an often-overlooked installation prerequisite is to allow such pumps to float; they should never be bolted down on the foundation. In other words, they must be free to move to wherever the associated piping is pushing them. Upgrading consisted of bolting a steel plate to the top of the concrete foundation and allowing the pump to freely move in whatever direction it wanted to go. Resist the temptation to insert only a single Teflon® plate between pump body and steel plate. The rough surfaces of plate and pump body will dig into the Teflon and inhibit movement. If you want low-friction movement, use either two Teflon plates or none at all.

Photo credit: Hydro Inc.

Deep-well vertical pump.

Note that single-stage vertical pumps are also available with an extended-length distance piece bridging the approximately 8-inch distance between the motor frame and pump housing. This will allow insertion of a suitable spacer coupling. The less expensive and



Vertical column pump, showing sleeve-type shaft bearings and rigid connectors at shaft sections (see reference 3).

more widely used standard version (API designation OH5) depicted in figure 1 uses a rigid coupling and short motor shaft. Here, the prevailing loads must be absorbed by the motor bearings whereas, in the slightly more expensive extended-length version, the loads are distributed over both motor and pump bearings.

Pump styles incorporating rigidly coupled short shafts and styles with pump-to-motor shafts bridged by a flexible spacer coupling, are available with drivers delivering well in excess of 100 kW. The extended length distance piece version requires slightly more attention to vibratory resonance suppression. However, competent vendors and reliability-focused users know how to avoid surprises related to resonance-induced vibration activity.

Today's analytical methods can be used to recommend where and what external pipe locations or supports will benefit from stiffening or bracing. Alternatively, an adjustable weight pendulum could be mounted at the structure to move resonances away from pump speeds and their respective multiples. In any event, many existing vertical pumps benefit from upgrading at the next repair opportunity.

Bearing upgrades are not usually needed for OH5 style inline pumps. However, wear ring replacement is often cost-justified. Top-of-the-line carbon-filled Perfluoro-Alkoxy (PFA/CF) materials have been used to upgrade the wear rings in virtually every type of pump. PFA/CF has also become the material of choice in situations where metallic wear rings are not standing up to harsh conditions (see reference 2). Perfluoro-Alkoxies are in the Teflon family but exhibit a lower coefficient of thermal expansion (CTE) than either Teflon or the metallic wear parts used earlier in a particular pump design.

UPGRADING MULTI-STAGE VERTICAL PUMPS

Multi-stage deep well pumps are available in styles and models that range from just one horsepower and single stage to multi-stage versions that often comprise over twenty stages and horsepower levels in the mid four-digit range (see reference 3). Some have their column bearings encased in a tube or inner pipe which allows strict separation between lubricant and the liquid (“pumpage”) being pumped in the surrounding annulus. In other words, the pumpage rises between the inner pipe and a much larger diameter outer pipe. However, in the most popular style (see figure 2), there is no separate inner pipe. On its way from pump suction to discharge, the pumpage makes contact with the column bearings, one of which is shown in figure 3.

INVOLVE EXPERIENCED PUMP REBUILDERS

The largest independent repair-upgrader has branch facilities in countries around the world and pre-qualifying (assessing the competence) one of the rebuilder’s nearby locations will save much time later. A qualified rebuilder will be staffed by key employees with instant access to a team of highly experienced design engineers. Expect this team to be stationed at the rebuild shop’s HQ location in a major industrial city. Designating a rebuilder with a test stand for vertical column pumps in the high power and deep-well categories could prove advantageous. Discontinuing metallic wear parts and replacing them with carbon fiber-filled Perfluoro-Alkoxy (PFA/CF) wear rings is usually cost justified and should be part of the upgrading (see reference 2).

BEARING UPGRADES

A closer look at more substantial bearings and advantageous lube application methods is desired whenever in-plant failure statistics point to weaknesses.

This is when reliability-focused plants consider upgrading to better bearings and lube application methods. Possible bearing upgrades and proven lube application methods include tapered roller bearings and oil mist lubrication (see reference 4).◆

Heinz P. Bloch resides in Montgomery, Texas. His professional career commenced in 1962 and included long-term assignments as Exxon Chemical’s regional machinery specialist for the United States. He holds B.S. and M.S. degrees (cum laude) in mechanical engineering from the New Jersey Institute of Technology’s Newark College of Engineering (“NCE”) and was honored as one of ten inaugural inductees into NCE’s “Top 100 Hall of Fame.”

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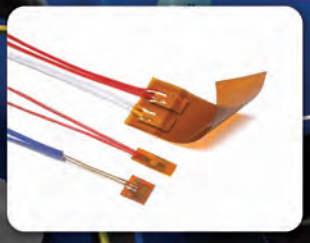

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Providing Hope (and Water) to Those in Need

Xylem partners with Hometown H_2O to install water well for retired Oregon couple

By Joe Vesey, Xylem

For thirty-four years, Steve and Lana Gleason made due without a traditional residential water system. The couple, who live in the rural logging community of Jewell, Oregon, pumped water for washing from a nearby river and made 40-mile round trips from their home to haul drinking water from a spring.

Now retired, the Gleasons are both sixty-nine and facing mounting health concerns. Steve Gleason suffers from chronic obstructive pulmonary disease (COPD) and heart issues, which make the arduous treks to the river and spring even more dangerous. Add to that the risks that COVID-19 bring to the elderly and immunocompromised, the potential outcomes of not having direct access to running water are bleak.

By December 2019, silt from the river flow built up in the Gleasons' existing river pump, causing it to fail and forcing the couple to use nonpotable water collected from a rain barrel. Although Steve purchased a new pump, he couldn't get it to work. After two months without running water to their home, the Gleasons heeded a neighbor's recommendation to apply for assistance through the Water Well Trust (WWT), a nonprofit arm of the Water Systems Council established to provide wells for Americans who do not have a safe drinking water supply. Working with Xylem and Hometown H_2O, a domestic water program of the Chris Long Foundation dedicated to bringing access to clean and sustainable water to the more than two million Americans without it, WWT identified the Gleasons as a family in need.

Steve and Lana Gleason, beneficiaries of Hometown H_2O .

HOMETOWN HEROES

Hometown H_2O was launched in late 2019 as a result of a partnership between the Chris Long Foundation's Waterboys initiative, Xylem Inc., and the Water Well Trust. The new well, which provides potable water directly to the Gleasons' home, marks Hometown H_2O's second well donation project in partnership with Xylem.

"The fact that senior Americans with underlying health conditions must get usable water from two different locations on a regular basis—especially during a global pandemic—should not exist; however, issues like these are far more prevalent than people realize," says Chris Long, two-time Super Bowl champion and founder and chairman of the Chris Long Foundation.

Goulds Jet Pumps, like the NSF 61 certified J+ Convertible Jet Pump seen here, may be used on shallow or deep well applications.

Xylem donated Goulds Water Technology brand equipment and local Xylem distributor partner Mitchell Lewis and Staver coordinated its discounted installation through pump installer McMullen Water Systems and water well driller McMullen Drilling of Portland, Oregon.

A CHALLENGE WORTH ACCEPTING

The simple goal of providing access to clean water for the Gleasons ultimately proved anything but easy.

"It was a long and emotional process as we uncovered many obstacles that nearly brought this project to a halt," says David Brown, Mitchell Lewis and Staver CEO.

When the project got underway in late June, the first two wells McMullen Drilling attempted produced just 2 gallons per minute of saltwater. A third attempt resulted in 120 feet of dry sandstone. The crew then drilled a fourth hole at the lowest point on the Gleasons' property, but after boring down 100 feet, 200 feet, then 300 feet, drillers determined that site, too, was a nonproducer.

After the fourth failed drilling, McMullen returned to the drawing board to figure out another solution.

"They told us they would do whatever it takes, but if there's no water, there's no water, so we were concerned it wasn't going to happen," says Lana Gleason. "We were very relieved when we found out things were moving forward."

Ultimately, the decision was made to move back to the original drilling site where the crew drilled a fifth saltwater-producing well. The site picked up 2 gallons per minute of saltwater with a total dissolved solids (TDS) level of 3,400—typically a good-producing well will have at least 10 gallons per minute and a TDS below 600. The team added a reverse osmosis filtration system, two separate holding tanks (one for the well to pump into and one for treated water) and a booster system to move clean water up to the Gleasons' home.

MOVING WATER TO WHERE IT'S NEEDED

Once the well was drilled, team members installed a Goulds Water Technology 7GS05R 4-inch submersible pump with a 1/2 horsepower two-wire motor. Sizing a "reduced stage" pump helped minimize the amount of lift from the well, thus offering protections against over-pumping. Additionally, the volunteer team trenched 300 feet of pipe and electrical, installed a Goulds Water Technology Jet Pump, HydroPro Tank, 2,500-gallon poly tank and a reverse osmosis (RO) system with 2-gallon reserve tank for under-the-sink operation.

Additionally, Mitchell Lewis and Staver made a $10,000 donation

> "These teams of professionals pushed the limits of creativity and ingenuity to provide a solution where the Gleason family can now enjoy clean water."
>
> —David Brown, Mitchell Lewis and Staver CEO

to the Waterboys program through Xylem Watermark, which is matching donations 1:1 during the pandemic for a total of $20,000. Waterboys will use the funds for its domestic initiatives to bring clean water to communities in need.

"This type of opportunity to collaborate with these premier organizations and make a real difference in people's lives doesn't come along every day," Brown says.

"These teams of professionals pushed the limits of creativity and ingenuity to provide a solution where the Gleason family can now enjoy clean water."

PROVIDING HOPE IN UNCERTAIN TIMES

While the pandemic restricted Xylem employees from traveling to Oregon to volunteer, Watermark, Xylem's corporate social responsibility program, provides initiatives for Xylem partners to carry out its mission of volunteering. Taking social distancing precautions amid COVID-19 concerns, Mitchell Lewis and Staver employees purchased materials and built the well house for the new water well, helping ensure its longevity for the Gleasons' access to water.

"One thing no one should have to worry about, especially during such uncertain times, is having access to clean, safe water," says Susan O'Grady, director, Americas building services and agriculture, Xylem. "But, in fact, there is a very real water crisis in the U.S., which is being further compounded by the COVID-19 pandemic. Now, more than ever, our unique position in the water sector in coordination with our national and global partners, gives us the great honor and responsibility to address these water challenges swiftly."

Following the installation of the water well and home improvement projects, Steve Gleason expressed the couple's gratitude.

"We've lived thirty-four years on this road and we've pumped out of the river the entire thirty-four years so this is going to be quite the treat," he says. "Everyone has done a wonderful job. We knew it was going to be hard; we didn't know it was going to be this hard, but they persisted." ◆

Joe Vesey is Xylem's chief marketing officer and chair of Xylem Watermark. As a leading global water technology company, Xylem is dedicated to solving the world's most challenging water issues. As a part of this mission, Xylem Watermark, the company's corporate social responsibility program, was founded ten years ago. The program is an integral part of realizing Xylem's vision: a world where water issues are no longer a barrier to human health, prosperity and sustainable development. For more information about the partnership between Xylem Inc. and the Chris Long Foundation's Waterboys initiative, visit **www.goulds.com/waterboys**.

Supporting Arc Flash Safety

Mobile interface removes personnel from hazardous areas

By George Roscoe, Siemens

An arc-flash event—a fiery explosion that can result from short circuits in electrical distribution equipment—is one that facility managers shudder to think about. An arc flash occurs when electrical clearances are reduced or compromised by deteriorating insulation or human error. The arc flash follows an undesired through-air conductive path between two energized conductors or between an energized conductor and ground.

The results are often violent and when a human is in close proximity to the arc flash, serious injury and even death can occur. Reaching an exorbitant temperature of 35,000 degrees Fahrenheit (19,426 degrees Celsius)—four times the temperature on the surface of the sun—an arc flash is a phenomenon to be avoided at all costs. An arc flash can be caused by many things including

- Dropped or misplaced tools
- Faulty installation
- Accidental contact with energized conductors
- Condensation
- Insulation failure
- Corrosion
- Dust

On average, there are five to ten arc-flash incidents per day in the United States resulting in more than 30,000 injuries and 400 deaths annually, with approximately 80 percent of the fatalities due to burns, not shocks. Energy management stakeholders are keenly aware of and compliant with PPE regulations for field workers performing electrical infrastructure tasks within defined proximities, but consistently grapple with the challenge of putting a worker in harm's way.

At Siemens, we couldn't agree more. Although exposure to energized equipment is a reality, effective prevention means removing the need for exposure in the first place. From this perspective, even 18 inches is too close.

REMOTE CONTROL WITH SM@RTGEAR MOBILE

With Sm@rtGear™ Mobile, visualization takes center stage, providing a dashboard-driven interface that can display switchboards or switchgear views. Sm@rtGear Mobile removes workers from the arc-flash hazard zone, enabling remote execution of potentially dangerous procedures, as follows:

Open/Close Breakers

Closing a breaker that has active power on the line side when the equipment is first energized or after equipment maintenance is an operation that has increased arc-flash hazard potential. Sm@rtGear Mobile eliminates manual contact by enabling the operator to close the breaker from outside the arc-flash hazard zone and removes the need for a costly remote control panel.

Activate/De-activate Breaker Maintenance Mode

One of primary drivers for arc-flash incident energy is the clearing time of the upstream protective device. If the upstream protective device has a maintenance mode option, the clearing time can be reduced by lowering the pickup setting and time delay (if applicable) of the upstream protective device. Typically, it is the instantaneous pickup setting that is lowered to below the calculated arc-flash arcing current value.

The maintenance mode option is a standard Sm@rtGear Mobile feature and can be configured and activated from outside the arc-flash hazard boundary. This reduces the arc-flash incident energy exposure for anyone approaching the electrical distribution equipment.

Remotely Monitor and Configure Intelligent Devices

Sm@rtGear Mobile enables operators to remotely monitor and configure breakers, meters, relays, etc., that are embedded in the electrical distribution equipment. Remote monitoring and configuration are an effective way to maintain separation between personnel and energized equipment.

CONCLUSIONS AND RECOMMENDATIONS

Arc-flash safety is highly regulated in terms of both labeling and personal protective equipment (PPE) requirements. Of course, the recommended way to protect workers is to de-energize equipment prior to working on it. When de-energization is not feasible, incorporating guidelines from NFPA and OSHA into an organizational arc-flash study is critical.

The organizational study should include the organization's actual level of danger and the required PPE for workers based on that level. Electrical systems are

dynamic and change over time. Internal changes, such as adding new equipment can affect the level of arc flash energy. A study must be updated every time the system changes. External changes, such as a utility changing transformers or changes at the utility's closest substation can severely impact the level of arc-flash energy.

Ultimately, the best approach to preventing arc-flash injury is remote operation and monitoring. Sm@rtGear Mobile creates a safer work environment by removing workers from harm's way through visualization of voltage, current, power, operating conditions, and tripping event diagnostics. By delivering real-time data to maintenance personnel and engineers on their mobile devices, energy stakeholders can be assured that consistent monitoring is taking place and increased safety levels are the result. ◆

Siemens Corporation is a U.S. subsidiary of Siemens AG, a global powerhouse focusing on the areas of electrification, automation, and digitalization. One of the world's largest producers of energy-efficient, resource-saving technologies, Siemens is a leading supplier of systems for power generation and transmission. For more information, visit **www.usa.siemens.com/indelectricalsafety**.

Reinventing Primer to Prevent Marine Shipping Corrosion

Advanced primer converts rust into a protective layer and can be applied by any method, without the need to sandblast first

By Martin Lawrence, NanoRustX LLC

For the marine shipping industry, preventing corrosion is a critically important operational and safety issue for fleets, whether tanker, container, dry bulk, general cargo, passenger, or roll-on roll-off vessel. The continual exposure to seawater and salty air is a corrosive combination that can shorten the service life of everything made of steel such as hulls, decks, cargo, and ballast tanks. In addition, corrosive cargoes, as well as cargo and equipment damage can accelerate corrosion, while increasing maintenance cost and safety risk. Because the corrosion of steel is

NanoPrime application near water.

such a concern in a marine environment, it is common for a full re-priming and re-painting to occur during dry docking every five years or so, with touch up occurring on a continual basis.

IMPORTANCE OF MARINE PRIMERS

Marine primers represent a critical foundation for paints and coatings in harsh maritime environments. However, they have historically been unable to effectively deal with the eventual formation and recurrence of rust. Traditional primers only encapsulate rust until the paint/primer is scratched, chipped, or breached and moisture and oxygen migrate under the film, allowing the corrosion to spread.

As a result, maintenance personnel or coating applicators must repeatedly utilize costly, time-consuming, and environmentally hazardous surface preparation methods such as sandblasting to prepare surfaces for priming and repainting. However, not all environments can withstand sandblasting, which can damage critical surfaces and be impractical for reaching hard-to-access areas such as cracks and crevices.

Now, however, more advanced primers have been formulated that set a higher performance bar in corrosive environments. These reactive primers go beyond encapsulating rust to instead convert it to a protective material (iron phosphate) to minimize the risk of further corrosion. The chemical bond provides superior adhesion and corrosion protection, while eliminating under-film corrosion.

The rust conversion formulation also differs from prior technologies by using a non-toxic, ultra-low VOC water-based acrylic polymer solution that can be applied with minimal surface preparation and without the need to sandblast steel substrates.

PRIMER PITFALLS ALLOW CORROSION

One of the main reasons that maritime vessels are so susceptible to corrosion is that traditional primers have serious deficiencies in this area. A common failure of primers is not sufficiently protecting against under-film corrosion.

A primer must first form an effective chemical bond to the metal substrate. Without this, rust promoters like salty sea spray, oxygen, and humidity will creep underneath the primer causing further corrosion. Most primers only encapsulate the iron oxide, which is not 100 percent effective in preventing further corrosion.

NanoPrime near water.

Another reason that so much marine shipping industry infrastructure is prone to rust when utilizing typical primers is that a high level of surface preparation is required because most corrosion primers are sensitive to chlorides.

Even a minute amount of chloride on the steel can cause coating system failure. This is why leading coating manufacturers demand extreme levels of surface cleaning (sandblasting) and chloride removal to a level of 5 micrograms per square meter, which is nearly impossible to achieve. Even when sandblasting is used for surface preparation, flash rusting will occur.

In response, the search for more enduring corrosion protection for maritime vessels and infrastructure has involved the development of long-lasting primers that correct traditional deficiencies.

LASTING CORROSION PROTECTION

NanoRustX (NRX) NanoPrime, for example, works by chemically reacting with iron and iron oxide (rust) to form iron phosphate and creates a Nano bond with both metallic and painted surfaces. The chemically bonded layer is insoluble and extremely corrosion resistant. This "bonding" process also provides superior adhesion and flexibility and stops under-film corrosion that occurs when conventional coatings are damaged.

The non-toxic, ultra-low VOC primer contains nano-polymers for added strength and durability and has been tested to successfully coat surfaces from rust-free to up to 700 microns of rust. The elasticity of the advanced primer makes it very durable in temperature variations from -90 to 400 degrees Fahrenheit (-67 to 200 degrees Celsius).

Because the advanced primer actually chemically reacts with galvanized steel surface, no surface preparation is required other than a water wash. The water-based acrylic polymer is not sensitive to chlorides or rust and can actually neutralize them. Unlike initial generations of rust converting primers, the primer performs equally well on clean, partially corroded, and heavily rusted surfaces. Typically, a power wash (240 bar/3500 psi) is all that is needed before applying to steel (clean or corroded), galvanized steel or aluminum in order to remove loose paint, dirt, and grease. The primer can be applied to a corroded surface by hand brush, roller, or airless spray gun on the substrate. After the application of the primer, a single coat of a low VOC top coat will complete the job.

NEW COATINGS METHODS IN ACTION

The primer has successfully been used on a wide variety of shipping vessel applications to quickly and cost effectively deter corrosion without extensive surface preparation.

In Baltimore, Maryland, when a major roll-on roll-off carrier providing end-to-end, international transport of heavy vehicles and equipment was experiencing rusting and pitting on the upper deck of a vessel due to offshore conditions, the vessel engineer sought new coating methods that could be easily applied for maintenance, even during operation.

Due to its properties, NRX NanoPrime was selected. An electric deck scaler was used to remove existing paint and rust, followed by an electric wire brush machine and a 3,200-psi water blast. Heavily rusted and pitted areas were spot primed, and two coatings of primer were applied. The crew then applied a JOTUN Pioner top coat. The combined system has provided protection against offshore conditions, and is still

NanoPrime salt spray test panel after 7,775 hours.

effectively protecting the deck after two years, according to the roll-on roll-off carrier. It is now used as a simple, effective maintenance solution while the vessel is underway.

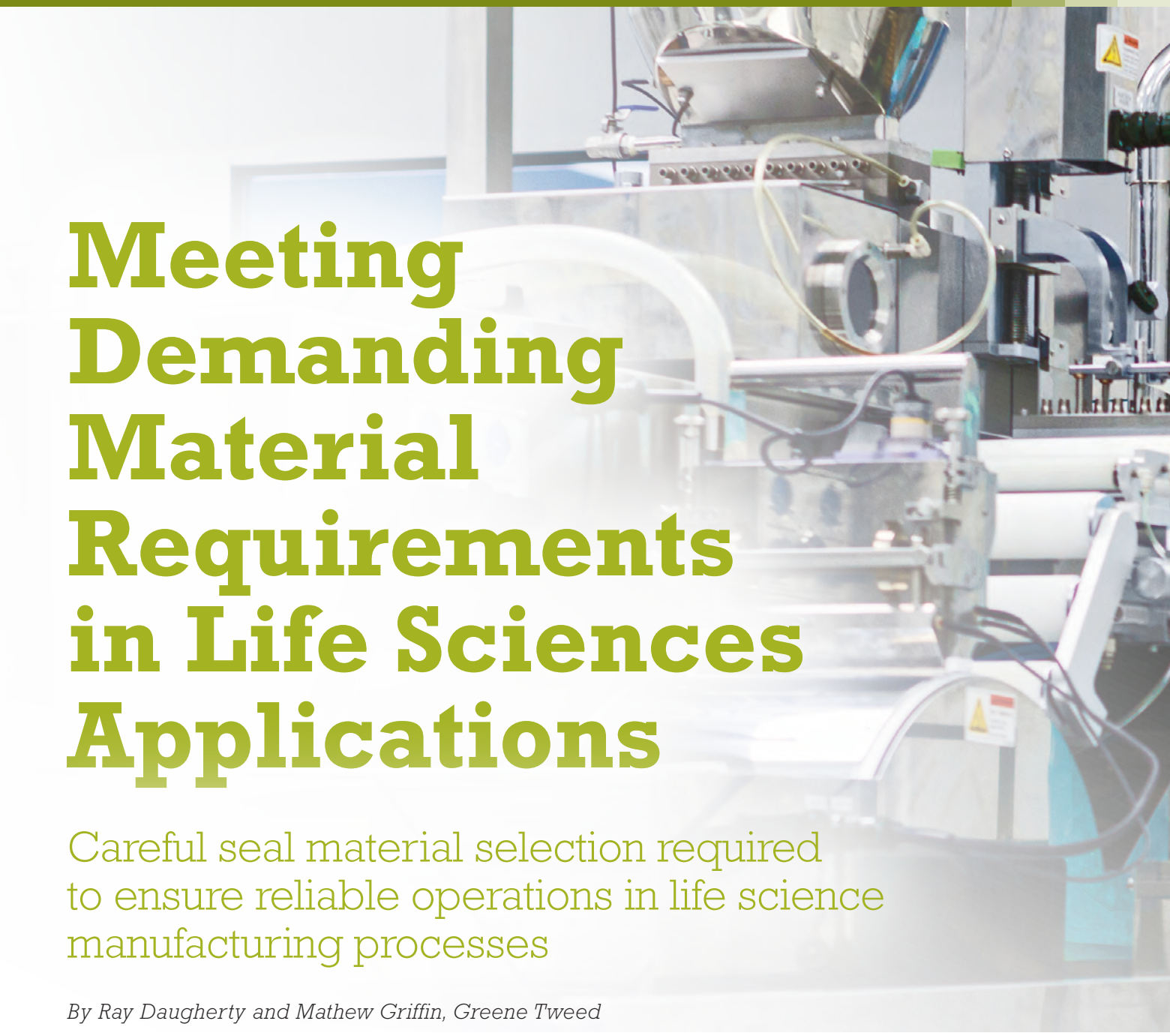
In a different application, a marine towing vessel in Staten Island, New York, used for petroleum transport was undergoing maintenance in port when the vessel captain sought a more durable corrosion coating that could withstand working damage. The starboard side of vessel had rusted gashes and holes from damage that had not been recoated, and the sea spray in the vessel's work environment had accelerated corrosion.

Again, the emphasis was on providing an effective corrosion coating easily applied without interrupting a busy operating schedule. The solution, it turns out, was to use a 5,000 PSI high pressure water blast to remove loose paint, rust and any other contaminants; then to spot prime heavily rusted areas, followed by applying two coats of the advanced primer. The crew then applied a black International Interthane 990 topcoat.

The combined system has provided protection against offshore conditions, while preventing under-film corrosion in case of any further working damage that breaches the coating. After two years, the towing vessel captain has reported that the coating is a significant improvement over previous methods.

While the marine shipping industry has long battled corrosion, the use of advanced primers that convert rust into a protective layer, applied by any method, promises to help keep vessels in good working order far longer, with less costly maintenance, than traditional methods. ◆

Martin Lawrence is managing director of New Jersey-based NanoRustX LLC, a supplier of advanced primer technologies. For more information, call 973.751.2200, email sales@nanorustx.com, or visit **www.nanorustx.com.**



Meeting Demanding Material Requirements in Life Sciences Applications

Careful seal material selection required to ensure reliable operations in life science manufacturing processes

By Ray Daugherty and Mathew Griffin, Greene Tweed

A wide range of materials can be found in life sciences applications such as the manufacturing of pharmaceuticals, medical devices, and analytical equipment. All of these materials, however, need to be highly pure and stable to a wide array of solvents and temperatures. Materials in life sciences applications must be able to meet stringent demands for safety, quality assurance, and reliability in order to keep costs down and meet end users' needs. It can be difficult to gauge these needs, though, given that life sciences equipment manufacturers might not know the exact uses for their products in end users' applications.

Take, for example, a pump manufacturer: though that manufacturer must choose the materials and material sources for their pumps, they must do so without knowing what each and every end user will be handling with those pumps. As a result, they must choose materials that will ensure safety, quality, and reliability across a wide range of use cases. In life sciences, that means ensuring that all materials are inert, stable across temperatures, and robust in the face of frequent use or harsh sterilization procedures. This article will explore how sealing materials, in particular, have been developed to meet these stringent needs in life sciences applications.

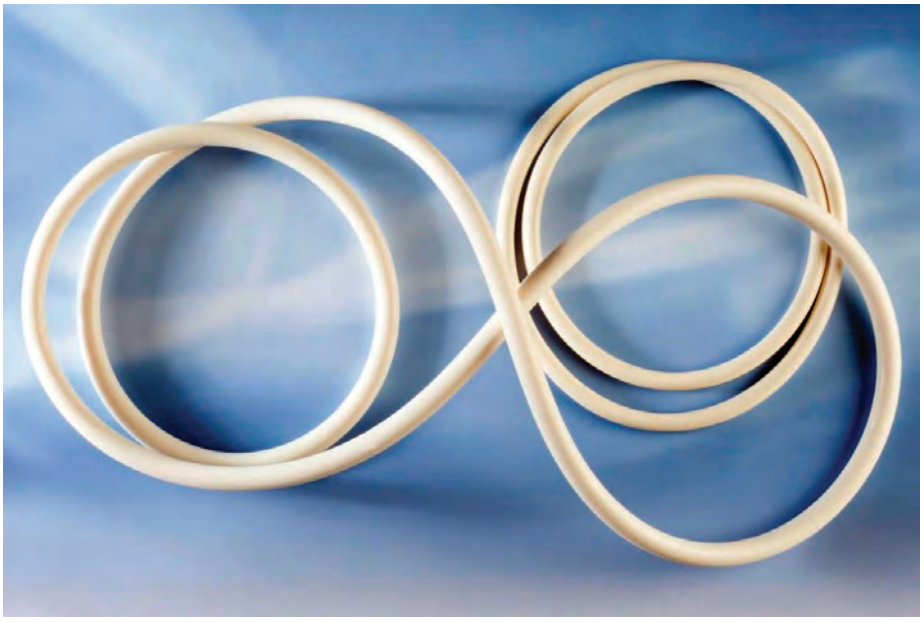
SEAL MATERIALS FOR LIFE SCIENCES

Seals are a critical component in a wide range of life sciences manufacturing applications. In pharmaceutical

manufacturing, seals are used in pumps, valves, filters, regulators, dryers, and sanitary connections. In analytical instrumentation, they are also found in pumps and valves, as well as in chromatography equipment. Some medical devices, like dialyzers, ventilators, and surgical tools, also make use of seals to protect the devices and the patient's body.

As with most materials in life sciences applications, seals must meet stringent demands for safety and efficacy. Depending on their end use, this might translate to suitability for high temperature use, chemical compatibility, minimizing leachables and extractables, or robustness in the face of sterilization with steam, chemicals, or radiation. Elastomeric seals such as o-rings, gaskets, and diaphragms are often the weakest point of manufacturing systems, and their failure can result in adulteration of drug products or specimens, which can then incur subsequent investigations, and high costs.

Some examples of elastomers used for seals in life sciences applications include silicone, EPDM, FKM, and PTFE-encapsulated silicone; each of these has benefits, as well as conditions to which they are not suitable. Though inert, silicone breaks down under high pH conditions, and doesn't tolerate steam sterilization well. It is therefore not safe for all life sciences applications, since it may be impossible to sterilize completely.



Perfluoroelastomer seals, like this Chemraz® o-ring, deliver longer service time between repairs, which reduces maintenance and unexpected downtime.

Pharmaceutical manufacturing relies on reliable, inert seals to maintain safety and efficiency.

Ethylene propylene diene monomer (EPDM) rubber can be manufactured to be compatible with steam but may suffer degradation when in contact with non-aqueous solutions. As a result, some cleaning products are not compatible, and processes involving animal fats or fatty molecules could attack the material's surface and lead to quality issues.

Fluoroelastomer (FKM) can handle non-aqueous materials, but, like silicone, breaks down under high pH conditions. The common cleaning product sodium hydroxide (lye)—used to remove organic matter in bioprocessing, chromatography, medical device decontamination, and many more applications—is thus incompatible with FKM seals.

Encapsulated seals, which utilize PTFE over silicone or FKM, are sometimes used in life sciences applications as seals on doors or lids that have to open and close. This is an inappropriate use of this kind of seal, as the PTFE becomes brittle over time and cracks. Once cracks form, the process fluids swell the silicone or FKM, resulting in catastrophic failure of the seal and then contamination of the pharmaceutical product.

Each of these seal materials can be useful so long as their specific end use is known and these exceptions can be avoided. All of them, however, can be dangerous—and expensive—if used in manufacturing products whose end uses are unknown, and incompatible conditions occur. The expense occurs in the case of failure, when seals must not only be replaced, but manufacturing or processing must halt. These halts usually last for a week or more, as teams across the organization determine the cause of failure, design corrective actions, and implement necessary maintenance. In life sciences applications where both labor and product costs are high, unplanned downtime and discarding batches of products after a failure can be extremely costly, even to the order of millions of dollars.

MEETING CHALLENGES WITH SUPERIOR SEALING SOLUTIONS

How, then, can manufacturers ensure their parts are meeting the needs of all their customers, whether in research, food or pharmaceuticals? The key is selecting a seal material with the greatest possible compatibility across a wide range of temperatures, chemical profiles, clean procedures, and more. One such material is perfluoroelastomer (FFKM), like Greene Tweed's Chemraz®, which has been specified into a variety of critical applications, including life sciences, for more than thirty years.

Chemraz perfluoroelastomers contain higher amounts of fluorine than other sealing materials, thus ensuring stability in higher temperature conditions up to 662 degrees Fahrenheit

(350 degrees Celsius), a wider chemical compatibility range, and minimization of leachables and extractables. The material is inert to nearly all solvents and reactants. Combining this inertness with its high temperature profile and other features, Chemraz perfluoroelastomers can safely be sterilized repeatedly with steam, chemicals, or radiation and remain functional and safe.

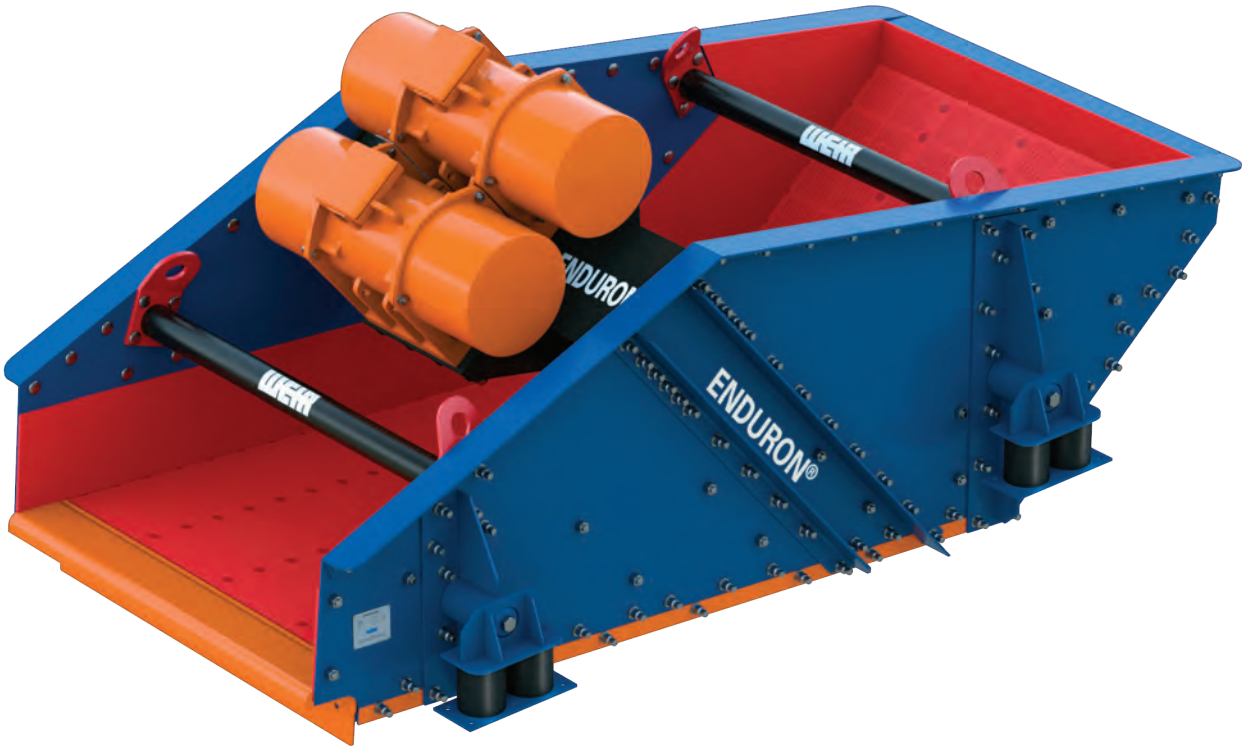
This kind of wide compatibility range can lead to cost savings in the long term. Seals manufactured from Chemraz deliver an increased mean time between repairs (MTBR), and so they can be replaced less frequently, require less maintenance, and minimize unexpected downtime for failures. What's more, they minimize adulteration and batch loss because of their robustness in nearly all conditions.

Greene Tweed offers Chemraz materials suited for life sciences up to 500 degrees Fahrenheit (260 degrees Celsius) for continuous operations; other portfolio options exist for excursions up to 662 degrees Fahrenheit (350 degrees Celsius). Greene Tweed engineers consult with engineers in life sciences applications in order to understand what material would best suit each individual manufacturing process.

SUPERIOR SEALING MATERIALS AT WORK

Perfluoroelastomers have been proven to deliver significant benefits in a number of life sciences applications. Chemraz products, for example, have been used by a major pharmaceutical manufacturer responding to the COVID-19 crisis, using the seals in syringe pumps to ensure compatibility with active pharmaceutical ingredients. They have also been used as a replacement for silicone in plasma cutters thanks to their superior thermal resistance. By ensuring compatibility across a wider range of solvents and temperatures than other materials, these materials improve reliability and uptime throughout life sciences manufacturing applications. ◆

Ray Daugherty is new business development—life sciences and **Mathew Griffin** is product marketing analyst for Greene Tweed, a leading global manufacturer of high-performance thermoplastics, composites, seals, and engineered components. Combining more than 150 years of technical expertise and commercial knowledge in a variety of markets, Greene Tweed collaborates with customers to develop engineered solutions that meet challenging performance requirements and reduce total cost of ownership. For more information, call 215.256.9521 or visit **www.gtweed.com**.



MPT
Modern Pumping Today®

Featured Product

JANUARY 2021

WEIR

Enduron® Dewatering Screens

The Enduron dewatering screen plays an integral part in a plant's success, combining effective particle classification with robust wear life. When in operation, the Enduron dewatering screen receives the hydrocyclone feed, which is between 65 to 70 percent solids content by weight, and produces a dewatered product ready for sale.

The screens are linear-motion and inclined uphill—meaning that product is moved up a 5 to 10 percent inclination, which is only achievable through linear motion excitation. Gravity causes the water to run back downhill into the sump, producing a dry sand product.

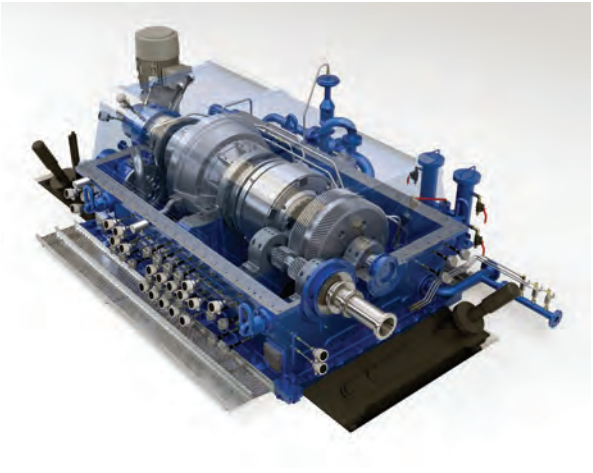
Enduron dewatering screens use an apogee designed to achieve a cut size of 300 microns, which combines with a large compact bed of sand to filter trapping fines less than 300 microns. Our screens utilize epoxy adhesive between all mating surfaces to protect against corrosion. Additionally, an all-bolted construction with locking bolts ensures the overall structural integrity of the screen.

These robust screens also feature Linatex premium rubber on all key areas of wear. This industry-leading wear material is complemented by the Enduron dewatering screen's first-class manufacturing process. The fabricated components are full-penetrated welded, heat stress-relieved and validated through a range of non-destructive testing including x-ray measurements and die penetration testing to produce a screen you can rely on.

For more information, visit www.global.weir.

REED MANUFACTURING
CPDWW Cordless Power Drive

Lightweight yet powerful CPDWW cordless power drive from Reed adapts to drilling and tapping machines or attaches to exercise valves Around 15 pounds, the cordless power drive is easy to handle and provides impressive torque. For operator safety, there is a power kick-off feature. Add the Reed VokuClutch utility clutch for valve work or add the Reed TMPDA adapter to connect Reed and other common tapping or drilling machines. Designed for waterworks use, this unit concentrates on needs of in-ditch operators. For more information, call 800.666.3691, email reedsales@reedmfgco.com, or visit www.reedmfgco.com.

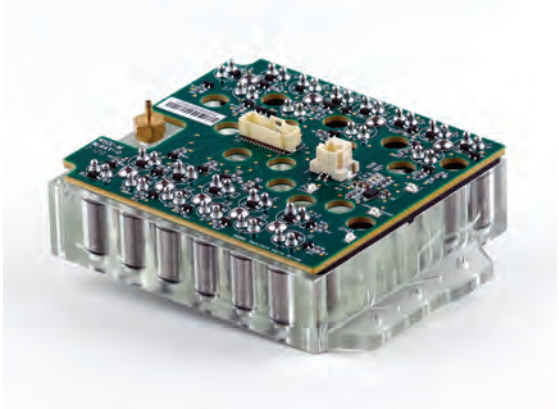


VOITH TURBO
VoreconNX Variable Speed Drive

Voith's VoreconNX variable speed drive is standardized and modularized by design, which allows for easy parts swapping and maintenance. The variable speed drive runs with minimal vibration while delivering low-range power up to 10 megawatts. The unit was tested at Voith's Crailsheim, Germany, factory where it ran through a series of standardized performance tests including a speed ramping, overspeed protection, and defined-load point tests. Voith Turbo North America currently has several other VoreconNX units that have been ordered for use in the United States and Canada. For more information, visit www.voith.com/voreconnx.

SIEMENS
High-inertia 1FK7-HI Servomotors

These self-cooled 1FK7-HI servomotors provide stall torque in the 3 Nm to 20 Nm range and are offered in IP64 or IP65 with IP67 flange degree of protection, with selectable options for plain or keyed shaft, holding brake, 22-bit incremental or absolute encoders, as well as eighteen color options. A mechanical decoupler between the motor and encoder shaft protects the encoder from vibrations, providing a long service life. In cases where the encoder needs to be exchanged, the device automatically aligns the encoder signal to the rotor pole position, enabling feedbacks to be changed in the field quickly. For more information, visit www.usa.siemens.com/motioncontrol.



NORGREN
Integrated Fluid Manifold

Norgren has partnered with a leading molecular diagnostics company to support the expansion of the company's infectious disease identification technology. Under EAU from the FDA, SARS-CoV-2 has been added to the diagnostic test which detects additional respiratory pathogens to diagnose other common respiratory illnesses in about forty-five minutes. At the heart of the rapid detection system is Norgren's integrated fluidic sub-assembly. The precision laminated acrylic valve manifold provides a reduced footprint, eliminates leak points, and allows for faster instrument assembly-all while increasing performance reliability. For more information,visit www.norgren.com.

BLACKMER

System One High Temperature Series Pumps

Utilizing high-temperature flanges, elastomers, and a unique centerline mount that supports high temperatures, System One High Temperature Series pumps are able to exceed the 400 degrees Fahrenheit (204 degrees Celsius) standard temperature limit of conventional centrifugal pumps. This unique design feature allows the System One High Temperature Series to safely and reliably transfer critical and valuable fluids in a wide variety of high-temperature applications, including thermal oils, petrochemical, heat transfer, plastics, paper, and more. For more information, visit **www.blackmer.com**.

CORTEC

CX-HB3.0 Hydra-balance Choke and Panel System

The new CX-HB3.0 Hydra-balance Choke and Panel System offers drilling operations an increased level of value and functionality within managed pressure drilling (MPD), underbalanced drilling (UBD), and other drilling set point applications. API 6A and NACE MR0175 compliant, the system is a hydraulic dual choke unit and can be controlled via a compact remote panel that can be installed in close proximity to the driller. This new system has been designed to provide higher levels of accuracy, ease of use, and field-friendly serviceability for end users seeking a simple set point solution. For more information, visit **www.uscortec.com**.

SHIMADZU SCIENTIFIC INSTRUMENTS

FTIR Plastic Analysis System

Shimadzu Scientific Instruments announces a new Fourier Transform Infrared (FTIR) Spectrophotometer Plastic Analysis System that includes proprietary UV- and thermal-damaged plastics libraries to facilitate highly accurate qualification and to determine the state of deterioration when analyzing foreign substances, contaminants, and microplastics. The plastic analysis system features Shimadzu's IRSpirit FTIR spectrophotometer, QATR-S single-reflection ATR attachment, and the Plastic Analyzer Method Package. Even users unfamiliar with FTIR analysis can start work immediately. For more information, visit **www.ssi.shimadzu.com**.

PUCK

Long Reach Agi 1708 Agitation Trailer

Puck developed the Long Reach Agi to be the end-all-be-all solution for flexible agitation needs. This revolutionary piece of equipment can mix a wider variety of pits and slurry stores without the need to crane in an agitation boat. By freeing up the need for additional equipment on-site, applicators save time and money. To accomplish these objectives, the company equipped Long Reach Agi with the first-ever telescoping boom. This game-changing boom has an unprecedented length of 50 feet–once its two stages are fully extended. For more information, visit **www.puck.com/x**.

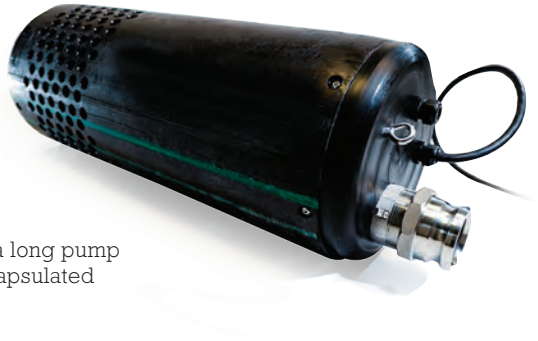
POLYGON COMPANY
Composite Tubes and Bearings

Polygon Company has developed composite tubes and bearings that meet the high-pressure conditions and toughest design challenges in the oil and gas industry. Innovation matters in the oil and gas industry, and Polygon is a proven partner in developing breakthrough solutions. Polygon's advanced composite tubing and bearings are ideally suited to both exploration and production settings in the oil and gas industry. Applications for the high-performance composites include exploration sensor housings, valves, platform cranes and sheaves, actuators, blow-out preventers, pumps, top drives, drill components, draw works, and more. For more information, visit **www.polygoncomposites.com/industries/oil-gas**.

DOVER PRECISION COMPONENTS
TruTech™ High Performance Materials

Dover Precision Components has made significant investments in its materials technology initiative to fully integrate materials research with engineering expertise and practical experience in machinery applications. A world-class team of material scientists has been assembled to develop proprietary TruTech polymeric materials, optimize process parameters, and ensure product quality. A dedicated materials laboratory featuring state-of-the-art mechanical, chemical, optical, and thermal analysis equipment, as well as advanced friction and wear testing, provides the necessary tools to fully evaluate materials and their signature properties. For more information, visit **www.doverprecision.com**.

Q.E.D. ENVIRONMENTAL SYSTEMS
Torpedo™ G1275 Pumps



The Torpedo G1275 pumps handle pumping conditions that would cause many other types of pumps to fail. To prevent failure, the pumps are constructed of cast iron and stainless steel, and fitted with heavy-duty bearings and seals. The hardened, high-chrome impeller assembly can pass solids that would stall using most pumps available on the market. Torpedo G1275 pumps feature hardened impellers, which resist abrasion and wear, preventing wear and tear. This ensures a long pump life in aggressive situations. The pumps resist corrosion by means of an HDPE-encapsulated body, stainless steel water jacket, and polymer power cable. For more information, visit **www.qedenv.com**.

BALTIMORE AIRCOIL COMPANY
Nexus Modular Hybrid Cooler

The BAC Nexus Modular Hybrid Cooler was designed to minimize maintenance cost by reducing spray water volume by up to 60 percent, by allowing accessibility to all components at the front of the unit, and by operating dry when temperature and climate allow. What's more, it reduces water treatment costs with its DiamondClear Design, which prevents stagnant water in the system and minimizes scale build-up and biological growth. The new optional, compact, and fully-integrated UV water disinfecting system rounds out the product's enhanced water management system. For more information, visit **www.baltimoreaircoil.com/nexus**.

Pandemic Community Tracing Right Under Our Feet

Aquasight's Mahesh Lunani on how sewage surveillance can save lives

Last year in Michigan, the municipal government of Macomb County, Oakland University, and Michigan State University partnered with water monitoring systems provider Aquasight, launching a pilot program of sewage surveillance for infectious diseases like COVID-19 to enable better healthcare and economic planning. On a recent episode of MPT's podcast, Aquasight's founder and CEO, Mahesh Lunani, joined us to discuss this program and its benefits for the future. An excerpt of that conversation follows.

MPT: Just to be clear, no evidence suggests COVID-19 can be transmitted via municipal water systems, but there are benefits to monitoring them for infectious disease. What is this pilot program looking for and how can it help the community?

Mahesh Lunani: This pandemic has brought to the attention that sewage surveillance provides very important, valuable information about infectious diseases.

So by strategically sampling our collection system using methods and techniques that we already know, that exist in the wastewater treatment plant, and by combining this with more advanced testing methods and concentration methods that are being developed, and honed as we speak, and couple that with understanding about wastewater data, demographics data, as well as the health data that exists around that particular community, this itself to giving early warning of where COVID spread might be occurring. It's been found that sewage surveillance can provide between three or ten days of advanced notification on the spread or evolution of COVID-19 in a community.

MPT: How can health officials best make use of this type of data, both during our current pandemic and in preparation for what may come in the future?

Mahesh Lunani: To address a pandemic, we need community-based testing, and sewage surveillance is really community-based testing. And this is complementing the human individual testing that there has been a lot of focus on. The way we see this evolving, is, if public health officials—from governments local and state—want to have a bit more information, more data to make proper health care and economic planning, community based testing is giving strong signals on spread—or, the other way around, if levels are declining, then the health officials can plan their uses of resources.

MPT: That seems to be what's so useful about a community-based monitoring effort, as part of the problem we see with the pandemic now is trying to play catch up with the facts on the ground.

Mahesh Lunani: We need both the macro and micro level when we when we attack a problem. And the macro level is like a heat map. Think about this as the heat maps that will show the hotspots and high-risk areas. But there's also a greater opportunity here: We know, in general, through our smart analytics, that the high-risk areas are within a community. We have a sophisticated model by which we can filter through the high-risk areas based on where we understand how Coronavirus really impacts the old-age population, low-income population, and different levels of the entire demographic spectrum. We could strategically also look for targeted areas for community-based testing through sewage programs, and bring that into the smart analytics platform to be able to show where we think is more risk or less risk. ◆

To listen to an extended version of this interview, be sure to subscribe to MPT's podcast, The Efficiency Point.

UNDER PRESSURE

"Unprecedented times create unprecedented problems. Griffco Valve rose to our challenge and exceeded all expectations."

Tyler Brandewie, Senior Operations Manager
Preferred Global Equipment

When a major manufacturer of COVID-19 essential products was about to cease production due to the failing of a pressure relief valve, procurement specialist Tyler Brandewie contacted us after hours on a Friday night for a replacement.

"Not only was Griffco quick to respond, they built and shipped product to my customer the next day–Saturday. Their hard work, extraordinary customer service, and consistent communication enabled the manufacturer to continue production of these essential household items. This avoided thousands of dollars in lost downtime during the fight to flatten the curve.

"With strong communication and solid customer service seemingly waning across the entire industry, it was a relief to know there are still manufacturers out there that prioritize their customers, as Griffco did for us. For that, we are grateful."

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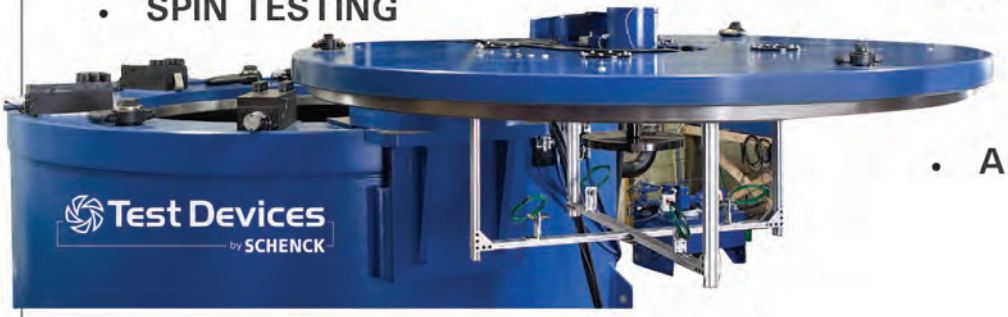

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