

Process safety takes center stage at AFPM Summit opening

ADRIENNE BLUME, *Hydrocarbon Processing*

The AFPM Operations & Process Technology Summit opened in Atlanta on October 1 with a keynote speech from Dawn Wurst, Vice President of Process and Asset Safety for Georgia-Pacific Chemicals LLC.

Wurst discussed the idea of process safety as a “have to, want to and need to” ideology. In 2007, she was working for Flint Hills Resources when the company experienced a tank explosion at its Pine Bend refinery. No one was injured in the incident, but it was a wake-up call that made Wurst realize that she needed to spend the rest of her career in process safety, because “we had set up our employees for failure that day.”

Safety as a “have to.” The US Occupational Safety and Health Administration (OSHA) established requirements for process safety in 1991, which led to several new industry

safety requirements, including audits. Wurst showed a video about an incident at a Flint Hills facility where an employee lost his life while working on a heater that exploded. The takeaways from the short film—work together, take care of each other and stop to get answers before continuing work if uncertainties are present—are key tenants in process safety practice.

Wurst explained how stricter industry safety standards led to greater discipline around change management and OSHA-covered units; increased requirements for the safeguarding of units; and the upgrade of documentation for, and involvement of key personnel in, risk reviews. Personal safety and process safety must be considered together, rather than separately, to achieve a total view of safety, Wurst asserted. “We cannot look at any view of safety without examining the impact of

both types of safety,” she said. However, she also warned that “process safety is not intuitive,” and the answers to problems or questions may not always be obvious.

In the past, questionable mistakes in process safety have been made that included overconfidence in rule compliance, an over-reliance on experienced personnel to be individually responsible for unit process safety, and a scattered approach to safety. Another issue arises when operators limit actions to regulatory requirements—i.e., what items are likely to come up in an audit; or the coverage of process units only, rather than coverage of hazards throughout the entire plant.

Other mistakes made include a lack of true engagement and clear communication about the understanding of the role of process safety

▶ See **KEYNOTE**, page 3



DAWN WURST, Vice President of Process and Asset Safety for Georgia-Pacific Chemicals LLC, delivered Monday morning’s keynote address to kick off the 2018 AFPM Operations & Process Technology Summit.

Merla Zollinger receives Q&A Lifetime Service Award

ADRIENNE BLUME, *Hydrocarbon Processing*

Merla Zollinger is the recipient of the 2018 Lifetime Service Award for the AFPM Operations & Process Technology Summit. Zollinger joined the AFPM Summit (formerly known as AFPM Q&A/NPRA Q&A) in 1991, working in the technical department, where she logged speaker talks and prepared papers for publication.

She later moved to the program side of the conference, working directly with panelists to prepare their presentations and organize the program in advance of the Q&A meeting each year. During this time, Zollinger was nicknamed “Eagle Eye” by her colleagues for her ability to spot proofreading errors and inconsistencies.

She also conceived of the idea for the AFPM Q&A Answer Book, which is published to provide greater technical details to attendees and to allow conference participants to provide additional input after the sessions.

Zollinger then became involved with the logistics side of AFPM Q&A and has been instrumental in the incorporation of the plant automation

sessions into the process technology Q&A, and in the rebranding of the meeting to AFPM Operations & Process Technology Summit.

Upon acceptance of the award, Zollinger said that she was honored

to be a part of “the great organization” that is AFPM. She cited several fond memories of the first Q&A sessions in Anaheim, and thanked attendees for the opportunity to serve them and the industry. ●



MERLA ZOLLINGER (right), shown here with longtime friend and colleague **CHRIS MCDOWELL** from Andeavor, is the recipient of the 2018 Lifetime Service Award.

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KEYNOTE, continued from page 1

for front-line personnel; training that is not tied to tasks; and long, verbose process safety management (PSM) training sessions. Training must be made more applicable and targeted, so that employees truly understand what they are doing and how it affects the safety of their units, Wurst said. She also stressed that computer-based training may not be an effective training method for process safety. PSM measures must be tied to equipment events, and safety measures should be segregated by team and/or unit so that safety progress or setbacks can be properly identified and addressed.

Safety as a “want to.” The industry must see process safety as a “competitive advantage—something that we want to do,” Wurst said. Industry has built its own safety metrics based on API 754, which was issued in 2010. This led to the formation of various safety improvements, such as burner management systems, safety interlocks and mechanical integrity minimum standards for critical equipment.

In 2012, the industry rolled out a greater effort to advance process safety. This effort included event and metrics sharing among plant operators, thorough site assessments, the establishment of regional networks for process safety communications, and motivations for hazard identification and practices sharing among operators.

Wurst cited evidence in facilities of process safety improvements, including improvements in heater controls due to virtual reality training that provides a more realistic sensory experience of process safety incidents. Other improvements are corrosion under insulation (CUI) program success in identifying, mitigating and preventing corrosion; better relief device analysis and response; safe limits audits and revisions that help

operators know the difference between safe limits and operating limits; line-walking initiatives led by the front line; improvements in safety instrumented systems; and advances in facility siting.

“Improvements are usually not cheap,” Wurst acknowledged. She explained that it can be difficult to spend money on something that may not seem necessary or that does not provide returns, but the compelling benefit is the prevention of process safety incidents that can lead to loss of life and profit losses.

Extensions of process safety applications have included the voluntary implementation of safety concepts in non-PSM-covered areas, such as tank farms. Another large area of improvement is mechanical integrity for process safety site assessments.

Safety as a “need to.” “Process safety is a vital part of taking the industry forward,” Wurst said. “The bar keeps going up as far as what we are expected to be doing and what we need to do for our communities.” The industry is tasked with balancing the expectations of individual company management with community expectations.

Forthcoming in process safety improvement initiatives are the greater integration of process safety with operations and maintenance, such as integrity operating windows and dynamic mechanical analyses—methods Wurst called “ways we are upping the game.”

Additional areas for process safety improvements are the application of human performance concepts and new training technology that focuses on process safety. Finally, acting on external learning versus waiting for safety incidents to happen is paramount. “We have to actually do something about safety to make it have value,” Wurst noted. •

Digital Bond CEO examines consequences of cyber attacks

ADRIENNE BLUME, *Hydrocarbon Processing*

Dale Peterson, Founder and CEO of Digital Bond Inc., gave a keynote talk at Monday morning’s Cybersecurity Panel about the consequences and likelihood of cybersecurity events.

He described a generic scenario in which a company’s board of directors and senior executives are relaxed about cyber risk for a control system because no cybersecurity incidents have happened in a long time. Then, an outside risk is identified, and a risk assessment uncovers missing patches, employee account sharing and the use of clear text protocols.

To address such problems, Peterson said, “In most cases, the best we can do is a *yes, and*—meaning *yes*, we will fix that problem, *and* here is what we can do to address risk.” Cybersecurity professionals must control the conversation with management about cybersecurity risk for industrial control systems, or else risk more severe security breaches and consequences.

Regarding cybersecurity, Peterson explained that senior executives often ask the same questions: Are we secure? Could an incident happen to us? “How to answer that first question—you can’t say yes, but the answer isn’t really no, either,” Peterson explained. More informed questions from senior management include: If I spend the money you are asking for, can you guarantee that we will be secure? If we spend that money, how much have we reduced risk? How much risk remains?



DALE PETERSON, Founder and CEO of Digital Bond Inc.

Risk is equal to the consequences of an incident multiplied by the likelihood of an event happening, Peterson said. Cybersecurity is focused almost entirely on the likelihood part of the equation, but more time must be spent focusing on the other half of the equation. Should more security be utilized, or should the consequences be reduced?

The most common protection failure, Peterson explained, is allowing highly privileged remote access to personnel, such as process engineers and support vendors. Attackers use spearphishing to gain access to users within the enterprise with remote access to the control system, thereby allowing them to wage an attack when desired.

▶ See **DIGITAL BOND**, page 8

SCHEDULE OF SESSIONS AND SPECIAL EVENTS

TUESDAY OCTOBER 02, 2018

7 a.m.–5 p.m.	Registration
7–8 a.m.	EMpower Breakfast
8–10 a.m.	Concurrent Sessions: <ul style="list-style-type: none"> • Cybersecurity • Operational Planning, Control & Automation Technologies • Principles & Practices—Hydroprocessing • Q&A and Discussion Session—Crude/Vacuum Distillation and Coking
10–10:15 a.m.	Coffee Break
10:15 a.m.–12 p.m.	Concurrent Sessions cont.
12–2 p.m.	Lunch in Exhibit Hall
2–3:30 p.m.	Concurrent Sessions: <ul style="list-style-type: none"> • Cybersecurity • Operational Planning, Control & Automation Technologies • Principles & Practices—Crude/Vacuum Distillation and Coking • Q&A Session—FCC
3:30–3:45 p.m.	Refreshment Break
3:45–5:15 p.m.	Concurrent Sessions cont.
5:15–6:45 p.m.	Women in Refining Networking Event Reception open to registered women only.

WEDNESDAY OCTOBER 03, 2018

7:30–10 a.m.	Registration
8–9:30 a.m.	Concurrent Sessions: <ul style="list-style-type: none"> • Cybersecurity Exercise—See “CyberStrike” below • Principles & Practices—FCC • Principles & Practices—Fostering Profitability
8–11 a.m.	Cyber Strike—A Cybersecurity Exercise—SOLD OUT Coordinated by the Department of Energy
9:30–9:45 a.m.	Coffee Break
9:45–11 a.m.	Concurrent Sessions cont.



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Publisher

Catherine Watkins

AFPM Contacts

Jaime Zarraby

Diana Cronan

Editor

Mike Rhodes

Contributing Editors

Adrienne Blume

Stephanie Cano

Production Manager

Angela Bathe Dietrich

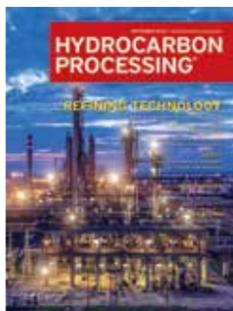
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Houston, TX 77252-77046
713-529-4301

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Advanced analytics improve refinery operations

KRISTA NOVSTRUP, Seeq

As shown in the following three examples, advanced analytics application software is being used to improve refinery operations by providing quick insights into the existing big data stored in process historians.

Heat exchanger monitoring, end-of-cycle prediction. The challenge for this refiner was to proactively predict the end of cycle for a heat exchanger due to fouling. This would enable risk-based maintenance planning, the optimization of processing rates to improve margins, the optimization of required heat energy to minimize operating costs and the minimization of maintenance costs.

The solution was to use a Seeq formula, specifically a first-principles equation, to calculate the heat transfer coefficient (U) from stored temperatures and flowrates in the process historian. The next step was to use Seeq's prediction tool to create a model to predict U -value data as a function of time, and to determine the end-of-cycle date versus the known minimum U performance threshold (FIG. 1). Once this methodology was applied to one heat exchanger, it was then applied to additional units across the refinery.

Benefits included the monitoring of

heat exchanger performance degradation to allow risk-based maintenance planning. The refinery was also able to optimize operational plans based on potential rate reduction penalties and planned maintenance costs. Unplanned production rate reductions due to heat transfer constraints were eliminated, saving millions of dollars. Unplanned heat exchanger maintenance was minimized, saving thousands more. Payback was achieved by predicting and planning for a single failure event.

Fixed-bed catalyst end-of-run prediction. The challenge was to predict end of run for a fixed-bed catalyst system to optimize near- and long-term economics. This required the selection and examination of historical data for training the correlations, which were auto-updated as new data became available. Another challenge was to provide insights to enable collaborative analysis and investigation between the refinery licensor and the catalyst vendor.

The solution was to use Seeq formulas to implement first principles equations to calculate normalized weighted average bed temperature (WABT) for the fixed-bed reactor system. The next step was to normalize WABT for feed-rated, feed and product quality, treat

gas ratio, etc. Seeq prediction was then used to create a model to predict normalized WABT as a function of time within steady-state conditions. This enabled the refinery to determine the end-of-run date vs. the known WABT performance threshold, and to apply this methodology to their other fixed-bed catalyst processes.

Benefits included monitoring of catalyst deactivation to allow co-optimization of near-term economics and risk-based maintenance planning. Better prediction of end of run allowed more effective analysis of the tradeoff between rate reduction and maintenance costs. Calculation of end of life for the catalyst enabled the rapid detection of unexpected changes and performance of corrective actions.

Salt deposition risk monitoring. The challenge was to identify when the refinery was operating at a high risk of salt deposition in crude and fluid catalytic cracking (FCC) fractionator overheads and hydroprocessing effluent trains. These depositions can lead to unplanned shutdowns from highly accelerated corrosion and fouling. Results needed to be presented as a continuous signal and expressed as a percent of time at risk. The data re-

quired for analysis resided in multiple systems unaligned in terms of time stamps and other metadata.

The solution was to import time-series lab data [hydrogen sulfide (H_2S), ammonia (NH_3), hydrochloric acid (HCl), etc.] and process data (temperature) into Seeq. The next step was to use a Seeq formula to calculate salt deposition temperatures for ammonium bisulfide (NH_4HS) and ammonium chloride (NH_4Cl), and to compare these values to limits using first principles with safety margins. The final step was to use Seeq deviation search and histogram functions to identify high-risk periods, and to provide visualization of at-risk results.

Benefits included the minimization of lost production from fouling in trays, exchangers and pipes, and the elimination of unplanned shutdowns from accelerated corrosion, which can lead to safety incidents and millions of dollars in terms of lost margin opportunity. Unplanned maintenance was greatly reduced, saving thousands more, with payback realized by predicting and planning for one failure event.

Takeaway. For each of these three examples, the data could have been analyzed using spreadsheets or other general-purpose software tools, but the required effort, complexity and time would have been excessive. Assistance from IT and data scientist experts would have been required, adding complications due to the required coordination.

Using Seeq, an advanced analytics application specifically designed to work with process time-series data, substantially reduced the required effort. It also cut complexity, allowing refinery process engineers and experts to interact directly with the data of interest using an iterative process, a requirement for solving these and other difficult process problems. ●



KRISTA NOVSTRUP is a Principal Analytics Engineer with Seeq Corp., helping customers gain insight and value from their data. Prior to joining Seeq, she was with ExxonMobil Research and Engineering Co. for eight years. Her most recent position at ExxonMobil was as Global Technology Lead, supporting planning optimization. Dr. Novstrup earned a BS degree in chemical engineering from the University of Washington and a PhD in chemical engineering from Purdue University.

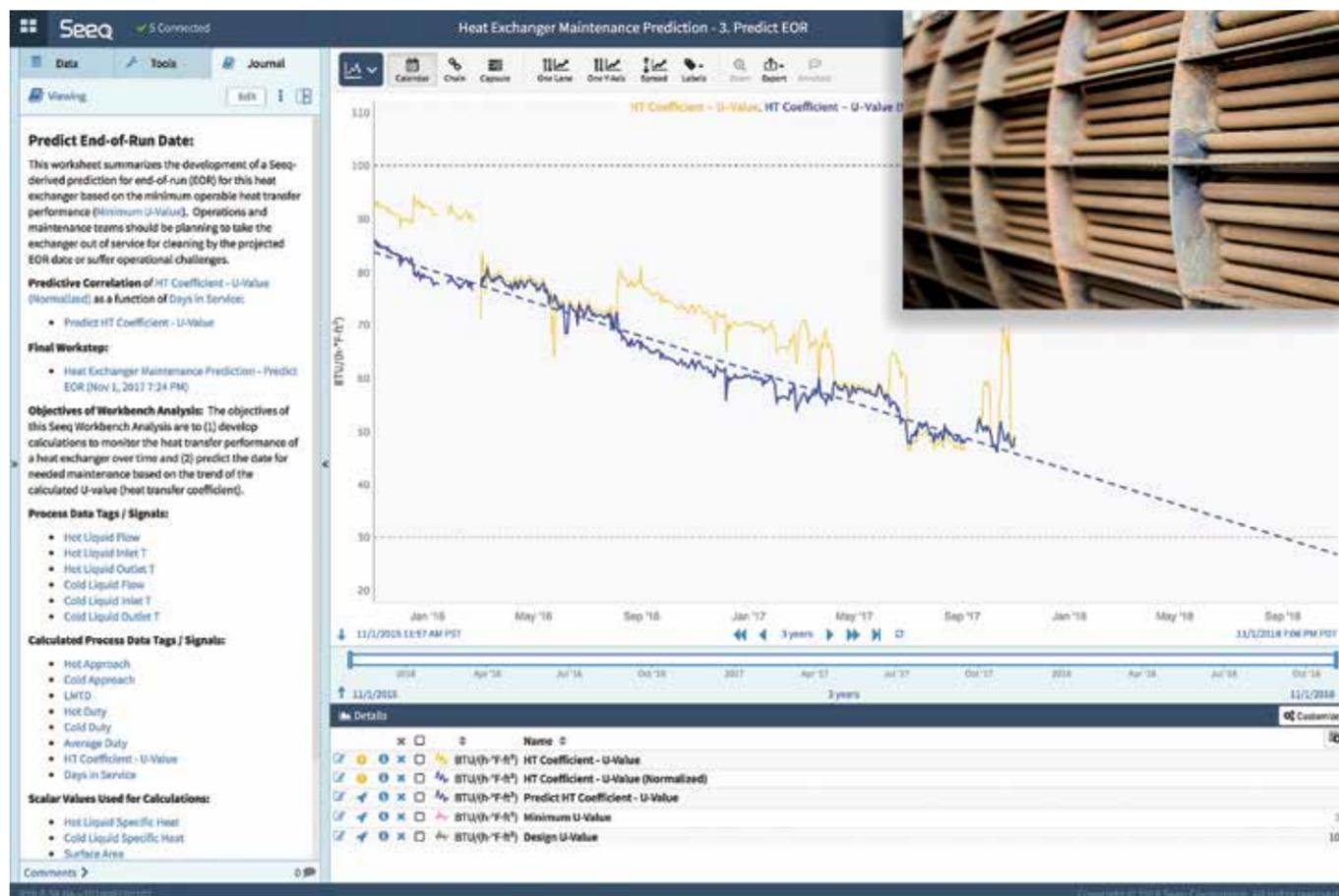


FIG. 1. Seeq, an advanced analytics application, was used to predict the end-of-run date for a heat exchanger, eliminating a refinery's unplanned production rate reductions due to heat transfer constraints.

US CRUDE OIL STOCKS BUILD AS REFINERS SHARPLY CUT RUNS

US crude oil stockpiles rose as refineries sharply reduced output for seasonal maintenance, while gasoline stocks increased and distillate inventories fell, according to the Energy Information Administration (EIA). After five consecutive weeks of drawdowns to the lowest levels since February 2015, crude inventories rose 1.9 MMbbl to 396 MMbbl in the week to Sept. 21. The

build was unexpected as analysts forecast a decrease of 1.3 MMbbl.

Refinery crude runs fell by 901,000 bpd, EIA data showed. Refinery utilization rates fell by 5 percentage points to 90.4%, the lowest since May, driven by seasonal declines in Midwest and East Coast refining activity.

According to the EIA data, distillate stock-

piles, which include diesel and heating oil, fell 2.2 MMbbl vs. expectations for a 752,000-bbl increase. Net US crude imports fell the week of Sept. 21 by 495,000 bpd. Crude stocks at the Cushing, Oklahoma delivery hub rose by 461,000 bbl, EIA said. Gasoline stocks rose by 1.5 MMbbl compared with analyst expectations in a Reuters poll for a 788,000-bbl gain. ●



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EXCITING CHANGES
COMING IN 2019

Protect against the imminent threat of drone attacks

SCOTT HURST, Fortem Technologies

It is said that the best offense is a good defense. This could not be truer when it comes to the oil and gas industry. The Department of Homeland Security (DHS) has called the oil and gas sector one of the most powerful engines of the US economy. As such, it is incumbent upon this industry to protect itself from malicious and errant threats, and to accept accountability as a key factor in the stability of the nation's economy.

The industry's importance makes it a tempting target for "bad actors" that wish to cause destruction, sow chaos and threaten national security. The National Consortium for the Study of Terrorism and Responses to Terrorism (START) has determined that 1,480 terrorism incidents were detected against oil and gas facilities globally between 2011 and 2016, a 387% increase from 20 years ago. These threats are here to stay and will gain sophistication as drone technologies advance, costs decrease and the ability to weaponize drones improves.

Anatomy of a threat. Many types of drones are inexpensive, easy to acquire and require little operational training. A moderately sophisticated drone can be purchased for less than an iPhone and can be legally piloted in the US by a 16-year-old. The potential exists that anyone can acquire a drone and outfit it with powerful surveillance cameras, explosives or even nerve gas. However, today's threats do not always come in the form of extremists, either domestic or foreign.

Most drone operators lack training, do not always follow Federal Aviation Administration (FAA) regulations and choose not to abide by no-fly zone restrictions. While security professionals, the Federal Bureau of Investigation (FBI) and the DHS worry about criminal and terrorist-operated drones, security professionals must also take preemptive action against the "clueless or careless" drone operator.

According to research company Gartner, roughly *three million* commercial and consumer drones shipped in 2017; research firm Statistics MRC estimates a compound annual growth rate (CAGR) of 21% over the next five years. Eventually, the airspace will be impacted by hobbyist drone operators. Purposeful or not, a drone may enter a secure zone and threaten the safety of personnel and facilities, including refineries, petrochemical facilities, tank farms and pipelines. Small, relatively quiet drones can enter a facility's airspace undetected, and by then it may be too late to prevent harm.

Surveillance vulnerability. Cyber security and surveillance issues are prevalent. The Federal Trade Commission has presented security flaws in three off-the-shelf drones, showing that anyone can access and watch the drone's video feed undetected because the data traffic is unencrypted. A simple WiFi connection makes it easy to hijack consumer drones within the vicinity of a power plant or other infrastructure, and to use the device to surveil via video for malicious reasons.

Purposeful attacks and near-misses. At the end of 2015, federal authorities investigated an incident in Linden, New Jersey in which a small drone crashed into a car outside a Phillips 66 oil refinery. No immediate threat was identified, but officials registered concern because it was in the wake of the Paris terrorist attacks. Refinery owners and operators must consider the intent of a small drone near their facility when little reason exists for it to be flying there.

In July of this year, Greenpeace launched a drone into the airspace of EDF's Bugey nuclear plant in Bugey, near Lyon, France, and then crashed it into the spent fuel cell container. This demonstrative attack served as a reminder of the plant's vulnerability—an intentional drone attack on a power plant, nuclear facility or fuel processing plant could be catastrophic. If a drone flew into the cooling engine of a nuclear plant, it would likely disable the entire cooling process of the plant, with devastating effects. "You do not need massive amounts of energy for a nuclear plant to destabilize. The plant has enough energy to destroy itself. Drones can be used to tickle the plant into instability," said John Large of the FBI.

Setting up your offense to mitigate the risk. The oil and gas industry can mitigate the risks posed by drones by installing available drone defense technology. Fortem Technology's SkyDome™ monitors a facility's airspace and alerts security profes-

sionals of intrusions. SkyDome utilizes artificial intelligence (AI) and advanced radar to create a "network mesh" that protects the airspace around and above designated locations (FIG. 1). In addition to detecting and classifying potential threats, SkyDome gathers data on the drones with the airspace for forensic purposes.

The oil and gas industry, and organizations like AFPM, can lobby for regulations that clearly define acceptable countermeasures. In fact, the federal government requires chemical processing facilities to have a terrorist plan in place, and to specifically address airborne and drone threats. With the increasing availability of "dark drones" or non-RF-emitting drones, it is important to ensure that any counter-UAS (unmanned aircraft system) be able to detect dark drones. Fortem's SkyDome solution can operate in all weather conditions, day and night, and leverages artificial intelligence (AI) and advanced radar to detect these non-RF-emitting waypoint drones.

Radar-based solutions can pinpoint the exact location of intruder drones and monitor their trajectory to understand the threat potential in real time. Additionally, hunter drones like Fortem's DroneHunter can be deployed to autonomously engage and safely remove the threatening drone.

Technology will drive security. The private sector is driving incredible innovation in technology to provide security for businesses facing drone threats. Cyber security threats, the mass adoption of drones and lagging federal regulations have created a fertile environment for attacks and accidents. Senate Homeland Security Committee Chairman Ron Johnson stated, "The federal government does not yet have the legal authority it needs to protect the American public from these kinds of threats. The threats posed by malicious drones are too great to ignore."

Now, more than ever, there is an urgency to understand and mitigate these potential risks. The oil and gas industry must act in identifying the best solution to safeguard its infrastructure and personnel from this new and present danger. ●



FIG. 1. The oil and gas industry can mitigate the risks posed by drones by installing available drone defense technology. Fortem Technology's SkyDome monitors a facility's airspace and alerts security professionals of intrusions.

PEMEX PLANS US LIGHT CRUDE IMPORTS FROM LATE OCTOBER

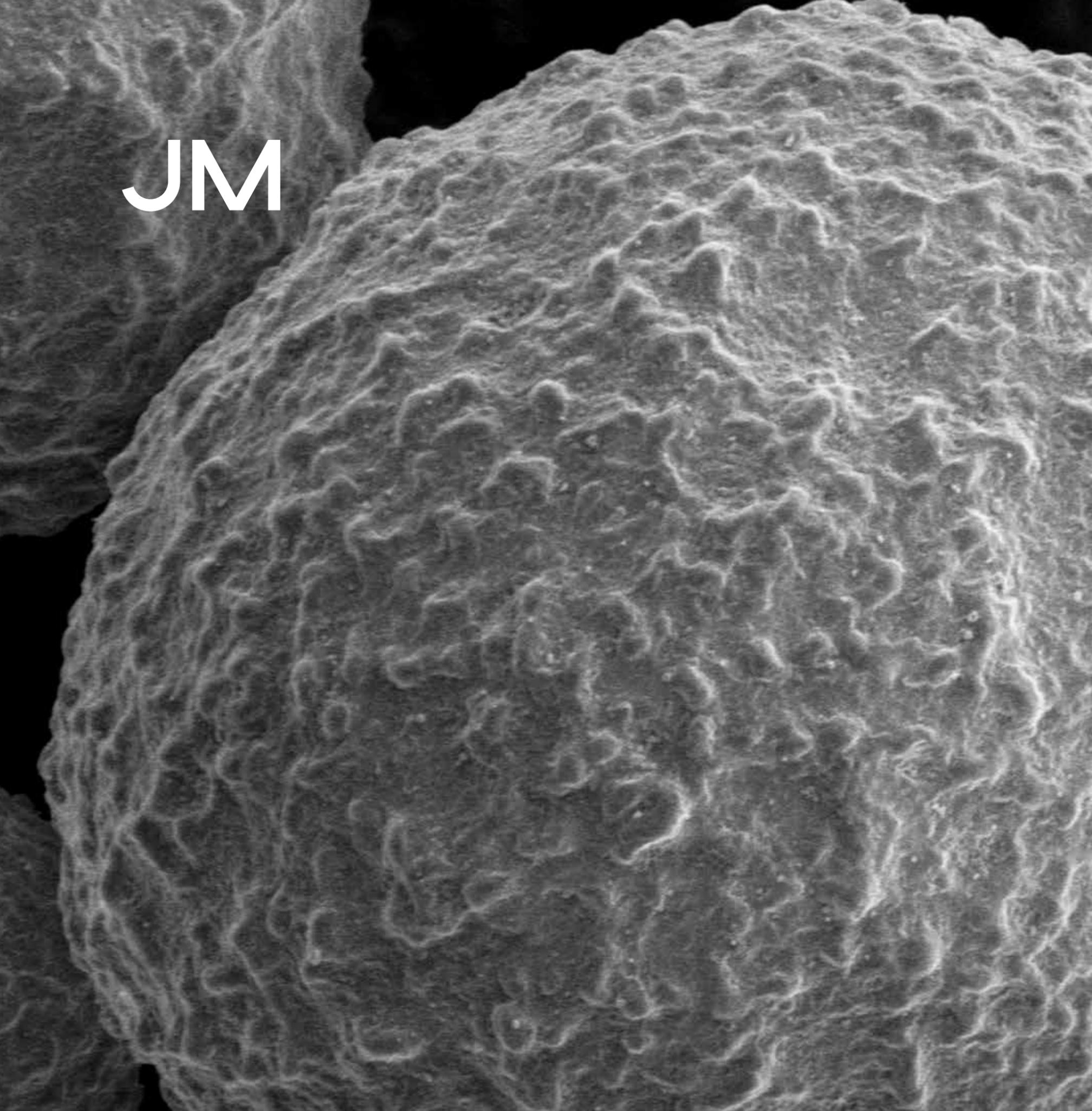
Mexican state-run oil company Pemex expects to begin importing light crude oil, likely from the US, in late October and at least until the present administration of President Enrique Peña Nieto leaves office on Nov. 30, its CEO said.

In a Reuters interview at the Mexican Petroleum Congress in Acapulco, Pemex CEO Carlos Trevino said, "Approximately 100,000 bpd is what we are going to import to process and incorporate into our refineries, mostly at Salina Cruz."

Like Pemex's other five refineries, Salina Cruz has recently been producing far below capacity due to accidents and operational problems, as well as

Pemex's focus on maximizing the value of its oil even if that means refining less domestically. Mexico's refining network can process up to 1.6 MMbpd of crude. It has been working this year at around 40%. Mr. Trevino expects that oil auctions scheduled for February, which include the selection of key partners for Pemex, will take place as planned.

Mexican President-elect Andres Manuel Lopez Obrador has said that oil auctions are suspended until contracts already awarded over the past few years have been reviewed. Pemex, whose oil production and refining volumes have continued declining this year amid the depletion of some of its main oilfields, will not meet its crude output target of 1.95 MMbpd in 2018. ●



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SUEZ expands its H₂S scavenger offering

WILLARD HARVEY, SUEZ – Water Technologies & Solutions

The sulfur content of processed crude oils continues to rise, and the transport of sour hydrocarbon fluids of various types is expanding. Due to the danger of hydrogen sulfide (H₂S) exposure, protecting personnel in the loading/unloading and transport process, in addition to the general population, is of the utmost importance.

SUEZ – Water Technologies & Solutions has expanded the product choices in its ProSweet* line of H₂S scavenger products. SUEZ can now

treat hydrocarbon and water streams with some of the most effective and cost-efficient products in the market. What has not changed is the SUEZ commitment to combine state-of-the-art products with comprehensive onsite service and ongoing support to ensure that H₂S vapor regulations and specifications are safely met with holistic problem resolution at a low overall operating cost. While some challenges require chemical treatment to reduce the threat of H₂S vapor exposure, the

main objective is to find the real cause and provide winning solutions for clients through root cause analysis, onsite observation and applying engineering remedies, where possible.

The new scavengers include an asphalt/heavy oil treatment program and a patented treatment aimed at all hydrocarbons (including crude oils), with a focus on reducing reliability and corrosion risks to process equipment due to lowering salting potential compared to the most common treatments.

transported intermediate hydrocarbon cargoes are being treated with H₂S scavengers. The most common treatment used is triazine-based. While very effective at removing H₂S, triazines as a chemical choice often cause downstream issues when the treatments reach processing areas. Issues can include desalter upsets, equipment fouling, loss of heat transfer, process corrosion and wastewater treatment nitrogen content, among others.

SUEZ has invented and patented a non-triazine, oil-soluble and low-salting product specifically formulated to treat hydrocarbon streams that will be further processed. The product is oil-soluble and readily mixes with hydrocarbons. The low-salting formula minimizes the potential for formation of corrosive salts in distillation equipment and overhead systems. The potential reduction in overhead salt point formation temperatures for different products at typical operating conditions is shown in FIG. 2. The new ProSweet* product shows lower salt points than the byproducts generated by either MA or MEA triazines. In contrast to triazines, the SUEZ product has minimal to no impact on desalter performance. This product is available in Canada, and release in other countries is expected soon.

To learn more about the expanded H₂S scavenger programs, or other ways we can help improve safety, reliability and operational success in refinery operations, drop by the SUEZ exhibit (#47) during the exhibit hall sessions, or visit www.suezwatertechnologies.com.

NOTES

* Trademark of SUEZ; may be registered in one or more countries

Example 1: Asphalt/bitumen/heavy oil treatment. One of the new products is designed to improve treatment performance for asphalt, bitumen or other heavy oils that must be handled and stored hot. The product rapidly forms a thermally stable RxS reaction product that does not negatively impact bitumen/asphalt/heavy oil quality, a feature that is considered the benchmark for these types of high-temperature refinery products. Additionally, the product does not contribute to fouling at temperatures below 177°C (350°F). As FIG. 1 shows, the new program is more effective than traditional chemistries and can drive vapor H₂S down to zero (100% removal), if desired. Additionally, this product is more concentrated than previous versions, allowing less chemical to be used and lowering the total cost of operation. The new products are effective up to 260°C (500°F) and eliminate problems encountered when water-based triazines or amines are used to scavenge H₂S in asphalt and other heavy oils.

Example 2: Patented low-salting H₂S scavenger. Increasingly, crude oils and

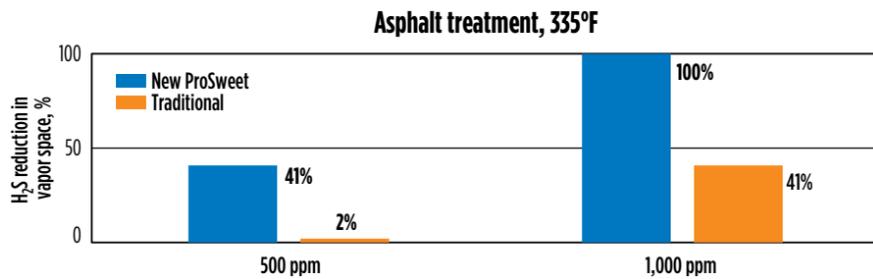


FIG. 1. Asphalt treatment results (higher is better).

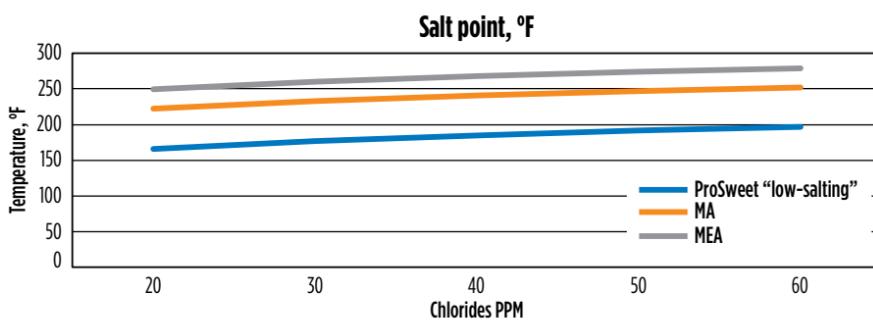


FIG. 2. Salt formation temperature curves (lower is better).

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DIGITAL BOND, continued from page 3

Peterson gave an example of a cyber attack on a Ukraine power system on December 23, 2015, wherein cyber attackers gained remote access to a SCADA system, enabling them to open breakers at substations one by one and turn off the power supply. The attackers were engaged with the network for a full six months prior to the multistage, planned attack. They uploaded their own firmware to the SCADA system, thereby “bricking” a serial Ethernet Moxa devices into an unrecoverable state. This rendered the SCADA system useless. The hackers also killed the drives of all connected computers and drained the power system’s backup power supply. Additionally, they flooded the power company’s call center so that actual customers could not place service calls.

To reduce the likelihood of a random attack, Peterson recommends installing fewer patches, establishing individual accounts for operators and making frequent password changes. However, mitigating high consequences as a means of addressing cybersecurity is a more complex and urgent matter. Consequences to business, the

economy and the environment should be monitored, without high consequences to OT or IT security programs.

Peterson gave the example of a vibration monitoring system. The questions to be asked include: Can the system trip the turbine? Can the trip point be changed from a computer? Is that computer on the control system?

It is also essential to separate cyber safety from the control system. This time, Peterson gave an example of a glass-making factory. Attackers could hack into the factory’s control system and turn up the heat on a process line to the highest level, thereby causing tens of millions of dollars in damage, as well as a line outage of up to six months. However, a manual controller installed on the line would enable operators to modify the heat manually in the case of a cyber attack, which would yield “dramatic consequence reduction for the price of a small local control,” Peterson said.

In closing, the CEO recommended, “Make sure to look at both sides of the risk equation, and make sure you are deploying solutions that will actually make a difference.”

A circular plastics economy: Long on intentions, short on solutions

The public, environmentalists, brand owners, institutions and now governments are responding to the rising tide of negative perception of plastics caused mainly by their improper disposal after use. The reaction to their environmental impact has been to increase efforts to reduce and ban plastics and/or increase their reuse and recycling.

Plastics are an integral part of everyday life; more than half of them are consumed in non-durable applications. Replacing plastics with other products and increasing recycling brings complications that will take time and resources to resolve. What replaces plastics? Metal? Wood? Paper? Glass? Plastics are incredibly efficient and cost-effective, so finding alternative solutions for their myriad applications and benefits is not an easy task.

Along the supply chain. Understanding the implications for natural resources and the environmental consequences of shifting away from plastics must consider the entire supply chain. For example, plastics are extensively used in food packaging to prevent spoilage, which in turn reduces transportation costs, food costs and energy requirements. If plastic food packaging is banned, spoilage increases, leading

to more land, water, pesticides and equipment being consumed. Is this better for the environment?

What of the circular plastics economy (FIG. 1)? There is little doubt that increased plastic waste must be addressed, and a circular economy certainly helps tackle this issue.

A major win would be to improve waste management and collection infrastructures globally. Collection and reduction of litter are major issues, primarily in developing countries, where a sizable portion of the discarded waste eventually finds its way into the oceans through a small number of rivers. While this appears to be a simple issue to resolve, it is not. Urbanization, which contributes to poverty reduction, places pressure on resources. Governments are unable to build infrastructure quickly enough to keep pace.

Recycling would be the preferred avenue, with the focus on a circular economy. Wood Mackenzie Chemicals is a strong believer that recycling around the world will only increase, led by rigid single-use packaging applications. The easiest plastics to recycle are those used in injection and blow-moulded applications, which represent approximately one third of global polyethylene (PE), polypropyl-

ene (PP) and polyethylene terephthalate (PET) consumption in 2018. Film represents another one third.

Volume growth. Wood Mackenzie Chemicals' long-term forecast shows lower growth rates, considering these dynamics, but growing populations and improving living conditions in developing markets are positives for the petrochemicals industry. In fact, despite the issues discussed, chemical demand will persist.

While growth rates will be lower,

the sheer size of the market today generates sizeable volume growth. Ethane and naphtha will remain the primary feedstocks for petrochemicals and plastics, with ethane capturing most of the growth. Considering the expectation of transport demand peaking, we forecast chemicals to make up the largest proportion of oil demand growth in the next two decades, and to account for almost all growth by 2035. Approaching 2040, our forecast shows chemicals making up 20% of total oil demand. ●



FIG. 1. A circular plastics economy helps tackle the issue of increased plastic waste.

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GWR solves refinery level measurement challenges

LYDIA MILLER, Emerson Automation Solutions

While no one-size-fits-all solution is appropriate for every level application in refineries, guided-wave radar (GWR) comes close. A GWR device uses a metal probe to extend into a tank or vessel to serve as a waveguide. The

probe concentrates the energy pulse to get a very reliable reading that minimizes false echoes and interference from equipment inside the tank. GWR is well adapted to tricky refinery level measurement applications.

Working in tight spaces. Common refinery equipment configurations include stilling wells or bypass chambers (bridles). Chambers are mounted on the outside of tanks and vessels of all shapes and sizes, and often include valves to allow instrumentation isolation for verification, maintenance or removal for service without interfering with production. They are also useful when in-tank restrictions do not allow mounting of the instrument in the vessel. GWR instruments are ideal for chambers, provided that a 3-in. minimum diameter is used for optimal results. Room should be left at the top and bottom of the chamber outside of the measurement span to allow for upper and lower null zones, and enough process connections should be included to allow the chamber liquid to mimic the tank or vessel.

Stilling wells are mounted inside a vessel to isolate the transmitter from disturbances such as turbulence, foam and other objects. The coaxial probe of a GWR transmitter is its own small stilling well and is an alternative to adding another for clean fluid applications. Desalter units can benefit from the use of a stilling well

when using GWR for reliable interface level control.

Handling turbulent or boiling hydrocarbons. GWR thrives in difficult environments where liquid turbulence may exist, changing pressure conditions or liquid density fluctuations. This can apply to reactors, receiver/economizers or chillers. In some natural gas liquid applications, a drop-in pressure allows the liquid to boil. Differential pressure level measurements have difficulty compensating for changing densities, which can make their readings unreliable.

While GWR is unaffected by changing densities, it can struggle with low dielectric constant (DK) products common to refineries. This is solved by using a feature called “probe end projection” to help when a low-DK product is experiencing boiling or turbulence. This feature allows the radar transmitter to calculate the level even when these disruptions cause the transmitter to lose the surface echo.

When the microwave signal travels down the probe, part of the signal is reflected by the surface, but the rest



FIG. 1. A verification reflector placed on a GWR probe allows for proof testing a high level point without raising liquid levels to that point.

▶ See **GWR**, page 12



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Connected Plant: The industry's ticket to the digital future

JOHN GUGEL, Honeywell UOP

For most of the last century, advancements in refining and petrochemicals manufacturing were incremental. New processes and catalysts were significant if they could improve conversion, reduce waste products or lower energy consumption by just one or two percentage points.

While these advancements compounded to yield enormous improvements—almost all of them were made possible by more sophisticated chemistry and metallurgy, larger scale, and more capable control systems and automation—the basic design of refineries and the way they work remains largely unchanged from a generation ago.

Many operators still struggle to know exactly what plants are experiencing and even the scope of their true capabilities. We routinely see refineries and petrochemical plants operating at parameters far lower than their actual capabilities, while others may be running too hard or constrained by operational bottlenecks.

The problem can be even more severe for companies with retiring operating staff. These are often the people who know the units and their capabilities best. When they leave,

they are turning over entire plants to a new generation whose experience is measured in years rather than decades, and who can err on the side of caution or needlessly overwork parts of the complex.

Significant advances will continue in chemistry, metallurgy and all other mechanics of refineries and petrochemical plants. However, the next revolution in the industry will be governed by new technological capabilities enabled by digitization, and this goes far beyond just automating existing processes.

The future of digitalization. Digitization allows us to connect processes, assets and the people who operate them to make operations more reliable, profitable and secure than ever (FIG. 1). In doing so, they can continually redefine the benchmark of optimal performance and reliability.

Historically, operational expertise in a refinery or petrochemical plant was developed over periods of decades, with the staff supported by technology providers who advised them on plant operations and optimization. Technology providers, such as UOP, benefitted from the insights

gained from reliable performance data captured over a century of operations, under different conditions and with a wide variety of feeds. These data and experiences formed the basis for operational recommendations to customers and can now be put to far better and more effective use. We can use cloud-based platforms to distill data into a service that monitors and proactively informs plant operators on a continuous basis. We have created predictive models to guide customers' operational decisions as their process economics change, so they can be

more agile and profitable. This is what we now call the Connected Plant.

By understanding how processes, assets and people interact, the Connected Plant can greatly improve operational efficiency and reliability, helping customers avoid millions of dollars in losses due to downtime and underperformance.

Honeywell is the only service provider with the depth of UOP's process knowledge, the analytical capabilities provided by Honeywell Process

► See **CONNECTED PLANT**, page 12



FIG. 1. Cloud-based platforms can be used to distill data into a service that monitors and proactively informs plant operators on a continuous basis.

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GWR, continued from page 10

continues down the probe. When it reaches the probe end, it causes a second reflection. Since even a low-DK material causes the microwave signal to move more slowly than in air, that reflection is shifted. Using the amount of the shift and the known DK of the material, it is possible to calculate the actual amount of liquid in the tank or vessel. This calculation can be used if the signal from the surface is not strong enough due to boiling or turbulence.

Simplifying proof testing. GWR transmitters can also be equipped with a verification reflector, which is a target placed on a flexible probe above the normal fluid level at a defined point (FIG. 1). The tar-

get has a specific echo signature that the transmitter tracks. When it comes time for proof testing a high-level alarm, the GWR transmitter's software tells the system that the signature echo from the reflector is the level in the vessel. This allows a test of the system for a high level without raising the fluid level in the tank, minimizing additional safety risks.

Takeaway. These are just three of the many possible applications able to benefit from these critical advantages and characteristics of GWR:

- Very accurate, typically within a few millimeters over distances of 40 m or more
- No moving parts

- Tolerates most dirty and sticky environments using a single-lead probe, with signal quality metrics for proactive maintenance
- Adaptable to special alloys for aggressive products, such as hydrofluoric acid
- Probes can be rigid or flexible
- High pressures are not a problem
- Broad operating temperature range
- Many models can even include SIL certification for use in safety-instrumented functions.

These elements working together make GWR technology exceptionally versatile and well suited to refinery environments. ●

SHELL TO HANDLE CONTRACT NEGOTIATIONS FOR US REFINERY INDUSTRY

Royal Dutch Shell Plc will be handling industry negotiations on a national contract covering 30,000 US refinery and chemical plant workers represented by the United Steelworkers Union (USW).

The talks begin formally in January and Shell, which has represented its peers since 1997, is lead negotiator on behalf of companies including BP, Chevron Corp, Exxon Mobil Corp. and others. The union is aiming for a three-year contract with wage increases of approximately 6%/yr. The contract to be negotiated between Shell and USW will set the pattern for contracts between local unions and refineries, chemical plants and pipeline operators. ●

CONNECTED PLANT, continued from page 11

Solutions, and the ability to combine them to provide deep understanding of process operations in real time.

Honeywell has dozens of Connected Plant systems in operation or in the process of being installed. These new software-enabled services are bringing demonstrable improvements in optimization and reliability, as well as a deeper level of understanding into the true capabilities of a plant, identifying bottlenecks, verifying causes and accelerating the performance of plant operators of all experience levels.

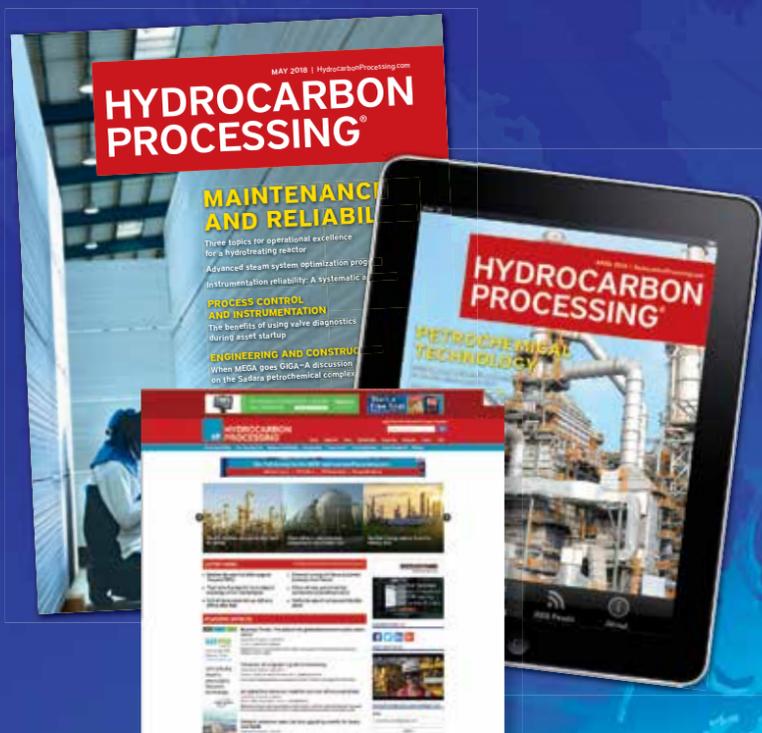
Where in operation, these cloud-based services have demonstrated the capability to expand throughput by 2%, raise productivity by 4% and deliver roughly \$25 MM/year in incremental profit for an average refinery. These capabilities are entirely due to the application of UOP's unmatched experience through a digital service.

Operating staff now can monitor their refineries and petrochemical plants and receive timely alerts when parameters are exceeded or trending unfavorably. They can act much earlier than ever before, improving latent underperformance or even avoiding problems that could slow or interrupt production. ●

The era of digitization through Connected Plant technologies is already well under way and will become the new standard for the industry. We believe that refiners and petrochemicals manufacturers that adopt Connected Plant technologies will significantly improve their competitiveness through higher process performance and on-stream reliability. ●



JOHN GUGEL is President of Honeywell UOP. Since joining UOP in 1992, Mr. Gugel has held roles in business management, sales, marketing, project management and engineering. He most recently served as VP and General Manager of UOP's process technology and equipment business. He also served as VP and General Manager of the company's gas processing and hydrogen business. In previous roles, he served as Global Director of UOP's refining business, and its engineered and fabricated plants division that managed the design, procurement and construction of process units for customers around the world. He also served as General Manager of sales for the Americas and Asia regions. Prior to joining UOP, he was a project engineer in Amoco Chemical Co.'s capital projects group. Mr. Gugel earned BS and MS degrees in civil and environmental engineering from the University of Wisconsin, and an MBA from Northwestern University's Kellogg School of Management.



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Drop-in catalyst solution delivers significant benefits

Challenge. A North American refiner utilizing waxy atmospheric gas oil feed was experiencing high liquefied petroleum gas (LPG) and naphtha yields. The refiner was producing 3,000 bpd of ultra-low sulfur diesel (ULSD) in winter mode (FIG. 1). The refiner achieved its target of a deep cloud point reduction for a waxy feed, but this came at the expense of significant distillate yield loss. Cracking dewaxing results in high LPG and naphtha yields. The refiner's goal was to increase profitability by increasing distillate yields.

Solution. ExxonMobil worked with the refiner to assess options and identify the best value solution, leveraging ExxonMobil's technical expertise and owner-operator experience. The cracking dewaxing catalyst was replaced with ExxonMobil's drop-in MIDW™ technology, which is highly selective to diesel and minimizes the production of LPG and naphtha through the isomerization of n-paraffins to iso-paraffins, rather than cracking the paraffins out of the diesel range. Additionally, updated distributor designs were recommended to improve contacting efficiencies.

Result. The implementation of ExxonMobil's catalyst technology and

optimization knowledge (FIG. 2) resulted in a 42% increase in distillate yield at constant pour point and cloud point. LPG and naphtha yields decreased by 16% and 26%, respectively (FIG. 3).

By switching to ExxonMobil's high-performing MIDW catalyst, the refiner was able to achieve an estimated annual benefit of \$10 MM/year.

The discussion process for planning such a project follows these steps:

- Initial non-confidential consultations
- Development of proposal
- Basic engineering package, including basic design specification and operating guide
- Engineering support during front-end engineering design (FEED) and engineering, procurement and construction (EPC) stages
- Technology transfer, training, catalyst loading and startup support
- Unit monitoring support.

More than 10 MIDW units are operating globally, with more than five under design. While many MIDW units are in colder climates (Russia, North America, Northern Europe) where a clear need exists for winter

diesel, units in the Middle East, India and Singapore are producing Euro V diesel for export. The ability to retrofit an existing unit with MIDW technology to capture significant value makes this one of the most attractive fuels technologies in the industry. ●

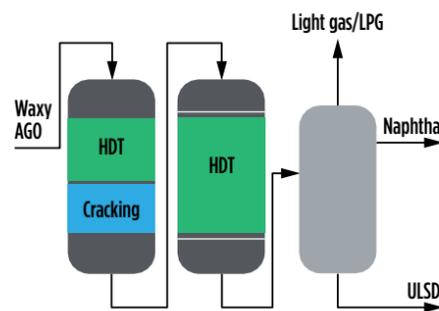


FIG. 1. A North American refiner was producing 3,000 bpd of ultra-low sulfur diesel (ULSD) in winter mode.

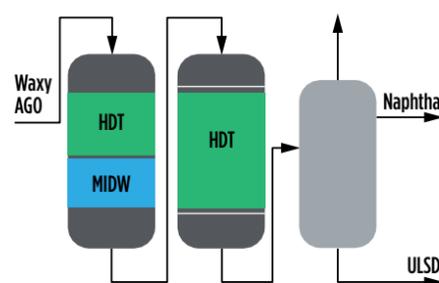


FIG. 2. The optimized ExxonMobil drop-in catalyst solution delivers significant benefits.

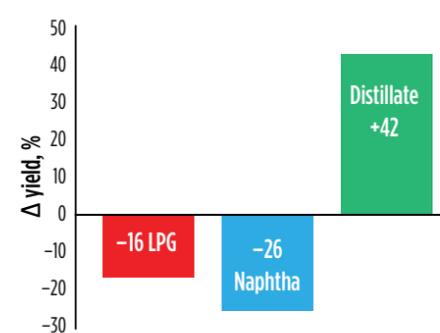


FIG. 3. The implementation of ExxonMobil's catalyst technology and optimization knowledge resulted in a 42% increase in distillate yield at constant pour point and cloud point, and a decrease in LPG and naphtha yields of 16% and 26%, respectively.

UPCOMING AFPM EVENT

Environmental Conference
October 14–16, 2018
Marriott Rivercenter
San Antonio, Texas

The AFPM Environmental Conference program focuses on regulatory and policy issues. Technical presentations and Q&A sessions are designed to address the impacts of various environmental regulations on refineries and petrochemical plants, and to provide solutions and compliance mechanisms for a facility.

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SCENES FROM THE 2018 AFPM SUMMIT



1



2



3



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5



6



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8



9

- 1 The Sunday evening kickoff networking event always provides an opportunity to gather and socialize with industry colleagues.
- 2 **Christian Arnoux** from Valero Energy Corp., **Gayl Mercado** from Axens North America, **Tim Sheppard** from HR Alkylation Consultants LLC and **Lance Tallman** from CITGO Petroleum Corp. formed the panel for Monday morning's Gasoline Processes Q&A session. Subjects for discussion included alkylation, isomerization, catalytic reforming, cat-poly alkylation and catalytic reforming.
- 3 At Sunday night's kickoff networking event, **Taylor Cowan** (left) and **Suzanne Schroeder** from SUEZ Water Technologies & Solutions looked ahead to another successful Summit.
- 4 Drinks in hand, two AFPM Summit attendees start their conference with smiles.
- 5 Monday morning's Operational Planning, Control & Automation Technologies (OPCAT) session kicked off as **Dr. Fani Boukouvala** delivered the keynote address: Data-driven Mathematical Modeling and Global Optimization Framework for Entire Petrochemical Planning Operations.
- 6 Honeywell UOP's **Kolapo Alade-Lambo** experienced a virtual reality game at his company's hospitality suite Sunday evening.
- 7 With so many industry experts in attendance, the AFPM Summit is a great place for the exchange of ideas and techniques.
- 8 Industry veterans **Warren Letzsch** of TechnipFMC, **Maureen Price** of Fluor Corp. and **Bob Riley** of W. R. Grace & Co. welcomed the chance to reconnect.
- 9 Two NFL Atlanta Falcons cheerleaders joined DuPont Clean Technologies' **Jeff Crouch** (center) and friends at Sunday night's sports bar-themed hospitality suite.



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2019 AFPM MEETINGS

Annual Meeting

March 17 – 19
Marriott Rivercenter
San Antonio, TX

**International Petrochemical
Conference**

March 24 – 26
Grand Hyatt
San Antonio, TX

**International Base Oils &
Waxes Conference**

March 24 – 26
Grand Hyatt
San Antonio, TX

**National Occupational &
Process Safety Conference**

April 24 – 25
The Gaylord Texan
Grapevine, TX

Security Conference

April 30 – May 1
Sheraton Austin at the Capital
Austin, TX

**Labor Relations/
Human Resources Conference**

May 2 – 3
Sheraton Austin at the Capital
Austin, TX

**Reliability & Maintenance
Conference and Exhibition**

May 21 – 24
The Gaylord Texan
Grapevine, TX

Board of Directors Meeting

September 8 – 10
The Broadmoor
Colorado Springs, CO

**Operations & Process
Technology Summit**

October 14 – 16
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Environmental Conference

October 27 – 29
Grand America Hotel
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