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Leading with safety, focusing on reliability, succeeding in operations

CHET THOMPSON, President and CEO, American Fuel & Petrochemical Manufacturers

Welcome to the 71st Annual AFPM Operations & Process Technology Summit, and thank you for joining us in Atlanta, Georgia. The Summit, previously the Q&A Technology Forum, has a long history. What began as a meeting for industry leaders to get together, ask questions and share information has become a dynamic, interactive and energetic forum designed to share best practices, technical expertise, professional development and networking opportunities. The Summit is the place to be.

Our theme this year, "Lead with Safety, Focus on Reliability, Succeed in Operations," reflects the core principles we infuse into our operations, at our facilities and among our employees every day. In Washington D.C. and in state capitals throughout the country, we advocate for policies that enable and support these core principles. We do the work that we do every day to ensure that you can operate as safely, securely, reliably and efficiently as possible. The right policies enable the US refining and petrochemical industries' continued growth, as well as the ability to provide the products that elevate the standards of living globally.

At AFPM, we respect the growing demands on your time and have worked to provide an informative yet exciting program over the next few days. The must-attend technical presentations cover a wide range of topics, including crude/vacuum distillation and coking, gasoline processes, fluid catalytic cracking units (FCCUs), hydroprocessing, automation and controls, and operations planning. The FCC panel alone boasts more than 100 years of industry expertise.

Cybersecurity will have a continued presence at the Summit, with presentations focused on contemporary issues such as industrial control systems, ransomware, risk management, the Industrial Internet of Things (IIoT) and supply chain security. Back by popular demand, the New Manager Morning Mixer, the Emerging Leaders Networking Event and the Women in Industry Reception will help you expand your industry contacts and support professional growth.

For those of you who have committed to this event for years, welcome back and thank you. We appreciate your continued support and input. You have made this event what it is today. For our first-time attendees, I am positive this is the beginning of a lifetime of experiences with AFPM. Welcome, and enjoy your time at the Summit. ●

INSIDE THIS ISSUE

The Internet of Vulnerable Things

CHRIS GROVE, CISSP, NSA-IAM, is Director of Industrial Security at Indegy and has more than 25 yr of experience in cyber security. Previously, he managed large-scale data and application security projects at Imperva for government and defense agencies, law enforcement and the intelligence community. He has presented at Black Hat, RSA, InfoSec and Gartner conferences on cloud security, hacking, cyber defense strategies and more.

Chris Grove, CISSP, NSA-IAM and Director of Industrial Security at Indegy, is making a presentation titled, *The Internet of Vulnerable Things: How to secure ICS environments* on Tuesday, Oct. 2 at 2 p.m. in M304. AFPM and *Hydrocarbon Processing* had the opportunity to ask Mr. Grove about his thoughts on security concerns in the energy sector.

AFPM/*HP:* What is the current state of industrial security in the energy sector?

GROVE: According to Homeland Security Secretary Kirstjen Nielsen, "We are in crisis mode. A Category 5 hurricane has been forecast." Ms. Nielsen made the statement at a July conference in New York, where she announced plans for a new National Risk Management Center that would help government and the private sector better coordinate efforts to protect critical infrastructure.

In a recent survey conducted by SANS on Industrial Internet of Things (IIoT) security, 60% of respondents who are in security roles with energy, utility, oil and gas, and manufacturing organizations said they are not patching their IIoT devices and systems. Less than 5% who work in operational technology (OT)—not information technology (IT)—roles said that they were confident in their company's ability to secure these new infrastructures.

Clearly, we have security gaps in OT networks, and they must be addressed before a major incident occurs.

AFPM/*HP:* What are the biggest threats in the energy sector?

GROVE: It boils down to a lack of visibility, security and control.

Energy, like most industrial sectors, is playing catchup when it comes to security. This is primarily because industrial control systems (ICSs) were built before cyberthreats existed, and they were designed to be standalone islands without connection to the outside world. The problem is only getting worse with the adoption of the IIoT, which is spreading the notion of connecting everything to everything in plant environments. This new level of interconnectedness is exposing OT infrastructures to risks and vulnerabilities that were never envisioned when they were first pressed into service.

OT network managers lack even the most rudimentary capabilities that IT managers take for granted: monitoring network activity for vulnerabilities, unexpected activity and changes, and indicators of compromise.

► See GROVE, page 3

FIG. 1. The number of hacker groups targeting the energy sector is soaring, and some intruders have gained hands-on access to power grid systems and now have "red button" capabilities that can shut down operations.

A Better Perspective
on Hydroprocessing Solutions

In the refining industry, market conditions are always evolving with new regulatory requirements, global demand shifts, and the use of heavier feedstocks among other factors. ART Hydroprocessing can help you take a better perspective on these challenges based on our deep understanding of refinery operations and a full spectrum of hydroprocessing catalysts solutions that maximize profits by balancing run length, severity, feed flexibility, contaminants, and operating constraints.

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AFPM/*HP:* What is needed to mitigate the risks?

GROVE: The first step for energy companies is improving visibility into ICS networks. This all begins with asset management. Without fully understanding which assets exist in a network, they cannot be protected. This includes knowing everything about each device, such as which firmware versions are installed, what code and logic they are executing, what configurations are in place, etc.

In the event of an incident, an up-to-date asset inventory can dramatically reduce the time it takes to restore devices to a known good state and resume operations.

Next comes the detection and prevention of unauthorized process changes from both internal and external threats, and even human error. To protect ICS networks from these risks, specialized monitoring and control technologies that combine both rules-based detection, as well as advanced heuristics, are essential.

Comprehensive visibility into the control-plane activities of industrial networks can enable energy companies to enforce effective security and access management policies that govern who is allowed to make what changes, when and how.

Equally important is real-time monitoring of engineering changes made to industrial controllers, either over the network or directly on the devices. This 360° visibility is the most effective way to detect unauthorized activities.

Finally, a paper trail in the form of advanced forensics is essential to give context to the "who, what and why." This enables security personnel to quickly pinpoint the cause of the alarm and mitigate the threat.

AFPM/*HP:* Is the energy sector doing enough?

GROVE: According to reports by two prominent security consultant firms, the energy sector is not doing nearly enough. Precision Analytics LLC and the CAP Group estimate that energy companies, ranging from drillers to pipeline operators to utilities, invest less than 0.2% of their revenue in cyber security. That number is at least one third less than the corresponding figure for banks and other financial institutions.

Part of the reason for these low levels of spending is that the industry has been rapidly implementing new technologies to generate more oil and gas at a lower cost following a historic, three-yr decline in crude prices.

Over the past few years, the industry has been quickly adding electronic sensors and other monitoring capabilities to track data from 900,000 oil and gas wells and 300,000 miles of pipelines. This data is being used to wring efficiencies from every step of the manufacturing, refining and distribution processes.

Unfortunately, these IIoT technologies are also creating a primary source of security vulnerability and a much broader attack surface.

We know that the number of hacker groups targeting the energy sector is soaring. Symantec Corp. alone says that it is tracking at least 140 groups, up from 87 in 2015, some with links to foreign countries. It has been documented that intruders have gained hands-on access to power grid systems and now have "red button" capabilities that can shut down operations (**FIG. 1**).

We need to do more before a storm hits. As a resident of Florida, I know that you do not wait for a hurricane before repairing your roof. The last thing you want to do is develop your emergency plans and gather supplies during an emergency. Planning ahead is truly the only prevention and remedy. ●

AFPM

2018 OPERATIONS & PROCESS TECHNOLOGY SUMMIT

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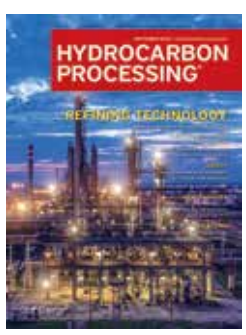


SCHEDULE OF SESSIONS AND SPECIAL EVENTS

SUNDAY SEPTEMBER 30, 2018

3–6:30 p.m.	**Registration and badge pickup**
4:30–5:30 p.m.	**Emerging Leaders Networking Event**
5:30–6:30 p.m.	**The Summit Kickoff Networking Event**

MONDAY OCTOBER 01, 2018

7 a.m.–6:30 p.m.	**Registration**
7–8 a.m.	**New Manager Morning Mixer**
8–8:55 a.m.	**General session** featuring Dawn Wurst, VP—Process & Asset Safety, Georgia-Pacific Chemicals LLC
9–10 a.m.	**Concurrent Sessions:** • Cybersecurity • Operational Planning, Control & Automation Technologies • Principles & Practices—Emerging Leaders Town Hall • Q&A and Discussion Session—Gasoline Processes
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:** • Cybersecurity • Operational Planning, Control & Automation Technologies • Principles & Practices—Gasoline Processes • Q&A and Discussion Session—Hydroprocessing
3:30–3:45 p.m.	**Refreshment Break**
3:45–5:15 p.m.	**Concurrent Sessions cont.**
5:15–6:30 p.m.	**Reception in Exhibit Hall**

TUESDAY OCTOBER 02, 2018

7 a.m.–5 p.m.	**Registration**
7–8 a.m.	**EMpower Breakfast**
8–10 a.m.	**Concurrent Sessions:** • 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:** • 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:** • 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.**

A new generation of catalyst: TK-6001 HySwell

HENRIK RASMUSSEN, Haldor Topsoe Inc.

Tremendous improvements in catalyst technology have been made over the past 20 yr–30 yr to comply with ultra-low-sulfur fuel legislation and to maximize production of gasoline by shifting more toward vacuum gasoil (VGO) hydrocracking. However, jet and diesel refiners are still looking for the absolute top-tier NiMo catalyst for their ultra-low-sulfur diesel (ULSD) and hydrocracker pretreat reactors.

The dramatic drop in natural gas prices, particularly in the US, has resulted in a low production cost for hydrogen (H_2), making it very profitable to catalytically add H_2 to middle distillate fractions, thereby increasing liquid volume swell with higher volumetric yields of valuable products.

Haldor Topsoe's newly-launched catalyst, TK-6001 HySwell™, begins a new era within alumina-based hydrotreating catalysts by maximizing activity for nitrogen removal and, consequently, achieving higher volume swell.

From BRIM® and HyBRIM™ to HySwell. Topsoe's latest catalyst technology, HySwell, involves an improved production technique for NiMo hydrotreating catalysts. It combines the BRIM and HyBRIM technologies with a unique, proprietary catalyst preparation step designed to achieve an optimal interaction between the active metal structures and the alumina carrier. The result is a substantial increase in the activity of both the direct desulfurization sites and the indirect hydrogenation sites without compromising catalyst stability.

Today, Topsoe's NiMo catalysts have increased in activity by more than 500%, as compared to the catalysts produced in the mid-1980s.

Higher activity, same stability. When applying the TK-6001 HySwell catalyst in either ULSD or hydrocracker pretreatment service, the improved activity can be utilized to treat more severe feeds or obtain longer cycle lengths. In the case of a hydrocracker, the additional activity can also be used to lower the nitrogen slip from the pretreat section to the cracking section, resulting in higher conversion and better yields. TK-6001 HySwell will also increase the volume swell due to better hydrogenation functionality, thereby creating a significant economic driver for many refineries by producing more valuable barrels.

The ULSD pilot plant testing in FIG. 1 provides a side-by-side comparison of hydrotreating catalysts TK-611 HyBRIM and TK-6001 HySwell at identical operating conditions. The additional aromatic saturation activity achieved at the same operating conditions results in additional volume yield (swell) due to the increased saturation of the mono-aromatics.

The pretreatment stage in a hydrocracker is a fixed-bed catalytic process implemented with the primary objective of reducing the feed organic nitrogen compounds from typical levels of 500 ppm N–2,000 ppm N down to 10 ppm N–30 ppm N levels in the reactor effluent. Nitrogen compounds have a significantly negative influence on the cracking functionality of the acidic hydrocracking catalysts and, consequently, on the performance of the hydrocracker. Also, aromatic compounds are very difficult to convert over the zeolitic hydrocracking catalyst. Lowering both feed nitrogen and feed aromatic content has a significant impact on the feed reactivity and on the hydrocracker's overall performance.

The same type of experiment is illustrated in FIG. 2 for VGO at hydrocracker pretreatment conditions. The nitrogen slip from the test unit with TK-611 HyBRIM is 27 wtppm, but TK-6001 HySwell can lower the feed nitrogen to as little as 3.5 wtppm. Such a substantial difference represents a step-out improvement for any hydrocracker pretreat unit.

A strong correlation exists between the observed density improvement and the degree of aromatic saturation (% HDA), which is controlled by the catalyst's hydrogenation activity, the presence of inhibitors (such as nitrogen species) and by thermodynamic equilibrium. The overall amount of H_2 consumed by hydrodearomatization (HDA) reactions is also dependent on the actual amount of aromatics present in the feed.

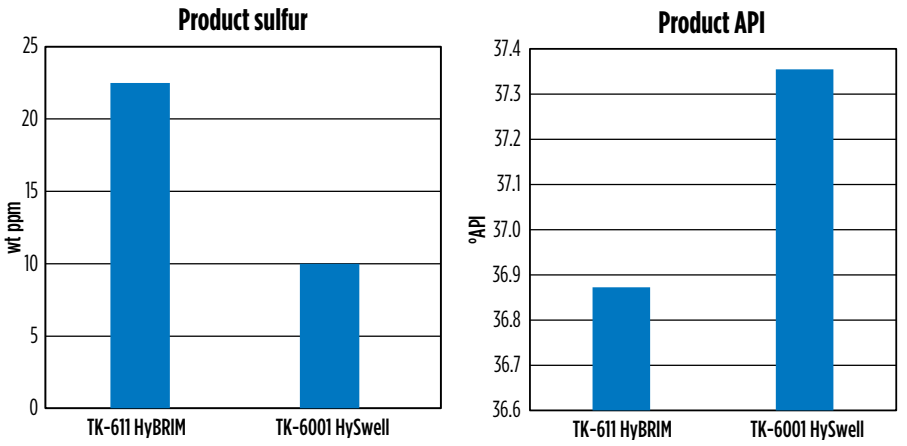
A simple way to quantify the volume swell is to compare the liquid product density with the feed density. This is an easy approach and is based on available data; however, it does not take yield losses into account. The correct method is to compare the increase in the C_5+ volume yield with the fresh feed. While this method is accurate, the data is not always readily available from commercial units or from simple pilot tests, as it requires fractionation and the ability to close the mass balance.

Volume swell arising from nitrogen removal and aromatic saturation is equally or more important in the hydrocracker, as this has a significant contribution to the overall volume swell seen over the hydrocracker. As mentioned here, the removal of organic nitrogen and aromatics in the hydrocracker pretreatment step has a positive impact on the actual feed reactivity. However, it also affects the conversion, the actual yields and light ends make, and the temperature required to create the actual hydrocracking. Typically, the degree of thermal cracking over the pretreatment catalysts is very small. All Topsoe pretreatment catalysts are optimized for maximum hydrodenitrogenation (HDN) and aromatic saturation activity. Further, none of the Topsoe pretreatment catalysts are formulated with any acidity and show very little cracking activity.

FIG. 3 illustrates the density and aromatics distribution achieved over Topsoe's top-tier hydrocracking pretreatment catalysts. The straight-run (SR) feed tri+ aromatics are lowered from typical levels of 10 wt%–15 wt% to very low levels, indicating the high reactivity of those species. In VGO streams containing cracked components, the feed tri+ aromatics are typically higher, often as high as 15 wt%–25 wt%. The performance difference between the catalysts tested is not very pronounced when it comes to di-aromatics (naphthalene derivative) saturation. Again, the di-aromatics are lowered from typical levels of 10 wt%–15 wt% to 1 wt%–3 wt% levels. Basically, all tested catalysts do a good job when it comes to di- and tri+ aromatics saturation.

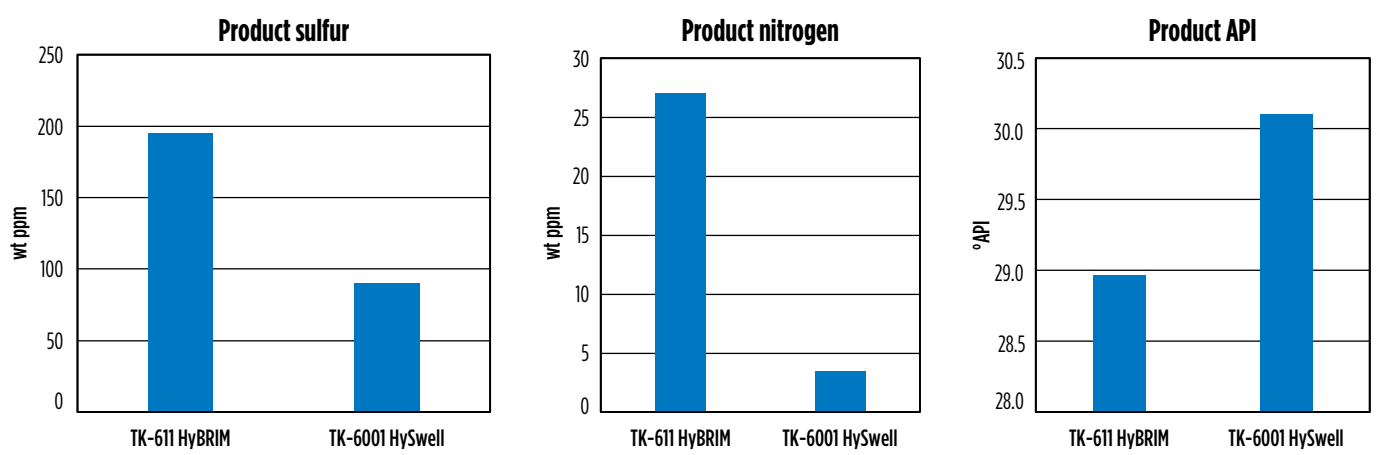
However, the mono-aromatic compounds have a different reactiv-

▶ See CATALYST, page 13



Test conditions, ULSD	
Feed sulfur	1.18 wt%
Feed nitrogen	293 wt ppm
Density	30° API
Pressure	1,020 psig
Temperature	Targeting < 10 ppm S

FIG. 1. Performance comparison of TK-611 HyBRIM with TK-6001 HySwell in ULSD service.



Test conditions, VGO feed	
Feed sulfur	1.91 wt%
Feed nitrogen	1,500 wt ppm
Density	22° API
Pressure	2,031 psig
Temperature	Targeting < 30 ppm N

FIG. 2. Performance comparison of TK-611 HyBRIM with TK-6001 HySwell in hydrocracker pretreatment service.

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EXCITING CHANGES
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Sour water optimization: Solutions that make dollars and sense

Pentair's hydrocarbon recovery technology (HRT™) provides refiners and gas processors with improved amine/hydrocarbon separation relative to what is achievable through the implementation of conventional residence tanks or separators. Residence tanks are ineffective at separating emulsified hydrocarbon from amine, allowing essentially all dispersed hydrocarbon to pass through to the sour water stripper. The HRT technology was developed to intercept and recover even stable emulsified hydrocarbons, allowing essentially zero free hydrocarbons to pass through to the stripper section of the sour water system. As a result, the stripper column enjoys stable operation, maximized throughput and minimized potential for upsets to the sulfur recovery unit (SRU).

Most sour water systems experience either periodic or continuous hydrocarbon upsets, leading to stripper foaming, diminished capacity, fouling of heat transfer surfaces and, in extreme cases, shutdown due to the inability to process accumulated sour water. Pentair's HRT technology (**FIG. 1**) allows free hydrocarbon levels exiting the sour water residence tank to be reduced from levels greater than 5% to a few ppm. The potential exists to dramatically improve hydrocarbon and solids separation from sour water without the need to expand existing residence tank capacity. This results in greater stripper stability and reliability as processors can achieve nearly complete hydrocarbon/sour water separation. Additionally, the potential for hydrocarbon-induced upset and the impacts on plant throughput and emissions are dramatically mitigated.

FIG. 1. With Pentair's HRT technology, the potential exists to dramatically improve hydrocarbon and solids separation from sour water without the need to expand existing residence tank capacity.

Adding sour water residence tank capacity to address hydrocarbon carryover to the sour water stripper may require a capital expenditure of several million dollars or more. HRT provides superior hydrocarbon recovery, increased flexibility and a smaller footprint, while reducing required capital by more than two thirds. HRT combines both superior performance and economic returns.

Effective recovery of hydrocarbons and solids from sour water systems mitigates the potential for process upsets and ensures reliable, stable stripper operations, benefitting both plant performance and community health and safety. HRT technology affords proven performance while eliminating the need for expensive excess sour water storage capacity. Additionally, HRT may be used to recover valuable hydrocarbon products lost to the sour water system, providing a solution that makes both dollars and sense.

Hydrocarbons in the sour water system are typically present on a continuous basis at up to 10,000 ppm, and to levels greater than 50,000 ppm during upsets. As little as 5,000 ppm Cat naphtha lost to the sour water system from a fluid catalytic cracking (FCC) main fractionator overhead accumulator operating at 100 gal/min of water represents 262,800 gal of potential product gasoline lost per year, with conceivable recoverable product values upwards of $500,000.

Reliable, proven performance. Pentair's HRT technology has been installed on sour water systems to address both hydrocarbon upsets and hydrocarbon-induced fouling. Implementation of the HRT technology on sour water systems provides increased operating flexibility, avoidance of lost energy costs, and dramatically reduced maintenance costs associated with stripper and exchanger fouling. The robust design affords reliable performance in a scalable, modular package that is appropriate for new capital projects, as well as placement in existing sour water units. Each system is designed to address the specific operational constraints of the facility.

The HRT system may be applied not only to total plant sour water systems for contaminant control, but also to individual sour water streams to recover valuable hydrocarbons lost to undercarry from separators or accumulators. Often, capacity creep or capacity expansions are not met with comparable increases in the capacity of ancillary product recovery or separator systems. Consequently, substantial product losses to the sour water system may occur. Recovery of product hydrocarbon from specific point sources in the sour water system can reduce the overall hydrocarbon burden on the strippers and may also result in significant annual product recovery values.

Free hydrocarbon recovery efficiencies of the HRT technology have been demonstrated at greater than 99.8% with hydrocarbon concentrations greater than 5%, and with hydrocarbon specific gravities above 0.9, allowing effective separation of hydrocarbons as heavy as gasoils. The HRT technology assists in maintaining a balanced system that provides higher system reliability and energy efficiency, as well as reduced potential for emissions, product loss and stripper maintenance. ●

IMPROVE RELIABILITY, FLEXIBILITY, THROUGHPUT AND PROFITABILITY

Crude unit fractionators are susceptible to ammonium chloride and amine hydrochloride salt formation, especially when running lower overhead temperatures or operating with a cold reflux or pumparound return. When these chloride salts form, they result in severe corrosion and fouling from salts and corrosion products formed in the tower, compromising unit reliability and profitability.

Athlon Solutions' CSC (Chloride Salt Control) technology is a patented, high-base strength chemistry that effectively removes and prevents salt formation. In salt removal applications, the CSC displaces any other bases from existing deposits to form its own salt. In salt prevention, the CSC acts as a chloride scavenger that selectively forms a salt with the chloride in place of that salt's counter ion. The salt resulting from CSC technology has multiple advantages because of its low corrosivity and excellent mobility, allowing refiners to improve reliability, maximize unit flexibility, and increase or recover throughput and profitability.

Case history: Proven amine displacement. Lab testing conducted with both pure salts and salt-containing deposits has confirmed the effectiveness of CSC in displacing weaker bases. Field verification was also desired. One US refiner experienced salt formation in the top section of its tower. The overhead temperature operated above the salt point, but the cold pumparound return led to shock condensation and associated salt and corrosion product buildup.

A CSC trial was implemented to determine if lab displacement results could be confirmed. During the CSC injection, cyclohexylamine, a steam neutralizer in use, was measured at higher than normal levels in the pumparound. This gave field confirmation that the CSC does displace weaker bases in refinery process systems.

Case history: From cleaning to continuous challenge. A Gulf Coast refinery began experiencing fouling issues in its atmospheric crude tower, which resulted in a reduction in crude charge rate. This tower operates with a low overhead temperature (approximately 200°F) to maximize distillate. Ionic modeling predicted that both MEA hydrochloride and ammonium chloride salts were forming inside of the tower. While MEA forms a liquid salt and ammonia forms a solid salt, both are very corrosive and can lead to an accumulation of corrosion product.

Solution and benefits. The CSC technology was selected for a trial to attempt removal of the chloride salts. Upon application, a spike in chlorides was observed in the heavy naphtha draw, indicating successful salt movement from the tower. The CSC trial recovered 25% of the crude charge rate and was considered a success. The unit later went into turnaround. Since starting up, the CSC has been injected on a continuous basis to prevent the harmful chloride salts from forming. No evidence of increased pressure drop, which the refinery expected, has been observed with this continuous application in place, allowing the refinery to continue operating at a low overhead temperature without fouling limitations impacting profitability. ●

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Reimagine the advanced process control paradigm

ALLAN KERN, APC Performance LLC

In the wake of robust advanced process control (APC) activity over the past several decades, industry now finds itself with an APC paradigm that is largely obsolete, often unhelpful and sometimes misleading. The time is opportune to rethink APC, to shape an updated, more accurate, realistic and useful paradigm from today's vantage point, and to form the basis for greater APC accomplishment going forward.

Role of APC. A traditional and fundamental way to summarize the essential role of APC in real-time process control and optimization is shown in **FIG. 1.** It can be elaborated upon as follows:

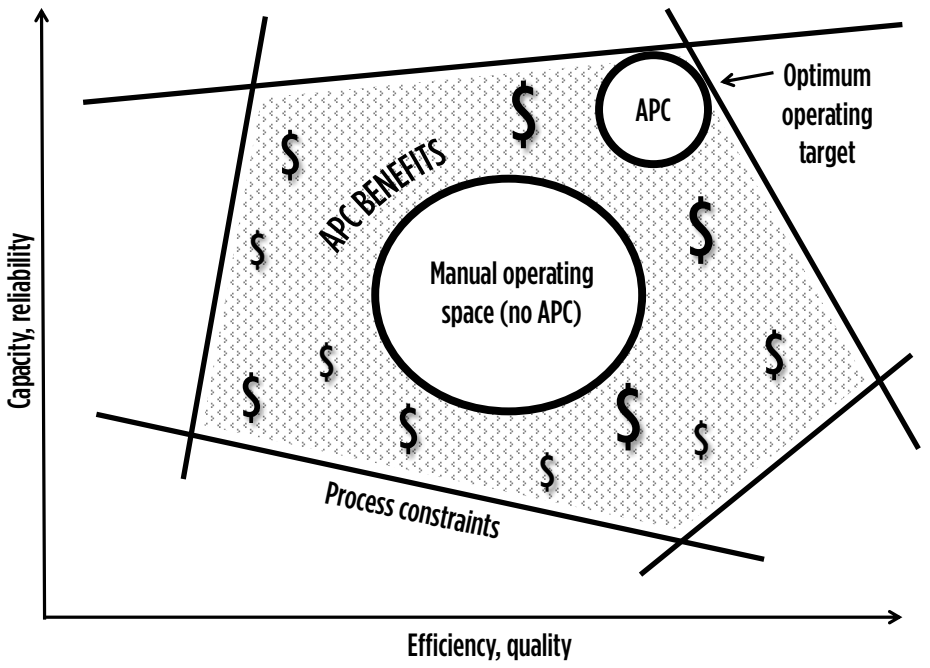

FIG. 1. APC earns benefits by holding the process closer to constraints than manual control, even as the process operating point and constraint limits move dynamically.

- APC can keep a process closer to constraints, because its automated nature can move the process away from encroaching constraints in a responsive and reliable manner, should that become necessary due to unexpected disturbances or changes in process conditions. By the same token, APC can automatically pursue constraints as they move further away, to capture additional earnings.
- In the absence of an automated APC application, operators tend to keep the process further from constraints to provide greater time to respond and a wider margin of error, should manual intervention become necessary. This greater distance from constraints typically translates into a cost penalty in terms of an incremental loss of capacity, yield, energy efficiency, etc.

This way of viewing and understanding the essential role of APC in process operation remains useful and valid today. However, several other aspects of the original paradigm have grown obsolete, unhelpful or even misleading.

Legacy APC paradigm. **TABLE 1** summarizes several gaps between the legacy APC paradigm and a reimagined paradigm that embraces experience gained, lessons learned, and more realistic goals and expectations. Where issues remain unresolved (as several core issues do), the reimagined paradigm fills in with promising possibilities, providing an APC vision going forward.

One pillar of the conventional paradigm is that APC is highly specialized and can be expected to remain so. However, the general trend in the reimagined paradigm is to evolve APC toward a core competency at the industrial process operation level, where more agile, affordable and smaller-footprint multivariable control tools are required to meet both process automation and process operation objectives (**FIG. 2**).

The gaps in the existing paradigm have undermined efficient communication between stakeholders and impeded progress. An updated paradigm that more accurately reflects up-to-date technology, and that accepts alternatives to some of the persistent root issues that have impeded APC progress in the past, will help APC to move forward again more rapidly. ●

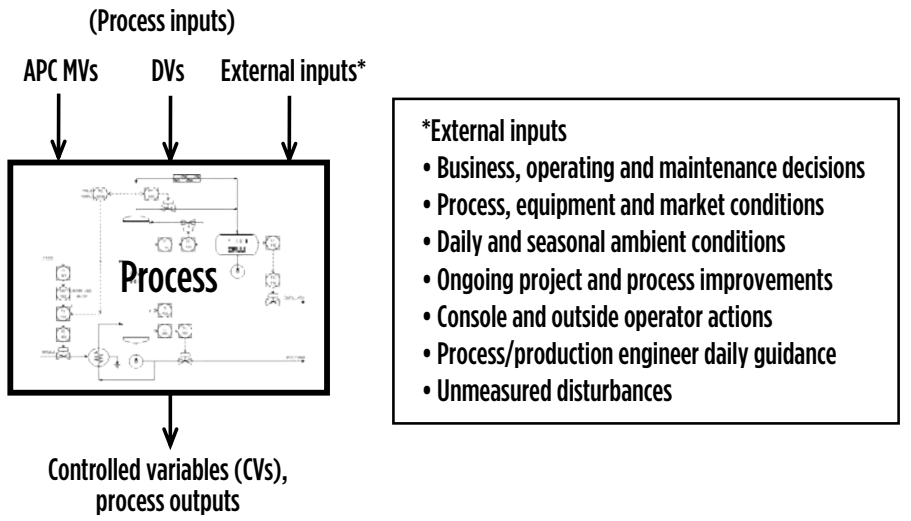

FIG. 2. Many factors affect a process' controlled variables (CVs), making it problematic to identify the particular contribution of APC to benefits or performance.

LYONDELLBASELL BEGINS CONSTRUCTION OF PO/TBA PLANT

LyondellBasell has begun construction of what will be the largest propylene oxide (PO) and tertiary butyl alcohol (TBA) plant ever built. The $2.4-B Houston-area project represents the company's single-largest capital investment. Once in operation, the plant will produce 470,000 metric tpy of PO and 1 MM metric tpy of TBA. Startup is planned for 2021.

To optimize product balances and realize synergies between LyondellBasell sites, two facilities will be constructed on existing manufacturing sites. The 140-acre PO/TBA plant will be built at the LyondellBasell Channelview Complex located in Channelview, Texas while an associated 34-acre ethers unit, which will convert TBA to oxyfuels, will be built at the company's Bayport Complex in Pasadena, Texas.

Based on an analysis by the Greater Houston Partnership, LyondellBasell's PO/TBA project is estimated to generate more than $453 MM in tax benefits for the county, school district, community college and other local taxing districts over a 10-year period.

PO is used to make bedding, furniture, carpeting, coatings, building materials and adhesives, while TBA will be converted to two ether-based oxyfuels, methyl tertiary butyl ether (MTBE) and ethyl tertiary butyl ether (ETBE). Both MTBE and ETBE are high-octane gasoline components that help gasoline burn cleaner and reduce emissions from automobiles. ●

TABLE 1. A legacy APC paradigm and a reimagined paradigm (or vision)

Legacy (obsolete) APC paradigm	Updated APC paradigm and vision
APC is essentially synonymous with model-based predictive multivariable control technology (MPC), and is often exclusive of other approaches to APC.	APC refers to "a broad range of techniques and technologies implemented within industrial process control systems," including MPC and advanced regulatory control (ARC), especially where more agile, higher-frequency, higher-availability, more specialized or smaller-footprint solutions are desired.
Process models are central to APC technology. The majority of APC activities center around obtaining and maintaining large numbers of detailed models. Most aspects of performance are related to model quality.	Model-based control theory is sound, but over-emphasis on models can be counter-productive. Sustained model accuracy is often impractical to achieve, since many process responses change frequently or dynamically. Models that are dynamic and not static pose a fundamental conundrum for model-based control. APC must re-orient itself so that high-fidelity models are the exception, not the rule.
An embedded optimizer is also an integral part of APC applications. The optimizer solves for both the optimum steady-state solution and the optimum path (minimum cost or error) to the steady-state optimum.	The optimum steady-state solution, or target operating point, is always well-known to the operating team, from the planning unit down to console operators. Targets can be entered directly into the APC application, rather than dynamically solved. An embedded optimizer is often redundant and unnecessary, while compounding application cost and complexity.
The greater the number of variables and models, the more complete the solution. Matrix designs comprising dozens of variables and hundreds of models are common and are considered good practice.	Operating personnel typically utilize a much smaller set of variables to manage and optimize their processes. The greater the number of variables and models in APC, the less reliability and higher cost the application will have. Established operational practice provides the most effective basis for matrix design.
APC is a new concept and technology made possible by computers.	Multivariable control has always been a central concept of industrial process operation, and has historically been carried out manually by operators. MPC is one way to automate this function. Noably, other non-model-based solutions, such as automating the methods used by operators, do not rely on detailed models, an optimizer or an outsized matrix.
APC is the way to achieve aggressive profit maximization.	The value of APC lies in alternately backing away from encroaching constraints and pursuing receding constraints (as explained above), while carefully observing process speed limits and preserving process stability. Aggressive minimization of transient error is usually neither a large earner nor desirable behavior in industrial process operation.
The current APC paradigm is well suited to the industrial process operation environment.	High cost, high maintenance, low agility, specialized support, short lifecycle, etc., are strongly misaligned with industrial process operation and flexible manufacturing criteria in modern complex refineries.
APC economics are solid. APC costs can be high, but the earnings are worth the investment. APC makes millions of dollars per year.	APC economics remain an area of concern. Costs have not decreased. High maintenance, specialized support and performance monitoring were unplanned and have added further costs of ownership. Meanwhile, benefits have not been as tangible as hoped and often remain a matter of faith (**FIG. 2**). Costs, maintenance and benefits must come into alignment.
APC control performance is excellent and far exceeds what can be accomplished without APC, in terms of multivariable control and optimization.	Performance also remains an area of concern. Degraded performance, low utilization and short lifecycles remain common problems. The question remains whether less complex, less expensive and smaller-footprint solutions can successfully automate the core multivariable control applications and capture the benefits.
APC is inherently specialized and technical, and warrants a special place in terms of budgeting, scheduling, planning, support, etc. This can be expected to continue in the future.	Multivariable control is fundamental to process control and operation, and must become a core competency at operating facilities—i.e., applications that reside at the DCS level, support that falls within the scope of onsite control engineers, sustained maintenance-free lifecycles, costs and schedules that fall within normal operating plans, etc.

2018 SUMMIT SPEAKER AND PANELIST BIOS

OPTS GENERAL SESSION

Dawn Wurst, VP of Process & Asset Safety, Georgia-Pacific Chemicals LLC
Monday, October 1, 8–8:55 a.m.

Dawn Wurst is the Vice President of Process & Asset Safety for Georgia-Pacific, part of Koch Industries. Ms. Wurst has 25 years of EH&S experience in the refining industry, including primarily safety and process safety roles. Before joining Georgia-Pacific in 2017, she worked for 22 years with Flint Hills Resources, where she most recently led the Process Safety capability. Ms. Wurst earned her BS degree in engineering from the University of Wisconsin-Madison and was a founding member of the API 754 Committee for Process Safety Metrics.

OPERATIONAL PLANNING, CONTROL & AUTOMATION TECHNOLOGIES (OPCAT) SESSION

Dr. Fani Boukouvala, Assistant Professor, Georgia Institute of Technology
Monday, October 1, 9–10 a.m.

Scientific discovery relies heavily on computer simulations, and the roles of computer simulations and data are continuously growing. At the same time, advanced instrumentation is enabling the collection of large amounts of data. Dr. Boukouvala's research interests lie in the interface of traditional process systems engineering, mathematical programming and advanced data analytics for the development of novel modeling and optimization tools, driven by applications in energy and pharmaceuticals. Dr. Boukouvala holds a BSChE degree from the National Technical University of Athens, Greece and a PhD in chemical and biochemical engineering from Rutgers University.

CYBERSECURITY OENING KEYNOTE

Dale Peterson, Chairman, S4 Events
Monday, October 1, 9–10 a.m.

Dale Peterson secures industrial control systems (ICS). For more than 15 years, he has been on the leading edge helping security-conscious asset owners effectively and efficiently manage risk to their critical assets. He has pioneered numerous ICS security tools and techniques, such as the first-intrusion detection signatures for ICS that are now in every commercial product. In 2007, Mr. Peterson created S4 Events to showcase the best offensive and defensive work in ICS security and to build a community. S4 is now the largest and most advanced ICS event in the world. Mr. Peterson is constantly pushing the ICS community to move faster and get better.

CLOSING KEYNOTE

Jeffrey Gray, Deputy Chief, Control Systems Training Section of the National Cybersecurity Training and Exercise Center of Excellence, National Cybersecurity and Communications Integration Center, DHS
Tuesday, October 2, 4:30 p.m.

Jeffrey Gray is the Deputy Chief, Control Systems Training Section, of the National Cybersecurity Training and Exercise Center of Excellence. He is responsible for building a dynamic system of public-private partnership among government and private asset owners within the nation's 16 critical infrastructure sectors, reducing risk to control systems via training and awareness. Mr. Gray has more than 25 years of experience in government and military roles in communications, operations and administration. He served in various capacities during his career, including duty stations at the USAF Space and Missile Systems Center in El Segundo, California, the National Defense University and the Defense Information Systems Agency. Additionally, Mr. Gray commanded both the Combat Photography flight and the Plans and Programs flight for the Air Force's 1st Combat Camera Squadron. He is a veteran of Operation Enduring Freedom and Operation Iraqi Freedom, and a graduate of the University of Alabama.

PANELISTS

Saeed Al Alloush, Saudi Aramco

Christian Arnoux is a Process Engineering Manager for Valero's Benicia, California refinery. Previously, he was a Senior Refinery Models Engineer for Valero in San Antonio, Texas from February 2016 to August 2018. His responsibilities in the simulation models group included developing, maintaining and supporting use of multiple refinery planning, scheduling and process simulation models with a focus on reforming and alkylation. Prior to Valero, Mr. Arnoux worked in field operating services for UOP-Honeywell, assisting on process unit startups, checkouts and troubleshooting across various UOP licensed technologies worldwide. Mr. Arnoux holds a BS degree in chemical engineering from the Illinois Institute of Technology in Chicago, Illinois and has 10 years of experience in the hydrocarbon processing industry.

Travis Beltz is Manager, Technical Services, Illinois Refining Division for Marathon Petroleum Co. Mr. Beltz joined MPC in 1995 as a Tech Services Engineer within the Illinois Refining Division. He has held positions of increasing responsibility in various refining roles in technical services, operations and product control at multiple MPC locations, including the Detroit refinery in Michigan, the Galveston Bay refinery in Texas, corporate headquarters in Ohio and the Robinson refinery in Illinois. Mr. Beltz received a BS degree in chemical engineering from the Rose-Hulman Institute of Technology.

Robert Boettger, HollyFrontier

Bill Cates, Hunt Refining

Jeff Caton, Axens North America

Tiffany Clark began her career with BASF as an FCC Account Manager in late 2017. Prior to joining BASF last year, she worked for Marathon Petroleum Co. for 15 years. She has spent approximately half of her career supporting FCC operations in both technical service and operations roles, in addition to multiple roles in process engineering, refinery economics, planning and scheduling, and process safety. Ms. Clark earned a BS degree in chemical engineering from Texas A&M University and an MBA degree from the University of Houston.

Jeff Crouch, DuPont Clean Technologies

Neil Howard is a Senior Staff Engineer in Chevron's Technology Marketing Group. He has served various functions within Chevron Lummus Global (CLG) and Advanced Refining Technologies (ART) over the last 10 years. He now directs his efforts toward hydrocracking technical service, technical proposal development for catalyst reloads and hydrocracking catalyst development support. Mr. Howard holds a BS degree in chemical engineering from the University of California at Davis and has more than 30 years of refining industry experience.

Michael Kimbrell has 40 years of industrial experience in petroleum refining and petrochemical manufacturing, as well as heavy oil processing with a specialty in delayed coking since 2004. Mr. Kimbrell has served in roles in operations management in crude oil distillation; vacuum tower operation; delayed cokers; sulfur recovery units, including Claus and tail gas units; hydroprocessing units, including vacuum gasoil, diesel and naphtha hydrotreaters; and semi-regen catalytic reformers. His process design experience includes revamps to crude and vacuum units, two new delayed cokers, a combined-cycle cogeneration plant and a tail gas unit.

Alec Klinghoffer is an Operations Superintendent at CVR Energy, Wynnewood refinery, and is responsible for managing the operation of the FCC, Prime G, olefin treater and HF alkylation units. Previously, Dr. Klinghoffer spent three years as a Senior Economics and Planning Engineer at the Wynnewood refinery. He has held various technical and operations positions over his career. Before returning to CVR Energy, Dr. Klinghoffer took a sabbatical from the oil industry and served as the Operations Superintendent at Kior Inc., a biodiesel company that converted biomass (wood chips) to diesel fuel. His duties included hiring and training new operators, writing operating procedures, and providing operations and technical support to complete and start up the full-scale plant in Columbus, Mississippi, after which he returned to CVR Energy. He began his career at R&D with Phillips (and subsequently ConocoPhillips) working on SZorb and FCC operation and catalyst research. Dr. Klinghoffer has participated on previous FCC and gasoline panels at AFPM. He holds a BS degree in chemistry from Towson State University and a PhD in chemical engineering from Texas A&M University.

Casey Lang is a Senior Process Engineer for Merrick & Co. in Greenwood Village, Colorado. During his career, he has implemented process and optimization initiatives for technology upgrades that maximize equipment performance and incorporate industry best practices for FCC, HF alkylation and reformer/isomerization units. Mr. Lang has extensive experience in FEL development, process hazard analysis and reliability-centered maintenance programs, including root cause investigations, failure mode and effect analyses and risk prioritization. Mr. Lang holds a chemical engineering degree from New Mexico State University and has more than 18 years of experience as a process specialist and project engineer for large US energy companies and refineries.

Minaz Makhania is an FCC Technology Services Specialist based in UOP's regional office in Delhi, India. In her present role, Ms. Makhania is responsible for providing monitoring, troubleshooting, training, optimization, startup and turnaround support for UOP-licensed FCC units in FEI and Africa regions. She has 15 years of experience in the refining industry, with the majority in FCC technology. She has spent six years in UOP FCC technology services. Prior to joining UOP, she worked for Reliance Industries Ltd. at the Jamnagar refinery in India. Ms. Makhania earned her BS degree in chemical engineering from Saurashtra University in Rajkot, Gujarat. She is pursuing a PhD in chemical engineering from the Indian Institute of Technology in Delhi.

Gayl Mercado is a Technologist at Axens North America, covering Axens' gasoline pool and olefin technologies. Ms. Mercado has held several positions within Axens during her 10-year career, covering the full portfolio of technologies and services provided by the company. During her career, she has supported process engineering, technical services, strategic client analysis, intellectual property and technical proposal development. In her present role as a Technologist, she is responsible for the development of catalyst and process licensing proposals in the gasoline and olefins fields, technical support for the clients and technologies she covers, and providing guidance to other departments within the organization. Ms. Mercado holds a BS degree in chemical engineering from the University of Delaware.

Brandon J. H. Payne is a Lead Products Application Engineer for SUEZ Water Technologies & Solutions, HPI Corrosion, in The Woodlands, Texas. He is responsible for technical support, program development and application optimization for the company's refinery process chemical programs used in refinery corrosion management. He has process engineering, project engineering and chemical consulting experience in refineries across North America and in the Middle East. Mr. Payne holds a BS degree in chemical engineering from the University of Illinois Urbana-Champaign, has more than 20 years of experience in the hydrocarbon processing industry, and is a licensed Professional Engineer in the states of Illinois and Michigan.

Tim Shepperd is Vice President of Technical Services for HF Alkylation Consultants (HFAC) based in Baton Rouge, Louisiana. Since 2014, he has led the technical team that provides support for the safe and profitable operation of more than 125 HF alkylation units around the world. HFAC's team of consultant/engineers are counted among the very best in the industry. Mr. Shepperd has spent almost his entire 30-year career involved with HF alkylation units in engineering, licensing and operations for Mobil, ConocoPhillips, UOP and HFAC.

Robert Steinberg is a Hydroprocessing Subject Matter Expert for Motiva Enterprises in Houston, Texas. He assists process engineers, supports operations for all of Motiva's hydrotreaters and hydrocrackers, and is responsible for catalysts, technology and projects for these units. Mr. Steinberg has design and operating experience with hydrotreaters, hydrocrackers and lube oil production in North America and Europe. He earned BS and MS degrees from MIT and has more than 36 years of experience in the refining industry.

Dewey Stuart is the Process Engineering Specialist for FCC, alkylation and coking units at Motiva Refining in Port Arthur, Texas. He has been associated with FCC technology and has gained experience in abnormal situation management, various startup and shutdowns, turnarounds, unit optimization, process hazard analysis, catalyst changes and modernization projects. Mr. Stuart also has previous experience with crude distillation units and three years of general industry troubleshooting and diagnostics services. He earned his BS degree in chemical engineering from Lamar University in Beaumont, Texas.

Lance Tallman joined CITGO Petroleum in 2004 as a Process Design Engineer in the strategic planning and capital projects department. He transitioned to the operations engineering department in 2008 and held various process engineering unit assignments, including vacuum and solvent extraction units at the lube and wax facility, SRUs, TGTUs, ULSD HT and Cat gasoline HT. He then moved to the business optimization group in 2011 and held various positions, including Gasoline Blender and Clean Products Planner in the logistics group and LP Analyst in the economics group. Mr. Tallman moved back to the operations engineering department and served as the Process Engineering Group Leader, covering the wastewater, alkylation, amine regeneration, SWS, SRUs, TGTUs and treating areas. He earned a BS degree in chemical engineering from McNeese State University and has more than 14 years of experience in the refining industry.

Wendy F. Wildenberg is a Technical Leader, primarily in hydroprocessing technology for Flint Hills Resources. She spends her time working on large capital projects in hydroprocessing areas, as well as training/mentoring, troubleshooting, process safety improvements, increased reliability and improved optimization in hydroprocessing and biodiesel technologies. During her 26 years of experience with FHR/Koch, Ms. Wildenberg has held a variety of technical and operational roles, working out of the FHR-Pine Bend location. She earned a BS degree in chemical engineering from the University of Wisconsin-Madison. ●

Considerations for helical piles on revamp petrochemical and refining projects

ERIC WEY, FLUOR

While helical piles have been used for many years on petrochemical and refining revamp projects, their use has been restricted due to load capacity limitations and skepticism about performance. However, when installing in low-overhead conditions or for temporary foundations, helical piles (FIG. 1) can provide shorter installation schedules and improved economics.

Based on several recent US Gulf Coast petrochemical projects, seven points should be considered when selecting pilings for a project:

1. **Not all helical piles are created equal.** The ultimate axial capacity of helical piles depends on the soil bearing at the helices. Even "off-the-shelf" helical piles, with limited capacity, may need to be adjusted in length due to site-specific bearing depths. This adjustment can be determined only through a site soil investigation.
2. **Specification and design issues.** Use a project specification to cover detailed topics specific to the facility and the expected performance of the helical piles. Topics should include allowable stress design factors, allowable settlement, lateral deflection limitations, corrosion and installation torque.
3. **Settlement issues.** Helical piles must undergo significant axial settlement to reach ultimate axial capacity due to bearing on the helices. The amount of axial settlement at the allowable capacity, using a typical factor of safety on ultimate capacity, may be too large for petrochemical structures with interconnecting piping and sensitive equipment nozzles. In these cases, reductions in allowable axial capacity may be appropriate. In soil conditions that are primarily cohesive with no clearly defined high-capacity bearing layer, allowable capacity limitations based on shaft skin friction capacity should be considered.
4. **Corrosion issues.** Several options exist to manage the corrosion issues associated with helical piles, including steel thickness corrosion allowance, galvanizing, fusion-bonded epoxy and filling the shaft annulus with grout or concrete. The most recommended solution is often a steel thickness corrosion allowance, because the thickness is often governed by installation torque, which does not need to include the corrosion allowance.
5. **Advantages in low-overhead installation and temporary foundations.** The two main choices for low-overhead pile installation in refinery revamp projects are auger cast-in-place piles (auger cast piles) and helical piles. Low-overhead auger cast piles require the auger to be installed in sections until the final depth is reached. The same auger sections must be removed individually as the auger is withdrawn and the grout is installed. Low-overhead helical pile sections are torqued into the soil once; therefore, they are installed at a faster rate than low overhead auger cast piles. Helical piles also have an advantage as temporary foundations because they can be unscrewed out of the ground and reused if undamaged.
6. **Limitations.** Although large, custom-designed helical piles have been proven by pile testing to have much higher capacities than smaller, off-the-shelf helical piles, they are incapable of achieving the capacity of other, larger-diameter driven or cast-in-place piles. In addition, the large settlements expected at allowable pile loads make the use of helical piles a poor choice for deflection-sensitive petrochemical equipment.
7. **Economics.** High steel costs for helical piles make their material costs higher than those of concrete cast-in-place piles. Cost savings in the time and labor for installation can sometimes make up the difference, especially in low-overhead installation conditions. In addition, auger cast pile installation creates significant soil spoils, which can be very costly to dispose of if contaminated. On the contrary, helical piles do not create spoils during installation, and so those costs can be avoided. When included in the total cost of pile installation, contaminated soil remediation avoidance can make helical piles more economical than other pile solutions where remediation cannot be avoided.

FIG. 1. Custom-designed helical piles have been used successfully on a number of recent petrochemical revamp projects.

Takeaway. Custom-designed helical piles have been used successfully on a number of recent petrochemical revamp projects. When installed in low-overhead conditions or for temporary foundations, helical piles can provide the shortest installation schedule, least soil spoils, least field hours for installation and the most economical solution. ●

NEW STANDARD IN PROCESS HEATING CONTROL AND MONITORING

Thermon Group Holdings Inc. has unveiled its TraceNet™ Genesis control and monitoring system for managing heat trace circuit performance on process lines, tanks and instrumentation.

Thermon TraceNet Genesis skid.

The TraceNet Genesis System provides instant access to comprehensive heat trace circuit information, including circuit performance history, fault analysis and circuit drawings. The system provides instant on-panel access to heat trace circuit performance trending and histories of up to 6 mos, for up to 72 heat trace circuits.

A 6-mos history that reflects, for example, fluctuations or a steady decay in temperature can indicate that the system requires inspection to determine whether the thermal insulation is being compromised or if an individual heater is not operating properly. By analyzing this data, maintenance engineers can assess the timing, process operating conditions and any undesirable symptoms as early indicators of future problems.

The TraceNet Genesis System allows circuit isometric drawings to be stored and viewed locally at the heat trace panel. As a result, maintenance engineers can quickly determine the circuit's precise location and quickly respond to alerts. An easy-to-navigate touchscreen user interface offers a modern and intuitive user experience similar to mobile device apps and gives a simple overview of the overall system, showing the operating status of 72 circuits at a glance. With a single touch, the user can easily navigate into circuit details to modify setpoints, manage alarms, see trending or view a drawing. All prompts are self-explanatory, and users can master the system within minutes with little or no training. The TraceNet Genesis System supports eight different languages: English, Arabic, Chinese, Spanish, French, Japanese, Korean and Russian. ●

CATALYST, continued from page 4

ity, where the catalyst activity plays a strong role. The amount of mono-aromatics in the product originates from feed mono-aromatics, such as heavily substituted benzene structures, and various substituted naphthenic structures. Mono-aromatics are also created from cascading the poly-aromatics through saturation to mono-aromatic compounds. The much lower reactivity of the mono-aromatic compounds requires a more powerful catalyst with the strongest hydrogenation functionality.

The data in **FIG. 3** illustrates that TK-6001 HySwell provides a much larger volume swell than the hydrocracker pretreatment catalysts at the same operating conditions. In addition, the reactivity of the feed for the downstream hydrocracking catalysts is substantially increased, which means that it is easier to crack. The increased hydrogenation activity enhances the unit flexibility in terms of the required liquid hourly space velocity (LHSV) and/or the required temperature to achieve a given conversion.

Despite the low feed aromatic content in this SR VGO feed, TK-6001 HySwell delivers 20% higher volume swell compared to TK-611 HyBRIM at hydrocracker pretreatment conditions. This volume swell for this specific hydrocracking unit represents an additional estimated profit of $40 MM/yr, even after subtracting the cost of the extra H_2 that is consumed in the hydrotreater.

Takeaway. The higher activity of TK-6001 HySwell compared to the second-generation TK-611 HyBRIM catalyst unlocks additional flexibility to obtain longer catalyst cycles, more throughput, better product qualities and the possibility of processing more severe feedstocks. The activity boost can be translated into significantly lowering the reactor temperature in hydrocracker pretreating units and ULSD units, while simultaneously obtaining the same conversion of sulfur and nitrogen. TK-6001 HySwell catalyst will improve the overall profitability and economy of all hydrocracker pretreating units and ULSD units in multiple ways. ●

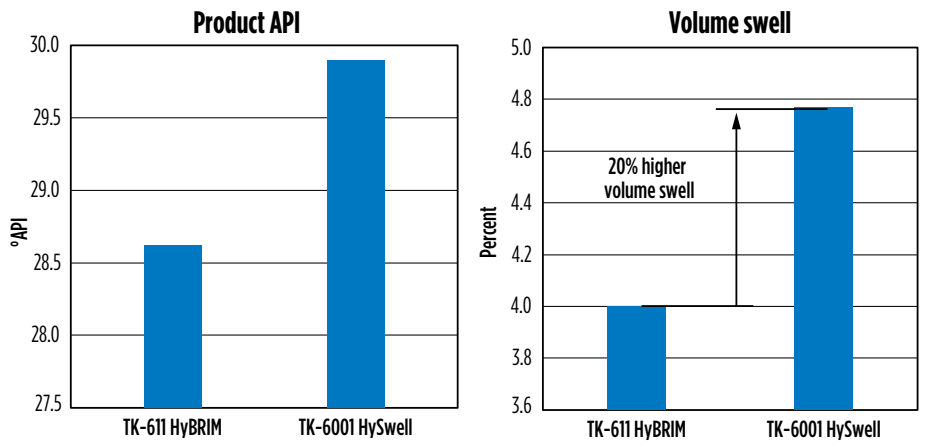

FIG. 3. Obtained volume swell with HyBRIM and HySwell catalysts in hydrocracker pretreatment service.

THOMPSON: AFPM EMPOWERING INDUSTRY EMPLOYEES TO TELL OUR STORIES

At AFPM, we are proud of the contributions that our workforce makes to the strength, prosperity and well-being of our country.

As I travel the US meeting with our workforce, I am constantly reminded of how connected our facilities are to their communities, and how dedicated our employees are to making their communities a better place. From staffing the local volunteer fire department to supporting local schools, to making heroic rescues during hurricane Harvey, our industries' employees do not just make great products, they are also great people.

The world needs to hear more about our products and why we make them, and about our people. We have not always been great at sharing the positive impact of our work. AFPM is on a mission to change the narrative of our industries, and as our most trusted spokespeople, industry employees must be part of the chorus.

That is why we launched EMpower, a new program designed to provide our employees with a greater voice and the tools needed to accurately tell the story of the fuel and petrochemical manufacturing sectors.

At empower.afpm.org, industry employees can view videos and download fact sheets and infographics about what we do, how we do it and why it is important. AFPM also has training programs for employees who are involved in their communities to learn how to have more constructive conversations about our industries. All resources were developed with the input of hundreds of industry employees, and we are always adding more.

If you would like more information about how your company can take advantage of these resources, please contact us at empower@afpm.org. ●

Process enhancements return summertime profits to winter levels

UMESH MATHUR, Aggreko

Summertime does not necessitate a drop in refinery throughput or the output of lower-quality products when compared to winter levels. Historical data shows that performance of equipment in plants dramatically worsens when high temperatures and humidity are present.

For years, facility managers were resigned to accepting degradation in plant performance when ambient temperatures increase. They typically reduced throughput to maintain safe operations, environmental compliance and product purity. This had the knock-on effect of forcing upstream and downstream units to cut back on production, at a time when market demand typically peaks and profit margins are high.

Today, process enhancement with temporary chilling equipment can solve bottleneck issues and seasonal limitations, allowing facilities to operate at optimal throughputs year-round and maximize revenues.

Identifying the problem. Increased heat and humidity have a significant adverse impact on major heat exchange equipment throughout the plant, causing sub-par performance.

Cooling in most facilities relies on water from a cooling tower, ambient air or a combination of the two. Intensifying summer heat can raise cooling water temperatures by as much as 30°F above winter levels, and ambient air can be as much as 60°F–70°F warmer.

If the cooling water being used is 30°F warmer than winter levels, then process streams will also be 30°F warmer. This can dramatically increase volatile emissions, potentially causing the facility to be in violation of US Environmental Protection Agency (EPA) regulations.

It is possible to reverse these effects through strategic cooling. However, cooling the cooling water to process equipment is extremely inefficient from a thermodynamic viewpoint because it wastes much of the cooling provided. A far better approach is to cool the process stream directly. For example, normal cooling water could be replaced by a dedicated loop with a temporary cooling tower or refrigerated chiller. In other cases, a secondary exchanger can also be deployed to reduce stream temperatures by a further 10°F–15°F.

FIG. 1. A large-scale cooling tower deployment.

FIG. 2. NGL recovery: Targeted process cooling enhancements are profitable.

Closing the loop. A closed-circuit targeted cooling solution relies on a dedicated cooling tower or refrigerated chillers to drop process stream temperatures dramatically, even during the heat of summer. Installing rental heat exchangers, cooling towers or refrigerated mechanical chillers provides temporary, yet much-needed, relief from summertime heat (**FIG. 1**).

By reversing the effects of summer, it becomes feasible to return to normal winter capacity while maintaining product purities and observing environmental and process safety constraints. The improvements from these engineered solutions are evident immediately and can be implemented in days or weeks using rental equipment.

Since these production problems occur only during the summer months, it is generally difficult to justify capital projects (such as expensive mechanical refrigeration equipment) and the hiring of required specialists for operation and maintenance. Aggreko has delivered such seasonal solutions for thousands of projects over the last 15 years.

The economics of renting such equipment can deliver a 5:1–40:1 return on investment (ROI). The equipment itself can be safely inserted into a running plant without the need for a shutdown, and without creating discontinuity of any kind, in a few short days.

Maximizing LPG recovery. In the summer, as refinery cooling water temperatures rise, absorber lean oil temperatures increase markedly, often by more than 20°F when compared to winter conditions. This increases the loss of valuable propane to fuel gas.

A Gulf Coast refinery wanted to recover as much propane as possible for sale as LPG product by minimizing such losses to fuel gas. Aggreko Process Services developed the ideal cooling solution for the absorber column using auxiliary mechanical chillers and heat exchangers (**FIG. 2**).

The project enabled the plant to restore summertime propane recovery to levels seen only in the winter. A production increase of several hundred barrels per day of propane was achieved, yielding an economic benefit of more than $25,000/day. ●

UMESH MATHUR, P.E., is a Technology Advisor at Aggreko Process Services, based in Houston, Texas. He has worked for Aggreko for more than six years, and his industry experience spans 52 years in process technology, engineering design, plant operations, process control and real-time optimization. He has worked in major refinery, petrochemical, gas processing and fractionation plants around the world.

Welcome to Atlanta

As the capital and most populous city in Georgia, Atlanta is a booming metropolis with Southern charm and world-class sophistication. The city boasts a bustling nightlife; thriving and unique restaurants; a world-class theatre, music and arts community; one of the busiest airports in the world; and a diverse economy with dominant sectors that include commerce, finance, research, information technology, education, media, art and entertainment. With more than 30 universities and colleges located in the city, Atlanta is also a center for higher education.

Nestled in the foothills of the Appalachian Mountains (FIG. 1), the city was founded as a transportation hub at the intersection of two railroad lines in 1837. After the Civil War, the city rose from its ashes to become a national center of commerce and the unofficial capital of the "New South." During the 1960s, Atlanta became a major organizing center of the civil rights movement, with Dr. Martin Luther King Jr., Ralph David Abernathy and students from Atlanta's historically black colleges and universities playing major roles in the movement's leadership.

Out and about. Atlanta's parks, public spaces, nature preserves and rivers provide opportunities for the outdoor adventurer, such as hiking **Stone Mountain** or paddling down the **Chattahoochee.** Explore miles of the **Atlanta BeltLine** by foot or on two wheels. After working up an appetite, stop in one of the many restaurants along the path to relax and refuel. The 30-acre **Botanical Gardens** are nestled in the northern corner of **Piedmont Park,** and the lush gardens light up for special events and seasonal activities. **Centennial Olympic Park** pays homage to the city's Olympic legacy and offers downtown views in every direction. The **Georgia Aquarium, World of Coca-Cola, CNN Center, Center for Civil and Human Rights,** and **Chick-fil-A College Football Hall of Fame** are only steps away. **Atlantic Station** offers concert and event venues, restaurants, and major retailers and local boutiques in this walkable, outdoor shopping mecca.

Atlanta is passionate about its sports. It is one of the few US cities to boast professional teams from the country's most popular sports: the NFL's Atlanta Falcons, the NBA's Atlanta Hawks, the WNBA's Atlanta Dream, MLB's Atlanta Braves and MLS's Atlanta United FC. Atlanta was home to the 1996 Summer Olympic Games and will be hosting Super Bowl LIII at Mercedes-Benz Stadium (FIG. 2) on February 3, 2019. The Tour Championship, the final PGA Tour event of the season, is played annually at East Lake Golf Club. The Peachtree Road Race is the largest 10k road race in the country, attracting some 60,000 participants each Fourth of July.

While you are here, sample the varied and unique cuisine, talk to the friendly locals and enjoy the area's natural beauty. Wherever your Atlanta adventure leads you, this unique city is open and welcoming to visitors. •

FIG. 1. Atlanta's rolling hills and dense tree coverage have earned it the nickname of "the city in a forest."

FIG. 2. The unique Mercedes-Benz Stadium will host Super Bowl LIII in 2019.

Applying digital transformation to operational excellence

ROBERT GOLIGHTLY, AspenTech

No matter how you look at it, the real significance of digital transformation in energy is driving operational excellence. While technology certainly plays a large role in achieving this, it is the leaders and people within an organization who are responsible for seeing these efforts across the finish line.

To achieve operational excellence and increase productivity, companies in asset-intensive industries must first define a clear roadmap. Begin with the application or use case, and then work backward. This roadmap should align with the company's business objectives, have measurable outcomes and demonstrate very clear return on investment (ROI). It should also consider previous efforts to transform digitally, such as existing sources of digital data, models and architectures (**FIG. 1**).

One of the biggest use cases is asset performance management, using digital transformation to get the most out of existing assets. As part of a holistic asset optimization strategy, it offers energy companies the opportunity to minimize cost in a sustainable way to maximize productivity, minimize risk, and improve quality and energy management, as well as create competitive differentiation.

This approach to digital transformation is the winning combination in pushing operational excellence efforts across the finish line.

Downstream dreams, digital realities. Why does downtime matter for the downstream? AspenTech recently conducted a study of 240 energy industry customers and confirmed what most people know: improving reliability is a key refining objective, and the performance of different refining operations varies widely.

Unplanned downtime is an operational excellence challenge that should be addressed:

- 51% of the survey respondents reported an average yearly planned downtime of 25 days or greater, while 22% reported a much lower average of 10 days or less
- 34% reported unplanned downtime of more than 11 days/year, while 40% reported 4 days–10 days of unplanned downtime in an average year.

For a high-throughput refinery, one unplanned (or planned) day of downtime can put $4 MM or more of revenue in jeopardy against that refinery's monthly plan. Clearly, a razor-sharp focus on refinery availability—or, more broadly, reliability—is strategic.

Companies believe that a focus on technologies, such as machine learning, will enable them to better predict equipment failure and prescribe preventative and maintenance actions, and to do so long enough in advance to improve plant uptime. In fact, 40% of companies believe that this area of applied digitalization can save more than 16% of operating expenses (OPEX).

Change in market environment, change in mindset. Transitioning to an analytics-enabled, fact-based, decision-making culture is a journey that requires a change in mindset away from viewing plants as depreciating assets, to viewing them as drivers of business performance and sustainability. Asset optimization and asset performance management are adopted by energy industry leaders as sustainable drivers of growth. Maximizing the net return on energy production assets will become a strategic priority, not just an operational metric.

Data-based decision making (**FIG. 2**) means less reliance on expert-driven decision processes. The automation of knowledge work makes best practices discovered from data available to more people, inside the plant as well as throughout the enterprise. This enables faster and better decisions based on high-quality information that is extracted and distilled from multiple data points, representing a significant change in standard operating procedure for energy companies.

Looking ahead: Innovate to sustain. Changing industry dynamics offer oil, gas and chemical companies, and the engineering and construction firms that serve them, powerful opportunities to improve performance with a systematic approach to consistently obtain the highest possible returns from their assets.

Energy companies must act now, because early adopters are leapfrogging the laggards. Changes in organization and structure are needed to adapt to new and dynamic market forces that are imposing greater complexity on the industry today. For most companies, market leadership will require the continuous optimization of assets throughout the plant's lifecycle by aligning design, operational and maintenance processes to maximize production capacity, quality and profitability.

The US energy industry is showing signs of significant re-energization. To remain competitive, geopolitics aside, energy firms need sustainable competitiveness, which will require breakthrough innovation that offers profitability, as well as the ability to sustain optimal performance and operational excellence over the long term. ●

FIG. 1. To increase operational excellence, companies must develop a clear roadmap that aligns with its business objectives, has measurable outcomes and demonstrates clear ROI.

FIG. 2. Decision-making based on high-quality information that is extracted and distilled from multiple data points represents a significant change in standard operating procedure for energy companies.

ROBERT GOLIGHTLY is Product Marketing Lead for the AspenTech Asset Performance Management suite. Previously, he managed the product marketing function for the company's Advanced Process Control and Manufacturing Execution Systems product lines. His professional background includes work for SaaS provider FineTooth, as well as Pavilion Technologies.

Stepper drive internationally certified for use in hazardous locations

ERIC RICE, Applied Motion Products

Applied Motion offers the first and only step motor drive internationally certified for use in hazardous locations. The STAC6-Q-H stepper drive (**FIG. 1**) is ATEX and IECEx certified for Class I, Zone 2 locations, and UL certified for Class 1, Div. 2, Group C & D locations. The HazLoc step motor drive is approved for use in hazardous industrial applications throughout the US, Canada, Europe and the Middle East.

Addressing the need for step motors in hazardous locations in the oil and gas industry, among others, the STAC6-Q-H stepper drive operates in environments where flammable gases, vapors or liquids may be present in the air in quantities to produce explosive or ignitable mixtures. Applications across a broad range of industries include driving a step motor to control the braking and speed of the drill string of an oil rig.

Powered by single-phase 120 VAC that generates a nominal 160 VDC internal bus, the STAC6-Q-H provides superior performance when paired with high-quality NEMA 23, 24, 34 or 42 frame step motors. An advanced anti-resonance algorithm ensures optimal torque over a wide speed range, while microstepping to 51,200 steps/rev provides for smooth, high-resolution positioning.

An encoder feedback option is available for enhanced system accuracy using Applied Motion's Stall Detection and Stall Prevention features, which overcome the limitations of open-loop step motor systems. The drive can run stored programs created with Applied Motion's Q programming language and has enough input/output signals to connect to multiple external devices or sensors.

Key features include:

- Torque ripple smoothing
- High power output for medium and large step motors
- Seven digital inputs and three digital outputs, all optically isolate
- Two analog inputs, +/–10 volt range.

The development of the STAC6-Q-H stepper drive is the result of Applied Motion's dedication to developing high-performance motor drives that meet specific customer needs. The drive offers the same high level of performance provided by existing STAC6 stepper drives, while adding certification for use in hazardous locations. It is the only stepper drive in the world that is certified internationally by UL, ATEX, and IECEx. This global coverage gives Applied Motion's partners operating in hazardous environments in the oil, gas and printing industries a best-in-class solution for their motion control applications. The hazardous location rating on this drive minimizes the cost and time involved in gaining regulatory compliance. ●

FIG. 1. The hazardous location rating on Applied Motion's STAC6-Q-H stepper drive minimizes the cost and time involved in gaining regulatory compliance.

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Baker Hughes, a GE company	29
BASF Corporation	36/37
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Chem32 LLC	11
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Chevron Phillips Chemical Company LP	4
Clariant	9
ClearSign Combustion Corporation	13
CRI Criterion Inc./Shell Global Solutions	46
Crystaphase	23
The Dow Chemical Company	43
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Emerson Automation Solutions	45
Eurecat U.S.	24
Forum Energy Technologies	10
Haldor Topsoe Inc.	21
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Matheson	6
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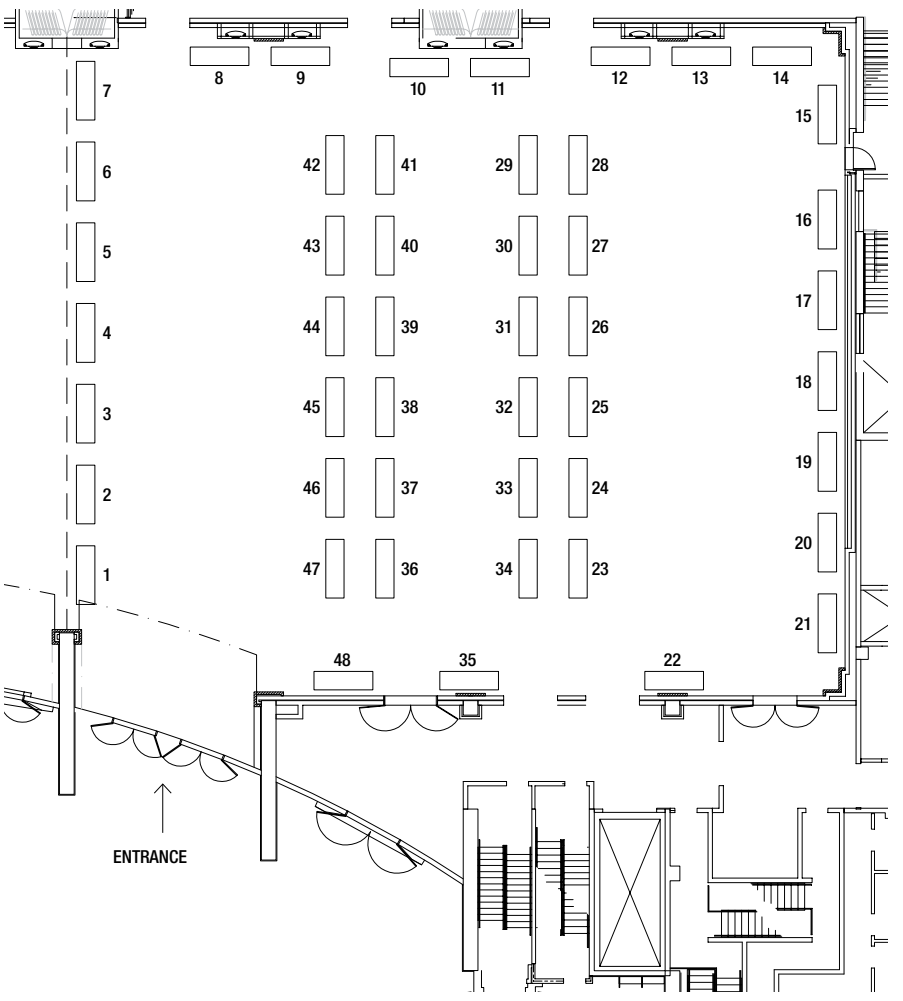
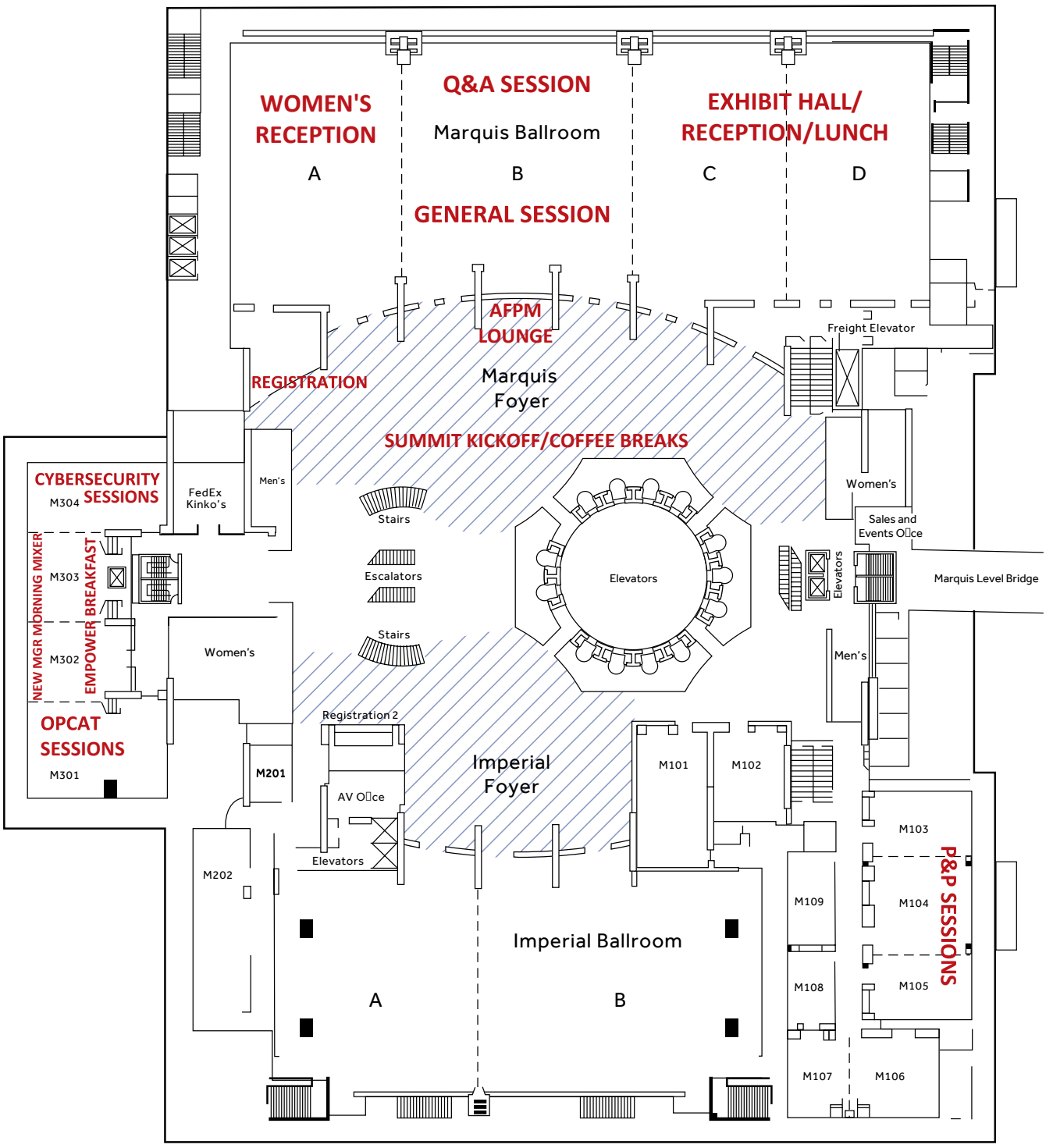


MEETING ROOMS MAP



HOSPITALITY DIRECTORY

This guide is a directory of the companies that host hospitality functions at the Operations & Process Technology Summit. Open hours are determined by the individual host in compliance with AFPM's policy not to conflict with regularly scheduled Association sessions and activities and to close by 1 a.m.

COMPANY LOCATION	DAY
Albemarle Corporation	
International Salon 9	Mon.
Athlon, a Halliburton Service	
International Salon 6	Mon.
Axens North America, Inc	
International Salon 2	Mon.
BASF Corporation	
Suite __	Sun.
CRI Catalysts/Criterion Catalysts/Shell Global Solutions	
International Salon 5	Mon.
DuPont Clean Technologies	
International Salon B	Sun., Mon.
Haldor Topsoe, Inc.	
International Salon 7	Mon., Tues.
Honeywell UOP	
International 8	Sun., Mon., Tues.
Johnson Matthey/Tracerco	
International Salon 3	Sun., Mon., Tues.
Linde Engineering North America	
International Salon 10	Mon.
Reactor Resources/Chevron Phillips	
International Salon 1	Mon.
TechnipFMC	
International Salon 4	Mon.
W. R. Grace & Co./ART Hydroprocessing	
Suite __	Sun., Mon., Tues.
Wood	
International C	Mon.

Suites are held on the sleeping room floors. Numbers can be found in the AFPM Mobile App or the Hospitality Notice Board in the AFPM Registration area.

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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
Marriott Rivercenter
San Antonio, TX

Environmental Conference
October 27 – 29
Grand America Hotel
Salt Lake City, UT

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