

The refinery of today

J. Travis Capps is vice president of energy and gases for Valero Energy. He is also a fast-talking, facts-equipped speaker who was eager to present Valero's case before Tuesday morning's general session. Armed with an array of bullet points, graphs, figures and catchy acronyms, Mr. Capps was thorough in describing the "Valero way" and happy to enlighten listeners with the knowledge that Valero is the world's largest independent refiner.



J. Travis Capps, Valero

The company has 16 refineries including its recent acquisitions in Pembroke, UK, and Meraux, Louisiana. The average capacity for these refineries is 190,000 bpd, and they provide gasoline for Valero's 6,800 branded marketing sites.

"Looking back to 2007, it is important to frame how we got to where we are today," Mr. Capps said. "Back in 2007, we wanted to change the conversation from being the biggest refiner to the best refiner. So we decided to work on excellence in each category."

Part of that commitment to excellence is Valero's

emphasis on process safety management and exceeding industry performance. Mr. Capps likes to say that Valero's business philosophy is best summed up by the company's refinery manager in Quebec. In essence, he believes that safety, compliance with environmental regulations and stellar reliability are the right way of doing business.

"Profitability is an outcome of two things," Mr. Capps explained. "Market conditions and excellence in your refinery operations."

For the refinery of today, Mr. Capps urged the adoption of the following principles to create profitability: a common management framework; a safe workplace; environmentally sound practices; and a reliable supply-chain management philosophy.

Common management framework. This framework starts at the top, with corporate leadership setting a vision and offering an actionable plan. This plan should define uniform management expectations as well as the practices and standards needed to achieve them. It should use the leverage of organizational knowledge and provide a basis for refinery performance metrics.

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As another Q&A comes to a close, we hope you enjoyed your stay in the Texas Hill Country.

Quench overrides can control hydrocracker temperature excursions

Hydrocracker high-temperature excursions and runaway reactions can be avoided with the help of new, advanced regulatory control strategies such as quench overrides, two officials said at the NPRA Q&A and Technology Forum on Tuesday.

Paul Robinson of Criterion Catalysts & Technologies said that preventing excursions requires proper maintenance and operations, process monitoring, process training, turnaround planning and quality hardware and software.

"Early detection and preemptive action can stop excursions before they become serious enough to require depressurizing," Mr. Robinson explained to an audience on plant automation. "Quench and heater overrides provide both."

CITGO's Dennis Zelmanski spoke about a September 2009 incident at his

company's Lake Charles, Louisiana, facility. In that case, a loss of preheat caused cycling of temperatures. From there, quench controls looked at bed inlets only. Cycling caused a low inlet temperature. In response, the quench flow decreased and heater firing increased. In the end, the incident led to a flaring event, a production disruption of three to four days, and a unit shutdown.

From that event, however, CITGO learned several lessons. Those lessons included never adding heat in a hurry, slowing down the tuning on heater controls, limiting how quickly heater fuel gas can increase, and limiting how quickly hydrogen quench can increase.

Mr. Zelmanski also said the company learned to limit the allowed size of set-point and output changes. In addition, CITGO wanted to protect against any bed temperature rate-of-

change exceeding 1 degree Fahrenheit per minute.

Now, quench overrides significantly help the company meet those goals. The quench override takes over by increasing the hydrogen quench when a bed outlet temperature or a bad temperature rate-of-change is too high, Mr. Zelmanski said. The system executes once per second.



Left: Paul Robinson of Criterion discussed how to control hydrocracker temperature excursions. Right: Dennis Zelmanski of CITGO spoke about his company's experiences with quench overrides.



Right: Dennis Zelmanski of CITGO spoke about his company's experiences with quench overrides.



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Schedule of sessions and special events

Wednesday, October 12, 2011

7:30–8 am	Early Bird Coffee and Rolls Grand Oaks Ballroom J
7:30–10 am	Registration Ballroom Foyer Registration Desk
8–9:30 am	Plant Automation: Turning Data into Information—A Texas Shootout Grand Oaks Ballroom I
8–11 am	Principles & Practices: FCC Grand Oaks Ballroom E-G
	Principles & Practices: General Plant Services Grand Oaks Ballroom H
9:30–9:45 am	Coffee Break Grand Oaks Ballroom J
9:45–11 am	Plant Automation: Turning Data into Information—A Texas Shootout (cont.) Grand Oaks Ballroom I
12–5 pm	Post-Conference Refining Technology Seminars Individual seminar times may vary. Contact host company for more information.
	<ul style="list-style-type: none"> • Hydrogen Plant Seminar and Q&A presented by Süd-Chemie The seminar is designed to provide useful knowledge and key understanding to engineers, operators, and other key stakeholders of hydrogen plants. Lunch provided. For more information contact Jill Parman of Süd-Chemie at Jill.Parman@sud-chemie.com.* • Fundamentals of Overhead System Corrosion presented by Baker Hughes This course is designed for refinery engineers who want to expand their knowledge of aqueous corrosion in refinery processing units. For more information contact Rachel Verbit of Baker Hughes at rachel.verbit@bakerhughes.com.*
	* The company providing the seminar will determine and apply their own registration policies.



NPRA

Q&A and Technology Forum Conference news

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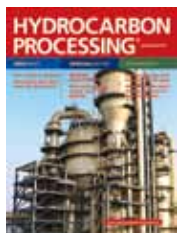
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Improving plant asset monitoring

Wireless technology is superior to most wired alternatives for modern plant asset monitoring, a senior applications consultant with Emerson Process Management said on Tuesday.

Speaking at the NPRA Q&A and Technology Forum in San Antonio, Emerson's Nikki Bishop said that most wireless solutions take roughly two hours to install, compared to two days for older, wired alternatives. "The wireless solution involves a low installation cost and an easy setup," Ms. Bishop said at the forum's plant automation session.

For pumps and blowers in particular, Emerson's wireless solutions can collect almost all needed data, Bishop explained. As such, asset monitoring is essential to optimal plant performance. About 25% of unplanned plant outages are related to equipment failure, she noted.

In one recent case, CITGO installed Emerson's pump health monitoring system in the crude unit at its Lemont refinery, Ms. Bishop said. Previously, CITGO's troubleshooting data collection was only compiled during upset conditions. There was no continuous data collection for use in comparisons.

However, with the new wireless system, data is being collected continuously, which leads to better analysis. It is now easier for the company to see how individual operations are impacting the pumps, Bishop said.



Nikki Bishop of Emerson told listeners how to improve plant reliability via essential asset monitoring.

Moreover, modern asset monitoring will soon extend to all essential elements of a plant—not only pumps and blowers, but also heat exchangers, tanks, fired heaters, simple compressors and nearly all rotating equipment. "Essential asset monitoring is important for improved performance," Ms. Bishop asserted. "Catching an equipment issue before it fails can be many times the cost of the monitoring equipment."

"You monitor because you don't want bad things to happen," she continued. "Lost production, injuries, environmental impact, fines, reduced cost, bad press—these are all big factors. Also, wireless monitoring makes the application affordable." ■

Understanding operator alarms

It is better to use graphs than raw data to present an operational alarm overview to plant operators, according to Robin Brooks, managing director of Process Plant Computing Ltd.

Mr. Brooks, who spoke at the Tuesday plant automation session at the NPRA's Q&A and Technology Forum in San Antonio, said operating envelopes can be the missing link between alarm limits, operating limits, process control and key performance index (KPI) achievement.

"The idea is that we need to find better values for operator alarms," he explained. "You don't know where the boundary is. There are some that come inside normal operations, and those you don't need." By not fully understanding data, some human operators can waste time by responding to data that is not necessarily accurate or indicative of a problem. They also might not understand the context, Mr. Brooks explained.

Alternatively, other human operators can have too little time to respond by waiting until plant data is so concerning that there is insufficient time for human response before the automated system kicks in, often resulting in a system shutdown. Relying on such auto-



Robin Brooks of Process Plant Computing Ltd. believes better operating envelopes can help plant managers.

mated systems can also be very expensive, he said.

Instead, human operators need to exist between these two extremes. The best way to get to that point is to use graphs, Mr. Brooks said, calling on his own experience with plant operators. Many things are related to one another, but with separate streams of data, operators might not grasp the context.

On the other hand, graphs allow the convergence of alarms, alerts and process control. "Do we really not understand, or is it just because we couldn't see it until now?" Mr. Brooks said after showing a graphed demonstration. We understand graphs, not numbers." ■

Technology advancements reduce crude unit challenges of opportunity

Over the past few years more and more challenging crudes are being processed in refineries. The margins these crudes bring to the refiner are more of an incentive to develop ways to process with minimal impact. These incentives have helped drive innovation and new technology offerings. NALCO has taken up the challenge to develop innovative technologies to meet the needs of the refiner. Two in particular are a novel approach to desalting aid chemistry development and a near real-time analyzer for pH, chloride (Cl) and iron (Fe).

Systematic statistical approach for desalting aid design. Historically, NALCO has refined existing laboratory screening techniques, like the Portable Electric Desalter (PED) and introduced new technologies, such as the Dynamic Visual Desalter (DVD) in an evolving research effort to find more effective

demulsifiers. More recently NALCO's focus has been centered on developing new demulsifier chemistries to improve overall desalting performance where challenging crudes are being introduced.

Some of the key crudes we've characterized to help steer the design of new chemistries have been heavy sour Canadian (Cold Lake, Western Canadian Select, Albion Heavy), heavy South American (Hamaca, Merey, Boscan), and other regional crudes (ESPO, Al Shaheen, M100, etc.). Different crude properties manifest into various processing challenges around the desalter, which can negatively impact downstream processes like waste water operations, overhead corrosion and preheat fouling.

Once the main problem areas have been identified (linked back to actual field observations), the design of experiments can be built and tested.

The goal is to determine an optimum blend of demulsifier building blocks (resin molecule, its molecular weight, and the amount and type of branching) that provides improved performance related to a particular crude or crude blend problem (like high solids loading, stubborn emulsions or oil undercarry). One such experiment utilized the PED but also included a statistical study into solids removal efficiencies.

Fig. 1 is an example of the output of such a test where each corner of the triangle was a different demulsifier component. The significance of the "shift" in results is statistically validated.

Armed with this potential next generation candidate chemistry, NALCO

then employs its in-house pilot plant desalting unit (DVD) to determine, as an example, its efficacy in controlling and reducing emulsion growth.

Fig. 2 shows the visual emulsion during a test run (a), along with various microscopy performed at different mix valve settings (b, c, d).

Near real-time analyzer for crude overheads. One aspect of processing opportunity crudes is the "unknown" influence on the crude unit overhead corrosion. The typical approach is for a refiner to slowly increase the percentage of new opportunity crude and watch for impacts. It can take days or weeks whilst the evaluation is done in determining this impact with respect to percentage of these high margin crudes in the feed slate. One way to shorten this is to have an analyzer that generates near real-time data on health of the overhead circuit, thereby, allowing the refiner to focus attention to the impacts on cut points and product qualities.

NALCO started introducing the 3D TRASAR for crude unit overhead analyzer (CUA) over the past couple of years to select global locations. The concept of Nalco's CUA is predicated on the aspect that the key to controlling corrosion, without throwing metallurgy at the problem, is the ability to capture accurate data in real time, detecting and closing the corrosion window before significant damage occurs.

NALCO's CUA continuously takes process water from the crude unit overhead to the analyzer where specially designed pH electrodes provide a real-time measure of the pH of the accumulator water. Simultaneously, the analyzer performs an automated, on-line analysis of chloride, and of total iron concentration, in the process water.

The analysis of chloride and iron is performed at preselected intervals depending on system conditions. In full automation mode CUA will detect the onset of an overhead corrosion event in time to adjust the corrosion control chemical program, using closed-loop automated controllers. This approach minimizes the over-feed and under-feeding of chemical additives, such as neutralizers, filmers

and caustic. Fig. 3 shows the initial control logic.

This process also alerts refinery operations and technical staff, as well as NALCO field engineers so further root cause solutions could be identified and acted upon.

Results from one of NALCO's CUA have demonstrated its value in providing data in time for corrective adjustments to the corrosion control program. Even without the full automation package the availability of this real-time data enables the refiner to control overhead corrosion, extend equipment life, avoid unplanned shutdowns, decrease off-spec material and costly reprocessing, and reduce maintenance costs.

In one of the early test sites a refiner had a recurrent corrosion issue in the overhead exchangers that would force unscheduled shutdowns or process unit slowdowns to replace damaged overhead bundles. Using data collected alone with active participation by operations and NALCO, the refiner was able to decrease the average corrosion rate by more than 60% as measured by corrosion probes. In addition, once in full control mode, the chemical additive costs were reduced by 30–40% without sacrificing reliability.

Another example of the value of NALCO's CUA is its ability to catch upsets as it is on guard 24/7/365. Fig. 4 shows a recent example of an event caught while processing challenge crudes.

Changing the severity and frequency of challenges presented by processing opportunity crudes requires changes in the way desalting and crude overhead corrosion programs are designed and implemented. Not only are new additives often required but the way these products are developed also needs to follow more exacting protocols. In addition to changing the developmental pathway new monitoring techniques are required to allow real time control of a highly variable process. As a result, the refiners' decision making process around mitigation strategies and improvement projects can be made with a higher degree of confidence, ultimately achieving better reliability long-term. ■

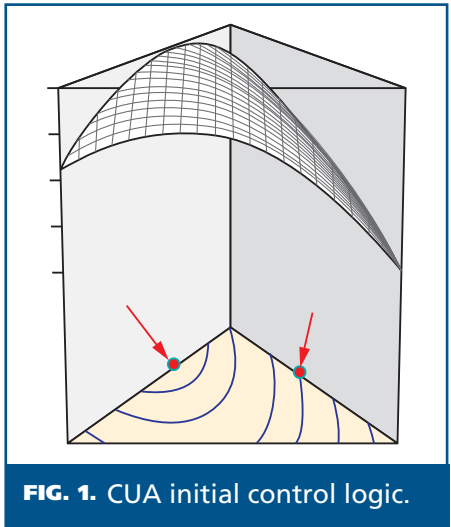


FIG. 1. CUA initial control logic.

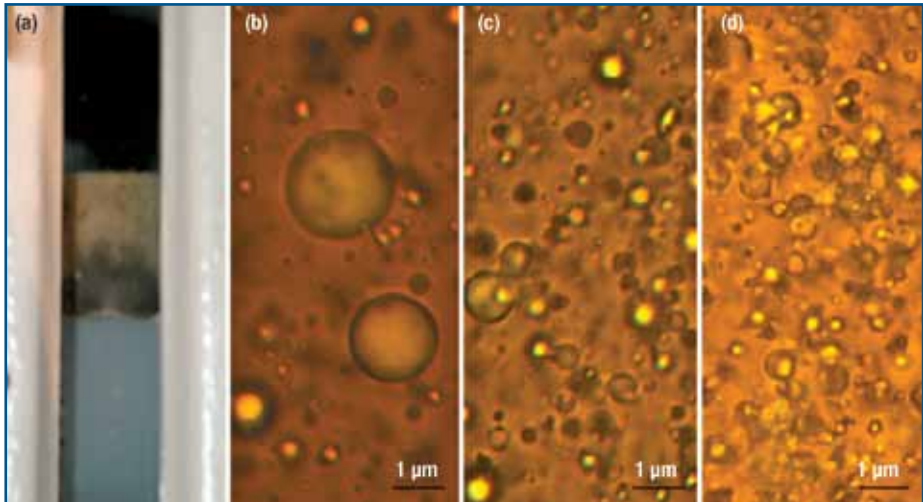


FIG. 2. Emulsion observation at various mixing energies.

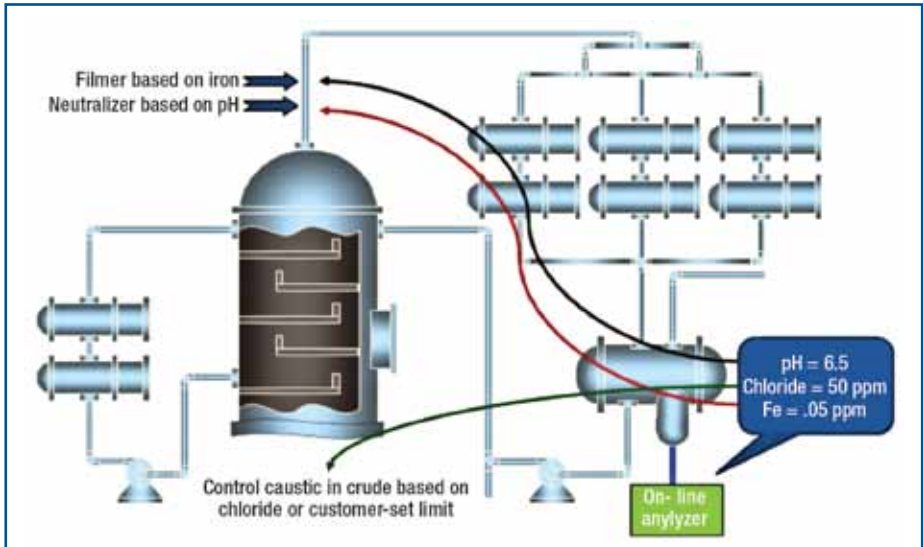


FIG. 3. CUA initial control logic.

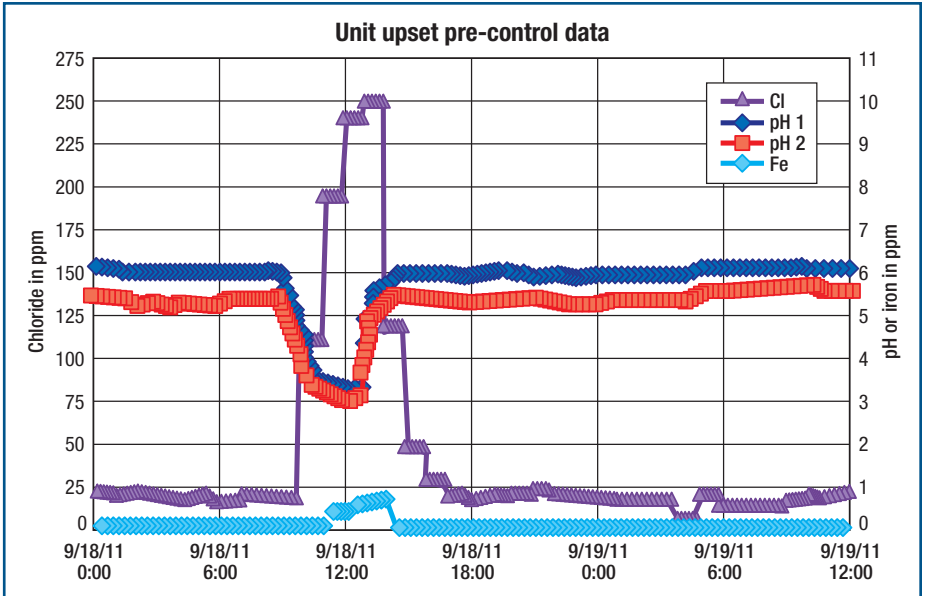


FIG. 4. Event captured.

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Multi-period crude blending optimization is getting more attention

D. DONG, M3 Technology

With the price of crude oil hovering around 100 dollars a barrel, multi-period crude blending optimization is getting more attention. Crude blending optimization will help refineries use more economical crudes, stabilize refinery operation by reducing the feed quality variations, and evaluate spot crude purchases quickly.

Crude blending optimization involves both an online blending optimization component (process control) and an offline blending optimization component (scheduling/blending systems). The online component focuses on real-time and current operation. It adjusts crude feed using ratio control or blend property control to meet crude blend specifications. While the offline component focuses on the next blend, tomorrow's activities and future operations. It handles both operational aspects, such as running crude units within safe operating limits, feed specifications, and other constraints, and business aspects, such as using the most economical crude, and

evaluating a spot purchase quickly. The outputs from the offline component are the inputs into the online components as "set points". The actual operations from the online component can be fed back to the offline component to adjust future operations.

Nowadays, it is very common for a typical US gulf coast refinery to have more than a dozen crudes in their refinery tanks at one time. Many such refineries will process 40 to 50 different crudes a year. To handle so many different crudes is challenging. On the physical facility side, most refineries have very tight crude tankage storage capacity that makes crude segregation very difficult. On the business side, market conditions have been changing and crude supply is getting more dynamic. Spot crude purchases are becoming the normal business practice. On the operation side, there are many variables, such as crude delivery delays, processing a crude type that has never been processed before, and rapid operation changes to meet

market demand. Keeping up with so many changes while running the refinery in a safe, stable, and optimal way is anything but easy. Multi-period crude blending optimization is becoming a critical tool to help refineries to achieve the above goals.

M3's product SIMTO M-Blend is a multi-period crude blending optimization tool. M-Blend uses LP and NLP algorithms to optimize the crude blend schedule to meet blend specifications and satisfy operational constraints. The blending specifications can include properties such as API, Sulphur, TAN and the qualities of crude unit product streams, such as the Conradson carbon residue of the atmospheric residue stream, as well as product yield constraints, such as the percentage of vacuum residue. Some other features include:

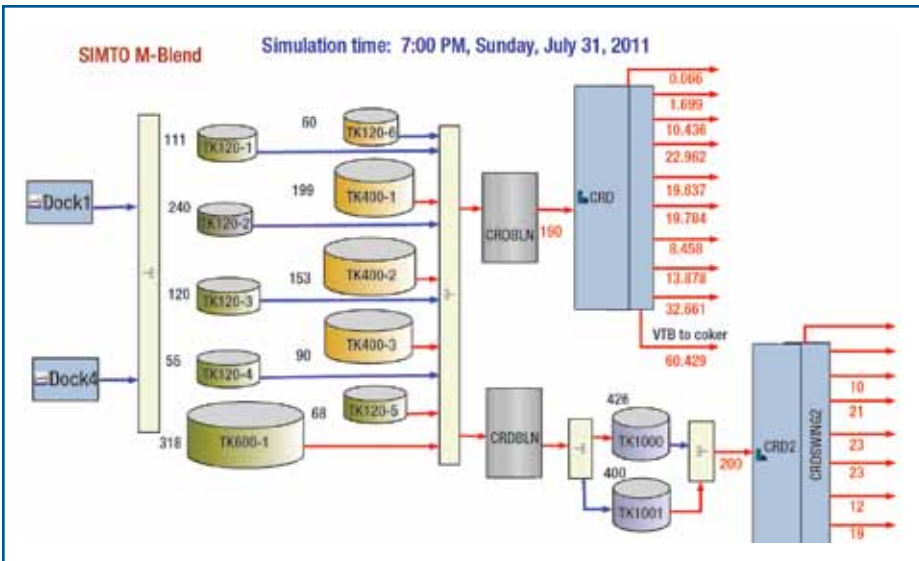
- The length of each blend is automatically determined to minimize the number of crude switches
- Manually set the crude receipt unloading plan or automatically determine the crude receipt unloading plan
- Handle crude composition tracking when the receiving tank does not have perfect mixing
- Manage short-term blending schedule (days) together with long-term blending schedule (weeks or months)
- Fully integrated with SIMTO dock scheduling, refinery unit scheduling and product blending optimization.

The crude tank blending configurations vary from refinery to refinery. In general, there are two types of crude tank blend configurations. In most refineries, multiple crude tanks can feed the crude unit at the same time. In some refineries, only one crude tank (charge tank) can feed the crude unit at a time. When one charge tank is feeding the crude unit, another charge tank

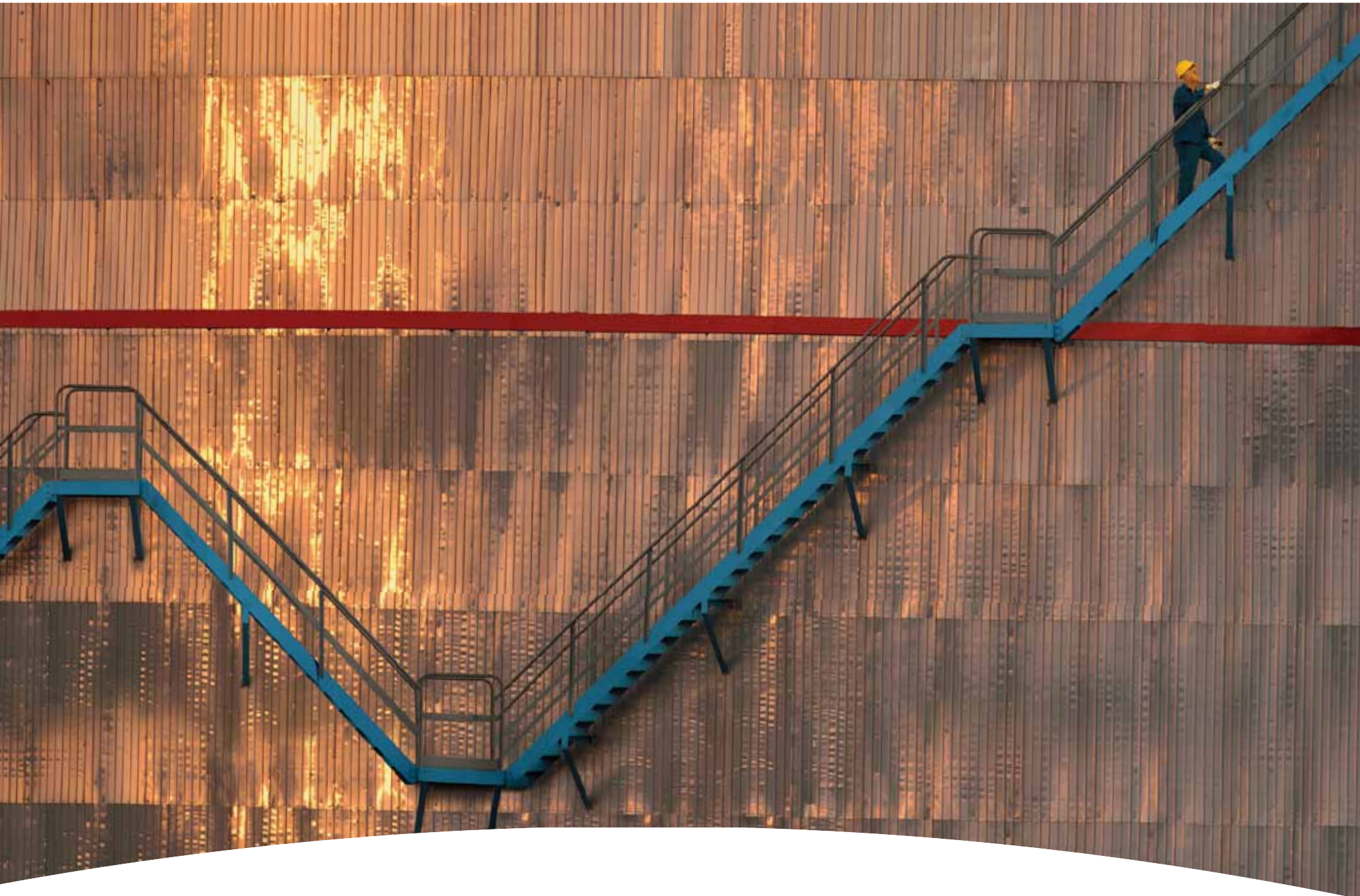
is being prepared. Fig. 1 illustrates both configurations. The multi-period crude blending optimization calculates the optimal crude blend recipe and when to switch the crude feed to a different recipe. In addition, it can determine the crude unloading plan for the crude receipts from docks or pipelines automatically, or use a predetermined unloading plan. The optimization not only determines the recipe of the current blend, but also the recipes of all blends in the optimization window. The optimization window can be from a few days to a few months. The current operation and future operations will be balanced. For example, if there is a very sour crude receipt coming in 10 days, the multi-period blend optimization will automatically adjust the blend recipes over the next 10 days to leave more sweet crudes in inventory to balance the sour crude when it arrives.

The potential benefits from multi-period crude blending optimization are significant. These benefits include the tangible benefits, such as reduced crude inventories, reduced demurrage cost and using more economical crude, plus the intangible benefits such as more stable refinery operations, quick crude evaluations, and easier crisis handling. Crude prices are closely related to crude qualities. Consider the case, if a 200,000 barrels per day refinery can increase average sulphur from 3.0 to 3.2 and the average API can be lowered from 22 to 20, then the crude savings is estimated to be \$10 million based on World Bank 2004 data.

Finally, here are my questions for you: Do you still operate with the same old approach to scheduling and blending crudes today as was done 10 or 15 years ago when the crude was only \$20 per barrel? Is any action needed? ■



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Oil sands: Too dirty for the EU

S. ROMANOW, *Hydrocarbon Processing*

In his book, *Why We Hate The Oil Companies*, John Hofmeister, former President of Shell Oil Co., reiterates the need to have a diverse and varied set of resources to meet future energy demand. No hydrocarbon resource should be demonized or deemed unfit as a potential energy source. Over the next 30 years, all hydrocarbon resources will play a role in meeting future energy demand. Time is needed to allow innovation and R&D efforts to crack the code and bring "green," nonfossil fuel energy to economic viability.

Unfortunately, heavy, unconventional oils and oil sands are under immense scrutiny and, in some cases, are being criticized as a "dirty" oil by environmentalists. Case in point: Canada, a major oil sands producer, has been at odds with the European Commission (EC). The EC, an executive body comprised of all European Union (EU) member countries, is considering classifying bitumen (oil extracted from oil sands) as a "dirty" oil. Such a designation would limit bitumen as crude feedstock, which would be a death blow for Canadian oil exports. This proposal has been sent to the EU member states to ratify over the next four to six weeks. Approval would limit the use of bitumen in European refineries, unless users decreased their carbon footprint by 6%. Such an effort definitely has the potential to raise oil prices higher, as a major hydrocarbon resource would be effectively "banned" in the EU.

The problem is not limited to Europe. In the US, heated discussion continues over the \$7 billion Keystone XL pipeline. This pipeline would provide more than 500,000 bpd of Canadian crude through the US Midwest to US Gulf Coast refineries. More importantly, the pipeline would offer a reliable supply of crude oil to US refineries.

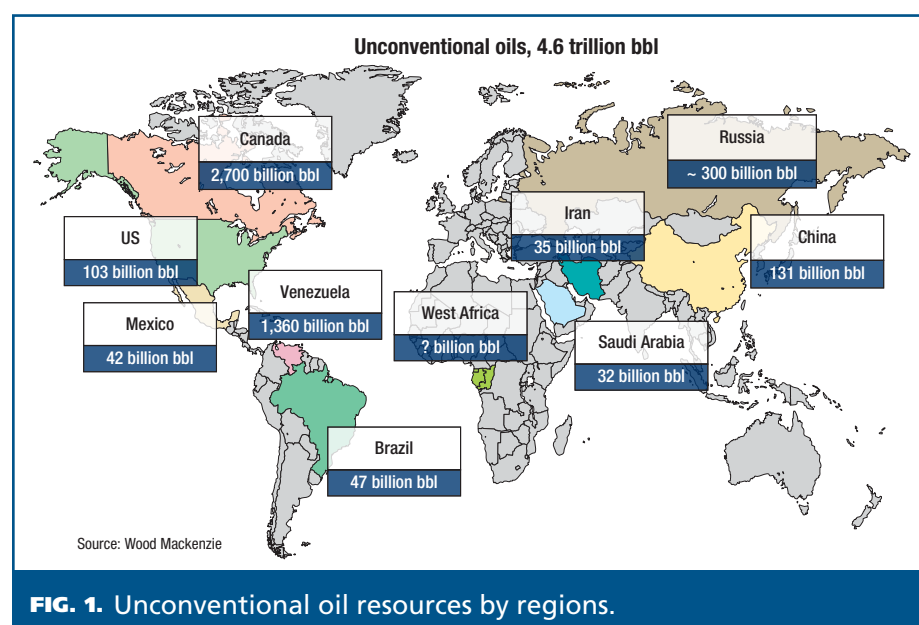
Hearings on the Keystone XL pipeline are pitting jobs and the environment against each other. During a town meet-

ing in Port Arthur, Texas, members of local unions supported the pipeline to provide much-needed construction jobs and to ensure crude supplies for the local refining industry. However, a busload of Houston-based environmentalists arrived at the same meeting and protested the pipeline's construction, citing negative impacts on children's health from higher pollutant levels released during the refining of oil sands crude.

The "rub" in using oil sands as feedstock centers on the greenhouse gas (GHG) emissions generated during the production, processing and combustion of oil sands-based transportation fuels. Depending on which study is applied, the GHG emissions range from three times to just over 6% of the GHGs emitted by traditional crude oils. A huge gap exists in the validity of oil sands-based GHG emissions levels.

In the past, many of the negative views on oil sands were due to strip mining and tail ponds from oil sands extraction. The industry is improving these processes and reducing their environmental impacts. Imperial Oil, a major oil sands producer, is developing next-generation processes to decrease tailing ponds usage and recover old tailing ponds for industrial use. New processes are even more efficient for water usage. Imperial Oil is investing \$60–80 million on R&D efforts for innovative oil sands technologies.

NPRA continues to testify for the approval of the Keystone XL pipeline. Canadian oil sands offer reliable crude supplies to the US from a friendly neighbor, as well as the creation of new jobs. Alberta, Canada, has 170 billion barrels of recoverable oil reserves, outranking the reserves of Saudi Arabia. Availability of light sweet crudes is diminishing, and much of the new capacity expansions in North America will be to handle the heavy crudes now on the market. ■



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Advancements in refinery product blending

Changing environmental regulations, fluctuating demand, and rising numbers of product specifications (specs) are exerting pressure on already thin refinery margins. Combined with an uncertain economy, refineries are closely examining their scheduling and blending processes and technologies to better meet production targets and improve margins. In this Q&A session, *Hydrocarbon Processing* spoke with Alycia Wiegenstein, AspenTech's product design manager for refinery scheduling and blending technologies to discuss market trends, the latest blending advancements and best practices in blend scheduling.

Q: From a non-technical view, please describe product blending:

A: Basically, blending is the process of taking components from petroleum refining and combining them in to products that can be taken to market. The purpose of the blending process is to make products from refined components that meet the desired specs on time. Refineries try to find the combinations of blending recipes that make the best use (or most profitable use) of the given components. In petroleum refining, finished products include gasoline, distillates, fuel oils, and others.

Q: Why is blending so important in today's refining market? What is driving refiners to examine their blending processes?

Over the years, the requirements for finished products have become increasingly stringent. It's a global phenomenon due to the need to lower sulfur in gasoline and fuel oil products. Strict product specs combined with increasing numbers of product specs complicate the refining process. A refiner that used to produce 10 different grades of gasoline may now be producing 15 grades or more. Also, crudes that are difficult to process have entered the market changing the yields and quality of the blending components. Newly discovered crudes from South America and the US Gulf Coast are more sour (high sulfur) and heavy which require more processing and produce more bottom of the barrel components such as resid (residual). Many US refineries are older and were specifically designed to process regional crudes. As new crudes enter the market, refineries are increasing the number of crudes processed. This expanded slate leads to crude composition changes, which indirectly impact the quality of the components available for finished product blending. Lastly, strict product specs such as CARB gasoline combined with increasing numbers of global products specs further complicate the refining process.

Q: So how is the industry responding to changing product specs and crude slates?

A: It has been an evolving dynamic. Initially, the refining industry responded by adding more processing units like hydro-crackers and hydro-treaters, cokers, etc. In addition to changes in available crudes, there have been changes in product specs. You have to keep in mind that a refinery has to be flexible — it has to be able to change operations to produce the most profitable products. In the recent recession, the demand for gasoline decreased. Refineries responded by producing more middle distillates and moved their traditional gasoline components into the distillate pool. Increasing ethanol specs complicate blending requirements; ethanol blending is complicated and far from linear. With changing crude slates, fluctuating demand, and stricter product specs, refining companies have much to consider.

Q: Some of our readers are interested in tools with rundown blending capabilities. What are your thoughts?

A: Rundown blending is taking a unit stream straight into the finished product tank, eliminating the need for component or intermediate tanks. There are several reasons that refineries are looking for tools to support rundown blending. 1) If you visit a refinery, you'll see that much of their real estate is in use. In other words, there

is inadequate room to add additional intermediate units and finished product tanks. 2) It is difficult to make a business case for adding new tanks or units (even if you have the room to expand) because they are a significant capital cost, and they are expensive to maintain. 3) Extra tanks won't help a refinery maintain competitive advantage — it's expensive to have component products and finished products in storage. A refinery's key objective is to keep products moving so that they can make more products—to remain profitable.

Q: You've shared that changing crude slates and product specifications are increasing blend scheduler requirements. What else makes blending complicated?

The move away from tank blending has increased the number of refineries that are blending directly to a pipeline (inline blending) or directly to a ship. With regards to pipeline blending, it is imperative that the refinery keeps tight control of the blend as its margin of error is minimal. It's tempting to give yourself a safety factor in specs to avoid shipping off-spec product. These buffers can lead to gasoline that was targeting an 87 octane that ships at 89 or above. That's called quality product giveaway — and the refinery just lost money.

Q: Is this why many refineries are using scheduling and blend scheduling technologies?

A: Yes, there are multiple advantages that blend scheduling technologies provide a refiner. To put it simply, as blending specs become more complicated, blend equations become more complicated and difficult to maintain in spreadsheets. Blend technologies incorporate both linear and non-linear calculations to enhance blend accuracy. Prior to blend scheduling technologies, refineries were limited to time-based scheduling due to spreadsheet limitations. Now refineries have flexibility around an event which allows them to provide up to the minute optimization through blend scheduling automation. Blend scheduling optimization tools use an equation based approach that leverages blend model libraries to ensure that recipes are consistent. With spreadsheets, blends were conducted over a day; averages were calculated on a daily basis. There is a lot of room for error in a 24 hour period. This new precision allows more accurate blending down to the minute which is imperative when you are dealing with something like pipeline blending.

One best practice is the use of optimization tools, like Aspen's Multi-Blend Optimizer (MBO). With Aspen MBO, one can analyze 1,000 events and determine the optimal blend. The magnitude and volume of what this achieves translates into substantial savings for our clients.

With the new online control systems in the plants, the push is for more direct interfaces with the controllers. The new blending technologies allow for this direct communication. Aspen's MBO contains the Blend Control Interface (BCI) that allows the blender to publish directly to the control system. This takes the onerous task of maintaining interfaces from the client and imbeds it in the tool.

Q: Please share some specific examples of benefits received from blending technology.

A: In general, our clients tell us that they are achieving increased throughput and capacity. One specific example is a Super Major who used the power of our planning tool (Aspen PIMS) combined with Aspen MBO to optimize production among three of its refineries. The refineries were serving different demand centers, but were close enough geographically to exchange components (for blends) if necessary to achieve optimal results. In fact, they perform a detailed model validation analysis of predicted vs. actual that narrows the gap between the production plan and the actual. In addition to the general benefits, this Super Major can now better determine which crudes to buy and which gasoline grades should be made at each refinery to supply their demand centers.

Another example from a different Super Major is an ongoing effort to standardize their business processes and technologies at its refineries across the globe. Refinery scheduling is becoming a lost art. The era of schedulers remaining in the business role for 20+ years is in decline. Many companies now rotate schedulers and blenders through the role for a two to three year period. Because of this trend, once the scheduler moves on, the nuances of blend scheduling and their domain expertise can be lost—especially when each scheduler maintains their own spreadsheet. With a standard process and intuitive tools supporting that process, a new blend scheduler can be brought up to speed quickly—saving the refinery money in the process.

Q: You've mentioned super majors; what about smaller refineries? Do they require blend scheduling optimization?

A: Any refinery can benefit from optimizing their blending. Essentially, blend scheduling automation provides the ability to adjust blend schedules, reducing the need for re-blends and quality product giveaway. As refineries begin to export more finished products to differing geographies, each with their own product specifications, they will need optimization in order to meet the specs and satisfy demand. Also, the prices of feedstocks have been rising; blend optimization ensures you are making the most out of your purchases.

Q: What advancements do you anticipate in the near term in blend technologies?

A: Optimization is a tool that increases accuracy in blending and enhances the overall execution of the plan. We have the technology now that surpasses day-long, week-long and month-long schedules; we are now able to manage by events. We can also manage multiple blends over multiple periods while providing visibility into the entire refining operation. As less traditional ways of blending become more prevalent, such as blending straight to ship, the available tools will have to evolve to accommodate those requirements. AspenTech is well positioned and committed to helping our clients address these challenges. ■

For more information, contact Alycia Wiegenstein at Alycia.Wiegenstein@aspentech.com or visit www.aspentech.com.

News in brief

Procedure Accelerator released

Innovatia is proud to announce the launch of Procedure Accelerator, its latest software product. This product is an innovative software application that greatly simplifies the task of creating and maintaining operating procedures in complex industrial environments. Procedure Accelerator is a single source framework enabling the client to define an action once, while deploying it in many operating procedures. This technology is instrumental to our clients' operator driven reliability programs. Although applicable to many industries, the initial focus is the HPI where clients are now observing immediate results.

"Innovatia worked closely with industry clients in the development and deployment of Procedure Accelerator. The result is a product that helps clients accomplish their safety, reliability, and environmental objectives," said Blair Morgan, GM of Procedure Accelerator, Innovatia Inc.

Clients are observing a 90% reduction in the effort to develop and maintain their procedures. The improved details and accuracy of the procedures enables their operations excellence initiatives to also produce significant measurable operational benefits.

Procedure Accelerator is being marketed to HPI clients in North America and around the world. ■

GE's LoSALT ionic modeling dramatically improves crude unit corrosion control

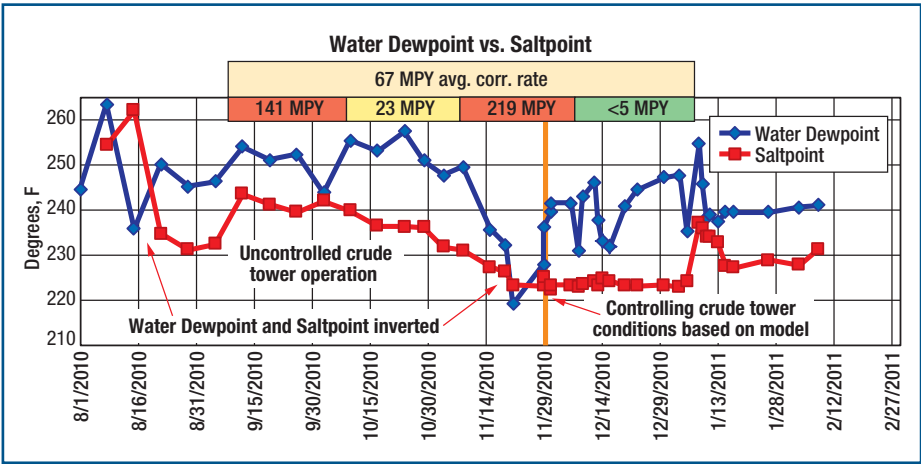
Challenge. A North American refinery began experiencing severe corrosion in the atmospheric fractionator overhead system. The problem culminated in necessary bundle repair two times within a three-month period in 2010. During this timeframe, “spot,” excursion corro-

sion rates were estimated to be in excess of 1,000 mpy. A comprehensive program was put into place to identify and address the problem.

Solution. The program included 30-day exchanger shell UT thickness

measurements, corrosion probe and corrosion coupon readings, optimizing desalting efficiency and caustic injection. Additionally, a full analysis of the crude tower overhead was implemented using the GE's LoSalt ionic equilibrium model.

in an inversion of the water dew point and the neutralizer salt point causing subsequent extreme corrosion rates. As a result of the modeling analysis, operating changes were implemented. The resulting tower conditions were then again modeled to verify the associated changes. As a result of the program, consecutive UT thickness readings verified that average corrosion rates had decreased by 80% and that the most recent measurements showed <5 mpy corrosion. Measurable improvements were also realized in desalting efficiencies, overhead chlorides and chemical usage. The value generated via this project includes monetary savings through sustained crude throughput, reduced maintenance costs, and chemical optimization totaling over \$600,000. ■



News in brief

Proposed ethane pipeline

Enterprise Products said on Tuesday that it has started a binding open commitment period for capacity on a proposed pipeline designed to transport ethane from the Marcellus and Utica shale regions in Pennsylvania, West Virginia and Ohio to the US Gulf coast. The partnership has already met with interested

shippers willing to execute long-term contracts to support the project, it said, and expects sufficient market support during the open commitment period. The open commitment period runs from Tuesday, October 11 through Thursday, November 10. The approximately 1,230-mile pipeline would have an initial capacity of 125,000 bpd, and can

be quickly expanded to meet increased shipper demand, the company said. The pipeline would deliver ethane to Enterprise's natural gas liquids storage complex at Mont Belvieu, Texas. Through connections at Mont Belvieu, ethane production from the Marcellus and Utica shales would have access to every ethylene plant in the US. ■

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“The bottom line is, we expect to have safe, stable and reliable operations,” Mr. Capps said. “Without core principles, you won’t be able to get there.”

Good management. Mr. Capps defines good management as: plan, do, check and act. The elements of this idea are illustrated below:

1. Planing (leadership should say what it expects)
2. Protection of people and the environment
3. People and skills development
4. Operations reliability and mechanical integrity
5. Technical excellence and knowledge management
6. Management change

7. Business competitiveness
8. External stakeholder relationships
9. Assurances and review

Technical networks. Technical networks leverage the inherent diversity in the system to define best practices for each discipline. Subject matter experts (SMEs) and executive sponsors ensure that each network is aligned with the corporate vision, Mr. Capps said. Valero uses site representatives to participate and vote on new technical standards and work processes, with refinery leadership networks reviewing resource requirements.

The technical network process improves buy-in by employees at sites and accelerates the communication

of standards to the people doing the work. Key networks in any oil company improvement strategy include: materials and inspections, electrical safety and reliability, rotation equipment network, process control, utilities, and operations.

Supply chain. According to Mr. Capps, the supply chain is a core way in a commodity world that companies can differentiate from one another. Valero is constantly evaluating opportunities to process lower-cost crude oils by talking with crude suppliers about where new crudes are coming from. In 2010, Valero ran 86 different crude oils in its refineries.

As part of this process, a company must have flexible hardware and refinery locations to process crudes. For instance, Valero’s McKee and Ardmore refineries process West Texas Intermediate (WTI) or other crudes that price at or below WTI. However, with crude oil from the Eagle Ford shale continuing to be discounted compared to alternatives, Mr. Capps expects the discount to narrow from WTI-like levels as the competition for supply increases.

One of Valero’s refineries positioned to process Eagle Ford crude is Three Rivers, which was expected to ramp up to 25,000 bpd by the end of March 2011. Valero isn’t stopping with Three Rivers, though. The company expects to process 60,000 bpd of Eagle Ford crude by the end of 2011. “We still believe in hardware, configurations and invest-

ment in refineries,” Mr. Capps said. “Flexible configurations make money today and allow us flexibility to go after unique crudes.”

Speaking about Valero’s recently acquired Pembroke refinery, Mr. Capps believes it enhances the company’s margin optimization strategy in the Atlantic Basin, as it has elastic capability to deliver to West Africa and Asia.

Exports. The bulk of Valero’s diesel exports are out of its US Gulf Coast system. Its Aruba refinery can supply Latin America and Europe. “We have the flexibility to move products to where market demand is big,” Mr. Capps noted.

Exports are a core part of Valero’s growth strategy. Its Gulf Coast system is well positioned for global export opportunities, and Mr. Capps noted that Valero’s large, complex refineries on the Gulf Coast are competitive due to low-cost opportunities and feedstocks. “The structural supply-demand imbalance in Latin America and diesel shortages in Europe are providing higher-margin export opportunities,” he said.

New NPRA name change. Mr. Capps also weighed in on NPRA’s decision to change its name to AFPM. “Refining is an area of US manufacturing that can compete anywhere in the world,” he said. “I look at this as pointing out to the general public that manufacturing *is* refining, and refining creates US jobs.” ■



J. Travis Capps of Valero speaks to NPRA conference attendees.

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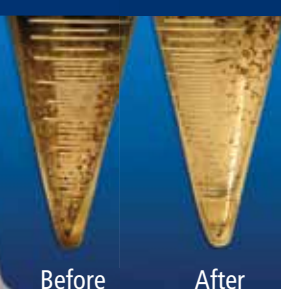
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Foster Wheeler is investing resources in Latin America

At Foster Wheeler, we continue to demonstrate our ability to deliver local engineering content and global expertise in a variety of countries to meet the requirements of our clients. Our success is a reflection of our technical expertise, our long-term customer relationships, and our selective approach in pursuit of new prospects where we believe we have significant differentiation. Foster Wheeler has the flexibility and the strength to be able to deliver large or small projects successfully anywhere in the world. As part of our strategic renewal initiative, one of the key regions where we are focusing on bidding and winning work is Latin America.

Our team is currently working on projects and actively bidding and winning new work in the region, as clients

continue to place confidence in our capabilities. We believe world demand for energy and chemicals will continue to grow over the long term and that clients will continue to invest in new and upgraded capacity to meet that demand. We believe that Central and South America is one of the regions that will see significant investment to meet regional and global demand.

We are already working on many projects in the region, in upstream and downstream, including Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Trinidad and Tobago, Uruguay and Venezuela.

Take Colombia for example. We have expanded our local operations in Colombia, which we believe is a strategically important country. We opened a new

office in Bogotá providing our expertise in detailed engineering and procurement, supporting upstream, downstream and infrastructural developments, building on more than 30 years of local presence and experience in Colombia. We focused a considerable amount of business development effort in Colombia over recent years and received notable wins with Ecopetrol S.A. for the Barrancabermeja refinery and REFCAR for the Cartagena refinery.

For example, at the Barrancabermeja refinery, Colombia's largest refinery, located in the middle of the Magdalena Valley, north of Bogotá, Foster Wheeler will perform the second phase scope for an existing contract for the Project for the Modernization of the Refinery in Barrancabermeja. This includes addi-

tional project management consultancy (PMC) and front end engineering design (FEED), detailed engineering for the crude unit revamps, assisting Ecopetrol in the selection process for engineering, procurement and construction (EPC) contracts and control and supervision of the EPC and construction contractors.

The new units will include a 54,000 bpd delayed coking unit (Foster Wheeler's SYDEC technology), 80,000 bpd hydrocracker and 16,700 bpd coker naphtha hydrotreater, 200 million standard cubic feet per day hydrogen production unit, sour water strippers, amine regeneration, 250 long tons per day sulfur recovery unit with tail gas treating, offsites and utilities and a major modification of several of the existing atmospheric and vacuum crude distillation units.

The project is intended to bring significant economic opportunities to the local community both short and long term. As the PMC contractor, Foster Wheeler has the responsibility to assist Ecopetrol's social management team for community relations and development of human talent in the surrounding community.


We are also the PMC contractor for the REFCAR Cartagena refinery master plan project. This expansion project increases the refinery's capacity from 80,000 bpd to 165,000 bpd, and will also improve the fuel quality to meet Colombian and international environmental specifications. The upgraded facility will produce ultra low sulfur gasoline and diesel from a heavy crude oil slate.

The Cartagena refinery, the second largest in the country, located on the northern coast of Colombia, will be expanded and modernized with the addition of a new integrated crude and vacuum unit, hydrocracker, delayed coker unit, diesel and naphtha hydrotreaters and alkylation unit along with associated hydrogen, sulfur recovery, utilities and offsite facilities. A major revamp of the FCC unit is being implemented to maximize propylene production as a petrochemical feedstock.

Our engineering centers around the world can undertake all types of projects from feasibility studies to large complex EPC contracts. We own industry-leading technology in delayed coking, solvent de-asphalting, sulfur recovery and hydrogen production processes, and have access to numerous technologies owned by others.

Foster Wheeler designs, engineers and constructs leading-edge processing facilities and related infrastructure for the upstream oil and gas, LNG, gas-to-liquids, coal-to-liquids, coal-to-chemicals, refining, chemicals & petrochemicals, pharmaceuticals, biotechnology & healthcare, mining & metals, environmental and power industries, globally.


Our company has a lot to offer clients in this fast-developing and large region across all of our core business lines. Our project pipeline is packed with important projects that are shaping the region's future. Foster Wheeler is certainly blazing the way in Latin America. ■



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Plant automation focus

Refiners can benefit from advanced business intelligence systems

Chevron has increased the operating performance and profitability of its El Segundo refinery in California by switching to advanced business intelligence techniques, a business analyst for the company said at the NPRA Q&A and Technology Forum.

Francisco Chavez addressed attendees at the forum's plant automation session, saying the company had switched its focus to meter and data quality, including rigorous material and yield account-

ing. "It all starts with process data quality," Mr. Chavez said. "Our foundation for improving is timely and accessible, accurate data."

Previously, the company's analysis tool of choice was Microsoft Excel. However, Chevron found that Excel was leading to data silos and multiple versions of truth. There was no easy way to monitor meter, unit and overall refinery performance, and data lacked the analysis rigor to ensure precision and accuracy, he said. Moreover, Chevron needed a way to present information in context and enable collaborative interaction.

The path the company chose was to expand its "historian" to real-time infrastructure. Buoyed by a Sigmafine mass-balancing system, the data preci-

sion and accuracy has recently improved, along with fewer data silos and only one version of the truth, Chavez said. Other benefits include improved work flows and collaboration, a reduction of stock losses, improved accounting and situational awareness, and an ability to proactively respond.

Overall, Mr. Chavez said Chevron learned that there was no silver bullet, and that understanding the value of an "infrastructure" can be difficult. However, once implemented, the benefits revealed themselves, and the refinery's performance is improving. "We've found that the best practice is focus on an evolutionary, continuous improvement approach. It's not a big-bang solution."

Going forward, areas of business improvement for Chevron will include increased interactivity via social media and mobile devices, Chavez said.

Chevron's El Segundo refinery is the 17th-largest in the US, with 273,000 bpd of capacity, according to the US Energy Information Administration (EIA).

Refiners need better hydrogen management

An increased focus on proper hydrogen management could lead to significantly higher profits at many global refineries, according to Rick Manner, an official with KBC Advanced Technologies.

Mr. Manner, who spoke at an NPRA Q&A session on hydroprocessing principles and practices, said there is often room for improvement in hydrogen plant operations at a typical refinery.

"Hydrogen management is often given low priority," Mr. Manner said. "People are too busy, overburdened with other responsibilities, or not properly trained on how to run hydrogen plants or hydrogen systems. Quite often, they get extremely low priority. There's some very low-hanging fruit on what to fix."

In particular, optimizing hydrogen use could be very attractive for high-margin units where crude selection is limited by hydrogen availability. When you're screening heavy crudes, you see this crude is low-margin or high-margin, but you don't see why," Mr. Manner said. "You can find out."

Hydrogen management studies can help companies identify and relieve constraints and improve hydrogen utilization, he noted. Mr. Manner said that some refinery operators needed to change their outlook toward such maintenance costs. "Some of these guys don't want to lose money [on maintenance] even if it costs 10 times that in profitability," he said. "It can be a major problem. I understand it's a difficult decision for a manager to make to have a turnaround, but sometimes you need to bite the bullet and accept that you're not making a lot of money." ■



Chevron business analyst Francisco Chavez told attendees about how to improve refining data collection.



KBC's Rick Manner said refiners could increase profits with more focus on hydrogen operations.

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Around and about



Ron Parise of Nalco answers a question during the crude/vacuum distillation & coking Q&A session.



The room was packed for the crude/vacuum distillation & coking Q&A.



Reinhart Gross of OMV Refining & Marketing talked about optimization blend operations at a European refinery.



Gregory Rogers of Enterprise discussed his company's metrics for vendor selection.



Champion Technologies had a strong presence at this year's Q&A.



The Exhibit Hall was a setting for food, networking and information, not necessarily in that order.



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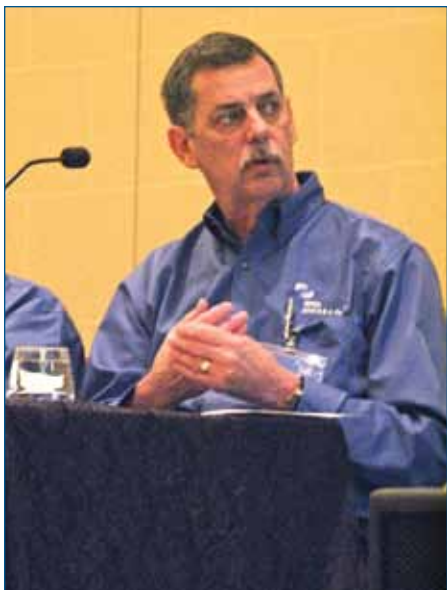
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Scenes from the forum



UOP's Mike Windham answers a question during the gasoline processes Q&A.



Adan Araiza and Solly Ismail from BASF enjoyed the reception.



From left to right: Lubrizol's Ryan Chun, Shaw Group's Warren Letzsch, Lubrizol's C. David Roberts, Mitchell M. Jackson and Gabriel Ngoi.



Valero's Erik Myers ponders his response during the Q&A on gasoline processes.



Jerold Danis of Equity Engineering Group discussed common damage mechanisms in hydroprocessing units.



Cameron representatives talk with conference attendees.




Attendees at Albemarle's "Green Zone" suite talked over beverages and Monday Night Football.



TriStar Global Energy Solutions sent its business development group to the meeting: Bo Guevara, April Bardwell and Jerry Roland.



From left to right, Nalco's Paul Fearnside, Crystal Brockington and Ron Parise.



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Johnson Matthey, Tracerco and Intercat sponsored a casino night in their suite.



Dow Chemical played host to a Cuban band.



From left to right: Hydrocarbon Processing CEO John Royall, Albemarle's Chris Dean, Hydrocarbon Processing's Josh Mayer, Albemarle's Stephen Murff, Albemarle's Jack R. Wilcox.



GE played card games in its third-floor suite.



Alisha Nash, far right, and Brian Lefebure, second from left—each from Hunter Buildings—are accompanied by Laura Kane (left) and Bill Wageneck from Hydrocarbon Processing.

Why PAS 55?

M. LAPLANTE, Meridium

I learned from a very young age to evaluate the value associated with my actions by asking, why? Often we preoccupy ourselves with just the 'what' and 'how,' overlooking the 'why.' In this discussion of the PAS 55 Specification for the Optimized Management of Physical Assets, we will focus on 'why' PAS 55 and evaluate the value it brings to an organization.

PAS 55 enables an organization to establish essentially two things. First, it enables a line of sight between the boardroom and the tactical level of the organization. Secondly, most organizations have only a partial view of risk; PAS 55 is a means of helping an organization remove as much uncertainty (risk) about its future performance as possible.

We don't have to travel far to find examples of what can result from a skewed line of sight between the boardroom and the plant floor. Take for example the Deepwater Horizon, Tesoro Anacortez, San Bruno and Upper Big Branch catastrophes. In the aftermath of investigating these types of incidents, one of the first questions asked is, "Why didn't management see this coming?" This question is generally followed by direct or indirect accusations that upper management, in their desire to save money, cut programs aimed at the prevention of these types of incidents and put profits ahead of safety. Although there are perhaps a few cases in which management could be accused of having a wanton and reckless disregard of the circumstances under which cuts were made, these incidents are more a symptom of a 'partial' view of risk and a lack of a line of sight between decisions made in upper management, and the impact these decisions have at the tactical level.

There is a fixed chasm between corporate executives and the people who work at a tactical level. An executive assessment of how assets are performing is for the most part made through a quarterly performance report. If the financial and operational numbers meet the organization's projected goals, this is seen by management as validation that company assets are being well-managed, even if there are unaddressed defects. This assumption can have catastrophic consequences when cost-cutting becomes necessary and cuts are made without accounting for all of the risks. The perennial problem is that the members of top management, as talented as they might be, often make cost-cutting decisions using only a partial view of risk. But what if executives had a line of sight into the state of their organization's assets at a more granular level revealing incidents waiting to happen? Would the chief executive intervene at some earlier point? Would the types of incidents mentioned above have even occurred?

Similar to a person who feels fine and is shocked to find out through an MRI that they have cancer, assets too can be performing their functions while masking potentially serious problems. While the MRI reveals to the patient an unexpected and unwelcomed prob-

lem, the information the MRI provides also transfers control from the disease, to the patient. Similarly, the structure provided by PAS 55 can provide executives with a direct line of sight into the asset related problems unknowingly plaguing a company's daily performance, as well as exposing weaknesses that could result in a catastrophic event.

The business benefits of managing asset risk. Are there benefits associated with expanding the assessment of operational risk to include asset and asset systems?

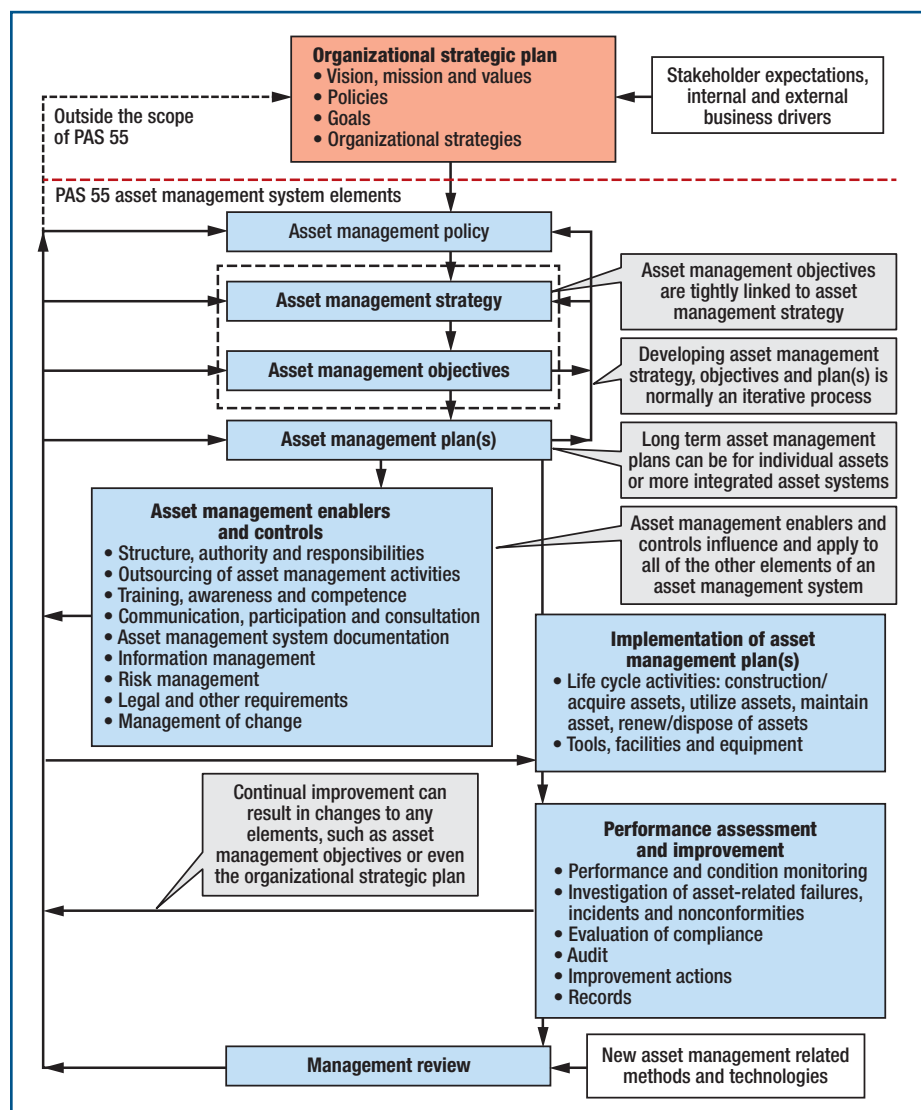
- Yes, from a Wall Street perspective, says Dr. Mark Wilde, a senior analyst for Deutsche Bank. According to Dr. Wilde, financial markets place a premium on stability and predictability. In the credit markets, capital is easier for low-risk companies who enjoy 10–12% greater valuation multiples than their peers.

- Yes, from an oil and global risk perspective, says Dr. Kent Moors, an oil policy expert and global risk consultant. According to Dr. Moors, risk management is an essential part of strategic decision making, not an appendix to it; it's an evolving and flexible process, and a structure is needed to deal with the things that will go wrong well in advance of their occurrence.

- Yes, from an International Standards Organization (ISO) perspective, says Rhys Davies, chair of ISO Committee PC 251. According to Mr. Davies, containing risk requires a purposeful, measured approach to risk mitigation and a contingency plan for when an event occurs (and it will). Both require the quantity and granularity of data far greater than the partial view of risk that currently exists in most organizations.

Case studies. The effort required by organizations to comply with PAS 55 will vary. Many businesses currently do a great deal of what the specification demands and have been doing so for years. The financial markets have rewarded these companies for their disciplined approach to asset management. For mature businesses, the benefit exists in sharpening the line of sight and making the view of risk more visible, accessible and comprehensive across all functions of the business.

For example, can makers have consistently out-performed the S&P 500 through even the deepest part of the Great Recession. One would think that mature companies, in mature markets, would be damaged the worst during an economic crisis, but data suggests just the opposite. Representing one of the oldest industries since the beginning of the 20th century, can makers continually face pressure from alternative packaging and from customers who think they can do a better job of manufacturing their own packaging. Yet, these businesses, through strategic commodity risk mitigation and disciplined use of cash, have seen consistent increments of share pricing well above the rate of growth of the S&P Index. If these businesses had sat back and assumed that



their assets and cash were being well-managed, would they have had demonstrable, continued success? If they had not developed strategies for removing uncertainty, might they have very well been defeated by the recession?

Another example of a mature organization succeeding by taking the next step of incremental maturity is MRT Corporation of Hong Kong. In 2005 their metrics for rolling stock reliability had improved from 1,000 car Km/failure to 3,500 car Km/failure. The railway operating cost per revenue car Km has decreased by 20% since the year 2000.

Established, mature organizations offer lessons on how to safely maximize predictable production at the lowest sustainable cost, while managing the risk profile of the business. The *Survey on Asset Management and Reliability Best Practices* delivers additional evidence to support this position reporting, "Firms that move the decision making about maintenance and reliability to higher organizational levels, thus placing a higher importance on asset performance management, performed better."

As we look to the future, we can depend on the vision of finance executives to guide our thinking and approach to how assets are managed. At the 2011 CFO.com Core Concerns Conference, CFOs of manufacturing firms projected that capacity utilization will increase from the current 74% to 76% by year end. This is a promising indicator from a sector that has been leading the recovery. The top three concerns voiced by CFOs in accomplishing their future goals were the ability to:

1. Maintain margin
2. Attract and retain qualified employees
3. Forecast results.

Each of these concerns can be directly impacted by the PAS 55 Specification. First, the ability to maintain margin is largely determined by what happens at the tactical level of the organization. If top management develops the right culture and leads the front line supervisors and craftsmen to embrace the idea of asset performance management, margins will be protected through their actions. Second, qualified employees, particularly in the area of reliability, are primarily motivated by purpose and are willing to promote the cause if leadership demonstrates its commitment to asset performance management. The structure of PAS 55 offers the ability for leadership to demonstrate that commitment. Third, although the ability for senior executives to forecast results and offer guidance on the performance of their companies is never easy, the accuracy of the guidance is dependent on how much uncertainty about the future has been removed. The distilled essence of PAS 55 can be summarized in the following way:

PAS 55 is a structure that provides the ability for an organization to systematically remove uncertainty by revealing to top management how well assets and asset systems are being managed. It also provides top management with the structure to determine what the next level of incremental maturity needs to be and lights the path to reaching it. ■

Marc Laplante is a senior solution specialist at Meridium, Inc. and an official member of the US Technical Advisory Group (TAG) to ISO Project Committee 251. The TAG represents the US interests in the development of ISO 55000 standard for asset management which is expected to be promulgated in early 2014. For more information, contact info@meridium.com.

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