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NOVEMBER 2008

HOW WIRELESS SPEEDS INNOVATION AT BP

THE STRATEGIC ROLE OF WIRELESS IN REFINING AUTOMATION TECHNOLOGY

EMERSON Process Management

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BP Speeds Innovation with Wireless

Improvements in equipment monitoring and availability are among the benefits already realized.

BP AND Emerson Process Management continue to collaborate on the application of wireless technology to speed use of the innovative technology for business improvement. BP has expanded its Cherry Point refinery applications, installed Emerson's Smart Wireless network throughout its tank farm in its R&D facility in Naperville, Ill., U.S., and is making installations at its other refineries around the world.

BP Cherry Point is a 225,000-bpd refinery located in northwestern Washington state in the U.S., and is the largest supplier of calcined coke to the aluminum industry. One out of every six aluminum cans is made using BP Cherry Point's calcined coke. Smart Wireless transmitters on the refinery's calciner unit monitor bearing and calciner coke temperatures to help prevent fan and conveyor failure. Fans can cost up to $100,000 to repair, but more important, can be down for up to 10 days with associated production losses. The 15-transmitter wireless installation, done in 2006, is believed to be the world's first industrial wireless mesh network, and continues to run reliably while eliminating operator rounds in the field.

Cherry Point has expanded wireless use to 35 transmitters, including tank farm and utility applications, and installation of an Emerson Smart Wireless gateway in the diesel unit to make it ready for wireless devices.

"The principal advantage we see around wireless is the ability to accumulate and analyze a much greater array of data than would otherwise be economically possible," says Mike Ingraham, technology manager for Cherry Point refinery. "Wireless enables us to get more data, more efficiently, more economically than we ever have been able to in the past. We really hope our wireless technology will be a principal tool in maintaining plant availability while expanding our flexibility to meet fuel specs and an ever-changing array of feedstock."

BP'S TANK FARM PROVING GROUND

At BP's research and development campus near Chicago, a tank farm (pictured above and on cover) provides a venue to try out new wireless functions as they become available. The real-world environment in a pilot-scale operation provides feedback to Emerson Process Management, the wireless network provider, and hands-on experience for refinery management.

A second facility, BP Naperville R&D, is a world-class technology center that includes a recently modernized tank farm feeding an expanding number of pilot plants that develop processing technology options for BP refining worldwide.

"Following the first application of Smart Wireless at BP's Cherry Point refinery, which BP saw as a success, the company installed a 45-transmitter network at the Naperville tank farm. Operational for about one year, this has provided strong operational experience, and a platform for testing the technology, leading to significant take-up of wireless at BP refineries throughout the world.

> **"Wireless is an important enabler for refinery-of-the-future technologies.... It's a very important vehicle for getting instrumentation into places where wired instrumentation would be too expensive or, frankly, not very practical."**
>
> *— Mark Howard, commercial technology manager, BP*

"The wireless devices allow our operators to be more efficient, collecting data from one central point as opposed to walking around the tank farm and recording all the values," says a BP representative. "The other advantage of the wireless devices is that they supply data continuously for recording in our historian, allowing us to see what is happening in the tank farm at any time of the day."

The Naperville wireless network uses Rosemount wireless transmitters to monitor suction and discharge pressures, levels, flow and temperatures. New wireless functions are installed as they become available, and emphasis is on collaboration with Emerson to expand the capabilities as rapidly as possible to cover refinery-wide applications. The real-world environment in a pilot-scale operation provides feedback to Emerson and hands-on experience for refinery management. Options for refinery process optimization and sharing of wireless automation technology are thereby shared globally by the Refining Technology team.

"Wireless is an important enabler for refinery-of-the-future technologies," comments Mark Howard, commercial technology manager at BP. "It helps us deploy the sort of instrumentation, sensors and analytical devices that we need for condition monitoring to support

CRODA, CFE LAPEM WIN WIRELESS INNOVATOR AWARDS

At the Emerson Global Users Exchange 2008, an end-user panel awarded Croda Inc.'s moving railcar monitoring application as "Most Creative" and CFE LAPEM's temporary power unit monitoring application as having the "Most Significant Business Impact" in Emerson's Smart Wireless Innovators Application Contest.

Designed to recognize creativity and business value from applications of the company's Smart Wireless solutions, entries in this first annual contest were from production, manufacturing and distribution facilities around the world.

The "innovation" criteria included the extent to which the use of wireless was novel; the identification of previously unknown process issues; the degree to which using wired technology wouldn't have been possible; and the extent of real operations improvement.

The winning score went to Croda Inc., an international specialty chemical maker, for its monitoring of temperatures in moving railcars at its plant in Mill Hall Pa., U.S.

The "business results" criteria included demonstrated dollar savings in operations; installation savings compared to a wired approach; time savings for implementing with wireless; and the extent to which safety or environmental effects were improved.

Scoring highest was CFE LAPEM, a laboratory analysis group within the Federal Electrical Commission of Mexico. LAPEM has five analysis teams that set up temporary measurement facilities at each of 140 power plants. One team's easy establishment of a temporary wireless network in power plants made it possible to increase its productivity and plant coverage by 10% and to increase annual service revenue by US$512,000.

"We are excited at the great range of wireless applications across industries and around the world that we received," commented Peter Zornio, chief strategic officer of Emerson Process Management. "The contest unveiled what is really an amazing display of ease of use, flexibility, reliability and business value delivery."

At Croda, wireless temperature transmitters help boost operator safety and efficiency.

WIRELESS PROMISES BIG CAPEX SAVINGS

At last month's Emerson Global Users Exchange, John Dolenc (pictured) presented a detailed study on the potential impact of wireless technology in the construction of a new capital project, in particular, a hypothetical hydrotreater.

"Wireless communication technology can reduce the total installed cost of monitoring instrumentation," said Dolenc.

In the case of the hydrotreater, 44% of measurement points were deemed appropriate for wireless, yielding an overall instrumentation savings of up to 41% compared with all analog wiring. Watch for the detailed results of Dolenc's analysis in the next issue of WirelessNow, where the study will be expanded to include the role of wireless on a fieldbus project.

predictive maintenance, tracking feedstock through the value chain and a host of other applications. Wireless is a very important vehicle for getting instrumentation into places where wired instrumentation would be too expensive or, frankly, not very practical."

Howard adds, "Looking ahead, we like the move toward standards such as *Wireless*HART in the Emerson technology. We like being able to access new wireless transmitters as quickly as we can deploy them, and we're getting very robust operation. We look forward to a greater range of instrumentation becoming available."

"We value highly the collaboration with BP Refining Technology team," says John Berra, chairman, Emerson Process Management. "Smart Wireless was conceived through years of research and development that led to Emerson's pioneering introduction to the market in 2006. Key in this effort was the parallel pioneering effort by BP in its trial mesh installation of Smart Wireless at Cherry Point in that same year. Our combined efforts have, I believe, moved the age of wireless forward at an accelerated pace."

"We share BP's important objective of speeding innovation to deliver standard interoperable wireless technology for improved plant reliability, safety and environmental compliance," concludes Berra.

WIRELESS AT WORK

BOISE BOOSTS SAFETY RESPONSE

Until recently and until wireless, Boise's St. Helen, Ore., U.S., paper mill did not have a monitoring network for its eye-wash and safety-shower stations, relying instead upon individual radio communications.

"But we have numerous people at our mill—including drivers who are unloading chemicals—who don't have an avenue to communicate directly with the operators," explains Boise's Jeff Taylor. "And although we use lots of radios at the plant, none of the contractors and only some of the employees have them."

So to better ensure the overall safety of both plant personnel and its contractors, the mill explored options to alert the control room automatically if any of its eye-wash or safety-shower stations were activated. That way, operators could quickly dispatch assistance to the station and investigate for possible injuries.

But at an estimated $40,000, the tab to install hard-wired monitors on the eight safety stations was pricey. "We had looked into installing a wired network monitoring system, but it was cost-prohibitive to do so," Taylor says. "But by installing a wireless network instead, we were able to save about 60% in installation costs."

Today, when any one of the eye-wash or safety-shower stations at the mill is turned on, Rosemount wireless discrete transmitters in a self-organizing Smart Wireless field network immediately communicate with the mill's operating system, and the alert is conveyed to the mill control room.

The switches and Smart Wireless Gateway were easy to install and commission. Some of the switches are as far as 200 feet from the gateway. The gateway interfaces with an OPC server, which delivers reliable data to the mill's operating system. The robust wireless network monitors the switches every 15 seconds.

"Because we have established this wireless network infrastructure," Taylor adds, "we anticipate that for low cost we can easily add additional transmitters at our mill for use with other applications."

Your First Wireless Network

A new generation of engineering tools are making it easier than ever to get up and running with wireless.

COST SAVINGS are an oft-cited advantage to using wireless networks in industrial environments. Eliminate the wire and conduit or armored cable—together with the I/O and engineering costs associated with them—and, presto! Costs for an incremental process measurement plummet by as much as a factor of 10.

But for a growing roll call of leading process manufacturers, it's not the cost-saving aspects of wireless networks that are the primary driver for adoption. Rather, it's the *easy* part.

Indeed, all wireless field networks are easier and less costly to install than traditional wired systems, simply because they're wireless.

RULES OF THUMB FOR MANUAL NETWORK DESIGN

Although a new breed of automated tools are available to streamline wireless network design (see sidebar, p7) manual rules of thumb can also be used.

Starting with a scale layout of the process unit or area, draw connecting lines between each planned wireless device and neighboring wireless devices that meet any of the following criteria:

- The distance between wireless devices with no obstructions is less than 750 ft (230 m).
- The distance between wireless devices with moderate infrastructure is less than 250 ft (75 m). Moderate infrastructures typically are able to support vehicular traffic.
- The distance between wireless devices with heavy infrastructure is less than 100 ft (30 m). Heavy infrastructures typically are unable to support vehicular traffic.

As a best practice during the design phase, each wireless device should be connected to three other wireless devices, even though the wireless connection distances may vary by direction. Having three connections during the design phase ensures each device has two alternate connections after installation.

If a wireless device does not have three connections during the design phase, then add additional measurement points or use a range extender to fortify connectivity.

There should not be any connectivity lines between wireless devices in the following situations:

- The path between wireless devices crosses a large obstruction, such as a large building or an entire process unit. (In these circumstances, it is probably best to add another gateway.)
- A device is in an enclosed area, such as an equipment room, that isolates the device from the other wireless devices. (Use remote electronics to move the antenna outside the enclosure or add a repeater device just outside the enclosure.)

WIRELESS AT WORK

AUSTRALIAN TERMINAL KEEPS BITUMEN FLOWING

At Terminals Pty.'s facility in Geelong, Victoria, Australia, bitumen is unloaded from ships through a pipeline 3,000 ft (900 m) long and 8 in. (200 mm) in diameter. Because bitumen solidifies at ambient temperature, electric heaters operate all along the pipeline to keep the bitumen hot (160 °C) and fluid. If a heater fails, a cold spot could form, causing the bitumen to solidify and plug the line, an expensive problem.

"We needed to monitor the bitumen line," according to Bitumen Terminal project manager Joe Siklic, "to make the operators aware of cooling anywhere in the line from the ship to the storage facility, which could result in an emergency shutdown. Any delay in unloading could keep a ship at the pier longer than planned with demurrage costing up to $30,000 per day."

The terminal chose wireless technology, Siklic says, for its lower initial cost and minimal maintenance as compared with hard wiring. Eight Rosemount wireless temperature transmitters are evenly spaced along the pipeline, sending temperature readings on one-minute intervals to a Smart Wireless Gateway on shore that channels data to the AMS Suite predictive maintenance software used for instrument configuration and performance monitoring. The collected data also are forwarded to a SCADA system in the terminal control center via fiber-optic cable.

Due to the self-organizing nature of this technology, each wireless device acts as a router for other nearby devices, passing the signals along until they reach their destination. If there is an obstruction, transmissions simply are rerouted along the mesh network until a clear path to the Smart Wireless Gateway is found. All of this happens automatically, without any involvement by the user, providing redundant communication paths and better reliability than direct, line-of-sight communications between individual devices and their gateways.

"This is an ideal application for wireless," Siklic said. "Since numerous paths exist to carry the transmissions, the network would easily compensate for a transmitter failure, and the operators would be warned. This wireless network has proved to be reliable, compatible with existing control equipment and cost-effective."

But unlike line-of-sight or point-to-point wireless approaches, self-organizing mesh networks, such as those based on the *Wireless*HART standard, don't require detailed site surveys or specialized equipment to implement.

With a brand new generation of planning and management tools, it's easier than ever to ensure that your first wireless effort performs optimally from the start.

> **"This wireless network has proved to be reliable, compatible and cost-effective."**
>
> *— Joe Siklic, project manager, Bitumen Terminal, Terminals Pty.*

ESTABLISH PROJECT SCOPE

For your first *Wireless*HART self-organizing wireless network, it's best to focus on a logical plant area or single processing unit, such as a tank farm or distillation unit. Doing so has three primary benefits:

- It helps ensure that all the wireless devices will be within a reasonable signal range of each other, since they'll be placed in a relatively limited area.
- With several devices in the same area, there are more available communication paths for routing messages around obstructions or other interference.
- It's easier to integrate the data into information systems if all data sources follow the same organizational structure—which in most plants is based on process units.

If a process unit is of complex design, for example, an enclosed multiple-floor manufacturing facility, then it may be optimal to scope a wireless network to each floor. For process facilities that are extremely compartmentalized by steel and concrete, you may want to treat each large enclosure as a process unit.

PLAN LOCATIONS, VALIDATE DESIGN

The wireless devices' role as routers in a self-organizing network requires enough devices in proximity to each other to support reliable communication paths.

The first step in planning your first wireless network is to obtain or create a scaled drawing of the process unit or area where the network will be installed. (For an outdoor facility, the images available on Google Earth—http://earth.google.com—can be used to create one.) Within the scoped area, identify the measurement points that satisfy current and future application needs.

With the scaled drawing completed, you have two choices going forward. Wireless device locations can be plotted by hand, and the anticipated reliability of network communication gauged by the guidelines listed in the sidebar on p5, "Rules of Thumb for Manual Network Design."

Another option is to use Emerson Process Management's new AMS Wireless SNAP-ON tool to validate a planned network's design easily and automatically (see adjacent sidebar, "New Tool Eases Wireless Network Design"), and to optimize the network's ongoing operation.

Once the device locations are plotted and validated, choose a location for the wireless gateway that provides power, is convenient for the physical (or possibly wireless) connection to the host control or information system and, ideally, provides a direct wireless connection (without a "hop") to 25% of the wireless devices in the network.

For even the smallest networks, have at least two devices that communicate directly with the gateway. For larger networks, a useful rule of thumb is one additional directly connected device for every eight devices in the network.

GATEWAY FIRST, THEN ADD DEVICES

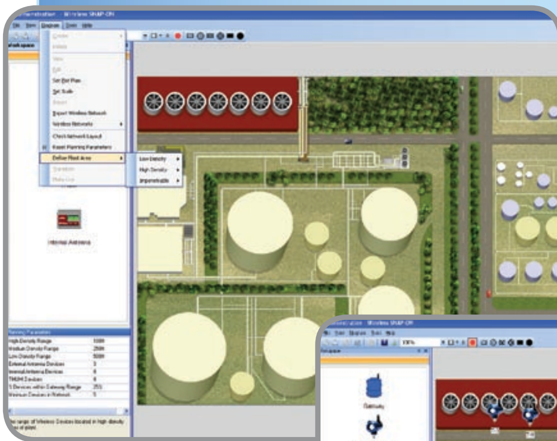
You must follow two essential rules when when you install your first self-organizing network: Install and power up the gateway first; then the wireless devices nearest the gateway.

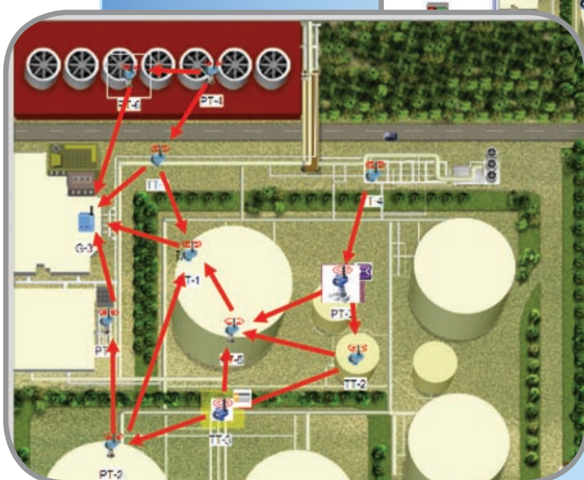
For the highest signal quality, install the gateway outdoors (minimum rating of Class I Div II or Zone 2) at least 3 ft (1 m) above other canopy structures, such as above the roof of a control room. If outdoor mounting is not an option, connect the gateway to a remote omni-directional antenna using a cable no longer than 20 ft (6 m).

Once the gateway is up, start with the field devices that are clos-

NEW TOOL EASES WIRELESS NETWORK DESIGN

While there are well-developed rules of thumb for manually validating that a WirelessHART network configuration will provide adequate connectivity (see sidebar, p5), a new engineering tool from Emerson Process Management now makes the job even easier.





This view is useful for detecting any potential weak points in the self-organizing network.

Called the AMS Wireless SNAP-ON, the tool allows users to drag and drop devices and gateways onto a plant layout, then easily validate and optimize the network design against known best practices. Further, once the network is up and running, the tool allows the user to maintain the network easily by graphically displaying network traffic and diagnostic data.

To design a wireless network using the AMS Wireless SNAP-ON, the user first imports an image of the process area where the network will operate (top image).

Then he or she sets the image's scale by drawing a line across any two points and typing in the distance. The user then designates whether the process area represents an environment of high, medium or low density of process equipment.

The user then drags and drops desired WirelessHART devices and gateway(s) onto the plant layout. Then the user automatically validates the design against best practices planning parameters (middle image).

In this image, the red circle indicates a violation of best practices that might be addressed by adding another measurement point or wireless repeater to complement current communication paths.

For wireless networks already in operation, the user is able to see the device icons from the HART Device Descriptor (DD) and the self-organizing network communication pathways (bottom image).

WIRELESS AT WORK

LAPEM STREAMLINES EFFICIENCY TESTING

On behalf of Mexico's Federal Electrical Commission (CFE), wireless technology is helping to streamline the measurement of thermal efficiencies at power generating units throughout the country.

LAPEM, the Testing Laboratory of Equipment and Materials, has five analysis teams that set up temporary measurement facilities at each of 140 power plants, but wanted to increase the frequency at which each plant was tested. In contrast to traditional wired measurements, one team's easy establishment of a temporary wireless network made it possible to increase its productivity and plant coverage by 10 percent. This led to an annual revenue increase of US$512,000 for the unit. It has also improved the revenue of the Federal Electrical Commission by pushing higher output for each plant while reducing costs.

The ease of use and the reliable performance of Emerson's Smart Wireless system resulted in a decision by the Laboratory Analysis group to equip all five of its analytical teams with wireless instrumentation. Their productivity is expected to increase by another 40 percent with faster turnaround time between services. As a result, all five teams should perform 25 more assessment services per year, producing an extra US$1,375,000 annually without adding personnel. Each of the 140 power units can now be visited and analyzed every other year.

"In the past, we could only cover about 50 plants per year," said Oscar Martinez Mejia of LAPEM. "We needed to reduce turnaround time at each plant in order to reach every plant on a two-year cycle. Emerson's Smart Wireless made it possible for the team equipped with wireless devices to cut their on-site time by one-third, enabling them to complete more services in a year's time and proving the value of wireless."

"It takes 15 days to install and commission wired instruments, take the readings, and tear down the setup," Martinez Mejia said. "Then, another week is needed for reporting and other activities before a team can move on to the next plant. In the future, they will be able to cover 75 plants per year, because the on-site work can be done in just 10 days using wireless devices."

est to the gateway. Most *Wireless*HART devices, including Emerson Process Management's Smart Wireless instruments, have process connections and mounting engineered to the same practices and systems that govern wired instrumentation today, with the exception of the loop wiring.

> **"Wireless made it possible for the team to cut their on-site time by one-third."**
>
> *— Oscar Martinez Mejia, CFE LAPEM*

Once the first devices are working, you can be confident of a reliable communication path for the others and a solid foundation for expanding the network. You can use repeaters to temporarily strengthen the network until all the devices are installed or until the network surrounds an entire process unit completely.

FORTIFY AND EXPAND

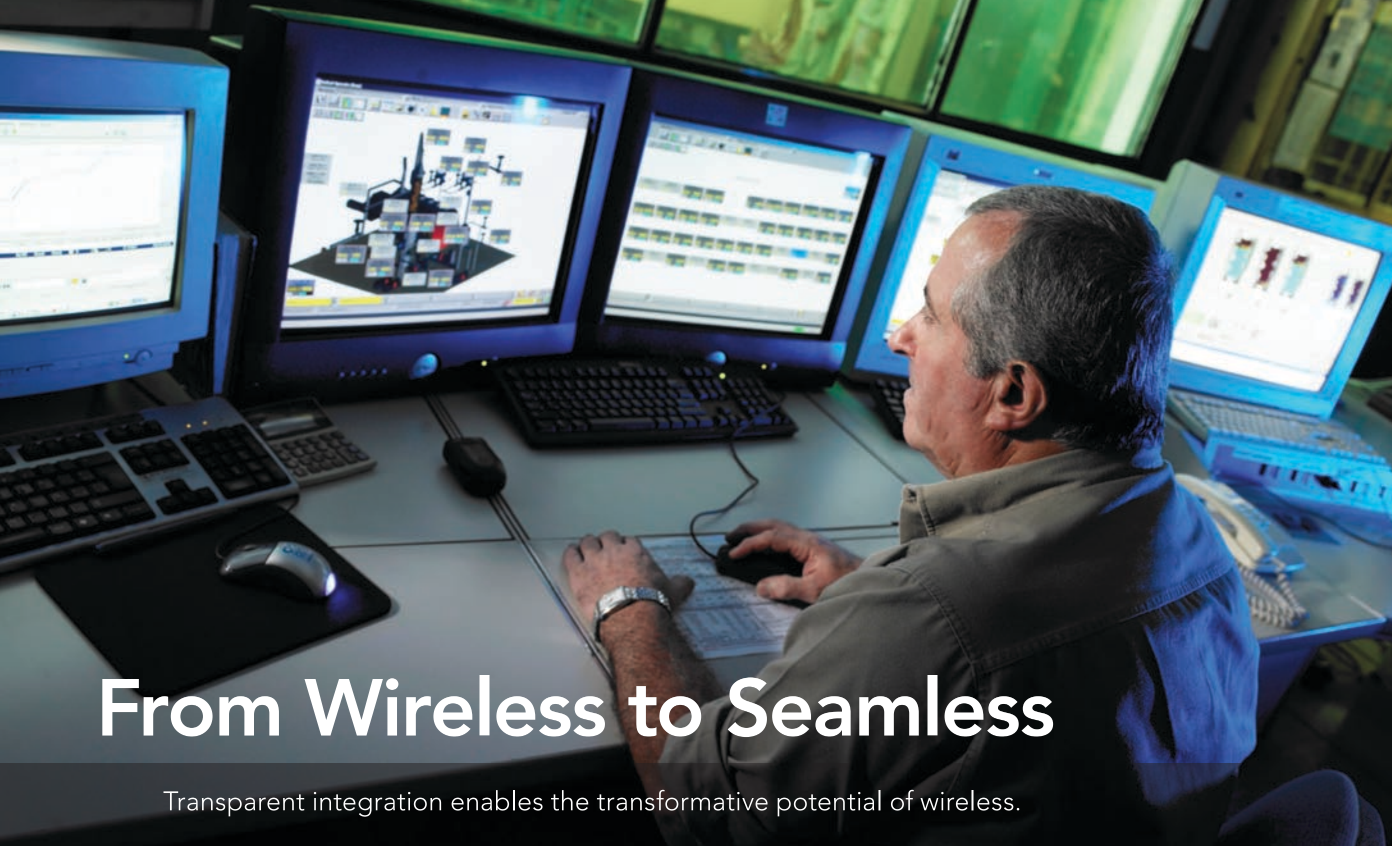
Once you've verified that each device has joined the network and is communicating properly, identify any "pinch points," where messages from several wireless devices must all pass through a single device or repeater at any point on their way to the gateway.

Use additional repeaters or measurement devices to eliminate this vulnerability. Emerson's new AMS Wireless SNAP-ON tool (see sidebar, p7) makes this task especially easy by graphically displaying network traffic patterns. Further, once the network is up and running, the tool allows the user to maintain the network easily by graphically displaying network traffice and diagnostic data.

Overall, the wireless devices in your self-organizing network will have good connections if it meets the following criteria:

- At least 99% of messages sent by each device reach the assigned gateway.
- At least 70% of transmissions between two nodes (one "hop") are successful.
- Device batteries last as long as expected.
- Radio signal strength in the gateway diagnostics is good. This check can be misleading on its own (weak signals can still get through if the path is stable), but it can help identify a problem when it arises.

When it comes to adding devices to your first *Wireless*HART self-organizing wireless network, remember that, in general, bigger really is better. In fact, the more wireless nodes in the network, the easier it is to expand. It really is that easy.



From Wireless to Seamless

Transparent integration enables the transformative potential of wireless.

TO SUSTAIN BUSINESS performance in today's complex and competitive environment, continuous innovation is critical. And within the global process industries, this innovation increasingly relies on collaborative decision-making based on the very latest information—available at all levels of the enterprise, within and across organizational boundaries. In fact, companies will rely on better information integration to provide a critical productivity boost in view of today's shortage of skilled workers.

Fortunately, the advent of wireless technology and standards for in-plant use has coincided with the development of complementary tools to ease integration tasks. Indeed, the seamless integration of wireless into current plant architectures holds the potential to improve productivity dramatically by providing ready access to better information.

Meanwhile, the integration of wireless networks into your current plant automation hierarchy may be simple—but in most cases it's not yet entirely automatic. So then, a brief review of the current options for making your wired and wireless worlds work well together.

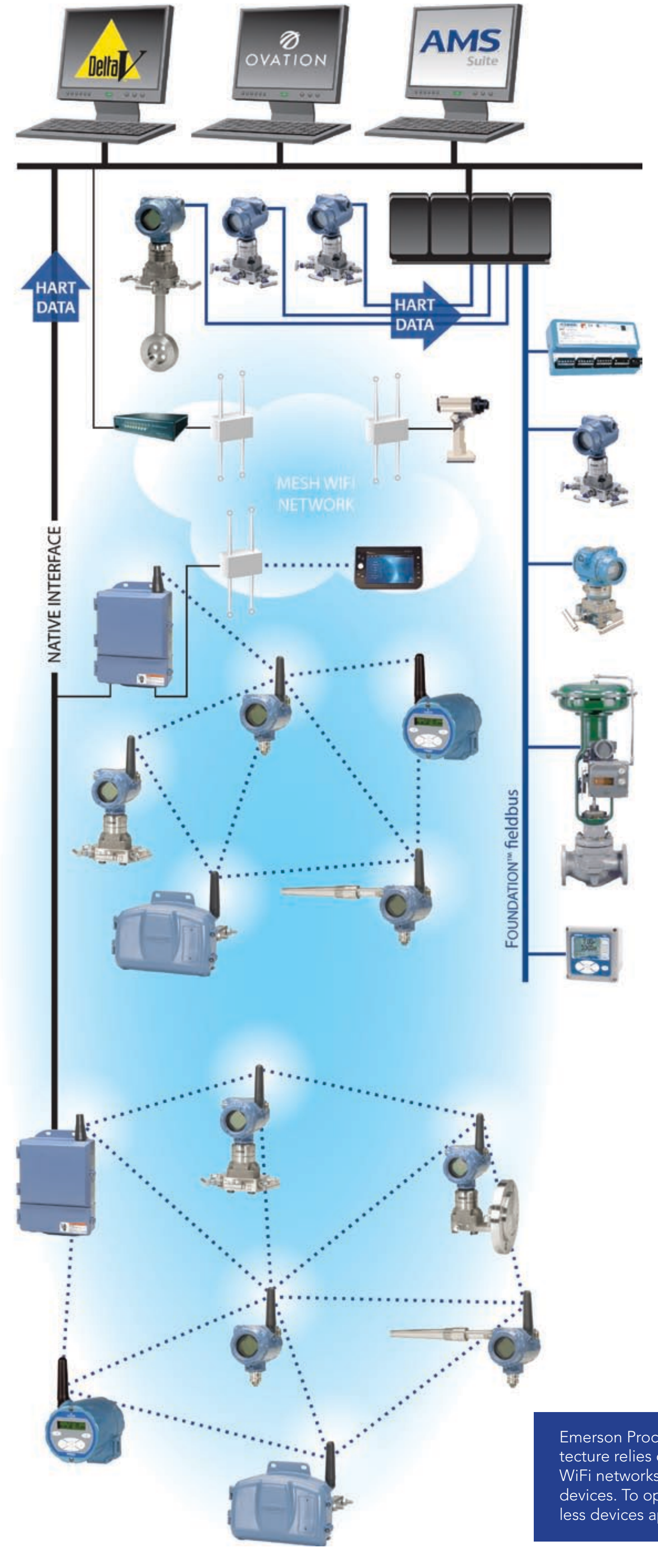
THROUGH THE GATEWAY

As with the transition between any two disparate networks, the integration of wireless into a host control or information system relies on a gateway to translate, for example, *Wireless*HART into Ethernet.

When adding a wireless network to an existing process unit, it's typically the interface requirements of the host system that will dictate what type of gateway interface will be needed. With the connectivity options listed below, the gateway can be integrated with a wide range of host systems, including Emerson's DeltaV and Ovation control systems, Emerson's AMS Suite asset management application, as well as a wide range of programmable logic controllers, process historians and other legacy control systems.

PRIMARY WIRELESS INTEGRATION PROTOCOLS

Protocol	*Typical Host*
Modbus/RTU	Distributed control systems (DCSs) and programmable logic controllers (PLCs)
Modbus/TCP	DCSs, PLCs and human-machine interfaces (HMIs)
OPC	Data historians and HMIs
Ethernet	Asset management systems and other applications on the plant LAN
HTTP	Web interfaces used for configuration and simple monitoring
XML and CSV (comma-separated values)	Bulk data transfer



GO NATIVE

The best-case scenario for wireless integration is a host system such as Emerson's DeltaV, Ovation or AMS Suite, the latest generations of which now include native support for wireless devices. Indeed, for users of these systems no integration *per se* is required—wired and wireless field devices appear transparently on the system without requiring special wireless or communication know-how.

In the latest iterations of DeltaV and Ovation, the Smart Wireless Gateway can even be "auto-sensed" and "auto-configured" for quick and easy start-up and commissioning. Essentially, the gateway becomes just another control network node. In addition, HART alerts from *Wireless*HART devices pass directly through to the AMS Suite: Intelligent Device Manager, eliminating the need for an additional network.

Nu-West Industries' phosphate-based fertilizer plant in Soda Springs, Idaho, U.S., is among those process manufacturers leveraging this native capability. Remote tank level measurements feed wirelessly through a Smart Wireless Gateway into the plant's DeltaV automation system where Emerson's AMS Suite: Intelligent Device Manager application recognizes readings that are out of norm, enabling operations to take action to control reactions in the tank.

SERIAL LIMITATIONS

If your application uses a serial Modbus communication link, first verify that the host system has available connection capacity. A good estimate for the number of Modbus registers required is three times the number of data points to

Emerson Process Management's Smart Wireless architecture relies on industry-standard WirelessHART and WiFi networks to communicate seamlessly with wireless devices. To operators and maintenance personnel, wireless devices appear just like wired ones.

enable remote monitoring of the process variable and device status indicators. It's also important to note that with serial systems, security measures are limited to physical isolation of the components; data cannot be encrypted and access cannot be managed due to protocol limitations.

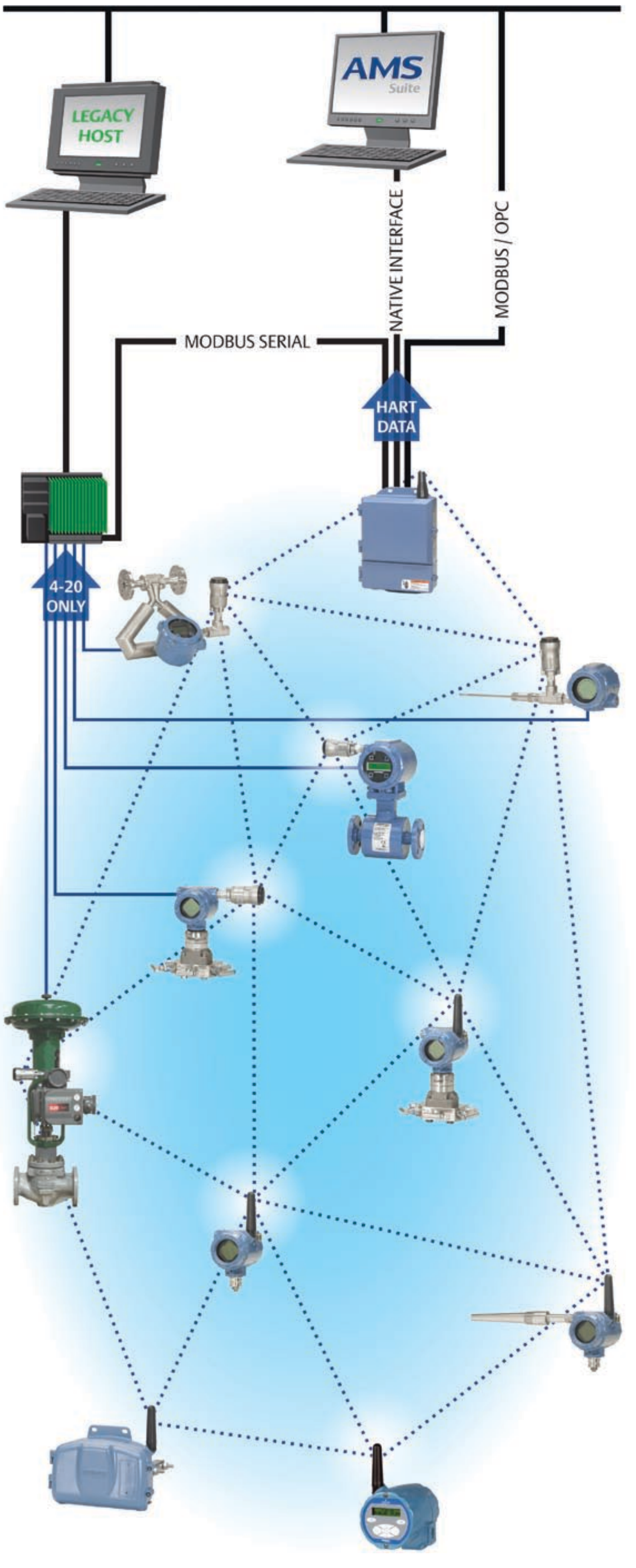
Hunt Refining in Tuscaloosa, Ala., U.S., uses a Smart Wireless Gateway to gather wireless temperature measurements from several hot asphalt tanks 400 ft (130 m) away from the control room. In this case, two-wire Modbus connects the gateway to the plant's DeltaV control system and AMS Suite application.

"The installation was simple, and the transmitters came up and talked with the gateway as soon as power was applied," says Dennis Stone, Hunt Refining process control engineer. "The gateway was easily connected to the distributed control system via a two-wire Modbus communication."

ETHERNET OPTIONS

Finally, if the host application requires integration via Modbus TCP/IP, OPC or HTML, then either a wireless or wired Ethernet connection is the way to go. Ethernet communications will have fewer restrictions than serial systems, but may require the involvement of your IT department. The IT department can identify the connection point and integrate the gateway through Ethernet firewalls and provide remote access to the gateway. Ethernet also allows the gateway to be managed securely like any other device in a IT network.

Wireless Ethernet provides high bandwidth to handle both diagnostic and measurement data. In fact, with power as the only requirement, you can place the gateway almost anywhere that's in range of the devices as well as the host connection. For the same reason, it's easy to move the gateway if needed.



A Great Place to Start

A survey of the process industry's favorite first applications for wireless field networks.

AS COLLECTIVE INTEREST in wireless gathers momentum, a growing number of process manufacturers are seeking that first, relatively low-risk application that will allow them to validate the technology within their own cultures and operating environments.

And while the reasoning and justification varies widely, many process manufacturers continue to choose a field-level network of measurement devices as their first foray into the wireless world, according to Emerson Process Management, which today has several years and hundreds of wireless implementations under its corporate belt.

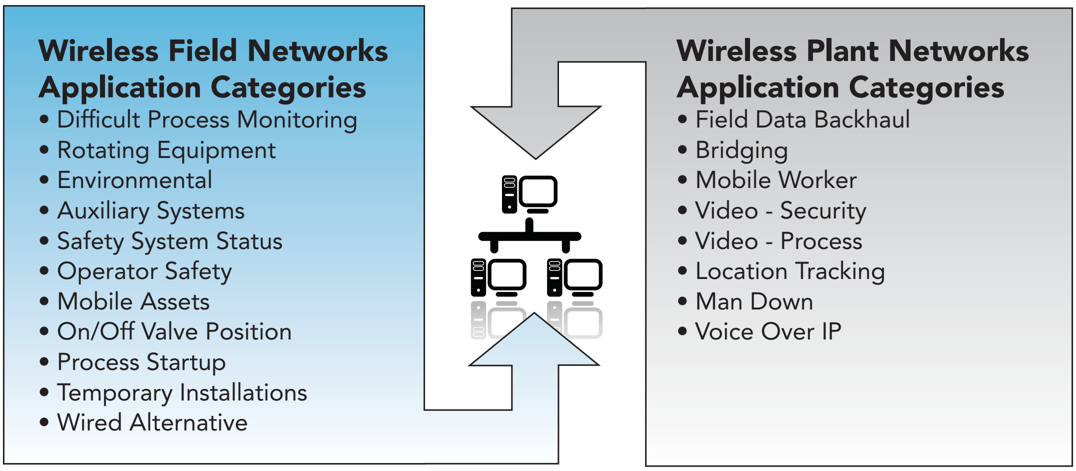
Indeed, while most current application requests are for field-network applications, says Jane Lansing, vice president of marketing for Emerson Process Management, "we're increasingly working with customers on plant-level applications, such as for mobile workers and the location of assets and people."

And while none of the applications surveyed in this article may apply directly to your plant's situation, it's likely there's one that has much in common with them. (See figure below for application categories.)

HEAT EXCHANGER AND FILTER MONITORING

Heat exchangers, which often are run until fouling adversely affects unit performance, represent an excellent application for wireless. They rarely are instrumented,

Wireless Deployment is Driven by Customer Business Need



even in newer plants, but wireless monitors enable personnel to determine when maintenance is needed.

For example, a major refiner in Europe developed an equipment health system for keeping an eye on its heat exchangers. One of the company's engineers explains, "Monitoring heat exchangers for fouling allowed us to establish which heat exchanger was the most fouled. This knowledge gives us the opportunity to compare increases in the throughput with cleaning cost and to make better economic decisions."

Filters present another application opportunity. Many filters are run until they clog, but users can improve their performance significantly and save energy by using wireless monitors. One major refinery uses wireless to detect plugged filters on coker unit pumps, which is critical to prevent damage to the pump on loss of suction.

TANK MONITORING

Tank farms pose a unique instrumentation problem: Each of dozens of storage tanks may have to be monitored for level, temperature, pressure and so on. Because of the cost of running wiring underground over the vast distances involved, tank farms often are not instrumented.

Hunt Refining Company in Tuscaloosa, Ala., U.S., uses wireless temperature transmitters to monitor hot asphalt tanks. When very hot asphalt is added to a tank, the hot fluid can "melt through" the stored asphalt and reach cold pockets, where any moisture present can flash off violently. This can cause a tank roof failure, which costs $200,000 to repair. Wireless temperature transmitters are spaced around each tank to monitor for cold pockets.

CHECKING PUMP AND MOTOR HEALTH

When a vital pump or motor fails, it can cause a very expensive process shutdown, a leak or other problems.

Installing wireless vibration monitors on key pumps and motors is proving a wise investment for process plants. Vibration data is transmitted wirelessly to a control system that detects and diagnoses problems long before the pump or motor fails, allowing the plant to schedule maintenance or replacement at its convenience.

MONITORING MOBILE ASSETS

Some process units, such as skids, pumps, compressors, portable laboratories and test equipment, are mobile. A major life-sciences company installed wireless on its moving skid platforms,

CONSIDER A WIRELESS FIELD NETWORK WHEN YOUR APPLICATION HAS...

- **Manually collected data:** Wireless can eliminate the need to send technicians into the field to read gauges
- **"Must have" measurements:** Environmental or safety regulations may require additional measurements. Wireless allows the easy placement of instruments where needed.
- **Need for diagnostics:** Many plants have hundreds of HART-based instruments. Wireless allows access to diagnostic information in HART devices.
- **Electrical classification problems:** Wireless instruments can be installed in hazardous environments more easily than wired instruments.
- **"Want to have" measurements:** Wireless permits adding instruments in locations that could not previously be justified.
- **Long distances involved:** Wireless can eliminate the need for long cable runs and trenching to connect tank farms and similar assets spread over a wide area.
- **Many pumps and motors:** Plants often have hundreds of pumps and motors. And while continuous condition monitoring is noble in concept, wiring vibration sensors to all of them would be prohibitive. Wireless allows an easy connection.
- **Extreme environments:** Hot, dangerous and/or hazardous environments make it difficult to install instruments and run wire. Wireless minimizes the problem.
- **Crowded environments:** Wireless eliminates the need to snake new wires through crowded enclosures and conduit.
- **New wiring is too expensive:** Installed costs of $50 to $100 per foot can make adding new wired measurement points cost-prohibitive.
- **Need for feedback:** Manual valves that have no position feedback can cause safety problems. Wirelessly monitoring can cost as little as 10% of a wired solution.
- **No other way:** Wireless works for mobile assets, remote sites and rotating equipment where using wired instruments is impossible or impractical.

While many users choose a wireless instrument network as their first wireless project because of the high ROI, recent advances such as this new Panasonic U1 mobile operator station for Emerson's DeltaV system, will accelerate the adoption of worker mobility applications. This ultra-lightweight, ruggedized PC is Class 1, Div 2, and includes both WiFi and cellular network connections.

WIRELESS AT WORK

INEOS KÖLN PREVENTS UNSCHEDULED DOWNTIME

Emerson Smart Wireless technology is enabling polyethylene maker INEOS to detect blocked filters within polyethylene pellet transportation tubes that can lead to production downtime at its plant in Cologne, Germany.

INEOS produces polyethylene, which is used for a very broad range of products including pipes, packages, films and coating. Polyethylene pellets ready for customer use are transferred to the plants' silo store through pneumatic conveying systems. Pellets are entrained in streams of air and effectively "blown" from one location to another. The in-coming air is filtered to prevent any pollution of final product.

The filters become blocked over time and lose their efficiency, which in turn affects the quality of the end product. INEOS could have established a preventive maintenance routine and cleaned the filters on a time based schedule. However, this could mean that filters are cleaned when they don't need it, or that filters could block between cleanings.

Cleaning and unblocking the filters requires INEOS to stop the blowing and that is not good for the process. Should a blockage take place on a weekend, the maintenance costs are higher.

INEOS chose to clean the filters on a predictive basis, before they become blocked and lose too much efficiency. By closely monitoring the filter condition the maintenance team can schedule the cleaning work at a time that will minimize the cost and disruption caused.

INEOS explored the possibility of installing an online system that would closely monitor the condition of the filter and ensure availability. Using differential pressure meters it is possible to monitor the condition of the filters online. However, because of the location of these filters, connecting the required measurement points back to the control system using a wired solution was not feasible.

"The filters are very hard to reach and the high cost of installing cabling to connect the devices prevented us from installing the online condition monitoring points we wanted." explained Frank Mehlkopf, maintenance engineer, INEOS Köln GmbH.

Instead, they turned to wireless. "We found Smart Wireless so easy to use and we are currently testing it at eight filters in our logistic area," said Mehlkopf. "These transmitters don't even need to have line of sight to the gateway....We fully intend to take advantage of this."

which included pumps, filtration and milling equipment. The skids can be moved anywhere in the five-story building, and successfully communicate through 12-in. reinforced concrete floors.

EXTREME ENVIRONMENTS

Installing instrumentation in extreme environments causes problems for both the instrumentation and personnel. Extreme environments can mean temperature extremes, wet or dusty conditions or hazardous, explosive conditions.

At Usiminas (Usinas Siderúrgicas de Minas Gerais S.A.), one of the world's top steel producers, wireless temperature transmitters are being used to monitor roll bearing oil temperature at the company's heavy plate steel mill in Ipatinga, Brazil.

"This more accurate and redundant data allows us to better maintain the roll bearings and to avoid unscheduled shut downs," says Carlos Augusto Souza de Oliveira, Usiminas instrumentation supervisor.

ROTATING EQUIPMENT AND TURBOMACHINERY

Wireless analyzers increasingly are used to monitor rotating equipment, such as turbines, generator sets, reciprocating engines, compressors and other motor-driven systems. Since such machines are often very large and expensive, diagnostic equipment that can predict pending problems allows users to fix small problems before they become very large problems.

Rotating process equipment is also difficult to monitor with wired instruments. At Coogee Chemicals in Australia, wired instruments failed frequently on a rotating reactor, so Coogee installed wireless pressure and temperature transmitters.

ENERGY USAGE MONITORING

Monitoring energy usage is vital, but often difficult to do with wired instruments. When a plant is first built, many measurement points are considered, but not installed because of time or cost. Now, when the measurements are needed, the cost of wiring new sensors is prohibitive.

Wireless lets users go into an existing plant and install the appropriate monitors. For example, at BP Bitumen near Brisbane, Australia, two wireless transmitters were deployed quickly to manage fuel delivery from temporary propane tanks that were rushed into service during a shutdown of the regular fuel system. The wireless transmitters allowed BP Bitumen to monitor the temporary propane system until the main fuel system came back on line.

TEMPORARY MEASUREMENTS

Wireless allows systems integrators and end users to install temporary instrumentation and monitors in various parts of the process to check on developments during process start-ups or turnarounds, and for troubleshooting.

At Usiminas' flat plate steel mill in Ipatinga, Brazil, wireless temperature transmitters are helping to prevent roller bearing failures that entail thousands of dollars in repairs and a minimum of 600 metric tons lost production.

HEAT TRACING

Heat tracing is used in the hydrocarbon industry to keep materials in pipelines and processes at the correct temperature. Wireless makes it possible to monitor heat-tracing temperatures quite easily.

WELLHEAD MONITORING

Oil and natural gas wellheads typically are located in remote areas, where wiring and trenching are not practical because of long distances. Wellheads often operate unmanned, are rarely visited by maintenance personnel and are potentially hazardous. Wireless makes it possible to monitor these sites.

> **"If I see a problem in our process, it's fairly simple for me to move a pressure transmitter elsewhere."**
>
> *–Jan Huijben, incineration manager, Technochem Environmental*

One example is the more than 600 wireless Emerson devices currently on their way to the Morichal District oil fields of Venezuela. PDVSA, the Venezuelan state-owned oil company, will use the devices to monitor more than 180 wells, delivering pressure and temperature data.

"We need more reliable and accurate measurements for better wellhead control in order to increase production and meet our commitment to the government," comments Euclides Rojas, automation and IT manager at Morichal. "Our long-term goal is to modernize more than 500 wells. Emerson's wireless communications technology has proven itself in our rigorous field trials and is the cost-effective solution we've been seeking for this purpose."

WIRELESS AT WORK

TECHNOCHEM TROUBLESHOOTS WITH MOBILE MEASUREMENTS

"If I see a problem in some part of our process, it is fairly simple for me to take a pressure transmitter and move it elsewhere," says Jan Huijben, incineration manager at Technochem Environmental Complex (TEC) Pty, Ltd., a provider of waste treatment, incineration and distillation services for pharmaceutical and petrochemical companies in Singapore. "I can often determine what's going on in just five minutes, address the issue and quickly return the transmitter to its original application."

Imagine pulling off this nifty troubleshooting trick using the wired tank farm instrumentation the company initially considered when Huijben arrived last year. Then, an accurate tank level measurement system was needed, along with an automated method of moving that data into a computer database. In addition to using the data for tracking and managing inventories, it was needed to schedule incoming customer delivery and provide customers with order status, including assurance that their chemical wastes had been treated and destroyed.

Today, Emerson Process Management's Smart Wireless field network is automating inventory management and monitoring levels in fourteen tanks at TEC. Among the benefits apparent since April 2008 are the elimination of "clipboard rounds," more accurate real-time data for process efficiency, documentation to verify that specific chemical wastes have been destroyed, and access to the data via the company network. When management personnel are at another site, they can view the process data and order changes if necessary. Electronic connection of select data for customers is being developed.

In an unanticipated bonus, some of the fourteen Rosemount wireless pressure transmitters are moved from place to place to aid in troubleshooting and new process development in TEC's continuous improvement culture. "The flexibility of Emerson's self-organizing wireless technology makes it much easier to troubleshoot problems as well as evaluate new applications," says Huijben. Indeed, TEC is planning further use of Smart Wireless. "At first, we thought this technology was too expensive for us," Huijben adds, "but we now believe we are saving money with it."

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