



## **Monsanto's Focus on Asset Reliability Reaps Productivity and Cost Avoidance Benefits using HART Technology**

### **PROJECT OBJECTIVES**

- Embraced an asset reliability optimization strategy to prioritize, plan and schedule downtime for predictive maintenance (PdM), preventive maintenance (PM) and control valve maintenance programs.
- Expand opportunities to take advantage of the plant's new smart I/O infrastructure to incorporate data using HART Protocol.
- Identify instrumentation issues before they impact production for better planning of scheduled, predictive maintenance repairs.

### **SOLUTION**

- Implemented Asset Criticality review and assigned ratings to more than 14,000 pieces of equipment and instrumentation plant wide, including transmitters, control valves, and vapor sensors.
- Used the 700 installed HART technology-enabled devices and smart valve positioners to take advantage of both handheld and remote office-based systems.
- Analyzed their data to quantify predictive versus reactive work by generating a "bad actor" list that shows how much "cost avoidance" the reliability program is providing.
- Integrate intelligent HART device information with plant control, CMMS (SAP), asset management and maintenance systems...and users.
- Using the intelligent device information significantly reduced costs and improved plant operations and enabled the transition from reactive to proactive and predictive maintenance.

### **RESULTS**

- By getting connected to the information in their HART devices, they improved instrument reliability and reduced reactive maintenance costs

- Deployed predictive and condition-based techniques for early detection of instrument issues (plugging, fouling, etc.) and prevented incidents costing \$100,000 per hour of downtime.
- Increased availability, improved reliability and reduced downtime
- Eliminated incidents of expedited products and environmental and safety problems that can result when work is rushed during unplanned outages.
- Reduction in the number of nuisance alarms and the ability to “turn off” tracking for some previously tracked data.
- Identified “bad actor” devices through reliability efforts saving the plant \$800,000 to \$1.6 million per year in cost avoidance.

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For the past few years, Monsanto’s Muscatine, Iowa, manufacturing facility has undergone a transformation in communication, in part through exploiting the capabilities of HART Communication in order to enhance reliability data and help the plant achieve a new level of productivity. The success the plant had incorporating instrument data into a comprehensive reliability strategy earned the plant the 2012 HART Plant of the Year Award.

The Muscatine facility spans 150 acres and employs more than 450 to operate and manage eight process units running 24/7, year round, to produce agricultural chemical products including Roundup herbicide and Acetanilide Select Chemistry products including Harness Xtra, Degree Xtra, and Warrant herbicides. Starting in 1997, the installation of HART Communication-compliant devices has helped enable the plant to switch from batch to continuous operation across processing units as well as in its Waste Treatment and Utility process and Formulations and Packaging process.

Operating since 1961, the plant has undergone various changes and expansions, resulting in a variety of automation systems. Ongoing efforts have helped to integrate systems site wide, including an SAP computerized maintenance management system (CMMS) and Emerson’s AMS asset management system.



This is a distributed platform that includes a central server, which hosts a master database and interfaces with three DeltaV distributed control systems (DCSs) and four legacy Provox DCSs. Additional applications are also installed, including: ValveLink software to manage control valves, AlertTrack for pushing critical device alerts to plant personnel; AMS Wireless for interfacing with a WirelessHART Protocol-based network; and Connector software for pushing/pulling information between the database and the calibration database. These systems and applications manage control networks site-wide.

In turn, control networks connect to more than 600 HART Communication-enabled devices with more than 3,200 instrument assets total.

## Setting asset priorities

"Asset Prioritization is the foundation of all our Reliability Programs," says Joel Holmes, site reliability engineer. That prioritization consists of continual evaluation and ranking of equipment according to several criteria that, in turn, determine the level of criticality for individual plant assets.

Initial efforts to prioritize assets included the reliability team's 2006 discovery of a dramatic 30% error in its SAP CMMS system, which lacked the ability to track reliability work such as labor and material costs to the level of specific assets. In keeping with the plant's Lean Sigma initiative, the plant reduced that error to below 5% by instituting order codes and deficiency notifications. This translated into more than 5,000 SAP records corrected.

By 2008, the plant's use of predictive maintenance (PdM), included various conditioned-based monitoring technologies. These include vibration, infrared thermography, motor analysis/testing, lubrication/greasing and ultrasonic analysis. These paid-off in one case with detection of the early signs of plugging in two mass flowmeters; back-flushing prevented up to six hours of downtime that valued at \$100,000 per hour.

"By implementing conditioned based monitoring techniques, we can effectively identify, diagnose, troubleshoot, and ultimately repair issues prior to their effects negatively impacting production," Holmes says.

## Hooking-up with HART technology

Since 2008, the plant has instituted a new level of reliability optimization to help prioritize, plan and schedule maintenance downtime for ongoing PdM, PM and control valve maintenance programs. This began with the Asset Criticality reviews in which the reliability team assigned ratings to more than 14,000 pieces of equipment and instrumentation plant wide, including transmitters, control valves, and vapor sensors. Each asset was evaluated and assigned an A, B or C ranking, most critical devices getting an "A" ranking, while others--such as run-to-fail assets or those with inline spares--being assigned a "C."

The installation of the asset management system made it possible for the plant to use of smart I/O communication with digital fieldbuses as well as, for the first time, the digital portion of the HART protocol's signal. Today, the system encompasses approximately 700 HART technology-enabled devices and smart valve positioners.

There are two phases to the program, representing two levels of use of HART Communication:

- Phase I employs evaluations in the field using a handheld communicator or mobile computer to capture diagnostic data to an Excel-based file and, in turn, the CMMS, along with any deficiency notifications. This allows technicians to effectively identify, plan, schedule, kit the needed parts and execute PM/PdM tasks.
- Phase II takes fuller advantage of HART protocol and compliant software (i.e., ValveLink for Fisher and Trovis-View for Samson valve positioners) to remotely capture and

compare diagnostic test results with historical data to determine any instance of degraded performance.

### **From hand-held to WirelessHART**

Before the asset management system was in place, HART Communication was not used at the plant other than for device configuration. Today, the protocol is used in the field as well as in the asset management system, which Holmes says serves as “a smart handheld on steroids.”



Of course, it's that and more. The asset management system supports a full, digital I/O infrastructure as well as HART Technology-enabled I/O, however, older, legacy systems don't fully support this infrastructure. In such cases, handheld communicators allow personnel to perform diagnostics and testing. However, Monsanto is continuing to deploy HART technology in a way that will soon bring such data into seamless integration with all-digital fieldbus data using WirelessHART technology. This allows standard-compliant modems or adapters to send/receive data between HART technology-enabled devices and the control/automation system.

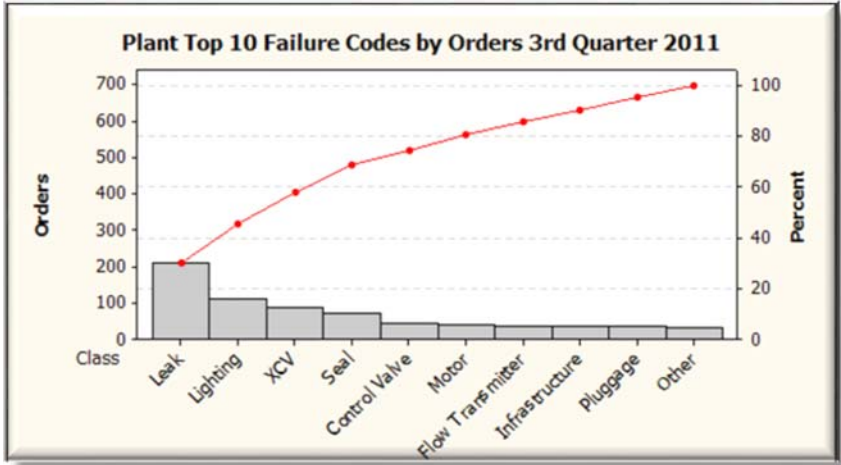
Where this has been deployed, data from devices communicating over Foundation Fieldbus and WirelessHART protocols are seamlessly integrated into the asset management system for a fuller presentation of diagnostic information.

WirelessHART was first installed at the site's waste water facility. This was followed by a gateway adapter at one of the site's Acetanilide herbicide manufacturing units, which include wireless data on six level instruments for pump seal pots. Five additional WirelessHART gateways have been purchased for installation in the near future. Plans call for WirelessHART network coverage to extend across the entire facility.

### **ROI paves way for plant wide expansion**

As a result of the program's demonstrated ROI, the reliability programs have been steadily migrated across the entire facility, providing for increased availability, improved reliability, reduced downtime, and a reduction in reactive work.

The benefits range from small improvements, such as a reduction in the number of nuisance alarms and the turning off of previously required data flows to quantified dollar sums that are fueling expansion of the project. For instance, code analysis data in the asset management system helps to quantify predictive vs. reactive work. In turn, this generates a Top Ten “Bad Actor” list with dollar figures on cost avoidance. This helps quantify the level of cost avoidance the reliability programs have been providing...and has helped leverage the program's expansion plant-wide. Averages of 12 deficiency orders are entered each month; a cost avoidance of over \$1600/work order, it correlates to over \$200 thousand dollars annually since 2008.



“By increasing our focus on Asset Reliability, We’ve made a positive step change in key focus areas, not to mention ROI,” he says. He calculates that since 2008, when reliability program began, the plant has achieved between \$800,000 and \$1.6 million in cost avoidance per year. Connecting HART

Communication and other protocol instruments to the asset management system is one key reason why, because it provided a direct dynamic tie to the health of his instruments. This, in turn, has helped eliminate instances of expedited products, worker stress and mistakes during outages and the environmental and safety problems that can ensue from technical teams operating in a panic situation.

“HART-enabled devices (measurement devices and smart valve positioners) are at the core of this achievement. Now management is asking the reliability group to identify what we want to do next.” he says.

