FIELDCOMM GROUP™

PLANT OF THE YEAR 2014

Nucor Steel Tuscaloosa, Tuscaloosa, AL, USA
Plant of the Year 2014 Award Winner

Nucor Steel Tuscaloosa updates its reporting system with *Wireless*HART®, and gains reliability, heads off water leaks, maintains process and equipment, avoids shutdowns and downtime—and even maintains overhead cranes.

PROJECT OBJECTIVES

- Monitor water usage, and be able to troubleshoot it to catch problems quickly.
- Replace old wireless system because it was only about 60% reliable with lost and dropped communications, number of transient errors we were getting, and how often it needed to be worked on.
- Reduce maintenance time on existing system which required dealing with wireless transmitter issues for several hours every week.

SOLUTION

- Use of *Wireless*HART technology 24/7 to bring about significant reliability improvements to plant operations
- Use of HART data as part of reliability and environmental programs
- Installed *Wireless*HART technology at an existing steel mill using existing personnel

RESULTS

- Achieved 100% network data reliability
- After some basic technology and product training, the team found they could do their wireless upgrade and installation almost entirely in-house
- Four *Wireless*HART Gateways create to wireless mesh network that covers the entire plant and their outputs connect to seven radios which create a wireless backhaul network to their PLCs
- *Wireless*HART Installation includes 36 temperature transmitters of which 2 use extended range antennas, 19 DP transmitters and 1 adapter connected to a wired HART device on the water monitoring application
- Depending on the application, they also saved 50-80% with *Wireless*HART compared to the costs of a wired solution

- Savings from monitoring the overhead crane were estimated at $150,000-$250,000 per event by taking action before a major problem disables the crane
- They expanded their application to include 19 DP transmitters in the plant's bag house and water filtration system and then to monitor the mill's overhead crane bearing temperature and vibration

---

Nucor Steel Tuscaloosa (www.nucortusk.com) engineers are using HART® and *Wireless*HART technology as part of a reliability improvement program to accurately monitor critical water resources used at their plate steel mill connected to an asset management application for reliable measurement readings, device diagnostics, failure analysis, and preventative/predictive condition-based maintenance. Using the intelligent device information significantly reduced costs and improved plant operations as it enabled the transition from reactive to proactive maintenance and improved plant operations.

Sometimes making one improvement yields a jackpot of others.

For instance, Nucor Steel's plate mill in Tuscaloosa, Ala., recently needed a more reliable recording and reporting system to accurately monitor water resources used at the mill, but the existing reporting system wasn't reliable, its network connectivity was poor, and technical support was lacking.

As a result, Nucor Steel Tuscaloosa Inc. (www.nucortusk.com) replaced its old, point-to-point wireless system in operation during 2009-13 with a new, mesh-based wireless solution. Also, rather than hiring an outside engineer or contractor, the plant's engineers and technicians found they could do almost all of the design and installation of their wireless replacement project on their own.

Well, the new mesh and *Wireless*HART solution not only provided more reliable reporting about the plant's water system, but it also delivered a cornucopia of other benefits to Nucor's operations. In fact, the new wireless system achieved so many gains that the Tuscaloosa mill was awarded the FieldComm Group 2014 Plant of the Year Award.

Plant provenance

The present Tuscaloosa facility was built in 1985 on the site of what was once a paper mill (Figure 1). In 2004, Nucor Steel bought the mill and all of its assets from Corus, formerly British Steel.

The Tuscaloosa mill presently has about 430 employees, which Nucor calls "teammates," and operates 365 days a year. They convert scrap metal into 5.25-in. slab steel, which is then rolled out into 1/8-in. to 2-in. thick temper plate steel. They can also coil steel up to 1 in. thick. Steel from the mill is used for pipelines, building plate, tug boats, barges, and pressure vessels. Ben Springer, environmental technician at Nucor Steel Tuscaloosa, reports the mill can produce more than 1.2 million tons of steel per year, so it also annually consumes a lot of industrial,

non-potable water, which it gets at low pressure from Lake Tuscaloosa via the municipality. The mill sprays this water on its steel strand as it moves through the machines in its production line, both to help form the steel and to cool its equipment. This distribution system's water meters are monitored by transmitters that send back 4-20 mA signals via wireless to indicate flow rates and other parameters.

"The monitoring system is needed to see how much water is being used and where," says Springer. "By knowing this we can look for ways to conserve water and manage how we use the water in our process. We can also use the monitoring system as a troubleshooting aid if a failure of equipment or piping infrastructure occurred."

Migrating to mesh

To improve its water monitoring system, the Tuscaloosa team initially had to weigh several options, including continuing to invest in current wireless infrastructure, investigating alternate solutions such as manual collection of data, implementing a wired solution, or investigating an alternative wireless solution that better met their needs. A wired system wasn't an option because the location of the water meters would have require miles of excavation and new cables, a restricted number of analog cards in their PLCs, and limited flexibility for future applications.

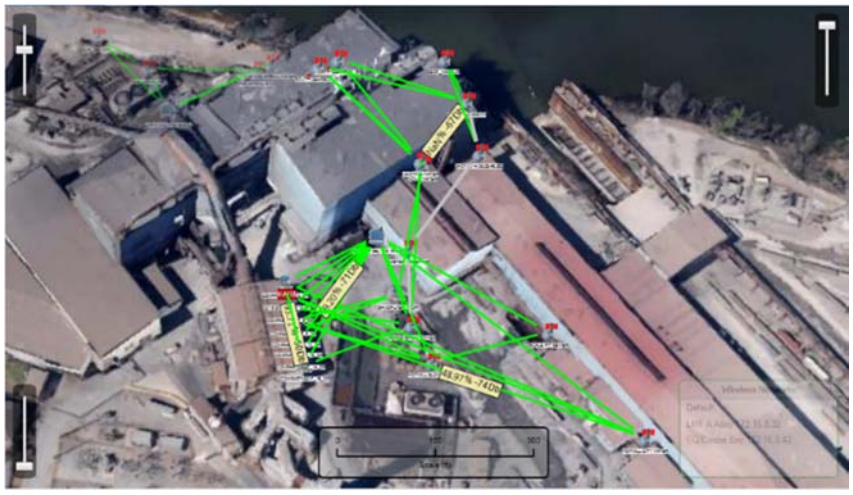
However, the team's research found that *Wireless*HART was an open protocol, and they eventually selected it because it didn't require a radio frequency (RF) survey, it cost less than other options, and its devices offered a self-organizing mesh network, secure communications, easier deployment, simple system integration, multiple vendor options and total digital communications.

"The main goal was to monitor our water usage, and be able to troubleshoot it," says Springer. "We didn't have leaks yet, but if we did have an issue, we wanted to catch it quickly. This wouldn't be possible with the old wireless system because it was only about 60% reliable based on the many times it lost and dropped communications, the number of transient errors we were getting, and how often we had to work on it. We were dealing with wireless transmitter issues for several hours every week."

Design, install, and succeed

Following some basic training on the wireless gateways, transmitters and support devices they planned to install, the Tuscaloosa team found they could do their wireless upgrade almost entirely in-house with some help from local sales representative Russell Poor. They deployed several wireless tools from Emerson Process Management, including Smart Wireless gateways/servers and Asset Management Suite (AMS) Wireless Snap-On planning software, which works with Google Maps.

These components use *Wireless*HART to communicate to four gateways, and their output is connected to seven radios from ProSoft Technology, which creates an IEEE 802.11 (WiFi) wireless backhaul network for communications from the gateways. The radios create their backhaul network to the PLCs, and the data can be access by using an OPC server application. This network receives input from 34 *Wireless*HART temperature transmitters, two



*Wireless*HART temperature transmitters with extended range antennas, 19 *Wireless*HART DP transmitters, and one *Wireless*HART adapter connected to a wired HART device.

The four gateways presently cover 90% of the Tuscaloosa mill, and can easily go to 100% coverage if needed. The Prosoft radios are mounted 80-90 ft. up on the bag house, so no added towers were required.

Results attract cranes

Springer reports that the mill's new *Wireless*HART network achieved 100% data reliability that was on-time and validated. "It was much better than we expected," he says. "It's easy to get data out of the system. The *Wireless*HART signals go through buildings without any problems, and its meshing provides for a strong network with only a few routers needed, which help make the network even stronger. Depending on the application, we also saved 50-80% with *Wireless*HART compared to the costs of a wired system."

Beyond checking water use at the mill, the Tuscaloosa team discovered they could also use *Wireless*HART to monitor 19 DP transmitters in the plant's bag house and water filtration system. "When you melt steel, one of the byproducts is dust, and so the bag house is basically a large dust-collection system with big filter bags," explains Springer. "Measuring pressure drops in the bag house helps us determine when the bags need to be cleaned."

Next, these results began to draw interest from the mill's overhead crane maintenance team, who realized they could use *Wireless*HART to monitor bearing temperature and vibration. The crane moves steel in and out of the mill's production process, and also transports its ladle for casting and forming products.

Consequently, sensors and transmitters on the crane were added to the mill's *Wireless*HART - based network, where they deliver updates every 2-4 seconds. In the crane's gearbox/bearing monitoring application, savings were estimated at $150,000-$250,000 per event because now they can monitor the bearings, and take action before a major problem disables the crane.

"Because of the high reliability and automated monitoring of *Wireless*HART, we can now plan maintenance to our processes and equipment, rather than having unplanned shutdowns due to equipment failure," adds Springer. "We're now able to provide accurate and reliable data for the process points measured. *Wireless*HART is helping us reduce cost and prevent costly downtime."