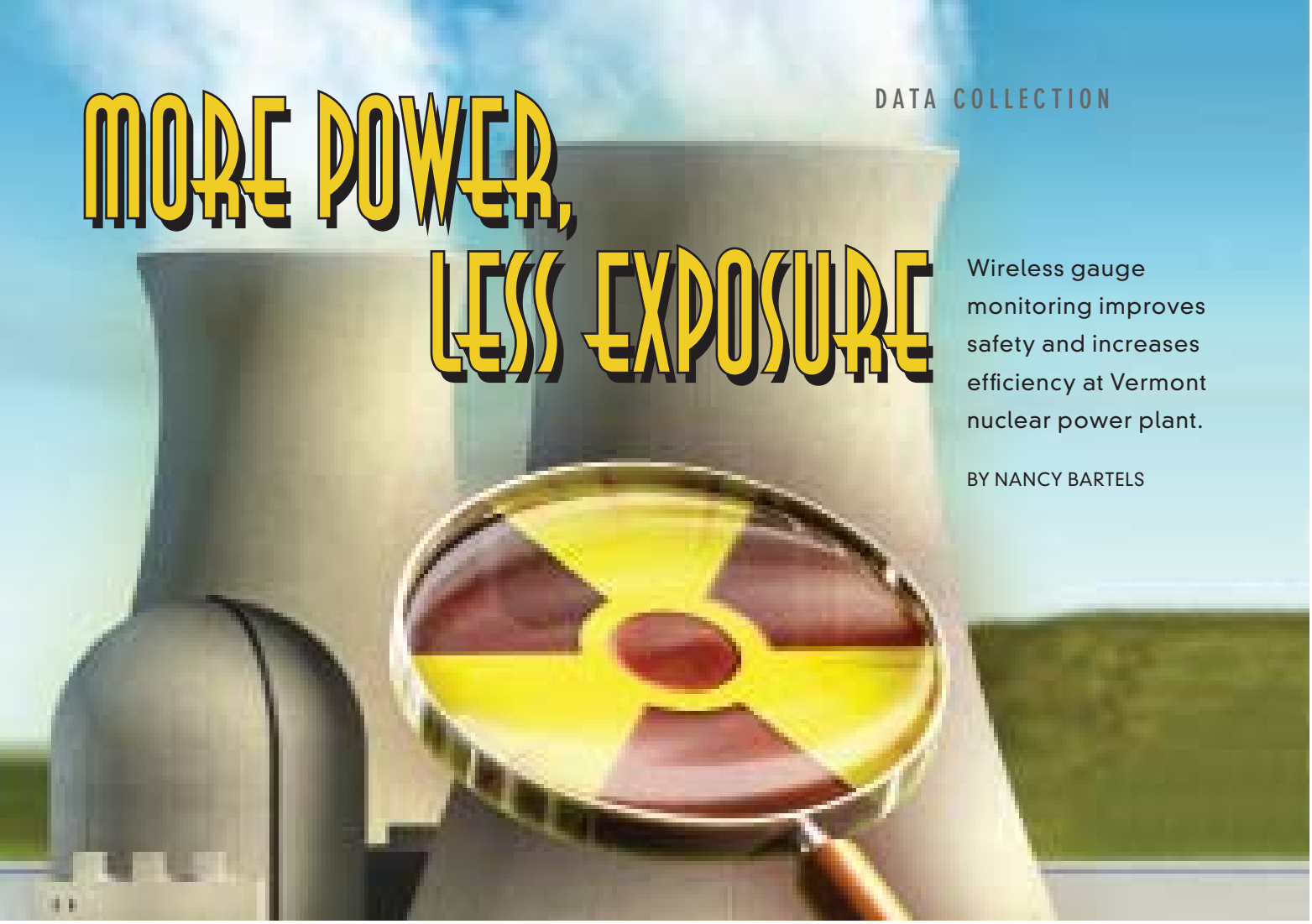
MORE POWER, LESS EXPOSURE

Wireless gauge monitoring improves safety and increases efficiency at Vermont nuclear power plant.

BY NANCY BARTELS



The Vermont Yankee nuclear power plant in Vernon, Vt., supplies one-third of the state's power. Owned by Entergy Corp., the second-largest nuclear generator in the U.S., it employs 650 people and produces 650 MW of power.

Since acquiring Vermont Yankee in 2002, Entergy reports that it has saved its customers in New England about $330 million. It adds that Vermont Yankee also generates about $100 million in economic benefits through payroll, taxes and local purchases.

This important generator, both of power and income for the region, has a vested interest in clean, cost-effective, safe and efficient operation.

Aiming for ALARA

The nuclear industry has an ongoing goal of reducing the radiation exposure of its employees to "as low as reasonably achievable" (ALARA). The Vermont Yankee facility obviously shares that goal, but it also faced some challenges. With more than 100 gauges monitored manually throughout the plant, Entergy had several issues to address. Manual readings generated too many errors. With more than half the gauges located in controlled areas where radiation exposure is possible, Vermont Yankee's management wanted to eliminate as many visits to those areas as it could. Finally, it also needed to address the problem of infrequent gauge measurements with periods of six hours or more when no measurements were available.

"We knew that we needed an advanced technology to help us improve our nuclear safety and performance at the Vermont facility, and recognized the benefits that wireless technology could provide as a cost-effective means of achieving these goals," says Gary Von der Esch, Vermont Yankee's operations manager.

Going Wireless

The situation seemed tailor-made for a wireless solution. Vermont Yankee partnered with Honeywell Process Solutions to implement and optimize the use of wireless gauge reader (WGR) technology to reduce radiation exposure and enhance system monitoring. The WGR is an instrument that attaches to the front of existing analog gauges, and then transmits a gauge reading wirelessly via WiFi 802.11b/g protocol. It comes with different adapters to accommodate gauges with different diameters and different types of gauges, such as panel-mounted, process, magnahelic and photohelic.

The WGR solution also has an application gateway that includes the database where the gauge information is stored; OPC server software for interfacing with other host systems; and Internet-based software that is used to trend, alarm and analyze the gauge data.

Vermont Yankee engineering and operations personnel iden-

tified 13 spots where the current gauge could only be read near the equipment being monitored, and installed WGRs at those locations.

"With the WGR installed, our operators can perform rounds and observe plant conditions without spending additional time in high-radiation areas to manually record gauge readings," explains Von der Esch. "The operator can now take the gauge reading in seconds from any network computer—reducing time, human error and expanding system monitor data points—but most importantly reducing radiation exposure."

The enhanced monitoring capability also enables operators and engineers to gather data on the performance of the system in between scheduled readings, which means they have improved analysis of the system when needed. "Going forward, Vermont Yankee will establish a feed from the WGRs to the process computer, which will allow the system data from the WGRs to be captured and mapped against other system data for analysis," adds Von der Esch.

Safety and Savings

In addition to reducing the time that personnel need to be near energized and high-temperature pressure equipment, Vermont Yankee has documented annual cost savings. "By reducing the need for operators and engineers to have access to radiation areas to gather data, we are able to have gauges in both our Reactor and Turbine buildings, and the WGR technology provides a very cost-effective tool to help us achieve the nuclear industries' goal of reducing radiation exposure to ALARA," says Von der Esch.

However, the savings go beyond achieving ALARA goals. The wireless technology also eliminated wasted man-hours traveling into and out of the plant. During the trial phase of the implementation, Honeywell's WGRs documented a savings of 730 person hours annually for a labor cost savings of $29,200.

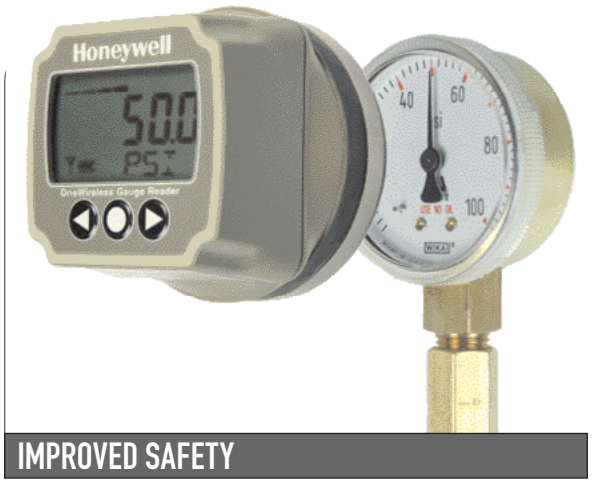


Figure 1. Honeywell's wireless gauge readers reduced workers' time spent exposed to radiation.

The full implementation going forward has the potential to save more than 2,000 person hours and approximately $90,000 plus in annual labor costs.

More Innovation

Entergy also partnered with Honeywell to help find a process to achieve its ALARA goals. Key elements to the success of this innovation were the adapting and testing period prior to installation. Vermont Yankee was able to provide timely information and recommendations to Honeywell that were quickly adopted to improve performance and reliability of the wireless devices.

Innovative technologies used in the WGRs at the Vermont Yankee facility include:

- Miniature cameras that capture an image of the gauge face—much like cameras on cell phones today;
- Software to calculate the angle of the gauge needle and calculate a digital reading;
- LED lights to illuminate the gauge face so that optical images can be captured;
- Ultra low-powered WiFi radio that conserves power, allowing the device to operate from two commercially available long-life batteries.

"This technology opened the door to unimagined opportunities and benefits, including dose reduction, improved equipment monitoring, real-time readings and more data points for analysis," continues Von der Esch.

Productivity and Efficiency

The use of WGRs saves time for the operator performing rounds, reduces potential human error, and provides real-time updates to the system. With data being collected every 15 minutes, the WGRs feed more extensive data into statistical process control models. This increases the ability to monitor variation early, set trend parameters, and give personnel more time to appropriately respond to evolving situations.

"Honeywell's WGRs provided a solution to the inefficiencies we saw in our current system, allowing us to save time, reduce dose, and provide continued monitoring—enabling our employees to spend more time doing more productive work such as analyzing data," says Von der Esch.

In addition to the documented benefits above, the WGR technology is transferable to any commercial facility using the 802.11 b/g communications protocol. Entergy has plans to incorporate the technology into additional fleets.

"Vermont Yankee has demonstrated the efficiency of the WGRs, and has plans to expand the use of these devices to continue to drive down dose. We will look at expanding the system monitoring features by feeding the data to the plant process computer, building an alarm notification into the program, and looking at other applications for equipment monitoring," concludes Von der Esch. ■

Nancy Bartels is Control's managing editor.