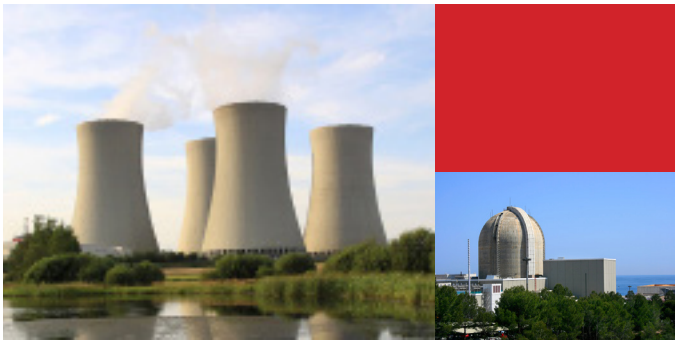
CURTISS-WRIGHT



Best Practices in Plant Reliability and Performance

A DIGITAL SYSTEMS SUCCESS STORY

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— Senior Electrical/I&C Engineer

Organization
A Utility in the Northeastern United States

Challenge
Single point vulnerabilities in the plant's existing analog feedwater system meant the system needed to be updated and replaced

Solution
Curtiss-Wright installed a new digital feedwater monitoring system with additional redundancy built in

Results
The feedwater system is now easier to use and adjust as needed, and future work on the unit's sister reactor may implement similar techniques

The Electrical/I&C design team at a large northeastern power plant determined that the feedwater control system at their Unit 1 reactor needed to be upgraded to ensure stable plant operations. The existing analog system dated back to the founding of the plant in the 1960s. Because the system was based on single-line components, engineers were conscious of numerous single-point vulnerabilities—where a minor issue could potentially result in major problems.

"With single-line components, a signal travels from one card to the next card to the next card as each feedwater process is executed," explains a senior Electrical/I&C design team engineer. "If any one of those cards has a problem, the downstream cards could be affected, causing a potential issue. We noted 40 components that were subject to these single-point vulnerabilities."

As the team responsible for designing and implementing new digital control systems at the site, one of the Electrical/I&C design team's primary objectives was to eliminate these single-point vulnerabilities in the plant's critical control systems. This is particularly important in feedwater control systems, which regulate the flow of water to the turbines during normal plant operations, as well as during plant heat-up and cool-down cycles. If a feedwater component isn't working properly—and there isn't a backup or redundant component in place—water and steam fluctuations can reduce plant efficiency and even trip the reactor.

It's not an uncommon problem: many industry sources have identified faulty feedwater control systems as one of the major contributors to automatic reactor trips. "If a key component fails or has a problem, it could potentially take down the whole system," the senior engineer added. "In our case, in one instance, a card failure caused a scram—a complete and immediate shutdown of the reactor."

The team set out to retrofit the feedwater control system and associated programmable logic controller (PLC). Following a competitive bid process, they contracted with Curtiss-Wright to implement a digital system. They also considered off-the-shelf solutions from

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other, larger companies, but they deemed them less flexible and more expensive than the Curtiss-Wright solution. "We realized we could work with Curtiss-Wright to customize their system and integrate it with complementary PLC equipment from RTP," the engineer recalls. "Working with Curtiss-Wright, we believed we could employ a simpler solution that would reduce costs and ensure a better return on investment."

IMPLEMENTING DIGITAL CONTROLS

Curtiss-Wright helped the team select, configure, and integrate the new hardware components, and spearheaded all software development tasks. The heart of the project involved establishing new digital controls for the feedwater system in conjunction with an RTP TAS 3000 PLC. The new system has two chassis and multiple cards for redundancy.

"We executed a wholesale redesign and replacement of every component, while maintaining the existing control scheme of the analog system," the senior engineer explains. "We started from scratch and spec'd out the best and the most cost effective way to upgrade the system. Curtiss-Wright helped us fast-track the project."

Curtiss-Wright supplied detailed drawings, answered the team's questions, and made continual adjustments to ensure they delivered what the plant needed. They kept the Electrical/I&C design team informed about their progress during weekly status meetings and maintained a traceability matrix to ensure that all requirements were met.

The team was then invited to participate in the factory-acceptance testing process at Curtiss-Wright's facility. Once everything appeared to be working correctly, Curtiss-Wright shipped the new gear to the site, where the team installed the system during a refueling outage. "It was a very fast cycle, with a 19-day installation and five days of thorough and robust testing," the senior engineer says. "We had the opportunity to put the system through some very tough scenarios while we were bringing the reactor back online."

EASIER MAINTENANCE AND REDUCED RISK

The system went live with the new feedwater control system in April 2019 and it has been working well since then. According to the design team, the digital system offers more precise methods for checking water levels, setting configuration parameters, and adjusting data points based on an influx of sensor data. Because the new controls were constructed to be as similar to the old controls as possible, the plant operators did not experience much of a learning curve. Thorough documentation and on-site training helped ensure a complete skills-transfer to the operator team.

"I've heard only positive reviews from our operators and everyone else who interacts with the system," the senior engineer says. "Everything is very modular and redundant, and the system is easy to configure and adapt using the PLC."

Previously, there was no way to maintain the feedwater control system while it was online, and the analog interface offered very little configurability. "With an analog system, you pretty much just plan it, build it, and use it," the engineer adds. "You had to wait until a refueling outage to made adjustments. Now we can watch it run and make adjustments on the fly if a level is fluctuating too quickly or too slowly."

Perhaps most importantly, having redundant channels reduces risk, since the engineering team can replace cards and other components on the fly. If a component is faulty, the operators can switch to the other channel and work out the issue while the plant stays online.

While the unit is nearing end-of-life, the Electrical/I&C team foresees additional upgrades to the control systems at its sister reactor, with this feedwater project as a steppingstone. "Digital upgrades can be very advantageous for the plant," the senior engineer concludes. "They just need to be well thought out and thoroughly tested, which is what Curtiss-Wright has helped us to achieve. It has been a long relationship, and a good one. Curtiss-Wright has had a positive impact at many levels."

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