Southern Nuclear Sets New Outage Record at Vogtle Unit 2

BY DONNA RUFF

Refueling machine mast lowering a fuel assembly into the core. Core reload was done in 11.5 hours less than the planned schedule. Note – The blue glow occurs when a charged particle, such as an electron, travels faster than the speed of light in water – it’s called the Cherenkov Effect. Photo courtesy: Elizabeth Adams, Southern Nuclear.
A bout halfway through the spring 2016 outage at the Alvin W. Vogtle electric generating station in eastern Georgia, workers were ahead of schedule and gaining momentum. Vogtle ended the outage 32.5 hours ahead of their scheduled outage duration. According to Southern Nuclear Operating Co., this represents the best outage time in the company’s history.

“It’s all about teamwork, looking ahead, communicating and following the schedule,” said Keith Taber, Site Vice President for Units 1 and 2.

Southern Nuclear, Westinghouse Electric Co., Day & Zimmermann and General Electric – the outage team – developed an achievable schedule. They identified contingency planning for high-risk activities that, if not implemented correctly, could delay the outage. Once the team had a detailed plan, all that remained was for the working teams to follow the schedule, provide timely and accurate updates, and make sure their contingency plans were established and tested.

The team also maintained clear and consistent communications, and with early and frequent participation of new senior management who were involved in planning and accountability, removing any roadblocks that arose during the outage. Lessons learned from previous outages were examined and applied as part of continuous learning and improvement. The payoff was significant.

Any day added or removed from a planned outage equates to millions of dollars in expense or revenue. Outages are expected to be accurately planned and precisely executed in terms of safety, time and quality of work. For power plant outages, where completing more than 9,000 tasks is common, this is no small effort.

**PLANNING**

Structured, thorough planning in which all outage work is identified far in advance of the actual outage using tools such as condition-based maintenance data, operator data and subject matter experts, is the first step to a successful outage. This is necessary to schedule work being performed by plant and contract personnel in an integrated schedule that optimizes these resources. Planning starts several years in advance. Vogtle’s outage strategic plan maps out major projects through 2023. The more detailed milestone schedule includes the next three outages. Deadlines for “pre-outage” milestones occur year-round, the bulk of which are due in the six to nine months prior to refueling. In this case, there was only a six-month window between the spring and fall outages.

The detailed and collaborative planning done by the plant and by contractor personnel on the scope and schedule was the foundation for a successful outage, said Vogtle Outage Manager Mike Griffin.

“For this outage, we laid out the most accurate and realistic schedule we’ve ever developed,” Griffin said. “Schedule fidelity and table top readiness reviews were fundamental in delivering the best outage we have ever executed.”

Vogtle follows a set procedure and publishes its milestone schedule almost immediately following the last outage 18 or six months in advance, depending on the cycle year. Southern Nuclear and Westinghouse are Alliance Partners. For the latter, this means that as soon as Vogtle’s milestone schedule is published, Westinghouse aligns and schedules the people and equipment needed to make sure that all of the plant’s outage needs, for which the company is responsible, are met. Two months before an outage begins, Southern Nuclear and all of the contractors involved in the outage follow a strict procedure-based process. This process includes meetings onsite that Southern Nuclear and contractor executives attend to challenge the outage teams and verify the details concerning all aspects of implementing the outage, including budgeting and the progress of pre-outage activities.

Under the plant’s new senior leadership, Vogtle had already begun to improve cross-functional teamwork to facilitate earlier identification of methods to increase efficiency, which advanced their work management practices. It paid off just as well during the outage, Taber said. “The behaviors we’ve established for work management and the way we get things done while the units are online are really paying off now as we execute 2R18,” he said on Day 11 of the outage.

Cross-organizational teamwork was also positively affected with plant and contractor teams identified earlier. Westinghouse Outage Manager Larry Burrows said, “Normally in an outage, the team doesn’t feel like a team until five or six days into the outage. In this case, everyone knew who the teams were and who they would be working with two to three weeks prior to the start of the outage. New senior management really got the teams to take ownership of their work – there was a very positive can-do teamwork approach.”

Contributors:

Elizabeth Adams is site communications lead at the Alvin W. Vogtle electric generating station. Larry Markle is customer account manager for Southern Nuclear Operating Co. at Westinghouse Electric Co.
Contractors were also brought on-site much earlier for the larger-scope work. This was coupled with extensive preplanning and improving the approach to such work, especially the installation of a new refueling machine.

**AN EXAMPLE OF CONTINUOUS LEARNING SUCCESS**

Westinghouse was contracted to supply and install a new refueling machine for Unit 2. They had done the same for Unit 1, but not in the timeframe planned or desired. To correct that performance for the Unit 2 outage, Westinghouse and Vogtle personnel worked together to capture and take into account more than 100 lessons learned. They made changes to all four involved procedures: Installation, Demolition (of the old refueling machine), Site Initialization Procedure and Site Acceptance Testing. The improvement process began almost immediately after the Unit 1 outage ended.

This work included two refueling machine project management leads from Vogtle spending eight weeks with Westinghouse personnel at Westinghouse’s Shoreview, Minnesota, site, which is dedicated to designing and manufacturing equipment required to move fuel assemblies. One of them also spent a week at the Waltz Mill Field Services Center of Excellence located in Madison, Pennsylvania, where the installation team is based. The refueling machine team reviewed video footage Westinghouse had taken with a Go-Pro® camera during the Unit 1 installation. They applied this information during a rigorous retesting of the Unit 2 refueling machine and proceeded to make modifications which eliminated obstacles to the machine’s movement that had been encountered during the Unit 1 installation.

To accomplish it, Vogtle and Westinghouse project leads and engineers worked together and created a device they used to avoid a problem faced during the Unit 1 installation. The device is a mock-up identical to the lower portion of the refueling machine bridge. Using it, they were able to sweep the entire area of the machine’s movements along the embedded rail track on which it rides before the refueling machine was brought into containment for installation. The embedded rail track is used to guide the refueling machine during operation. Also based on lessons learned, Westinghouse pre-installed dozens of clamps and wiring connectors on the refueling machine, which reduced the scope of electrical work that would need to be done in containment on the critical path schedule. It also eliminated drilling inside containment for the clamp installation, which had proved time-consuming and presented foreign materials challenges during the Unit 1 installation. Additionally, the teams conducted electrical walk-downs in three phases: performing two independent reviews in Shoreview – one each by Westinghouse and Vogtle personnel – and a third on-site at Vogtle Unit 2.

Some pre-installation work needed to be conducted outside. To avoid delays that had been caused by inclement weather during the Unit 1 installation, the team erected a 50-foot-high, 136-foot-wide, 60-foot-deep tent with lighting, heating and ventilation that allowed workers to unwrap, inspect, prepare and pre-assemble portions of the refueling machine. They also were able to conduct walk-downs of the machine, including foreign material inspections and wiring.
placement verification. Additional pre-work included pre-identifying and stenciling into the refueling machine the locations of each weld that would be made in containment.

Time continued to be saved on the refueling machine with streamlined activities during the Site Initialization Procedure and Site Acceptance Testing phases – the final processes that had to be completed before the new machine could be used to reload the fuel. Time was saved by conducting encoder testing at the factory and by identifying and removing duplicative steps between the two final processes. The on-site testing sequence was also optimized to minimize movement of the refueling machine, and to reduce hoists over the reactor core.

All of this resulted in the Unit 2 refueling machine installation being completed in half the time of the Unit 1 installation and a day ahead of the planned schedule. Since this installation was driving the critical path schedule, this savings was helpful to the overall outage schedule. A consistent and improved communications

On a more typical 18-month schedule, meetings between Vogtle and the outage support team would be held daily. On the six-month compressed schedule, the Alliance Partners and key contractors met twice each day. Mr. Taber attended many of those meetings, helping to drive accountability for work and follow-through, as well as remove obstacles if they arose. But more of a presence of senior management did not mean that people were less empowered. The decision-making was driven to the worker level whenever possible. Workers would report up twice per day and this proved a very effective approach for efficiency, accountability and removing potential barriers from completing tasks before they impacted schedule.

Another important improvement and among the top lessons learned per Mr. Griffin is the value of all-inclusive schedule reviews. “All-inclusive schedule reviews means that when we met to review an outage task, we included everyone required to make that outage activity a success. Every person on the team with a role was there to go through a dry rehearsal of what their job was and what was required to complete it,” he said. In the past, it was incumbent upon people to read the schedule and make it happen. The all-inclusive schedule reviews ensured that all of the tasks were completely understood by all team members, whether plant or contractor personnel.

Another significant communication improvement was equipment-based. Vogtle had made a major upgrade in communication technology to expand communication with, and within, containment groups. In past years, radiation protection, refueling and polar crane personnel wore headsets and belt packs to communicate but all were on different systems. With the new system, which was fully implemented during 2R18, more groups – including containment coordinators, radiation protection, polar crane, refuel team, Radium Inc. nozzle dam team and Westinghouse eddy current technicians had dedicated channels on the same system. An additional open miscellaneous channel was assigned to the refueling machine team. The contracted nozzle dam and eddy current teams brought in their own equipment and that equipment was connected to Vogtle’s new system, which had not been possible in the past.

Vogtle’s new communication system incorporates key panels in the Control Room and in the plant’s Outage Control Center. The new key panels equipped Vogtle’s Unit 2 Control Room personnel with the ability to communicate with the refuel team and containment coordinators, and Vogtle Outage Control Center personnel to connect to more than a dozen different groups at the press of a button. With safety always a top consideration, certain teams, such as the polar crane and refuel teams, could be heard and could communicate among themselves, but could not be interrupted by personnel outside the teams. This safeguard is meant to avoid distractions during heavy load and fuel assembly moves.

Westinghouse also applied a relatively new communication system this outage, known as the LiveCAN™ Field Communications System. This portable and rapidly deployable system supplied the Westinghouse full-scope refueling effort with audio, video and data communications capabilities. Developed by Westinghouse in 2015, LiveCAN connected Westinghouse field workers in containment to Westinghouse on-site project management personnel and to the Westinghouse Outage Control Center located at the Waltz Mill Field Services Center of Excellence. Real-time data sharing via the...
LiveCAN system assisted the Westinghouse refueling team in making a big contribution to the overall outage success. With fuel reload faster than predicted using the new refueling machine, the reload was completed 11.5 hours earlier than the planned schedule. The new refueling machine’s enhanced reliability and production capabilities will continue to contribute to improved refueling performance.

ADHERENCE TO SCHEDULE

To help drive workflow in containment, Vogtle implemented another new strategy for 2R18 with the addition of containment managers, one each on the day and night shifts. During the outage, their main job was to drive critical path activities and ensure personnel were ready to perform a task the minute it could be undertaken. Vogtle wisely selected two seasoned veterans, Tom Petrak and Steve Waldrup. Both are former shift managers, Vogtle Outage Control Center leads and NRC-licensed Senior Reactor Operators.

“We’re always looking a day or two ahead to try to identify what might challenge us from meeting the schedule. I see the role of containment manager as doing everything I can to help the people working in containment understand what the OCC [Outage Control Center] is trying to accomplish with regards to working the schedule,” Petrak said.

The guidance of containment managers with authority and a great degree of experience helped outage personnel develop more proactive behaviors, Waldrup said.

“I see the whole mindset of people inside containment changing,” he said. “I think we’re changing the culture on how we execute critical path – which is going to shrink the time it takes to do all these activities.”

During the spring 2016 outage, Vogtle performed most critical-path tasks in less than the allotted time, and the presence of containment managers receives some of the credit for this achievement.

With a large part of the outage work, 66 percent, Westinghouse also had an experienced outage manager in the field, Larry Burrows, and also made some strategic changes.

For refueling activities, Westinghouse flipped its model from the Unit 1 outage staffing of 10 technicians and 18 containment support workers to the Unit 2 outage model of 18 technicians and 10 containment support workers. Technicians can move fuel, but the support workers cannot.

While maintaining the same headcount, more technicians meant a qualified person was always available to move fuel and insert shuffles as soon as these tasks could be done rather than waiting until one was available.

“The skill level of the technicians and the containment support workers was very important,” Burrows said.

“People were able to safely conduct their tasks with little supervision. I was there for many reasons, but a main one was to get ahead of any unforeseen or emergent issues, remove the roadblocks and then let competent people get the job done.”

Burrows felt that the collaboration
between the site personnel and contracted personnel was excellent. “Whenever we needed site personnel to get involved so we could continue a task, they were ready, whether it was maintenance, mechanical, electrical or chemical groups,” he said. “We had great collaboration and the outage preplanning and execution were done very well.”

There was no single improvement that made the Vogtle Unit 2 spring 2016 outage the best in the company’s history.

There were changes in strategy, increased and all-inclusive participation in schedule review meetings, lessons learned examined and applied, an exemplary collaboration between teams and plant and contractor personnel, senior management support, employee empowerment and teams brought on-site earlier than in the past, among others.

Most importantly, the Vogtle spring 2016 outage was completed with no significant human performance or safety events. Every task was completed safely.

Performance like this will help the U.S. nuclear industry reach the goals of its Nuclear Promise initiative of continuing to improve safety, reliability and economic performance, including reducing operating costs 30 percent by 2018.