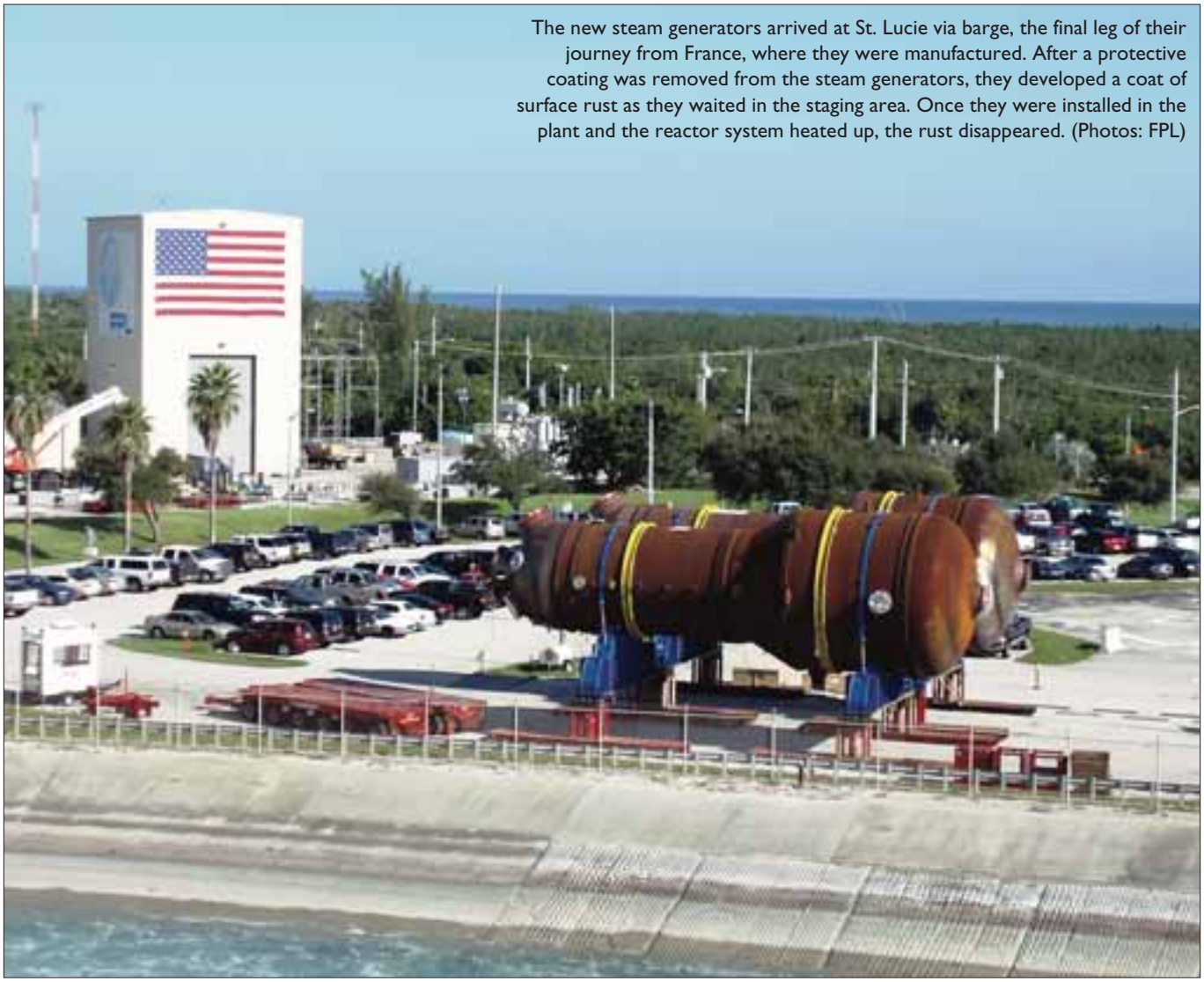

The new steam generators arrived at St. Lucie via barge, the final leg of their journey from France, where they were manufactured. After a protective coating was removed from the steam generators, they developed a coat of surface rust as they waited in the staging area. Once they were installed in the plant and the reactor system heated up, the rust disappeared. (Photos: FPL)

Steam generators, reactor head changed out at St. Lucie-2

BY RICK MICHAL

More than 16 500 activities were accomplished during St. Lucie-2's 17th refueling outage.

FLORIDA POWER & LIGHT Company's St. Lucie-2 was returned to service earlier this year following a refueling outage during which the work performed ranked among the most ambitious and complex of its kind in the nuclear power industry. "This is the most significant project work conducted since original construction," said Gordon Johnston, site vice president.

Florida Power & Light (FPL) is the principal subsidiary of FPL Group, Inc. The St. Lucie plant, located in Hutchinson Island, Fla., consists of two Combustion Engineering pressurized water reactors that are each rated at 856-MWe. St. Lucie-1 started commercial operation in December 1976, and St. Lucie-2 in August 1983.

Unit 2's 17th refueling outage started last September 30 and ended on January 4. Planning for the outage began in spring 2005. Johnston said that the work accomplished during the outage, consisting of 16 535 activities, represented an investment of more than $300 million in capital improvements.

Conner

Richard Conner, FPL Group's nuclear outages director, said that a major goal of the project was the replacement of St. Lucie-2's two steam generators, each measuring 75 feet tall and 19 feet in diameter, and weighing close to 500 tons. Another big job was changing out the unit's reactor vessel head, measuring about 8 feet high and 16 feet in diameter, and weighing more than 70 tons. The original vessel head had some minor cracking that was repaired during a previous outage, Conner said.

To replace these giant components, an opening had to be created in the containment building through which the old components could be removed and the new ones bought in. After the job was completed, the opening had to be sealed up.

Other significant work during the outage included replacing a 6500-horsepower reactor coolant pump motor and modifying

An original steam generator is removed from its cubicle inside the containment building. Both of the original steam generators were treated with a blue anticontamination coating prior to their removal. They were to be shipped to a disposal facility in Memphis, Tenn.

the containment sump, which is a system inside the containment building that is used to collect and filter spilled coolant for reuse in the event of an accident. Also accomplished was the replacement of one-third of the PWR's 217 fuel assemblies and other routine maintenance throughout the plant.

The normal refueling activities were critical path until fuel offload was completed, at which time the steam generators' removal and replacement took over critical path, Conner said.

To support the outage, the plant used workers from throughout FPL's nuclear power plant fleet—which includes the Turkey Point plant, in Florida City, Fla., the Duane Arnold plant, in Palo, Iowa, the Seabrook plant, in Seabrook, N.H., and the recently acquired Point Beach plant, in Two Rivers, Wis. In addition, 1683 contract workers were brought on site for the outage, according to Conner. "Incentive and retention programs were initiated by some of the larger contractors in order to attract qualified personnel from around the United States," he said. "These programs worked well and the planned staffing levels were achieved."

There were no security concerns with getting the extra workers on site each day, because an additional access/egress gate was opened and staffed 24 hours a day during the outage, and work shifts were staggered to aid in the high volume of personnel entering and leaving the plant. In addition, Conner said, security equipment was repaired and calibrated before the start of the outage.

There also were no problems getting components to the site in time for the outage. Conner said that before the project started, FPL personnel had meetings with suppliers and visited their fabrication shops to ensure timely deliveries of parts.

St. Lucie-2's return to service was delayed because of some equipment issues—which included repairs to an electrical component on one of the unit's 91 control rod assemblies—that were identified during a series of tests and inspections that must be conducted to make sure that all equipment is operating properly.

Conner said that the following six issues emerged during the outage that were significant enough to negatively affect the outage schedule:

- The porosity of the welding on a reactor cooling system (RCS) hot leg, a result of initial construction.
- A breakdown of the foreign object search-and-retrieval equipment used in the RCS piping.
- Alterations that were required for the temporary power transformer.
- Delays in reinstalling small-bore piping.
- Fit-up issues on the control element drive mechanism's cooling ductwork.

Continued

Right: One of St. Lucie-2's two new steam generators, weighing in at 500 tons, is moved into the containment building through an opening created for moving large components in and out. Each steam generator is 75 feet long and contains nearly 9000 tubes.

Below: The original 140-ton reactor vessel head was bagged and a bottom seal plate installed prior to its removal from the containment building. A special up-ending/down-ending cart was used to transport the old reactor vessel head and steam generators out of containment and the new ones in.

■ The binding and the uncentered position of the cooling water system block on a temporary lifting device.

The cost of the outage came in at 2 percent less than the budget goal, but because of the six significant issues, the duration of the outage was nine days longer than the business goal, and total radiation dose to workers was 10 person-rem over goal. As a result, Conner said, he was not satisfied with all phases of the outage. "There were too many significant issues that could have and should have been prevented," he said.

A critique held after the outage identified areas of weakness where improvements were needed. Specifically, Conner explained, because the outage's duration went long, a better job would have to be done in planning and executing various phases of future outages in order to cut down on the plant's out-of-service time.

On the positive side, however, he said he was pleased that there were no lost-time injuries, the budget was controlled, there were no regulatory findings or significant issues raised by the Nuclear Regulatory Commission or the Institute of Nuclear Power Operations, and there was no delay in the startup of the reactor after the completion of the outage.

Conner concluded that the outage's successes, and also its shortcomings, were mainly on the shoulders of the team assembled to plan and execute the company's refuelings. "As with any project of this magnitude, a project team is assigned, from engineering to the final implementation, and the team shares the successes and failures of the project," he said. "This is the fourth major component installation project in which this team has been involved, and most of the work the team has done has been very successful." NN