UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report Nos. 50-325/95-21 and 50-324/95-21

Licensee: Carolina Power and Light Company
P. O. Box 1551
Raleigh, NC 27602

Docket Nos. 50-325 and 50-324 License Nos. DPR-71 and DPR-62

Facility Name: Brunswick Steam Electric Generating Plant Units 1 and 2

Inspection Conducted: September 18 - 22, 1995

Inspector: _____ 10/26/95
Paul Kellogg, Team Leader Date Signed

Accompanying Personnel: L. King, Reactor Inspector
G. Cha, NRC Consultant

Approved by: _____ 10/26/95
David Verrelli, Acting Chief Date Signed
Special Inspections Branch
Division of Reactor Safety

SUMMARY

Scope:

A Service Water System Self-Assessment Inspection was conducted on September 18-22, 1995, according to NRC inspection Module 40501. Temporary Instruction 2515/118 for service water inspections was also used as the reference to determine the adequacy of the Licensee's self assessment and status of corrective actions. Two of the primary objectives of this followup inspection were to (1) perform an independent overview evaluation of the service water systems and (2) to evaluate the quality and depth of the licensee's self-assessment.

Results:

With regard to both objectives, The licensee's self assessment had good breadth and depth. Service water personnel have a very good knowledge of the system. The chlorination program is keeping the heat exchangers clean. The hydraulic model of the service water system is a strength. The current erosion/corrosion program is a strength. Weaknesses were identified in the air side testing of room coolers, water hammer evaluations, RHR heat exchanger testing and non-destructive testing of Heat exchanger tubes.

REPORT DETAILS

1. Persons Contacted

Licensee Personnel

*B. Altman, Manager, Outage and Scheduling
G. Anthony, System Engineer
W. Campbell, Vice President, Brunswick Nuclear Plant
*J. Gannon, Maintenance Manager
*J. Gawron, Manager, Environmental and Radiations Controls
M. Grantham, Supervisor, BOP Fluid Systems
*D. Hicks, Manager Regulatory Affairs
*J. Holden, Manager, Brunswick Engineering Support Section
*G. Honma, Manager, Licensing and Regulatory Programs
*J. Lyash, Operations Manager
*W. Levis, Director Site Operations
*R. Lopriore, Plant Manager
M. Marano, Manager, Site Support Services
J. Martin, Plant Controller
S. Riffle, Service Water System Engineer
C. Schacher, Assessor, Nuclear Assessment Department
S. Tabor, Senior Specialist Regulatory Affairs
J. Thompson, Manager, Nuclear Assessment Department
J. Titrington, Supervisor, Mechanical BOP
R. Williams, Supervisor Materials and Contracts

Other licensee employees contacted included engineers, technicians, operators and office personnel.

U. S. Nuclear Regulatory Commission

*P. Byron, Resident Inspector

2. Background and Objectives

During the period, May 16, 1994 to June 10, 1994, a Service Water SWSOPI self assessment was performed at the Brunswick Nuclear Plant by a CP&L team and contract individuals. The assessment team utilized NRC Temporary Inspection 2515/118, Revision 1, INPO 90-15, Performance Objectives and Criteria for Operating and Near-term Operating License Plants, and industry experience gained from previously performed inspections of service water systems as a basis for the assessment. The assessment identified two strengths, two issues and two weaknesses. Additionally 10 Adverse Condition Reports were generated to document those issues requiring timely actions. The strengths noted in the assessments were improved availability/capability of the service water system and the quality of training for operations and maintenance of the service water system. The two issues identified were engineering

support was identified as possibly not being able to provide necessary design control and configuration control documentation contained omissions and errors. The two weaknesses were corrective action closeouts were not effective in driving concerns and issues through to completion in a timely manner and attention to plant maintenance as indicated by labeling problems and a need to ensure that greater emphasis is given to improving system condition. On July 2, 1994, the licensee issued the final SWSOPI self assessment report.

During the period, September 18, 1995 through September 22, 1995, a three-member NRC team performed a followup inspection. The focus of this inspection was to review the licensee's final inspection report, to ascertain the progress made in addressing inspection findings, and to perform an abbreviated, independent review of the service water systems.

3. Review of the licensee's Self Assessment

The team reviewed this self-assessment to confirm whether it has satisfied the action items, and the other requirements of Generic Letter 89-13. The team concluded that the self-assessment is adequate, but for issues that follows, the team found that further elaboration is necessary. Nevertheless, most of these issues were discussed in the self-assessment, and resulted in licensee produced draft Engineering Service Requests for followup.

a. Service Water Intake Structure Inspection and Cleaning, and Continuous Chlorination for Biofouling Control

The Service Water Intake Structure for Units 1 and 2 are inspected once per Unit 1 refueling cycle for biofouling organisms, sediment, and corrosion. Silt accumulation above a pre-established limit (3.7 feet) are removed by vacuuming. Biofouling thickness greater than a pre-established limit (7 inches) are removed by scraping and vacuuming. The structural members in the intake structure are inspected for corrosion and degradation. The inspection of January 1991 showed silt accumulation was greater than the above limit and therefore had to be removed, biofouling growth thickness was below the 7 inch limit. The inspection of January 1994 showed no excessive silt or biofouling. Subsequent inspection frequencies other than the present basis of every Unit 1 refueling outage is under evaluation.

The licensee provides continuous chlorination of the Service Water System, and monitors free available chlorine to ensure that adequate levels of chlorination are maintained. The Service Water System is sampled on a daily basis, the sample locations are at the outlet side of the RBCCW heat exchangers (Nuclear Header), and at the outlet side of the TBCCW heat exchangers (Conventional Header). These locations are downstream of any components that could become blocked as a result of macrofouling. The chlorine level at these locations are maintained above 0.5 ppm free available chlorine.

Continuous chlorination appears to be highly effective in the control of biofouling, this has been confirmed by inspections of safety related heat exchangers.

The team considered the inspection and cleaning of the Service Water Intake Structure, and the continuous chlorination program to be strengths.

b. Safety Related Heat Exchangers

The following safety related heat exchangers are cooled by service water: RHR heat exchangers, Diesel Generator Jacket Water Coolers, Core Spray Room Coolers, RHR Room Coolers, RHR SW Pump Motor Coolers, and SW Pump Motor Oil Coolers.

The license indicated that there are currently no tubes plugged in the Unit 1 and Unit 2 safety related heat exchangers. Non-destructive testing was never performed to establish a baseline survey of the condition of the tubes. The team indicated that if a baseline survey were conducted the current status of the tubes could be confirmed and the information utilized in the preparations for life extension. The licensee drafted an Engineering Service Request that addressed the additional need of a basis for maximum tube plugging.

c. RHR Heat Exchangers

The licensee had instituted a program for testing of the RHR heat exchangers by determining a heat balance. The data accumulated to date indicated that this testing program still need attention if useful data is to be obtained. The team reviewed the last two sets of test results and found the heat balances between the service water side and the RHR water side to differ by as much as 40 percent. Further analyses based on this data to calculate fouling factor and trending thereof are not possible.

The licensee agreed to reevaluate the test procedure to modify and upgrade accordingly. Additionally, the test procedure did not mention instrument calibration and accuracy, which are required parameters. The licensee has a draft Engineering Service Request to address this issue.

d. RHR Pump and Core Spray Room Coolers

The only test performed on the RHR and Core Spray Room Coolers is the service water flow verification performed on a refueling outage frequency. There is no test performed on the air side. Nevertheless, both the water side and the air side are inspected and cleaned on a refueling outage frequency. These coolers were replaced in 1990, and they were shop performance tested by the manufacturer. The service water flows to the RHR and Core Spray Room Coolers were found to be adequate to meet their design

requirements for both normal and degraded conditions. The Reactor Building Environmental Report showed the RHR Room and Core Spray Room temperature responses are well below the minimum equipment qualification limit by using 90 percent of the respective cooler capabilities. Nevertheless, as-installed airflow tests of these safety related room coolers to confirm the adequacy of the fan capacity should be accomplished to substantiate that design basis heat removal capabilities do exist. The team noted that other licensee's had been recently successful in obtaining good air side data. The need to verify the air flows was also identified in the self-assessment. There is no draft Engineering Service Request for further action on this issue.

e. Hydraulic Analysis

The licensee successfully adapted a university developed hydraulic computer program to model the Service Water System. This program was calibrated with test data, and is capable of predicting flows within 5 percent of measured. This hydraulic model was used to provide confirmation that the Service Water System is operable and capable of meeting its design basis function. The team considers the adaption and use of the hydraulic computer program a strength.

An exception to this is that the hydraulic model was developed with the "old" service water pumps. All pumps have since been replaced and have better flow/head characteristics. Furthermore, the hydraulic model does not consider the worst case pump performance as the result of degradation allowed by ASME Section XI testing. These deficiencies were identified in the self-assessment, and were further addressed by a licensee's draft Engineering Service Request.

f. Water Hammer

The following document "Analysis of Potential for Water Hammer in the Service Water System" was prepared and reviewed in the summer of 1989 but has never being approved. A thorough investigation is recommended to assure that all potential for water hammer are identified and alleviated for all modes of operation. The team considers the lack of an approved analysis to address the potential for water hammer a weakness. The self-assessment identified this as an issue and the licensee has a draft Engineering Service Request for followup.

4. Service Water System Maintenance

The team reviewed the licensees self assessment of the maintenance area of the service water system. A review was made of all the issue identification forms to determine what problems had been identified in the maintenance area. The inspectors reviewed a copy of the open safety related work requests and the completed work requests from 1991 to 1995. The procedure for the repetitive failure detection program OWMP-004, R 2

was also reviewed. The procedure states that repetitive failures are identified and summarized in a monthly report and quarterly a status report is issued for all repetitive failures identified during the 18 month period. The last monthly and quarterly reports were reviewed. The inspectors conducted a walkdown of the Unit 2 service water system with the licensee system engineer and conducted a separate walkdown of Unit 1 service water system. The team indicated to the licensee that an 18 month period is to narrow a window to determine repetitive failures. Previous service water inspections of other plants identified pump problems that were not identified by the 18 month criteria and the Maintenance Rule may require a longer period.

a. System leakage

The results of the review of the issue identification forms were that the team saw no comments on the number of leaks identified or any documentation on a review of maintenance training on the service water system. Discussions with the self assessment team indicated these areas had not been reviewed. The printout of open safety related work requests for the service water indicated that there were a number of leaks identified. A followup by the team on the number of leaks with the system engineer indicated that there was a reactive program to repair the leaks and inspect other areas that were similar.

b. Cavitation/Erosion

The team was concerned about the cavitation occurring at the Valtek valve V382 on both units. Unit 1 had a soft patch installed on the discharge piping downstream of the valve due to a thru wall pinhole leak. The licensee indicated that the piping was to be replaced at the next outage and that it had been evaluated by UT as being acceptable. There was also a soft patch due to a thru wall leak on the piping just down stream of the connection of the vital header to the nuclear service header on Unit 2. This pipe was also scheduled for replacement. A welded cap was also installed on a pinhole leak on the conventional service water at the elbow from the 2B conventional pump discharge to the conventional header. The licensee indicated that the similar elbows had been UT inspected and were acceptable. The team's observations were that the licensee was acting in the reactive mode instead of having a program in place to determine pipe wall thinning. However, a new program has been developed to actively look for piping problems. Several modifications have been made to replace carbon steel piping with CuNi piping. The team was concerned that CuNi will not withstand some of the erosion taking place downstream of the Valtek valves used to throttle service water discharge from the RBCCW coolers. The licensee stated that alternative materials that did not erode as fast were being investigated. The licensee enters the large bore service water piping during the outages to identify breakdown in

the cement liner and make repairs. The patches were in piping where an internal inspection was not possible.

c. Maintenance Procedure and Training

The team found that the maintenance procedure for the new service water pumps was on administrative hold. This had been previously identified by the licensee assessment team. The licensee provided a draft revision of the maintenance procedure for the new service water pumps. The team discussed maintenance training with the licensee and visited the maintenance training facility. The licensee has ordered a 1/3 scale model of the service water pumps and intends to develop a training plan for maintenance personnel. The licensee presently has training in place for pump alignment and valve training.

d. Fix It Now (FIN) Team

The team discussed the operation of the FIN team with the licensee. This has reduced the backlog significantly by expediting minor maintenance work. The FIN teams of which there are two consist of team leaders and SROs, AOs, I&C and mechanical maintenance personnel and a health physics person. They are able to perform minor maintenance using simplified paperwork and thus reduce the backlog which allows the regular scheduled maintenance to concentrate on other work requiring the necessary paperwork.

e. Equipment Problems

During the Unit 1 walkdown the team noted that the 2A Traveling Screen backwash was isolated , the 1B Sreenwash Pump was tagged out for high vibrations and the 1A Nuclear Service Pump Strainer differential pressure gage was pegged low. The team discussed the problems with the licensee and determined that the licensee was taking action to correct the problems.

The team determined that the maintenance program has been effective in correcting problems on the service water system. However, continued attention must be paid to the maintenance of this system.

5. Conclusions

Two of the primary objectives of the follow-up inspection were (1) to perform an independent overview evaluation of the service water systems and (2) to evaluate to quality and depth of the licensee's self-assessment. With regard to these objectives, the team determined that the licensee's self-assessment had good breath and depth. The items identified had been assigned for action and actions were being carried out. The service water system appeared to be in good mechanical condition and appropriate maintenance was being performed for the most part.

6. Exit interview

The team conducted and exit meeting on September 22, 1995 at the Brunswick Nuclear Plant to discuss the major areas reviewed during the inspection, the strengths and weaknesses observed, and the inspection results. A list of documents reviewed during this inspection is included as Attachment A of this report. The licensee did not identify any documents or processes as proprietary. There were no dissenting comments at the exit meeting.

7. Acronyms and Initialisms

| | |
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| AMSE | American Society of Mechanical Engineers |
| AO | Auxiliary Operator |
| CuNi | Copper - Nickel |
| I&C | Intrumentation and Control |
| INPO | Institute of Nuclear Power Operations |
| NRC | Nuclear Regulatory Commission |
| ppm | parts per million |
| SRO | Senior Reactor Operator |
| SWSOPI | Service Water System Operational Performance Inspection |
| RBCCW Reactor | Building Closed Cooling Water |
| RHR | Residual Heat Removal |
| TBCCW | Turbine Building Closed Cooling Water |