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

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Report Nos.: 50-325/90-10 and 50-324/90-10

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 1 and 2

Inspection Conducted: March 5 thru 9, and March 15, 1990

Inspectors: D. A. Seymour — Date Signed: 4-11-90

R. P. Carrion for — Date Signed: 4-11-90

Approved by: T. R. Decker, Chief — Date Signed: 4-11-90
for
Radiological Effluents and Chemistry Section
Emergency Preparedness and Radiological
Protection Branch
Division of Radiation Safety and Safeguards

SUMMARY

Scope:

This routine, unannounced inspection was conducted in the areas of radiological effluents, plant chemistry, and environmental monitoring.

Results:

1. Two items concerning the operability condition of the hydrogen gas monitoring instrumentation and radwaste effluent flow measurement device were reviewed. The item concerning the hydrogen gas monitoring instrumentation was closed, the other item remains open (Paragraph 2).

2. The Environmental Monitoring Program was effective in assessing the impact of radiological releases (Paragraph 4).

3. Brunswick liquid and gaseous effluents were well within Technical Specifications, 10 CFR 20, and 10 CFR 50 effluent limitations (Paragraph 5).

4. The recent reorganization has not compromised the licensee's ability to control radioactive material (Paragraph 6).

5. Hydrogen Water Chemistry control has been implemented in Unit 1. It had been implemented previously in Unit 2 and the NRC had approved a change to the Technical Specifications to allow an increase in the Main Steam Line Monitor set points, thereby permitting an increase in the amount of injected hydrogen (Paragraph 7).

In the areas inspected, violations or deviations were not identified.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*A. Cheatham, Manager, Environmental and Radiation Control (E&RC)
*J. Davis, Project Specialist, Environmental and Chemistry (E&C)
*W. Dorman, Manager, Quality Assurance/Quality Control (QA/QC)
S. Fitzpatrick, Senior Specialist, E&RC
*J. Gurgainous, Foreman, E&C
*J. Harness, Site General Manager
*T. Harris, Specialist, Regulatory Compliance
*R. Poulk, Supervisor, Regulatory Compliance
*C. Robertson, Manager, E&C
*B. White, Senior Specialist, E&RC

Other licensee employees contacted during this inspection included engineers, technicians, and administrative personnel.

Nuclear Regulatory Commission

D. Nelson, Resident Inpsector
*W. Ruland, Senior Resident Inspector

*Attended exit interview

Acronyms and Initialisms used throughout this report are listed in the last paragraph.

2. Licensee Action on Previously Identified Inspector Follow-up Items (92701)

(Open) Inspector Follow-up Item (IFI) 50-325/85-12-01 and 50-324/85-12-01: Inoperable condition of hydrogen gas monitoring instruments in the Augmented Offgas System to be corrected and returned to service.

As discussed in Inspection Report No. 88-28, dated September 23, 1988, the operation of the new in-line hydrogen monitoring equipment in the Augmented Offgas Systems was tied to the implementation of Hydrogen Water Chemistry (HWC) in both units. The licensee implemented HWC for Unit 2 on December 28, 1988, and for Unit 1 on February 23, 1990. Although hydrogen was being injected into the feedwater of both units, the complete Hydrogen Injection System, of which the Hydrogen Gas Monitoring System was part, was still in the testing phase. Because of this, the complete system had not been accepted from the construction group as operable. Part of the delay was incurred while waiting for a Technical Specification (TS) change (see Paragraph 7), and part has been due to other system problems. Because the hydrogen analyzers were part of the total system, they could not be

declared operable and, therefore, the licensee continued to remain in an Action Statement of the TS. The licensee has projected operability dates for the Hydrogen Injection System on or before June 30, 1990, for both units. Based on these dates, this item is considered closed.

(Open) IFI 50-324/88-28-01: Inoperable condition of the radwaste liquid effluent flow measurement device.

Since the last inspection in this area there had been no significant progress toward the repair/replacement of the flow integrator in the radwaste liquid effluent piping. The licensee continued to remain in an Action Statement of TS 3.5.8.

The inspectors determined, through conversations with the licensee, that this project had been "rolled" into a pipe repair/replacement project for the radwaste liquid effluent pipe. The combined project had a high cost versus marginal increased safety improvement and thus was given a low overall priority for completion. At the time of this inspection, the licensee expected to separate these two projects and rewrite the proposal for the repair/replacement of the flow integrator. This should result in a higher priority rating for this item. This item remains open.

3. Effluent Radiation Monitors (84750)

Tables 4.3.5.9-1 of the Unit 1 and Unit 2 TSs required that channel calibrations of the gaseous effluent radiation monitors be completed at least once per 18 months. The completed channel calibration packages for the following gaseous effluent radiation monitors were reviewed:

Monitor	Completion Date
Steam Jet Air Ejector Off-Gas Radiation Monitor (Unit 2)	January 22, 1990
Reactor Building Roof Vent Radiation Monitor (Unit 2)	December 15, 1988

Tables 4.3.5.8-1 of the Unit 1 and Unit 2 TSs required that channel calibrations of certain liquid effluent radiation monitors also be completed at least once per 18 months. The completed channel calibration package for the following liquid effluent radiation monitor was reviewed:

Monitor	Completion Date
GE Service Water Effluent Radiation Monitor (Unit 1)	December 1, 1989

Tables 4.3.1-1 and 4.3.2-1 of the Unit 1 and Unit 2 Technical Specifications required that channel calibrations of certain Reactor Protection System instrumentation and Isolation Actuation instrumentation be completed at least once per 18 months. The completed channel

calibration package for the following high radiation monitor was reviewed:

Monitor	Completion Date
Main Steam Monitor (Unit 2)	February 15,1990

In addition to the channel calibrations, the inspectors discussed with cognizant licensee personnel the surveillance requirements for channel checks and source checks for selected components of the Main Stack Monitoring System and the Reactor Building Ventilation System, including methods used and frequency of checks.

All packages for the monitors were properly completed and reviewed. No discrepancies were noted by the inspectors.

4. Radiological Environmental Monitoring Program (84750)

The inspectors conducted a review of the radiological environmental and monitoring surveillance program to determine if the status of the program was consistent with sampling requirements, analytical requirements, and schedules specified in TS 3.12.1.

The inspectors reviewed the "Radiological Environmental Technical Specifications Monitoring Program, Environmental and Radiation Control Procedure: E&RC-1301," Volume VIII, Revision 8, dated May 10, 1989, which sets forth the environmental radiological surveillance requirements for compliance with the plant's TSs. The inspectors interviewed cognizant licensee personnel about the program and observed ten sampling stations; including two air sampling, one water sampling, two licensee-maintained gardens, and five radiological monitors in the form of TLDs attached to trees/poles. These sampling stations were located off site as well as on site, arranged approximately in a circle to obtain accurate samples regardless of wind direction. While about half of the sampling stations are concentrated within two miles of the site, the rest are dispersed at distances of up to 23 miles from the site. The inspectors checked Station No. 201, which included both an air sampling unit and a radiological monitor (in the form of a TLD). The air sampling unit's filter and cartridge were checked for proper fit and placement. Calibration for its pump was also checked. The area around the station was well maintained, with no trees (which could pose potential damage from falling limbs) in the immediate vicinity. It was noted that the State of North Carolina has established a monitoring station at this site. The inspectors checked Station No. 400, a water sampling station located on a pier in the intake canal. It was found to be functioning properly. The inspectors saw two of the licensee's gardens (Station Nos. 800 and 801) from which broadleaf samples, in the form of lettuce, collards, and turnips, are sampled. The one at Station No. 800 had recently been tilled in preparation for spring planting. Evidence of wildlife (deer tracks) was noted at Station No. 801. The inspectors verified that the TLDs at Station Nos. 2, 3, 5, 13, and 37 were properly located and showed no signs of tampering.

TS 3.12.2 requires the licensee to perform an annual land use census, the results of which are to be included in the Annual Radiological Environmental Operating Report. The inspectors interviewed cognizant licensee personnel about the annual land use census. For about two weeks in the late spring, licensee representatives drive around the community interviewing people to determine who has gardens larger than 500 square feet and what is being raised. The representatives also are alert for any new milking animals.

The inspectors did not identify any violations or discrepancies in the areas reviewed.

5. Radiological Effluents (84750)

a. Semiannual Radioactive Effluent Release Reports

TS 6.9.1.8 requires the licensee to submit a Semi-Annual Radiological Effluent Release Report within the time periods specified in TS 6.9.1.9 covering the operation of the facility during the previous six months of operation.

The inspectors reviewed the semiannual radioactive effluent release reports for 1989. This review included an examination of the liquid and gaseous effluents for 1989 as compared to those of 1988 and 1987. This data is summarized below.

Two abnormal releases were reported in 1989. Both of these releases were liquid releases occurring in the last two quarters of 1989. One release occurred in September and was caused by heavy rainfall due to Hurricane Hugo. This release was made from the Storm Drain Collector Basin to the Discharge Canal, lasted 881 minutes and released 8.81E-04 curies of activity. The second release was caused by a small leak in the Unit 1 Reactor Building Closed Cooling Water/Service Water Heat Exchanger. The leak was caused by the dezincification of a tube sheet plug. The heat exchanger was repaired and the leak stopped.

A comparison of liquid tritium and gross alpha discharge data for 1987, 1988, and 1989 showed no significant trends. Liquid fission and activation products did show an increase for 1989. The licensee indicated that, in part, this was due to the washdown of fuel shipment casks. Pipe replacement for Unit 2 during an outage added activity to the liquid fission and activation products. Gaseous fission and activation products, gaseous iodine, and gaseous particulates showed slightly decreasing trends. Gaseous tritium showed an increase over this period, although the increase was not significant.

Radioactive Effluent Release Summary

Brunswick, Units 1 and 2	1989	1988	1987
Abnormal Releases	2	0	3
Activity Released (curies)			
a. Liquid			
1. Fission and Activation Products	1.56E+00	8.32E-01	7.15E-01
2. Tritium	1.80E+01	3.10E+01	1.93E+01
3. Gross Alpha	7.70E-05	less than LLD	1.06E-03
b. Gaseous			
1. Fission and Activation Gases	1.36E+03	1.58E+03	2.64E+04
2. Iodines	1.51E-02	2.27E-02	5.01E-02
3. Particulates	3.41E-02	1.54E-01	1.32E-01
4. Tritium	9.17E+00	5.55E+00	6.06E+00

For 1989, Brunswick liquid and gaseous effluents were well within TSs, 10 CFR 20, and 10 CFR 50 effluent limitations.

b. 1989 Gaseous and Particulate Effluents (84750)

TSs 3/4.11.2.1 through 3/4.11.2.8 define the operating requirements, radioactive gaseous effluent release limits and surveillance requirements for the gaseous radwaste treatment systems. The inspectors discussed operation maintenance, sampling, and analysis with licensee personnel.

The inspectors reviewed the "Weekly Gas Report" for gaseous and particulate effluent release of the stack and vents for 1989 to determine if the releases met licensee commitments and to determine if any trends were developing. The inspectors did not discern any patterns or trends to these releases. Furthermore, the highest weekly doses, consistently to the thyroid due to particulates and iodine, showed a maximum of 2.78% of the administrative weekly limit. On a monthly basis, The maximum was 1.10 percent of the administrative limit.

For 1989, Brunswick liquid, gaseous, and particulate effluents were well within Tss, 10 CFR 20, and 10 CFR 50 effluent limitations.

The inspectors also reviewed Radiological and Chemistry Summaries prepared for use by plant management. The summaries indicate plant performance for the last three years compared to industry norms and projected goals for this year. These summaries generally illustrate that plant management is cognizant of the progress in these areas and is taking an active role to enhance the programs.

The inspectors reviewed the Radwaste Daily Status Report of March 7, 1990 and noticed that over half of the liquid waste inventory was due to inleakage. It was also noted that the inleakage was greater than the amount of inventory processed, thereby increasing the inventory for the day. The inspectors also noted that it would take almost two days to process the existing inventory at the processing rate indicated in the report, assuming no additional inleakage. Cognizant licensee personnel were aware of this on-going situation and were trying to determine the source of the inleakage so as to reduce it and, consequently, the volume of water discharged.

As part of this inspection, the inspectors reviewed selected systems in place at Brunswick for monitoring and accounting for radioactive gaseous effluents, including iodine, noble gases, tritium, and radionuclides in particulate form. The inspectors observed two members of the licensee staff collect routine samples from the main stack monitoring system, which included a noble gas activity monitor, an iodine sampler, a particulate sampler, a system effluent flow rate measurement device, and a sample flow rate measurement device. This stack is shared by both units. Proper sampling techniques and health physics practices were observed.

The inspectors discussed the representativeness of the samples obtained from the Main Stack Monitoring System with licensee personnel, and determined that at the time of the inspection that there was some question as to whether isokinetic sampling was being achieved as required by Section 11.5.2.3 of the FSAR. Discussions with the licensee revealed that the licensee had determined in 1988 that isokinetic sampling may not have been occurring, based on measured flows through the sample nozzle and the main stack. The licensee also determined that the sample pump appeared to be incorrectly sized and could not pull the sample flow required for isokinetic sampling of the main stack. Their review of the design basis for the sampling system showed a design stack flow of 41580 scfm, whereas measured stack flows averaged approximately 60500 scfm for 1987 through 1989. The licensee determined that the measured stack flow corresponded to the plant main stack design flow of 61000 scfm.

In addition, in 1989, licensee personnel concerned with this issue became aware of the results of a study performed in 1981 by an outside consultant, indicating that the measured main stack flow rate may have been high by as much as 30 percent. The flow measurement device in the stack consists of a single flow element. Inaccurate flow readings can result when a single point element is used to measure flow in a stack with a large cross-sectional area, such as the main stack, because these stacks can have irregular flow profiles.

The inspectors reviewed selected documentation provided by the licensee for planned (previous to this inspection) actions to be taken to rectify this situation. These actions included: accurately

determining the flow volume out of the main stack; replacing the flow measurement device with a multiple point probe; and evaluation the current sampling set-up and determining if it needs to be replaced or modified in order to obtain isokinetic sampling. The project for accurately determining the stack flow and for replacing the flow measurement probe was waiting for upper management budget approval as of March 9, 1990. The licensee hoped to complete this work in 1990, pending project approval. The licensee had not established a firm date for completion of this work.

However, the inspectors noted that the gaseous effluent activity levels at this site were less than one percent of the regulatory limits and errors incurred as a result of the possible non-isokinetic sampling would be minimal. These errors would increase with increasing particle size. Since all but one of the flows into the main stack pass through filter banks (thereby effectively eliminating particles with a diameter greater than 0.3 microns), these errors were estimated by the licensee to be very small (less than one percent). The exception was the turbine gland seal flow, which should not make a particle contribution to the overall stack flow, given the nature and path of the flow.

However, since the licensee has committed in the FSAR to isokinetic sampling, and isokinetic sampling requires a knowledge of stack flow with a reasonable degree of accuracy, this issue will be tracked as an IFI (90-10-01) and will be reviewed during subsequent inspections.

No violations or deviations were identified.

6. Organization (84750)

TS 6.2.2 describes the licensee's organization.

The inspector reviewed the licensee's organization, staffing level and lines of authority as they related to radiation protection and radioactive material control to verify that the licensee had not made organizational changes which would adversely affect the ability to control radiation exposures or radioactive material.

The inspectors determined that in September of 1989, Brunswick underwent a reorganization. Overall approximately 500 people were cut from staffing at all sites. At Brunswick, the Environmental Section was merged into the Chemistry Department resulting in the elimination of one foreman and five technicians. Conversations with licensee representatives indicated that the reorganization affected work distribution in the respect that some

non-regulatory tasks were eliminated or the frequency reduced, and overtime was being used for training and for the completion of some jobs. The Corporate Support Staff was also reduced, but this did not impact Brunswick to a large degree. Because of the reduction in staff, some projects that normally would be completed by Brunswick personnel were being given to Corporate.

No violations or deviations were identified.

7. Water Chemistry (84750)

Since the last inspection (89-17), the licensee has implemented HWC control in Unit 1 to help reduce or stop crack growth caused by IGSCC in RCS piping and welds. HWC had been implemented in Unit 2 previously. Liquid hydrogen for the HWC was stored on site in a tank farm. Hydrogen was pumped from the tank farm and was injected into the suction of the condensate booster pumps of both units. Unit 1 required approximately 11.5 scfm of gaseous hydrogen, while Unit 2 required 15 scfm of gaseous hydrogen. The amount of hydrogen required in each unit depended on measured values of the electrochemical potential (ECP). An optimum ECP of -230 millivolts (mV) was recommended to completely retard crack growth in welds. The lower the ECP, the lower the crack growth.

The inspectors reviewed the licensee's system for measuring the ECP. These measurements determine the amounts of hydrogen needed to suppress IGSCC and crack growth. The inspectors noted that small differences in the amounts of hydrogen injected brought about large drops in ECP. An injection rate of 10.6 scfm resulted in an ECP of +20 mV, while an injection rate of 11.0 scfm dropped the ECP to -300 mV.

The inspectors also reviewed the results of the licensee's Crack Arrest Verification System (CAV). This system utilized coupons of Iconel 182, Iconel 600, and stainless steel 304 placed in an autoclav located off a line on the recirculation inlet manifold. These results consisted of graphs depicting crack length versus time, with HWC being introduced at 3000 hours. The graphs for the Iconel 182 and stainless steel 304 coupons showed a plateauing of the crack length occurring at 3000 hours, the change for the Iconel 600 was less dramatic but still discernible.

One side effect of HWC is that it caused the dissolved oxygen (DO) levels in the feedwater to drop. This drop in DO caused a thicker spinel film to form in the recirculation piping. Because this spinel layer poses a radiological problem, the licensee has had an outside contractor decontaminate the recirculation piping for Unit 1 once and for Unit 2 twice, using a mixture of citrox, oxalic acid, and ethylenediamine tetraacetic acid. This was performed prior to outages where there were substantial radiation levels in the drywell. The licensee had been injecting oxygen into the condensate system to combat this drop in dissolved oxygen. The licensee also discussed the fact that much still has to be learned about HWC. For example, the environment in the core

may be very different from that in the recirculation piping and may need higher levels of injected hydrogen to suppress IGSCC and cracking. Another side effect of HWC is that the conductivity of the Reactor Water Clean Up (RWCU) System dropped since the inception of HWC to 0.061 micromho/cm, well below the allowable limit as defined in TS Table 3.4.4-1. As a result, the RWCU filters had an extended lifetime. The licensee was injecting oxygen into the steam jet air injectors in order to recombine a percentage of the injected hydrogen with the oxygen to keep the hydrogen concentration below TS limits.

Since the last inspection (89-17), the licensee has had changes to the Unit 2 Technical Specifications approved by the NRC which allowed them to increase the main steam line monitor trip set points. This approval enabled the licensee to increase the scfm of hydrogen injected into the RCS and took into account the increase in nitrogen-16 carried over into the MSLs and the resultant increase in radiation levels. The inspectors also reviewed Amendment No. 139 to the Facility Operating License DPR-71 and Amendment No. 171 to DPR-62. These amendments allowed for adjustment of the Main Steam Line (MSL) Radiation Monitors while Hydrogen Water Chemistry was in service. The inspectors also reviewed the technical specification changes associated with the adjustment of the MSL radiation monitor. NRR concluded that these amendments and the TS changes associated with the permanent HWC System were acceptable. The inspectors also walked down selected portions of the HWC injection system, including the control panels for the hydrogen and oxygen.

Violations or deviations were not identified.

8. Exit Interview

The inspection scope and results were summarized on March 9, 1990 with those persons indicated in Paragraph 1. The inspectors described the areas inspected and discussed in detail the inspection results as listed in the summary. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

9. Acronyms and Initialisms

AOG - Augmented Off Gas
CAV - Crack Arrest Verification
CFR - Code of Federal Regulation
DO - Dissolved Oxygen
ECP - Electrochemical Potential
FSAR - Final Safety Analysis Report
HWC - Hydrogen Water Chemistry
IFI - Inspector Follow-up Item
IGSCC - Intergranular Stress Corrosion Cracking
MSL - Main Steam Line
mV - millivolt
No. - Number
NRC - Nuclear Regulatory Commission

NRR - Nuclear Reactor Regulation
QA - Quality Assurance
QC - Quality Control
RCS - Reactor Coolant System
RWCU - Reactor Water Clean Up
scfm - standard cubic feet per minute
TLD - Thermoluminesent Dosimeter
TS - Technical Specification