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

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Report Nos.: 50-325/90-34 and 50-324/90-34

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: August 20-24, 1990

Inspectors: R.B. Shortridge for 9/18/90
F. N. Wright Date Signed

R. B. Shortridge 9/18/90
R. B. Shortridge Date Signed

Approved by: 9/19/90
J. P. Potter, Chief Date Signed
Facilities Radiation Protection Section
Emergency Preparedness and Radiological
Protection Branch
Division of Radiation Safety and Safeguards

SUMMARY

Scope:

This routine, unannounced inspection of radiation protection activities included a review of the licensee's organization and management controls, As Low As Reasonably Achievable (ALARA) program, external exposure controls, and licensee actions on previous inspection findings.

Results:

One non-cited violation was identified for failure to follow licensee procedures. The licensee had recently initiated numerous ALARA program enhancements and licensee management and staff appeared to be supportive of ALARA program goals and initiatives.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*K. Altman, Manager, Regulatory Compliance
*F. Blackman, Manager, Operations
*A. Cheatham, Manager, Environmental and Radiation Control (E&RC)
*K. Cove, Senior Specialist, Control and Administration
*W. Dorman, Manager, Quality Assurance and Quality Control
*J. Harness, General Manager
*J. Henderson, Manager, Radiation Controls, E&RC
*J. Holder, Manager, Outage Management and Modifications
*R. Kitchen, Manager, Unit Two Mechanical Maintenance
*J. Leviner, Manager, Engineering Projects
*W. Link, Senior Specialist, Regulatory Compliance
*J. Moyer, Technical Assistant to Plant General Manager
*W. Simpson, Manager, Control and Administration
*R. Smith, Manager, Radiation Controls, E&RC
*P. Sneed, ALARA Supervisor, E&RC
*R. Starkey, Vice President Brunswick Nuclear Project (VPBNP)
J. Terry, Radiation Control Project Specialist
*L. Wheatley, In Service Inspection
G. Worley, Radiation Control Foreman - Radioactive Waste

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

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*D. Collins, Branch Chief, Emergency Preparedness and Radiological Protection, Region II
*D. Prevatte, Senior Resident Inspector

*Attended exit interview held August 24, 1990

2. Organization and Management Controls

a. Organization

The inspector reviewed changes made to the licensee's organization, staffing levels, and lines of authority as they related to radiation protection, and verified that the changes had not adversely affected the licensee's ability to control radiation exposures or radioactivity.

The inspector determined that the former Radiation Control Manager of Operations had taken a position with the corporate health physics (HP) staff. The new Manager of Operations came from within the plant

radiation protection staff and, as a result, several staff personnel had changed responsibilities and duties. The inspector reviewed the qualifications of newly appointed Radiation Control Supervisors and determined that they met the qualification requirements specified in licensee Technical Specifications (TSs).

Within the scope of the review, no violations or deviations were identified.

b. Management Controls

In a previous inspection conducted at Brunswick in July 1990, the inspector reviewed licensee audit report QAA/0021-90-02A, Quality Assurance Audit of Brunswick Nuclear Project ALARA Program conducted April 2 to June 5, 1990. The audit staff included technical specialists from CP&L facilities having experience in radiation protection and ALARA activities. The audit identified significant findings concerning the licensee's ability to effectively plan and implement maintenance and modification activities. The audit did not identify or document ALARA program compliance problems but did document several program weaknesses deserving management attention. The audit letter for the audit report requested that the plant staff respond to those findings. During the inspection, the inspectors determined that the licensee was responding to the program weaknesses identified in the audit.

Within the scope of this review, no violations or deviations were identified.

3. Maintaining Exposures As Low As Reasonably Achievable (ALARA) (83728)

10 CFR 20.1(c) states that persons engaged in activities under licenses issued by the NRC should make every reasonable effort to maintain radiation exposures as low as reasonably achievable. The recommended elements of an ALARA program are contained in Regulatory Guide 8.8, "Information Relevant to Ensuring that Occupational Radiation Exposure at Nuclear Power Stations will be ALARA," and Regulatory Guide 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures ALARA."

The inspectors discussed the ALARA program with licensee representatives and reviewed actions being taken by the licensee in response to program weaknesses previously identified by the NRC. The inspectors also reviewed licensee preparations for the upcoming Unit 1 Refueling Outage and Recirculation System Pipe Replacement Project.

In parallel with routine refueling operations, the licensee scheduled 47 days to: replace reactor recirculation riser piping from the ring header up to and including the inlet safe-ends, the removal of eight weld overlays, and perform mechanical stress improvement on 34 associated welds. The work scope of the Unit 1 pipe replacement is larger than the

Unit 2 pipe replacement that was performed for 475 person-rem. Licensee representatives stated that the collective personnel exposure goal for the Unit 1 pipe replacement portion of the outage was 376 person-rem. Also, the experience gained during the Unit 2 recirculation pipe replacement would allow a number of dose saving measures to be incorporated into the planned work that should make the more challenging goals achievable. The inspectors determined that the licensee had integrated several dose reduction activities in the project that should result in significant collective dose reductions.

The inspectors discussed the following short and long term licensee initiatives that are being implemented to reduce radioactivity source term and collective personnel radiation exposures.

- CP&L formed two management oversight committees to provide input and approval for ALARA initiatives to reduce source term at utility facilities over the long term. The inspectors determined that the list of dose reduction initiatives developed by the committee was substantive.

- The VPBNP allocated $50,000 to be used in incentive programs for collective dose reduction activities. The licensee was implementing a new incentive program that rewarded staff work units for obtaining group goals which include ALARA objectives. The licensee's plan allows up to ten units to qualify for a $1,500 award.

- The site ALARA Committee had authorized the use of radiation status boards to be placed throughout the plant and employee outage handbooks to be distributed to each employee that addresses all ALARA aspects of the scope and details of the upcoming outage.

- To limit unplanned work the licensee required the VPBNP to approve expanding work scopes during outages.

- Dose reduction incentives are incorporated into vendor contracts to reward contractors for good performance in reducing collective personnel dose.

- Incorporating ALARA awareness subjects in all safety meetings.

- Improved radiation dose tracking programs to provide supervisors of small work groups dose reports to utilize in monitoring their staff's radiation exposures.

- The licensee had just established a dose accountability program for unit supervisors which required the supervisors to review their staff's collective dose totals monthly. The program required unit supervisors to provide justifications to the VPBNP for significant dose differences when actual collective personnel exposures exceeded dose projections for the period. The supervisors were also required

to submit proposed corrective actions to resolve the dose differences.

At the conclusion of the inspection, the radiation protection group discussed additional ALARA program improvement proposals that were still being evaluated for implementation. These included the following:

- Increased spent fuel pool cooling capacity to allow fuel transfer from the reactor core to spent fuel pool storage, earlier than currently allowed. The licensee currently has to wait approximately 30 days for fuel decay heat decreases because the current fuel pool coolant temperature limits are exceeded when hot fuel is moved to the spent fuel pool following unit shutdowns. The licensee believes that personnel exposures could be reduced if the core could be unloaded earlier and the refueling outage length shortened.

- Modifying licensee procedures to require ALARA reviews in the early phases of work plan developments for design changes and modifications.

- Additional staff exposure to other licensee ALARA programs through onsite visits.

Within the scope of this review, no violations or deviations were identified.

4. External Exposure Controls

The inspectors reviewed the licensee's external exposure control program. The review was made with respect to the criteria contained in licensee TS, 10 CFR 20, "Standards for Protection Against Radiation," and applicable licensee procedures. Evaluation of the licensee's performance in this area was based on observations during plant tours, discussions with licensee personnel, and review of licensee documentation.

a. Tours of Radiation Control Areas (RCAs)

The inspectors toured the radiological areas of the plant and reviewed the following matters:

- Posting, barricading and access control, as appropriate, to radiation and high radiation areas.

- Control of radioactive material and contaminated material.

- Personnel adherence to radiation protection procedures, radiation work permits, and good radiological control practices.

- Use of personnel contamination control devices.

- Use of personnel dosimetry.

The inspectors determined that selected radiation and high radiation areas inspected and surveyed by the inspector appeared to be properly posted as required by 10 CFR 20.203.

Within the scope of this review, no violations or deviations were identified.

b. Access Control for High Radiation Areas

The inspector reviewed the licensee's access control procedures for accessing high radiation areas. The licensee's TS 6.12.2 requires high radiation areas having a whole body dose rate greater than 1,000 millirem per hour (mrem/hr) be secured by locking or positive access controls. NRC Inspection Report 90-06, issued March 8, 1990, documented a violation of licensee TS 6.12.2 for failure to maintain positive access control of areas having whole body radiation dose rates in excess of 1,000 mrem/hr. The inspectors determined that the licensee had identified another example of the violation on August 3, 1990, when a door to the Unit 1 Condenser Bay was left open. Licensee corrective actions for the previously identified violation were not completed when the August 3, 1990 violation of the TS requirements occurred. The inspectors discussed the additional example of the TS 6.12 violation with licensee management. The inspectors notified licensee management that since the licensee's corrective actions for the violation documented in the 90-06 report had not been fully implemented, no additional enforcement actions would be made for the August 3, 1990 violation. However, additional examples of the violation following the corrective action completion date of August 16, 1990 would be reviewed for additional enforcement actions.

Within the scope of this review, no deviations were identified.

c. Control of Radioactive Material

Licensee TS 6.8.1 requires that written procedures be established, implemented, and maintained covering the activities recommended in Appendix A of Regulatory Guide 1.33, November 1972.

Regulatory Guide 1.33, November 1972, Appendix A, Paragraph 9.e states that general procedures for control of maintenance repair, replacement, and modification work should be prepared prior to beginning work.

TS 6.11 requires that written procedures for personnel be prepared consistent with the requirements of 10 CFR Part 20 and shall be approved, maintained, and adhered to for all operations involving personnel radiation exposures.

At approximately 1245 on May 9, 1990, an event occurred in the Unit 1 cask washdown area located on the licensee's refueling floor that resulted in several personnel contaminations, intakes of measurable radioactive material, and the spread of radioactive contamination to clean areas of the licensee's refueling floor and refueling floor dress-out areas.

Licensee workers were preparing to sample and flush a spent fuel shipping cask when the event occurred. The licensee was using the shipping cask to transfer spent fuel from the Brunswick spent fuel pool to the Harris spent fuel pool for storage. The licensee routinely flushed the returning shipping cask to remove residual boron and loose radioactive contamination before the cask was placed in the licensee's spent fuel pool. Licensee Procedure E&RC 0582, "Handling the IF-300 Cask," Revision 5, provided licensee maintenance and HP personnel instructions for use of a spent fuel shipping cask. The procedure included instructions for flushing the cask internals with demineralized water and a specified valve line-up sequence for that task. However, the licensee's employees failed to follow the valve opening sequence specified in the procedures. When one of the workers uncoupled the demineralized water supply line from the shipping cask he was sprayed with viscous radioactive contamination. The licensee reported that approximately 200 milliliters of the radioactive material having a consistency similar to tomato paste was discharged from the cask. The worker notified an assisting HP technician of the release.

The HP technician performed a radiation survey and determined that adjacent clean areas of the refueling floor and the refuel floor change room on the 98 foot elevation were contaminated during the event. Radiation surveys made by the technician detected the following contamination levels:

- The clean area adjacent to the cask washdown area was contaminated with radioactive material measuring 30-40 mrem/hr.

- The general area in the cask washdown area exhibited 200-300 mrem/hr with 3-5 rem per hour (rem/hr) on the floor where the spill occurred.

- The cask drain line exhibited 10-12 rem/hour.

Fuel shipment work was stopped, contaminated areas were secured, and decontamination started.

Licensee continuous air monitors showed airborne radioactivity increases following the event, however, the licensee's analysis of the filters did not indicate airborne radioactive contamination at maximum permissible concentrations (MPCs). Ten licensee personnel in adjoining areas received whole body counts for internal exposures. Six of the ten had positive gastrointestinal tract results, and one

of the six also had a measurable lung intake. The exposures varied from 2.1 to 5.1 MPC hours of cobalt-60.

Follow-up whole body analyses, conducted within three days of their exposures, were all less than the minimum detectable activities. Four licensee personnel were contaminated during the event. The worker that was sprayed with radioactivity received a skin dose of 11 millirem from cobalt-60 contamination. The licensee was able to decontaminate most of the areas outside the cask washdown area by the following day.

The licensee investigation of the incident was documented in the Plant Incident Summary as Report 90-13. The licensee concluded that the root cause of the event was personnel error resulting from failure to follow procedures.

Licensee corrective action for the event included:

- Providing a storage container for required equipment and labeling the required equipment.
- Revising E&RC-00582, "Handling the IF-300 Cask," to clarify responsibilities and strengthen critical steps.
- Retrain all individuals involved with IF-300 fuel cask handling and loading, including a description of the event.

The inspector stated that failure to follow the valve sequencing order specified in procedure E&RC 0582 appeared to be a violation of licensee TS 6.8.1. However, this licensee identified violation was not cited because the criteria specified in Section V.G.1 of the NRC Enforcement Policy were satisfied (NCV: 50-325/90-34-01).

Within the scope of this review, no deviations were identified.

5. Action on Previous Inspection Findings (92701, 92702)

a. (Closed) Inspector Follow-up Item (IFI) 50-325/88-33-03: The number of people onsite with measurable radiation dose is consistently higher than the industry norm.

In 1989, the licensee performed an organizational analysis that resulted in significant reduction in personnel on site. This item is closed.

b. (Closed) IFI 50-325/88-33-04: The Corporate audit program is not resulting in ALARA program improvements.

The inspectors reviewed licensee Quality Assurance Audit, QAA/0021-90-02, dated June 29, 1990, of the Brunswick ALARA Program. The inspectors noted that the findings were substantive and the

licensee responses to the findings indicated that appropriate actions would be taken to resolve the findings satisfactorily. This item is closed.

c. (Closed) IFI 50-325/88-33-05: A method is needed to require additional ALARA reviews for jobs prior to exceeding the dose projections.

The licensee has established flags in the licensee's computerized dose tracking system at a percent completion of a specific job as a means of identifying the need for further ALARA review. This item is considered closed.

d. (Closed) IFI 50-325/89-36-01: Review/evaluate the personnel contamination event that occurred on the Unit 2 refueling floor on October 25, 1989.

Based on a review of the event, where a person was contaminated on the face while operating a chain hoist, the inspectors determined the licensee's corrective actions were appropriate. This item is closed.

e. (Closed) IFI 50-325, 324/90-06-02: Develop and implement a comprehensive source term and collective dose reduction plan.

Based on radiation exposure data collected by the NRC, collective personnel dose at Brunswick 1 and 2 has been among the highest for Boiling Water Reactors (BWRs) in the industry. During the three years 1987, 1988, and 1989 collective dose per reactor was 710, 894, and 893 respectively. The three year collective dose average was 825 person-rem, the fourth highest among BWRs nationwide. ALARA program weakness over the past years necessitated that a comprehensive program be developed to reverse this trend.

In 1990, the licensee took positive corrective actions with development of a source term and collective dose reduction program. A Dose Reduction Steering Committee and Dose Reduction Committee were formed comprised of corporate and site management. A task force was formed to address the ALARA issues at Brunswick. The inspectors determined that Brunswick was actively seeking substantive ways to reduce collective dose. Significant dose reduction recommendations had been prepared and will be presented to the corporate committee for approval in September 1990. This item is considered closed.

f. (Closed) Violation 50-325, 324/90-06 -01: Failure to control access to locked high radiation areas.

The licensee experienced six separate events in 1989 and 1990 where access doors to locked high radiation areas had been found unlocked and unguarded. No unwarranted radiation dose had been associated with the events.

To correct the violations of NRC regulations, the licensee has taken the following measures: incorporated training material in general employee training regarding proper control of locked high radiation areas, special counseling was given to operations and radiation control personnel who are primary users of these areas, locked high radiation areas key control procedures were revised requiring verification sign-off for personnel using high radiation areas, and management directives addressed compliance with plant procedures controlling access to high radiation areas were issued. This item is considered closed.

y. (Open) Unresolved Item 50-325, 324/90-34-44: Radioactive Waste Cleanup Phase Separator Tank (RWCUPST) Room Reportability.

In a previous NRC inspection performed by the site Resident Inspectors, concerns for the conditions found in the RWCUPST room and applicability of the reporting requirements specified in 10 CFR 20.403 for the room conditions were referred to a Region II radiation specialist for review as an unresolved item.

The inspectors determined that the licensee's RWCUPST room contained spent resin on the floor that was 6-12 inches deep. The spilled spent resin had the consistency of dried mud and had accumulated over a period of years from tank overflows. The inspectors determined that the conditions in the room did not pose a safety problem, in that, the room was properly posted and controlled. Access to the room was not required for routine operation activities and the licensee routinely monitored the radiological conditions in surrounding areas to detect changing radiological conditions. The room, as described in the FSAR, was built with a radwaste drain and sufficient shielding to accomodate the resin either in the tank or on the floor.

The inspectors reviewed the applicability of the reporting requirements specified in 10 CFR 20.403 to the conditions found in the RWCUPST room. The requirement states that the NRC must be notified whenever any event involving by-product, source, or special nuclear material, causes or threatens to cause damage to property in excess of $2,000. The licensee's initial assessment concluded that the "as found" conditions in the RWCUPST room were not reportable. The inspectors also determined that the room condition did not meet the reportability requirements of 10 CFR 20.403. The inspectors also determined that the licensee's Engineering staff had performed a safety review analysis on February 7, 1990, of the conditions in the RWCUPST room and concluded that the existing conditions in the room could remain without undue hazard to the health and safety of the public and that the RWCUPST room did not constitute an un-reviewed safety question.

This item will remain open pending a review of the safety evaluation by the NRC.

6. Exit Interview

The inspection scope and findings were summarized on August 24, 1990, with those persons indicated in Paragraph 1 above. The inspectors described the areas inspected and discussed in detail the inspection findings listed below. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspectors during this inspection. Dissenting comments were not received from the licensee.

One licensee identified violation, was identified as a NCV for failure to follow a operations procedure for handling a spent fuel shipping cask (Paragraph 4).

Licensee management was informed that one previous violation, one Unresolved Item, five IFIs discussed in Paragraph 5, and one NCV discussed in Paragraph 4, were closed during this inspection.