



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

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Report Nos.: 50-325/89-36 and 50-324/89-36

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: October 23-27, 1989

Inspectors: <u>William B. Gloersen</u>	<u>11/22/89</u>
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Accompanying Personnel: J. Potter

Approved by: <u>J. Potter</u>	<u>11/24/89</u>
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Facilities Radiation Protection Section	
Emergency Preparedness and Radiological	
Protection Branch	
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SUMMARY

Scope:

This routine, unannounced inspection was conducted in the areas of occupational exposure, shipping and transportation during extended outages, and previously identified followup items. The inspectors also examined the licensee's radiation protection plan for the Unit 2 recirculation pipe replacement project.

Results:

In the areas inspected, no violations or deviations were identified.

A need for improvement was observed in the licensee's recirculation pipe replacement mock-up training program, in that neither specific performance criteria nor specific performance goals were specified. A program area strength was observed in the licensee's well written and technically thorough response to an NRC initiative regarding the generation of instrument efficiency factors for determining source strengths of hot particles.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *C. Blackman, Manager, Operations
- *S. Callis, Licensing
- *A. Canterbury, Unit 1 Mechanical Maintenance Manager
- *A. Cheatham, Manager, Environmental and Radiation Control (E&RC)
W. Conn, Radiation Control Foreman
- *W. Dorman, Manager, Quality Assurance
- *K. Enzer, Manager, Regulatory Compliance
- *S. Hamilton, Senior Specialist, E&RC
- *J. Harness, General Manager
G. Haynes, ALARA Technician
- *R. Helme, Manager, Technical Support
- *J. Henderson, Manager, Radiological Controls, E&RC
- *J. Holder, Manager, Outage Management and Modification
R. Kury, ALARA Specialist, E&RC
K. O'Donnell, Radwaste Technician, E&RC
- *R. Poulk, Supervisor, Regulatory Programs
- *C. Robertson, Manager, Environmental and Chemistry, E&RC
C. Shelton, Radiological Controls Technician, E&RC
P. Sneed, Project Specialist, E&RC
- *R. Starkey, Manager, Brunswick Nuclear Project
J. Terry, ALARA Supervisor, E&RC
L. Tripp, Manager, Radiological Controls, E&RC

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

NRC Resident Inspector

- *W. Ruland, SRI

*Attended exit interview

2. Radiation Protection Plan - Unit 2 Recirculation Pipe Replacement Project (83750, 83729, TI 2512/13)

The inspector reviewed the licensee's Recirculation Pipe Replacement Project (RPRP) Radiation Protection Plan dated September 1, 1989. Key elements discussed in the Radiation Protection Plan included the following: (1) Project Schedule; (2) Organization and responsibilities; (3) ALARA program; (4) Exposure goals; (5) RPRP exposure tracking and trending system; and (6) Waste disposal.

After reviewing the RPRP "Radiation Protection Plan" and NUREG/CR-4494, "Radiological Assessment of BWR Recirculatory Pipe Replacement," the inspectors observed that the licensee had either incorporated or were planning to incorporate nearly all of the accumulated experience and major engineering dose reduction techniques outlined in NUREG/CR-4494. The following significant practices were noted:

- Use of chemical decontamination of the reactor coolant system before the replacement efforts (the licensee used a three step Citrox process which was highly successful).
- Use of temporary shielding, such as in-vessel shielding, N2 inlet riser shielding, manifold shielding, nozzle plugs, and general area shielding (the licensee planned to use a dedicated crew to install temporary shielding more efficiently).
- Use of contractors with specialized expertise in pipe replacement (the licensee selected General Electric as the primary contractor for the RPRP).
- Use of a multi-element external dosimetry system (the licensee will use TLDs, finger TLDs, self-reading, pocket dosimeters, and digital alarming dosimeters).
- Use of ALARA procedures and planning prior to performing pipe replacements.
- Use of full-sized mockups and appropriate training for maintenance and health physics (HP) personnel.
- Review of exposure data by supervisors and radiation protection personnel and use of a formalized dose tracking system (the licensee was developing crew identification numbers that would allow the RPRP group to track personnel exposure by task for use as a management tool to maintain exposure ALARA).
- Use of protective clothing, respiratory protection, and portable ventilation equipment (the licensee borrowed two 8000 CFM portable HEPA ventilation units from another licensee for use in the drywell).
- Use of remotely operated welding and cutting equipment.
- Use of shielded storage areas for contaminated equipment.

No violations or deviations were identified.

3. Recirculation Pipe Replacement Project Training (83750)

The inspectors reviewed the licensee's ALARA training program as it related to the RPRP. Included as part of this review was the RPRP indoctrination training course and ALARA mock-up training conducted by the

licensee's primary RPRP contractor. The RPRP ALARA training course provided advanced training to supplement the General Employee Training (GET) received by project personnel. The following areas were included in the course:

- Project work space
- ALARA goals and organization for RPRP
- Dose mitigating measures
- Radiological good practices
- Work area access and egress
- Remote video and communications
- HP policies for drywell work
- Use of portable ventilation
- Mock-up training
- ALARA suggestion program
- Project exposure training program
- Radwaste minimization

After reviewing the course outline and handouts pertaining to ALARA practices, it appeared that the licensee's project ALARA training course was adequate and that it generally included the commitments made in the RPRP Unit 2 Radiation Protection Plan.

The inspectors also reviewed the licensee's mock-up training program and observed mock-up training procedures and lesson plans at the mock-up training facilities. At the time of this inspection, the licensee was in the process of conducting mock-up training exercises and, had not yet qualified anyone on a particular procedure. The licensee's mock-up facility included the following equipment:

- N2 Safe End/Nozzle - short pipe studs welded to the reactor vessel to provide an interface between the carbon steel vessel and the stainless steel piping
- Sweepolet/Manifold - transition section between the ringheader and riser
- Shielded Safe End Transport Can

The licensee attempted to simulate working conditions as closely as possible including space configuration, work area tents, and lighting conditions. Machining, welding, and cutting equipment identical in form and operation to equipment which will actually be used for Unit 2 work, was being used for mock-up training. Sufficient protective clothing, dosimetry, and respirators were available to support the conduct of mock-up training. The licensee was waiving the use of coveralls, hoods, and rubber shoes for mock-up training activities where only a single set of protective clothing and no respiratory protection was required. In these cases, the trainees were donning protective hand gloves. The inspectors toured the pipe replacement vendor training building with licensee representatives and observed the welding/cutting training in

progress. Licensee representatives stated that all crafts performing welding/cutting operations in plant would be fully qualified prior to performing the operation. The inspectors observed trainees performing ALARA mockup requirements associated with welding and cutting and noted that the training was conducted in accordance with RWP requirements and under conditions that are anticipated in the drywell.

The inspectors also reviewed Procedure CPL-TRA, "BSEP Recirc Pipe Replacement Project Personnel Training Program," Revision 1, October 24, 1989 and Lesson Plan, "N2 Nozzle Weld Prep Cuts with 820 Machine," Revision 0, October 10, 1989. The inspectors noted a few weaknesses in the procedure and discussed the following possible improvement items with licensee representatives:

- ° Performance criteria (i.e., pass/fail criteria) for trainees were not specified.
- ° Performance measurements (e.g., time required to perform a task satisfactorily; number of successful task completions in order to qualify an individual) were not specified
- ° Involvement of BSEP QC inspectors in mock-up training was not specified.

The licensee agreed to review the areas noted above. From discussion with licensee representatives, it was determined that the RPRP job foremen also functioned as task instructors so it would be possible to have more than one instructor for a particular task. The inspectors noted that work crew performance could be affected by the variability and qualifications of the instructors. The licensee was aware of this and was closely monitoring mock-up training activities.

No violations or deviations were identified.

4. Occupational Exposure During Extended Outages (83750, 83729, TI 2512/13)

a. Organization and Management Controls

In September, the Environmental and Radiation Control (E&RC) Unit staff was reduced from 127 to 108 as a result of a company wide organizational analysis. The most significant change in E&RC was the outplacement of a technical supervisor. An ALARA supervisor and staff of four, and the technical staff of three reported directly to the Manager of E&RC. The present HP organization, staffing level, and lines of authority as related to the outage, appeared to be adequate.

On October 25, 1989, Unit 2 was in day 47 of 160 of the Refuel 8 outage and was 13 days behind schedule. Licensee representatives stated that the primary causes for the delays were hurricane "Hugo" and problems with control rod drive rebuilds. Although the

preparation for the pipe replacement portion of the outage was nearly complete, the actual seven week contractor portion of the pipe replacement outage had not started. Licensee representatives stated that preparations for reactor vessel drain down were in progress, and upon completion; the contractor would be in charge of replacing the recirculation piping from the ring header up to and including the safe ends.

b. External Exposure Control

The inspectors observed the program for external exposure controls over a three day period. Tours were made in the reactor building and drywell. The inspectors noted that individual doses were maintained on a colored card carried by the worker. Different colors of dose cards represented various levels of authorized dose. The worker entering the drywell or reactor building surrendered the dose tracking card to an HP technician at the control point prior to entering the restricted area. HP briefed the workers on radiological requirements for entry to the applicable work area within the restricted area. For each entry into the reactor building or containment the worker was required to update the dose card to reflect the remaining allowable dose for the entry. Workers entering high radiation areas were provided with a radiation monitoring device that indicated dose rate or a device that integrates dose and alarms at a pre-set dose. The inspectors observed work on three radiation work permits (RWPs) 1855, 2010, and 2011 that involved preparation and removal operations for the recirculation pipe replacement in accordance with RWP and HP procedure requirements. No problems were observed.

c. Internal Exposure Control

10 CFR 20.103(a) establishes the limits for exposure of individuals to concentrations of radioactive materials in air in restricted areas. Additionally, this regulation requires that suitable measurements of concentrations of radioactive materials in air be performed to detect and evaluate the airborne radioactivity in restricted areas and that appropriate bioassays be performed to detect and assess intakes of radioactivity. The inspectors reviewed selected whole body count results for the period January 1, 1989 through October 26, 1989. During that period, there were eight individuals whose maximum permissible organ burden (MPOB) was greater than or equal to 2 percent but less than 10 percent, apparently due to activities at the plant. The inspectors observed that the licensee followed Procedure E&RC-0420, "Personnel Bioassay Methods," which stated that when the MPOB was greater than or equal to 2 percent but less than 10 percent the individual would shower and be recounted until there was less than 10 percent difference between consecutive counts. On October 25, 1989, during the removal of the shroud head bolts on the Unit 2 Refueling Floor, an airborne contamination event occurred involving five individuals. The highest

individual organ burden after three showers was 8.1 percent MPOB (GI Tract). The principal nuclides detected were Co-60 and Mn-54. On October 26, 1989, the MPOB had decreased to 4.2 percent. At the time of this inspection, the licensee was preparing an "Experience Report," however, this report was not completed on October 27, 1989 when the inspection was terminated. The inspectors indicated to licensee management that the completed "Experience Report" would be reviewed during a subsequent inspection in order to evaluate the sequence of events, root cause analysis and immediate and long term corrective actions. This item will be tracked by the NRC as an inspector followup item (IFI) (IFI: 50-324/89-36-01: Review/Evaluate the Experience Report Describing the Unit 2 Refueling Floor Contamination Event).

d. Maintaining Doses ALARA

The inspectors discussed the program to maintain workers exposure to occupational dose ALARA with licensee representatives. The ALARA coordinator for the pipe replacement project provided data for the chemical decontamination of the recirculation piping. The vendor performed the system decontamination using Citrox chemical decontamination process and achieved a general area decontamination factor (DF) 7.5 on loop 2A and a contact DF of 16. The data for loop B showed a lower DF for contact on the piping. The HP ALARA coordinator stated that a general area DF of 7.8 was attained for general area but a contact DF of 11.2 was probably due to inleakage of coolant during the decontamination operation. The collective dose to perform the system decontamination was 15.7 person-rem, and the postulated dose to be saved was estimated to be 400-600 person-rem.

The HP project ALARA coordinator also discussed the following system flushes to minimize collective dose by reducing source term in the systems:

1. A high pressure low volume water lance of the core spray lines was used to perform the system flush, that resulted in a 2.25 DF contact and resultant contact reading on the hot spots of 120 and 300 mrem/hr. The overall DF as a result of both system flushes on core spray on "A" loop was 10 and on "B" loop was 4.
2. The jet pump nozzles were flushed using a variation of pressure and volumes with a water lance. The decontamination operation resulted in an average DF of 6.7. The four day operation was performed at the reactor vessel annulus (thermal sleeve/nozzle pipe juncture) and has a postulated collective dose savings of 63 person-rem.
3. A water flush was also used to reduce a radiation hot spot of 250 rem/hr contact on the drain path for the reactor water cleanup (RWCV) valves. The hot spot was reduced to 700 mr/hr contact and has a postulated collective dose savings of

4 person-rem. The pipe was relocated for better access during normal operations and to keep radiation hot spots from forming.

The inspectors observed that closed circuit television cameras (CCTV) were also used to minimize dose. The licensee had in place 25 CCTV cameras connected to remote monitors through the reactor building and drywell. Licensee representatives stated that an additional 25 CCTV cameras were being installed for the pipe replacement outage.

e. Control of Radioactive Materials and Contamination, Surveys and Monitoring

During tours of the Unit 2 reactor building and drywell, the inspectors performed radiation and contamination surveys and compared the results with surveys performed by the licensee. No discrepancies were noted. The inspectors also examined licensee radiation protection instrumentation and verified that the instruments were in current calibration.

The inspectors reviewed records of personnel contamination events (PCEs) for 1989. The licensee identified 374 PCEs from January through September 1989. Licensee representatives stated that 99 were skin contaminations while 275 were clothing, non-gaseous, contaminations and that they expected to finish the year below the goal of 420 PCEs. To reduce the number of PCEs at the station, personnel that experienced clothing contaminations were required to attend a briefing by their foreman on contamination controls and good radiological work practices. Personnel that had skin contamination were required to have a briefing by the HP operations manager.

The licensee maintained approximately 414,831 square feet (ft²) of the reactor building as controlled for decontamination purposes. Currently 80,000 ft² of this area or 19 percent was contaminated, which was the goal to be under for 1989.

f. Transportation

10 CFR 71.5 requires that licensees who transport licensed material outside the confines of its plant or other place of use, or who deliver licensed material to a carrier for transport, shall comply with the applicable requirements of the regulations appropriate to the mode of transport of the Department of Transportation (DOT) in 49 CFR Part 170 through 189.

10 CFR 20.311(b) requires that each shipment of radioactive waste to a licensed land disposal facility be accompanied by a shipment manifest, and also specifies the required entries on the manifest.

The inspector reviewed selected records of radioactive waste and radioactive materials shipments, including a DOT Spec. 7A shipment (89-193), made during 1989. The shipping manifests examined were

prepared consistent with 49 CFR requirements. The radiation and contamination survey results were within the limits specified for the mode of transport and shipment classification and the shipping documents were being completed and maintained as required. The licensee has shipped a total of 769 radioactive waste shipments since the last violation in June 1986, indicating a well managed program.

g. Solid Waste

10 CFR 20.311(d)(i) requires that licensees prepare all waste such that the waste is classified in accordance with 10 CFR 61.55 and meets the waste characteristic requirements specified in 10 CFR 61.56.

At the time of this inspection, the licensee used a vendor-supplied computer program "WASTETRACK" which processed input information obtained from a package of waste to determine the package's waste classification and transportation type. The program identified non-gamma emitters based on the scaling factors developed by the corporate staff for the particular waste stream from which the waste was generated. Beginning on January 1, 1990, the licensee planned to change their waste classification software to "RADMAN."

Radioactive waste disposal for the recirculation pipe replacement project will be segregated into three separate waste streams; (1) dry active waste (DAW); (2) chemical decontamination resins; and (3) recirculation piping disposal. DAW generated as a result of the RPRP will be sorted and packaged for shipment to the Scientific Ecology Group (SEG) for supercompaction and ultimate disposal to a licensed land disposal facility. The licensee will implement its Volume Reduction Program which includes waste tracking and daily interactions with work areas in order to enhance proper waste volume reduction practices. The "Citrox" chemical decontamination process yielded approximately 220 cubic feet of both depleted cation mixed-bed resins (non-chelated) and anion resins containing chelates and 50 cartridge filters. The licensee requested and received a variance from the State of South Carolina allowing for the disposal of chelated resins (greater than 1 percent chelating agents) in a dewatered high integrity container (HIC). The inspector reviewed the letter from the State of South Carolina granting the variance. The licensee plans to dispose of the ten recirculation inlet risers and safe-ends to the SEG for compaction and disposal. Due to the relatively high expected dose rates on the safe-ends (5-15 R/hr), the licensee will have a vendor analyze samples of the piping for proper waste classification. Additionally, the primary RPRP contractor will provide shielded containers to minimize the handling exposure.

No violations or deviations were identified.

5. Licensee Action on Previously - Identified Inspection Findings (92701)

(Closed) IFI 50-325/88-43-01: Add guidance to E&RC-0230 on the use of finger TLDs for special jobs involving the direct handling of highly radioactive objects. The licensee revised E&RC-0230, "Issue and Use of Radiation Work Permit," Revision 17, March 2, 1989, to include specific guidance on the use of finger TLDs. The guidance on when to use finger TLDs included the following: handling compact sources directly; when beams exist in an extremity area, and when beta radiation is primary radiation of concern. The licensee planned to collect data and perform studies comparing wrist TLDs and finger TLDs. The results will be assessed and the need for additional studies will be determined by November 30, 1989. This item is considered closed.

(Closed) IFI 50-325/88-43-02: Correlate gamma spectroscopy results and portable instrument spray results when quantifying the activity of hot particles. The licensee performed a study "Report on the Generation of Instrument-to-Activity Factors and Other Items Associated With Revision to E&RC-0213," dated December 10, 1988. In that study, the licensee determined instrument reading to activity factors for four cases: (1) RM-14 instrument with both HP-210 and N222 probes; and (2) RO-2 instrument with open and closed windows. The licensee also performed a study to demonstrate that there was no significant difference in the gamma spectroscopy calibration factors when using either a point source (less than 4 mm diameter) or a particulate filter calibration source (47 mm diameter). The licensee demonstrated no significant difference in the efficiency calibration factors at 5 cm and 30 cm source-to-detector distances. The licensee presently makes all "point" source activity determinations using a particulate filter geometry. The inspector noted that the study was thorough and well written. This item is considered closed.

6. Exit Interview

The inspectors met with licensee representatives (denoted in Paragraph 1) at the conclusion of the inspection on October 27, 1989. The inspectors summarized the scope and findings of the inspection. The inspectors also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspectors during the inspection. The licensee did not identify any such documents or processes as proprietary. Dissenting comments were not received from the licensee.

Item NumberDescription and Reference

50-325/89-36-01

Review/evaluate the Experience Report describing the Unit 2 Refueling Floor contamination event (Paragraph 4.c.)

Licensee management was informed that the two IFIs discussed in Paragraph 5 were considered closed.