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

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Report No.: 50-400/89-24

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

Docket No.: 50-400 License No.: NPF-63

Facility Name: Shearon Harris

Inspection Conducted: September 25-29, 1989

Inspector: Thomas R Decker for 10/30/89
C. A. Hughey Date Signed

Approved by: Thomas R Decker 10/30/89
T. R. Decker, Chief Date Signed
Radiological Effluents and Chemistry Section
Emergency Preparedness and Radiologial
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:

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

One followup item concerning the contamination of liquid radwaste monitors was closed (Paragraph 2).

Liquid and gaseous radioactive effluents were well within Technical Specifications, 10 CFR 20, and 10 CFR 50 effluent and offsite dose limitations for 1988 and the first half of 1989 (Paragraph 3).

The chemistry counting room quality control program was adequate in ensuring the accuracy of plant radiochemical measurements (Paragraph 4).

Reactor coolant system Iodine activities for the period indicated good fuel cladding integrity (Paragraph 5).

Plant secondary chemistry had been maintained generally within the guidelines recommended by the Steam Generator Owners Group. There had also been noticeable improvements in secondary chemistry during the period (Paragraph 6).

Meteorological and radiation monitoring equipment used in the environmental monitoring program appeared well maintained and was effective in assessing the impact of radiological releases to the environment (Paragraph 7).

A vendor-supplied radwaste demineralizer package was being used to process liquid radwastes instead of the permanently supplied system and had significantly reduced the amount to solid radwastes generated at the site (Paragraph 8).

REPORT DETAILS

1. Persons Contacted

Licensee Employees

S. Buch, Technician
D. Cahill, Environmental Radiochemistry Supervisor
W. Cerame, Technician
T. Drum, Senior Scientist
A. Garrou, Senior Specialist, Emergency Preparedness
*C. Hinnant, Plant General Manager
J. Leonard, Project Specialist, Radwaste
W. Payton, Technician
*A. Poland, Senior Project Specialist
*R. Richey, Manager, Harris Nuclear Project
B. Sears, Foreman
*J. Sipp, Manager, Environmental and Radiation Control
*M. Wallace, Senior Specialist, Regulatory Compliance
E. Wills, Project Specialist

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

Nuclear Consulting Services, Inc.

M. Pest

NRC Resident Inspector

*M. Shannon

*Attended exit interview

2. Licensee Action on Previously Identified Inspector Followup Item (92701)

a. (Closed) Inspector Followup Item (IFI) 50-400/88-24-01: Review licensee resolution of contamination of liquid radwaste monitors.

As discussed in Inspection Report Nos. 88-24 and 89-01, contamination buildup in the stainless steel sample chambers of the liquid radwaste monitors during discharges, along with extremely low radiation alarm setpoints of the monitors, caused these setpoints to be routinely exceeded during releases, thereby prematurely terminating discharges. This forced the licensee to declare these monitors inoperable, placing the licensee in ACTION statements of the Technical Specifications (TSs).

The monitors affected were as follows:

(1) REM-3540, Treated Laundry and Hot Shower Tank Discharge
(2) REM-3541, Waste Monitor Tank Discharge
(3) REM-3542, Secondary Waste Sample Tank Discharge

The licensee had previously indicated that forthcoming changes to the off-site dose calculation manual (ODCM) involving the incorporation of background counts into the setpoint calculations and increasing dilution water flow to the cooling tower blowdown line would permit an increase in monitor setpoints during discharges sufficient to eliminate spurious discharge terminations.

The licensee had, as previously committed, revised the setpoint calculation methodology in the ODCM. This allowed the licensee to raise the monitor setpoints prior to discharges sufficient to prevent background counts and slight contamination buildup from masking the setpoint.

Monitors REM-3540 and REM-3541 were placed back in service during February 1989, and monitor REM-3542 was placed back in service during July 1989. This item is considered closed.

b. (Open) IFI 50-400/88-24-02: Review licensee resolution of flow measurement device operability in plant stacks.

As discussed in Inspection Report No. 88-25, turbulent flow problems in three out of four plant gaseous effluent stacks (Nos. 1, 5, and 5a) caused by the relatively short and wide design of these stacks had prevented the licensee from accurately measuring the flow rates out of these stacks. This had placed the licensee in continuous ACTION statements of the TSs requiring periodic flow rate estimations. Previous flow modifications had been unsuccessful in restoring uniform flows to the plant stacks.

The licensee stated that, to resolve the issue, the total flow through a stack would be quantified by the summation of all individual influents into each stack. This would be applicable for stacks 1, 5, and 5a. To accomplish this, a microprocessor unit would summarize the influents for each stack by sensing the operation of the fan motors under various fan configurations. Microprocessor flow values would be determined from in situ flow measurements under various fan configurations. Plans were for the system to be installed, tested and operational by September 1989.

At the time of this inspection, however, the system was not operational as previously planned, but measurable progress had been made toward resolution of this complicated problem. The design work, plant change requests and safety evaluations had all been completed. Installation of the system had begun about two weeks prior to this inspection. Because of an upcoming outage, completion time of this

project could not be accurately predicted. This item will be closely followed during upcoming inspections in this area. This item remains open.

3. Semiannual Effluent Release Reports (84750)

The inspector reviewed the semiannual radioactive effluent report for the period January 1 through June 30, 1989. This review included an examination of the liquid and gaseous effluent release data for this period as compared to 1988 and 1987 data. This data is summarized in the attachment to this report.

On March 11, 1989, an unplanned gaseous release occurred when a leak occurred out of a sample bomb as a volume control tank cover gas sample was being collected. The sample bomb was being purged at the sample collection point within the primary sample sink/hood. The sample hood was operational at the time, therefore, the leaking gas was directed through the sample hood into the reactor auxiliary/fuel handling building exhausts and eventually out of the plant vent stack No. 1. The release occurred over about an 1½ hour period. The alarm setpoint of the stack No. 1 radiation monitor was never exceeded during the release and the release was subsequently identified during the routine shift review of the radiation monitoring system trends by health physics personnel.

The release was quantified by the integration of the radiation monitoring readings to be 3.2 curies of noble gas and was properly included in the accountability table of the first half of 1989 seminannual effluent release report. This release was determined by the licensee to be fully monitored and well below TS offsite dose limitations.

Gaseous effluents showed no significant trends between 1987 and the first half of 1989. Liquid tritium and gross alpha releases also showed no significant trends. Liquid fission and activation products did, however, show an increasing trend into 1989, although well within TS limits. Liquid and gaseous effluents were well within TSs, 10 CFR 20, and 10 CFR 50 effluent limitations for 1988 and the first half of 1989.

No violations or deviations were identified.

4. Counting Room (84750)

The licensee's counting room Quality Assurance program was reviewed to ensure compliance with selected and applicable portions of Regulatory Guide 4.15, Quality Assurance for Radiochemical Monitoring Programs (Normal Operations) Effluent Streams and the Environment, Revision 1, February 1978. The following observations were made:

a. Daily intensity, gain, resolution, and background quality control charts for the four intrinsic germanium detectors for July through September 1989 were generally within specified limits, indicating stable detector performance.

b. Daily background and reliability (efficiency) checks for gross alpha and gross beta analyses for the two LB5100 gas flow proportional counters were within specified control limits for the period July through September 1989.

c. Daily efficiency and background checks for the Packard 4530 liquid scintillation counter used for tritium analyses were within specified control limits for the period July through September 1989.

d. All comparative results of a recent confirmatory measurements program between the NRC and the licensee of selected radionuclides (Tritium, Strontium-89, Strontium-90, and Iron-55) were within agreement (see supplement to Inspection Report No. 50-400/89-01, May 30, 1989). Although within agreement, however, the licensee's tritium value was about 17 percent lower than the NRC value.

   Quarterly, the licensee participated in an extensive split gamma spectroscopic, tritium, gross alpha, and gross beta analyses program with an outside vendor. The inspector reviewed the results of this cross-check program for the first and second quarter of 1989. The licensee and the vendor were in agreement for all isotopes, however, the licensee's liquid tritium analyses were biased lower than the vendor's analyses. This low bias as compared to both vendor and NRC liquid tritium results prompted the licensee to investigate the cause. It was suspected that distillation time of the sample insufficient to properly rinse the distillation column was the cause of the low biases. Later analyses with known tritium standards verified this to be the cause and procedures were being corrected at the time of the inspection.

e. The inspector reviewed the yearly efficiency calibration packages for the intrinsic germanium detectors completed during June 1989 and verified that lower limit of detection verifications were performed following the calibrations.

No violations or deviations were identified.

5. Reactor Coolant System Chemistry (84750)

The inspector reviewed trend plots of various reactor coolant chemistry parameters for the period April through September 1989, and noted the following observations:

a. Reactor coolant system (RCS) chloride levels had been maintained consistently below 10 parts per billion (ppb) for the period which was well below Technical Specifications limits of 150 ppb (Section 3/4.4.7).

b. There had been a consistent increase over the present fuel cycle (2) in silica in the RCS and refueling water storage tank (RWST) caused by the recycling and reuse of reactor coolant. Because of the

inability of the borated chemical and volume control system demineralizers to remove excess silica from the RCS, the licensee was considering raising the current administrative limit to the recommended Westinghouse limit (300 ppb).

c. During 100 percent power steady state operations, dose equivalent Iodine-131 averaged about 3.0E-3 microcuries per gram. The TS limit was less than or equal to one microcurie per gram dose equivalent Iodine-131 (Section 3/4.4.8). Iodine-131/133 ratio averaged about 0.08 for the period. These indicated good fuel cladding integrity with very low fission product leakage into the RCS other than expected from tramp uranium in the cladding. Average RCS gross activity for the period ranged between 4.0E-1 to 6.0E-1 microcuries per gram. RCS tritium activity for the period ranged between 2.0E-1 and 4.0E-1 microcuries per gram. Lower iodine, tritium and gross activity values in the RCS directly affect lower radwaste production, liquid effluents, and gaseous effluents.

d. To reduce activated corrosion product transport in the RCS thereby reducing source term, the licensee was going to continue to maintain a modified lithium-boron control scheme during the next fuel cycle (Cycle 3). Cycle 2 was to end in October 1989.

This program established the pH of the RCS at about 7.0 at the beginning of the fuel cycle with about 2.2 parts per million (ppm) lithium. Over the fuel cycle, the lithium concentration would be maintained constant at 2.2 ppm until the RCS boron (boric acid) concentration was diluted to a point where the RCS pH increased to 7.4. After that point, the lithium concentration would be reduced at a constant rate along with the boron concentration to maintain a constant RCS pH of 7.4 through the end of the fuel cycle. These elevated lithium programs at other facilities appeared to have been effective in reducing general plant dose rate source term.

No violations or deviations were identified.

6. Steam Cycle Chemistry (84750)

A review of secondary chemistry graphs for the period April through September 1989 indicated that plant chemistry, except for minor transients, had been maintained within the the guidelines recommended by the Steam Generator Owners Group (SGOG). Individual parameters of importance are discussed below:

a. Steam generators chloride levels had been consistently maintained below 2 ppb. The SGOG recommended action level is 20 ppb. This can be attributed to more efficient condensate polisher operation and minimal condenser cooling water inleakge.

b. Steam generators sodium levels had improved from between 3 to 10 ppb to below 1 ppb during the period. Since sodium concentration directly affects cation conductivity, there had also been a noticeable improvement in steam generator blowdown cation conductivity during the same period from between 0.20 to 0.25 micromhos/centimeter (umho/cm) to between 0.15 to 0.20 umho/cm. This was well below the SGOG recommended level of 0.8 umho/cm. In general, these improvements could be attributed to the lowering of the sodium concentration limit on the condensate polishers effluent prior to taking a polisher bed out of service, improved rinses of condensate polisher mixed beds prior to placing them back in service thereby reducing sulfate throw, and the alternating of anion bed regenerations.

Feedwater cation conductivity had been maintained generally less than 0.06 umho/cm indicating relatively pure feedwater.

c. Steam generator sulfate levels had been generally maintained below the SGOG's recommend action level of 20 ppb during steady state power operations. Sulfate spikes had been noted, however, immediately after placing newly regenerated condensate polisher beds back in service and during steam generator blowdown isolations during daily calorimetric testing. These spikes had been minimized during the period by improved condensate polisher regeneration techniques as discussed above and by increased blowdown rates just prior to blowdown isolations required for plant calorimetric testing.

Acid sulfate hideout in steam generator crevices, however, can occur at the high operating temperatures of steam generators. The Harris unit had been operating generally at steady state 100 percent power for about 200 days prior to this inspection. During the unit shutdown prior to the upcoming outage, the licensee planned a "hot soak" hold at 350 degrees F to dissolve the insoluble acid sulfates out of the steam generator crecivices. Sulfates exhibit a reverse solubility at this temperature. The results of this operation would be a more indicative of sulfate hideout in the steam generator crevices. Required periodic gamma spectroscopic measurement of steam generator blowdown samples had indicated no primary to secondary leakage.

d. The inspector examined the facilities and equipment of the plant make-up water treatment system. The system consisted of two trains, each containing in sequence an upflow prefilter, carbon filter (for organics removal), cation bed demineralizer, vacuum degasifier, anion bed demineralizer, and a mixed bed demineralizer. Flow rate through each train was approximately 300 gallons per minute. Total capacity of the cation and anion bed prior to regeneration was about 450,000 galllons. Total capacity of each mixed bed demineralizer prior to regeneration was about 3,000,000 gallons. The final effluent conductivity of the plant was normally less than 0.06 umho/cm. The effluent is piped to a storage tank where dissolved

oxygen is maintained normally less than 30 ppb with a nitrogen sparge into the tank.

No violations or deviations were identified.

7. Environmental Monitoring (84750)

The inspector toured selected offsite radiological environmental monitoring sites with a licensee representative. This tour included site Nos. 1, 3, 4, 19, 26, 38, 53, and the Olive Dairy. Each site contains selected combinations of air particulate and charcoal sampling apparatus, licensee and NRC/State thermoluminescenct dosimeters (TLDs), composite water samplers, sediment and vegetable sampling locations, and milk sampling locations. These site locations are specified in the Harris ODCM. The sites were verified by the inspector to be at the locations described and to contain the required equipment as specified in the ODCM. Except for minor equipment problems, all equipment was in working order and appeared to be well maintained.

Calibration records were reviewed for several air sampler flow meters used to quantify total flow through the air particulate and charcoal filters used for off-site environmental monitoring. These dry gas meters were verified annually to be within ±10 percent of a factory certified Kurz Flow Meter. If the meter passed this acceptance criteria a correction factor was then calculated to be used when determining total flow through the meter.

Section 6.1.2 of the ODCM requires that quarterly TLD measurements of locations within three miles of plant center be compared with the four year preoperational TLD measurements to determine any significant radiation exposure to members of the public from direct radiation sources (containment, outside storage tanks, transport of radioactive material, etc.). The inspector reviewed the above described quarterly TLD measurements for calendar year 1987 and 1988, and noted no significant trends above preoperational background levels.

Section 3.3.3.4 of the TSs describes minimum operability and channel check requirements for the meteorological monitoring instrumentation. The inspector verified that the required daily channel checks were being performed by main control room personnel. Two channels each of the wind speed, wind direction and air temperature differential instrumentation was verified to be operable at the meteorological tower location. TSs only require one channel each to be operable.

No violations or deviations were identified.

8. Radwaste (84750)

The inspector examined the equipment associated with a vendor supplied liquid radwaste demineralizer package. This system was being used instead of the permanently installed radwaste system to decontaminate liquid waste

prior to discharge to the environment (See Inspection Report No. 50-400/89-01).

The system consisted of, in series, one 24 micron bag filter, two 10 micron cartridge filters, four 20 cubic foot demineralizer beds and a post filter. A polyelectrolyte was injected into the influent prior to the filters to increase Niobium-95 removal efficiency. Inlet system pressure was about 90 psig and outlet pressure was about 10 psig with system flow at 30 gallons per minute. Total efficiency of the system for the removal of radioactivity prior to discharge was between 96-99 percent depending on the isotope mix.

Since using the vendor supplied skid instead of the installed system, there had been a significant reduction in solid radwastes generation. This was mostly because the wastes from the installed system (i.e., evaporator bottoms) required solidification prior to shipment to a burial site whereas the vendor supplied system only required resin dewatering in a shipping liner prior to shipment. The solidification process significantly increases solid waste volume.

The licensee indicated that operation of the vendor unit had resulted in higher operations personnel radiation exposure because filters in the skid had to be changed out manually. However, since the skid was passive (no moving parts), little maintenance was required and higher operator exposure was offset by lower maintenance personnel exposure.

In case of an unexpected increase in radwaste liquid volume, significant radioactivity increases due to fuel leaks, or primary to secondary leakage, the permanently installed system was maintained in an operable/standby status.

No violations or deviations were identified.

9. Audits and Appraisals (84750)

Section 6.5.4.1.f of the TSs (Administrative Controls) requires an annual audit of the radiological environmental monitoring program. The inspector reviewed audit QAA/0022-89-03, dated August 14, 1989. This audit appeared to satisfy the TS requirements and licensee identified findings had been resolved or were being tracked to final resolution.

No violations or deviations were identified.

10. Exit Interview

The inspection scope and results were summarized on September 29, 1989, with those persons indicated in Paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results listed above. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

One followup item concerning the contamination of liquid radwaste monitors was closed (IFI 50-400/88-24-01) (Paragraph 2).

Liquid and gaseous radioactive effluents were well within TSs, 10 CFR 20, and 10 CFR 50 effluent and offsite dose limitations for 1988 and the first half of 1989 (Paragraph 3).

The chemistry counting room quality control program was adequate in ensuring the accuracy of plant radiochemical measurements (Paragraph 4).

RCS Iodine activities for the period indicated good fuel cladding integrity (Paragraph 5).

Plant secondary chemistry had been maintained generally within the guidelines recommended by the SGOG. There had also been noticeable improvements in secondary chemistry during the period (Paragraph 6).

Meteorological and radiation monitoring equipment used in the environmental monitoring program appeared well maintained and was effective in assessing the impact of radiological releases to the environment (Paragraph 7).

A vendor-supplied radwaste demineralizer package was being used to process liquid radwastes instead of the permanently supplied system and had significantly reduced the amount to solid radwastes generated at the site (Paragraph 8).

ATTACHMENT

SHEARON HARRIS
RADIOACTIVE EFFLUENT SUMMARY

No. of Abnormal Releases	1987	1988	1st half 1989
a. Liquid	0	0	0
b. Gaseous	0	1	1
Activity Released (Curies)			
a. Liquid			
1. Fission and Activation Products	9.08E-1	8.04E-2	8.25E-2
2. Tritium	2.48E+2	4.01E+2	2.22E+2
3. Gross Alpha	2.73E-4	2.55E-6	0.00E+0
b. Gaseous			
1. Fission and Activation Gases	1.71E+3	2.25E+3	7.92E+2
2. Iodines	0.00E+0	0.00E+0	0.00E+0
3. Tritium	0.00E+0	0.00E+0	0.00E+0
4. Gross Alpha	3.15E-6	1.03E-7	0.00E+0
5. Particulate	4.43E-6	4.59E-5	0.00E+0