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

Report No.: 50-261/89-04

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

Docket No.: 50-261 License No.: DPR-23

Facility Name: H. B. Robinson

Inspection Conducted: January 30 - February 3, 1989

Inspector: Charles A. Hughey 2/23/89
C. A. Hughey Date Signed

Approved by: John B. Kahle 2/23/89
J. B. Kahle, Chief Date Signed
Radiological Effluents and Chemistry Section
Emergency Preparedness and Radiological Protection Branch
Division of Radiation Safety and Safeguards

SUMMARY

Scope: This routine, unannounced inspection was in the areas of radiological effluents, chemistry, and health physics practices associated with spent fuel transfer operations.

Results: Because of the use of a recently installed radwaste demineralizer system and the replacement of leaking fuel, there was a significant decreasing trend in gaseous iodine released between 1987, and the first half of 1988 (Paragraph 2).

There had been a noticeable reduction in the general plant dose rate source terms during the recent outage as compared to the previous outage due to the use of an elevated lithium control program in the reactor coolant system during the last fuel cycle. Plans were to continue the program and incorporate improvements including the further increase of lithium levels (Paragraph 4).

The inspector observed proper health physics practices and precautions during the initial fuel handling and loading operations associated with the Independent Spent Fuel Storage Facility (Paragraph 8).

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

REPORT DETAILS

1. Persons Contacted

Licensee Employees

R. DuFresne, Project Engineer
*J. Eaddy, Jr., Supervisor, Environmental and Chemistry
*W. Farmer, Senior Engineer, Technical Support Group
*S. Griggs, Aide, Regulatory Compliance
*J. Harrison, Project Specialist, Environmental and Chemistry Support
J. Hill, Environmental and Chemistry, Technician I
*R. Morgan, General Manager
*R. Smith, Manager, Environmental and Radiation Control
K. Williamson, Project Engineer

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

NRC Resident Inspectors

L. Garner
K. Jury

*Attended exit interview

2. Semi-Annual Effluent Report (84750)

The inspector reviewed the semi-annual radioactive release report for the period January 1 through June 30, 1988. This review included an examination of the liquid and gaseous effluent data for the period as compared to 1987 data. This data is summarized in the attachment to this report. No abnormal gaseous or liquid releases were reported during the first half of 1988. A significant decreasing trend was noted in gaseous iodine releases between 1987, and the first half of 1988. The total potential gaseous iodine dose for the first half of 1988 was only 0.9 percent of annual limit versus 23.9 percent of the limit for 1987. This was attributable to the use of a newly installed contract demineralizer system that eliminated the need for use of the radwaste evaporators and the replacement of leaking fuel cladding/assemblies during the 1987 refueling outage.

The licensee reported in the first half of 1988 semi-annual effluent report the release of 4.27 E-04 curies of cobalt-60 from the H. B. Robinson Unit 1 boiler to onsite ash ponds. The release from this fossil unit occurred subsequent to a chemical cleaning of the boiler. This release to the ash ponds was approved by the South Carolina Department of Health and Environmental Control pursuant to USNRC

Information Notice 86-90: Request for Disposal of Very Low-Level Radioactive Waste Pursuant to 10 CFR 20.302, November 3, 1986.

The licensee indicated that the cobalt-60 contamination came from concentration in the boiler during previous years (1970's) when Unit 1 obtained make-up water (slightly contaminated) from the Unit 2 primary water storage tank and from Unit 1 condenser leaks prior to the 1984 replacement of the Unit 2 steam generators. Prior to the replacement, there were many primary to secondary leaks of reactor coolant into the steam cycle that resulted in increased quantities of radionuclides being discharged into Lake Robinson. Unit 1 has long since ceased obtaining make-up water from the Unit 2 primary water storage tank.

The first chemical cleaning of the Unit 1 boiler occurred October 24, 1981. Approximately 30 millicuries of cobalt-60 was removed. During the last chemical cleaning on May 25, 1988, approximately 0.4 millicuries of cobalt-60 was removed indicating a definite decreasing trend. This boiler would require chemical cleaning approximately every seven years. The activity released to the ash ponds was not included when calculating offsite doses from liquid effluents.

No violations or deviations were identified.

3. Plant Chemistry (84750)

At the time of the inspection, Unit 2 was proceeding out of a refueling outage toward plant start-up.

During the outage, eddy current testing was performed on all three steam generators. Twenty percent of each of the steam generator tubes were tested. This was the third time for testing since the 1984 steam generator replacement, the first time being 100% base line testing. The results were very positive with only one tube being plugged in steam generator C. This was the first tube to be plugged since the 1984 replacement.

There was no sludge lancing of steam generators during this outage due to low amounts of sludge removed during the previous outage. Lancing will most likely be performed next outage.

A review of chemistry data grpahs for the period January 1 through September 30, 1988, indicated that secondary plant chemistry, except for minor transients, was maintained well within the guidelines recommended by the Steam Generator Owner's Group. Steam generator blowdown cation conductivities averaged between 0.12 and 0.15 micromhos/cm (umho/cm), well below the recommended level of 0.8 umho/cm. Blowdown chloride and sulfate concentrations were maintained at or below 5 parts per billion (ppb). Condensate dissolved oxygen levels averaged about 7 ppb during power operations. Feedwater cation conductivity averaged about 0.6 umho/cm. Feedwater dissolved oxygen was non-detectable with pH averaging 9.1 during power operations.

During 1982, the licensee replaced the Unit 2 condenser. This new condenser contained integral tube sheets (304SS) pressurized with condensate water to serve as an intermediate barrier to circulating water in-leakage into the condensate. Since that replacement there had been no known leaks through the tubes or the tube sheets into the condensate system.

No violations or deviations were identified.

4. Reactor Coolant System Chemistry (84750)

The inspector reviewed selected chemistry data plots of the reactor coolant system (RCS) for the period January 1 through September 30, 1988.

Chloride levels in the RCS had been maintained below 20 ppb (detection limit) except for two minor transients that were quickly returned to normal. Technical Specification limit for RCS chlorides was 150 ppb. During power operations, dissolved hydrogen concentration averaged about 40 cubic centimeters per kilogram (cc/kg). Although this is well within the recommended limits of 20-50 cc/kg, it is above the 25-35 cc/kg range discussed in the Electric Power Research Institute (EPRI) PWR Primary Water Chemistry Guidelines (August 1988) to reduce the possibility of stress corrosion cracking in the steam generator tubes. Recent studies have suggested that dissolved hydrogen increases the susceptibility of some mill-annealed alloy 600 steam generator tubing to stress corrosion cracking at the higher temperatures seen in the RCS. Although the licensee was aware of this discrepancy, they indicated that volume control tank pressure limitations required to maintain seal water flow to the reactor coolant pump seals prevented reducing dissolved hydrogen to below 35 cc/kg.

During the last fuel cycle (cycle 12) the licensee, in cooperation with Westinghouse and EPRI, had initiated an elevated lithium control program in the RCS. This program was designed to minimize primary side corrosion and reduce deposition and activation of corrosion products on the fuel cladding. This program had been previously tested and shown to be successful at other power plants, both domestic and foreign.

Recent studies by EPRI had shown that fuel assembly deposits consisted of a nickel ferrite structure. Previous corrosion product transport models had assumed a magnetite structure. Data on corrosion of alloy 600 (72 percent nickel based alloy used in steam generator tubing) indicated lower corrosion rates at higher pH levels. Alloy 600 is the main source of cobalt-58 around the plant (Ni-58 (n,p) Co-58). As pH was increased for both nickel ferrites and magnetite, the temperature coefficient of solubility became less negative then positive resulting in corrosion product deposition on out-of-core surfaces rather than fuel cladding, resulting in fewer activated corrosion products, especially Co-58.

At the beginning of the last fuel cycle (cycle 12) at Robinson Unit 2, initial criticality was achieved at a lithium concentration of 2.2 parts

per million (ppm) and a corresponding boron concentration of about 1000 ppm. This established the initial RCS pH at 7.03 (at 575 °F). Over the fuel cycle the lithium was maintained constant at 2.2 ppm until the RCS boron was diluted to a point (300 ppm B) where the RCS pH (at 575 °F) reached 7.4. At that point, the lithium concentration was reduced at a constant ratio along with the boron concentration to maintain a constant RCS pH of 7.4 for the remainder of the fuel cycle.

Although exact numbers had been hard to accumulate, the plant health physics (HP) staff had noted significant reductions in general plant dose rate source terms during the outage as compared to the previous outage.

In order to continue further reductions in the source term, the licensee was increasing the lithium concentration further during the next fuel cycle (cycle 13). Initial criticality would be achieved at 3.35 ± 0.15 ppm lithium, establishing the initial RCS pH at 7.2, slightly higher than cycle 12. Lithium would be again maintained constant until a pH of 7.4 is reached at about 600 ppm B. As with the previous cycle, lithium concentration would be reduced at a constant ratio along with the normal reduction in RCS boron concentration to maintain a pH of 7.4 for the remainder of the fuel cycle.

In order to still further reduce crud inventories in the RCS, the letdown filter had been reduced from a nominal 5 micron filter to a nominal 1 micron filter. This filter is located after the letdown ion exchangers. Previous testing by the licensee indicated that the letdown ion exchangers were removing suspended solids equivalent to a 0.5 micron filter but some material was still passing through. Although a reduction in filter size was not the final answer it was a step in the right direction.

No violations or deviations were identified.

5. Count Room (84750)

The inspector reviewed newly constructed quality control charts for the chemistry count room gamma spectroscopy detectors for January 1989. These charts consisted of daily background, resolution, energy and efficiency checks for each of 3 detectors. All plotted data was within established control limits implying stable detector performance. A review of the alpha/beta proportional counter and liquid scintillation counter daily background and efficiency checks for December 1988 also indicated stable instrument performance. As of February 1, 1989, all count room control charts would be plotted for the entire year on the same control charts. At the time of the inspection, charts for the alpha/beta and liquid scintillation detectors were constructed monthly although control limits were established annually. By plotting for a one year period on the same charts long term trends would be easier to spot.

No violations or deviations were identified.

6. Service Water System (84750)

Due to microbiologically influenced corrosion (MIC) in the Unit 2 service water system, the licensee had initiated a material replacement program. By the end of the outage, all service water piping inside the containment building had been replaced with AL6X high grade stainless steel. Additional portions of the service water system would be replaced during upcoming outages.

To control MIC in the service water system, a water treatment program was initiated consisting of sodium hypochlorite addition along with a biodispersent and defoaming agent (if needed). A chemical addition/chlorination system for the service water system had been installed with some problems still to be worked out.

The corrosion of the system would be monitored using a side stream sampling apparatus (simulated heat exchanger) to monitor and measure fouling deposits. This monitor (DATS - Deposit Accumulation Testing System) would also measure heat transfer resistance as fouling deposits accumulate. Material corrosion would also be monitored by placing representative corrosion coupons in the side sample stream. At the time of the inspection the licensee was also considering additional methods to monitor biofouling and slime growth.

No violations or deviations were identified.

7. Process and Effluent Monitors (84750)

The general physical condition of the process and effluent radiation monitors appeared adequate after an inspection of selected portions of the following monitors.

a.	RMS-9	RCS letdown radiation monitor (room area radiation monitor)
b.	RMS-14	Radionoble gas monitor (trip actuation during waste gas decay tank releases)
c.	RMS-15	Condenser Air Ejector Exhaust Monitor
d.	RMS-16	Service Water Effluent Line Monitor
e.	RMS-17	Component Cooling Water Monitor
f.	RMS-18	Liquid Radwaste Effluent Line Monitor
g.	RMS-19A	Steam Generator Blowdown Line A Monitor
h.	RMS-19B	Steam Generator Blowdown Line B Monitor
i.	RMS-19C	Steam Generator Blowdown Line C Monitor

j.	RMS-22	E&RC Building HVAC Exhausts Monitor
k.	RMS-31A	Main Steam Line A Monitor
l.	RMS-31B	Main Steam Line B Monitor
m.	RMS-31C	Main Steam Line C Monitor
n.	RMS-34 A/B/C	Plant Vent PING Monitor (Lo Range)
o.	RMS-35	Plant Vent Stack Monitor (Mid Range)
p.	RMS-36	Plant Vent Stack Monitor (High Range)
q.	RMS-37	Condensate Polisher Regenerative Wastes Monitor

No violations or deviations were identified.

8. Inspection of Health Physics Activities Associated with the Dry Storage of Spent Fuel (TI 0110/5)

The inspector observed HP activities during the IF-300 shipping cask movement from the shipping cask decontamination area to the spent fuel pool, the transfer of spent fuel to the shipping cask/dry shield canister (DSC), shield plug placement into the shipping cask on top of the DSC, and movement of the shipping cask back to the decontamination area. These activities occurred February 1-3, 1989. This operation was authorized under Special Nuclear Material License No. SNM 2502. The licensee's radiation protection aspects of this operation were described in Special Procedure SP-857, H. B. Robinson Independent Spent Fuel Storage Installation, Operational Testing Procedures R-1 through R-3, Radiation Monitoring of the HBR ISFSI, Revision 1, dated February 1, 1989.

During the previously described sequence, the inspector observed proper HP practices and precautions by all personnel involved. Due to radiation levels measured at the center line of the shielded plug after spent fuel loading being in excess of the original calculated and anticipated dose rates, the operation was suspended, and the cask was moved back to the spent fuel pool where the fuel was unloaded and placed back into spent fuel pool storage.

No violations or deviations were identified.

9. Exit Interview

The inspection scope and results were summarized on February 3, 1989, with those persons indicated in Paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

ATTACHMENT

H. B. ROBINSON RADIOACTIVE EFFLUENT SUMMARY

	1987	First half of 1988
No. of Abnormal Releases		
a. Liquid	0	0
b. Gaseous	0	0
Liquid Waste Released (Gallons)	2.18 E+07	5.65 E+05
Activity Released (Curies)		
a. Liquid		
1. Fission and Activation Products	7.36 E-01	1.76 E-01
2. Tritium	2.47 E+02	4.35 E+02
3. Gross Alpha	<LLD	<LLD
b. Gaseous		
1. Fission and Activation gases	7.70 E+02	2.28 E+02
2. Iodines	2.08 E-02	3.49 E-04
3. Tritium	1.39 E-01	4.97 E+00
4. Particulates	1.56 E-05	1.68 E-05