UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
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Report No: 50-261/95-04

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 Nuclear Power Plant

Inspection Conducted: January 23 - 27, 1995

Inspector: R P Carrion 24 FEB '95
R. P. Carrion, Radiation Specialist Date Signed

Accompanied by: R. B. Shortridge, Senior Radiation Specialist
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Approved by: J R Decker 2/24/95
T. R. Decker, Chief Date Signed
Radiological Effluents and Chemistry Section
Radiological Protection and Emergency Preparedness Branch
Division of Radiation Safety and Safeguards

SUMMARY

Scope:

This routine, announced inspection was conducted in the areas of the organization of the Environmental and Radiation Control (E&RC) Department, audits, plant water chemistry, the Post Accident Sampling System (PASS), the Semiannual Radiological Effluent Release Report, the Radiological Environmental Monitoring Program (REMP), process and effluent monitoring, confirmatory measurements, radioactive material transportation, and followup of Deviation (DEV) 50-261/94-14-01.

Results:

The licensee's organization of its Environmental and Radiation Control Department, which included the radioactive material processing and shipping unit, satisfied Technical Specification (TS) requirements. (Paragraph 2)

The licensee's audit process was capable of identifying programmatic weaknesses and making recommendations for corrective action to management and satisfied the TS audit requirements. (Paragraph 3)

The licensee had implemented an effective over-all chemistry program to maintain the components of both the primary and secondary systems. (Paragraph 4)

The PASS was capable of fulfilling its intended sampling function and the licensee had made progress in expanding the number of qualified technicians to operate the PASS. (Paragraph 5)

The licensee's Semiannual Radioactive Effluent Release Report was complete and satisfied regulatory requirements. (Paragraph 6)

The licensee had good programs in place to monitor releases of radiological effluents and plant operations caused minimum impact to the environment and virtually no dose to the general public. (Paragraph 7)

The licensee's program for liquid and gaseous processing and monitoring was being successfully implemented. (Paragraph 8)

The licensee maintained a good Counting Room radiochemical analysis program for the detection of beta-emitting radionuclides, as evidenced by the results of the confirmatory measurement exercise. (Paragraph 9)

The licensee's shipping of radioactive material was conducted in a competent, professional manner. (Paragraph 10)

Deviation 50-261/94-14-01, "Failure to Include in Performance Test Procedures Provisions for Testing and Test Acceptance Criteria which are Consistent with the Commitments Contained in the UFSAR," was closed. (Paragraph 11)

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*J. Boska, Manager, Electrical/Instrumentation and Control Engineering
*W. Brand, Environmental and Radiation Control (E&RC)
*M. Brown, Manager, Design Engineering
*M. Burch, E&RC
*B. H. Clark, Manager, Maintenance
*W. A. Christensen, Supervisor, Environmental and Chemistry (E&C)
*R. Dayton, Controller Project Specialist
*J. A. Eaddy, Manager, E&C
*W. Farmer, Nuclear Assessment Department (NAD)
*C. Gray, Manager, Materials/Contracts
*D. T. Gudger, Senior Specialist, Regulatory Programs
*J. L. Harrison, Manager, Radiological Controls
*J. Henderson, NAD
*M. Herrell, Manager, Training
*M. Knaszak, Manager, Project Management
*J. Kozyra, Licensing and Regulatory Programs
*R. Krich, Manager, Regulatory Affairs
*K. Jury, Manager, Licensing/Regulatory Programs
*F. L. Lowery, Manager, Work Control
*J. Lucas, Manager, Technical Training
*J. McKay, NAD (Plant Harris)
*G. D. Miller, Manager of RESS
M. Millinor, Senior Specialist, E&RC
*R. M. Reynolds, NAD
*E. Rothe, NAD
*D. Siemon, Manager, Outage
*R. Warden, Manager, NAS Plant Support
*T. Wikerson, Manager, E&RC
*L. Williams, Manager, Security
*L. Woods, Manager, Technical Support
*D. Young, Plant General Manager

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

Nuclear Regulatory Commission

C. Ogle, Resident Inspector
*W. T. Orders, Senior Resident Inspector

*Attended exit interview

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

2. Organization (84750 and 86750)

Technical Specification (TS) 6.2 describes the licensee's organization.

The inspector reviewed the licensee's organization, staffing levels, and lines of authority as they related to the Environmental and Radiation Control (E&RC) Unit to verify that the licensee had not made organizational changes since the last inspection which would adversely affect the control of radiation exposures and/or radioactive material in the areas reviewed.

The Environmental and Radiation Control (E&RC) Unit, under the direction of the E&RC Manager, consisted of 62 positions organized into two functional areas: Environmental and Chemistry (E&C) and Radiation Control (RC). E&C was divided into two primary functions, Chemistry and Environmental, which were further supported by three Senior Specialists, under the direction of the E&C Manager. RC was divided into three groups for Job Coverage (including radioactive waste shipping), which were further supported by four Senior Specialists, under the direction of the RC Manager. The unit had been reorganized since the last review of this area. (Refer to Inspection Report (IR) 50-261/93-24, Paragraph 2.)

The inspector concluded that the licensee's E&RC organization satisfied TS requirements.

No violations or deviations were identified.

3. Audits (84750 and 86750)

TS 6.5.3.2 specifies the types and frequencies of audits to be conducted under the direction of the Nuclear Assessment Department (NAD). In order to evaluate compliance with the TSs and assess quality of the licensee's audit programs, the inspectors reviewed two Assessment Reports (R-ERC-94-01 and R-ERC-94-02) of the E&RC Unit conducted January 4-12, 1994 and November 28 through December 9, 1994, respectively by the NAD. The assessment was effected through performance-based, real-time observations; technical reviews; and interviews with plant personnel. Data was collected under operating plant conditions involving work on both the day and night shifts. The data/observations were categorized by functional area with a short description. The assessments included audits of several specified areas, including the E&RC Organization, Radiological Environmental Monitoring Program (REMP), Offsite Dose Calculation Manual (ODCM), Process Control Program (PCP), and radwaste handling, packaging, and transport, and were found to be well-planned and documented, with a clearly-defined scope. Data and observations were reviewed and distilled to arrive at a general evaluation for the assessment.

Assessment Report R-ERC-94-01 identified four issues: two in radioactive contamination control, one in chemistry, and one in solid radioactive waste. Specifically, in chemistry, management expectations

for chemistry activities were found to be inadequate to achieve improved performance and several examples were cited. In solid radioactive waste, problems were found to exist in the administration of radioactive material shipment documentation, citing two examples with the potential for violating Federal Regulations, specifically, 10 CFR 20.1001 to 10 CFR 20.2402 and 49 CFR 172.201(c). The evaluation of the E&RC self-assessment by NAD during this audit concluded that the self-assessment was generally effective but noted that improvements in scheduling and completion of those scheduled self-assessments, generating meaningful self-assessment trending data, and developing the ability to self-identify problem areas were required to achieve continual improvement. One other item was identified for management consideration, concerning the verification of the performance of the off-site protective clothing laundry vendor in light of increased personnel contaminations at the plant. No specific strengths or weaknesses were identified. Previous issues were reviewed for effectiveness of corrective action. The issue concerning the difficulties in using the plant E&RC procedures had been addressed by the revision of approximately seventy procedures to correct deficiencies and make improvements. However, because the revisions of some procedures had not been completed, the NAD kept the issue open dependent upon review of the completed revisions.

Assessment Report R-ERC-94-02 identified one issue (concerning external radiation exposure controls), two strengths (the reduction of personnel contamination events and the reduction of dissolved oxygen in the condensate), and two weaknesses (E&RC program improvements were not implemented in a timely manner and computer programs used to determine curie content and shipping classification for non-burial radioactive material shipments were not procedurally controlled to ensure compliance with regulations). Also, four items were noted for management consideration, including replacing chromates as a corrosion inhibitor with a non-hazardous corrosion inhibitor to preclude the potential of generating mixed hazardous wastes. Previous issues and weaknesses were reviewed for effectiveness of corrective action. The issue concerning the difficulties in using the plant E&RC procedures had been addressed by completing the revisions of the previously-referenced procedures to correct deficiencies and make improvements. The NAD determined that procedure clarity and completeness had been improved by the revisions and closed the issue. The issue concerning management expectations for chemistry activities being inadequate to achieve improved performance was determined to have improved but examples of needed improvements were noted (housekeeping in the E&C Laboratory, poor contamination control practices, etc.) and, therefore, the issue remained open. The issue concerning the administration of radioactive material shipment documentation had been addressed through revision of the applicable procedures. A review by NAD of shipping papers determined that the papers were correct, reflecting the revisions of the procedures.

The inspectors noted that an audit finding in Assessment Report R-ERC-94-01 identified Chemistry personnel who had performed activities with inadequate training and qualification. The inspectors followed up on the licensee's corrective actions in detail. The licensee issued an

Adverse Condition Report (ACR) which referenced the issue. The E&C technician performed activities on a new piece of counting/analysis equipment although his qualification was for another piece of equipment. In addition, the new piece of equipment was placed in service without training reports being completed to document personnel training. Furthermore, qualification cards had not been developed to record the training. The licensee's root cause determination identified that poor communications were partly responsible for the event and that re-assignment of a training individual without re-assigning administrative responsibilities for the training also contributed. In addition, the licensee's training section did not have a defined process for performing needs analysis, job analysis, or task analysis. The inspectors viewed this as a challenge to be reviewed at a later date. The licensee's training assessment subsequently determined that the new piece of equipment was not sufficiently unique to require specific training. However, the most significant problems identified in the licensee's evaluation of the root cause were addressed. The inspectors noted that each of the programmatic weaknesses identified during the licensee's root cause evaluation was corrected in a timely manner. Based on a review of this ACR, discussions with training personnel and E&C supervision, records review, and review of NAD surveillances, the inspector determined that the licensee's program for self-identification of problems affecting quality was effective. Corrective actions were taken in a timely manner and were well-documented. Licensee training personnel had not completed revising the task training matrix for chemistry at the close of this inspection.

The inspectors concluded that the licensee's audit process was capable of identifying programmatic weaknesses and making recommendations for corrective action to management and that the TS audit requirements were satisfied.

No violations or deviations were identified.

4. Plant Water Chemistry (84750)

At the time of this inspection, the unit was in its sixteenth fuel cycle. The next refueling outage is scheduled for mid-April 1995. The inspector reviewed the plant chemistry controls and operational controls affecting plant water chemistry for the period of October 1 through November 30, 1994.

a. Primary Plant Water Chemistry

1. TS-Required Parameters

TS 3.1.6 specifies that the concentrations of dissolved oxygen (DO) and chloride in the Reactor Coolant System (RCS) be maintained below 0.10 parts per million (ppm) and 0.15 ppm, respectively, when the reactor coolant temperature exceeds 250 °F. TS 3.1.4 specifies that the total specific activity of the reactor coolant be limited to less than or

equal to 1.0 microcuries/gram (μCi/g) dose equivalent iodine (DEI) under all modes of operation.

Table 4.1-2 of TS 4.1 specifies the sampling frequencies for these parameters. These parameters are related to corrosion resistance and fuel integrity. The oxygen parameter is established to maintain oxygen levels sufficiently low to prevent general and localized corrosion. The chloride parameter is established to provide protection from halide stress corrosion. The activity parameter is established to minimize personnel radiation exposure during emergency operation and maintenance.

Pursuant to these requirements, the inspector reviewed data which correlated reactor power output to chloride, DO, and DEI of the reactor coolant for the period referenced above. The inspector determined that the parameters were maintained well below TS limits. Typical values for DO and chloride were less than 0.001 ppm (the Lower Limit of Detection (LLD) for the "light tube" method of analysis) and less than 0.020 ppm (the LLD for the mercuric nitrate titration method of analysis), respectively. The inspector noted that chloride analysis using the ion chromatograph yielded a concentration of 0.005 ppm. Typical DEI values at steady-state conditions were 2.0E-3 μCi/ml.

2. Early Boration Program

The inspectors discussed the Early Boration Program used by the Plant during shutdown prior to refueling. The licensee had used the early boration technique during the last three shutdowns. In the most recent shutdown (Refueling Cycle 15 in September 1993), a non-lithiated mixed bed demineralizer was placed in service to remove the lithium from the RCS and the system was borated to greater than 2000 ppm for refueling activities. The system was mechanically de-gassed and hydrogen and nitrogen was placed in the Volume Control Tank as a cover gas. The schedule followed the guidance of EPRI TR-101884, PWR Primary Shutdown and Startup Chemistry Guidelines. The following tables summarize the results of the last three outages (Table 1) and the specific composition of the activity removed during the last shutdown (Table 2).

Table 1

Refueling Cycle	Year	Curies Removed	Lithium Program
13	1990	288.34	Elevated 3.5
14	1992	838.20	Modified 2.2
15	1993	880.03	Modified 2.2

Table 2 (Total Curies Removed)

Radionuclide	Particulate	Soluble	% of Total	Total
Co-58	4.16	848.02	96.8	852.18
Co-60	0.61	15.01	1.8	15.62
Mn-54	0.04	5.14	0.6	5.18
Cr-51	3.45	3.60	0.6	7.05
Totals	8.26	871.77	99.8	880.03

The inspectors concluded that the licensee's Early Boration Program had shown good results in curie removal (and, therefore, reduced potential dose to outage workers).

b. Secondary Plant Water Chemistry

Section 3.G(1) of the Plant Operating License requires the licensee to implement and maintain a Secondary Water Chemistry Program to inhibit steam generator tube degradation.

The inspectors discussed the impact of the licensee's program on the condition of the steam generators (SGs). Since the SG replacement in 1984, sludge lancing has been carried out during the respective refueling outages as summarized below:

Robinson Sludge Removal History

Fuel Cycle No.	SG A			SG B			SG C		
	lbs.	% Magnetite	%Cu	lbs.	% Magnetite	%Cu	lbs.	% Magnetite	%Cu
10	75	50	75	50	50	30	88	45	35
11	45	60	25	28	55	26	16	85	5
12	Not done during this outage.								
13	40	72	28	96	69	31	96	71	29
14	Not done during this outage.								
15	17.5	85	15	85	85	15	72	89	11

The inspectors reviewed the history of plugged tubes in the SGs. To date, the number of plugged tubes was 2, 0, and 4 for SG A, SG B, and SG C, respectively.

The inspectors reviewed the potential of iron fouling of the SGs. The licensee's SGs are Westinghouse Model 44F, which recent industry events have indicated are susceptible to reduced heat transfer capability due to the accumulation of iron around the tube support plates and quatrefoil openings. The licensee had completed an estimate of the fouling potential based on calculations which assumed varying concentrations of iron in the feedwater. Considering the iron concentration in the plant feedwater since the beginning of the current fuel cycle, the estimate showed that the point at which a chemical cleaning may be required would occur between thirty to forty Effective Full Power

Years (EFPY) of operation (or well after the design life of the plant). The licensee was scheduled to inspect the upper tube support plates and the quatrefoil openings during the next refueling outage.

Based on this review, the inspectors concluded that the licensee had taken proactive steps to preserve/protect its SGs through effective implementation of its Secondary Water Chemistry Program.

Based on these findings, the inspectors concluded that the licensee had implemented an effective over-all chemistry program to maintain the components of both the primary and secondary systems.

No violations or deviations were identified.

5. Post Accident Sampling System (PASS) (84750)

Sections 3.G(3) and (4) of the Plant Operating License requires the licensee to implement and maintain a program "to determine the airborne concentration in vital areas under accident conditions" and "to ensure the capability to obtain and analyze reactor coolant, radioactive iodines, and particulates in plant effluents, and containment atmosphere samples under accident conditions." The program should enable the licensee to obtain information critical to the efforts to assess and control the course and effects of an accident. Furthermore, the program shall include: training of personnel, procedures for sampling and analysis, and provisions for maintenance of sampling and analysis. Also, Criterion 2.a of NUREG-0737 states that a program shall be implemented such that the sample be promptly obtained and analyzed (within three hours) under accident conditions without incurring a radiation exposure to any individual in excess of 3 and 18 3/4 rem to the whole body or extremities, respectively.

The inspector reviewed the status of the licensee's efforts to expand the pool of qualified technicians with the Chemistry Supervisor. The Chemistry Procedure, CP-088, "Post Accident Diluted Liquid Sampling," detailed the steps required to operate the PASS to obtain a liquid sample remotely. This procedure was the result of a decision to have two levels of qualification for the PASS, one level which would allow a technician to take liquid and gaseous samples and do normal operations, and another (higher) level which could trouble-shoot and maintain the system as well as do the normal operations. CP-083, "Post Accident Containment Air Sampling," detailed the steps required to operate the PASS to obtain a Containment air sample remotely." The inspector reviewed training records of the E&C technicians and determined that nine technicians were qualified to take both liquid and gaseous PASS samples and that one additional technician was qualified to take gaseous samples.

The inspectors reviewed the annual operability testing done during 1993. The results were acceptable for two of the on-line measurements (pH and boron), two of the diluted samples (gross ionic liquid activity and

DIE), all five of the cask sample parameters (gross liquid activity, DEI, boron, pH, and chloride), and the Containment atmosphere sample (gross activity). The results were unacceptable for two of the on-line measurements (total gas and hydrogen) and one of the diluted samples (gross gaseous activity). Some relatively minor problems at the PASS Panel were noted (a leaking valve and a burette which "hung up" at the ten percent level) during the testing. The inspectors reviewed a draft of the results for 1994 and noted improved results over those of the previous year, with all but one of the above-identified parameters satisfying the acceptance criteria. The exception was the total gas of the on-line measurements. (However, if either hydrogen or total gas passes, the acceptance criteria is satisfied.) The above-referenced problems of the PASS Panel had been resolved.

The inspectors walked down the system, including the PASS Panel and the area where the sample would be taken and placed into the shielded carrier (the "pig") for transporting the sample to the laboratory for analysis. The system was clean and well-maintained, except for four Deficiency Tags (Nos. 107069, 104904, 105943, and 104906). Work Requests had been written for each and would be worked as plant priorities permitted. The inspectors also discussed the system's sampling points, flow paths, etc. with the chemistry technician who accompanied the inspectors during the walkdown of the PASS and determined that he was quite knowledgeable about its functions and operation.

The inspectors concluded that the PASS was capable of fulfilling its intended sampling function and that the licensee had made progress in expanding the number of qualified technicians to operate the PASS.

No violations or deviations were identified.

6. Semiannual Radioactive Effluent Release Report (84750)

TS 6.9.d requires the licensee to submit a Semiannual Radiological Effluent Release Report within the time periods specified covering the operation of the facility during the previous six months of operation. The TS also states the requirements for the content and format of the report. The inspector reviewed the reports for the second half of 1993 and the first half of 1994 and compared the results to those of 1991 and 1992 to verify compliance and to determine trends which might have occurred in liquid and gaseous effluent releases. These data are summarized on the following page.

Robinson Radioactive Effluent Release Summary

	1991	1992	1993	1994*
Abnormal Releases				
Liquid	0	0	0	0
Gaseous	0	0	0	0
Activity Released (curies)				
a. Liquid				
1. Fission and Activation Products	2.35E-1	2.28E-1	5.47E-2	2.50E-2
2. Tritium	1.88E+2	3.94E+2	8.44E+2	2.89E+1
3. Gross Alpha	< LLD	< LLD	< LLD	< LLD
b. Gaseous				
1. Fission and Activation Gases	2.26E+0	7.49E+0	3.99E+2	5.64E+1
2. Iodines	< LLD	1.21E-6	1.47E-3	1.93E-7
3. Particulates	1.73E-4	1.39E-4	9.31E-5	1.12E-8
4. Tritium	4.48E+0	1.88E+0	7.95E+0	1.40E+0

*First half of 1994 only

A comparison of data from liquid and gaseous effluents 1991, 1992, 1993, and the first half of 1994 showed a significant decreasing trend in liquid fission and activation products. Discussions with cognizant licensee personnel determined that the reduction was the result of a change in the way that the waste water was processed. The Waste Water Demineralization System (WWDS), which processed water from both the Waste Holdup Tank (WHUT) and Chemical and Volume Control System (CVCS), employed a system of pre-filters and filters to remove suspended solids larger than 0.45 micrometers (μm) in diameter. This configuration had successfully removed suspended solids, which previously had been removed by becoming entrapped in the matrix of the bead resin and removed with the resin when the resin bed was replaced. The past practice had resulted in relatively short run lives for the resin beds due to an increase in the pressure differential across the bed. Upon removal of the residual suspended solids, the licensee had realized longer run times for and greater efficiency of the resin beds, resulting in liquid radioactive releases of substantially less activity than in the past. A decline in gaseous particulate releases was noted while gross alpha releases remained less than the LLD. The inspector noted an increase for 1993 (compared to the previous two years) in the releases of gaseous fission and activation gases, iodine, and tritium and liquid tritium. Discussions with the licensee determined that the gaseous fission and activation gases and iodine activities rose as the result of leaking fuel in 1993. The fuel was replaced during the refueling outage of that year at the conclusion of its fifteenth fuel cycle. The results for the

first half of 1994 showed declines, reflecting non-leaking fuel. The rise in gaseous tritium activity released was attributed to elevated levels of boron in the RCS due to the extended length of the fifteenth fuel cycle.

There were no changes to the REMP (as a result of the Land Use Census), the Process Control Program (PCP), the Off-site Dose Calculation Manual (ODCM), or the Radioactive Waste Systems (liquid, gaseous, or solid) during the second half of 1993 and the first half of 1994.

No outside liquid holdup tank or waste gas decay tank exceeded its regulatory limit of 10 curies and 1.90E+4 curies, respectively, during these reporting periods.

Reportable instrumentation inoperability events occurred during these reporting periods. On September 20, 1993, Radiation Monitors R-19A, R-19B, and R-19C (Steam Generator Blowdown Monitors) were intentionally powered down (and declared inoperable) to cause the Steam Generator Blowdown Valves to isolate to facilitate work related to the refueling outage. The monitors were returned to service on October 31, 1993. On November 30, 1993, the Gas Analyzer, which monitors waste gas streams for potentially explosive mixtures of hydrogen and oxygen, was declared inoperable and removed from service when an Engineering Evaluation determined that it was no longer capable of performing TS-required "continuous monitoring" function. Plant Modification 1159 had been written to upgrade the monitor and PIR 92-295 had been written to replace broken components for which parts were no longer available. The Gas Analyzer remained out of service as of mid-1994.

The table on the following page summarizes solid radwaste shipments for burial or disposal for the previous two and a half years. These shipments typically include spent resin, filter sludge, dry compressible waste, and contaminated equipment.

Robinson Solid Radwaste Shipments

	1991	1992	1993	1994*
Number of Waste Disposal Shipments	90	92	73	46
Volume (cubic meters)	64.5	62.5	44.0	23.0
Activity (curies)	95.4	446.7	25.7	87.1

*First half of 1994 only

For solid radwaste, the most significant change noted for the period reviewed was a decrease in the volume of disposed radwaste. The licensee attributed the improvement to the previously-referenced enhancements in the WWDS.

During the periods reviewed, the licensee had made no shipments of spent fuel to the Harris Plant for storage in the Spent Fuel Pool there.

The inspector reviewed the hypothetical maximum yearly dose estimates to a member of the public located at the site boundary from radioactive materials in gaseous and liquid effluents released during 1993 as reported in the Semiannual Radioactive Effluent Release Report. (The NRC PC-DOSE computer code was not available during this inspection to verify the licensee's calculation for the dose contribution to the maximum exposed individual from the radionuclides in liquid and gaseous effluents released to unrestricted areas.) The following table includes the annual dose calculations due to gaseous and liquid effluents for 1993:

Robinson Power Station
Cumulative Estimated Doses from Effluents

Dose Pathway	1991	1992	1993	Annual Limit
Airborne				
Gamma Air Dose (mrad)	4.32E-3	1.77E-3	1.44E-1	10
Beta Air Dose (mrad)	3.33E-3	7.28E-3	4.37E-1	20
Critical Organ Dose (mrem)	6.21E-2[1]	2.36E-2[1]	6.12E-1[2]	15
Liquid				
Total Body Dose (mrem)	8.87E-3[3]	5.70E-3[4]	4.60E-3[3]	3
Critical Organ Dose (Teenager Liver)(mrem)	1.61E-2	9.49E-3	5.89E-3	10

[1]Child's Skin
[2]Child's Thyroid
[3]Adult
[4]Teenager

The release of radioactive material to the environment from Robinson for the year was a small fraction of the 10 CFR 20, Appendix B and 10 CFR 50, Appendix I limits. As can be seen from the data presented above, the annual dose contributions to the maximum-exposed individual from the radionuclides in liquid and gaseous effluent released to unrestricted areas were all less than two per cent of the limits specified in the ODCM. The inspector noted that for the three-year period, the gamma and beta air doses had spiked during 1993, a result of leaking fuel during that period. Doses due to liquid effluents continued a decreasing trend.

The inspector concluded that the Semiannual Radioactive Effluent Release Report was complete and satisfied regulatory requirements.

No violations or deviations were identified.

7. Radiological Environmental Monitoring Program (REMP) (84750)

The purpose of the REMP is to measure any accumulation of radioactivity in the environment and to assess trends, to determine whether this radioactivity is the result of operations at the plant, and to assess the potential dose to the offsite populations based on the cumulative measurements of any plant-originated radioactivity via the monitoring of specific elements of exposure pathways, and to detect unanticipated pathways for the transport of radionuclides through the environment.

a. Annual Radiological Environmental Operating Report

TS 6.9.1.2.3 requires that the Annual Radiological Environmental Operating Report be submitted prior to May 1 of the following year of the Report. TS 6.9.1.2.3 also states format and content requirements for the Report.

The inspector reviewed the Report for calendar year 1992 to verify compliance with the TSs. The Report had been submitted in compliance with TS 6.9.1.2.3 on April 6, 1993, and the format and contents were as prescribed by the TS. The inspector determined that the Report was in compliance with the TSs.

Approximately 1170 samples of twelve different media types from indicator stations were collected and 1341 analyses and measurements were made during the year. Detectable radioactivity attributable to plant activities was identified in 20 total samples (of surface water, bottom sediment, and aquatic vegetation), less than two percent of the measurements. All detectable radionuclides in the environmental samples were less than reportable levels, as defined in the TSs. Overall, the radiological environmental data indicated that plant operations in 1993 had no significant impact on the environment or public health and safety. Only tritium activity in fish samples constituted a potential source of public exposure. Modeling estimates indicated that a potential dose to a member of the public due to consumption of fish from Lake Robinson was reported to be 0.009 mrem per year. Specifically, the report noted the following:

1) Air Sampling

361 air samples were collected from indicator stations and 52 from control stations throughout 1993, with the following results:

- In all cases, iodine-131 activities were less than the LLD.

- The mean gross beta activity was only somewhat higher for the indicator stations vs. the control stations (1.85E-2 vs. 1.75E-2 picocuries per cubic meter (pCi/m^3)) and less than the preoperational data of 1.4E-1 picocuries per cubic meter. The lower 1993 values were attributed to a reduction of worldwide fallout which occurred during the preoperational years. No discernable impact from plant operations was apparent from the data.

- Quarterly composite gamma analyses for air particulate samples revealed no radionuclides typical of plant effluents.

2) Broadleaf Vegetation

One control and two indicator stations were utilized for sampling broadleaf vegetation. Fifteen of thirty samples taken from the indicator sites contained concentrations of Cs-137 with an average of 2.90E-1 picocuries per gram (pCi/g) (wet), while 8 of 15 of the samples taken from the control site contained concentrations of Cs-137 with a mean concentration of 3.21E-1 pCi/g (wet). From these results, it was concluded that the indicator values were consistent with those of the control station and were indicative of worldwide fallout, not plant effluents.

3) Fish

Samples of free-swimmer and bottom-feeding fish were collected from Lake Robinson and Prestwood Lake (the first downstream lake) and compared to similar fish samples from a control lake unaffected by plant operations. Eleven of twelve fish samples collected contained traces of Cs-137. The activity levels of the samples from the indicator stations were lower than those from the control stations. Therefore, no plant-related dose was assigned due to the presence of the radionuclide. (The data were very similar to the results of the samples taken in 1992.)

4) Groundwater

Groundwater sampling indicated that no samples (of 36) contained detectable tritium or gamma activity. This finding was consistent with those of previous years.

5) Milk

Twenty-six samples from the control milk station and 26 samples from the indicator stations were collected and

analyzed. I-131 and gamma activities were all less than the LLD.

6) Shoreline Sediment

No radionuclides of plant origin were detected in the four samples of shoreline sediment. However, Cs-137 was detected in one sample in 1993, attributed to atmospheric fallout.

7) Bottom Sediment

Samples of bottom sediment were collected from Lake Robinson. Co-60 activity was detected at 0.7 pCi/g, representing a slight decrease over the 1991 and 1992 values of 1.0 pCi/g and 1.4 pCi/g, respectively. Cs-137 activities at the indicator stations also decreased over those of 1992.

8) Food Products

Food products (collards, turnips, tomatoes, and peaches) were sampled and analyzed, primarily for interlaboratory comparisons. Gamma activities were all less than the LLD.

9) Aquatic Vegetation

Samples of aquatic vegetation contained Co-58, Co-60, and Cs-137. The Co-58 and Co-60 activities were lower in 1993 than in 1992 in Lake Robinson (0.06 pCi/g (wet) vs 1.4 pCi/g (wet) for Co-58 and 0.6 pCi/g (wet) vs 1.5 pCi/g (wet) for Co-60, respectively) and were not observed further downstream at Prestwood Lake or the Auburndale Plantation. Trace Cs-137 activity levels were detected only in Lake Robinson during 1992.

10) Surface Water

Eighteen of twenty-four samples of surface water of Lake Robinson indicated a presence of tritium (a beta emitter) which was attributed to plant operations. The mean activity levels had increased from those of 1992 to 4.13E+3 pCi/l (from 2.29E+3 pC/l in 1992). Gamma analyses of monthly composites of surface water samples detected no radionuclides typical of plant effluents.

11) Direct Radiation

Direct radiation exposure in the plant environs was measured by the placement of thermoluminescent dosimeters (TLDs) around the plant forming inner and outer concentric circles of approximately one and five miles, respectively. The expectation was that if a plant effect existed, dose

measurements of the inner circle would exceed those of the outer circle. This condition was not observed.

The Radiochemistry Laboratory at the Harris Energy and Environmental Center in New Hill, North Carolina, provides radioanalytical services for CP&L's nuclear plant radiological environmental surveillance programs. The laboratory is a participant in the EPA's cross-check program and uses its performance in the program as a major determinant for the accuracy and precision of its own analytical results. During 1993, a comparison of the laboratory's reported values with those of the EPA's known activity found 100 percent to be within three standard deviations.

b. Comparison of State of South Carolina vs Robinson Results

The South Carolina Bureau of Radiological Health entered into a contractual agreement with the NRC to measure the concentrations of radioactivity and radiation levels in the environs of four nuclear power plants within the state, including Robinson. The principal objective of the contract is to provide independent assurance that environmental measurements made by NRC licensees are valid. To this end, the State of South Carolina:

- Coordinates sampling activities with those of the NRC licensees.
- Collects and analyzes environmental media samples.
- Takes appropriate action in the investigation of elevated levels of radioactivity in the environment.
- Participates in and reports results of the EPA's Intercomparison Studies Program.
- Reports the results of the State's and licensee's environmental radiological verification monitoring program.

The inspectors compared several air sample results for gross beta and I-131, surface water results for tritium, milk sample results for I-131 and K-40, and fish sample results for K-40 and Cs-137 as reported by the licensee to those listed in the 1993 Annual Report for the surveillance of radioactivity and radiation levels in the environment, submitted by the South Carolina Department of Health and Environmental Control. The comparisons of the results were acceptable.

c. Status of Sampling Stations

The inspectors accompanied a technician to review the physical condition and operability of five air sampling stations (Nos. 2, 3, 5, 6, and 55) and one surface water sampling station (SW 40).

In addition, the inspectors noted that TLDs were observed at all of the air samplers and that the State of South Carolina had co-located its air samplers and TLDs at Station Nos. 2 and 5. The air sampling stations were located in areas free of tall weeds/vegetation which might interfere with obtaining representative samples. The inspector noted that all of the sampling units were new (having been installed in late November 1994), were within calibration, and were well-maintained. The inspectors noted that the sampling stations were located per the REMP and that there was no evidence of vandalism of either the air samplers or TLDs. Review of the surface water sampling station found it to well-maintained.

The inspectors concluded that the sampling stations and their associated instrumentation were well-maintained and within calibration.

The inspector concluded that the licensee had good programs in place to monitor releases of radiological effluents. Plant operations caused minimum impact to the environment and virtually no dose to the general public.

No violations or deviations were identified.

8. Liquid and Gaseous Effluent Processing and Monitoring (84750)

a. Release Permits

TSs 3.9.1 and 3.9.2 state requirements for liquid effluent concentrations and TSs 3.9.3, 3.9.4, and 3.9.5 state requirements for gaseous concentrations. TSs 3.5.2 and 3.5.3 define the operating requirements for the radioactive liquid and gaseous effluent instrumentation systems, respectively. The inspectors reviewed three Liquid Radioactive Waste Permits and five Gaseous Radioactive Waste Permits for January 1995, including LRW # 950009-L, LRW # 950013-L, LRW # 950014-L, GRW # 950007-G, GRW # 950008-G, GRW # 950009-G, GRW # 950010-G, and GRW # 950011-G, to verify compliance. The liquid releases included two continuous releases (one of condensate polisher waste water effluent and one of Steam Generator blowdown) and one batch release (from a Waste Condensate Tank (WCT)). The gaseous releases included three continuous releases (from the Fuel Handling Building exhaust, Radwaste Building effluent vent, and the plant vent) and two batch releases (both to relieve pressure in the Containment Building). Pre-release calculations were complete and included dose projections to the public (including whole body and critical organ) as well as the percentage of 10 CFR 50 quarterly and annual limits. The release history included the release start and stop times as well as radiation monitor information. The post-accountability calculations determined total activity released and verified compliance with 10 CFR 20 limits and quarterly and annual limits of 10 CFR 50.

b. Observation of Gaseous Release

The inspectors reviewed selected portions of the procedures used to generate a Gaseous Waste Release Permit (950025-G) and to obtain a gaseous sample. Specifically, the inspectors reviewed Environmental Monitoring Procedures EMP-022, "Gaseous Waste Release Permits," Revision 22, and EMP-025, "Gaseous Effluent Sampling and Analysis Requirements," Revision 22 and concluded that they were adequate for the intended purpose. The inspector observed a licensee technician obtain a gaseous grab sample and return it to the Count Room for analysis and noted that the procedure was followed closely. Proper sampling techniques and health physics practices were employed. Upon completion of the analysis, the Control Room was given the Release Permit for execution. The inspectors observed the channel check of the radiation monitor and the initiation of the release. The release was executed without incident.

The inspectors concluded that the program for liquid and gaseous processing and monitoring was being successfully implemented.

No violations or deviations were identified.

9. Confirmatory Measurements (84750)

10 CFR 20.201(b) requires the licensee to perform surveys as necessary to evaluate the extent of radiation hazards. In an effort to evaluate the licensee's analytical capabilities, the licensee was provided spiked liquid samples for analysis pursuant to the NRC Confirmatory Measurements Program. Specifically, the licensee was requested to analyze samples of beta-emitting radionuclides containing tritium (H-3), iron-55, and strontium-90. The licensee reported the analytical results of this batch on September 3, 1993 via the corporate Energy and Environmental (E&E) Center, located at the Shearon Harris Nuclear Power Plant (SHNPP). As indicated in Attachment 1, the licensee's analytical results were in agreement with the prepared concentrations for the three isotopes identified. Attachment 2 provides the criteria for assessing the agreement between the licensee's analytical results and the prepared concentrations.

The inspector concluded that the licensee maintained a good Counting Room radiochemical analysis program for the detection of beta-emitting radionuclides.

No violations or deviations were identified.

10. Transportation of Radioactive Materials (86750)

a. Transportation Activities

The inspectors reviewed the licensee's program for the preparation and shipping of NRC-certified packages of radioactive materials.

Program areas observed included: the observation of a receipt and shipment of radioactive material to a laundry in Columbia, South Carolina; a review of shipping paper documentation; and a review of licensee training for personnel performing specific tasks involving transportation.

Licensee transportation personnel were observed by the inspector during the receipt of a shipment of radioactive material. The licensee representative inspected the driver credentials and made a safety inspection of the truck. Initial surveys were performed and offloading went without incident. The vehicle was loaded immediately after receipt and left the site. The inspectors reviewed the shipping papers for the shipment and the surveys and did not identify any discrepancies.

The inspectors performed a review of all shipments of radioactive material made by the licensee in 1994. Major items for discussion included: bill of lading, preparation for shipment checklist, the radioactive material manifest, the emergency response instructions for the shipment, vehicle inspection report, and prior notification forms. Subsequently, the inspector reviewed shipping documentation for the following:

- 49 CFR 172.201(c) requires shipping papers consisting of more than one page to be consecutively numbered and the first page to bear a notation specifying the total number of pages included in the shipping paper.

- The inspector noted that the description of the shipment required by 49 CFR 172.201-205 was correct as was the sequential and total numbering of the shipping documentation pages.

- 49 CFR 201(d) requires, in part, that the shipping papers must contain an emergency response telephone number, as prescribed in Subpart G of Part 172 of this subchapter.

- 49 CFR 173.421(a-f) states, in part, that radioactive materials whose activity per package does not exceed the limits specified in paragraph 173.423 are excepted from the specification packaging, shipping paper certification, marking, and labeling requirements of this subchapter and requirements of this subpart.

The inspectors noted that all shipments reviewed met the above listed requirements and were well-documented.

b. Transportation Training

49 CFR 172.602 defines emergency response information and states that this information can be used in the mitigation of an accident

involving hazardous materials. It also defines, what information, as a minimum, the shipping papers must contain.

49 CFR 172.604 requires that a person who offers a hazardous material for transportation must provide a 24-hour emergency response telephone number (including the area code or international access code) for use in the event of an emergency involving the hazardous material. The telephone number must be, in part; 1) monitored at all times the hazardous material is in transportation, including storage incidental to transportation; 2) the number of a person who is either knowledgeable of the hazardous material being shipped and has comprehensive emergency response and incident mitigation information for that material, or has immediate access to a person who possesses such knowledge and information; and 3) entered on the shipping papers following the hazardous material description.

At 1539 hours on January 25, 1995, the inspectors called the emergency response number on the shipping papers for a laundry shipment that was shipped to Columbia, South Carolina earlier in the day. The inspectors explained to the control room operator that this was a drill to determine how they would respond to an actual emergency involving the radioactive material shipment enroute. The operator stated that the Shift Supervisor (SS) was absent from the control room and would return my call upon arrival. The SS returned the call 20 minutes into the drill scenario. The inspectors discussed the drill scenario with the SS and noted that he was able to answer fundamental questions about the radioactive materials shipment and was able to discuss basic emergency measures involving a mishap with the shipment. However, the response by the SS was outside the established 15-minute guideline for providing emergency response information. The inspectors discussed this item at the exit meeting with licensee management, specifically, that the licensee reinforce training on established procedures for telephone response to an emergency involving a radioactive materials shipment enroute.

The inspectors also reviewed training records for personnel responsible for the transportation of hazardous materials and E&C technicians having a transportation interface. The inspectors identified what appeared to be a problem with the qualifications of one of the technicians involved in the receipt and shipment of laundry on January 25, 1995. A technician who had not been completely signed off on his qualification card was observed performing tasks. However, after meetings with licensee training personnel and management, the inspectors were satisfied that the licensee was operating within procedural requirements. (The licensee provided procedural acceptance which allowed personnel in training to perform a specific task while under the direct supervision of a fully-qualified worker in that specific task. The individual in question was working under the direct supervision of another fully-qualified worker.)

c. Transportation Audits

10 CFR 71.137 requires the licensee to carry out a comprehensive system of planned and periodic audits to verify compliance with all aspects of the quality assurance program and to determine the effectiveness of the program. The audits must be performed in accordance with written procedures or checklists by appropriately-trained personnel not having direct responsibilities in the areas being audited. Audited results must be documented and reviewed by management having a responsibility in the areas audited. Followup action, including re-audit of the deficient areas, must be taken where indicated.

The inspector reviewed the following NAD audits:

- R-ERC-94-01, Robinson Environmental and Radiation Control, dated February 7, 1994.

- R-ERC-94-02, Robinson Environmental and Radiation Control, dated January 10, 1995.

The inspectors noted that the audits were comprehensive in nature and identified deficiencies that if not corrected may result in violations of NRC regulations. The audits had the appropriate level of management review/distribution and management was knowledgeable of significant issues identified in the audits. A detailed review of selected audit findings showed that the corrective actions were appropriate and that they either had been corrected or were being corrected in a timely manner. The inspectors noted that re-audits were being performed for previous audit findings.

The inspectors concluded that the licensee's program for the shipping of radioactive materials was effective.

No violations or deviations were identified.

11. Followup on Previously Identified Issues (92701)

Deviation (DEV) 50-261/94-14-01, "Failure to Include in Performance Test Procedures Provisions for Testing and Test Acceptance Criteria which are Consistent with the Commitments Contained in the UFSAR." This issue was originally addressed in IR 50-261/94-14, when it was noted that Sections 6.4 and 9.4.2 of the Updated Final Safety Analysis Report (UFSAR) required, in part, that the Control Room envelope be maintained under a positive differential pressure with respect to adjacent areas and the outdoors during the emergency pressurization mode. Furthermore, periodic testing is required to demonstrate that the Control Room is pressurized to a minimum of 1/8" of water (gage) with respect to the outdoors. While Procedures OST-750, "Control Room Emergency Ventilation System," and EST-023, "Control Room Emergency Ventilation System,"

included provisions for testing the differential pressure between the Control Room and the outdoors, neither included provisions for testing the differential pressure with respect to adjacent areas. Also, the acceptance criteria of both procedures for the differential pressure with respect to the outdoors was "greater than zero" rather than a minimum of 1/8" of water (gage).

The licensee had revised the procedures to meet the commitments of the UFSAR and conducted surveillance testing to assure that a minimum differential pressure of 1/8" of water (gage) was obtainable. The surveillance testing was unsatisfactory when originally done in late October 1994 but was satisfactorily completed on November 9, 1994. The inspectors noted that the related issue of ensuring control over design and testing activities affecting safe plant operations (specifically, the differential pressure issues raised by the Deviation) had been addressed by the Resident Inspectors in IR 50-216/94-16 and resulted in a Violation and Civil Penalty.

Based upon the items reviewed and the actions taken by the licensee to respond to the referenced Violation and Civil Penalty, the inspectors concluded that Deviation 50-261/94-14-01, "Failure to Include in Performance Test Procedures Provisions for Testing and Test Acceptance Criteria which are Consistent with the Commitments Contained in the UFSAR," had been satisfactorily addressed. Therefore, it is closed.

12. Exit Interview (84750)

The inspection scope and results were summarized on January 27, 1995 with those persons indicated in Paragraph 1. The inspector described the areas inspected and discussed the inspection results, including likely informational content of the inspection report with regard to documents and/or processes reviewed during the inspection. The licensee did not identify any such documents or processes as proprietary. Dissenting comments were not received from the licensee.

Item Number	Status	Description and Reference
50-261/94-14-01	Closed	DEV - Failure to include in performance test procedures, provisions for testing and test acceptance criteria which are consistent with the commitments contained in the UFSAR. (Paragraph 11).

13. Acronyms and Initialisms

ACR - Adverse Condition Report
CFR - Code of Federal Regulations
Ci - curie
CP - Chemistry Procedure
CP&L - Carolina Power and Light

CVCS - Chemical and Volume Control System
°F - degrees Fahrenheit
DEI - Dose Equivalent Iodine
DEV - Deviation
DO - Dissolved Oxygen
DOT - Department of Transportation
E&C - Environmental and Chemistry
E&E - Energy and Environmental
EFPY - Effective Full Power Years
EMP - Environmental Monitoring Procedure
EPA - Environmental Protection Agency
EPRI - Electrical Power Research Institute
E&RC - Environmental and Radiation Control
EST - Engineering Surveillance Test
g - gram
IR - Inspection Report
l - liter
lb - pound
LLD - Lower Limit of Detection
μCi - micro-Curie (1.0E-6 Ci)
μm - micro-meter (1.0E-6 meter)
m - meter
ml - milli-liter
mRad - milli-Rad
mrem - milli-rem
NAD - Nuclear Assessment Department
NRC - Nuclear Regulatory Commission
ODCM - Offsite Dose Calculation Manual
OST - Operation Surveillance Test
PASS - Post Accident Sampling System
pCi - pico-Curie (1.0E-12 Ci)
PCP - Process Control Program
ppm - parts per million
PWR - Pressurized Water Reactor
REMP - Radiological Environmental Monitoring Program
RC - Radiation Control
RCS - Reactor Coolant System
SG - Steam Generator
SHNPP - Shearon Harris Nuclear Power Plant
SS - Shift Supervisor
TLD - Thermoluminescent Dosimetry
TS - Technical Specification
UFSAR - Updated Final Safety Analysis Report
WCT - Waste Condensate Tank
WHUT - Waste Holdup Tank
WWDS - Waste Water Demineralization System

ATTACHMENT 1

COMPARISON OF NRC AND CP&L ANALYTICAL RESULTS
REPORTED SEPTEMBER 3, 1993

Type of Sample: Unknown NRC Spikes
Units: μCi/ml

Radio-nuclide	Licensee's Value (μCi/ml)	NRC Value (μCi/ml)	Reso-lution	Ratio	Compar-ison
H-3	1.30 E-4	(1.29 +/- 0.06)E-4	22	1.01	Agree
Fe-55	1.35 E-5	(1.23 +/- 0.06)E-5	21	1.10	Agree
Sr-90	2.30 E-5	(2.33 +/- 0.12)E-5	19	0.99	Agree

ATTACHMENT 2

CRITERIA FOR COMPARISONS OF ANALYTICAL MEASUREMENTS

This attachment provides criteria for the comparison of results of analytical radioactivity measurements. These criteria are based on empirical relationships which combine prior experience in comparing radioactivity emission, and the accuracy needs of this program.

In these criteria, the "Comparison Ratio Limits"[1] denoting agreement or disagreement between licensee and NRC results are variable. This variability is a function of the ratio of the NRC's analytical value relative to its associated statistical and analytical uncertainty, referred to in this program as "Resolution".[2]

For comparison purposes, a ratio between the licensee's analytical value and the NRC's analytical value is computed for each radionuclide present in a given sample. The computed ratios are then evaluated for agreement of disagreement bases on "Resolution." The corresponding values for "Resolution" and the "Comparison Ratio Limits" are listed in the Table below. Ratio values which are either above or below the "Comparison Ratio Limits" are considered to be in disagreement, while ratio values within or encompassed by the "Comparison Ratio Limits" are considered to be in agreement.

TABLE

NRC Confirmatory Measurements Acceptance Criteria
Resolution vs. Comparison Ratio Limits

Resolution	Comparison Ratio Limits for Agreement
< 4	0.4 - 2.5
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
> 200	0.85 - 1.18

[1]Comparison Ratio = $\frac{\text{Licensee Value}}{\text{NRC Reference Value}}$

[2]Resolution = $\frac{\text{NRC Reference Value}}{\text{Associated Uncertainty}}$