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

MAY 21 1987

Report No.: 50-261/87-14

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

Docket No.: 50-261 License No.: DPR23

Facility Name: H. B. Robinson

Inspection Conducted: May 4-8, 1987

Inspector: W. J. Ross 5-18-87
Date Signed

Accompanying Personnel: R. R. Marston

Approved by: J. B. Kahle, Section Chief 5-18-87
Division of Radiation Safety and Safeguards
Date Signed

SUMMARY

Scope: This routine unannounced inspection was conducted in the area of plant chemistry, Inspection and Enforcement Notices 86-106 and 86-108, and closeout of outstanding inspection items.

Results: No violations or deviations were identified.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*G. P. Beatty, Vice President, Robinson Nuclear Project
*R. E. Morgan, General Manager
*J. M. Curley, Director, Regulatory Compliance
*R. M. Smith, Manager, Environmental and Radiation Control (E&RC)
W. Christensen, Laboratory Foreman (E&RC)
R. Chambers, Supervisor, Performance Engineering
R. Dufresne, Engineer, Design Engineering
J. A. Laddy, Chemistry Supervisor (E&RC)
J. Harrison, Principal Specialist (E&RC)
R. Hitch, Chemistry Specialist (E&RC)
J. Murray, Supervisor, Water Treatment, Operations
D. Nelson, Operations Supervisor
L. Smith, Chemistry Specialist, Plant Training

Nuclear Regulatory Commission

*H. Krug, Senior Resident Inspector
*R. Latta, Resident Inspector

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on May 8, 1987, with those persons indicated in Paragraph 1 above. The inspector described the areas inspected and discussed the inspection findings. No dissenting comments were received from the licensee. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspector during this inspection.

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

4. Plant Chemistry

This inspection was a re-assessment of the licensee's program to prevent degradation of the primary coolant pressure boundary (specifically the steam generator tubes) from erosion/corrosion mechanisms. Through discussions with cognizant personnel, review of pertinent procedures and chemistry control data, and walkdowns of key components of the secondary cooling water cycle, the inspector evaluated the effectiveness of the design and operation of the plant as well as the efficiency of the

chemistry control program in maintaining the desired integrity of the steam generator tubes and in providing release of radioactive species.

a. Review of Plant Design and Operation

During this inspection the plant was in a refueling outage after fuel cycle eleven, i.e., the second fuel cycle after major modifications of the steam generators and the balance of plant had been completed (see Inspection Report 50-261/84-49 dated January 14, 1985). During his last inspection, in September 1985, the inspector had established that these modifications had greatly increased the licensee's capability to prevent inleakage of potentially corrosive chemical species and to maintain feedwater and steam generator water at a level of purity sufficient to meet the recommendations of the Steam Generator Owners Group (SGOG) and the Electric Power Research Institute (EPRI). This followup inspection revealed that continued improvement had been made in achieving and maintaining high quality secondary cooling water. The effectiveness of the principal components of the secondary cooling water system and summarized below.

(1) Main Condenser - No problems had been encountered from inleakage of air or condenser cooling water into the condenser hotwells. Consequently, chemistry control parameters had been maintained at levels considerably below SGOG/EPRI limits; e.g., cation conductivity approximately 0.06-0.07 umho/cm, dissolved oxygen approximately 5 ppb, and pH approximately 9.1. Air inleakage had been less than 10 SCFM (standard cubic feet per minute) and was readily removed by the condenser air ejector system.

(2) Service Water System - As reported in Inspection Report 50-261/84-49, January 14, 1985, severe attack of stainless steel pipe that provide flow of Service Water to containment fan coolers had been observed during the steam generator replacement outage. The degradation of these pipes was attributed to microbiological induced corrosion (MIC). During the current refueling outage the Service Water System was being flushed with water that contained hydrogen peroxide to eliminate all bacteria and environments that facilitate microbiologically induced corrosion (MIC).

The inspector was informed that a "MIC Tracking Program" had been established to identify environmental and operating conditions that might be conducive to growth of bacteria within plant systems.

(3) Water Treatment Plant - Although purification of well water for condensate makeup and other plant uses had been complicated by the presence of relatively high levels of silica, the product of the water treatment plant had been essentially pure water (i.e., a specific conductivity of approximately 0.06 unho/cm). The

licensee had previously added hydrazine to the water in the condensate storage tank to counteract inleakage of air (oxygen) into this tank. This practice was no longer in effect because the presence of thermal-degradation products of hydrazine (especially ammonia) had complicated the use of this water for regeneration of ion-exchange resins in the deep-bed condensate polishers (i.e., conductivity measurements could not differentiate between ammonia and ionic impurities being washed off of the resins). The inspector was informed that the dissolved oxygen level of water in the CST continued to be less than 100 ppb - a level that could be efficiently removed by the condenser air ejector when CST water was pumped to the hotwell for condensate makeup.

(4) Condensate Cleanup System - Because of the high purity of both the condensate and makeup water the licensee had been able to maintain full-flow polishing of the condensate with minimal regeneration of the deep-bed demineralizers; i.e., usually only one of the six beds were regenerated per week. The regeneration procedure had been routinely performed without contaminating the feedwater with regenerant chemicals (sulfuric acid and sodium hydroxide) or by leakage of ion exchange resin beads from the demineralizers. The inspector attributed this excellent record, in part, to the design of the regeneration tanks, the use of neutral ion exchange resins to maintain separation between the cation and anion resin beads, and to the high level of training and competence of the radwaste operators. These operators had been dedicated to the operation of this system since it was installed during the steam generator replacement outage.

(5) Feedwater - An audit of chemistry control data that had been acquired since the inspector's last site visit in 1985 showed that, except for the presence of hydrazine and ammonia that had been continuously added for chemistry control of pH and oxygen, the feedwater was essentially pure water; i.e., cation conductivity of approximately 0.06 umho/cm. This condition had been achieved by continuously polishing the condensate and by recycling the water from the feedwater heater drains back to the hotwell until this drain water was sufficiently pure to pump forward to the feedwater pumps for augmented feedwater flow.

(6) Steam Generator Cleanliness - The continuous improvement in the licensee's capability to clean-up the water in the steam generator by means of both the condensate polishers and the steam generator blowdown system had been reflected in a decrease in the cation conductivity of the steam generator blowdown from 0.6 to approximately 0.2 umho/cm during the tenth fuel cycle and further decrease to approximately 0.15 umho/cm during the eleventh fuel cycle. Likewise, transport of solid ion oxide "sludge" from carbon steel pipe, throughout the balance of plant, to the steam generators had been relatively small during

the tenth fuel cycle (approximately 80 pounds per steam generator) and even less during the eleventh fuel cycle (45 lbs, 28 lbs, and 16 lbs of sludge removed from Steam Generators A, B and C respectively). Finally, an audit of chemistry data during periods of plant cooldown during the eleventh fuel cycle indicated that very low levels (less than 10 ppb) of "hideout" as sulfate, chloride, or sodium - remained in the steam generators. The inspector considered that the licensee had attained a level of cleanliness in the steam generators that should prevent formation of local corrosive environments.

Although the licensee had not tested the integrity of the steam generator tubes by eddy current measurements during the current refueling outage, no evidence of cracks of other types of degradation had been observed during the outage after cycle ten (the initial fuel cycle with the new steam generator tubes.

(7) Steam Generator Blowdown - The inspector was informed that, during the current refueling outage, modifications of the steam generator blowdown systems were being made so that this water could be cycled back to the hotwell and reclaimed rather than wasted as in the past. These modifications should not only conserve thermal energy and water but should reduce the demand for condensate makeup and, therefore, further reduce the probability for ingress of contaminants into the secondary water system.

(8) Replacement of Low-Pressure Turbine Rotors - The inspector observed the replacement of the plant's low-pressure rotors (shrunk-on turbine disks) with rotors of a new design that, among other advantages, will reduce the probability of disk failure from stress corrosion cracking. The new rotors were cast as an integral unit of disks and bore and, therefore, without keyways and crevices that had become the locale for the initiation of cracks in the shrunk-on models.

No violations or deviations were identified.

b. Review of the Licensee's Chemistry Program

The following elements of the licensee's water chemistry program were reviewed during this inspection.

(1) Staff - Since the inspector's last site visit the 21-person Chemistry Staff that is under the direction of the Manager of Environmental and Radiation Control had been reorganized into an analytical staff under the Laboratory Supervisor and a specialist staff under the Principal Specialist. After discussions with key personnel from the Chemistry staff, the inspector concluded that the licensee had sufficient personnel resources and expertise to fully implement the type of chemistry

program recommended by the SGOG as well as to comprehend and resolve potential and/or actual site specific chemistry problems.

The analytical staff had been divided into five shifts that worked on the same schedules as the corresponding operations staff so that a "team" concept could be developed.

(2) Training - A continuing training course that encompassed eighteen modules was being implemented by the Plant Training Department to supplement the on-the-job training being provided to chemical technicians. All subjects covered by the qualification cards required to perform all chemistry control responsibilities were to be taught throughout a five-year cycle and subsequent two-year requalification periods.

(3) Procedures - The Chemistry staff had developed a draft of a new PWR Chemistry Guidelines Manual for H. B. Robinson Steam Electric Plant. The inspector established that this draft manual implemented corporate policy and guidance for the development of a chemistry program that fulfills all Technical Specification requirements and which endorses and implements SGOG recommendations for both primary and secondary chemistry.

(4) Primary Chemistry Control - The inspector verified that the criteria for purity of the reactor coolant required by Technical Specification 3.1 had been met during the interval since the inspector's last site visit. The chemistry staff, with the help of personnel from the corporate support group, had been reviewing the information recently provided in the EPRI Primary Chemistry Guidelines as well as performing other studies in an effort to reduce the radiation levels of activation products in the reactor coolant. The inspector was informed that cobalt-58 had been the major source of radiation in the RCS since new Inconel tubes had been installed in the steam generators. The cobalt-58/cobalt-60 ratio had been decreasing during the last two years as the tubes became passivated with oxide film and less nickel-58 was being transported to the reactor and activated to cobalt-58.

(5) Secondary Chemistry Control - As discussed earlier in this report, the key chemistry parameters recommended by the SGOG and EPRI for control and diagnostic purposes had been routinely monitored by the Chemistry staff. Both inline and grab sampling procedures had been used. The inspector observed that additional chemistry technicians were continuing to become qualified in the use of state-of-the-art analytical instrumentation such as ion chromatography and atomic spectrophotometry for analyzing grab samples for trace levels of anions and metal ions.

Through an audit of secondary chemistry control data the inspector established that the licensee had been able to maintain the level of impurities, both solid and soluble, in the secondary cooling system at essentially the purity of demineralized water. Consequently, the criteria recommended by the SGOG had been significantly improved upon, so that the secondary water system was considered to be well protected against the various types of corrosion that were encountered before the steam generator tubes were replaced.

No violations or deviations were identified.

5. IE Notice 86-106, Feedwater Line Break

The inspector reviewed the licensee's actions that had been taken in response to this Notice that described the degradation and failure of feedwater lines at the Surry Nuclear Power Plant in December 1986. These actions are summarized as follows:

a. A special pipewall-thinning examination was performed on pipes that were considered to be similar to the degraded pipes at Surry. Errosion was found to be negligible.

b. Pipe design changes were not considered to be either necessary or a viable option for wall thinning.

c. Water temperature changes were not considered to be necessary or a viable option to prevent wall thinning.

d. The feasibility of increasing the pH feedwater to 9.3-9.6 is being considered as a means to reduce corrosion of carbon steel pipe.

e. A new procedure (MI10) for surveillance of steam and steam/water pipes was implemented during the last two refueling outages. Corrosion of feedwater drain lines was identified, and some of this piping has been scheduled for replacement during the current refueling outage.

f. This Notice had been discussed with several other utilities that had experienced erosion/corrosion in two-phase (wet steam) pipes.

6. IE Notice 86-108, Degradation of Reactor Coolant System Pressure Boundary Resulting from Boric Acid Corrosion

The inspector established that the licensee had completed a review of this Notice with the following results:

a. All RCS piping and nozzles in HBR2 were verified to have been fabricated from stainless steel

b. A review of the maintenance history and the program for lubricating threaded fasteners had been completed in 1982 in response to IE Bulletin 82-02 (which addressed the same subject). No problem areas were identified. Subsequent reviews were performed in 1983 and 1984 in response to INPO reports. Again, no further problems were found.

c. Although the plant ISI program was based on an earlier Edition of the ASME Code, the licensee reviewed its program versus the 1986 Edition which has more stringent requirements for the inspection of bolted joints. This review did not identify any need for further action.

d. Present procedures require that complete walkdown inspection of the primary coolant boundary be made before startup of the plant from a refueling outage and during shutdown for a refueling outage (before cooldown).

During the current refueling outage the licensee had observed a pinhole leak in the weld of CRD No. K6. When the insulation had been removed from the reactor vessel no damage to the carbon steel head had been observed. The faulty weld had been cut out and replaced. Photographs of the affected area indicated that boric acid crystals had not been widespread; however, the containment fan cooler had been plugged with boric acid crystals that had been deposited from steam that had been swept into the head ventilation ducts.

The inspector was informed that several similar pinhole leaks had been encountered in the past.

7. Inspector Followup Items (92701)

a. (Closed) 86-IN42: IE Information Notice No. 86-42, Improper Maintenance of Radiation Monitoring Systems. The inspector verified that plant procedures required independent verification of restoration lineup for ESF systems.

b. (Closed) Inspector Followup Item (IFI) 85-15-01: Evaluate PASS Shielding Studies with Respect to Sample Piping External to PASS Panel, Access Areas, and Operator Location. The inspector discussed this item with cognizant licensee personnel and reviewed documentation pertaining to the item. The evaluation had been completed, and the work was scheduled to be completed by the end of the current calendar year.

c. (Closed) IFI 86-19-02: Review Licensee's Evaluation of Cobalt-58 Results in RCS and Liquid Wastes. The inspector established that the licensee had determinated that inconsistencies between detectors had resulted from Co-58 being in suspension in RCS and had proposed methods for accurately determining cobalt-58 concentrations.

d. (Closed) IFI 86-14-01: Correct Typos in Second Half 1985 Semi-Annual Report; Evaluate Total Error Estimate; Provide Analytical LLD Values

Instead of Zero in the Semi-Annual Report. The inspector noted that the Semi-Annual Report for the second half of 1986 provided a table of LLDs and used the terminology "less than LLD," instead of "0" or "not detected." The licensee provided corrected pages for the two 1984 reports and the two 1985 reports. The licensee also provided an analysis of the individual and total measurement errors.