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SUBJECT: Forwards 120-day response to GL 97-07, "Degradation of Control Rod Drive Mechanism Nozzle & Other Vessel Closure Head Penetrations."

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CP&L

Carolina Power & Light Company
PO Box 165
New Hill NC 27562

William R. Robinson
Vice President
Harris Nuclear Plant
SERIAL: HNP-97-152
10 CFR 50.54(f)

JUL 29 1997

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
RESPONSE TO NRC GENERIC LETTER 97-01, "DEGRADATION OF CONTROL ROD DRIVE MECHANISM NOZZLE AND OTHER VESSEL CLOSURE HEAD PENETRATIONS"

Dear Sir or Madam:

Carolina Power & Light Company (CP&L) hereby responds to NRC Generic Letter 97-01 (GL 97-01), "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations" for the Harris Nuclear Plant (HNP). As committed to in HNP letter dated April 25, 1997, Enclosure 1 provides the required 120-day written response to GL 97-01.

Please refer any question regarding this submittal to Mr. J. H. Eads at (919) 362-2646.

Sincerely,

W R Robinson

JHE/eoe

Enclosure

W. R. Robinson, having been first duly sworn, did depose and say that the information contained herein is true and correct to the best of his information, knowledge and belief; and the sources of his information are employees, contractors, and agents of Carolina Power & Light Company.

Darlene S. Yarborough
Notary (Seal)

DARLENE S. YARBOROUGH
NOTARY
***
PUBLIC
HARNETT COUNTY, NC

My commission expires: 2-6-2000

c: Mr. J. B. Brady (NRC Senior Resident Inspector, HNP)
Mr. L. A. Reyes (NRC Regional Administrator, Region II)
Mr. V. L. Rooney (NRR Project Manager, HNP)

A075 /1

bc:

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File:H-X-0545

GL 97-01 120-DAY RESPONSE

INTRODUCTION:

Generic Letter 97-01 (GL), *"Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations,"* was issued to request licensees to describe their program for insuring the timely inspection of PWR control rod drive mechanism (CRDM) and other vessel head penetrations (VHP). This response provides Harris Nuclear Plant (HNP) information relative to the information requested by the GL.

Prior to issuance of the GL, HNP worked with the Westinghouse Owners Group (WOG), the Electric Power Research Institute (EPRI), and the Nuclear Energy Institute (NEI) to understand the operational experience, identify technical issues, cause factors, relative importance, and solutions. One of these tasks was the development of safety evaluations that characterized the initiation of damage, propagation and consequences. These safety evaluations are contained in WCAP 13565 Revision 1, "Alloy 600 Reactor Vessel Adapter Tube Cracking Safety Evaluation," and are applicable to HNP. The NRC reviewed the safety evaluations and issued a safety evaluation report (SER) to NEI on November 19, 1993. The safety evaluations and the SER establish the basis for HNP continued operation.

RESPONSE TO REQUESTED INFORMATION ITEM 1.1:

"1.1 *A description of all inspections of CRDM nozzle and other VHPs performed to the date of this generic letter, including the results of these inspections."*

Response:

Visual examinations of the reactor vessel head, including the CRDM penetration areas, are performed during each refueling outage, based on HNP procedures which implement commitments to Generic Letter 88-05 "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants." In order to assure compliance with the assumptions of the safety evaluation provided in WCAP 13565 Rev 1, examinations of the CRDM penetration area for boric acid were included in the HNP Generic Letter 88-05 program, beginning in March of 1994. These examinations were performed during refueling outages #5, #6 and #7.

Additionally, consistent with the requirements of the ASME Code Section XI edition to which HNP is committed the following examinations have been performed during past outages: the weld joint located between the reactor vessel head flange and the reactor vessel head has been examined by a magnetic particle surface examination and an ultrasonic examination, selected cono-seal bolting have been examined using VT-1 examination techniques, and selected CRD housing to CRDM penetration welds have been examined using liquid penetrant examination techniques.

Although none of these examinations specifically examine the interface area between the reactor vessel head and the CRDM penetrations, they do necessitate that personnel perform these examinations within the reactor vessel head penetration region. Therefore, if a reactor vessel head penetration experienced a leak, it is likely that the resulting boric acid build-up/corrosion would have been identified by the personnel performing one of these examinations.

System leakage tests for the RCS are also conducted following each removal and replacement of the reactor vessel head. After the RCS is placed into operation, the region around the reactor vessel head flange is visually examined using VT-2 examination techniques to identify any leakage. Such examinations have provided yet another opportunity to observe evidence of boric acid build-up/corrosion stemming from a leaking CRDM penetration.

None of these past examinations have identified evidence of leakage or boric acid corrosion originating from the reactor vessel closure head penetration areas.

No inservice volumetric examinations have been performed on the HNP reactor vessel closure head penetrations.

<u>RESPONSE TO REQUESTED INFORMATION ITEM 1.2 THROUGH 1.4:</u>

"1.2 *If a plan has been developed to periodically inspect the CRDM nozzle and other VHPs:*

a) Provide the schedule for first, and subsequent, inspections of the CRDM nozzle and other VHPs, including the technical basis for this schedule.

b) Provide the scope for the CRDM nozzle and other VHP inspections, including the total number of penetrations (and how many will inspected), which penetrations have thermal sleeves, which are spares, and which are instrument or other penetrations."

1.3 *If a plan has not been developed to periodically inspect the CRDM nozzle and other VHPs, provide the analysis that supports why no augmented inspection is necessary.*

1.4 *In light of the degradation of CRDM nozzle and other VHPs described above, provide the analysis that supports the selected course of action as listed in either 1.2 or 1.3, above. In particular, provide a description of all relevant data and/or tests used to develop crack initiation and crack growth models, the methods and data used to validate these models, the plant-specific inputs to these models, and how these models substantiate the susceptibility evaluation. Also, if an integrated industry inspection program is being relied on, provide a detailed description of this program."*

Response:

Based on both domestic and foreign data relative to PWSCC, it is generally recognized that this cracking mechanism is strongly dependent on operating time and temperature. For the two domestic plants that have found evidence of CRDM cracking, D.C. Cook Unit 2 and Oconee Unit 2, the plant operating time and vessel head temperatures ranged from approximately 87K hours at 604°F and 127K hours at 602°F, respectively. The HNP reactor vessel design is such that a portion of the reactor coolant inlet flow is diverted up into the upper head region, thus maintaining the operating temperature within the area of the CRDMs close to that of the Reactor Coolant System cold leg temperature of approximately 551°F (i.e., Tcold reactor vessel head design). Based on the relatively short operating time for HNP (i.e., approximately 70K effective full power hours) and the Tcold reactor vessel head design, as compared against the other domestic plants that conducted volumetric inspections, HNP should be considered as one of the less susceptible plants in the domestic industry for PWSCC. Current HNP plant procedures require periodic visual examinations of the reactor vessel head penetrations in accordance with previous commitments made in response to Generic Letter 88-05, in addition to those other vessel head examination activities noted in the response to Item 1.0, above.

In a proactive effort to establish when volumetric examinations might be warranted for our plants, in 1994, CP&L evaluated the susceptibility of reactor vessel head penetrations for the H. B. Robinson Nuclear Plant (RNP) to PWSCC. The results of the plant-specific evaluation indicated that volumetric examinations would not be warranted prior to 1999 for RNP. Due to similarities in plant design and penetration materials, coupled with its longer operating time and hotter reactor vessel head temperature (i.e., approximately 150K hours and 598°F for RNP versus 70K hours and 551°F for HNP), the RNP conditions would be expected to bound those for the HNP reactor vessel head penetrations.

From a domestic industry perspective, each of the three PWR owners groups, the Electric Power Research Institute (EPRI), and the Nuclear Energy Institute (NEI) are cooperatively working to compile information on the estimated operating time from January 1, 1997, needed to initiate and propagate a crack 75% through-wall in a vessel penetration. This information will be evaluated to determine if an adequate number of plants have or are planning to examine as a part of an integrated industry inspection program. CP&L is a member of both EPRI and the Westinghouse Owners Group. This evaluation is expected to be completed by the end of 1997.

Additionally, Dominion Engineering, Inc., is currently working under contract with EPRI to develop a computer software module for use by utilities in accessing their plant-specific PWSCC risk probabilities. This software product is being based on the PWSCC risk model which has been previously applied to several domestic

plants by the contractor. CP&L is participating as a member of the Utility Advisory Group for this EPRI product. Once the beta testing version of the software is available in late 1997, CP&L plans to use the product for further evaluation of PWSCC risk at the CP&L plants. The final version of the software is anticipated to be available for use in 1998.

Carolina Power & Light Company (CP&L) currently has no confirmed plans or schedule for conducting volumetric examinations of reactor vessel head penetrations at HNP. The need and timing for future volumetric examinations at HNP will continue to be evaluated and updated, based on the results of the ongoing industry programs also described above. Once any confirmed plans for conducting volumetric examinations at the HNP are established, the NRC will be informed accordingly, regarding the schedule and scope for these activities.

RESPONSE TO REQUESTED INFORMATION ITEM 2:

"2 Provide a description of any resin bead intrusions, as described in IN 96-11, that have exceeded the current EPRI PWR Primary Water Chemistry Guidelines recommendations for primary water sulfate levels, including the following information:

- *2.1 Were the intrusions cation, anion, or mixed bed?*
- *2.2 What were the durations of these intrusions?*
- *2.3 Does the plant's RCS water chemistry Technical Specifications follow the EPRI guidelines?*
- *2.4 Identify any RCS chemistry excursions that exceed the plant administrative limits for the following species: sulfates, chlorides or fluorides, oxygen, boron, and lithium.*
- *2.5 Identify any conductivity excursions which may be indicative of resin intrusions. Provide a technical assessment of each excursion and any follow-up actions.*
- *2.6 Provide an assessment of the potential for any of these intrusions to result in a significant increase in the probability for IGA of VHPs and any associated plan for inspections"*

Response:

CP&L has reviewed the plant historical records to determine if any incident of resin ingress, similar to those which occurred in 1980 and 1981 at the Jose Cabrera (Zorita) plant, has occurred at HNP. This data search was structured to identify all resin intrusion events into the primary coolant system with a magnitude greater than 1 ft^3 (30 liters). The threshold of 1 ft^3 was chosen as a conservative lower bound since it represents less than 15% of the estimated volume of resin released into the reactor coolant system during the two events at Jose Cabrera.

Routine analysis for sulfate in reactor coolant was performed for plant operation from January 3, 1987 to the present. A sulfate concentration in the range of 15 to 17 ppm peak concentration was used as the indicator of cation resin ingress. This concentration is approximately equivalent to a volume of 1 ft^3. The actual sulfate concentration has been less than 0.1 ppm (EPRI Guideline value).

Had sulfate increases indicated resin ingress to the magnitude of the threshold quantity identified above, additional data evaluation would have been conducted to look for a corresponding depression in pH or elevation in lithium as corroborating information of the incident. In the case of the use of sulfate data as the indicator, specific conductance would also have been included as confirmatory data had a significant in-leakage event been identified.

It was unnecessary to review plant records for boron, chlorides, fluorides and oxygen, because these species are not viewed as valid indicators of cation resin ingress and degradation within the primary coolant system of a PWR. Borate, chloride and fluoride anions could be associated with the anion portion of mixed bed resin (cation plus anion); however, if mixed bed resin leakage to the RCS occurred, the cation portion of the resin would contain the sulfate indicator described above. Detectable dissolved oxygen in reactor coolant, during power operation with appropriate hydrogen overpressure on the volume control tank and specified residual dissolved hydrogen in the reactor coolant, could not occur and, therefore, could not be associated with the resin in-leakage.

Based on the results of this review, it is concluded that a Zorita plant type resin intrusion has not occurred in the past at HNP.

The primary water chemistry control program at HNP is implemented in accordance with plant procedures which have been based on the EPRI *Primary Water Chemistry Guidelines* since March 13, 1991 and the Westinghouse Chemistry Criteria and Specifications prior to that. These industry guidelines were evaluated for applicability to HNP and applicable guidelines were incorporated into plant chemistry procedures with appropriate modifications when necessary.