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MEMORANDUM FOR: James E. Richardson, Director
Division of Engineering Technology
Office of Nuclear Reacto. Regulation

FROM: Goutam Bagchi, Chief
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SUBJECT: STRUCTURAL AUDIT AT H.P. ROBINSON NUCLEAR POWER PLANT UNIT 2

During April 13-16, 1992, I performed a structural audit at Robinson Nuclear Plant (RNP) Unit 2 together with NRC HQ staff (Yong Kim in ESGB/DET and Hai-Boh Wang in RSIB/DRIS) and its consultant's personnel (Richard Morante and Joseph Braverman from Brookhaven National Laboratory). Joseph Lenahan and Larry Garner from Region II accompanied the staff during the audit, and the audit team was joined by Ronnie Lo, NRC Project Manager for the plant.

At the entrance meeting with Carolina Power and Light (CP&L) Company representatives in the afternoon of April 13, I explained the purpose of the audit that ESGB/NRR/NRC needs to obtain information of the current status of the structural integrity, any ongoing structural degradation and extent thereof, causes of the degradation and its implication on structural functionality in order to assure the safety and integrity of the operating nuclear power plants. I indicated that any failures, degradations, maintenance, surveillance, modifications/repairs of safety related structures were of interest in our audit. Lists of the attendees at the entrance and exit meetings are contained in Enclosure 1.

A formal presentation was made by CP&L personnel on Tuesday, April 14. A copy of the agenda used in the presentation is included in Enclosure 2. Some of the topics covered include design/codes for category 1 structures, seismic design criteria, containment structures, support anchorages, spent fuel pool and racks, intake structure, masonry walls, steel/concrete piles, safety-related storage tanks, buried piping, dam design and maintenance, civil/structural LERs and 10 CFR 50.59 evaluations, and plant safety procedures for natural phenomena.

In the morning of Wednesday, April 15, the audit team performed a walkdown inside the containment. The team examined the polar crane support, refueling pool, containment dome liner and spray ring from a distance, by standing on the operating deck. In addition, the containment liner below the dome was examined up close at various elevations. At the lower level, the team examined the shield

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wall, equipment hatch, piping supports, pump bay, RPV head storage area, cable tray and conduit supports, HVAC duct supports, and concrete basemat for signs of degradation and conditions.

No structural failure or major degradations were observed during the walkdown inside the containment structure. However, the walkdown examination noted some discoloration on the vertical liner at an insulation joint, liner bulge, corrosion of three component cooling water valves, corrosion of support to main feed water line A, and peeling and cracking of the coating on the concrete surface of the basemat. The audit team suggested that although the corrosion and peeling/ cracking of the coating are not severe, they warrant CP&L attention and maintenance action to prevent further and more rapid degradation.

In the afternoon, the audit team examined the dam structure located at the southern end of Lake Robinson. The water contained in this lake is used by the RNP Unit 2 and the adjacent coal-fired plant Unit 1. The water surface is controlled by the concrete overflow spillway in the gate and the entire length of the earth dam. Although the dam is the responsibility of the plant Unit 1, CP&L arranges for dam inspections every five years to fulfill the requirements of USNRC Regulatory Guide 1.127. It should be noted that there is no licensing commitment for RNP Unit 2 to conform to the Regulatory Guide 1.127.

The walkdown examination of the dam structure identified some leakage around the side of the gates onto the steel beams that support the gates. Also, spalled concrete underneath two beam seats that support the walkway over the dam gates, and spalled concrete and holes at water line were identified. It was suggested that CP&L should evaluate the observations noted, and take remedial action, if necessary, to prevent conditions that could lead to further degradation.

After the dam examination, the audit personnel were separated into two teams. Team A consisted of H. Wang, J. Lenahan and myself and Team B consisted of Y. Kim, R. Morante and J. Braverman. Team A took the Walkdown Route 1, while Team B took the Walkdown Route 2. The details of the Walkdown Routes 1 and 2 are shown in Enclosure 3. During the walkdowns, the following major structures, areas, and components were examined: reactor auxiliary building, turbine building, exterior of containment, waste evaporator area, boric acid batch room, safeguard area, control room, diesel generator rooms, safety injection pump room, emergency bus rooms, battery rooms, spent fuel pool heat exchanger area, RHR pump area, seismic monitor room, refueling water storage tank, primary water storage tank, concrete floors, walls, ceiling, roofs, structural steel, conduits/cables and their supports, piping support anchorages, seismic gaps between buildings, equipment supports, and masonry walls.

No structural and component failures or major degradations were observed. However, there were a few locations with signs of water infiltration, several cases of insufficient thread engagements, loose nuts, missing washers, and one case of a missing nut, minor corrosion of structural steel in the Seismic Class 1 area of turbine building, and some corrosion of nuts at the base anchorage to storage tanks. The audit team suggested that CP&L needs to establish a

monitoring program and/or to take remedial action to prevent further degradation.

In the morning of Thursday, April 16, the entire audit team examined the intake structure at the shoreline to Lake Robinson. The areas examined were lower and ground levels of pump areas including concrete floor, walls and ceiling, service water pipings and their supports, and pump anchorages.

The walkdown examination in the intake structure revealed severe pitting on the service water line, corrosion of rod hanger supports, degraded condition of the friction clamp on the south service water header and degraded condition of the strainer foundation bolts. Based on a discussion between the NRR and Region II staff it was agreed that Region II will inspect the service water line by using the ultrasonic testing technique to determine the severeness of the pitting on the line, and integrity and functionality of the line.

After the intake structure walkdown, the audit team reviewed the 10 CFR 50.59 program at Robinson Unit 2 as it relates to civil/structural modifications and evaluations. From a list of specific 10 CFR 50.59 packages, the audit team selected five packages to review. From the limited review, it was observed that CP&L significantly improved the 10 CFR 50.59 evaluation procedure during the past few years. Each package contained a detailed safety analysis along with the appropriate evaluation forms as required by the current CP&L program manual for 10 CFR 50.59. This observation is consistent with the recent SALP report assessments of the licensees 10 CFR 50.50 packages.

CP&L personnel provided responses and documents in an effort to address and resolve some of the questions and concerns raised by the audit team during the formal presentation session and during the walkdowns. The audit team then reviewed and discussed the observations noted during the entire visit. Photographs for some of the key observations noted above are presented in Enclosure 4.

During the exit meeting held at 2:00 p.m., I reiterated the purpose of the NRC staff visit. I presented the observations of the audit team. I indicated that the observations were being presented to CP&L for their benefit. Any action CP&L takes as a result of these observations is considered voluntary. A summary of the presentation in the exit meeting is following:

1. There are no findings from the audit that violate the compliance requirements. Most civil/structural plant features have performed very well considering that the plant has been operating for approximately 21 years. However, there are some structures/components which do show signs of varying degrees of aging degradation. They are: (i) discoloration on the vertical liner at an insulation joint, liner bulge, corrosion of the component cooling water valves and their supports, and peeling and cracking of the coating on the concrete surface of the basemat in the inside containment building, (ii) leakage around the side of the gates, spalled concrete underneath beam seat, and spalled concrete and holes at

water line in the dam structure, (iii) several cases of insufficient thread engagements, loose nuts, missing washers and nut, minor corrosion of structural steel in the buildings, and (iv) severe pitting on the service water line, corrosion of rod hanger supports, degraded conditions of the friction clamp on the service water header and the strainer foundation bolts in the intake structure. These signs of degradations may warrant CP&L attention, maintenance, and/or remedial action, if necessary, to prevent conditions that could lead to further and more rapid degradation.

2. Based on the presentation and documentation submitted by CP&L during the audit, it is not clear to what extent RNP meets the general design criteria for natural phenomena. The audit team recognizes that requirements for certain plant features of the individual plant are different from the requirements of other plants, but CP&L needs to have a detailed review of the design criteria on protection against natural phenomena. The reactor water storage tank at this plant is designed as Seismic Category I; but it is not protected against tornado missiles. There may be other such examples of equipment designed to provide seismic resistance but not protected against tornado missiles. It was pointed out to CP&L that the best way to assess the effect of external events is to integrate this activity into the severe accident review effort under the Individual Plant Examination for External Events program.

3. The team found that progresses are being made on the piping improvement program, e.g., service water system piping replacements. This is a significant program and it is essential to follow up the IE Bulletin 79-14. Timely completion of this program needs CP&L management attention.

4. Recently, CP&L has developed a design guide for periodic structural inspections of Seismic Category I structures to monitor the structural integrity and provide a baseline for plant restart following a seismic event. The audit team believes that this is a very useful program, which, if properly implemented, will prevent the development of any significant degradation of structures and civil engineering features.

5. As a result of the audit on the design calculations, CP&L is advised to review the dynamic analysis of Category I structures supported by pile foundation to determine the more accurate design margin of the safety. The NRC HQ staff will review the calculation of the thrust block for the buried service water piping.

6. Region II will inspect the pitting on the service water line in the intake structure and the pipe support base plate which straddles what appears to be a seismic gap in a building.

It should be noted that CP&L was very well prepared for the ESGB/NRR/NRC structural audit. On behalf of the audit team, I gratefully acknowledged the cooperation and enthusiastic support provided by the CP&L corporate and the plant staff.

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Enclosure: As stated

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