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SUBJECT: Comments on NUREG-1003, "DES re Steam Generator Repair at HB Robinson Steam Electric Plant Unit 2." Marked-up pages encl.

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CP&L

Carolina Power & Light Company

OCT 31 1983

SERIAL: LAP-83-496

Director of Nuclear Reactor Regulation
Attention: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing
United States Nuclear Regulatory Commission
Washington, DC 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261
LICENSE NO. DPR-23
DRAFT ENVIRONMENTAL STATEMENT
COMMENTS

Dear Mr. Varga:

Carolina Power & Light Company (CP&L) hereby submits its comments from its review of NUREG-1003 "Draft Environmental Statement related to steam generator repair at H. B. Robinson Steam Electric Plant Unit No. 2," transmitted to us in September 1983. Areas of the Draft Environmental Statement (DES) which require revision are listed below. Pages containing typographical errors have been appropriately marked and attached.

(1) Page 2-1, Section 2.1, Paragraph 3

Revise the third sentence to read ". . . to remove sludge buildup occurring on the steam generator tube sheet and tube support plates and . . ."

(2) Page 2-3, Section 2.2, Paragraph 2

Revise the first sentence to read ". . . will result in continuing power reduction, and . . ."

Page 4-10, Section 4.2, Paragraph 3

Revise the fifth sentence to read ". . . tube degradation will continue causing further reductions in power output from the unit." and the sixth sentence to read "Although these power reductions are not anticipated . . . in view of these reductions."

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(3) Page 3-1, Section 3.1(3)

Revise the sentence to read "improving internal blowdown design by the use of two 2 inch internal blowdown pipes for continuous blowdown which provides for a constant removal of impurities from . . ."

(4) Page 3-4, Section 3.2, Paragraph 1

Delete "and partially replacing the steam separation equipment in" from the second sentence. Carolina Power & Light Company will not be replacing the steam separators.

(5) Page 3-4, Section 3.2, Paragraph 1

Revise the last sentence to read: "The new steam generator lower assemblies will be received by rail, and will be stored in a temporary laydown area west of the protected area."

Page 4-11, Section 4.3.1, Paragraph 2

Revise the third sentence to read as above.

(6) Page 3-4, Section 3.2, Paragraph 4

Revise the first sentence to read ". . . in position on a transport trailer." and the second sentence to read "This trailer will carry . . ."

(7) Page 3-4, Section 3.2, Paragraph 5

Revise the first sentence to read "After the lower assemblies . . ." A determination on the sequence for removing the old steam generator lower assemblies (SGLA) from and installing the new SGLAs in containment has not yet been finalized. The sequence of the SGLA movements will not impact the evaluations presented in the DES.

(8) Page 4-9, Section 4.1.2.4, Paragraph 1

Revise the fourth sentence to read "This building is approximately 1500 ft. from the nearest site boundary." The SGLA tomb is approximately 1500 ft. from the nearest site boundary, not 5000 ft. as stated in the DES.

(9) Page 4-10, Section 4.2, Paragraph 2

The first sentence should be revised to read ". . . beginning in July 1984." to reflect the change in the repair program schedule.

(10) Page 4-11, Section 4.3.1, Paragraphs 2 and 6, and Page 5-5, Section 5.6.1, Paragraph 4

Delete information concerning the use of solvents in the decontamination of the steam generators. Carolina Power & Light Company has chosen a grit blast method to be performed by the Westinghouse Electric Corporation. No solvents will be used. See CP&L letter dated July 15, 1983 (Serial: LAP-83-320) for further information.

(11) Page 4-11, Section 4.3.1, Paragraph 3

Revise the first sentence to read ". . . repair will take place on areas within the site boundary previously used as laydown areas during original plant construction."

Page 4-13, Section 4.3.3, Paragraph 1

Delete "within the security fence" from the first sentence.

All construction and associated activities for the SG repair will not be within the security fence (the protected area). Refer to CP&L letter dated August 11, 1983 (Serial: LAP-83-367) and the FSGRR Section 3.1.2 for further details.

(12) Page 4-11, Section 4.3.1, Paragraph 3

Revise the fourth sentence to read "They will be stored on site in a . . ." The SGLAs will be stored on site in the SGLA tomb with their final disposition being decided upon at a later date.

(13) Page 4-13, Section 4.3.2, Paragraph 1

Sentences 2 and 3 of this paragraph are apparently based in part on the information provided in Sections 2.6.2 a) and b) and 6.6.1 of the Final Steam Generator Repair Report. We believe these sentences may be misleading as written and should be replaced by the following:

During previous operations, frequent unit shutdowns for steam generator inspections required significant consumption of water for the purpose of leak testing prior to tube plugging, hydrostatic testing after tube plugging, and maintenance of steam generators in wet-layup. Following repair, the steam generator tubes will remain intact, thereby minimizing the need for periodic inspections and the water consumption requirements associated with the inspections.

(14) Page 5-1, Section 5.2, Paragraph 1

Revise the fourth sentence to read ". . . result in approximately 706 person-rems per steam generator . . ."

Page 5-2, Section 5.3, Paragraph 5 and Page 5-5, Table 5.1

Revise to show an exposure of 2120 person-rem (as shown on Page 4-4, Section 4.1.1.3 and Page 4-9, Section 4.1.2.6(1)).

Carolina Power & Light Company has estimated the total occupational exposure for the repair program to be 2120 person-rem. See CP&L letter dated July 14, 1983 (Serial: LAP-83-317) for further information.

If you should have any questions concerning this transmittal, please contact a member of the Nuclear Licensing Staff.

Yours very truly,

M. A. McDuffie

for A. B. Cutter
Vice President
Nuclear Engineering & Licensing

AWS/ccc (8267NLU)
Attachment

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2 BACKGROUND

The steam generator repair program proposed by CP&L is essentially identical to the steam generator repairs completed by the Florida Power and Light Company (FPL) for Turkey Point Units 3 and 4, and essentially similar to the repairs conducted at Surry Power Station Units 1 and 2. Each of the plants contain two Westinghouse three-loop pressurized water reactors (PWRs). Each plant began operation using a sodium phosphate secondary water chemistry treatment: H. B. Robinson Unit 2 in June 1971 and Turkey Point in late 1974. The Turkey Point repair program was approved June 24, 1981 and repair commenced in June 19, 1981 for Unit 3 and was completed April 7, 1982. Unit 4 repair commenced October 16, 1982 and was completed May 16, 1983.

2.1 History of Steam Generator Operation

H. B. Robinson Steam Electric Plant Unit No. 2 (HBR-2) began commercial operation on March 7, 1971. Like almost all units with U-tube design steam generators, it began operation using a sodium phophate secondary water chemistry treatment. This treatment was designed primarily to remove precipitated or suspended solids by blowdown and was successful as a scale inhibitor.

Eddy current testing began in 1972, when steam generator tube leaks occurred. Upon determining the cause to be caustic corrosion, feedwater chemistry specifications (the sodium to phosphate ratios) at HBR-2 were adjusted to ensure that acceptable caustic conditions would be maintained in the steam generator.

HBR-2 and San Onofre Unit 1 had not experienced phosphate wastage at the rate experienced at other plants using phosphate chemistry during the period when the other PWRs converted to all-volatile-treatment (AVT) chemistry control in the secondary system. Therefore, in 1975, HBR-2 chose not to switch from a sodium phosphate treatment to an AVT chemistry for the steam generator secondary coolant, since the steam generator condition would not be significantly improved and might possibly be degraded. Instead, actions were taken such as "sludge lancing" during outages to remove sludge buildup occurring on the steam generator tube support sheet and condenser air inleakage was more stringently monitored and controlled. Eddy current inspection of tubes during outages was continued to determine tube condition and to monitor the status of tube degradation.

Based on Electric Power Research Institute (EPRI) recommendations, HBR-2 continued to monitor condenser inleakage strictly and to make other modifications to the system to assist in alleviating the inleakage problem. Among these modifications the feedpoint for hydrazine, an oxygen scavenger, and injection into the feedwater system were changed.

In 1980, HBR-2 began experiencing problems with stress corrosion cracking in tubes near the tubesheets. As a result of a high level of stress corrosion cracking activity above the tubesheet area observed during the August 1981

3 DESCRIPTION AND SCOPE OF THE PROPOSED REPAIR

A drawing showing the principal parts of a typical steam generator is presented in Figure 3.1. Figure 3.2 shows the regions where the main cuts are proposed to remove the degraded steam generator. The figure also shows the radiation levels in the work area. A brief description of the CP&L proposed repair procedure follows.

3.1 Changes

A number of changes have been made in the materials, the design, and the operating procedure for the replacement steam generators to ensure that the corrosion and denting problems will not recur. Among the more important of these changes are

(1) using all-volatile-treatment chemistry control in the secondary system from the beginning of operation

(2) changing the flow distribution baffle design to produce greater lateral flow across the surface of the tubesheet to minimize the number of tubes exposed to sludge

(3) improving lateral blowdown design to give 2-in. internal blowdown pipes for continuous blowdown providing for constantly removing impurities from the secondary water systems and steam generators

(4) minimizing the potential for buildup impurities forming in the crevice region by means of full depth expansion of tubes in the tubesheet (The original steam generators were only partially expanded in this region.)

(5) selecting corrosion-resistant material for the support plates using SA-240 type 405 ferritic stainless steel to reduce corrosion in the crevices between the tube and tube support plate, thus minimizing tube denting

(6) thermally treating the Inconel 600 heat exchanger tubes for better corrosion resistance

(7) using a broached hole pattern with a quatrefoil design in the support plates rather than separately drilled flow holes to minimize the accumulation of corrosion products where the tubes pass through the plates

Other plant support systems modifications either have been accomplished or will be accomplished to increase the operating reliability and flexibility and to improve the secondary side resistances to corrosion and consequently minimize the potential for future repairs as a result of corrosion product buildup. Some of the more important changes are:

(1) Remove copper-based alloys condenser tube and replace with Type 439 stainless steel.

(2) Replace feedwater headers with stainless steel tubes.

(3) Replace moisture separator reheater tube bundles with stainless steel.

3.2 Steam Generator Repair

CP&L is planning to repair all three steam generators at HBR-2. The repair will consist of replacing the lower assembly of each steam generator including the shell and the tube bundle and refurbishing and partially replacing the steam separation equipment in the upper assembly. The old lower assembly will be removed from the containment building through the existing equipment hatch and transported to a special storage facility that will be constructed on the HBR-2 site. The new steam generators will be received by rail, and will be stored west of the existing storage area in the yard.

Before initiating the repair work, the unit will be shut down and all systems will be placed in condition for long-term layup. The reactor vessel head will be removed for defueling. All of the normal procedures for fuel cooling and fuel removal will be followed. The fuel will be removed from the reactor and placed in the spent fuel storage facility, and then the reactor vessel head will be replaced. The equipment hatch will be opened and access control will be established. Two to three feet of the biological shield wall will be removed to provide access to the steam generators.

During this preparatory work, the cutting of the system piping will begin. This will include cutting and removal of sections of steam lines, feedwater lines, and miscellaneous smaller lines for the service air and water and the instrumentation systems. The steam generator will then be cut at the transition cone, and the steam dome will be removed and will be refurbished outside containment in a temporary protective enclosure. After the channel cut at the bottom (see Figure 3.2), the lower assembly will be lifted from its support to the working level where it will be welded shut.

Following this, the steam generator lower assembly will be lowered and placed in position on a transport mechanism. This mechanism will carry the assembly through the equipment hatch. A mobile crane will lift the lower assembly onto a transporter that will carry it to the steam generator storage facility on the site. The other two lower assemblies will be lifted from their location, welded shut, and lowered through the same hatch where the first steam generator was removed.

After all three lower assemblies have been removed and stored, their replacements will be transported from the temporary storage location to the equipment hatch. The same machinery used to remove the lower assemblies will be used to install the new assemblies in their cubicles. The steam generator's lower assembly will be reinstalled and rewelded to the old bottom section. The upper assembly with its refurbished internals will be mounted on the lower assembly. After welding the two assemblies together, the piping will be reconstructed.

3.3 Post-Installation Testing

Once the major repair activities have been completed, cleaning, hydrostatic testing, baseline inservice inspections, and preoperational testing of instruments, components, and systems will follow. The reactor will then be refueled

reactors. Although the dose resulting from the steam generator repair will increase the annual occupational dose average of 914 person-rems to approximately 1107 person-rems, this is still well below the 1400 person-rems per reactor annual average which is an upper bound dose average of PWRs experiencing high levels of special maintenance work. The licensee has taken appropriate steps to ensure that occupational doses will be maintained within the limits of 10 CFR Part 20 and the ALARA concept. The additional health risks from these doses over normal risks are quite small, less than 1% of normal risk to the project work force as a whole. The risk to an average individual in the work force will be lower than the risk incurred from participation in many commonplace activities. The individual risks associated with exposures involved in the repair will be controlled and limited so as not to exceed the limits set forth in 10 CFR 20 for occupational exposure. For the foregoing reasons, the staff concludes that the environmental impact from occupational exposure will not significantly affect the quality of the human environment.

4.1.2 Public Exposure

This section contains conservative estimates of the impacts on the public from the proposed steam generator repair project. The major sources of direct radiation and environmental pathways were considered in preparing this section, as shown in Figure 4.1. The section includes doses from radioactive effluents released during the steam generator repair, doses from the storage or disposal of solid radioactive wastes, and the impacts due to solid waste storage.

4.1.2.1 Doses From Effluents

Public radiation exposure from the HBR-2 steam generator repair can be evaluated by comparing the estimated quantities of radioactive effluents from the steam generator repair with annual average releases from normal operations.

The licensee has estimated the amount of radioactivity that will be released in liquid and gaseous effluents as a result of the repair. Those estimates are presented in Table 4.3. The staff has reviewed the licensee's estimates (CP&L, 1983 ~~1971~~) and concluded that they are reasonable. The expected releases from the repair are less than both the final environmental statement (FES) estimates (NUREG-75/024) and the plant's actual annual releases for normal operations.

On the basis of this comparison, the staff concludes that the offsite environmental impact that may occur during the period of this procedure will be smaller than that which occurs during normal operation.

The staff has estimated the doses to individual members of the public as well as the population as a whole in the area surrounding HBR-2 based on the radioactive effluents which the licensee estimated for the repair (summarized in Table 4.3) and on the calculational methods presented in Regulatory Guides 1.109 and 1.113. The staff estimated the total body dose for an adult at the worst site boundary location, 0.27 mile south of the plant resulting from the release of airborne radioactive effluents during the steam generator repair effort. An airborne release source term of 140 Ci, consisting primarily of Xe-133 and Kr-85 (Table 4.3) and an annual average (ground level continuous release) atmospheric dispersion factor of 4×10^{-5} sec/m^3 (Memorandum, March 14, 1983) were used in these estimates. The total body dose from external gamma radiation for

discharges, endangered species will not be directly affected by the replacement program. A colony of red cockaded woodpeckers has been identified on the licensee's property well outside of the security fence. This colony appears to be co-existing with the industrial usage of the property. The stresses to the woodpeckers from the steam generator replacement program are believed to be within the envelope of other stresses of power generation activities at the site and, therefore, no impact is expected.

4.4 Environmental Impact of Postulated Accidents

The design and plant operating parameters that are relevant to accident analyses will not change as a result of a steam generator repair effort. Therefore, the assessment of the environmental impact of postulated accidents presented in the FES of April 1975 (NUREG-75/024) will be unchanged and remains valid.

The safety evaluation also considers accidents that are unique to the repair effort. The accidents considered were accidents that occurred during cutting operations and lifting accidents inside and outside of containment, both from the point of view of damage to the steam generator itself and to nearby components and structures. All the accidents were evaluated with large factors of conservatism. The one with the largest calculated dose was found to be release of activity following the drop of the steam generator outside of the containment building.

About 31 Ci of radioactive materials could be dislodged if the welded end plate over the primary side of the steam generator failed during the drop. The staff estimated that a release of half of the "loose" activity might occur. The limiting potential receptor from the point of view of both breathing rate and dose conversion factors is the teenager's lung. Average meteorological conditions were postulated, and the potential receptor was assumed to be at the exclusion area boundary. The radiological consequence evaluated for these conditions is a dose of about 0.1 mrem. Several areas of conservatism are present in this evaluation: (1) the drop accident itself is unlikely, (2) it is unlikely that the welded end plate could completely fail, and (3) the amount of activity that was considered to be dislodged and released to the environment was conservatively estimated.

Some amount of activity, primarily Co-60, would probably be carried to the site boundary and deposited as "contamination" in case of an actual accident. It is not possible to evaluate quantitatively the amount of activity that actually might be transported to the boundary, mainly because the effects of the factors of conservatism listed above cannot be evaluated. It is the staff's judgment, however, that the amount would be acceptably small.

Compliance with staff guidelines related to postulated accidents involving steam generators is discussed in the Safety Evaluation Report (NUREG-1004, to be published). For the purposes of assessing the environmental impact of accidents, the staff has compared the environmental impact of an accident with 10 CFR 20, which is applicable to normal operation, and concluded that the consequences of accidents are comparable to those allowed during normal operation. The combination of the potential environmental impact with the probability of occurrence of accidents results in a risk to the public that is acceptably small.

Radiation dose to workers from decontamination efforts can vary depending upon the process. The staff views both methods under consideration for primary surface decontamination to be equally effective, with exposure levels in the range 5 to 60 person-rems to be expected from either method. References NUREG/CR-2963 and NUREG/CR-1595 give more detailed information on decontamination methods.

5.6.2 Alternative Disposal Methods

CP&L identified five disposal alternatives for the steam generator lower assemblies once they are removed from containment. These alternatives are presented in Table 5.2 along with licensee's estimates of economic and person-rem costs.

Table 5.2 Disposal alternatives: Economic and radiological costs

Alternative	Applicant's cost estimate	
	1983 dollars	Person-rems
1 Immediate intact offsite shipment without decontamination	2,870,000	30-50
2 Immediate intact offsite shipment with~~oute~~ decontamination	3,361,000	40-70
3 Long-term intact onsite storage	2,858,000	10-20
4 Immediate cut-up and offsite shipment with decontamination	5,396,000	175-350
5 Immediate cut-up and offsite shipment without decontamination	5,637,000	550-1650

NUREG/CR-1595 discusses the radiological costs of several alternative methods for disposing of removed steam generators. This discussion is summarized in Table 5.3. The licensee's estimates of person-rem exposure under each alternative compare favorably with the Table 5.3 estimates.

Based on a comparison of the economic and person-rem costs of these five alternatives (Table 5.2), alternative 1, immediate intact offsite shipment without decontamination, and alternative 3, long-term intact onsite storage, seem best. The licensee plans to proceed with onsite storage of the steam generators. This would still allow CP&L to proceed with alternative 1 should future conditions enhance its desirability.