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KRICH,R.M. Carolina Power & Light Co.
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SUBJECT: Responds to RAI re GL 95-03, "Circumferential Cracking of Steam Generator Tubes."

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Robinson Nuclear Plant
3581 West Entrance Road
Hartsville SC 29550

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United States Nuclear Regulatory Commission
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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
REGARDING RESPONSE TO GENERIC LETTER 95-03, "CIRCUMFERENTIAL CRACKING OF STEAM GENERATOR TUBES"

Gentlemen:

NRC letter dated June 13, 1996, requested additional information regarding our initial response to Generic Letter (GL) 95-03, "Circumferential Cracking Of Steam Generator Tubes," submitted by letter dated June 27, 1995. The additional information was requested to be provided within 30 days of receipt of the request. Since the NRC letter was received on June 21, 1996, the response was to be submitted by July 22, 1996. However, as discussed in our letter dated July 22, 1996, we stated that we would provide the requested information by July 31, 1996.

The enclosure to this letter contains the requested information and a discussion of changes to our plans for steam generator tube inspections to be conducted during the upcoming refueling outage, i.e., Refueling Outage 17. This information is being provided prior to Refueling Outage 17 as committed in our initial response to GL 95-03.

Questions regarding this matter may be referred to me at (803) 857-1802.

Very truly yours,

R. M. Krich
Manager - Regulatory Affairs

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Enclosure
JSK/klb
c: Mr. S. D. Ebneter, Regional Administrator, USNRC, Region II
Ms. B. L. Mozafari, USNRC Project Manager, HBRSEP
Mr. W. T. Orders, USNRC Senior Resident Inspector, HBRSEP

090009

H. B. Robinson Steam Electric Plant, Unit No. 2
Response to Request for Additional Information Regarding Generic Letter 95-03,
"Circumferential Cracking of Steam Generator Tubes"

Request 1

"The following areas have been identified as being susceptible to circumferential cracking:

a. Expansion transition circumferential cracking
b. Small radius U-bend circumferential cracking
c. Dented location (including dented tube support plates) circumferential cracking
d. Sleeve joint circumferential cracking

In your response, areas b, c, and d were not specifically addressed. Please submit the information requested in Generic Letter (GL) 95-03 per the guidance contained in the GL for this area (and any other areas susceptible to circumferential cracking). The staff realizes that some of the above areas may not have been addressed since they may not be applicable to your plant; however, the staff requests that you clarify this (e.g., no sleeves are installed; therefore, the plant is not susceptible to sleeve joint circumferential cracking).

If a voltage threshold is used for determining the severity of dented locations (if applicable), provide the calibration procedure used (e.g., 2.75 volts peak-to-peak on 4-20% through wall ASME holes at 550/130 mix)"

Response 1

All inspections specified below will be conducted in one steam generator. For small radius U-bend (i.e., rows 1 and 2) circumferential cracking, industry experience to date for the Model F Steam Generator (SG) owners indicated that this is not an encountered damage mechanism for Westinghouse Model F SGs, with Inconel alloy 600 thermally treated tubing, i.e., the model of SG currently installed in the H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2. However, we conservatively plan to perform a 20% inspection using rotating probe technology of the rows 1 and 2 U-bend region. This change is provided in accordance with our commitment in our initial response to GL 95-03, dated June 27, 1995, to inform your of any changes to our inspection plans.

With respect to dented intersections (i.e., within +/- 2 inches of support or top-of-tubesheet intersections) for all three SGs, there are approximately 25 indications in SG "A," 175 indications in SG "B," and 70 indications in SG "C." Note that the majority of these indications were identified during the period of time when the voltage threshold used was 2.0 volts regardless of the dent indication location. Thus, identification of these indications as dents with the 2.0 volt threshold was very conservative. There is currently no evidence of any active denting degradation mechanism in the HBRSEP, Unit No. 2 SGs. These areas have not been inspected using rotating probe technology in the past. The industry practice is to inspect those dent indications, caused by magnetite expansion/active denting degradation mechanism, with a rotating probe and a site specified amplitude criterion. Although we are not experiencing active

denting degradation, we are including rotating probe inspections of 100% of our hot leg dented intersection indications with amplitude greater than 2.0 volts as part of our inspection plan. It is well recognized that suspect areas on the hot leg side of a SG are the most susceptible to degradation. As we perform our 100% bobbin coil inspection, we will verify, for any existing dent indication, that there are no significant changes from past inspection results. Any new hot leg dent indications greater that the applicable threshold (i.e., 2.0 volts at a structure, 10.0 volts within the free span) identified as part of our plan will be inspected using a rotating probe.

Sleeve joint circumferential cracking is not applicable to our SGs since there are no sleeves.

A voltage threshold is used to record dent indications at HBRSEP. A threshold of 2.0 volts peak-to-peak regardless of location was used through 1992. In 1993, a change to the threshold was implemented, which involved using a threshold of 10.0 volts for free span dent indications (i.e., dent indications not at a support or top-of-tubesheet) and 2.0 volts peak-to-peak for dent indications at structures in accordance with site-specific Analysis Guidelines. For HBRSEP, the free span dent indications are measured with a 400 Khz differential channel, and the 400/100 mix channel is used to measure dent indications at structures.

The voltage setup is accomplished by setting the 400 Khz differential channel to approximately 5 volts peak-to-peak using the 20% flat bottom holes on the American Society of Mechanical Engineers (ASME) calibration standard. This setting is saved and stored to all other channels.

Request 2

"In your response, it was indicated that the next SG tube inspections would be performed with a bobbin coil with some rotating pancake coil probe examination of manufacturing burnishing mark (MBM) indications. Please indicate whether MBM indications are located at regions susceptible to circumferential cracking.

Furthermore, given that the bobbin coil is not qualified for the detection of circumferentially oriented indications per the Electric Power Research Institute Guidelines which were cited in your response, please discuss the basis for your statement that the planned inspections are effective in detecting precursors to circumferential SG tube cracking as well as actual circumferential cracks (i.e., does data exist that supports that the bobbin coil is capable of reliably detecting prototypic circumferential indications at the locations susceptible to circumferential cracking, thereby ensuring that these regions were, in fact, inspected)."

Response 2

For manufacturing buff marks at intersections within +/- 2 inches of support or top-of-tubesheet intersections for all three SGs, we have approximately nine indications in SG "A," of which two are on the hot leg side, 11 indications in SG "B," of which none are on the hot leg side, and 22 indications in SG "C," of which two are on the hot leg side, one of which is in a plugged tube. As stated in our initial response to GL 95-03, we plan to inspect all hot leg MBM indications within the SG scheduled for inspection by rotating probe regardless of location with respect to structures.

Although bobbin coil eddy current testing (ECT) inspections are not effective in directly identifying circumferential tube cracking, our review of industry experience shows that circumferential cracking is often preceded by precursor damage, such as top-of-tubesheet axial cracking, tube support plate and top-of-tubesheet denting, and short axial intergranular attack regardless of location, that is detectable by bobbin coil ECT. However, since our initial response, we have added a 40% top-of-tubesheet examination using rotating probe technology to our inspection scope for the upcoming Refueling Outage 17, scheduled to begin in September 1996. This change information is provided in accordance with our commitment in our initial response to GL 95-03, dated June 27, 1995, to inform your of any changes to our inspection plans.

Request 3

"During the Maine Yankee outage in July/August 1994, several weaknesses were identified in their eddy current program as detailed in NRC Information Notice 94-88, "Inservice Inspection Deficiencies Result In Severely Degraded Steam Generator Tubes." In Information Notice 94-88, the staff observed that several circumferential indications could be traced back to earlier inspections when data was reanalyzed using terrain plots. These terrain plots had not been generated as part of the original field analysis for these tubes. For the rotating pancake coil (RPC) examinations performed at your plant locations susceptible circumferential during the previous inspection (i.e., previous inspections per your Generic Letter 95-03 response), discuss the extent to which terrain plots were used to analyze eddy current data. If terrain plots were not routinely used at locations susceptible to circumferential cracking, discuss whether or not the RPC eddy current data has been reanalyzed using terrain mapping of the data. If terrain plots were not routinely used during the outage and your data has not been reanalyzed with terrain maping of the data, discuss your basis for not reanalyzing your previous RPC data in light of the findings at Maine Yankee.

Discuss whether terrain plots will be used to analyze the RPC eddy current data at locations susceptible to circumferential cracking during your next SG tube inspection (i.e., the next inspection per your Generic Letter 95-03 response)."

Response 3

As a practice of conservatism to compensate for potential inadequacies in analysis techniques in the past, we have required data analysis personnel to perform a review of terrain plots of RPC data. This practice has been used on RPC data reviewed at HBRSEP by our present ECT vendor. As required by the site-specific Analysis Guidelines, we will continue to review data for RPC inspections, including terrain plots.

Since our initial response we have revised our inspection scope for the next refueling outage based on industry experience as indicated above. The major inspection scope additions since that time are the inclusion of a top-of-tubesheet RPC inspection, and inspection of the rows 1 and 2 U-bends. As indicated in our initial response to GL 95-03, we will be inspecting SG "A," using the scope described in this response and in our initial submittal.