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Progress Energy

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

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION
ON THE STEAM GENERATOR INSERVICE INSPECTION RESULTS

Ladies and Gentlemen:

The steam generator inservice inspection results for Refueling Outage 21 (RO-21) at H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, were submitted to the NRC by letters dated November 11, 2002, November 14, 2002, and February 11, 2003. An electronic mail message received from the NRC Project Manager for HBRSEP, Unit No. 2, on April 10, 2003, requested additional information pertaining to the RO-21 results. The request for additional information was discussed in a conference call on June 11, 2003, between HBRSEP, Unit No. 2, and NRC staff personnel involved in the review of the steam generator inspection results.

The request for additional information provided on April 10, 2003, is contained in the attachment to this letter. The response to the request for additional information is also provided in the attachment.

If you have any questions regarding this matter, please contact me.

Sincerely,

C. T. Baucom
Supervisor – Licensing/Regulatory Programs

CAC/cac

Attachment

c: Mr. L. A. Reyes, NRC, Region II
Mr. C. P. Patel, NRC, NRR
NRC Resident Inspector

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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

NRC Request:

By letters dated November 11, 2002 (ML023170211), November 14, 2002 (ML023220203), and February 11, 2003 (ML030440106), Carolina Power and Light Company, the licensee for H. B. Robinson Steam Electric Plant (HBRSEP), Unit No. 2, provided reports summarizing the steam generator tube inspections performed during their 2002 inspection.

In order for the staff to complete its review of these reports, the following information is requested:

1. Three tubes were plugged in steam generator A (R37C50, R38C50, and R37C51) due to wear near the top of the tubesheet. A loose part was suspected to cause the damage, but none was determined to be present at this location. For two of these three tubes, it was indicated that there was a slight change in the indication between 1999 and 2001, while for one tube there was no indication present during the last inspection (in 1996).

   (a) For the two tubes where there was a change in the indication, please discuss whether a loose part was confirmed to be present during the 1999 inspection and how these indications were dispositioned at that time.

HBRSEP, Unit No. 2, Response:

For the two tubes, R37C50 and R38C50, where a slight change was noted, there was no loose part present during the inspection in 1999. The indications were identified in 1999 as benign geometry conditions, i.e., a manufacturing anomaly, and were left in service. It should be noted that the slight change in these indications is considered very small in magnitude.

Prior to the 1999 inspection, industry information became available related to benign signals at the top-of-tubesheet transition. A paper was presented at the 1998 Steam Generator (SG) Workshop regarding the Surry Unit 2 1997 SG tube inspections, including eddy current and ultrasonic (UT) evaluations. Examples of this data were obtained and used for training and data comparison. Data was also obtained from the similar Turkey Point Units for tubes that had received both eddy current and UT inspections to disposition anomalous signals. This combined data was used for training the data analysts and for comparison when anomalous signals were found in the HBRSEP, Unit No. 2, steam generator tubesheet transitions. Many of these sample anomalous signals include a distortion in the tubesheet transition area on the low frequency channels, indicating an abnormal drilled hole. When the tube fills in this area

during hydraulic expansion, it takes the shape of the anomaly and presents a benign volumetric signal. During the 1999 inspection, a volumetric signal was reported in two of the three tubes as described above, with associated anomalous signals on the low frequency channel. No loose part was identified to be present during the 1999 inspection.

These indications appeared similar to the Surry and Turkey Point benign indications and were treated as such. The indications were not sized at that time because they were classified as benign. The indications were not considered to be caused by loose parts.

In Refueling Outage (RO)-21 in 2002, HBRSEP, Unit No. 2, performed a top-of-tubesheet chemical cleaning in the interest of preserving steam generator integrity. The eddy current data for this outage was obtained after completion of the chemical cleaning and associated sludge lancing. This cleaning resulted in data that had less influence from secondary deposits and confirmed no loose parts were present. As a result, the data was even more definitive than previous data and the indications were classified as volumetric mechanical wear type indications. Deployment of a new process, such as the chemical cleaning, can result in an inspection transient, which was recognized during planning for RO-21. In 2002 (RO-21), indications on both of the subject tubes were sized at 41% throughwall using a conservative technique of a 1/16 inch flat bottom hole wear standard. This is the slight change that was described. Based on their locations, these indications are considered to be manufacturing anomalies that have been present since the steam generators were placed in service. Based on this information, the tubes were conservatively, preventatively plugged.

NRC Request:

(b) If a loose part was present, discuss how the part was determined to be present (e.g., through eddy current testing or visual).

HBRSEP, Unit No. 2, Response:

No loose part was determined to be present in 1999 or in 2002.

NRC Request:

(c) If no part was determined to be present in 1999, discuss the implications with respect to your ability to assess the potential for loose parts damage, in general. In addition, if no loose part was determined to be present in 1999, discuss what actions were taken to rule out the potential that the indications were caused by another degradation mechanism (e.g., corrosion). The staff notes that the affected tubes are not located in the periphery of the steam generator where loose part damage normally occurs.

HBRSEP, Unit No. 2, Response:

In order to detect a potential loose part, a low frequency channel scan is performed at 35 kHz for bobbin and rotating coil inspections, which is the industry-recognized technique for such an inspection. Based on the discussion in item (a) above, HBRSEP, Unit No. 2, has no reason to question the effectiveness of this technique.

Also, as mentioned previously, in 1999 these indications were concluded to be tubesheet anomalies based on the comparison to similar plant data where UT inspections and pulled tube analyses have been performed. To assess the indication characterization, the data was compared against a known volumetric wear type indication identified inbundle in SG "C" in RO-20 (2001), and for which UT was deployed to further characterize the indication. They were also compared to previous known loose part/mechanical wear type indications for which visual inspection information is available. These investigations identified that the indications in these three tubes were closely comparable to these known past volumetric/mechanical wear type indications. As indicated above, it is more likely that these indications are manufacturing anomalies that have been present since the steam generators were placed in service.

NRC Request:

2. For the loose part located near the tube in steam generator B at Row 34 column 43, please discuss how the loose part was determined to be present. Please discuss whether the part was removed. Please discuss the nature of the part.

HBRSEP, Unit No. 2, Response:

A loose part signal was detected during a rotating coil inspection low frequency scan. Based on the eddy current signal, steam generator geometry, and a bounding examination of the surrounding tubes, the part was determined to be small in volume and not expected to affect the surrounding tubes, and therefore the part was not removed. The surrounding tubes were examined using a plus point coil and no indications were identified. The wear was small and sized at 20% throughwall. The tube was conservatively, preventatively plugged and staked. The tube was last examined in 1998 with no indication present.

NRC Request:

3. For the indication in steam generator C at Row 45 Column 41, it appears that the degradation grew over the course of an operating cycle from "non-detectable" to 50% through-wall. Discuss what was done to confirm that this indication is from loose parts. Discuss the implications of these results.

HBRSEP, Unit No. 2, Response:

The indication was determined to be volumetric in nature, as there was no axial or circumferential component evident during analysis of the data that was comparable to known wear type indications identified during past inspections. There was no evidence of corrosion degradation. The indication was present just below (0.42 inches) the lower surface of the sixth tube support plate, in a peripheral point tube (a "corner" tube) in an area where upward flow could likely drive a loose part into this location. This further reinforces the fact that this indication was due to wear from a transient loose part. In addition, adjacent tubes were examined with no indications identified, and data analysis revealed the loose part to no longer be present. Also, HBRSEP, Unit No. 2, currently includes peripheral tubes, typically two tubes in from the periphery, as part of the sample plan for each eddy current inspection and has done so since the Fall 1999 outage (RO-19).

Additionally, HBRSEP, Unit No. 2, typically performs sludge lancing each outage. As part of that process, a post-lancing close-out visual inspection is performed in the annulus and blowdown lane regions to assess vendor performance and to look for loose parts/foreign material. In addition, during RO-21 in October 2002, a visual inspection of eight selected columns inbundle in steam generator "C" was performed both before and after the chemical cleaning.

NRC Request:

4. Wear and a distorted support indication (DSI) was reported in steam generator B for the tube located in row 24 column 65. Please clarify this "indication type." Please discuss the results of any rotating probe exams for this indication.

HBRSEP, Unit No. 2, Response:

A rotating coil examination was performed and the indication was determined to be volumetric in nature, as there was no axial or circumferential component evident during analysis of the data that was comparable to known wear type indications identified during past inspections. The indication was within the support (second tube support plate on the hot leg side) and between the land contact areas. No low frequency signal indicative of a loose part was detected. The signal was determined to be from a transient loose part and the tube was preventively plugged. Industry operating experience based on visual inspections at tube support plates has identified this potential.

This indication was initially classified as a distorted support indication (DSI) from the bobbin coil examination. A DSI is indicative of potential degradation within a support. Further diagnostics using the rotating coil are performed on such indications. In this case, the additional examination using the rotating coil resulted in this indication being classified as "wear" as described above. The indication was sized at 30% throughwall and the tube was conservatively, preventatively plugged. The tube had last been

examined in 1998 (RO-18) using a bobbin coil and no indication was present. In addition, five surrounding tubes were examined in RO-21 with no indications present.

NRC Request:

5. Please clarify whether the indication in tube R4C39 in steam generator A is located within the confines of the tube support plate or whether the indication is below the plate. If the indication is below the support plate, clarify whether the indication is attributed to loose parts wear or mechanical wear with the tube support plate.

HBRSEP, Unit No. 2, Response:

The subject indication is just below the support (0.32 inches, third tube support plate on the cold leg side) with no low frequency signal indicative of a loose part detected. The indication was sized at 37% throughwall. The indication was determined to be from a transient loose part and the tube was preventively plugged. The tube was last examined in 1996 (RO-17) and there was no indication present. In addition, four surrounding tubes were examined in RO-21 with no indications present.

NRC Request:

6. A number of tubes were reported in your November 14, 2002, submittal with indications on both the hot-leg and cold-leg side of the steam generator. Some of these indications were reported in previous inspections (refer to ML021900019) and were primarily attributed to prior maintenance activities (e.g., sludge lancing or wrapper modification) or to transient loose parts. For each of the indications detected during the 2002 outage:

   (a) Discuss how these indications were detected (e.g., bobbin coil, rotating probe).

HBRSEP, Unit No. 2, Response:

Each indication was initially detected with the bobbin coil probe.

NRC Request:

   (b) Discuss the nature of these indications (e.g., loose part wear, wear due to sludge lance equipment, etc.).

HBRSEP, Unit No. 2, Response:

Transient loose part wear and mechanical wear due to contact with maintenance equipment are indistinguishable when reviewing an eddy current trace. Given the nature of these indications, it is clear that they are one type or the other. Of these, a number have been confirmed to be volumetric wear type indications through visual inspection. It should be noted that HBRSEP, Unit No. 2, performs close-out visual inspections of the annulus and blowdown lane of each steam generator after each sludge lancing evolution, which is currently performed every outage. The location of the indications with respect to the tubesheet surface and tube bundle further substantiates this conclusion. Given their relatively consistent height above the tubesheet, contact with maintenance equipment is considered the most likely cause of these indications.

NRC Request:

(c) Discuss whether these indications have changed with time (provide an analysis of the progression of each indication from the time it was first detected until the present).

HBRSEP, Unit No. 2, Response:

As part of the eddy current sample plan, HBRSEP, Unit No. 2, examines selected previous indications for possible changes since the first time an indication was observed. Significant changes could be indicative of the onset of active degradation. HBRSEP, Unit No. 2, has observed no discernable changes in these indications that could be representative of such a precursor. These indications will continue to be monitored in accordance with planned inspection activities.

NRC Request:

(d) Discuss what actions, if any, have been taken to confirm the cause of the degradation.

HBRSEP, Unit No. 2, Response:

A rotating coil examination was performed on these indications when initially detected, and they were determined to be volumetric in nature, as there was no axial or circumferential component evident during analysis of the data. The indication was comparable to known wear type indications identified during past inspections, and a number have been confirmed to be volumetric wear type indications through visual inspection. In addition, these small peripheral indications just above the top-of-tubesheet were re-examined with a rotating coil in RO-21 with no significant changes identified.

NRC Request:

(e) If the indications have changed with time, discuss the potential that an active mechanism (e.g., corrosion) may be the cause of some of these indications.

HBRSEP, Unit No. 2, Response:

The indications have not changed with time.

NRC Request:

7. It appears that there are (and have been) several tubes affected by loose parts. Discuss whether loose parts are routinely removed from the steam generator upon identification. Discuss the source of these loose parts. Discuss what actions, if any, were taken during the 2002 outage to remove loose parts from the steam generator.

HBRSEP, Unit No. 2, Response:

As indicated in the preceding information, HBRSEP, Unit No. 2, inspects for the presence of loose parts using both visual and eddy current techniques. Wear type indications are investigated using a low frequency scan to determine the presence of a loose part. Visual inspections are comprised of an inspection of the annulus and blowdown lane, and during some outages, inspections down some columns within the tube bundle. The visual inspection program also utilizes feedback from the eddy current inspection, in some cases obtaining actual videotape of specific flaws. In Spring 1996 (RO-16), a full bundle top-of-tubesheet inspection was performed.

Identified loose parts are assessed for the potential to cause tube damage, and those determined to be detrimental are either removed or analyzed and tracked with potentially affected tubes being included in the scope of future examinations. For those that are tracked and have subsequently been inspected, no further degradation has been identified. The loose parts typically seen result from either maintenance activities on the secondary side of the plant (e.g., small wire brush remnants, small screws, small machining windings/remnants) or degradation of secondary system components through normal plant operation (e.g., small pieces of flexitallic gaskets). In 2002 (RO-21), a visual inspection of the annulus and blowdown lane in each steam generator was performed, as well as an inspection of eight tube lanes in steam generator "C." Four small items were retrieved during RO-21.

NRC Request:

8. The NRC staff was notified shortly after the 2002 inspection outage that tube R6C35 in steam generator C had a restriction of manufacturing origin near the top

of the tubesheet. The tube would not pass a 0.700-inch probe but it passed a 0.680-inch probe. With respect to this finding, please address the following:

(a) Please clarify the size of the bobbin probe used during the general inspection. The staff notes that most plants with 7/8-inch outside diameter tubing typically use a 0.720-inch probe. The brief description of the results may lead one to conclude that a 0.700-inch probe is being used for the "general" inspection.

HBRSEP, Unit No. 2, Response:

A 0.720 inch probe was used for the bobbin inspection program. A 0.700 inch diameter bobbin probe is not being used for the general bobbin inspection. The information provided via e-mail dated November 12, 2002, was regarding a rotating coil (RC) probe inspection of this tube at the top-of-tubesheet on the hot leg side. The identification of "restricted" within the report is a misnomer in that the tube was not examined with a 0.680 inch diameter probe because it was restricted, but because of an issue with data quality. The tube is not "restricted."

During the examination with the 0.700 inch diameter RC probe, the data obtained was of questionable quality due to difficulty with probe rotation due to the tube geometry at the expansion transition. Actually, this tube is not "restricted." The code of "restricted" was used as a "best fit" for a tube that required a smaller diameter RC probe. The tube received a full-length bobbin examination with the 0.720 inch probe in RO-20. The smaller (0.680 inch diameter) RC probe was used to accommodate a geometry change in the tube to obtain a less noisy examination and better data quality. Both the 0.700 inch diameter and the 0.680 inch diameter RC probes are authorized for use by the applicable examination technique specification sheet (ETSS). This geometry condition has been previously experienced with this tube and it shows no change from the previous examination. Either size RC probe is acceptable, since the coils are surface riding and the spring-flex range of the probe tracks the inner diameter of the tube.

At the time of the November 12, 2002, e-mail, the final report was in review and the information regarding this tube has since been clarified in the report.

NRC Request:

(b) What was the largest size probe that ever passed through the 'restricted' tube? How many times has it been inspected since the steam generators were installed?

HBRSEP, Unit No. 2, Response:

The tube was inspected with a 0.720 inch diameter bobbin probe in May 2001 (RO-20). The tube was inspected with a 0.720 inch diameter bobbin probe in 1984 (baseline), 1987, 1988, 1990, 1992, 1995 and 2001. The first RC examination was performed in

2001 (RO-20) and it was inspected with a 0.680 inch diameter RC probe. It was not initially inspected with a 0.700 inch diameter RC probe in 2001 (many tubes were examined with a 0.680 inch diameter probe, since there were other tubes that needed the smaller diameter probe and it was "on station" at the time the tube at R6C35 was examined).

NRC Request:

(c) If the tube passed a larger probe than 0.680-inch in the past, what is the basis for concluding that the tube became restricted from a manufacturing geometric indication? Was this manufacturing indication present since baseline? If so, has it changed? Were any additional examinations performed on this tube besides the bobbin coil examination.

HBRSEP, Unit No. 2, Response:

The tube is not "restricted." This is a misnomer and the subject code was used as a "best fit." This has since been clarified in the report. This tube was previously examined using a 0.680 inch diameter RC probe (qualified per ETSS) in 2001 (RO-20). The condition experienced with liftoff of a 0.700 inch diameter RC probe was first seen in 2002 (RO-21), and based on this being a geometric indication, it has been in existence since the steam generators were placed in service in 1984. The tube shows no change from the previous examination and no degradation has been noted. The tube received a bobbin examination in RO-20 with a 0.720 inch diameter bobbin probe. Further historical bobbin examinations are provided above.

NRC Request:

(d) Was the tube plugged?

HBRSEP, Unit No. 2, Response:

The tube was not plugged, since it is not degraded and has not exceeded any of the plugging criteria or limits.