May 7, 2003

MEMORANDUM TO: Allen G. Howe, Chief, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

FROM: Eva A. Brown, Project Manager, Section 2 /***RA***/
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: SAINT LUCIE UNIT 2 - SUBMISSION OF DRAFT REQUEST FOR ADDITIONAL INFORMATION AND SUMMARY OF A CONFERENCE CALL REGARDING STEAM GENERATOR TUBESHEET AMENDMENT (TAC NO. MB7317)

On April 14, 2003, the attached request for additional information (RAI) in draft form (Attachment 1) was forwarded to Florida Power and Light (FPL, the licensee). The RAI is related to FPL's application to amend the Saint Lucie Unit 2 Facility Operating License (NPF-16) to modify the definition of steam generator (SG) tube inspection as contained in Technical Specification 4.4.5.4.a.8 for operating Cycle 14.

During discussions held on April 16, 2003, between U.S. Nuclear Regulatory Commission (NRC) staff and the licensee, the licensee indicated that Saint Lucie was participating with the industry on the generic resolution of the tubesheet inspection issue. Consistent with that effort, FPL had submitted a letter dated March 31, 2003, which revised the scope of the Unit 2 planned SG inspections during the upcoming outage. The inspection was modified to exceed the scope described in the application by revising the depth of the inspection with Plus Point probes inside the tubesheet to a minimum of 7 inches, as referenced from the bottom of the tube expansion transition for all active hot leg tubes. Additionally, any detected degradation within or below the 7-inch inspection zone would be plugged.

During the discussion, the NRC staff indicated it was addressing the inspection of the SG tubes in the tubesheet region generically and that previously other plants did not have approval of an amendment prior to start-up. However, the NRC staff did indicate that it would be interested in discussing the SG inspection results with the licensee prior to completion of the spring 2003 Unit 2 outage. Based on its participation in the pending resolution of the generic issue, an intention to modify the requested duration of the proposed amendment from one operating cycle to a permanent change, the change in inspection scope consistent with the March 31, 2003, letter and feedback from the NRC staff, the licensee indicated its intention to withdraw the application and resubmit it at a later date.

As the licensee intends to withdraw the amendment, the NRC staff has decided not to formally issue the attached RAIs to FPL. A list of participants on the conference call is attached (Attachment 2).

Docket No. 50-389

Attachments: As stated

cc w/attachments: See next page

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REQUEST FOR ADDITIONAL INFORMATION (RAI)

STEAM GENERATOR TUBESHEET AMENDMENT REQUEST

FLORIDA POWER AND LIGHT

SAINT LUCIE UNIT 2

DOCKET NO. 50-389

Technical Specifications (TSs):

1. A key assumption in determining the extent of the inspection into the tubesheet (i.e., from the top of the secondary face of the tubesheet) is that the tube is not degraded. As currently written, the TSs would permit flaws in this region to remain in service provided they did not exceed the tube plugging limit (i.e., flaws that are less than 40-percent through-wall could remain in service).

Discuss plans for assessing flaws in this region. If the plans include allowing flaws to remain in service in this region, provide the technical basis that a flaw at the tube repair limit will not affect the structural and leakage integrity of the tube (flaw growth and non-destructive examination (NDE) uncertainty should be accounted for in this analysis). If the plans do not include allowing flaws to remain in service in this region, discuss the need to modify the TSs to clarify this.

2. As currently written, the TSs are not specific with respect to the types of probes to be used in the region near the top of the tubesheet and/or the capabilities of such probes (e.g., the inspection shall be capable of detecting all flaw types that may potentially occur at specific locations along a tube).

Since the inspection distance was based on tubing that was not degraded, discuss the plans for inspecting the region of the tube below the secondary face of the tubesheet such that all potential flaws in this region will be reliably detected (i.e., the inspection technique must be capable of finding axial and circumferential cracks as well as other forms of degradation present in the top several inches of the tubesheet (5-inches based on the current analysis)). In addition, discuss the need to modify the TSs to be specific on the types of inspections that must be performed in this region.

3. The 5-inch proposed inspection distance is based, in part, on the amount of tube engaged within the tubesheet. This engagement starts at the bottom of the expansion transition.

Discuss the need to modify the inspection requirements in the TSs to specify that the 5-inch inspection distance into the tubesheet is from the top of the tubesheet or the bottom of the expansion transition, whichever is lower. The Nuclear Regulatory Commission (NRC) staff recognizes that the uncertainty term used in determining the 5-inch inspection distance may account for more than the uncertainty in determining the inspection distance; however, in order to rely on an argument that the uncertainty term accounts for the variability in the position of the bottom of the expansion transition relative to the top of the tubesheet, the following information would need to be quantified:

a) the uncertainty associated with determining the inspection distance (i.e., measuring from the top of the tubesheet or from the bottom of expansion transition to some specified distance (e.g., 5 to 8 inches)), and

b) the maximum distance the bottom of the expansion transition can be from the top of the tubesheet (based on as-built (or field) measurements).

4. It was noted that incomplete expansions have been detected in operating plants and the inspection length criterion would not be applied to those tubes.

Clarify this requirement within the TSs, if this condition applies. Also discuss the type of inspections performed on these tubes in the tubesheet region (e.g., rotating probe examination for the entire portion of tube within the tubesheet).

Leakage Analysis

5. Clarify the statement that "the leak rate criterion was derived from the MSLB [main steam line break] accident induced leak rate limit of 0.5 gallons per minutes (gpm) per steam generator, which is bounding based on the traditional limiting condition for operation limit for event initiation."

6. Provide the basis for the assumption that only a certain fraction of the tubes will have through-wall flaws in the tubesheet region. This explanation should address, but not necessarily be limited to, why only a certain fraction of tubes would exhibit through-wall flaws given the plant has a 40- (or potentially 60-) year license. In addition, it should specifically address what data is available supporting the flaw density assumption in the lower region of the tubesheet. Alternatively, propose a technically justifiable methodology for projecting the number, severity, and location of flaws in the tubesheet region to be used in predicting the amount of leakage for comparison to the acceptance limit (0.5 gpm per the proposal). Also address whether all degradation modes that can be present in the lower part of the tubesheet are addressed in this analysis (e.g., axial and circumferential cracking, etc.).

7. In determining the amount of leakage from the steam generator, a fraction of the tubes are assumed to have through-wall flaws and that they leak at the rate determined during the testing program.

Which leak rate value from the testing program is used during this analysis? If not the bounding leak rate, provide the basis for not assuming the bounding leak rate (see general comment below).

8. The leak rates for various test specimens were determined without the effects of the dilation of the tube holes as a result of bowing of the tubesheet. This hole dilation will result in increased leakage for a given size flaw in the upper half of the tubesheet. To account for this effect it is presumed that an additional allowance to the inspection distance to account for the potential increased leakage as a result of bow during a steam line break was added. Essentially, this equates to stating that a flaw at a specified depth (say 3-inches) without dilated holes will leak the same as a flaw at a deeper depth (say 5-inches) when the holes are dilated.

In this example, the inspection distance allowance for tubesheet bow was assumed to be 2-inches (the numbers above are for illustrative purposes only).

Discuss the basis for assuming that the adjustments to the inspection distance actually accounts for the effects of tubesheet bow (hole dilation) during a steam line break and results in a reasonable prediction of the amount of leakage. The NRC staff recognizes there may be conservatisms in the leak rate analysis (e.g., use of metal disintegration machining (MDM) cut specimens); however, additional data is needed to determine whether the conservatisms in the analysis actually account for the effects of tubesheet bow (hole dilation).

9. The data in Table 5-1 does not appear to match the data in Appendix C. In particular the average leak rates for specimens 7 and 10 listed in Table 5-1 do not appear to be consistent with the data in Appendix C.

Clarify (were the room temperature tests combined with the operating temperature tests?).

10. It was indicated on page 23 of WCAP-15975-P, Revision 0, "NDE Inspection Strategy for the Tubesheet Region in St. Lucie Unit 2," that after the basis test program, additional tests were performed.

Discuss the reason for these additional tests, and the results.

11. The NRC staff notes that with increased pressure it would normally be expected that (1) the joint would be tighter, resulting in less leakage and (2) the driving force for the leakage would be greater, resulting in more leakage. Therefore, it is not clear whether a lower (or higher) steam line break pressure would be conservative. The NRC staff also notes that the test program data does not appear to support a tighter joint at increased pressures (at least in the range of interest, which is from operating pressures to steam line break pressures).

What is the pressure assumed to be observed during a steam line break? Was the pressure used during the leak rate tests conservative with respect to this value?

12. Figure 5.3 of WCAP-15975-P provides a plot of leak rate as a function of joint length for the single tube mockup leak tests at room temperature and normal operating temperature.

Clarify whether this figure includes all of the single tube mockup leak data discussed in WCAP-15975-P. If not, why not?

Structural Integrity

13. Discuss the basis for not using the load at first slip in determining the required tube engagement area. The NRC staff notes that the tube may not pull out of the tubesheet after it initially begins to slip; however, if the inspection distance is based on the maximum load, a tube may separate resulting in increased leakage from these tubes during a steam line break. Discuss how this effect was accounted for in the leakage analysis. The NRC staff notes that W-star was based on the load at first slip. Provide a reanalysis of the inspection distance using the load at first slip as the basis. Include in this analysis the reduction in contact load from tubesheet bow at various distances within the tubesheet.

14. The goal of the inspection program is to ensure that all tubes meet the performance criteria. In this case, the goal (from a structural integrity standpoint) is that no tubes pull out from the tubesheet. To ensure this, it would seem appropriate to use the worst-case test results in determining the inspection distance unless tube specific information is available that would permit determining the pullout length on a per tube basis.

Provide an analysis of the inspection distance using the worst-case test results (i.e., the specimen which exhibited the least resistance to pullout per unit length during the test). This analysis should be based on the load at first slip.

15. The NRC staff notes that you indicate the worst-case specimen is not consistent with the rest of the data and it was considered anomalous on the basis of bore surface variability in the fabrication of the specimen; however, it is not clear that this may not represent standard variations that may be present in the field. To eliminate data, it must be demonstrated that the test was invalid and all data in the database must be evaluated in the same manner (to ensure the database is not biased).

For the datapoint with the lowest pull force, discuss what surface roughness data supports the conclusion that this bore surface roughness cannot occur in the field.

16. From a structural integrity standpoint, a tube must withstand pullout during normal operation with a margin of 3, and it must be able to withstand pullout during postulated accidents with a margin of 1.4. The submittal indicates a pullout during normal operation with a factor of 3, but for pullout during postulated accidents it is stated that the normal operation criterion is conservative relative to the 1.4 criterion during postulated accidents (including accounting for the dilation of the tubesheet holes). The NRC staff recognizes that the axial loading acceptance criteria is greater with a margin of 3 against normal operation than with a margin of 1.4 against accident loadings; however, the amount of tubesheet bow, the temperature, and pressure are different under postulated accident conditions.

Provide the analysis which demonstrates that the pullout distance during normal operation is more conservative than the pullout distance during postulated accidents using the appropriate safety factors. In addition, please clarify whether the loss of contact pressure values associated with tubesheet bow provided in Section 6.0 are associated with normal operation or steam line break.

17. Once degradation is observed in the upper region of the tubesheet, it would be expected that additional degradation would be observed in this region in the future.

Given that the inspection distance is based on non-degraded tubing, discuss the need to increase the inspection distance (from a structural integrity standpoint) to account for the potential for degradation to initiate, or for non-detected indications to grow, over the next operating cycle. Increases in the inspection distances (from a leakage integrity standpoint) would be needed if through-wall flaws were expected to be observed in this region at the time of the next inspection.

18. Discuss whether it was verified that MDM cutting did not result in solidification at the tube-tubesheet interface. It was only indicated that there was no evidence that this occurred.

19. Section 3.1.3 of WCAP-15975-P discusses supplemental in situ pressure testing pullout tests.

Discuss how these tests were performed and the results of these tests. Please discuss whether any tests were performed in the pressure range of interest (at and below postulated accident differential pressures).

20. Figure 4.6 of WCAP-15975-P plots the Boston Edison and single tube mockup results on the same graph. Only specimens tested at room temperature and pressure were plotted. The data were adjusted to account for material properties, process, and tube wall thickness differences.

Discuss how these adjustments were made and their technical basis. Discuss why all test specimens were not included in this graph, given that the test results indicate no significant increase in contact pressure when the temperature and pressure were raised. Regardless of the answer, provide a plot with all of the data distinguishing the Boston Edison data from the single tube mockup specimens and distinguishing those performed at ambient pressure and temperature from those performed at operating pressure or temperature.

21. Discuss why all of the Boston Edison data in Appendix B of WCAP-15975-P is not used in the analysis of Section 4 of WCAP-15975-P. Include all of the data in the analysis unless the tests were invalid. If invalid, provide the reasons why they were invalid.

22. In Section 6.0 of WCAP-15975-P a process anomaly was mentioned and indicated that this was discussed in Section 4.2. Section 4.2 does not appear to discuss this process anomaly and its potential effect on the pullout tests performed at pressure.

Discuss the process anomaly referenced in Section 6.0 of the WCAP and the potential effect on the pullout tests performed at pressure.

23. In Table 4-2, the actual joint length for specimens 20 and 21 were not recorded.

Provide the actual joint length for specimens 20 and 21.

<u>General</u>

24. The test data for the pullout tests indicate that temperature and pressure may not play a critical role in determining the tube engagement area (i.e., the length of tube needed to resist tube pullout). The leakage test data, however, indicate that the leakage value at normal operating temperature was comparable to the leakage value determined at room temperature for one specimen, whereas for the other specimen the leakage at normal operating temperature was significantly less than the leakage value determined at room temperature. As a result, it would appear that the test data is inconclusive on the effects of temperature on joint tightness.

Discuss plans for (a) either performing additional testing to further refine the structural or leakage analysis to determine whether temperature and pressure play a significant role in the tightness of the joints or (b) taking a conservative approach (i.e., using the most conservative results) in assessing the structural and leakage integrity of the tubes.

Inspection Results

25. Discuss whether the bobbin probe was (will be) used to inspect the lower portion of the tubesheet during the spring 2003 outage and what forms of degradation the bobbin probe is qualified to detect in this region.

26. Discuss the number, severity, and location (with respect to the top of the tubesheet) of all flaws detected below the bottom of the expansion transition. Include in this information the outage in which the flaw was detected, the type of degradation, and the probe which detected the degradation (e.g., rotating probe, bobbin probe, transmit-receive probe, etc.). Results from the 2003 outage, when available, should be provided.

27. Clarify whether all tubes with imperfections within the tubesheet region were plugged.

PARTICIPANTS

NUCLEAR REGULATORY COMMISSION CONFERENCE CALL

WITH FLORIDA POWER AND LIGHT

APRIL 16, 2003

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