December 16, 2004

Mr. J. A. Stall
Senior Vice President, Nuclear and
Chief Nuclear Officer
Florida Power and Light Company
P.O. Box 14000
Juno Beach, Florida 33408-0420

SUBJECT: ST. LUCIE PLANT, UNIT 2 - REQUEST FOR ADDITIONAL INFORMATION REGARDING PROPOSED LICENSE AMENDMENT TO DEFINE THE DEPTH OF REQUIRED TUBE INSPECTIONS AND CLARIFY THE PLUGGING CRITERIA WITHIN THE TUBESHEET REGION OF THE ORIGINAL STEAM GENERATORS (TAC NO. MC5084)

Dear Mr. Stall:

By letter dated November 8, 2004, Florida Power and Light Company submitted an amendment request to revise the Technical Specification (TS) Section 4.4.5.4 to modify the definitions of steam generator tube “Plugging Limit” and “Tube Inspection,” as contained in TS Items 4.4.5.4.a.6 and 4.4.5.4.a.8, respectively, for St. Lucie Unit 2. The purpose of these modifications is to define the depth of the required tube inspections and to clarify the plugging criteria within the tubesheet region.

The U.S. Nuclear Regulatory Commission staff has reviewed your submittal and finds that a response to the enclosed Request for Additional Information is needed before we can complete the review. This request was discussed with your staff on December 9, 2004, and Mr. George Madden indicated that a response would be provided by January 14, 2005. If you have any questions, please feel free to contact me at 301-415-3974.

Sincerely,

/RA/

Brendan T. Moroney, Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No.: 50-389

Enclosure: Request for Additional Information

cc w/encl: See next page

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December 16, 2004

Mr. J. A. Stall
Senior Vice President, Nuclear and
Chief Nuclear Officer
Florida Power and Light Company
P.O. Box 14000
Juno Beach, Florida 33408-0420

SUBJECT: ST. LUCIE PLANT, UNIT 2 - REQUEST FOR ADDITIONAL INFORMATION REGARDING PROPOSED LICENSE AMENDMENT TO DEFINE THE DEPTH OF REQUIRED TUBE INSPECTIONS AND CLARIFY THE PLUGGING CRITERIA WITHIN THE TUBESHEET REGION OF THE ORIGINAL STEAM GENERATORS (TAC NO. MC5084)

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Sincerely,

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Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No.: 50-389

Enclosure: As stated

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION

FLORIDA POWER AND LIGHT COMPANY

ST. LUCIE NUCLEAR POWER PLANT, UNIT 2

DOCKET NUMBER 50-389

1. Please provide the expected normal operating differential pressure for the length of time that this amendment will be implemented.

2. Please discuss the expected condition of your tube-to-tubesheet joint. For example, discuss whether you would expect minor corrosion at the top-of-the-tubesheet (similar to what might have been present in some of the test specimens) or whether there is any sludge buildup at the top of the tubesheet.

3. The licensee assumed that the tubesheet joints on the cold-leg side would not leak since less stress corrosion cracking is expected on the cold-leg side due to the lower temperatures. Given that stress corrosion cracking could potentially occur on the cold-leg side, discuss the need to modify the methodology such that leakage from cracks on the cold-leg side would be accounted for once cracking begins to develop.

4. Please clarify whether the proprietary value for the uncorrected joint length listed on page 4-8 is correct.

5. Please clarify whether the last sentence in section 2.1 should indicate that the referenced joint lengths were "corrected" for tubesheet dilation and non-destructive examination positional uncertainty.

6. Please clarify the statement on page 3-9 which indicates that the "average load was determined by normalizing the load to a one-inch engagement length and averaging the total data." The staff was under the impression that the pullout force was determined from Figures 5-1 through 5-3 using a lower 95 percent bound to the data.

7. Did slipping occur at any locations (e.g., in the grips) other than the tube-to-collar joint during the pullout testing? If so, discuss the effect on the results.

8. Was the simulated tubesheet (collar) hole surface finish measured for the test samples? If so, compare the measured surface finish for the smooth and rough bore samples. How do these surface finishes compare to those expected for smooth and rough bore steam generator tubesheet holes?

9. Contact loads were calculated from the pullout load and coefficient of friction as part of the tubesheet deflection analysis. Was the coefficient of friction determined from testing performed on prototypical Combustion Engineering design samples? Discuss whether this coefficient of friction applies to both smooth bore and rough bore tubesheets.

10. In the evaluation of the required joint length to resist tube pullout, the slope of the bounding (95 percent) regression line illustrated in Figures 5-1 through 5-3 were used. Given that all tubes should resist pullout from the tubesheet, confirm that if the force per unit length for the most limiting specimen were used to determine the required length of

expanded tube needed to resist pullout that this length would still be less than the proposed inspection distance (10.1 inches).

11. In several places, the basis for selecting 600EF for the leak rate testing was discussed (e.g., pages 3-1 and 4-3). The basis appears to rely on past precedent for a degradation mechanism at a different location. Given the differences in the location of the degradation and the effect that pressure and temperature can have at sealing the crevice between the tube and the tubesheet, it would appear that in this case, consideration must be given to the range of temperatures and pressures that could occur during the various design basis accidents. To this end, please confirm that the combination of pressure and temperature used in determining the "accident induced leakage per joint" (i.e., 2560 pounds per square inch at 600EF) bounds the leakage from other combinations of pressure and temperature that may be experienced during your design basis accidents.

12. In determining the "cumulative no-dilation joint length," the effects of pressure and temperature were addressed analytically. Discuss whether the actual pullout and leak rate data support the magnitude of this analytical adjustment. For example, do the pullout test data indicate that the pullout strength for the hot, pressurized samples is greater than the ambient pressure, room temperature tests by the amount of the analytical adjustment?

13. It was indicated that during the leak testing program that the pump stroke volume was measured periodically and that the exact pump stroke volume was used for each test. Please provide the pump stroke volume for each test. In addition, for each leak rate test performed at the Churchill facility, please indicate whether the leak rates were measured through condensing the leakage or whether they were calculated based on pressure changes on the secondary side environment.

14. Please describe the Churchill facility and provide additional detail of how the leak rates were determined. In particular, address how the density of superheated steam was used in determining the leak rate.

15. In several instances, it was indicated that all samples were tested at room temperature before testing at elevated temperatures (e.g., pages 4-2 and 4-3). Please clarify this statement. For example, Specimen 1 was tested at room temperature, elevated temperatures, and then again at room temperature (see bottom of page 4-1). In addition, several joint lengths were made from each specimen (e.g., Sample 2 had joint lengths of 3, 2, and 1.5 inches). As a result, it is not clear how the room temperature tests of the 1.5-inch joint could have been performed before the elevated temperature test of the 3-inch joint. See related questions regarding whether the elevated temperatures may have affected the leak rates of subsequent room temperature tests.

16. On page 4-3, it was indicated that a few tests had pressures and temperatures outside the targeted range and were not included in Appendix B. Please provide this data. In addition, please discuss whether any of this excluded data would have resulted in a more conservative leak rate estimate (e.g., were the leak rates for any of the excluded data points significantly greater than the bulk of the data retained given the actual conditions of the test).

17. In section 4.6, the effects of temperature change on the leak rate at constant pressure were discussed. Please explain the trends in the Figures 4-3 through 4-6. In particular, discuss why during the cooldown phase of some of the specimens the leak rate was higher than during the heatup phase and for other specimens the opposite trend was noted.

18. Please provide a plot of the leak rate versus time for the 3.5-inch joint length of Specimen 37. It does not appear to be included in Appendix C. Regarding the leak rate assigned to the 3-inch joint length of Specimen 3, it is not clear that a conservative leak rate was assigned to this specimen given the leak rate versus time plot in Appendix C. Please discuss.

19. Discuss any theories on why the leak rate is independent of tubesheet hole roughness. The pullout tests are dependent on roughness.

20. Provide a history for the test samples including the dates for sample fabrication, time between fabrication, subsequent leak tests and pullout tests, and the storage conditions between each step. Identify any samples other than Samples 7 and 37 that had an extended period between initial and final tests? Was any testing (e.g., visual, destructive analysis) performed to characterize the initial condition or final condition of the samples with respect to the presence and amount of oxides?

21. Section 4.4 states that there was an effect of time in the leak rate data and that the higher leak rates were typically observed at the start of testing. Discuss whether this observation is consistent with previous leak rate testing programs and to what this effect is attributed to? Discuss the basis for the statement that this is uncharacteristic of leakage that would be observed in an operating steam generator.

22. Provide the criteria used to determine if leak rate data was valid and should be included in Table 4-1 (i.e., the elevated temperature leak rate data). Identify which leak rate tests were determined not to be valid.

23. A comparison of the room temperature leak rates from Sample 1 to the Combustion Engineering Owners Group Task 1154 leak rates was made to conclude storage for 3 years did not have a significant effect on the samples. The room temperature test performed after a high temperature test had a much lower leak rate than the initial room temperature test. Discuss whether these results suggest that the elevated temperature leak rate test performed between the initial and final room temperature leak rate tests may have influenced the results through the formation of oxides in the crevice (annular gap) or by some other mechanism.

24. Provide the sequence in which the leak rate tests shown in the Table of Page A-5 were performed (i.e., the sequence of the tests performed at the Westinghouse Science and Technology Division in Churchill). From this table, it appears that Sample 7 was tested in the Churchill facilities in the following order: deionized water with low oxygen levels, deionized water with high oxygen levels, and primary water (low oxygen). The leak rate for the primary water tests (performed after the high oxygenated tests) are higher than the original low oxygen tests. Given the theory that the original 1154 test program results are invalid because the oxygenated water used during these tests resulted in "blocking the leak path," please discuss the trend in the Sample 7 leak rate (i.e., higher

leak rate following the oxygenated test). In addition, given the uncertain initial condition of the samples (with respect to the presence of oxides within the crevice) and considering that testing in a higher oxygen containing environment occurred prior to testing in simulated primary water tests, doesn't the presence of oxides complicate the evaluation of water chemistry effects?

25. The effects of temperature and differential pressure on leak rates seem inconsistent. For example, in some cases the room temperature leak rates increase with increasing differential pressure (e.g., the first set of normal operating and steam line break leak rate values for Specimen 1) and in other cases the leak rates stay the same or decrease with increasing differential pressure (e.g., the second set of normal operating and steam line break leak rate values for Specimen 1). Data from the room temperature leak tests at the Science and Technology Division (STD) show a consistent increasing leak rate with increasing differential pressure. Please provide any insight into this apparent discrepancy in the leak rate data. In your response, discuss the type of pump used during the Windsor tests and whether any check valves were in the supply lines.

    An example of inconsistent trends with temperature is: the leak rate for Specimen 1 with a joint length of 3 inches increases at steam line break pressure when the temperature was changed from 400 to 600 degrees; however, the leak rate for Specimen 2 with a joint length of 2 inches decreases at steam line break pressure when the temperature was changed from 400 to 600 degrees.

    The elevated temperature leak rates determined at the Churchill facility are always greater than the corresponding room temperature tests. Please discuss any insights on this trend since the analysis provided in Section 4.6 would indicate that the leak rate should decrease with increasing temperature.

26. Room temperature leak rates measured at the Windsor facility (Samples 7 and 37) are higher compared to the room temperature leak rates measured at the STD facility. Given that oxides may have influenced the STD test results, how can effects in test water chemistry differences or test facility differences be discerned?

27. The effects of temperature and pressure were estimated from the data in Table 4-5. What criteria were used to select the data in Table 4-5? Does the median value change if all data are included?

28. Metallography was performed to evaluate the potential for blockage of the tube-to-collar crevice as a result of the electrical discharge machining (EDM) cutting process (refer to page 7-4). How many cross sections of the tube-to-collar sample were examined with the microscope? Were all areas observed similar to that shown in Figure 7-5?

29. Fittings were cut off and welded on the ends of the samples as necessary to make new EDM cuts to shorten the joint length. In addition, welding was used to repair any leaks at the fittings prior to leak testing. Were the tube or collar temperatures monitored during welding? If so, indicate the peak temperature reached at the tube collar interface during welding. Discuss whether sample heating from welding could result in mechanical loosening of the joint or promote oxide growth on the samples?

30. Please discuss your plans to submit the following information concerning indications found in the tubesheet region (including the expansion transition) within 90 to 120 days after each inspection: number of total indications, location of each indication (e.g., TTS - 1.0), orientation (axial, circumferential, volumetric) of each indication, severity of each indication (e.g., near through-wall or not through-wall), and whether the indication initiated from the inside or outside diameter.

    In addition, discuss your plans to provide the cumulative number of indications detected in the tubesheet region as a function of elevation within the tubesheet (e.g., 12 indications at expansion transition (TTS), 6 indications within 1 inch of TTS, 3 indications from 1 inch to 2 inches below the TTS, etc.).

Principal Contributors: Kenneth J. Karwoski
Paul A. Klein

Date: December 16, 2004