March 5, 2002

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 1 - REQUEST FOR ADDITIONAL INFORMATION REGARDING THE 10 CFR PART 50, APPENDIX R, K1 EXEMPTION CLARIFICATION/REQUEST (TAC NO. MB0300)

Dear Mr. Stall:

By letter dated October 4, 2000, Florida Power and Light Company (FPL) resubmitted Title 10, *Code of Federal Regulations*, Part 50, Appendix R, Exemption Request K1, which dealt with cable separation issues in the St. Lucie Unit 1 containment building. In subsequent discussions with the U.S. Nuclear Regulatory Commission (NRC) staff, the FPL staff indicated they could provide a plant-specific fire model, which would support a deterministic evaluation. On August 31, 2001, the NRC issued a Request for Additional Information (RAI) needed to continue its evaluation using a deterministic approach. In its November 29, 2001, response to the NRC's RAI, FPL enclosed the "Fire Hazard Assessment of Exposure to Safe Shutdown Raceways, St. Lucie Unit 1."

The NRC staff has reviewed your submittal and finds that a response to the enclosed RAI is needed before the review can be completed.

This request was discussed with your staff on February 11, 2002. On February 27, Mr. Ken Frehafer of your staff agreed that a response would be provided within 45 days of receipt of this letter.

If you have any questions, please 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. 50-335

Enclosure: RAI

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION

10 CFR PART 50, APPENDIX R, EXEMPTION K1

ST. LUCIE PLANT, UNIT 1

DOCKET NO. 50-335

Please provide the answers to the following questions regarding the "Fire Hazard Assessment of Exposure to Safe Shutdown Raceways, St. Lucie Unit 1."

1. What is the "Factor of Safety" built into your evaluation conclusions? Provide the critical spacing for the base case.

2. Figure 3 shows flamemastic coating only on the cable trays. Were the individual cables completely coated also?

3. The Institute of Electrical and Electronics Engineers (IEEE) Fire-Induced Vulnerability Evaluation (FIVE) final report, April 1992, utilizes a critical heat flux of 10 kW/m^2 for qualified cable and 5 kW/m^2 for non-qualified cable. Your evaluation utilized 11.7 kW/m^2 for qualified cable and 5.7 kW/m^2 for non-qualified cable from a 1991 IEEE report. Justify using the larger critical heat fluxes.

4. Worst Case Fire: The modeling used cable loading from Trays M100, C100, and C101 with a total fill of 26 percent. However, at Plan Point 2307, Trays M120 and C120, has a fill total of 29.3 percent. Justify why the location chosen is the worst case fire loading?

5. A stacked vertical tray configuration was modeled, but the drawing on page 1 of Appendix A of Attachment 3 shows the cable trays in a side-by-side configuration. The vertical height is over 9 feet and each tray is 2 feet wide giving the three trays a 54 ft^2 (5 m^2) surface area. The report models a 15-inch wide vertical fire at some undefined height, which doesn't seem to portray the actual configuration. In addition, wouldn't the fire grow horizontally on the lower and upper elevations at the same time? Justify in more depth the vertical cable fire scenario.

6. Ventilation within containment can be considerable. Equation (10) assumes no wind effects, but in actual conditions in containment, mechanical ventilation produces wind-aided flame spread. Explain why the effect of wind was not considered in this analysis. How would it effect the burning characteristics of the cable trays, the flame propagation speed, the height and location of the fire plume in respect to the target cable tray, smoke detector response time, and the evaluation conclusions?

7. Pages 3-207 to 3-210 in the Society of Fire Protection Engineers (SFPE) Handbook of Fire Protection Engineering, 2nd Edition 1995, provide a discussion and correlation to determine the emissive power of large, sooty hydrocarbon fires. For example, Figure 3-11.10, on page 3-208 illustrates that the emissive power for liquid petroleum gas pool fires is a non-linear function of the pool diameter. Based on the experimental data, the

following correlation is provided to calculate emissive power of the fire, which is non-linear equation:

$$E_{av} = E_m e^{-SD} + E_s\left(1 - e^{-SD}\right)$$

Where

E_m = maximum emissive power of luminous spots (approximately 140 kW/m^2),
E_s = emissive power of smoke (approximately 20 kW/m^2),
S = a parameter determined using experimental data (0.12 m^{-1}), and
D = diameter of the pool fire (m).

On page 26 of 62 of the St. Lucie Fire Hazard Assessment, Equation (12) is provided to compute the emissive power of the source fire, which is a linear function of cable tray width.

$$E_s = \frac{\dot{Q}_R}{\left(2.X_s.F_h\right) + W_t} \qquad (12)$$

Where

E_s = emissive power of the source fire (kW/m^2),
$\dot{Q}_R$ = radiant energy release rate (kW),
X_s = maximum flame spread distance (m),
F_h = flame height from a line fire (m), and
W_t = width of the cable tray (m).

The units of emissive power are kW/m^2, which are not consistent in Equation (12) as:

$$E_s = \frac{kW}{m^2 + m}$$

Since emissive power is an important input to Equation (9) on page 26 of 62 to determine the radiative heat flux to the target (cables), explain why there is a basic difference between these two equations, i.e., linear and non-linear.

8. Table 3 on page 30 of 62 provides the incident heat flux calculation for the maximum expected fire scenario. Provide details for the calculation of $\dot{q}_r''$, including values of all variables, e.g., $F_{s\text{-}t}$, E_s, F_h, etc. Provide the Equation Number used to calculate the values of t_d and $\dot{q}_r''$.

9. Provide the Equation Number used to calculate Target Heat Flux in the last column of the Table on page 45 of 62.

10. Provide the values of $W_{p.c}$ in Equation (2).

11. Explain the difference between t_b in Equation (4) and t_{dur} in Equation (6).

12. Equation (9) estimates heat flux at a target, $\dot{q}''_t$, but Tables 5a through 5h provide calculations for $\dot{q}_r$ (kW/m^2). Explain the difference between these two heat fluxes.

13. The values from the SFPE Handbook appear to have been multiplied by 4 in Equation (10). Explain.