October 16, 2003

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: TURKEY POINT PLANT UNITS 3 AND 4 - REQUEST FOR ADDITIONAL INFORMATION REGARDING STATION BLACKOUT ANALYSIS USING RETRAN CODE (TAC NOS. MB8728 AND MB8729)

Dear Mr. Stall:

During a Safety System Design and Performance Capability inspection, the Nuclear Regulatory Commission (NRC), Region II inspectors identified concerns regarding changes to the emergency operating procedures used to recover from a station blackout that significantly altered the mitigation strategy. The inspection findings are documented in NRC Inspection Report 50-250(251)/2002-006, dated January 3, 2003.

The NRC staff requires additional information to resolve Unresolved Item No. 50-250(251)/02-06-01, “Adequacy of Station Blackout (SBO) Strategy/Analysis and Loss of AC Power Emergency Operating Procedures.” The NRC staff’s Request for Additional Information is enclosed. This request was discussed with your staff on September 23, 2003. On October 8, 2003, Ms. Olga Hanek agreed that a written response would be provided within 45 days of the date of this letter. If you have any questions, please feel free to contact me at (301) 415-2315.

Sincerely,

/RA/

Eva A. Brown, Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-250 and 50-251

Enclosure: Request for Additional Information

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION

STATION BLACKOUT COPING ANALYSIS

TURKEY POINT PLANT UNITS 3 AND 4

DOCKET NOS. 50-250 AND 50-251

These questions are related to Florida Power and Light's engineering evaluation, PTN-ENG-SENS-02-0065, Engineering Evaluation to Document Compliance with Station Blackout Requirements.

1. The RETRAN code has been accepted generically by the U.S. Nuclear Regulatory Commission (NRC) staff for reactor transients. The NRC staff does not consider RETRAN suitable for loss-of-coolant accident (LOCA) analyses. This results from the code not being qualified against appropriate separate effects tests and integral experiments for phenomena expected during conditions of a LOCA. These conditions involve a sufficient reduction in primary inventory that produces a steam bubble in the upper head while voiding in the steam generators (SGs) creates a steam condensation environment necessary for heat removal. While the event in question is a very small LOCA, it is pertinent to demonstrate that RETRAN is capable of simulating this type of event.

   a. Describe the benchmarks of RETRAN against integral system and separate effects testing to demonstrate that RETRAN can simulate a cooldown of the reactor coolant system (RCS) with the head voided and condensation characterizing the heat removal in the steam generators. Include comparisons of RETRAN to separate effects, as well as integral data (for example, comparisons of the code to condensation tests, the MIT pressurization tests, Marviken critical flow, Containment Systems Experiments and GE blowdown experiments, etc.).

   b. Provide a discussion of the amount of condensation calculated during the event. This discussion should include a plot of the injection rate, condensation rate, break flow rates, and break qualities versus time for the event.

   c. Describe the modeling of the break, including whether or not the slip model was used.

   d. Identify the primary steam condensation correlation employed in RETRAN, and provide a justification for the applicability of the correlation to condensation in the small vertical tubes of the SG.

   e. Discuss whether the SGs drain during the small LOCA event described above and how the condensation correlation is applied when two-phase is flowing through the active tube region.

Enclosure

f. Since the transfer of stored energy in the metal walls to the coolant was not modeled, the calculated cooldown times to a RCS temperature of 377 °F may be too rapid. Typically, metal wall heat addition can contribute as much as the equivalent of 20 to 30 percent of the decay heat as additional heat deposited into the RCS for small breaks in the RCS. The 10 percent uncertainty added to the decay heat curve does not appear to capture wall heat effects. Describe how the omission of wall heat impacts the conclusions of the analysis. Include the effect of increasing the multiplier on decay heat to account for the lack of the wall heat sources or include metal wall heat effects into the model.

g. Describe the atmospheric dump valve area during the cooldown and indicate whether the cooldown rate becomes limited by the valve position before Residual Heat Removal (RHR) entry conditions are achieved.

h. A constant reactor coolant pump (RCP) seal leakage of 25 gallons per minute (gpm) per pump is assumed, while the break is 25 gpm and varies with pressure. Justify the assumption that the RCP seal leakage is constant and indicate why a critical flow model was not used to calculate the leakage. Indicate how the break flow was determined as a function of pressure and break enthalpy.

i. Identify what volumes employed the slip option. Was the slip option used in the steam generator primary active tube region? What code benchmarks were performed to justify the use of slip? Demonstrate that RETRAN can predict phase separation in components. Also, explain whether the slip option maximizes the size of the condensing surface when steam develops in the top of the active tube region.

2. Only 78 gpm per steam generator was assumed for emergency feed flow. Since emergency feedwater was not initiated for 30 minutes, the liquid inventory would be rapidly exhausted during the first 30 minutes of the event. Given these conditions, discuss whether the two-phase level on the secondary side drops below the top of the tubes exposing the top portion of the tubes to steam. If so, describe whether the primary to secondary temperature difference will increase, as well as RCS pressure. Additionally, provide the secondary two-phase level versus time. Note, that if there is the potential for the secondary two-phase level to recede below the top of the tubes during the early portion of the event, a single cell representation may not be appropriate. Justification for the secondary model, including level swell benchmarking will be needed. Describe the benchmarks used to justify the secondary, single cell model.

3. A single volume is used for the upper head. Because an equilibrium model was employed, this region fills completely at 375 minutes, which does not appear to be correct. Once the SGs refill with liquid and single phase natural circulation is re-established, a bubble will remain in the upper head region (unless the RCPs are re-started or the head vent is used). Thus, following refill, the upper head will become superheated with wall heat transfer from the steam controlling the degree of steam superheat. The use of the single volume to represent the upper head and the equilibrium model will artificially condense the steam in this region, enabling a complete and early refill. Discuss whether a bubble in the upper head will significantly delay the

ability to cool down the RCS to RHR entry conditions within the 8-hour period. A bubble in the upper head would cause the pressurizer level to decrease during charging pump operations. Given these considerations, discuss whether entry into shutdown cooling will be achieved before the condensate storage tank is exhausted. Discuss whether entry into shutdown cooling will be delayed if a fill-and-drain method is used and metal wall heat is taken into account. Include the capacity of the condensate storage tank and identify the time to exhaust this supply during the cooldown.

4. In the event full charging is used or a high pressure safety injection pump initiates, which will fill the pressurizer with hot water early in the sequence, discuss how the RCS pressure will be reduced to enter shutdown cooling once the entry temperature is achieved. With hot water trapped in the pressurizer, pressurizer sprays or a fill-and-drain method would be needed to reduce pressurizer pressure. Please describe the method employed to cool the pressurizer. Determine whether there is sufficient condensate supply to accommodate an extended cooldown if needed.

5. Explain the basis for assuming 72 gpm charging flow.

6. In Attachment 3, page 1 of 2, the pressurizer level is shown to increase after 120 minutes with constant charging flow less than the constant RCP leakage during the event (72 gpm in vs. 125 gpm out). Please explain the pressurizer level behavior. In this hot standby condition, the liquid level in the vessel and loops would drain down to the break elevation. To preclude uncovery, the injection rate would thereafter need to exceed the boil-off rate in the system to prevent uncovery, and this boil-off rate would depend on the decay heat level. Please demonstrate that when the two-phase level in the RCS decreases to the break elevation, sufficient time has elapsed to enable the 72 gpm injection rate to exceed the boil-off in the RCS. Also demonstrate that the lack of a wall heat model, which will increase the RCS boil-off rate, does not impose additional injection requirements during the cooldown.

7. Explain why the RCS pressure does not remain at the power operated relief valve (PORV) setpoint (until auxiliary feedwater is initiated at 15 minutes) after it opens at 80 seconds. If the PORV sticks open, discuss the time available until the core uncovers and what other injection sources are available to preclude core uncovery.

8. The Tagami/Uchida correlations are typically used for minimum pressure evaluations for LOCA containment back pressure boundary conditions. The evaluation implies the containment model represents a bounding or maximum pressure determination. If a maximum pressure/temperature is to be determined, containment wall condensation and other heat removal capabilities would need to be minimized. Explain how the results of these containment calculations are used.

9. The constant RCP leakage of 100 gpm is approximately 12 pounds per second (lbs/sec) at 367 psia and 380 °F, the conditions at the end of the cooldown. Since the constant charging flow of 72 gpm at 100 °F is 9.9 lbs/sec, the injection rate during the entire 8-hour event does not exceed the loss through the break (except when the accumulators inject). At some point, the injection would need to be increased to refill the system with liquid. Explain how inventory is controlled during the long term.

cc:

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