Florida Power & Light, 9760 S.W. 344 ST. Florida City, FL 33034

FPL

MAY 26 2011
L-2011-169
10 CFR 50.90

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555-0001

Re: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Response to NRC Request for Additional Information Regarding
Extended Power Uprate License Amendment Request No. 205 and
Containment and Ventilation Issues

References:

(1) M. Kiley (FPL) to U.S. Nuclear Regulatory Commission (L-2010-113), "License Amendment Request No. 205: Extended Power Uprate (EPU)," (TAC Nos. ME4907 and ME4908), Accession No. ML103560169, October 21, 2010.

(2) Email from J. Paige (NRC) to T. Abbatiello (FPL), "Turkey Point EPU – Containment and Ventilation (SCVB) Request for Additional Information - Round 1.2 (Part 2)," Accession No. ML11119A002, April 28, 2011.

By letter L-2010-113 dated October 21, 2010 [Reference 1], Florida Power and Light Company (FPL) requested to amend Renewed Facility Operating Licenses DPR-31 and DPR-41 and revise the Turkey Point Units 3 and 4 Technical Specifications (TS). The proposed amendment will increase each unit's licensed core power level from 2300 megawatts thermal (MWt) to 2644 MWt and revise the Renewed Facility Operating Licenses and TS to support operation at this increased core thermal power level. This represents an approximate increase of 15% and is therefore considered an extended power uprate (EPU).

By email from the U.S. Nuclear Regulatory Commission (NRC) Project Manager (PM) dated April 28, 2011 [Reference 2], additional information regarding containment analysis and ventilation issues was requested by the NRC staff in the Containment and Ventilation Branch (SCVB) to support their review of the EPU License Amendment Request (LAR). The RAI consisted of six (6) questions regarding emergency core cooling system (ECCS) pump performance; specifically, Net Positive Suction Head Requirements (NPSH) for the Residual Heat Removal (RHR) and Containment Spray (CS) pumps, and the impact of post accident debris generation on RHR and CS pump performance. These six RAI questions and the applicable FPL responses are documented in the Attachment to this letter.

In accordance with 10 CFR 50.91(b)(1), a copy of this letter is being forwarded to the State Designee of Florida.

This submittal does not alter the significant hazards consideration or environmental assessment previously submitted by FPL letter L-2010-113 [Reference 1].

This submittal contains no new commitments and no revisions to existing commitments.

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NRR

Should you have any questions regarding this submittal, please contact Mr. Robert J. Tomonto, Licensing Manager, at (305) 246-7327.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on May 26, 2011.

Very truly yours,

Michael Kiley
Site Vice President
Turkey Point Nuclear Plant

Attachment

cc: USNRC Regional Administrator, Region II
USNRC Project Manager, Turkey Point Nuclear Plant
USNRC Resident Inspector, Turkey Point Nuclear Plant
Mr. W. A. Passetti, Florida Department of Health

Turkey Point Units 3 and 4

RESPONSE TO NRC RAI REGARDING EPU LAR NO. 205
AND SCVB CONTAINMENT AND VENTILATION ISSUES

ATTACHMENT

Response to Request for Additional Information

The following information is provided by Florida Power and Light Company (FPL) in response to the U. S. Nuclear Regulatory Commission's (NRC) Request for Additional Information (RAI). This information was requested to support License Amendment Request (LAR) No. 205, Extended Power Uprate (EPU), for Turkey Point Nuclear Plant (PTN) Units 3 and 4 that was submitted to the NRC by FPL letter L-2010-113 on October 21, 2010 [Reference 1].

In an email dated April 28, 2011 [Reference 2], the NRC staff requested additional information regarding FPL's request to implement the EPU. The RAI consisted of six (6) questions from the NRC's Containment and Ventilation Branch (SCVB) regarding emergency core cooling system (ECCS) pump performance; specifically, Net Positive Suction Head Requirements (NPSH) for the Residual Heat Removal (RHR) and Containment Spray (CS) pumps, and the impact of post accident debris generation on RHR and CS pump performance. These six RAI questions and the applicable FPL responses are documented below.

SCVB-1.2.1 Provide the basis for the NPSH required (NPSHR) of the residual heat removal (RHR) and containment spray (CS) pumps (tested value, extrapolation to flows other than tested flows), including flow rates assumed, and a comparison with the flow rate for the LOCA peak cladding temperature (PCT analyses). What head drop value is used for NPSHR (3% head drop or other)?

The basis for the NPSHR of the RHR, High Head Safety Injection (HHSI), and CS pumps is the NPSHR curve from each of the vendor pump test curves. The basis for the NPSHR curves is the 3% head drop value, which is standard for factory tests of the pumps. The flow rates assumed for the NPSH analysis versus the LOCA PCT analysis are detailed below for the safety injection phase.

Pump	NPSH Analysis Flow	LOCA PCT Analysis Flow
RHR	4163 gpm	3033 gpm
CS	1750 gpm	1761 gpm
HHSI	576 gpm	496 gpm

Note that the NPSH Analysis Flows provided above are for the limiting system alignment for each pump during safety injection. These flows fall on the NPSHR curves for tested flows and no curve extrapolation was necessary. The LOCA PCT analysis flow for the containment spray pump is maximized to result in a lower containment pressure. Since maximum containment spray pump flow is assumed for this analysis, the flow was calculated assuming a maximum Refueling Water Storage Tank (RWST) level, whereas the RWST level is minimized in the NPSH analysis to minimize static head. The difference in RWST level assumed in each analysis accounts for the higher CS pump flow used in the PCT analysis. The NPSH analysis is conservative despite the lower flow rate because the static head to the CS pump is minimized.

SCVB-1.2.2 Provide details of the method of calculating NPSH available (NPSHA) for the RHR and CS pumps (e.g., RWST level, containment atmospheric pressure, vapor pressure, head loss through suction piping, sump water temperature). Also, clarify the statement in licensing report (LR) Section 2.6.5.2.2 that "NPSH evaluations for the recirculation phase assume 212°F sump temperature and 0 psig containment pressure." Specifically, is the statement intended to convey that containment atmospheric pressure and the vapor pressure terms in NPSHA are assumed to nullify each other, thus resulting in no credit for CAP?

The method used for calculating NPSHA for the RHR, HHSI and CS pumps is the "classical" method of calculating NPSH. The suction source elevation (RWST or sump) is minimized for the specific system alignment, and the water source surface pressure is assumed to be the saturation pressure of the liquid. By making this assumption, the atmospheric pressure and the vapor pressure terms in the NPSHA equation cancel out, and no credit is taken for elevated pressure at the liquid surface. The pump flow rate is maximized to result in a conservatively high NPSHR from the vendor pump curve, and a high flow rate through the suction piping. The suction piping losses are calculated by the Fathom computer model using the calculated flow and the input hydraulic resistances.

The statement "NPSH evaluations for the recirculation phase assume 212°F sump temperature and 0 psig containment pressure," is included to support the fact that the containment atmospheric pressure and the vapor pressure terms in the NPSHA calculation nullify each other, and the only positive term is the static head supplied by the elevation difference between the sump liquid elevation and the pump inlet elevation. Therefore, no Containment Accident Pressurization (CAP) has been considered in the NPSH analyses.

SCVB-1.2.3 Provide calculated NPSH margins for the RHR and CS pumps at the EPU conditions for however long a duration the calculations were performed during design basis accidents. Describe the lineup of the pumps and provide the results in a tabular form, clearly indicating NPSHA and NPSHR for each pump.

The NPSH calculation results for the system alignments that provide the most limiting NPSHA during a design basis accident are presented in the table below. The values presented below are not dependent on operating duration of the pumps. The values are calculated assuming limiting system conditions, as described in the response to SCVB-1.2.2 above.

		NPSHA	NPSHR	Margin
Safety Injection	HHSI Pump[1]	33.8 ft	28 ft	5.8 ft (20.7%)
	CS Pump[2]	30.4 ft	25 ft	5.4 ft (21.6%)
	RHR Pump[3]	55.6 ft	16.5 ft	39.1 ft (237%)
Recirculation	RHR Pump[4]	14.9 ft	12.5 ft	2.4 ft (19.2%)

[1]The limiting alignment for HHSI pump NPSH during the safety injection phase is at the point when the RWST is at the minimum allowable level (low-low level alarm setpoint) and two HHSI pumps and one CS pump are operating. The HHSI pumps are delivering to all three cold legs (0 psig pressure), and the CS pump is spraying to containment at 0 psig.

[2]The limiting alignment for CS pump NPSH during the safety injection phase is at the point when the RWST is at the low level alarm setpoint and four HHSI pumps, two RHR pumps and two CS pumps are operating. The HHSI pumps and RHR pumps are delivering to all three cold legs (0 psig pressure), and the CS pumps are spraying to containment at 0 psig.

[3]The limiting alignment for RHR pump NPSH during the safety injection phase is at the point when the RWST is at the low level and four HHSI pumps, one RHR pump and two CS pumps are operating. The RHR pump is to be stopped when the RWST reaches the low level setpoint in preparation for switchover to the recirculation phase. The HHSI and RHR pumps are delivering to all three cold legs (0 psig pressure), and the CS pumps are spraying to containment at 0 psig.

[4]The limiting alignment for the RHR pump during the recirculation phase is during cold leg recirculation with two HHSI pumps and one CS pump operating, which is the normal cold leg recirculation alignment at EPU conditions. The sump is assumed to be at the minimum elevation allowable for sump recirculation, and the containment pressure is assumed to be equivalent to the sump fluid vapor pressure. In this system alignment, the RHR pump is providing suction flow to the HHSI and CS pumps, which are delivering to three RCS cold legs and the containment, respectively.

Note: There is sufficient NPSHA at the HHSI and CS pumps during the recirculation phase since the pump suctions are aligned to the RHR pump discharge. See also the response to SCVB-1.2.5 below.

SCVB-1.2.4 Demonstrate that NPSH margin still exists after including the uncertainties in the required NPSH, without crediting CAP. The NRC staff, in consultation with a pump expert, determined that a 21-percent margin on the '3%- required NPSH' would conservatively envelope the uncertainties discussed in the draft guidance document. It is acceptable to the NRC staff, if desired, to use this value in lieu of performing detailed plant specific uncertainty evaluation.

As indicated in the table in the response for SCVB-1.2.3 above, both the CS and RHR pumps in the safety injection alignment have sufficient margin to satisfy for the requested 21% margin. Also, as indicated in the same table, the RHR pump in the recirculation alignment does not meet the requested 21% margin. However, a conservative suction flow path was assumed in the NPSHA analysis. It was assumed that the B train RHR pump was taking suction through the A train sump suction piping, which created a conservatively high head loss from the sump to the pump suction. The plant operating procedures do not align the pump this way, but instead align the A train RHR pump to take suction through the A train sump suction path. In this alignment, the NPSHA to the RHR pump is 15.4 feet, which is a margin of 2.9 feet (23.2%).

Similarly, the HHSI pump in the safety injection alignment falls slightly short of the 21%. The HHSI pump curve assumed in the NPSHA analysis is a maximum composite curve of all of the HHSI vendor pump curves that is then increased to account for instrument uncertainty and over-frequency operation. This results in a conservative estimate of the maximum performance of the HHSI pumps (i.e., the assumed pump performance of the HHSI pumps in the NPSHA calculation provides approximately 5% higher performance than the vendor curves). Completing the NPSHA analysis for the HHSI pumps using a "better estimate," or vendor, pump curve results in at least 21% margin on NPSHA for the HHSI pumps.

SCVB-1.2.5 It was stated in LR Section 2.6.5.2.5 of the EPU that during recirculation phase, adequate NPSH margin is available if only one RHR pump and one CS pump are operated simultaneously. Provide additional details on this lineup, how it differs from other lineups, and the reasons why NPSH margin is impacted.

In the cold leg and hot leg recirculation alignments at Turkey Point, the RHR pump takes suction from the sump and boosts the CS and HHSI pumps in a "piggy-back" alignment, during which the CS and HHSI pumps receive suction flow from the discharge of the RHR pump, not directly from the containment sump. Because of this system alignment, the RHR pump flow is dictated primarily by the number of pumps to which it is supplying flow. For the EPU, two HHSI pumps and one CS pump must be operating during recirculation. This alignment establishes the limiting recirculation phase NPSH and results in a total RHR pump flow of roughly 3,500 gpm, for which there is sufficient NPSHA (see responses to SCVB-1.2.3 and SCVB-1.2.4, above). For EPU, plant emergency operating procedures will assure that only one RHR pump, two HHSI pumps, and one CS pump are run during the recirculation phase and, thus, preclude operation of two RHR pumps or two CS pumps.

SCVB-1.2.6 Provide a discussion of how the post accident debris generation at Turkey Point is impacted by the EPU and the resultant impact on the sump strainer head loss and on the RHR pump NPSH evaluations.

As explained in the following paragraphs, EPU has minimal effect on the issues that need to be addressed to resolve NRC concerns on the resolution of Generic Safety Issue 191 (GSI-191) for Turkey Point. As a result, all future evaluations related to the resolution of GSI-191 will consider both the current and EPU conditions, and the review and approval of the Turkey Point EPU LAR should be considered to be independent of the resolution of GSI-191.

EPU impact on post-accident debris generation with respect to GSI-191 will be bounded by the ongoing GSI-191 resolution. Parameters affecting the zones of influence used in calculating debris destruction radii are independent of RCS operating conditions, including temperature and pressure; rather, the zones of influence are dependent on the geometry of the RCS and associated piping, and that geometry is not being altered by EPU. Changes made to debris loading resulting from EPU modifications (including beneficial changes such as reductions in fiber, calcium silicate, or aluminum quantities), will be considered in the ongoing GSI-191 resolution.

EPU has no adverse impact on post-accident containment sump flow rates with respect to GSI-191 debris transport. The recirculation phase flows are driven by break size, location, and the flow rates of the ECCS and CS pumps. These are not a function of RCS operating parameters or post-LOCA decay heat rates. The EPU flow rates for the ECCS and CS pumps are being maintained within the design flow rates used for the sump design.

EPU has no impact on post-accident containment sump conditions relevant to GSI-191. Marginal increases in sump level and temperature resulting from EPU are bound by existing analyses for GSI-191.

The combined effects of debris generation, transport, sump strainer head loss and ECCS NPSH margin will be addressed in FPL's resolution to GSI-191 for both current and EPU conditions.

References

1. M. Kiley (FPL) to U.S. Nuclear Regulatory Commission (L-2010-113), "License Amendment Request No. 205: Extended Power Uprate (EPU)," (TAC Nos. ME4907 and ME4908), Accession No. ML103560169, October 21, 2010.
2. Email from J. Paige (NRC) to T. Abbatiello (FPL), "Turkey Point EPU – Containment and Ventilation (SCVB) Request for Additional Information - Round 1.2 (Part 2)," Accession No. ML11119A002, April 28, 2011.