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

FPL.

APR 1 4 2011

L-2011-115
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
Reactor Materials 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 - Vessels and Internals Integrity (CVIB) Requests for Additional Information - Round 1", Accession No. ML110420241, February 11, 2011

(3) M. Kiley (FPL) to U.S. Nuclear Regulatory Commission (L-2011-029), "Response to NRC Request for Additional Information Regarding Extended Power Uprate License Amendment Request No. 205 and Reactor Materials Issues – Round 1," Accession No. ML110700068, March 9, 2011.

(4) Email from J. Paige (NRC) to T. Abbatiello (FPL), "Turkey Point EPU - Vessels and Internals Integrity (CVIB) Requests for Additional Information - Round 2", Accession No. ML110840267, March 25, 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 February 11, 2011 [Reference 2], additional information regarding reactor material issues was requested by the NRC staff in the Vessels and Internals Integrity Branch (CVIB) to support the review of the EPU License Amendment Request (LAR) [Reference 1]. FPL provided its responses to the NRC request by letter L-2011-029 dated March 9, 2011 [Reference 3].

By email from the NRC PM dated March 25, 2011 [Reference 4], additional information regarding PTN's pressure-temperature (P-T) limit calculations was requested by the NRC staff in CVIB to further support their review of Reference 1. The Request for Additional Information (RAI) consisted of one (1) follow-up question regarding the P-T limit calculational methodology. The RAI question and the FPL response are documented in the Attachment to this letter.

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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.

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 April 14, 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 CVIB REACTOR MATERIALS 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) 205, Extended Power Uprate (EPU), for Turkey Point Nuclear Plant (PTN) Units 3 and 4 that was submitted to the NRC by FPL via letter (L-2010-113) dated October 21, 2010 [Reference 1].

In an email dated February 11, 2011 [Reference 2], additional information regarding reactor material issues was requested by the NRC staff in the Vessels and Internals Integrity Branch (CVIB) to support their review of the EPU LAR. FPL provided its responses to the NRC's request by letter L-2011-029 dated March 9, 2011 [Reference 3]. On March 25, 2011 FPL received an RAI via email from the NRC Project Manager (PM) regarding FPL's request to implement the EPU [Reference 4]. The RAI consisted of one follow-up question regarding PTN's pressure-temperature (P-T) limit calculational methodology required to further support their review of the EPU LAR. The single RAI question and associated FPL response is documented below.

**CVIB-2.1** **In the licensee's RAI response letter dated March 9, 2011, Figure 1, the Modified Technical Specification (TS) Bases 3/4.4.9, states that WCAP-14040-NP-A, Rev. 2, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Curves" is one of the methodologies used to evaluate the fracture toughness properties and to determine the allowable pressure-temperature relationships. However, in the response to CVIB-1.4-b, the methodology of WCAP-14040-NP-A, Rev. 4 is referenced with respect to the determination of the coolant-to-crack tip temperature differential. In addition, during the conference call on January 26, 2011, the licensee identified that the methodology used to generate the P-T limits was the same as that described in WCAP-15092, Rev. 3, which incorporates the provisions of Code Case N-588. WCAP-14040-NP-A, Rev. 2 does not incorporate the Code Case N-588 provisions, but WCAP-14040-NP-A, Rev. 4, incorporates the provisions of Code Case N-588.**

**The Nuclear Regulatory Commission staff therefore requests the licensee to:**

1. **Clarify which revision of WCAP-14040-NP-A is used as the basis for the P-T limit calculations for Turkey Point Units 3 and 4, (Rev. 2, Rev. 4, or a combination of both) and correct the TS bases as necessary.**

   The P-T limit calculations for Turkey Point Units 3 and 4 were performed using WCAP-14040-NP-A, Revision 2. The provisions of ASME Code Case N-588 have not been incorporated into this revision of the WCAP; however, the Code Case was utilized in the development of the P-T limit curves (See response to item 2 below). See Figures 1 and 2 for TS Bases changes.

2. **Confirm that the provisions of Code Case N-588 were used in the development of the P-T limits for Turkey Point, Units 3 and 4.**

   The P-T limit curves for Turkey Point Units 3 and 4 were generated using the axial and circumferential flaw methodology contained in Code Case N-588. The limiting axial and circumferential material adjusted reference temperature (ART) values were used in the generation of the P-T limit curves.

# Figure 1: Modified P-T Limits TS Bases (For Information Only)

| Procedure No.: | Procedure Title: | Page: |
|---|---|---|
| | | 71 |
| 0-ADM-536 | Technical Specification Bases Control Program | Approval Date: 1/19/10 |

**ATTACHMENT 1**
(Page 60 of 112)

**TECHNICAL SPECIFICATION BASES**

WCAP-14040-NP-A, Revision 2, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Curves" with consideration of ASME Code Case N-588.

3/4.4.9 (Cont'd)

4. The pressurizer heatup and cooldown rates shall not exceed 100°F/h and 200°F/h, respectively. The spray shall not be used if the temperature difference between the pressurizer and the spray fluid is greater than 320°F, and

5. System preservice hydrotests and inservice leak and hydrotests shall be performed at pressures in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section XI.

The fracture toughness properties of the ferritic materials in the reactor vessel are determined in accordance with the NRC Standard Review Plan, the version of the ASTM E185 standard required by 10 CFR 50, Appendix H, and in accordance with additional reactor vessel requirements.*

XI

1995

The properties are then evaluated in accordance with Appendix G of the ~~1983~~ Edition of Section ~~III~~ of the ASME Boiler and Pressure Vessel Code and the additional requirements of 10 CFR 50, Appendix G and the calculation methods described in Westinghouse Report ~~GTSD-A-1.12, Procedure for Developing Heatup and Cooldown Curves.~~

through 1996 Addenda

Heatup and cooldown limit curves are calculated using the most limiting value of the nil-ductility reference temperature, ~~RTNDT~~, at ~~the end of 19~~ effective full power years (EFPY) of service life. The ~~19~~ EFPY service life period is chosen such that the limiting ~~RTNDT~~, at the 1/4T location in the core region is greater than the ~~RTNDT~~, of the limiting unirradiated material. The selection of such a limiting ~~RTNDT~~ assures that all components in the Reactor Coolant System will be operated conservatively in accordance with applicable Code requirements.

heatup rates of 60 and

48

$RT_{NDT}$

3.4-2 and 3.4-3,

The heatup and cooldown limit curves, Figures ~~3.4-2, 3.4-3 and 3.4-4~~ are composite curves prepared by determining the most conservative case with either the inside or outside wall controlling, for ~~any heatup rate up to~~ 100 degrees F per hour and cooldown rates of ~~up to~~ 100 degrees F per hour. The heatup and cooldown curves were prepared based upon the most limiting value of predicted adjusted reference temperature at the end of the applicable service period (~~19~~ EFPY).

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20,40,60, and

The reactor vessel materials have been tested to determine their initial ~~RTNDT~~; the results of these tests are shown in Tables B 3/4.4-1 and B 3/4.4-2. Reactor operation and resultant fast neutron (E greater than 1 MeV) irradiation can cause an increase in the ~~RTNDT~~. Therefore, an adjusted reference temperature, based upon the fluence and chemistry factors of the material has been predicted using Regulatory Guide 1.99, Revision 2, dated May 1988, Radiation Embrittlement of Reactor Vessel Materials. The heatup and cooldown limit curves of Figures ~~3.4-2, 3.4-3, and 3.4-4~~ include predicted adjustments for this shift in ~~RTNDT~~ at the end of the applicable service period.

3.4-2 and 3.4-3

$RT_{NDT}$

* Topical Report BAW-2308, Revision 2-A is the source for the initial weld materials properties for Linde 80 welds.

W2003:DPS/ln/cls/cls

## Figure 2: Modified P-T Limits TS Bases (For Information Only)

| Procedure No.: | Procedure Title: | Page: |
|---|---|---|
| 0-ADM-536 | Technical Specification Bases Control Program | 75 |
| | | Approval Date: 1/19/10 |

WCAP-14040-NP-A, Revision 2, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves" with consideration of ASME Code Case N-588.

**ATTACHMENT 1**
(Page 64 of 112)

**TECHNICAL SPECIFICATION BASES**

3/4.4.9 (Cont'd)

Section XI of the 1995 Edition through 1996 Addenda

Allowable pressure-temperature relationships for various heatup and cooldown rates are calculated using methods derived from Appendix G in ~~Section III~~ of the ASME Boiler and Pressure Vessel Code as required by Appendix G to 10 CFR Part 50 and Westinghouse Report ~~GTSD-A-1.12, Procedure for Developing Heatup and Cooldown Curves.~~

Appendix G of the 1995 Edition through 1996 Addenda of ASME Section XI

The general method for calculating heatup and cooldown limit curves is based upon the principles of the linear elastic fracture mechanics (LEFM) technology. In the calculation procedures a semi-elliptical surface defect with a depth of one-quarter of the wall thickness, T, and a length of 3/2T is assumed to exist at the inside of the vessel wall as well as at the outside of the vessel wall. The dimensions of this postulated crack, referred to in ~~Appendix G of ASME Section III~~ as the reference flaw, amply exceed the current capabilities of inservice inspection techniques. Therefore, the reactor operation limit curves developed for this reference crack are conservative and provide sufficient safety margins for protection against nonductile failure. To assure that the radiation embrittlement effects are accounted for in the calculation of the limit curves, the most limiting value of the nil-ductility reference temperature, ~~RTNDT~~, is used and this includes the radiation-induced shift, ~~ARTNDT~~, corresponding to the end of the period for which heatup and cooldown curves are generated. $\Delta RT_{NDT}$ $K_I$ $RT_{NDT}$

The ASME approach for calculating the allowable limit curves for various heatup and cooldown rates specifies that the total stress intensity factor, ~~KI~~, for the combined thermal and pressure stresses at any time during heatup or cooldown cannot be greater than the reference stress intensity factor, ~~KIR~~, for the metal temperature at that time. ~~KIR~~ is obtained from the reference fracture toughness curve, defined in Appendix G to the ASME Code. The ~~KIR~~ curve is given by the equation: $K_{Ia}$

$K_{Ia}$ $\rightarrow$ ~~$K_{IR}$~~ $= 26.78 + 1.223 \exp [0.0145(T-RT_{NDT} + 160)]$ $RT_{NDT}$ (1)

Where: ~~KIR~~ is the reference stress intensity factor as a function of the metal temperature T and the metal nil-ductility reference temperature ~~RTNDT~~. Thus, the governing equation for the heatup-cooldown analysis is defined in Appendix G of the ASME Code as follows:

$< K_{Ia}$

$C K_{IM} + K_{IT} \leq$ ~~$K_{IR}$~~ (2)

Where: $K_{IM}$ = the stress intensity factor caused by membrane (pressure) stress,

$K_{IT}$ = the stress intensity factor caused by the thermal gradients,

$K_{Ia}$ $\rightarrow$ ~~$K_{IR}$~~ = constant provided by the Code as a function of temperature relative to the $RT_{NDT}$ of the material,

C = 2.0 for level A and B service limits, and

C = 1.5 for inservice hydrostatic and leak test operations.

W2003:DPS/ln/cls/cls

**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 - Vessels and Internals Integrity (CVIB) Requests for Additional Information - Round 1," Accession No. ML110420241, February 11, 2011.
3. M. Kiley (FPL) to U.S. Nuclear Regulatory Commission (L-2011-029), "Response to NRC Request for Additional Information (RAI) Regarding Extended Power Uprate (EPU) License Amendment Request (LAR) No. 205 and Reactor Materials Issues – Round 1," Accession No. ML110700068, March 9, 2011.
4. Email from J. Paige (NRC) to T. Abbatiello (FPL), "Turkey Point EPU - Vessels and Internals Integrity (CVIB) Requests for Additional Information - Round 2," Accession No. ML110840267, March 25, 2011.