FPL.

10 CFR 50.55a
L-2014-105
April 14, 2014

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

Re: Turkey Point Unit 3
Docket No. 50-250
Inservice Inspection Plan - Fifth Inspection Interval
Unit 3 Relief Request No. 1 – Response to Follow-up Request for Additional Information

References:
1) Florida Power & Light Company letter L-2014-096 to the Nuclear Regulatory Commission, "Inservice Inspection Plan - Fifth Inspection Interval, Unit 3 Relief Request No. 1", dated April 4, 2014

2) Email to Florida Power & Light Company, "Request for Additional Information Turkey Point Unit 3 Fifth Inspection Interval Relief Request No. 1 Revision 0 Repair of Pressurizer Stainless Steel Heater Sleeve Without Flaw Removal Docket No. 50-250", dated April 8, 2014

3) Florida Power & Light Company letter L-2014-100 to the Nuclear Regulatory Commission, "Inservice Inspection Plan - Fifth Inspection Interval, Unit 3 Relief Request No. 1 - Response to Request for Additional Information", dated April 9, 2014

4) Email to Florida Power & Light Company, "Follow-up Request for Additional Information Turkey Point Unit 3 Fifth Inspection Interval Relief Request No. 1 Revision 0 Repair of Pressurizer Stainless Steel Heater Sleeve Without Flaw Removal Docket No. 50-250", dated April 10, 2014

Pursuant to 10 CFR 50.55a(a)(3)(ii), Florida Power & Light Company (FPL) requested Nuclear Regulatory Commission (NRC) approval to use an alternative to a certain requirement in the ASME Boiler and Pressure Vessel Code, Section XI, in Reference 1. A NRC request for additional information (RAI) was forwarded to FPL in Reference 2. FPL responded to the Reference 2 RAI via Reference 3. A follow-up RAI was forwarded to FPL by the NRC in Reference 4. Attached is the FPL response to the

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NRR

Florida Power & Light Company

9760 SW 344th St., Florida City, FL 33035

Reference 4 RAI.

Please contact Robert Tomonto, Licensing Manager, at 305-246-7327 if you have any questions or require any additional information about this submission.

Very truly yours,

Michael Kiley
Site Vice President
Turkey Point Nuclear Plant

Attachment: Response to Follow-up Request for Additional Information Concerning Turkey Point Unit 3 Relief Request No. 1 for the 5th Inspection Interval

cc: Regional Administrator, USNRC Region II
Senior Resident Inspector, USNRC, Turkey Point Nuclear Plant

Turkey Point Unit 3
Fifth Inspection Interval - Relief Request No. 1
Response to Follow-up Request for Additional Information

By email dated April 10, 2014, the Nuclear Regulatory Commission (NRC) staff forwarded to the Florida Power & Light Company (FPL) a follow-up request for additional information (RAI) concerning FPL's request for relief from a certain provision of the ASME Boiler and Pressure Vessel Code. FPL submitted the request for relief by letter L-2014-096 dated April 4, 2014 and responded to an initial April 8, 2014 RAI on April 9, 2014 (FPL letter L-2014-100). The FPL response to the April 10, 2014 RAI follows.

NRC RAI

RAI 5 (Follow up to RAI 3a)

The response to Request for Additional Information (RAI) 3a in FPL's April 9, 2014 letter emphasizes that heatup and cooldown transients with insurge/outsurge transients dominate fatigue crack growth in the generic evaluation for Combustion Engineering (CE) designed pressurizers (Ref. 1, 2). In Table 1 of the RAI response, transients were listed that were not considered in the generic CE evaluation. Some of these transients have very large numbers of cycles over the life of the plant, such as plant loading at 5% per minute, plant unloading at 5% per minute, and steady state fluctuations (initial and random). The temperature range for some of these cycles, although less than that of the insurge/outsurge during heatup and cooldown, is around 100 degrees F for some of these transients.

Would any of the transients listed in Table 1 that were not considered in the generic CE evaluation be expected to contribute significantly to fatigue crack growth? If not, provide an explanation for why these transients would not be expected to be significant contributors to fatigue crack growth. If any of the other transients would contribute significantly to fatigue crack growth, provide justification that fatigue crack growth for the Turkey Point, Unit 3 pressurizer would remain bounded by the generic evaluation.

FPL Response to RAI 5

Table 1 in the response to RAI-3.a. lists design transients for the Turkey Point Unit 3 and 4 pressurizers. The transients and cycles are generally similar between Westinghouse and Combustion Engineering (CE) designs, except that there are 500 heatup/cooldown (HU/CD) cycles in the CE design, and only 200 in the Westinghouse design. This makes use of the CE design calculation conservative for this application. The CE evaluation in References 1 and 2 reviewed the pressurizer transients of the participating CE plants, and concluded that only HU/CD and operating basis earthquake (OBE) made any meaningful contribution to fatigue crack growth. The purpose of the pressurizer is to maintain system pressure while accounting for expansion and contraction of the system volume which occurs as the temperature changes. Most of the action in the pressurizer occurs as it experiences insurges and outsurges, with the accompanying temperature changes in the bottom head and surge nozzle. It is also important to note that the transient cycles listed in the table in the response to RAI-3.a. are for the design life of the plant, and the relief request is for only one operating cycle.

RAI 6 (Follow up to RAI 3b)

In response to RAI 3, Item b, FPL provided a graph of fracture toughness (K_{IC}) versus temperature for the Turkey Point, Unit 3 pressurizer bottom head material. However, both of the heater sleeve flaw evaluations referenced in the relief request (Ref. 1, 2) used elastic-plastic fracture mechanics (EPFM) techniques to demonstrate stability of the final flaw, because the American Society of Mechanical Engineers, Boiler and Pressure Vessel Code (ASME Code), Section XI linear elastic fracture mechanics (LEFM) acceptance criteria were not met. This is specifically noted in Section 6.3.3.2 of Reference 3. Also in Reference 2, EPFM was used as the basis for accepting the final flaws.

Therefore, the staff requests that FPL (1) provide the material resistance (J-R) curve for the Turkey Point, Unit 3 pressurizer bottom head material (2) justify the use of the J-R curve in this application if it is not based on test data, and (3) demonstrate that the J-R curve is bounded by (i.e., provides equivalent or greater resistance to fracture) the J-R curve used in Refs 1 and 2.

FPL Response to RAI 6

The SA-216 Gr. WCC cast steel has a minimum yield strength less than 50 ksi, therefore, the ASME Code reference toughness curves apply directly to them. To further demonstrate this, additional fracture toughness tests were completed on materials of the same time period [4], and those were provided in the previous RAI response. This demonstrates that these materials are similar in behavior to those used in the previous evaluations, and the fracture toughness models used in those evaluations are equally applicable here.

The results summary sections of [1 and 3] listed stability results using the linear elastic fracture mechanics method (LEFM, K_I versus K_{IC}) for the transients, except insurge/outsurge. The end of cooldown (CD) is limiting among these transients. The elastic-plastic fracture mechanics method (EPFM, $J_{applied}$ and J-R curves) was used to evaluate stability for insurge/outsurge transients. Per Figure 6-16 of [3], the limiting event for stability is 320°F CD in-surge.

There are no J-integral fracture resistance (J-R) curve data available for the pressurizer head SA-216 Gr. WCC cast steel materials, as this type of fracture toughness testing was not required in the 1965 ASME Section III Code. The material J-R curve used for the evaluations in [1 and 3] was for typical reactor pressure vessel steel. The J-R curve was determined from Equation 17 of Regulatory Guide (RG) 1.161 (Ref. 5), without the margin factor (MF) of 0.749. As noted in Section 6.3.3.2.2 of [3], an MF of 1.0 was used since $J_{applied}$ was conservatively multiplied by a factor of 3.0 in order to address the recommended safety factor (SF) of 1.15 and 1.25 for Levels A and B, respectively. Furthermore, a lower bound Charpy upper shelf energy (CVN_{USE}) value of 70 ft-lbs [3] was used in lieu of unavailable plant-specific Charpy tests of the pressurizer plate. This value is consistent with Branch Technical Position (BTP 5-2), Fracture Toughness Requirements, for pressure vessel materials.

The relevant input data used calculating $J_{applied}$ and $J_{Material}$ are:

σ_y = 43.74 ksi, Material Yield Strength at Temperature @ 610°F

CVN_{USE} = 70 ft-lb, Upper Shelf Energy from Charpy test

The model for the J-R curve in equation 17 of [5] is:

$$J_R = (MF)\ \{C1(\Delta a)^{C2} exp[C3\ (\Delta a)^{C4}]\}$$

For high toughness materials, where the sulfur level is below 0.018%, the constants for this equation are provided in [5] as:

$$C1 = exp[-2.44 + 1.13\ ln(CVN) - 0.00277\ T]$$

$$C2 = 0.077 + 0.116\ lnC1$$

$$C3 = -0.0182 - 0.0092 lnC1$$

$$C4 = -0.409$$

From this discussion and the preceding equation, it is shown that the J-R curve equation is primarily a function of the CVN_{USE}. For the J-R calculations shown in [3], the Charpy upper shelf energy was 70 ft-lb.

There are no plant specific data available for the SA-216 Gr. WCC cast steel used in the Turkey Point pressurizer heads. However, a number of heats of the same type of material were tested in [4], and full Charpy curves were obtained on three of them. These Charpy curves, shown in Figure 1 through Figure 3, demonstrate that the upper shelf Charpy energy is at least 100 ft-lb for each heat. Tests also demonstrate that the sulfur level for these materials is typically less than 0.018 weight percent. Therefore, the Regulatory Guide equations used in [3] for the previous evaluation are directly applicable.

Based on these evaluations, the model used in [1 and 3] is more limiting than a similar model based on the material of the Turkey Point Pressurizer head.

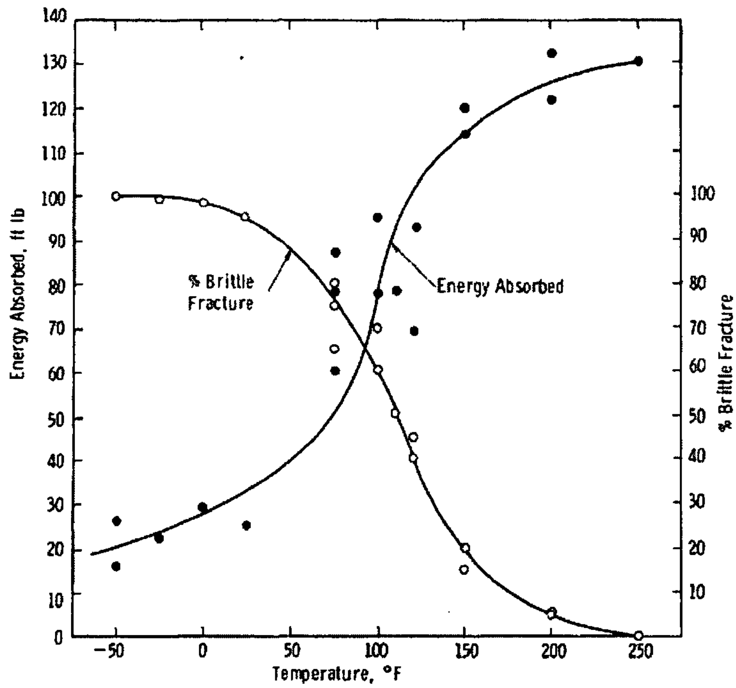

Figure 1: Temperature Dependence of the Charpy "V" Notch Impact Properties of SA-216 Gr. WCC, Heat 4312. (Sulfur content = 0.013 wt. %) [4]

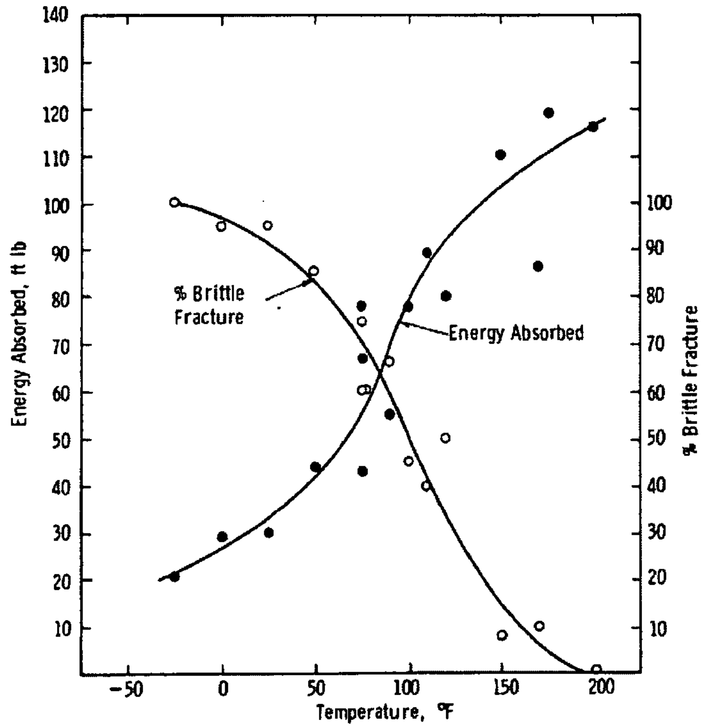

Figure 2: Temperature Dependence of the Charpy "V" Notch impact properties of SA-216 Gr. WCC, Heat 4394. (Sulfur content = 0.011 wt. %)

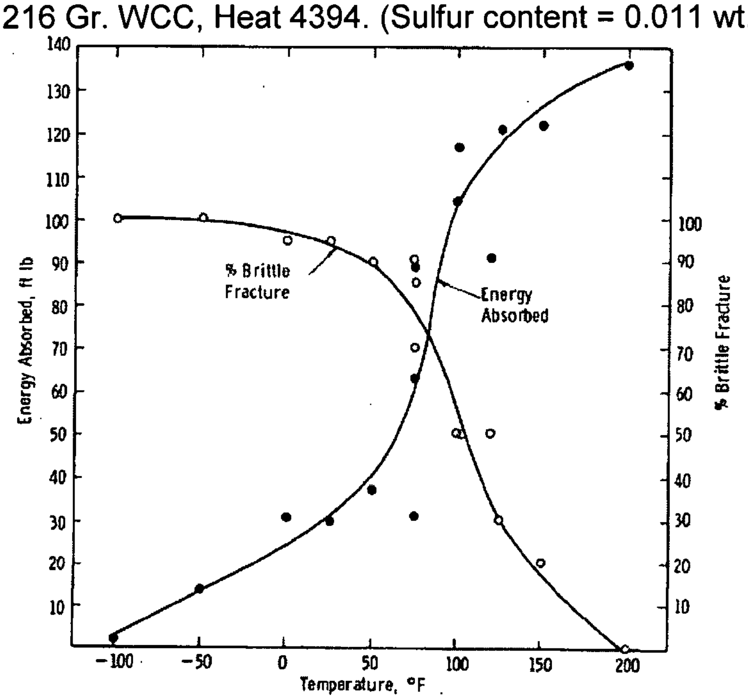

Figure 3: Temperature Dependence of the Charpy "V" Notch impact properties of SA-216 Gr. WCC, Heat 4547. (Sulfur content = 0.010 wt. %)

References

1. WCAP-15973-P-A, Rev. 0, "Low-Alloy Steel Component Corrosion Analysis Supporting Small-Diameter Alloy 600/690 Nozzle Repair/Replacement Programs" (ML050700433) (non-proprietary version available at ML050700431)

2. Areva Calculation 32-9156231-000, "CCNPP-1 PZR Heater Sleeve As-Left J-Groove Weld Flaw Evaluation for IDTB Repair - Non-Proprietary," (ML11132A183)

3. Calculation CN-CI-02-71, Rev 1, "Summary of Fatigue Crack Growth Evaluation Associated with Small Diameter Nozzles in CEOG Plants." (ADAMS Accession No. ML041540237)

4. Westinghouse Report, 72-1E7-FCAST-R1, "Fracture Toughness and Crack Growth Rate Properties for A216 WCC Grade Cast Steel," April 7, 1972. (Westinghouse Proprietary Class 2)

5. US NRC Regulatory Guide 1.161, Rev. 0, "Evaluation of Reactor Pressure Vessels with Charpy Upper-Shelf Energy Less Than 50 Ft-Lb," June 1995.