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February 27, 2015
L-15-023

10 CFR 50.90

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

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Response to Request for Additional Information Regarding a Request to Amend Technical Specification 3.4.11, "RCS Pressure and Temperature (P/T) Limits" (TAC No. MF4351)

By correspondence dated June 23, 2014 (Accession No. ML14174A633), FirstEnergy Nuclear Operating Company (FENOC) submitted a request to amend Technical Specification 3.4.11, "RCS Pressure and Temperature (P/T) Limits," for the Perry Nuclear Power Plant.

By correspondence dated December 3, 2014 (Accession No. ML14323A666), the Nuclear Regulatory Commission (NRC) requested additional information to complete its review. FENOC's response to this request is attached.

There are no regulatory commitments contained in this submittal. If there are any questions or additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at (330) 315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on February 27, 2015.

Sincerely,

Ernest J. Harkness

Attachment: Response to December 3, 2014 Request for Additional Information

cc: NRC Region III Administrator
NRC Resident Inspector
NRC Project Manager
Executive Director, Ohio Emergency Management Agency,
State of Ohio (NRC Liaison)
Utility Radiological Safety Board

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By correspondence dated June 23, 2014, FirstEnergy Nuclear Operating Company (FENOC) submitted a license amendment request for Nuclear Regulatory Commission (NRC) review and approval. By correspondence dated December 3, 2014, NRC staff requested additional information to complete its review. The requested information is presented below in bold type, followed by the FENOC response.

1. **On April 29, 2003, the U.S. Nuclear Regulatory Commission (NRC) issued Amendment 127, which established the current pressure-temperature (P-T) limits. The P-T limits depend not only on the selection of controlling material, but also the adjusted reference temperature (ART) of the controlling material. Attachment 4, to the submittal dated June 23, 2014, states on page 7 that:**

   > **However, it was noted that another seam weld material was controlling and therefore the P/T curves were not revised.**

   Since the issuance of Amendment No. 127, identify whether Reference 19 to Attachment 4 and/or any other reactor pressure vessel (RPV) structural integrity documents, consistently reference the same ART values of the controlling material and the materials listed in Table 1 of Attachment 4. Provide the basis for any revisions of these ART values made since the issuance of Amendment 127.

   Response:
   Documents issued since Amendment No. 127[1] consistently reference the ART values of the controlling material and the other materials listed in Table 1 of Attachment 4. The only ART value that was changed since issuing the amendment is the surveillance weld referenced as "Heat No. or lot 5P6214B" in Table 1 of Attachment 4. For this weld, the 32 effective full power year (EFPY) ART value increased from 5 degrees Fahrenheit (°F) to 12°F due to Boiling Water Reactor Vessel and Internals Project (BWRVIP) integrated surveillance activities.

2. **Table 1 of Attachment 4 identified that Plate C2557-1 controls ART for the water level instrument nozzle (WLIN). Address whether the initial nil-ductility transition reference temperature (RT_{NDT}) for all plates was determined in accordance with American Society of Mechanical Engineers Boiler & Pressure Vessel Code (ASME Code), Section III, NB-2331, using the test data from transverse Charpy specimens.**

   Response:
   The initial RT_{NDT} for all plates was determined in accordance with ASME Code Section III, NB-2331, "Materials for Vessels," using test data from transverse Charpy specimens.

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[1] NRC letter dated April 29, 2003 (Accession No. ML030700189).

3. **The licensee indicates that the proposed P-T limits are based on the Boiling Water Reactor Owners Group (BWROG) report BWROG-TP-11-023-A, "Linear Elastic Fracture Mechanics Evaluation of General Electric Boiling Water Reactor Water Level Instrument Nozzles for Pressure-Temperature Curve Evaluations." As indicated in the safety evaluation for BWROG-TP-11-023-A, the BWROG clarified that the loads from the piping attached to the safe end of the instrument nozzle were considered in the evaluation. Attachment 4 states; however, on page 9 that:**

   > **Pipe reactions from the instrument line were not included as the resulting stress was determined to be negligible.**

   Attachment 4 states that the unit pressure stress intensity factor is 68.4 ksi-in$^{0.5}$. Given that the value of 69.4 ksi-in$^{0.5}$ used in the subsequent calculations on page 10, address the discrepancy in the stress intensity factors.

   Response:
   The unit pressure stress intensity factor of 68.4 ksi-in$^{0.5}$, as cited on page 9 of Attachment 4, is a typographical error. The correct unit pressure stress intensity factor, which is used in subsequent calculations, is 69.4 ksi-in$^{0.5}$. Based on a review of Attachment 4, this discrepancy occurs only once (page 9 of Attachment 4) and does not affect the results of any calculations performed. This discrepancy has been documented in FENOC's corrective action program.

4. **Sample bottom head curve calculations in Appendix B (pages B-20, B-23, and B-27) to SIR-05-044, Revision 1, "Pressure-Temperature Limits Report Methodology for Boiling Water Reactors," indicated that the calculated pressure is reduced by the static head to arrive at the adjusted pressure. Attachment 4 states on page 12 that:**

   > **The corresponding static head is 853.13 inches x 0.0361 psi/inch = 30.8 psig. This value is used to decrease the allowable pressure for the upper vessel and beltline curves. The bottom head curves were not changed in this update and the data source for these curves [is] referenced in the attachments.**

   Discuss whether the bottom head curves were updated to account for the static head, considering that the bottom head will experience the full effect of the static head, if not explain why.

   Response:
   In the June 23, 2014 submittal[2] to update the P/T limit curves, FENOC stated the bottom head curves remain unchanged (that is, they were not updated). In its June 4, 2002 submittal to update the P/T limit curves, FENOC provided General

[2] FENOC letter dated June 23, 2014 (Accession No. ML14174A633), Attachment 4, page 2.

Electric documentation[3] detailing the inclusion of reactor pressure vessel hydrostatic pressure in the development of the bottom head curves. On April 29, 2003, the NRC issued Amendment No. 127. Therefore, since the bottom head curves already consider the effect of static head, updating the curves is not necessary.

5. **Attachment 4 states on page 14 that:**

> **RT_{NDT} values for the closure flange materials are found in DIN [Document Index] 19, Attachment 3, Table 4-1, and is equal to 10 degrees F.**

Address whether this value is based on transverse Charpy data. If not, discuss how this value was determined.

Response:
The RT_{NDT} values for the closure flange materials are based on test data from transverse Charpy specimens.

6. **Attachment 4 states on page 16 that:**

> **The leak test data from the last three refuels was plotted against the revised WLIN curve for 22 EFPY [effective full-power year]. Test pressure slightly exceeded the new 22 EFPY curve. A review of the 32 EFPY curve indicated that test temperature will have to increase above 125 degrees F[ahrenheit] to achieve similar test pressures.**

a. **Discuss why an evaluation in accordance with ASME Code, Appendix E, "Evaluation of Unanticipated Operating Events," is not necessary.**

Response:
In support of the proposed 32 EFPY P/T limit curves in the June 23, 2014 submittal, Attachment 4 developed P/T limit curves for both 22 EFPY and 32 EFPY using the more recent BWROG pressure-temperature limits report methodology[4], a boundary integral evaluation method. That BWROG methodology employs a less refined analytical approach, as discussed on page 16 of Attachment 4. Using the BWROG methodology resulted in the proposed P/T limit curves shifting slightly to the right. The purpose of the Attachment 4 statement "test pressure slightly exceeded the new 22 EFPY curve" was to assess the potential effect of the proposed P/T limit curves on future plant operation and testing. The current 22 EFPY P/T limit curves were not exceeded during plant operation or testing. Therefore, an ASME Appendix E evaluation was not required or performed.

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[3] FENOC letter dated June 4, 2002 (Accession No. ML021650244), Attachment 7, page 20.
[4] Licensing Topical Report BWROG-TP-11-023-A, Revision 0, "Linear Elastic Fracture Mechanics Evaluation of General Electric Boiling Water Reactor Level Instrument Nozzles for Pressure-Temperature Curve Evaluations."

b. Provide the test pressure and temperature line for future operation to demonstrate that this line is to the right and below the proposed pressure test curves to 32 EFPY in Figure 3.4.11-1(a).

Response:
Technical Specification 3.4.11 Bases states, "Since the P/T limits are not derived from any DBA [Design Basis Accident], there are no acceptance limits related to the P/T limits. Rather, the P/T limits are acceptance limits themselves since they preclude operation in an unanalyzed condition." Therefore, an additional test pressure and temperature line for future operation is not required.

7. Attachment 4 states on page 18 regarding historical review of heatup and cooldown data that:

> **The historical data indicates no violation of the 22 EFPY revised curves was observed. The 32 EFPY curves were satisfied with the exception of the leak test curves. The minimum temperature of the leak test needs to be increased to satisfy the impact of the WLIN Leak Test curve at 32 EFPY, Attachment 2.**

a. This statement from page 18 of Attachment 4 appears to contradict the statement highlighted in request for additional information-6 from page 16 of the same document. Clarify whether the "no violation" from page 18 means an "insignificant violation" was observed. Identify whether there are any other "insignificant violations" for the 22 EFPY curves during the last 3 outage cycles.

Response:
As stated in the response to RAI 6a above, past test data was reviewed only to assess the potential effects of the proposed P/T limit curves on future plant operation and testing. A review of FENOC's corrective action program for the period covering the last three outage cycles did not identify any violations or insignificant violations of the current P/T limit curves. Therefore, the current 22 EFPY P/T limit curves were not exceeded during plant operation or testing.

b. The last sentence of the quote indicated that the minimum temperature of the leak test needs to be increased to satisfy the impact of the WLIN Leak Test curve at 32 EFPY. Explain how the minimum temperature increase will be accomplished (i.e. test procedure revision, etc...).

Response:
Applicable operating procedures and operator aides (for example, the plant computer) are updated to reflect the approved changes to P/T limit curves. These updates are addressed during the implementation period following receipt of an amendment.

8. **The NRC staff understands that, beginning with the next fuel cycle, Global Nuclear Fuel (GNF) 2 fuel will be loaded into the reactor core replacing General Electric (GE) 14 fuel. Explain whether the fluence calculations supporting the proposed P-T limits are bounding for both fuel designs.**

   Response:
   As cited in the Perry Nuclear Power Plant (PNPP) USAR[5], neutron fluence values are determined using an NRC-approved neutron fluence calculation methodology[6]. These fluence values are periodically updated, based on the results of the NRC-approved BWRVIP[7] material surveillance specimen initiative. However, as stated in the response to RAI 9 below, "the current fluence values remain applicable" and are bounding for both fuel designs as discussed below.

   The GNF2 fuel bundle design is more efficient [more uranium per bundle, resulting in the same cycle energy using less new bundles] than the GE14 design. For the PNPP reactor core, this results in a reduced number of new fuel bundles needed in each reload batch. Over time, this results in more twice-burned fuel bundles being carried over into a third operating cycle than would be the case using only the GE14 fuel design. Since core designers load these twice-burned bundles on the core periphery, this will result in a reduction in peripheral fuel bundle power, which reduces reactor vessel fluence. Therefore, since the reactor vessel fluence will be reduced with the introduction of GNF2 fuel, the fluence calculations supporting the proposed P/T limit curves are bounding for both GE14 and GNF2 fuel designs.

9. **The P-T limit curves being updated by the licensee remove the 22 EFPY curves while updating the 32 EFPY curves. The updated 32 EFPY curves show differences compared to the current 32 EFPY curves currently in Technical Specification (TS) 3.4.11. Please provide a detailed description of the fluence calculations used to determine the proposed 32 EFPY P-T limit curves for implementation into TS 3.4.11.**

   Response:
   On June 4, 2002, FENOC submitted a license amendment request to update the P/T limit curves. On April 29, 2003, the NRC issued Amendment No. 127, which established the current P/T limit curves. In the June 23, 2014 submittal[8] to update only the 32 EFPY P/T limit curves, FENOC stated the current fluence values remain applicable (that is, they have not been updated since Amendment No. 127). The noted differences in the updated 32 EFPY curves as compared to the current 32 EFPY curves are due to other reasons, such as the different methodology discussed in the response to RAI 6a above. Therefore, a detailed description of the fluence calculations is not necessary.

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[5] Updated Safety Analysis Report (USAR) Section 5.3.1.6.2, "Neutron Flux and Fluence Calculations."
[6] NRC Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence."
[7] Boiling Water Reactor Vessel and Internals Project (BWRVIP) BWRVIP-86-A, "BWR Vessel and Internals Project, Integrated Surveillance Program (ISP) Implementation Plan."
[8] FENOC letter dated June 23, 2014, Attachment 4, page 3.