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L-10-321

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

SUBJECT:
Beaver Valley Power Station, Unit No. 2
Docket No. 50-412, License No. NPF-73
Request for Additional Information Response Related to License Amendment Request for Revised Steam Generator Inspection Scope Using the F* Methodology (TAC No. ME3498)

By letter dated February 26, 2010 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML100630422), FirstEnergy Nuclear Operating Company (FENOC) submitted a license amendment request to revise the Technical Specifications by expanding the scope of the steam generator inspections using the F* inspection methodology to the steam generator cold-leg tube sheet region. Additional information was requested by the Nuclear Regulatory Commission (NRC) staff in a letter dated October 1, 2010 (ADAMS Accession No. ML102740027). The FENOC response to the NRC staff request for additional information (RAI) is attached.

There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager–Fleet Licensing, at 330-761-6071.

I declare under penalty of perjury that the foregoing is true and correct. Executed on November 30, 2010.

Sincerely,

Paul A. Harden

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NRR

Attachment:

Response to NRC RAI Related to Revised Steam Generator Tube Inspection Scope Using the F* Methodology at Beaver Valley Power Station, Unit No. 2

cc: NRC Region I Administrator
NRC Resident Inspector
NRC Project Manager
Director BRP/DEP
Site BRP/DEP Representative

By letter dated February 26, 2010, FirstEnergy Nuclear Operating Company submitted a license amendment request (LAR). The LAR would revise the Technical Specifications by expanding the scope of the steam generator (SG) inspections using the F* inspection methodology to the SG cold-leg tubesheet region at Beaver Valley Power Station, Unit No. 2 (BVPS-2). In order to complete their review of the LAR, the Nuclear Regulatory Commission (NRC) staff requested additional information in a letter dated October 1, 2010. Each request for additional information (RAI) in the October 1, 2010 letter is presented below in bold type and is followed by the FENOC response.

RAI 1

The paragraph at the bottom of page 7, of the Enclosure to the February 26, 2010, letter, seems to indicate that BVPS-2 had outages during the spring and fall of 2009 (i.e., 2R09 [spring 2009] and 2R14 [fall 2009]). Clarify the outage history listed in this paragraph.

FENOC Response

Refueling outage 2R09 occurred in February of 2002. The sentence in the paragraph at the bottom of Page 7 that makes reference to 2R09 should read, "The first occurrence of hot leg PWSCC was reported at the 2R09 (Spring 2002) outage (11.13 effective full power years [EFPY]), and is far later in the plant's operating history compared to similar plants which did not shotpeen prior to operation." The other listed outages (2R11, 2R12, 2R13, and 2R14) occurred as indicated in the paragraph.

RAI 2

The discussion on page 3 seems to indicate that a temperature differential (ΔT) of 471 degrees Fahrenheit (°F) was used with a differential pressure of 2650 pounds per square inch (psi) to calculate the F* value under faulted conditions. Section 2.1.5 of WCAP-16385-NP (ADAMS Accession No. ML051040084) indicates that a ΔT of 460 °F (530 - 70) was used for calculating the F* value under faulted conditions. Confirm the ΔT used in the analysis for faulted conditions. In addition, confirm that the analysis is consistent with your design and licensing basis steam line break accident.

FENOC Response

Both normal operating and faulted conditions were considered when determining the F* value. A limiting ΔT of 460°F was used for calculating F* under faulted conditions with a temperature of 530°F assumed for both hot and cold legs. The applied faulted condition primary-to-secondary pressure differential of 2650 psi is more conservative than the steam line break (SLB) accident. A normal operating condition sensitivity case was also investigated using a ΔT of 471°F and a bounding primary-to-secondary pressure differential of 1550 psi (700 psia steam pressure). The resulting F* value is bounded by the faulted condition value of 1.97 inches.

Technical Specification 3.4.11 requires the power operated relief valves (PORVs) to be operable in Modes 1, 2 and 3. The limiting primary-to-secondary pressure differential experienced during a postulated SLB accident will be limited by the PORVs to approximately 2350 psi. At a ΔT of 460°F and SLB pressure differential of 2350 psi, the F* value is reduced to 1.94 inches. The assumed hot and cold leg temperature of 530°F is consistent with the F* hot leg analysis previously performed for BVPS-2 and is bounded by the ΔT at the peak primary-to-secondary pressure differential of 2350 psi. Therefore, it can be concluded that the F* analysis conditions bound the design and licensing basis.

RAI 3

The licensee stated on page 6 that the BVPS-2 Technical Specification (TS) Section 5.5.5.2.d.5 requires 100 percent full-length inspection of each SG tube using a bobbin probe. The NRC staff notes that TS 5.5.5.2.d. does not specify which type of probe is to be used, but rather, indicates that the inspection shall be performed with the objective of detecting flaws that may satisfy the applicable tube repair criteria. Clarify the intent of your original statement. In addition, confirm that tubes at BVPS-2 are being inspected with probes capable of detecting flaws that may satisfy the applicable tube repair criteria.

FENOC Response

The sentence in question will be clarified to state "BVPS-2 SG inspections fulfill Specification 5.5.5.2.d.5 by inspecting 100 percent of the inservice tubes in the hot leg tubesheet region with the objective of detecting flaws that may satisfy the applicable tube repair criteria of Specification 5.5.5.2.c.5 every 24 effective full power months or one interval between refueling outages (whichever is less)." The intent of the original statement was to indicate that SG tubes at BVPS-2 are inspected to satisfy the requirements of Technical Specification Section 5.5.5.2.d, in part, by the use of probes capable of detecting flaws that may satisfy the applicable tube repair criteria.

RAI 4

In Attachment 1 of the February 26, 2010, letter, TS 5.5.5.2.d.6 proposed adding a requirement for a 20% minimum sample of the cold-leg tubes when the F* alternate repair criterion (ARC) are implemented on the cold-leg side of the tubesheet. The current TSs are largely performance-based and generally do not specify a sample size, except for ARC where the potential for cracking is known to exist and a 100% sample is specified (i.e., TS 5.5.5.2.d.5). In addition, it is not clear as to what the first sentence of TS 5.5.5.2.d.6 is implying. Since the

inspection of the cold-leg tubesheets are already covered by other portions of your TSs, discuss your plans to delete this proposed paragraph.

FENOC Response

The last sentence of Section 5.5.5.2.d (on page 5.5-10) states, a degradation assessment (DA) shall be performed to determine the type and location of flaws to which the tubes may be susceptible and, based on this assessment, to determine which inspection methods need to be employed and at what locations. The current DA for BVPS-2 considers cold leg top-of-tubesheet degradation as non-relevant, that is, degradation should not occur for several more operating cycles. As such, there is no requirement to inspect the cold leg top-of-tubesheet. However, due to the 2R14 SG "A" hot leg top-of-tubesheet examinations resulting in greater than one percent of the tubes inspected being defective, a 20 percent sample of the SG "A" cold leg top-of-tubesheet region will be inspected during 2R15. Therefore, FENOC proposes to leave Section 5.5.5.2.d.6 as written.

RAI 5

Plants implementing other alternate repair criteria, such as H*, have committed to monitoring for slippage during each inspection of the SGs. Discuss your plans to commit to monitoring for tube slippage as part of the SG tube inspection program.

FENOC Response

Tube slippage has not been observed or reported from the field. The tube expansion process used at BVPS-2 is mechanical rolling (sometimes referred to as hard roll). This process provides a unit length resistive load capability far in excess of hydraulically expanded tubes. The mechanical roll process involves an interference fit between the tube and tubesheet hole. That is, if the tubesheet hole were to be enlarged, or removed (as in a laboratory specimen), the residual stresses in the tube due to the expansion process would cause the tube to expand by approximately 0.0015 inch. The applied F* methodology for BVPS-2 includes a minimum inspection distance of three inches below the top of tubesheet. This is greater than the F* length required to preclude tube pullout for the limiting analysis condition. Therefore, monitoring of tube slippage, as was imposed for the H* criteria, is not required due to the mechanical rolling process employed for the BVPS-2 tubing.

RAI 6

Recent changes to SG finite element models have resulted in other ARC analyses (i.e., H*) showing a loss of contact pressure at the top of the tubesheet for up to as much as four inches in other SG designs. Discuss whether the information from the H* program (e.g., changes to coefficients of thermal expansion, probabilistic analyses, revised finite element models, non-destructive examination uncertainty) would challenge the adequacy of the proposed inspection distance in the current LAR.

FENOC Response

Unlike hydraulically expanded tubing, BVPS-2 mechanical roll expanded tubing provides for an interference fit between the tube and tubesheet hole. Postulated deflection of the tubesheet hole would not exceed the tube OD growth due to residual stresses from the roll expansion process, and pressure and thermal expansion effects.

The BVPS-2 and prior F* analyses were based on a two-dimensional deflection model of the tubesheet. The H* analysis included an updated, three-dimension finite element model. The current condition specific, three-dimensional finite element model used to support the H* alternate repair criterion analysis results in smaller displacement than the two-dimensional models used to support F*. That is, the more refined 3-D model predicts lesser displacement than the 2-D model, when applied to the same SG design. There is no loss of contact pressure for the F* condition when using the 2-D model results. Application of the more current 3-D model would result in a reduction of the F* values as the calculated amount of tube hole deflection would be less than currently analyzed. In addition, minor influences upon the F* distance that could be imposed due to variance in material properties would be offset by conservatism that already exists in the 2-D model used for the F* analysis. Therefore, the information from the H* program does not challenge the adequacy of the proposed inspection distance in the current license amendment request.

RAI 7

BVPS-2 is authorized to repair tubes by sleeving. Since some of the sleeve joints may be installed near the tube end, such that 3 inches of tubing is not present below the lower end of the lower sleeve joint, discuss your plans to modify your proposed TSs to not allow F* to be applied in tubing sleeved in this manner.

FENOC Response

Three different sleeve designs are licensed for use at BVPS-2, (a) the Alloy 800, (b) the tungsten inert gas (TIG) welded, and (c) the laser welded sleeve. The Alloy 800 sleeve design locates the lower sleeve-to-tube joint at the approximate mid-plane elevation of the tubesheet. Thus, the end of the sleeve is located approximately 10 inches above the primary face of the tube end. This leaves approximately 10 inches of the parent tube below the end of the sleeve for inspection and implementation of F*.

The TIG welded and laser welded sleeve design locates the lower end of the sleeve coincident with the primary face of the tube end. These designs do not leave any parent tube extending beyond the sleeve end that would require inspection. Therefore, F* can not be implemented with these sleeve designs.

Based on the design of the tubes sleeves as described above, modification of the proposed Technical Specification is not necessary.