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FirstEnergy Nuclear Operating Company

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April 14, 2006
L-06-041

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

Subject: Beaver Valley Power Station, Unit No. 2
BV-2 Docket No. 50-412, License No. NPF-73
Response to Request for Additional Information on
License Amendment Request 183 (TAC No. 6768)

By letter dated April 11, 2005, the FirstEnergy Nuclear Operating Company (FENOC) submitted License Amendment Request (LAR) 183 that will revise Steam Generator inspection scope by using the F* methodology for Beaver Valley Power Station Unit No. 2. In letters dated December 2, 2005 and January 27, 2006, FENOC responded to an October 28, 2005 request for additional information from the NRC. Subsequently, by letter dated February 28, 2006, the NRC requested further information regarding the FENOC submittals. The FENOC responses to this request are provided in Attachment 1. Attachment 2 provides a list of regulatory commitments contained in this submittal.

If there are any questions or if additional information is required, please contact Mr. Gregory A. Dunn, Manager – FENOC Fleet Licensing, at (330) 315-7243.

I declare under penalty of perjury that the foregoing is true and correct. Executed on April 14, 2005.

Sincerely,

James H. Lash

Attachments
1. FENOC Response to Request for Additional Information
2. Commitment List

A001

References:

1. Beaver Valley Unit No. 2 License Amendment Request No. 183 - Revised Steam Generator Inspection Scope, dated April 11, 2005
2. Beaver Valley Power Station, Unit No. 2 - Revised Steam Generator Inspection Scope-Request for Additional Information (TAC No. 6768), dated October 28, 2005
3. Beaver Valley Power Station, Unit No. 2 - Response to Request for Additional Information on License Amendment Request regarding Revised Steam Generator Inspection Scope (TAC No. 6768), dated December 2, 2005
4. Beaver Valley Power Station, Unit No. 2 - Supplement to License Amendment Request No. 183, Revised Steam Generator Inspection Scope (TAC No. MC6768), dated January 27, 2006
5. Beaver Valley Power Station, Unit No. 2 - Request for Additional Information – Approval of F* Methodology For Steam Generator Tube Inspections (TAC No. 6768), dated February 28, 2006

c: Mr. T. G. Colburn, NRR Senior Project Manager
Mr. P. C. Cataldo, NRC Senior Resident Inspector
Mr. S. J. Collins, NRC Region I Administrator
Mr. D. A. Allard, Director BRP/DEP
Mr. L. E. Ryan (BRP/DEP)

ATTACHMENT 1 to L-06-041

FENOC Response to Request for Additional Information

BEAVER VALLEY POWER STATION UNIT NO. 2 (BVPS-2)

STEAM GENERATOR (SG) F* INSPECTION METHODOLOGY

DOCKET NO. 50-412

By letter dated April 11, 2005 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML051040080), FirstEnergy Nuclear Operating Company (FENOC, the licensee), submitted a license amendment request for BVPS-2, to revise the scope of SG tube inspections. The amendment defines a distance called F* (F-star), which is measured downward into the tubesheet. The portion of tubing in the tubesheet below the F* distance would be excluded from inspection. Technical justification for this change was provided in Westinghouse Topical Report WCAP-16385-P, Revision 1, "F* Tube Plugging Criterion for Tubes with Degradation in the Tubesheet Roll Expansion Region of the Beaver Valley Unit 2 Steam Generators," dated March 2005.

In letters dated December 2, 2005 (ADAMS Accession No. ML053420343), and January 27, 2006 (ADAMS Accession No. ML060330258), FENOC responded to an October 28, 2005, RAI from the Nuclear Regulatory Commission (NRC) staff. The licensee also provided clarifying information in a telephone conference on February 7, 2006. In order to complete its review, the NRC staff needs the additional information requested below.

1. It is the NRC staff's understanding from your proposed technical specification (TS) revisions that all unsleeved tubes in the hot-leg tubesheet will be inspected within the F* distance or to 3.0 inches below the top of the tubesheet (TTS), whichever is greater (licensee's January 27, 2006, letter). It is also the NRC staff's understanding that all unsleeved tubes will be repaired or removed from service upon detection of service-induced degradation within the F* distance or 3.0 inches below the TTS, whichever is greater. Since no inspection will be required below the F* distance or 3.0 inches below the TTS, whichever is greater, and no service-induced degradation can be left in service in the region inspected, it is not clear how you will implement your plan to address leakage by applying the value of 1.1×10^{-4} gpm to primary water stress-corrosion cracking (PWSCC) eddy current indications (>3 V on the 300 KHz +Point channel) found below the F* distance (licensee's December 2, 2005, letter, response to RAI No. 6). Please clarify how leakage from tubes degraded within the tubesheet will be addressed, both within and below the F* distance (or 3.0 inches below the TTS, whichever is greater).

Response

Proposed TS 4.4.5.4.a.6.a describes plugging or repair limits for tubes to which the F* methodology would be applied. Tubes required by these criteria to be plugged or repaired would have no leakage assessed. For a tube that is acceptable for continued operation per the proposed repair limits, with an indication amplitude greater than 3 volts by +Point (300 kHz), a leakage allowance of 1.1 x 10^{-4} gpm will be applied to that tube in the condition monitoring report. If the postulated indication amplitude at the end of the next operating cycle is projected to exceed 3 volts, a leakage allowance of 1.1 x 10^{-4} gpm will be applied to the operational assessment. If the +Point amplitude of the flaw is less than 3 volts, no leakage allowance will be applied.

2. **It is the NRC staff's understanding that the leakage rates presented in Table 2-2 of WCAP-14697 for 7/8-inch diameter SG tubes were calculated values based on test measurements for 3/4-inch diameter tubes. In Section 2.3.1 of WCAP-14697, which addresses the applicability of 3/4-inch diameter tube test results to 7/8-inch diameter tubes, the correction factor for contact pressure is based on a linear relationship between contact pressure and leakage flow. That is, the leakage flow for the 7/8-inch diameter tubing is considered 20 percent higher than that for the 3/4-inch diameter tubing based on a 20 percent lower contact pressure. Please discuss the basis for using a linear relationship between contact pressure and leakage flow.**

Response

Although WCAP-14697 applied a simple linear relationship, more recent finite element modeling shows that reduction in contact pressure due to bowing in a Model 51 SG (7/8 inch diameter tube) is less than or equal to a Model D SG (3/4 inch diameter tube). Therefore, the 20 percent greater leakage that a linear relationship would predict for 7/8 inch diameter tubes is unnecessary and conservative. Tubesheet bow analyses associated with WCAP-14697 used a simple conservative perforated plate model intended to overestimate the amount of tubesheet bow and the attendant reduction in contact pressure associated with Steam Line Break (SLB) versus normal operating conditions. Contact pressures for Model D and Model 51 rolled joints prior to adjustment for tubesheet bow are essentially equal. Finite element modeling of tubesheet deflections have been performed since the initial F* analyses were performed. Results of the finite element analyses show that the Model 51 tubesheet is at least as stiff as the Model D tubesheet. Thus, the reduction in contact pressure due to tubesheet bow for a Model 51 SG is less than for the Model D SG. Therefore, the 1.2 factor applied in the simpler WCAP-14697 model is conservative.

The suggested leakage allowance of 1.1 x 10^{-4} gpm for identified indications is based on conservative roll joint leakage rate test data for 3/4 inch diameter tubes. A conservative 3/4 inch diameter leak rate value based on testing was scaled up proportionately to reflect greater available leakage flow cross-sectional area of a 7/8 inch diameter tube. In addition, the factor of 1.2 was applied to arrive at the 7/8 inch diameter leakage allowance. Therefore, 1.1 x 10^{-4} gpm is a conservative value.

The suggested leakage allowance for BVPS-2 is conservative when compared to W* leakage test data when equivalent contact pressures are considered.

3. **In your December 2, 2005, RAI response to RAI No. 7, it appears that you propose to implement the F* criterion to the portion of the parent tube below a sleeve joint in the tubesheet. In the periphery of the tube bundle, hole dilation is greater near the bottom of the tubesheet than at the top of the tubesheet. Please discuss whether it has been confirmed that the hole dilation in the peripheral tubes at the locations where sleeve joints can be established are bounded by the dilations calculated near the top of the tubesheet in the center of the tube bundle.**

Response

Yes, contact pressures developed from finite element modeling of a Model 51 SG tubesheet at several elevations within the tubesheet including the mid-plane region of the tubesheet, which is the approximate elevation of tube-sleeve hardroll joints, indicate that hole dilations near the top of the tubesheet bound dilations in the mid-plane region.

ATTACHMENT 2 to L-06-041

Commitment List

The following list identifies those actions committed to by FirstEnergy Nuclear Operating Company (FENOC) for Beaver Valley Power Station (BVPS) Unit No. 2 in this document. Any other actions discussed in the submittal represent intended or planned actions by FENOC. They are described only as information and are not regulatory commitments. Please notify Mr. Gregory A. Dunn, Manager – FENOC Fleet Licensing, at (330) 315-7243 of any questions regarding this document or associated regulatory commitments.

Commitment	Due Date
1. Administrative controls shall be established to ensure that: a. Steam generator tubes that are determined to be acceptable for continued operation per the TS plugging and repair limits that pertain to implementation of the F* methodology, with an indication amplitude greater than 3 volts by +Point (300 kHz), shall be assessed a leakage allowance of 1.1×10^{-4} gpm in the condition monitoring report and b. If the postulated indication amplitude at the end of the next operating cycle is projected to exceed 3 volts, a leakage allowance of 1.1×10^{-4} gpm will be applied to the operational assessment.	Upon Implementation of License Amendment