October 28, 2005

Mr. L. William Pearce
Vice President
FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Post Office Box 4
Shippingport, PA 15077

SUBJECT: BEAVER VALLEY POWER STATION, UNIT NO. 2 (BVPS-2) - REVISED STEAM GENERATOR INSPECTION SCOPE - REQUEST FOR ADDITIONAL INFORMATION (RAI) (TAC NO. MC6768)

Dear Mr. Pearce:

By letter dated April 11, 2005, you submitted a license amendment request (LAR) for BVPS-2 to revise the scope of steam generator tube inspections. Specifically, the amendment requests that the portion of tubing in the tubesheet below a distance referred as "F-star", be excluded from inspection. The Nuclear Regulatory Commission (NRC) staff has determined that additional information contained in the enclosure to this letter is needed to complete its review. These questions were discussed with your staff during a teleconference on October 19, 2005. As agreed to by your staff, we request that you provide your response within 30 days of receipt of this request in order for the NRC staff to meet your requested LAR review schedule.

If you have any questions, please contact me at 301-415-1402.

Sincerely,

/RA//

Timothy G. Colburn, Senior Project Manager, Section I
Project Directorate I
Division of Operator Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-412

Enclosure: RAI

cc w/encl: See next page

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SECOND-ROUND REQUEST FOR ADDITIONAL INFORMATION (RAI)

RELATED TO FIRSTENERGY NUCLEAR OPERATING COMPANY (FENOC)

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

EXTENDED POWER UPRATE (EPU)

DOCKET NO. 50-412

By letter dated April 11, 2005 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML051040080), First Energy Nuclear Operating Company (FENOC) submitted a license amendment request (LAR) to revise the scope of steam generator tube inspections. Specifically, the amendment defined a distance called "F-star" (F*), which is measured toward the hot-leg tube end from the bottom of the roll transition. 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 (Attachment D to the LAR).

The Nuclear Regulatory Commission (NRC) staff reviewed the information provided and determined the following information is needed to complete its review:

1. Your proposal includes modifying Technical Specification (TS) 4.4.5.2.e to require "rotating pancake coil inspection of the hot leg tubesheet F* distance or less than or equal to 3.0 inches below the top of the tubesheet, whichever is greater, for 100 percent of the tubes sampled." Given the NRC staff's position in Generic Letter 2004-01, "Requirements for Steam Generator Tube Inspections," it is not clear why a specific probe (rotating pancake coil) is listed in the TSs. The proposal is so specific that it will require you to use this technology even if other, more advanced probes are used to examine the hot-leg tubesheet F* distance. For example, non-rotating probe technology (e.g., array probes) could not be used to satisfy this TS. Multiple probe types may be required if, for example, a form of degradation occurs (or is postulated to occur) that cannot be reliably detected in the F* distance using a rotating pancake coil. What plans do you have to modify the TSs to avoid these limitations?

2. The proposed TS 4.4.5.2e, requires the F* inspection for "100 percent of the tubes sampled." The NRC staff does not understand the F* sampling requirements indicated by this statement, since it could either indicate: (a) that 100% of the active tubes will be inspected with a rotating probe for the entire F* distance, or (b) that 100% of the F* distance (e.g., approximately 3 inches) will be inspected for a sample of the active tubes. What plans do you have to modify the TSs to clarify the meaning of this statement?

3. Section 3, "Applied Inspection Length," of WCAP-16385-P, Revision 1, states there are 10 tubes with the bottom of the roll transition (BRT) located more than 1 inch below the hot-leg top of the tubesheet. It also describes an adjustment in the inspection distance to

ensure an adequate length of engaged tubing below the BRT is inspected. This adjustment calls for an inspection of at least 2.22 inches below the BRT (1.97 inches F* plus a 0.25-inch non-destructive examination uncertainty).

Section 3, "Applied Inspection Length," of WCAP-16385-P, Revision 1, also describes the use of the 95% confidence value for defining the location of the BRT and including this in the inspection distance to ensure adequate inspection of the tubes within the tubesheet. Given that all tubes must resist pullout from the tubesheet, and that TS 4.4.5.4.a.8 requires examination of the F* distance or less than or equal to 3.0 inches below the top of the tubesheet, whichever is greater, an inspection based on the 95% confidence value for the BRT location may not meet the TS requirement.

Since implementation of your proposed TS requires knowing the location of the BRT for each tube, please confirm that your procedures will ensure the length of tubing defined in TS 4.4.5.4.a.8 will be inspected (i.e., that the length of tubing inspected is not based on a non-bounding statistical determination of the location of the BRT).

As noted above, TS 4.4.5.4.a.8 requires examination within the tubesheet of "only the portion of the tube within the F* distance or less than or equal to 3.0 inches below the top of the tubesheet, whichever is greater." Including the phrase, "less than or equal to" means the required inspection distance could default to the F* distance whenever the F* distance is within 3.0 inches of the top of the tubesheet. If your intent was to require an inspection of, at least, the top 3.0 inches of the length of the tube that is within the tubesheet, please clarify the wording in the proposed TS.

4. In your evaluation (WCAP-16385-P, Revision 1), was any testing or analysis performed to evaluate the effect of thermal cycling on preload? Please discuss the results or the reason this was unnecessary.

5. WCAP-16385-P, Revision 1 determines the F* value based on 4% and 8% tube plugging. In addition, WCAP-16385-P, Revision 1 addresses the effects of plugging in excess of 8% of the tubes (refer to Section 3.1). Please provide the F* distance (using the methodology described in the WCAP) for your analyzed plugging limit for your current and EPU conditions. If this value of F* exceeds that specified in your current proposal, discuss your plans for modifying your TSs.

6. Regarding accident induced leakage, you indicated in your LAR that:

   > Any primary-to-secondary leakage from tube degradation below the F* length is so minimal for postulated steam line break event conditions that it will not affect offsite dose calculations and can therefore be neglected.
   >
   > WCAP-11306, Revision 2 describes a methodology for calculating leakage for cracks left in service and the justification for neglecting the total contribution of leakage through cracks below the F* distance to steamline break (SLB) consequences.
   >
   > SLB leakage is limited by leakage flow restrictions resulting from the crack and tube-to-tubesheet contact pressures that provide a restricted leakage path above the indications and also limit the degree of crack opening compared to free span

indications. The total leakage (for all such tubes) meets the industry performance criterion, plus the combined leakage developed by any other alternate repair criteria, and will be maintained below the maximum allowable SLB leak rate limit.

The methodology for determining leakage provides for large margins between calculated and actual leakage values in the F* criteria.

Please provide the methodology that will be used for determining the amount of accident induced leakage as a result of implementing the F* criterion. If you will be assuming there is no accident-induced primary-to-secondary leakage as a result of implementing the F* criterion, please provide the test data and analysis supporting this approach. The test data and analysis should specifically address the effects of tubesheet bow including the maximum “no contact length” of the most-limiting tube within the tubesheet.

7. TS 4.4.5.4.a.8 addresses tube inspections. In proposed TS 4.4.5.4.a.8, you indicated that "[w]ithin the tubesheet this [inspection] includes only the portion of the tube within the F* distance or less than or equal to 3.0 inches below the top of the tubesheet, whichever is greater. The tube-to-tubesheet weld is excluded from this inspection requirement. This exclusion does not apply to tubes with sleeves installed in the tubesheet region." Please clarify this wording since it is not clear whether it was your intent to require an inspection of the tube-to-tubesheet weld when the tubes are sleeved or whether your intent was to require a full-length tube inspection when a tube is sleeved (i.e., it is not clear what exclusion is being referred to). Furthermore, the basis for eliminating the requirement to inspect the parent tube within the tubesheet at, and below, a sleeve joint, was not provided (this includes the tube-to-tubesheet weld).

   TS 4.4.5.4.a.6 addresses the tube plugging or repair limit. Since proposed TS 4.4.5.4.a.8 may (see related question above) require an inspection of the entire tubesheet region for a tube that is sleeved, it is possible that degradation could be detected in those tubes. However, proposed TS 4.4.5.4.a.6 a) 3.0 would no longer specify the plugging or repair limit for any degradation identified in the parent tube of a tube sleeved in the tubesheet region if the degradation is located below the F* distance or below 3-inches from the top of the tubesheet, whichever distance is greater. Please discuss your plans for modifying the TS repair limits to ensure that the repair limits for the parent tube (of a tube sleeved in the tubesheet region) is clearly specified.

8. Please confirm that your operating parameters will always be bounded by the conditions for which the F* distance was determined in WCAP-16385-P, Revision 1 (e.g., temperature, pressures, etc.). If actual operating conditions may not always be bounded by what was assumed in your analysis, what controls are in place to ensure you won’t operate outside the bounds of this analysis.

9. Please discuss the expected condition of the tube-to-tubesheet joint. For example, discuss the amount of corrosion expected at the top of the tubesheet (similar to what may have been present in some of the test specimens) and whether there is sludge buildup at the top of the tubesheet.

10. Given the inherent assumption that neither structurally significant nor leakage-significant flaws will develop within the F* distance, and assumptions on degradation below the F* distance, please discuss your plans to provide the information listed below following each inspection. Similarly, please discuss your plans to modify the TSs to include reporting this information. Please confirm you do not expect to find structurally significant or leakage-significant flaws within the F* distance.

    a. Number of total indications, location of each indication, orientation of each indication, severity of each indication, and whether the indications initiated from the inside or outside surface.

    b. The cumulative number of indications detected in the tubesheet region as a function of elevation within the tubesheet.

    c. Projected end-of-cycle accident-induced leakage from tubesheet indications. This leakage shall be combined with the postulated end-of-cycle accident-induced leakage from all other sources. If the preliminary estimated total projected end-of-cycle accident-induced leakage from all sources exceeds the leakage limit, the NRC staff shall be notified prior to unit restart.

11. Although the TS Bases were provided for information only, the staff notes that the Bases do not appear to acknowledge that sleeves could be installed within the tubesheet region and that different inspection and acceptance limits would apply to tubes with sleeves in the tubesheet region (i.e., F* does not apply to sleeved tubes). In addition, the staff notes that some of the Bases wording may need to be changed as a result of responding to the above questions. Please discuss your plans to modify the Bases as a result of the questions/comments above.

Beaver Valley Power Station, Unit Nos. 1 and 2

cc:

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