June 20, 2003

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. 1 (BVPS-1) - ISSUANCE OF STEAM GENERATOR CONFERENCE CALL SUMMARY (TAC NO. MB7271)

Dear Mr. Pearce:

On March 3, 2003, the Nuclear Regulatory Commission (NRC) staff participated in a pre-outage conference call with FirstEnergy Nuclear Operating Company (FENOC) representatives. Additional calls regarding the ongoing steam generator tube inspection activities at BVPS-1 were held with FENOC representatives on March 25 and 27, 2003. Enclosure 1 contains a summary of the conference calls. Additionally, enclosure 2 contains materials made available to the NRC staff by FENOC representatives to facilitate the calls. If you have any questions, please contact me at (301) 415-1402.

Sincerely,

***/RA/***

Timothy G. Colburn, Senior Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-334

Enclosures: 1. Summary of Conference Calls
2. Licensee-Provided Materials

cc w/encls: See next page

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SUMMARY OF CONFERENCE CALLS

FIRSTENERGY NUCLEAR OPERATING COMPANY

REGARDING STEAM GENERATOR INSPECTION RESULTS

AT BEAVER VALLEY POWER STATION, UNIT NO. 1 (BVPS-1)

Pre-Outage Conference Call

On March 3, 2003, the Nuclear Regulatory Commission (NRC) staff participated in a pre-outage conference call with FirstEnergy Nuclear Operating Company (FENOC or the licensee) to discuss several steam generator (SG) issues which were recently identified at Diablo Canyon Power Plant, Unit 2 (DC2). These issues included: (1) observing higher than anticipated voltage growth in an axial outside diameter stress corrosion crack (ODSCC) at a tube support plate (TSP) intersection, and (2) identifying circumferential cracks in higher row U-bends (i.e., greater than row 2).

Similar to DC2, BVPS-1 implements a voltage-based repair criteria for axial ODSCC indications at TSP intersections in accordance with Generic Letter (GL) 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking." At DC2, a change in the voltage response for an indication was much higher than anticipated. This change in voltage was attributed to an increase in the through-wall length of the flaw. That is, at the time of the last inspection of the flaw in 2001, the flaw was nearly through-wall (or through-wall) for some short distance. During the course of the next operating cycle, the flaw's through-wall length grew to a total length of approximately 0.45 inches, resulting in a substantial increase in the voltage response. At the time of the inspection in 2001, the flaw had an atypically high rotating-probe voltage when compared to the bobbin voltage of the indication (a ratio of rotating-probe voltage-to-bobbin voltage greater than 1.0 is atypical). The voltage associated with the rotating probe was from a +Point™ coil.

Since BVPS-1 implements the GL 95-05 repair criteria, the NRC staff discussed this issue with the licensee for BVPS-1. During the call, representatives from BVPS-1 indicated that currently approximately 3300 indications are left in service in accordance with the repair criteria discussed in GL 95-05. In the past two outages, more than 1000 indications with bobbin voltages less than two volts were examined using a rotating probe equipped with a +Point™ coil. For the indications which remained in service from the previous outage and were inspected with a rotating probe, the licensee indicated there were no unusual +Point™-to-bobbin-coil-voltage ratios as was observed at DC2.

Consistent with past practice, the licensee for BVPS-1 will be performing rotating-probe examinations of a minimum of 100 indications per SG which have bobbin-voltage amplitudes less than two volts to ensure flaw morphology is consistent with that described in GL 95-05. These examinations are in addition to those specified in GL 95-05. The NRC staff indicated that the preliminary findings at DC2 raised an issue of whether additional rotating-probe examinations, (i.e. in addition to those usually performed in support of GL 95-05) were necessary to ensure adequate tube integrity for the period of time between inspections.

At DC2, circumferential cracks were observed in the U-bend region of higher row tubes (i.e., greater than row 2). Typically, circumferential cracks have only been identified in tubes with smaller bend radii (e.g., rows 1, 2). As a result of these findings, the licensee for BVPS-1 indicated it planned to perform a 100% +Point™ examination of the U-bend region of all active tubes in all steam generators during their upcoming outage. For the last four cycles, BVPS-1 had performed a +Point™ examination of the U-bend region of 100% of the active row 1 and 2 tubes and a 20% sample of the row 3 tubes.

Outage Conference Calls

On March 25-27, 2003, the NRC staff participated in conference calls with FENOC representatives regarding the ongoing (i.e. 1R15) SG tube inspection activities at BVPS-1. At the time of the calls, the 100% bobbin-coil inspections were nearly complete and rotating pancake-coil (RPC) inspections were ongoing.

In support of the conference call, the licensee provided a summary of their initial inspection scope, expansion criteria, inspection results and other preliminary information related to their ongoing SG inspection. The following paragraphs highlight some of the more detailed discussions that occurred.

Primary-to-secondary leakage during the operating cycle leading up to the 1R15 outage did not exceed 0.05 gallons per day. Following a plant trip which occurred mid-cycle, no further leakage was detected.

The licensee examined 100% of the tubes from 6 inches above the tubesheet to 8 inches below the hot leg top-of-tubesheet with a +Point™ probe. The remainder of the tube within the tubesheet is only inspected with the bobbin probe which is not qualified for detecting axial or circumferential flaws in that region. The 8-inch inspection distance is intended to ensure structural and leakage integrity of the tubes. In the hot leg top-of-tubesheet region, a total of 18 axial primary-water stress corrosion cracking (PWSCC) indications, 45 axial ODSCC indications, and eight circumferential ODSCC indications had been detected at the time of the conference calls. Some of these indications were located within the tubesheet below the expansion transition region. The NRC staff has previously raised a concern with other licensees about whether identification of a flaw in a tube below the expansion transition region should result in expansion of the inspection scope (i.e. more than 8 inches below the top-of-tubesheet) with a rotating probe. The NRC staff's position was that the finding of flaws in the 8-inch zone below the top-of-tubesheet clearly indicates the potential for similar cracks to be present deeper into the thickness of the tubesheet. Given the clear potential for similar cracks deeper into the thickness of the tubesheet, and because the bobbin probe is not qualified to detect flaws in that region, the NRC staff raised concerns whether an inspection technique capable of reliably detecting flaws should be utilized. FENOC indicated they have a technical basis for limiting the inspection distance which is based on ensuring steam generator tube structural and leakage integrity. Given the generic nature of this issue, the NRC staff is addressing the issue generically with the industry.

The U-bend region in rows 1 to 46 was examined with the +Point™ probe to inspect for cracking similar to that reported in February 2003 by the licensee for DC2 (ML030650146). Except for one row 1 tube, there were no PWSCC flaws detected with circumferential orientation in the U-bend region at BVPS-1. Three tubes contained +Point™ signals suggestive of axial PWSCC in

the U-bend region of outer row (i.e., > row 2 ) tubes. Two of these indications appeared to be associated with dents at anti-vibration bar intersections, a third was slightly above the hot leg tangent point. The licensee was unsure if these indications were flaw-related or eddy current test artifacts. At the time of the call, the licensee was planning on plugging these tubes and was considering additional eddy inspection techniques to further evaluate these indications. These U-bend indications were not detected with the bobbin-coil probe.

The licensee indicated that the following information summarized their initial +Point™ probe inspection plans, results, and subsequent scope expansion of dents and dings.

- 100% of the dents (i.e., at tube support plate intersections) greater than 5 volts bobbin were examined, and 20% of the dents on the hot leg which were greater than 2 volts bobbin were examined.
  - Axial ODSCC (estimated at 46% through-wall) was reported at one intersection containing a 2.91 volt dent.
  - The inspection scope of dents was increased to 100% of all hot leg dents greater than 2 volts bobbin. Two additional ODSCC indications measuring 60% and 51% through-wall, were reported at intersections containing 3.1 and 2.5 volt dents, respectively.

- 20% of the dings (i.e., freespan) greater than 5 volts bobbin were examined in all SGs, and 20% of the dings greater than 2 volts bobbin located between the top-of-tubesheet and the third tube support plate on the hot leg were examined (due to recent experience with degradation in this region at another plant)
  - An ODSCC indication was identified in a 6.39 volt ding located at 01H+3.2 inches in SG B
  - The inspection scope of dings was increased to 100% of dings greater than 5 volts bobbin in SG B.

The TSP alternate repair criteria established in GL 95-05 is implemented at BVPS-1. Overall, the licensee reported the voltage distribution of TSP ODSCC indications similar to the previous outage (1R14) results. The maximum distorted support plate signal with possible indication (DSI) in any SG was 4.59 volts. A total of 22 tubes exceeded the 2.0 volt repair criteria set forth in the BVPS-1 Technical Specifications. These tubes were to be plugged.

Axial cracking was reported in the parent tube of 28 previously sleeved tubes. The parent tube indications were reported to be adjacent to the sleeve hard roll region, approximately 1.5 inches from the tube end. The licensee initially stated a suspected cause of the indications may have been related to heat affected zone effects or permeability variation since all parent tubes with indications previously had plugs that were gas tungsten arc weld relaxed to permit plug removal and sleeve installation. FENOC representatives indicated all tubes with sleeves were inspected and all tubes with indications will be removed from service.

The licensee stated insitu pressure testing would include any row 1 or row 2 U-bend with PWSCC indications, high row U-bend PWSCC indications, and any new degradation mechanisms observed in the generators. The NRC staff indicated we would like to be informed if a tube fails an insitu pressure test or if leakage occurs during the insitu pressure test.
In addition to the typical questions (ML030350082) addressed by the licensee in support of the 1R15 outage call, the NRC staff requested information on four other topics based on a review

of the 1R14 SG inspection report since these topics had potential bearing on the current inspection. The topics discussed during the conference call are summarized below.

- Four collapsed sleeves were discovered in 1R14 and an additional collapsed sleeve was discovered during 1R15. The licensee performed a structural evaluation and concluded that neither the hard roll (i.e., the lower joint of the sleeve) nor the weld (upper joint of the sleeve) were structurally challenged by the collapse. Although historical and industry information suggest that only a few sleeves would be affected by a similar event in the future, the licensee stated that plugging margin was sufficiently high such that it would bound the collapse of all sleeves.

- As requested, the licensee elaborated on the difference between a DSI and potential tube support plate indication (PSI) eddy current code. DSI is a distorted support plate signal that could represent axial ODSCC in a tube at a TSP intersection. PSI is a possible support indication that could represent a flow hole misdrilling that results in either a locally thinned tube hole ligament or partially missing ligament. In other words, a PSI code represents the condition of the TSP not the tube. Rotating probe inspection is used to estimate the arc length of the "missing" ligament. If missing material is detected by RPC, the PSI is changed to a confirmed tube support plate indication (CSI). If axial ODSCC degradation is located at a TSP intersection with a PSI/CSI indication, the voltage-based alternate repair criteria is not applied at this location.

- Cold leg top-of-tubesheet indications that required plugging in 1R14 were attributed to loose part wear or sludge lance rail interaction. No sludge lance equipment was used during 1R15 and no cold leg indications were reported.

- A majority of the discussion during the three outage conference calls centered on FENOC's inspection scope and disposition strategy for large mix residual signals at the TSP intersections. Based on discussions with NRC staff, FENOC modified their inspection scope and plugging plans. One hundred percent of mix residual signals with amplitudes large enough to cause a 1.0 volt bobbin indication to be masked or misread were examined with a +Point™ probe. All mixed residual indications with ODSCC flaws identified using the +Point™ probe and with a resulting reference bobbin voltage greater than 1.0 volt were repaired. The staff summarized their understanding of the licensee's actions and basis related to the issue and requested additional information regarding the technical basis for this 1.0-volt mix channel bobbin-voltage repair criteria. In addition, NRC staff requested that this information be included in the licensee's 90-day report to the NRC.

Other than the questions pertaining to the mix residual signal evaluation, the NRC staff did not identify any additional issues requiring follow-up at this time.

Mary O'Reilly, Attorney
FirstEnergy Nuclear Operating Company
FirstEnergy Corporation
76 South Main Street
Akron, OH 44308

FirstEnergy Nuclear Operating Company
Regulatory Affairs/Performance Improvement
Larry R. Freeland, Manager
Beaver Valley Power Station
Post Office Box 4, BV-A
Shippingport, PA 15077

Commissioner James R. Lewis
West Virginia Division of Labor
749-B, Building No. 6
Capitol Complex
Charleston, WV 25305

Director, Utilities Department
Public Utilities Commission
180 East Broad Street
Columbus, OH 43266-0573

Director, Pennsylvania Emergency Management Agency
2605 Interstate Dr.
Harrisburg, PA 17110-9364

Ohio EPA-DERR
ATTN: Zack A. Clayton
Post Office Box 1049
Columbus, OH 43266-0149

Dr. Judith Johnsrud
National Energy Committee
Sierra Club
433 Orlando Avenue
State College, PA 16803

J. H. Lash, Plant Manager (BV-IPAB)
FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Post Office Box 4
Shippingport, PA 15077

Rich Janati, Chief
Division of Nuclear Safety
Bureau of Radiation Protection
Deparment of Environmental Protection
Rachel Carson State Office Building
P.O. Box 8469
Harrisburg, PA 17105-8469

Mayor of the Borough of Shippingport
P O Box 3
Shippingport, PA 15077

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Resident Inspector
U.S. Nuclear Regulatory Commission
Post Office Box 298
Shippingport, PA 15077

FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
ATTN: M. P. Pearson, Director Services and Projects (BV-IPAB)
Post Office Box 4
Shippingport, PA 15077

FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Mr. B. F. Sepelak
Post Office Box 4, BV-A
Shippingport, PA 15077