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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
Response to Request for Additional Information Regarding 2015 Steam Generator Inspection Reports (CAC No. MF7472)

By letters dated January 22, 2016 (Accession No. ML16025A168) and April 6, 2016 (Accession No. ML16097A452), FirstEnergy Nuclear Operating Company (FENOC) submitted reports summarizing the results of the 2015 steam generator tube inspections for Beaver Valley Power Station, Unit No. 2. The Nuclear Regulatory Commission (NRC) has requested additional information to complete its review of the reports (Accession No. ML16147A284). The FENOC response to the NRC request is attached. During the development of the responses, FENOC identified changes needed to the original January 22, 2016 submittal. As a result, Beaver Valley Unit 2 End-of-Cycle 18 Analysis and Prediction for End-of-Cycle 19 Voltage-Based Repair Criteria 90-Day Report, will be submitted in a separate correspondence.

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

Sincerely,

for M. L. Richey

Marty L. Richey

Attachment: Response to Request for Additional Information

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

The Nuclear Regulatory Commission (NRC) staff has requested additional information (Accession No. ML16147A284) to complete its review of the FirstEnergy Nuclear Operating Company (FENOC) Beaver Valley Power Station, Unit No. 2 (BVPS-2) 2015 steam generator (SG) tube inspection reports. The NRC staff's request for additional information (RAI) is provided below in bold text followed by the FENOC response.

RAI 1, Letter dated January 22, 2016:

On page 3-2, the criteria for identifying dents with indication is described. This process is used for the detection of signals, which could be confirmed as primary water stress corrosion cracking (PWSCC) at tube support plate (TSP) intersections. Please confirm that the voltage screening criteria (greater than or equal to 1.25 volts) were used for the identification of dents and that the detection of PWSCC at both dented and non-dented TSP intersections did not implement a voltage screening criteria (i.e., all PWSCC indications were identified/reported regardless of the signal amplitude).

Response:

Any TSP location with bobbin coil signal parameters that lie within the normal indication reporting phase analysis window are reported as a dent/ding with possible indication (DNI). A supplemental screening process was developed and implemented in 2006, which enhances the reporting capabilities for axial PWSCC at dented TSP intersections. This screening criteria uses a bobbin coil signal amplitude of ≥ 1.25 volts in the 400/100 mix channel with a signal phase angle of < 55 degrees. Any signal with these parameters is automatically retested with a Plus Point probe. These screening parameters were developed from the Electric Power Research Institute's (EPRI) examination technical specification sheet (ETSS) 96012 data set. The 1.25 volt signal response represents the total residual signal at the TSP, thus the influence of both the flaw and the TSP residual (dent) are included. This ETSS is applicable for detection of axial PWSCC indications in < 2.0 volt dented TSP intersections. All flaws in this data set, having a local maximum depth of ≥ 40 percent through wall (TW), contain signal amplitudes of > 1.25 volts and phase angles < 50 degrees, or are judged reliably detectable by manual analysis. Application of the screening criteria to the ETSS 96012 dataset results in a binomial probability of detection (POD) for flaws ≥ 40 percent TW, which satisfies the EPRI Pressurized Water Reactor Steam Generator Examination Guideline requirements for detection qualification. Thus, the applied screening parameters will produce detection capabilities consistent with ETSS 96012. Such bobbin indications are reported as a DNI and 100 percent of these indications are re-inspected with a Plus Point probe.

The identification of possible DNI signals is not restricted to this process as the normal analysis process can identify an indication as a DNI based on the bobbin signal characteristics. All DNI indications are subsequently re-tested with a Plus Point probe.

RAI 2, Letter dated January 22, 2016:

The last sentence on page 3-3 states, "The growth during Cycle 18 for all indications was under 0.4 volts." Table 3-4 lists a column titled "Largest Growth, Volts." Please verify that this column lists the size of the indication that experienced the largest voltage growth (and not the largest growth rate experienced at the tube support elevation, since some of the values are greater than 0.4 volts). If not, please clarify.

Response:

The input files for the analysis were reviewed. The maximum indication growth rate was confirmed to be less than 0.40 volts for Cycle 18 for all SGs. Table 3-4 incorrectly includes new indications in the "Largest Growth, Volts" column. The text is correct and Table 3-4 will be revised. The Beaver Valley Unit 2 End-of-Cycle 18 Analysis and Prediction for End-of-Cycle 19 Voltage-Based Repair Criteria 90-Day Report will be submitted in a separate correspondence.

RAI 3, Letter dated January 22, 2016:

Table 3-1 indicates the number of indications not tested with a +Point probe. It does not appear that the larger indications were inspected with a +Point probe. Please discuss how you decided which indications to inspect with a +Point probe (e.g., were indications more likely to exhibit extreme voltage growth selected? If extreme voltage growth is observed, it could result in a flaw exceeding the tube integrity performance criteria).

Response:

Generic Letter (GL) 95-05 requires that bobbin coil distorted support plate indications (DSI) with signal amplitudes > 2.0 volts be inspected with a rotating probe. No DSI indications > 2.0 volts were reported at the 2R18 outage, thus none were required to be inspected with a rotating probe. However, certain DSI signals were still inspected with a Plus Point probe. The purpose of this examination was to confirm that the DSI signal exhibited little or no signal change when reported from the Plus Point probe, which was found to be consistent with the indicated bobbin coil observations. The DSI signals that were inspected with a Plus Point probe included those which were confirmed to contain axial outside diameter stress corrosion cracking (ODSCC) at the 2R16 or 2R17 outages. Operating experience has shown that indications associated with extreme voltage growth had bobbin coil signal (DSI) amplitudes near the repair limit. There were no DSI indications > 2.0 volts reported during the 2R18 outage. Therefore, none of the

DSIs reported during 2R18 exhibited characteristics that would suggest extreme voltage growth. The DSI growth rate trending for Cycle 18 was consistent with the trending of all previous cycles. That is, DSI signal amplitude growth was exceptionally small, and was confirmed by the Plus Point inspection results. As no DSI signal amplitudes exceeded 2.0 volts for 2R18, 2R17, and 2R16, the BVPS Unit 2 DSIs exhibit no propensity for extreme voltage growth.

RAI 4, Letter dated January 22, 2016:

In Table 6-1, the "Input" column for Steam Generator (SG) C appears to be missing a value for the 1.3 volt bin. Please clarify. Were 4 indications detected in the 1.3 volt bin? If so, did your leakage and burst calculations assume there were 6.7 indications in this bin?

Response:

Subsequent review of the input files for Table 6-1, Predicted Voltage Distribution at EOC-19, indicates an error in the SG C input for the 1.30 volts bin. Four indications are present in the 1.21 to 1.30 volts bin. The input file was corrected to account for the four indications in the 1.30 volts bin.

The SG C input was re-run for 1,000,000 iterations consistent with the other SGs. Table 6-1 will be revised to correct this error. Both the revised maximum projected leak rate of 0.300 gallons per minute (gpm) and maximum conditional burst probability of 4.87×10^{-5} are below the allowable limits (2.2 gpm and 1.0×10^{-2}, respectively). The Beaver Valley Unit 2 End-of-Cycle 18 Analysis and Prediction for End-of-Cycle 19 Voltage-Based Repair Criteria 90-Day Report will be submitted in a separate correspondence.

RAI 5, Letter dated April 6, 2016:

Please confirm that no degradation was associated with any of the plugs.

Response:

No degradation was associated with any installed tube plugs.

RAI 6, Regarding the April 6, 2016 letter:

Please identify all tubes with axial or circumferential cracking at freespan dings. What were the sizes of the dings? Were the flaws detected by bobbin and/or rotating probe? If the flaws were initially only detected with the rotating probe, and the dent/ding signal was close to the inspection threshold (e.g., 1 volt for freespan dings), please discuss why no additional rotating probe inspections below the original inspection threshold were necessary.

Response:

In SG A, one axial ODSCC indication was reported in Row 30 Column 43 at the 3rd hot leg TSP, + 6.7 inches, coincident with a ding. The bobbin coil ding amplitude was 6.70 volts. The axial ODSCC indication was reported only from the Plus Point probe, as the qualified bobbin coil detection technique is applicable only to dings ≤ 5 volts. Still, the bobbin coil data for this location indicates a phase angle rotation of 165 degrees in the reporting channel. The 165 degrees phase does not meet the bobbin coil reporting criteria for a freespan DNI (≤ 155 degrees on Channel 5). However, the bobbin coil has suggested a possible flaw-like response since 2008, with a slight phase rotation each outage. Prior to the 2008 bobbin coil data, the phase response was 178 degrees, suggesting no degradation.

In SG A, one circumferential ODSCC indication was reported in Row 15 Column 48 at the 6th hot leg TSP, + 39.9 inches, coincident with a ding. The bobbin coil ding amplitude was 3.63 volts. The bobbin coil ODSCC detection technique is not applicable to circumferential ODSCC; thus detection is available only from the Plus Point probe. All reportable freespan dings are inspected each outage with a Plus Point probe.

In SG C, one axial ODSCC indication was reported in Row 9 Column 72 at the 8th hot leg TSP, +41.66 inches (approximately ½ inch above the cold leg bend tangent). This location was initially suspected to be associated with a ding; however, closer scrutiny indicated that the horizontal noise component near the indication is associated with the bend tangent and not a ding. This indication was reported from Plus Point probe. However, review of the bobbin coil data indicated that a reportable signal is present. This indication was determined to be associated with a residual scratch or gouge resultant from the original tube bending process. There were no circumferential cracking indications identified at free span dings in SG C.

There were no axial or circumferential cracking indications identified at free span dings in SG B.

RAI 7, Letter dated April 6, 2016:

Please identify the tubes with axial outside diameter stress corrosion cracking associated with freespan scratches or gouges at U-bend tangents. How were these indications originally detected (e.g., bobbin and/or rotating probe)? If the flaws were initially only detected with a rotating probe, please discuss whether any sample expansions were performed or why none were necessary.

Response:

(RAI 6 response contains the discussion concerning qualified techniques). Row 9 U-bends were not part of the base scope inspection plan. The base scope inspection plan included a 42 percent Plus Point probe sample of Row 3 through Row 8 U-bends for detection of potential oblique PWSCC in each of the three SGs. As a result of detecting

a single PWSCC indication in SG C (Row 3 Column 88), the Plus Point probe inspection scope was expanded to 100 percent of Row 3 through Row 10 U-bends in SG C. No additional PWSCC indications were reported in SG C; however, the axial ODSCC indication in Row 9 Column 72 was subsequently reported. Evidence of a ding cannot be discerned from the prior (2003) Plus Point probe inspection data for this tube at the elevation of the 2R18 indication. However, two signals, 180 degrees opposite each other and located on the tube flanks were observed.

These signals are similar to known OD scratch locations as confirmed from the tube pull examinations from other plants. Specifically, during an investigation of the original reporting of oblique PWSCC in Row 3 through Row 10 U-bends at Diablo Canyon in 2003, it was identified that the method used for tube bending used three different processes; one process for Rows 1 and 2, one process was for Rows 3 through 9, and one process was used for Rows 10 and higher. Thus, it was concluded that the indication in Row 9 Column 72 is associated with the Row 3 through Row 9 bending process. As the 2R18 U-bend Plus Point inspection program included 42 percent of Row 3 through 8, the sampling of this area satisfies the requirements for non-affected SGs. In addition, the bobbin data for approximately 50 percent of the Row 9 and 10 U-bends in the unaffected SGs was screened at the bend tangents with no similar signals being observed. In 2003, 100 percent of the Row 3 through Row 10 U-bends was inspected with a Plus Point probe. Since 2003, Plus Point probe sampling of Rows 3 through 8 has been performed at each outage in each SG with the applied scopes ranging from 25 percent to 42 percent. Application of the Row 3 through Row 9 bending process suggests that such an indication could only exist in these rows.

RAI 8, Letter dated April 6, 2016:

Please discuss whether any ligament breach indications were detected and discuss the size/extent of these indications.

Response:

Information was previously provided in letter dated April 6, 2016 (Accession No. ML16097A452) Enclosure "Unit #2 – 2R18 SG 180-Day Report". Reference Attachment A, "BV Unit #2 2R18 SG Examination Results 2RCS-SG21A Tubes with Service Induced Indications" page 9 and Attachment B, "BV Unit #2 2R18 SG Examination Results 2RCS-SG21B Tubes with Service Induced Indications" page 14 for the size of the ligament breach indication reported in SG B.

No possible ligament breach indications were reported in SG C.

RAI 9, Letter dated April 6, 2016:

Please confirm that none of the sleeved tubes were plugged.

Response:

No sleeved tubes were plugged during 2R18.