UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 9, 2017

Mr. Marty L. Richey, Site Vice President
FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Mail Stop A-BV-SEB1
P.O. Box 4, Route 168
Shippingport, PA 15077

SUBJECT: SUMMARY OF MAY 4, 2017, CONFERENCE CALL WITH FIRSTENERGY NUCLEAR OPERATING COMPANY REGARDING THE SPRING 2017 STEAM GENERATOR INSPECTIONS AT BEAVER VALLEY POWER STATION, UNIT 2 (CAC NO. MF9572)

Dear Mr. Richey:

On May 4, 2017, a conference call was held between the U.S. Nuclear Regulatory Commission (NRC) staff and representatives of FirstEnergy Nuclear Operating Company (the licensee) regarding the ongoing steam generator inspection activities at Beaver Valley Power Station, Unit 2. A list of the participants is provided as Enclosure 1. The conference call summary is provided as Enclosure 2. A list of questions discussed during the call is provided as Enclosure 3.

Based on the information provided by the licensee, the NRC staff did not identify any issues that warranted immediate followup action. However, the NRC staff asked to be notified if any unusual conditions were detected during the remainder of the outage.

Please direct any inquiries to me at (301) 415-2934 or Booma.Venkataraman@nrc.gov.

Sincerely,

Booma Venkataraman, Project Manager
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-412

Enclosures:
1. List of Participants
2. Conference Call Summary
3. Steam Generator Tube Inspection Discussion Points

cc w/enclosures: Distribution via Listserv

LIST OF PARTICIPANTS

MAY 4, 2017, CONFERENCE CALL WITH

FIRSTENERGY NUCLEAR OPERATING COMPANY

BEAVER VALLEY POWER STATION, UNIT 2

SPRING 2017 STEAM GENERATOR INSPECTIONS

U.S. NUCLEAR REGULATORY COMMISSION
Alan Huynh
Paul Klein
James Danna
Booma Venkataraman
Harold Gray

FIRSTENERGY NUCLEAR OPERATING COMPANY
Gary Alberti
Lauren Zalesny
Dave McCreary
Charles O'Neill
Greg Kammerdeiner

WESTINGHOUSE
Bill Cullen

SUMMARY OF CONFERENCE CALL

WITH BEAVER VALLEY POWER STATION, UNIT 2

REGARDING THE SPRING 2017

STEAM GENERATOR TUBE INSPECTIONS

DOCKET NO. 50-412

On May 4, 2017, the staff of the Steam Generator Tube Integrity and Chemical Engineering Branch of the Division of Engineering, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission (NRC), participated in a conference call with FirstEnergy Nuclear Operating Company, Inc. (the licensee) regarding the ongoing Steam Generator (SG) tube inspection activities at Beaver Valley Power Station, Unit 2. The licensee provided draft information for the outage call, which is attached.

Beaver Valley Power Station, Unit 2, is a 3-loop plant with Westinghouse Model 51M SGs. Each SG contains 3,376 mill-annealed Alloy 600 tubes with a nominal outside diameter of 0.875 inches and a nominal wall thickness of 0.050 inches. The tubes are supported by a number of carbon steel Tube Support Plates (TSPs) and Alloy 600 Anti-Vibration Bars. The tubes were roll expanded for the full depth of the tubesheet. The entire length of tube interior within the tubesheet was shot-peened on both the hot-leg and cold-leg side of the SG prior to operation. In addition, the U-bend region of the small radius tubes were in-situ stress relieved prior to operation.

In addition to the depth-based tube repair criteria, the licensee is also authorized to apply the voltage-based tube repair criteria for predominantly axially-oriented Outside Diameter Stress Corrosion Cracking (ODSCC) at the TSP elevations. In addition, the licensee is authorized to leave flaws within the tubesheet region in service provided they satisfy the F* repair criterion.

Additional information discussed during the conference call and not included in the document provided by the licensee is summarized below:

- At the time of the call, the SG tube inspections were 93 percent complete.

- Regarding the "non-degraded ligaments" in SG A, the licensee stated that there were 35 to 90 degrees of separation between initiation sites. If there were only 2 initiation sites, up to 120 degrees of separation could exist between them."

- Regarding the circumferential ODSCC indication in SG A, the licensee stated that the value of 31 degrees characterizes the circumferential extent of the indication and not the phase angle. Furthermore, the licensee sent followup information to the staff to show that this ODSCC indication was bounded by previous in-situ pressure tests.

- The licensee performed in-situ pressure tests on the tubes located at row 31, column 63, and row 8, column 26, on May 6, 2017. The amplitudes of the indications were 0.49 volts (V) for the larger indication and 0.2V with a circumferential extent of 275 degrees for the smaller indication. Both in-situ pressure tests confirmed that the SG structural integrity performance criteria were met.

- The NRC staff noted that sleeves were first installed in the Beaver Valley Power Station, Unit 2, SGs in 2014 and are approved to remain in service for up to five cycles of operation.

- The NRC staff asked for the number of plugged tubes in the SGs if all 164 sleeving candidates in SGs A and B were repaired with sleeves. The licensee stated that at the time of the call, there were 22, 12, and 14 plugging candidates for Top of Tubesheet (TTS) degradation in SGs A, B, and C, respectively. Furthermore, the licensee stated that there were approximately 60 total plugging candidates for all degradation mechanisms.

- The licensee stated that the replacement of the current SGs is planned for 2023.

The following abbreviations are used in the document provided by the licensee:

ASCA – Advanced Scale Conditioning Agent
AVB – Anti-Vibration Bar
BLG – Bulge
BVPS2 – Beaver Valley Power Station, Unit 2
DNG – Ding
DNI – Dent/Ding with Possible Indication
DSI – Distorted Tube Support Plate Signal with Possible Indication
EPRI – Electric Power Research Institute
FOSAR – Foreign Object Search and Retrieval
FSH – Freespan Signal, History
GL – Generic Letter
MBH – Manufacturing Burnish, History
NSAL – Nuclear Safety Advisory Letter
NQI – Non-Quantifiable Indication
ODSCC – Outside Diameter Stress Corrosion Cracking
OXP – (Tubesheet) Overexpansion
PIP – Plug-in-Plug
PWSCC – Primary Water Stress Corrosion Cracking
STH – Sleeve Top Hot
TEC – Tube End Cold
TSP – Tube Support Plate
TTS – Top of Tubesheet
TW – Through-Wall

The NRC staff did not identify any issues that required followup action at this time; however, the NRC staff asked to be notified in the event that any unusual conditions were detected during the remainder of the outage.

STEAM GENERATOR TUBE INSPECTION DISCUSSION POINTS

The following discussion points have been prepared to facilitate the conference call arranged with the licensee to discuss the results of the Steam Generator (SG) tube inspections to be conducted during the upcoming spring 2017, Beaver Valley Power Station, Unit 2 (BVPS2), refueling outage. This conference call is scheduled to occur towards the end of the planned SG tube inspections, but before the inspections and repairs are completed.

The NRC staff plans to document a summary of the conference call, as well as any material that is provided in support of the call.

1. **Discuss any trends in the amount of primary-to-secondary leakage observed during the recently completed cycle.**

Primary to secondary leakage was not reported during the previous operating cycle.

2. **Discuss whether any secondary side pressure tests were performed during the outage and the associated results.**

Secondary side pressure tests were not performed and were not planned.

3. **Discuss any exceptions taken to the industry guidelines.**

There are no known exceptions to the industry guidelines.

4. **For each SG, provide a description of the inspections performed, including the areas examined and the probes used (e.g., dents/dings, sleeves, expansion-transition, U-bends with a rotating probe), the scope of the inspection (e.g., 100 percent of dents/dings greater than 5V and a 20 percent sample between 2 and 5V), and the expansion criteria.**

Base Scope Programs:

- 100% full length 0.720 bobbin inspection (except Rows 1 and 2 U-bends) per Generic Letter (GL) 95-05 in non-sleeved tubes and from Tube End Cold to 08C in sleeved tubes in Rows 3 and 4
- 100% 0.720 bobbin inspection from cold leg tube end to Sleeve Top Hot (STH) in sleeved tubes Rows 5 and higher
- 100% 0.700 inch bobbin examination in U-bend region of Rows 3 and 4
- 100% 0.630 wide groove bobbin examination from STH to 08H in sleeved tubes Rows 2 through 4
- 100% hot leg TTS +POINT probe inspection from 6 inches above to 3 inches below TTS in non-sleeved tubes

- 100% 0.610 gimbaled +POINT probe full length from STH +3 to SBH -4 inches in sleeved tube 100% Row 1 and Row 2 small radius U-bend +POINT probe inspection in each SG using midrange +POINT coil

- 100% +POINT probe inspection at all dented (hot and cold leg) Tube Support Plate (TSP) intersections >5V

- 100% +POINT probe inspection of all TSP Distorted Tube Support Plate Signal with Possible Indication (DSI) / Dent/Ding with Possible Indication (DNI) signals >2V

- 100% +POINT probe inspection of all freespan dings (all reported voltages)

- 100% +POINT probe inspection of Row 3 through Row 10 U-bends in SG C (top TSP to top TSP)

- 33% +POINT probe inspection of Row 3 through Row 10 U-bends in SG A and SG B (top TSP to top TSP)

- 100% +POINT probe inspection of hot leg dents >2V but <5V at 01H, 02H, 03H, and 04H

- 33% +POINT probe inspection of hot leg dent >2V but <5V volt at 05H, 06H, 07H, and 08H

Special Interest +POINT Probe (Mid-Range Unless Otherwise Noted) Inspections:

- 100% inspection of bobbin special interest I-codes, such as freespan differential signals meeting change criteria

- 100% inspection at TSP DSI signals >1V (not required per GL 95-05)

- 25% inspection of all bobbin TSP mix residuals >1.5V but <2V plus 100% of >2V mix residuals (Outside Diameter Stress Corrosion Cracking (ODSCC) concern). TSP mix residuals have bobbin phase angles >55 degrees

- 100% inspection of all TSP residuals with bobbin phase angle <55 degrees and >1.25V on the bobbin P1 mix Channel (PWSCC concern – reported as bobbin DNI)

- High frequency +POINT probe testing of Row 1 U-bends with excessive noise values

- High frequency +POINT probe confirmatory testing of all U-bend PWSCC indications reported with the mid-range +POINT coil

- 100% inspection of all dents at Anti-Vibration Bar (AVB) sites (+/- 1 inch of AVB)

- 100% inspection of all newly reported signals at AVBs plus any atypical growth (>6% through-wall (TW) growth for Cycle 19) AVB wear indications

- 100% inspection of all freespan signals not resolved as MBH/FSH or without historical review

- 100% +POINT probe inspection of Bulge (BLG)(1) and (Tubesheet) Overexpansion (OXP) bobbin reports in hot leg tubesheet below F* distance but above tubesheet neutral axis plus 100% +POINT probe inspection of cold leg BLG and OXP bobbin reports above the TTS

- 20% inspection of the SG C cold leg TTS region from +6 to -3 inches using a targeted inspection region (see Appendix A), including all SG C cold leg crevice depths >0.5 inch

- 100% inspection of newly reported PLP signals (includes 2-tube box) plus locations adjacent to tubes plugged in prior outages for PLP interaction (2 tube box), plus one tube box around SG A 01C PLP signals from 2R18

Visual Inspections:

- Tube plug video inspection, including plug-in-plug (PIP) repaired plugs

- Divider plate to channelhead, divider plate to stub runner visual inspection per Nuclear Safety Advisory Letter-12-1, plus visual inspection of the tubesheet-to-channelhead Z-seam area

- SG secondary side Foreign Object Search and Retrieval (FOSAR) of annulus and tube lane with FOSAR of in-bundle PLP reports from eddy current testing

- Visual inspection of the SG A steam drum region including the feedring repair patch installed at 2R13

5. **For each area examined (e.g., tube supports, dent/dings, sleeves, etc.), provide a summary of the number of indications identified to date for each degradation mode (e.g., number of circumferential primary water stress-corrosion cracking (PWSCC) indications at the expansion transition). For the most significant indications in each area, provide an estimate of the severity of the indication (e.g., provide the voltage, depth, and length of the indication). In particular, address whether tube integrity (structural and accident induced leakage integrity) was maintained during the previous operating cycle. In addition, discuss whether any location exhibited a degradation mode that had not previously been observed at this location at this unit (e.g., observed circumferential PWSCC at the expansion transition for the first time at this unit).**

SG A:

There are 141 tubes affected by ODSCC at the hot leg Top of Tubesheet (TTS); 15 are axial ODSCC, 126 are circumferentially ODSCC.

The 300 kHz +Pt amplitudes range from 0.08V to 0.49V with an average of 0.14V. Indicated maximum depths range from 0%TW to 88%TW; it should be noted that phase-based depth assessment of small voltage signals can be inaccurate due to the expansion transition geometry

and deposit influence. Indicated circumferential crack arc lengths range from 30 to 275 degrees.

Note that the larger affected arc lengths are an artifact of the reporting process for integrity purposes. The largest indicated arc lengths are comprised of two to three individual initiation sites separated by non-degraded ligaments and the indicated arc length is the total affected length across all initiation sites.

The longest axial crack length is 0.28 inch.

In SG A, two tubes were reported with mixed mode (axial and circumferential) degradation at the hot leg TTS. On one, the axial and circumferential indications are not interacting with a 42-degree separation distance between the indications. On the other, the axial and circumferential are interacting. The arc length of the circumferential indication is 35 degrees arc and the axial ODSCC indication length is 0.12 inch. A 60-degree non-degraded ligament separated the interacting flaws and a second circumferential indication of approximately 40-degrees arc. Neither of these will be pressure tested.

SG B:

71 affected tubes at hot leg TTS; 1 axial, 70 circumferential. +Pt amplitude range from 0.07V to 0.45V with an average of 0.14V. Indicated arc lengths of 20 to 239 degrees. The axial crack length is 0.10 inch.

SG C:

20 affected tubes at hot leg TTS; 1 axial, 19 circumferential. +Pt amplitude range from 0.07V to 0.38V with an average of 0.14V. Indicated arc lengths of 30 to 252 degrees. The axial crack length is 0.16 inch.

Other Indications of Note:

SG A:

A circumferential ODSCC indication was reported on a 2.13V ding. This is not a new mechanism for BVPS2; the +Pt amplitude of 0.89V and 31 degrees is bounded by prior in-situ pressure tests for such indications at BVPS2.

SG B:

Three tubes were reported with axial ODSCC at dings in the U-bend region. Axial lengths range from 0.14 to 0.33 inch.

All were reported as DNI by bobbin and confirmed as axial ODSCC. The ding amplitude of one was 5.6V and prior reported as a Ding (DNG) in history. The other two are at <5V dings; no DNG report exists in history.

One tube (R15 C3) was reported with a volumetric degradation signal in the U-bend. It is believed that this indication is associated with AVB insertion during manufacture.

SG C:

A freespan axial ODSCC indication was reported above 06C; axial length is 0.38 inch. A <1V ding may be coincident with the indication. The indication was reported as NQI from bobbin and confirmed by +Pt.

AVB Wear:

48 indications in SG A with a maximum depth of 34%TW, 90 indications in SG B with a maximum depth of 37%TW, 4 indications in SG C with a maximum depth of 34%TW.

6. Describe repair/plugging plans.

A number of tubes in all three SGs will be either plugged/stabilized or sleeved depending on the type and location of the indication.

All crack indications at the TTS not addressed by alternate repair criteria will be plugged or sleeved. Circumferential indications at the TTS not sleeved will also be stabilized.

All freespan crack indications will be plugged.

7. Describe in-situ pressure test and tube pull plans and results (as applicable and if available).

One tube in SG A will be in-situ pressure and leak tested due to a circumferential crack at the hot leg TTS. The signal amplitude is equal to the threshold amplitude for testing recommended by the EPRI In-Situ Pressure Test Guidelines.

Another tube in SG A may also be conservatively tested for the same mechanism. The signal amplitude of this indication is well below the threshold for testing of the Guidelines.

8. Discuss the following regarding loose parts:

- **what inspections are performed to detect loose parts;**

  Secondary Side FOSAR of the annulus and tube lane regions in each SG are being completed to detect and remove loose parts. Additionally, with FOSAR, this will be done for in-bundle PLP reports from eddy current testing.

- **a description of any loose parts detected and their location within the SG (including the source or nature of the loose part, if known);**

  Only two objects were detected from FOSAR. No metallic objects have been found. One object was removed (a sludge rock in SG B). The other broke up when retrieval was attempted.

- **if the loose parts were removed from the SG; and**
- **indications of tube damage associated with the loose parts**

No damage was detected due to the objects on the tubes surrounding the objects was detected. No damage due to loose parts has been detected in all three SGs.

9. Discuss the scope and results of any secondary side inspection and maintenance activities (e.g., in-bundle visual inspections, feed-ring inspections, sludge lancing, assessing deposit loading, etc).

The secondary side inspection included the following inspections:

- SG secondary side FOSAR of annulus and tube lane with FOSAR of in-bundle PLP reports from eddy current testing
- Visual inspection of the SG A steam drum region including the feedring repair patch installed at 2R13
- iASCA chemical cleaning and sludge lance of all three SGs

An iASCA (ASCA with carbon steel corrosion inhibitor) was applied in all SGs. The estimated quantity of deposits removed was 2,000 pounds per SG.

Sludge Lancing has been completed in two of the three SGs. Approximately over 500 pounds of sludge was removed from SG B, and over 450 pounds was removed in SG C.

The SG A Steam Drum inspection showed no little to no change in the erosion-corrosion of the components in the Steam Drum. This includes the feedring, the feedring repair patch (both inside and outside the feedring), the J-Nozzles on the feedring, secondary moisture separators, mid-deck plate components, intermediate deck plate components, and pressure and level taps. Additionally, the UT thickness testing was completed on the feedring and the feedring repair patch. All locations showed little to no change from the last SG A Steam Drum inspection in 2R16.

10. Discuss any unexpected or unusual results.

While an expected increase in cracking indications at the TTS was expected based on plant trending and following iASCA (due to improved detection capabilities), the magnitude of the increase in SG A and SG B was not anticipated.

11. Provide the schedule for SG-related activities during the remainder of the current outage.

Tube sleeving will occur in SG A and B to repair those indications located at the top-of-tubesheet. The total number of sleeves to be installed has yet to be determined. There are 113 sleeving candidates in SG A and 51 candidates in SG B. No sleeving will occur in SG C. Tubes that cannot be sleeved will be plugged.

SUBJECT: SUMMARY OF MAY 4, 2017, CONFERENCE CALL WITH FIRSTENERGY NUCLEAR OPERATING COMPANY REGARDING THE SPRING 2017 STEAM GENERATOR INSPECTIONS AT BEAVER VALLEY POWER STATION, UNIT 2 (CAC NO. MF9572) DATED JUNE 9, 2017

DISTRIBUTION:

PUBLIC
AJohnson, NRR
RidsNrrLALRonewicz Resource
RidsACRS_MailCTR Resource
RidsRgn1MailCenter Resource
ResourceRidsNrrDeEsgb Resource
PKlein, NRR
MGray, R-I
RidsNrrDorlLpl1 Resource
AHuynh, NRR
HGray, R-I
RidsNrrPMBeaverValley Resource
SKennedy, R-I
TWertz, NRR
JBowen, OEDO

ADAMS Accession No.: ML17158B166 *by memorandum

OFFICE	DORL/LPL1/PM	DORL/LPL1/LA	DE/ESGB/BC*	DORL/LPL1/BC	DORL/LPL1/PM
NAME	BVenkataraman	LRonewicz	AJohnson	JDanna	BVenkataraman
DATE	06/08/2017	06/08/2017	05/19/2017	06/09/2017	06/09/2017

OFFICIAL RECORD COPY