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

June 15, 2011

Mr. Paul Harden
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: BEAVER VALLEY POWER STATION, UNIT NO. 2 - SUMMARY OF CONFERENCE CALL REGARDING THE SPRING 2011 STEAM GENERATOR TUBE INSPECTION RESULTS (TAC NO. ME5882)

Dear Mr. Harden:

The Nuclear Regulatory Commission (NRC) staff formally reviews all steam generator (SG) inservice inspection summary reports submitted by licensees in accordance with the plant's Technical Specification requirements. The NRC staff also participates in conference calls with most licensees when approximately 70% of the SG tube inspections are completed. On March 21, 2011, the NRC staff participated in a conference call with FirstEnergy Nuclear Operating Company representatives regarding the ongoing SG tube inspection activities for the Beaver Valley Power Station, Unit No. 2 during refueling outage 15. The summary of the conference call is enclosed and a copy of the licensee's discussion points is attached.

Please contact me at (301) 415-1016, if you have any questions regarding this issue.

Sincerely,

Nadiyah S. Morgan, Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-412

Enclosure:
As stated

cc w/encl: Distribution via Listserv

SUMMARY OF CONFERENCE CALL

REGARDING THE SPRING 2011 STEAM GENERATOR TUBE INSPECTION RESULTS

BEAVER VALLEY POWER STATION, UNIT NO. 2

DOCKET NO. 50-412

On March 21, 2011, the Nuclear Regulatory Commission (NRC) staff participated in two conference calls with representatives of FirstEnergy Nuclear Operating Company, Inc. (the licensee) regarding the ongoing steam generator (SG) tube inspection activities at Beaver Valley Power Station, Unit No. 2 (BVPS-2) during refueling outage 15 (RFO15). Information provided by the licensee for the conference calls is included as an attachment to this enclosure.

The SGs at BVPS-2 are Westinghouse model 51 SGs. Each SG contains 3,388 mill annealed Alloy 600 tubes. Each tube has a nominal outside diameter (OD) of 0.875-inch and a nominal wall thickness of 0.050-inch. The tubes are supported by a number of carbon steel tube support plates and Alloy 600 anti-vibration bars (AVB). The tubes were roll expanded at both ends for the full length of the tubesheet. The entire length of tube within the tubesheet was shot-peened on both the hot 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. There are no sleeves installed in the BVPS-2 SGs.

Additional clarifying information or information not included in the document provided by the licensee is summarized below:

- The amount of sludge removed from the SGs during RFO15 was approximately 48 pounds more than was removed during RFO14, and the licensee was going to investigate possible causes.

- The licensee confirmed that they have not implemented the voltage based alternate repair criteria for predominantly axially oriented OD stress corrosion cracking (ODSCC) at the tube support plate (TSP) elevations.

- The licensee reported that the largest confirmed distorted tube support plate indication was 1.08 volts.

- The licensee clarified that the maximum +Pt™ amplitude of 0.34 volts, for the axial ODSCC indication at the TSP, and the longest length from profiling, which is 0.65-inch, came from two different flaws.

- The licensee reported that the freespan ding in the tube at row 31 column 59, located at TSP 06H +41.3 inches, has a bobbin coil voltage of 1.74 volts, and that this amplitude had increased from approximately 1.0 volt during the previous outage.

Enclosure

- Historic AVB wear growth rate has been around 1 percent per operating cycle, and there are approximately 40 AVB wear indications in SG A, 70 in SG B, and 2 in SG C.

- The licensee confirmed that there were no secondary side inspections of the feedring or moisture separators during RFO15.

- The licensee indicated that they would not be repairing tubes by sleeving this outage.

- The licensee indicated that they monitored the eddy current data for noise and the data was less noisy than in the prior outage.

- The initial inspection scope was not expanded (i.e., the results did not warrant expansion).

- The following abbreviations were used by the licensee in the attachment:

    - AVB – anti-vibration bar
    - BLG – Bulge
    - CIRC - circumferential
    - DNI – dent with an indication
    - DSI – distorted tube support indication
    - ECT – eddy current testing
    - EOC – end of cycle
    - EPRI – Electric Power Research Institute
    - F* – F star
    - FOSAR – foreign object search and retrieval
    - FSI – freespan indication
    - kHz – kilohertz
    - NDE – non-destructive examination
    - NQI – non-quantifiable indication
    - ODSCC – outside diameter stress corrosion cracking
    - OXP – Overexpansion
    - PDA - percent degraded area
    - PLP – potential loose part
    - psi – pounds per square inch
    - PWSCC – primary water stress corrosion cracking
    - Rxx Cyy – row number column number
    - RPC – rotating pancake coil
    - SPR –support plate residual
    - TS – technical specification
    - TSH – tubesheet hot
    - TSP – tube support plate
    - TTS – top of the tubesheet
    - TW – through wall
    - V – volt(s)

The NRC staff did not identify any issues that required follow-up 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.

Subsequent to the outage call, the licensee notified the NRC staff that the tube in Row 29 Column 12 of SG C had sporadic permeability variations between the 4th cold leg tube support plate and 7th hot leg tube support plate. The licensee indicated that the arc length of the permeability signal ranged from approximately 30 degrees on the hot-leg to approximately 45 degrees on cold-leg and that the signal looked like a shallow scratch on the OD of the tube, probably from tube insertion during bundle fabrication. The licensee's review of historical eddy current data for this tube showed the permeability signal was present; however, it was more severe in this outage. Since magnetically biased bobbin and +Pt^{TM} probes did not adequately compensate for the permeability variations on this tube, the licensee decided to perform an in-situ pressure test on the tube (a whole tube pressure test). After the in-situ pressure test, a region based inspector indicated that the testing was completed satisfactorily, no issues were identified, and the tube was being stabilized and plugged.

Beaver Valley Power Station Unit 2
FENOC/NRC Outage Update: March 21, 2011

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 2011, Beaver Valley Power Station, Unit No. 2 (BVPS-2) refueling outage. This conference call is scheduled to occur towards the end of the planned SG tube inspections, but before the completion of the inspections and repairs.

The Nuclear Regulatory Commission 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.

   RESPONSE: No primary-to secondary leakage was observed during the recently completed cycle (EOC15).

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

   RESPONSE: No secondary side pressure tests were performed during the current outage.

3. Discuss any exceptions taken to the industry guidelines.

   RESPONSE: No exceptions have been taken 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% of dents/dings greater than 5 volts and a 20% sample between 2 and 5 volts), and the expansion criteria.

   RESPONSE: See Page 4.

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 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 BVPS-2 (e.g., observed circumferential primary water stress-corrosion cracking at the expansion transition for the first time at BVPS-2).

   RESPONSE: See Page 5.

6. Describe repair/plugging plans.

   RESPONSE: All crack-like indications not addressed by the F* inspection methodology are plugged. All circumferential indications are stabilized prior to plugging. All AVB wear exceeding TS repair limit is plugged. To date, the largest AVB wear depth reported is 37%TW. Any observed foreign object wear with object remaining will be stabilized and plugged.

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

RESPONSE: In situ pressure test screening follows the guidance of Rev 3 of EPRI In Situ Pressure Test Guidelines.

Largest amplitude axial ODSCC indication is bounded by the proof and leakage screening criteria, thus testing is not required.

Largest amplitude circumferential ODSCC indication is bounded by the leakage screening threshold, thus leakage testing is not required. Structural integrity of circumferential ODSCC indications was established based on flaw parameters and shown to be well below the structural limit (including NDE uncertainty).

8. Discuss the following regarding loose parts:

- what inspections are performed to detect loose parts.
- a description of any loose parts detected and their location within the SG (including the source or nature of the loose part, if known).
- if the loose parts were removed from the SG.
- indications of tube damage associated with the loose parts.

RESPONSE: FOSAR is used to detect foreign objects from the secondary side. FOSAR is performed in the periphery annulus region and tube lane region. The FOSAR plan applied at BVPS2 using a two-pass process. That is, the video probe is inserted into one inspection port, pushed around the periphery to the opposite inspection port, and withdrawn. The inspection is performed during the withdraw process. The probe is then inserted into the opposite inspection port, pushed around the periphery to the opposite inspection port, and withdrawn. The inspection is performed during the withdraw process. This is repeated for both the hot and cold leg sides, thus, the FOSAR is in essence performed twice. This procedure permits multiple viewing angles for each tube location, thus increasing the potential for foreign object detection.

Eddy current methods are also used for foreign object detection. Newly reported PLP signals from eddy current inspection are visually examined. All historic PLP signals have previously been visually examined.

In SGA, no metallic foreign objects were detected. In SGB, one wire, approximately 0.04 inch diameter, 2.5 inches length was observed by FOSAR and retrieved. In SGC, a small piece of weld slag, approximately 1/16 inch thick, and roughly ½ inch diameter was observed by FOSAR and retrieved.

In SGA, a foreign object wear scar at that cold leg top-of-tubesheet was observed by eddy current (+Pt). This location (R24 C84) is near the periphery and adjacent to a tube plugged in 1998 due to foreign object wear. R24 C84 has not been inspected using RPC probes at any prior outage. The estimated depth is <30%TW. Evidence of a PLP is not present by eddy current. The SGA FOSAR was performed prior to detection of this indication. The video data was reviewed; no visual evidence of a foreign object can be observed. The tube will remain in service.

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

RESPONSE: The response to Question 8 describes the FOSAR plan implemented. Sludge lancing was performed in all SGs. Total deposit removal amounts were:

SGA 69 lbs

SGB 52 lbs

SGC 101 lbs

Deposit loading is evaluated each outage using Westinghouse Scale Profiling analysis.

10. Discuss any unexpected or unusual results.

RESPONSE: None observed to date.

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

RESPONSE: Finish special interest inspection. Generate tube stabilization & tube plugging reports. Install stabilizers & tube plugs. Generator closeout

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% of dents/dings greater than 5 volts and a 20% sample between 2 and 5 volts), and the expansion criteria.

Mechanism	Location	Probe	Initial Inspection	Expansion
Axial and Circumferential ODSCC and PWSCC	TTS	+Pt	100% hot leg from +6"to -3"; 20% cold leg from +6" to -3" SGA	100% Cold leg SGA; 20% Cold Leg for C-3 condition in SGB, SGC
Axial ODSCC	Freespan, TSP	Bobbin	100% full length	None
	TSP	+Pt	100% all DSI, DNI, NQI, FSI; 100% SPR reports ≥2V, 25% SPR reports ≥1.5V but <2V	100% SPR reports ≥1.5V for confirmation in ≥1.5V SPR
Axial ODSCC	Dented TSP >5V	+Pt	100% hot and cold leg dents >5V	None – potential expansion if circ detected
PWSCC	Dented TSP	+Pt	100% >2V dents at 01H thru 04H, 100% >5V dents	100% hot leg dents >2V for PWSCC detection
		Bobbin	100% TSP signals >1.25V, <55 degrees	None
PWSCC	Row 1 and 2 U-bends	+Pt	100%	100% Row 3 for Row 2 detection
PWSCC	Row 3 thru 8 U-bends	+Pt	25%	100% Row 3 thru 10
AVB wear	AVB	Bobbin	100% full length	None
Axial ODSCC	Dings ≤5V	Bobbin	100% full length	None
Axial and Circ ODSCC	Dings (all voltages)	+Pt	100%	None
Thinning	TSP	Bobbin	100% full length	None
Pitting	Sludge Pile	Bobbin	100% full length	None
Loose Part Wear	Freespan	Bobbin	100% full length	None
		+Pt	100% hot leg TTS, bounding of historic plugged wear locations	None unless FOSAR identified objects not observed by bobbin
PWSCC	Bulges/overexpansion below F*	+Pt	100% hot leg BLG/OXP below F* but above neutral axis	None

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 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 BVPS-2 (e.g., observed circumferential primary water stress-corrosion cracking at the expansion transition for the first time at BVPS-2).

Top-of-Tubesheet:

No PWSCC has been reported at the top-of-tubesheet, supporting the benefit of shot peening. Only ODSCC indications have been reported at the expansion transition and sludge pile.

Inpsection Range: +6 to -3 inches about TTS (tube basis)				
SG	Number Axial PWSCC	Number Circ PWSCC	Number Axial ODSCC	Number Circ ODSCC
A	0	0	0	16
B	0	0	3	22
C	0	0	1	6
Total	0	0	4	54

Flaw length assessment follows a two-pass process. The first pass is performed at the resolution stage and is intended to provide a bounding length assessment. The second pass includes profiling to more accurately assess flaw parameters of those indications which exceed the screening values.

Axial ODSCC:

Length: 0.16 to 0.28 inch length (first pass)

Maximum length from profiling is 0.20 inch

Voltage: 0.10 to 0.31 volt, average of 0.19 volt, in 300 kHz

Maximum Depth (Appendix I sizing): 46 to 56%TW

Circ ODSCC:

Length: 20 to 267 degrees arc, average of 84 degrees arc (first pass). The 267 degree arc indication was found to be comprised of two shorter cracks with non-degraded ligaments between the cracks from profiling.

Voltage: 0.06 to 0.29 volt, average of 0.15 volt, in 300 kHz

Depth:

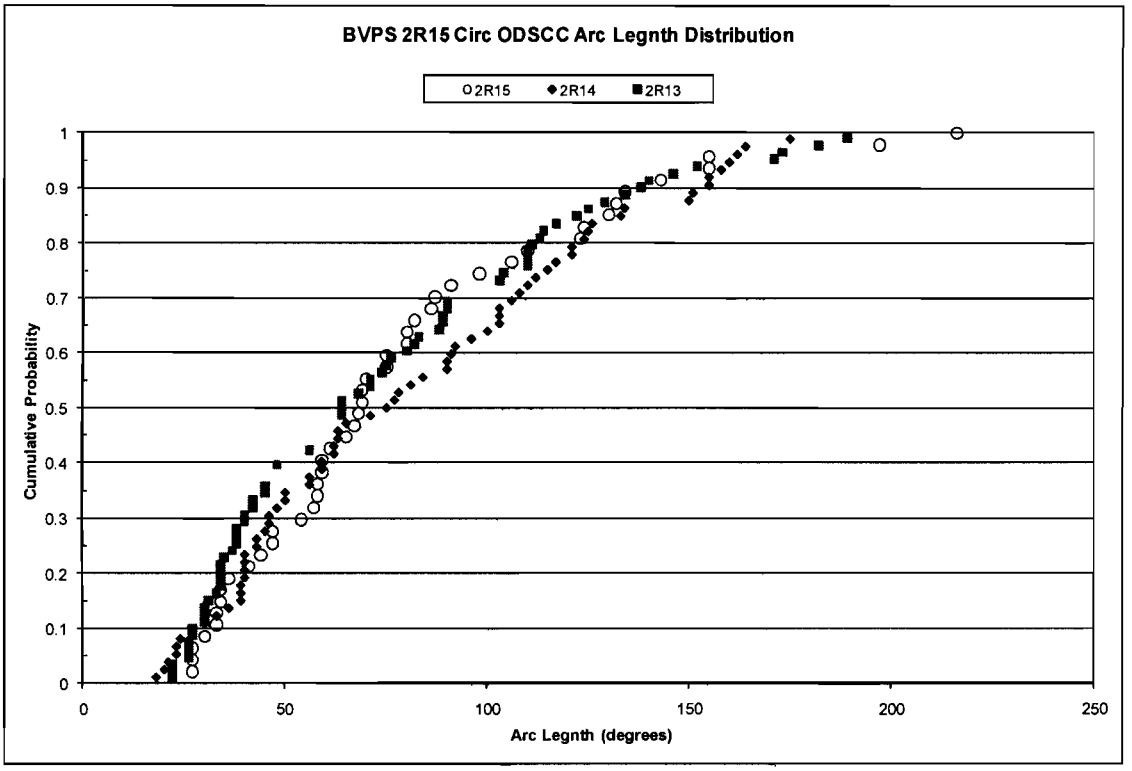
0 to 79%TW, average of 36%TW, based on phase analysis:

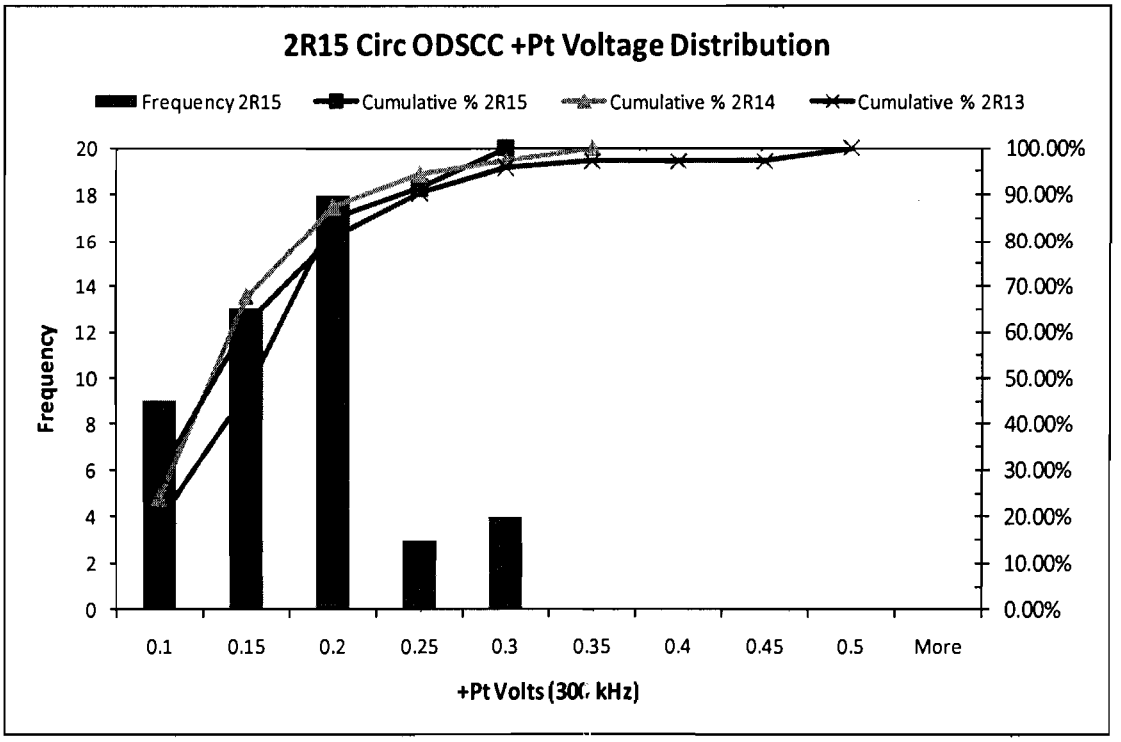
31 to 57%TW, average of 47%TW, based on Appendix I amplitude correlation of axial ODSCC

All first pass arc lengths of 160 degrees or greater were either profiled or further examined to define more appropriate arc length, ligaments, etc.

Based on a correlation of PDA vs +Pt amplitude from pulled tube data, the largest PDA at 95% probability of 60% has a lower 95/50 burst pressure of 5530 psi.

Long term trending of circumferential ODSCC at TTS flaw parameters shows little change. The following plots present the circ ODSCC arc length and +Pt voltage distributions for the last three outages.





Tube Support Plates:

Axial ODSCC confirmed by +Pt on 5 tubes in SGA, 19 tubes in SGB, and 4 tubes in SGC.

Maximum +Pt amplitude of 0.34 volt correlates to 60%TW; longest length from profiling is 0.65 inch.

All initial screening lengths of 0.40 inch or greater were profiled.

Other Indications of Note:

A circumferential ODSCC indication was reported on R31 C59 at 06H +41.3 inches at a freespan ding. The flaw parameters (0.37 volt, 137 degrees phase, 26 degrees arc) are bounded by the flaw parameters reported at 2R13 and 2R14, which were in situ proof and leak tested with no evidence of leakage, burst, or significant flaw change post test. In situ testing is not planned for this indication.

One tube was reported with an axial PWSCC indication at a dented TSP intersection. Flaw parameters are 1.15 volts in 300 kHz, and 0.20 inch length. The indication was reported as DNI by bobbin and confirmed by +Pt. Review of the historic bobbin data suggests signal distortion for several outages. Depth from phase angle analysis is 60%TW. Depth using an amplitude based regression developed from laboratory and pulled tube specimens is 58%TW.

June 15, 2011

Mr. Paul Harden
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SUBJECT: BEAVER VALLEY POWER STATION, UNIT NO. 2 (BVPS-2) - SUMMARY OF CONFERENCE CALL REGARDING THE SPRING 2011 STEAM GENERATOR TUBE INSPECTION RESULTS (TAC NO. ME5882)

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/ra/
Nadiyah S. Morgan, Project Manager
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Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-412
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