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

June 23, 2014

Site Vice President
Arkansas Nuclear One
Entergy Operations, Inc.
1448 S.R. 333
Russellville, AR 72802

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 2 – SUMMARY OF CONFERENCE CALL WITH ENTERGY OPERATIONS, INC. TO DISCUSS 2014 STEAM GENERATOR TUBE INSPECTIONS (TAC NO. MF3897)

Dear Sir or Madam:

On May 27, 2014, the U.S. Nuclear Regulatory Commission (NRC) staff participated in a conference call with Entergy Operations, Inc. (the licensee), personnel to discuss the steam generator inspection activities taking place at Arkansas Nuclear One, Unit 2, during the 2014 refueling outage. The call was conducted in response to an NRC letter dated April 17, 2014, (Agencywide Documents Access and Management System Accession No. ML14104B609). Enclosure 1 contains a summary of the conference call, as prepared by the NRC staff. Enclosure 2 is the summary of discussion points provided by the licensee in advance of the call.

If you have any questions, please contact me at (301) 415-2833 or by e-mail at Peter.Bamford@nrc.gov.

Sincerely,

Peter Bamford

Peter J. Bamford, Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-368

Enclosures:
1. Conference Call Summary
2. Summary of Discussion Points

cc w/encls: Distribution via Listserv

SUMMARY OF MAY 27, 2014, CONFERENCE CALL

REGARDING SPRING 2014 STEAM GENERATOR INSPECTIONS

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 2

DOCKET NO. 50-368

On May 27, 2014, the U.S. Nuclear Regulatory Commission (NRC) staff participated in a conference call with representatives of Entergy Operations, Inc. (the licensee), regarding the ongoing steam generator (SG) inspection activities at Arkansas Nuclear One, Unit 2 (ANO-2). In support of the conference call, the licensee provided the information in Enclosure 2.

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

- ANO-2 replaced the original SGs with Westinghouse Model Delta 109 SGs. The replacement SGs have been in service for 14 calendar years. The fourth SG inservice inspections are being performed in the current refueling outage (refueling outage 23). The SGs are at the end of their first inspection interval defined by the technical specifications. ANO-2 has been inspecting the SGs every third refueling outage.

- In the ANO-2 SG Primary to Secondary Leakrate (H-3) Gallons per Day (GPD) graph on page 7 of Enclosure 2, the y-axis units are GPD.

- Verification of anti-vibration bar (AVB) positions will be performed with eddy current auto analysis after the SG tube inspections are complete. The estimated time to complete the verification is 2 weeks.

- The licensee confirmed that the referenced Westinghouse letter to Entergy, MPENT-12-001 on page 2 of Enclosure 2 refers to Nuclear Safety Advisory Letter 12-01.

- The wear growth rate of the preliminary operational assessment for the current outage (at 95/50 probability/confidence interval values) is 4.5 percent.

- Plugging AVB indications greater than or equal to 30 percent through wall allows the licensee to operate on a three-cycle inspection schedule.

- No tube-to-tube wear was identified in the current outage.

- There were a total of 80 AVB indications in both SGs in the previous inspection.

- The inspections identified no wear associated with loose parts.
- The secondary side inspections performed in both SGs did not identify any erosion or cracks in the feed ring, primary or secondary steam separators, or the outlet venturi.
- The licensee clarified that the three machine remnants referenced on page 5 of Enclosure 2 refer to very small machine turnings (i.e., lathe turning).
- An evaluation of blockage of the top support plate will be done as part of the eddy current auto-analysis that is verifying the position of the AVBs.
- At the time of the call, the licensee stated that approximately 100 percent of the eddy current analysis was complete and the AVB location analysis still had 2 weeks until completion.
- The licensee confirmed that the replacement SGs did not have a stay cylinder, that the center region formerly occupied by the stay cylinder had been filled in with tubes, and that there was a 6-inch-wide open lane in the middle of the replacement SGs.

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

2R22 = Unit 2 Refueling Outage 22
ANO2 = Arkansas Nuclear One, Unit 2
CMOA = Conditional Monitoring Operational assessment
CR-ANO-2-2014-01539 = Condition Report (CR) number
EPRI = Electric Power Research Institute
ETSS = examination technique specification sheet
NEI 97-06 = Nuclear Energy Institute Steam Generator Program Guidelines
N/A = not applicable
NDE = nondestructive evaluation
PWR = pressurized water reactor
REV = Revision
TTS = Top of tubesheet

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

Enclosure 2
Licensee Summary of Discussion Points as of May 27, 2014

STEAM GENERATOR TUBE INSPECTION DISCUSSION POINTS
ENTERGY OPERATIONS, INC.
ARKANSAS NUCLEAR ONE, UNIT 2

May 27, 2014

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 2014 refueling outage at Arkansas Nuclear One, Unit 2. 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 U.S. 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.**

   No indication of primary-to-secondary leakage present prior to the current refueling outage (2R23).

   (Argon – 41 less than minimum detectable, Tritium ~ 1 gallon per day)

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

   No secondary side pressure tests have been performed or scheduled for 2R23.

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

   No exceptions were taken to NEI 97-06 and EPRI Steam Generator Guidelines.

4. **For each steam generator, 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.**

Primary Side Scope

Based on anti-vibration bar wear and loose part wear, the steam generator (SG) primary and secondary inspection scope planned for ANO2 2R23 is described below. The inspection plan, techniques, and personnel are appropriate for all potential damage mechanisms and are in accordance with the EPRI PWR SG Examination Guidelines. A technique validation assessment was performed to verify that the eddy current techniques are capable of detecting expected degradation.

Eddy Current Bobbin Probe Examinations (Both SGs)

- 100 % bobbin in both generators from tube end to tube end. No expansion required.
- Verification of anti-vibration bar (AVB) positions per design specification.
- Sludge height measurement above the tubesheet.

Eddy Current Array and Rotating Probe Examinations (Both SGs)

- Tubes in the periphery (3 outermost tubes) and adjacent to the no-tube lane (rows 1-4) was examined with the array probe from the 1st tube support plate (TSP) to the tube end for potential loose parts. Potential loose parts (PLPs) and wear identified due to loose parts will require expansion of the program dependent on the location of the tube
- All wear 20% through wall (TW) and greater was tested with the array probe.
- All previously identified potential loose part signals were tested with the array probe. Areas were bound in both steam generators. All previously identified loose part indications (LPI) was tested with the +Point™ probe and depth sized. No expansion required.
- Diagnostic testing of selected bobbin probe indications (i.e., I-Codes, possible loose parts (PLP)) was performed with either the array or +Point probe, depending on technique applicability, with the exception of manufacturing issues (i.e., manufacturing burnish marks (MBM's), dents).

Primary Side Visual Inspections (Both SGs)

- Visual examination of the previously installed plugs – (5 in SGA and 13 in SGB)
- MPENT-12-001 -visual inspection of the divider plate welds and cladding inspections.

Secondary Side Scope

Per NEI-97-06, the steam generator program shall include measures to maintain steam generator secondary side integrity. The secondary side inspection plan for ANO2 details the specific inspections for 2R23. A summary of these inspections is provided below:

Upper Secondary Side Inspections (Both SGs)

- Inspections of the steam drum which included the feed ring, primary and secondary steam separators and the outlet venturi.
- Evaluation of sludge in the sludge collector. Sludge lancing will not be performed.

Lower Secondary Side Inspections (Both SGs)

- An annulus inspection was performed using remote equipment on both generators to evaluate possible loose parts. The inspection was performed completely around the periphery and across the center tube lane in both generators.
- Evaluate blockage of the top support plate – this will be performed by eddy current testing post outage.

Inspection Scope Expansion

The need for, and extent of, any expansion in the examination scope will be determined based upon technical specification requirements and guidance provided in the EPRI SG Examination Guidelines. Scope expansions may also be required to support the operational assessment for the next operating period.

When new potential loose parts (PLPs) were detected we expanded in one location in each steam generator for loose parts (bounding).

5. **For each area examined (e.g., tube supports, dent/dings, sleeves, etc.), please 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).**

There were no crack-like indications reported.

Wear growth rates were consistent with the 2R22 Operational Assessment. Growth rate for the 2R22 Operational Assessment were based on a 95/50 probability/confidence computation of 4.85 %TW/EFPY (effective full power years)

There were 10 tubes with AVB wear indications ≥ 30% TW and 3 tubes with AVB (anti-vibration bar) wear ≥ 40% TW (through wall). The largest wear indication was 43% TW.

The maximum growth for repeat wear was 26%. The max growth for new wear was 22% for three cycles.

No free span wear was found.

No loose part wear was found.

Tube Integrity was maintained for previous interval for all degradation mechanisms.

Table of Indication Types

Anti-Vibration (ABV) Wear					Tube Support Plate (TSP) Wear			
SG A		SG B			SG A		SG B	
Tubes	Indications	Tubes	Indications		Tubes	Indications	Tubes	Indications
86	125	69	102		9	9	16	20

6. **Describe repair/plugging plans.**

A total of 5 tubes were plugged due to AVB wear indications ≥ 30% TW.

A total of 5 tubes were plugged due to AVB wear indications ≥ 30% TW.

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

   None - No indications exceeded screening criteria have been identified to date.

8. **Discuss the following regarding loose parts:**

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

   Tubes in the periphery (3 outermost tubes) and adjacent to the no-tube lane (rows 1-4) are examined with the array probe from the 1st TSP to the tube end.
   All previously identified loose parts are examined.

   All detected loose parts and loose part wear is bounded.

   Visual inspection and foreign object search and retrieval (FOSAR) in the SG A and SG B

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

   CR-ANO-2-2014-01539 for possible loose parts (PLPs) identified in SG B during refueling outage 2R23 eddy current testing (ECT). Tube wall wear was NOT indicated at the three loose part locations. The machine remnants have been retrieved and no tube wear has been observed

   - **if the loose parts were removed from the SG**

   Three machining remnants were removed from SG B.

   - **indications of tube damage associated with the loose parts**

   None, machine remnants had no associated wear from eddy current testing

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).**

   - Inspections of the steam drum which includes the feed ring, primary and secondary steam separators and the outlet venturi. This was done in both SG A/B. All inspected components found in satisfactory condition
   - Evaluation of sludge in the sludge collector. Just a thin layer of sludge was identified. No loose parts were identified in the sludge collector. This was done in both the SG A/B. Sludge lancing was not performed.
   - An annulus inspection using remote equipment was performed on both SG A/B to evaluate possible loose parts. The inspection was performed completely around the periphery and across the center tube lane in both generators. In SG A no major PLPs identified. SG B three machine remnants were removed.

- Evaluate blockage of the top support plate – this will be performed post outage with eddy current auto-analysis.

10. Discuss any unexpected or unusual results.

No unexpected or unusual results.

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

5/26 – Bowl Close Out SG A / SG B
5/27 – Equipment Off Load

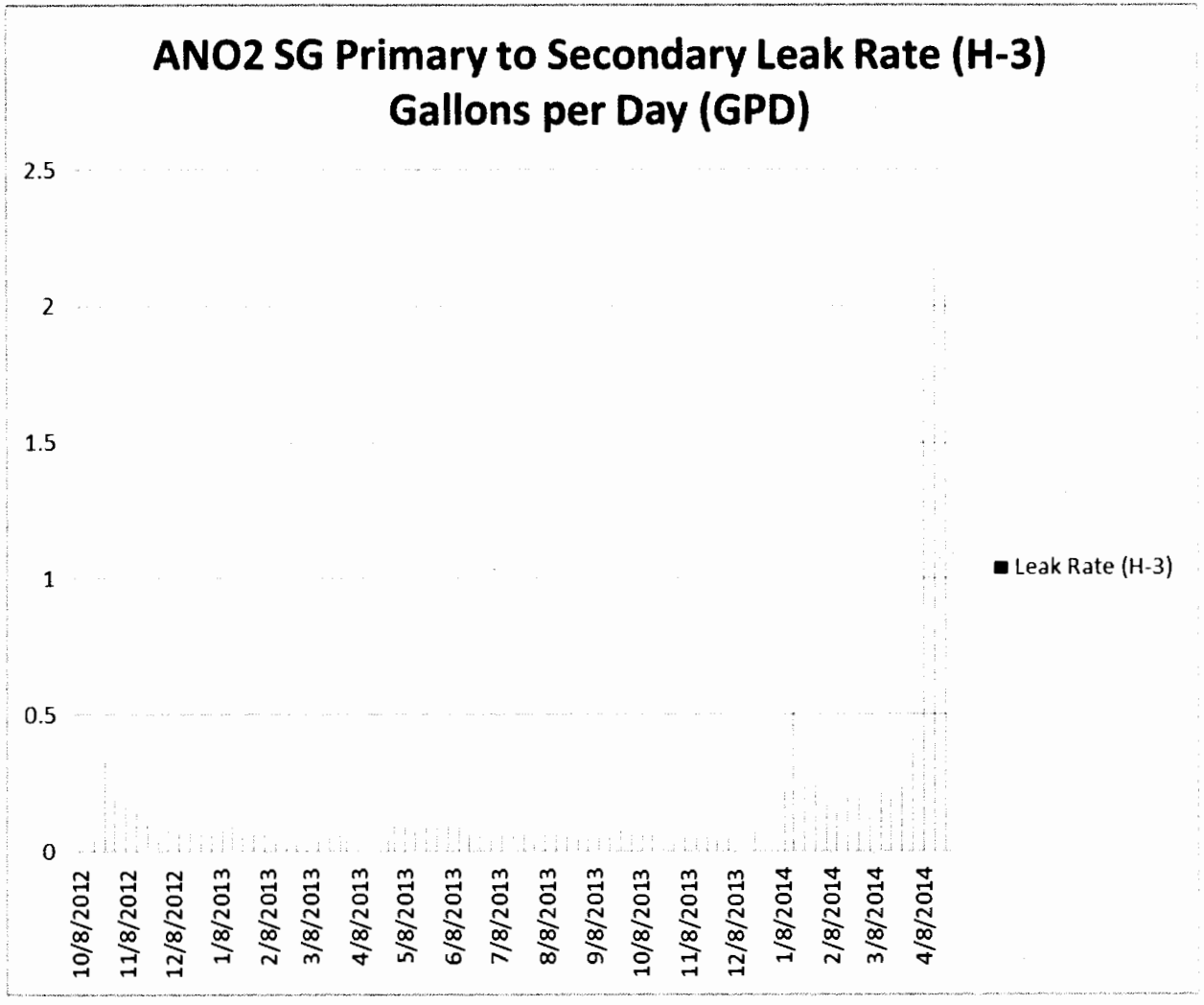
ANO2 SG Primary to Secondary Leak Rate (H-3)
Gallons per Day (GPD)
2.5
2
1.5
1
0.5
0
10/8/2012
11/8/2012
12/8/2012
1/8/2013
2/8/2013
3/8/2013
4/8/2013
5/8/2013
6/8/2013
7/8/2013
8/8/2013
9/8/2013
10/8/2013
11/8/2013
12/8/2013
1/8/2014
2/8/2014
3/8/2014
4/8/2014
Leak Rate (H-3)

Table-1: ANO Unit 2 Degradation Assessment for 2R23 Qualified Inspection Techniques

Degradation Mechanism	***Location***	***Inspection Technique***	***EPRI ETSS***
Tube Wear	AVB / TSP / Tube-to-tube	Bobbin / Differential / Detection & Sizing Bobbin / Absolute / Detection & Sizing Bobbin / Absolute / Detection	96004.1 Rev 13 96910.1 Rev 10 27901.1 Rev 1
Tube Wear	Loose parts	Bobbin / Differential / Detection +Point™ / Detection / Sizing	21998.1 Rev. 4 27901.1 Rev. 0 27901.2 Rev.0 27901.4 Rev.0 27901.5 Rev.0 27902.1 Rev.0 27902.2 Rev.0 27902.4 Rev.0 27902.5 Rev.0 27903.1 Rev.0 27903.2 Rev.0 27903.4 Rev.0 27903.5 Rev.0 27904.1 Rev.0 27904.2 Rev.0 27904.4 Rev.0 27904.5 Rev.0 27905.1 Rev.0 27905.2 Rev.0 27905.4 Rev.0 27905.5 Rev.0 27906.1 Rev.0 27906.2 Rev.0 27906.4 Rev.0 27906.5 Rev.0 27907.1 Rev.0 27907.2 Rev.0

Degradation Mechanism	***Location***	***Inspection Technique***	***EPRI ETSS***
			27907.4 Rev.0 27907.5 Rev.0
Volumetric Degradation (PLP wear) at TTS and Free Span	TTS / Loose Parts		

Table-2: ANO Unit 2 Degradation Assessment Sizing Technique Uncertainties

							Depth Sizing Parameters				
Degradation Mechanisms	**Probe**	**EPRI ETSS**	**Site ETSS Number**	**Demonstrated / Extended Applicability**	**Detection**	**Sizing Applicability**	**Actual %TW vs. NDE %TW**	**Technique Uncertainty (Sy,x) %TW**	**Analyst Uncertainty %TW**	**Total Uncertainty %TW**	**Total Uncertainty @ 95/50 %TW**
Wear at Tube Support Plates and AVB's	Bobbin	96004.1 Rev. 13		AVB & TSP / Loose Part Wear (part present)	All	CMOA @ AVB & TSP	y=0.98x + 2.89	4.19	2.10	4.68	7.71
Support Structure and PLP Wear (Part Present)	+Point™	96910.1 Rev. 10		AVB / None	All	CMOA @ AVB	y=1.01x + 4.30	6.68	3.34	7.48	12.31
Volumetric	+Point™	21998.1 Rev. 4		Freespan / None	All	CMOA @ Freespan	Y=1.02x + 5.81	6.28	3.14	7.05	11.60
Foreign Object Wear	+Point™	2790X series		PLP	All	CMOA Freespan, expansion transitions, and at structures (part not present)	N/A	N/A	N/A	N/A	N/A

Notes

1. Demonstrated applicability for 2790X series includes PLP wear (part not present)
2. Total NDE uncertainty is equal to the square root sum of the squares (SRSS) of the technique uncertainty and analyst uncertainty. Technique uncertainty is typically presented on the applicable ETSS as the variable Sy,x. Analyst uncertainty is taken to equal one-half the technique uncertainty. Combining these uncertainties (technique + analyst) via SRSS results in a total NDE uncertainty approximately equal to 1.12 * technique uncertainty. Total uncertainty at 95% probability with 50% confidence is calculated as 1.645 times the total uncertainty.

June 23, 2014

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/RA/

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Docket No. 50-368

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DATE	6/23/14	6/19/14	6/13/14	6/23/14	6/23/14

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