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October 27, 2014

Site Vice President
Duke Energy Progress, Inc.
H. B. Robinson Steam Electric Plant, Unit No. 2
3581 West Entrance Road
Hartsville, South Carolina 29550

SUBJECT: H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2 - SUMMARY OF CONFERENCE CALL REGARDING STEAM GENERATOR INSPECTIONS DURING A FORCED OUTAGE IN SPRING 2014 (TAC NO. MF5001)

Dear Sir/Madam:

On March 24, 2014, the U. S. Nuclear Regulatory Commission staff participated on a conference call with representatives of Duke Energy Progress, Inc. (the licensee) regarding the ongoing steam generator inspection activities at H. B. Robinson Steam Electric Plant (Robinson), Unit 2. Robinson, Unit 2, performed the steam generator inspection activities because of a steam generator tube leak caused by foreign material introduced during a maintenance activity on the Auxiliary Feedwater System during the fall 2013 refueling outage that resulted in a forced outage in spring 2014.

Enclosed you will find the staff's summary of the conference call. A list of discussion questions were discussed on the call. The licensee provided the answers to the list of discussion questions prior to the conference call via email (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14290A216). The information is also enclosed in this letter.

Additionally, the licensee submitted the Steam Generator Tube Inspection Report for the spring 2014 forced outage, dated September 29, 2014 (ADAMS Accession No. ML14282A020), in accordance with the Robinson Unit 2 Technical Specifications, Section 5.6.8, "Steam Generator Tube Inspection Report," and is currently under NRC staff review.

If you have any questions regarding this matter, please call me at 301-415-2760, or email me at Martha.Barillas@nrc.gov.

Sincerely,

/RA/

Martha Barillas, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-261

Enclosures:
1. Conference Call Summary
2. Response to Standard NRC Questions

cc w/enclosures: Distribution via ListServ

CONFERENCE CALL SUMMARY

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT 2, REGARDING

SPRING 2014 FORCED OUTAGE STEAM GENERATOR INSPECTIONS

DOCKET NO. 50-261

On March 24, 2014, the staff of the Steam Generator Tube Integrity and Chemical Engineering Branch of the Division of Engineering participated in a conference call with representatives of Duke Energy Corporation (the licensee) regarding the ongoing steam generator (SG) inspection activities at H. B. Robinson Steam Electric Plant (Robinson), Unit 2. In support of the conference call, the licensee provided Enclosure 2 to this letter.

Robinson Unit 2 has three Westinghouse model 44F SGs. Each SG contains 3214 thermally treated Alloy 600 tubes. Each tube has a nominal outside diameter of 0.875 inch and a nominal wall thickness of 0.050 inch. The tubes are supported by stainless steel support plates with quatrefoil-shaped holes and V-shaped Alloy 600 anti-vibration bars.

Robinson Unit 2 performed these SG inspections because of primary-to-secondary SG leakage that resulted in a forced outage in March 2014.

Abbreviations used in the licensee-provided document (Enclosure 2) include:

- ΔP – differential pressure
- FOSAR – foreign object search and retrieval
- gpd – gallons per day
- gpm – gallons per minute
- MSLB – main steam line break
- PLP – possible loose part
- psig – pounds per square inch gauge
- RPC – rotating pancake coil
- SG – Steam Generator

Additional clarifying information regarding the licensee-provided document and information not included in the licensee-provided document is summarized below.

- In Item 1 of Enclosure 2, the fourth sentence should read 0.6 gpd, not 0.6 gpm.

- The hot-leg temperature of the plant is 604 degrees Fahrenheit.

- The licensee indicated that the leakage rate described in Item 1 increased in a rather consistent manner, without rapid increases followed by rapid decreases (i.e., there were only a few spikes in the leak rate readings).

- After the secondary side pressure test was conducted on SG "C," the leak rate of the tube increased, but both before and after the secondary side pressure test, the leak rate remained in the "drops per minute" range.

- In the previous refueling outage (RFO28), which was performed in fall 2013, 100 percent of all three SG hot-legs were inspected from the hot-leg tube end to the first tube support plate, with an array probe.

- Once the leak was discovered, and prior to the forced shutdown, the licensee reviewed all of the eddy current data (bobbin probe, array probe, and +Point™ probe) from RFO28 for SG "C" and all of the bobbin coil eddy current data for SGs "A" and "B." The review showed that there was no indication present in the leaking tube in the previous refueling outage (RFO28), and no indications were missed.

- There were no indications found in the H* region of the tubesheet for any of the SGs during the spring 2014 outage.

- Of the 30 wear indications in SG "C" (referred to in item 5), the licensee clarified that about half were related to loose parts (and that they had been tracking many of these indications for years), but none seemed related to the leaking tube. Only one of these indications is close to the leaking tube and this indication has a depth of 14-percent through-wall. This tube will remain in service since the loose part was removed.

- In the information provided under "Steam Generator B" of Item 5, the first sentence should state that there were 18 wear indications detected in the "B" SG, not the "A" SG.

- The wear indications listed in SGs "A" and "B" (15 in SG "A" and 18 in SG "B") were a mixture of wear indications from anti-vibration bars, tube support plates, and loose parts.

- All leak rates provided in the table (in Item 6) are measured in gallons per minute. The first half of the table has the leak rates with the part still present.

- In describing the source of the loose parts found in SG "C" (in Item 7), the licensee stated that a section of main feedwater piping for both SGs "B" and "C" was replaced during RFO28. When a vertical section of feedwater pipe was cut for SG "C," the two halves of the pipe sprung apart and machining shavings that had been created during the cutting of the pipe, fell into the lower half of the vertical section of pipe. The shavings then tumbled through the large radius elbow at the bottom of the vertical leg of pipe, so when the licensee looked into the pipe, they could not see any shavings. The licensee stated that they did not perform a boroscope inspection of the pipe prior to installing the foreign material exclusion barriers during RFO28.

- At the time of the call, the licensee had completed a boroscope examination of all feedwater piping from the location of the section replaced (through a pressure tap) during RFO28 to the inlet nozzle of SG "C." No boroscope inspections were performed in SG "B" due to differences in maintenance activities.

- The licensee stated that metallurgy had confirmed that the loose part that caused the leak was carbon steel, which is the same material as the feedwater piping.

- In regards to ongoing visual inspections, the licensee was planning to perform a 100-percent visual inspection of the SG C tubesheet.

- At the time of the call, the plugging plans only included the leaking tube in SG "C."

- The trending results of the in situ pressure testing were expected to be completed by Wednesday, March 26, 2014, and the licensee said they would provide the results to the resident inspector. The trending was performed because of the significant differences in leakage rates with and without the loose part present and because there was a decreasing trend in leakage as pressure was increased from normal operating differential pressure to main steamline break differential pressure.

Response to NRC Standard Questions for
Robinson Unit 2 MCO29 Forced Outage, March 2014

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

   Duke Response:

   Robinson Cycle 29 operation began on November 4, 2013. Primary-to-secondary leakage was below the detection limit until February 27, 2014. On February 27, an indication of primary-to-secondary leakage was detected. The initial leak rate was calculated to be 0.6 gpm based on the air ejector off-gas grab sample result. The "C" steam generator was identified as the source of the leakage based on blowdown radiation monitor readings. The leak rate progressively increased over the next nine days. A maximum leak rate of 37.45 gpd was observed on March 7 based on the air ejector off-gas grab sample. A controlled unit shutdown commenced on the evening of March 7 and the unit was off-line by early March 8.

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

   Duke Response:

   A secondary side pressure test was conducted on the "C" steam generator to determine the leaking tube(s). The leaking tube was evident under static head conditions. The secondary side was then pressurized to 750 psig. No other leaking tubes were identified.

3. Discuss any exceptions taken to the industry guidelines.

   Duke Response:

   No exceptions have been taken to the industry 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.

- *Population Not Inspected During R28 with Bobbin (~50%) (excluding Row 1 and 2 u-bends)*
- *Previous Indications with Bobbin (volumetric degradation and historical PLP's)Around Previously Plugged Tubes with Bobbin*
- *Special Interest Locations with Array (as identified by bobbin)*
- *Tube Leak Location Post In-Situ Test with Bobbin, Array, and RPC*
- *Around Leaking Tube Post In-Situ with Array*

The inspection scope was expanded in the "C" steam generator to include the following:

- *All Remaining Tubes with Bobbin (excluding Row 1 & 2 u-bends)*
- *100% Top-of-Tubesheet with Array Probe on both the Hot and Cold Leg Sides*

Steam Generator "A" and "B"

The initial inspection scope for the "A" and "B" steam generators was as follows:

- *Population Not Inspected During R28 with Bobbin (~50%) (excluding Row 1&2 u-bends)*
- *Previous Indications with Bobbin (volumetric degradation and historical PLP's)*
- *Around Previously Plugged Tubes with Bobbin*
- *Special Interest Locations with Array (as identified by bobbin)*

The inspection scope was expanded in the "A" and "B" steam generators to include the following:

- *Top-of-Tubesheet with Array Prove 5 Tubes Deep Around Periphery and Open Lane on both the Hot and Cold Leg Sides*

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 t is location at this unit (e.g., observed circumferential primary water stress corrosion cracking at the expansion transition for the first time at this unit).

Duke Response:

Steam Generator "C"

Other than the leaking tube, 30 wear indications were detected in the "C" steam generator. The largest of these indications was 31% through-wall. No indications of stress corrosion were detected.

The flaw in the leaking tube was confirmed by eddy current testing to be 100% through-wall. The leaking tube (31-15) is approximately three rows deep from the periphery on the hot leg side of the steam generator. The flaw was detected at 0.84 inches above the top of the tubesheet. The flaw had a length of 0.31 inches and width of 0.25 inches as measured by eddy current. The +Point voltage was 4.79. Structural and accident induced leakage integrity requirements were met during the previous operating period based on in-situ pressure testing results. The flaw causing the tube leak was confirmed to have been caused by wear from a loose part.

Steam Generator "A"

15 wear indications were detected in the "A" steam generator. The largest of these indications was 26% through-wall. No indications of stress corrosion were detected.

Steam Generator "B"

18 wear indications were detected in the "A" steam generator. The largest of these indications was 35% through-wall. No indications of stress corrosion were detected.

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

Duke Response:

In-situ pressure testing was performed on the leaking tube in the "C" steam generator (31-15). A limited scope in-situ test was performed prior to removing the loose part from the flaw location. A complete in-situ test was performed after removing the loose part. Both the accident induced leakage performance criteria (< 0.11 gpm) and the structural integrity performance criteria (no burst) were met.

Test Step	***Nominal Pressure***	***Corrected Test Pressure***	***Westinghouse Test Pressure***	***Test Results Leak Rate***
Normal Operation ΔP	1450	1653	1700	0.0511
MSLB ΔP (transient)	1600	1824	1900	0.0599
Intermediate Step	2235	2548	2600	0.0712
Safety Valve Set Point	2560	2918	3000	0.0804
Normal Operation ΔP	1450	1653	1700	0.0584
Removed Part				
Normal Operation ΔP	1450	1653	1700	0.0250
MSLB ΔP (transient)	1600	1824	1900	0.0070
Intermediate Step	2235	2548	2600	0.0791
Safety Valve Set Point	2560	2818	3000	0.0852
Normal Operation ΔP	1450	1653	1700	0.0638
Intermediate Step	N/A	3500	3500	No Burst
Intermediate Step	N/A	4000	4000	No Burst
Intermediate Step	N/A	4500	4500	No Burst
3X Normal Operation ΔP	4350	4959	5000	No Burst

No tube pulls have been performed. None are planned.

7. Discuss the following regarding loose parts:
   1) What inspections are performed to detect loose parts?
   2) A description of any loose parts detected and their location within the SG (including the source or nature of the loose part, if known).
   3) If the loose parts were removed from the SG.
   4) Indications of tube damage associated with the loose parts.

Duke Response:

1. *A visual inspection was performed of the annulus region and the outermost 5 tube rows at the top of the tubesheet on all three steam generators. In addition, a more detailed visual inspection of the tubesheet region is being performed on the "C" steam generator. This includes areas in the inner portion of the tube bundle at the tubesheet elevation.*
2. *A number of loose parts were found in the "C" steam generator. These loose parts were identified to be machining remnants. The remnants are believed to have originated from a specific maintenance activity during the R28 outage related to the replacement of a section of feedwater piping leading to the "C" steam generator. One of these remnants is responsible for creating the flaw that resulted in the tube leak. No similar loose parts were identified in the "A" or "B" steam generators. One piece of gasket material was identified and removed from the "A" steam generator. One small screw was identified and removed from the "B" steam generator.*
3. *Each of the loose parts identified in the "A" and "B" steam generator have been removed. A number of the loose parts have been removed from the "C" steam generator. Visual inspection and loose parts retrieval is still in progress in the "C" steam generator.*
4. *One of the loose parts identified in the "C" steam generator is responsible for creating the flaw that resulted in the tube leak. Several small wear scars were seen during visual inspection. No loose parts remained in these areas.*

8. 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.).

   Duke Response:

   In addition to the visual inspections discussed above, a visual inspection is planned for the downcomer region of the "C" steam generator to look for possible loose parts. This inspection will be performed from the upper deck elevation in the steam drum region.

9. Discuss any unexpected or unusual results.

   Duke Response:

   The only unexpected or unusual result found is the presence of a significant number of loose parts in the "C" steam generator. As stated above, the loose parts are believed to be due to a specific maintenance activity to replace a section of piping in the feedwater system during the R28 outage.

10. Provide the schedule for steam generator-related activities during the remainder of the current outage.

    Duke Response:

    Eddy current testing is complete in all three steam generators. FOSAR work continues in the "C" steam generator. An inspection of the downcomer region is planned for March 25.

If you have any questions regarding this matter, please call me at 301-415-2760, or email me at Martha.Barillas@nrc.gov.

Sincerely,

/RA/

Martha Barillas, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
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