

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

July 12, 2016

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Serial No. 16-248
NAPS/JHL
Docket No. 50-339
License No. NPF-7

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
NORTH ANNA POWER STATION UNIT 2
STEAM GENERATOR TUBE INSPECTION REPORT

Pursuant to Technical Specification 5.6.7 for North Anna Power Station Unit 2, Dominion is required to submit a 180-day steam generator tube inspection report. The attachment to this letter provides the steam generator tube inspection report for the North Anna Unit 2 Spring 2016 outage.

Should you have any questions or require additional information, please contact Mr. Donald R. Taylor at (540) 894-2100.

Very truly yours,



Gerald T. Bischof
Site Vice President

Attachment

Commitments made in this letter: None

A001
NRR

cc: U.S. Nuclear Regulatory Commission
Region II
Marquis One Tower
245 Peachtree Center Avenue, NE
Suite 1200
Atlanta, Georgia 30303-1257

NRC Senior Resident Inspector
North Anna Power Station

Dr. V. Sreenivas
NRC Project Manager
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop O8 G9A
11555 Rockville Pike
Rockville, Maryland 20852

ATTACHMENT

**NORTH ANNA UNIT 2
180-DAY NRC REPORT REGARDING
STEAM GENERATOR TUBE INSPECTION
PER TECHNICAL SPECIFICATION 5.6.7**

**VIRGINIA ELECTRIC AND POWER COMPANY
(DOMINION)**

SPRING 2016 - NORTH ANNA UNIT 2 STEAM GENERATOR INSPECTIONS

During the North Anna Unit 2 Spring 2016 outage, steam generator (SG) inspections were completed in accordance with Technical Specification (TS) 5.5.8.d for steam generators "A" and "C". Transmittal of this report satisfies the reporting requirement specified in TS 5.6.7.

The Unit 2 steam generators have accrued 18.4 Effective Full Power Years (EFPY) of operation as of the end of Cycle 24 (March, 2016).

Initial entry into Mode 4 occurred on April 8, 2016 (0930 hours); therefore, this report is required to be submitted by October 5, 2016.

Italicized wording represents TS verbiage. The required information is provided under each reporting requirement as follows:

A report shall be submitted within 180 days after the initial entry into Mode 4 following completion of an inspection performed in accordance with the Specification 5.5.8, "Steam Generator (SG) Program." The report shall include:

a. The scope of inspections performed on each SG

The following primary side inspections were performed in steam generators "A" and "C":

- Video examination of both channel heads (as-found / as-left).
- 100% full-length inspection utilizing bobbin coil probe for all tubes except for Row 1 U-bends
- 28% of hot leg top of tubesheet (+/-3") utilizing rotating coil probe with tube selection including 50% of the secondary side critical area in the sludge zone, 50% of all tubes within five tubes of the bundle periphery, and other randomly sampled locations
- 17% of cold leg top of tubesheet (+/-3") utilizing rotating coil probe with tube sample constituting 56% of all tubes within five tubes of the bundle periphery
- 100% Row 1 (98 tubes) U-bend region utilizing rotating coil probe
- Special interest inspections of dents/dings with rotating coil probe (Sample: 100% of dents/ding \geq 5 Volts; all new dents)
- Special interest rotating coil probe exams of largest voltage tubesheet overexpansions (OXP) (SG "A" 39 hot leg and 7 cold leg tests, SG "C" 80 hot leg and 19 cold leg tests)
- Inspection of all bobbin coil I-codes (i.e., possible indications) with rotating coil probe. Results identified in Table 1 below.

Table 1 – Bobbin Probe Indication / Special Interest Exam Summary

KEY: tubes / indications / indications tested with +Point	SG "A"	SG "C"
I-Codes and S-Codes	2 / 2 / 1	9 / 9 / 9
New Dent**	7 / 8 / 8	0 / 0 / 0
Dents ≥ 5 Volts**	2 / 2 / 2	1 / 1 / 1
Hot Leg Straight Dent	10 / 10 / 8	6 / 6 / 6
U-bend Dent	29 / 31 / 8	11 / 13 / 1
Cold Leg Straight Dent	8 / 8 / 1	9 / 12 / 0
Hot Leg Straight Manufacturing Burnish Mark (MBH)	14 / 14 / 14	11 / 11 / 11
U-bend MBH	2 / 2 / 0	4 / 4 / 0
Cold Leg Straight MBH	10 / 11 / 0	12 / 14 / 0
Historical Hot Leg OXP	353 / 451 / 39	503 / 790 / 80
Historical Cold Leg OXP	149 / 170 / 7	603 / 998 / 19
No Tube Expansion	0 / 0 / 0	1 / 1 / 1

**Included in the dent totals

The following secondary side inspections were performed in steam generators "A" and "C":

- Steam drum visual inspections to evaluate the cleanliness and structural condition of all accessible subcomponents including moisture separators, drain systems, and interior surfaces.
- Drop down examinations through the primary separators to assess the cleanliness and structural condition of the upper tube bundle and anti-vibration bar (AVB) supports.
- Visual inspections of J-nozzle to feeding internal interface for flow assisted corrosion in the carbon steel portions of the tee and inlet sections.
- Visual inspections of upper tube support plates via 7th tube support plate (TSP) handholes to assess structural condition and cleanliness, including that of TSP wedges and associated welds.
- Ultrasonic thickness measurement of selected feeding locations.

b. Degradation mechanisms found

No indications of degradation were detected in SG "A", although 8 new dents were reported in 7 tubes with 5 new dents occurring at AVB #1. The new dents were scattered throughout the bundle rather than clustered near each other. The new dents ranged from 2.0 to 2.4 volts, were examined with a rotating probe, and

showed no signs of degradation.

The eddy current inspection identified four indications of degradation in three different tubes in SG "C".

- Tube R2-C13 contains a tube-to-tube support plate wear indication at the second support plate on the cold leg side. The indication coincides with broach land location. This tube remains in service.
- Tube R2-C93 contains a tube-to-tube support plate wear indication at the third support plate on the cold leg side. The indication coincides with broach land location. This tube remains in service.
- Tube R47-C49 contains two foreign object wear indications at the third support plate on the cold leg side. The indications coincide with the broach opening location rather than the broach land. This tube was plugged and stabilized.

c. *Nondestructive examination techniques utilized for each degradation mechanism*

The 2016 tube inspections focused on the degradation mechanisms listed in Table 2 utilizing the referenced eddy current techniques.

Table 2 – Inspection Method for Applicable Degradation Modes

Classification	Degradation Mechanism	Location	Probe Type
Potential	Tube Wear	Anti-Vibration Bars	Bobbin – Detection Bobbin and +Point™ – Sizing
Potential	Tube Wear	Flow Distribution Baffle (FDB)	Bobbin – Detection Bobbin and +Point™ – Sizing
Existing	Tube Wear	Tube Support Plate (TSP)	Bobbin – Detection Bobbin and +Point™ – Sizing
Potential	Tube Wear	Freespan & AVB tangents (Row 8, 14, 26)	Bobbin – Detection Bobbin or +Point™ – Sizing
Potential	Tube Wear (foreign objects)	Freespan, Top-of-Tubesheet (TTS), FDB, and TSP	Bobbin and +Point™ – Detection +Point™ - Sizing
Potential	IGA/ODSCC	Hot Leg TTS sludge pile critical area	Bobbin and +Point™ – Detection +Point™ - Sizing
Potential	OD Pitting	TTS sludge pile critical area	Bobbin – Detection +Point™ - Sizing

Relevant/Informational Inspection	PWSCC	Hot leg TTS sludge pile critical area and within-tubesheet anomaly locations	+Point™ – Detection and Sizing
Relevant/Informational Inspection	IGA/ODSCC PWSCC	Row 1 U-bends	+Point™ – Detection and Sizing
Relevant/Informational Inspection	IGA/ODSCC	Freespan, FDB, TSP	Bobbin – Detection +Point™ - Sizing
Relevant/Informational Inspection	IGA/ODSCC	TTS outside the critical area	+Point™ – Detection and Sizing

d. Location, orientation (if linear), and measured sizes (if available) of service induced indications

- Tube R2-C13 contains a tube-to-support wear indication at the second support plate on the cold leg side. The indication coincides with broach land location and has been maximum depth sized at 12% through wall using Examination Technique Specification Sheet (ETSS) 96910.1. The indication extends 0.45 inches in the axial direction and has an arc length of 49° in the circumferential direction. This tube remains in service.
- Tube R2-C93 contains a tube-to-support wear indication at the third support plate on the cold leg side. The indication coincides with broach land location and has been maximum depth sized at 6% through wall using ETSS 96910.1. The indication extends 0.40 inches in the axial direction and has an arc length of 42° in the circumferential direction. This tube remains in service.
- Tube R47-C49 contains two foreign object wear indications at the third support plate on the cold leg side. The indications coincide with the broach opening location rather than the broach land. One indication has been maximum depth sized at 33% through wall using ETSS 27901.1. The indication extends 0.29 inches in the axial direction and has an arc length of 56° in the circumferential direction. The other indication has been maximum depth sized at 20% through wall using ETSS 27901.1. The indication extends 0.13 inches in the axial direction and has an arc length of 35° in the circumferential direction. The foreign object that caused the wear is no longer in contact with the tube.

e. Number of tubes plugged during the inspection outage for each degradation mechanism

- Two tubes were plugged during this inspection. Both tubes were removed from service by plugging with stabilizers installed on the cold leg side.
- Tube R47-C49 contains two foreign object wear indications at the third support plate on the cold leg side. One indication has been maximum depth sized at

33% and the other indication has been maximum depth sized at 20% through wall.

- Tube R46-C49 identified a foreign object in contact with the tube at the third support plate on the cold leg side. The foreign object appears to be wedged within a broach opening adjacent to the tube but has not caused wear on that tube. This location is inaccessible and the foreign object cannot be retrieved.
- f. *The number and percentage of tubes plugged to date, and the effective plugging percentage in each steam generator*

Table 3 summarizes the current tube plugging status for North Anna Unit 2 steam generators.

Table 3 – Current Tube Plugging Status

Steam Generator	Number of Plugged Tubes	Percent Plugged
A	1	0.03%
B	0	0.00%
C	7	0.19%
Total	8	0.07%

- g. *The results of condition monitoring, including the results of tube pulls and in-situ testing*

The Condition Monitoring and Operational Assessment (CMOA) concluded that the structural integrity, accident leakage, and operational leakage performance criteria have all been met for SG "A" and "C". None of the inspection results from this outage would invalidate the CMOA prepared for SG "B". Therefore, condition monitoring has been met for the just completed operating interval and thus tube pulls and in-situ pressure testing were not necessary.