VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

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United States Nuclear Regulatory Commission
Attention: Document Control Desk
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VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNIT 2
STEAM GENERATOR TUBE INSPECTION REPORT
FOR THE SPRING 2017 REFUELING OUTAGE

Technical Specification 6.6.A.3 for Surry Power Station Units 1 and 2 requires the submittal of a Steam Generator Tube Inspection Report to the NRC within 180 days after T_{avg} exceeds 200°F following completion of an inspection performed in accordance with Technical Specification 6.4.Q, Steam Generator Program. Attached is the Surry Unit 2 report for the Spring 2017 refueling outage.

If you have any questions concerning this information, please contact Mrs. Candee G. Lovett at (757) 365-2178.

Very truly yours,

Fred Mladen
Site Vice President
Surry Power Station

Attachment: Surry Unit 2 Steam Generator Tube Inspection Report for the Spring 2017 Refueling Outage

Commitments made in this letter: None

A047
NRR

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ATTACHMENT

SURRY UNIT 2
STEAM GENERATOR TUBE INSPECTION REPORT
FOR THE SPRING 2017 REFUELING OUTAGE

VIRGINIA ELECTRIC AND POWER COMPANY
(DOMINION ENERGY VIRGINIA)

SURRY UNIT 2
STEAM GENERATOR TUBE INSPECTION REPORT
FOR THE SPRING 2017 REFUELING OUTAGE

The following satisfies the Surry Power Station Technical Specification (TS) reporting requirement Section 6.6.A.3. During the Surry Unit 2 Spring 2017 End-Of-Cycle 27 (EOC27) refueling outage, Steam Generator (SG) inspections in accordance with TS 6.4.Q were completed for SGs A, B, and C.

The Unit 2 SGs are in the 4th inspection period, which has a duration of 72 Effective Full Power Months (EFPM). This was the fourth and final inspection in the 4th inspection period.

Surry Unit 2 exceeded 200°F on June 1, 2017; therefore this report is required to be submitted by November 28, 2017. At the time of this inspection, the Unit 2 SGs had operated for 349.6 EFPM since the first in-service inspection.

In the discussion below ***bold italicized*** wording represents TS verbiage and the required information is provided directly below each reporting requirement. A list of acronyms is provided at the end of this report.

A report shall be submitted within 180 days after Tavg exceeds 200°F following completion of an inspection performed in accordance with the Specification 6.4.Q, "Steam Generator (SG) Program." The report shall include:

a. The scope of inspections performed on each SG,

Primary Side

During the Unit 2 EOC27 refueling outage, primary side inspections were performed in SGs A, B and C. The eddy current inspections included the following:

Steam Generators A and C:

- Array inspection of all in-service tubes from TSH -17.89" to the lowermost hot leg support structure (either BPH or 01H).
- Motorized Rotating Pancake Coil (MRPC) inspections of specific locations of special interest based on array or previous eddy current results.

Steam Generator B:

- Bobbin inspection of all in-service tubing except the u-bends of Rows 1 and 2.
- MRPC inspections of the u-bends of Rows 1 and 2.
- Array inspection of all in-service tubes from TSH -17.89" to the lowermost hot leg support structure (either BPH or 01H).

- Array inspection of all in-service tubes from TSC -17.89" to the lowermost cold leg support structure (either BPC or 01C).
- Array inspection of hot leg straight sections of all in-service tubes with high residual stress.
- MRPC inspections of locations of special interest based on bobbin and array inspection results.

As-found and as-left visual examinations were performed in both channel heads in SG B and the hot leg channel heads of SGs A and C. No degradation associated with the divider plate, welds, cladding, channel head, channel head drain, or previously installed plugs was observed. Examination of the bottom of the bowl and drain in the dry condition showed no degradation.

Secondary Side

Listed below is a summary of the secondary side work performed in the Surry Unit 2 steam generators during the EOC27 outage.

SGs A, B, and C:

- Sludge lancing was performed in all three steam generators.
- Post-lancing visual examination of the top-of-tubesheet annulus and no-tube lane to identify and remove any retrievable foreign objects (FOSAR).
- Visual investigation of any accessible locations having eddy current signals potentially related to foreign objects.

SG C:

- Visual examination, from the steam drum of all accessible steam drum components and structures, including the feedring, j-nozzles, and the primary and secondary moisture separators. The upper tube bundle and 7th tube support plate (TSP) were also inspected via probe drops through the primary moisture separators. No degradation or any other condition adverse to quality was observed during the secondary side internals inspections.

b. Degradation mechanisms found,

Degradation mechanisms targeted by the inspection plan included anti-vibration bar (AVB) wear, pitting, foreign object wear, TSP wear and stress corrosion cracking (SCC). AVB wear, foreign object wear, and tube support plate wear were detected during the current outage. There was no reportable pitting and no cracking observed above the H-star region in 2017.

c. Nondestructive examination techniques utilized for each degradation mechanism,

The inspection program focused on the degradation mechanisms listed in Table 1 and utilized the referenced eddy current techniques.

Table 1 – Inspection Method for Applicable Degradation Modes

Classification	Degradation Mechanism	Location	Probe Type
Existing	Wear	Anti-Vibration Bars	Bobbin – Detection and Sizing
Existing	OD Pitting	Top-of-Tubesheet (TTS)	Bobbin and Array – Detection +Point™ - Sizing
Existing	Wear	Tube Support Plate	Bobbin – Detection +Point™ – Sizing
Existing	Tube Wear (foreign objects)	Freespan and TTS	Bobbin and Array – Detection +Point™ - Sizing
Existing	PWSCC	Tubesheet Overexpansions (OXP)	Array – Detection +Point™ - Sizing
Existing	PWSCC	Tube Ends	N/A*
Existing	Tube Wear	Flow Distribution Baffle	Bobbin – Detection +Point™ – Sizing
Potential	ODSCC PWSCC	Bulges, Dents, Manufacturing Anomalies, and Above-Tubesheet Overexpansions (OVRs)	Array – Detection +Point™ - Sizing
Potential	ODSCC	Tubesheet Crevice in Tubes With No Tube Expansions (NTEs)	N/A**
Potential	Tube Slippage	Within Tubesheet	Bobbin - Detection
Potential	ODSCC PWSCC	Hot Leg TTS	Array – Detection +PointTM - Sizing
Potential	ODSCC PWSCC	Row 1 and 2 U-bends	+Point™ – Detection and Sizing
Potential	ODSCC	Freespan and Tube Supports	Bobbin – Detection +Point™ - Sizing
Potential	ODSCC PWSCC	High Residual Stress Tubes	Bobbin and Array – Detection +PointTM - Sizing

* Inspection not required per technical specification alternate repair criteria.
** The tubes with no tubesheet expansion (NTE) have already been plugged.

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

As stated in the (b) response above, service induced indications were identified. Tables 2 and 3 provide the required information.

Table 2 - Surry 2 Spring 2017 Inspection Summary – AVB Indications for SG B

SG	Row	Col	AVB Number	Depth (%TW) ETSS 96041.1
				2017
B	24	57	AV1	17
B	26	64	AV2	13
B	31	58	AV2	12
B	32	69	AV2	7
B	33	60	AV3	13
B	35	78	AV3	10
B	37	71	AV3	9
B	37	75	AV3	10
B	38	51	AV4	13
B	38	74	AV4	16
B	38	74	AV2	14
B	38	74	AV1	11
B	44	60	AV2	7
B	45	57	AV1	9

Table 3 - Summary of Non-AVB-Wear Volumetric Degradation Identified

SG	Row	Col	Location	ETSS	Axial Length (in)	Circ Length (in)	Maximum Depth 2R27	Initially Reported	Signal Present Prior to Current Outage?	Cause	Foreign Object Remaining?	In-Situ Tested?	Plugged & Stabilized?
A	11	45	TSH + 0.77	27901.1	0.25	0.43	24%TW	2012	Yes. No change since 2006.	Foreign Object	No	No	No
A	15	16	TSH + 0.14	27901.1	0.24	0.43	24%TW	2012	Yes. No change since initial detection.	Foreign Object	No	No	No
A	17	16	TSH - 0.13	27901.1	0.29	0.59	29%TW	2002	Yes. No change since initial detection.	Foreign Object	No	No	No
A	18	16	TSH - 0.09	27901.1	0.24	0.43	25%TW	2002	Yes. No change since initial detection.	Foreign Object	No	No	No
A	39	24	TSH + 0.26	27901.1	0.24	0.43	18%TW	2009	Yes. No change since 2006.	Foreign Object	No	No	No
A	43	61	BPH + 0.47	27901.1	0.24	0.53	23%TW	2009	Yes. No change since 2002.	Foreign Object	No	No	No
A	43	64	BPH + 0.49	27901.1	0.24	0.43	23%TW	2009	Yes. Possible minor change 2002 to 2009. No change since.	Foreign Object	No	No	No
B	18	81	TSC + 0.04	27901.1	0.24	0.53	25%TW	2017	Yes. No change since 2014.	Foreign Object	No	No	No
B	18	81	TSC + 0.31	27901.1	0.19	0.37	19%TW	2017	Yes. No change since 2014.	Foreign Object	No	No	No
B	23	82	TSH - 0.09	27901.1	0.19	0.43	21%TW	2003	Yes. No change since initial detection.	Foreign Object	No	No	No
B	34	66	TSC + 0.17	27901.1	0.25	0.48	23%TW	2017	Yes. No change since 2014.	Foreign Object	No	No	No
B	36	26	TSC - 0.15	27905.1	0.29	0.48	25%TW	2008	Yes. No change since initial detection.	Foreign Object	No	No	No
B	37	27	TSC + 0.0	27901.1	0.29	0.53	26%TW	2008	Yes. No change since initial detection.	Foreign Object	No	No	No

SG	Row	Col	Location	ETSS	Axial Length (in)	Circ Length (in)	Maximum Depth 2R27	Initially Reported	Signal Present Prior to Current Outage?	Cause	Foreign Object Remaining?	In-Situ Tested?	Plugged & Stabilized?
B	41	42	TSC + 0.01	27901.1	0.29	0.48	19%TW	2017	Yes. No change since 2014.	Foreign Object	No	No	No
B	42	42	TSC - 0.12	27901.1	0.24	0.48	30%TW	2014	Yes. No change since initial detection.	Foreign Object	No	No	No
B	46	52	TSC + 9.2	27901.1	0.24	0.43	18%TW	2017	No wear signal in 2014 based on lookup.	Foreign Object	No	No	No
C	28	22	TSH + 0.14	27901.1	0.35	0.54	29%TW	2014	Yes. No change since initial detection.	Foreign Object	No	No	No
C	28	23	TSH + 0.21	27901.1	0.24	0.54	26%TW	2014	Yes. No change since initial detection.	Foreign Object	No	No	No
C	28	23	TSH + 0.54	27901.1	0.3	0.43	27%TW	2014	Yes. No change since initial detection.	Foreign Object	No	No	No
C	28	71	TSH + 0.29	27901.1	0.36	0.54	22%TW	2009	Yes. No change since 1996.	Foreign Object	No	No	No
C	30	48	BPH + 0.55	27901.1	0.19	0.49	20%TW	2015	Yes. No change since 2014.	Foreign Object	No	No	No
C	30	74	TSH + 6.53	27901.1	0.29	0.48	19%TW	2014	Yes. No change since 1996.	Foreign Object	No	No	No
C	32	36	BPH + 0.61	27901.1	0.3	0.43	18%TW	2009	Yes. No change since initial detection.	Foreign Object	No	No	No
C	33	17	TSH + 2.76	27901.1	0.35	0.54	20%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	34	18	TSH + 1.05	27901.1	0.35	0.49	22%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	34	20	TSH + 0.95	27901.1	0.35	0.49	25%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	34	74	TSH + 0.08	27901.1	0.3	0.54	27%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No

SG	Row	Col	Location	ETSS	Axial Length (in)	Circ Length (in)	Maximum Depth 2R27	Initially Reported	Signal Present Prior to Current Outage?	Cause	Foreign Object Remaining?	In-Situ Tested?	Plugged & Stabilized?
C	35	19	TSH + 0.29	27901.1	0.29	0.54	28%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	35	22	TSH + 1.02	27901.1	0.35	0.54	29%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	35	30	TSH + 0.11	27901.1	0.29	0.49	32%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	36	32	BPH + 0.62	27901.1	0.24	0.43	21%TW	2015	Yes. No change since 2008.	Foreign Object	No	No	No
C	36	68	TSH + 0.2	27901.1	0.57	0.49	26%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	37	31	TSH + 0.03	27901.1	0.4	0.43	25%TW	2011	Yes. No change since 1996.	Foreign Object	No	No	No
C	37	32	TSH + 0.03	27901.1	0.3	0.49	23%TW	2011	Yes. No change since 2005.	Foreign Object	No	No	No
C	37	33	TSH + 0.06	27901.1	0.3	0.54	26%TW	2011	Yes. No change since 1996.	Foreign Object	No	No	No
C	37	34	TSH + 0.03	27901.1	0.36	0.54	26%TW	2009	Yes. No change since 1996.	Foreign Object	No	No	No
C	37	35	BPH + 0.64	27901.1	0.4	0.49	31%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	37	54	TSH + 0.14	27901.1	0.29	0.43	23%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	38	32	BPH + 0.61	27901.1	0.3	0.43	24%TW	2011	Yes. No change since 2005.	Foreign Object	No	No	No
C	38	53	TSH + 0.15	27901.1	0.24	0.49	22%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	39	32	BPH + 0.63	27901.1	0.24	0.38	22%TW	2011	Yes. No change since 2005 based on bobbin.	Foreign Object	No	No	No
C	39	32	BPH + 0.61	27901.1	0.24	0.38	24%TW	2011	Yes. No change since 2005 based on bobbin.	Foreign Object	No	No	No

SG	Row	Col	Location	ETSS	Axial Length (in)	Circ Length (in)	Maximum Depth 2R27	Initially Reported	Signal Present Prior to Current Outage?	Cause	Foreign Object Remaining?	In-Situ Tested?	Plugged & Stabilized?
C	39	34	BPH + 0.65	27901.1	0.29	0.59	23%TW	2011	Yes. No change since 2005.	Foreign Object	No	No	No
C	40	34	BPH + 0.6	27901.1	0.35	0.49	22%TW	2011	Yes. No change since 2005.	Foreign Object	No	No	No
C	44	42	TSH + 0.17	27901.1	0.35	0.43	23%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	44	43	TSH + 0.18	27901.1	0.25	0.49	21%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	44	47	TSH + 0.05	27901.1	0.35	0.43	25%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	44	60	BPH + 0.24	96910.1	0.4	0.43	5%TW	2015	Yes. No change since 2014.	TSP Wear	N/A	No	No
C	45	42	TSH + 0.31	27901.1	0.3	0.49	19%TW	2015	Yes. No change since 2005.	Foreign Object	No	No	No
C	45	43	TSH + 0.75	27901.1	0.35	0.38	19%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	45	43	TSH + 0.26	27901.1	0.3	0.49	22%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	45	43	TSH + 0.32	27901.1	0.29	0.43	23%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No
C	45	47	TSH + 0.19	27901.1	0.35	0.54	23%TW	2005	Yes. No change since initial detection.	Foreign Object	No	No	No

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

No tubes were plugged during RFO 2R27.

f. The number and percentage of tubes plugged to date, and the effective plugging percentage in each steam generator.

Table 4 provides the plugging totals and percentages to date.

Table 4 – Tube Plugging Summary

	Tubes Installed	Tubes Plugged To-Date
SG A	3,342	30 (0.9%)
SG B	3,342	19 (0.6%)
SG C	3,342	50 (1.5%)
Total	10,026	99 (1.0%)

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

All tubes with degradation identified during the Spring 2017 inspection satisfied condition monitoring requirements for SG tube structural and leakage integrity. Further, the results from the current outage inspection validate prior outage operational assessment assumptions. Tube pulls and in-situ pressure testing were not required during the current outage.

h. The primary to secondary LEAKAGE rate observed in each SG (if it is not practical to assign the LEAKAGE to an individual SG, the entire primary to secondary LEAKAGE should be conservatively assumed to be from one SG) during the cycle preceding the inspection which is the subject of the report,

Routine primary-to-secondary leak monitoring is conducted in accordance with station procedures. During the cycle preceding EOC27 refueling outage, no measurable primary-to-secondary leakage (i.e., >1 GPD) was observed in any Unit 2 SG.

i. The calculated accident induced LEAKAGE rate from the portion of the tubes below 17.89 inches from the top of the tubesheet for the most limiting accident in the most limiting SG. In addition, if the calculated accident induced LEAKAGE rate from the most limiting accident is less than 1.80 times the maximum operational primary to secondary LEAKAGE rate, the report should describe how it was determined,

The permanent alternate repair criteria (PARC) requires that the component of operational leakage from the prior cycle from below the H-star distance be multiplied by a factor of 1.8 and added to the total accident leakage from any other source and compared to the allowable accident induced leakage limit. Since there is reasonable assurance that no tube degradation identified during this outage would have resulted in leakage during an accident, the contribution to accident leakage from other sources is zero. Assuming that the prior cycle operational leakage of <1 GPD originated from below the H-star distance, and multiplying this leakage by a factor of 1.8 as required by the PARC, yields an accident induced leakage value of <1.8 GPD. This value is well below the 470 GPD limit for the limiting SG and provides reasonable assurance that the accident induced leakage performance criteria would not have been exceeded during a limiting design basis accident.

j. The results of the monitoring for tube axial displacement (slippage). If slippage is discovered, the implications of the discovery and corrective action shall be provided.

No indications of tube slippage were identified during the evaluation of bobbin probe examination data from SG B. All tubes in SGs A and C were screened for slippage during EOC26 (no indications were identified) and will again be screened during EOC28.

Acronyms

AVB	Anti-Vibration Bar
BPC	Baffle Plate Cold
BPH	Baffle Plate Hot
C/L	Cold Leg
ECT	Eddy Current Testing
EFPM	Effective Full Power Month
EOC	End of Cycle
ETSS	Examination Technique Specification Sheet
FOSAR	Foreign Object Search and Retrieval
GPD	Gallons Per Day
H/L	Hot Leg
MRPC	Motorized Rotating Pancake Coil
NSAL	Nuclear Safety Advisory Letter
NTE	No Tube Expansion
OD	Outer Diameter
ODSCC	Outside Diameter Stress Corrosion Cracking
OVR	Over Roll
OXP	Over Expansion
PARC	Permanent Alternate Repair Criteria
PLP	Possible Loose Part
PWSCC	Primary Water Stress Corrosion Cracking
SCC	Stress Corrosion Cracking
SG	Steam Generator
TEC	Tube End Cold-leg
TEH	Tube End Hot-leg
TSC	Top of Tube Sheet Cold-leg
TSH	Top of Tube Sheet Hot-leg
TSP	Tube Support Plate
TTS	Top of Tubesheet
TW	Through Wall