VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

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VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1
STEAM GENERATOR TUBE INSPECTION REPORT
FOR THE SPRING 2021 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 1 report for the Spring 2021 refueling outage.

If you have any questions concerning this information, please contact Mr. Michael M. True, Jr. at (757) 365-2446.

Very truly yours,

Douglas C. Lawrence
Site Vice President

Attachment: Surry Unit 1 Steam Generator Tube Inspection Report for the Spring 2021 Refueling Outage

Commitments made in this letter: None

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ATTACHMENT 1

SURRY UNIT 1
STEAM GENERATOR TUBE INSPECTION REPORT
FOR THE FOR SPRING 2021 REFUELING OUTAGE

VIRGINIA ELECTRIC AND POWER COMPANY
(DOMINION ENERGY VIRGINIA)

SURRY UNIT 1
STEAM GENERATOR TUBE INSPECTION REPORT
FOR THE SPRING 2021 REFUELING OUTAGE

The following satisfies the Surry Power Station Technical Specification (TS) reporting requirement section 6.6.A.3. During the Surry Unit 1 Spring 2021 End-Of-Cycle 30 (EOC30) refueling outage, Steam Generator (SG) inspections in accordance with TS 6.4.Q were completed for SG A, B, and C.

This was the second inspection within the 5th period which has duration of 72 effective full power months (EFPM).

Surry Unit 1 exceeded 200°F on May 28, 2021; therefore, this report is required to be submitted by November 24, 2021. At the time of this inspection, the Unit 1 SGs had operated for 383.1 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 attached 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 1 EOC30 refueling outage, primary side inspections were performed in SG A, B, and C. The eddy current inspections included the following:

- Full length bobbin inspection of all in-service tubing except the u-bends of Rows 1 and 2
- Rotating Coil 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)
- Full length Array inspection of all in-service tubes with high residual stress
- Rotating Coil inspections of locations of special interest based on bobbin and array inspection results

As-found and as-left visual examinations were performed in the hot-leg and cold-leg channel heads. 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 1 steam generators during the EOC30 outage.

Steam Generator A, B, and C

- Visual examination of historical foreign object-related locations identified during previous outages and documented in the Surry 1R30 Degradation Assessment (ETE-CEP-2021-1002).
- Top of Tubesheet water lancing.
- Visual investigation of any accessible locations having eddy current signals potentially related to foreign objects, and removal of retrievable foreign objects.
- Visual examination in the steam drum of all accessible steam drum components and structures including the feedring and moisture separators. The upper tube bundle and 7th TSP were also inspected via the primary moisture separators. Perforations of two riser barrels due to erosion was identified in SG C. No other secondary component degradation or any other condition adverse to quality was observed during these inspections.

b. Degradation mechanisms found.

Primary side (tubes)

- Degradation modes observed were anti-vibration bar (AVB) wear and various legacy volumetric indications (two maintenance related, several foreign object related, some TSP wear, and a few of undetermined origin). None of this degradation exceeded the 40%TW technical specification plugging criteria.
- A single stress corrosion crack (PWSCC) was detected within the tubesheet of SG C.

Secondary side

- Perforations of two riser barrels due to erosion were identified in SG C. Repairs were performed during the RFO by welding a 16"x16"x0.25" (thick) Inconel 600 impingement plate over each location of the erosion.

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	Wear	Tube Support Plate	Bobbin - Detection +Point™ - Sizing
Existing	Tube Wear (Foreign Objects)	Freespan and TTS	Bobbin and Array - Detection +Point™ - Sizing
Existing	Tube Wear	Flow Distribution Baffle	Bobbin - Detection +Point™ - Sizing
Existing	OD Pitting	Top-of-Tubesheet (TTS)	Bobbin and Array - Detection +Point™ - Sizing
Existing	ODSCC PWSCC	Hot Leg TTS	Array - Detection +Point™ - Sizing
Existing	PWSCC	Tube Ends	N/A*
Potential	PWSCC	Tubesheet Overexpansions (OXP)	Array - Detection +Point™ - Sizing
Potential	ODSCC PWSCC	Bulges, Dents, Manufacturing Anomalies, and Above-Tubesheet Overexpansions (OVR)	Array/+Point - Detection +Point™ - Sizing
Potential	ODSCC	Tubesheet Crevice in Tubes With NTE	N/A**
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 +Point™ - Sizing
Potential	Tube Slippage	Within Tubesheet	Bobbin - Detection

* 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, volumetric service induced indications were identified. Tables 2 and 3 provide the required information.

Table 2 - Surry 1 EOC30 Inspection Summary – AVB Wear Indications

SG	Row	Col	AVB No.	Wear Depth (%TW) ETSS 96041.1	
				Previous	Current
				EOC28	EOC30
A	9	54	AV1	13	11
A	12	45	AV1	13	17
A	12	45	AV4	12	15
A	12	47	AV4	15	12
A	21	86	AV2	11	9
A	30	57	AV2	12	16
A	30	57	AV3	12	14
A	32	14	AV4	9	12
A	32	48	AV3	11	15
A	32	65	AV2	11	17
A	32	66	AV2	9	10
A	32	69	AV2	21	25
A	32	69	AV3	16	20
A	32	69	AV4	17	21
A	33	16	AV2	12	11
A	33	63	AV3	20	25
A	33	63	AV4	16	20
A	33	66	AV1	11	11
A	33	66	AV2	13	11
A	34	59	AV2	12	16
A	34	62	AV2	-	12
A	35	17	AV2	12	14
A	35	78	AV2	14	14
A	36	47	AV1	11	9

SG	Row	Col	AVB No.	Wear Depth (%TW) ETSS 96041.1	
				Previous	Current
A	36	75	AV2	15	13
A	36	76	AV2	11	11
A	37	75	AV2	12	13
A	37	75	AV3	12	11
A	38	62	AV1	-	12
A	38	62	AV4	8	14
A	38	73	AV3	11	15
A	39	42	AV1	15	13
A	39	71	AV2	11	INR
A	39	71	AV4	10	INR
A	39	72	AV2	11	10
A	39	72	AV4	15	13
A	40	42	AV1	11	13
A	40	69	AV4	10	12
A	44	55	AV2	11	12
A	45	40	AV4	11	11
A	46	43	AV1	11	13
A	46	43	AV2	8	13
A	46	44	AV1	13	15
A	46	44	AV4	11	12
A	46	45	AV1	15	14
A	46	45	AV4	10	12
				EOC29	**EOC30**
B	22	72	AV3	18	17
B	26	61	AV3	14	16
B	28	57	AV1	10	12
B	28	66	AV2	12	12
B	28	83	AV2	10	9
B	31	33	AV2	19	18
B	32	26	AV3	10	12
B	34	58	AV2	27	27
B	34	58	AV3	22	23

SG	Row	Col	AVB No.	Wear Depth (%TW) ETSS 96041.1	
				Previous	Current
B	34	58	AV4	11	13
B	34	79	AV3	11	11
B	35	17	AV1	9	11
B	35	17	AV2	12	14
B	35	17	AV3	26	26
B	36	33	AV3	9	10
B	36	65	AV4	15	15
B	38	22	AV2	12	13
B	38	22	AV3	11	14
B	38	25	AV3	10	10
B	39	24	AV3	13	12
B	39	29	AV2	12	12
B	39	36	AV3	14	13
B	39	66	AV1	11	11
B	40	25	AV2	20	18
B	40	26	AV2	9	12
B	40	28	AV2	11	12
B	41	27	AV2	12	14
B	41	27	AV3	10	13
B	41	47	AV2	12	11
B	42	29	AV1	12	11
B	42	29	AV2	17	16
B	42	30	AV2	15	15
B	42	30	AV3	14	13
B	43	32	AV2	13	15
B	43	34	AV3	14	15
B	43	39	AV2	11	13
B	45	37	AV2	11	14
B	45	37	AV3	12	13
B	45	38	AV2	11	9
B	46	45	AV2	17	18
				EOC28	**EOC30**

SG	Row	Col	AVB No.	Wear Depth (%TW) ETSS 96041.1	
				Previous	Current
C	22	7	AV3	11	11
C	24	33	AV2	8	10
C	27	10	AV3	13	14
C	33	16	AV2	10	11
C	34	16	AV2	11	11
C	35	17	AV1	25	25
C	35	17	AV4	11	12
C	35	46	AV2	14	13
C	35	46	AV3	15	14
C	35	77	AV3	8	12
C	37	24	AV2	12	12
C	38	67	AV3	23	22
C	39	23	AV1	19	18
C	39	23	AV2	21	21
C	39	23	AV3	29	30
C	39	69	AV3	13	16
C	40	66	AV2	8	12
C	42	31	AV1	24	24
C	42	31	AV2	24	24
C	42	31	AV3	21	22
C	42	31	AV4	15	16
C	43	31	AV2	14	13
C	44	59	AV2	8	12
C	45	38	AV3	8	11
C	45	40	AV4	11	14
C	45	58	AV1	7	10
C	45	58	AV4	9	11

Table 3 - Surry 1 EOC30 Inspection Summary – Non-AVB Volumetric Degradation

SG	Row	Col	Location	ETSS	Max Depth (%TW)	Cause	Foreign Object Remaining?	Plugged & Stabilized?
A	1	86	TSC +15.63"	21998.1	27	Lancing Equipment Damage	N/A	No
A	2	57	06C -0.37"	96910.1	13	TSP Wear	N/A	No
A	3	66	05C -0.74"	27901.1	25	Foreign Object	No	No
A	6	88	TSH +0.33"	27901.1	25	Foreign Object	No	No
A	8	38	TSH +0.37"	21998.1	16	Legacy Pitting	N/A	No
A	34	67	TSH +0.04"	27901.1	23	Foreign Object	No	No
A	38	27	TSC +0.11	27901.1	22	Foreign Object	No	No
			TSC +0.74	27901.1	24			
A	38	30	TSC +1.78"	27901.1	21	Foreign Object	No	No
B	1	7	TSH+0.24"	21998.1	22	Historical SG Maintenance	N/A	No
B	12	51	TSC+0.48"	21988.1	11	Unknown. Small volumetric	N/A	No
B	31	15	BPH +0.59"	27901.1	20	Foreign Object	No	No
B	31	16	BPH +0.59"	27901.1	23	Foreign Object	No	No
B	32	15	BPH +0.59"	27901.1	18	Foreign Object	No	No
B	32	18	BPH +0.61"	27901.1	19	Foreign Object	No	No
B	33	17	BPH+0.61"	27901.1	15	Foreign Object	No	No
B	33	18	BPH +0.62"	27901.1	19	Foreign Object	No	No
B	35	20	BPH +1.11"	27902.1	17	Foreign Object	No	No
B	37	31	04H-24.37"	21998.1	12	Unknown. Small volumetric	N/A	No
B	40	50	TSH +0.31"	27901.1	33	Foreign Object	No	No
B	40	51	TSH +0.31"	27901.1	34	Foreign Object	No	No
B	41	51	TSH +0.16"	27901.1	23	Foreign Object	No	No

SG	Row	Col	Location	ETSS	Max Depth (%TW)	Cause	Foreign Object Remaining?	Plugged & Stabilized?
B	45	48	TSC+2.55"	21998.1	33	Unknown. Small volumetric	N/A	No
C	3	52	TSC +0.37"	27901.1	32	Foreign Object	No	No
C	4	68	06C -0.31"	96910.1	12	TSP Wear	N/A	No
C	15	49	04H -0.57"	96910.1	15	TSP Wear	N/A	No
C	26	85	BPH + 0.55"	27901.1	30	Foreign Object	No	No
C	27	82	BPH +0.61"	27901.1	28	Foreign Object	No	No
C	29	82	BPH + 0.58"	27901.1	28	Foreign Object	No	No
C	36	24	BPH -0.23"	96910.1	6	FDB Wear	N/A	No
C	36	64	TSC +0.07"	27901.1	29	Foreign Object	No	No
C	36	66	TSC +0.03"	27901.1	25	Foreign Object	No	No
C	38	66	TSC +0.19"	27901.1	28	Foreign Object	No	No
C	44	50	BPH -0.28"	96910.1	5	FDB Wear	N/A	No
C	45	52	BPH -0.31"	96910.1	4	FDB Wear	N/A	No

As stated in the (b) response above, one stress corrosion crack (PWSCC) was detected within the tubesheet of SG C. Table 4 provides the required information.

Table 4 - Surry 1 EOC30 Inspection Summary – Stress Corrosion Cracking

SG	Row	Col	Location	Degradation	%TW	Orientation	Length	Voltage	Probe
C	11	42	TSH-0.34	PWSCC	41	Circumferential	28°	0.74	+Point

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

Tube Row 11 Col 42 was stabilized and plugged during RFO 1R30.

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

Table 5 provides the plugging totals and percentages to date.

Table 5 – Tube Plugging Summary

	Tubes Installed	Tubes Plugged To-Date
SG A	3,342	44 (1.3%)
SG B	3,342	26 (0.8%)
SG C	3,342	42 (1.3%)
Total	10,026	112 (1.1%)

Since no sleeving has been performed in the Surry Unit 1 steam generators, the effective plugging percentage is the same as the actual plugging percentage.

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

All tubes with degradation identified during the Spring 2021 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 EOC30, no measurable primary-to-secondary leakage was observed in any Unit 1 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. Since the prior cycle

operational leakage was zero, the accident induced leakage originating from below the H-star distance would also be zero. 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 A, B, and C.

Acronyms

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
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
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