

VIRGINIA ELECTRIC AND POWER COMPANY  
RICHMOND, VIRGINIA 23261

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United States Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, DC 20555-0001

Serial No. 12-640  
SPS-LIC/CGL R1  
Docket No. 50-280  
License No. DPR-32

**VIRGINIA ELECTRIC AND POWER COMPANY**  
**SURRY POWER STATION UNIT 1**  
**STEAM GENERATOR TUBE INSERVICE INSPECTION REPORT**  
**FOR THE SPRING 2012 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 2012 refueling outage.

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

Very truly yours,



N. L. Lane  
Site Vice President  
Surry Power Station

Attachment: Surry Unit 1 Steam Generator Tube Inspection Report for the Spring 2012 Refueling Outage

Commitments made in this letter: None

A047  
NRR

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**ATTACHMENT**

**SURRY UNIT 1 STEAM GENERATOR TUBE INSPECTION REPORT  
FOR THE SPRING 2012 REFUELING OUTAGE**

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

**SURRY UNIT 1 STEAM GENERATOR TUBE INSPECTION REPORT  
FOR THE SPRING 2012 REFUELING OUTAGE**

The following satisfies the Surry Power Station Technical Specification (TS) reporting requirement in TS 6.6.A.3. During the Surry Unit 1 Spring 2012 refueling outage, steam generator (SG) inspections in accordance with TS 6.4.Q were completed for all three SGs.

This was the first inspection in the 4th inspection period which has a duration of 60 Effective Full Power Months (EFPM).

Surry Unit 1 exceeded 200°F on June, 2 2012; therefore, this report is required to be submitted by November 29, 2012. The SGs had operated for 300.1 EFPM at the time of this inspection.

***Bold italicized*** text represents TS verbiage. The required information is provided under each reporting requirement as follows:

***A report shall be submitted within 180 days after  $T_{avg}$  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***

The planned eddy current examination scope is identified below in Table 1. The only scope expansions required were those necessary to bound foreign objects and foreign object related degradation, as well as to resolve ambiguous indications. A complete summary of the tube examinations performed during the outage is provided in the final inspection status (Table 2).

The primary side inspections activities also included a video/visual examination of all six channel heads (as-found/as-left, specifically including all plugs, the divider plate weld region, and the bottom of the bowl per NSAL-12-1 with the bowl dry). No anomalous conditions associated with these inspections were found.

**Table 1 - Primary Side Examination Scope**

<b>Scope</b>	<b>SG A</b>	<b>SG B</b>	<b>SG C</b>
Bobbin Probe: Full Length (except row 1 and 2 U-bends)	100%	-	100%
Array Probe: H/L Tubesheet and Expansion Transition	100%	36%	100%
Array Probe: C/L Tubesheet and Expansion Transition	37%		36%
Plus Point Probe: Row 1 and 2 U-bends (07C to 07H)	100%		100%

**Table 2 – EOC24 Actual ECT Examination Scope**

Scope Description	Extent	SG A	SG B	SG C
		Acquired	Acquired	Acquired
<b>Bobbin Coil Exams</b>				
Full Length	TEHTEC	3023		3031
C/L Straight (Row 1-2)	7HTEC	181		275
H/L Straight (Row 1-3)	7CTEC	264		181
H/L Candycane (Row 3)	7HTEH	10		94
Restricted Tube (R5C35)	TEHTEC	1		
C/L Candycane (Row 3)	7HTEC	83		
<b>Array Exams</b>				
H/L Array (Non-Baffle Plate)	TSH1H	835	266	837
H/L Array (Baffle Plate)	TSHBPH	2463	931	2469
C/L Array (Non-Baffle Plate)	TSC1C	295		282
C/L Array (Baffle Plate)	TSCBPC	933		924
C/L Array (Bounding)	Various	2		
<b>MRPC Exams</b>				
U-bend +PT (Row 1-2)	7H7C	181		181
Select Tube +PT	Various	33	12	68
<b>MRPC Special Interest</b>				
H/L Previous Indications	Various	17	10	10
H/L Previous DNT>2V	Various	167		130
H/L Indications	Various	45	1	40
U-bend Previous DNT>2V	Various	2		3
U-bend Indications	Various	14		3
C/L Previous Indications	Various	3		1
C/L Previous DNT>2V	Various	3		2
C/L Indications	Various	33		10
<b>Total</b>		<b>8588</b>	<b>1220</b>	<b>8541</b>

The following Secondary side exams were conducted:

SGs A, B, and C:

- Post-lancing visual examination of the top-of-tubesheet annulus and no-tube lane.
- Visual examination of historical foreign object-related locations.
- Visual investigation of any accessible locations having eddy current indications potentially related to foreign objects and removal of retrievable foreign objects.

SG A:

- Visual examination, from the steam drum in SG A, of all accessible steam drum components and structures, including the feedring exterior, the upper tube bundle, and 7<sup>th</sup> TSP via probe drops through the primary moisture separators. No adverse conditions were noted during this inspection.

***b. Active degradation mechanisms found***

Degradation mechanisms targeted by the inspection plan included anti-vibration bar (AVB) wear, pitting, foreign object wear, tube support wear, and stress corrosion cracking (SCC) at various locations within the steam generator tube bundle. AVB wear, foreign object wear, tube support plate wear, one legacy pit indication, and one legacy sludge lance wear flaw were detected. No SCC was detected.

A permanent alternate repair criteria (ARC) was incorporated into the Surry Technical Specifications, effective during the EOC24 outage. The ARC specifies that tubes with service-induced flaws located greater than 17.89 inches below the top of the tubesheet do not require plugging. Tubes with service-induced flaws located in the portion of the tube from the top of the tubesheet to 17.89 inches below the top of the tubesheet shall be plugged upon detection.

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

Inspections focused on the following degradation mechanisms listed in Table 3 utilizing the referenced eddy current techniques.

**Table 3 – Inspection Method for Applicable Degradation Modes**

<b>Classification</b>	<b>Degradation Mechanism</b>	<b>Location</b>	<b>Probe Type</b>
Existing	Tube Wear	Anti-Vibration Bars	Bobbin – Detection Bobbin and +PointTM – Sizing
Existing	Tube Wear	Tube Support Plate	Bobbin – Detection Bobbin and +PointTM – Sizing
Existing	Tube Wear (foreign objects)	Freespan, TTS, FDB, TSPs	Bobbin and Array – Detection +PointTM - Sizing
Existing	ODSCC	Hot Leg Top-of-Tubesheet Sludge Pile Area	Bobbin and Array – Detection +PointTM - Sizing
Existing	PWSCC	At the Tube ends TE + 4 Inches	Inspection not required per PARC
Existing	PWSCC	Hot Leg Top-of-Tubesheet	Array – Detection and Sizing
Existing	OD Pitting	Top-of-Tubesheet	Bobbin – Detection +PointTM - Sizing
Potential	Tube Wear	Flow Distribution Baffle	Bobbin – Detection Bobbin and +PointTM – Sizing
Potential	ODSCC	Freespan and Tube Supports	Array – Detection +PointTM – Sizing
Potential	PWSCC	Hot Leg Within Tubesheet Anomaly locations	Array – Detection +PointTM – Sizing

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

As stated in the (b) response above, several wear type indications were noted. Tables 4 and 5 provide the detailed information regarding these indications.

**Table 4 – AVB Indications**

SG	Row	Col	AVB No.	Depth (%TW) (ETSS 96004.1)	
				2009	2012
SGA	9	54	AV1	11	11
SGA	12	45	AV2	11	11
SGA	12	47	AV4	14	13
SGA	30	57	AV2	16	15
SGA	32	48	AV3	15	14
SGA	32	65	AV2	14	11
SGA	32	66	AV2	-	11
SGA	32	69	AV2	22	22
SGA	32	69	AV3	17	15
SGA	32	69	AV4	19	19
SGA	33	16	AV2	11	12
SGA	33	63	AV3	20	20
SGA	33	63	AV4	14	15
SGA	33	66	AV1	10	12
SGA	33	66	AV2	12	15
SGA	34	59	AV2	14	11
SGA	35	17	AV2	-	10
SGA	35	78	AV2	12	14
SGA	36	47	AV1	-	11
SGA	36	75	AV2	14	15
SGA	36	76	AV2	12	10
SGA	37	75	AV2	12	11
SGA	38	62	AV4	10	10
SGA	39	42	AV1	11	12
SGA	39	71	AV4	11	10
SGA	39	72	AV4	14	15
SGA	40	42	AV1	13	14
SGA	40	69	AV4	11	13
SGA	46	43	AV1	11	12
SGA	46	44	AV1	13	13
SGA	46	45	AV1	14	15
SGA	46	45	AV4	10	10

**Table 4 – AVB Indications (continued)**

SG	Row	Col	AVB No.	Depth (%TW) (ETSS 96004.1)	
				2009	2012
SGC	24	33	AV2	-	10
SGC	27	10	AV3	11	12
SGC	33	16	AV2	-	11
SGC	35	17	AV1	20	25
SGC	35	17	AV4	10	11
SGC	35	46	AV2	-	12
SGC	35	46	AV3	14	15
SGC	38	67	AV3	16	24
SGC	39	23	AV1	16	18
SGC	39	23	AV2	18	20
SGC	39	23	AV3	22	26
SGC	39	69	AV3	15	15
SGC	42	31	AV1	19	23
SGC	42	31	AV2	19	23
SGC	42	31	AV3	16	19
SGC	42	31	AV4	13	15
SGC	44	47	AV3	11	10
SGC	45	38	AV3	10	10
SGC	45	40	AV4	13	12
SGC	45	58	AV4	11	10

- Not reported during that outage.

**Table 5 – Summary of Non-AVB-Wear Volumetric Degradation**

SG	Row	Col	Location	ETSS	Max Depth (%TW)	Axial Length (in)	Circ. Length (in)	Initially Reported	Signal Present Prior to Current Outage?	Cause	Foreign Object Remaining?	In-Situ Tested?	Plugged & Stabilized?
A	2	57	06C-0.39"	96910.1	19	0.29	0.37	2006	Yes. No change since initially reported.	TSP Wear	n/a	No	No
A	3	66	05C-0.78"	27901.1	26	0.30	0.45	2009	Yes. No change since initially reported.	Foreign Object	No	No	No
A	6	88	TSH+0.28"	27901.1	25	0.30	0.40	2006	Yes. No change since initially reported.	Foreign Object	No	No	No
A	8	38	TSH+0.45"	21998.1	21	0.27	0.35	2001	Yes. No change since initially reported.	Legacy Pitting	No	No	No
A	34	67	TSH+0.01"	27901.1	24	0.27	0.37	2006	Yes. No change since initially reported.	Foreign Object	No	No	No
A	38	30	TSC+1.78"	27901.1	19	0.33	0.42	2006	Yes. No change since initially reported.	Foreign Object	No	No	No
B	1	7	TSH+0.26"	21998.1	20	0.70	0.29	2007	Yes. No change since initially reported.	Historical SG Maint-	n/a	No	No
B	31	15	BPH+0.55"	27901.1	19	0.32	0.35	2010	Yes. No change since initially reported.	Foreign Object	No	No	No
B	31	16	BPH+0.58"	27901.1	22	0.27	0.40	2010	Yes. No change since initially reported.	Foreign Object	No	No	No
B	32	15	BPH+0.50"	27901.1	18	0.24	0.35	2010	Yes. No change since initially reported.	Foreign Object	No	No	No
B	32	18	BPH+0.59"	27901.1	19	0.24	0.38	2010	Yes. No change since initially reported.	Foreign Object	No	No	No
B	33	18	BPH+0.58"	27901.1	21	0.29	0.46	2010	Yes. No change since initially reported.	Foreign Object	No	No	No
B	35	20	BPH+1.10"	27902.1	17	0.51	0.43	2010	Yes. No change since initially reported.	Foreign Object	No	No	No
B	40	50	TSH+0.24"	27901.1	31	0.32	0.48	2007	Yes. No change since initially reported.	Foreign Object	No	No	No
B	40	51	TSH+0.34"	27901.1	33	0.35	0.48	2007	Yes. No change since initially reported.	Foreign Object	No	No	No
B	41	51	TSH+0.10"	27901.1	24	0.27	0.37	2007	Yes. No change since initially reported.	Foreign Object	No	No	No
C	27	82	BPH+0.58"	27901.1	27	0.32	0.49	2010	Yes (2000). No change since 2000.	Foreign Object	No	No	No
C	36	24	BPH-0.22"	96910.1	3	0.31	0.40	2012	Yes (2006). Not present in 2000.	TSP Wear	n/a	No	No
C	36	64	TSC+0.04"	27901.1	30	0.29	0.40	2012	No relevant RPC exams in history.	Foreign Object	No	No	No
C	38	66	TSC+0.11"	27901.1	29	0.40	0.46	2009	Yes. No change since initially reported.	Foreign Object	No	No	No

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

No tubes required plugging as a result of SG inspections performed during the EOC24 outage.

***f. Total number and percentage of tubes plugged to date***

Table 6 provides the plugging totals and percentages to date.

**Table 6 – Tube Plugging Summary**

	<b>Tubes Installed</b>	<b>Tubes Plugged To-Date</b>
SG A	3,342	44 (1.3%)
SG B	3,342	26 (0.8%)
SG C	3,342	36 (1.1%)
Total	10,026	106 (1.1%)

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

The condition monitoring assessment of the EOC24/REOC19 structural and leakage integrity concluded that the Surry Unit 1 steam generators, as indicated by the results of the primary and secondary side inspections performed during this outage; satisfy required structural and leakage integrity criteria. Therefore, there was no need to pull tubes or in-situ test.

***h. The effective plugging percentage for all plugging in each SG***

Since none of the Surry Unit 1 SG tubes have been sleeved, the effective plugging percentage is identical to the plugging percentages provided in the response to (f).

***i. 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***

During the cycle preceding the EOC24 outage, no measurable primary-to-secondary leakage (>1 GPD) was observed in any Unit 1 SG.

- j. 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 ARC 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 1.80 as required by the permanent ARC, yields an accident induced leakage value of <1.80 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.

- k. 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 SGs A or C. No bobbin probe examinations were performed in SG B during EOC24. All tubes in SG B were screened for slippage during EOC23 (no slippage was identified) and will again be screened during EOC25.

**Acronyms**

<b>ARC</b>	Alternate Repair Criteria
<b>BPC</b>	Baffle Plate Cold
<b>BPH</b>	Baffle Plate Hot
<b>C/L</b>	Cold Leg
<b>DNT</b>	Dent
<b>EOC</b>	End of Cycle
<b>ETSS</b>	Eddy Current Technical Specification Sheet
<b>GPD</b>	Gallons Per Day
<b>H/L</b>	Hot Leg
<b>MRPC</b>	Motorized Rotating Pancake Coil
<b>OD</b>	Outside Diameter
<b>ODSCC</b>	Outside Diameter Stress Corrosion Cracking
<b>PWSCC</b>	Primary Water Stress Corrosion Cracking
<b>REOC</b>	Replacement End of Cycle
<b>RPC</b>	Rotating Pancake Coil (also a generic term for rotating probes of any kind)
<b>TEC</b>	Tube End Cold Leg
<b>TEH</b>	Tube End Hot Leg
<b>TSC</b>	Top of Tubesheet Cold Leg
<b>TSH</b>	Top of Tubesheet Hot Leg
<b>TSP</b>	Tube Support Plate
<b>TW</b>	Through Wall