

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261
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United States Nuclear Regulatory Commission
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VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNIT 1
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
2019 STEAM GENERATOR INSERVICE INSPECTION REPORT

By letter dated March 11, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20087H009), Virginia Electric and Power Company (Dominion Energy Virginia) submitted information summarizing the results of steam generator (SG) tube inspections performed at Surry Power Station Unit 1 during the fall 2019 refueling outage. On June 4, 2020, the NRC requested additional information related to the SG inspections. The NRC's question and Dominion Energy Virginia's response are provided in the attachment to this letter.

If you have any questions or require additional information, please contact Mr. Michael True at (757) 365-2446.

Respectfully,



Fred Mladen
Site Vice President
Surry Power Station

Attachment - Response to NRC Request for Additional Information Regarding Fall 2019
Steam Generator Tube Inspection Report - Surry Power Station Unit 1

Commitments made in this letter: None

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ATTACHMENT

**Response to NRC Request for Additional Information Regarding
Fall 2019 Steam Generator Tube Inspection Report**

Surry Power Station Unit 1

**Virginia Electric and Power Company
(Dominion Energy Virginia)**

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
REGARDING SURRY UNIT 1
FALL 2019 STEAM GENERATOR TUBE INSPECTIONS

NRC Comment

By letter dated March 11, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20087H009), Virginia Electric and Power Company (the licensee) submitted information summarizing the results of the fall 2019 steam generator tube inspections performed at Surry Power Station (Surry), Unit 1. These inspections were performed during refueling outage (RFO) 29. Technical Specification (TS) 6.6.A.3 requires that a report be submitted within 180 days after T_{avg} exceeds 200°F following completion of an inspection of the SGs performed in accordance with TS 6.4.Q, "Steam Generator (SG) Program."

To complete its review of the inspection report, the U.S. Nuclear Regulatory Commission staff requests the following additional information:

- 1. Please clarify the sampling strategy for eddy current examination of features such as dents, dings, and bulges in the Surry Unit 1 SGs. Table 1, "Inspection Method for Applicable Degradation Modes," of the inspection report lists the methods used for inspections, but the report does not identify how inspection methods were applied to some special interest features (for example, the selection criteria for examination of dents and dings with specialized probes).*

Response

An eddy current examination is performed on each steam generator at Surry Power Station every other refueling outage. The in-service tube base scope includes a 100% bobbin probe exam, 100% array probe exam of the top-of-tubesheet on both the hot-leg and cold-leg (including all overexpansions within the tubesheet down to the H* distance), 100% full length array probe of all "Tier 1" tubes identified with potentially high residual stress, and a +Point™ exam of all over rolls (4), bulges (3), and low row (row 1 and 2) U-bends.

In addition to the base scope, a preplanned special interest scope was developed, which includes a sample of previously identified dents, dings, manufacturing burnish marks, volumetric indications, and wear (excluding AVB wear). In total, 162 special interest locations were preplanned to be examined using specialized probes and diagnostic techniques.

The specific dent/ding scope included fifty percent of previously identified dents/dings >2 Volts located in hot-leg straight sections (TSH +0.00 to 07H+1.00"), plus any additional

indications required to ensure that the five largest voltage dents/dings in hot-leg straight sections are included in the sample. Also, the five largest voltage dents/dings located between the cold-leg tubesheet and the straight section of the hot-leg, (between TSC and 07H+1.01") are included in the preplanned scope.

There were 116 in-service tubes with 137 dent/ding indications measuring > 2 Volts on the hot-leg straight section in SG-B reported in 1R27. A 50% sample yields 69 indications for inspection. Fifty-seven (57) indications were not inspected in 1R27 and were preplanned for inspection with +Point™ probe during the 1R29 outage. The five largest dents (by voltage) were also included in the sample for inspection. Additional indications from 1R27 were selected to maintain the 50% minimum sample requirement. A total of 70 dent indications in 65 tubes were scheduled for testing.

During the examination, indications are detected including permeability variations, deposits, possible loose parts signals, and ambiguous or anomalous indications, which require additional categorization with diagnostic techniques. These indications are examined with a +Point™ probe. The total special interest scope in SG-B during 1R29 was 219 indications.

- 2. With respect to the secondary-side inspections, please clarify for each SG whether foreign objects or loose parts were removed, and the number and type of objects removed.*

Response

Surry Power Station has recently escalated efforts to remove all foreign objects from the secondary side of the steam generators. Several foreign objects were removed from each of the three Surry steam generators during 1R29 via water lancing or foreign object search and retrieval activities. Some enhanced, localized in-bundle lancing was also performed to aid in these removal efforts. A description of the foreign objects removed from the Surry steam generators is contained in Table 1.

- 3. Table 3, "Surry 1 EOC29 Inspection Summary- Non-AVB Volumetric Degradation," of the inspection report, which lists non-antivibration bar volumetric degradation, includes an indication in tube Row 33 Column 17, which the staff did not find in previous inspection reports. Please clarify whether this is a legacy indication or a newly reported indication that may be a result of recent degradation. If there is evidence of recent degradation, please discuss if a loose part may still be present. The staff notes that nearby tubes have previously reported loose part indications but without evidence of a loose part remaining.*

Response

The indication in Surry Unit 1 SG-B, tube R33 C17 at structure BPH has been reported by bobbin as a Distorted Support Signal (DSS) since 2010. DSS indications receive a special interest inspection with either or both Motorized Rotating Pancake Coil (MRPC) and Array at each inspection. The result of the special interest inspections has consistently been No Degradation Found (NDF), Indication Not Recordable (INR), or in one case, X-Probe Signal (XPS). In the 2019 inspection the Lead Level III chose to report the indication as wear (WAR) and estimated the depth at 15% TW using EPRI technique 27901.1. This was a conservative decision based on industry experience of fretting wear from foreign material on the secondary side, the indication's location relative to the structure and the signal's appearance, and response to the various inspection probes. The subject indication is very shallow resulting in varying degrees of detection over the past inspections and shows no change since the 2010 inspection. The area around this tube was thoroughly examined visually to confirm that no foreign object remains at this location.

Table 1: Foreign Objects Removed During 1R29

SG-Item#	Description	Location	Configuration	ECT Results	Estimated Size	Fixity	2019 Disposition
A-4	Historical (1R24) cluster of fine wire and sludge at TSH	R14-C49 R14-C50	Legacy cluster of fine wire and sludge located at TSH behind the center tie-rod	ECT not performed during 1R29	Not Determined	Removed during lancing	Legacy cluster of fine wire was removed during 1R29 TTS lancing.
A-11	(1R29) Irregular shaped object at TSC	R14-C4 R14-C5	Irregular shaped object discovered at TSC during post lance SSI	ECT not performed during 1R29	0.75" x 0.38" x 0.38"	Retrieved	During 1R29 object was both discovered and retrieved from the SG. SSI noted no tube damage during retrieval process.
A-12	(1R29) Round object at TSH	R27-C14 R26-C14	Round object discovered at TSH during post lance SSI	ECT not performed during 1R29	0.63" x 0.44" x 0.44"	Retrieved	During 1R29 object was both discovered and retrieved from the SG. SSI noted no tube damage during removal process.
A-14	(1R29) Irregular shaped object at TSH	R40-C44 R40-C45	Irregular shaped object discovered at TSH during post lance SSI	ECT not performed during 1R29	0.81" x 0.44" x 0.38"	Retrieved	During 1R29 object was both discovered and retrieved from the SG. SSI noted no tube damage during retrieval process.
A-15	(1R29) Flake at TSC	R42-C31 R42-C30 R43-C31	Flake discovered at TSC during post lance SSI	ECT not performed during 1R29	1.0" x 0.38" x 0.06"	Retrieved	During 1R29 object was both discovered and retrieved from the SG. SSI noted no tube damage during retrieval process.
A-16	(1R29) Scale at TSC	R44-C37 R44-C36 R43-C36	Piece of scale discovered at TSC during post lance SSI	ECT not performed during 1R29	0.50" x 0.38" x 0.06"	Retrieved	During 1R29 object was both discovered and retrieved from the SG. SSI noted no tube damage during retrieval process.
A-17	(1R29) Irregular shaped object at TSC	R44-C38	Irregular shaped object discovered at TSC during post lance SSI	ECT not performed during 1R29	0.50" x 0.31" x 0.06"	Retrieved	During 1R29 object was both discovered and retrieved from the SG. SSI noted no tube damage during retrieval process.
A-18	(1R29) Irregular shaped object at TSC	R45-C44 R45-C45	Irregular shaped object discovered at TSC during post lance SSI	ECT not performed during 1R29	0.56" x 0.44" x 0.06"	Retrieved	During 1R29 object was both discovered and retrieved from the SG. SSI noted no tube damage during retrieval process.
A-19	(1R29) Irregular shaped object at TSC	R46-C46 R46-C45	Irregular shaped object discovered at TSC during post lance SSI	ECT not performed during 1R29	0.63" x 0.38" x 0.06"	Retrieved	During 1R29 object was both discovered and retrieved from the SG. SSI noted no tube damage during retrieval process.
A-20	(1R29) Round object at TSH	R2-C93 R3-C93	Round object discovered at TSH during post lance SSI	ECT not performed during 1R29	0.50" x 0.44" x 0.44"	Retrieved	During 1R29 object was both discovered and retrieved from the SG. SSI noted no tube damage during retrieval process.
A-23	(1R29) Irregular object at TSH	R39-C65 R38-C65 R38-C64 R39-C64	Irregular shaped object discovered at TSH during post lance SSI	ECT not performed during 1R29	0.40" x 0.40" x 0.30"	Retrieved	During 1R29 object was both discovered and retrieved from the SG. SSI noted no tube damage during retrieval process.

SG-Item#	Description	Location	Configuration	ECT Results	Estimated Size	Fixity	2019 Disposition
A-24	(1R29) Irregular object at TSH	R4-C83 R4-C82	Irregular shaped object discovered at TSH during post lance SSI	ECT not performed during 1R29	0.75" x 0.38" x 0.40"	Retrieved	During 1R29 object was both discovered and retrieved from the SG. SSI noted no tube damage during retrieval process.
A-25	(1R29) Irregular object at TSH	R1-C74 R1-C75	Irregular shaped object discovered at TSH during post lance SSI	ECT not performed during 1R29	No measurement taken	Retrieved	During 1R29 object was both discovered and retrieved from the SG. SSI noted no tube damage during retrieval process.
A-27	(1R29) Lancing strainer parts	TTS	Parts captured in the lancing strainers during 1R29 TTS lancing	N/A	Various parts ranging from ~1/8" to ~1/2"	Removed	During 1R29, many objects were captured in the SG A lancing strainers. Most are sludge related. There were also fragments of small diameter wire and flex gasket material.
B-1	Historical (1R21) BPH wear locations. (1R29) PLP R33-C18 BPH+0.54 (1R29) WAR R33-C17 BPH+0.61	R31-C15 / BPH +0.54 R31-C16 / BPH+0.51 R32-C15 / BPH+0.54 R32-C18 / BPH+0.55 R33-C18 / BPH+0.66 R35-C20 / BPH+1.13	Historical foreign object wear on the H/L side of the baffle plate New PLP and WAR at 1R29	WAR PLP	N/A	Scale pulled back but broke apart	1R29 wear not newly developed, rather newly reported. Wear (R33-C17) was present 1R23 and 1R25. PLP (R33-C18) due to loose scale adjacent to tube. Scale pulled back but broke apart. No potential for wear growth going forward. Continue to monitor with ECT affected and bounding tubes (bounding of plugged and in-service tubes with wear).
B-7	Historical (1R27) Lodged round object at TSH was retrieved (1R29). Likely hard sludge.	R39-C26 R39-C27 R40-C26 R40-C27	Foreign object was retrieved prior to performing ECT	NDD	0.4" diameter	Retrieved	During 1R29, object was retrieved prior to ECT. Array results were INF and NDD for affected and bounding tube.
B-11	(1R29) Irregular object at TSH. Likely hard sludge.	R43-C52 R43-C53	Foreign object was retrieved prior to performing ECT	NDD	0.5" x 0.5" x 0.15"	Retrieved	During 1R29, object was retrieved prior to ECT. Array results were NDD for affected and bounding tubes.
B-14	(1R29) Lancing strainer parts	TTS	Parts captured in the lancing strainers during 1R29 TTS lancing	N/A	Various parts ranging from ~1/8" to ~1/2"	Removed	During 1R29, many parts were captured in the SG B lancing strainers. Most were sludge related. There were also fragments of flex gasket material.

SG-Item#	Description	Location	Configuration	ECT Results	Estimated Size	Fixity	2019 Disposition
B-16	(1R29) Array PLPs (three tubes) confirmed with +Point	R25-C31 / TSC+2.23" R26-C31 / TSC+1.74" R27-C32 / TSC+1.17"	Array PLPs (at TSC) confirmed with +Point. Confirmed as a wire.	PLP (Array) PLP (+Point) No wear	Wire 3.8" x 0.1"	Retrieved	Small diameter wire was retrieved from tube locations with PLP. No associated wear. No future threat to tube integrity.
C-2	Historical (1R20) hard sludge	R1-C48 / TSH R1-C47 / TSH	Referred to previously as "debris" but it is actually hard deposit material between the affected tubes. The material was removed by sludge lancing	ECT not performed during 1R29	N/A	Removed via sludge lancing	Post-lancing, the deposition was no longer present. Tubes have been routinely examined with no wear identified.
C-28	(1R29) Ring shaped object at TSC	R30-C48 R30-C49 R31-C48 R31-C49	Ring shaped object resembling the skeleton of a hex nut at TSC	ECT not performed during 1R29	0.8" x 0.25"	Retrieved	Object was retrieved during 1R29 pre-lance inspection. No evidence of tube damage identified by SSI.
C-29	(1R29) Soft sludge rock at TSC	R40-C47 R40-C48	Sludge rock that disintegrated (C/L) during retrieval attempt. Debris remains in the SG	ECT not performed during 1R29	Disintegrated	Broke apart during retrieval	Sludge rock disintegrated during pre-lance retrieval attempt. Poses no threat to tube integrity going forward.
C-30	(1R29) Small strip resembling flex gasket covered in sludge at TSC	R43-C54 R44-C54	Objects resembles a small piece of flex gasket covered in sludge at TSC	ECT not performed during 1R29	0.3" x 0.2" x 0.2"	Retrieved	Object was retrieved during 1R29. No evidence of tube damage identified by SSI.
C-31	(1R29) Hard sludge at TSC	R44-C60	Hard sludge found near the annulus at TSC	ECT not performed during 1R29	0.3" x 0.15" x 0.15"	Retrieved	Sludge was retrieved during 1R29. No evidence of tube damage identified by SSI.
C-32	(1R29) Hard sludge at TSH	R42-C51 R42-C52	Hard sludge found at TSH	ECT not performed during 1R29	0.4" x 0.25" x 0.15"	Retrieved	Sludge was retrieval during 1R29. No evidence of tube damage identified by SSI.
C-33	(1R29) Soft scale at TSH	R42-C49 R43-C49	Scale retrieved from SG and broke apart, in hand, outside the SG	ECT not performed during 1R29	Broke apart	Retrieved	Scale was retrieved and subsequently broke apart outside the SG. Poses no threat to tube integrity going forward.
C-34	(1R29) Hard sludge / scale at TSH	R42-C46 R43-C46	Hard sludge found at TSH	ECT not performed during 1R29	0.15" x 0.15"	Retrieved	Sludge/scale was retrieved during 1R29. No evidence of tube damage identified by SSI.

SG-Item#	Description	Location	Configuration	ECT Results	Estimated Size	Fixity	2019 Disposition
C-35	(1R29) Hard sludge / scale at TSC	R44-C36 R44-C37	Hard sludge / scale found at TSC	ECT not performed during 1R29	0.55" x 0.25"	Retrieved	Sludge/scale was retrieved during 1R29. No evidence of tube damage identified by SSI.
C-36	(1R29) Round object at TSH	R1-C6 R2-C6	Round shaped object resembling hard sludge at TSH	ECT not performed during 1R29	0.55" x 0.45" x 0.40"	Retrieved	Object was retrieved during 1R29. No evidence of tube damage identified by SSI.
C-39	(1R29) Lancing strainer parts	TTS	Parts captured in the lancing strainers during 1R29 TTS lancing	N/A	Various parts ranging from ~1/8" to ~1/2"	Removed	During 1R29, many objects were captured in the SG C lancing strainers. Most are sludge related. There were also fragments of small diameter wire and flex gasket material.
C-40	(1R29) Semi-circular shaped object at TSH. Likely hard sludge.	R1-C43 R2-C44	Semi-circular shaped object identified during post lance FOSAR.	ECT not performed during 1R29	0.50" x 0.50" x 0.25"	Retrieved	Object was retrieved during 1R29. No evidence of tube damage identified by SSI.
C-44	(1R29) Small wire at TSH	R6-C29	Small wire with one end embedded in hard collars at TSH	ECT not performed during 1R29	1.15"	Retrieved	Object was retrieved during 1R29. No evidence of tube damage identified by SSI.
C-45	(1R29) Hard sludge rock at TSH	R43-C45 R44-C45	Hard sludge rock found at TSH.	ECT not performed during 1R29	0.60" x 0.30" x 0.30"	Retrieved	Sludge rock was retrieval during 1R29. No evidence of tube damage identified by SSI.

ABBREVIATIONS AND ACRONYMS

AILPC	Accident Induced Leakage Performance Criteria	LPS	Loose Part Signal
ARC	Alternate Repair Criteria	MAA	Multiple Axial Anomaly
AVB	Anti-Vibration Bar	MBM	Manufacturing Burnish Mark
BET	Bottom of Expansion Transition	NDF	No Degradation Found
BLG	Bulge	NOPD	Normal Operating Pressure Differential
BOC	Beginning Of Cycle	NTE	No Tube Expansion
BPC	Baffle Plate Cold	OA	Operational Assessment
BPH	Baffle Plate Hot	ODSCC	Outer Diameter Stress Corrosion Cracking
CDS	Computer Data Screening	OVR	Over Roll
CM	Condition Monitoring Assessment	OXP	Over Expansion
CMOA	Condition Monitoring and Operational Assessment	PARC	Permanent Alternate Repair Criteria
DA	Degradation Assessment	PDA	Percent Degraded Area
DDH	Distorted Dent History	PIT	Pit
DDI	Distorted Dent w/Indication	PLP	Possible Loose Part
DDS	Distorted Dent Signal	POD	Probability Of Detection
DMT	Deposit Minimization Treatment	PTE	Partial Tube Expansion
DNT	Dent	PVN	Permeability Variation
ECT	Eddy Current Test	PWSCC	Primary Water Stress Corrosion Cracking
EFPY	Effective Full Power Years	QDA	Qualified Data Analyst
EOC	End Of Cycle	REOC	Replacement End Of Cycle
ETSS	Examination Technique Specification Sheet	RPC	Rotating Pancake Coil (generic term for all rotating probes)
FAC	Flow Assisted Corrosion	SAA	Single Axial Anomaly
FDB	Flow Distribution Baffle	SCC	Stress Corrosion Cracking
FK	Foreign Object Tracking System Key	SG	Steam Generator
FOSAR	Foreign Object Search And Retrieval	SIPC	Structural Integrity Performance Criteria
FOTS	Foreign Object Tracking System	SSI	Secondary Side Inspection
GPD	Gallons Per Day	TSC	Tube Sheet Cold
HRS	High Residual Stress	TSH	Tube Sheet Hot
INF	Indication Not Found	TSP	Tube Support Plate
INR	Indication Not Reportable	TTS	Top of Tubesheet
LGV	Local Geometry Variation	TW	Through Wall
LPM	Loose Part Monitoring	VOL	Volumetric