Southern Nuclear

Cheryl A. Gayheart
Regulatory Affairs Director

3535 Colonnade Parkway
Birmingham, AL 35243
205 992 5316 tel
205 992 7601 fax

cagayhea@southernco.com

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Vogtle Electric Generating Plant – Unit 1
1R21 Steam Generator Tube Inspection Report

Ladies and Gentlemen:

In accordance with the requirements of the Vogtle Electric Generating Plant Technical Specification 5.6.10, Southern Nuclear Operating Company submits the enclosed report of the steam generator tube inspections performed during the twenty-first refueling outage on Unit 1 (1R21).

This letter contains no NRC commitments. If you have any questions, please contact Jamie Coleman at 205.992.6611.

Respectfully submitted,

Cheryl A. Gayheart
Regulatory Affairs Director

CAG/kgl/sm

Enclosure: 1R21 Steam Generator Tube Inspection Report

Cc: Regional Administrator
NRR Project Manager – Vogtle 1 & 2
Senior Resident Inspector – Vogtle 1 & 2
RType: CVC7000

Vogtle Electric Generating Plant – Unit 1
1R21 Steam Generator Tube Inspection Report

Enclosure

1R21 Steam Generator Tube Inspection Report

Introduction

The Vogtle Electric Generating Plant (VEGP) twenty-first refueling outage on Unit 1 (1R21) outage was conducted after Steam Generator (SG) service equivalent to 1.43 effective full power years (EFPY) from previous SG eddy current inspections. During this operational interval, no tube leakage was reported. Approximately 40.72 effective full power months (EFPM) of the 72 EFPM in the fourth sequential period have been accrued at Vogtle 1R21. VEGP 1R21 is the third inspection of the period. Analysis based on conservative assumptions used in the Condition Monitoring (CM) and Operational Assessments (OA), demonstrated that there were no tubes that exceeded the Reg. Guide 1.121 or NEI-97-06 Revision 3 criteria for tube integrity during Cycle 21.
The eddy current inspections were performed by the Steam Generator Maintenance Services Group of the Westinghouse Nuclear Services Division. Secondary data analysis was performed by NDE Technology under direct contract with Southern Nuclear Operating Company (SNC). During VEGP 1R21, a total of three tubes were plugged. None of the indications exceeded the condition monitoring limits identified in the Degradation Assessment and therefore did not require in-situ pressure testing. Permanent H* Alternate Repair Criteria (ARC) has been approved for implementation by the NRC. Therefore, SNC and Westinghouse omitted tube end +Point™ inspections below top of tubesheet (TTS) -15.2 inches. TTS inspections ranged from TTS +3 inches to TTS -15.2 inches. The scope and results of inspections on each SG, are described below.

Vogtle 1R21 SG Scope

The scope for 1R21 involved the scheduled inspections listed below. In accordance with the EPRI PWR SG Examination Guidelines, Revision 8, the 1R21 program addressed Vogtle 1 degradation mechanisms observed from prior inspections as well as those regarded as potential degradation mechanisms. In-service inspection (ISI) examination used Bobbin and Rotating Pancake Coil (RPC) +Point™ Eddy Current Testing (ECT) inspection methods. Scope during 1R21 included:

- Bobbin examination of tubes with previously detected indications of degradation.
- 50% +POINT™ probe examination of hot leg (HL) tubes in SGs 1/2/3 and 100% in SG4 from the top of the tubesheet (TTS) to the licensed ARC depth for H* (TSH +3/-15.2 inches). This inspection satisfies the required periodic sample that accompanies regulatory approval of H*.
- 50% +POINT of the HL tube bulge (BLG) and overexpansion (OXP) populations in all four SGs. This scope was captured as part of the HL tubesheet inspection scope.
  - Scope expanded to 100% in SG4 in course of the tubesheet program scope expansion.

  The BLG and OXP indications are defined as follows:
  - BLG = differential mix diameter discontinuity signal within the tubesheet of 18 volts or greater as measured by bobbin coil probe.
  - OXP = a tube diameter deviation within the tubesheet of 1.5 mils or greater as measured by bobbin coil profile analysis.

- +POINT probe examination of the HL and cold leg (CL) periphery and tubelane, excluding tubelane Columns 12 through 111, three tubes deep from TTS +3/-15.2 inches on the HL side and TTS +3/-3 inches on the CL side in all SGs.

- 50% +POINT probe examination of Row 1 and Row 2 U-bends from the top TSP on the HL side to the top TSP on the CL side in all SGs.
  - Scope expanded to 100% in all SGs upon discovery of Row 1 axial primary water stress corrosion cracking (PWSCC) indication in SG2.

- +POINT probe examination of Special Interest of bobbin possible flaw locations including U-bends in both the HL and CL.

- All secondary side foreign objects identified and any existing possible loose part (PLP) indications from the most recent inspection were 'boxed-in' by at least one tube with +POINT probe. Newly reported PLPs or foreign object wear indications were 'boxed-in' by at least two tubes with +POINT probe inspection.

- 25% +POINT probe examination of dents and dings ≥ 2 volts in HL straight lengths and U-bends of all SGs. This sample was taken from the total number of dents and dings identified during previous inspections and any additional identified by the bobbin program.

- 100% +POINT probe examination of all HL and CL TSP intersections, HL and CL TTS expansion
  transitions and all dents and dings ≥ 2 volts of 2-sigma high stress tubes in all SGs.

- 100% visual inspection of all installed tube plugs from the primary side in all SGs.

- Visual inspection in all SGs of channel head primary side HL and CL inclusive of the entire divider plate to channel head weld and all visible clad surfaces. The known anomaly in the CL channel head of SG1, previously dispositioned, was evaluated for a change from the analyzed condition during this inspection.

Secondary Side activities performed included:
- TTS Sludge Lancing in all SGs
- Foreign Object Search and Retrieval (FOSAR) in all SGs

Inspection Expansion

Vogtle 1R21 SG in-service inspections (ISI) required non-destructive examination (NDE) inspection scope expansion for the low row U-bend +Point probe inspections to be increased from 50% to 100% of the Row 1 and Row 2 U-bend regions in all SGs. Scope expansion was due to detecting an indication of axial PWSCC in a Row 1 U-bend in SG2.

Damage Mechanisms Found and NDE Techniques Utilized

Many of the damage mechanisms found during 1R21 inspections were identified in previous inspections and in the 1R21 SG Degradation Assessment. The only new damage mechanism

discovered on Unit 1 was mechanical wear at tube support plate. The damage mechanisms are listed below with the associated inspection method:

- Mechanical wear due to a foreign object was found in all SGs. +Point and bobbin techniques were used to evaluate the wear.
- Mechanical wear at anti-vibration bars (AVBs) were found in all SGs. Bobbin technique was used to evaluate the wear.
- Mechanical wear and wall loss from secondary side cleaning processes found in all SGs. + Point techniques was used to evaluate the wear.
- Mechanical wear at tube support plate was found in SGs 1 and 4. +Point and bobbin techniques were used to evaluate the wear.
- ODSCC at the hot leg expansion transitions were found in SG 4. + Point techniques was used to evaluate the wear.
- PWSCC in the small radius U-Bends was found in SG 2. + Point techniques was used to evaluate the wear.

Service Induced Indication Descriptions

Mechanical Wear due to Foreign Objects

Foreign objects have been previously reported as the cause for tube wear at Vogtle Unit 1 during prior inspections. Therefore, wear due to foreign objects is classified as an existing degradation mechanism and has been addressed in the SG inspections performed during Vogtle 1R21.

Table 1, Possible Loose Part (PLP) Indications, lists the data record for the eddy current signals corresponding to a PLP. Previous historical PLP indications listed showed no significant change in eddy current signal response. There were 9 newly reported PLP signals in 2R21. Two of the newly reported PLP indications within SG4 were identified as a metallic object that was removed from the SG. No evidence of tube wear associated with these PLP signals was detected visually or through eddy current testing.

Table 2 lists tube wear indications attributable to loose parts and foreign objects in 1R21. The foreign object wear indications with percent through-wall (PCT) identified show no apparent growth or change outside of measurement uncertainties. There was 1 newly reported volumetric indication in 1R21 which measured at a depth of 9% TW. This indication was found in SG 2 at R53 C48 on top of TSC. There was no evidence of a loose part associated with this indication at this tube or surrounding tubes detected using eddy current testing.

In 1R21, the largest volumetric wear flaw was measured at 32% TW. The through-wall depth is less than the volumetric wear condition monitoring limit of 48% TW at $3\Delta P_{NO}$. For pressure-only loading of volumetric flaws, structural integrity implies meeting leakage integrity at accident conditions since the steam line break accident condition pressure differential is much smaller

than $3\Delta P_{NO}$. Based on the inspection data,1R21 condition monitoring (CM) has been met for degradation associated with foreign object wear indications.

Table 1: Vogtle 1R21 Possible Loose Part Indications (PLP)

SG	Row	Column	Indication	Location
1	25	8	PLP	TSH + 0.55
1	25	9	PLP	TSH +0.56
1	38	73	PLP	TSH +0.15
1	28	77	PLP	TSH +0.12
1	29	77	PLP	TSH +0.17
1	29	78	PLP	TSH +0.21
1	3	79	PLP	TSC +0.08
1	32	85	PLP	TSH +0.07
1	36	87	PLP	TSH +0.07
1	36	88	PLP	TSH +0.11
1	20	90	PLP	TSH +0.19
1	14	112	PLP	TSH +1.55
1	15	112	PLP	TSH +1.59
2	18	8	PLP	TSH +0.9
2	19	8	PLP	TSH +0.75
2	50	35	PLP	TSH +0.4
2	51	35	PLP	TSH +0.46
2	35	106	PLP	TSH +0.2
2	36	106	PLP	TSH +0.18
4	30	18	PLP	TSH +1.49
4	31	18	PLP	TSH +1.69
4	8	107	PLP	TSH +0.14
4	14	119	PLP	TSC +0.15
4	14	120	PLP	TSC +0.16

TSH- Tubesheet region on HL side
TSC-Tubesheet region on CL side

Table 2: Vogtle 1R21 Foreign Object Wear Indications (PCT)

SG	Row	Column	Indication	Percent[1]	Location
1	24	66	PCT	7	3C +24.97
1	55	82	PCT	24	BPH +0.48
1	56	82	PCT	3	BPH +0.64
1	41	97	PCT	22	TSC +0.09
1	39	100	PCT	13	TSH +0.3
1	41	100	PCT	15	TSH +0.24
1	41	100	PCT	32	TSH +0.14
1	41	101	PCT	24	TSH +0.19
1	41	102	PCT	21	TSH +0.17
1	41	103	PCT	22	TSH +0.49
2	6	1	PCT	6	1C +1.25
2	54	46	PCT	14	TSC +0.08
2	53	48	PCT	9	TSC +0.34
3	29	111	PCT	12	BPH -0.13
3	30	111	PCT	32	BPH +0.78
4	40	57	PCT	9	6H +13.11
4	49	89	PCT	9	BPH +0.37
4	38	104	PCT	12	BPH +0.15

[1]Indicates the tube percent through wall depth measured by a qualified bobbin or +Point technique.

TSH- Tubesheet region on HL side
TSC-Tubesheet region on CL side
3C- Tube Support Plate 3 on CL side
1C- Tube Support Plate 1 on CL side
6H- Tube Support Plate 6 on HL side
BPH- Baffle Plate on HL side

Mechanical Wear at Anti-Vibration Bar (AVB) Supports

The complete listing of AVB wear locations and eddy current signals is provided in Table 3 through 6. All AVB wear locations in each SG have been examined; there were no wear locations which exceeded the Technical Specification plugging limit of 40% through-wall (TW). Stabilizer installation was not required for plugging.

During 1R21, the maximum AVB wear indication reported was 38% TW which occurred at two locations; SG1 at R41C44 AV3 and SG2 at R39C103 AV5. The largest depth AVB wear indication of 38% TW satisfies the 64% TW condition monitoring limit at $3\Delta P_{NO}$. CM has been met at the 1R21 inspection for degradation associated with AVB wear.

Table 3 : Vogtle 1R21 SG1 AVB Wear Indications

SG	Row	Column	% TWD[1]	Location[2]	SG	Row	Column	%TWD[1]	Location
1	23	40	9	AV6	1	39	48	25	AV3
1	23	116	12	AV6	1	39	48	24	AV4
1	24	116	13	AV2	1	39	48	17	AV5
1	24	116	15	AV5	1	39	87	9	AV4
1	26	115	14	AV2	1	39	90	9	AV2
1	26	115	10	AV5	1	39	90	12	AV3
1	26	116	15	AV1	1	39	95	10	AV3
1	26	116	24	AV6	1	39	104	11	AV4
1	27	100	10	AV5	1	40	20	14	AV4
1	27	115	10	AV1	1	40	34	9	AV2
1	27	115	12	AV6	1	40	34	10	AV3
1	28	114	9	AV2	1	40	34	16	AV4
1	28	115	16	AV1	1	40	34	8	AV6
1	28	115	26	AV6	1	40	38	13	AV3
1	32	104	10	AV6	1	40	38	15	AV4
1	34	107	11	AV1	1	40	47	31	AV3
1	34	107	15	AV3	1	40	47	34	AV4
1	35	16	15	AV4	1	40	47	10	AV5
1	35	18	12	AV6	1	40	47	12	AV6
1	35	34	7	AV3	1	40	62	19	AV3
1	35	34	7	AV4	1	40	62	11	AV4
1	35	104	12	AV3	1	40	62	10	AV5
1	35	104	9	AV4	1	40	75	10	AV3
1	36	49	8	AV3	1	40	94	10	AV4
1	36	105	13	AV3	1	40	104	16	AV3
1	37	77	15	AV3	1	40	104	16	AV4
1	37	77	13	AV6	1	41	18	12	AV4
1	37	100	13	AV5	1	41	18	10	AV5
1	37	102	23	AV5	1	41	18	17	AV6
1	38	16	18	AV1	1	41	23	15	AV3
1	38	16	20	AV2	1	41	23	12	AV4
1	38	16	17	AV3	1	41	34	7	AV4
1	38	16	31	AV4	1	41	44	25	AV2
1	38	16	11	AV5	1	41	44	38	AV3
1	38	16	10	AV6	1	41	51	8	AV2
1	38	62	11	AV4	1	41	51	11	AV4
1	38	108	8	AV1	1	41	80	11	AV3

SG	Row	Column	% TWD[1]	Location[2]	SG	Row	Column	%TWD[1]	Location
1	38	108	10	AV6	1	41	96	10	AV4
1	39	48	16	AV2	1	41	96	10	AV6
1	42	34	15	AV4	1	45	30	13	AV5
1	42	37	12	AV6	1	45	36	11	AV5
1	42	43	11	AV2	1	45	90	17	AV2
1	42	43	11	AV3	1	45	90	10	AV3
1	42	43	13	AV4	1	46	41	5	AV1
1	42	43	14	AV5	1	46	75	11	AV6
1	42	47	9	AV6	1	47	99	11	AV2
1	42	97	13	AV3	1	48	97	13	AV1
1	42	97	12	AV4	1	49	28	19	AV4
1	43	21	9	AV2	1	49	28	23	AV5
1	43	21	10	AV3	1	49	88	9	AV4
1	43	21	30	AV4	1	50	29	13	AV1
1	43	21	33	AV5	1	50	29	10	AV2
1	43	21	10	AV6	1	51	45	10	AV6
1	43	75	11	AV6	1	52	33	20	AV2
1	43	78	16	AV5	1	52	33	20	AV3
1	43	81	13	AV4	1	52	39	22	AV2
1	43	81	10	AV5	1	52	39	29	AV3
1	43	82	16	AV3	1	52	39	30	AV4
1	43	83	9	AV1	1	52	39	12	AV5
1	43	83	19	AV2	1	52	44	22	AV4
1	43	83	19	AV3	1	52	44	11	AV5
1	43	83	20	AV4	1	52	91	13	AV1
1	43	83	12	AV5	1	53	39	11	AV6
1	43	85	14	AV2	1	53	43	7	AV2
1	43	91	32	AV2	1	53	43	8	AV5
1	43	91	18	AV3	1	53	43	11	AV6
1	43	91	15	AV4	1	53	87	10	AV3
1	44	21	15	AV3	1	53	90	11	AV3
1	44	21	17	AV4	1	53	90	13	AV6
1	44	21	19	AV5	1	54	36	13	AV2
1	44	75	11	AV6	1	54	37	15	AV1
1	44	80	8	AV3	1	54	37	11	AV5
1	44	80	13	AV4	1	54	37	13	AV6
1	44	80	9	AV5	1	54	45	9	AV2
1	44	102	11	AV2	1	54	53	12	AV2
1	45	26	13	AV3	1	54	53	10	AV3

SG	Row	Column	% TWD[1]	Location[2]	SG	Row	Column	%TWD[1]	Location
1	45	26	11	AV5	1	54	83	10	AV1
1	45	30	15	AV3	1	54	83	11	AV6
1	57	45	21	AV2	1	58	49	13	AV5
1	57	45	36	AV3	1	58	49	13	AV6
1	57	45	11	AV5	1	58	51	13	AV6
1	57	45	14	AV6	1	58	75	13	AV1
1	57	47	9	AV3	1	58	76	10	AV6
1	57	47	9	AV5	1	59	62	12	AV6

Table 4: Vogtle 1R21 SG2 AVB Wear Indications

SG	Row	Column	% TWD[1]	Location[2]	SG	Row	Column	%TWD[1]	Location
2	26	49	11	AV2	2	38	89	13	AV2
2	27	115	9	AV2	2	38	89	13	AV3
2	27	115	9	AV5	2	38	89	14	AV4
2	28	12	8	AV2	2	38	89	17	AV5
2	28	112	12	AV2	2	38	89	11	AV6
2	28	112	12	AV6	2	38	99	7	AV3
2	30	110	11	AV2	2	38	105	10	AV5
2	32	12	6	AV1	2	38	106	28	AV5
2	32	12	20	AV3	2	38	107	12	AV3
2	32	37	8	AV6	2	38	107	11	AV6
2	33	74	13	AV3	2	38	108	9	AV3
2	34	106	14	AV3	2	38	108	11	AV4
2	34	108	16	AV4	2	39	18	12	AV4
2	35	13	12	AV3	2	39	20	11	AV3
2	35	13	13	AV4	2	39	38	21	AV2
2	35	13	12	AV5	2	39	100	8	AV5
2	35	13	10	AV6	2	39	103	38	AV5
2	35	14	14	AV3	2	39	105	15	AV2
2	35	14	12	AV5	2	39	105	14	AV3
2	35	17	12	AV3	2	39	105	23	AV5
2	35	18	9	AV6	2	40	22	11	AV3
2	35	25	10	AV3	2	40	22	10	AV4
2	35	32	11	AV4	2	40	30	8	AV4
2	35	32	10	AV6	2	40	37	17	AV4
2	35	83	15	AV3	2	40	39	13	AV4
2	35	83	9	AV4	2	40	41	13	AV2
2	35	83	21	AV5	2	40	41	15	AV3
2	35	83	15	AV6	2	40	41	14	AV4
2	35	100	8	AV5	2	40	93	19	AV2
2	35	101	11	AV5	2	40	93	13	AV3
2	35	104	14	AV3	2	40	93	23	AV5
2	35	105	16	AV5	2	40	95	7	AV3
2	35	105	13	AV6	2	40	98	23	AV5
2	36	13	6	AV3	2	40	105	13	AV2
2	36	42	10	AV2	2	40	105	10	AV3
2	36	42	10	AV4	2	40	105	23	AV5
2	36	108	9	AV6	2	41	33	25	AV4
2	37	34	9	AV2	2	41	33	21	AV5

SG	Row	Column	% TWD[1]	Location[2]	SG	Row	Column	%TWD[1]	Location
2	37	97	12	AV3	2	41	39	11	AV3
2	41	39	16	AV4	2	42	97	35	AV4
2	41	42	18	AV2	2	42	97	11	AV5
2	41	42	10	AV3	2	42	100	17	AV3
2	41	42	29	AV4	2	42	100	20	AV4
2	41	42	34	AV5	2	42	101	9	AV2
2	41	100	9	AV3	2	42	101	16	AV4
2	41	100	14	AV5	2	42	101	14	AV5
2	41	103	21	AV5	2	43	63	19	AV4
2	42	56	8	AV2	2	43	68	13	AV3
2	42	66	15	AV3	2	43	68	14	AV5
2	42	72	17	AV2	2	43	81	10	AV5
2	42	72	18	AV3	2	43	84	13	AV3
2	42	72	10	AV5	2	43	84	14	AV5
2	42	76	7	AV1	2	43	87	17	AV2
2	42	76	28	AV2	2	43	87	19	AV3
2	42	76	19	AV3	2	43	87	12	AV4
2	42	76	19	AV4	2	43	87	25	AV5
2	42	76	36	AV5	2	43	88	13	AV2
2	42	76	19	AV6	2	43	88	20	AV3
2	42	84	12	AV3	2	43	88	20	AV5
2	42	84	8	AV4	2	43	91	31	AV2
2	42	84	13	AV5	2	43	91	21	AV3
2	42	86	14	AV3	2	43	91	13	AV4
2	42	87	9	AV2	2	43	91	31	AV5
2	42	88	17	AV4	2	43	91	15	AV6
2	42	91	10	AV2	2	43	93	17	AV2
2	42	91	17	AV4	2	43	93	24	AV3
2	42	92	15	AV4	2	43	93	23	AV4
2	42	92	13	AV5	2	43	93	16	AV5
2	42	94	18	AV3	2	43	94	12	AV2
2	42	94	24	AV4	2	43	94	13	AV3
2	42	94	12	AV5	2	43	94	11	AV4
2	42	95	10	AV2	2	43	95	17	AV4
2	42	96	12	AV2	2	43	95	16	AV5
2	42	96	12	AV3	2	43	95	12	AV6
2	42	96	16	AV4	2	43	96	11	AV3
2	42	96	14	AV5	2	43	96	15	AV5
2	42	97	11	AV2	2	44	96	8	AV5

SG	Row	Column	% TWD[1]	Location[2]	SG	Row	Column	%TWD[1]	Location
2	42	97	22	AV3	2	44	100	8	AV4
2	45	94	11	AV3	2	50	92	14	AV2
2	46	49	10	AV2	2	50	92	19	AV3
2	46	49	25	AV3	2	50	92	10	AV4
2	46	49	18	AV4	2	51	81	12	AV2
2	46	50	24	AV1	2	51	81	12	AV4
2	46	50	34	AV2	2	52	79	10	AV4
2	46	50	33	AV3	2	52	91	21	AV2
2	46	50	31	AV4	2	52	91	14	AV5
2	46	50	25	AV5	2	53	61	12	AV5
2	46	50	12	AV6	2	53	79	18	AV2
2	46	53	12	AV5	2	53	79	23	AV3
2	46	53	10	AV6	2	53	87	14	AV5
2	46	58	27	AV2	2	54	36	8	AV2
2	46	58	10	AV3	2	54	75	10	AV5
2	46	58	12	AV4	2	54	84	8	AV2
2	46	58	15	AV5	2	54	84	23	AV3
2	46	94	12	AV4	2	54	84	20	AV4
2	46	96	14	AV2	2	54	84	30	AV5
2	46	98	14	AV5	2	54	84	12	AV6
2	47	90	8	AV3	2	55	83	21	AV5
2	48	86	13	AV4	2	55	84	25	AV5
2	48	86	10	AV5	2	56	72	13	AV2
2	48	98	11	AV3	2	56	72	14	AV3
2	48	98	17	AV4	2	57	72	8	AV1
2	48	98	21	AV5	2	57	79	14	AV4
2	48	98	25	AV6	2	57	79	16	AV5
2	49	89	12	AV3	2	50	89	37	AV4
2	49	89	22	AV4					
2	49	89	23	AV5					
2	49	91	9	AV5					
2	50	83	12	AV2					
2	50	83	10	AV3					
2	50	84	11	AV2					
2	50	84	30	AV3					
2	50	84	33	AV4					
2	50	84	13	AV5					
2	50	89	20	AV2					
2	50	89	18	AV3					

Table 5: Vogtle 1R21 SG3 AVB Wear Indications

SG	Row	Column	% TWD[1]	Location[2]	SG	Row	Column	%TWD[1]	Location
3	20	55	9	AV2	3	39	17	9	AV5
3	25	115	7	AV2	3	39	17	27	AV6
3	25	115	10	AV5	3	39	20	11	AV4
3	28	8	16	AV1	3	39	21	11	AV2
3	28	8	21	AV6	3	39	21	12	AV5
3	28	51	8	AV5	3	39	26	32	AV2
3	32	52	6	AV1	3	39	26	13	AV5
3	34	110	9	AV4	3	39	29	17	AV2
3	35	16	11	AV1	3	39	32	9	AV3
3	35	16	17	AV3	3	39	35	12	AV2
3	35	16	12	AV4	3	39	35	27	AV3
3	35	16	11	AV5	3	39	35	20	AV4
3	36	13	11	AV5	3	39	35	13	AV5
3	36	29	7	AV2	3	39	48	6	AV4
3	36	34	9	AV2	3	39	51	11	AV3
3	36	34	11	AV5	3	39	57	7	AV2
3	36	34	10	AV6	3	39	62	7	AV4
3	36	44	8	AV2	3	39	63	17	AV3
3	36	44	10	AV5	3	39	63	9	AV5
3	37	106	8	AV6	3	39	66	16	AV3
3	37	107	17	AV1	3	39	66	11	AV4
3	37	107	13	AV4	3	39	66	16	AV5
3	37	107	13	AV5	3	39	67	14	AV3
3	37	108	10	AV1	3	39	67	15	AV4
3	37	108	10	AV2	3	39	82	10	AV5
3	37	108	12	AV6	3	39	102	17	AV2
3	38	17	12	AV6	3	39	102	24	AV5
3	38	34	9	AV2	3	40	18	8	AV3
3	38	34	11	AV4	3	40	18	9	AV4
3	38	34	8	AV5	3	40	18	10	AV6
3	38	35	11	AV5	3	40	19	9	AV1
3	38	69	10	AV3	3	40	19	15	AV2
3	38	106	16	AV3	3	40	19	10	AV4
3	38	106	10	AV5	3	40	19	19	AV5
3	38	106	16	AV6	3	40	19	13	AV6
3	38	107	15	AV4	3	40	30	23	AV5
3	39	17	11	AV2	3	40	30	11	AV6
3	39	17	26	AV3	3	40	35	11	AV4

SG	Row	Column	% TWD[1]	Location[2]		SG	Row	Column	%TWD[1]	Location
3	39	17	21	AV4		3	40	38	9	AV6
3	40	41	10	AV3		3	41	102	10	AV6
3	40	91	13	AV3		3	41	103	14	AV5
3	40	96	10	AV3		3	41	103	12	AV6
3	40	97	17	AV3		3	42	21	15	AV2
3	40	97	15	AV4		3	42	21	15	AV3
3	40	98	16	AV2		3	42	21	16	AV4
3	40	98	8	AV3		3	42	21	17	AV5
3	40	98	10	AV4		3	42	22	11	AV2
3	40	100	17	AV2		3	42	22	9	AV4
3	40	100	10	AV4		3	42	22	10	AV5
3	40	100	12	AV5		3	42	22	11	AV6
3	40	101	13	AV2		3	42	23	7	AV2
3	40	101	12	AV5		3	42	23	10	AV3
3	40	102	24	AV2		3	42	23	29	AV4
3	40	102	12	AV6		3	42	23	14	AV5
3	40	104	11	AV2		3	42	25	12	AV4
3	40	104	20	AV4		3	42	25	8	AV5
3	40	104	11	AV5		3	42	26	17	AV4
3	40	104	15	AV6		3	42	26	18	AV5
3	40	105	14	AV6		3	42	27	14	AV2
3	40	106	15	AV6		3	42	27	11	AV4
3	41	19	12	AV3		3	42	27	25	AV5
3	41	19	17	AV4		3	42	28	12	AV2
3	41	19	29	AV5		3	42	28	9	AV3
3	41	19	11	AV6		3	42	28	10	AV4
3	41	20	16	AV4		3	42	28	9	AV5
3	41	20	15	AV5		3	42	28	10	AV6
3	41	21	17	AV4		3	42	29	9	AV3
3	41	21	14	AV5		3	42	29	14	AV4
3	41	24	10	AV3		3	42	29	9	AV5
3	41	89	13	AV5		3	42	35	26	AV4
3	41	99	14	AV3		3	42	35	18	AV5
3	41	99	29	AV5		3	42	38	9	AV6
3	41	100	11	AV2		3	42	43	15	AV2
3	41	100	10	AV4		3	42	43	13	AV5
3	41	102	23	AV2		3	42	43	6	AV6
3	41	102	32	AV3		3	42	48	9	AV3
3	41	102	29	AV4		3	42	50	6	AV1

SG	Row	Column	% TWD[1]	Location[2]	SG	Row	Column	%TWD[1]	Location
3	41	102	13	AV5	3	42	50	27	AV2
3	42	50	16	AV3	3	45	69	12	AV2
3	42	50	34	AV4	3	45	69	10	AV3
3	42	50	8	AV5	3	45	69	17	AV5
3	42	58	11	AV2	3	45	77	14	AV2
3	42	58	19	AV3	3	45	77	11	AV3
3	42	63	23	AV4	3	45	77	9	AV4
3	42	66	12	AV3	3	45	82	23	AV3
3	42	66	17	AV4	3	45	82	18	AV4
3	42	67	12	AV3	3	45	100	12	AV5
3	42	67	11	AV5	3	46	24	11	AV4
3	42	102	11	AV4	3	46	25	7	AV3
3	42	102	11	AV6	3	46	25	11	AV4
3	44	22	9	AV3	3	46	25	14	AV5
3	44	22	9	AV4	3	46	25	10	AV6
3	44	22	14	AV5	3	47	26	16	AV5
3	44	26	31	AV2	3	47	30	11	AV5
3	44	102	9	AV4	3	47	35	9	AV2
3	45	22	12	AV5	3	47	35	13	AV4
3	45	40	18	AV3	3	47	38	18	AV2
3	45	40	13	AV4	3	47	38	28	AV4
3	45	40	16	AV5	3	47	38	10	AV5
3	45	40	9	AV6	3	47	45	9	AV2
3	45	46	12	AV1	3	47	45	20	AV4
3	45	46	35	AV2	3	47	56	11	AV3
3	45	46	34	AV3	3	47	95	9	AV6
3	45	46	23	AV4	3	47	96	25	AV4
3	45	46	19	AV5	3	48	25	9	AV6
3	45	48	17	AV2	3	48	27	8	AV2
3	45	48	26	AV3	3	49	34	28	AV4
3	45	48	18	AV5	3	49	34	13	AV5
3	45	48	7	AV6	3	49	92	10	AV4
3	45	49	27	AV2	3	49	92	13	AV5
3	45	49	30	AV3	3	49	93	11	AV6
3	45	61	13	AV3	3	49	96	12	AV4
3	45	61	18	AV4	3	49	96	14	AV5
3	45	61	21	AV5	3	49	96	31	AV6
3	45	64	22	AV3	3	50	33	10	AV3
3	45	67	22	AV3	3	50	33	11	AV4

SG	Row	Column	% TWD[1]	Location[2]		SG	Row	Column	%TWD[1]	Location
3	45	67	24	AV4		3	50	33	10	AV5
3	50	83	17	AV5		3	53	84	13	AV5
3	50	86	13	AV2		3	54	88	9	AV1
3	50	86	9	AV3		3	54	88	9	AV6
3	50	86	16	AV5		3	57	53	11	AV6
3	51	55	11	AV3		3	58	52	15	AV6
3	51	55	13	AV4		3	58	61	10	AV1
3	51	55	9	AV5		3	59	61	14	AV4
3	51	92	12	AV6		3	59	63	14	AV6
3	53	84	20	AV3		3	59	68	15	AV6
3	53	84	31	AV4						

Table 6: Vogtle 1R21 SG4 AVB Wear Indications

SG	Row	Column	% TWD[1]	Location[2]	SG	Row	Column	%TWD[1]	Location
4	27	8	16	AV6	4	33	111	19	AV3
4	27	9	20	AV5	4	33	111	22	AV4
4	27	43	9	AV5	4	33	111	18	AV6
4	27	51	12	AV2	4	34	15	8	AV5
4	28	40	18	AV5	4	36	13	8	AV1
4	28	65	10	AV5	4	36	13	8	AV2
4	28	82	10	AV2	4	36	14	8	AV1
4	28	82	11	AV5	4	36	39	21	AV3
4	30	9	19	AV2	4	36	79	15	AV4
4	30	9	36	AV5	4	36	104	14	AV2
4	30	9	6	AV6	4	36	104	10	AV3
4	30	20	9	AV2	4	36	104	10	AV5
4	30	40	12	AV2	4	36	105	9	AV2
4	30	40	16	AV5	4	36	105	12	AV5
4	30	40	9	AV6	4	36	106	8	AV5
4	30	85	9	AV2	4	36	106	9	AV6
4	30	113	10	AV5	4	36	107	10	AV3
4	30	114	31	AV5	4	36	109	10	AV3
4	31	111	8	AV1	4	37	80	6	AV4
4	31	111	11	AV2	4	37	107	15	AV3
4	32	106	12	AV3	4	37	107	12	AV5
4	32	107	10	AV2	4	38	19	8	AV5
4	32	110	11	AV3	4	38	35	9	AV2
4	32	111	9	AV1	4	38	52	9	AV3
4	32	111	14	AV3	4	38	52	12	AV4
4	32	111	9	AV4	4	38	55	9	AV4
4	33	12	13	AV2	4	38	74	9	AV2
4	33	12	11	AV3	4	38	76	14	AV3
4	33	12	6	AV4	4	38	76	16	AV4
4	33	12	11	AV6	4	38	76	8	AV6
4	33	34	11	AV3	4	38	86	15	AV4
4	33	34	11	AV4	4	38	96	15	AV2
4	33	34	11	AV5	4	38	96	7	AV4
4	33	91	7	AV2	4	38	96	9	AV5
4	33	91	10	AV4	4	38	103	12	AV4
4	33	108	12	AV3	4	38	103	10	AV5
4	33	110	21	AV3	4	38	104	11	AV3
4	33	110	12	AV5	4	38	104	22	AV4

SG	Row	Column	% TWD[1]	Location[2]	SG	Row	Column	%TWD[1]	Location
4	33	110	8	AV6	4	38	104	14	AV5
4	38	108	14	AV4	4	40	87	15	AV4
4	39	37	11	AV2	4	40	87	17	AV5
4	39	37	11	AV3	4	40	88	14	AV3
4	39	51	13	AV4	4	40	88	19	AV4
4	39	51	11	AV5	4	40	88	14	AV5
4	39	51	15	AV6	4	40	88	12	AV6
4	39	56	12	AV2	4	40	90	7	AV3
4	39	56	17	AV3	4	40	90	14	AV4
4	39	56	14	AV4	4	40	90	8	AV5
4	39	58	10	AV2	4	40	92	9	AV3
4	39	58	23	AV4	4	40	92	13	AV5
4	39	58	13	AV6	4	40	93	17	AV2
4	39	75	16	AV5	4	40	93	12	AV5
4	39	78	10	AV5	4	40	95	12	AV2
4	39	95	10	AV2	4	40	95	12	AV3
4	39	95	11	AV4	4	40	95	25	AV4
4	39	107	11	AV3	4	40	95	12	AV5
4	40	24	13	AV5	4	40	100	14	AV2
4	40	25	10	AV3	4	40	100	8	AV3
4	40	29	11	AV2	4	40	100	11	AV4
4	40	39	16	AV3	4	40	100	9	AV5
4	40	56	16	AV3	4	40	100	11	AV6
4	40	62	26	AV2	4	40	105	9	AV2
4	40	62	35	AV3	4	40	105	19	AV4
4	40	62	28	AV4	4	40	105	20	AV5
4	40	62	12	AV5	4	40	106	12	AV2
4	40	78	18	AV2	4	40	106	22	AV3
4	40	78	16	AV3	4	40	106	18	AV4
4	40	78	9	AV5	4	40	106	29	AV5
4	40	80	10	AV3	4	41	23	10	AV2
4	40	80	10	AV5	4	41	97	15	AV5
4	40	82	11	AV2	4	41	99	14	AV5
4	40	82	23	AV3	4	41	105	9	AV3
4	40	82	36	AV4	4	42	20	10	AV6
4	40	82	19	AV5	4	42	100	18	AV2
4	40	84	16	AV2	4	42	100	15	AV3
4	40	84	9	AV5	4	42	100	18	AV4
4	40	86	12	AV4	4	42	100	11	AV5

SG	Row	Column	% TWD[1]	Location[2]	SG	Row	Column	%TWD[1]	Location
4	40	86	9	AV5	4	42	100	11	AV6
4	42	101	17	AV3	4	50	76	15	AV4
4	42	101	24	AV4	4	50	76	29	AV5
4	42	101	29	AV5	4	53	89	12	AV4
4	42	104	10	AV1	4	53	90	9	AV1
4	42	104	17	AV3	4	53	90	11	AV5
4	42	104	11	AV4	4	53	90	11	AV6
4	43	46	20	AV6	4	54	36	12	AV5
4	43	66	14	AV2	4	54	38	8	AV1
4	43	66	13	AV3	4	54	38	10	AV5
4	43	85	12	AV2	4	54	38	8	AV6
4	43	92	15	AV3	4	54	87	9	AV2
4	43	93	11	AV4	4	54	87	10	AV3
4	43	101	14	AV3	4	54	87	12	AV4
4	43	101	15	AV4	4	55	40	10	AV6
4	43	101	27	AV5	4	55	82	10	AV4
4	44	91	15	AV5	4	55	82	11	AV5
4	44	96	8	AV2	4	56	41	10	AV5
4	44	96	31	AV3	4	56	81	11	AV6
4	44	96	23	AV4	4	57	55	10	AV6
4	44	96	14	AV6	4	58	48	9	AV5
4	44	97	24	AV2	4	58	65	10	AV1
4	44	97	22	AV4	4	58	73	12	AV6
4	44	97	26	AV5	4	58	76	14	AV5
4	44	99	10	AV4	4	59	57	14	AV5
4	44	99	10	AV6	4	59	59	10	AV2
4	45	22	11	AV3	4	59	59	12	AV5
4	45	22	10	AV5	4	50	76	16	AV3
4	45	98	19	AV5					
4	45	101	9	AV1					
4	45	101	6	AV5					
4	45	101	9	AV5					
4	48	97	10	AV6					
4	49	95	8	AV3					
4	50	63	17	AV2					
4	50	63	23	AV3					
4	50	63	18	AV4					
4	50	63	11	AV5					
4	50	76	12	AV2					

[1]% TWD-Percent Through-wall Depth [2]AV#- Location of AVB intersection with the tube (there are up to 6)

Mechanical Wear and Wall Loss from Secondary Side Cleaning Processes

Table 7 lists tube locations and volumetric indications associated with the ultrasonic energy cleaning (UEC) and pressure pulse cleaning (PPC) secondary side cleaning processes. The examinations performed to address this existing degradation mechanism are an element of the bobbin inspection program and + POINT probe for sizing. Based on these NDE uncertainty levels and the results, it is apparent that there has been no measurable progression in the wall loss associated with these historical indications. Further, the mechanisms that caused this form of degradation are no longer applied and therefore no wear progression can occur. The lack of growth confirms that degradation exceeding the structural and leakage integrity limits is unlikely during the inspection interval of up to three cycles.

The reported Row 1 volumetric indications tubes have also been observed by visual inspection in prior outages. Visually they too resembled tube oxide removal patterns observed in qualification testing for UEC. No foreign objects have been determined to be associated with these tube wear indications. These tubes have been left in service for several inspection intervals with no indications of tube wall loss outside of NDE measurement uncertainties.

During 1R21, the largest indication of mechanical wear and wall loss from secondary side cleaning measured 37% TW. This is much smaller than the 48% TW condition monitoring limit at $3\Delta P_{NO}$ and meets the SG structural performance criteria. Based on the inspection data presented in Table 7 in comparison to the limits, CM has been met at the 1R21 inspection for degradation associated with indications of wear and wall loss from secondary side cleaning processes.

Table 7: Vogtle 1R21 Tube Wall Loss from Secondary Cleaning Process

SG	Row	Column	Volts	Indication	%TWD	Location
1	1	83	0.1	PCT	10	TSH
1	1	87	0.56	PCT	37	TSH
1	58	70	0.26	PCT	22	BPH
2	1	70	0.04	PCT	4	TSC
2	1	70	0.08	PCT	8	TSC
2	1	70	0.05	PCT	5	TSC
2	1	78	0.09	PCT	9	TSC
2	1	78	0.05	PCT	5	TSC
2	1	82	0.04	PCT	4	TSC
2	1	91	0.41	PCT	DSS[1]	BPC
2	10	101	0.36	PCT	INR[2]	BPH
2	16	6	0.12	PCT	11	BPC
2	16	7	0.34	PCT	27	BPC

[1]DSS – Distorted Support Signal. No Degradation Found (NDF) with +POINT Probe
[2]INR – Indication Not Reportable. No Degradation Found (NDF) with +POINT Probe
%TWD-Percent Through-wall Depth
PCT- Volumetric Indication
TSH-Tubesheet Region on the HL Side
BPH-Baffle Plate on the HL side
TSC-Tubesheet Region on the CL side
BPC-Baffle Plate on the CL side

Mechanical Wear at Tube Support Plate

Mechanical wear at the tube support plate is a new damage mechanism reported during 1R21. Flow-induced vibrations that cause tube support wear are governed primarily by thermal hydraulic characteristics and the sizes of the as-built tube-to-support gaps. This suggests that the occurrence and wear rates are subject to SG specific conditions and will vary between plants and between SGs at a specific plant.

The bobbin coil is the detection technique for TSP wear flaws. However, with the implementation of the alternate inspection program, not all tubes received full length bobbin coil examination. Table 8 shows the wear at tube support plate locations. The mechanical wear at Tube R20C53 TSP 05H in SG1 was measured at 5% TW and the wear indicated at Tube R44C21 TSP 07H was measured at 18% TW. Both wear indications were detected by the +POINT probe.

During 1R21, the largest indication of mechanical wear and wall loss from secondary side cleaning measured 18% TW. This is much smaller than the 53% TW condition monitoring limit at $3\Delta P_{NO}$ and satisfies the SG structural performance criteria.

Table 8: Vogtle 1R21 Wear at Tube Support Plate Locations

SG	Row	Column	Volts	Indication	%TWD	Location
1	20	53	0.1	PCT	5	5H
1	44	21	0.16	PCT	18	7H

5H- Tube Support Plate 5 on HL side
7H- Tube Support Plate 7 on HL side
PCT – Foreign Object Wear

ODSCC at the Hot Leg Expansion Transitions

ODSCC at the hot leg expansion transitions is an existing degradation mechanism for Vogtle 1, and this experience has been considered in the Vogtle 1R21 eddy current inspection scope development in accordance with the guidelines. During 1R21, there were three axial ODSCC indications reported by the +POINT probe analysis in two tubes located at the top of the tubesheet hot leg expansion transition location. Two flaws were contained in Tube R5C90 at TSH-0.24 inch and TSH-0.3 inch below the top of the tubesheet at the bottom of the expansion transition. These two axial ODSCC flaws in Tube R5C90 are circumferentially separated by approximately 150 degrees and are not considered to be interactive since the flaw separation is greater than the 0.25 inch criteria for multiple flaw interaction. In addition, an axial indication was reported in Tube R16C65 at TSH-0.27 inch below the top of the tubesheet. Condition monitoring requirements have been satisfied at the 1R21 inspection for degradation associated with ODSCC at the hot leg expansion transitions.

Table 9 provides a listing of the indications reported with their associated depth and extents.

Table 9: Vogtle 1R21 Axial ODSCC at Expansion Transitions

SG	Row	Col	Volts	Ind	Max Depth %TWD	Circ Ext. (deg)	Circ Ext. (inches)
4	5	90	0.38	SAI	62.3	45	0.27
4	5	90	0.24	SAI	67.7	40	0.24
4	16	65	0.67	SAI	71.0	51	0.30

SAI – Single Axial Indication
%TWD-Percent Through-wall Depth
Ind. – Indication
Circ. Ext.- Circumferential Extent

PWSCC at Tube Bulge and Overexpansion Locations Within Tubesheet

There were no PWSCC indications reported from the inspection at tube bulge and overexpansion locations within tubesheet from +POINT probe analyses during 1R21. Therefore, condition monitoring requirements have been satisfied at the 1R21 inspection for tube bulge and overexpansion locations within tubesheet.

PWSCC in the Small Radius U-Bends

Axial PWSCC in the Row 1 and 2 U-bends is classified as an existing degradation mechanism in the Vogtle Unit 1 SGs. Both axial and circumferential PWSCC at the U-bends are detectable by +POINT probe inspections.

During 1R21, an axial PWSCC indication was detected in the U-bend of Tube R1C58 in SG2. The location of the indication was near the U-bend apex at TSP 07H+5.05 and was coincident with a geometric anomaly. The maximum depth of the indication was measured at 55% TW with a conservative length of 0.40 inch. The tube was plugged and no stabilizer was installed as there is no potential for future tube severance with axial SCC degradation in the low row U-bend. Table 10 provides a listing of the indication reported with its associated depth and extents.

The critical crack length for which 100% TW axial flaw would satisfy the $3\Delta P_{NOP}$ structural integrity performance criteria is 0.38 inch. The axial length of the indication was 0.40 inch as measured by depth profiling, thus exceeding the critical crack length criteria by a small margin. The condition monitoring limit for a 0.40 inch axial ID part-through-wall flaw is 62% TW. The axial ID indication measured in Tube R1C58 was 55% TW which satisfies the 62% TW condition monitoring limit. The burst pressure for this flaw measuring 55% TW with an axial length of 0.40 inch is 4481 psi, which is in excess of the minimum acceptable $3\Delta P_{NOP}$ burst pressure limit of 4044 psi. Therefore, condition monitoring structural integrity requirements have been satisfied during 1R21 inspection for degradation associated with PWSCC at the tube small radius U-bends.

Table 10: Vogtle 1R21 Axial PWSCC in the Small Radius U-Bends

SG	Row	Col	Volts	Ind	Max Depth %TWD	Circ Ext. (deg)	Circ Ext. (inches)
2	1	58	1.47	SAI	55	63	0.38

SAI – Single Axial Indication
%TWD-Percent Through-wall Depth
Ind. – Indication
Circ. Ext.- Circumferential Extent

PWSCC at Hot Leg Expansion Transitions

Axial PWSCC at hot leg tubesheet expansion transitions was first identified during the last inspection in 1R20. There were no PWSCC indications reported from Hot Leg Expansion Transitions from +POINT probe analyses during 1R21.Therefore, condition monitoring requirements have been satisfied at the 1R21 inspection for degradation associated with PWSCC at the Hot Leg Expansion Transitions.

Tube Plugging/Number of Tubes Plugged

Table 11 presents a summary list of all SG tubes plugged in 1R21 and the related degradation mechanism.

Table 11: Vogtle 1R21 Plugging List

SG	Row	Column	Indication	Location	Plugging Basis	Stabilizer	Degradation Mechanism
2	1	58	SAI	TSP 7H+5.05	Axial PWSCC	No	PWSCC in the Small Radius U-Bends
4	5	90	SAI	TSH -0.24	Axial ODSCC	Yes- HL TTS	Axial ODSCC at Tubesheet Expansion Transitions
4	5	90	SAI	TSH -0.30	Axial ODSCC	Yes- HL TTS	
4	16	65	SAI	TSH -0.27	Axial ODSCC	Yes- HL TTS	

SAI – Single Axial Indication
HL TTS – Hot Leg Top of Tubesheet

Table 12: Total Plugged Tubes after Vogtle 1R21

SG	#Tubes	1R21 # Plugged	Total # Plugged	% Plugging
1	5,626	0	29	0.52%
2	5,626	1	28	0.50%
3	5,626	0	40	0.71%
4	5,626	2	82	1.46%
Total	22,504	3	179	0.80%

Tube Slippage Monitoring and Leakage Considerations

The bobbin data collected have been screened for large amplitude tubesheet indications of greater than 50 volts with a phase angle between 25° and 50° suggestive of tube severance from all four SGs showed no tube severance indications reported; therefore, no indications of slippage were identified.

None of the indications reported during the Vogtle 1R21 SG inspections were evaluated to have primary to secondary leakage under accident induced conditions. There was no leakage from the portion of tubing within the H* depth for which to apply the leak rate factor associated with the alternate repair criteria. Since there was no calculated leakage from any other sources none of the Vogtle 1 SGs installed tube plugs require leakage calculations. Therefore, for these indications the accident induced leakage rate would be zero, satisfying the accident induced leakage performance criteria.

Other Inspections

SG Channel Head Primary Side Bowl Inspections

During Vogtle 1R21, a visual inspection of the SG channel head bowl of the SG hot leg and cold leg divider plate and drain line areas, inclusive of the entire divider plate to channel head weld and all visible clad surfaces, were performed in accordance with Westinghouse NSAL-12-1 and industry operating experience. This inspection was performed using the SG manway channel head bowl cameras. The cladding anomaly previously detected during 1R20 was visually re-inspected during 1R21 and showed no discernable changes in shape or size. No other channel head degradation was observed in any SGs during 1R21.

Secondary Side Activities Discussion

During Vogtle 1R21, TTS deposit cleaning sludge lancing was performed in all four SGs. A total of 31.45 pounds of sludge was removed from all four SGs. FOSAR inspections were conducted in the secondary side of all SGs during VEGP 1R21. These FOSAR inspections were performed at the TTS region around the annulus as well as the no-tube lane through the center of the tube bundle. The FOSAR scope also included known

foreign object locations from prior inspections. Secondary side visual inspections were also conducted at locations of historical PLP indications and any new PLP indications identified by the eddy current program.

Condition Monitoring Conclusions

Based on the inspection data and the condition monitoring (CM) assessment, no tubes exhibited degradation in excess of the condition monitoring limits. No tubes required in situ pressure testing to demonstrate structural and leakage integrity. There was no reported SG primary to secondary leakage prior to the end of the Vogtle 1 SG inspection interval. No new indications of secondary side tube degradation attributable to foreign objects have been identified. All indications detected in this inspection were below the calculated integrity limits and therefore met the condition monitoring requirements provided. A final OA has been performed considering the indications detected during 1R21 and degradation growth rates. The final OA concludes that steam generator tube structural and leakage integrity will be maintained until the end of the inspection interval when all SGs will be inspected again. Based on application of conservative AVB wear growth rates, the condition of the Vogtle Unit 1 SG tubes has been analyzed with respect to continued operability of the SGs until the end of Cycle 22 without exceeding the performance criteria. The first occurrence of mechanical wear at TSP locations was detected during 1R21. Flaw growth projections for the detected and assumed undetected flaws show that no TSP wear degradation exceeding the structural and leakage integrity limits is anticipated at 1R22.Based on worst-case flaw projection, operation until the end of Cycle 22 is not expected to produce assumed undetected SCC flaws that exceed the performance criteria for structural and leakage integrity. This conclusion has been reached based on conservatively applied degradation growth rates using a combination of deterministic and probabilistic methods. Therefore, the SG performance criteria for structural and leakage integrity were satisfied for the preceding Vogtle 1 SG operating interval for all four SGs.