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W3F1-2014-0041

November 06, 2014

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: 180 Day Steam Generator Tube Inspection Report for the 19TH Refueling Outage
Waterford Steam Electric Station, Unit 3
Docket No. 50-382
License No. NPF-38

Dear Sir or Madam:

Attached is the 180 Day RF19 Steam Generator Tube Inspection Report for Entergy Operations, Inc (EOI) Waterford Steam Electric Station Unit 3. This report is being submitted in accordance with Technical Specification 6.9.1.5 and provides the complete results of the Refueling Outage 19 Steam Generator Tube Inspection.

There are no new commitments contained in this letter.

Please contact John Jarrell Regulatory Assurance Manager at (504) 739-6685 if you have questions regarding this information.

Sincerely,

JPJ/JDW

Attachments

1. 180-Day Steam Generator Tube Inspection Report for the 19TH Refueling Outage

A001
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Attachment 1
to
W3F1-2014-0041

180-Day Steam Generator Tube Inspection
Report for the 19TH Refueling Outage

Refuel (RF) 19 180-Day Special Report

During this period of reporting, Waterford 3 had one inspection. In April 2014, Entergy performed the first in-service inspections on the replacement steam generators. These generators were installed during the refuel outage eighteen (RF-18) and were placed inservice in January 2013.

Waterford 3 (WF3) Technical Specification (TS) 6.9.1.5 requires Entergy Operations to submit a 180 day report to the NRC that outlines the details of the steam generator (SG) tubing inspections that were performed during the reporting period. The report shall include:

6.9.1.5

A. The scope of inspections performed on each steam generator.
B. Degradation mechanisms found.
C. Nondestructive examination techniques utilized for each degradation mechanism.
D. Location, orientation (if linear), and measured sizes (if available) of service induced indications.
E. Number of tubes plugged during the inspection outage for each degradation mechanism.
F. The number and percentage of tubes plugged to date, and the effective plugging percentage in each steam generator.
G. The results of condition monitoring, including the results of tube pulls and in-situ testing.

DESIGN

The replacement steam generators for Waterford 3 are a Westinghouse Delta 110 design. The tube bundle consists of 8968 U-tubes fabricated from thermally treated Alloy 690. The tubing material complies with the requirements of ASME Section II SB-163, ASME Section III, NB-2000. The nominal outside diameter (OD) of each U-tube is 0.75 in. The nominal tube wall is .044 inches thick for tube rows 1 and 2 and .043 inches thick for all other tube rows (rows 3 through 138). The ends of the tubes are expanded the full depth of the tubesheet and welded to the cladding on the tubesheet primary side.

The tubes are supported on the secondary side by eight (8) tube support plates. The tube support plate material is stainless steel (ASME SA-240, Type 405). All tube support plates have trefoil-shaped holes arranged on a triangular pitch, produced by broaching, to reduce the potential for tube dry out and chemical concentration in the regions where the tubes pass through the tube support plates.

Five (5) sets of anti-vibration bars (AVBs) are installed to provide support for the U-bend region of the tube bundle. The anti-vibration bar assemblies stiffen the U-bend region of the tube bundle and facilitate proper tube spacing and tube alignment while mitigating tube vibration. The first set of anti-vibration bar assemblies are installed into the U-bend to a depth of, and including, row five (5). The second set of anti-vibration bar assemblies are installed into the U-bend to a depth of, and including, row eighteen (18). The third set of anti-vibration bar assemblies are installed into the U-bend to a depth of, and including, row thirty-four (34). The fourth set of anti-vibration bar assemblies are installed into the U-bend to a depth of, and including, row fifty-five (55). The fifth set of anti-vibration bar assemblies are installed into the U-bend to a depth of, and including, row eighty-four (84), except for one special bar that is inserted to row eighty-three (83). Each anti-vibration bar assembly consists of a "V" shaped, rectangular bar of stainless steel (ASME SA- 479, Type 405) and two (2) end caps of thermally treated Alloy 690 (ASME SB-166, Alloy UNS N06690). Each end of each anti-vibration bar assembly is secured to the U-bend peripheral retaining rings of thermally treated Alloy 690 (ASME SB-166, Alloy UNS N06690) by welding the corresponding end cap with SFA-5.14 CL. ERNiCrFe-7 weld metal. Twenty (20) U-shaped retainer bars of chrome plated, thermally treated Alloy 690 (ASME SB-166, Alloy UNS N06690) are installed between several U-tubes. Both ends of the U-shaped retainer bar are welded with SFA-5.14 CL. ERNiCrFe-7 weld metal to the anti-vibration bar retaining ring of each anti-vibration bar set. These retainer bars provide support to the anti-vibration bar assemblies during seismic and postulated steam line break loading conditions.

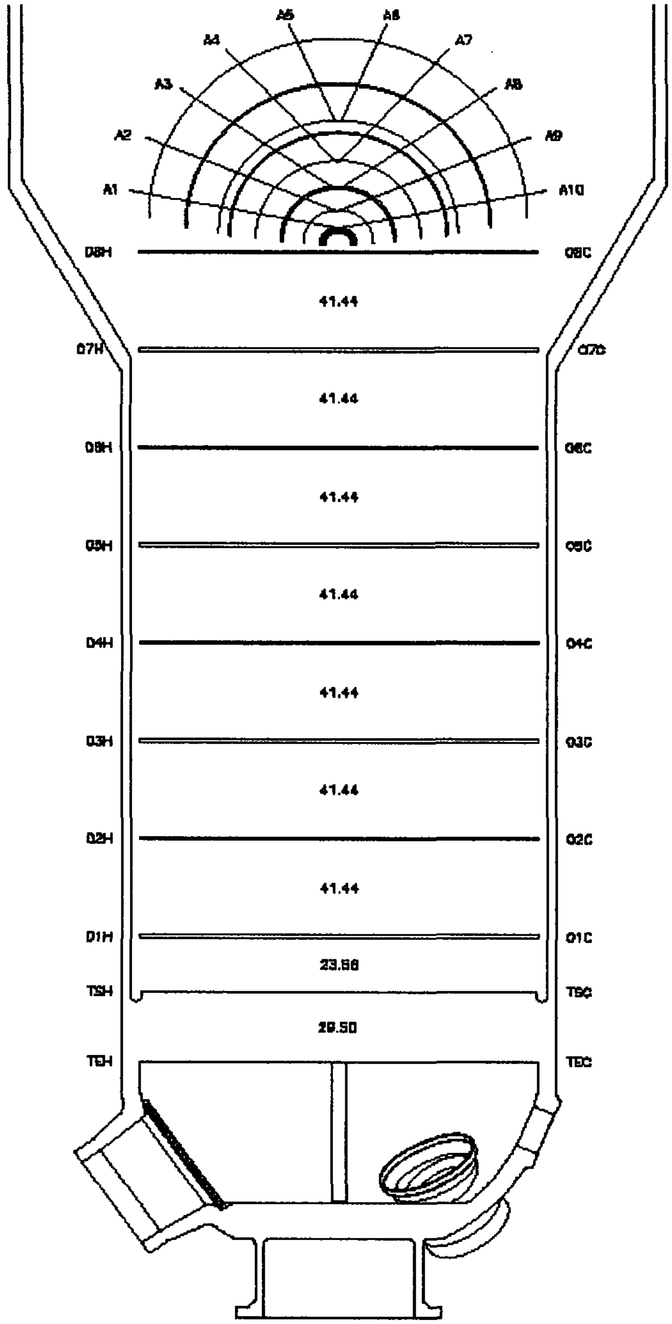

FIGURE 1

Waterford-3 Delta 110
Steam Generator Design

Table 1
Waterford 3 Steam Generator Primary Inspection Plan

Outage	Year	Cycle EFPM	SG Cumulative EFPM	Inspection Period EFPM	Sequential Inspection Period	Notes
RF19	2014	14.6	14.6	N/A	N/A	First ISI
RF20	2015	17.3(est)	31.9(est)	17.3(est)	First	No Inspection
RF21	2017	17.3(est)	49.2(est)	34.6(est)	First	Inspect

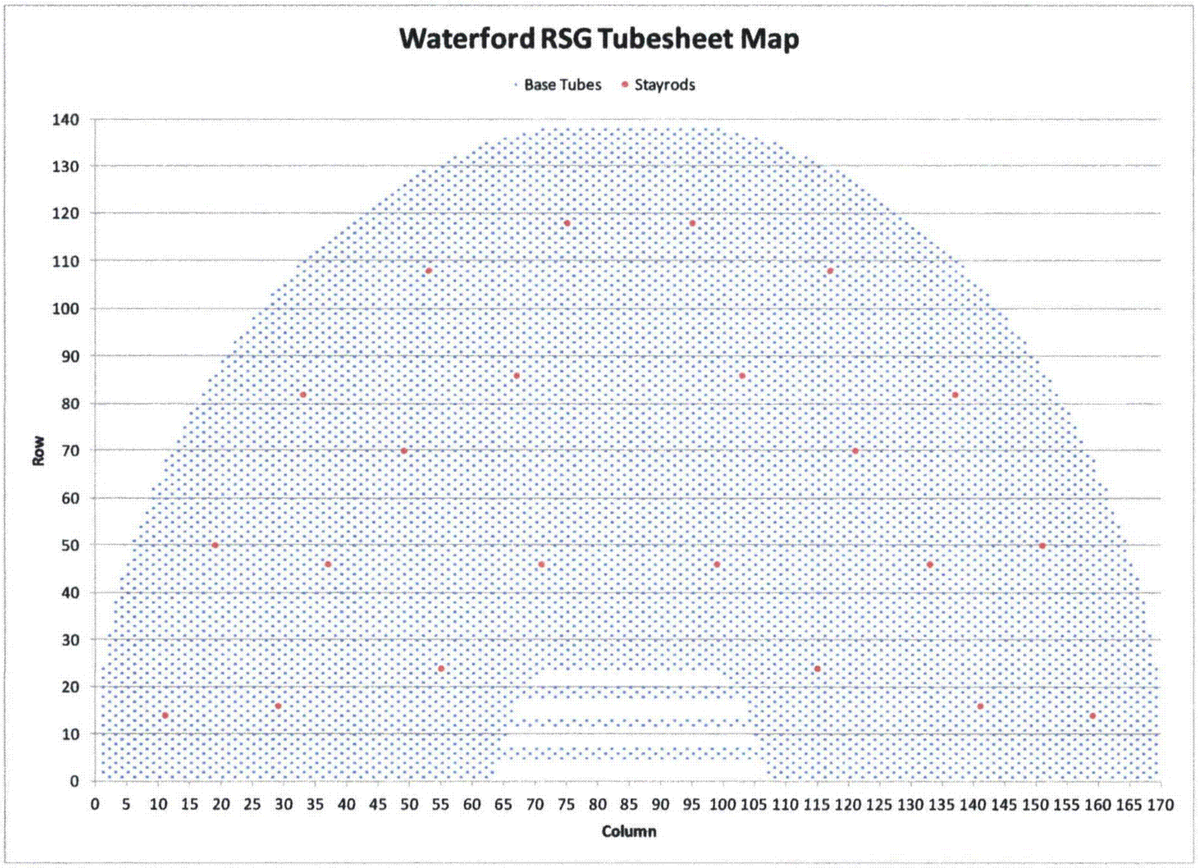

FIGURE 2
Waterford-3 Delta 110
Steam Generator Tubesheet

A. The Scope of Inspections Performed on Each Steam Generator.

The initial in-service inspection plan included:

- 100% 0.610 inch bobbin coil inspection full length Rows 3 and above; 100% Rows 1 and 2 straight legs only
- 100% 0.590 inch mid-range +Pt Rows 1 and 2 U-bends from top TSP to top TSP
- 100% bobbin coil inspection Rows 1 and 2 U-bends from top TSP to top TSP at 12 ips (1)
- +Pt inspection of hot and cold leg TTS +/- 3 inches for detection of PLPs (periphery, tube lane, central tube void region)
- +Pt special interest testing as necessary including:
  - Any freespan bobbin I-code
  - Any bobbin I-code at a TSP intersection
  - Any AVB wear indication >15%TW based on bobbin coil analysis
  - Possible loose parts/foreign object (PLP) signals including all immediately surrounding tubes until PLP signals are no longer reported (i.e., "boxing")
  - Freespan dings >5V (2)
  - TSP dents >2V (3)
  - Bulge (BLG) with preferential selection based on bobbin coil 600 kHz signal amplitude >18V
  - Over-expansions (OXP) above the TTS
- Pancake coil RPC special interest testing of bobbin PRX signals >1V
- Channel head bowl visual inspection per NSAL-12-1 including divider plate to channel head juncture

(1): The 0.610 inch diameter bobbin probe will be attempted first. If tangent point noise levels are judged excessive, the 0.600 inch diameter bobbin probe can be utilized.

(2): SCC at freespan dings is judged non-relevant, similarly, freespan wear is judged non-relevant in the absence of foreign objects. The recommended +Pt inspection of >5V dings is performed to satisfy the full length testing requirement and to establish that foreign objects are not present.

(3): As no industry qualification for the detection of wear in dented TSP intersections is available, the +Pt inspection of dented TSP intersections is performed to establish that no wear is present.

Primary Bowl Examinations

The hot leg and cold leg primary side channel heads in each SG were visually inspected during the current outage. The inspections were prompted by industry experience at two plants that identified wastage of the carbon steel channel head pressure boundary as result of a breach in the channel head stainless steel cladding and/or in the divider plate to channel head cladding. The visual inspection results did not identify any anomalies or degradation of the cladding or welds.

AVB position evaluation were completed during the W3 RSG preservice inspections in 2012. The AVBs are uniformly installed in all of the columns in accordance with the design.

The Secondary Side Inspection and FOSAR:

The inspection plan was developed to specifically address the areas of potential degradation due to recent industry inspection results. These included:

a. FOSAR of annulus region at the top of the tubesheet
b. Visual inspections of the upper steam drum and support structures
c. Visual inspection of the feed ring, spray nozzles and support structures.

Steam drum region inspections performed at RF19 were quite extensive and included;

Steam outlet nozzle venturis
Mid-deck region
Primary separator ID above swirl vanes
Lower deck region
Spray cans
Feedring ID region
Feedring structural supports
Thermal sleeve to nozzle/pipe welds
Sludge collector internals

Visual inspection of the upper steam drum components listed above identified no anomalies. As the moisture separation equipment is constructed using carbon steels with measurable chrome content or nickel-based alloys, erosion/corrosion of these components is not expected.

Visual examination of the exterior of the spray cans and the ID of the feedring showed no foreign material present. The diameter of the holes in the spray cans is slightly less than the minimum tube-to-tube dimension in the pitch direction of 0.28 inch, and can effectively act as foreign material screens.

Due to observed feedwater pipe vibrations during Cycle 19 Entergy selected to perform a visual inspection of the feedring structural supports and thermal liner welds. No anomalies were noted.

Visual inspection of the inside of the sludge collector segments showed deposit accumulation, although attempts to measure the height of the deposit pile were not performed.

The general condition of the secondary side components showed a light magnetite coating, which is expected, and a positive indicator that local high velocity conditions are not present.

At the TTS, many tube-to-tubesheet juncture locations showed an accumulation of deposit with oxidation of the deposit. As magnetite is primarily composed of iron, exposure to atmospheric conditions can result in general oxidation (rust).

B. Degradation Mechanisms Found.

- Non-Service Induced Wear at AVBs in SG 31 and 32 (PSI)

Table B-1 – Fabrication Indications

SG	Dings*	Proximity	Bulge	WAR
31	665	90	3	10
32	32	116	3	9

* Note – Dings were called with a threshold of ≥ 1.0 volts

Table B-2: PSI Indications of Tube Wear

SG31				SG32			
Row	Col	Locn	%TW	Row	Col	Locn	%TW
68	159	A07	3	46	5	A03	4
63	160	A04	5	46	5	A03	4
63	160	A07	4	63	160	A04(+)	1
56	161	A04	3	63	160	A04(-)	2
58	161	A04	3	63	160	A07	2
60	161	A04	3	51	164	A08	4
62	161	A04	4	46	165	A03	2
62	161	A07	3	46	165	A08	2
51	164	A03	2	46	165	A08	1
51	164	A08	2				

Table B-2 identifies those tubes in each SG reported to contain wear-like indications in the PSI. These indications were reported from +Pt examination as part of the effort to monitor tube-to-AVB gaps. The initial bobbin analysis did not report these indications as flaw-like for all locations. In several cases the bobbin report was performed to provide a matching signal for the +Pt indication. As noted in Table B-2, the maximum reported indication depth is 5%TW.

At RF19 no appreciable change in the bobbin coil signature was noted for these locations, suggesting little or no further advancement of the degradation, and that the mechanism is not associated with traditional tube vibration mechanisms. As a result, Entergy reclassified these indications as indication not reportable (INR) during the RF19 inspection.

The only Service Induced degradation was wear at AVB in SG31 and SG32. These indications are provided in Table D-1 for SG31 and Table D-2 for SG32. There were four tubes preventatively plugged (PTP) in SG32 which enables the Operational Assessment to successfully analyze a 2 cycle Operating Interval.

C. Nondestructive Examination Techniques Utilized for Each Degradation Mechanism.

Summary of SG Tube Degradation Mechanisms and Inspection Requirements: Detection Information: Waterford RF19							
Degradation Mechanism	**Location**	**Probe Type**	**EPRI Technique Sheet (1)**	**Detection Variable**	**Appendix H or I Qualified**	**Inspection Sample Plan**	**Expansion Plan**
Existing Degradation Mechanisms:							
Wear (not service induced)	AVBs	0.610 inch Bobbin	ETSS 96004.1	Phase	Yes	100% full length	No Expansion
Potential Degradation Mechanisms							
Wear (service induced)	AVBs, TSPs	0.610 inch Bobbin (detection)	ETSS 96004.1	Phase	Yes	100% full length, both SGs	No Expansion
		+Pt (confirmation)	ETSS 21998.1	Phase	Yes	100% bobbin indications	No Expansion
Volumetric Degradation (not corrosion related) and General Tube Signal Identification	Freespan	0.610 inch Mag Bias Bobbin	ETSS I28413	Phase	Yes	100% full length, both SGs	+Point boxing-in to bound PLPs
		0.610 inch +Pt	ETSS 21998.1, ETSS I28425	Phase	Yes	Any freespan bobbin I-code, any I-code at tube supports	No expansion
PLP Identification and General Tube Signal Identification	TTS (both legs)	0.610 inch 3-coil +Pt	ETSS 21409.1	Phase	Yes	Sampling of peripheral tubes, Hot and Cold Leg TTS +/- 3 inches	+Point boxing-in to bound PLPs and indications
	Freespan, including U-bends	0.600 inch or 0.610 Bobbin	ETSS I28413	Phase	Yes (2)	100% full length, both SGs	No Expansion
General Signal Identification	Row 1 and 2 U-bends	0.580 inch U-bend +Pt	ETSS 96511.2	Phase	Yes	100% Row 1 and 2 from 08H to 08C	No Expansion
Potential Manufacturing Buff Marks	All	0.610 inch Mag Bias Bobbin	ETSS 96010.1	Phase	Yes	100% full length, 3 SGs	No Expansion
		0.580 or 0.610 inch +Pt	ETSS 21998.1	Phase	Yes	+Point MBIs	No Expansion

(1): The Acquisition and Analysis Technique Sheets (ACTS and ANTS) detail the plant specific guidelines for application of the EPRI ETSSs.
(2): Existing bobbin coil qualification database does not include U-bend regions. This program is performed to establish a baseline condition for future bobbin inspection of Row 1 and 2 U-bends.

<table>
<tr><th colspan="7">Summary of SG Tube Non-flaw Signal Disposition Categories Applicable Inspection: Waterford 3 RF19</th></tr>
<tr><th>Degradation Mechanism</th><th>Location</th><th>Probe Type & No.</th><th>EPRI Technique Sheet</th><th>Detection Variable</th><th>Inspection Sample Plan</th><th>Expansion Plan</th></tr>
<tr><th colspan="7">Resolution for Classification of Extraneous Indications</th></tr>
<tr><td rowspan="2">Dings, Dents, PVN</td><td rowspan="2">All</td><td>0.610 inch Mag Bias Bobbin Coil</td><td>ETSS I28413</td><td>Phase</td><td>100% full length, both SGs</td><td rowspan="3">Expansion according to degradation mechanism confirmed</td></tr>
<tr><td>0.610 inch +Pt; 0.610 inch Mag Bias +Pt for PVN as needed</td><td>ETSS 22401.1</td><td>Phase</td><td>100% Dings >5V, Dents, 2V, PVN >1V</td></tr>
<tr><td>Anomalous Tubesheet Signals</td><td>Tubesheet expansion joint</td><td>0.610 inch 3-coil +Pt</td><td>ETSS 20511.1</td><td>Phase</td><td>BLG above TTS, DTI in tubesheet</td></tr>
<tr><td rowspan="2">Tube-to-Tube Proximity</td><td rowspan="2">U-bends</td><td>0.610 inch Mag Bias Bobbin Coil</td><td>N/A, see Reference (A)</td><td>Vertical maximum voltage and phase</td><td>100% full length, both SGs</td><td>None</td></tr>
<tr><td>0.580 inch pancake coil</td><td>N/A, see Reference (A)</td><td>Vertical maximum voltage and phase</td><td>Bobbin PRX >1V</td><td>None</td></tr>
<tr><td>Tube-to-AVB Proximity</td><td>U-bends</td><td>0.580 inch pancake coil</td><td>N/A, see Reference (A)</td><td>Peak-to-Peak voltage</td><td>None</td><td>Sampling may be performed based on inspection results</td></tr>
</table>

A) LTR-SGMP-12-42, Revision 1, "Waterford RSG Tube-to-Tube and Tube-to-AVB Proximity Testing Summary," July 2012

D. Location, Orientation (if linear), and Measured Sizes (if available) of Service Induced Indications.

Table D-1 "SG31 Service Induced Indications- Wear at AVBs"

SG	ROW	COL	VOLTS	PER	LOCATION		COMMENT
31	57	74	0.11	7	A07	-0.05	
31	99	76	0.15	8	A08	0	
31	83	78	0.19	10	A07	0.11	
31	68	83	0.19	9	A07	0.11	
31	64	87	0.17	8	A03	-0.16	
31	109	92	0.14	7	A05	-0.33	

Table D-2 "SG32 Service Induced Indications- Wear at AVBs"

SG	ROW	COL	VOLTS	PER	LOCATION		COMMENT
32	99	72	0.2	10	A04	0	
32	101	76	0.3	13	A08	0.06	
32	112	79	0.17	9	A08	0	
32	114	79	0.14	8	A08	-0.09	
32	95	80	0.15	8	A05	0	
32	99	80	0.19	10	A05	0.15	
32	115	80	0.25	13	A05	0.2	
32	117	80	0.13	7	A07	-0.05	
32	112	81	0.21	11	A07	-0.28	
32	122	81	0.19	10	A07	-0.09	
32	107	82	0.12	7	A07	0	
32	117	82	0.17	9	A08	-0.09	
32	126	83	0.17	9	A05	0	
32	103	84	0.12	7	A07	0	
32	121	84	0.14	8	A06	-0.12	
32	120	85	0.31	14	A06	-0.05	PTP*
32	99	86	0.12	8	A08	-0.1	
32	129	86	0.3	15	A05	0	PTP*
32	131	86	0.19	12	A05	-0.08	
32	122	87	0.22	11	A06	0.05	
32	124	87	0.16	9	A04	0	
32	124	87	0.12	7	A05	0.05	
32	99	88	0.16	10	A05	-0.12	
32	99	88	0.16	10	A06	-0.04	
32	107	88	0.12	8	A06	-0.07	
32	127	88	0.13	9	A07	-0.1	
32	98	89	0.1	7	A06	0	
32	114	89	0.1	7	A09	0.13	
32	118	89	0.14	9	A02	-0.1	
32	126	89	0.72	25	A05	0.32	PTP*
32	103	90	0.14	8	A04	-0.09	
32	117	90	0.2	11	A05	0.08	
32	125	90	0.33	14	A08	0	PTP*
32	104	91	0.26	13	A06	0.07	
32	126	91	0.14	8	A04	0	
32	93	96	0.13	7	A03	0	
32	82	97	0.13	8	A02	-0.16	
32	82	97	0.26	13	A03	0	

*Preventative Tube Plug

E. Number of Tubes Plugged During the Inspection Outage for Each Degradation Mechanism.

Table E-1

Tube Status	SG - 31	SG - 32
Tubes in service prior to RF19	**8968**	**8968**
Total Number of tubes previously removed from service	**0**	**0**
Repair Candidates from RF 19:		
Service Induced Wear at AVBs	**0**	**4**
Total Candidate Tubes Repaired	**0**	**4**
Total Repair	**SG - 31**	**SG - 32**
Total Stabilizers Installed - RF19	**0**	**0**
Total Tubes Plugged - Post RF19	**0**	**4**
Total SG % Plugged - Post RF19	**0.0%**	**0.04%**

F. Total Number and Percentage of Tubes Plugged to Date and the Effective Plugging Percentage.

Table F-1

Total Number and Percentage of Tubes Plugged to Date

Year	Outage	EFPY	SG31 Plugs	SG32 Plugs	Total	Cumulative Plugging
2012	Pre-Service	0	0	0	0	0
2014	RF19	1.20	0	4	4	4
Total Plugged to Date			**0**	**4**	**4**	**4**
Percent Plugged to Date			**0**	**0.04%**		

Table F-2

Effective Plugging Percentage

Generator	# Plugged	% Plugged
SG31	0	0%
SG32	4	0.04%

G. The Results of Condition Monitoring, Including the Results of Tube Pulls and In-situ Testing.

Waterford 3 did not perform any tube pulls or in-situ testing during the RF19 inspection. Based on the Waterford 3 RF19 inspection results, no tubes contained indications which represented a challenge to structural or leakage integrity and all condition monitoring requirements are satisfied.

No primary to secondary leakage is predicted for the eddy current indications observed during the baseline in the event of a postulated SLB event.

Waterford 3 has a current Plant Specific Leakage limit of 0.375 gallons per minute for an "accident-induced leakage limit". The predicted leakage is zero, thus the accident-induced leakage limit is met.

OVERALL CONCLUSIONS

During the Waterford 3 first inservice steam generator tube inspection, no indications were found exceeding the structural integrity limits (i.e., burst integrity > 3 times normal operating primary to secondary pressure differential across SG tubes).

Therefore, no tubes were identified to contain eddy current indications that could potentially challenge the tube integrity requirements of NEI 97-06. Similarly, all operational assessment structural and leakage integrity requirements are satisfied. Based on the observed indications, the Waterford 3 SGs are expected to meet all structural and leakage integrity requirements at EOC-21 when the second in-service inspection will be performed.