NEXTera ENERGY SEABROOK

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U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Seabrook Station

Steam Generator Tube Inspection Report

Enclosed is the Seabrook Station Steam Generator Tube Inspection Report. NextEra Energy Seabrook, LLC is submitting this report in accordance with Seabrook Station Technical Specification 6.8.1.7, Steam Generator Tube Inspection Report. This report provides the results of the steam generator tube inspections conducted during refueling outage 14 in April 2011.

If you have any questions regarding this submittal, please contact me at (603) 773-7745.

Sincerely,

NextEra Energy Seabrook, LLC.

Michael O'Keefe
Licensing Manager

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cc: NRC Region I Administrator
G. E. Miller, NRC Project Manager
W. J. Raymond, NRC Senior Resident Inspector

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1.0 Introduction

Appendix A provides a list of acronyms.

Seabrook Station is a Westinghouse four-loop pressurized water reactor with Model F SGs. The SGs are U-tube heat exchangers with tube bundles fabricated using thermally treated Alloy 600 tubing. A row and column number identifies each tube. Each SG contains 5,626 tubes arranged in 59 rows and 122 columns. Nominal tube OD is 0.688" with a 0.040" nominal wall.

During Seabrook's thirteenth refueling outage (OR13) in October, 2009, SGs A, B, C, and D were inspected with ECT. During that inspection, one axial ODSCC indication was detected in the hot-leg tubesheet expansion transition region of a tube in SG-C. Per TS 6.7.6.k.d.3, an inspection for the damage mechanism reported was required to be performed in the next outage (OR14). The ECT inspection in OR14 was performed in accordance with Seabrook Station TS 6.7.6.k. This report presents the results of the inspection pursuant to TS 6.8.1.7, "Steam Generator Tube Inspection Report."

Seabrook Station TS 6.7.6.k and the EPRI Steam Generator Examination Guidelines, Revision 7, define the required inspection periods and their duration. For Alloy 600TT tubing, the first inspection interval is 120 EFPM; the second inspection interval is 90 EFPM; the third and subsequent inspection intervals are 60 EFPM. The requirement to complete inspection of 100% of the tubes by the end-point of the inspection interval was met by the previous inspections performed at OR13. The inspection performed during OR14 was performed to inspect for a specific degradation mechanism, expansion transition ODSCC.

2.0 Scope of Inspections Performed

The inspection scope was required by Seabrook Station TS 6.7.6.k.d.3 and the EPRI Steam Generator Examination Guidelines, Revision 7. The defined inspection scope for OR14 was:

- SG-C: 100% Hot leg TTS, ± 3", +Point examination.
- SG A, B, & D: 20% Hot leg , TTS ± 3", +Point examination
- Visual inspection of all mechanical and weld plugs.
  +Point inspection bounding the tubes exhibiting PLP signals during the inspection.
- 100% inspection of previously reported wear indications in the scope range of ±3".

Inspection Expansion

There were no inspection expansions.

Secondary Side

The following work was performed on the secondary side of the SGs:

- Top-of-Tubesheet ASCA.
- Sludge Lancing.
- FOSAR in the tube lane and annulus areas.
- SG C Nail retrieval.

3.0 Degradation Mechanisms Found

The following degradation mechanism was observed in the Seabrook Station SGs during OR14:

- One new volumetric indication was reported in SG-A in tube R55C70 at TSH+0.14"
  (Most likely caused by transient foreign object)

4.0 NDE Techniques for Damage Mechanisms

Following is a list of the EPRI ETSS used for degradation detection during the OR14 ECT inspection (with the rotating +Point coil).

• Wear due to Foreign Objects	EPRI ETSS # 27901.3 through 27907.3
• Sludge Pile ODSCC	EPRI ETSS # I28413
• Tubesheet Expansion ODSCC	PRI ETSS #21409.1 and #21410.1
• Tubesheet Expansion PWSCC	EPRI ETSS #20510.1 and #20511.1

5.0 Service Induced Flaws

Volumetric Indications

Volumetric indications were reported in three of the four SGs as summarized in Table 1. One new volumetric indication was reported during OR14 in SG-A. This indication is similar to previously reported indications at the top of the tubesheet. Typically, indications of wear due to transient foreign objects exhibit no growth during subsequent operation. The previously reported indications exhibited no evidence of growth since the time when they were identified in prior inspections. Similarly, no growth of the new

volumetric indication attributed to a transient foreign object is expected. These indications met the performance requirements for condition monitoring and, absent growth, also meet the requirements for operational assessment. These indications are acceptable for continued operation until, at least, OR15.

Table 1
Volumetric Indications

SG	Row	Col	Location (@OR14)	ECT Code	Depth (%TWD) per ETSS 21998.1		
					OR11	OR13	OR14
A	49	29	TSH+0.22"	VOL/PCT	22%	22%	22%
	50	29	TSH+0.22"	VOL/PCT	11%	11%	15%
	55	70	TSH+0.14"	VOL/PCT	NDD	NDD	19%
B	43	96	TSH+0.05"	VOL/PCT	22%	21%	19%
C	43	26	TSH+0.14"	VOL/PCT	21%	23%	21%
	44	26	TSH+0.16"	VOL/PCT	13%	13%	9%

Foreign Objects/PLP

Wear due to impingement of foreign objects on the tubes is categorized as an existing degradation mechanism due to the confirmation of loose parts in prior inspections at Seabrook. Foreign objects may be identified by both visual inspection from the secondary side and by ECT inspection from the primary side. Visual inspections result in photographic evidence of foreign objects, if any, and ECT inspection results in PLP codes.

The only new objects identified were "sludge rocks," indigenous materials that have been shown not to damage the tubes.

During the OR11 ECT inspection, a foreign object with associated wear was detected. The foreign object that caused the wear was subsequently identified as a metallic nail. The nail was successfully removed from the SG during OR14 and, therefore, does not represent future potential for damage. Fourteen tubes surrounding the prior location of the nail remain plugged.

Only two known or presumed remaining foreign objects remain in the SGs.
Foreign objects known to exist in the SGs are:

- A small dumbbell-shaped object tightly captured between two plugged tubes above the top-of-tubesheet in SG-C. The object has been lodged between the two tubes since the first inspection in OR01.

- An object just above R6C2 – 5H in SG-A. The object was identified during OR08. Seven surrounding tubes were plugged to provide a boundary against wear propagation.

Thus, the performance criteria for operational assessment are satisfied and operation of the SGs until the next inspection at OR15 is justified. Sludge rocks are not considered to have the potential to damage the tubes. Further, wear on active tubes attributed to non-resident, transient foreign objects has not exhibited any growth; therefore, satisfaction of performance criteria for condition monitoring also satisfies the criteria for operational assessment. It is concluded that tubes with volumetric indications (attributed to foreign object wear) that are still in service are acceptable for continued operation until the next inspection at OR15.

Table 2 summarizes the PLP indications found in the SGs during the TTS (±3″) +Point RPC program of the primary side ECT inspection. Also shown on Table 2 are the results of prior inspections (OR11 and OR13) at the same locations. In SG-C, a PLP call in R40C92 from the OR13 inspection was confirmed to have NDD during OR14.

Table 2
Seabrook Steam Generator Potential Foreign Objects (PLP)

SG	Row	Col	Location (OR13)	OR11	OR13	OR14
A	1	9	TSH+0.18″	NDD	PLP/NDD	PLP
	1	10	TSH+0.29″	NDD	PLP/NDD	PLP
	1	11	TSH+0.12″	NDD	PLP/NDD	PLP
B	3	104	TSH+0.09	NR	PLP	INR
C	40	92	TSH+0.05″	NR	PLP	NDD
D	41	27	TSH+0.06″	NR	PLP	PLP
	42	27	TSH+0.04″	NR	PLP	PLP

6.0 Plugging

There were no tubes plugged in OR14.

The current plugging level and percentage in each steam generator is shown in table 3. This is also the effective plugging level.

Table 3
Total Tubes Plugged and Plugging Percentage

	SG-A	SG-B	SG-C	SG-D	Total
Tubes Plugged	**34**	**25**	**50**	**64**	**173**
Percent Plugged	**0.6%**	**0.4%**	**0.8%**	**1.1%**	**0.77%**

7.0 Condition Monitoring Assessment Results.

All indications found in OR14 satisfy the condition monitoring requirements of NEI 97-06 for structural and leakage integrity. No indications were found to exceed structural limits. These conclusions are based on the evaluations included in this report as supported by the conclusions of the OR13 condition monitoring and operational assessment and are summarized below:

a. No indications of ODSCC or PWSCC were detected during OR14. Therefore, these degradation mechanisms are not of concern for operation until OR15.

b. Volumetric indications meet the requirements for condition monitoring at 95% probability and 50% confidence. The maximum observed indication was 22% TWD, attributed to a transient foreign object. The structural limit for the local wear is 70% TWD. The evaluation of the observed wear indication, including all sizing uncertainties from the applicable ETSS, shows that the requirements for condition monitoring have been met.

c. No volumetric indications attributed to pitting were observed.

8.0 Observed Leak Rates

The only observed operational leakage is in SG-B. The leakage fluctuates between 0.2 and 0.7 gpd. There is no observed leakage in SGs A, C, or D.

9.0 Calculated Accident Induced Leakage

Seabrook operations in Cycle 13 were free from primary to secondary SG leakage in SGs-A, C and D.

Leakage between 0.2 gpd and 0.7 gpd has been reported in SG-B for a number of cycles without change. The observed leakage is well within the TS limits for Seabrook. Because the temporary ARC approved prior to OR13 is in place until OR15, the leakage criteria of this ARC still apply. The maximum predicted accident induced leakage would be 1.75 gpd of it is assumed that the entire observed leakage stems from the tubesheet expansion region in SG B.

10.0 Secondary Side Inspections/Cleaning

Top of tubesheet ASCA were applied to all four SGs. Approximately 98 lbs of iron were removed from all SGs during the process.

Sludge lancing removed approximately 323 lbs from the top of tubesheet area from all four SGs.

FOSAR inspections of the annulus and tube lanes were performed in all four SGs. Other than sludge rocks and a soft, flexible item characterized as "duct tape" (which was removed), no foreign objects were found.

The foreign object located in SG-C on the FDB in OR11 was successfully removed in OR14.

Appendix A
Accronyms

ARC	Alternate Repair Criteria
ASCA	Advanced Scale Conditioning Agents
AVB	Anti Vibration Bar
DBA	Design Bases Accident
ECT	Eddy Current Testing
EFPM	Effective Full Power Months
EPRI	Electric Power Research Institute
ETSS	Examination Technique
FDB	Flow Distribution Baffle
FOSAR	Foriegn Object Search and Retrieval
DSI	Distorted Support Indication
DSS	Distorted Support Signal
GPD(gpd)	Gallons per Day
HL	Hot Leg
ID	Inner Diameter
NDD	No Degradation Detectable
NDF	No Degradation Found
NEI	Nuclear Energy Institute
OD	Outside Diameter
ODSCC	Outside Diameter Stress Corrosion Cracking
PCT	Percent
PLP	Possible Loose Part
PWSCC	Primary Water Stress Corrosion Cracking
SAI	Single Axial Indication
SCC	Stress Corrosion Cracking
SG	Steam Generator
TS	Technical Specifications
TSP	Tube Support Plate
TTS	Top of Tube Sheet
TWD	Though Wall Distance
VOL	Volumetric