NEXTera® ENERGY SEABROOK

SBK-L-21056
May 20, 2021

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

Seabrook Station
Docket No. 50-443

Seabrook Station
Response to Request for Additional Information Regarding Seabrook Steam Generator Tube Inspection Report Review

References:

1. NextEra Energy Seabrook, LLC letter SBK-L-20127, "Steam Generator Tube Inspection Report", October 20, 2020 (ML20295A551).
2. NRC "Request for Additional Information Regarding Seabrook Steam Generator Tube Inspection Report Review", April 07, 2021 (ML21097A251).

In Reference 1, NextEra Energy Seabrook, LLC (NextEra Energy Seabrook) submitted the 2020 Steam Generator Tube Inspection Report required by Technical Specification (TS) 6.8.1.7, which provided the results of the steam generator tube inspections conducted during Refueling Outage (RFO) 20 in April 2020.

In Reference 2, the NRC requested additional information to complete their evaluation of the information provided within Reference 1.

The enclosure provides NextEra Energy Seabrook's response to the NRC's Request for Additional Information (RAI).

If you have any questions regarding this correspondence, please contact Mr. Matthew Levander, Licensing Manager, at (603) 773-7631.

No new or revised commitments are included in this letter.

Executed on May 20, 2021.

Sincerely,

NextEra Energy Seabrook, LLC

Matthew Levander
Licensing Manager

Enclosure

cc: NRC Region I Administrator
NRC Project Manager
NRC Senior Resident Inspector

Enclosure to SBK-L-21056

Response to Request for Additional Information Regarding Seabrook Steam Generator Tube Inspection Report Review

By letter dated October 20, 2020 (Agencywide Documents Access and Management System Accession No. ML20295A551), NextEra Energy Seabrook, LLC (the licensee) submitted information summarizing the results of the spring 2020 steam generator (SG) tube inspections performed at Seabrook Station, Unit No. 1 (Seabrook) during refueling outage 20 (OR20).

In reviewing the submitted information, the U.S. Nuclear Regulatory Commission (NRC) staff has determined that additional information is necessary to complete its review.

Responses to the requests for additional information (RAI) are provided below.

Note: A list of the acronyms and abbreviations used in the responses to the RAIs is provided in the last section of the Enclosure.

RAI – 1:

Appendix B of the report states that review of the eddy current data from previous inspections identified discernable signals for some of the axial outside diameter stress corrosion cracking (ODSCC) indications detected at dented tube support plate intersections during the OR20 inspection in spring 2020. Cracking at tube geometric changes, such as dents, can be difficult to detect due to the presence of masking signals. The report states that the signals were not identified as flaw signals during the previous inspections. For those axial ODSCC indications at dented tube support plates in OR20 that had discernable signals in previous inspections, please provide the following:

a. Describe the analysis approach, including techniques and historical data review, that led to the conclusion that cracks were present in the dented locations.

b. For each crack indication, using the new analysis protocol developed in 2020, identify the inspection in which a flaw signal was first discernable.

c. Discuss the lessons learned from the 2020 inspections and any actions being taken to increase the probability of detecting similar cracks in future inspections.

d. Please discuss any insights about relative eddy current probe performance and the importance of supplemental inspections. For example, Table 2 of the report shows ODSCC indications in adjacent tubes (Row 10 Column 121 and Row 11 Column 121) at dents with bobbin probe voltage less than two volts. Both indications were classified as bobbin probe distorted dent signals and +Point™ single axial indications, but the array probe detected only one of them.

Seabrook Station Response to RAI – 1:

a. During OR20, the bobbin probe analysis approach for dents at structures was as follows: Per the dent/ding flowchart in the bobbin ETSS, signals measuring ≤175 degrees on Channel P1 (or if an ID indication is present in the dent) are to be reported as DDI (distorted dent indication). Analysis instructions also allow the data analysts to report "DSI" (distorted support indication) from channel P1 if the signal is distorted and flaw-like. The data analysis guidelines instruct the data analysts to review history from the oldest bobbin data digitally available for each SG (OR5/OR6).

   As discussed in Section A of the OR20 SG Tube Inspection Report (Reference 1), dents >5 volts were part of the +Point™ special interest exams. For most of the dented locations examined, the signal from the dent was straight-forward and not distorted. In those cases, the resolution analysts assigned the "no degradation found" (NDF) reporting code. Except

for the dent in tube R16C5 at 08H, all the dents associated with crack-like indications in OR20 were traceable to preservice inspection data with no change in voltage (amplitude). The dent in tube R16C5 at 08H first appeared in the 1997 data and measured at 0.95 volts.

The dent indication in tube R16C5 at 08H reached the ≥ 2 volts bobbin probe reporting criteria in OR20 (see Table 2-1 below) and had a small distorted signal that had obviously changed from the 1997 data, and was assigned a "distorted dent indication" (DDI) code. The +Point™ probe exam of the location also showed a strong/clear (high POD) SAI indication. This 2020 indication in tube R16C5 heightened sensitivity during the inspection to the analysis of dented locations with complex +Point™ probe signals. It was judged that this could be indicative of possible ODSCC at the dented locations. Although the other tubes in SG-B with bobbin dent indications did not exhibit the obvious change from the 1997 bobbin data as evident in tube R16C5, they all had fairly complex +Point™ signals. Due to the discovery of the confirmed SAIs in R16C5 at 08H, the resolution analysis team agreed the most conservative approach was to report (as SAIs) all +Point™ probe indications at dented structures that had distorted +Point™ signals.

b. Using the approach of reviewing the earliest available +Point™ historical data, initial signal formation for the SAIs reported in OR20 was observed as follows:

Location			Flaw signal first discernable in
Row	Col	elevation	
10	121	08H+0.31	OR20
11	121	08H+0.4	OR15
14	119	08H+0.51	OR15
15	120	08H-0.63	OR15
16	120	08H+0.41	OR15
		08H-0.45	OR15
13	120	08H-0.37	OR15
14	120	08H+0.49	OR15
		08H-0.42	OR15
15	119	08H+0.61	OR15
16	119	08H+0.63	OR15
		08H-0.33	OR15
16	5	08H+0.51	OR20
		08H-0.48	OR20
42	102	08C-0.51	OR17

c. The key lessons learned for Seabrook from the 2020 SG inspections are as follows:
   - Use earliest available +Point™ data for historical comparison: During the OR20 ECT exams, historical +Point™ data was available for use by the resolution analysts to review/compare flaw-like signals; however, the resolution analysis instructions did not specify the inspection year's data to use for that review. As a result, the process lacked clear guidance for performing historical lookbacks of +Point™ coil data so that indications showing discernable signals may be identified at the earliest opportunity. In future inspections, resolution analysis instructions will require the resolution analysts to use the earliest available +Point™ data when reviews are performed. Industry guidance

including a flow-chart for TSP Dent analysis is also being revised by SGMP to emphasize the year of data to be used for historical reviews.

- Ensure ECT analysts are trained to recognize complex low-level signals: This lesson was the main take-away from the SAI reported in the tube at R16C5 at 08H (described in the response to Item a. of RAI-1). Some complex dent/crack-like indications could potentially be mischaracterized since the dent and/or lift-off signals may affect some potential flaw signals. Future ECT analysts taking the site-specific performance demonstration (SSPD) training prior to a SG inspection will be trained to identify distorted +Point™ signals that could potentially be ODSCC at the dented locations. Seabrook has provided the OR20 crack-like indications and historical crack-like data back to 2012 to EPRI SGMP for posting on EPRIq.com so that other plants can include the data signals in their SSPDs for future inspections.
- Analysts should also use multiple channels to diagnose dents at structures: The ¼ prime frequency differential channel (bobbin coil) has typically been used to determine if a free-span ding indication had changed from history. A review of OR20 results show that the change of dent-related indications at structures was more evident when using the ¼ prime frequency differential channel. This experience was provided to the EPRI SGMP and is being used to develop guidance to further aid ECT resolution analysts in the detection of a signal change (when compared to historical data) for dent indications at structures.

d. The DDS indications in tubes R10C121 and R11C121 at 08H were reported in OR20 at 2.41V and 4.06V, respectively; corrected information is provided in Table 2-1 below. Since the array probe has limited EPRI-qualified Appendix H/I techniques, technique extension was used for different regions of interest (ROIs) in the Seabrook SGs in OR20 including axial ODSCC at dented TSPs. ETSS 20402.1 Rev 5 was justified for the array probe to be extended for axial ODSCC at dents at structures up to 7.5 volts. The array probe employs an array of non-surface riding coils and has less sensitivity to small surface imperfections (compared to surface-riding RPC probes like +Point™) as the probe passes through the tube. It is plausible that this characteristic may be the underlying reason for the discrepancy in the array probe results for the indications that were sampled in OR20.

   The array probe results obtained in OR20 during Appendix H/I technique extension, highlight the importance of using multiple probe types during diagnostic/special interest and supplemental exams. Even though the array probe may be qualified for the application, a confirmatory reading with the +Point™ probe at "dents at structures" is recommended during future inspections for Seabrook based on the experience from the OR20 SG ECT exams.

RAI – 2:
Table 2 shows that the detected cracks had bobbin probe voltages either less than 2 volts or greater than about 9 volts. Please describe how this distribution for crack indications compares to the distribution of all bobbin probe dent voltages (i.e., dents with and without cracks), and whether any correlation was identified between cracking and bobbin probe dent voltage.

Seabrook Station Response to RAI – 2:

Correction to reported information: In Table 2 of the OR20 SG Tube Inspection Report (Reference 1), four indications were inadvertently denoted with bobbin dent sizes "<2V" instead of "≤5V". Corrected information for these indications is provided in Table 2-1 below along with the actual reported bobbin dent voltages.

Table 2-1

Location			Bobbin dent		
Row	Col	elevation	size	voltage in OR20	Code
10	121	08H+0.31	≤5V	2.41V	DDS
11	121	08H+0.4	≤5V	4.06V	DDS
16	5	08H+0.51	≤5V	2.16V	DDI
		08H-0.48	≤5V	1.13V	DSI

Response to RAI-2: As shown in Table 2 of Reference 1, the OR20 crack-like indications at dents had bobbin probe reporting codes: DDI/DSI, DDS and DNT. In the analysis below, for each type of bobbin dent code reported, the bobbin probe dent sizes of crack-like indications are compared with the distribution of bobbin probe dent sizes at the uppermost TSP.

DDI: Only one other bobbin DDI was reported on a tube without cracks. It was in the cold leg (08C) and measured 2.13V by the bobbin probe. The 2.13V is of the same order of magnitude as the single 2.16V on the crack-like indication (see Table 2-1 above). It was also noted that the bobbin DDI on the non-cracked tube was also on a peripheral tube like the OR20 crack-like indications. (DSI: Although DSI is not a dent reporting code, for completeness, it should be noted that no other bobbin DSI indications were reported in the top TSP during the OR20 inspection.)

DDS, DNT: The remaining OR20 crack-like indications were classified as bobbin DDS (HL only) and bobbin DNT (HL, CL). The population distribution of reported bobbin probe dent voltages in the top TSP is summarized in Table 2-2 below:

Table 2-2

Bobbin code	Elevation	Total	Range (Volt)	Median	Mean	Std Dev
DDS	08H	156	0.62 – 4.65	2.48	2.64V	0.88
DNT	08C	175	2.25 – 19.24	7.24	8.01V	3.22
DNT	08H	105	2.1 – 16.01	6.91	7.18V	2.81

Referring to Table 2 of Reference 1 and Table 2-2 above, the following observations are noted:

- For the two crack-like indications reported as DDS by bobbin in OR20 (Table 2), the bobbin probe dent voltage of one was closer to the mean of the distribution; the other was closer to the top of the voltage range. It was also noted that the tube with the SAI reported at R10C121 (Table 2) also had a non-cracked bobbin DDS reported at the lower edge of the TSP. Although not crack-like, the DDS at the lower edge reported the highest bobbin probe dent voltage (4.65V) of the entire DDS population at 08H.
- For the single crack-like indication reported in the CL (Table 2), the bobbin probe DNT voltage was close to the mean of the distribution.

- The remaining 10 crack-like indications coded as bobbin DNT in the HL in OR20 (Table 2) were all ≥9V, and above the mean and median of the bobbin probe dent voltage distribution. The largest cracked dent voltage (16.01V) was also the highest voltage in the distribution of all bobbin probe DNT voltages at 08H.

RAI – 3:
The report identifies volumetric wear indications from tube support plates in SG-C and SG-D that were newly reported in OR20 but had discernable signals in previous inspections according to historical data review. Two of the indications had depths of 23 and 28 percent through-wall when first reported in OR20. Please describe the site reporting requirements for volumetric indications relative to these indications.

Seabrook Station Response to RAI – 3:

The bobbin coil reporting requirements for indications at tube support plates (TSPs) in the OR20 Bobbin ETSS were to report "DSI" from Channel P1 if the signal is distorted and flaw-like.

Channel P1 is a 2-channel mix that is designed/utilized by the data analyst to mix out the tube support response from the calibration standard's TSP ring, and output only the flaw component of the signal. The Channel P1 mix does not always completely mix out the TSP component of the mix channel output; therefore, some TSP residual may remain, making detection of low-level wear challenging.

This was the case for the 2 newly reported TSP wear indications in OR20. A bobbin DSI of 0.19V was reported for the indication in SG-C (R6C39). A historical review showed that the indication was visible back to the 2006 inspection with very little change between 2006 and 2020. A bobbin DSI of 0.33V was reported for the indication in SG-D (R5C100). Historical review showed that the indication was visible in 2018 with a very slight change from 2018 to 2020. The +Point™ sizing results (23%, 28%) of the two indications are likely overly conservative.

Abbreviations and Acronyms:

CL	Cold Leg	NDF	No Degradation Found
DDI	Distorted Dent Indication	ODSCC	OD Stress Corrosion Cracking
DDS	Distorted Dent Signal	POD	Probability of Detection
DNT	Dent	ROI	Region of Interest
DSI	Distorted Support Indication	RPC	Rotating Pancake Coil
ECT	Eddy Current Testing	SAI	Single Axial Indication
EPRI	Electric Power Research Institute	SG	Steam Generator
ETSS	Exam Technique Spec Sheet	SGMP	SG Management Program
HL	Hot Leg	SSPD	Site-Specific Performance Demonstration
ID	Inside Diameter		
NDD	No Degradation Detectable	TSP	Tube Support Plate