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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

References:

1. SBK-L-12274, Steam Generator Tube Inspection Report, December 31, 2012 (ML 13008A160)
2. SBK-L-14190, Steam Generator Tube Inspection Report, October 14, 2015 (ML 14297A090)

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 17 in the fall of 2015.

Included in this report is a revision to previously-provided AVB Wear data in Steam Generator Tube Inspection Reports for the outage 15 (Reference 1) and outage 16 (Reference 2) inspections. The revisions made were due to inadvertent errors in the Indications displayed in the AVB Wear tables for these inspections for SG-A only. The corrected data is provided in Table 3b of the report.

This letter contains no new regulatory commitments.

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NRR

If you have any questions regarding this submittal, please contact me at (603) 773-7512.

Sincerely,

NextEra Energy Seabrook, LLC.

Michael Ossing
Licensing Manager

Enclosure

cc: NRC Region I Administrator
R. Gladney, NRC Project Manager
NRC Senior Resident Inspector

Enclosure

Steam Generator Tube Inspection Report

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OR17 Steam Generator Tube Inspection Report

Introduction:

The enclosed Steam Generator Tube Inspection Report for Seabrook Unit 1 is submitted for the inspection of the SGs during refueling outage 17 (hereafter referred to as the OR17 inspection or outage), as required by Technical Specification section 6.8.1.7. Per the Seabrook Unit 1 Technical Specification section 6.7.6.k, the first ISI period is 120 EFPM; the second ISI period is 96 EFPM; the third and subsequent inspection periods are 72 EFPM. The inspection in OR17 was performed in accordance with Technical Specification 6.7.6.k, and was the third inspection of the SGs in the third ISI period. At unit shutdown for the OR17 inspection, the SGs had operated for approximately 21.79 EFPY (261.5 EFPM) since installation. This included operation for approximately 1.426 EFPY (17.1 EFPM) during the fuel cycle (cycle 17) leading up to the OR17 inspection. Initial entry into Mode 4 following completion of the OR17 inspection was made on November 5, 2015.

Seabrook Unit 1 is a Westinghouse 4-loop PWR with Model F steam generators. The SGs are U-tube heat exchangers with tube bundles fabricated using thermally treated Alloy 600 tubing. 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 thickness. The tubes have a square pitch arrangement and are supported by stainless steel, broached-hole, quatrefoil tube support plates (TSPs). The inspection of the SGs during the OR17 outage met the requirements of the Seabrook Unit 1 Technical Specifications and the EPRI SGMP: PWR Steam Generator Examination Guidelines, Revision 7.

Appendix A provides a list of acronyms used in this report. Appendix C provides a list of imperfections.

A. Scope of Inspections Performed on each SG

The inspection scope for OR17 met the requirements of Seabrook Unit 1 Technical Specification 6.7.6.k.d. Unless otherwise noted, the defined OR17 inspection scope in all 4 SGs was:

Primary-side:

- 100% full-length bobbin probe examination of all active tubes except U-bends of Rows 1 and 2. [This includes all high stress (minus 2-sigma) tubes, and 100% of dings/dents >2V and ≤ 5V.]
- 50% of U-bends of Rows 1 & 2 using the +Point™ probe
- Peripheral tubes (3 outermost tubes of each row) exposed to the annulus, and the tube-free lane inspected in the HL and CL at ± 3 inches from TTS using the +Point™ probe.
- 50% sample in HL from +3 inches TTS to the H* depth (-15.21 in.) using the +Point™ probe, including 50% of the BLG/OXP within the H* depth.
- Special interest exams based on the results of bobbin coil exams; 100% +Point™ probe inspection of all "I-codes" from bobbin.
- Augmented inspection (after bobbin) to improve the POD of axial ODSCC flaws at TSPs:
  - +Point™ probe inspection of all high stress (minus 2-sigma) tubes at HL & CL TSP locations.
  - Sampling of large noise residuals on non-high stress tubes in the HL at TSP locations using the +Point™ probe - characterized by a vertical maximum noise component of ≥ 0.45 volt on the P1 mix channel.
  - Approximately 68% of HL tubes in the +3 inches TTS to H* depth location in targeted zones that are prone to sludge deposition, using the +Point™ probe. (Note: only 50% was needed to complete the 100% sampling within the third ISI period.)

- Dings/Dents > 5V in the HL, U-bends and uppermost CL TSP (called 08C) using the +Point™ probe. [This included 100% of freespan Dings (small population); Dents: 100% sampled in SG-A and SG-D (small population); 80% in SG-B including 100% at 08C; 50% in SG-C.][1]
- Dings/Dents > 5V in the CL of low row tubes (Rows 1-10) from the FDB in the CL (01C) through second highest TSP (07C), using the +Point™ probe.

- Visual inspection of all mechanical and welded plugs.
- Channel head visual inspection, and bowl scan per Westinghouse NSAL 12-1, "Steam Generator Channel Head Degradation," January 5, 2012.

Inspection Expansion:

Two PWSCC indications (SG-A, SG-C) and one ODSCC indication (SG-C) were identified just below the TTS in the HL of 3 tubes. This resulted in an expansion of the inspection per the EPRI SGMP: PWR Steam Generator Examination Guidelines, Revision 7 and the degradation assessment. Specifically,

- PWSCC Indications: The +Point™ probe inspection scope was increased from 68% to 100% of the HL tubes from +3 inches TTS to the H* depth in the affected SGs (SG-A, SG-C).
- ODSCC Indication: The +Point™ probe inspection scope was increased from 68% to 100% of the HL tubes from +3 inches TTS to -3 inches in the affected SG (SG-C).
- No expansion was required in the unaffected SGs (SG-B, SG-D) since the base scope sampling included 68% of the +3 inches TTS to the H* depth (which was more than the 20% minimum).

Additional details on the PWSCC and ODSCC indications identified during the OR17 inspection is provided in section D and Appendix B of this report.

Secondary-side:

- Sludge lancing in all 4 SGs.
- FOSAR in all 4 SGs. Included TTS in-bundle inspections in 16 columns per SG.
- Upper bundle in-bundle (UBIB) inspection in SG-C.
- Upper steam drum inspection in SG-C.

B. Degradation Mechanisms Found

The following degradation mechanisms were identified during the OR17 inspection:

- Axial ODSCC in the HL expansion transition of SG-C
- Axial PWSCC just below the TTS in the HL of SG-A and SG-C
- Wear at AVB contact points.
- Wear (volumetric) indications at, or above the TTS and at TSPs.
- Maintenance-related wear at the FDB and in the free span.
- Foreign object wear

[1] Clarification on the horizontal tube support structures at Seabrook is available in NRC ADAMS Document, ML15128A188.

C. NDE Techniques utilized for each Degradation Mechanism

Table 1 is a list of the EPRI ETSSs used for degradation detection during the OR17 ECT inspection.

Table 1 - NDE Techniques for Degradation Mechanisms

Degradation Mechanism / Location	Detection Probe	Technique (ETSS)	
		Detection	Sizing
Wear at AVBs	Bobbin	96004.1 Rev 13	96004.3 Rev 13 (bobbin) 10908, Rev 1 (+Point™)
Wear at FDB and free span	Bobbin	96004.1 Rev 13	96004.1 Rev 13 (bobbin)
Wear at TSPs	Bobbin	96004.1 Rev 13	96910.1 Rev 10
Wear due to Foreign Objects at TTS +3 in.	+Point™	27901.3 thru 27907.3 Rev 1	21998.1 Rev4 27901.3 thru 27907.3 Rev 1
Wear due to Foreign Objects: Freespan, at Structures, or PLP present	+Point™	27901.3 thru 27907.3 Rev 1	21998.1 Rev 4 27901.3 thru 27907.3 Rev 1
	Bobbin	27091.2 Rev 1 21998.1 Rev 4	21998.1 Rev 4 96910.1 Rev 10
Axial ODSCC at sludge pile	Bobbin	96008.1 Rev 14 I28431 Rev 2	96008.1 Rev 14
	+Point™	21409.1 Rev 7-A 21410.1 Rev 6-C I28424 Rev 3-A I28425 Rev 3-A	21410 Rev 6-C I28431 Rev 3-A I28432 Rev 3-A
Axial ODSCC at TSPs, free span and Dents	Bobbin (dents < 5V)	96008.1 Rev 14 I28413, Rev 3 I28411, Rev 3	21409.1, Rev 7
	+Point™ (dents ≥ 5V)		I28431, Rev 2 128432, Rev2
PWSCC and ODSCC at TTS Expansion Transition	+Point™	ID: 20510.1 Rev 7-C 20511.1 Rev 8-A OD: 21409.1 Rev7-A 21410.1 Rev 6-C 20507.1 Rev 6 Ghent 3/4 Circ 20508.1 Rev 6 Ghent 3/4 Axial	20510.1 Rev 7-C 20511.1 Rev 8-A I28431 Rev 2-A 21410.1 Rev 6-C
PWSCC at Tubesheet Expansion Region (TTS to H* depth)	+Point™	20510.1 Rev 7-C 20511.1 Rev 8-A	20510.1 Rev 7-C 20511.1 Rev 8-A
Axial ODSCC at Dings and Dents (>2V but ≤ 5V)	Bobbin	10013.1 Rev 1 24013.1 Rev 2	I28431-A I28432-A
OD Pitting at sludge pile	Bobbin	96005.2 Rev 9	21998.1 Rev 4

D. Location, orientation (if linear), and measured sizes (if available) of service induced indications

ODSCC:

A single indication of axial ODSCC (SAI) was detected in SG-C in the HL expansion transition region (TSH-0.22 in.) of tube R26C61. The indication length was 0.17 inches; this equates to a structural equivalent length (SEL) of 0.11 inch, with 0.14 Volts as the largest signal amplitude. The structural equivalent depth (SED) was determined to be 36.4% based on a depth profile of the flaw. The tube was re-tested with the Ghent probe which confirmed the +Point™ indication. The tube was last examined at this location using

a rotating probe (MRPC) during the OR14 inspection in 2011; there was no evidence of the flaw at that time. There are no bulges or over-expansions (BLG/OXP) at this location.

PWSCC:

A single indication of axial PWSCC (SAI) was detected in SG-A in the HL expansion transition region (TSH-0.26 in.) of tube R20C80. The indication length was 0.14 inches; this equates to a SEL of 0.09 inch, with 0.60 Volts as the largest signal amplitude. The SED was determined to be 82.63% based on a depth profile of the flaw. The tube was re-tested with the Ghent probe which confirmed the +Point™ indication. The tube was last examined at this location using a rotating probe (MRPC) during the OR13 inspection in 2009; there was no evidence of the flaw at that time. There are no BLGs or OXPs at this location.

A single indication of axial PWSCC (SAI) was detected in the tube-to-tubesheet expansion region, just below the HL (TTS-0.62) of tube R39C46 in SG-C. The indication length was 0.13 inches; this equates to a SEL of 0.11 inch, with 0.65 Volts as the largest signal amplitude. The SED was determined to be 38.46% based on a depth profile of the flaw. The tube was re-tested with the Ghent probe which confirmed the +Point™ indication. The tube was last examined at this location using a rotating probe (MRPC) during the OR14 inspection in 2011; there was no evidence of the flaw at that time. There are no BLGs or OXPs at this location.

A single indication of axial PWSCC (SAI) was detected in the HL tubesheet (at the hydraulic tack expansion) of tube R24C56 in SG-D. The SAI is located at about 19 inches below the TTS (below the H* depth of 15.21 inches). The largest signal amplitude was 1.26 Volts. The indication was not sized since areas below the H* depth are excluded from inspection/repair through the alternate repair criteria (ARC) per Technical Specification 6.7.6.k.d. There is no previous MRPC inspection data in this area of the tube.

The SCC indications identified during the OR17 inspection are summarized in Table 2 below. No additional SCC indications (apart from the ones in Table 2) were identified during the OR17 inspection, including inspection expansion. See Appendix B for additional information including length/depth profiles of the above PWSCC and ODSCC indications that were profiled. The sizes of the listed indications below and the length/depth profiles in Appendix B supersede all preliminary indication data made available for review during the inspection at OR17.

Table 2 - OR17 SCC Indications

SG	Tube	Degradation Mechanism	Location	ETSS	Length (in.)		Depth (%)		Max Volts (+Point™)
					Measured	SEL	Max	SED	
A	R20C80	PWSCC	SAI at TTS-0.26"	20511.1 Rev 8	0.14 in.	0.09 in.	99%	82.63%	0.60V
C	R26C61	ODSCC	SAI at TTS-0.22"	I28431 Rev 2	0.17 in.	0.11 in.	45%	36.4%	0.14V
	R39C46	PWSCC	SAI at TTS-0.62"	20511.1 Rev 8	0.13 in.	0.11 in.	88%	38.46%	0.65V
D	R24C56	PWSCC	SAI at TTS-19.21"	Indication not profiled; below H* distance; not required.					

AVB Wear:

AVB wear continues to be an existing degradation mechanism in all four SGs at Seabrook. Table 3a summarizes the current inspection results for AVB wear, and the list of AVB indications reported during OR17 are included in Appendix C. The "number of indications" includes pre-existing and new indications. AVB indications were detected in all 4 SGs, as expected. One tube (R50C79 in SG-A) had 2 AVB wear indications ≥ 40% TW. The highest AVB wear indication was 42% TW. The total number of AVB indications is typical among the population of Model F SGs.

Table 3a - OR17 AVB Wear

SG	No. of Indications	Number of Indications ≥40% TW	New Indications[1]		New Tubes[2]
			Number	Max Depth	
SG-A	359	2 (1 tube)	17	20% TW	11
SG-B	274	0	10	17% TW	7
SG-C	243	0	5	17% TW	5
SG-D	477	0	14	22% TW	5

1. Includes indications on tubes without prior indications
2. Newly-reported with AVB wear indications with no prior history of AVB indications.

AVB Wear - Historical Data (corrected):

During the last cycle, revisions to the condition monitoring and operational assessment (CMOA) reports for the OR15 and OR16 inspections were issued by the SG inspection vendor. The key changes made were due to inadvertent errors in the Indications displayed in the AVB Wear tables for these inspections[2] for SG-A only. This was documented in Seabrook's corrective action program. The revised entries are all conservative in that each resulted in less "number of indications" (including new ones), "max %TWD" and/or "new tubes" w/ AVB wear. The revised AVB Wear indication table entries for OR15 and OR16 in SG-A is provided in Table 3b. (Only entries shown with a "strike-through" have been revised.)

Table 3b: OR15 & OR16 Corrected AVB Wear Data for SG-A

Inspection	No. of Indications	Number of Indications ≥40% TW	New Indications		New Tubes
			Number	Max Depth	
OR15	~~358~~ 357	3 (3 tubes)	24	20% TW	11
OR16	347	0	~~3~~ 2	~~17%~~ 14% TW	~~3~~ 2

Wear (Volumetric) Indications At or Above the TTS and at FDBs:

One newly-reported volumetric indication was detected in each of SG-B, SG-C and SG-D. These are low-level signals that were detected by the bobbin probe and subsequently confirmed as volumetric indications by the rotating +Point™ probe. A review of previous bobbin inspection data from the OR13 inspection shows that the indications in SG-B and SG-C were present at that time, but do not exhibit change relative to the OR17 data beyond normal signal variance. No new volumetric indications were reported in SG-A. The maximum depth among the newly reported volumetric indications is 32% TWD as sized using the technique of ETSS 21998.1. The maximum depth volumetric indication reported during the OR17 inspection is 39% TWD; this indication is associated with a historical maintenance activity. Of the previously reported volumetric indications, none showed evidence of growth.

Volumetric indications reported during the OR17 inspection are summarized in Table 4, which also includes prior calls, if any, from the previous inspection (OR16). These wear indications were all attributed to maintenance-related (MNT) activity, TSPs or transient foreign objects (FOs). Indications reported in row 1 that are located approximately 18" above the tubesheet or above the flow distribution baffle (FDB) plate are attributed to sludge lancing equipment used in the past. The wear indications were caused by interaction of the tubes with the sludge lance rail. The system has been redesigned to prevent this type of tube damage. Indications at the edge of support intersections (TSPs) that are axially aligned with the land contact point are attributed to wear through interaction with asperities in the support plate material.

The volumetric indications were all dimensionally sized using qualified ERPI ETSSs for the +Point™ probe. The specific ETSS used for each indication is based on the shape of the flaw from the ECT data; the ones used are listed at the bottom of Table 4.

[2] OR15 and OR16 SG Tube Inspection Reports are documented in ADAMS Accession Nos. ML13008A160 and ML14297A090, respectively.

Table 4 - OR17 Volumetric Indications

SG	Row	Col	Location	OR16	OR17	Comment
A	1	87	TSC+18.85"	28% A	28% A	MNT
A	1	36	TSC+18.09"	24% A	25% A	MNT
A	1	11	01C-1.68"	19% B	20% B	MNT
A	35	80	03H-0.46"	29% A	29% A	FO
A	35	88	03H-0.96"	16% A	21% A	FO
A	49	29	TSH+0.16"	No +Pt Test	22% A	FO (no growth from OR15)
A	50	29	TSH+0.12"	No +Pt Test	11% A	FO (no growth from OR15)
B	1	11	TSC+18.45"	31% A	33% A	MNT
B	1	87	TSH+18.32"	38% A	38% A	MNT
B	1	87	TSC+18.32"	39% A	39% A	MNT
B	1	112	TSH+18.35"	16% A	17% A	MNT
B	1	119	01H+16.16"	13% D	15% D	MNT
B	2	98	06C-0.83"	29% A	31% A	FO (called TSP before)
B	2	113	07H+1.07"	25% A	25% A	FO
B	5	86	04H-0.42"	9% C	14% C	TSP
B	22	97	05H-0.56"		32% C	TSP (newly reported) Present in 2009, no change
B	43	96	TSH+0.06"	No +Pt Test	19% A	FO (no growth from OR15)
B	54	87	01C+0.57"	18% A	19% A	FO
C	1	87	TSH+17.94"	34% A	31% A	MNT
C	1	87	TSC+17.94"	11% D	13% D	MNT
C	1	112	TSH+18.36"	22% A	18% A	MNT
C	3	90	07C-0.64"	21% A	18% A	TSP
C	3	113	05C-0.80"	29% A	32% A	FO
C	5	57	06C-0.64"	24% A	24% A	TSP
C	28	104	05C-0.63"	20% A	24% A	FO
C	32	24	04H-0.4"	26% C	30% C	TSP
C	32	35	07C+19.45"	9% A	8% A	FO
C	39	19	TSC+4.05"		8% A	FO (newly reported) Present in 2009, no change
C	43	26	TSH+0.07"	No +Pt Test	23% A	FO (no growth from OR15)
C	44	26	TSH+0.12"	No +Pt Test	11% A	FO (no growth from OR15)
D	1	87	TSH+18.42"	DFS	32% A	MNT
D	6	108	03H-0.41"	NDD	8% C	TSP (newly reported)
D	13	4	01C+0.41"	26% A	24% A	FO (called TSP before)
D	21	52	04H-0.41"	21% A	21% A	FO
D	42	19	03C+0.20"	4% C	10% C	TSP

Note: The EPRI ETSSs used for the rotating +Point™ probe depth sizing were: A = 21998.1 Volumetric Indications; B = 27902.3 Axial Groove Wear; C = 96910.1 Wear at Tube Supports; D = 27906.3 Tapered Wear

Foreign Objects Wear and PLP Indications:

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 the current and prior inspections at Seabrook. Volumetric indications that are at the edge of support intersections which are *not* aligned axially with the land contact point or which reside slightly above or below the support are attributed to interaction with transient loose parts. Similarly, indications in close proximity to the tubesheet are considered to originate from transient loose parts. The ECT results showed no evidence that foreign objects were currently present at these locations; the volumetric indications (Table 4) due to foreign object (FO) wear were due to transient foreign objects. No damage was identified in neighboring tubes as a result of foreign objects recovered in OR17 (discussed below in "secondary-side visual inspections").

In SG-A, potential loose part (PLP) indications were reported on 3 contiguous tubes in the Row 1 tubes and on a Row 18 tube. Because of their location, these PLPs are interpreted as sludge, or sludge rocks, which are benign to the tubes. These tubes remain in service. The PLPs were visually confirmed as a sludge rock between column 9 and column 10. There was no visible foreign object between column 10 and 11. These PLP indications have been reported at prior inspections. In SG-B, 5 tubes with PLP indications were reported; no damage to any tube was detected at these locations. Because of their history and location, the PLPs are attributed to sludge rocks and scale which are benign to the tubes. One PLP was reported above the 4th broached TSP on the HL (05H) in the interior of the bundle. All other PLPs were reported within a maximum distance of 4.67 inches above the TTS. Inspection of the adjacent tubes confirmed the absence of PLP signals in the surrounding tubes. These tubes remain in service. In SG-C, 2 adjacent tubes were reported with a PLP signal about 0.1" above the HL TTS in the interior of the bundle. The location of these tubes is typical for expected accumulation of deposits. No evidence of tube damage was found. The tubes remain in service. In SG-D, 6 tubes were reported with PLP signals. The PLP signals were reported in three clusters of contiguous tubes, one on the CL in the periphery and the other 2 on the CL in the interior above the TTS. Video review, the location, and pattern of these PLPs suggest the presence of deposits at these locations. No damage was associated with any of the PLP signals and the tubes were left in service.

Table 5 summarizes the PLP indications during the TTS (+3" to H* depth) +Point™ probe program and the 100% bobbin probe inspection of the tubes in the primary-side ECT inspection. Most of the PLP indications had been reported previously. No damage to the tubes was associated with these PLP locations.

Table 5 - Potential Loose Parts (PLPs)

SG	Row	Col	Location
A	1	9	TSH+0.14"
	1	10	TSH+0.14"
	1	11	TSH+0.13"
	18	118	TSH+0.47"
B	17	25	05H+0.82"
	25	10	TSC+4.37"
			TSC+4.61"
	24	10	TSC+4.5"
			TSC+4.67"
			TSC+0.29"
	24	9	TSC+0.2"
	30	6	TSH+0.58"
C	39	92	TSH+0.1"
	40	92	TSH+0.08"
D	8	67	TSC+1.41"
			TSC+1.41"
	1	33	TSC+0.27"
	21	29	TSC+0.81"
			TSC+0.82"
	20	29	TSC+0.98"
			TSC+0.81"
	21	28	TSC+1"
			TSC+1.02"
	20	28	TSC+1.01"
			TSC+1"

Secondary-side Visual Inspections:

- A total of approximately 64 lbs. of sludge was removed from the 4 SGs based on sludge lancing. Small amounts of soft sludge deposits were noted in the tubesheet annulus and tubelane areas during foreign object search after sludge lancing. Hard scale deposits were also noted on some tubes during TTS In-bundle exams.
- Ten (10) foreign objects were identified during FOSAR activities in OR17. They comprised of sludge rocks, scale, pieces of low-grade wires, a piece of scaffold wire and a legacy (dumbbell-shaped) object. All objects were retrieved with the exception of 2 legacy items: the dumbbell-shaped object in SG-C and a sludge rock in SG-A. Both legacy objects were confirmed to have remained in the same position since the last secondary-side inspection (OR15). An engineering evaluation is in place for the dumbbell-shaped object. No tube damage was observed in any SG during FOSAR activities.
- Upper bundle in-bundle (UBIB): Inspection was performed in SG-C to assess the condition of the quatrefoil lobes of the 3 uppermost TSPs. Inspections were performed in the 3rd flow slot for columns 76/77, and the 2nd flow slot for columns 70/71 on both the HL and CL. Deposits consisted on some sludge and scale build-up. In general, there was minimal obstruction of the quatrefoils, and the majority of the openings were visible.
- Upper Steam Drum: Visual inspection was performed in SG-C and included a sample of the primary and secondary moisture separators. Components inspected were found to be covered with mostly uniform layer of sparkling magnetite. The J-tubes of the feedring were found to have clean, sharp edges at the discharge orifices with only a very minimal amount of scouring observed. No anomalies were observed or documented during the upper steam drum visual inspections.

Geometric Anomalies:

In all four SGs, BLG signals were reported just above the TTS. Geometric anomalies at Seabrook are limited to BLG indications, artifacts of the tube expansion process, which occur principally within the tubesheet expansion region and occasionally above the TTS. All of the BLG indications reported at OR17 were previously reported during OR15 and prior inspections. No degradation was associated with any of the BLG signals. BLG indications were reported in R22C75 in SG-D at about 2.3 and 3.7 inches above the tubesheet on the CL. These indications were reported previously during OR15 and before. No degradation was detected in these BLG signals. The list of OR17 BLG indications is provided below in Table 6.

Table 6 - OR17 Bulge Indications Above the Tubesheet

SG	Row	Col	Loc'n @ OR17
A	46	98	TSH+0.62"
	48	63	TSH+0.58"
	21	101	TSC+9.98"
B	13	99	TSH+0.91"
	15	111	TSC+1.21"
C	14	119	TSH+0.08"
D	34	42	TSC+0.89"
	22	75	TSC+3.67"
	22	75	TSC+2.33"

Results of Misc. Special Interest Inspections:

Tubesheet Expansion Zone (TSEZ) Inspection: BLG/OXP signals have been associated with expansion region PWSCC in the industry operating experience and thus, are the most likely initiation points for PWSCC in the expansion region. A 50% sample of the BLG/OXP indications in the tubesheet expansion zone was inspected from the TTS+3" to the H* depth with the +Point™ probe. (The PWSCC indications in the TSEZ of SG-C and in the expansion transition region of SG-A were not associated with BLG/OXP locations. Inspection expansion led to a 100% +Point™ probe inspection from the TTS+3" to the H* depth in these SGs.) No evidence of degradation was found during this inspection within the TSEZ that is associated with BLG/OXP signals.

Tube Plug Inspection: The currently installed plugs were inspected for evidence of leakage as characterized by boron "star" patterns. The borated plugs were categorized in accordance with Westinghouse procedure MRS 2.4.2 Gen-44, Revision 1; "Visual Inspection of Plugs". No dripping plugs were identified; all plugs were classified as Category 1 and were found to be dry.

Channelhead Visual Inspection: Westinghouse NSAL 12-1 recommended visual inspection of the channelhead to determine if degradation of the channelhead cladding, the divider plate-to-channelhead weld and the weld at the top of the channelhead bowl drain tube had occurred. These areas were inspected during the OR17 outage. The observed condition during the OR17 inspection is consistent with the manufacturing process and does not exhibit any degradation. It was concluded that a condition similar to that documented in NSAL12-1 does not exist at Seabrook.

High Stress Tubes: 100% bobbin probe inspection of all high stress tubes was included in the base inspection scope for OR17. To increase the POD of axial ODSCC flaws at TSPs in these tubes, the OR17 inspection scope was augmented by performing +Point™ probe inspection at all HL and CL TSP locations. No SCC was detected during the inspections of the high stress tubes.

Potential Tube-to-Tube Wear: There are several tubes that were plugged for AVB wear in the first or second inspection interval. Based on this, a number of tubes in the U-bend were identified for monitoring for potential tube-to-tube contact with previously plugged, but continuing-to-wear, tubes. The adjacent tubes in the same row are monitored for tube to-tube wear. No evidence of any tube-to-tube contact was found during the OR17 inspection.

AVB wear was identified as a post-plugging continuing degradation mechanism with the potential for tube separation and subsequent damage propagation, based on an industry study regarding concerns identified in U.S. NRC Information Notice 2002-02. For Seabrook, an analysis was performed of the tubes plugged for AVB wear during the initial inspections based on linear extrapolation of observed wear depths. Based on this analysis, tubes were identified that are candidates for de-plugging and stabilization before the end of operating life of the SGs. A subsequent analysis was performed for Seabrook to determine if the tubes plugged for AVB wear represented a significant potential for separation and damage propagation. The analysis concluded that three (3) previously-plugged tubes required de-plugging, stabilization and re-plugging prior to the end of operating life of the SGs: R56C82 in SG-A (stabilize prior to 22.2 EFPY), R28C55 and R30C51 in SG-B (stabilize prior to 34.9 EFPY). To demonstrate its commitment to stabilizing plugged tubes to ensure that they do not compromise the integrity of adjacent active tubes per NRC IN 2002-02, Seabrook de-plugged and stabilized all 3 tubes listed above during the OR17 inspection.

U-bend Vibration and Fatigue Assessment: Although SGs with broached, stainless steel TSPs are specifically excluded by NRC GL 88-02, it may be postulated that the quatrefoil penetrations in the uppermost TSP can become occluded leading to a change in fixity condition at the TSP that may be structurally similar to corrosion-induced denting at the TSP. As a result, prior to the OR17 inspection, a Seabrook-specific analysis was performed by Westinghouse to evaluate the existing Seabrook condition with regard to the potential for fatigue failure of tubes due to an out-of-design specification AVB location and/or AVB insertion patterns that could lead to flow peaking factors. The results of this analysis showed that one tube (R10C10 in SG-A) was found to potentially have a high fatigue usage factor (≥ 1) if high levels of occlusion (blockage) exist at the TSP quatrefoil penetrations. The levels of occlusion needed to

meet this condition are not representative of Seabrook, and the analysis determined that for conditions representative of Seabrook, no remedial action is required. As a proactive step, this tube was tested in OR17 with a rotating probe on the HL side to determine if the tube remains free of an initiating flaw, and to provide information regarding the deposit accumulation in the TSP quatrefoils. The inspection data shows no evidence of deposits - indicating that the tube is not occluded. The OR15 data for this tube also showed no evidence of deposits. Results of the UBIB inspection in OR17 (discussed above under "secondary-side visual inspections) also show that the majority of the openings of the sampled, quatrefoil uppermost-TSP were visible, and any deposits noted were not obstructing the quatrefoils. This tube remains in service.

E. Number of tubes plugged during the inspection outage for each degradation mechanism

Four (4) tubes were plugged based on the OR17 inspection; the tubes plugged for each degradation mechanism are summarized below in Table 7:

Table 7 - OR17 Tubes Plugged

SG	Tube	Degradation Mechanism	Notes
A	R50C79	AVB Wear	40% at AV3, 42% at AV4
	R20C80	PWSCC (SAI)	PWSCC just below the TTS
C	R26C61	ODSCC (SAI)	ODSCC just below the TTS
	R39C46	PWSCC (SAI)	PWSCC just below the TTS

F. Number and percentage of tubes plugged to date, and the effective plugging percentage in each steam generator

The number and percentage of SG tubes plugged to-date, and the effective plugging percentage in each SG are summarized in Table 8.

Table 8 - Tubes plugged to-date and effective plugging percentage

	SG-A	SG-B	SG-C	SG-D	Total
Tubes Plugged	39	27	58	65	189
Percent Plugged	0.69%	0.48%	1.03%	1.16%	0.84%

G. Results of Condition Monitoring, including the results of tube pulls and in-situ testing

All indications found in OR17 satisfy the condition monitoring requirements of NEI 97-06 for structural and leakage integrity. No indications were found to exceed structural limits. The tubes identified for plugging were screened against the in-situ test selection criteria contained in the EPRI SGMP Steam Generator In Situ Pressure Test Guidelines, Rev 4, and provided for Seabrook conditions. None of the tubes identified for plugging met the requirements for in-situ testing.

a. Four (4) SAIs were identified below the TTS in the HL on 4 tubes during the OR17 inspection. One was characterized as ODSCC (R26C61 in SG-C) and was located in the expansion transition region; the others were PWSCC indications. One of the PWSCC indications (R24C56 in SG-D) was located below the H* depth (in the tube-to-tubesheet tack expansion region) and was therefore excluded from inspection and repair per site Technical Specifications. This tube remains in service. The other PWSCC indications were located just below the TTS (R20C80 in SG-A, R39C46 in SG-C). The ODSCC and PWSCC indications (apart from the one below the H* depth) were all evaluated for burst and leakage. Each was predicted to have 95% probability at 50% confidence of burst pressure that is greater than the limiting differential pressure ($3\Delta P_{NOP}$) for Seabrook of 3775 psid. All of the indications identified during the OR17 inspection met the CM requirements; none passed the screening criteria for burst and leakage testing. Additional information on the SCC indications is provided in Appendix B.

b. AVB wear continues to be an existing degradation mechanism at Seabrook. The overall incidence of AVB wear in the Seabrook SGs is consistent with the Westinghouse Model F SG operating experience. The maximum observed AVB wear indication (42% TW) was less than the structural limit (75% TW) for AVB wear, and met the CM requirements with 95% probability at 50% confidence, (when all uncertainties are considered at their 95% probability values).

c. Volumetric indications (indicative of mechanical wear) were reported in each of the 4 SGs and were attributed to tube interaction with historical maintenance equipment, foreign objects, or tube support structures. Volumetric indications at the FDB, TTS, and TSPs, Wear at the FDB and at, and above, the TTS were predicted to not progress; this was verified at the OR17 inspection. The highest volumetric indication (39% TWD) has shown no growth since the last inspection (OR16), and is less than the structural limit (75% TWD) when all uncertainties are considered. Therefore volumetric indications met the CM requirements with 95% probability at 50% confidence.

d. The previously-reported wear at the FDB was reported again during OR17. Examination of the prior inspection signals shows that the signals are not changing. FDB wear is attributed to the application of pressure pulse cleaning of the SGs and is observed in other Model F SGs at the same locations and depths. The magnitude of the wear does not challenge the requirements for condition monitoring.

e. The maximum wear observed during the OR17 inspection due to foreign objects was 32% TWD; the structural limit for the local wear is 65% TWD. There was no wear associated with any of the PLP indications reported during the OR17 inspection. Wear due to foreign objects meets the performance requirements for Condition Monitoring.

f. No pitting was observed during the OR17 inspection.

g. The predicted accident induced leakage for H* meets the Condition Monitoring leakage requirements. In SG-B, in which operating leakage has been observed, the predicted leakage from the tubesheet expansion region is 2.45 gpd (.0017 gpm). No leakage was detected from the prior ODSCC indications in SGs B and C. SGs A and D are free from indications with the potential to leak and have no reportable normal operating leakage. Therefore, the Seabrook SGs meet the Condition Monitoring requirements with regard to leakage.

h. The OR17 inspection results validate the projections and conclusions of the Operational Assessment of the previous inspection at OR15.

H. Primary-to-secondary leakage rate observed in each SG during the previous cycle

Seabrook has tracked detectable normal operating leakage in SG-B that has varied between 0.066 gpd and 0.983 gpd during the fuel cycle preceding the OR17 inspection. This low level of leakage has been detected for several cycles. No normal operating leakage has been detected in SG-A, SG-C, or SG-D.

I. Calculated accident induced leakage rate

For application of H*, Seabrook committed that the component of operational leakage from the prior cycle from below the H* distance will be multiplied by a factor of 2.49 and added to the total accident leakage from any other source and compared to the allowable accident induced leakage limit.

The assumed value for accident induced leakage in the Seabrook UFSAR is 500 gpd (=0.35 gpm) for the faulted steam generator and 940 gpd through the remaining three SGs, for a total leakage of 1440 gpd (=1.0 gpm). As stated in Section H, SG-B experienced leakage in the range of 0.066 gpd to 0.983 gpd in the fuel cycle preceding the OR17 inspection. Since there is no observed operating leakage from the remaining SGs (SG-A, SG-C and SG-D), the predicted accident induced leakage for each of these is zero.

Because there is no other degradation mechanism in SG-B that has been shown to be the source of the observed leakage, the entire observed operating leakage is assumed to come from the tubesheet

expansion region. Conservatively assuming that the operating leakage in SG-B is at the upper end of the observed range (i.e. 0.983 gpd), the predicted accident induced leakage (Q_{DBA}) in SG-B is:

Q_{DBA} = 2.49 x 0.983 gpd = 2.45 gpd (=0.0017 gpm)

Therefore, since the predicted accident induced leakage from SG-B (2.45 gpd) is less than the UFSAR limit (500 gpd) for leakage through any one SG, and less than the total leakage limit for all SGs (1440 gpd), the accident induced leakage performance criteria are met.

J. Results of monitoring for tube axial displacement (slippage)

A condition for licensing H* was to monitor for tube slippage within the tubesheet region. Monitoring for slippage was accomplished in accordance with the slippage monitoring guidance provided in Westinghouse LTR-SGMP-09-140 "H*: Guidance for Monitoring Tube Slippage Using the Bobbin Probe Data", September 22, 2009 (proprietary). No tube slippage was detected during the OR17 inspection.

APPPENDIX A - List of Acronyms

ARC	Alternate Repair Criteria
AVB	Anti Vibration Bar
BLG	Bulge
CL	Cold Leg
CM	Condition Monitoring
DA	Degradation Assessment
DBA	Design Bases Accident
DFS	Differential Freespan Signal
ECT	Eddy Current Testing
EFPM	Effective Full Power Months
EFPY	Effective Full Power Years
EPRI	Electric Power Research Institute
ETSS	Examination Technique Specification Sheet
FDB	Flow Distribution Baffle
FO	Foreign Object
GPD (gpd)	Gallons per Day
GPM (gpm)	Gallons per Minute
HL	Hot Leg
MNT	Maintenance Related
NDD	No Degradation Detectable
NEI	Nuclear Energy Institute
OD	Outside Diameter
ODSCC	Outside Diameter Stress Corrosion Cracking
OXP	Over-expansion
Per	Percent Through-Wall
PLP	Possible Loose Part
POD	Probability of Detection
PWSCC	Primary Water Stress Corrosion Cracking
SAI	Single Axial Indication
SCC	Stress Corrosion Cracking
SED	Structural Equivalent Depth
SEL	Structural Equivalent Length
SG	Steam Generator
SLB	Steam Line Break
TEC	Tube End Cold
TEH	Tube End Hot
TSC	Tube Sheet Cold
TSH	Tube Sheet Hot
TSP	Tube Support Plate
TTS	Top of Tube Sheet
TW	Through Wall
TWD	Through Wall Depth
VOL	Volumetric

APPPENDIX B - SCC Indications sized in OR17

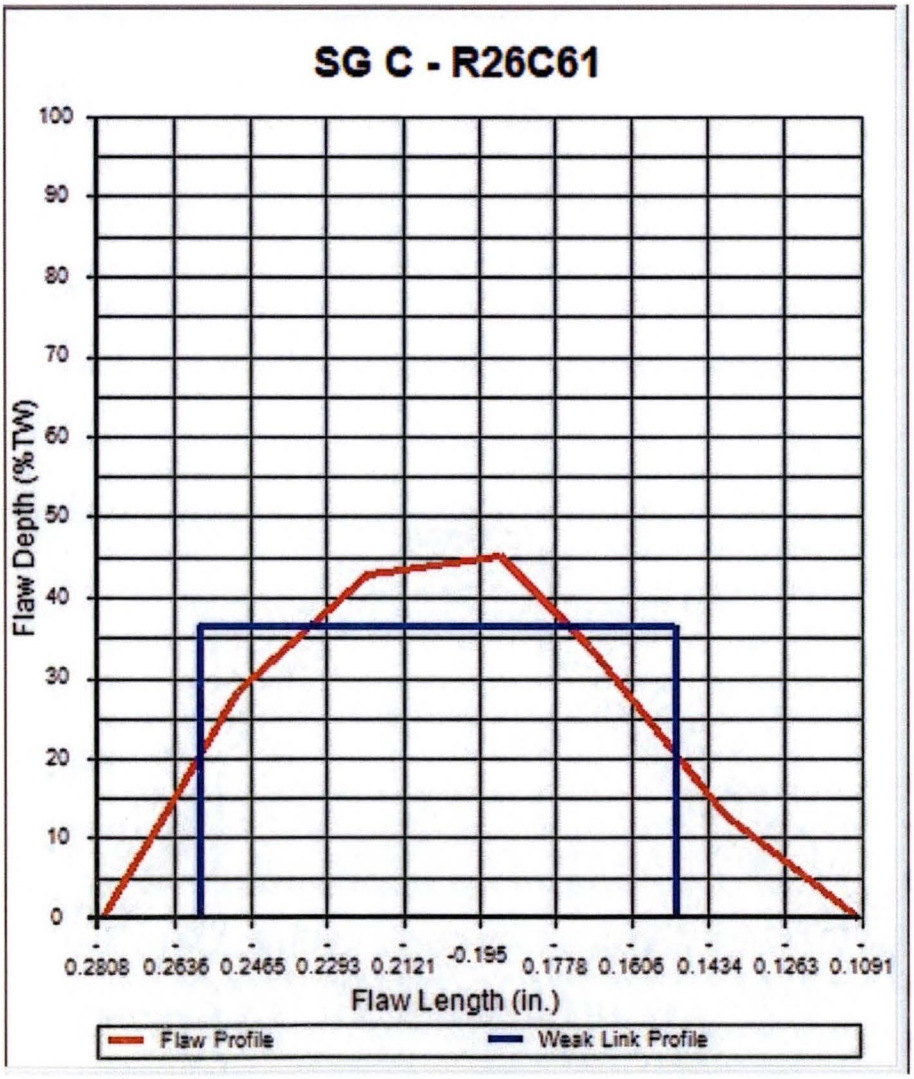
ODSCC: SG-C (R26C61)

An indication of axial ODSCC was confirmed in R26C61 just below the top of the hot leg tubesheet. The tube was last inspected during OR14 and re-analysis of the results at that time shows no flaw present. The indication has a SEL of 0.11 inch and a SED of 36.4% TW.

The ODSCC indication was assessed with regard to the need for in-situ testing. Using the known material properties for R26C61, the predicted burst pressure at 95% probability/50% confidence for the limiting indication is 7022 psid, which exceeds the $3\Delta P_{NOP}$ pressure differential for Seabrook of 3775 psid. The voltage threshold ($V_{L\text{-}THR}$) for leak testing for ODSCC cracks is given as 1.0V in the OR17 degradation assessment (DA). Similarly, the voltage threshold (V_{CRIT}) for significant SLB leakage is given as 2.5V for ODSCC in the OR17 DA. The maximum voltage for this indication is 0.14V; therefore, leak testing was not required and there is no significant potential for SLB leakage from this indication. The indication in tube R26C61 meets the CM criteria for leak and burst. The tube does not require in-situ testing.

The length/depth profiles of the ODSCC indication based on the amplitude sizing method of ETSS I28431 Rev. 2 is provided in Figure B-1 below:

Figure B-1: OR17 Length/Depth Profiles of Axial ODSCC Indication in SG-C, R26C61 (ETSS I28431, Rev. 2)



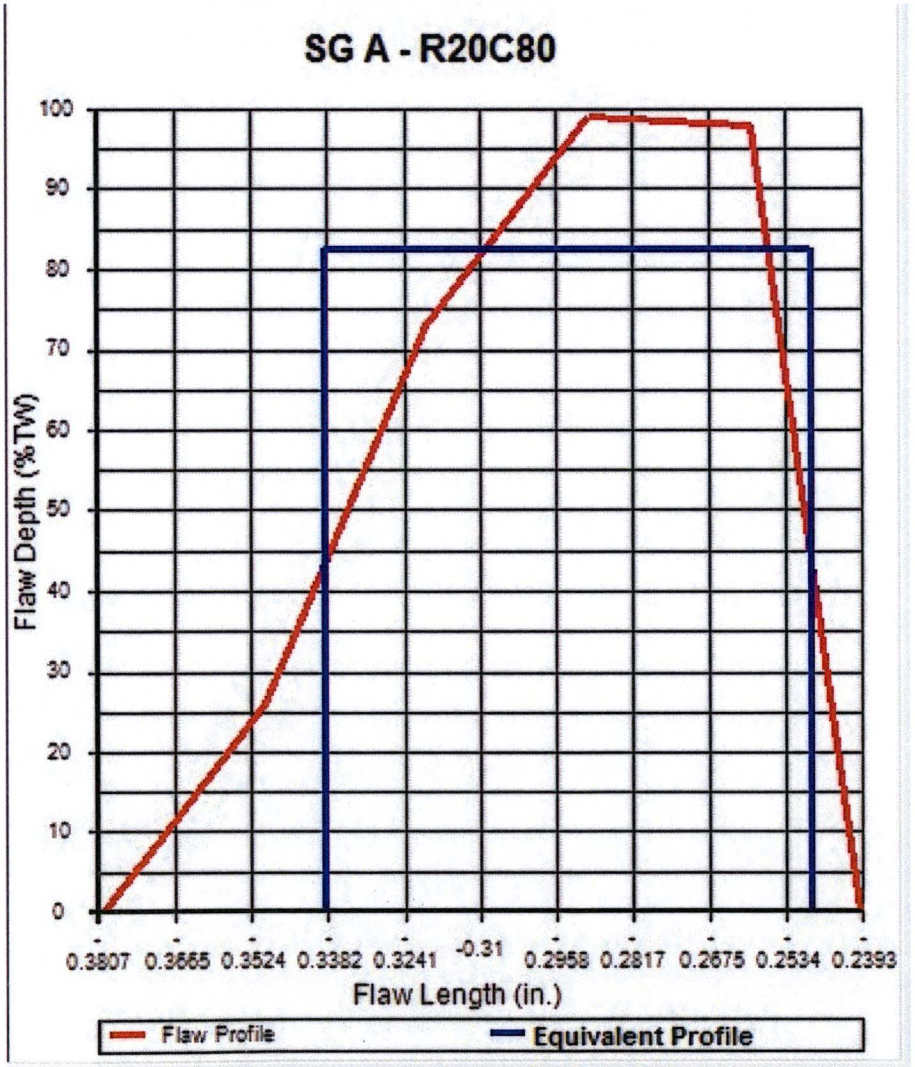
PWSCC: SG-A (R20C80)

An indication of axial PWSCC was confirmed in R20C80 just below the top of the hot leg tubesheet. The tube was last inspected during OR13 and re-analysis of the results at that time shows no flaw present. The indication has a SEL of 0.09 inch and a SED of 82.63% TW.

The PWSCC indication was assessed with regard to the need for in-situ testing. Using the known material properties for R20C80, the predicted burst pressure at 95% probability/50% confidence for the limiting indication is 6659 psid, which exceeds the $3\Delta P_{NOP}$ pressure differential for Seabrook of 3775 psid. The voltage threshold ($V_{L\text{-}THR}$) for leak testing for PWSCC cracks is given as 1.5V in the OR17 DA. Similarly, the voltage threshold (V_{CRIT}) for significant SLB leakage is given as 4.0V for PWSCC in the OR17 DA. The maximum voltage for this indication is 0.60V; therefore, leak testing was not required and there is no significant potential for SLB leakage from this indication. The indication in tube R20C80 meets the CM criteria for leak and burst. The tube does not require in-situ testing.

The length/depth profiles of the PWSCC indication based on phase angle method of ETSS 20511.1, Rev. 8 is provided in Figure B-2 below:

Figure B-2: OR17 Length/Depth Profiles of Axial PWSCC Indication in SG-A, R20C80 (ETSS 20511.1, Rev. 8)



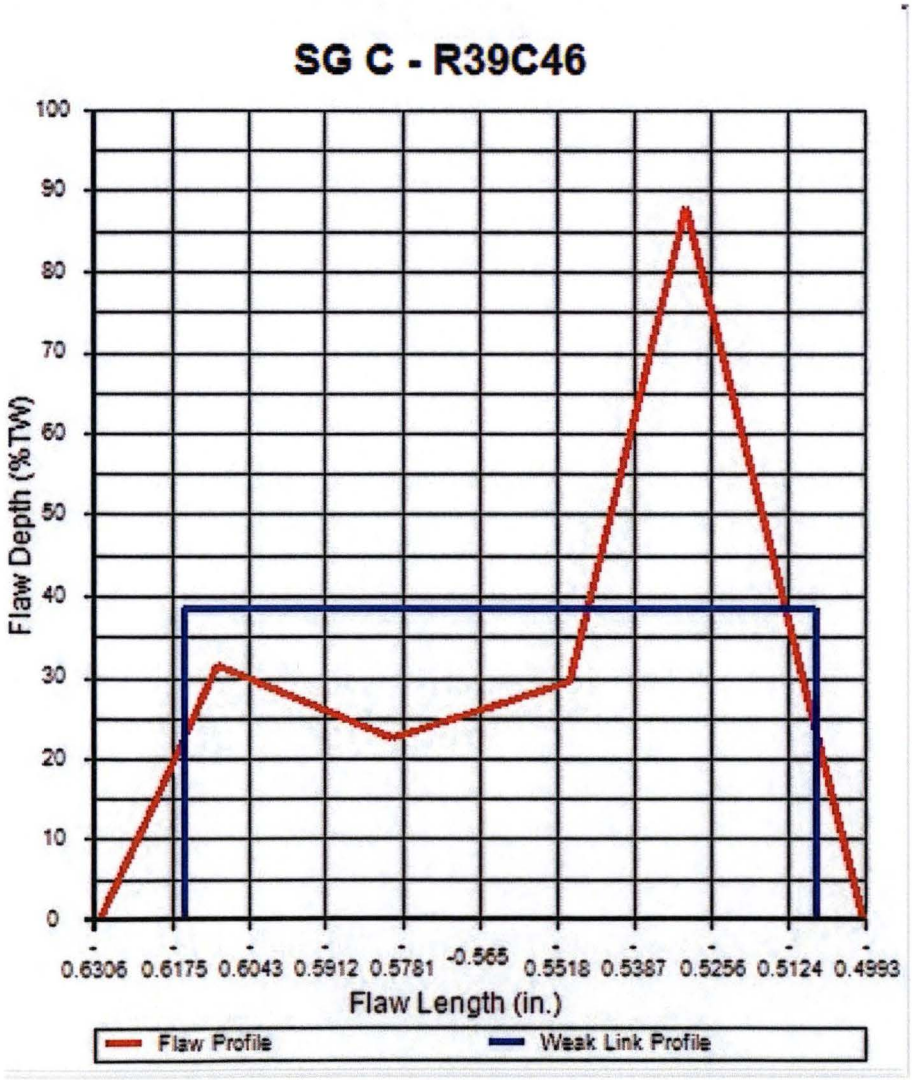
PWSCC: SG-C (R39C46)

An indication of axial PWSCC was confirmed in R39C46 just below the top of the hot leg tubesheet. The tube was last inspected during OR14 and re-analysis of the results at that time shows no flaw present. The indication has a SEL of 0.11 inch and a SED of 38.46% TW.

The PWSCC indication was assessed with regard to the need for in-situ testing. Using the known material properties for R39C46, the predicted burst pressure at 95% probability/50% confidence for the limiting indication is 7149 psid, which exceeds the $3\Delta P_{NOP}$ pressure differential for Seabrook of 3775 psid. The voltage threshold ($V_{L\text{-}THR}$) for leak testing for PWSCC cracks is given as 1.5V in the OR17 DA. Similarly, the voltage threshold (V_{CRIT}) for significant SLB leakage is given as 4.0V for PWSCC in the OR17 DA. The maximum voltage for this indication is 0.65V; therefore, leak testing was not required and there is no significant potential for SLB leakage from this indication. The indication in tube R39C46 meets the CM criteria for leak and burst. The tube does not require in-situ testing.

The length/depth profiles of the PWSCC indication based on phase angle method of ETSS 20511.1 Rev. 8 is provided in Figure B-3 below:

Figure B-3: OR17 Length/Depth Profiles of Axial PWSCC Indication in SG-C, R39C46 (ETSS 20511.1, Rev. 8)



SG	Row	Col	Per	Locn
A	1	11	20	01C
A	1	36	25	TSC
A	1	87	28	TSC
A	4	87	9	06C
A	5	108	12	06C
A	17	67	16	AV1
A	17	71	15	AV1
A	18	58	18	AV1
A	19	40	31	AV1
A	19	54	24	AV1
A	19	58	20	AV1
A	19	61	17	AV1
A	19	61	13	AV6
A	20	48	18	AV1
A	23	36	16	AV1
A	23	37	14	AV6
A	23	42	22	AV6
A	23	45	18	AV5
A	23	45	16	AV6
A	23	52	18	AV2
A	23	52	16	AV5
A	23	59	20	AV2
A	23	59	19	AV5
A	23	61	12	AV2
A	24	7	20	AV1
A	24	7	16	AV6
A	24	59	20	AV2
A	24	59	19	AV5
A	24	59	15	AV6
A	24	71	17	AV2
A	24	71	19	AV5
A	25	7	20	AV1
A	25	56	20	AV2
A	25	59	18	AV2
A	25	68	15	AV1
A	25	83	20	AV2
A	26	107	35	AV6
A	27	12	18	AV6
A	27	63	17	AV2
A	27	112	17	AV1
A	27	112	14	AV5
A	28	44	17	AV2
A	28	44	17	AV5
A	28	59	29	AV2
A	28	59	24	AV5
A	29	11	22	AV2
A	29	71	16	AV2
A	29	82	25	AV2
A	29	82	18	AV6
A	29	84	18	AV5
A	29	84	14	AV6
A	29	94	29	AV2
A	30	11	24	AV5
A	30	12	13	AV1
A	30	12	18	AV5
A	30	12	17	AV6
A	30	31	17	AV5
A	30	58	22	AV5
A	30	58	21	AV6
A	30	64	16	AV2
A	30	64	11	AV5
A	30	68	11	AV1
A	30	68	13	AV2
A	30	89	15	AV2
A	30	95	18	AV6
A	30	102	14	AV5
A	30	109	16	AV1
A	30	109	18	AV5
A	30	109	17	AV6
A	30	111	17	AV1
A	30	111	19	AV5
A	31	11	25	AV5
A	31	12	38	AV5
A	31	12	25	AV6
A	31	13	18	AV6
A	31	64	15	AV2
A	31	68	15	AV2
A	32	89	16	AV3
A	33	14	20	AV1
A	33	14	15	AV2
A	33	15	17	AV4
A	33	15	25	AV5
A	33	15	20	AV6
A	33	71	11	AV1
A	33	71	13	AV2
A	33	92	20	AV1
A	34	17	13	AV3
A	34	17	15	AV6
A	34	51	23	AV2
A	34	51	20	AV3
A	34	59	15	AV2
A	34	59	13	AV3
A	34	87	19	AV3
A	34	87	21	AV4
A	34	95	16	AV3
A	34	97	20	AV2
A	35	14	21	AV2
A	35	14	21	AV4
A	35	14	24	AV5
A	35	14	17	AV6
A	35	31	20	AV3
A	35	31	24	AV5
A	35	55	20	AV2
A	35	55	15	AV4
A	35	58	23	AV1
A	35	58	35	AV2
A	35	58	39	AV3
A	35	58	38	AV4
A	35	58	31	AV5
A	35	58	20	AV6
A	35	61	17	AV1
A	35	61	21	AV2
A	35	61	21	AV3
A	35	61	38	AV4
A	35	61	34	AV5
A	35	61	18	AV6
A	35	70	17	AV2
A	35	73	26	AV2
A	35	73	19	AV3
A	35	80	29	03H
A	35	88	21	03H
A	36	110	13	AV2
A	37	87	17	AV2
A	37	99	19	AV1
A	37	99	20	AV3
A	37	99	19	AV4

SG	Row	Col	Per	Locn
A	37	102	21	AV1
A	37	102	14	AV4
A	37	102	16	AV5
A	37	105	21	AV1
A	37	105	23	AV4
A	39	63	17	AV2
A	39	63	21	AV3
A	39	79	16	AV2
A	39	79	20	AV3
A	39	79	27	AV4
A	39	79	25	AV5
A	39	80	22	AV3
A	40	71	27	AV2
A	40	86	19	AV1
A	40	86	24	AV2
A	40	86	15	AV4
A	40	86	16	AV5
A	40	94	22	AV2
A	40	96	14	AV1
A	40	102	17	AV3
A	40	102	20	AV4
A	40	103	19	AV3
A	40	103	28	AV4
A	40	103	27	AV5
A	41	35	13	AV3
A	41	50	16	AV1
A	41	50	23	AV2
A	41	50	24	AV3
A	41	50	20	AV4
A	41	50	34	AV5
A	41	53	21	AV1
A	41	53	26	AV2
A	41	53	21	AV3
A	41	53	29	AV4
A	41	53	29	AV5
A	41	54	30	AV2
A	41	54	26	AV3
A	41	54	16	AV5
A	41	58	17	AV1
A	41	58	24	AV2
A	41	58	21	AV3
A	41	58	22	AV4

SG	Row	Col	Per	Locn
A	41	58	18	AV5
A	41	59	29	AV2
A	41	59	20	AV3
A	41	59	17	AV5
A	41	68	23	AV2
A	41	68	39	AV3
A	41	68	30	AV4
A	41	68	29	AV5
A	41	68	21	AV6
A	41	78	20	AV2
A	41	78	22	AV3
A	41	78	13	AV5
A	41	102	16	AV1
A	41	102	19	AV4
A	41	102	20	AV5
A	41	103	24	AV1
A	41	103	15	AV3
A	41	103	23	AV4
A	41	103	25	AV5
A	42	22	15	AV4
A	42	58	24	AV3
A	42	58	18	AV4
A	42	58	17	AV5
A	42	72	17	AV1
A	42	72	22	AV2
A	42	72	36	AV3
A	42	72	20	AV4
A	42	72	30	AV5
A	42	72	18	AV6
A	42	80	12	AV1
A	42	80	30	AV2
A	42	80	33	AV3
A	42	80	22	AV4
A	42	80	20	AV5
A	42	80	26	AV6
A	42	81	23	AV4
A	42	83	19	AV2
A	42	103	21	AV1
A	43	20	15	AV6
A	43	55	24	AV2
A	43	98	16	AV5
A	44	94	14	AV2

SG	Row	Col	Per	Locn
A	44	94	16	AV3
A	44	94	18	AV4
A	44	98	17	AV1
A	44	98	18	AV2
A	44	98	26	AV3
A	44	98	18	AV4
A	44	98	18	AV5
A	44	100	14	AV1
A	44	100	15	AV5
A	44	101	20	AV1
A	44	102	13	AV2
A	44	102	13	AV3
A	45	67	24	AV2
A	45	68	23	AV2
A	45	74	20	AV1
A	45	74	19	AV2
A	45	74	30	AV3
A	45	74	34	AV4
A	45	76	15	AV1
A	45	80	14	AV3
A	45	80	17	AV4
A	45	98	13	AV4
A	46	65	21	AV4
A	46	65	25	AV5
A	46	71	14	AV3
A	46	71	19	AV4
A	46	71	22	AV5
A	46	77	21	AV2
A	46	77	16	AV3
A	46	77	25	AV4
A	46	94	15	AV6
A	46	95	18	AV4
A	46	95	23	AV5
A	46	95	26	AV6
A	46	97	19	AV6
A	46	98	21	AV4
A	46	98	18	AV5
A	46	98	17	AV6
A	47	85	28	AV5
A	47	89	21	AV3
A	47	89	20	AV6
A	47	95	15	AV1

SG	Row	Col	Per	Locn
A	47	95	23	AV2
A	47	95	25	AV3
A	47	95	25	AV4
A	47	95	18	AV5
A	47	95	20	AV6
A	47	98	17	AV5
A	48	31	18	AV3
A	48	31	16	AV4
A	48	31	16	AV5
A	48	31	19	AV6
A	48	60	24	AV6
A	48	63	14	AV1
A	48	63	24	AV2
A	48	63	24	AV3
A	48	63	24	AV4
A	48	63	20	AV5
A	48	64	24	AV2
A	48	83	18	AV3
A	48	83	22	AV4
A	48	92	15	AV6
A	48	94	15	AV4
A	48	94	19	AV6
A	48	95	18	AV4
A	48	95	21	AV5
A	48	95	26	AV6
A	48	96	21	AV6
A	49	29	22	TSH
A	49	48	11	AV1
A	49	54	13	AV3
A	49	57	13	AV2
A	49	57	16	AV4
A	49	57	16	AV5
A	49	57	15	AV6
A	49	60	14	AV3
A	49	64	24	AV1
A	49	65	17	AV1
A	49	65	23	AV2
A	49	65	37	AV3
A	49	65	24	AV4
A	49	65	21	AV5
A	49	76	22	AV2
A	49	88	14	AV2

SG	Row	Col	Per	Locn
A	49	88	25	AV3
A	49	88	24	AV4
A	49	88	30	AV5
A	49	88	15	AV6
A	49	90	16	AV5
A	49	90	17	AV6
A	49	91	20	AV5
A	50	29	11	TSH
A	50	38	17	AV4
A	50	38	20	AV5
A	50	60	17	AV2
A	50	60	16	AV3
A	50	66	19	AV2
A	50	71	17	AV2
A	50	79	16	AV2
A	50	79	40	AV3
A	50	79	42	AV4
A	50	79	22	AV5
A	50	80	16	AV3
A	50	80	16	AV4
A	50	80	14	AV5
A	50	85	19	AV2
A	50	85	31	AV3
A	50	85	29	AV4
A	50	85	24	AV5
A	50	85	22	AV6
A	50	88	24	AV6
A	50	95	24	AV3
A	50	95	25	AV4
A	50	95	36	AV5
A	50	95	31	AV6
A	51	52	18	AV4
A	51	53	14	AV4
A	51	71	14	AV4
A	51	75	19	AV5
A	51	86	16	AV1
A	51	86	26	AV2
A	51	86	17	AV3
A	51	86	19	AV4
A	51	86	19	AV6
A	51	90	19	AV2
A	51	90	19	AV3

SG	Row	Col	Per	Locn
A	51	90	24	AV4
A	51	90	23	AV5
A	51	90	20	AV6
A	52	53	16	AV2
A	52	57	19	AV3
A	52	73	20	AV5
A	52	88	17	AV3
A	52	88	31	AV4
A	52	88	28	AV5
A	52	88	23	AV6
A	52	89	18	AV3
A	52	89	30	AV4
A	52	89	36	AV5
A	52	89	33	AV6
A	52	90	19	AV6
A	53	45	31	AV2
A	53	45	16	AV3
A	53	69	20	AV5
A	53	89	20	AV1
A	53	90	17	AV4
A	54	86	12	AV2
A	55	41	15	AV5
A	55	41	18	AV6
A	56	57	10	AV2
A	56	81	14	AV4
A	57	48	19	AV1
A	57	48	19	AV2
A	57	52	19	AV1
A	57	61	17	AV2
A	58	50	15	AV6
A	58	76	19	AV2
A	58	76	18	AV3

SG	Row	Col	Per	Locn
B	1	11	33	TSC
B	1	87	39	TSC
B	1	87	38	TSH
B	1	112	17	TSH
B	1	119	15	01H
B	2	98	31	06C
B	2	113	25	07H
B	5	86	14	04H
B	12	65	14	AV1
B	15	68	14	AV1
B	17	64	13	AV1
B	17	77	13	AV1
B	18	66	17	AV1
B	18	74	13	AV1
B	19	66	17	AV1
B	20	60	19	AV1
B	20	60	11	AV6
B	20	60	17	AV6
B	21	68	14	AV1
B	21	77	14	AV1
B	21	115	14	AV6
B	22	69	14	AV1
B	22	89	16	AV2
B	22	89	17	AV6
B	22	97	32	05H
B	22	116	10	AV2
B	23	47	16	AV1
B	23	47	14	AV2
B	23	56	16	AV1
B	23	56	16	AV2
B	24	45	15	AV2
B	25	51	17	AV1
B	25	51	20	AV2
B	25	51	21	AV5
B	25	82	14	AV2
B	25	112	12	AV1
B	27	42	17	AV2
B	27	57	16	AV2
B	27	63	17	AV5
B	27	81	14	AV5
B	27	107	20	AV5
B	27	112	14	AV1

SG	Row	Col	Per	Locn
B	28	42	18	AV5
B	28	65	14	AV2
B	28	65	16	AV6
B	28	78	19	AV2
B	28	115	11	AV2
B	28	115	15	AV5
B	29	30	12	AV2
B	29	32	12	AV6
B	29	38	16	AV2
B	29	38	17	AV5
B	29	38	13	AV6
B	29	51	13	AV2
B	29	79	30	AV1
B	29	79	24	AV2
B	29	79	22	AV5
B	29	79	15	AV6
B	29	89	16	AV2
B	29	101	15	AV2
B	29	113	18	AV1
B	29	113	16	AV5
B	29	113	10	AV6
B	30	43	17	AV2
B	30	43	20	AV5
B	30	43	19	AV6
B	30	49	15	AV2
B	30	58	14	AV5
B	30	61	26	AV2
B	30	61	36	AV5
B	30	62	18	AV2
B	30	66	16	AV1
B	30	66	14	AV2
B	30	66	21	AV5
B	30	66	13	AV6
B	30	71	15	AV5
B	30	73	17	AV2
B	30	73	19	AV5
B	30	75	28	AV2
B	30	75	21	AV5
B	30	79	18	AV2
B	30	79	13	AV5
B	30	80	16	AV1
B	30	80	21	AV2

SG	Row	Col	Per	Locn
B	30	80	19	AV5
B	30	81	25	AV2
B	30	81	29	AV5
B	30	87	17	AV2
B	30	87	27	AV5
B	30	87	17	AV6
B	30	106	14	AV1
B	30	106	16	AV6
B	30	109	15	AV5
B	30	111	18	AV2
B	30	111	21	AV5
B	30	112	12	AV1
B	30	112	21	AV2
B	30	112	17	AV5
B	31	66	11	AV6
B	31	111	25	AV5
B	31	112	18	AV1
B	31	112	21	AV2
B	32	81	13	AV2
B	32	82	22	AV2
B	32	82	15	AV5
B	32	82	15	AV6
B	32	83	14	AV2
B	32	83	15	AV3
B	32	83	17	AV5
B	32	86	18	AV2
B	32	86	18	AV3
B	32	86	17	AV4
B	32	88	16	AV1
B	32	88	17	AV2
B	32	88	20	AV3
B	32	88	16	AV5
B	32	103	18	AV2
B	32	109	18	AV5
B	32	109	14	AV6
B	33	95	15	AV2
B	33	104	20	AV2
B	33	104	16	AV4
B	33	107	15	AV3
B	33	107	19	AV5
B	33	109	15	AV4
B	33	109	29	AV5

SG	Row	Col	Per	Locn
B	34	14	15	AV5
B	34	14	17	AV6
B	34	70	22	AV2
B	34	70	15	AV3
B	34	70	15	AV4
B	34	72	16	AV2
B	34	85	11	AV6
B	34	94	18	AV2
B	34	94	15	AV5
B	34	94	15	AV6
B	34	98	18	AV2
B	34	98	21	AV3
B	34	100	15	AV5
B	34	100	17	AV6
B	34	101	13	AV2
B	34	101	14	AV6
B	34	103	14	AV5
B	34	103	19	AV6
B	34	105	16	AV6
B	35	44	16	AV1
B	35	44	14	AV2
B	35	55	18	AV4
B	35	58	16	AV2
B	35	58	21	AV3
B	35	58	21	AV4
B	35	58	18	AV5
B	35	59	15	AV1
B	35	59	19	AV2
B	35	59	17	AV3
B	35	59	15	AV4
B	35	67	19	AV2
B	35	67	18	AV3
B	35	67	16	AV4
B	35	68	9	AV1
B	35	68	17	AV2
B	35	68	22	AV3
B	35	68	25	AV4
B	35	68	25	AV5
B	35	71	13	AV3
B	35	98	19	AV3
B	35	98	16	AV4
B	35	104	17	AV3
B	35	104	18	AV6
B	36	59	17	AV2
B	36	59	12	AV6
B	36	64	13	AV3
B	36	64	17	AV4
B	36	65	31	AV2
B	36	65	20	AV3
B	36	65	13	AV4
B	36	65	22	AV5
B	37	54	15	AV2
B	37	54	21	AV4
B	37	58	14	AV3
B	37	69	25	AV2
B	37	87	15	AV2
B	37	87	15	AV3
B	38	41	16	AV6
B	39	48	12	AV2
B	39	48	18	AV3
B	39	48	17	AV4
B	39	48	18	AV5
B	39	49	14	AV1
B	39	49	22	AV2
B	39	49	26	AV3
B	39	49	15	AV4
B	39	54	13	AV1
B	39	54	20	AV2
B	39	54	24	AV3
B	39	54	26	AV4
B	39	54	20	AV5
B	39	56	15	AV1
B	39	56	18	AV2
B	39	57	12	AV1
B	39	57	17	AV2
B	39	57	16	AV3
B	39	57	16	AV4
B	39	57	13	AV5
B	39	59	18	AV1
B	39	60	14	AV1
B	39	60	17	AV2
B	39	60	24	AV3
B	39	60	18	AV4
B	40	48	20	AV2
B	40	48	33	AV2
B	40	48	37	AV3
B	40	48	32	AV4
B	40	48	32	AV5
B	40	48	19	AV6
B	40	74	12	AV2
B	41	61	20	AV2
B	41	61	22	AV4
B	41	61	19	AV5
B	41	75	25	AV2
B	41	75	23	AV3
B	41	75	21	AV4
B	41	75	17	AV5
B	42	64	14	AV2
B	42	64	13	AV5
B	42	81	17	AV2
B	42	103	16	AV4
B	43	20	12	AV2
B	43	69	20	AV2
B	43	69	18	AV3
B	43	69	27	AV4
B	43	69	27	AV5
B	43	75	25	AV2
B	43	75	21	AV3
B	43	75	30	AV4
B	43	75	28	AV5
B	43	96	19	TSH
B	44	62	10	AV2
B	44	62	11	AV4
B	45	27	11	AV6
B	45	33	16	AV2
B	45	41	17	AV2
B	45	41	14	AV3
B	45	41	13	AV4
B	45	47	15	AV5
B	45	74	16	AV2
B	45	86	22	AV1
B	46	66	11	AV3
B	47	71	15	AV1
B	47	71	22	AV2
B	47	71	29	AV3
B	47	71	15	AV4

APPENDIX C – OR17 List of Imperfections (non-SCC)

SG	Row	Col	Per	Locn
B	47	74	17	AV2
B	48	25	15	AV5
B	48	71	13	AV4
B	49	33	13	AV2
B	49	78	20	AV2
B	49	78	18	AV4
B	50	93	12	AV2
B	50	93	12	AV4
B	50	95	20	AV6
B	51	70	19	AV5
B	51	70	23	AV6
B	53	34	21	AV6
B	53	44	12	AV6
B	53	90	17	AV4
B	53	90	24	AV5
B	53	90	15	AV6
B	54	36	14	AV5
B	54	66	13	AV3
B	54	86	16	AV2
B	54	86	13	AV4
B	54	86	18	AV5
B	54	87	19	01C
B	54	87	13	AV3
B	54	87	21	AV5
B	55	63	20	AV3
B	55	69	14	AV2
B	55	69	18	AV3
B	56	69	15	AV2
B	56	71	12	AV2
B	56	82	21	AV5
B	57	50	17	AV6
B	57	55	16	AV6
B	57	69	15	AV2

SG	Row	Col	Per	Locn
C	1	87	13	TSC
C	1	87	31	TSH
C	1	112	18	TSH
C	3	90	18	07C
C	3	113	32	05C
C	5	57	24	06C
C	10	63	14	AV1
C	10	63	17	AV6
C	10	64	14	AV1
C	11	67	14	AV1
C	14	62	14	AV1
C	15	35	14	AV1
C	15	64	15	AV1
C	15	67	19	AV1
C	16	37	15	AV6
C	19	59	20	AV1
C	19	62	16	AV1
C	22	34	15	AV2
C	24	7	14	AV1
C	24	7	13	AV6
C	24	98	15	AV1
C	25	56	16	AV2
C	26	8	14	AV1
C	28	66	17	AV2
C	28	104	24	05C
C	30	11	16	AV1
C	30	11	17	AV5
C	30	11	12	AV6
C	30	113	22	AV2
C	30	113	14	AV5
C	30	113	14	AV6
C	30	114	18	AV2
C	30	114	13	AV5
C	30	114	12	AV6
C	31	111	19	AV5
C	32	24	30	04H
C	32	35	8	07C
C	32	110	11	AV3
C	33	42	20	AV4
C	33	42	19	AV6
C	33	106	16	AV2
C	33	106	17	AV3
C	33	106	21	AV4
C	33	111	17	AV2
C	33	111	20	AV5
C	34	28	17	AV4
C	35	13	26	AV2
C	35	13	16	AV3
C	35	13	23	AV4
C	35	13	32	AV5
C	35	13	18	AV6
C	36	43	14	AV2
C	37	17	17	AV5
C	37	23	14	AV1
C	37	23	16	AV4
C	37	23	19	AV5
C	37	40	16	AV2
C	37	40	19	AV3
C	37	40	16	AV4
C	37	40	14	AV5
C	37	40	16	AV6
C	37	47	18	AV4
C	37	47	16	AV5
C	37	55	16	AV2
C	37	56	16	AV2
C	37	78	15	AV5
C	37	83	17	AV2
C	37	85	19	AV2
C	37	85	20	AV3
C	37	85	22	AV4
C	37	85	23	AV5
C	37	85	17	AV6
C	38	79	20	AV2
C	38	101	19	AV6
C	38	102	19	AV4
C	38	102	22	AV5
C	39	19	16	TSC
C	39	42	22	AV2
C	39	42	17	AV3
C	39	42	19	AV4
C	39	45	23	AV2
C	39	45	29	AV3
C	39	45	27	AV4
C	39	45	35	AV5
C	39	45	18	AV6
C	39	69	25	AV2
C	39	69	23	AV3
C	39	69	31	AV4
C	39	69	25	AV5
C	40	36	13	AV1
C	40	36	16	AV2
C	41	22	17	AV2
C	41	22	18	AV3
C	41	22	15	AV4
C	41	22	20	AV5
C	41	23	18	AV1
C	41	23	19	AV5
C	41	23	16	AV6
C	41	30	14	AV4
C	41	30	20	AV5
C	41	30	18	AV6
C	41	39	20	AV2
C	41	39	19	AV5
C	41	39	23	AV6
C	41	41	17	AV1
C	41	41	32	AV2
C	41	41	21	AV3
C	41	41	21	AV4
C	41	43	16	AV2
C	41	43	16	AV3
C	41	43	29	AV4
C	41	43	16	AV5
C	41	80	22	AV2
C	41	80	32	AV3
C	41	80	23	AV4
C	41	80	20	AV5
C	41	93	13	AV1
C	41	93	15	AV2
C	41	93	13	AV3
C	41	93	17	AV4
C	41	93	20	AV5
C	41	100	18	AV3
C	41	100	21	AV4
C	41	100	25	AV5
C	41	100	19	AV6
C	42	23	22	AV4

SG	Row	Col	Per	Locn
C	42	23	25	AV5
C	42	24	16	AV6
C	42	25	13	AV2
C	42	25	14	AV3
C	42	25	15	AV4
C	42	25	17	AV5
C	42	25	15	AV6
C	42	31	17	AV1
C	42	31	25	AV2
C	42	31	14	AV3
C	42	56	15	AV2
C	42	71	20	AV2
C	42	71	15	AV5
C	42	92	19	AV2
C	42	92	20	AV3
C	42	92	16	AV4
C	42	92	20	AV5
C	42	102	16	AV1
C	42	102	20	AV2
C	42	102	34	AV3
C	42	102	32	AV4
C	42	102	17	AV5
C	42	102	23	AV6
C	43	23	16	AV1
C	43	23	24	AV3
C	43	23	18	AV4
C	43	23	13	AV5
C	43	26	23	TSH
C	43	100	18	AV2
C	43	100	17	AV3
C	43	100	35	AV4
C	43	100	22	AV5
C	43	102	22	AV2
C	43	102	25	AV3
C	43	102	36	AV4
C	43	102	32	AV5
C	43	102	19	AV6
C	44	22	18	AV2
C	44	26	11	TSH
C	44	75	22	AV1
C	44	75	19	AV2
C	44	100	17	AV2
C	44	100	23	AV3
C	44	100	32	AV4
C	44	100	33	AV5
C	44	100	19	AV6
C	46	36	20	AV2
C	46	36	24	AV3
C	46	36	31	AV4
C	46	36	22	AV5
C	46	79	18	AV2
C	46	79	22	AV3
C	46	79	25	AV4
C	46	79	18	AV5
C	46	79	20	AV6
C	46	97	17	AV3
C	46	97	23	AV4
C	46	97	16	AV5
C	47	30	19	AV5
C	47	35	11	AV1
C	47	35	20	AV2
C	47	35	27	AV3
C	47	35	28	AV4
C	47	35	15	AV5
C	47	40	16	AV2
C	47	40	12	AV3
C	47	40	17	AV6
C	47	57	12	AV2
C	47	62	14	AV4
C	47	76	20	AV1
C	47	76	19	AV2
C	47	83	19	AV5
C	47	86	18	AV4
C	47	86	16	AV5
C	47	93	10	AV1
C	47	93	22	AV3
C	47	93	25	AV4
C	47	93	30	AV5
C	47	94	13	AV2
C	47	94	16	AV3
C	47	94	22	AV4
C	47	94	17	AV5
C	47	94	16	AV6
C	47	96	11	AV3
C	47	96	16	AV5
C	47	96	13	AV6
C	47	98	14	AV3
C	47	98	16	AV4
C	47	99	14	AV4
C	47	99	31	AV5
C	47	99	28	AV6
C	48	30	15	AV4
C	48	30	18	AV5
C	48	30	17	AV6
C	48	33	21	AV5
C	48	35	17	AV4
C	48	35	16	AV5
C	48	47	17	AV1
C	48	47	17	AV2
C	48	47	15	AV3
C	48	97	16	AV2
C	48	97	16	AV3
C	48	97	16	AV4
C	49	95	28	AV5
C	51	49	18	AV1
C	51	49	24	AV2
C	51	49	14	AV3
C	51	67	14	AV4
C	51	67	18	AV6
C	53	33	13	AV3
C	53	35	14	AV2
C	53	35	15	AV4
C	53	63	16	AV2
C	53	67	15	AV1
C	53	67	31	AV2
C	53	67	33	AV3
C	53	67	23	AV4
C	53	70	18	AV1
C	53	70	24	AV2
C	53	70	19	AV3
C	54	35	15	AV4
C	54	37	18	AV1
C	54	68	22	AV2
C	54	87	16	AV3
C	54	87	19	AV4
C	54	87	24	AV5

APPENDIX C – OR17 List of Imperfections (non-SCC)

SG	Row	Col	Per	Locn
C	55	39	17	AV1
C	56	65	15	AV3
C	58	51	18	AV6

SG	Row	Col	Per	Locn
D	1	87	32	TSH
D	6	108	8	03H
D	12	2	18	AV1
D	13	4	24	01C
D	16	64	21	AV1
D	16	64	19	AV6
D	17	72	23	AV1
D	17	75	20	AV6
D	21	52	21	04H
D	22	86	18	AV2
D	22	93	15	AV2
D	22	93	16	AV6
D	24	6	23	AV1
D	24	6	24	AV6
D	25	82	22	AV2
D	25	82	20	AV5
D	26	8	19	AV1
D	26	8	21	AV6
D	26	40	18	AV5
D	26	41	16	AV2
D	26	52	14	AV2
D	27	8	14	AV1
D	27	8	27	AV6
D	27	36	15	AV5
D	27	39	29	AV2
D	27	39	30	AV5
D	27	39	23	AV6
D	27	44	25	AV2
D	27	76	10	AV1
D	27	76	20	AV2
D	27	76	17	AV5
D	27	96	17	AV6
D	27	111	11	AV5
D	27	115	18	AV2
D	27	115	19	AV5
D	28	69	11	AV2
D	28	88	20	AV5
D	28	115	15	AV2
D	28	115	23	AV5
D	29	34	30	AV2
D	29	34	23	AV5
D	29	83	18	AV1
D	29	83	23	AV5
D	30	12	15	AV1
D	30	12	14	AV5
D	30	66	19	AV2
D	30	66	20	AV5
D	31	113	13	AV1
D	32	12	23	AV1
D	32	12	19	AV2
D	32	12	19	AV3
D	32	12	38	AV5
D	33	58	22	AV1
D	33	58	24	AV2
D	33	58	20	AV3
D	33	96	17	AV1
D	33	96	18	AV2
D	33	107	15	AV4
D	34	15	16	AV1
D	34	15	19	AV4
D	34	17	14	AV1
D	34	17	17	AV2
D	34	17	17	AV3
D	34	17	14	AV4
D	34	22	17	AV2
D	34	22	19	AV3
D	34	22	15	AV4
D	34	22	17	AV5
D	34	22	18	AV6
D	34	30	17	AV3
D	34	30	16	AV5
D	34	35	17	AV2
D	34	35	17	AV5
D	34	40	16	AV4
D	34	40	20	AV5
D	34	40	22	AV6
D	34	43	19	AV2
D	34	48	18	AV5
D	34	50	17	AV2
D	34	50	19	AV3
D	34	69	23	AV2
D	34	69	21	AV3
D	34	69	31	AV4
D	34	69	30	AV5
D	34	69	15	AV6
D	34	70	14	AV2
D	34	71	20	AV2
D	34	73	34	AV2
D	34	73	23	AV3
D	34	73	29	AV4
D	34	73	20	AV5
D	34	73	17	AV6
D	34	75	15	AV3
D	34	76	15	AV2
D	34	76	18	AV3
D	34	76	17	AV4
D	34	76	19	AV5
D	34	92	18	AV4
D	34	103	16	AV3
D	34	109	21	AV5
D	35	22	19	AV3
D	35	22	17	AV4
D	35	22	21	AV6
D	35	37	30	AV2
D	35	37	26	AV3
D	35	37	20	AV6
D	35	51	22	AV1
D	35	51	20	AV2
D	35	51	19	AV4
D	35	53	22	AV3
D	35	69	34	AV2
D	35	69	35	AV3
D	35	69	21	AV4
D	35	69	14	AV5
D	35	69	17	AV6
D	35	71	10	AV1
D	35	71	21	AV2
D	35	71	15	AV3
D	35	83	24	AV3
D	35	83	23	AV4
D	35	86	17	AV4
D	35	86	20	AV6
D	35	88	18	AV2
D	35	88	16	AV3
D	35	88	23	AV4
D	35	89	19	AV2

SG	Row	Col	Per	Locn
D	35	89	15	AV3
D	36	16	17	AV3
D	36	40	19	AV2
D	36	40	18	AV3
D	36	40	18	AV4
D	36	40	15	AV5
D	36	40	17	AV6
D	36	41	20	AV2
D	36	46	17	AV5
D	36	67	23	AV2
D	36	67	11	AV3
D	36	80	13	AV3
D	36	82	18	AV1
D	36	82	30	AV2
D	36	82	23	AV3
D	36	82	26	AV4
D	36	82	27	AV5
D	36	90	18	AV2
D	37	16	24	AV1
D	37	16	20	AV2
D	37	16	28	AV3
D	37	16	26	AV4
D	37	16	19	AV5
D	37	16	25	AV6
D	37	19	21	AV6
D	37	38	22	AV2
D	37	38	21	AV3
D	37	38	28	AV4
D	37	38	23	AV5
D	37	39	23	AV2
D	37	39	26	AV3
D	37	39	27	AV4
D	37	39	26	AV5
D	37	39	22	AV6
D	37	40	22	AV3
D	37	40	21	AV4
D	37	40	22	AV6
D	37	45	28	AV2
D	37	45	23	AV3
D	37	45	24	AV4
D	37	45	20	AV5
D	37	48	21	AV1

SG	Row	Col	Per	Locn
D	37	48	21	AV2
D	37	48	29	AV3
D	37	48	24	AV4
D	37	48	22	AV5
D	37	48	21	AV6
D	37	58	28	AV2
D	37	59	26	AV2
D	37	59	24	AV3
D	37	59	29	AV4
D	37	59	22	AV5
D	37	73	18	AV2
D	37	77	15	AV1
D	37	77	21	AV2
D	37	77	28	AV3
D	37	77	31	AV4
D	37	77	17	AV5
D	37	84	18	AV4
D	37	84	22	AV6
D	38	35	17	AV6
D	38	73	22	AV2
D	38	73	22	AV3
D	38	73	19	AV4
D	38	73	17	AV5
D	39	18	23	AV1
D	39	18	23	AV4
D	39	18	26	AV5
D	39	19	25	AV2
D	39	19	28	AV3
D	39	24	23	AV2
D	39	36	22	AV5
D	39	38	22	AV3
D	39	41	25	AV2
D	39	41	28	AV3
D	39	41	35	AV4
D	39	41	26	AV5
D	39	41	23	AV6
D	39	44	23	AV1
D	39	44	25	AV3
D	39	44	28	AV4
D	39	44	27	AV5
D	39	44	27	AV6
D	39	50	24	AV2

SG	Row	Col	Per	Locn
D	39	50	28	AV3
D	39	50	25	AV5
D	39	57	19	AV1
D	39	57	28	AV2
D	39	57	30	AV3
D	39	57	22	AV4
D	39	57	29	AV5
D	39	59	26	AV3
D	39	62	26	AV2
D	39	74	15	AV2
D	39	75	16	AV2
D	39	82	16	AV1
D	39	82	25	AV2
D	39	82	24	AV3
D	39	82	20	AV4
D	39	82	20	AV5
D	39	89	19	AV1
D	39	89	16	AV2
D	39	94	17	AV2
D	39	94	18	AV3
D	39	94	14	AV4
D	39	96	16	AV5
D	39	102	22	AV1
D	39	103	19	AV1
D	39	103	17	AV2
D	40	19	14	AV1
D	40	21	20	AV2
D	40	21	17	AV3
D	40	21	15	AV6
D	40	23	19	AV1
D	40	23	20	AV4
D	40	24	16	AV2
D	40	24	15	AV3
D	40	24	14	AV4
D	40	24	17	AV5
D	40	26	18	AV3
D	40	66	14	AV1
D	40	66	35	AV2
D	40	66	31	AV3
D	40	66	24	AV3
D	40	66	20	AV4
D	40	66	28	AV4

SG	Row	Col	Per	Locn
D	40	66	27	AV5
D	40	66	17	AV6
D	41	18	15	AV4
D	41	20	22	AV2
D	41	20	22	AV3
D	41	20	26	AV4
D	41	20	28	AV5
D	41	20	16	AV6
D	41	34	18	AV2
D	41	34	16	AV3
D	41	34	16	AV4
D	41	35	19	AV3
D	41	36	16	AV1
D	41	36	18	AV3
D	41	38	23	AV3
D	41	51	17	AV2
D	41	51	19	AV3
D	41	56	23	AV1
D	41	56	38	AV2
D	41	56	32	AV3
D	41	56	28	AV4
D	41	56	34	AV5
D	41	56	26	AV6
D	41	59	23	AV3
D	41	59	32	AV4
D	41	66	25	AV2
D	41	66	19	AV3
D	41	66	14	AV4
D	41	66	18	AV5
D	41	71	19	AV2
D	41	90	18	AV2
D	41	104	18	AV2
D	41	104	15	AV5
D	42	19	10	03C
D	42	19	17	AV1
D	42	19	21	AV3
D	42	19	20	AV4
D	42	19	13	AV5
D	42	20	17	AV6
D	42	24	17	AV1
D	42	24	20	AV2
D	42	24	17	AV3

SG	Row	Col	Per	Locn
D	42	24	29	AV4
D	42	24	16	AV5
D	42	37	25	AV2
D	42	37	24	AV3
D	42	37	17	AV4
D	42	37	16	AV6
D	42	39	17	AV3
D	42	39	21	AV4
D	42	40	18	AV6
D	42	46	17	AV2
D	42	46	30	AV3
D	42	46	19	AV4
D	42	46	23	AV5
D	42	47	20	AV2
D	42	47	19	AV3
D	42	47	20	AV4
D	42	47	21	AV5
D	42	77	18	AV5
D	42	92	19	AV1
D	42	92	17	AV2
D	42	92	19	AV3
D	42	92	21	AV4
D	42	92	25	AV5
D	42	92	21	AV6
D	42	98	20	AV3
D	42	98	19	AV4
D	42	98	22	AV5
D	42	98	17	AV6
D	43	21	20	AV2
D	43	21	26	AV3
D	43	21	20	AV4
D	43	21	26	AV5
D	43	21	28	AV6
D	43	22	14	AV4
D	43	24	16	AV2
D	43	24	14	AV3
D	43	24	15	AV5
D	43	49	18	AV3
D	43	51	17	AV2
D	43	51	17	AV3
D	43	51	16	AV4
D	43	51	28	AV5

SG	Row	Col	Per	Locn
D	43	54	18	AV2
D	44	26	18	AV1
D	44	26	21	AV2
D	44	26	18	AV3
D	44	26	25	AV4
D	44	26	18	AV5
D	44	36	18	AV1
D	44	36	16	AV2
D	44	36	22	AV3
D	44	45	20	AV3
D	44	45	27	AV5
D	44	45	18	AV6
D	44	48	35	AV3
D	44	48	25	AV4
D	44	48	24	AV5
D	44	91	24	AV2
D	44	91	33	AV3
D	44	91	31	AV4
D	44	91	29	AV5
D	44	91	16	AV6
D	44	101	16	AV3
D	44	102	19	AV5
D	45	27	16	AV5
D	45	40	20	AV5
D	45	40	19	AV6
D	45	66	12	AV1
D	45	66	19	AV2
D	45	66	13	AV3
D	46	25	17	AV4
D	46	25	22	AV5
D	46	25	19	AV6
D	46	30	20	AV3
D	46	30	33	AV4
D	46	30	36	AV5
D	46	32	15	AV2
D	46	32	16	AV6
D	46	38	16	AV2
D	46	38	20	AV3
D	46	38	36	AV4
D	46	38	35	AV5
D	46	38	19	AV6
D	46	39	22	AV4

SG	Row	Col	Per	Locn
D	46	39	38	AV5
D	46	39	20	AV6
D	46	42	27	AV4
D	46	42	28	AV5
D	46	42	18	AV6
D	46	60	17	AV4
D	46	98	18	AV3
D	47	28	14	AV4
D	47	49	32	AV2
D	47	49	25	AV3
D	47	53	21	AV4
D	47	53	29	AV5
D	47	53	24	AV6
D	47	61	22	AV4
D	47	61	16	AV6
D	47	92	17	AV3
D	47	97	15	AV3
D	47	97	15	AV5
D	48	65	21	AV4
D	49	27	19	AV3
D	49	28	18	AV5
D	49	28	15	AV6
D	49	36	14	AV2
D	49	36	16	AV4
D	49	36	16	AV5
D	49	36	16	AV6
D	49	42	17	AV6
D	49	43	17	AV1
D	49	43	21	AV2
D	49	43	17	AV5
D	49	52	16	AV1
D	49	52	36	AV2
D	49	52	26	AV3
D	49	52	22	AV4
D	49	52	15	AV5
D	49	52	18	AV6
D	49	55	17	AV1
D	49	55	21	AV2
D	49	55	19	AV3
D	49	81	28	AV4
D	49	81	21	AV5
D	49	82	17	AV6
D	49	87	15	AV3
D	49	87	21	AV4
D	49	93	16	AV6
D	49	94	19	AV1
D	49	94	18	AV2
D	49	94	16	AV3
D	49	94	23	AV5
D	49	94	20	AV6
D	50	44	18	AV2
D	50	44	15	AV3
D	50	50	25	AV4
D	50	93	17	AV5
D	50	94	26	AV5
D	50	94	34	AV6
D	51	62	13	AV2
D	52	33	19	AV1
D	52	33	19	AV3
D	52	33	34	AV4
D	52	33	25	AV5
D	52	33	24	AV6
D	52	35	21	AV2
D	52	35	26	AV3
D	52	35	18	AV4
D	52	35	30	AV5
D	52	35	16	AV6
D	53	34	14	AV4
D	53	43	19	AV2
D	53	62	15	AV1
D	53	89	21	AV6
D	54	43	19	AV2
D	54	43	20	AV4
D	54	58	13	AV2
D	54	80	11	AV3
D	55	39	13	AV3
D	55	41	19	AV2
D	55	76	12	AV4
D	55	82	11	AV2
D	56	41	28	AV2
D	56	41	15	AV3
D	56	41	34	AV4
D	56	41	28	AV5
D	56	41	25	AV6
D	56	43	17	AV2
D	56	43	20	AV3
D	56	69	22	AV3
D	56	69	20	AV4
D	56	69	26	AV5
D	56	69	21	AV6
D	56	81	23	AV5
D	56	81	22	AV6
D	56	82	11	AV5
D	56	82	17	AV6
D	57	72	15	AV5
D	58	58	13	AV1
D	58	58	13	AV6
D	58	75	19	AV2
D	58	75	14	AV5
D	58	75	16	AV6
D	59	59	18	AV5
D	59	60	17	AV1
D	59	62	21	AV5
D	59	66	18	AV1