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 19 in the Fall of 2018.

This letter contains no new regulatory commitments.

If you have any questions regarding this submittal, please contact me at (603) 773-7932.

Sincerely,

NextEra Energy Seabrook, LLC.

Kenneth J. Browne
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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OR19 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 19 (hereafter referred to as the OR19 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 OR19 was performed in accordance with Technical Specification 6.7.6.k, and was the last inspection of the SGs in the third ISI period. At unit shutdown for the OR19 inspection, the SGs had operated for approximately 24.56 EFPY (294.8 EFPM) since installation. This included operation for approximately 1.41 EFPY (16.9 EFPM) during the fuel cycle (cycle 19) leading up to the OR19 inspection. Initial entry into Mode 4 following completion of the OR19 inspection was made on October 24, 2018.

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 OR19 outage met the requirements of the Seabrook Unit 1 Technical Specifications and the EPRI SGMP: PWR Steam Generator Examination Guidelines, Revision 8.

References to Seabrook's prior SG Tube Inspection Reports in the third inspection period are tabulated in Appendix A along with a list of acronyms used in this report. Appendix B provides a list of imperfections (non-SCC indications).

A. Scope of Inspections Performed on each SG

The inspection scope for OR19 met the requirements of Seabrook Unit 1 Technical Specification 6.7.6.k.d. For all sample inspections, tube selection priority was given to the ones not inspected in OR17 to meet the sequential period requirements in Technical Specifications. Unless otherwise noted, the defined OR19 base 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.
- 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 2 rows of tubes in the tube-free lane were inspected in the HL and CL using the +Point™ probe. The extent was ± 3 inches in the CL and +3 inches above the TTS to the H* depth (-15.21 in.) in the HL.
- 50% sample of non-peripheral tubes in the HL from +3 inches above the TTS to the H* depth (-15.21 in.) using the +Point™ probe, including 50% of the BLG/OXP within the H* depth of the tubesheet.
- 50% of Dings/Dents > 5V in the HL (freespan, supports), U-bend and uppermost CL TSP (called 08C) using the +Point™ probe.
- +Point™ probe inspection of all "high stress" (minus 2-sigma) tubes at HL & CL TSP locations.
- 100% +Point™ probe inspection at HL TSP locations on non-high stress tubes that have a large noise residual (defined as locations with a vertical maximum noise component of >0.45 volt on the P1 mix channel.
- Special interest exams based on the results of bobbin coil exams including +Point™ probe inspection of all "I-codes" from bobbin.
- Visual inspection of all mechanical and welded plugs.
- Channel head visual inspection, and bowl scan per Westinghouse NSAL 12-1 Rev 1, "Steam Generator Channel Head Degradation," October 2017.

Inspection Expansion:

One PWSCC indication in the HL TTS region of SG-C resulted in an expansion of the inspection to 100% of tubes in the HL of SG-C from +3 inches above the TTS to the H* depth (-15.21 in.) using the +Point™ probe, per the EPRI SGMP: PWR Steam Generator Examination Guidelines, Revision 8. No inspection expansion was required in the other SGs since the minimum sample size requirement was met by the base scope described above for the HL tubesheet program. Additional details on the PWSCC indication is provided later in the report.

Secondary-side:

- TTS sludge lancing in all 4 SGs.
- FOSAR in all 4 SGs. Included TTS in-bundle inspections in each SG.
- Upper steam drum inspection in SG-D.

B. Degradation Mechanisms Found

The following degradation mechanisms were identified during the OR19 inspection:

- An axial PWSCC indication at the TTS in the HL of 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

C. NDE Techniques utilized for each Degradation Mechanism

Table 1a is the list of the EPRI ETSSs used for degradation detection during the OR19 ECT inspection.

Table 1a - NDE Detection Techniques for Degradation Mechanisms

Detection probe	ETSS used for Detection	Degradation Mechanism	Location / Applicability
Bobbin	I96041.1 Rev 5	Wear	AVB locations
Bobbin	96004.1 Rev 13	Wear	TSP and FDB locations
Bobbin +Point™	27091.2 Rev 2 21998.1 Rev 4	Wear	Due to foreign objects
Bobbin	96005.2 Rev 9	Pitting	In the freespan and sludge pile
Bobbin	I-28411 Rev 4	Axial ODSCC	At FDBs locations
Bobbin	I-28412 Rev 4 I-28413 Rev 5		In the freespan
Bobbin	I-28413 Rev 5		At broached TSPs
Bobbin	24013.1 Rev 2 10013.1 Rev 1		At Dents/Dings ≤ 5V
+Point™	22401.1 Rev 4 96703.1 Rev 17 I-28424 Rev 4 I-28425 Rev 4		At Dents/Dings > 5V
+Point™	10411.1 Rev 0		In low row U-bends
+Point™	21409.1 Rev 7 I28424 Rev 4 I28425 Rev 4		In the sludge pile/expansion transition
+Point™	20511.1 Rev 8	Axial PWSCC	At expansion transition
	20510.1 Rev 7	Circ PWSCC	
+Point™	20511.1 Rev 8 I11524 Rev 0	Axial/Circ PWSCC	At BLGs/OXPs
+Point™	96511.1 Rev 16 96511.2 Rev 16 99997.1 Rev 10		In low row U-bends

Table 1b is the list of the EPRI ETSSs used for degradation sizing based on the degradation mechanisms reported during the OR19 ECT inspection.

Table 1b - NDE Sizing Techniques for Degradation Mechanisms

Sizing probe	ETSS used for Sizing	Degradation Mechanism	Location / Applicability
Bobbin	96004.3 Rev 13	Wear	AVB locations
+Point™	96910.1 Rev 11	Wear	At broached TSP locations
+Point™	21998.1 Rev 4 27902.3 Rev 2 27906.3 Rev 1	Wear (volumetric)	Due to foreign objects, and caused by legacy sludge lance equipment
+Point™	20511.1 Rev 8	Axial PWSCC	At expansion transition (for CM purposes)

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

PWSCC:

A single axial indication (SAI) of PWSCC was detected at the TTS expansion transition in SG-C during the HL tubesheet inspection program using the +Point™ probe. The indication was found in tube, R33C93, and was characterized as shown in Table 2 below. This tube is not a "high stress tube", and there are no bulges or over-expansions (BLG/OXP) at this location. Since the indication was short and shallow by the +Point probe, the location was retested with the Ghent probe, which confirmed the indication. The indication is very similar to the 20% ID axial EDM notch in the ETSS 20511.1 calibration standard. However, when the 100%, 60% and 40% axial ID notches were used to create the sizing calibration curve, the "deeper" segments on the crack ends are less than one-half the signal amplitude in the center, which is not consistent with basic eddy current theory. Therefore, the indication was more accurately sized by establishing the phase versus depth curve on the 100%, 60%, and 20% axial ID notches (using the 20% I.D. axial notch instead of the 40% I.D. axial notch) then measuring the depth at the peak amplitude (center) and conservatively assuming that the flaw is uniformly deep over the measured length. Additional information on the results of condition monitoring for this indication is provided in Section G of this report.

Table 2 - OR19 SCC Indications

SG	Tube	Degradation Mechanism	Location	ETSS[1]	Measured Length[2] (in.)	Measured Depth[2] (%)	Max Volts (+Point™)
C	R33C93	PWSCC	SAI at TSH+0.04″	20511.1 Rev 8	0.21 in.	22%	0.58V

1. ETSS 20511.1, Revision 8 (with the 20% anchoring the low end of the curve instead of the 40% ID axial notch)
2. The structural equivalent length and depth are conservatively assumed equal to the measured length and depth, based on the assumptions made to acquire the crack dimensions using a modified ETSS 20511.1

Appendix B provides a listing for each SG of the tubes with other service-induced indications, showing locations and measured sizes.

AVB Wear:

AVB wear continues to be an existing degradation mechanism in all four SGs at Seabrook. Table 3 summarizes the current inspection results for AVB wear, and the list of AVB indications reported during OR19 are included in Appendix B. In Table 3, the "number of indications" includes pre-existing and new indications. AVB indications were detected in all 4 SGs, as expected. The highest AVB wear indication was 39% TW. The total number of AVB indications is typical among the population of Model F SGs.

Table 3 - OR19 AVB Wear

SG	No. of Indications	No. of Indications ≥40% TW	New Indications(1)		New Tubes(2)
			Number	Max Depth	
SG-A	375	0	21	22% TW	15
SG-B	286	0	14	20% TW	11
SG-C	257	0	14	23% TW	7
SG-D	498	0	25	19% TW	14

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

Wear (Volumetric) Indications At or Above the TTS:

Volumetric wear indications reported in OR19 are attributed to: a) maintenance-related (MNT) activity; b) wear at horizontal tube support structures, or c) wear due to transient foreign objects (FOs). Eight newly-reported volumetric indications were detected in OR19: 5 in SG-A and 3 in SG-C. Volumetric indications (VOL, SVI) reported during OR19 are summarized in Table 4.

a) Indications reported in row 1 that are located approximately 18" above the tubesheet or above the 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. One such indication (R1C112 in CL of SG-C) was newly-reported in OR19; however, the signal has been present for several outages without change, and was discernable through noise and reported as NDD in OR17. All other maintenance-related volumetric indications remain essentially unchanged and within inspection technique variabilities from previous inspections.

b) One newly-reported TSP volumetric wear indication was reported in SG-A (R18C82 at 06C). The indication was discernable, but not reported in previous inspections; however, this indication is unchanged. The TSP wear indication in tube R22C97 in SG-B was inspected with +Point™ in OR19 and reported a 28% TW, consistent with the 32% TW reported for the OR17 inspection[1]. All other volumetric wear indications at TSPs remain essentially unchanged from previous inspections.

c) 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 wear indications in the following areas are considered to originate from transient foreign objects (loose parts): ones that are at the edge of TSP intersections which are not aligned axially with the land contact point, that reside slightly above or below the TSP, and ones in close proximity to the to TTS. Four foreign object-related VOL indications (not associated with PLPs) were newly-reported in OR19; 2 in SG-A and 2 in SG-C. Two single volumetric indications (SVI) associated with PLPs were also reported in SG-A, and were plugged and stabilized, along with a tube at an adjacent location which also had a PLP signal.

The volumetric indications (Table 4) 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.

[1] Reference Response to RAI #2 in NRC ADAMS Document Accession No. ML16302A398

Table 4 - OR19 Volumetric Indications

SG	Row	Col	Location	OR19	Comment
A	1	87	TSC+18.85	31% A	MNT
A	1	36	TSC+18.09	23% A	MNT
A	1	11	01C-1.68	21% B	MNT
A	4	87	06C-0.5	9% C	TSP
A	5	108	06C-0.58	14% C	TSP
A	18	82	06C-0.62	7% C	TSP (newly reported); present in 2009, no change
A	21	26	03H-0.64	18% A	FO (newly reported), no PLP present (VOL)
A	35	80	03H-0.46	32% A	FO
A	35	88	03H-0.96	25% A	FO
A	45	23	01H+0.79	11% B (1)	FO with PLP (SVI). plugged & stabilized
A	46	24	01H+0.62	19% B (1)	FO w/ PLP (SVI). DSI since 2009. plugged & stabilized
A	49	29	TSH+0.16	22% A	FO
A	50	29	TSH+0.12	14% A	FO
A	53	33	TSH+0.33	10% A	FO VOL (newly reported); no PLP present
B	1	11	TSC+18.45	35% A	MNT
B	1	87	TSH+18.32	39% A	MNT
B	1	87	TSC+18.32	39% A	MNT
B	1	112	TSH+18.35	17% A	MNT
B	1	119	01H+16.16	13% D	MNT
B	2	98	06C-0.83	35% A	FO
B	2	113	07H+1.07	27% A	FO
B	5	86	04H-0.42	14% C	TSP
B	22	97	05H-0.56	28% C	TSP
B	43	96	TSH+0.06	19% A	FO
B	54	87	01C+0.57	19% A	FO
C	1	87	TSH+17.94	38% A	MNT
C	1	87	TSC+17.94	11% D	MNT
C	1	112	TSH+18.36	26% A	MNT
C	1	112	TSC+18.29	15% A	MNT (newly reported); present in 2015, no change
C	3	90	07C-0.64	23% A	TSP
C	3	113	05C-0.80	33% A	FO
C	5	57	06C-0.64	26% A	TSP
C	28	104	05C-0.63	25% A	FO
C	32	24	04H-0.4	27% C	TSP
C	32	35	07C+19.45	9% A	FO
C	39	19	TSC+4.05	17% A	FO
C	42	98	04H-0.8	12% A	FO (newly reported), no PLP present; plugged
C	43	26	TSH+0.07	24% A	FO
C	43	98	04H-0.61	27% A	FO (newly reported), no PLP present; plugged
C	44	26	TSH+0.12	12% A	FO
D	1	87	TSH+18.42	33% A	MNT
D	6	108	03H-0.41	10% C	TSP
D	13	4	01C+0.41	26% A	FO
D	21	52	04H-0.41	24% A	FO
D	42	19	03C+0.20	11% 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

Misc. Special Interest Inspections:

- Some PLP signals in OR19 had been reported previously, and nearly all of the PLP signals were either historical and not associated with a volumetric indication or were observable by secondary-side FOSAR examination. No damage to the tubes was associated with these PLP signal locations. [The exceptions were the 2 tubes with SVI indications and the adjacent tube with a PLP signal (no wear)].

- Geometric Anomalies: Based on the sample of bulges and over-expansions (BLG/OXP) inspected in OR19, no evidence of any degradation was found. All BLG signals above the TTS were previously-reported in OR17, and no degradation was associated with any of the BLG signals.

- No SCC indications were detected during the inspection of high stress tubes at HL and CL TSP locations. SCC was also not reported on non-high stress tubes having large noise residuals.

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

Six (6) tubes were plugged based on the OR19 inspection; the tubes plugged for each degradation mechanism are summarized below in Table 5:

Table 5 - OR19 Tubes Plugged

SG	Tube	Degradation Mechanism	Location	Notes
A	R45C23	PLP with wear (SVI)	01H+0.71	11% at OR19; stabilizer installed.
	R45C24	PLP, no wear	01H+0.36	Preventively plugged due to its proximity to tubes with foreign object wear. Stabilizer installed.
	R46C24	PLP with wear (SVI)	01H+0.6	19% in OR19, DSI present from at least 2009. Stabilizer installed.
C	R33C93	SAI (PWSCC)	TSH+0.04	Axial PWSCC at Expansion Transition
	R42C98	FO Wear, no PLP	04H-0.8	12%TW, no prior history. Preventatively plugged due to proximity to R43C98
	R43C98	FO Wear, no PLP	04H-0.73	27%TW, no prior history. Preventatively plugged due to atypical growth

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 6.

Table 6 - Tubes plugged to-date and effective plugging percentage

	SG-A	SG-B	SG-C	SG-D	Total
Tubes Plugged	42	27	61	65	195
Percent Plugged	0.75%	0.48%	1.08%	1.16%	0.87%

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

All indications found in OR19 satisfy the condition monitoring (CM) 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 5, and provided for Seabrook conditions. None of the tubes identified for plugging met the requirements for in-situ testing. The OR19

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

1. A single axial indication (SAI) of PWSCC was detected in tube, R33C93, at the TTS expansion transition in SG-C during the HL tubesheet inspection program using the +Point™ probe. For this indication, the maximum +Point™ probe voltage was 0.58 volt for a crack length of 0.21 inch, which is slightly above the first ISPT proof screen per the Seabrook degradation assessment. However, the crack length (0.21 inch) was less than the structural length for a 100%TW crack (0.40 inch). The flaw maximum +Point™ probe voltage is also significantly less than the initial V_{CRIT} and V_{THR-L} voltage screens for leakage integrity. The indication was shown to have 95% probability at 50% confidence burst pressure greater than the limiting differential pressure of 3900 psid. Thus, it passed the screening criteria for burst and leak testing. Therefore, condition monitoring requirements are met, and an ISPT was not necessary. No pitting was observed during the OR19 inspection.

2. The maximum observed AVB wear indication (39% TW) meets the CM requirements with 95% probability at 50% confidence, (when all uncertainties are considered at their 95% probability values).

3. The maximum observed volumetric indications (indicative of mechanical wear) were 39% TW. These indications have shown no growth since the last inspection, and are less than the structural limit when all uncertainties are considered. All volumetric indications met the CM requirements with 95% probability at 50% confidence.

4. The maximum wear observed during the OR19 inspection due to foreign objects was 35% TW; the structural limit for the local wear is 56% TWD. There was no wear associated with any of the PLP indications reported during the previous inspection. The 2 SVI indications (Table 4) which had associated PLPs were both plugged and stabilized since the growth rate cannot be adequately quantified. The previously-reported wear at the FDB was reported again during OR19. These signals are not changing, and the magnitude of the wear does not challenge the requirements for condition monitoring. Therefore, wear due to foreign objects meets the performance requirements for Condition Monitoring.

5. 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 2.49 gpd (.0017 gpm). No leakage was detected from the SCC indication in SG-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.

6. Channelhead Components Visual Inspection:
   - Tube Plug Inspection: During the inspection of tube plugs in OR19, all installed plugs were confirmed to be in their correct location. In addition, all plugs were found to be dry; no dripping plugs were identified. No degradation or visible signs of leakage were noted on the plugs during the visual inspection.
   - Other Channelhead Inspections: Visual inspection of various channelhead components were performed to identify degradation per guidance in Westinghouse NSAL 12-1 Rev 1, “Steam Generator Channel Head Degradation” and LR-ISG-2016-01, “Changes to Aging Management Guidance for Various Steam Generator Components.” Areas inspected include the divider plate-to-channelhead weld, the weld at the top of the channelhead bowl drain tube, the channelhead-to-tubesheet girth weld seam region, the divider plate, and all cladded surfaces of the channelhead bowl and tubesheet. No degradation was found; the observed condition during the OR19 inspection is consistent with the manufacturing process.

7. Secondary-side Inspections and Maintenance:
   - Sludge Lancing and FOSAR: A total of approximately 130.5 lbs. of sludge was removed from the 4 SGs based on sludge lancing in OR19. The TTS region was essentially clean with some hardened collars noted at the center of the bundle where flow rates are low during operation.

Nine (9) foreign objects were identified during FOSAR activities in OR19. Two (2) of the objects (sludge rocks) were removed. The remaining objects comprised mainly of sludge rocks, and 2 legacy objects: a previously-reported dumbbell-shaped object, and a hollow metal fitting identified in OR19 in SG-D. The newly-identified metal object appears to have been in place since the SG was manufactured since it fills the gap between 4 neighboring tubes, and cannot be retrieved. No wear was identified on any of the 4 bounding tubes during ECT, and no tube damage was observed in any SG during FOSAR activities.

- Upper Internals Inspection: Visual inspections performed in SG-D (for erosion/corrosion, mechanical damage, foreign material and unusual conditions) included the dryers, swirl vanes, feedring and J-nozzles. A band of discoloration was observed on the wall of the steam drum, just above the feedring. This appears to have been caused by a thin layer of magnetite that had spalled from the wall in this region; however, the base material appears to be intact. A minimal amount of scouring was observed inside some of the J-tubes at the interface with the feedring. UT thickness readings were taken at select locations on the feedring; no abnormal conditions were noted. No erosion/corrosion or degradation was noted during visual inspections of the upper steam drum components.

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 0.2 gpd and 1.0 gpd during the fuel cycle preceding the OR19 inspection. This low level of leakage has been detected for several cycles, fluctuating between 0 and 1.2 gpd. 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 0.2 gpd to 1.0 gpd in the fuel cycle preceding the OR19 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. 1.0 gpd), the predicted accident induced leakage ($Q_{DBA)}$ in SG-B is:

Q_{DBA} = 2.49 x 1.0 gpd = 2.49 gpd (=0.0017 gpm)

Therefore, since the predicted accident induced leakage from SG-B (2.49 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 OR19 inspection.

APPPENDIX A - Additional Information

References to prior SG Tube Inspection Reports (3rd inspection period)

Inspection #	EOC	Outage	NRC ADAMS Accession No.
1	EOC-15	OR15	ML13008A160
2	EOC-16	OR16	ML14297A090
3	EOC-17	OR17	ML16120A203
4	EOC-18	OR18	ML17291B270

Abbreviations and Acronyms:

ARC	Alternate Repair Criteria
AVB	Anti Vibration Bar
BLG	Bulge
CL	Cold Leg
CM	Condition Monitoring
DA	Degradation Assessment
DBA	Design Bases Accident
DNG	Ding
DNT	Dent
ECT	Eddy Current Testing
EFPM	Effective Full Power Months
EFPY	Effective Full Power Years
EPRI	Electric Power Research Institute
ETSS	Exam Technique Spec Sheet
FDB	Flow Distribution Baffle
FO	Foreign Object
FOSAR	Foreign Object Search and Retrieval
GPD (gpd)	Gallons per Day
GPM (gpm)	Gallons per Minute
HL	Hot Leg
ID	Inside Diameter
ISPT	In-Situ Pressure Test
MNT	Maintenance Related
NDD	No Degradation Detectable
NEI	Nuclear Energy Institute
NSAL	Nuclear Safety Advisory Letter
OD	Outside Diameter
ODSCC	OD Stress Corrosion Cracking
OXP	Over-expansion
Per	Percent Through-Wall
PLP	Possible Loose Part
POD	Probability of Detection
PWSCC	Primary Water SCC
SAI	Single Axial Indication
SCC	Stress Corrosion Cracking
SED	Structural Equivalent Depth
SEL	Structural Equivalent Length
SG	Steam Generator
SGMP	SG Management Program
SLB	Steam Line Break
SVI	Single Volumetric Indication
TS	Tubesheet
TSC	Tube Sheet Cold
TSH	Tube Sheet Hot
TSP	Tube Support Plate
TTS	Top of Tube Sheet
TW	Through Wall
TWD	Through Wall Depth
UFSAR	Updated Final Safety Analysis Rpt
V_{CRIT}	Critical voltage for leakage
V_{THR-L}	Threshold voltage for leak testing
VOL	Volumetric

SG	Row	Col	Per	Locn
A	1	11	21	01C
A	1	36	23	TSC
A	1	87	31	TSC
A	4	87	9	06C
A	5	108	14	06C
A	17	67	14	AV1
A	17	71	14	AV1
A	18	58	15	AV1
A	18	82	7	06C
A	19	40	29	AV1
A	19	54	21	AV1
A	19	58	16	AV1
A	19	61	16	AV1
A	19	61	13	AV6
A	20	48	14	AV1
A	21	26	18	03H
A	23	36	12	AV1
A	23	37	14	AV6
A	23	38	14	AV2
A	23	42	19	AV6
A	23	45	19	AV5
A	23	45	16	AV6
A	23	52	15	AV2
A	23	52	15	AV5
A	23	59	23	AV2
A	23	59	20	AV5
A	23	61	11	AV2
A	24	7	17	AV1
A	24	7	14	AV6
A	24	59	21	AV2
A	24	59	20	AV5
A	24	59	15	AV6
A	24	71	16	AV2
A	24	71	16	AV5
A	25	7	18	AV1
A	25	56	16	AV2
A	25	59	16	AV2
A	25	68	14	AV1
A	25	83	14	AV2
A	26	107	29	AV6
A	27	12	13	AV6
A	27	63	17	AV2
A	27	112	13	AV1
A	27	112	14	AV5
A	28	44	16	AV2
A	28	44	16	AV5
A	28	59	28	AV2
A	28	59	22	AV5
A	29	11	21	AV2
A	29	71	12	AV2
A	29	82	23	AV2
A	29	82	18	AV6
A	29	84	19	AV5
A	29	84	16	AV6
A	29	94	30	AV2
A	30	11	25	AV5
A	30	12	12	AV1
A	30	12	18	AV5
A	30	12	16	AV6
A	30	31	16	AV5
A	30	58	18	AV5
A	30	58	18	AV6
A	30	64	17	AV2
A	30	64	15	AV5
A	30	68	15	AV1
A	30	68	15	AV2
A	30	89	12	AV2
A	30	95	12	AV6
A	30	102	19	AV5
A	30	109	15	AV1
A	30	109	15	AV5
A	30	109	16	AV6
A	30	111	15	AV1
A	30	111	19	AV5
A	31	11	19	AV5
A	31	12	35	AV5
A	31	12	21	AV6
A	31	13	15	AV6
A	31	64	16	AV2
A	31	68	15	AV2
A	31	69	16	AV5
A	31	105	13	AV1
A	32	89	14	AV3
A	33	14	16	AV1
A	33	14	12	AV2
A	33	15	12	AV4
A	33	15	22	AV5
A	33	15	18	AV6
A	33	71	14	AV1
A	33	71	13	AV2
A	33	92	19	AV1
A	33	106	16	AV1
A	34	17	13	AV3
A	34	17	12	AV6
A	34	51	24	AV2
A	34	51	23	AV3
A	34	59	15	AV2
A	34	59	13	AV3
A	34	87	17	AV3
A	34	87	17	AV4
A	34	94	19	AV1
A	34	95	16	AV3
A	34	97	19	AV2
A	34	103	16	AV1
A	35	14	17	AV2
A	35	14	17	AV4
A	35	14	20	AV5
A	35	14	13	AV6
A	35	31	17	AV3
A	35	31	19	AV5
A	35	55	16	AV2
A	35	55	13	AV4
A	35	58	24	AV1
A	35	58	34	AV2
A	35	58	39	AV3
A	35	58	39	AV4
A	35	58	32	AV5
A	35	58	20	AV6
A	35	61	14	AV1
A	35	61	17	AV2
A	35	61	19	AV3
A	35	61	35	AV4
A	35	61	30	AV5
A	35	61	14	AV6
A	35	70	17	AV2
A	35	73	24	AV2
A	35	73	20	AV3
A	35	80	32	03H
A	35	88	25	03H

SG	Row	Col	Per	Locn
A	36	110	12	AV2
A	37	87	13	AV2
A	37	99	13	AV1
A	37	99	16	AV3
A	37	99	17	AV4
A	37	102	26	AV1
A	37	102	19	AV4
A	37	102	20	AV5
A	37	105	17	AV1
A	37	105	22	AV4
A	37	105	15	AV5
A	39	63	21	AV2
A	39	63	20	AV3
A	39	79	13	AV2
A	39	79	18	AV3
A	39	79	25	AV4
A	39	79	24	AV5
A	39	80	21	AV3
A	40	71	23	AV2
A	40	86	20	AV1
A	40	86	28	AV2
A	40	86	20	AV4
A	40	86	21	AV5
A	40	94	25	AV2
A	40	94	20	AV4
A	40	96	17	AV1
A	40	102	20	AV3
A	40	102	24	AV4
A	40	103	16	AV3
A	40	103	25	AV4
A	40	103	25	AV5
A	41	35	15	AV3
A	41	50	15	AV1
A	41	50	20	AV2
A	41	50	22	AV3
A	41	50	25	AV4
A	41	50	37	AV5
A	41	53	18	AV1
A	41	53	17	AV2
A	41	53	18	AV3
A	41	53	24	AV4
A	41	53	25	AV5
A	41	54	28	AV2

SG	Row	Col	Per	Locn
A	41	54	26	AV3
A	41	54	17	AV5
A	41	58	15	AV1
A	41	58	21	AV2
A	41	58	21	AV3
A	41	58	20	AV4
A	41	58	17	AV5
A	41	59	26	AV2
A	41	59	17	AV3
A	41	59	13	AV5
A	41	68	20	AV2
A	41	68	36	AV3
A	41	68	27	AV4
A	41	68	25	AV5
A	41	68	18	AV6
A	41	78	16	AV2
A	41	78	20	AV3
A	41	78	12	AV5
A	41	84	16	AV2
A	41	84	15	AV4
A	41	91	22	AV1
A	41	91	21	AV2
A	41	102	19	AV1
A	41	102	22	AV4
A	41	102	24	AV5
A	41	103	21	AV1
A	41	103	12	AV3
A	41	103	22	AV4
A	41	103	24	AV5
A	41	103	15	AV6
A	42	22	14	AV4
A	42	58	29	AV3
A	42	58	20	AV4
A	42	58	21	AV5
A	42	72	18	AV1
A	42	72	21	AV2
A	42	72	33	AV3
A	42	72	25	AV4
A	42	72	30	AV5
A	42	72	18	AV6
A	42	80	11	AV1
A	42	80	31	AV2
A	42	80	33	AV3

SG	Row	Col	Per	Locn
A	42	80	23	AV4
A	42	80	20	AV5
A	42	80	27	AV6
A	42	81	19	AV4
A	42	83	14	AV2
A	42	103	20	AV1
A	43	20	13	AV6
A	43	55	19	AV2
A	43	98	23	AV5
A	44	66	17	AV1
A	44	94	18	AV2
A	44	94	22	AV3
A	44	94	20	AV4
A	44	98	19	AV1
A	44	98	23	AV2
A	44	98	29	AV3
A	44	98	23	AV4
A	44	98	21	AV5
A	44	100	18	AV1
A	44	100	21	AV3
A	44	100	21	AV5
A	44	101	22	AV1
A	44	102	18	AV2
A	45	23	11	01H
A	45	67	18	AV2
A	45	68	18	AV2
A	45	74	20	AV1
A	45	74	22	AV2
A	45	74	29	AV3
A	45	74	33	AV4
A	45	76	17	AV1
A	45	80	14	AV3
A	45	80	15	AV4
A	45	98	18	AV4
A	46	24	19	01H
A	46	65	20	AV4
A	46	65	26	AV5
A	46	71	11	AV3
A	46	71	19	AV4
A	46	71	18	AV5
A	46	77	19	AV2
A	46	77	19	AV3
A	46	77	25	AV4

SG	Row	Col	Per	Locn
A	46	94	20	AV6
A	46	95	14	AV4
A	46	95	20	AV5
A	46	95	19	AV6
A	46	97	16	AV6
A	46	98	26	AV4
A	46	98	23	AV5
A	46	98	20	AV6
A	47	85	23	AV5
A	47	89	19	AV3
A	47	89	17	AV6
A	47	95	13	AV1
A	47	95	19	AV2
A	47	95	22	AV3
A	47	95	22	AV4
A	47	95	14	AV5
A	47	95	16	AV6
A	47	98	20	AV5
A	48	31	17	AV3
A	48	31	17	AV4
A	48	31	14	AV5
A	48	31	16	AV6
A	48	60	24	AV6
A	48	63	15	AV1
A	48	63	25	AV2
A	48	63	26	AV3
A	48	63	25	AV4
A	48	63	22	AV5
A	48	64	25	AV2
A	48	83	16	AV3
A	48	83	21	AV4
A	48	91	15	AV3
A	48	91	14	AV4
A	48	91	12	AV5
A	48	92	18	AV6
A	48	94	21	AV4
A	48	94	18	AV5
A	48	94	23	AV6
A	48	95	12	AV4
A	48	95	17	AV5
A	48	95	22	AV6
A	48	96	24	AV6
A	49	28	12	AV2

SG	Row	Col	Per	Locn
A	49	29	22	TSH
A	49	48	12	AV1
A	49	54	15	AV3
A	49	57	12	AV2
A	49	57	13	AV4
A	49	57	14	AV5
A	49	57	12	AV6
A	49	60	14	AV3
A	49	64	26	AV1
A	49	65	16	AV1
A	49	65	23	AV2
A	49	65	38	AV3
A	49	65	26	AV4
A	49	65	21	AV5
A	49	76	19	AV2
A	49	88	18	AV2
A	49	88	29	AV3
A	49	88	28	AV4
A	49	88	33	AV5
A	49	88	21	AV6
A	49	90	21	AV5
A	49	90	19	AV6
A	49	91	13	AV5
A	50	29	14	TSH
A	50	38	18	AV4
A	50	38	19	AV5
A	50	60	15	AV2
A	50	60	14	AV3
A	50	66	18	AV2
A	50	71	14	AV2
A	50	80	17	AV3
A	50	80	16	AV4
A	50	80	15	AV5
A	50	85	12	AV2
A	50	85	27	AV3
A	50	85	24	AV4
A	50	85	19	AV5
A	50	85	18	AV6
A	50	88	27	AV6
A	50	95	24	AV3
A	50	95	27	AV4
A	50	95	36	AV5
A	50	95	31	AV6

SG	Row	Col	Per	Locn
A	51	52	16	AV4
A	51	53	14	AV4
A	51	71	15	AV4
A	51	75	19	AV5
A	51	86	21	AV1
A	51	86	29	AV2
A	51	86	24	AV3
A	51	86	21	AV4
A	51	86	17	AV6
A	51	90	23	AV2
A	51	90	23	AV3
A	51	90	28	AV4
A	51	90	27	AV5
A	51	90	22	AV6
A	52	53	14	AV2
A	52	57	13	AV3
A	52	73	19	AV3
A	52	73	20	AV5
A	52	88	22	AV3
A	52	88	35	AV4
A	52	88	33	AV5
A	52	88	27	AV6
A	52	89	13	AV3
A	52	89	26	AV4
A	52	89	31	AV5
A	52	89	29	AV6
A	52	90	23	AV6
A	53	33	10	TSH
A	53	45	23	AV2
A	53	45	12	AV3
A	53	69	17	AV5
A	53	89	16	AV1
A	53	90	19	AV4
A	54	86	16	AV2
A	55	41	16	AV5
A	55	41	16	AV6
A	56	57	12	AV2
A	56	81	13	AV4
A	57	48	17	AV1
A	57	48	17	AV2
A	57	52	12	AV1
A	57	61	13	AV2
A	58	50	15	AV6

SG	Row	Col	Per	Locn
A	58	76	17	AV2
A	58	76	19	AV3

SG	Row	Col	Per	Locn
B	1	11	35	TSC
B	1	87	39	TSC
B	1	87	39	TSH
B	1	112	17	TSH
B	1	119	13	01H
B	2	98	35	06C
B	5	86	14	04H
B	12	65	16	AV1
B	15	68	18	AV1
B	17	64	19	AV1
B	17	69	13	AV1
B	17	77	12	AV1
B	18	66	17	AV1
B	18	74	17	AV1
B	19	66	18	AV1
B	20	60	26	AV1
B	20	60	16	AV6
B	20	60	13	AV6
B	21	68	16	AV1
B	21	77	14	AV1
B	21	115	14	AV6
B	22	36	13	AV1
B	22	36	13	AV2
B	22	36	14	AV6
B	22	69	14	AV1
B	22	89	18	AV2
B	22	89	17	AV6
B	22	97	28	05H
B	22	116	13	AV2
B	23	47	22	AV1
B	23	47	17	AV2
B	23	49	18	AV1
B	23	49	14	AV2

SG	Row	Col	Per	Locn
B	23	56	18	AV1
B	23	56	16	AV2
B	24	43	16	AV2
B	24	43	16	AV5
B	24	45	16	AV2
B	25	51	19	AV1
B	25	51	23	AV2
B	25	51	21	AV5
B	25	82	14	AV2
B	25	112	16	AV1
B	27	42	19	AV2
B	27	57	14	AV2
B	27	63	16	AV5
B	27	81	13	AV5
B	27	107	20	AV5
B	27	112	15	AV1
B	28	42	17	AV2
B	28	42	16	AV5
B	28	65	13	AV2
B	28	65	15	AV6
B	28	78	18	AV2
B	28	115	16	AV2
B	28	115	15	AV5
B	29	30	17	AV2
B	29	32	16	AV6
B	29	38	16	AV2
B	29	38	17	AV5
B	29	38	14	AV6
B	29	51	18	AV2
B	29	79	30	AV1
B	29	79	24	AV2
B	29	79	21	AV5
B	29	79	17	AV6
B	29	89	14	AV1
B	29	89	17	AV2
B	29	101	19	AV2
B	29	113	18	AV1
B	29	113	23	AV5
B	29	113	13	AV6
B	30	43	18	AV2
B	30	43	22	AV5
B	30	43	23	AV6
B	30	49	16	AV2

SG	Row	Col	Per	Locn
B	30	58	18	AV5
B	30	61	23	AV2
B	30	61	35	AV5
B	30	62	18	AV2
B	30	66	15	AV1
B	30	66	17	AV2
B	30	66	21	AV5
B	30	66	15	AV6
B	30	71	15	AV5
B	30	73	15	AV2
B	30	73	15	AV5
B	30	75	28	AV2
B	30	75	21	AV5
B	30	79	16	AV2
B	30	79	13	AV5
B	30	80	14	AV1
B	30	80	21	AV2
B	30	80	19	AV5
B	30	81	25	AV2
B	30	81	29	AV5
B	30	87	19	AV2
B	30	87	29	AV5
B	30	87	19	AV6
B	30	106	17	AV1
B	30	106	19	AV6
B	30	109	18	AV5
B	30	111	17	AV2
B	30	111	23	AV5
B	30	112	15	AV1
B	30	112	20	AV2
B	30	112	17	AV5
B	31	66	16	AV6
B	31	111	25	AV5
B	31	112	16	AV1
B	31	112	19	AV2
B	32	81	13	AV2
B	32	82	25	AV2
B	32	82	16	AV5
B	32	82	16	AV6
B	32	83	14	AV2
B	32	83	15	AV3
B	32	83	17	AV5
B	32	86	19	AV2

SG	Row	Col	Per	Locn
B	32	86	18	AV3
B	32	86	17	AV4
B	32	88	14	AV1
B	32	88	17	AV2
B	32	88	17	AV3
B	32	88	14	AV5
B	32	103	18	AV2
B	32	109	18	AV5
B	32	109	15	AV6
B	33	95	17	AV2
B	33	104	16	AV2
B	33	104	14	AV4
B	33	107	13	AV3
B	33	107	16	AV5
B	33	109	15	AV4
B	33	109	30	AV5
B	34	14	17	AV5
B	34	14	20	AV6
B	34	70	23	AV2
B	34	70	16	AV3
B	34	70	15	AV4
B	34	72	16	AV2
B	34	82	16	AV2
B	34	85	13	AV2
B	34	85	11	AV6
B	34	94	16	AV2
B	34	94	15	AV5
B	34	94	15	AV6
B	34	98	17	AV2
B	34	98	17	AV3
B	34	100	15	AV5
B	34	100	15	AV6
B	34	101	15	AV2
B	34	101	12	AV6
B	34	103	16	AV5
B	34	103	19	AV6
B	34	105	16	AV6
B	35	44	18	AV1
B	35	44	15	AV2
B	35	55	18	AV4
B	35	58	15	AV2
B	35	58	21	AV3
B	35	58	21	AV4
B	35	58	19	AV5
B	35	59	14	AV1
B	35	59	17	AV2
B	35	59	12	AV3
B	35	59	15	AV4
B	35	67	19	AV2
B	35	67	18	AV3
B	35	67	14	AV4
B	35	68	8	AV1
B	35	68	16	AV2
B	35	68	20	AV3
B	35	68	21	AV4
B	35	68	21	AV5
B	35	71	10	AV3
B	35	98	17	AV3
B	35	98	14	AV4
B	35	104	15	AV3
B	35	104	15	AV6
B	36	59	17	AV2
B	36	59	13	AV6
B	36	64	13	AV3
B	36	64	16	AV4
B	36	65	31	AV2
B	36	65	20	AV3
B	36	65	14	AV4
B	36	65	22	AV5
B	37	54	10	AV2
B	37	54	17	AV4
B	37	58	14	AV3
B	37	69	23	AV2
B	37	87	15	AV2
B	37	87	18	AV3
B	38	41	16	AV6
B	39	48	9	AV2
B	39	48	19	AV3
B	39	48	17	AV4
B	39	48	17	AV5
B	39	49	14	AV1
B	39	49	27	AV2
B	39	49	28	AV3
B	39	49	21	AV4
B	39	54	12	AV1
B	39	54	17	AV2
B	39	54	22	AV3
B	39	54	21	AV4
B	39	54	16	AV5
B	39	56	16	AV1
B	39	56	18	AV2
B	39	57	11	AV1
B	39	57	16	AV2
B	39	57	14	AV3
B	39	57	15	AV4
B	39	57	13	AV5
B	39	59	18	AV1
B	39	60	10	AV1
B	39	60	11	AV2
B	39	60	21	AV3
B	39	60	12	AV4
B	40	48	32	AV2
B	40	48	15	AV2
B	40	48	35	AV3
B	40	48	28	AV4
B	40	48	27	AV5
B	40	48	15	AV6
B	40	74	11	AV2
B	41	61	20	AV2
B	41	61	22	AV4
B	41	61	15	AV5
B	41	75	23	AV2
B	41	75	22	AV3
B	41	75	19	AV4
B	41	75	16	AV5
B	42	64	11	AV2
B	42	64	11	AV5
B	42	81	18	AV2
B	42	103	16	AV4
B	43	20	15	AV2
B	43	69	17	AV2
B	43	69	15	AV3
B	43	69	26	AV4
B	43	69	27	AV5
B	43	75	24	AV2
B	43	75	19	AV3
B	43	75	29	AV4
B	43	75	28	AV5
B	43	96	19	TSH

SG	Row	Col	Per	Locn
B	44	62	10	AV2
B	44	62	10	AV4
B	45	27	15	AV6
B	45	33	22	AV2
B	45	41	23	AV2
B	45	41	21	AV3
B	45	41	18	AV4
B	45	47	15	AV5
B	45	74	11	AV2
B	45	86	22	AV1
B	46	66	11	AV3
B	47	71	15	AV1
B	47	71	20	AV2
B	47	71	28	AV3
B	47	71	15	AV4
B	47	74	13	AV2
B	48	25	12	AV5
B	48	71	13	AV4
B	49	33	19	AV2
B	49	78	21	AV2
B	49	78	18	AV4
B	50	93	14	AV2
B	50	93	16	AV4
B	50	95	17	AV6
B	51	70	16	AV5
B	51	70	19	AV6
B	53	34	21	AV6
B	53	44	11	AV6
B	53	90	14	AV4
B	53	90	22	AV5
B	53	90	16	AV6
B	54	36	17	AV5
B	54	66	14	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	55	18	AV3
B	55	63	16	AV3
B	55	69	11	AV2
B	55	69	18	AV3

SG	Row	Col	Per	Locn
B	56	69	15	AV2
B	56	71	13	AV2
B	56	82	22	AV5
B	57	50	15	AV6
B	57	55	16	AV6
B	57	69	14	AV2
B	58	57	20	AV2

SG	Row	Col	Per	Locn
C	1	87	11	TSC
C	1	87	38	TSH
C	1	112	15	TSC
C	1	112	26	TSH
C	3	90	23	07C
C	3	113	33	05C
C	5	57	26	06C
C	9	67	14	AV1
C	9	74	14	AV1
C	10	63	24	AV1
C	10	63	19	AV6
C	10	64	19	AV1
C	11	67	19	AV1
C	11	72	16	AV1
C	14	62	17	AV1
C	15	35	12	AV1
C	15	64	19	AV1
C	15	67	20	AV1
C	16	37	16	AV6
C	19	59	16	AV1
C	19	62	19	AV1
C	22	34	18	AV2
C	24	7	18	AV1
C	24	7	19	AV6
C	24	98	15	AV1
C	25	10	12	AV1
C	25	56	19	AV2
C	26	8	17	AV1
C	28	66	19	AV2
C	28	104	25	05C

SG	Row	Col	Per	Locn
C	30	11	16	AV1
C	30	11	16	AV5
C	30	11	15	AV6
C	30	113	22	AV2
C	30	113	15	AV5
C	30	113	16	AV6
C	30	114	17	AV2
C	30	114	14	AV5
C	30	114	10	AV6
C	31	111	19	AV5
C	32	24	27	04H
C	32	35	9	07C
C	32	110	15	AV3
C	33	42	21	AV4
C	33	42	21	AV6
C	33	106	13	AV2
C	33	106	18	AV3
C	33	106	22	AV4
C	33	111	17	AV2
C	33	111	16	AV5
C	34	28	17	AV4
C	34	28	17	AV5
C	35	13	13	AV1
C	35	13	28	AV2
C	35	13	18	AV3
C	35	13	28	AV4
C	35	13	35	AV5
C	35	13	19	AV6
C	36	43	17	AV2
C	37	17	18	AV5
C	37	23	16	AV1
C	37	23	11	AV4
C	37	23	19	AV5
C	37	40	18	AV2
C	37	40	18	AV3
C	37	40	15	AV4
C	37	40	15	AV5
C	37	40	16	AV6
C	37	47	20	AV4
C	37	47	12	AV5
C	37	55	19	AV2
C	37	56	19	AV2
C	37	78	14	AV5

SG	Row	Col	Per	Locn
C	37	83	16	AV2
C	37	85	22	AV2
C	37	85	18	AV3
C	37	85	21	AV4
C	37	85	19	AV5
C	37	85	18	AV6
C	38	79	20	AV1
C	38	79	18	AV2
C	38	101	16	AV6
C	38	102	18	AV4
C	38	102	21	AV5
C	39	19	17	TSC
C	39	42	20	AV2
C	39	42	15	AV3
C	39	42	20	AV4
C	39	45	22	AV2
C	39	45	30	AV3
C	39	45	26	AV4
C	39	45	37	AV5
C	39	45	17	AV6
C	39	69	23	AV2
C	39	69	21	AV3
C	39	69	30	AV4
C	39	69	29	AV5
C	40	36	15	AV1
C	40	36	19	AV2
C	41	22	19	AV2
C	41	22	19	AV3
C	41	22	16	AV4
C	41	22	20	AV5
C	41	22	17	AV6
C	41	23	21	AV1
C	41	23	20	AV5
C	41	23	16	AV6
C	41	30	14	AV4
C	41	30	20	AV5
C	41	30	20	AV6
C	41	39	27	AV2
C	41	39	22	AV4
C	41	39	23	AV5
C	41	39	24	AV6
C	41	41	21	AV1
C	41	41	35	AV2

SG	Row	Col	Per	Locn
C	41	41	23	AV3
C	41	41	22	AV4
C	41	43	19	AV2
C	41	43	19	AV3
C	41	43	29	AV4
C	41	43	17	AV5
C	41	80	21	AV2
C	41	80	34	AV3
C	41	80	22	AV4
C	41	80	19	AV5
C	41	93	10	AV1
C	41	93	13	AV2
C	41	93	13	AV3
C	41	93	17	AV4
C	41	93	22	AV5
C	41	100	19	AV3
C	41	100	20	AV4
C	41	100	28	AV5
C	41	100	14	AV6
C	42	23	21	AV4
C	42	23	25	AV5
C	42	24	17	AV6
C	42	25	13	AV2
C	42	25	14	AV3
C	42	25	17	AV4
C	42	25	17	AV5
C	42	25	13	AV6
C	42	31	14	AV1
C	42	31	27	AV2
C	42	31	13	AV3
C	42	56	16	AV2
C	42	71	21	AV2
C	42	71	17	AV5
C	42	92	17	AV2
C	42	92	23	AV3
C	42	92	16	AV4
C	42	92	20	AV5
C	42	98	12	04H
C	42	102	15	AV1
C	42	102	18	AV2
C	42	102	36	AV3
C	42	102	35	AV4
C	42	102	17	AV5

SG	Row	Col	Per	Locn
C	42	102	23	AV6
C	43	23	19	AV1
C	43	23	29	AV3
C	43	23	17	AV4
C	43	23	20	AV5
C	43	26	24	TSH
C	43	98	27	04H
C	43	100	17	AV2
C	43	100	17	AV3
C	43	100	36	AV4
C	43	100	26	AV5
C	43	102	22	AV2
C	43	102	25	AV3
C	43	102	34	AV4
C	43	102	30	AV5
C	43	102	19	AV6
C	44	22	16	AV2
C	44	26	12	TSH
C	44	75	21	AV1
C	44	75	22	AV2
C	44	100	17	AV2
C	44	100	22	AV3
C	44	100	36	AV4
C	44	100	36	AV5
C	44	100	19	AV6
C	46	36	22	AV2
C	46	36	26	AV3
C	46	36	33	AV4
C	46	36	25	AV5
C	46	79	17	AV2
C	46	79	21	AV3
C	46	79	22	AV4
C	46	79	17	AV5
C	46	79	21	AV6
C	46	97	17	AV3
C	46	97	23	AV4
C	46	97	15	AV5
C	47	30	22	AV5
C	47	35	18	AV1
C	47	35	24	AV2
C	47	35	32	AV3
C	47	35	32	AV4
C	47	35	20	AV5

SG	Row	Col	Per	Locn
C	47	40	21	AV2
C	47	40	16	AV3
C	47	40	23	AV4
C	47	40	22	AV5
C	47	40	20	AV6
C	47	57	13	AV2
C	47	62	14	AV4
C	47	76	19	AV1
C	47	76	21	AV2
C	47	83	18	AV5
C	47	86	17	AV4
C	47	86	16	AV5
C	47	93	10	AV1
C	47	93	22	AV3
C	47	93	25	AV4
C	47	93	35	AV5
C	47	94	14	AV2
C	47	94	16	AV3
C	47	94	24	AV4
C	47	94	20	AV5
C	47	94	16	AV6
C	47	96	13	AV3
C	47	96	16	AV5
C	47	96	14	AV6
C	47	98	17	AV3
C	47	98	18	AV4
C	47	99	17	AV4
C	47	99	30	AV5
C	47	99	27	AV6
C	48	30	16	AV4
C	48	30	20	AV5
C	48	30	17	AV6
C	48	33	21	AV5
C	48	35	17	AV4
C	48	35	20	AV5
C	48	47	17	AV1
C	48	47	19	AV2
C	48	47	14	AV3
C	48	97	16	AV2
C	48	97	19	AV3
C	48	97	18	AV4
C	49	95	27	AV5
C	50	28	19	AV1

SG	Row	Col	Per	Locn
C	51	49	18	AV1
C	51	49	26	AV2
C	51	49	20	AV3
C	51	67	14	AV4
C	51	67	17	AV6
C	53	33	15	AV3
C	53	35	18	AV2
C	53	35	13	AV4
C	53	63	17	AV2
C	53	67	15	AV1
C	53	67	32	AV2
C	53	67	34	AV3
C	53	67	23	AV4
C	53	70	18	AV1
C	53	70	25	AV2
C	53	70	17	AV3
C	54	35	14	AV4
C	54	37	16	AV1
C	54	39	18	AV1
C	54	68	24	AV2
C	54	87	15	AV3
C	54	87	18	AV4
C	54	87	23	AV5
C	55	39	18	AV1
C	56	65	15	AV3
C	58	51	15	AV6
C	59	67	16	AV6

SG	Row	Col	Per	Locn
D	1	87	33	TSH
D	6	108	10	03H
D	12	2	13	AV1
D	13	4	26	01C
D	16	64	20	AV1
D	16	64	19	AV6
D	17	72	18	AV1
D	17	75	15	AV6
D	21	52	24	04H
D	22	86	14	AV2
D	22	93	13	AV2
D	22	93	15	AV6
D	24	6	22	AV1
D	24	6	21	AV6
D	24	89	13	AV5
D	24	89	13	AV6
D	24	91	14	AV2
D	24	116	11	AV5
D	25	82	18	AV2
D	25	82	13	AV5
D	26	8	17	AV1
D	26	8	22	AV6
D	26	40	11	AV1
D	26	40	18	AV5
D	26	41	15	AV2
D	26	41	14	AV5
D	26	52	14	AV2
D	26	83	13	AV2
D	26	114	13	AV2
D	27	8	15	AV1
D	27	8	26	AV6
D	27	36	17	AV5
D	27	39	29	AV2
D	27	39	31	AV5
D	27	39	24	AV6
D	27	44	24	AV2
D	27	76	13	AV1
D	27	76	19	AV2
D	27	76	16	AV5
D	27	89	14	AV1
D	27	89	14	AV2
D	27	96	11	AV5
D	27	96	13	AV6
D	27	111	17	AV5
D	27	115	21	AV2
D	27	115	20	AV5
D	28	69	10	AV2
D	28	88	18	AV5
D	28	115	13	AV2
D	28	115	22	AV5
D	29	34	27	AV2
D	29	34	24	AV5
D	29	83	10	AV1
D	29	83	16	AV5
D	29	113	15	AV2
D	30	12	12	AV1
D	30	12	11	AV5
D	30	66	22	AV2
D	30	66	19	AV5
D	31	113	10	AV1
D	32	12	16	AV1
D	32	12	13	AV2
D	32	12	16	AV3
D	32	12	38	AV5
D	33	58	18	AV1
D	33	58	21	AV2
D	33	58	19	AV3
D	33	96	13	AV1
D	33	96	14	AV2
D	33	107	15	AV4
D	34	15	11	AV1
D	34	15	16	AV4
D	34	17	9	AV1
D	34	17	14	AV2
D	34	17	14	AV3
D	34	17	12	AV4
D	34	22	12	AV2
D	34	22	15	AV3
D	34	22	12	AV4
D	34	22	12	AV5
D	34	22	15	AV6
D	34	30	14	AV3
D	34	30	13	AV5
D	34	35	13	AV2
D	34	35	12	AV5
D	34	40	13	AV4
D	34	40	17	AV5
D	34	40	19	AV6
D	34	43	16	AV2
D	34	48	15	AV5
D	34	50	14	AV2
D	34	50	15	AV3
D	34	69	24	AV2
D	34	69	22	AV3
D	34	69	33	AV4
D	34	69	31	AV5
D	34	69	12	AV6
D	34	70	16	AV2
D	34	71	19	AV2
D	34	73	36	AV2
D	34	73	27	AV3
D	34	73	32	AV4
D	34	73	28	AV5
D	34	73	18	AV6
D	34	75	11	AV3
D	34	76	15	AV2
D	34	76	17	AV3
D	34	76	17	AV4
D	34	76	19	AV5
D	34	92	10	AV4
D	34	103	18	AV3
D	34	109	21	AV5
D	35	22	11	AV3
D	35	22	11	AV4
D	35	22	9	AV6
D	35	37	24	AV2
D	35	37	17	AV3
D	35	37	12	AV6
D	35	51	13	AV1
D	35	51	11	AV2
D	35	51	13	AV4
D	35	53	14	AV3
D	35	53	12	AV4
D	35	69	31	AV2
D	35	69	33	AV3
D	35	69	18	AV4
D	35	69	14	AV5
D	35	69	14	AV6
D	35	71	10	AV1

SG	Row	Col	Per	Locn
D	35	71	19	AV2
D	35	71	15	AV3
D	35	83	24	AV3
D	35	83	21	AV4
D	35	86	11	AV4
D	35	86	14	AV6
D	35	88	13	AV2
D	35	88	13	AV3
D	35	88	19	AV4
D	35	89	21	AV2
D	35	89	17	AV3
D	36	16	16	AV3
D	36	40	21	AV2
D	36	40	19	AV3
D	36	40	18	AV4
D	36	40	15	AV5
D	36	40	16	AV6
D	36	41	20	AV2
D	36	46	14	AV5
D	36	67	23	AV2
D	36	67	11	AV3
D	36	80	11	AV3
D	36	82	15	AV1
D	36	82	26	AV2
D	36	82	18	AV3
D	36	82	22	AV4
D	36	82	23	AV5
D	36	90	14	AV2
D	37	16	15	AV1
D	37	16	11	AV2
D	37	16	22	AV3
D	37	16	18	AV4
D	37	16	12	AV5
D	37	16	15	AV6
D	37	19	9	AV6
D	37	38	13	AV2
D	37	38	13	AV3
D	37	38	20	AV4
D	37	38	12	AV5
D	37	39	15	AV2
D	37	39	17	AV3
D	37	39	19	AV4
D	37	39	18	AV5

SG	Row	Col	Per	Locn
D	37	39	13	AV6
D	37	40	13	AV3
D	37	40	14	AV4
D	37	40	13	AV6
D	37	45	20	AV2
D	37	45	14	AV3
D	37	45	14	AV4
D	37	45	13	AV5
D	37	48	13	AV1
D	37	48	13	AV2
D	37	48	21	AV3
D	37	48	16	AV4
D	37	48	13	AV5
D	37	48	11	AV6
D	37	58	26	AV2
D	37	58	19	AV3
D	37	59	17	AV2
D	37	59	14	AV3
D	37	59	20	AV4
D	37	59	11	AV5
D	37	73	15	AV2
D	37	77	16	AV1
D	37	77	22	AV2
D	37	77	30	AV3
D	37	77	32	AV4
D	37	77	18	AV5
D	37	84	13	AV4
D	37	84	19	AV6
D	37	105	14	AV4
D	38	35	18	AV6
D	38	73	21	AV2
D	38	73	17	AV3
D	38	73	19	AV4
D	38	73	15	AV5
D	39	18	12	AV1
D	39	18	17	AV4
D	39	18	20	AV5
D	39	19	13	AV2
D	39	19	19	AV3
D	39	24	16	AV2
D	39	36	11	AV5
D	39	38	10	AV3
D	39	41	15	AV2

SG	Row	Col	Per	Locn
D	39	41	18	AV3
D	39	41	26	AV4
D	39	41	18	AV5
D	39	41	13	AV6
D	39	44	15	AV1
D	39	44	17	AV3
D	39	44	21	AV4
D	39	44	17	AV5
D	39	44	16	AV6
D	39	50	16	AV2
D	39	50	18	AV3
D	39	50	16	AV4
D	39	50	18	AV5
D	39	57	13	AV1
D	39	57	22	AV2
D	39	57	22	AV3
D	39	57	13	AV4
D	39	57	20	AV5
D	39	59	15	AV3
D	39	62	25	AV2
D	39	74	15	AV2
D	39	75	17	AV2
D	39	82	13	AV1
D	39	82	21	AV2
D	39	82	19	AV3
D	39	82	17	AV4
D	39	82	16	AV5
D	39	89	21	AV1
D	39	89	17	AV2
D	39	94	15	AV2
D	39	94	14	AV3
D	39	94	13	AV4
D	39	96	11	AV5
D	39	102	17	AV1
D	39	103	20	AV1
D	39	103	18	AV2
D	40	19	12	AV1
D	40	21	18	AV2
D	40	21	16	AV3
D	40	21	15	AV6
D	40	23	15	AV1
D	40	23	14	AV4
D	40	24	15	AV2

SG	Row	Col	Per	Locn
D	40	24	12	AV3
D	40	24	13	AV4
D	40	24	12	AV5
D	40	26	12	AV3
D	40	66	12	AV1
D	40	66	32	AV2
D	40	66	32	AV3
D	40	66	25	AV3
D	40	66	27	AV4
D	40	66	19	AV4
D	40	66	26	AV5
D	40	66	19	AV6
D	41	18	13	AV4
D	41	20	19	AV2
D	41	20	21	AV3
D	41	20	23	AV4
D	41	20	24	AV5
D	41	20	14	AV6
D	41	34	13	AV2
D	41	34	13	AV3
D	41	34	11	AV4
D	41	35	15	AV3
D	41	36	14	AV1
D	41	36	14	AV3
D	41	38	18	AV3
D	41	38	12	AV4
D	41	51	13	AV2
D	41	51	17	AV3
D	41	56	12	AV1
D	41	56	32	AV2
D	41	56	24	AV3
D	41	56	21	AV4
D	41	56	28	AV5
D	41	56	19	AV6
D	41	59	9	AV3
D	41	59	24	AV4
D	41	66	27	AV2
D	41	66	21	AV3
D	41	66	14	AV4
D	41	66	16	AV5
D	41	71	17	AV2
D	41	90	14	AV2
D	41	104	12	AV2
D	41	104	11	AV5
D	42	19	11	03C
D	42	19	14	AV1
D	42	19	17	AV3
D	42	19	14	AV4
D	42	19	13	AV5
D	42	20	12	AV6
D	42	24	13	AV1
D	42	24	15	AV2
D	42	24	13	AV3
D	42	24	26	AV4
D	42	24	12	AV5
D	42	37	21	AV2
D	42	37	20	AV3
D	42	37	13	AV4
D	42	37	12	AV6
D	42	39	16	AV3
D	42	39	13	AV3
D	42	39	20	AV4
D	42	39	17	AV4
D	42	40	19	AV6
D	42	46	14	AV2
D	42	46	24	AV3
D	42	46	16	AV4
D	42	46	22	AV5
D	42	47	17	AV2
D	42	47	17	AV3
D	42	47	17	AV4
D	42	47	18	AV5
D	42	77	17	AV5
D	42	92	15	AV1
D	42	92	13	AV2
D	42	92	14	AV3
D	42	92	16	AV4
D	42	92	20	AV5
D	42	92	17	AV6
D	42	98	13	AV3
D	42	98	14	AV4
D	42	98	16	AV5
D	42	98	14	AV6
D	43	21	15	AV2
D	43	21	23	AV3
D	43	21	15	AV4
D	43	21	23	AV5
D	43	21	26	AV6
D	43	22	10	AV4
D	43	24	11	AV2
D	43	24	11	AV3
D	43	24	11	AV5
D	43	49	14	AV3
D	43	51	17	AV2
D	43	51	13	AV3
D	43	51	15	AV4
D	43	51	25	AV5
D	43	54	18	AV2
D	44	26	16	AV1
D	44	26	19	AV2
D	44	26	15	AV3
D	44	26	22	AV4
D	44	26	12	AV5
D	44	36	17	AV1
D	44	36	17	AV2
D	44	36	21	AV3
D	44	45	14	AV2
D	44	45	14	AV3
D	44	45	24	AV5
D	44	45	17	AV6
D	44	48	18	AV2
D	44	48	31	AV3
D	44	48	23	AV4
D	44	48	22	AV5
D	44	48	16	AV6
D	44	69	13	AV2
D	44	91	27	AV2
D	44	91	33	AV3
D	44	91	30	AV4
D	44	91	29	AV5
D	44	91	16	AV6
D	44	101	16	AV3
D	44	102	13	AV5
D	45	27	14	AV5
D	45	40	16	AV5
D	45	40	17	AV6
D	45	66	12	AV1
D	45	66	20	AV2
D	46	25	14	AV4

SG	Row	Col	Per	Locn
D	46	25	19	AV5
D	46	25	18	AV6
D	46	30	18	AV3
D	46	30	29	AV4
D	46	30	31	AV5
D	46	32	13	AV2
D	46	32	14	AV6
D	46	38	14	AV2
D	46	38	18	AV3
D	46	38	37	AV4
D	46	38	35	AV5
D	46	38	17	AV6
D	46	39	20	AV4
D	46	39	39	AV5
D	46	39	18	AV6
D	46	42	25	AV4
D	46	42	27	AV5
D	46	42	15	AV6
D	46	60	21	AV4
D	46	98	9	AV3
D	47	28	11	AV4
D	47	49	35	AV2
D	47	49	24	AV3
D	47	53	20	AV4
D	47	53	27	AV5
D	47	53	19	AV6
D	47	61	22	AV4
D	47	61	19	AV6
D	47	92	17	AV3
D	47	97	16	AV3
D	47	97	15	AV5
D	48	65	20	AV4
D	49	27	13	AV3
D	49	28	20	AV5
D	49	28	14	AV6
D	49	36	13	AV2
D	49	36	16	AV4
D	49	36	15	AV5
D	49	36	15	AV6
D	49	41	13	AV2
D	49	42	16	AV6
D	49	43	15	AV1
D	49	43	14	AV2

SG	Row	Col	Per	Locn
D	49	43	15	AV5
D	49	52	17	AV1
D	49	52	36	AV2
D	49	52	28	AV3
D	49	52	24	AV4
D	49	52	18	AV5
D	49	52	20	AV6
D	49	55	13	AV1
D	49	55	18	AV2
D	49	55	14	AV3
D	49	81	28	AV4
D	49	81	23	AV5
D	49	82	15	AV6
D	49	87	14	AV3
D	49	87	18	AV4
D	49	93	13	AV6
D	49	94	15	AV1
D	49	94	15	AV2
D	49	94	12	AV3
D	49	94	21	AV5
D	49	94	19	AV6
D	50	44	19	AV2
D	50	44	15	AV3
D	50	50	24	AV4
D	50	89	14	AV6
D	50	93	12	AV5
D	50	94	13	AV4
D	50	94	20	AV5
D	50	94	26	AV6
D	51	62	12	AV2
D	52	33	14	AV1
D	52	33	19	AV3
D	52	33	32	AV4
D	52	33	20	AV5
D	52	33	20	AV6
D	52	35	18	AV2
D	52	35	27	AV3
D	52	35	16	AV4
D	52	35	30	AV5
D	52	35	16	AV6
D	53	34	11	AV4
D	53	43	12	AV2
D	53	62	13	AV1

SG	Row	Col	Per	Locn
D	53	89	17	AV6
D	54	43	16	AV2
D	54	43	16	AV4
D	54	58	11	AV2
D	55	39	9	AV3
D	55	41	11	AV2
D	55	76	9	AV4
D	55	82	15	AV2
D	56	41	26	AV2
D	56	41	9	AV3
D	56	41	30	AV4
D	56	41	25	AV5
D	56	41	19	AV6
D	56	43	13	AV2
D	56	43	13	AV3
D	56	65	19	AV3
D	56	69	16	AV3
D	56	69	19	AV4
D	56	69	26	AV5
D	56	69	21	AV6
D	56	81	19	AV5
D	56	81	18	AV6
D	56	82	13	AV5
D	56	82	15	AV6
D	57	72	8	AV5
D	58	58	11	AV1
D	58	58	11	AV6
D	58	75	18	AV2
D	58	75	14	AV5
D	58	75	17	AV6
D	59	59	14	AV5
D	59	60	12	AV1
D	59	62	12	AV5
D	59	66	11	AV1