VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

May 24, 2010

Attention Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555-0001

Serial No. 10-220
SS&L/TJN R0
Docket No. 50-281
License No. DPR-37

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNIT 2
STEAM GENERATOR TUBE INSERVICE INSPECTION REPORT FOR THE 2009 REFUELING OUTAGE

Technical Specification 6.6.A.3 for Surry Power Station Units 1 and 2 requires the submittal of a Steam Generator Tube Inspection Report to the NRC within 180 days after Tavg exceeds 200°F following completion of an inspection performed in accordance with the Technical Specification 6.4.Q, Steam Generator Program. Attached is the Surry Power Station Unit 2 report for the 2009 refueling outage.

If you have any questions or require additional information, please contact Mr. Trace J. Niemi at 757-365-2848.

Sincerely,

G. T. Bischof
Site Vice President
Surry Power Station

Attachment

Commitments made in this letter: None

A047
NRR

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CONCURRENCE:
See Station Correspondence Review and Approval Form

ACTION PLAN:
None

VERIFICATION OF ACCURACY:
1. Areva Steam Generator Services Integrated Report, Surry Power Station - Unit 2, December 2009- 2R22, Revision 0, 12/9/09
2. Letter from Virginia Electric and Power Company to the USNRC dated September 30, 2009 (Serial No. 09-455B), "Virginia Electric And Power Company (Dominion), Surry Power Station Units 1 And 2, Proposed License Amendment Request, One-Time Alternate Repair Criteria for Steam Generator Tube Inspection/Repair for Units 1 And 2"
3. WCAP-17092-P, June 2009, Revision 0, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model 51F)"
4. E. Turko 5/4/10 LotusNote to T. Niemi, Subject: RE: 180 day report R15
5. Engineering Challenge review 180 day SG report from the 2009 U2 RFO (ref. Engineering Log 4/7/2010 15:12)
6. Unit 2 Control Room Narrative Log for 11/25/09, RCS temperature exceeds 200F

COMMITMENTS (STATED OR IMPLIED):
None

CHANGES TO UFSAR, USAR, QA TOPICAL REPORT, OR ISFSI SAR:
None

Attachment 1

SURRY UNIT 2
STEAM GENERATOR TUBE INSERVICE INSPECTION REPORT
FOR THE 2009 REFUELING OUTAGE

SURRY POWER STATION
VIRGINIA ELECTRIC AND POWER COMPANY

SURRY UNIT 2
STEAM GENERATOR TUBE INSERVICE INSPECTION REPORT
FOR THE 2009 REFUELING OUTAGE

The following information satisfies the Surry Power Station Technical Specification (TS) reporting requirement section 6.6.A.3. During the Surry Unit 2 fall 2009 (EOC22) refueling outage, steam generator (SG) inspections were completed in accordance with TS 6.4.Q for all three SGs.

The Unit 2 SGs were in the 3rd inspection period which had a duration of 60 Effective Full Power Months (EFPM). The fall 2009 outage was the last outage of two in the second half of the 3rd period.

TS 6.6.A.3 requires a SG Tube Inspection Report to be submitted to the NRC within 180 days following the unit Tavg exceeding 200°F. Unit 2 Tavg exceeded 200°F on November 25, 2009, therefore this report is required to be submitted by May 24, 2010. At the time of this inspection, the current SGs had operated for 268.5 EFPM since the first inservice inspection.

For EOC22, a one-time alternate tube repair criterion (ARC) was submitted to allow tubes with service-induced flaws located greater than 16.7 inches below the top of the tubesheet to not require plugging. Tubes with service-induced flaws located in the portion of the tube from the top of the tubesheet to 16.7 inches below the top of the tubesheet would be plugged upon detection. Associated with the ARC is a requirement to perform a one-time Eddy Current Testing (ECT)-based measurement of Bottom of Expansion Transition (BET) location for each tube on both the hot leg and cold leg. No significant deviation from the assumed BET value was found during a historical review of ECT data.

The report information is provided under each ***bold italicized*** TS 6.6.A.3 item shown below. A list of acronyms is attached at the end of this report.

A report shall be submitted within 180 days after Tavg exceeds 200°F following completion of an inspection performed in accordance with the Specification 6.4.Q, "Steam Generator (SG) Program." The report shall include:

a. The scope of inspections performed on each SG

The initial eddy current examination scope is identified below in Table 1. The only scope expansions required were those necessary to bound foreign objects and foreign object related degradation, and to resolve ambiguous indications. A detailed summary of the actual EOC22 ECT examination scope is provided in the final inspection status (Table 2).

The following special interest rotating +Point™ probe inspection criteria were also applied during the EOC22 outage:

SG A Only
- All bobbin "I (indication)-codes"
- All PLP, PVN, OVR, BLG, and LGV

- All DNT with "NEW" in Util1 field (not found during previous inspections)
- Previous foreign-object related locations flagged for examination
- Tube locations which may have been damaged by foreign objects identified during the secondary side visual inspection (SSI)
- Tube locations with visible damage as identified during the SSI
- Bound (1 tube deep) all RPC-confirmed PLPs
- Bound (1 tube deep) all newly reported non-AVB VOL and non-AVB WAR that could have been caused by a foreign object
- All previously reported PITs (none), hot leg "A (anomalies)-Codes", LPS (loose part signal), LPM (loose part monitoring), and RPC-confirmed PLPs
- All indications of tube wall loss previously reported and sized with an RPC probe (excluding AVB wear)
- All tube regions which cannot be examined effectively with the bobbin probe due to data quality concerns
- All NTE/PTE from the top-of-tubesheet down to and including the location of the expansion transition
- The five largest voltage DNTs located between TEC and 07H+1.0"
- A sample of hot leg MBM/MBH (20% or 20 tests whichever is less)

<u>SGs B & C</u>

- All previous OVR
- Previous foreign-object related locations flagged for examination
- Tube locations which may have been damaged by foreign objects identified during the secondary side visual inspection (SSI)
- Tube locations with visible damage as identified during the SSI
- Bound (1 tube deep) all RPC-confirmed PLPs
- Bound (1 tube deep) all newly reported non-AVB VOL and non-AVB WAR that could have been caused by a foreign object
- All previously reported PITs (none), hot leg "A-Codes", LPS, LPM, and RPC-confirmed PLPs
- All indications of tube wall loss previously reported and sized with an RPC probe (excluding AVB wear)
- All NTE/PTE from the top-of-tubesheet down to and including the expansion transition region
- In Tier 1 High Residual Stress tubes, examine the following:
  - Hot leg tubesheet, full depth (per Table 1)
  - All current and previous H (history calls)-codes
  - All current and previous S (previous H-codes retested in later outages)-Codes
  - All previous A-Codes (hot and cold leg)
  - All current DNT, BLG, OVRs, LGV, and MBM/MBH
  - All AVB Wear Indications

The primary side work scope also included a video / visual examination of all six channel heads (as-found / as-left), specifically including all plugs, as well as the divider plate weld region.

Tubesheet Overexpansions

During previous outages, all hot leg and cold leg tubesheet overexpansions were identified using computer data screening (CDS) methods. These overexpansions are of interest because they are potential initiating sites for tube corrosion. During the current outage, a random sample of tubesheet OXPs as well as all OVRs were examined with +Point™ probes. The OXP and OVR examination count is summarized below in Table 3 and Table 4. In total, 60% of the SG "A" hot leg OXPs, and 30% of the SG "A" cold leg OXPs were examined with +Point™ probes. Incidental +Point™ sampling of OXPs in the hot legs of SGs "B" and "C" was also performed. No OXP or OVR related degradation was identified.

Table 1 – EOC22 Planned ECT Examination Scope

Scope	SG A	SG B	SG C
Bobbin probe: 100% Full Length (except for row 1 and 2 ubends)	✓		
Rotating Probe: H/L Expansion Transition (TSH±3")	66% Sample	58% Sample	58% Sample
Rotating Probe: Tier 1 High Stress Tubes (TEH to TSH+3") Tier 1 High Stress Tubes (H/L Tube Supports)	N/A*	100% 100%	100% 50%
Rotating Probe: 50% H/L Dents ≥2 Volts	✓	✓	✓
Rotating Probe: 100% Row 1 and 2 U-bends (From support 07C to 07H)	✓		
Rotating Probe: C/L Periphery (50% five tubes deep, TSC±3")	✓		
Rotating Probe: 50% H/L OXP Sample (TSH-16.7" to TSH+3")	✓		
Rotating Probe: 20 Largest Voltage C/L OXPs (TEC-16.7" to TSC+3")	✓		

*There are no tier 1 high stress tubes in SG A

Table 2 – EOC22 Actual ECT Examination Scope (Final Inspection Status)

		S/G A					S/G B					S/G C				
Scope Description	**Extent**	**Plan**	**Acq'd**	**%**	**Comp**	**%**	**Plan**	**Acq'd**	**%**	**Comp**	**%**	**Plan**	**Acq'd**	**%**	**Comp**	**%**
Bobbin Coil Exams																
Full Length	TEH/TEC	3041	3041	100	3041	100										
C/L Candy Cane (Row 3)	7H*/TEC	94	94	100	94	100										
C/L Straight (Row 1-2)	7C*/TEC	184	184	100	184	100										
H/L Straight (Row 1-3)	7H*/TEH	278	278	100	278	100										
MRPC Exams																
H/L Tubesheet (Full Depth)	TEH/TSH	60	60	100	60	100	2	2	100	2	100	14	14	100	14	100
H/L Tubesheet TSH +/-3	TSH/TSH	2206	2206	100	2206	100	1939	1939	100	1939	100	1939	1939	100	1939	100
C/L Tubesheet (Full Depth)	TEC/TSC	20	20	100	20	100										
C/L Tubesheet (TSC +/-3)	TSC	528	528	100	528	100										
Ubend RPC (R 1-2)	7C*/7H*	184	184	100	184	100										
High Stress Tubes (TSP)	Various						16	16	100	16	100	56	56	100	56	100
Special Interest																
H/L Previous DNT>2V	Various	129	129	100	129	100	57	57	100	57	100	46	46	100	46	100
H/L Previous Indications	Various	20	20	100	20	100	4	4	100	4	100	7	7	100	7	100
H/L Bobbin Indications	Various	23	23	100	23	100										
C/L Previous DNT >2V	Various	2	2	100	2	100										
C/L Previous Indications	Various											15	15	100	15	100
C/L Bobbin Indications	Various	7	7	100	7	100										
Ubend Previous DNT >2V	Various	2	2	100	2	100										
Ubend Previous Indications	Various											1	1	100	1	100
Ubend Bobbin Indications	Various	7	7	100	7	100										
Previous Foreign Object	Various	5	5	100	5	100	9	9	100	9	100	23	23	100	23	100
Bounding Tubes	Various	34	34	100	34	100	13	13	100	13	100	69	69	100	69	100
	Total	6824	6824	100	6824	100	2040	2040	100	2040	100	2170	2170	100	2170	100

*Support

Table 3 – Rotating Probe OXP Exams

(tubes/indications)	SG-A		SG-B		SG-C	
	Hot	Cold	Hot	Cold	Hot	Cold
Number of OXPs Above TTS-16.7" Examined	63 / 75	20 / 24	7 / 11	0 / 0	9 / 10	0 / 0
Total Number of OXPs Above TTS-16.7"	109 / 126	72 / 79	350 / 466	251 / 340	46 / 58	65 / 87

Table 4 – Rotating Probe OVR Exams

(tubes/indications)	SG-A		SG-B		SG-C	
	Hot	Cold	Hot	Cold	Hot	Cold
Number of OVRs Examined	3 / 3	0 / 0	1 / 1	0 / 0	5 / 5	4 / 4
Total Number of OVRs	3 / 3	0 / 0	1 / 1	0 / 0	5 / 5	4 / 4

Secondary Side

Listed below is a summary of the secondary side work performed in the Surry Unit 2 SGs during the EOC22 outage.

A Deposit Minimization Treatment (DMT) cleaning process was applied to SGs A, B, and C as preventive maintenance to reduce the inventory of deposit material on the secondary side of SGs. Deposit inventory reduction helps reduce the potential for tube corrosion, tube support broach hole blockage, and steam pressure loss due to heat transfer surface fouling. DMT utilizes a low concentration of oxalic acid which acts as a complexing agent in the dissolution of iron oxide deposits. A final passivation step employs lower concentration oxalic acid and hydrogen peroxide. The process results in very low corrosion rates for internal SG subcomponents.

SGs A, B, C

- Post sludge lancing top of tubesheet foreign object search and retrieval (FOSAR) at the top of the tubesheet, in the annulus, and no-tube lane
- Sludge sample retrieval for chemical analysis
- Post sludge lancing quick look on top of tubesheet and baffle plates to determine lancing effectiveness
- Visual investigation of historical foreign objects

SG C

- Steam drum visual inspection to include all major sub components as described in the secondary side inspection procedure/plan
- Internal feed-ring visual inspection of selected J-nozzle interfaces
- Visual top of tube bundle inspection via the primary moisture separator risers

b. Active degradation mechanisms found

Degradation mechanisms targeted by the inspection plan included anti-vibration bar (AVB) wear, pitting, foreign object wear, tube support wear as well as stress corrosion cracking (SCC) at various locations within the SG tube bundle. Only AVB wear, foreign object wear, and tube support plate wear were detected during the current outage. No indication of corrosion degradation was observed during this inspection. Lists of service induced indications are located in Section "d" of this report.

A one-time ARC was incorporated into the Surry Technical Specifications, effective during the EOC22 outage and during the operating cycle subsequent to the EOC22 outage. This ARC specifies that tubes with service-induced flaws located greater than 16.7 inches below the top of the tubesheet do not require plugging. Further, the ARC requires that tubes with service-induced flaws located in the portion of the tube from the top of the tubesheet to 16.7 inches below the top of the tubesheet be plugged upon detection. No degradation was identified in the areas inspected.

c. Nondestructive examination techniques utilized for each degradation mechanism

The inspection program focused on the degradation mechanisms listed in Table 5 and utilized the referenced eddy current techniques.

Table 5 – Inspection Method for Applicable Degradation Modes

Classification	Degradation Mechanism	Location	Probe Type
Existing	Tube Wear	Anti-Vibration Bars	Bobbin – Detection Bobbin or +Point™ – Sizing
Potential	Tube Wear	Flow Distribution Baffle	Bobbin – Detection +Point™ – Sizing
Existing	Tube Wear	Tube Support Plate	Bobbin – Detection +Point™ – Sizing
Existing	Tube Wear (foreign objects)	Freespan, TTS, TSP	Bobbin – Detection +Point™ - Sizing
Existing	Pitting	TTS	Bobbin – Detection +Point™ - Sizing
Potential	OD Corrosion PWSCC	Hot Leg Top-of-Tubesheet	+Point™ – Detection +Point™ - Sizing
Potential	OD Corrosion PWSCC	Hot Leg Dent Locations	+Point™ – Detection +Point™ - Sizing
Potential	OD Corrosion PWSCC	Hot and Cold Leg OVR and BLG	+Point™ – Detection +Point™ - Sizing
Potential	OD Corrosion PWSCC	Row 1 and 2 U-bends	+Point™ – Detection +Point™ - Sizing

Table 5 – Inspection Method for Applicable Degradation Modes (continued)

Classification	Degradation Mechanism	Location	Probe Type
Potential	OD Corrosion	Freespan and Tube Supports	Bobbin – Detection +Point™ - Sizing
Potential	PWSCC	Within-Tubesheet Overexpansions	+Point™ – Detection +Point™ - Sizing
Potential	OD Corrosion	Crevices formed by NTE/PTE	+Point™ – Detection +Point™ - Sizing
Potential	Tube Slippage	Within Tubesheet	Bobbin – Detection

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

As stated in the (b) response above, several wear type indications were noted. Tables 7, 8, and 9 provide the requested information for these indications.

AVB Wear Indications

A total of 23 AVB wear indications in 17 tubes were identified in SG "A" (see Table 7). None of the identified flaws exceeded the Technical Specification plugging limit (40%TW) or the 30%TW preventive plugging limit for AVB wear, and none were plugged. The maximum indicated depth was 28%TW (reported in tube SGA R36 C62).

Since 100% of the tubes in SG "A" received full-length bobbin examinations (except for row 1 and 2 u-bends) during the EOC22 outage, a direct comparison back to previous examination results is possible. Newly reportable AVB wear was reported in SG "A" during this outage, while one of the previously reported wear indications was not reportable during this outage and was therefore classified as INR (indication not reportable). The newly reportable indications do not indicate newly developed AVB wear but rather are the result of eddy current sizing uncertainty which caused some indications which were previously just below the 10% reporting criteria to be sized at greater than the reporting criteria. A summary of these EOC22 AVB wear indications is identified in Table 6.

Table 6 – EOC22 AVB Wear Results (New / INR)

SG	Total Number of New AVB Wear Tubes / Indications	Total Number of INR Tubes / Indications
A	8 / 11	1 / 1

Surry AVB wear growth has steadily decreased since its initial detection in the 1980s and no newly initiated AVB wear was identified during the EOC22 outage. No tubes required plugging due to AVB wear during this outage.

Table 7 – AVB Indications

SG	Row	Col	AVB No.	Depth (%TW) (ETSS 96004.1) 2006	Depth (%TW) (ETSS 96004.1) 2009	Upper Bound 2009 Depth (%TW) (for CM)	Projected 2012 Depth (%TW) (for OA)
A	25	57	AV2	18	17	33.4	47.4
A	26	9	AV4	11	11	27.6	41.6
A	26	86	AV3	21	22	38.3	52.3
A	28	69	AV3	0*	10	26.7	40.7
A	29	70	AV2	11	11	27.6	41.6
A	30	64	AV2	0*	11	27.6	41.6
A	33	61	AV3	0*	18	34.4	48.4
A	33	61	AV4	0*	15	31.5	45.5
A	36	62	AV2	26	24	40.2	54.2
A	36	62	AV3	14	16	32.5	46.5
A	36	62	AV4	29	28	44.1	58.1
A	36	66	AV3	0*	10	26.7	40.7
A	38	57	AV1	0*	14	30.5	44.5
A	38	72	AV4	26	25	41.2	55.2
A	38	74	AV4	20	19	35.4	49.4
A	40	49	AV1	12	12	28.6	42.6
A	40	49	AV2	0*	10	26.7	40.7
A	40	49	AV3	10	11	27.6	41.6
A	40	65	AV2	22	21	37.3	51.3
A	40	65	AV4	0*	12	28.6	42.6
A	40	66	AV3	0*	10	26.7	40.7
A	44	35	AV2	0*	12	28.6	42.6
A	45	44	AV2	0*	12	28.6	42.6

* Not reported in 2006. Used 0%TW as default depth.

Notes:
1) Total Random Sizing Uncertainty at 95/50: 13.5 %TW
2) Upper Bound 2009 Depth: [0.97] x [Field Call] + [3.45] + [13.5]
3) Fall 2012 Projected Depth: [Upper Bound 2009 Depth] + [(7.0%TW/Cycle) x 2 Cycles]

Table 8 – Surry Unit 2 AVB Statistical Summary

	SG A	SG B	SG C	Combined
Number of Tubes / Indications with AVB Wear Reported during the Current Outage	17 / 23	n/a	n/a	17 / 23
Number of Tubes In-Service with AVB Wear (following the current outage)	17	8	30	55
Total Number of Tubes Plugged during the Current Outage Due to AVB Wear	0	0	0	0
Total Number of Tubes Plugged to Date Due to AVB Wear (following the current outage)	1	5	10	16
Average Wear Rate of Repeat Indications (%TW/cycle)	0.03	0.29	0.05	0.06
95/50 Wear Rate of Repeat Indications (%TW/cycle)	1.7	1.0**	1.5	1.5
Conservative Average Wear Rate* (%TW/cycle)	2.2	2.3	1.3	1.6
Conservative 95/50 Wear Rate* (%TW/cycle)	7.5	4.8	7.5	7.0
Inspection Data Used (outage year)	2002, 2006, 2009	1997, 2003, 2008	2000, 2005, 2008	n/a
Number of Repeat Indication Data Points	24	7	68	99
Number of Data Points Including Repeat and Newly Reported Indications	36	15	80	131

* 1) Includes growth assumption for newly reported indications based on 0%TW at previous inspection,
2) Negative indicated growth rates were set equal to zero,

** Maximum value shown due to small number of data points.

Non-AVB-Wear Volumetric Degradation

Forty-seven tubes with indications of volumetric degradation, all but two attributed to foreign object wear, were identified during the EOC22 examinations (see Table 9). Nine of these tubes were plugged (SG "A" = 4, SG "B" = 2, SG "C" = 3) because the measured indication depth exceeded the 40%TW plugging limit; one of the nine was also stabilized. The two indications not attributed to foreign object wear were attributed to wear at a tube support plate intersection.

Table 9 – Summary of Non-AVB Wear Volumetric Degradation Identified

SG	Row	Col	Location	ETSS	Max Depth (%TW)	Axial Length (in)	Circ. Length (in)	Initially Reported	Signal Present Prior to Current Outage?	Cause	Foreign Object Remaining?	In-Situ Tested?	Plugged?
A	6	60	5H*-0.67	96910.1	12%TW	0.35	0.42	2009	Yes. No signal change since 2002.	TSP Wear	n/a	No	No
A	17	16	TSH+0.06	27901.1	29%TW	0.35	0.50	2002	Yes. No signal change.	Foreign Object	No	No	No
A	18	16	TSH+0	27901.1	24%TW	0.30	0.42	2002	Yes. No signal change.	Foreign Object	No	No	No
A	32	27	TSC+0.08	27901.1	20%TW	0.27	0.45	2006	Yes. No signal change.	Foreign Object	No	No	No
A	33	27	TSC+0.09	27901.1	24%TW	0.35	0.40	2006	Yes. No signal change.	Foreign Object	No	No	No
A	34	26	TSC+0.13	27901.1	40%TW**	0.35	0.45	2006	Yes. No signal change.	Foreign Object	No	No	Yes
A	39	24	TSH+0.37	27901.1	19%TW	0.30	0.42	2009	Yes. No signal change since 2006.	Foreign Object	No	No	No
A	40	28	TSC+0.1	27901.1	41%TW**	0.41	0.50	2006	Yes. No signal change.	Foreign Object	No	No	Yes
A	40	29	TSC+0.13	27901.1	42%TW**	0.44	0.47	2006	Yes. No signal change.	Foreign Object	No	No	Yes
A	42	52	TSC+0.29	27901.1	20%TW	0.38	0.45	2009	No	Foreign Object	No	No	No

Table 9 – Summary of Non-AVB Wear Volumetric Degradation Identified (cont.)

SG	Row	Col	Location	ETSS	Max Depth (%TW)	Axial Length (in)	Circ. Length (in)	Initially Reported	Signal Present Prior to Current Outage?	Cause	Foreign Object Remaining?	In-Situ Tested?	Plugged?
A	43	61	BPH+0.56	27901.1	22%TW	0.38	0.48	2009	Yes. No signal change since 2002.	Foreign Object	No	No	No
A	43	64	BPH+0.65	27901.1	24%TW	0.35	0.37	2009	Yes. Possible minor signal change since 2002.	Foreign Object	No	No	No
A	46	47	BPH+0.67	27901.1	50%TW (SD=44%TW)	0.38 (SL=0.28")	0.48	2009	No	Foreign Object	Yes	No	Yes and stabilized
A	46	48	BPH+0.66	27901.1	33%TW	0.44	0.45	2009	No	Foreign Object	Yes[1]	No	Yes and stabilized
B	21	11	2C*+0.76	27901.1	29%TW	0.32	0.40	2009	No	Foreign Object	Yes	No	Yes and stabilized
B	22	82	TSH+0.14	27901.1	55%TW** (SD=47%TW)	0.41 (SL=0.27")	0.56	2003	Yes. No signal change.	Foreign Object	No	No	Yes
B	23	82	TSH-0.01	27901.1	23%TW	0.30	0.37	2003	Yes. No signal change.	Foreign Object	No	No	No
B	36	26	TSC+0.02	27905.1	26%TW	0.40	0.40	2008	Yes. No signal change.	Foreign Object	No	No	No
B	36	27	TSC+0.17	27901.1	45%TW*	0.43	0.58	2008	Yes. No signal change.	Foreign Object	No	No	Yes

Table 9 – Summary of Non-AVB Wear Volumetric Degradation Identified (cont.)

SG	Row	Col	Location	ETSS	Max Depth (%TW)	Axial Length (in)	Circ. Length (in)	Initially Reported	Signal Present Prior to Current Outage?	Cause	Foreign Object Remaining?	In-Situ Tested?	Plugged?
B	37	27	TSC+0.14	27901.1	26%TW	0.38	0.45	2008	Yes. No signal change.	Foreign Object	No	No	No
C	28	71	TSH+0.31	27901.1	26%TW	0.36	0.48	2009	Yes. No signal change since 1996.	Foreign Object	No	No	No
C	32	36	BPH+0.56	27901.1	18%TW	0.25	0.40	2009	Yes. No signal change.	Foreign Object	No	No	No
C	33	17	TSH+2.68	27901.1	20%TW	0.33	0.42	2005	Yes. No signal change.	Foreign Object	No	No	No
C	34	18	TSH+1	27901.1	22%TW	0.33	0.45	2005	Yes. No signal change.	Foreign Object	No	No	No
C	34	20	TSH+0.93	27901.1	26%TW	0.33	0.45	2005	Yes. No signal change.	Foreign Object	No	No	No
C	34	39	BPH+0.55	27901.1	31%TW	0.33	0.48	2009	No	Foreign Object	Yes[2]	No	Yes and stabilized
C	34	74	TSH+0.13	27901.1	28%TW	0.33	0.42	2005	Yes. No signal change.	Foreign Object	No	No	No
C	35	19	TSH+0.34	27901.1	31%TW	0.33	0.42	2005	Yes. No signal change.	Foreign Object	No	No	No
C	35	22	TSH+1.08	27901.1	29%TW	0.36	0.45	2005	Yes. No signal change.	Foreign Object	No	No	No

Table 9 – Summary of Non-AVB Wear Volumetric Degradation Identified (cont.)

SG	Row	Col	Location	ETSS	Max Depth (%TW)	Axial Length (in)	Circ. Length (in)	Initially Reported	Signal Present Prior to Current Outage?	Cause	Foreign Object Remaining?	In-Situ Tested?	Plugged?
C	35	30	TSH+0.13	27901.1	38%TW	0.33	0.45	2005	Yes. No signal change.	Foreign Object	No	No	No
C	35	37	BPH+0.56	27901.1	25%TW	0.27	0.37	2005	Yes. No signal change.	Foreign Object	Yes[2]	No	Yes and stabilized
C	35	39	BPH+0.53	27901.1	26%TW	0.22	0.63	2009	No	Foreign Object	Yes	No	Yes and stabilized
C	35	69	TSH+0.09	27901.1	26%TW	0.36	0.37	2005	Yes. No signal change.	Foreign Object	No	No	Yes
			TSH+0.13	27901.1	44%TW	0.38	0.45						
			Overall Dimensions			0.38	0.82						
C	35	71	TSH+0.26	27901.1	41%TW**	0.41	0.48	2005	Yes. No signal change.	Foreign Object	No	No	Yes
C	36	37	BPH+0.55	27901.1	22%TW	0.25	0.42	2009	No	Foreign Object	Yes[2]	No	Yes and stabilized
C	36	68	TSH+0.18	27902.1	27%TW	0.6	0.45	2005	Yes. No signal change.	Foreign Object	No	No	No
C	37	34	TSH+0.03	27901.1	26%TW	0.33	0.45	2009	Yes. No signal change since 1996.	Foreign Object	No	No	No
C	37	35	BPH+0.57	27901.1	31%TW	0.33	0.48	2005	Yes. No signal change.	Foreign Object	No	No	No
C	37	54	TSH+0.19	27901.1	25%TW	0.36	0.45	2005	Yes. No signal change.	Foreign Object	No	No	No

Table 9 – Summary of Non-AVB Wear Volumetric Degradation Identified (cont.)

SG	Row	Col	Location	ETSS	Max Depth (%TW)	Axial Length (in)	Circ. Length (in)	Initially Reported	Signal Present Prior to Current Outage?	Cause	Foreign Object Remaining?	In-Situ Tested?	Plugged?
C	37	73	7C*-0.6	96910.1	14%TW	0.64	0.48	2005	Yes. No signal change.	TSP Wear	n/a	No	No
C	38	53	TSH+0.17	27901.1	22%TW	0.38	0.42	2005	Yes. No signal change.	Foreign Object	No	No	No
C	38	54	TSH+0.18	27901.1	40%TW**	0.36	0.42	2005	Yes. No signal change.	Foreign Object	No	No	Yes
C	44	42	TSH+0.16	27901.1	23%TW	0.33	0.42	2005	Yes. No signal change.	Foreign Object	No	No	No
C	44	43	TSH+0.23	27901.1	26%TW	0.3	0.42	2005	Yes. No signal change.	Foreign Object	No	No	No
C	44	47	TSH+0.09	27901.1	28%TW	0.33	0.39	2005	Yes. No signal change.	Foreign Object	No	No	No
C	45	43	TSH+0.3	27901.1	24%TW	0.36	0.42	2005	Yes. No signal change.	Foreign Object	No	No	No
			TSH+0.3	27901.1	23%TW	0.33	0.42						
			TSH+0.77	27901.1	19%TW	0.3	0.34						
			Overall dimensions			0.77	0.95						
C	45	47	TSH+0.24	27901.1	25%TW	0.33	0.42	2005	Yes. No signal change.	Foreign Object	No	No	No

SD=structurally significant depth
SL=structurally significant length

* Support

** 2009 sizing technique was more conservative than that used previously

Notes-

1. Assumed to be present between R46C47 and R46C48.
2. Assumed to be present

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

Table 10 summarizes EOC22 tube plugging by cause. Note that as a condition for the approval of the one-time ARC, Surry committed to remove from service tubes having partial tubesheet expansion (PTE) or no tubesheet expansion (NTE). None of the Surry Unit 2 tubes have been identified as having PTEs, however 11 tubes with NTEs were plugged.

Table 10 – EOC22 Plugging Summary – Number of Tubes Plugged

	SG "A"	SG "B"	SG "C"	Total
AVB Wear	0	0	0	0
Foreign Object Wear ≥40%TW	4*	2	3	9
Foreign Object Present	3**	1**	6**	10**
NTE	0	4	7	11
Total	7	7	16	30

*One of the four tubes was stabilized.
**Stabilized.

f. Total number and percentage of tubes plugged to date

Table 11 provides the plugging attributes and the percentage of tubes plugged through and including EOC22.

Table 11 – Cumulative Plugging

	Tubes Installed	Tubes Plugged To-Date
SG "A"	3,342	30 (0.9%)
SG "B"	3,342	18 (0.5%)
SG "C"	3,342	46 (1.4%)
Total	10,026	94 (0.9%)

g. The results of condition monitoring, including the results of tube pulls and in-situ testing

None of the tube degradation identified in Surry Unit 2 SGs during the EOC22 outage violated the structural performance criteria; thereby providing reasonable assurance that none of these flaws would have leaked during a limiting design basis accident.

Based on the evaluations documented, all degradation identified during the fall 2009 inspection satisfied condition monitoring requirements for SG tube structural and leakage integrity. Therefore, tube pulls and in-situ pressure testing were not necessary.

h. The effective plugging percentage for all plugging in each SG

Since none of the Surry Unit 2 SG tubes have been sleeved, the effective plugging percentage is identical to the plugging percentages provided in the response in Section "f" of this report.

i. For Unit 2 during Refueling Outage 22 and the subsequent operating cycle .... the primary to secondary leakage rate observed in each SG... during the cycle preceding the inspection which is the subject of the report

During the cycle preceding EOC22, no measurable primary-to-secondary leakage (i.e., >1 GPD) was observed in any Unit 2 SG.

j. For Unit 2 during Refueling Outage 22 and the subsequent operating cycle ...the calculated accident induced leakage rate from the portion of the tubes from below 16.7 inches from the top of the tubesheet for the most limiting accident in the most limiting SG. In addition, if the calculated accident induced leakage rate from the most limiting accident is less than 2.03 times the maximum operational primary to secondary leakage rate, the report should describe how it was determined.

The one-time ARC requires that the component of operational leakage from the prior cycle from below the 16.7 inch distance be multiplied by a factor of 2.03 and added to the total accident leakage from any other source and compared to the allowable accident induced leakage limit. Since there is reasonable assurance that no tube degradation identified during this outage would have resulted in leakage during an accident, the contribution to accident leakage from other sources is zero. Assuming that the prior cycle operational leakage of <1 GPD originated from below the 16.7 inch distance, and multiplying this leakage by a factor of 2.03, yields an accident induced leakage value of <2.03 GPD. This value is well below the 470 GPD limit for the limiting SG and provides reasonable assurance that the accident induced leakage performance criteria would not have been exceeded during a limiting design basis accident.

k. For Unit 2 during Refueling Outage 22 and the subsequent operating cycle ...the results of the monitoring for tube axial displacement (slippage). If slippage is discovered, the implications of the discovery and corrective action shall be provided.

The one-time ARC requires routine monitoring for tube slippage within the tubesheet and any tubes showing evidence of slippage require plugging. This condition could only occur if the tube severs circumferentially within the tubesheet, a condition which can be readily detected using bobbin probe inspection data. During the current outage inspection, this analysis was performed on both legs of all tubes in SG "A." No evidence of slippage was identified. Slippage monitoring in SG "B" and SG "C" will be accomplished during the 2011 outage.

Acronyms

AVB	Anti Vibration Bar
ARC	Alternate Repair Criteria
BET	Bottom of Expansion Transition
BLG	Bulge
BPH	Baffle Plate Hot
C	Column
CM	Condition Monitoring
CMOA	Condition Monitoring Operational Assessment
C/L	Cold Leg
DEP	Deposit
DMT	Deposit Minimization Treatment
DNG	Ding
DNT	Dent
ECT	Eddy Current Testing
EFPY	Effective Full Power Years
EOC	End of Cycle
ETSS	Eddy Current Technical Specification Sheets
FB	Fan Bar
FOSAR	Foreign Object Search and Retrieval
GPD	Gallons Per Day
LGV	Localized Geometric Variation
H/L	Hot Leg
LPI	Loose Part Indication
MBH	Historical Manufacturing Brandish Mark
MBM	Manufacturing Burnish Mark
MRPC	Motorized Rotating Pancake Coil
NOP	Normal Operating Pressure
NTE	No Tubesheet Expansion
NQH	Non-Quantifiable Historical Indication
NQI	Non-Quantifiable Indication
OA	Operation Assessment
OD	Outer Diameter
OVR	Over Roll
OXP	Over Expansion
PLP	Possible Loose Part
PTE	Partial Tubesheet Expansion
PVN	Permeability Variation
PWSCC	Primary Water Stress Corrosion Cracking
% TW	Percent Throughwall
R	Row
RPC	Rotating Pancake Coil
SG	Steam Generator
SLG	Sludge
SAI	Single Axial Indication
SCI	Single Circumferential Indication
SSI	Secondary Side Inspection
SVI	Single Volumetric Indication
Tavg	Average Reactor Coolant System Temperature
TEC	Tube End Cold-leg
TEH	Tube End Hot-leg
TSC	Top of Tube Sheet Cold-leg
TSH	Top of Tube Sheet Hot-leg
TSP	Tube Support Plate
TTS	Top of Tubesheet
TW	Through Wall
VOL	Volumetric Indication
WAR	Wear Indication
95/50	95% probability and 50% confidence