VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

February 28, 2002

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Serial No.: 02-072
NLOS/MM
Docket Nos.: 50-280/281
License Nos.: DPR-32/37

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
SURRY POWER STATION UNITS 1 AND 2
ANNUAL STEAM GENERATOR INSERVICE INSPECTION SUMMARY REPORT

Pursuant to Technical Specification 4.19.F.b for Surry Power Station Units 1 and 2, Virginia Electric and Power Company (Dominion) is submitting the results of the steam generator tube inservice inspections performed during 2001. The steam generator tube inspections conducted on Unit 1 during the Fall 2001 refueling outage are included in the Attachment. There were no steam generator tube inspections conducted on Unit 2 during 2001.

This letter does not establish any new commitments. Should you have any questions or require additional information, please contact us.

Very truly yours,

S. P. Sarver, Director
Nuclear Licensing and Operations Support

Attachment

cc: U. S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, GA 30303-8931

Mr. R. A. Musser
NRC Senior Resident Inspector
Surry Power Station

A047

Virginia Electric and Power Company (Dominon)
Surry Unit 1
2001 Annual Steam Generator Report

Virginia Electric and Power Company (Dominion)
Surry Unit 1 Summary
2001 Annual Steam Generator Report

Station	Unit	Outage Date	Generator Examined			Date of Report
Surry	1	October, 2001	A			11/14/2001

Scope of Inspection					
SG	**Inspection Program**	**Planned**	**Inspected**	**Inspection Method**	**Extent**
A	Bobbin	3331	3331	Bobbin	TEH - TEC
A	Row 1 U-Bend RC	91	91	U-Bend +Point RC	7H – 7C
A	TTS H/L RC	667	667	+Point RC	TSH +/- 3"
A	Special Interest Indications RC- H/L &C/L	As Necessary	149	+Point RC	Various freespan and TSP locations

Indications of Imperfections Detected							
SG	**NDE Method**	**Row**	**Col.**	**Indication Code**	**Location**	**Active Yes/No**	**% Measured Wall Penetration**
A	BOBBIN	10	44	VOL (WEAR)	7H + 26.68	No	16
A	BOBBIN	12	47	PCT	AV4	No	16
A	BOBBIN	32	48	PCT	AV3	No	13
A	BOBBIN	32	66	PCT	AV2	No	11
A	BOBBIN	32	69	PCT	AV2	No	22
A	BOBBIN	32	69	PCT	AV3	No	14
A	BOBBIN	32	69	PCT	AV4	No	17
A	BOBBIN	33	16	PCT	AV2	No	13
A	BOBBIN	36	75	PCT	AV2	No	16
A	BOBBIN	37	75	PCT	AV2	No	12
A	BOBBIN	37	75	PCT	AV2	No	14
A	BOBBIN	38	62	PCT	AV4	No	12
A	BOBBIN	39	71	PCT	AV4	No	12
A	BOBBIN	40	69	PCT	AV4	No	16
A	BOBBIN	41	32	PCT	AV3	No	12
A	BOBBIN	42	32	PCT	AV3	No	12
A	BOBBIN	42	47	PCT	AV1	No	30
A	BOBBIN	46	44	PCT	AV1	No	17
A	BOBBIN	46	43	PCT	AV1	No	16
A	BOBBIN	46	45	PCT	AV1	No	18
A	BOBBIN	46	45	PCT	AV4	No	19
A	BOBBIN	1	28	VOL(WEAR)	TSH + 16.21	No	28
A	BOBBIN	1	28	VOL(WEAR)	TSC + 15.98	No	16
A	BOBBIN	1	67	VOL(WEAR)	TSH + 15.91	No	25
A	BOBBIN	1	9	VOL(WEAR)	TSC + 15.83	No	< 10
A	+POINT RC	8	38	PIT	TSH + 0.42	No	15

Tube Plugging this Outage		
SG	**Reason/Mechanism**	**Tubes Plugged**
A	Sludge Lance Monorail Device %Wear	3
A	AVB %Wear	1
A	AVB Tip %Wear	1
Total Tubes Plugged		5

Repair Attributions				
SG	**Row**	**Column**	**Reason/Mechanism**	**Repair Method**
A	1	19	Sludge Lance Monorail Device %Wear	Plug
A	1	28	Sludge Lance Monorail Device %Wear	Plug
A	1	67	Sludge Lance Monorail Device %Wear	Plug
A	10	44	AVB Tip %Wear	Plug
A	42	47	AVB %Wear	Plug

Plugging/Repair Record					
SG	**Tubes Plugged**	**Tubes Repaired (Not Plugged)**	**Percent Plugged**	**Percent Repaired (Not Plugged)**	**Percent Plugged or Repaired**
A	16	0	0.48	0	0.48
B	14	0	0.42	0	0.42
C	13	0	0.39	0	0.39

TUBE INTEGRITY ASSESSMENT

1.0 Summary and Conclusion

Overall condition assessments are delineated in the Surry Steam Generator Monitoring and Inspection Program Plan. Consistent with the requirements of the NEI 97-06 Guideline, a pre-outage assessment was performed to identify any relevant or potential degradation mechanisms to be considered for the Surry Unit 1 steam generators and to identify the appropriate eddy current inspection scope and probes to be utilized during the inspection.

As required by NEI 97-06, performance criteria are established in three areas:

- Tubing Structural Integrity
- Operational Leakage
- Projected Accident Leakage

The inspection performed on "A" steam generator was consistent with the Program Plan. The results from the current and previous inspections formed the basis of the condition monitoring and operational assessment performed for this outage.

A condition monitoring evaluation of the Surry steam generator tube bundles is performed to verify that the condition of the tubes, as indicated by the inspection results, is in compliance with the plant licensing basis. Structurally significant indications are evaluated to confirm that the safety margins against leakage and burst are not exceeded at the end of the past operating cycle by using a bounding calculation. The results of the condition monitoring evaluation are used as a basis for the operational assessment, which demonstrates prospectively that the anticipated performance of the steam generators will likewise not exceed the performance criteria margins against leakage and tube burst during the ensuing operating period.

The condition of the Surry Unit 1 steam generators satisfy the safety margin requirements with respect to structural and leakage integrity. Evaluation of the indications identified during this inspection indicate acceptable tube integrity will exist at the end of the current operating cycle (Replacement EOC12). Condition monitoring and operational assessment requirements on burst pressure and accident condition leak rates are also satisfied. The condition monitoring and operational assessment for tube integrity was performed consistent with the requirements of the March 2000 EPRI Steam Generator Integrity Assessment Guidelines: Revision 1 (TR-107621-R1) and the requirements of NEI 97-06.

The only operational degradation mechanism identified during the inspection of "A" steam generator was tube wear due to the anti-vibration bars(AVB). The AVB wear-rates were consistent with past Unit 1 results. Limited free-span wear due to the sludge lance process performed during the Spring 2000 outage was identified in three (3) Row 1 tubes. All of the wear indications found were below the ASME Code calculated structural limit including 3 delta P burst pressure margins for uniform wall thinning.

The condition of the Surry Unit 1 "A" steam generator also satisfies the requirements for structural and leakage integrity margins for the last operating cycle. The results of the inspection of "A" steam generator were consistent with prior operational assessments and did not require any expansion of testing to other steam generators. No indications, including the non-operational Row 1 wear, exceeded the structural integrity limits. No tubes were found to contain eddy current indications that could potentially challenge tube integrity margins for burst and leakage. Projection of AVB wear indications for the next planned operating interval through 49.6 EFPM (Spring 2006) for "A" steam generator indicates that structural and leakage margin requirements will continue to be satisfied. The free-span wear indications were caused by contact with the sludge lance monorail during the Spring 2000 outage, were not related to plant operation and do not require projection of degradation rates. The operational assessment requirements are satisfied for Surry Unit 1 "A" steam generator. It is also concluded that the existing operational assessments for the other Unit 1 generators remain valid and no changes to their currently planned tubing inspection interval are necessary. The next inspection of "B" steam generator is scheduled for Spring of 2003 and the next inspection of "C" steam generator is planned for the Fall of 2004.

2.0 Surry Unit 1 – Summary of Evaluated Degradation Mechanisms, Inspection Methods, and Plan

Table 1 is a summary of the Surry Unit 1 tube plugging attributes. A total of thirty-eight (38) tubes were plugged in this unit prior to the Fall 2001 outage with mechanical tube wear at AVB contact points (15 tubes) being the main degradation mode. This mode of degradation is classified as "inactive" for all steam generators as defined by the EPRI Examination Guidelines. No corrosion related cracking degradation has been identified on this unit. A total of sixteen (16) tubes have been plugged due to non-corrosion related geometric anomalies.

Prior to the current outage, "A" steam generator had eleven (11) tubes plugged with two (2) tubes plugged due to tube wear at AVB contact points. In general, past practice has resulted in conservative plugging of tubes with AVB contact wear at less than the 40% through-wall (TW) plugging limit consistent with the Program Plan.

The inspections conducted on "A" steam generator were consistent with the Surry Station Steam Generator Monitoring and Inspection Program Plan as augmented by the pre-outage assessment. The inspection plan is outlined below:

- 100% full length bobbin inspection of 3331 tubes, which equates to a 33% sample of the total tube population in all three (3) steam generators.

- Focused rotating probe (Plus Point) inspections of the hot leg top of the tubesheet of 667 tubes, which is a 20% sample of the total tube population in "A" steam generator and equates to a 60 % sample of the critical area population.

- Single coil Plus Point rotating probe inspection of 100% of the U-bends in Row 1 (91 tubes) which equates to a 33% sample of the Row 1 U-bends in all three steam generators.

- Rotating probe confirmation of bobbin indications in accordance with the Surry Site Specific Analysis Guidelines.

During the Surry Unit 1 inspections, the Dominion NDE Level III performed random data checks as well as a final verification of the planned versus the completed inspection program.

Table 1

SURRY POWER STATION UNIT #1
PLUGGING ATTRIBUTES

DATE	Preservice			March-83			Nov-84			June-86			April-88			October-90			March-92			Feb-94			October-95		
EFPY	0			1.3			2.3			3.4			4.7			6			7.1			8.7			10		
S/G	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
AVB																			1				4				1
Freespan																			1								
Tube Pulls												1						2									
Foreign Object																											
Pitting																											
Anomalies																											
Other	1	1					3	1			2	1															
Sub-Total	1	1	0	0	0	0	3	1	0	0	2	2	0	0	0	0	0	2	2	0	0	0	4	0	0	0	1
TOTAL	2			0			4			4			0			2			2			4			1		

DATE	March-97			October-98			April-00			October-01			Total per S/G		
EFPY	11.3			12.7			14			15.5					
S/G	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
AVB	1								8	2			4	4	9
Freespan													1	0	0
Tube Pulls													0	0	3
Foreign Object					3								0	3	0
Pitting													0	0	0
Anomalies													0	0	0
Other	4				3					3			11	7	1
Sub-Total	5	0	0	0	6	0	0	0	8	5	0	0	16	14	13
TOTAL	5			6			8			5			43		

Total tubes plugged by category

17 AVB
1 Freespan
3 Tube Pulls
3 Foreign Objects
0 Pitting
0 Anomalies
19 Other

S/G Inspected

3.0 Condition Monitoring Assessment: Tube Integrity Evaluation

The condition monitoring assessment is an evaluation of the past operating cycle (Replacement Cycle 12) relative to structural and leakage integrity margin based on current inspection results. The condition of the Surry Unit 1 steam generators, as indicated by the results of the inspection performed on "A" steam generator, satisfy the structural and leakage integrity margin for the recently completed operating period.

3.1 Primary Side Inspection

No conditions indicative of corrosion degradation were noted during the eddy current inspection of "A" steam generator.

3.1.1 Bobbin Program

Sludge Lance Monorail Wear Indications

During the inspection of the Row 1 freespans, wear indications were identified in Columns 9, 28, and 67. These indications were located between 15.5 and 16.5 inches above the secondary side tubesheet surface. These areas were closely monitored based on notification prior to the outage of a similar event caused by sludge lance equipment at another unit serviced by Westinghouse. The same sludge lance equipment was utilized during the last Surry Unit 1 outage in the Spring of 2000. A summary of the eddy current findings for "A" steam generator and the referenced unit is provided in Table 2. Based on bobbin coil voltage and Plus Point characterization, the bounding indication that was reported was the indication in tube R1, C67. The depth of the indication, based on bobbin data, was 25%. The axial extent, based on Plus Point characterization, was 1.34". Bobbin coil depth sizing was performed using an amplitude curve based on the ASME flat bottom hole standard.

Westinghouse evaluated previously produced laboratory wear samples to determine the structural acceptability of the wear indications identified in the Row 1 tubes. These samples included a milled slot rotated 20 degrees about the tube axis (producing a check-mark shape), a 0.063" wide milled slot with a 45-degree runout to the tube OD surface, and milled slots of 0.063", 0.094", 0.125", and 0.250" width. Based on the geometry of the Row 1 tube configuration, the sludge lance rail must swing through a radius of at least 1.75" to contact the OD surface of the tube. Thus, the wear scar profile at the elevation of the center of the rail should be similar to the milled slots. Depth sizing of the laboratory notch samples using a phase-depth curve based on the flat bottom holes of the ASME standard produced excellent sizing results. For the flat bottom notches, the depth sizing uncertainty at 95% confidence was 7% TW. Axial length sizing capability using Plus Point was established for the lab samples discussed above. In all cases, axial length estimation was conservative by at least 0.25".

The maximum depth of the wear indication on tube R1, C67 at Surry Unit 1, based on a phase-depth curve in accordance with Eddy Current Technique Specification Sheet (ETSS) 96001.1, was estimated to be 25% TW (34 % TW NDE adjusted depth). Using Plus Point data, the axial length of the wear indication was measured at 1.34" (corrected to 1.09" based on Westinghouse laboratory data). Structural integrity performance of these indications can be approximated using the uniform thinning equation of NUREG/CR-0718. For a lower tolerance limit flow stress of 62.315 psi at 650 ° F with a uniform depth of 40% TW and an axial length of 1.09", the predicted burst capability is 6,239 psi. This model is assumed to be conservative for the Surry condition since it assumes a uniform depth, whereas

the sludge lance rail interaction will produce a tapered geometry. Circumferential arc involvement sizing capability was also established for the lab samples discussed above. For all cases, circumferential arc involvement was conservative by at least 25 degrees. The circumferential arc involvement of tube R1, C67 (hot leg) is reported to be 56.3 degrees. The interaction of a flat bar against the tube would be expected to produce a cross sectional wear shape that is very similar to the lab samples. With a circumferential overestimate of at least 25 degrees, the actual arc involvement on tube R1, C67 (hot leg) is 31.3 degrees. If a 40% deep notch is produced across a 0.875" OD tube, the resultant arc over which the scar acts is 35 degrees. Thus, it is established that the actual maximum depth in tube R1, C67 is less than 40%TW. Hence, the wear scars produced by the sludge lance rail interaction at Surry Unit 1 are quite similar to the wear scars observed at the other Model 51 unit. It is noted that the limiting wear scar at the referenced unit was in situ pressure tested to a maximum pressure of 4841 psi with no leakage or burst.

Table 2
Surry Unit 1 Freespan Wear Indications Eddy Current Data Summary

Tube	Location	Bobbin Depth (1)	Bobbin Amplitude (2)	Plus Point Depth (3)	Plus Point Amplitude	Plus Point Length
R1 C9	Hot Leg	NDD	NDD	Not Confirmed	Not Data	No Data
R1 C9	Cold Leg	N/A (4)	0.24 volts	18%	0.33 volts	0.69"
R1 C28	Hot Leg	28%	0.32 volts	20%	0.32 volts	1.05"
R1 C28	Cold Leg	16%	0.89 volts	23%	0.48 volts	0.89"
R1 C67	Hot Leg	25%	1.08 volts	34% (29%)	0.84 volts	1.34"
R1 C67	Cold Leg	NDD	0.96 volts	Not Confirmed	No Data	No Data
R1 C86	Hot Leg	N/A (4)	0.15 volts	Not Confirmed	No Data	No Data
R1 C86	Cold Leg	N/A (4)	0.36 volts	Not Confirmed	No Data	No Data
Plant "X" Eddy Current Data Summary						
R1 C9	Hot Leg	8%	0.16 volts	Not Confirmed	Not Confirmed	No Data
R1 C9	Cold Leg	N/A (4)	0.26 volts	Not Confirmed	Not Confirmed	No Data
R1 C28	Hot Leg	15%	0.55 volts	Not Confirmed	Not Confirmed	No Data
R1 C28	Cold Leg	N/A (4)	0.17 volts	Not Confirmed	Not Confirmed	No Data
R1 C67	Hot Leg	31%	0.97 volts	N/A	0.68 volts	1.25"
R1 C67	Cold Leg	10%	1.08 volts	N/A	0.72 volts	1.35"
R1 C86	Hot Leg	24%	0.12 volts	N/A	0.22 volts	0.66"
R1 C86	Cold Leg	18%	0.23 volts	N/A	No Data	No Data

Notes:

1. Depth based on phase-depth curve using ASME flat bottom holes.
2. Amplitude based on Channel 1, 400 kHz prime frequency.
3. Depth based on amplitude curve using flat bottom holes. For R1 C67, depth was also estimated using a phase depth curve on ASME flat bottom holes.
4. Due to low signal amplitude reasonable estimation of depth can not be made but confirmed to have wear scar by rotating coil exam.

AVB Wear Indications

Table 3 provides a summary of the indications reported in this category with growth evaluated from prior inspections. Nineteen(19) AVB intersections in seventeen(17) tubes were confirmed with tube wear in "A" steam generator. The maximum measured depth of 30% TW was reported on tube R42, C47 at AV1. No indication was reported on tube R42, C47 at AV1 in 1997. The 1997 data was reevaluated in 2001 and showed a 20% indication. Of the indications reported, only one (1) indication was not present in prior data. The new indication was recorded at 16% TW on tube R10, C44 at the upper apex. This was in an unexpected location since the upper AVB would not typically penetrate below Row 11. It is believed that the wear indication on R10, C44 resulted from contact with the "V" shaped tip of the AVB. No evidence of the indication could be found in the 1997 data. Tubes R42, C47 and R10, C44 were plugged.

The average growth rate per cycle for the reported indications since the last inspection (1997 – 49.3 EFPM) was 1.49% with the maximum being 5.33% TW. This growth rate is consistent with the performance previously noted for this generator

Table 3 - Summary of Reported AVB Indications Identified in "A" Steam Generator

Note: REOC = Replacement Generators End of Cycle

Row	Col	Inspection	Volts	PCT	Location	Calculated Tube Wear Rate from REOC 9 (%TW/Cycle)	Comments
10	44	10/1/01	0.37	16	7H + 26.68"	5.33	Wear indication located near the tip of the AVB during AVB area inspection. Reanalysis of '97 data showed no indications. Inspection with a 0.680 Plus Point probe was unsuccessful due to apparent interference of the U-bend tangent point with the "locator" portion of the probe. Without prior historical data and inability to provide confirmation with the rotating probe, this tube was plugged and removed from the AVB call list.
12	47	10/1/01	0.39	16	AV4	2.0	Review of 1997 data showed AVB indication of 10%
32	48	10/1/01	0.35	13	AV3	2.67	Review of 1997 data showed AVB indication of 11%
32	66	10/1/01	0.21	11	AV2	0.67	Review of 1997 data showed AVB indication of 9%
32	69	10/1/01	0.69	22	AV2	1.67	
		10/1/01	0.32	14	AV3	2.0	Review of 1997 data showed AVB indication of 8%
		10/1/01	0.44	17	AV4	1.67	
		3/1/97	0.34	17	AV2	1.89	
		3/1/97	0.19	12	AV4	1.33	

Row	Col	Inspection	Volts	PCT	Location	Calculated Tube Wear Rate from REOC 9 (%TW/Cycle)	Comments
33	16	10/1/01	0.32	13	AV2	1	
		3/1/97	0.16	10	AV2	0	
		3/1/92	0.85	18	AV2	3	
36	75	10/1/01	0.39	16	AV2	2.33	Review of 1997 data showed AVB indication of 9%
37	22	3/1/97	0.12	10	AV1	1.1	2001 inspection classified indication as ANR – Low amplitude signal makes identification uncertain
37	72	3/1/97	0.24	14	AV4	1.56	2001 inspection classified indication as ANR – Low amplitude signal makes identification uncertain
37	75	10/1/01	0.32	14	AV2	0	
		3/1/97	0.36	18	AV2	0.67	
		3/1/92	0.58	16	AV2	2.67	
38	62	10/1/01	0.26	12	AV4	0.67	Review of 1997 data showed AVB indication of 10%
39	71	10/1/01	0.25	12	AV4	3.0	Review of 1997 data showed AVB indication of 8%
40	69	10/1/01	0.42	16	AV4	0.17	
		3/1/97	N/A	INR	AV4	N/A	
		3/1/92	0.70	15	AV4	2.5	
41	32	10/1/01	0.26	12	AV3	0	Review of 1997 data showed AVB indication of 12%
42	32	10/1/01	0.27	12	AV3	1.0	Review of 1997 data showed AVB indication of 9%
42	47	10/1/01	1.45	30	AV1	3.0	Review of 1997 data showed AVB indication of 20%;location plugged
46	43	10/1/01	0.36	16	AV1	1.0	
		3/1/97	0.22	13	AV1	1.2	
46	44	10/1/01	0.36	17	AV1	0	
		3/1/97	N/A	INR	AV1	0	
		3/1/92	1.01	20	AVI	0	
		10/1/90	0.62	17	AV1	0	
		5/1/86	0.87	25	AV1	0	
46	45	10/1/01	0.38	18	AV1	1.7	
		10/1/01	0.41	19	AV4	2.7	Review of 1997 data showed AVB indication of 11%
		3/1/97	0.2	13	AV1	0	
		3/1/92	0.68	15	AV1	0	
		10/1/90	0.59	17	AV1	0	
		5/1/86	1.0	28	AV1	9.33	

DNT Signals

During the bobbin inspection program, 507 tubes were identified with "dent" indications. Of the 507 dents, 458 were between 2.00 and 4.99 volts, 77 were between 5 and 19.99 volts, and 2 were greater than 20 volts. The reporting voltage threshold for dent indications was lowered from 5 volts in 1997 to 2 volts during the current inspection. As specified in the Surry Site Specific Eddy Current Analysis Guidelines, dents or bulges $\geq$ to 3 volts without historical data must be inspected with a rotating surface riding coil. A total of 75 tubes required resolution using a Plus Point probe. No degradation was identified during the rotating coil characterization of the dent signals.

Evaluation of the dent indications at the 6th and 7th tube support plates revealed 28 tubes with dents at 7H, 6 tubes with dents at 6H and 6 tubes with dents at 7C. The dent indications at the 6th and 7th tube support plates appear to be concentrated in the periphery near the wedge regions. The dents are located at or near the edges of the support plate and are not representative of the denting issue and resultant corrosion degradation associated with drilled carbon steel plates. Dent indications at the 6th and 7th tube support plates were included in the rotating coil inspections referenced above with no degradation noted.

Other Signals

Other freespan bobbin signals required supplemental rotating probe examination due to insufficient history data or signal change attributes. These were typically low voltage signals associated with manufacturing buff marks (MBM), local geometric variations (LGV), or dents (DNT) introduced during the manufacture of the steam generator. The signals associated with these categories do not represent in-service degradation. However, these signals are being monitored over time to detect any change from the initial condition. If an indication had changed significantly or could not be identified in the history review, it was designated for rotating probe testing. A total of 74 locations (30 hot leg and 44 cold leg) were tested with Plus Point probe. All Non-Quantifiable Indications (NQI), except tube R10, C44, were resolved using the Plus Point probe. No crack-like or other forms of tube degradation were noted during the follow-up rotating probe inspection efforts. Attempts to characterize the indication in tube R10, C44 using a 0.680 single coil Plus Point probe was unsuccessful from both the hot and cold leg apparently due to the inability of the bobbin portion of the probe assembly to move through the tangent portion of the U-bend. The indication was located at 7H +26.68 inches. Tube R10, C44 was plugged based on the bobbin probe results.

3.1.2 Focused Rotating Coil Program

Plus Point inspection of the top of the hot leg tubesheet location was performed for 667 tubes. This program focused primarily on the low velocity region in the middle of the bundle. All signals were resolved in accordance with the Site Specific Analysis Guidelines. One location (R8, C38) was identified with a small volumetric-type indication. The indication was sized at 15% TW with a plus point probe and was likely caused by a foreign object or pre-chemical cleaning secondary side condition. The indication in tube R8, C38 was designated as a PIT indication due to its localized volumetric nature. No objects remain in the area as confirmed by eddy current. Due to the small size of the indication, as well as no confirmed corrosion related degradation, this tube remains in-service.

All of the Row 1 U-bends (91 tubes) were inspected with a 0.680 diameter single coil Plus Point U-bend probe. No indications were noted.

3.3 Operational Leakage

Routine primary-to-secondary leak monitoring is conducted in accordance with station procedures. Data trending based on Xe^{135} during the last cycle indicated a small primary-to-secondary leak in "B" steam generator. The average reported leak rate based on air ejectors for the recently completed operating period was 0.462 GPD with a standard deviation of 0.146 GPD. Best fit trending indicates a small increase in leakage since the beginning of the cycle. Review of the available industry experience continues to indicate that the ability to identify the specific source of a primary-to-secondary leak in this range is difficult and likely unsuccessful. The EPRI guideline indicates that leak rates < 5 GPD are difficult to trend using normal radiochemical grab sampling and process radiation monitors due to the lack of analytical certainty at very low radiochemical concentrations. Monitoring in accordance with industry guidelines will continue.

3.4 Projected Accident Leakage

Based on the fact that no through-wall indications or indications approaching the structural limit have been reported in the Surry station steam generators, no appreciable primary-to-secondary leakage would have been expected under accident induced loadings.

3.5 Condition Monitoring Conclusion

In order to demonstrate condition monitoring structural integrity, it is necessary to account for various uncertainties, which are subtracted from the structural limit. The result is then compared with the largest flaw measured. The largest flaw measured during the current inspection effort was a 30% AVB wear at AV1. Referenced in the Surry Steam Generator Program Plan, the structural limit using the ASME Code equation for uniform wear of a 7/8" diameter x 0.050" thick tube is 60% through wall (TW), that is 0.020 inch remaining wall. When the total NDE uncertainty of 8.58% is added to the measured value of 30%, a condition monitoring value of 38.6% TW is obtained. This value is well below the structural limit of 60%. Since there is no uncertainty in the ASME Code equation itself, there is no relational uncertainty that must be considered in determining the condition monitoring value.

The depth of the limiting sludge lance monorail wear indication (tube R1, C67 hot leg) was sized at less than 40%TW. Using the uniform thinning burst equation of NUREG/CR-0718 at a 40% depth, the predicted burst capability of the limiting indication is > 6,239 psi for a tube with material properties equal to the lower tolerance limit flow stress value. None of the Row 1 free-span wear locations would be expected to have burst capabilities less than the required 3 times normal operating pressure differential of 4,311 psi, hence the condition monitoring requirement for "A" steam generator is demonstrated. Based on industry experience, along with the results of "A" steam generator, no tubes in the Surry "B" or "C" steam generators would be expected to have burst capabilities less than the required 3 times normal operating pressure differential of 4,311 psi. Therefore, the condition of the Surry Unit 1 steam generators, as indicated by the results of the inspection performed on "A" steam generator, satisfy condition monitoring requirements for structural and leakage integrity margin for the recently completed operating period.

4.0 Operational Assessment: Tube Integrity and Leakage

4.1 Discussion

An operational assessment was performed to determine if the degradation mechanisms observed during the current inspection will continue to meet tube structural and leakage integrity requirements at the end of the upcoming cycle. This assessment included site-specific degradation growth rates and NDE uncertainties for the largest flaw remaining in service. The following sections summarize the growth rate evaluation and the NDE sizing uncertainty evaluations performed for the only observed degradation mechanism, AVB wear, to support the operational assessment.

The past operating interval between inspections of "A" steam generator was 49.3 Effective Full Power Months (EFPM). The projected operating interval until the next inspection of S/G "A" is approximately 49.6 EFPM.

The only degradation mechanism that is expected to occur over the long term is anti-vibration bar (AVB) wear. AVB wear can be reliably detected during the bobbin inspection program testing. Typically, indications begin to be reported at approximately 10% through-wall and, in general, are slow growing.

The average AVB wear rate for "A" steam generator over the last three operating cycles (EOC9 through EOC12) was 1.49% per cycle. The historical wear rate for "A" steam generator was 1.98% per cycle. Based on a 90/50 correlation, the higher historical value for average wear rate (1.98%/cycle), and a total NDE uncertainty of 8.58%, an evaluation was performed to determine the AVB wear depths for locations exhibiting AVB wear signals that will remain in service following the October 2001 inspection. A summary is provided in Table 4.

4.2 Sludge Lance Monorail Wear Indications

The wear scars produced by the sludge lance monorail interaction at Surry Unit 1 are not related to operation, hence no growth rate evaluation is required to address the operational assessment requirements. As discussed earlier, the indications seen at a referenced unit and Surry Unit 1 are quite similar in location and size. The limiting wear scar at the referenced unit was in-situ pressure tested to a maximum pressure of 4,841 psi with no leakage or burst. Based on the limiting indication seen in Surry Unit 1 "A" steam generator and using the uniform thinning burst equation of NUREG/CR-0718, the predicted burst capability is > 6,239 psi for a tube with material properties equal to the lower tolerance limit flow stress value. The experience at the referenced unit has shown that the indications are approximately equal for all the steam generators. Therefore, no tubes are assumed to remain in-service in the Surry Unit 1 "B" and "C" steam generators that would be expected to have burst capabilities less than the required 3 times normal operating pressure differential of 4311 psi. Further support for the structural acceptability is demonstrated by information provided in the EPRI Steam Generator Tubing Flaw Handbook. Using a conservative assumption of uniform wear depth along a 1.5" axial length indication, a burst pressure of 4,050 psi leads to a structural depth limit of 67.9% TW.

This assumes average material properties and a best fit burst equation. The sludge lance monorail wear indications are tapered and based on this type of profile, the maximum depth leading to a best estimate burst pressure of 4,050 psi is greater than 80% TW.

4.3 AVB Wear Depth Projections

As discussed earlier, the AVB wear growth rates were evaluated based on the final field data from the REOC 12 inspection. Table 4 provides a summary of the indications with projected REOC 15 results. The guidance provided in EPRI Steam Generator Integrity Assessment Guidelines, Revision 1 (TR-107621-R1) states that structural integrity should be demonstrated at the next inspection by showing that the tube meets the performance criteria with an overall uncertainty based on a probability of 0.90, evaluated at 50% confidence. This evaluation addressed all AVB wear conditions relative to tube integrity requirements at the end of the next planned operating interval (3 Cycles – 49.6 EFPM) for "A" steam generator. Table 4 lists the projected %TW for all AVB wear sites left in service for "A" steam generator.

Table 4
Summary of Fall 2001 Surry Unit 1 – Steam Generator "A" AVB Results/Projections

The following is a summary of inspection results used in the projections:

Number of Tubes with AVB Indications:	17 Tubes
Number of AVB Wear Sites:	19 Intersections
Number of New Indications Not Existing in 1997:	One (R10C44)
Average Wear Rate (%TW / Cycle) – EOC 12:	1.49 %/Cycle
Historical Average Wear Rate (% TW / Cycle):	1.98 %/Cycle90%/50%
Wear Rate Based REOC12 Results:	4.90 %/Cycle(Mean + 1.28 x Std. Dev.)
90%/50% Wear Rate Based on Historical S/G A Wear Rates:	5.41 %/Cycle(Mean + 1.28 x Std. Dev.)
NDE Sizing at 90% CL	8.58%
2006 Projection % TW	2001 % TW + [5.41 x 3 cycles] + 8.6 %

The following are projections applying the 90/50 wear rates on those tubes remaining in service:

Row / Column	2001 % TW	Projected 2006 %TW
R33C16	**13%**	**37.8%**
R41C32	**12%**	**36.8%**
R42C32	**12%**	**36.8%**
R46C43	**16%**	**40.8%**
R46C44	**17%**	**41.8%**
R46C45	**18%**	**42.8%**
	17%	**41.8%**
R12C47	**16%**	**40.8%**
R32C48	**13%**	**37.8%**
R38C62	**12%**	**36.8%**
R32C66	**11%**	**35.8%**
R32C69	**22%**	**46.8%**
	14%	**38.8%**
	17%	**41.8%**
R40C69	**16%**	**40.8%**
R39C71	**12%**	**36.8%**
R36C75	**16%**	**40.8%**

Row / Column	2001 % TW	Projected 2006 %TW
R37C75	**14%**	**38.8%**

4.4 Operational Leakage

Routine primary-to-secondary leak monitoring in accordance with station procedures will continue. Results from the current inspection did not indicate any degradation modes which may be causing the small leak being reported in the "B" steam generator. Data trending based on Xe^{135} will continue.

4.5 Projected Accident Leakage

No inspection findings indicated that leakage would have occurred since the findings confirm the lack of operative corrosion degradation mechanisms since unit replacement. The limited wear indications at AVB locations and the limited wear indications from the sludge monorail were conservatively removed from service. Therefore, no potential contribution to operational leakage would be observed from these indications or the lower level indications remaining in service.

4.6 Conclusion

The results of the operational assessment for "A" steam generator support an operating interval to REOC 15 (RFO 20) and indicate continued compliance with structural integrity and leakage performance criteria. Results from previous operational assessments for the "B" and "C" steam generators continue to support their planned inspection interval (S/G "B" – Spring 2003 and S/G "C" – Fall 2004) and also indicate continued compliance to structural integrity and leakage performance criteria.

If other issues are identified on other Surry steam generators in ensuing inspections or other relevant industry findings are noted during the inspection of similar model steam generators, review of planned inspection intervals will be conducted in accordance with the Program Plan requirements.

Results of secondary side inspections continue to demonstrate reliable operation. Continued diligence relative to chemistry and FME control will support long term performance. Evaluation and monitoring will continue as detailed in the Monitoring and Inspection Program Plan. Continued awareness of any related industry issues will be considered when planning future inspections.

Corrective Actions Planned

None

Evaluation (If SG condition does not meet previous cycle operational assessment)

Not Applicable