



February 28, 2006

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

Serial No.	06-175
NL&OS/ETS	
Docket Nos.	50-338
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License Nos.	NPF-4
	NPF-7

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
NORTH ANNA POWER STATION UNITS 1 AND 2
ANNUAL STEAM GENERATOR TUBE INSPECTION REPORT - 2005

Pursuant to Technical Specification 5.6.7.b for North Anna Power Station Units 1 and 2, Dominion is required to submit an annual steam generator tube inservice inspection report. The attachment to this letter provides the steam generator tube inspection report for North Anna Unit 2. There were no inservice inspections performed on the Unit 1 steam generator tubes during 2005.

This letter does not establish any new commitments. Should you have any questions or require additional information, please contact Mr. Thomas Shaub at (804) 273-2763.

Very truly yours,

A handwritten signature in cursive script that reads "C. L. Funderburk".

for C. L. Funderburk, Director
Nuclear Licensing and Operations Support
Dominion Resources Services, Inc.
for Virginia Electric and Power Company

Attachment

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

Mr. J. T. Reece
NRC Senior Resident Inspector
North Anna Power Station

Mr. S. R. Monarque
NRC Project Manager
U. S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Mail Stop 8-H12
Rockville, Maryland 20852-2738

Mr. J. E. Reasor
Old Dominion Electric Cooperative
Innsbrook Corporate Center
4201 Dominion Blvd.
Suite 300
Glen Allen, Virginia 23060

Attachment

Serial No. 06-175

**North Anna Unit 2
Annual Steam Generator Tube Inservice Inspection Report**

**North Anna Power Station
Units 1 and 2
Virginia Electric and Power Company
(Dominion)**

**Virginia Electric and Power Company (Dominion)
North Anna Unit 2
Annual Steam Generator Report**

Station	Unit	Outage Date	Generator Examined	Date of Report
North Anna	2	September, 2005	B	12/01/2005

Design Information

SG Model	TSP Type.	TSP Mat'l	# TSP	Baffle Mat'l	AVB Mat'l	# AVB
54F	Quatrefoil	Type 405 SS	7	Type 405 SS	Type 405 SS	3
# Tubes	Tube Dia.	Tube Mat'l	Tube Pitch	Tube Tks	Expansion	Heat X-fer Area
3592	0.875"	In 690TT	1.225"	0.50"	Full Hydraulic	54,500 sq. ft.

Scope of Inspection

SG	Inspection Program	Planned	Inspected	Inspection Method	Extent
B	Bobbin	3592	3592	Bobbin	TEC – TEH, Except Row 1 U-bends
B	Row 1 U-Bend RC	98	98	+ Point RC	7H – 7C
B	Hot Leg TTS RC	719	719	+ Point RC	TSH +/- 3"
B	Special Interest RC Exams	0	37	+ Point RC	Various

Indications of Imperfections Detected

SG	NDE Method	Row	Column	Indication Code	Location	Active Yes/No	Measured Wall Penetration
B	N/A	N/A	N/A	N/A	NONE	No	N/A

Tube Plugging

SG	Reason/Mechanism	Tubes Plugged
Total Tubes Plugged		
NONE		

Plugging Attributions

SG	Row	Column	Reason/Mechanism	Repair Method
B	N/A	N/A	NONE	N/A

Plugging/Repair Record

SG	Tubes Plugged	Tubes Repaired (Not Plugged)	Percent Plugged	Percent Repaired (Not Plugged)	Percent Plugged or Repaired
A	1	0	0.03	0	0.03
B	0	0	0	0	0
C	1	0	0.03	0	0.03

TUBE INTEGRITY ASSESSMENT SUMMARY

1.0 Evaluation Summary

Overall condition assessments have been documented in the North Anna Steam Generator Monitoring and Inspection Plan (Reference 1) and are consistent with the requirements of the NEI 97-06 Guidelines. A Pre-Outage Assessment (POA), Reference 2, was performed to identify any relevant condition to be considered for the North Anna Unit 2 steam generators that was not included in the referenced Program document. The assessment also identified the appropriate eddy current inspection scope, probes to be utilized during the inspection, and the appropriate detection and sizing information for degradation mechanisms that may be detected during the inspection.

As required by NEI 97-06, Performance Criteria are established in three areas:

- Structural Integrity – Margin of 3.0 against burst under normal steady state power operation and a margin of 1.4 against burst under the most limiting design basis accident.
- Operational Leakage – RCS operational primary-to-secondary leakage through one steam generator shall not exceed 150 gpd.
- Accident Induced Leakage – Leakage shall not exceed 1 gpm per steam generator during Main Steam Line Break (MSLB).

The Dominion steam generator (SG) program (Reference 1), which invokes NEI 97-06, requires that a condition monitoring (CM) assessment of SG tubes be performed to verify that the condition of the tubes, as determined from inservice inspection results, is in compliance with plant licensing basis. Structurally significant indications, if detected, are evaluated to confirm that the safety margins against leakage and burst were not exceeded at the end of this operating cycle using appropriate integrity assessment evaluation methods. The results of the condition monitoring evaluation are used as a basis for an operational assessment (OA) which demonstrates prospectively that the anticipated performance of the SGs will likewise not exceed the safety margins against leakage and tube burst during the ensuing operating period.

The inspections performed were consistent with the Program Plan and Revision 6 of the EPRI Steam Generator Examination Guidelines, including the Interim Guidance issued by EPRI (Reference 3 & 4). Specific Eddy Current Analysis Guidelines (Reference 5) with inspection vendor eddy current data analysis and data acquisition technique sheets were used for system calibration and data analysis.

A condition monitoring evaluation of the steam generator tube bundles was performed to verify that the condition of the tubes, as reflected in the inspection results, is in compliance with plant licensing basis and meet the required performance criteria. The results of the condition monitoring evaluation were used as a basis for the operational assessment. The operational assessment demonstrated that the anticipated performance of the steam generators would not exceed the performance criteria against leakage and tube burst during the ensuing operating period.

This report summarizes the condition monitoring and operational assessment of the inspection results from the North Anna Unit 2 "B" steam generator. It conforms to the March 2000 EPRI Steam Generator Integrity Assessment Guidelines, Revision 1 (Reference 6) and the requirements of NEI 97-06.

Prior to this outage there were no existing active degradation mechanisms affecting the North Anna Unit 2 SG tubes. The relevant potential degradation mechanisms identified in the POA are: Tube wear at anti-vibration bar (AVB) locations, pitting, tube wear at support plates, and tube wear caused by foreign objects.

No defective or degraded tubes were identified during this inspection. Hence, acceptable tube integrity at the end of the current operating cycle, Replacement EOC 7 (REOC-7), has been demonstrated. The absence of active tube degradation mechanisms in "B" steam generator and the absence of anomalous secondary side material conditions, which could impact future tube integrity, provide reasonable assurance that required margins of safety will be maintained through the next planned operating interval. The results of the inspection of the "B" steam generator confirm that the operational assessments for Unit 2 "A" and "C" remain valid.

2.0 Condition Monitoring (CM) Assessment Summary

A discussion of the pertinent inspection results and the evaluations performed is provided that supports the CM assessment.

2.1 Inspection Results

2.1.2 Eddy Current Inspection Results Summary

No material degradation of any type was observed during this inspection on the "B" steam generator. This continues to demonstrate excellent performance of the replacement generators with respect to mechanical and corrosion-induced degradation. In particular, North Anna Unit 2 has operated approximately 9.1 EFPY without any observed AVB wear, a mechanism typically observed in F-type SGs.

During the bobbin probe inspection program, possible loose part (PLP) indications near the secondary face of the tubesheet were identified in four tubes. No wear indication was observed on the tubes. A total of twenty (20) tubes, including the affected tubes, were examined with + Point to further confirm no damage existed. Follow-up visual examinations confirmed that the signals were the result of small "sludge rocks" in the vicinity of the affected tubes and not by foreign objects which could damage the tubes.

18 dent indications measuring greater than or equal to 2 volts were reported. None of the reported dent signals demonstrated change which may be indicative of degradation that would require testing with a rotating probe (+ Point), but as a part of the special interest sample program eight (8) dents in the hot leg straight lengths were examined. No indication of degradation was detected.

Manufacturing anomalies (2 with no tube expansion within in the tubesheet) previously reported where + Point tested with no observed degradation.

Although not judged to be susceptible to degradation at this point in steam generator life, locations within the tubesheet with "over-expansions" at surface imperfections were identified with a bobbin automated analysis program. Seven (7) of the highest voltage signals in the hot leg were tested as part of this special interest rotating coil program (+ Point) with no degradation noted. The highest reported bobbin voltage was ~ 58 Volts.

2.2.2 Visual Inspection Results Summary

The visual examinations performed during this refueling outage revealed no evidence of material degradation and no foreign objects. As discussed earlier, the Secondary Side Inspection (SSI) team investigated the locations corresponding to PLP indications and confirmed that the indications had been caused by "sludge rocks" which do not present a threat to tube integrity.

No degradation of secondary side internals was identified during this outage. Consequently, it is very unlikely that such degradation could initiate and advance to an extent that would impact tube integrity prior to the next examination.

2.2.3 Condition Monitoring Conclusion

The CM assessment is based on current inspection results. As discussed in Section 2.1.2, no indications of tube degradation were identified. In the absence of any tube degradation, it is concluded that the structural integrity performance criterion was not exceeded during the operating interval preceding this outage. In addition, the absence of degradation exceeding this criterion provides reasonable assurance that the accident leakage performance criteria would not have been exceeded during a design basis accident. No primary to secondary SG tube leakage (i.e., leakage was <1 GPD) was reported during the previous operating period. Therefore, the operational leakage performance criterion was also not exceeded during the operating period preceding this inspection.

3.0 Operational Assessment

The OA must demonstrate that the structural integrity performance criteria will not be exceeded prior to the next scheduled examination in any of the three North Anna Unit 2 SGs.

Although no degradation was identified during the current inspection of "B" SG or during previous inspections of the other two SGs, this OA will discuss the potential for foreign object wear and will evaluate the future growth of hypothetical, undetected AVB wear. Under the current chemistry control program, the initiation and development of corrosion degradation mechanisms in the North Anna Unit 2 SG tubing is not considered to be a credible event in the near-term. Future SG examinations will be conducted well in advance of the time at which degradation of this type is projected to occur.

3.1 Foreign Object Wear

Tube wear resulting from tube interaction with foreign objects is by its nature random, isolated, and difficult to predict. As discussed, the SG work activities performed during this refueling outage included extensive secondary side inspections. Steam drum, upper tube bundle, and in-bundle top of tubesheet visual examinations were performed in SG "B"; and post sludge lancing visual examinations were performed at the top of tubesheet in all three SGs. No foreign objects were identified. Extensive ECT examinations in SG "B" revealed no evidence of foreign objects or foreign object wear. As such, there is reasonable assurance that foreign objects will not cause the structural integrity performance criteria to be exceeded prior to the next tube examination in each steam generator. Because no wear exceeding the structural criteria is expected, it is reasonable to conclude that the operational leakage and accident leakage performance criteria will not be exceeded by foreign object wear.

3.2 AVB Wear

Even though no AVB wear indications have been identified in the North Anna SGs to date, it could reasonably be expected to develop eventually. Industry experience to date on similar design steam generators have reported AVB wear. AVB wear, detected and sized with the bobbin probe, typically begins to be reported at a depth of 10 %TW. Typical growth rates of 2 %TW to 5 %TW per fuel cycle have been experienced at Surry. The performance of the North Anna steam generators is expected

to at least equal that of Surry since close-gap AVB tolerance techniques were used during manufacture.

The following evaluation was performed to evaluate a potential undetected 10 %TW AVB wear condition relative to tube integrity requirements at the end of a potential four cycle run. The growth rate utilized is based upon the worst case Surry AVB growth since steam generator replacement. The upper 95%/50% AVB growth rate of 7.23%TW per operating cycle is used as the growth rate for calculating the time to reach the appropriate structural limit. Based on ETSS 96004.1 sizing performance parameters as provided in Ref. 5, the time is calculated as follows:

Best Estimate %TW: $y = 0.97 (10\%TW) + 3.49 = 13.2 \text{ %TW}$

Total Random Uncertainty @ 90/50: 10.7 %TW

Bounding Structural Limit
for AVB Wear (Ref. 5) 61 %TW

Time Interval to Reach Structural Limit (cycles):

Limit = 13.2 %TW + 10.7 %TW + [(7.23 %TW/cycle) x (Interval)] = 61 %TW

Interval = 5.1 cycles

This projected time interval required for hypothetical North Anna Unit 2 AVB wear to grow to a depth equaling the most conservative structural limit (uniform thinning), far exceeds the planned maximum operating interval for any of the North Anna Unit 2 SGs. Therefore, AVB wear does not represent a realistic concern from a tube structural integrity point of view during the next planned operating interval for SG B, or during the current operating intervals for SGs A and C. As such, no accident leakage or operational leakage concerns exist relative to AVB wear for any of the SGs.

3.3 Conclusions

The North Anna Unit 2 steam generators, as indicated by the results of the current condition monitoring evaluation of SG "B" and past assessments pertaining to the other steam generators, continue to satisfy the safety margin requirements with respect to structural and leakage integrity. No degradation exceeding the performance criteria was identified during this or any previous North Anna Unit 2 SG inspection. This evaluation has demonstrated that there is reasonable assurance that operation of the North Anna SGs for the planned operating interval is acceptable and will not cause the tube integrity performance criteria to be exceeded.

4.0 References

1. Dominion, "North Anna Steam Generator Monitoring and Inspection Plan," NAPS-SGMIP-001, Rev. 0, March 2004
2. Dominion, "S/G Monitoring Program Pre-Outage Assessment, North Anna Unit 2 – Fall 2005," August 2005
3. EPRI, Interim Guidance Letter, Rev. 6, "Examination Guideline Implementation, Tube Noise Criteria," L. Womack, April 30 2003
4. EPRI, "Interim Guidance on Revised Structural Integrity Performance Criterion", January 17, 2005
5. North Anna Site Specific Eddy Current Analysis Guidelines (NAPS-SGPMS-002), Rev. 8, September 20, 2005
6. EPRI, "SG Integrity Assessment Guidelines," TR-107621-R1, Rev. 1, March 2000

ATTACHMENT 1 Three Letter Codes

General Codes

ANF - ANOMALY NOT FOUND -Indicates that a previously reported anomaly cannot be found within .50" of the location where the anomaly was previously called.

ANR - ANOMALY NOT REPORTABLE - Indicates that a previously reported anomaly does not meet the present reporting criteria.

BDA - BAD DATA (retest) – Indicates that the data for the specified tube is not acceptable for analysis due to poor signal quality. The tube will be re-tested to the required extent.

INF - INDICATION NOT FOUND - Indicates that a previously reported INDICATION has not been found in the data being analyzed or that a tube/signal is being re-tested for positive identification (PID) and no signal is present in the retest data.

INR - INDICATION NOT REPORTABLE - Indication called in previous inspections that are still detectable but fall below current reporting criteria.

NDD - NO DETECTABLE DISCONTINUITY – The recorded data has no signal responses meeting the criteria established in the Site Specific Analysis Guidelines for degradation, damage precursors or anomalies.

NDF - No Degradation Found - Used to address a special interest location where no signal meeting the RC criteria (MBM, DNT, etc) is present. Location of rotating coil data verses the bobbin coil shall be verified to ensure correct location was inspected.

NT - NO TEST (re-test) – Indicates that the tube ROW, COLUMN was encoded on the tape; however, no inspection data was recorded for analysis.

OBS - OBSTRUCTED – Blockage of a tube that prevents passage of a defined minimum size probe through the tube.

PID - POSITIVE IDENTIFICATION - Verification of a signal at the same reported ROW/COL and at the same reported tube location.

PLG - PLUG – Indicates that the tube at the specified location has been plugged.

PVN - PERMEABILITY VARIATION – Condition where the test coil impedance changes due to a change in the tubing materials inherent tendency to conduct magnetic flux lines.

PLP – POSSIBLE LOOSE PART – Indicates the possible presence of a loose part in the generator.

RST - RESTRICTED - Blockage of a tube that prevents passage of a probe beyond a specified location within the tube.

TIU - TUBE I.D. UNCERTAIN (re-test) - Indicates that the ROW and/or COL identifier for a given tube is in doubt.

LAR - Lead Analysts Review - Condition not directly covered by the guidelines, ETSS, or other documentation that the data analyst feels should be brought to the attention of the resolution and/or

job lead analyst. Diagnostic testing or PID verifications that the analyst believes are not the correct tube number and/or the correct tube location shall be identified as LAR.

Bobbin Codes

BLG - BULGE - An area along the tube where the diameter of the tube has been abruptly deformed in an outward direction as compared to the nominal tube diameter.

CUD - COPPER DEPOSIT - The presence of copper deposits on the outside of the tube.

DNT - DENT – An area along the tube where the diameter of the tube has been abruptly reduced compared to the nominal tube diameter.

LGV - LOCAL GEOMETRIC VARIATION - A local reduction in tube diameter usually associated with a localized change in conductivity of the tube. LGV signals are caused by dings introduced during manufacturing/installation process and do not represent a discernible wall loss. The signals must be verified by history review to be called with bobbin (See rotating probe DNG code).

MBM - MANUFACTURING BURNISH MARK – A tubing condition where localized tubing imperfections were removed by buffing and are detectable due to the effects of cold working and minor localized wall thinning. The signal must be verified by history review to be called with bobbin.

MMB - MULTIPLE MANUFACTURING BUFF MARK - Multiple MBM signals in close proximity over a length of tube. The signals must be verified by history review to be called with bobbin.

NQI – NON-QUANTIFIABLE INDICATION – A bobbin signal requiring rotating coil examination for disposition.

NQN – NON-QUANTIFIABLE NONDEGRADED – A bobbin signal which was formally classified as NQI but has been determined to be anomalous or of a type which does not represent degradation.

PDS - POSITIVE DRIFT SIGNAL – Long (several inches to several feet) drift signals evident on absolute channels caused by variations in tube concentricity associated with the pilgring process. The signals may be located at random elevations and are generally only in one leg of the tube.

PTE – PARTIAL TUBE EXPANSION – Code used when only some portion of parent tube has been expanded into the carbon steel tube sheet. PTE shall be reported at the axial location(s) where nominal tube expansion ends and the partial begins, from the 400/100 mix channel. Bobbin and/or rotating coil data shall be carefully analyzed in the non-expanded crevice region.

NTE – NO TUBE EXPANSION – Code used when the parent tube has NOT been expanded into the carbon steel tube sheet from the top of the tube sheet to approximately 2.5" from the tube end. NTE shall be reported from the 400/100 mix channel, location as TSH +0.00. Bobbin and/or rotating coil data shall be carefully analyzed in the non-expanded crevice region.

Rotating Probe Codes

DNG - DING – A localized inward displacement of the tube caused by a mechanical impact on the OD surface.

MAA - MULTIPLE AXIAL ANOMALY - Multiple axially oriented signals located at the top of the tube sheet that the rotating coil data shows to result from an anomalous condition in the tube.

MCA - MULTIPLE CIRCUMFERENTIALLY ORIENTED ANOMALY - Multiple circumferentially oriented signals located at the top of the tube sheet that the rotating coil data shows to result from an anomalous condition in the tube.

MAI - MULTIPLE AXIAL INDICATION - Multiple axially oriented signals that the rotating coil data shows to result from flaws in the tube.

MBM - MANUFACTURING BURNISH MARK – A tubing condition where localized tubing imperfections were removed by buffing and are detectable due to the effects of cold working and minor localized wall thinning.

MCI - MULTIPLE CIRCUMFERENTIALLY ORIENTED INDICATION - Multiple circumferentially oriented signals reported from rotating probe data that the rotating coil data shows to result from flaws in the tube.

MMB - MULTIPLE MANUFACTURING BUFF MARK - Multiple MBM signals in close proximity over a length of tube.

NQN – NON-QUANTIFIABLE NONDEGRADED – A bobbin NQI signal which is determined to be anomalous or not to represent degradation.

PIT - PIT – Localized attack on tubing resulting from non-uniform corrosion rates caused by the formation of local corrosion cells. At Surry, the condition produces small volumetric indications with approximately the same axial and circumferential extent.

SAA - SINGLE AXIAL ANOMALY – A single axially oriented signal located at the top of the tube sheet that the rotating coil data shows to result from an anomalous condition in the tube.

SCA - SINGLE CIRCUMFERENTIALLY ORIENTED ANOMALY – A single circumferentially oriented signal located at the top of the tube sheet that the rotating coil data shows to result from an anomalous condition in the tube.

SAI - SINGLE AXIAL INDICATION – A single axially oriented signal that the rotating coil data shows to result from a flaw in the tube.

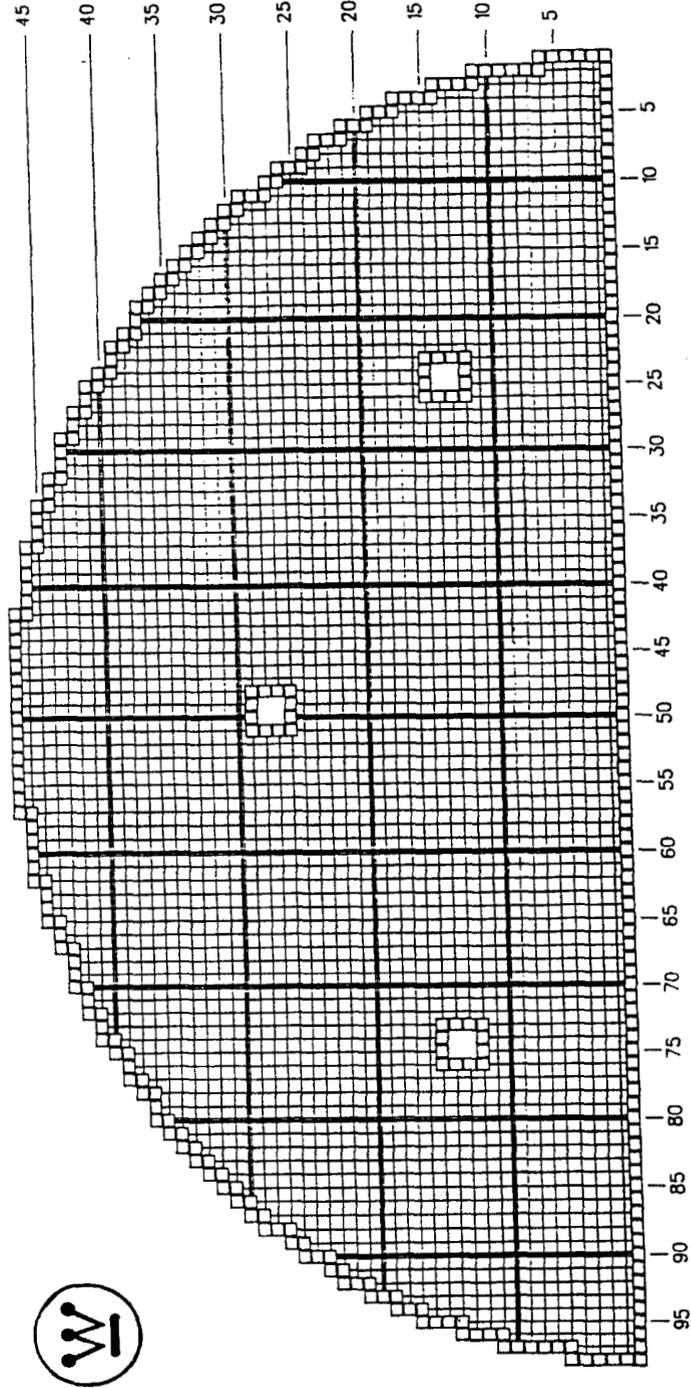
SCI - SINGLE CIRCUMFERENTIALLY ORIENTED INDICATION – A single circumferentially oriented signal that the rotating coil data shows to result from a flaw in the tube.

VOL – VOLUMETRIC – Indications of volumetric wall loss indicative of general localized thinning, wear or impingement.

SVI/MVI – SINGLE VOLUMETRIC INDICATION/MULTIPLE VOLUMETRIC INDICATIONS – Indications of volumetric wall loss indicative of general local inter-granular attack (IGA or IGA/SCC).

Attachment 2
North Anna Steam Generator Sketches

SERIES 54F



Attachment 2 (Continued)

