

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

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

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Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
ANNUAL STEAM GENERATOR INSERVICE INSPECTION SUMMARY REPORT

Pursuant to Technical Specification 6.9.1.5.b for North Anna 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 2000. The steam generator tube inspections conducted on Unit 1 during the spring 2000 refueling outage are included in the attachment. There were no inspections performed on Unit 2 steam generators in 2000.

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
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Mr. M. J. Morgan
NRC Senior Resident Inspector
North Anna Power Station

A047

North Anna Power Station
2000 Annual Steam Generator Report

Virginia Electric And Power Company
(Dominion)

**Virginia Electric and Power Company
(Dominion)
North Anna Unit 1
Annual Steam Generator Report**

Station	Unit	Outage Date	Generator Examined		Date of Report
North Anna	1	March 2000		B	04/11/00

Scope of Inspection					
SG	Inspection Program	Planned	Inspected	Inspection Method	Extent
B	Bobbin	1796	1796	Bobbin	TEC - TEH
B	Row 1 U-Bend RPC	98	98	Single Coil RPC	7H - 7C
B	TTSH RPC	719	720	3-Coil RPC	TSH +/- 3"

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
B	NONE	0
Total Tubes Plugged		0

Repair 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	0	0	0	0	0
B	0	0	0	0	0
C	1	0	0.03	0	0.03

TUBE INTEGRITY ASSESSMENT

1.0 Summary

Overall condition assessments have been delineated in the North Anna Steam Generator Monitoring and Inspection Program Plan. Consistent with the NEI 97-06 requirements, a pre-outage assessment was performed to identify any relevant or potential degradation mechanisms to be considered for the North Anna Unit 1 steam generators and to identify the appropriate eddy current inspection scope and probe capabilities.

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

- Tubing Structural Integrity
- Operational Leakage
- Projected Accident Leakage

The inspection performed on the “B” steam generator was consistent with the Program Plan. The results of the inspection formed the basis of the condition monitoring and operational assessment performed for this outage.

Condition monitoring and operational assessment of the steam generator tube bundles are performed to verify that the condition of the tubes, as reflected in the inspection results, is in compliance with plant licensing basis. Defects detected are evaluated to confirm that the Reg. Guide 1.121 margins against leakage and burst were not exceeded at the end of this operating cycle. The results of the condition monitoring evaluation are used as a basis for an operational assessment, which demonstrates that the anticipated performance of the steam generators will likewise not exceed the Reg. Guide 1.121 margins against leakage and tube burst during the ensuing operating period.

No degradation was identified during the inspection program. Hence, acceptable tube integrity at the end of the current operating cycle is demonstrated and condition monitoring and operational assessment requirements on burst pressure and accident condition leak rates are satisfied.

The condition of the North Anna Unit 1 steam generators, as indicated by the results of the condition monitoring evaluation, satisfy the requirements of Reg. Guide 1.121 with respect to structural and leakage integrity margin. The completed operating interval, i.e., time between the last steam generator “B” inspection, was approximately 46.2 EFPM and the cumulative operating period for the replacement S/Gs was 78.5 EFPM. The planned operating interval before the next inspection of steam generator “B” is approximately 50 EFPM. With no tube degradation being reported following the replacement EOC5 operation, no known condition exists that would fail to meet structural and leakage margin requirements before the end of next planned operating interval for steam generator “B”. Thus, the operational assessment requirements are satisfied.

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

No “Existing” degradation is being monitored and no degradation was observed this outage as expected, which is consistent with units having been replaced in 1993. Monitoring for the presence of “Relevant” and “Potential” degradation is conducted based on the assessment of prior inspection results, steam generator design features, and industry experience with similar steam generators.

The inspections conducted during this outage follow the philosophy established in the North Anna Steam Generator Monitoring and Inspection Program Plan. The pre-outage assessment noted no particular areas of concern. The pre-outage assessment also covers salient observations of industry experience. In addition, site specific data not available at the issuance of the December 1998 Program Plan such as secondary side deposit characterization and analyses have been evaluated and integrated into the inspection process, as appropriate. Details of the current inspection and results are included in the Steam Generator Services Summary Report provided by Westinghouse Electric Company. Hence, only the specific results relating to the condition evaluation will be covered here.

3.0 Condition Monitoring Assessment – Tube Integrity Evaluation

The condition monitoring assessment is an evaluation of the past operating cycle relative to structural and leakage integrity margin based on current inspection results. The condition of the North Anna Unit 1 steam generators, as indicated by the results of the inspection performed on the “B” steam generator, satisfies the requirements of Reg. Guide 1.121 with respect to structural and leakage integrity margin for the recently completed operating period. A discussion of the inspection results and the evaluations performed is provided in the following sections.

3.1 Primary Side Inspection

No findings corresponding to crack-like indications were observed on the inspection conducted on “B” steam generator. The planned 50% bobbin inspection of 1796 tubes full length not previously inspected completes 100% re-inspection of the tubes in this generator since the baseline inspection of 1992. Focused RPC inspections at the H/L top of tubesheet (719 tubes - 20% sample of the population) and in the Row 1 U-bend area (98 tubes - 100% of the tubes in this row) were conducted. No conditions indicative of corrosion degradation were noted from these eddy current programs. Conditions per the site specific analysis guidelines, which required follow-up RPC testing to resolve bobbin indications, were not observed on any tubes.

No tubing wear at AVB contact points was observed even in the initial stages of wear, approximately 10% thru-wall (TW). This is consistent with experience in the industry that the appearance of these indications in earlier F-type steam generators (i.e., Model F and 51-F with 600 TT tubing) typically begin at approximately the 4th to 5th cycle of operation. No wear has been observed on Unit 1 after 5 cycles of operation. Limited inspection populations on later generation Westinghouse F-type units with Alloy 690 tubing such as North Anna have not reported any AVB associated wear in data reported through mid 1999. Some later replacement Alloy 690 BWI (Canada) units have exhibited significant tube wear at AVB's during the first cycle that required plugging and require closer scrutiny.

Manufacturing buff mark (MBM) signals were typical of what was observed on baseline inspections and were resolved through comparison of signals per the analysis guidelines. None required additional RPC testing. Excellent correlation of signals indicates that A690TT tubing appears to be less susceptible to resistivity changes that affect eddy current signatures than does A600TT tubing.

RPC inspection of the top of the hot leg tubesheet location was performed for 720 tubes (1 more than the base scope plan). This program focused primarily on the low velocity region in the middle of the bundle. One anomalous indication (in tube R3C58 – SAA – single axial anomaly) and one MBM (in tube R10C52) were reported. The anomaly appeared to be produced by a ding in the transition area with no crack-like components and was resolved per the guidelines. The tube with the MBM signal showed it to be in the free-span area above the transition and traced back to baseline bobbin data and was resolved.

Ninety-eight Row 1 U-bends were inspected with single coil RPC probes. Data from six tubes showed C-scan signals that could be characterized as circumferential anomalies. The RPC lissajous was flat, indicative of a non-flaw-like signal. Repeat tests were performed from the hot leg side in both the push and the pull modes; however they did not resolve the signals. After discussion with Station Management regarding the options to resolve the signals, Plus Point testing was performed on these U-bends from the cold leg side. Evaluation of the Plus Point data showed no signals indicative of cracks. Hence, all tubes were determined to be free of flaws.

No observations, such as that found in the Fall 98 inspection (TSH + 10"; anomalous signal that was plugged) were found during the current inspection.

During this examination, the Dominion NDE Level III performed random data checks as well as a final verification of the planned versus completed inspection program. No issues were noted.

3.2 Secondary Side Inspections

Consistent with the North Anna Steam Generator Program Plan, NEI 97-06, and GL 97-06, secondary side inspections were performed to confirm that no secondary side condition existed that would impact tube integrity. Inspection at the 7th tube support plate, including wedge blocks, back-up bars and support structures, was performed and no issues identified. A light oxide deposit covered all tube support plate surfaces examined with no appreciable loose sludge. Tube surfaces showed minimal oxide buildup and no evidence of scale. No blockage or sludge build-up was noted within the tube support plate broached holes.

Sludge mapping was performed on a sample of 382 tubes on the current data collected on "B" steam generator. No conditions were found which would have adversely affected the operation of the North Anna Unit 1 steam generator "B" during the last operating interval. Secondary system corrosion product transport continues to be excellent with approximately 141 lbs. total for all three steam

generators having been passed forward over the last cycle. A cumulative total of approximately 845 lbs. was estimated since replacement based on the operating data up to the refueling shut down. This demonstrates continued good chemistry environment.

3.3 Operational Leakage

The primary-to-secondary leakage response limit of 100 GPD/steam generator from the Technical Specifications still exists as the limit imposed prior to replacement. Station procedures continue to use a lower administrative limit of 50 GPD/steam generator with a total rate of change limit of 60 GPD within 90 minutes to evaluate shut down actions. The value typically used in the industry as a critical leakage value requiring unit shutdown is 150 GPD/steam generator and/or a rate of change leakage limit of > 60 GPD/hour/steam generator and is referenced in EPRI Document on Primary-to-Secondary Leak Guidelines. An assessment has been completed as a part of the action plan to comply with the NEI 97-06 Steam Generator Program Document. It defined where enhancements or changes to current procedures are necessary as a result of the Revision 2 EPRI industry document. These changes are currently being processed. The current procedures are viewed as conservative with respect to the vintage of the replacement North Anna units in that no active degradation has been noted.

During the past operating cycle, no primary-to-secondary leakage was observed during plant operation. Monitoring continues per testing requirements of PT-46.3 B and PT-46.3 C. N -16 monitors continue to be used to provide fast response trending of any potential leakage.

3.4 Projected Accident Leakage

Since inspection findings have not identified any operative degradation mechanisms in the unit, no appreciable primary-to-secondary leakage would be expected under accident induced loadings.

3.5 Conclusion

The condition of the North Anna Unit 1 steam generators, as indicated by the results of the inspection performed on the "B" steam generator, satisfy the requirements of Reg. Guide 1.121 with respect to structural and leakage integrity margin for the recently completed operating period.

4.0 Operational Assessment: Tube Integrity And Leakage

4.1 Discussion

Based on information contained in Technical Report NE-1214, Rev. 0 "Fuel Management Scheme 1999-B," the past operating interval between inspections of the "B" steam generator was 46.2 EFPM and the cumulative operating period

for the replacement S/Gs was 78.5 EFPM. The projected operating interval until the next inspection of S/G B is approximately 50 EFPM. No conditions were identified during the current completed inspection efforts that would impact the structural and leakage performance of the Unit 1 steam generators through the next planned operating interval, thereby satisfying the operational assessment. In accordance with the referenced Program Plan logic of general and focused tubing inspections on one steam generator per refueling cycle, the findings of this inspection are consistent with maintaining this planned frequency of inspection.

The only degradation that is expected over the long term is minor wear at anti-vibration bar (AVB) locations. AVB wear, if present, is reported during bobbin testing. Typically, indications begin to be reported at approximately 10% through wall and, in general, are slow growing. Industry experience, to date, on similar Model F type replacement steam generators have reported no appreciable AVB wear. Typical growth of 2% to 5% throughwall per cycle has been experienced at Surry. The performance of the North Anna generators is expected to at least equal that of Surry since the close gap AVB tolerance techniques were used during manufacturing of the North Anna steam generators.

The following evaluation was performed to evaluate a potential existing 10% throughwall AVB wear condition relative to tube integrity requirements at the end of the next planned operating interval (3 Cycles - 50 EFPM) for the "B" steam generator. The projection is based on 5 % / Cycle growth rate and a total NDE uncertainty of 14.6 %.

$$\% \text{ TW (2004)} = 10\% \text{ TW (2000)} + [(5\% \text{ Growth / cycle}) \times 3 \text{ Cycles}] + 14.6\%$$

$$\% \text{ TW (2004)} = 39.6 \%$$

No structural integrity concern is identified for the planned operating interval of North Anna Unit 1 "B" steam generator.

Although there are no findings indicative of a concern, sensitivity to primary-to-secondary leakage events will continue with conservatively based monitoring procedures. Industry recommended action level and shutdown limits as indicated in Revision 2 to the EPRI Primary-to-Secondary Leakage Guideline are currently being incorporated.

Similar chemistry controls as in the past cycle should be maintained throughout the next cycle. Chemistry excursions or significant changes to treatment programs will be evaluated on a case by case basis relative to impact on planned inspection cycles and scopes. Due to low amounts of sludge being removed and continued low corrosion product transport, sludge lancing or other enhanced methods will continue to be planned on an every other outage basis. The laboratory analysis of scale samples and subsequent review of results will be continued and evaluated with respect to sludge lance frequency. Supplemental inspections and enhanced cleaning methods will be pursued consistent with the

Steam Generator Advisory Committee recommendations from the October 1999 meeting. Subsequent Program Plan requirements will be modified and approved as necessary.

4.2 Conclusion

Based on the results of this eddy current inspection, past inspections, and current chemistry operating practices, "B" steam generator meets the performance criteria to operate for at least three cycles before the next planned tubing inspection. If other issues are identified on other North Anna 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 per Program Plan requirements. Results to date indicate that the currently planned tubing inspection interval on "A" and "C" steam generators can remain as planned. Steam generator "A" is currently scheduled to be inspected in the Fall of 2001 and steam generator "C" is scheduled to be inspected in the Spring of 2003. The current inspection of steam generator "B" completes 100% bobbin re-inspection of tubes in all S/Gs since the baseline inspection of 1992.

Results of secondary side inspections continue to demonstrate reliable operation. Continuing diligence on chemistry and FME control will support long term performance. Evaluation and monitoring will continue as planned and further detailed in the Monitoring and Inspection Program Plan. Continuing 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

Maggie McClure 02/27/2001 08:57 AM

To: Jack Davis/NUC/VANCPower, Jim Crossman/NUC/VANCPower, Sonny Stanley/NUC/VANCPower,
David Dodson/NUC/VANCPower, Joyce Lawler/NUC/VANCPower, John
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cc:

Subject: Outgoing NRC Letter - NAPS Annual SG ISI Summary Report (01-048)



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