



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MANIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

Report Nos.: 50-338/92-02 and 50-339/92-02

Licensee: Virginia Electric and Power Company
Glen Allen, VA 23060

Docket Nos.: 50-338 and 50-339

License Nos.: NPF-4 and NPF-7

Facility Name: North Anna 1 and 2

Inspection Conducted: January 6-9 and 13-16, 1992

Inspector:

N. Economos
N. Economos

2-18-92
Date Signed

Accompanying Personnel: C. V. Dodd, Oak Ridge National Laboratory
K. Karwoski, NRR

Approved by:

J. J. Blake
J. J. Blake, Chief
Materials Processes Section
Engineering Branch
Division of Reactor Safety

2/20/92
Date Signed

SUMMARY

Scope:

By review of approved procedures and observation of eddy current data analysis, verify that steam generator tube examination and analysis of Unit 1, was consistent with the program as outlined by the licensee for the staff on January 6, 1992.

Results:

The inspector determined that the licensee was conducting the eddy current examination in a manner that was consistent with the inspection plan presented to the staff. A failure to adequately communicate critical rule basis, data analysis to the field and a lack of appropriate analyst training was in part responsible for inaccurate, analysis/evaluation on 8X1 probe data. The licensee identified the problem, stopped the analysis of 8X1 probe data and took remedial action to improve the reliability of data analysis and to demonstrate the adequacy of the 8X1 probe as a screening tool. Inspector recommendations aimed at improving inspection reliability and analyst proficiency were as follows:

- 1) 8X1 probe data could be improved if pull speed was reduced to less than six inches per second.

- 2) Modify the rotating pancake coil (RPC), coil data gathering procedure so that several probe pulls are made of the standard support ring with probe rotation turned off. This would allow the mix to be set up on the RPC coil to get better data.
- 3) Some clear intersections should be tested using the RPC coil as it may be more sensitive to deep and short defects.
- 4) The Zetec 3-coil probe RPC would be better at separating axial from circumferential cracks.

At the close of this inspection, bobbin probe examinations were complete. Inspections with the 8X1 probe and the rotating pancake coil were in progress in all three steam generators.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

D. Dodson, Level III Examiner Eddy Current
*R. D. Enfinger, Assistant Station Manager (Operations and Maintenance)
*M. Gettler, Project Manager, Steam Generator Replacement
*E. S. Grecheck, Manager ISI/NDE and Engineering Programs
*L. N. Hartz, Manager, Nuclear QA
*G. E. Kane, Station Manager
*P. Kemp, Supervisor Licensing
*J. O'Hanlon, Vice President Nuclear Operations
*R. F. Saunders, Assistant Vice President Nuclear Operations
*J. P. Smith, Manager, QA, North Anna
W. L. Stewart, Senior Vice President - Nuclear
*J. A. Stall, Assistant Station Manager (Nuclear Safety and Licensing)
*E. W. Throckmorton, Supervisor ISI/WDE Licensing
*A. L. Travis, Supervisor, NDE

Other licensee employees contacted during this inspection included QA/QC inspectors, engineers, and technicians.

Westinghouse Electric Corporation (W)

J. C. Hagood, Principal Engineer
B. Jolley, Site Coordinator

NRC Resident Inspectors

*M. Lesser, Senior Resident Inspector
*J. Taylor, Resident Inspector

*Attended exit interview

2. Steam Generator Mid-Cycle, Eddy Current Inspection Outage. Unit-1 (73753)

On January 6, 1992, representatives of the NRC, Virginia Electric and Power Company (VEPCO) and W, met in NRC Headquarters to discuss the status of the mid-cycle, North Anna Unit-1 steam generator (S/G) inspection. The licensee presented the inspection program, including the scope of the inspection plan, tube degradation mechanisms, evaluation of the eddy-current inspection program at North Anna, inspection plan and basis, analyst qualifications, revised eddy current analysis guidelines and tube plugging criteria. Technical issues regarding the S/G inspection plan, requiring resolution included (a) inspection of a random sample of tubes which had been previously inspected with the 8X1 probe, and with the RPC, so as to validate the adequacy of the 8X1 probe for screening purposes,

(b) determine whether a reduced 8X1 probe pull speed could improve lift-off performance and thereby improve sensitivity to crack indications at the S/G tube support plate intersections.

On January 7, 1992, at the North Anna site the inspector met with technical personnel to discuss inspection objectives and observe ongoing eddy-current (EC), inspection activities.

A summary of the EC program as presented by the licensee to the staff and to the inspector at the site was as follows:

<u>Inspection Performed</u>	<u>Extent of Inspection</u>	<u>Reason</u>
Bobbin Probe	100% available tubes. Full-length.	Detection of axial indications
8X1 Probe	100% tubes thru 7th tube support plate (TSP) on hot leg side. (4th TSP in 1991)	Detection of circumferentially oriented or volumetric degradation at the support plates and detection of indications at the support plates not found by bobbin probe.
Rotating Pancake Coil	100% at top of tubesheet. All available Row 2 U-bends and any potentially pluggable bobbin and/or 8X1 probe indications. Fatigue susceptible areas.	Detection of circumferential indications at the top of tubesheet. Detect U-bend degradation. Confirm bobbin or 8X1 probe indications.
	Review status of potential indications identified in the re-review of Unit 1 data.	Identify changes since March 1991 inspection.

In addition to the subject inspection program, the licensee outlined certain critical data analysis rule changes for the detection of circumferential cracks at the tube support plates (TSP), which were as follows:

- ° 8X1 Inspection Guidelines Do Not Require Frequency Correlation
- ° 8X1 Analysis Requires Particular Sensitivity To:

- Any Vertical Excursions In The Lissajous
- Separate Analysis Of The Upper And Lower Edge Of The TSP
- Quantifying The Number Of Coil Hits

Inconclusive RPC data cannot clear a potential indication. The complete body of eddy current data must be considered prior to removing a tube from the plug list.

The subject inspection program and its objectives were delineated in W procedures which had been reviewed and approved by the licensee's Level III Examiner. Two of the controlling procedures were as follows:

- VRA-21 Rev. 0 Eddy Current Inspection of Preservice and Inservice Heat Exchanger Tubing at North Anna 1 and 2.
- North Anna Units 1 and 2 Steam Generator Eddy Current Data Analysis Program November, 1991, Revision 2.

The subject inspection procedure was written to meet the intent of Regulatory Guide 1.83 Rev. 1 (7/95).

ASME Code Section XI, 1974 Edition with Summer 1976 Addenda through the 1989 Edition and Code Case N-401 were identified as applicable to this inspection. Personnel qualification requirements included those prescribed by ASNT-TC-1A for Level II A or Level III as applicable and successfully passing a site specific examination on specific probe type, i.e. bobbin, BX1 or RPC, used to acquire EC data. Site specific examinations included actual flaw signals from previous North Anna evaluations. Test results were reviewed and approved by the Licensee's Level III NDE Examiner. Within these areas the inspector observed training of EC analysts and reviewed test results/scores. In addition, the inspector reviewed training and test material to verify whether examples of S/G tubes which had undergone initial review and reanalysis were included in the testing and training material. Other observations included analysis of bobbin coil data for S/Gs "A" "B" and "C" and of the BX1 probe in S/G(s) A and B.

The inspector observed system calibration using the tube and the support plate standards. Probe speed was verified at this time. The inspector also reviewed final analysis reviews from S/G "A", recorded on tapes No. 1, No. 3, No. 5, and No. 7; for S/G "B", recorded on tape No. 3; and for S/G "C" recorded on tapes No. 1 and No. 3. This review was performed in order to ascertain whether analyses were being conducted by primary and secondary analysts, the type of indications identified, and what degree of consistency existed

between primary and secondary analysts. No resolutions had been documented during the timeframe (January 7-8, 1992), of this work effort. In general, these analyses showed the majority of the tubes were analyzed as having possible indications (PI(s)), at some intersection, while others showed that the locations selected for analysis differed between primary and secondary analysts. On January 10, 1992 the licensee issued Deviation Report N-92-57 to place S/G "C" in C-3 classification. In this report, the licensee noted that 50 tubes would be plugged due to rejectable indications. On January 13, 1992 Messers. C. Dodd and K. Karwoski accompanied the inspector to the site in order to observe specific areas of interest, and analytical aspects of the inspection including review of data, review of procedures and to discuss enhancement of data acquisition with the 8X1 and the RPC probes. At the conclusion of their visit on January 15, 1992, Mr. Dodd provided the licensee with the following observations and/or comments:

- (1) The 8X1 probe data may improve if pullspeed was reduced. This would result in smaller lift off variations.
- (2) Some indications appeared to change/grow on the RPC scan, although most remain the same. The pulled tube in S/G "B" (R11-C14) reviewed on the 1987 8X1 tape, would be declared a possible indication and slated for RPC examination under the current guidelines.
- (3) The data gathering procedure should be revised to allow the RPC probe to be pulled through the Support Ring Standard with the motor turned off. This would permit the mix to be established on the RPC, resulting in better data.
- (4) Some clear TSP intersections should be tested with the RPC, as it has a smaller coil diameter than the 8X1 probe and may be more sensitive to deep and short defects.
- (5) The Zetec, 3-coil RPC probe would probably be better at separating axial from circumferential crack indications.

On January 14, 1992 the licensee met with the inspector to report that they had determined that the analysis rule basis in the site approved procedure, permitted the analysts to evaluate certain signals on the 8X1 data, as opposed to calling everything with vertical excursions or displacement as required by the revised rules described in the presentation to the staff. This problem surfaced when the licensee determined that certain analysts failed to call certain tubes with known 8X1 probe identified indications. These tubes had been identified during the 1991 (W) re-review as having possible indications. The licensee included seven of these tubes in the current S/G examination to test the adequacy of this analysis.

In response to this problem, the licensee revised the rule basis to require that all indications on the 8X1 data depicting vertical excursions/displacement, be classified in the PI category, meaning that they would have to be examined with the RPC coil. The outcome of this revised rule was that practically every tube was earmarked for RPC coil examination. Realizing that this approach would result in a 100 percent RPC inspection, the licensee requested W assistance in the development of an action plan to validate the 8X1 data using RPC information. The plan would encompass retraining and testing of analysts, varying pull speed of the 8X1 coil to determine optimum pull rate, and perform certain RPC coil pulls through the standard support ring with the rotation turned off. Specifics on this action plan had not been finalized at the end of this inspection. Also, at the end of this inspection, all EC examinations on the cold legs of all three S/G(s) had been completed. The 8X1 probe examinations on the hot legs of the three S/G(s) was still in progress. Potential pluggable tubes identified as of January 16, 1992 were as follows:

<u>S/G</u>	<u>Tubes</u>
"A"	340
"B"	228
"C"	280

Within the areas inspected violations or deviations were not identified.

3. Steam Generator Replacement

The inspector met with the project manager for the steam generator replacement project to obtain a broad overview of procurement, fabrication, organization and preliminary installation schedules.

Within these areas, the inspector ascertained that the steam generators were being fabricated by W at the Pensacola Florida plant with material from Japan (plates, forgings) and Sweden (tubing). Inspections have been conducted by the licensee to the vendor plants and to the W plant in Pensacola; at the time of this discussion, the licensee was not aware of inspections having been performed by the NRC's vendor branch. The licensee representative provided the current organization chart for this project, which was reviewed to ascertain the extent of involvement by design engineering, materials management and health physics organizations. The inspector observed a video tape of the licensee's plans for removal of the present S/G(s) and installation of the new ones. A visit to the licensee's corporate offices will be scheduled to review in detail material procurement and installation specifications. At the time of these discussions, bids had been forwarded to and received from installation contractors. Although no decision had been made, one was expected sometime soon.

Within the areas inspected violations or deviations were not identified.

4. Exit Interview

The inspection scope and results were summarized on January 16, 1992, with those persons indicated in paragraph 1. The inspectors described the areas inspected and discussed in detail the inspection results. Although reviewed during this inspection, proprietary information is not contained in this report. Dissenting comments were not received from the licensee.