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NUCLEAR REGULATORY COMMISSION
REGION II
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ATLANTA, GEORGIA 30303-8931

August 3, 2001

Virginia Electric and Power Company
ATTN.: Mr. David A. Christian
Senior Vice President and
Chief Nuclear Officer
Innsbrook Technical Center - 2SW
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: NORTH ANNA POWER STATION - NRC SUPPLEMENTAL INSPECTION REPORT NOS. 50-338/01-07, 50-339/01-07

Dear Mr. Christian:

On July 7, 2001, the NRC completed a supplemental inspection at your North Anna Power Station. The enclosed report documents the inspection finding which was discussed on July 24, 2001, with Mr. L. Lane and other members of your staff.

This supplemental inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. This inspection examined the root cause analysis, extent of condition determination, and corrective actions associated with the Unit 2 White Reactor Coolant System Leakage Performance Indicator (PI) in the Barrier Integrity Cornerstone. A reactor coolant system valve packing leak resulted in the PI crossing the Green to White threshold value for the month of January 2001. The PI returned to the Green band in February 2001. The inspection was performed in accordance with inspection procedure 95001. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel.

Based on this inspection, we have concluded that your root cause evaluation was thorough and effectively identified the primary and contributing causes. The completed and proposed corrective actions, including actions to prevent recurrence, appropriately addressed the results of your root cause evaluation. Your implementation schedule was consistent with the overall safety significance of the problem.

No findings of significance were identified during the inspection.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available records (PARS) component of NRC's document system

(ADAMS). ADAMS is accessible from the NRC Web site at *http://www.nrc.gov/NRC/ADAMS/index.html* (the Public Electronic Reading Room).

Sincerely,

//RA//

Kerry D. Landis, Chief
Reactor Projects Branch 5
Division of Reactor Projects

Docket Nos. 50-338 and 50-339
License Nos. NPF-4 and NPF-7

Enclosure: NRC Supplemental Inspection
Report Nos. 50-338, 339/01-07

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U. S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.:	50-338 and 50-339
License Nos.:	NPF-4 and NPF-7
Report Nos.:	50-338/01-07 and 50-339/01-07
Licensee:	Virginia Electric and Power Company (VEPCO)
Facility:	North Anna Power Station, Units 1 and 2
Location:	1022 Haley Drive Mineral, VA 23117
Dates:	March 21 to July 7, 2001
Inspectors:	M. Morgan, Senior Resident Inspector J. Canady, Resident Inspector
Approved by:	K. Landis, Chief, Reactor Projects, Branch 5 Division of Reactor Projects

Enclosure

SUMMARY OF FINDINGS

IR 05000338-01-07, IR 05000339-01-07, on 03/21-07/07/2001, Virginia Electric and Power Company, North Anna Power Station, Units 1 & 2. Supplemental inspection for a Unit 2 White Reactor Coolant System Leakage Performance Indicator (PI) in the barrier integrity cornerstone. The leakage was from the C reactor coolant loop bypass valve packing. The PI data was reported to the NRC on April 18, 2001.

This inspection was conducted by the resident inspectors. No findings of significance were identified. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using IMC 0609, "Significance Determination Process" (SDP). The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described at its Reactor Oversight Process Website at *http://www.nrc.gov/NRR/OVERSIGHT/index.html*. Findings for which the SDP does not apply are indicated by "No Color" or by the severity level of the applicable violation.

A. Inspector Identified Findings

Cornerstone: Barrier Integrity

In accordance with the Action Matrix in NRC Manual Chapter 0305, "Operating Reactor Assessment Program," a supplemental inspection was performed to assess the licensee's identification, root cause and extent of condition evaluation, and corrective actions associated with a Unit 2 White Reactor Coolant System (RCS) Leakage Performance Indicator (PI). The PI crossed into the White band for January 2001 due to the partial failure of the reactor coolant system C loop bypass valve packing. After the valve packing was replaced and the unit restarted, the PI returned to the Green band for February 2001.

During this supplemental inspection, performed in accordance with inspection procedure 95001,"Inspection for One or Two White Inputs In a Strategic Performance Area," the inspectors determined that the problem was self-revealing and that the licensee's root cause evaluation was thorough and effectively identified the primary and contributing causes. The licensee determined that the failure was due to a lack of preventive maintenance and equipment aging. Due to no periodic program to replace the valve packing, the packing exceeded its operational life and failed after 18 years in service.

The licensee's immediate actions after indicated RCS identified leakage exceeded the Technical Specifications limit were proper. A Notice of Unusual Event was declared and the unit was removed from service to replace the packing. The licensee's completed and proposed corrective actions, including actions to prevent recurrence, adequately addressed the results of the root cause evaluation. Completed actions include replacing the packing of the similar Unit 2 valves on RCS loops A and B and placing the RCS system into the Maintenance Rule a(1) status. Proposed actions include replacing the packing on the Unit 1 loop bypass valves in the next refueling outage and developing a periodic packing replacement program for other similar RCS valves (168 per unit).

B. Licensee Identified Violation

A violation of very low significance which was identified by the licensee has been reviewed by the inspectors. The licensee entered the violation in their corrective action program. The violation is listed in Section 03 of this report.

Report Details

01 Inspection Scope

This supplemental inspection was performed by the resident inspectors in accordance with Inspection Procedure (IP) 95001, "Inspection for One or Two White Inputs in a Strategic Performance Area," as specified by the Action Matrix in NRC Manual Chapter 0305, "Operating Reactor Assessment Program." On April 18, 2001, the licensee officially reported that the Unit 2 Reactor Coolant System (RCS) Performance Indicator (PI) was White for the month of January 2001 due to a leak from the RCS C loop bypass valve, 2-RC-MOV-2587, packing to the primary drain transfer tank. This PI is in the barrier integrity cornerstone of the reactor safety strategic performance area.

The inspectors assessed the adequacy of the licensee's root cause analysis, determined if appropriate corrective actions were specified and scheduled commensurate with risk, and determined if the proposed actions were sufficient to prevent recurrence. The inspection was completed by a review of documents, inspections of plant equipment, and discussions with licensee personnel. The root cause analysis and specified corrective actions were identified in Root Cause Evaluation (RCE) N-2001-0122. The inspectors evaluated if the PI for January met the guidance in Nuclear Energy Institute (NEI) 99-02, "Regulatory Assessment Performance Indicator Guideline." The inspectors reviewed Licensee Event Report (LER) 50-339/2001-001-00 associated with the event. Documents reviewed are listed in the Attachment to this report.

02 Evaluation of Inspection Requirements

02.01 Problem Identification

a. Determination of who (i.e., licensee, self-revealing, or NRC), identified the issue and under what conditions.

The event was self-revealing. On January 19, Unit 2 was operating at 99 percent power in an end of cycle coast-down. Due to a computer calculated identified leakage rate of 0.804 gallons per minute (gpm) and increasing, operations personnel entered Abnormal Procedure (AP) 2-AP-16, "Increasing Primary Plant Leakage," at 6:15 a.m. At a remote indicator panel inside containment, personnel identified elevated temperatures on the packing leak-off line for the RCS C loop bypass valve 2-RC-MOV-2587. At 11:00 a.m. the computer calculated leak rate exceeded the Technical Specification (TS) 3.4.6.2 identified leakage limit of 10 gpm. At 11:45 a.m., a unit shutdown was commenced as required by TSs and due to RCS leakage being greater than 10 gpm, a Notification of Unusual Event (NOUE) was declared as required by their emergency plan. At 5:47 p.m. the unit was taken off-line. At 9:45 p.m. with the unit in Mode 3 (hot standby), the RCS C loop bypass valve was opened to its backseat and valve packing replacement activities were subsequently performed. The NOUE was terminated at 11:23 p.m. The inspectors verified this information was correct through documentation reviews and discussions with operations personnel.

The licensee documented this event in their corrective action program as plant issue N–2001-0122, and in the category 1 root cause evaluation (RCE) report N-2001-0122 and LER 50-339/2001-001-00.

The guidance in NEI 99-02 indicates that the maximum RCS leakage value, calculated using the TS methodology, during a month be used to determined the color of the RCS leakage PI. When the computer calculated RCS leakage rate value had exceeded 9.00 gpm, the licensee noted that they had failed to perform a hand calculation of RCS leakage calculation as required by procedure. This licensee identified violation is discussed in Section 3.0.a. At the time of shutdown the RCS leakage calculation performed in accordance with the TS methodology was 10.0 gpm. The threshold for Green to White and White to Yellow are greater than 50% and greater than 100% of the allowed TS limit of 10.0 gpm, respectively. Thus, the licensee determined that the Unit 2 January RCS Leakage PI was White. The NRC agreed that White was the correct color for the RCS Leakage PI.

b. Determination of how long the issue existed, and prior opportunities for identification.

The licensee noted in the evaluation that the potential for RCS leakage from the loop C bypass was suspected along with numerous other RCS valves following previous Unit 2 leakage fluctuations in June 1999. However, this valve packing and its packing leak-off line had not presented any discernable leakage during the 2000-2001 Unit 2 operational cycle. The packing leak-off line directed the leakage to the primary drain transfer tank (PDTT).

The evaluation also noted that the issue of potential for RCS packing leakage existed on Unit 2 since it was identified in November 1991. At that time a packing failure occurred on the Residual Heat Removal (RHR) system inlet valve. The corrective actions for that event focused on resolving leakage from the RHR system motor operated valves subject to RCS pressure but did not expand to evaluate other valves susceptible to similar failures such as the loop bypass valves. The evaluation further stated that the licensee based its maintenance practice for packing replacement, prior to the failure of the RCS C loop bypass valve, on a purely corrective event-based methodology.

The inspectors also noted, in NRC Integrated Inspection Report Nos. 50-338, 339/00-05 and 50-338, 339/00-04, that the licensee had detected slight increases in Unit 2 RCS leakage and that the licensee had made numerous entries into the containment to determine the source of the increased leakage. The inspectors also noted that the Region II branch chief, the resident inspectors, and various key licensee management personnel discussed the issue of increased Unit 2 leakage in a conference call on January 16, 2001.

The inspectors reviewed documentation associated with the increases in RCS identified leakage and subsequent containment entries and was unable to identify any prior opportunities for specifically identifying the valve packing that failed,

c. Determination of the plant-specific risk consequences (as applicable) and compliance concerns associated with the issue.

The licensee determined during the root cause evaluation (RCE) that no significant safety consequences resulted from the RCS C loop bypass valve leakage event because the leakage was contained and drained to the PDTT inside the containment building. The RCE stated that although approximately 60 percent of the packing material under the lantern ring was washed away, the material above the ring prevented leakage to the containment atmosphere (N-2001-0137). The licensee concluded that there was not an uncontrolled release of radioactive material and the health and safety of the public was not at risk at any time during the event. The inspectors agreed with the licensee's conclusion that the health and safety of the public was not placed at risk.

The licensee entered the RCS into the a(1) status of the Maintenance Rule (MR) for unreliability. An evaluation of the valve packing failure was determined to be a maintenance preventable functional failure by the MR Working Group due to exceeding the reliability performance criteria. The inspectors reviewed the MR Working Group's minutes, the MR corrective action evaluation, and the MR scoping matrix to determine if the licensee complied with the requirements of 10 CFR 50.65. No violation of NRC requirements was identified for not replacing the RCS C loop bypass valve packing prior to the event.

02.02 Root Cause and Extent of Condition Evaluation

a. Evaluation of methods used to identify root causes and contributing causes.

The inspectors confirmed that the root cause analysis (RCE N-2001-0122) was performed in accordance with Virginia Power Administrative Procedure (VPAP)-1604, "Root Cause Evaluation (RCE) Program," Revision 3. The analysis included evaluations of contributing factors and causal factors. The procedure required interviews of key personnel, data collection, document reviews, and preservation of physical evidence associated with the event; i.e., collection of the remaining valve packing material. In addition, the system engineers and their managers reviewed specific details about the failure and subsequently suggested short-term and long-term corrective actions.

b. Level of detail of the root cause evaluation.

The licensee determined that the root cause of the leakage event was attributable to a lack of preventive maintenance for the RCS C loop bypass valve packing which had been in service for greater than 18 years. The maintenance interval for the valve packing had exceeded its operational life. The RCE indicated that the licensee based its maintenance practice, prior to the failure, on a purely corrective event-based methodology. The licensee further noted that no periodic maintenance program existed for replacement of the packing on the RCS C loop bypass valve as well as the RCS A and B loop bypass valves.

Equipment aging was noted as a contributing factor to the valve packing leakage. Causal factors focused on packing replacement and included a lack of specific vendor

guidance and a periodic program for valve packing replacement. These factors, as described in the RCE, resulted in an ineffective preventive maintenance program for ensuring that the valve packing boundary was capable of continuing to perform its intended function.

The inspectors determined, from a review of procedures, the vendor manual for the valve packing, and industry operating experience, that the level of detail described in RCE N-2001-0122 was commensurate with the significance of the problem.

c. Consideration of prior occurrences of the problem and knowledge of prior operating experience.

The licensee reviewed NRC Information Notices and industry operating experience to see if similar problems had been previously reported. In addition, previous North Anna operating experience was evaluated. While no similar packing failure event was observed within the prior two years, a similar event occurred on Unit 2 in November 1991 with a Residual Heat Removal (RHR) system inlet valve. The 1991 event corrective action items focused on resolving leakage problems from RHR system motor operated valves that were subject to RCS pressure. The 1991 corrective actions did not evaluate other valves which were susceptible to similar packing failures.

The inspectors reviewed a representative sampling of industry operating experience documentation provided by the RCE team leader that was referenced in the RCE. The inspectors confirmed from this review that a consideration of prior occurrences of the problem and knowledge of prior operating experience was included in the RCE.

d. Consideration of potential common cause and extent of condition of the problem.

The licensee considered the potential for common cause and conducted an extent of condition review associated with potential packing failures. The licensee determined that the causes of the event could affect other safety-related equipment; i.e., the Unit 2 RCS A and B loop bypass valves and the similar Unit 1 valves. The licensee did not find other additional problems. Long-term corrective actions addressing the causes of the event were included in the licensee's corrective action program (N-2001-0122). The inspectors agreed that the licensee's reviews properly addressed common cause failures and extent of condition.

02.03 Corrective Actions

a. Appropriateness of corrective actions.

The packing was replaced for the other two Unit 2 RCS loop bypass valves during the March - April 2001 refueling outage as recommended in the RCE. The inspectors observed portions of this work. Proposed actions include replacing the packing on the Unit 1 loop bypass valves in the next refueling outage and developing a periodic packing replacement program for other similar RCS valves (168 per unit). The licensee formed a multi-discipline team to evaluate the periodicity and method of packing maintenance.

Responsibility for the formulation of a Valve Preventive Maintenance Program was assigned to the Component Engineering and Maintenance Department.

The inspectors determined from a review of the licensee's corrective action program computer data base and discussions with licensee personnel that appropriate corrective actions were specified for each root/contributing cause.

b. Prioritization of corrective actions.

The inspectors reviewed the licensee's actions subsequent to the event and concluded that the corrective actions were appropriately prioritized. The inspectors also determined that the licensee had appropriately prioritized short term corrective actions to restore valve operability. Additionally, the inspectors determined that licensee-identified long-term corrective actions were either scheduled for completion or were complete at the time of the inspection.

c. Establishment of schedule for implementing and completing the corrective actions.

Packing on the three Unit 1 RCS loop bypass valves are scheduled to be replaced during the September - October 2001 Unit 1 refueling outage. Other RCS valves, similar to the design and function of the loop bypasses are currently being scheduled for planned and routine preventive maintenance (PM).

d. Establishment of quantitative or qualitative measures of success for determining the effectiveness of the corrective actions to prevent recurrence.

Licensee management has reviewed and concurred with the RCE and proposed corrective actions. Enhanced monitoring and work control processing of all RCS valving has been implemented. Appropriate changes to the PM program, testing, calibration, and related procedures are being completed as of the issue date of this report. The management oversight team completed an independent assessment of the root causes, commonalities, and corrective actions. Further, the licensee has scheduled an in-house licensee oversight group assessment of the event in order to thoroughly evaluate and follow-up on the adequacy of the packing failure root cause finding and subsequent corrective actions. Monitoring of the effectiveness of the corrective actions will be accomplished as part of having the RCS in the MR a(1) status. The inspectors determined that the licensee had or will adequately address the issues to prevent recurrence.

03 Other Actilvities

a. Licensee Identified Violation

The following finding of very low significance was identified by the licensee and is a violation of NRC requirements which meets the criteria of Section VI of the NRC Enforcement Policy, NUREG-1600 for being dispositioned as a Non-Cited Violation (NCV).

NCV Tracking Number	Requirement Licensee Failed to Meet
50-339/01007-01	Technical Specification 6.8.1.c requires procedures be implemented for surveillance and testing activities of safety-related equipment. Section 6.8 of Periodic Test procedure 2-PT-52.2A, "Reactor Coolant System Leak Rate (Computer Calculation)," Revision 21, requires a hand calculation when the Reactor Coolant System (RCS) identified leakage exceeds 9.00 gpm. On January 19, 2001, the licensee violated TS 6.8.1.c when the computer calculated RCS leak rate exceed the 2-PT-52.2A limit and no hand calculation was performed. This is in the licensee's corrective action program as Plant Issue N-2001-0122. (No Color)

If you deny this NCV, you should provide a response with the basis for your denial, within 30 days of the date of this inspection report, to the United States Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001; with copies to the Regional Administrator, Region II; the Director, Office of Enforcement; United States Nuclear Regulatory Commission, Washington, DC 20555-0001;and the NRC Resident Inspector at the North Anna Power Station.

b. (Closed) LER 50-339/2001001-00: Unit Shutdown Required Due To Identified Reactor Coolant Leakage Exceeding Limits. Based on this supplemental inspection this LER is closed.

04 Management Meetings

Exit Meeting Summary

The inspectors presented the inspection results to Mr. L. Lane, Superintendent of Operations, and other members of licensee management on July 24, 2001.

The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

Attachment

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee

J. Crossman, Manager, Licensing
J. Davis, Manager, Station Nuclear Safety and Licensing
C. Funderburk, Manager, Station Operations and Maintenance
D. Heacock, Site Vice President
E. Hendrixson, Superintendent, Station Engineering
P. Kemp, Director, Nuclear Oversight
L. Lane, Superintendent, Operations
R. Page, Plant Radiation Monitoring Engineer
W. Renz, Director, Security and Emergency Preparedness
H. Royal, Superintendent, Nuclear Training
R. Shears, Superintendent, Maintenance
A. Stafford, Superintendent, Radiological Protection

ITEMS OPENED AND CLOSED

Item Opened and Closed

50-339/01-07-01	NCV	Failure to adhere to Unit 2 Reactor Coolant System Leak Rate Determination Procedure (Section 03.a)

Item Closed

50-339/2001001-00	LER	Unit Shutdown Required Due To Identified Reactor Coolant Leakage Exceeding Limits (Section 03.b)

LIST OF DOCUMENTS REVIEWED

Plant Issue Resolutions N-2001-0122 and N-2001-0137
Root Cause Evaluation N-2001-0122
Licensee Event Report 50-339/2001-001-00
North Anna Power Station Root Cause Evaluation Manual
VPAP-1604, “Root Cause Evaluation Program”
VPAP-0815, “Maintenance Rule Program”
NEI 99-02, “Regulatory Assessment Performance Indicator Guideline”

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