UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
245 PEACHTREE CENTER AVENUE N.E., SUITE 1200
ATLANTA, GEORGIA 30303-1200

October 13, 2021

Mr. Daniel G. Stoddard
Senior Vice President and Chief Nuclear Officer
Virginia Electric and Power Company
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060

SUBJECT: NORTH ANNA POWER STATION – BIENNIAL PROBLEM IDENTIFICATION AND RESOLUTION INSPECTION REPORT 05000338/2021013 AND 05000339/2021013

Dear Mr. Stoddard:

On September 3, 2021, the U.S. Nuclear Regulatory Commission (NRC) completed a problem identification and resolution inspection at your North Anna Power Station and discussed the results of this inspection with Mr. Fred Mladen and other members of your staff. The results of this inspection are documented in the enclosed report.

The NRC inspection team reviewed the station's corrective action program and the station's implementation of the program to evaluate its effectiveness in identifying, prioritizing, evaluating, and correcting problems, and to confirm that the station was complying with NRC regulations and licensee standards for corrective action programs. Based on the samples reviewed, the team determined that your staff's performance in each of these areas adequately supported nuclear safety.

The team also evaluated the station's processes for use of industry and NRC operating experience information and the effectiveness of the station's audits and self-assessments. Based on the samples reviewed, the team determined that your staff's performance in each of these areas adequately supported nuclear safety.

Finally, the team reviewed the station's programs to establish and maintain a safety-conscious work environment and interviewed station personnel to evaluate the effectiveness of these programs. Based on the team's observations and the results of these interviews the team found no evidence of challenges to your organization's safety-conscious work environment. Your employees appeared willing to raise nuclear safety concerns through at least one of the several means available.

One finding of very low safety significance (Green) is documented in this report. This finding did not involve a violation of NRC requirements.

If you disagree with a cross-cutting aspect assignment or a finding not associated with a regulatory requirement in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region II; and the NRC Resident Inspector at North Anna Power Station.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at http://www.nrc.gov/reading-rm/adams.html and at the NRC Public Document Room in accordance with Title 10 of the *Code of Federal Regulations* 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Stewart N. Bailey, Chief
Reactor Projects Branch 4
Division of Reactor Projects

Docket Nos. 05000338 and 05000339
License Nos. NPF-4 and NPF-7

Enclosure:
As stated

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NAME	M. Schwieg	D. Mas	J. Seat	L. McKown	S. Bailey
DATE	10/12/2021	10/13/2021	10/13/2021	10/13/2021	10/13/2021

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U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Numbers:	05000338 and 05000339
License Numbers:	NPF-4 and NPF-7
Report Numbers:	05000338/2021013 and 05000339/2021013
Enterprise Identifier:	I-2021-013-0003
Licensee:	Virginia Electric and Power Company
Facility:	North Anna Power Station
Location:	Mineral, VA
Inspection Dates:	August 16, 2021 to September 03, 2021
Inspectors:	D. Mas-Penaranda, Resident Inspector L. McKown, Senior Resident Inspector M. Schwieg, Senior Reactor Inspector J. Seat, Senior Project Engineer
Approved By:	Stewart N. Bailey, Chief Reactor Projects Branch 4 Division of Reactor Projects

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting a biennial problem identification and resolution inspection at North Anna Power Station, in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to https://www.nrc.gov/reactors/operating/oversight.html for more information.

List of Findings and Violations

Condition Monitoring Inspection Failure of Unit 1 Main Condenser			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Initiating Events	Green FIN 05000338/2021013-01 Open/Closed	[H.14] - Conservative Bias	71152B
A self-revealed Green finding was identified when the licensee failed to provide sufficient instruction and support in accordance with the self-imposed standard established in 0-NSP-CN-001, Inspection of the Main Condenser, Rev. 0. Specifically, an inadequate inspection resulted in the failure to identify adverse conditions associated with cyclic fatigue at the 1-SD-TK-2A, high level divert line and branch connection end cap within the North Anna Power Station Unit 1 main steam surface condenser which in turn resulted in component failure, loss of condenser vacuum, and a reactor trip on May 7, 2021.			

Additional Tracking Items

Type	Issue Number	Title	Report Section	Status
LER	05000338/2021-001-00	LER 2021-001-00 for North Anna Power Station, Unit 1, Manual Reactor Trip on Degrading Condenser Vacuum Due to Piping Failure	71153	Closed

INSPECTION SCOPES

Inspections were conducted using the appropriate portions of the inspection procedures (IPs) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html. Samples were declared complete when the IP requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program - Operations Phase." The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel to assess licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards. Starting on March 20, 2020, in response to the National Emergency declared by the President of the United States on the public health risks of the coronavirus (COVID-19), inspectors were directed to begin telework. In addition, regional baseline inspections were evaluated to determine if all or a portion of the objectives and requirements stated in the IP could be performed remotely. If the inspections could be performed remotely, they were conducted per the applicable IP. In some cases, portions of an IP were completed remotely and on site. The inspections documented below met the objectives and requirements for completion of the IP.

OTHER ACTIVITIES – BASELINE

71152B - Problem Identification and Resolution

Biennial Team Inspection (IP Section 02.04) (1 Sample)

(1) The inspectors performed a biennial assessment of the licensee's corrective action program (CAP), use of operating experience, self-assessments and audits, and safety conscious work environment.

- Corrective Action Program Effectiveness: The inspectors assessed the corrective action program's effectiveness in identifying, prioritizing, evaluating, and correcting problems. The inspectors also conducted an in-depth CAP review of the high head safety injection system, auxiliary feedwater system and emergency diesel generators.

- Operating Experience, Self-Assessments and Audits: The inspectors assessed the effectiveness of the station's processes for use of operating experience, audits and self-assessments.

- Safety Conscious Work Environment: The inspectors assessed the effectiveness of the station's programs to establish and maintain a safety-conscious work environment.

71153 - Follow Up of Events and Notices of Enforcement Discretion

Event Follow Up (IP Section 03.01) (1 Sample)

(1) LER 05000338/2021-001-00, North Anna Power Station, Unit 1, Manual Reactor Trip on Degrading Condenser Vacuum Due to Piping Failure (ADAMS Accession No. ML 21195A186). The inspection conclusions associated with this LER are documented in this report under Inspection Results Section.

INSPECTION RESULTS

Assessment	71152B

1. Corrective Action Program Effectiveness

Problem Identification: The team determined that the licensee was effective in identifying problems and entering them into the corrective action program and that there was a low threshold for entering issues into the corrective action program. This conclusion was based on a review of the requirements for initiating condition reports as described in licensee procedure PI-AA-200, "Corrective Action," and management's expectation that employees were encouraged to initiate condition reports. Additionally, site management was actively involved in the corrective action program and focused appropriate attention on significant plant issues.

Problem Prioritization and Evaluation: Based on the review of condition reports, the team concluded that problems were prioritized and evaluated in accordance with the condition report significance determination guidance in procedure PI-AA-200. The team determined that adequate consideration was given to system or component operability and associated plant risk. The team determined that plant personnel had conducted cause evaluations in compliance with the licensee's corrective action program procedures and that cause determinations were appropriate, and considered the significance of the issues being evaluated.

Corrective Actions: Based on a review of corrective action documents, interviews with licensee staff, and verification of completed corrective actions, the team determined that corrective actions were mostly timely, commensurate with the safety significance of the issues, and effective, in that conditions adverse to quality were corrected. For significant conditions adverse to quality, the corrective actions directly addressed the cause and effectively prevented recurrence. The team reviewed condition reports and effectiveness reviews to verify that the significant conditions adverse to quality had not recurred. Effectiveness reviews for corrective actions to prevent recurrence were sufficient to ensure corrective actions were properly implemented and were effective.

Based on the samples reviewed, the team determined that the licensee's corrective action program complied with regulatory requirements and self-imposed standards. The licensee's implementation of the corrective action program adequately supported nuclear safety.

2. Operating Experience

The team determined that the station's processes for the use of industry and NRC operating experience information and for the performance of audits and self-assessments were effective and complied with all regulatory requirements and licensee standards. The implementation of these programs adequately supported nuclear safety. The team concluded that operating experience was adequately evaluated for applicability and that appropriate actions were implemented to address lessons learned as needed.

3. Self-Assessments and Audits

The team determined that the licensee effectively performs self-assessments and audits to identify issues at a low level, properly evaluated those issues, and resolved them

commensurate with their safety significance.

Self-assessments were generally detailed and critical. The team verified that condition reports (CRs) were created to document areas for improvement and findings resulting from self-assessments and verified that actions had been completed consistent with those recommendations. Audits of the quality assurance program appropriately assessed performance and identified areas for improvement. Generally, the licensee performed evaluations that were technically accurate.

4. Safety Conscious Work Environment

Based on interviews with plant staff and reviews of the latest safety culture survey results to assess the safety conscious work environment on site, the team found no evidence of challenges to the safety conscious work environment. Employees appeared willing to raise nuclear safety concerns through at least one of the several means available.

Condition Monitoring Inspection Failure of Unit 1 Main Condenser			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Initiating Events	Green FIN 05000338/2021013-01 Open/Closed	[H.14] - Conservative Bias	71152B

A self-revealed Green finding was identified when the licensee failed to provide sufficient instruction and support in accordance with the self-imposed standard established in 0-NSP-CN-001, Inspection of the Main Condenser, Rev. 0. Specifically, an inadequate inspection resulted in the failure to identify adverse conditions associated with cyclic fatigue at the 1-SD-TK-2A, high level divert line and branch connection end cap within the North Anna Power Station Unit 1 main steam surface condenser which in turn resulted in component failure, loss of condenser vacuum, and a reactor trip on May 7, 2021.

Description: On May 7, 2021, with down power in progress following identification of exceedance of Chemistry Specification CH-99.600, secondary chemistry action level 3, operators manually tripped North Anna Power Station Unit 1 from 60 percent rated thermal power due to degrading condenser vacuum. Dominion Energy determined that high cycle fatigue piping failure of the 'A' high pressure heater drain receiver high level divert line caused damage to condenser tubes, resulting in the rapid degradation of secondary chemistry and vacuum.

The licensee performed material analysis of the piping failure location within the Unit 1 main condenser. The opened crack fracture surfaces displayed mixed morphologies. In most areas, particularly at the branch connection welds, the surfaces were either worn, eroded, corroded, or a combination of all three. This indicates that the cracking in these areas was not a single recent event but had initiated years ago along the outside of the weld. The licensee also observed breach marks on portions of the fractures. This further supports that the cracking was associated with fatigue failure that developed over time from variable loading conditions. Moreover, the material analysis found that the weld quality was poor at multiple locations. The welds appeared to be undersized and showed a lack of weld penetration. This resulted in LER 05000338/2021-001-00, North Anna Power Station, Unit 1, Manual Reactor Trip on Degrading Condenser Vacuum Due to Piping Failure (ADAMS Accession No. ML 21195A186).

North Anna Power Station performs condition monitoring of the main condensers via complete visual inspection in accordance with 0-NSP-CN-001, Inspection of the Main Condenser. This activity is performed every 36 months by engineering staff qualified to perform condition monitoring in accordance with the station aging management program. The licensee found that previous inspection of the failure location had been satisfied by performing an “eyes only” visual inspection from a walking surface, feet above, the area. Prior to the event, this methodology was determined adequate for identifying gross degradation. However, the lack of detailed inspection allowed fatigue cracking to propagate over multiple operating cycles until the piping failed and damaged condenser tubes.

Corrective Actions: The station has established corrective actions to improve the procedural guidance within 0-NSP-CN-001, providing greater detail on inspection methodology, enhancing component access via scaffolding, and incorporating technology and industry best practices.

Corrective Action References: CA8477763

Performance Assessment:

Performance Deficiency: The inspectors found that Dominion Energy's failure to provide sufficient instruction and support in accordance with the self-imposed standard established in 0-NSP-CN-001, resulting in unidentified fatigue damage and a reactor trip, was a performance deficiency reasonably within the licensee's ability to foresee and prevent.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Procedure Quality attribute of the Initiating Events cornerstone and adversely affected the cornerstone objective to limit the likelihood of events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, procedure 0-NSP-CN-001 lacked adequate steps to perform visual inspection of the Unit 1 main steam surface condenser. This resulted in the failure to identify adverse conditions, which based upon the licensee's material evaluation, persisted for multiple cycles of inspection, leading to equipment failure and a reactor trip. The inspectors used IMC 0612, Appendix E, “Examples of Minor Issues,” dated January 1, 2021, to inform answers to the more than minor screening questions and found this condition consistent with more than minor example 4.b.

Significance: The inspectors assessed the significance of the finding using Appendix A, “The Significance Determination Process (SDP) for Findings At-Power.” In accordance with Exhibit 1, Initiating Events Screening Questions, B. Transient Initiators, this event screens to Green as following the trip operators stabilized condenser vacuum to maintain functionality through unit recovery.

Cross-Cutting Aspect: H.14 - Conservative Bias: Individuals use decision making-practices that emphasize prudent choices over those that are simply allowable. A proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop. The licensee did not take a conservative approach to decision making associated with inspection of the Unit 1 main steam surface condenser, particularly when performing “eyes only” visual inspection of cyclically stressed components from feet away.

Enforcement: Inspectors did not identify a violation of regulatory requirements associated with this finding.

EXIT MEETINGS AND DEBRIEFS

The inspectors verified no proprietary information was retained or documented in this report.

- On September 3, 2021, the inspectors presented the biennial problem identification and resolution inspection results to Mr. Fred Mladen and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71152B	ALARA Plans	21-003	NUHOMs EOS Cask Loading Campaign	0
		21-003	NUHOMs EOS Cask Loading Campaign	1
		21-003-001	Work In Progress ALARA Review	0
	Corrective Action Documents	1141471 1124204 1126153 1127484 1128095 1128297 1129617 1132180 1134248 1138540 1136938 1141532 1142054 1149745 1150309 1150509 1151692 1151719 1154837 1158144 1158244 1161082 1161318 1161363 1164662 1165578 1165793 1168559 1168720	Condition Reports	

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		1169129 1170953 1174843		
		529636, 533999, 545489, 575536, 1011453, 1041183, 1041253, 1041402, 1041404, 1045981, 1054538, 1055192, 1060920, 1065357, 1065648, 1086171, 1086583, 1087121, 1087123, 1093954, 1108169, 1109238, 1110259, 1120669, 1120670, 1129404, 1141757, 1141866, 1153283, 1164943, 1174426, 1174644, 1177293,	Condition Reports associated with Chemical and Volume Control System Work Request Tags	

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		1177300		
		8236171 7876917	Corrective Actions	
		CA7932524		
		CA8477763		
		CR1138179		
		CR1165443 CR1137734 CR1135934 CR1132150 CR1129761		
		CR1178405		
		LEE CA 7784888	U1 Terry Turbine MS Drain Line repairs	
	Corrective Action Documents Resulting from Inspection	CR1103946, CR1178860, CR1178894, CR1178935, CR1179833, CR1179930, PA8567395		
	Engineering Evaluations	LEE CR1144530	Pressure Boundary Leak on Unit 2 "A" RCP Seal Injection Line	0
		LEE CR458189	Diesel Driven Fire Pump failure	0
		PIR1140204	OE#465752 Surry Fire Main Rupture	0
		PIR1141381	OE469857R20200213 Unattended Locked High Radiation Area	0
		PIR1146037	OE454908R20200430 Heater Drain Pump Motor Fire and Declaration of Unusual Event	0
		PIR1149770	OE475066R20200612 Unposted Locked High Radiation Area Created in Drywell Subpile Room	0
		PIR1150164	OE458344R20200619 Postulated Hot Short from DC Control Circuits Through Safe Shutdown Fire Protect	0
		PIR1166359	PART 21 - Limitorque Actuator Fatigue	0
	Miscellaneous		Emergency Diesel Generator System Monitoring Plan Requirements	

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
			Emergency Diesel Generator System Health Report, 2020 4th Quarter	06/15/2021
		LER 50-338/2021-001-00 (ML21195A186)	Manual Reactor Trip on Degrading Condenser Vacuum Due to Piping Failure	
		VTM 59-C550-00001	Cummins NT-280-IF water cooled engines	4
	Operability Evaluations		Analysis of 01-EE-EG-1J, Emergency Diesel Generator No. 1 Cylinder Piston Pin Bushing Degradation and Past Operability	03/13/2020
		CA8524213		
		CR1129761	SW MOVs HBC-0 Qualified Stroke Count Exceeded	0
		CR1132150	The licensing basis and design basis for the “Equipment hatch platform” are not aligned.	0
		CR1137734	MOV weak link not accurately modeling QSS stem cuts	0
		CR1165443	X-QS-MOV-X01 A/B Control Logic Results in Potential Negative Design Margin	0
	Procedures	0-MCM-1801-01	WELDING SAFETY-RELATED AND SEISMIC-RELATED EQUIPMENT	30
		0-MPM-01 07-01	DIESEL FIRE PUMP PREVENTIVE MAINTENANCE	20
		0-NSP-CN-001	Inspection of the Main Condenser	0
		1-PT-83.12H/J, 1H/J	Diesel Generator Test (Start by ESF Actuation) Followed by 24-Hour Run and Hot Restart Test	Rev. 33/34
		2-PT-83.12H/J, 2H/J	Diesel Generator Test (Start by ESF Actuation) Followed by 24-Hour Run and Hot Restart Test,	Rev. 35/36
		ER-AA-101	System Engineering Walkdowns	5
		MS-AA-WHS-133	In-Storage Maintenance of Items	6
		PI-AA-100-1007	Operating Experience Program	7
		RP-AA-300	ALARA Reviews and Reports	10
	Work Orders	59203355106		
		59102676139 59203137149 59203267789 59103099207 59203324709		

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		59203282506 59203294676 59203323891		
		59203301735 59203293580 59203302577 59203302579 59203302580		
		WO 59203356197		