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

May 13, 2022

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

SUBJECT: NORTH ANNA POWER STATION – INTEGRATED INSPECTION REPORT 05000338/2022001 AND 05000339/2022001 AND 07200056/2022001

Dear Mr. Stoddard:

On March 31, 2022, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at North Anna Power Station. On April 25, 2022, the NRC inspectors discussed the results of this inspection with Ms. Lisa Hilbert, Site Vice President and other members of your staff. The results of this inspection are documented in the enclosed report.

Two findings of very low safety significance (Green) are documented in this report. Both findings involved violations of NRC requirements. We are treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2 of the Enforcement Policy.

A licensee-identified violation which was determined to be of very low safety significance is documented in this report. We are treating this violation as a non-cited violation (NCV) consistent with Section 2.3.2 of the Enforcement Policy.

If you contest the violations or the significance or severity of the violations documented in this inspection report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region II; the Director, Office of Enforcement; 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,

Signed by Endress, Matthew
on 05/13/22

Matthew F. Endress, Chief
Reactor Projects Branch 4
Division of Reactor Projects

Docket Nos. 05000338 and 05000339 and 07200056
License Nos. NPF-4 and NPF-7

Enclosure:
As stated

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SUBJECT: NORTH ANNA POWER STATION – INTEGRATED INSPECTION REPORT 05000338/2022001 AND 05000339/2022001 AND 07200056/2022001 DATED MAY 13, 2022

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NAME	A. Rosebrook,	J. England	K.Carrington	J.Seat	M. Endress
DATE	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/13/2022

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U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Numbers:	05000338 and 05000339 and 07200056
License Numbers:	NPF-4 and NPF-7
Report Numbers:	05000338/2022001; 05000339/2022001; and 07200056/2022001
Enterprise Identifier:	I-2022-001-0034 and I-2021-001-0155
Licensee:	Virginia Power & Electric Company
Facility:	North Anna Power Station
Location:	Mineral, VA
Inspection Dates:	January 1, 2022 to March 31, 2022
Inspectors:	K. Carrington, Senior Resident Inspector J. England, Senior Resident Inspector (Acting) L. Jones, Senior Reactor Inspector D. Lanyi, Senior Operations Engineer A. Rosebrook, Senior Reactor Analyst M. Schwieg, Senior Reactor Inspector J. Seat, Senior Project Engineer B. Towne, Resident Inspector J. Viera, Senior Operations Engineer A. Wilson, Senior Project Engineer
Approved By:	Matthew F. Endress, 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 an integrated 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. A licensee-identified non-cited violation is documented in report section: 71111.11B.

List of Findings and Violations

Failure to Translate the Licensing Basis into Instructions for Fuel Handling Activities			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Barrier Integrity	Green NCV 05000338,05000339/2022001-01 Open/Closed	None (NPP)	60855
The inspectors identified a Green, non-cited violation (NCV) of Title 10, Code of Federal Regulations Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to assure that the design basis was correctly translated into procedures and instructions. Specifically, the inspectors identified that the licensee failed to translate the maximum cask lift elevation and the locking of the trunnion axis into site procedures.			

Inadequate Cable Separation for Vital AC Bus Control Power and Monitoring Circuits			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000339/2022001-02 Open/Closed	None (NPP)	71153
The NRC identified a Green, non-cited violation of 10 CFR Part 50, Appendix R, due to inadequate cable separation of safety-related control power cables routed through common fire areas. The design change process review for NA-13-00016, "Station Service Bus to Emergency Bus Crosstie Installation," failed to identify the violation of Appendix R requirements and a modification was installed on Unit 2 in 2013. The design review was a reasonable opportunity to identify the condition also existed on Unit 1.			

Additional Tracking Items

None.

PLANT STATUS

Unit 1 operated at or near 100 percent rated thermal power for the entire inspection period.

Unit 2 began the inspection period operating at 100 percent rated thermal power until entering its end of cycle coast down on February 27, 2022. On March 5, Unit 2 was shut down for refuel outage 2R28 and remained shut down for the rest of the inspection period.

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 performed activities described in IMC 2515, Appendix D, "Plant Status," observed risk significant activities, and completed on-site portions of IPs. 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.

REACTOR SAFETY

71111.01 - Adverse Weather Protection

Seasonal Extreme Weather Sample (IP Section 03.01) (1 Sample)

(1) The inspectors evaluated readiness for seasonal extreme weather conditions prior to the onset of cold temperatures for the station blackout diesel generator and service water systems, on January 3, 2022.

Impending Severe Weather Sample (IP Section 03.02) (1 Sample)

(1) The inspectors evaluated the adequacy of the overall preparations to protect risk-significant systems from impending severe weather [snow and low temperatures], from January 13 to 14, 2022.

71111.04 - Equipment Alignment

Partial Walkdown Sample (IP Section 03.01) (5 Samples)

The inspectors evaluated system configurations during partial walkdowns of the following systems/trains:

(1) Unit 2 'H' emergency diesel generator (EDG) system during 2J EDG system maintenance, on January 14, 2022;
(2) Unit 1 service water system, following Unit 2 service water pump run and the No. 4 auxiliary service water pump maintenance, the week of February 7, 2022;
(3) Unit 1 and Unit 2 vital 125-volt direct current (VDC) buses, in response to Surry condition report (CR)1190494**,** the week of February 14, 2022;

(4) Unit 1 and Unit 2 shared fuel pit cleaning and refueling and purification system during Unit 2 core offload, on March 16, 2022; and
(5) Unit 2 'J' EDG system during 2H 4160-volt emergency bus maintenance and prior to 2H EDG post-maintenance run, on March 17, 2022.

Complete Walkdown Sample (IP Section 03.02) (1 Sample)

(1) The inspectors evaluated system configurations during a complete walkdown of the Unit 2 low head safety injection system, from March 28 to March 31, 2022.

71111.05 - Fire Protection

Fire Area Walkdown and Inspection Sample (IP Section 03.01) (7 Samples)

The inspectors evaluated the implementation of the fire protection program by conducting a walkdown and performing a review to verify program compliance, equipment functionality, material condition, and operational readiness of the following fire areas:

(1) Fire Area 3-1, Unit 1 cable vault and tunnel and 280' rod drive room, on January 12, 2022;
(2) Fire Area 8, Unit 1 and Unit 2 turbine building, on January 21, 2022;
(3) Fire Area Z18, Unit 1 and Unit 2 fuel building, on January 27, 2022;
(4) Fire Area 5-2, Unit 2 normal switchgear room, on March 16, 2022;
(5) Fire Area 4-2, Unit 2 cable tray spreading room, on March 16, 2022;
(6) Fire Area 12, service water pump house, on March 16, 2022; and
(7) Fire Area 48, service water valve house, on March 16, 2022.

71111.08P - Inservice Inspection Activities (PWR)

PWR Inservice Inspection Activities Sample (IP Section 03.01) (1 Sample)

(1) The inspectors evaluated the following pressurized water reactor non-destructive examinations from March 13 to March 17, 2022:

Visual Inspections:

- Pressurizer auxiliary spray piping restraint 2-CH-R-1

Ultrasonic Examination

- Thermal sleeve tack welds SLV 12-422
- Thermal sleeve tack welds SLV 14-410
- Thermal sleeve tack welds SLV 06-417
- Thermal sleeve tack welds SLV 06-419

Liquid Penetrant Examination

- Reactor coolant safe end to elbow 6-RC-437.

The inspectors evaluated the licensee’s boric acid control program performance.

71111.11B - Licensed Operator Requalification Program and Licensed Operator Performance

Licensed Operator Requalification Program (IP Section 03.04) (1 Sample)

(1) Biennial Requalification Written Examinations

Inspectors evaluated the quality of licensed operator biennial requalification written examinations administered on February 4 and February 25, 2021.

Annual Requalification Operating Tests

Inspectors evaluated the quality of annual licensed operator requalification operating examinations administered the weeks of January 10 and January 24, 2022.

Inspectors performed an as-run evaluation of the facility licensee's annual requalification operating test the week of January 24, 2022.

Administration of an Annual Requalification Operating Test

Inspectors evaluated the effectiveness of the facility licensee in administering and evaluating facility staff during annual requalification operating tests required by 10 CFR 55.59(a)(2).

Requalification Examination Security

Inspectors evaluated the effectiveness of the facility licensee's requalification examination security measures.

Remedial Training and Re-examinations

Inspectors evaluated the effectiveness of remedial training conducted by the licensee and reviewed the adequacy of re-examinations for licensed operators who did not pass their required requalification examination.

Operator License Conditions

Inspectors evaluated individual licensed operator records to verify appropriate and effective processes for ensuring conformance with operator license conditions.

Control Room Simulator

Inspectors evaluated the adequacy of the facility licensee's control room simulator in modeling the actual plant and for meeting the requirements contained in 10 CFR 55.46.

Problem Identification and Resolution

Inspectors evaluated the licensee's ability to identify and resolve problems associated with both licensed operator and simulator performance.

71111.11Q - Licensed Operator Requalification Program and Licensed Operator Performance

Licensed Operator Performance in the Actual Plant/Main Control Room (IP Section 03.01) (1 Sample)

(1) The inspectors observed and evaluated licensed operator performance in the main control room during Unit 2 shutdown for Refuel Outage (RFO) 2R28, on March 5, 2022.

Licensed Operator Requalification Training/Examinations (IP Section 03.02) (1 Sample)

(1) The inspectors observed and evaluated operator requalification scenario SXG-29, on March 1, 2022, and just-in-time training for RFO 2R28, on March 2, 2022.

71111.12 - Maintenance Effectiveness

Quality Control (IP Section 03.02) (1 Sample)

The inspectors evaluated the effectiveness of maintenance and quality control activities to ensure the following SSC remains capable of performing its intended function:

(1) Unit 2 reactor coolant pump seals associated with work order (WO) 5920332554; and Unit 2 safety injection motor-operated valve 2869B associated with purchase order 4500629735.

71111.13 - Maintenance Risk Assessments and Emergent Work Control

Risk Assessment and Management Sample (IP Section 03.01) (5 Samples)

The inspectors evaluated the accuracy and completeness of risk assessments for the following planned and emergent work activities to ensure configuration changes and appropriate work controls were addressed:

(1) 500 KV switchyard transformer 6 bushing fire, on January 3, 2022;
(2) Unit 2 charging pump planned maintenance, on February 17, 2022;
(3) Unit 2 reactor cavity drain down and decreased inventory, the week of March 9, 2022;
(4) Shared 1A fuel pit cooling system pump gearbox oil bubbler found empty with core offloaded, on March 23, 2022; and
(5) Tornado watch and Unit 2 refueling cavity drain down activities, on March 31, 2022.

71111.15 - Operability Determinations and Functionality Assessments

Operability Determination or Functionality Assessment (IP Section 03.01) (5 Samples)

The inspectors evaluated the licensee's justifications and actions associated with the following operability determinations and functionality assessments:

(1) CR1188767, Conflicting Status Indications of Train A Reactor Trip Bypass Breaker, on January 11, 2022;

(2) CR1190093, 1-BY-BC-1-1 [Battery Charger] Ground Worsening, on February 11, 2022;
(3) CR1190294, 10M Windspeed and Backup Tower Windspeed [Sensors] Not Responding, on February 14, 2022;
(4) CR1193750, 2-RS-129 (2-RS-MOV-256B Inlet Vent Valve) requires Repair, on March 22, 2022; and
(5) CR1194625, During 2-PT-36.13J Auxiliary Relay 27XC-2J1 Did Not Pick Up, on March 24, 2022.

71111.18 - Plant Modifications

Temporary Modifications and/or Permanent Modifications (IP Section 03.01 and/or 03.02) (1 Sample)

The inspectors evaluated the following temporary or permanent modifications:

(1) Design Change NA-18-00096, Valve Removal from 1H EDG Crankcase Pressure Sensing Line.

71111.19 - Post-Maintenance Testing

Post-Maintenance Test Sample (IP Section 03.01) (4 Samples)

The inspectors evaluated the following post-maintenance testing activities to verify system operability and/or functionality:

(1) 2-PT-82.2B, 2J emergency diesel generator test following planned maintenance, on January 15, 2022;
(2) 2-SI-MOV-2890B valve operator as-left test following planned maintenance, on March 21, 2022;
(3) Post-maintenance testing following 2H1-2N-K1 motor control center bucket replacement, on March 23, 2022; and
(4) 2-IV station battery performance discharge test following replacement, on March 25, 2022.

71111.20 - Refueling and Other Outage Activities

Refueling/Other Outage Sample (IP Section 03.01) (1 Partial)

(1) (Partial)
The inspectors evaluated Unit 2 refueling outage (RFO) 2R28 activities from March 5 toMarch 31, 2022.

71111.22 - Surveillance Testing

The inspectors evaluated the following surveillance testing activities to verify system operability and/or functionality:

Surveillance Tests (other) (IP Section 03.01) (5 Samples)

(1) 2-PT-17.1, Control Rod Operability, on February 22, 2022;

(2) 2-PT-83.1, Simulated Loss of Offsite Power (LOOP) and ESF Actuation - H Bus, on March 6, 2022;
(3) 2-PT-57.4, Safety Injection Operational Test, on March 7, 2022;
(4) 2-PT-96.1, Refueling Systems Operability and Checkout, on March 10, 2022; and
(5) 2-PT-88.3J, Station Battery 2-III Modified Performance Test, on March 23, 2022.

Inservice Testing (IP Section 03.01) (1 Sample)

(1) 1-PT-71.1, 1-FW-P-2, Turbine Driven Auxiliary Feedwater Pump, IST Comprehensive Pump Test and Valve Testing, on February 22, 2022.

Containment Isolation Valve Testing (IP Section 03.01) (1 Sample)

(1) 2-PT-61.3, Containment Type C Test [Penetration 106 - Safety Injection Accumulator Test line to RWST Isolation Valve], on March 15, 2022.

OTHER ACTIVITIES – BASELINE

71151 - Performance Indicator Verification

The inspectors verified licensee performance indicators submittals listed below:

IE01: Unplanned Scrams per 7000 Critical Hours Sample (IP Section 02.01) (2 Samples)

(1) Unit 1 (January 1, 2021 through December 31, 2021)
(2) Unit 2 (January 1, 2021 through December 31, 2021)

IE03: Unplanned Power Changes per 7000 Critical Hours Sample (IP Section 02.02) (2 Samples)

(1) Unit 1 (January 1, 2021 through December 31, 2021)
(2) Unit 2 (January 1, 2021 through December 31, 2021)

IE04: Unplanned Scrams with Complications (USwC) Sample (IP Section 02.03) (2 Samples)

(1) Unit 1 (January 1, 2021 through December 31, 2021)
(2) Unit 2 (January 1, 2021 through December 31, 2021)

BI01: Reactor Coolant System (RCS) Specific Activity Sample (IP Section 02.10) (2 Samples)

(1) Unit 1 (January 1, 2021 through December 31, 2021)
(2) Unit 2 (January 1, 2021 through December 31, 2021)

BI02: RCS Leak Rate Sample (IP Section 02.11) (2 Samples)

(1) Unit 1 (January 1, 2021 through December 31, 2021)
(2) Unit 2 (January 1, 2021 through December 31, 2021)

OTHER ACTIVITIES – TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL

60855 - Operation Of An ISFSI

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) 2690, "Inspection Program for Storage of Spent Reactor Fuel and Reactor-Related Greater-than-Class C Waste at Independent Spent Fuel Storage Installations (ISFSI) and for 10 CFR Part 71 Transportation Packaging's."

Operation of An ISFSI (1 Sample)

(1) Operation of an Independent Spent Fuel Storage Installation

From August 9, 2021 through March 31, 2022, the inspectors performed a review of the licensee's ISFSI activities to verify compliance with regulatory requirements. During the on-site inspection, the inspectors observed and reviewed licensee activities in each of the five safety focus areas including occupational exposure, public exposure, fuel damage, confinement, and impact to plant operations.

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. Additionally, the inspectors performed independent walkdowns of the heavy load lifting equipment and the ISFSI haul path. The inspector also performed an independent radiation survey of the ISFSI pad.

INSPECTION RESULTS

Failure to Translate the Licensing Basis into Instructions for Fuel Handling Activities			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Barrier Integrity	Green NCV 05000338,05000339/2022001-01 Open/Closed	None (NPP)	60855
The inspectors identified a Green, non-cited violation of Title 10, Code of Federal Regulations Part 50, Appendix B, Criterion III, "Design Control," for the licensee's failure to assure that the design basis was correctly translated into procedures and instructions. Specifically, the inspectors identified that the licensee failed to translate the maximum cask lift elevation and the locking of the trunnion axis into site procedures.			
Description: On October 12, 1976, the NRC received License Amendment No.58 which included an analysis titled "An Analysis and Safety Evaluation of Spent Fuel Shipping Cask Handling at North Anna Power Station Unit 1 and 2." This analysis documents the results of a spent fuel cask drop analysis conducted for North Anna Power Station Units 1 and 2 and describes the necessity to confirm that the spent fuel handling system would be adequate to handle shipments of spent fuel. The conclusion of the analysis was to install a separating wall to prevent an accidentally dropped spent fuel cask from coming into contact with the spent fuel. Section 9B.2, "Arrangement of Spent Fuel Cask Handling System" of the analysis states that			

“the maximum cask elevation is 1 ft. above floor El. 291'10" by virtue of the yoke used with the spent fuel cask. This restraint on the system will be identified as an administrative control in the technical specifications for the spent fuel handling.”

Additionally, License Amendment No. 58 included the “Fuel Pool Separating Wall Design” (dated September 1976) that provides the design of the separating wall between the spent fuel cask loading area and the spent fuel storage area of the fuel pool. This design included the specific cask types analyzed and provided the assumptions which supported the conclusion that a fuel cask handling accident was unable to cause damage to stored spent fuel.

Section 3.0, “Accidents Considered” in the “Fuel Pool Separating Wall Design” states that “since the spent fuel cask is suspended from a crane that can move only in a north-south direction, the only way a horizontal velocity could occur which would cause the cask to move in the direction of the fuel storage area would be due to either a failure in a cask trunnion, lifting yoke, crane cable feature, or east-west earthquake excitation while the cask is sitting on the floor or ledge.” Section 3.0.a “Failure or Disengagement of One Trunnion or One-Half of the Lifting Yoke” states that to prevent this accident from happening that the administrative controls of the cask handling procedures will ensure that “the cask will be rotated before it is brought into the fuel building so that the trunnion axis will be aligned and locked in a north-south direction and kept in that orientation during its entire time in the fuel building."

NUREG-0053, “Safety Evaluation Report related to the operation of North Anna Power Station, Unit 1 and 2, Supplement No. 8” (dated December 1977) states in Section 9.1.4 “Fuel Handling Systems” that based on the review of the information in Amendment No. 56 (typographic error of No.58) that the NRC “concluded that the fuel handling system and facilities design is in conformance with Regulatory Guide 1.13, “Fuel Storage Facility Design Basis” and is acceptable.

During the week of August 9, 2021, the inspectors observed activities and reviewed documentation associated with the Independent Spent Fuel Storage Installation (ISFSI) campaign. During cask movement the NRC inspectors observed that the cask was lifted to an elevation approximately 4ft above the spent fuel pool coping to clear the handrail that was installed along the edge of the pool. Additionally, the inspectors observed that the cask trunnions, although initially orientated in the north-south direction, drifted from its initial position by approximately 5-10 degrees. The Inspectors reviewed procedure 0-OP-5.50, “NUHOMS EOS 37 PTH Dry Shielded Canister Loading and Handling” and identified that step 4.13 states that “when lifting the cask near the Cask Pit, then the height of the cask bottom must not exceed a height of 1’ 6” above the handrail or 5’ above the floor and should be minimized whenever possible.” Additionally step 4.12 states that “when the cask is near the Cask Pit area, then the cask trunnions and lifting yoke must be oriented in a North-South direction with the drain port facing Northwest.”

The inspector concluded that the licensee failed to correctly translate the licensing basis for the spent fuel shipping cask handling into procedure 0-OP-5.50, “NUHOMS EOS 37 PTH Dry Shielded Canister Loading and Handling.” Specifically, License Amendment No. 58 describes the maximum lift height as 1 ft above the floor and that the trunnion axis will be aligned and locked in a north-south direction. However, the site procedure states that the lifting height was limited to a maximum of 5 ft above the floor and failed to include the requirement to lock the trunnion alignment to prevent drift.

Corrective Actions: CR1191508

Performance Assessment:

Performance Deficiency: The team determined that the failure to translate the maximum cask lift elevation and the locking of the trunnion axis into site procedures was a performance deficiency.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Procedure Quality attribute of the Barrier Integrity cornerstone and adversely affected the cornerstone objective to provide reasonable assurance that physical design barriers protect the public from radionuclide releases caused by accidents or events. Specifically, the failure to incorporate the physical restriction into the spent fuel cask crane procedures increases the probability of a heavy load drop into on the spent fuel racks, due to a crane malfunction and/or human error resulting in damage to the fuel assemblies and a release of fission products.

Significance: The inspectors assessed the significance of the finding using IMC 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At-Power." The inspectors answered "no" to all of the questions in Section E of Exhibit 3, "Barrier Integrity Screening Questions," and the finding screened to "Green" (i.e., very low safety significance).

Cross-Cutting Aspect: Not Present Performance (NPP). No cross-cutting aspect was assigned to this finding because the inspectors determined the finding did not reflect present licensee performance.

Enforcement:

Violation: Title 10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, measures shall be established to assure that applicable regulatory requirements and the design basis be correctly translated into specifications, drawings, procedures, and instructions and that design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program.

Contrary to the above, the licensee failed to correctly translate the licensing basis for the spent fuel shipping cask handling into procedure 0-OP-5.50, "NUHOMS EOS 37 PTH Dry Shielded Canister Loading and Handling." Specifically, License Amendment No. 58 describes the maximum lift height as 1 ft above the floor and that the trunnion axis will be aligned and locked in a north-south direction. However, the procedure states that the lifting height was limited to a maximum of 5 ft above the floor and failed to include the requirement to lock the trunnion alignment to prevent drift.

Enforcement Action: This violation is being treated as a non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.

Licensee-Identified Non-Cited Violation	71111.11B
This violation of very low safety significance was identified by the licensee and has been entered into the licensee's corrective action program and is being treated as a non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.	

Violation: Title 10 of the Code of Federal Regulations (10 CFR) 55.49, "Integrity of examinations and tests," states, in part, that facility licensees shall not engage in any activity that compromises the integrity of any examination required by this part. The integrity of an examination is considered compromised if any activity, regardless of intent, affected, or, but for detection, would have affected the equitable and consistent administration of the examination.

Contrary to the above, on January 12, 2022, the licensee engaged in an activity that compromised the integrity of the requalification examination administered on January 12, 2022. Specifically, the North Anna simulator data interface link transmitted real-time simulator run data outside the licensee envelope for examination security. The licensee identified the violation, entered the issue into the corrective action program and took appropriate corrective actions.

Significance/Severity: Green. Inspectors assessed this violation using Inspection Procedure 71111.11, Appendix E, "Requalification Examination Security Checklist," where an examination compromise was determined to have occurred (item nine) and Inspection Manual Chapter 0609, Appendix I, "Licensed Operator Requalification Significance Determination Process," where no actual effect on equitable and consistent administration occurred. This issue screened as having very low safety significance (Green).

Corrective Action References: CR1189232, CA9206985, CA9207004, CA9207013

Inadequate Cable Separation for Vital AC Bus Control Power and Monitoring Circuits			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000339/2022001-02 Open/Closed	None (NPP)	71153

The NRC identified a Green non-cited violation of 10 CFR Part 50, Appendix R, due to inadequate cable separation of safety-related control power cables routed through common fire areas. The design change process review for NA-13-00016, "Station Service Bus to Emergency Bus Crosstie Installation," failed to identify the violation of Appendix R requirements and a modification was installed on Unit 2 in 2013. The design review was a reasonable opportunity to identify the condition also existed on Unit 1.

Description: On July 22, 2021, North Anna Power Station (NAPS) notified the NRC of both units being in unanalyzed conditions after discovering that safety-related emergency diesel generator (EDG) control cables for Units 1 and 2 were routed through common fire areas and were not meeting the requirements for cable separation as specified in 10 CFR Part 50, Appendix R. As a result, the station identified that a fire in these areas could prevent the Vital 4160 volt alternating current (VAC) buses from supplying safety-related loads during an accident. Subsequent review showed spurious operation of Vital AC bus supply breakers and undervoltage sensing circuits was also possible, and could cause an unrecoverable loss of an EDG and its associated 4160 VAC switchgear due to out-of-phase synchronization.

During walkdowns with the NAPS Appendix R engineer, the NRC discovered that a 2013 design change added an Appendix R vulnerability for spurious breaker operation and the loss of both emergency buses on Unit 2. The inspector reviewed design change, NA-13-00016, "Station Service Bus to Emergency Bus Crosstie Installation," and determined that the design change did not include an appropriate Fire Safe Shutdown Analysis review. This review was

required by procedure, DNES-AA-GN-1003, "Design Effects and Considerations," and provided Dominion with the opportunity to identify the vulnerability on Unit 1 and prevent the installation of the vulnerability on Unit 2. This was not identified during the licensee's cause evaluation following discovery of the condition in 2021. This added significant value.

In 2013, North Anna Power Station installed electrical cross-connects between the station transformers and the emergency buses. Specifically, cross-tie connection were added from station service bus 2C, cubicle 25C1 1, to emergency bus 2H, cubicle 251-11, and between station service bus IA, cubicle 15A1 1, to emergency bus 2J, cubicle 25J4. The modification included breaker installation, control, indication, and protection for the cross-tie between station service bus IA cubicle 15A11 to emergency bus 2J cubicle 25J4 and station service bus 2C cubicle 25011 to emergency bus 2H cubicle 251-11. The intent of the modification was to improve station reliability by installing a backup circuit from the station service transformer on Unit 2, to match what was installed on Unit 1.

The issue affected 59 discrete cables in five different fire areas and both units. These fire areas were:

4-1 CSR-1 Cable Tray Spreading Room Unit 1
4-2 CSR-2 Cable Tray Spreading Room Unit 2
5-1 NSR-1 Normal Switchgear Room Unit 1
5-2 NSR-2 Normal Switchgear Room Unit 2
8- Turbine Building

The licensee determined that spurious operations of the 1J, 1H, 2J, 2H normal and alternate power supply breakers, the emergency diesel generator breakers, and the undervoltage monitoring circuits for each bus was credible for a fire involving these cables.

Dominion Nuclear Facility Quality Assurance Program Description, DOM-QA-1, describes the quality system for the station. Section 3 describes the design change process. DOM-QA-1, Section 3.2.1 requires a “documented method to control these changes. Design and specification changes are subject to design control measures commensurate with those applied during the original design as amended by applicable design or licensing basis changes.” CM-AA-DDC-201, “Design Changes,” provides the documented method for the design change process. Section 3.1.11 requires actions to be performed in accordance with DNES-AA-GN-1003, “Design Effects and Considerations.” DNES-AA-GN-1003, Attachment 2, Section 1.4, requires the review of the Fire Safe Shutdown Analysis. This review is divided into two steps. The first step is the applicability of the requirement, and the second step is the impact of the design change. The Fire Safe Shutdown was correctly identified as applicable to the design change. The design change was incorrectly identified as having ‘no impact.’ The instructions for Attachment 2 require “If it is determined that there is ‘no impact’ in a section where a question is answered ‘Yes,’ document the basis for this determination in the change package.” The basis for the determination required the completion of CM-AA-FPA-102, “Appendix R summary Checklist” be documented within the design package. This document was not completed. This missing step may have identified the added vulnerability.

Corrective Actions: Upon identification of the issue, the licensee entered the issue into their corrective action program, established compensatory, hourly fire watches as directed by their fire protection program, conducted a cause evaluation and risk assessment of the issue, and developed and planned corrective actions to restore compliance with Appendix R cable separation requirements.

Performance Assessment:

Performance Deficiency: Dominion's failure to adequately evaluate design change, NA-DC-000-13-00016, in accordance with the documented site design change process was a performance deficiency. Specifically, the Fire Safe Shutdown Analysis review in Attachment 2 of DNES-AA-GN-1003, failed to identify the plant impact on safe shutdown during a fire. The design modification was not in accordance with design specifications and/or circuit conductor separation requirements.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Design Control attribute of the Mitigating Systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences.

Significance: The inspectors assessed the significance of the finding using Appendix F, “Fire Protection and Post - Fire Safe Shutdown SDP.” The inspectors initially assessed the significance of the finding using Inspection Manual Chapter (IMC) 0609, Attachment 4, Initial Characterization of Findings. Table 3, Significance Determination Process (SDP) Appendix Router, directed the inspectors to IMC 0609, Appendix F, "Fire Protection Significance Determination Process, " since question E2 was answered "yes": affects ability to reach and maintain safe shutdown conditions in the case of a fire. Appendix F, Attachment 1, questions 1.4.7 A, B, and C were all answered "no": credited safe shutdown equipment would have been affected; question 1.5.1-A was also answered "no" since the licensee does not yet have a Fire PRA. Therefore, a detailed risk assessment was required.

A regional senior reactor analyst (SRA) utilized SAPHIRE 8, version 8.2.3 and the North Anna Unit 1 & 2 SPAR model, version 8.56, dated February 28, 2017, and performed a Phase II and Phase III detailed risk assessment in accordance with IMC 0609, Appendix F. The SRA assumed the maximum SDP exposure time of one year and calculated the increase in risk for each unit. The detailed risk assessment is attached to this report. The dominant accident sequence was a fire in the Unit 2 normal switchgear room resulting in damage to the undervoltage monitoring cables for both the 2H and 2J vital buses, spurious operation of the undervoltage circuits, and a significant out-of-phase synchronization event on both buses.

The total change in core damage frequency due to the performance deficiency was calculated to be between 4.0 and 9.3 E-7 core damage events per year. This corresponds to a finding of very low safety significance (GREEN).

Cross-Cutting Aspect: Not Present Performance. No cross-cutting aspect was assigned to this finding because the inspectors determined the finding did not reflect present licensee performance.

Enforcement:

Violation: North Anna Operating License Condition 2.D for Units 1 and 2 requires, in part, that the licensee shall implement and maintain in effect, the provisions of the approved fire protection program, as described in the Updated Final Safety Analysis Report (UFSAR). Section 9.5.1.1 of the UFSAR states, in part, that the North Anna Power Station satisfies the regulatory criteria set forth in 10 CFR 50 Appendix R, Sections III.G.

Section III.G.2 requires, in part, that where cables and equipment of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located in the same fire area outside of primary containment, one of the following means of ensuring that one of the redundant trains is free of fire damage shall be provided:

- separation of cables and equipment by a fire barrier having a 3-hour rating; or
- separation of cables and equipment by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards. Fire detection and automatic fire suppression shall be installed in the fire area; or
- enclosure of cables and equipment of one redundant train in a fire barrier having a 1-hour fire rating. Fire detection and automatic suppression shall be installed in the fire area.

Contrary to the above, the licensee did not meet the requirements of 10 CFR Part 50, Appendix R, Section III.G.2 in that the licensee did not ensure that one of the redundant trains of cables for the vital AC power supply and emergency diesel generators' breakers for North Anna, Units 1 and 2, was free of fire damage by providing one of the aforementioned means stated in Section III.G.2. when it performed a design modification without evaluating plant impact on safe shut down.

Enforcement Action: This violation is being treated as a non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.

EXIT MEETINGS AND DEBRIEFS

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

- On March 17, 2022, the inspectors presented the Licensed Operator Requalification Inspection results to Ms. Lisa Hilbert, Site Vice President, and other members of the licensee staff.
- On March 23, 2022, the inspectors presented the Unit 2 ISI Inspection results to Lisa Hilbert and other members of the licensee staff.
- On March 31, 2022, the inspectors presented the Independent Spent Fuel Storage Installation Inspection results to Ms. Lisa Hilbert and other members of the licensee staff.
- On April 25, 2022, the inspectors presented the Integrated Inspection results to Ms. Lisa Hilbert and other members of the licensee staff.

THIRD PARTY REVIEWS

Inspectors reviewed the Institute of Nuclear Power Operations reports that were issued during the inspection period.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71111.04	Corrective Action Documents Resulting from Inspection	CR1189841		
71111.04	Corrective Action Documents Resulting from Inspection	CR1190968		
71111.04	Corrective Action Documents Resulting from Inspection	CR1190991		
71111.04	Drawings	11715-FB-035A Sheet 2	Flow/Valve Operating Numbers Diagram Yard - Fuel Oil Lines North Anna Power Station Unit 1	44
71111.04	Drawings	11715-FE-1E sheet 1	125V DC One Line Diagram North Anna Power Station	32
71111.04	Drawings	11715-FE-1E sheet 2	125V DC One Line Diagram North Anna Power Station	33
71111.04	Drawings	11715-FM-078A Sheet 4	Flow/Valve Operating Numbers Diagram Service Water System North Anna Power Station Units 1 & 2	108
71111.04	Drawings	11715-FM-078B Sheet 1	Flow/Valve Operating Numbers Diagram Service Water System North Anna Power Station Unit 1	37
71111.04	Drawings	11715-FM-078C	Flow/Valve Operating Numbers Diagram Service Water System North Anna Power Station Units 1 & 2	43
71111.04	Drawings	11715-FM-088A	FLOW/VALVE OPERATING NUMBER DIAGRAM FUEL PIT CLNG & REFUELING PUR. SYS. NORTHA ANNA POWER STATION UNIT 1 VIRGINIA POWER	23
71111.04	Drawings	12050-FE-1E	125VDC One-line Diagram North Anna Power Station - Unit 2	29
71111.04	Drawings	12050-FM-107A Sheet 1	Flow/Valve Operating Numbers Diagram Emergency Diesel ir Service System North Anna Power Station Unit 2 Virginia Power	14

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71111.04	Drawings	12050-FM-107A Sheet 2	Flow/Valve Operating Numbers Diagram Diesel Air Service System North Anna Power Station Unit 2 Virginia Power	13
71111.04	Drawings	12050-FM-107B Sheet 1	Valve Operating Numbers Diagram Emergency Diesel Lube Oil System North Anna Power Station Unit 2 Virginia Power	7
71111.04	Procedures	0-OP-49.1A	Valve Checkoff - Service Water	52
71111.04	Procedures	2-OP-46.4.3	Main Station Swing Battery Chargers 2C-I and 2C-II Operation	22
71111.04	Procedures	2-OP-6.1A	Valve Checkoff - 2H Diesel Engine Cooling Water	10
71111.04	Procedures	2-OP-6.2A	Valve Checkoff - 2J Diesel Engine Cooling Water	11
71111.04	Procedures	2-OP-6.3A	Valve Checkoff - 2H Diesel Engine Lube Oil System	7
71111.04	Procedures	2-OP-6.4A	Valve Checkoff - 2J Diesel Engine Lube Oil System	7
71111.04	Procedures	2-OP-6.6A	Emergency Diesel Generator Pre-Operational Check for 2H and 2J Diesel	33
71111.04	Procedures	2-OP-6.7A	Valve Checkoff - Diesel Air	3
71111.04	Procedures	2-OP-6.7A	Valve Checkoff - Diesel Air	3
71111.05	Fire Plans	0-FS-TB-1	Turbine Building Fire Fighting Strategy	3
71111.05	Fire Plans	1-FS-F-3	Fuel Building Safe Shutdown Equipment Fire Fighting Strategy	7
71111.05	Fire Plans	1-FS-S-2	Fire Fighting Preplan for Cable Vault and Tunnel and 280' Rod Drive Unit 1 Safe Shutdown Equipment	13
71111.08P	Corrective Action Documents	CR1117194		
71111.08P	Corrective Action Documents	CR1192916		
71111.08P	Drawings	12050-FM-083B	Flow/Valve Operating Diagram Reactor Coolant System	28
71111.08P	Drawings	12050-WMKS-0111W	Inservice Inspection Pzr Aux Spray Piping	2
71111.08P	Engineering Evaluations	CR1155234	BACCP Evaluation B Reactor Coolant Pump 2-RC-P-1B	10/07/2020
71111.08P	NDE Reports	NA-2-PT-22-015	Liquid Penetrant Examination Safe End of Elbow 6-RC-437	03/11/2022
71111.08P	NDE Reports	NA-2-VE-22-004	Ultrasonic Examination Thermal Sleeve Tack Weld 12-422	03/14/2022
71111.08P	NDE Reports	NA-2-VE-22-005	Ultrasonic Examination Thermal Sleeve Tack Weld 6-417	03/14/2022
71111.08P	NDE Reports	NA-2-VE-22-006	Ultrasonic Examination Thermal Sleeve Tack Weld 6-419	03/14/2022

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71111.08P	NDE Reports	NA-2-VE-22-007	Ultrasonic Examination Thermal Sleeve Tack Weld 14-410	03/14/2022
71111.08P	NDE Reports	NA-2-VT-22-052	Visual Examination of Restraint 2-CH-R-1	03/16/2022
71111.08P	Procedures	2-PT-48	ISI Engineering Periodic Test	27
71111.08P	Procedures	ER-AA-NDE-PT-300	Visible Solvent Removable Liquid Penetrant Examination Procedure	11
71111.08P	Procedures	ER-AA-NDE-VT-603	VT-3 Visual Examination Procedure	0
71111.08P	Procedures	ER-NA-NDE-UT-750	Phased Array Ultrasonic Examination of Thermal Sleeve Attachment Welds	1
71111.08P	Work Orders	59203285647		
71111.11Q	Miscellaneous		Critique Information Sheet -LORP Cycle 22-2-- Event SXG-29	
71111.11Q	Miscellaneous		Licensed Operator/STA Programs Simulator Performance Summary -- Scenario SXG-29, Rev.14	
71111.11Q	Miscellaneous		Nightshift Spring 2022 Spring Refueling Outage Shutdown JITT	
71111.11Q	Procedures	2-OP-3.7	Unit Shutdown from Mode 1 to Mode 5 for Refueling	59
71111.12	Corrective Action Documents	CR1194623	2-SI-MOV-2869B replacement disc surface irregularities	3/24/2022
71111.12	Miscellaneous		Purchase Order 45801175	
71111.12	Procedures	MS-AA-MVL-101	Quality Receipt Inspection	8
71111.12	Procedures	MS-AA-WHR-401	Receiving	13
71111.12	Shipping Records	Purchase Order 4500629735		
71111.12	Work Orders	59203325544	Replace FlowServe N-9000 seal	
71111.13	Drawings	12050-FM-095B Sheet 2	Flow/Valve Operating Numbers Diagram Chemical and Volume Control System North Anna Power Station Unit 2	50
71111.13	Procedures	0-AP-48	Charging Pump Cross-Connect	9
71111.13	Procedures	0-GOP-17.0	Time Critical Action Validation and Verification	19
71111.15	Corrective Action Documents	CR1194625	During 2-PT-36.13J, aux relay 27XC-2J1 (2J Bus Undervoltage relay) did not pick up	03/24/2022
71111.15	Procedures	EP-AA-303, Attachment 11	ERF Functionality Flowchart	23
71111.15	Procedures	VPAP-2802,	Emergency Response Unavailability Reportable Action	50

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		Attachment 3	Levels	
71111.19	Corrective Action Documents	CR1194344	Lift Land Sheet Identified as Incorrectly Annotated while performing testing for 2-SI-MOV-2890B	03/22/2022
71111.19	Corrective Action Documents Resulting from Inspection	CR1189316		
71111.19	Procedures	2-PT-88.4J	Station Battery 2-IV Modified Performance Test	15
71111.19	Work Orders	59203369037		
71111.19	Work Orders	WO#59203296512	2-SI-MOV-2890B-VALVOP actuator removal/QSS installation	03/21/2022
71111.20	Corrective Action Documents	CR1193631		
71111.20	Miscellaneous		Core Reload Assessment	
71111.20	Miscellaneous		2R28 Outage Shutdown Safety Assessment (March 6 - March 31, 2022)	
71111.20	Miscellaneous	CA11013665 FME Recovery Plan	Fuel Assembly 22S	3/15/2022
71111.20	Miscellaneous	Tagout: 2-22-SI-0210	LHSI Tagout	03/08/2022
71111.20	Procedures	2-OP-3.7	Unit Shutdown from Mode 1 to Mode 5 for Refueling	59
71111.20	Miscellaneous		2022 Outage Plan Safety Review- North Anna Unit 2	02/14/2022
71111.20	Procedures	OU-AA-200	Shutdown Risk Management	11
71111.20	Procedures	OP-AA-106	Infrequently Conducted or Complex Evolutions	11
71111.20	Procedures	0-GOP-13.3	Assessment of Maintenance Activities for Potential Loss of RCS Inventory	4
71111.20	Procedures	2-OP-5.4	Draining the Reactor Coolant System	79
71111.20	Procedures	2-OP-3.2	Unit Shutdown from Mode 3 to Mode 4	73
71111.22	Corrective Action Documents Resulting from Inspection	CR1192012		
71111.22	Corrective Action Documents	CR1193833	NRC Resident Identified: 2-PT-61.3 Attachment 69	03/15/2022

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
	Resulting from Inspection			
71111.22	Corrective Action Documents Resulting from Inspection	CR1193839	NRC Identified: Use of Peer Checks in 2-PT-61.3 Test Rig Installation	03/15/2022
71111.22	Miscellaneous	Unit 1 RCS Leakage Spreadsheet		
71111.22	Procedures	1-PT-71.1Q	1-FW-P-2, Turbine Driven Auxiliary Feedwater Pump and Valve Test	74
71111.22	Procedures	2-PT-61.3	Containment Type C Test	51
71111.22	Procedures	2-PT-88.3J	Station Battery 2-III Modified Performance Test	15
71111.22	Work Orders	59203370880		
71151	Miscellaneous		NAPS NRC Performance Indicator Data for [January 2021-December 2021]	
71151	Miscellaneous	NAPS MSPI Basis Document	NRC Mitigating System Performance Index (MSPI) Basis Document - North Anna Power Station Units 1 and 2	9

SRA Analysis Number: NA-2022-01
Analysis Type: SDP Detailed Risk Evaluation Appendix F
Inspection Report # (if issued): 2022-001
Plant Name/Unit Number: North Anna Units 1 & 2
Enforcement Action # (if applicable): n/a

OVERALL RISK SUMMARY

Using Appendix F for an issue where cables were run in violation of 10 CFR 50 Appendix R requirements which would cause mitigating equipment in five fire areas to be lost. Affects both units. Overall change in core damage frequency was between 4E-7 and 9.3 E-7 for each unit. Therefore, the finding is characterized as Low Safety Significance (Green).

BACKGROUND

On July 22, North Anna Power Station (NAPS) notified the NRC of both units being in unanalyzed conditions after discovering that safety-related emergency diesel generator (EDG) control cables for Units 1 and 2 were routed through common fire areas and were not meeting the requirements for cable separation as specified in 10 CFR 50 Appendix R. As a result, the station identified that a fire in these areas could prevent the Vital 4160 VAC Buses from supplying safety related loads during an accident. Subsequent review showed spurious operation of Vital A/C Bus supply breakers and undervoltage sensing circuits was also possible, which could cause an unrecoverable loss of an EDG and its associated 4160 VAC switchgear due to out of phase synchronization.

In 2013, the NAPS installed electrical cross-connects between the station transformers and the emergency buses. Specifically, a cross-tie connection from station service bus 2C, cubicle 25C1 I, to emergency bus 2H, cubicle 251-11, and between station service bus IA, cubicle 15A1 1, to emergency bus 2J, cubicle 25J4. The modification included breaker installation, control, indication, and protection for the cross-tie between station service bus IA cubicle 15A11 to emergency bus 2J cubicle 25J4 and station service bus 2C cubicle 25011 to emergency bus 2H cubicle 251-11. The intent of the modification was to improve station reliability by installing a backup circuit from the station service transformer on Unit 2, to match what was installed on Unit 1.

Dominion Nuclear Facility Quality Assurance Program Description, DOM-QA-1 describes the quality system for the station. Section 3 describes the design change process. DOM-QA-1, Section 3.2.1, requires a “documented method to control these changes. Design and specification changes are subject to design control measures commensurate with those applied during the original design as amended by applicable design or licensing basis changes.” CM-AA-DDC-201, “Design Changes,” provides the documented method for the design change process. Section 3.1.11 requires actions to be performed in accordance with DNES-AA-GN-1003, “Design Effects and Considerations.” DNES-AA-GN-1003 Attachment 2, Section 1.4, requires the review of the Fire Safe Shutdown Analysis. This review is divided into two steps. The first step is the applicability of the requirement, and the second step is the impact of the

design change. The Fire Safe Shutdown was correctly identified as applicable to the design change. The design change was incorrectly identified as 'no impact.' The instructions for Attachment 2 require "If it is determined that there is 'no impact' in a section where a question is answered 'Yes,' document the basis for this determination in the change package." The basis for the determination required the completion of CM-AA-FPA-102 "Appendix R summary Checklist" be documented within the design package. This document was not completed. This missing step may have identified the added vulnerability.

PERFORMANCE DEFICIENCY

Dominion failed to adequately evaluate design change, NA-DC-000-13-00016, in accordance with the documented site design change process. Specifically, the review of the Fire Safe Shutdown Analysis in accordance with Attachment 2 of DNES-AA-GN-1003, failed to identify the plant impact on safe shutdown during a fire. The design modification was not in accordance with design specifications and/or circuit conductor separation requirements.

EXPOSURE TIME

SDP maximum exposure time of one year applied since issue dates back to 2013 on Unit 2 and the 1980s for Unit 1.

DATE OF OCCURRENCE

1980 (Unit 1)/2013 (Unit 2) until July 22. 2021 (discover date when compensatory actions were put in place).

SAFETY IMPACT

Affected Structures, Systems, Components (SSCs), Operator Actions, and Risk-Relevant Functions: • 1H EDG, 1J EDG, 1H emergency bus, 1J emergency bus, 2H EDG, 2J EDG, 2H emergency bus, 2J emergency bus • Fire safe shutdown capability
Conditions when the performance deficiency would manifest Itself (e.g., type of event, plant configuration): The loss of the credited safe shutdown train for a fire in certain areas. Due to the PD, the fire mitigation strategies may not be successful for a fire in the Unit 1 and Unit 2 cable spreading and normal switchgear rooms and the turbine building mezzanine. (Fire Areas 4-1, 4-2, 5-1, 5-2, and 8)

RISK ANALYSIS/CONSIDERATIONS

Assumptions

The issue affected 59 discrete cables in five different fire areas.
These fire areas were:
4-1 CSR-1 Cable Tray Spreading Room Unit 1
4-2 CSR-2 Cable Tray Spreading Room Unit 2
5-1 NSR-1 Normal Switchgear Room Unit 1
5-2 NSR-2 Normal Switchgear Room Unit 2
8- Turbine Building

All fire areas 4-1,4-2,5-1, and 5-2 are classified as III G.1 with only safe shutdown communications equipment located in these rooms. Fire Area 8 was classified as III.G..2. There are no alternate safe shutdown procedures for fires in these fire areas.

The licensee determined that spurious operations of the 1J, 1H, 2J, 2H normal and alternate power supply breakers, the emergency diesel generator breakers, and the undervoltage monitoring circuits for each bus was credible for a fire involving these cables.

Spurious operation of the breakers would result in a loss of offsite power to the 4160 VAC bus or a loss of the EDG to the bus if running and would be recoverable. However, a spurious actuation of the undervoltage monitoring circuitry could cause the EDG to start and attempt to load onto an energized bus.

However, Out-of-Phase Synchronization (OOPS) events can cause severe damage to a machine and must be avoided. The worst case transient torque on the shaft occurs for an OOPS event at 120 degrees and that the worst-case high-current forces on the stator and transformer windings occur for an OOPS event at 180 degrees. An industry report (Attachment 3) evaluated the damage that a generator experiences during an OOPS event by comparing generator torque and current to those of acceptable synchronization, full-load, and a three-phase terminal fault. The damage to a generator due to an OOPS event may be catastrophic. Conventional generator protection provides little protection for OOPS events, and there is no commonly available guidance to address this issue. Thus, this would result in an unrecoverable loss of the affected 4160 VAC bus. Since synchronizing out of phase by up to +/- 40 degrees would not cause equipment damage a factor of 1-(40+40)/360 = 0.7777778 is applied.

It is also credible to have multiple spurious operation of two breakers during the same fire if the cables are in a credible fire's zone of influence in the space. Thus, a recoverable loss of a 4160 VAC bus, Plant Center Loss of Offsite Power, and a SBO event may be possible and must be evaluated for each unit (cables for both units run thru each fire area). In these cases, two MSS events must take place, so the MSS factor is taken twice. For the SBO events, the OOPS factor is also taken twice.

PRA Model used for basis of the risk analysis:

A regional senior reactor analyst (SRA) using SAPHIRE 8, Version 8.2.3, and the North Anna Unit 1 & 2 SPAR model, Version 8.56, dated February 28, 2017. North Anna does not have a completed Fire PRA and the Spar Model does not include any fire scenarios. North Anna IPEEE also does not address internal fires.

The licensee provided plant specific fire initiation frequencies for the affected fire areas which was considered best available information. Since the licensee's evaluated failure mechanism involves a multiple spurious short (MSS) causing inadvertent actuations of breakers, a factor of 0.3 was applied to account for the probability of an MSS (NUREG/CR-6850 Section 10). For OOPS events, a factor of 0.78 was applied as discussed above.

Fixed detection and automatic suppression is functional in all five fire areas and is credited assuming a NSP of 0.04 (CO2 suppression) and 0.05 (Sprinklers.) (NUREG/CR-6850)

Spurious operation of breakers are assumed to have the following affect:
Alternate Supply Breaker: Normally Open: If closes would trip Normal supply breaker on interlock and cause a PLOOP to the affected bus
Normal Supply Breaker: Normally Closed. If opens would cause a PLOOP to the affected bus.
EDG Output Breaker: Normally Open. Trips back open on interlock with the Normal supply breaker on interlock if closes (No Impact) or Loss of EDG if opens during transient.
UV Monitoring circuit -OOPS event resulting in loss of associated 4160 VAC bus.
Spurious Operation of breakers on one unit will have no impact on the other unit.

The SRA developed a spreadsheet and calculated the risk impact of each affected cable failure for each unit. A fire in these fire areas would result in a plant transient with the adjustments listed above. The SRA then calculated the Loss of Vital Bus, a Plant Centered Loss of Offsite Power, and SBO scenarios for a fire affecting multiple cables in the same fire area. The SBO scenarios in fire areas 5-1 and 5-2 were not considered credible due to physical separation of the cable within the room, however two cases (one including those sequences and one not including those sequences) were run as a sensitivity as the SBO sequences are the dominant risk contributors.

FLEX credit was conservatively not considered because the results were less than 1e-6. For SBO sequences following an OOPS event, the 4160 VAC bus itself might be damaged in cases where the sources were paralleled close to 180 degrees out of phase.

CALCULATIONS:
REPRESENTATIVE CASE CCDP
Case 1 (SBO sequences in 5-1 and 5-2 not credible): Unit 1 - 4.04 E-7; Unit 2 - 4.34 E-7
Case 2 (all SBO sequences considered): Unit 1 – 9.02 E-7; Unit 2 – 9.31 E-7
See attached spreadsheet

EXTERNAL EVENTS CONSIDERATIONS
This is a fire induced event only.

LARGE EARLY RELEASE FREQUENCY IMPACT
In accordance with IMC 0609 Appendix H since delta CDF is greater than 1 E-7 the finding is evaluated for LERF. Using Table 6.1 Phase 1 Screening-Type A Findings at Full Power the accident sequences SBO, LOOP, Loss of 4160 Bus, Transient all screen out in Phase I for LERF.

CONCLUSIONS/RECOMMENDATIONS
The Analyst recommends characterizing this issue as GREEN based upon delta CDF being less than 1 E-6.

ATTACHMENT

1. Appendix F spreadsheet
2. Inspection Report Input
3. OOPS, Out-of-Phase Synchronization – by Barner, Klingerman, Thompson, Chowdhury, Finney, Samineni March 2020
4. NUREG/CR-6850, ""EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities, Volume 2: Detailed Methodology," September 2005.

Analyst: A. Rosebrook Date: 2/24/22

Reviewed By: S. Sandel Date: 3/2/22