



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

December 11, 2024

EA-24-126

Eric S. Carr
President - Nuclear Operations
and Chief Nuclear Officer
Dominion Energy
5000 Dominion Blvd
Glen Allen, VA 23060

SUBJECT: NORTH ANNA POWER STATION, UNIT 2 - FINAL SIGNIFICANCE
DETERMINATION OF A WHITE FINDING AND NOTICE OF VIOLATION AND
ASSESSMENT FOLLOWUP LETTER; NRC INSPECTION REPORT
05000339/2024090

Dear Eric Carr:

The U.S. Nuclear Regulatory Commission (NRC) completed its final significance determination of the preliminary White finding discussed with Lisa Hilbert and other members of the Dominion Energy (Dominion) staff during an inspection exit meeting on November 18, 2024. The finding involved the failure to prescribe documented instructions appropriate to the circumstances for foreign material control prior to the assembly and installation of a relay in the Unit 2 'J' (2J) emergency diesel generator (EDG) system in January 2022, which resulted in the 2J EDG inoperability.

Following the exit meeting, the NRC staff was informed that Dominion did not contest the characterization of this finding as White and its associated violation as described in the exit meeting. In addition, Dominion declined the opportunity to discuss this issue in a regulatory conference or to provide a written response before the NRC made a final decision, and understood that NRC Inspection Manual Chapter 0609, Attachment 2 appeal rights only apply to those licensees that have either attended a regulatory conference or submitted a written response to a preliminary determination letter.

After considering the information developed during the inspection, the NRC has concluded that the finding is appropriately characterized as White. The NRC has also determined that the failure to prescribe documented instructions appropriate to the circumstances for foreign material control was a violation of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," as cited in Enclosure 1, Notice of Violation (Notice). The circumstances surrounding the violation and the basis for the significance determination are described in the enclosed inspection report (Enclosure 2). In accordance with the NRC Enforcement Policy, the Notice is considered an escalated enforcement action because it is associated with a White finding.

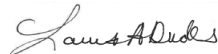
Dominion is required to respond to this enforcement action and should follow the instructions specified in Enclosure 1 when preparing the response. While the appeal rights for the characterization of the finding as White do not apply in this case, Dominion still has the opportunity to contest the violation and provide additional information that the NRC should consider with respect to the enforcement aspects of this case. The NRC review of Dominion's response to the Notice will also determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

The NRC has determined that the performance at North Anna Power Station, Unit 2 would be in the Regulatory Response Column of the Reactor Oversight Process Action Matrix beginning in the fourth quarter of 2024 (October 1, 2024). Therefore, the NRC plans to conduct a supplemental inspection in accordance with Inspection Procedure (IP) 95001, "Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area." This IP is conducted to provide assurance that the root and contributing causes for the performance issues are understood, and to provide assurance that the corrective actions are sufficient to address the root and contributing causes and prevent recurrence. This letter supplements, but does not supersede, the annual assessment letter issued on February 28, 2024 (ADAMS Accession Number [ML24053A267](#)).

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice and Procedure," a copy of this letter, its enclosures, and your response, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

If Dominion has any questions concerning this matter, please contact Laura Pearson of my staff at 404-997-4601.

Sincerely,



Signed by Dudes, Laura
on 12/11/24

Laura A. Dudes
Regional Administrator

Docket No.: 05000339
License No.: NPF-7

Enclosures:

1. Notice of Violation
2. Inspection Results w/Attachment

cc w/ encls: Distribution via LISTSERV

SUBJECT: NORTH ANNA POWER STATION, UNIT 2 – FINAL SIGNIFICANCE DETERMINATION OF A WHITE FINDING AND NOTICE OF VIOLATION AND ASSESSMENT FOLLOWUP LETTER; NRC INSPECTION REPORT 05000339/2024090 DATED DECEMBER 11, 2024

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NOTICE OF VIOLATION

Dominion Energy
North Anna Power Station

Docket No.: 05000339
License No.: NPF-7
EA-24-126

During an NRC inspection conducted from April 18 through November 18, 2024, a violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

Title 10 of the Code of Federal Regulations, Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," states, in part, that "activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings."

The licensee's Nuclear Facility Quality Assurance Program Description, DOM-QA-1, Revision 37, Section 2.7.1, states, in part, that Dominion Energy shall establish appropriate cleanliness controls for work on safety-related equipment to minimize introduction of foreign material and maintain system/component cleanliness throughout maintenance or modification activities, including documented verification of absence of foreign material prior to system closure.

Procedure 0-EPM-0702-04, "Inspection of EDG 'K' Relays and Contacts," is the governing procedure whose purpose is to "provide instructions for inspection and repair of EDG K relays and contacts."

North Anna Technical Specifications (TS) Limiting Condition for Operation (LCO) 3.0.1 requires, in part, that LCOs shall be met during the modes of applicability. TS LCO 3.8.1, "AC Sources," requires, in part, two operable emergency diesel generator (EDG) sets capable of supplying the onsite Class 1E distribution systems; and one EDG capable of supplying the onsite Class 1E AC distribution system on the other unit for each required shared component while in Modes 1, 2, 3, and 4.

Contrary to the above, on January 13, 2022, the licensee failed to prescribe appropriate documented instructions for an activity affecting the quality of the safety-related Unit 2 'J' (2J) EDG system. Specifically, licensee procedure 0-EPM-0702-04, "Inspection of K Relays and Contacts" did not provide instructions appropriate to the circumstances for foreign material control prior to the assembly and installation of the 2J EDG shutdown and generator field flash relay ("K1 relay"), as evidenced by the foreign material found obstructing the relay contacts which rendered the 2J EDG inoperable from January 18, 2024, to April 19, 2024. As a result of the 2J EDG's inoperability, the licensee failed to meet the operability requirements in TS LCOs 3.0.1 and 3.8.1 for two operable emergency diesel generators on Unit 2 and a diesel capable of supplying shared components on Unit 1 while in MODE 1. Once the EDG inoperability was identified on April 18, 2024, the licensee took appropriate corrective actions to restore EDG operability within the completion times established in TS 3.8.1.

This violation is associated with a White finding.

Pursuant to the provisions of 10 CFR 2.201, Dominion Energy is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Regional Administrator, Region II, and a copy to the NRC Resident Inspector at the facility that is the subject of this Notice of Violation (Notice), within 30 days of the date of the letter transmitting this Notice. This reply should be clearly marked as a "Reply to a Notice of Violation; EA-24-126" and should include: (1) the reason for the violation, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>, to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days of receipt.

Dated this 11th December 2024

**U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report**

Docket Number: 05000339

License Number: NPF-7

Report Number: 05000339/2024090

Enterprise Identifier: I-2024-090-0011

Licensee: Dominion Energy

Facility: North Anna Power Station, Unit 2

Location: Mineral, VA

Inspection Dates: April 18, 2024, to November 18, 2024

Inspectors: K. Carrington, Senior Resident Inspector

Approved By: James B. Baptist, Chief
Projects Branch 4
Division of Operating Reactor Safety

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting an NRC inspection at North Anna Power Station, Unit 2, 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

Failure to Prescribe Instructions Appropriate for Installation of Unit 2 'J' Emergency Diesel Generator Relay			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	White NOV 05000339/2024090-01 Open EA-24-126	[H.13] - Consistent Process	71153
A White (low-to-moderate safety significance) finding and an associated Violation of 10 CFR 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," was self-revealed when the Unit 2 'J' (2J) emergency diesel generator (EDG) experienced a loss of excitation, on April 18, 2024. Specifically, the licensee failed to prescribe documented instructions appropriate to the circumstances for foreign material control prior to the assembly and installation of a relay in the Unit 2 'J' (2J) emergency diesel generator (EDG) system in January 2022, which resulted in the 2J EDG inoperability for greater than its Technical Specification (TS) allowed outage time of 14 days.			

Additional Tracking Items

None

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/readingrm/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.

INSPECTION RESULTS

Failure to Prescribe Instructions Appropriate for Installation of Unit 2 'J' Emergency Diesel Generator Relay			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	White NOV 05000339/2024090-01 Open EA-24-126	[H.13] - Consistent Process	71153
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Description: On April 18, 2024, at 1300, the 2 'J' EDG was started for surveillance testing in accordance with 2-PT-82.2B, "2J Diesel Generator Test (Simulated Loss of Off-Site Power). Prior to loading the diesel to its emergency bus, a loss of generator field alarm was received locally in the field, signaling a loss of voltage and excitation. The diesel was subsequently secured and declared inoperable in accordance with TS Limiting Condition of Operation (LCO) 3.8.1, "A.C. Sources - Operating."

Licensee troubleshooting and investigation identified that the K1 (shutdown and generator field flash) relay failed. Upon disassembly, a plastic piece of foreign material was found lodged between the relay contacts. This plastic piece of material (source unknown but presumed to be from packaging) prevented the relay from operating as required. The relay was replaced, and the diesel was satisfactorily tested and restored to an operable status on April 19, 2024, at 2351.

The K1 latching relay consists of two relay subcomponents (K1R and K1M). Because the K1 relay comes in two parts, the relay must be assembled prior to installation. On January 13, 2022, the licensee replaced the K1 relay under WO59102493866, "K1/K2/K3/K4 Relay Replacement PM." The process for relay replacement consisted of each subcomponent undergoing its own receipt inspection in a warehouse onsite. Through interviews and

document reviews, the inspectors learned that these receipt inspections were nonintrusive in order to minimize damage to the K1 relay subcomponents or the introduction of foreign material. Moreover, the primary focus of the receipt inspections entailed verification of component labels and identification numbers.

After being receipt inspected and transferred to the shop for assembly, the new latching unit was bench tested, inspected, and installed in the field. The K1 relay bench testing and assembly was performed in accordance with maintenance procedure 0-EPM-0702-04, "Inspection of EDG 'K' Relay." The inspectors noted that this procedure allowed an opportunity for visual inspection of old relays intended for reuse in the plant; this inspection included looking for damage, cracks, burns, wear, relay binding, and ensuring relay cleanliness. However, the inspectors noted there were no instructions in the maintenance procedure for performing an inspection of the new relay prior to bench testing, assembly, or installation. According to inspector interviews, at the time of assembly, it was expected craft practice to perform a visual inspection of new relays.

Additionally, as a general practice, the licensee expected its employees to exercise foreign material exclusion controls in accordance with Dominion procedure MA-AA-102, "Foreign Material Exclusion," however, during their review of WO59102493866, the inspectors noted there were no details on what the foreign material controls entailed.

The inspectors determined the licensee failed to have adequate documented instructions for foreign material control prior to the assembly and installation of the relay, following its replacement in January 2022, which allowed foreign material to remain lodged between the relay contacts.

Corrective Actions: The licensee replaced the Unit 2 'J' EDG K1 relay, reperformed 2-PT-82.2B, performed a common mode failure evaluation of the 2 'H' EDG, and restored the diesel to an operable status. Additionally, the licensee performed an inspection of the same relay on other diesels, revised its electrical maintenance procedure, 0-EPM-0702-04, and completed a root cause evaluation.

Corrective Action References: CR1256999

Performance Assessment:

Performance Deficiency: The licensee's failure to prescribe documented instructions appropriate to the circumstances for foreign material control prior to the assembly and installation of a relay in the Unit 2 'J' (2J) emergency diesel generator (EDG) system in January 2022, 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 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. Specifically, failure of the K1 relay rendered the 2J EDG inoperable and incapable of performing its specified safety function.

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 "yes" to question 3, since the degraded condition represented a loss of PRA function of one train of a multi-train Technical Specification (TS) system for greater than

the TS-allowed outage time of 14 days and determined a detailed risk evaluation was warranted. Using the North Anna SPAR model Versions 8.80 (dated 05/26/2022), the initial probability of core damage frequency was determined to be $1.9E-6/yr$ which exceeds the $1E-7/yr$ threshold for a Green issue. The SRA performed a detailed risk evaluation (DRE) using the North Anna SPAR model version 8.82 when this model became available (see attachment).

A regional senior reactor analyst (SRA) conducted a detailed risk assessment the degraded condition. The details of the detailed risk assessment can be found in the attachment. The SRA assumed an exposure time of 2236 hours. The SRA used SAPHIRE 8 version 8.2.11 and the North Anna SPAR model version 8.82 dated 9/26/2023.

The representative case was determined to be the EPS-DGN-FS-DG1J; DIESEL GENERATOR 1J FAILS TO START set to TRUE, with N+1 FLEX Credit applied using change set -FLEX-CREDIT; ELAP DECLARED AND FLEX EQUIPMENT CREDITED and change set- FLEX-N+1, ELAP DECLARED AND N+1 FLEX EDG CREDITED and for Unit 2 and EPS-DGN-FS-DG2J; DIESEL GENERATOR 2J FAILS TO START set to TRUE, with N+1 FLEX Credit applied using change set -FLEX-CREDIT; ELAP DECLARED AND FLEX EQUIPMENT CREDITED and change set FLEX-N+1, ELAP DECLARED AND N+1 FLEX EDG CREDITED for Unit 1. The FLX-XHE-XL-RECOSP, OPERATOR FAILS TO RESTORE OFFSITE POWER FOLLOWING FLEX OPERATION (ELAP) basic event was also adjusted to reflect plant procedures being available for recovery from FLEX power line ups. The dominate accident sequence was a dual unit Weather Related Loss of Offsite power with a failure of the 2H EDG, Failure of the SBO EDG, Failure of the FLEX RCS Make up pumps, and failure to recover offsite power or the 2H EDG in 24 hours for internal events and a fire in the emergency switchgear room for external events.

Characterization of this issue is low to moderate safety significance (WHITE) due to change in core damage frequency being between approximately 5.12 and $7.31 E-6$ for Unit 2 and very low safety significance (GREEN) due to change in core damage frequency being less than $1E-6$ for Unit 1.

Cross-Cutting Aspect: H.13- Consistent Process: Individuals use a consistent, systematic approach to make decisions. Risk insights are incorporated as appropriate. Specifically, the licensee's process for implementing foreign material controls of the K1 relay were not well-defined or consistent.

Enforcement:

Violation: Title 10 of the *Code of Federal Regulations* (10 CFR) 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," states, in part, that "activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings."

The licensee's Nuclear Facility Quality Assurance Program Description, DOM-QA-1, Revision 37, Section 2.7.1, states, in part, that Dominion Energy establish appropriate cleanliness controls for work on safety-related equipment to minimize introduction of foreign material and maintain system/component cleanliness throughout maintenance or modification activities, including documented verification of absence of foreign material prior to system closure.

Procedure 0-EPM-0702-04, "Inspection of EDG 'K' Relays and Contacts," is the governing

procedure whose purpose is to provide instructions for inspection and repair of EDG K relays and contacts.

North Anna TS LCO 3.0.1 requires, in part, that LCOs shall be met during the modes of applicability. TS LCO 3.8.1, "AC Sources," requires, in part, two operable EDG sets capable of supplying the onsite Class 1E distribution systems; and one EDG capable of supplying the onsite Class 1E AC distribution system on the other unit for each required shared component while in Modes 1, 2, 3, and 4.

Contrary to the above, on January 13, 2022, the licensee failed to prescribe appropriate work instructions for an activity affecting the quality of the safety-related 2J EDG system. Specifically, licensee procedures 0-EPM-0702-04, "Inspection of K Relays and Contacts" did not provide instructions appropriate to the circumstances for maintaining foreign material controls during the assembly and installation of the K1 relay on the 2J EDG, which resulted in the failure to identify foreign material obstructing the relay contacts and rendered the 2J EDG inoperable from January 18, 2024, to April 19, 2024. As a result of the 2J EDG's inoperability, the licensee failed to meet the operability requirements in TS LCOs 3.0.1 and 3.8.1 for two operable emergency diesel generators on Unit 2 and a diesel capable of supplying shared components on Unit 1 while in MODE 1. Once the EDG inoperability was identified on April 18, 2024, the licensee took appropriate corrective actions to restore EDG operability within the completion times established in TS 3.8.1.

EXIT MEETINGS AND DEBRIEFS

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

- On November 18, 2024, the inspectors presented the NRC inspection results to Lisa Hilbert, Site Vice President, and other members of the licensee staff.

Basis for Significance Determination

PERFORMANCE DEFICIENCY (PD)

The inspectors determined the licensee's failure to prescribe documented instructions appropriate to the circumstances for foreign material controls prior for the 2J emergency diesel generator (EDG) K1 relay was a performance deficiency. As a result, implementation of the instructions resulted in installation of a relay with foreign material that affected relay operation and rendered the EDG inoperable.

SCREENING

Initial SDP Screening:

The inspectors determined the performance deficiency was more than minor because it was associated with the Procedure Quality 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. Specifically, failure of the K1 relay rendered the 2J EDG inoperable and incapable of performing its specified safety function.

The inspectors assessed the significance of the finding using the Mitigating Systems Cornerstone Screening Questions in Exhibit 2 of IMC 0609, Appendix A. The inspectors answered "yes" to question 3, since the degraded condition represented a loss of Probabilistic Risk Assessment (PRA) function of one train of a multi-train TS system for greater than the TS-allowed outage time of 14 days and determined a detailed risk evaluation was warranted.

EXPOSURE TIME

January 18 – April 19, 2024

The failure mechanism of the K1 relay was identified as a piece of foreign material that was discovered lodged between the relay contacts and precluded its operation. Prior to its failure, the relay was last replaced in January 2022. This condition is presumed to have existed since the replacement of the relay in 2022. Since that time, the 2J EDG was successfully run a total of 24 times for surveillance testing. Therefore, one can assume an exposure start time from the last successful run of the EDG on January 18, 2024, until the 2J EDG relay failure on April 18, 2024, plus the EDG repair time of 1 day. Based on this, the exposure time is 2238 hours.

RASP Manual Volume 1 section 2.3 Exposure Time = t + Repair Time

- $T = t + \text{Repair Time}$. For a failure that was determined to have occurred when the component was last functionally operated in a test or unplanned demand (e.g., failure occurred when the component was being secured), the exposure time (T) is equal to the total time from the last successful operation to the unsuccessful operation (t) plus repair time.
- This exposure time determination approach is appropriate for standby or periodically operated components that fail due to a degradation mechanism that is not gradually affecting the component during the standby time period.

Influential Assumptions:

- 1) The failure of the 2J EDG impacts risk for both Unit 2 and Unit 1.
- 2) Since the North Anna SPAR model only models Unit 1, the 2J EDG was surrogated by using the 1J EDG when determining the risk for Unit 2 and the 2J EDG was used when determining the risk for Unit 1.
- 3) The foreign material was present in the K-1 assembly since installation in January 2022, but it was only able to move when the relay mechanically changed state and shook the relay housing. Following the successful surveillance run of the 2J EDG on

January 18, 2024, the foreign material migrated to the K1 relay contactors. Thus, the entire standby period T is used.

- 4) North Anna does not have any procedural guidance to cross connect the Unit 1 EDGs to Unit 2 busses and vice versa. Additionally, some of the breakers on Unit 2 which were present in the SPAR model drawings, which could allow busses to be cross connected were removed or modified during modifications to the Unit 2, unit auxiliary transformer/start-up transformer (UAT/SUT) fast bus transfer circuit. Thus, the SPAR model basic events to cross connect the 1H to 2J and 2H to 2J bus (which default to True) cannot be adjusted for recovery.
- 5) Recovery of the 2J EDG was not considered reasonable since the foreign material could only be found following removal and disassemble of the K1 relay. Recovery of a second EDG failure and/or offsite power was credited by the SPAR model.
- 6) Since the foreign material was believed to be packing material, it was likely introduced during unpacking of the received equipment at North Anna or during packing by the vendor. In either case, this introduces a common cause failure mechanism thus common cause failure of all EDGs must be considered. This is the dominant risk driver for Unit 1 in this case.
- 7) The North Anna SPAR model does not contain any fire event sequences, and the licensee does not have a peer reviewed Regulatory Guide (RG) 1.200 compliant PRA. However, the licensee has a draft fire PRA it is developing for a future application for 10 CFR 50.69. While this model has not been peer reviewed, the SRA walked down the plant fire areas and reviewed the Fire PRA model and determined that this model could be considered best available information. Fire Risk results were the dominant risk contributor, particularly a fire in the emergency switchgear room which does not have adequate train separation.
- 8) The SRA walked down the licensee's FLEX implementation strategies, loss of offsite power (LOOP) procedures and Station Blackout (SBO) procedures. The SRA identified that North Anna FLEX strategy involves staging and connecting a 120 V FLEX DG immediately and using this DG to supply vital battery load still in service following the Deep Load Shed direct by ELAP procedures. This action would extend battery life to greater than 8 hours. Thus, if the credited 480 VAC FLEX EDGs failed, adequate time would be available to deploy and connect the N+1 FLEX EDG. The 120V FLEX DG is not modelled in the SPAR model, but the N+1 EDG is.
- 9) The SRA walked down the SBO EDG and the procedures for placing this EDG in service. The SBO EDG automatically starts on a LOOP and repowers the SBO building and lighting and the breaker controls to align the SBO EDG are located on a single panel, making this evolution more reliable than most plants.
- 10) The SRA noted that several of the dominant accident sequences were sequence 17-03-02 which is a Station Blackout with ELAP declared and all Flex Equipment successful, but power not recovered in 72 hours. This sequence was present for all four Loss of Offsite Power Events. Since there is sufficient fuel and redundant FLEX equipment on site and the FLEX strategy would call for SAFER equipment to be deployed to the site within 72 hours, non-recovery of onsite or offsite power alone would not cause a loss of long-term cooling function. Only operator error when restoring from FLEX would result in a loss of long-term cooling and failure of the top event. Reviewing cutsets and fault trees the SRA identified FLX-XHE-XL-RECOSP, OPERATOR FAILS TO RESTORE OFFSITE POWER FOLLOWING FLEX OPERATION (ELAP) was a sensitive term in this sequence. The SRA noted the SPAR-H Analysis assumed there were no procedures. Thus, the SRA adjusted the basic event by changing the performance shaping factor for procedures in both diagnosis and Action from not available to nominal. This changed the human error

probability (HEP) from 1.25E-1 to 2.6E-3. This impacts both the 24-hour and 72-hour power recovery top events.

REPRESENTATIVE CASE CCDP

The SRA used SAPHIRE 8 version 8.2.11 and the North Anna SPAR model version 8.82 dated 9/26/2023.

The representative case was determined to be the EPS-DGN-FS-DG1J; DIESEL GENERATOR 1J FAILS TO START set to TRUE, with N+1 FLEX Credit applied using change set -FLEX-CREDIT; ELAP DECLARED AND FLEX EQUIPMENT CREDITED and change set- FLEX-N+1, ELAP DECLARED AND N+1 FLEX EDG CREDITED and for Unit 2 and EPS-DGN-FS-DG2J; DIESEL GENERATOR 2J FAILS TO START set to TRUE, with N+1 FLEX Credit applied using change set -FLEX-CREDIT; ELAP DECLARED AND FLEX EQUIPMENT CREDITED and change set FLEX-N+1, ELAP DECLARED AND N+1 FLEX EDG CREDITED for Unit 1. The FLX-XHE-XL-RECOSP, OPERATOR FAILS TO RESTORE OFFSITE POWER FOLLOWING FLEX OPERATION (ELAP) basic event was also adjusted as discussed above for both units.

Case	Internal Events (IE)	Fire	Other External Events	Total
Representative Case U2	2.064E-6	3.96E-6	2.714E-7	6.295E-6
Representative Case U1	6.704E-7	N/A	8.348E-8	7.539E-7

Note 1: The 2J EDG is not credited for any Unit 1 Fire/Safe shutdown strategies.

The dominant accident sequence is a dual unit Weather Related Loss of Offsite power with a failure of the 2H EDG, Failure of the SBO EDG, Failure of the FLEX RCS Make up pumps, and failure to recover offsite power or the 2H EDG in 24 hours.

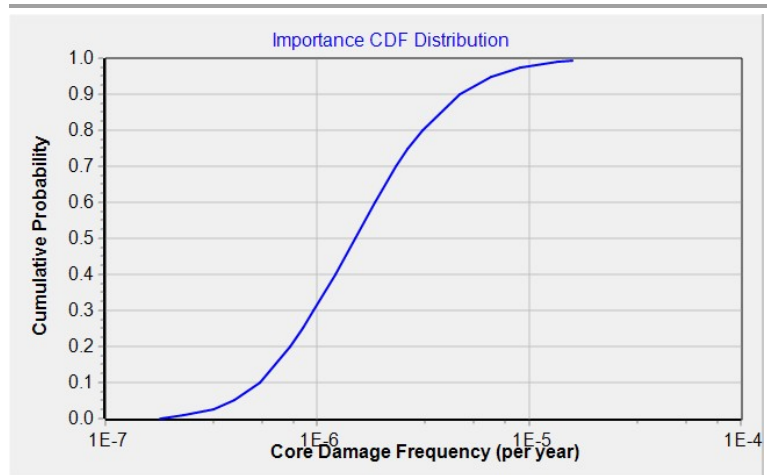
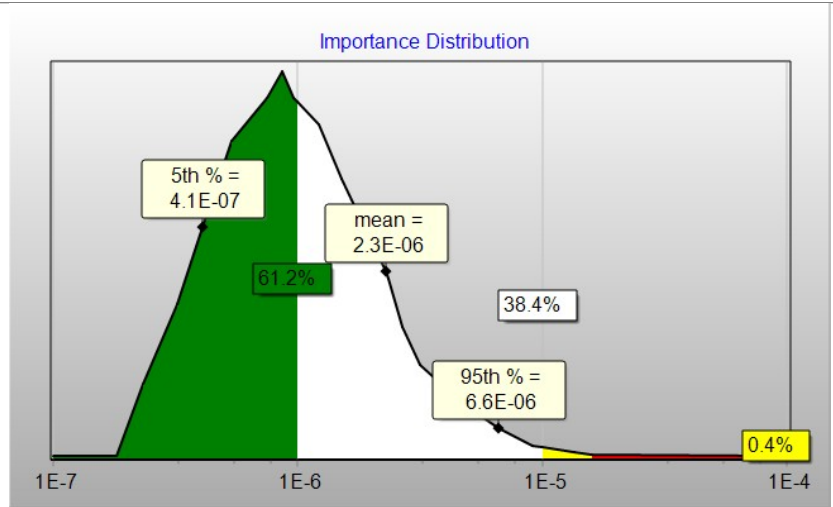
Uncertainty Analysis:

The SRA ran a Monte Carlo analysis for the Internal Events Representative Case. See below.

Uncertainty Plot:

Importance Distribution

5%	Median	Point Estimate	Mean	95%	Seed	Sample Size	Method
4.082E-7	1.508E-6	2.064E-6	2.283E-6	6.637E-6	12345	3825	Monte Carlo



Event Tree Dominant Results

Only items contributing at least 1.0% to the total conditional core damage probability (CCDP) are displayed.

<u>Event Tree</u>	<u>CCDP</u>	<u>CDP</u>	<u>Δ CDP</u>	<u>Description</u>
LOOPWR	1.157E-6	4.282E-8	1.114E-6	LOSS OF OFFSITE POWER (WEATHER RELATED)
LOOPSC	4.460E-7	1.570E-8	4.303E-7	LOSS OF OFFSITE POWER (SWITCHYARD CENTERED)
LOOPPC	2.998E-7	1.101E-8	2.888E-7	LOSS OF OFFSITE POWER (PLANT CENTERED)
LOOPGR	2.383E-7	7.300E-9	2.310E-7	LOSS OF OFFSITE POWER (GRID RELATED)
Total	2.337E-6	2.726E-7	2.064E-6	

Sensitivity Evaluations:

Sensitivity Evaluations:

- 1) A sensitivity was done for FLEX Credit. North Anna’s FLEX strategy involves the deployment of a 120 V generator to supply vital loads on the battery. Then the 480VAC FLEX generators are deployed. The 120V generator increases available time to deploy the 480 VAC FLEX EDGs from 4 hour to 8 hours giving adequate time to deploy the N+1 EDG. Sensitivities were run for No FLEX credit, nominal FLEX Credit, for N+1 EDG FLEX Credit), and for Crediting the FLEX PHASE 3 SAFER equipment. (Note: the FLX-XHE-XL-RECOSP adjustment is not included in these sensitivities.)
- 2) Since the Licensee model was used for Fire Events is not a peer reviewed RG 1.200 compliant PRA model, the licensee performed several sensitivities for their Fire PRA results, including adjusting model truncation, not crediting operator actions, and not considering common cause failures of the EDG. These sensitivities are reflected in the risk range reported in the final results and Table 7-1 below.
- 3) Sensitivities were also run in an attempt to replicate the licensee’s results for internal events in order to understand modelling differences. The SRA ran the following:
 - a. Treating the K-1 relay failure as a Failure to load run vice failure to start (FTS).
 - b. Setting the Failure to start to 1.0 vice true (IE no potential for a common cause failure due to PD) (Both Units)
 - c. Eliminating Station Blackout sequences where ELAP is successful but Offsite power is not restored in 24/72 hours leading to core damage.

Case	Internal Events	Fire	Other External Events	Total
Representative Case U2	2.064E-6	3.96E-6	2.714E-7	6.295E-6
Representative Case U1	6.704E-7	N/A	8.348E-8	7.539E-7
No FLEX U2	6.13E-6	3.96E-6	2.714E-7	1.03E-5
Nominal FLEX U2	3.73E-6	3.96E-6	2.714E-7	7.96E-6
N+1 FLEX U2	3.08E-6	3.96E-6	2.714E-7	7.31E-6
N+1 FLEX and SAFER U2	2.83E-6	3.96E-6	2.714E-7	7.06E-6
Licensee Rep Case U2	1.39E-6	3.96E-6	2.714E-7	5.62E-6
Licensee No potential for common cause (CC) U2	1.04E-6	3.81E-6	2.714E-7	5.12E-6
Licensee Truncation	1.39E-6	5.32E-6	2.714E-7	6.98E-6
Fail to Load run U2	2.11E-6	3.96E-6	2.714E-7	6.34E-6
PD no Potential	2.40E-6	3.81E-6	2.714E-7	6.48E-6

for CC U2				
Long Term offsite power restoration events removed U2	1.25E-6	3.96E-6	2.714E-7	5.48E-6
PD no Potential for CC U1	2.81E-7	N/A	8.348E-8	3.645E-7
Upper Bound U2	3.73E-6	5.32E-6	2.714E-7	9.32E-6
Lower Bound U2	1.04E-6	3.81E-6	2.714E-7	5.12E-6
Upper Bound U1	6.704E-7	N/A	8.348E-8	7.539E-7
Lower Bound U1	2.81E-7	N/A	8.348E-8	3.645E-7

Contributions from External Events:

Since change in core damage frequency (CDF) for internal events sequences was greater than 1E-7 external events were required to be considered. The licensee's draft fire PRA is considered the best available information in this case. Table 7-1 summarizes the licensee's results and sensitivities. The SRA also considered Internal Flooding, Seismic and Tornado High winds using the SPAR model. The delta CDF for internal flooding was negligible because flooding sequences which affected the Emergency Switchgear room also failed the 2J EDG as a consequence of the flood so the 2J EDG FTS does not appear in the cutsets for flooding as expected. Seismic and Tornado/High Winds were also minimal contributors.

Table 7-1 – Quantification and Sensitivity Study Results

Case	Truncation	Base	Re-Baseline (RBase)	Conditional (CRA)	Delta CDF (Annual)	Delta CDF (92d/365d Exposure Interval)	Factor Increase
Internal Events	1.00E-12	9.57E-07	9.06E-07	6.42E-06	5.51E-06	1.39E-06	-
Internal Fire	1.00E-09	4.46E-05	4.32E-05	5.89E-05	1.57E-05	3.96E-06	2.85
Truncation Sensitivity							
Internal Fire	1.00E-10	-	5.31E-05	7.42E-05	2.11E-05	5.32E-06	3.83
Un-Modified Model Sensitivity							
Internal Fire	1.00E-09	-	1.9059E-03	1.9237E-03	1.78E-05	4.49E-06	3.23
No Common-Cause Failure Sensitivity							
Internal Events	1.00E-12	9.57E-07	9.06E-07	5.03E-06	4.12E-06	1.04E-06	-
Internal Fire	1.00E-09	4.46E-05	4.32E-05	5.83E-05	1.51E-05	3.81E-06	3.66

Potential Risk Contribution from Large Early Release Frequency (LERF):

The SRA screened the finding for LERF in accordance IMC 0609 Appendix H. This would be a Type A finding at power. Per Table 6.1 Phase 1 Screening-Type A Findings at Full Power for a PWR with a Large Dry Sub atmospheric containment, SBO sequences screen out as they are not a LERF contributor and are GREEN for LERF.

Qualitative Risk Considerations

The SPAR model Only models Unit 1; however, the offsite power distribution configurations do differ between units. For Example, both the 2J and 1H emergency busses are fed from transfer bus F and SUT C while the 1J emergency bus is exclusively fed the D transfer bus and the A SUT. Additionally, a one-time configuration cross connecting the A and B SUT via the 0L Bus (for the SBO EDG) was approved and implemented. Thus, it is reasonable the 2J Bus could be fed via the 1H EDG thru the F Transfer Bus or via the A and/or B SUTs via the

0L and 0M SBO busses; however, there are no procedures directing this. Also, while procedure would allow the SBO EDG to be aligned to a unit with one vital bus deenergized, the operators would most likely re-align the SBO diesel to the other unit if both vital buses were deenergized. (The SPAR logic does not consider this)