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

May 9, 2024

John A. Krakuszeski
Site Vice President
Duke Energy Progress, LLC
8470 River Road SE
M/C BNP04
Southport, NC 28461-0429

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT – INTEGRATED INSPECTION REPORT 05000324/2024001 AND 05000325/2024001

Dear John A. Krakuszeski:

On March 31, 2024, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Brunswick Steam Electric Plant. On April 30, 2024, the NRC inspectors discussed the results of this inspection with Jay Ratliff 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. Two of these 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.

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 Brunswick Steam Electric Plant.

If you disagree with a cross-cutting aspect assignment in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region II; and the NRC Resident Inspector at Brunswick Steam Electric Plant.

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 Fannon, Matthew
on 05/09/24

Matthew S. Fannon, Chief
Reactor Projects Branch 4
Division of Reactor Projects

Docket Nos. 05000324 and 05000325
License Nos. DPR-62 and DPR-71

Enclosure:
As stated

cc w/ encl: Distribution via LISTSERV

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT – INTEGRATED INSPECTION REPORT 05000324/2024001 AND 05000325/2024001 DATED MAY 9, 2024

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ADAMS ACCESSION NUMBER: **ML24129A059**

X SUNSI Review		X Non-Sensitive ☐ Sensitive		X Publicly Available ☐ Non-Publicly Available	
OFFICE	RII/DRP	RII/DRP	RII/DRP		
NAME	J. Seat	G. Smith	M. Fannon		
DATE	5/9/2024	5/8/2024	5/9/2024		

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U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Numbers:	05000324 and 05000325
License Numbers:	DPR-62 and DPR-71
Report Numbers:	05000324/2024001 and 05000325/2024001
Enterprise Identifier:	I-2024-001-0020
Licensee:	Duke Energy Progress, LLC
Facility:	Brunswick Steam Electric Plant
Location:	Southport, NC
Inspection Dates:	January 01, 2024 to March 31, 2024
Inspectors:	C. Curran, Resident Inspector J. Diaz-Velez, Senior Health Physicist S. Downey, Senior Reactor Inspector K. Pfeil, Resident Inspector J. Rivera, Health Physicist G. Smith, Senior Resident Inspector
Approved By:	Matthew S. Fannon, 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 Brunswick Steam Electric Plant, 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

Inadequate Procedures Resulted in Damage to a Current Transformer and Subsequent Emergency Diesel Generator Fire			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000324/2024001-01 Open/Closed	[H.1] - Resources	71111.12
A self-revealed Green finding and associated non-cited violation (NCV) of technical specification 5.4.1.a, was identified for the licensee's failure to maintain adequate procedural guidance in testing procedure 0PM-GEN009D, "DG-4 Generator Voltage Regulator (Basler) Calibration," Rev. 3, regarding the testing of K1 relays.			

Failure to Maintain Adequate Procedures Related to Safety Relief Valve Maintenance Resulted in a Condition Prohibited by Technical Specifications			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Barrier Integrity	Green NCV 05000325,05000324/2024001-02 Open/Closed	[H.1] - Resources	71152A
A self-revealed Green finding and associated non-cited violation (NCV) of technical specification 3.4.3, was identified for the licensee's failure to maintain 10 operable safety relief valves (SRVs).			

Additional Tracking Items

Type	Issue Number	Title	Report Section	Status
LER	05000325/2023-001-00	LER 2023-001-00 for Brunswick Steam Electric Plant, Unit 1, Loss of Redundant Power Supply Operation Causes Turbine Trip and Subsequent Reactor Scram	71153	Closed
LER	05000324/2023-001-00	LER 2023-001-00 for Brunswick Steam Electric Plant, Unit No. 2, Two Main Steam Line Safety Relief Valves Inoperable	71153	Closed

PLANT STATUS

Unit 1 began the period at 100 percent rated thermal power (RTP) and operated at or near RTP until February 9, 2024, when the unit was shut down for a refueling outage. Following completion of the refueling outage, the reactor was taken critical on March 12 and a plant startup was commenced. On March 14, the main generator output breaker was closed, and a power ascension was commenced. Unit 1 reached RTP on March 21 following two rod improvements and continued to operate there for the remainder of the inspection period.

Unit 2 began the period at RTP and operated there until March 22 when power was reduced to 70 percent RTP to perform a control rod sequence exchange and turbine valve testing. Following the valve testing, sequence exchange, and one control rod improvement, the unit was restored to full RTP on March 25, where it continued to operate for the remainder 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

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 in preparation for winter storm Finn on January 9, 2024.

71111.05 - Fire Protection

Fire Area Walkdown and Inspection Sample (IP Section 03.01) (4 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) Unit 1 23’ cable spreading and 1A/1B battery rooms on February 7, 2024
(2) Unit 2 23’ cable spreading and 2A/2B battery rooms on February 7
(3) Unit 1 20’ turbine building condenser bay on February 22
(4) Unit 1 45’ turbine building condenser bay, ‘A’ feedwater heater room, and ‘B’ feedwater heater room on February 29

71111.07A - Heat Exchanger/Sink Performance

Annual Review (IP Section 03.01) (1 Sample)

On March 31, 2024, the inspectors completed an evaluation of the readiness and performance of:

(1) Unit 1 'B' residual heat removal (RHR) heat exchanger

71111.08G - Inservice Inspection Activities (BWR)

BWR Inservice Inspection Activities Sample - Nondestructive Examination and Welding Activities (IP Section 03.01) (1 Sample)

The inspectors evaluated boiling water reactor non-destructive testing by reviewing the following examinations from February 19 - February 23, 2024:

(1)
1. Liquid Penetrant Examination
    a. Weld No. 13 on Line 1-E11-119-3/4-300, socket weld, ASME Class 2. This included a review of associated welding activities (work order [WO]13534924)
    b. Weld No. 9-1 on Line 1-E11-119-3/4-300, socket weld, ASME Class 2. This included a review of associated welding activities (WO13534924)
2. Magnetic Particle Examination
    a. 1-E21-4CH51-ATT, welded attachment, ASME Class 1
3. Ultrasonic Examination
    a. 1B11-RPV-N4B, nozzle (N4B) to vessel weld, ASME Class 1
    b. 1B11-RPV-N4B-IRS, reactor pressure vessel nozzle (N4B) inner radius, ASME Class 1
    c. 1B21N4B-3-FWN4B135-1, feedwater safe end weld, ASME Class 1
    d. 1B21PS2D1-24-SWA, pipe to elbow weld, ASME Class 1
    e. 1B21PS2D1-24-SWB, elbow to pipe weld, ASME Class 1
4. Visual Examination
    a. VT-1 of 1-SW-103PG124-ATT, welded attachment, ASME Class 3
    b. VT-3 of 1-SW-103PG124, support, ASME Class 3

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 control room during the Unit 1 final feedwater temperature power/reactivity adjustments on January 8 and January 18, 2024.

71111.12 - Maintenance Effectiveness

Maintenance Effectiveness (IP Section 03.01) (1 Sample)

The inspectors evaluated the effectiveness of maintenance to ensure the following structures, systems, and components (SSCs) remain capable of performing their intended function:

(1) Emergency diesel generator (EDG)-4 current transformer (CT) failure on October 15, 2023 (nuclear condition report [NCR] 2490446)

71111.13 - Maintenance Risk Assessments and Emergent Work Control

Risk Assessment and Management Sample (IP Section 03.01) (2 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) Emergent failure of Unit 1 residual heat removal service water (RHRSW) outlet valve, 1E11-PDV-F068B on January 25, 2024
(2) Decay heat removal operations using natural circulation from February 20, 2024 to February 28, 2024

71111.15 - Operability Determinations and Functionality Assessments

Operability Determination or Functionality Assessment (IP Section 03.01) (7 Samples)

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

(1) Auto start of all four EDGs (NCR 2499358)
(2) Unit 1 safety relief valve ‘J’ adverse temperature trend (NCR 2487663)
(3) Unit 1 RHRSW outlet valve, 1-E11-PDV-F068B, motor overload (NCR 2502369)
(4) Unit 1 high battery cell level (NCR 2503438)
(5) Copper nickel elbows Part 21 Evaluation (NCR 2497086)
(6) Unit 1 'D' source range monitor preamplifier signal noise (NCR 2506529)
(7) Visual examinations of the torus liner below the water line (NCR 2507588 and engineering change [EC] 423910)

71111.18 - Plant Modifications

Temporary Modifications and/or Permanent Modifications (IP Section 03.01 and/or 03.02) (2 Samples)

The inspectors evaluated the following temporary or permanent modifications:

(1) Temporary modification to increase alarm setpoint, "1-B21-F013J Tailpipe Temperature," for temperature element 1-B21-TE-N004J due to nuisance annunciator (EC 423648)
(2) Unit 1 Main Generator Auto Voltage Regulator Replacement (EC 419653)

71111.20 - Refueling and Other Outage Activities

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

(1) The inspectors evaluated Unit 1 refueling outage, 1BR26, activities from February 12 to March 14, 2024.

71111.24 - Testing and Maintenance of Equipment Important to Risk

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

Post-Maintenance Testing (PMT) (IP Section 03.01) (2 Samples)

(1) Pressure testing following replacement of EDG-4 red station shuttle valve, 2-DSA-V188, in accordance with (IAW) WO20582318
(2) 2PT-24.1-2 “Service Water Pump and Discharge Valve Operability Test” Rev. 93 following maintenance on the Unit 2 'C' conventional service water discharge valve, 2-SW-17, IAW WO 20599922 and WO20593001

Surveillance Testing (IP Section 03.01) (4 Samples)

(1) 2MST-SW12Q, “SW Diesel Generator Cooling Water Supply Low Pressure Functional Test,” for EDG-3, 2-SW-PS-1996 on January 4, 2024
(2) 0PT-20.6, “Drywell to Torus Leak Rate Test,” Rev. 52 on March 9, 2024
(3) 0PT-20.5, "Integrated Primary Containment Leak Rate Test (ILRT),” Rev. 60 on March 9, 2024
(4) 0PT-80.1, “Reactor Pressure Vessel ASME Section XI Pressure Test,” Rev. 83 on March 11, 2024

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

(1) Local leak rate testing of main steam isolation valves (MSIVs) ‘A’, ‘B’, and ‘C’ penetrations on February 12, 2024, IAW 0PT-20.3A.5, MSIV Leak Test,” Rev 16

RADIATION SAFETY

71124.01 - Radiological Hazard Assessment and Exposure Controls

Radiological Hazard Assessment (IP Section 03.01) (1 Sample)

(1) The inspectors evaluated how the licensee identifies the magnitude and extent of radiation levels and the concentrations and quantities of radioactive materials and how the licensee assesses radiological hazards.

Instructions to Workers (IP Section 03.02) (1 Sample)

(1) The inspectors evaluated how the licensee instructs workers on plant-related radiological hazards and the radiation protection requirements intended to protect workers from those hazards.

Contamination and Radioactive Material Control (IP Section 03.03) (2 Samples)

The inspectors observed/evaluated the following licensee processes for monitoring and controlling contamination and radioactive material:

(1) Workers exiting the radiologically controlled area (RCA) during Unit 1 refueling outage.
(2) Workers exiting the drywell during Unit 1 refueling outage.

Radiological Hazards Control and Work Coverage (IP Section 03.04) (4 Samples)

The inspectors evaluated the licensee's control of radiological hazards for the following radiological work:

(1) Radiation Work Permit (RWP) no. 1500, task no. 7, "RB - TORUS DIVING-CLEANING (DIVERS ONLY) - HIGH RISK- LHRA/HCA", Rev. 25
(2) RWP no. 1500, task no. 26, "Torus Filter Removal - High Risk - SOER 01-1", Rev. 24
(3) RWP no. 1535, task no. 6, "RB/TB/BOP - MECHANICAL PM & CM/SUPPORT ACTIVITIES - LOW RISK (RA/CA)", Rev. 07 (for MSIV)
(4) RWP no. 1554, task no. 1, "RB RWCU Piping/Valve Replacement and Support - LOW RISK (RA/CA)", Rev. 07

High Radiation Area and Very High Radiation Area Controls (IP Section 03.05) (4 Samples)

The inspectors evaluated licensee controls of the following high radiation areas (HRAs) and very high radiation areas (VHRAs):

(1) Unit 1 drywell
(2) Unit 1 torus
(3) Unit 1 “B” reactor feed pump room
(4) Unit 1 primary sample station

Radiation Worker Performance and Radiation Protection Technician Proficiency (IP Section 03.06) (1 Sample)

(1) The inspectors evaluated radiation worker and radiation protection technician performance as it pertains to radiation protection requirements.

71124.08 - Radioactive Solid Waste Processing & Radioactive Material Handling, Storage, & Transportation

Radioactive Material Storage (IP Section 03.01) (3 Samples)

The inspectors evaluated the licensee's performance in controlling, labeling, and securing the following radioactive materials:

(1) Low level waste warehouse building
(2) Low level waste warehouse yard
(3) Sealed sources in rooms 1-020 and 1-021

Radioactive Waste System Walkdown (IP Section 03.02) (3 Samples)

The inspectors walked down the following accessible portions of the solid radioactive waste systems and evaluated system configuration and functionality:

(1) Unit 1, condensate phase separators
(2) Unit 0, radwaste control room / radwaste processing area (including radwaste de-watering skid and Iso-Lock sampler)
(3) Unit 1, spent resin tank area (pumps, valves, pipes)

Waste Characterization and Classification (IP Section 03.03) (3 Samples)

The inspectors evaluated the following characterization and classification of radioactive waste:

(1) Reactor water cleanup (RWCU) resin, sample #495545001, shipment 22-089
(2) Dry active waste (DAW), sample #580465001 IL, shipment 24-042
(3) Irradiated hardware (metal oxides) sample #712385-5, shipment 23-165a

Shipment Preparation (IP Section 03.04) (1 Sample)

(1) The inspectors observed the preparation of radioactive shipment 24-042 of dry active waste on March 5, 2024.

Shipping Records (IP Section 03.05) (5 Samples)

The inspectors evaluated the following non-excepted radioactive material shipments through a record review:

(1) Shipment #23-165a, Fuel Pool Irradiated Hardware, Type (B)
(2) Shipment #24-025, DAW, Type (B)
(3) Shipment #24-026, DAW, LSA-I
(4) Shipment #22-089, RWCU Powdex Resin, Type (B)
(5) Shipment #23-140, Filters (DAW), Type (B)

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, 2023 through December 31, 2023)
(2) Unit 2 (January 1, 2023 through December 31, 2023)

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

(1) Unit 1 (January 1, 2023 through December 31, 2023)
(2) Unit 2 (January 1, 2023 through December 31, 2023)

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

(1) Unit 1 (January 1, 2023 through December 31, 2023)
(2) Unit 2 (January 1, 2023 through December 31, 2023)

OR01: Occupational Exposure Control Effectiveness Sample (IP Section 02.15) (1 Sample)

(1) February 18, 2023 through March 8, 2024

71152A - Annual Follow-up Problem Identification and Resolution

Annual Follow-up of Selected Issues (Section 03.03) (2 Samples)

The inspectors reviewed the licensee's implementation of its corrective action program related to the following issues:

(1) Unit 1 automatic scram (NCR 2469554)
(2) Two Unit 2 safety relief valves did not meet technical specification (TS) requirements during B2C25 as-found testing (NCR 2473875)

71153 - Follow Up of Events and Notices of Enforcement Discretion

Event Report (IP Section 03.02) (2 Samples)

The inspectors evaluated the following licensee event reports (LERs):

(1) LER 05000324/2023-001-00, Two Main Steam Line Safety Relief Valves Inoperable, (ADAMS Accession No. ML23199A224). Following completion of the spring 2023 Unit 2 refueling outage, testing revealed two safety relief valves failed their acceptance criteria. This was in contrast to TS requirement 3.4.3 which requires that 10 of 11 valves shall be operable in Modes 1,2, and 3. The inspection conclusions associated with this LER are documented in this report under Inspection Results Section 71152A. This LER is Closed.

(2) LER 05000325/2023-001-00, Loss of Redundant Power Supply Operation Causes Turbine Trip and Subsequent Reactor Scram, (ADAMS Accession No. ML23166A081). On April 20, 2023, Unit 1 experienced a turbine trip and a subsequent reactor scram due to the failure of a 24-volt auctioneered power supply located within the turbine protection system. As a result of the loss of the power supply, the turbine bypass valves were non-functional, and the operators stabilized reactor pressure initially using the safety relief valves followed by use of the turbine drain valves. The operators quickly stabilized the plant in Mode 3. All safety systems functioned as expected. The inspectors performed a detailed review of the root cause of this event as documented in Section 71152A of this report. The inspectors determined that the cause of the condition described in the LER was not reasonably within the licensee's ability to foresee and correct, and therefore was not reasonably preventable. No performance deficiency nor violation of NRC requirements was identified. This LER is closed.

INSPECTION RESULTS

<table>
<tr><td colspan="4">Inadequate Procedures Resulted in Damage to a Current Transformer and Subsequent Emergency Diesel Generator Fire</td></tr>
<tr><td>Cornerstone</td><td>Significance</td><td>Cross-Cutting Aspect</td><td>Report Section</td></tr>
<tr><td>Mitigating Systems</td><td>Green
NCV 05000324/2024001-01
Open/Closed</td><td>[H.1] - Resources</td><td>71111.12</td></tr>
<tr><td colspan="4">A self-revealed Green finding and associated non-cited violation (NCV) of technical specification 5.4.1.a, was identified for the licensee's failure to maintain adequate procedural guidance in testing procedure 0PM-GEN009D, "DG-4 Generator Voltage Regulator (Basler) Calibration," Rev. 3, regarding the testing of K1 relays.</td></tr>
<tr><td colspan="4"><u>Description</u>: On October 15, 2023, Brunswick declared a Notification of Unusual Event (NOUE) due to a fire in the emergency diesel building lasting longer than 15 minutes. At the time of the event, EDG-4 was running for post maintenance testing and was shut down upon indication of a fire in the EDG basement and resultant Halon discharge/actuation. The dispatched fire brigade noted an acrid odor near an EDG-4 transformer but could not identify any active fire in the room. Initial investigation indicated damage to one of the three EDG-4 current transformers (CTs), ('B' phase CT, CT2-DG4-CT). During investigation into the cause of the damage to the EDG-4 'B' phase CT, the licensee determined that maintenance and testing on EDG-4 the week prior had potentially damaged (or weakened) multiple components including the CT.</td></tr>
</table>

Prior to the event, on October 14, 2023, following replacement of six-cylinder liner O-ring packages on EDG-4, a standard 24-month preventive maintenance (PM) was performed. During the performance of the PM using testing procedure 0PM-GEN009D, "DG-4 Generator Voltage Regulator (Basler) Calibration," the 2-DG4-K1 relay failed, and the test was halted. Testing was resumed after replacement of the relay but was again halted when operators were unable to flash the field on EDG-4. On October 15, 2023, it was identified that fuse 2-DG4-C6FU was blown. After replacement of the fuse, the licensee continued with PM testing until fire alarms were received in the control. After the EDG-4 'B' phase CT was determined to be the cause of the fire alarms and Halon discharge, all three CTs (one for each phase) associated with EDG-4 voltage regulator circuitry, were replaced.

Following replacement of all EDG-4 CTs, the licensee commenced a detailed causal analysis of the failure of all three electrical components (relay, fuse, and CT). It was ultimately determined that the cause of the relay, fuse, and CT failures, was improper operation of the excitation system. Specifically, the 2-DG4-K1 relay and 2-DG4-C6FU fuse simultaneously received start and stop signals, resulting in electrical transients and internal damage to both electrical components. Due to the cycling of the 2-DG4-K1 relay, the secondary side of 2-DG4-CT appeared as an open circuit. This resulted in no path for the CT current to flow, causing an increasing primary magnetizing force and an extremely high induced voltage in the secondary. In general, operation of a CT with the primary energized and the secondary in an open circuit condition, should be avoided to prevent damage to the CT due to potentially high generated currents. The improper operation of the excitation system was attributed to the testing setup required IAW 0PM-GEN009D. The procedure required that an exciter-stop jumper be installed prior to performing testing. This jumper bypasses the protective trips and creates a constantly energized circuit path to the 2-DG4-K1 trip coil, resulting in the cycling between open and closed positioning, that ultimately damaged the relay, fuse, and CT. The causal team attributed the failure to procedure 0PM-GEN009D not containing sufficient detail to ensure that Section 7.7 of the procedure was not implemented while the EDG-4 was running. The inadequate maintenance performed on October 15, contributed to damaging the EDG-4 'B' phase CT, thus creating a latent failure mode that manifested during a loaded post-maintenance testing run on October 15, and ultimately led to a fire in the EDG basement.
Corrective Actions: The immediate corrective action was to replace all three CTs associated with EDG-4. Additionally, the licensee revised EDG testing procedures, including 0PM-GEN009D, to ensure that future testing would only be completed with EDG-4 secured.

Corrective Action References: NCR 02490446, “DG4 Transformer Damage during DG4 break in run,” October 16, 2023

Performance Assessment:

Performance Deficiency: The licensee's failure to maintain adequate instructions pertaining to testing of safety-related systems as required by TSs was determined to be 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, lack of procedural guidance led to damage of multiple electrical components associated with EDG operation and resulted in the EDG building basement fire and declaration of a NOUE.

Significance: The inspectors assessed the significance of the finding using IMC 0609 Appendix A, “The Significance Determination Process (SDP) for Findings At-Power.” A regional Senior Reactor Analyst (SRA) performed a detailed risk assessment for the event. The SRA modelled the condition using SAPHIRE 8, version 8.2.9 and the Brunswick Unit 2 SPAR model, version 8.82, dated August 30, 2023. The SRA modelled the event as a fire in fire area FC238 to get the conditional core damage frequency for a fire in the space, and then applied the non-success probabilities for detection and suppression. The dominant fire sequence was a fire in fire area FC238 which results in a loss of offsite power and failure of the high-pressure coolant injection pump, a concurrent failure of the reactor core isolation cooling pump, and failure of operators to manually depressurize the RCS. The change in core damage frequency was less than 1 E-6 event/yr, which corresponds to a finding of very low safety significance (GREEN). Cross-Cutting Aspect: H.1 - Resources: Leaders ensure that personnel, equipment, procedures, and other resources are available and adequate to support nuclear safety.
Enforcement: Violation: Technical specification 5.4.1.a, "Administrative Control (Procedures)," states in part, that written procedures shall be established, implemented, and maintained covering the following activities including the applicable procedures recommended in Regulatory Guide 1.33, Appendix A, November 1972 (Safety Guide 33, November 1972). Safety Guide 33, Appendix A, Section I.1, states in part, that maintenance that can affect the performance of safety-related equipment should be properly planned and performed in accordance with written procedures, documented instructions, or drawings appropriate to the circumstances. Contrary to the above, on October 15, 2023 the licensee failed to maintain properly written procedures associated with maintenance affecting the performance of safety-related equipment. Specifically, maintenance procedure, 0PM-GEN009D, “DG-4 Generator Voltage Regulator (Basler) Calibration,” Rev. 3, failed to prevent damage to EDG components caused by concurrent operation and calibration of the EDG. Enforcement Action: This violation is being treated as a non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.

Failure to Maintain Adequate Procedures Related to Safety Relief Valve Maintenance Resulted in a Condition Prohibited by Technical Specifications			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Barrier Integrity	Green NCV 05000325,05000324/2024001-02 Open/Closed	[H.1] - Resources	71152A
A self-revealed Green finding and associated non-cited violation (NCV) of technical specification 3.4.3, was identified for the licensee's failure to maintain 10 operable safety relief valves (SRVs).			
Description: On May 23, 2023, Brunswick Nuclear Plant received an external test report associated with the 11 main steam line SRVs that were removed from Unit 2 during the spring 2023 refuel outage (RFO). The report noted that two of the 11 valves were found to have as found pilot valve lift setpoints outside the +/-3 percent tolerance required by TS 3.4.3, which requires 10 of the 11 installed SRVs to be operable. One valve lifted 3.8 percent above			

TS requirements and the other lifted 5.0 percent below. Corrosion bonding and a combination of degraded pilot valve assembly sub-component were the noted possible causes.

The licensee initiated an evaluation resulting in a causal report confirming the potential causes listed in the external test result report. Corrosion bonding is a known industry issue with SRVs due to the high temperature environments in which they operate. Corrosion causes the two plates of the SRV pilot valve to bond together, thus increasing lift setpoints. The valve with the lift setpoint above the TS limit was tested two additional times prior to any work being performed. The results for both subsequent tests were within TS requirements reinforcing the causal report findings.

During each RFO, all 11 SRV pilot valves are removed and shipped to a testing facility. The SRV pilot valves are tested and then refurbished to use as certified replacements during an upcoming RFO. Valves that fail testing requirements are rebuilt with new pilot valve spring sets. SRV pilot valve spring sets are delivered as a matched set and are meant to be installed as a set due to the machining process that ensures that all three set pieces fit together appropriately. During the disassembly of the second failed SRV (lift setpoint well below TS limits), it was noted that the pilot valve spring sets serial numbers did not match, meaning they were not installed as matched set. Upon completion of the casual evaluation, it was concluded that the mismatch in spring set serial numbers resulted in the SRV failing to meet TS lift set-point requirements.

Corrective Actions: All 11 of the SRV pilot valves were replaced with certified spares before Unit 2 startup from the spring 2023 RFO. The licensee confirmed that all other valves removed from Unit 2 during the spring 2023 RFO have matching spring sets and rebuild paperwork for all valves in operation in Unit 2 and Unit 2 document matching spring sets. The licensee issued written instructions to the vendor currently contracted to rebuild SRV pilot valves for Brunswick to ensure that all spring sets installed will have matching part numbers for all current and future rebuilds.

Corrective Action References: NCR 02473875, "Two Unit 2 SRVs did not meet TS requirements-B2C25 as-found testing" May 24, 2023

Performance Assessment:

Performance Deficiency: The licensee's failure to maintain 10 operable safety relief valves as required by TS was determined to be 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, lack of procedural guidance led to a mismatched spring set being installed in a SRV resulting in the SRV failing to open within the TS required pressure ranges.

Significance: The inspectors assessed the significance of the finding using IMC 0609 Appendix A, “The Significance Determination Process (SDP) for Findings At-Power.” The probabilistic risk assessment (PRA) function of the SRV’s appears to have been met even with the test failure. For the automatic depressurization system (ADS) manual depressurization function, the PRA success criteria is five of 11 SRVs open on demand, and for the pressure relief function one SRV is allowed to fail in the most limiting condition of an

anticipated transient without scram. Since the affected SRV lifted low, the pressure relief function was still maintained. When running the SPAR model to confirm this (SRVs are modelled with both valves conservatively failed), the results truncate out in insignificant values. Thus, the failure is of very low safety significance (GREEN). Cross-Cutting Aspect: H.1 - Resources: Leaders ensure that personnel, equipment, procedures, and other resources are available and adequate to support nuclear safety.
Enforcement: Violation: Technical specification 3.4.3, "Safety/Relief Valves (SRVs)," states in part, that 10 SRVs shall be operable. Contrary to the above, the licensee failed to maintain at least 10 operable SRVs during the previous RFO cycle (2021 - 2023) due to two SRVs failing set point testing on May 23, 2023. 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 April 30, 2024, the inspectors presented the integrated inspection results to John A. Krakuszeski, Site Vice President, and other members of the licensee staff.
- On February 22, 2024, the inspectors presented the in-service inspection results to Jay Ratliff, Plant General Manager, and other members of the licensee staff.
- On March 13, 2024, the inspectors presented the occupational radiation safety and transportation baseline inspection results to John A. Krakuszeski, Site Vice President, and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71111.08G	NDE Reports	B1-00173	Ultrasonic Examination of Nozzle (N4B) to Vessel Weld, 1B11-RPV-N4B	02/24/2024
		B1-00174	Ultrasonic Examination of 1B11-RPV-N4B-IRS, Nozzle (N4B) Inner Radius	02/24/2024
		B1-02513	Magnetic Particle Examination of Welded Attachment, 1-E21-4CH51-ATT	02/24/2024
		B1-03354	Ultrasonic Examination of Pipe to Elbow Weld, 1B21PS2D1-24-SWA	02/24/2024
		B1-03356	Ultrasonic Examination of Elbow to Pipe Weld, 1B21PS2D1-24-SWB	02/24/2024
		B1-04037	Visual Examination (VT-3) of Support, 1-SW-103PG124	02/20/2024
		B1-04153	Visual Examination (VT-1) of Welded Attachment, 1-SW-103PG124-ATT	02/20/2024
	Work Orders	13534924-01, 13534924-16		
71124.01	Corrective Action Documents	CRs 02461706, 02462288, 02496638	Various	
	Procedures	0APP-G16-A2	RADWASTE ANNUNCIATOR PROCEDURES FOR PANEL 2-G16-A2	Rev. 28
	Radiation Surveys	BNP-M-20221130-3	2R70_2RB 9' HPCI Roof.001	11/30/2022
		BNP-M-20230220-3	2T10_2TB 20' Condenser Bay.001	02/20/2023
		BNP-M-20231203-3	1R77 1RB-17' SRHR Dose Rate Alarm Investigation	12/03/2023
71124.08	Corrective Action Documents	CRs 00244040, 02440403, 02428977, 02428981, 02441314, 02453102, and	Various	

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		02466267		