

UNITED STATES NUCLEAR REGULATORY COMMISSION

REGION II 245 PEACHTREE CENTER AVENUE N.E., SUITE 1200 ATLANTA, GEORGIA 30303-1200

May 10, 2022

Mr. 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 05000324/2022001 AND 05000325/2022001

Dear Mr. Krakuszeski:

On March 31, 2022, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Brunswick Steam Electric Plant. On May 4, 2022, 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.

One finding of very low safety significance (Green) is documented in this report. This finding involved a violation of NRC requirements. 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 violation or the significance or severity of the violation 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 <u>http://www.nrc.gov/reading-rm/adams.html</u> and at the NRC Public Document Room in accordance with Title 10 of the *Code of Federal Regulations* 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

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

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

Enclosure: As stated

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SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT – INTEGRATED INSPECTION REPORT 05000324/2022001 AND 05000325/2022001 – DATED May 10, 2021

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DATE	5/9/2022	5/10/2022			

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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:	05000324/2022001 and 05000325/2022001
Enterprise Identifier:	I-2022-001-0032
Licensee:	Duke Energy Progress, LLC
Facility:	Brunswick Steam Electric Plant
Location:	Southport, NC
Inspection Dates:	January 01, 2022 to March 31, 2022
Inspectors:	 C. Curran, Project Engineer J. Diaz-Velez, Senior Health Physicist B. Kellner, Senior Health Physicist A. Rosebrook, Senior Reactor Analyst M. Schwieg, Senior Reactor Inspector G. Smith, Senior Resident Inspector J. Zeiler, Senior Resident Inspector
Approved By:	Matthew F. Endress, Chief Reactor Projects Branch 4 Division of Reactor Projects

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

Temporary Loss of Shutdown Cooling						
Cornerstone	Significance	Cross-Cutting	Report			
		Aspect	Section			
Mitigating	Green	[H.5] - Work	71111.20			
Systems	NCV 05000325/2022001-01	Management				
	Open/Closed					
A self-revealing Gre	een finding and associated Non-cited Violation	tion (NCV) of 10 CI	FR			
50.65.a(4), was ide	ntified for the licensee's failure to adequate	ly assess the risk o	of			
simultaneously performing maintenance on two reactor vessel level transmitters on Unit 1						
during a refueling o	utage. The maintenance ultimately resulte	d in a temporary lo	ss of			
shutdown cooling w	hile in a reduced inventory condition.	-				

Additional Tracking Items

Туре	Issue Number	Title	Report Section	Status
LER	05000325,05000324/20	Licensee Event Report	71153	Closed
	21-001-00	(LER) 2021-001-00 for		
		Brunswick Steam Electric		
		Plant, Units 1 and 2,		
		Automatic Specified System		
		Actuation due to Loss of		
		Power to Emergency Bus E3		

PLANT STATUS

Unit 1 began the period at 100 percent (full) rated thermal power (RTP) and operated there until January 12, 2022, when power was reduced to 70 percent RTP for a planned control rod improvement. Following the rod improvement, the unit was restored to full RTP on January 13 where it continued to operate until January 24 when an end-of-life power coast-down was commenced. Power was slowly lowered to 96 percent RTP until January 31 when a rod improvement was performed to restore the unit to full RTP on February 2. The unit continued to operate at full RTP until February 11, when power was reduced to 70 percent RTP for a rod improvement. Following the rod improvement, the unit was restored to full RTP on February 12. The unit continued to operate at full RTP between February 12 and March 4 except for February 22 and February 24 when two small down power maneuvers to 90 percent RTP were performed for the purpose of performing the final feedwater temperature reduction adjustments. On March 5, the unit was shutdown for a refueling outage for the remainder of the inspection period.

Unit 2 began the period at 100 percent RTP and operated there until January 14, 2022, when power was reduced to 95 percent RTP for a planned resin bed changeout. Following replacement of the resin, the unit was restored to full RTP on January 15 where the unit continued to operate until January 28 when power was reduced to 49 percent RTP due to high hotwell conductivity. On January 29, the unit was shutdown to repair the water-box tube leakage causing the high hotwell conductivity as well as pursue reactor coolant system (RCS) leak repairs to alleviate preexisting elevated drywell leakage. Following repairs to the water-box and the RCS, the reactor was taken critical on February 3. Reactor power was then slowly raised to 20 percent RTP and the main generator was then synchronized to the grid on February 4. Following generator synchronization, power was raised to 30 percent RTP and held there until February 6 for completion of water-box testing. Following this testing, power ascension was commenced and the unit reached full RTP on February 14. The unit continued to operate at full RTP until February 22 when the unit was reduced in power to approximately 60 percent RTP in order to perform power suppression testing. This testing was necessary to deduce the location of a potential fuel leak discovered as a result of routine chemistry sampling. Following completion of power suppression testing and the insertion of one suppression control rod, the unit began a slow power ascension. Full RTP was achieved on March 7 and the unit continued to operate at that power level 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

71111.04 - Equipment Alignment

Partial Walkdown Sample (IP Section 03.01) (1 Sample)

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

(1) Unit 1 nuclear service water and conventional service water (CSW) while the 1B CSW pump was out-of-service for pump replacement, on January 20, 2022

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

(1) The inspectors evaluated system configurations during a complete walkdown of the fire suppression system completed on March 14, 2022

71111.05 - Fire Protection

Fire Area Walkdown and Inspection Sample (IP Section 03.01) (6 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 suppression building on January 26, 2022
- (2) Unit 1 control building 23' elevation, on February 19, 2022
- (3) Unit 2 control building 23' elevation, on February 19, 2022
- (4) Unit 1 'A' & 'B' feedwater heater rooms and the Unit 1 motor generator (MG) set room, on March 22, 2022
- (5) Unit 1 condenser bay north 45' elevation, on March 30, 2022
- (6) Unit 1 turbine building 38' and 41' elevations, Unit 1 electrohydraulic control (EHC), and lube oil rooms, on March 31, 2022

71111.07A - Heat Exchanger/Sink Performance

Annual Review (IP Section 03.01) (1 Sample)

The inspectors evaluated readiness and performance of:

(1) Unit 1 'A' residual heat removal (RHR) heat exchanger (HX) following opening of the HX on March 8, 2022, during a refueling outage

71111.08G - Inservice Inspection Activities (BWR)

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

- (1) The inspectors evaluated boiling water reactor nondestructive testing by reviewing the following examinations from March 7 to March 11, 2022:
 - 1. Ultrasonic examination

- a. Jet pump Instrumentation penetration 1B11N8A-JPI-FWRI22-1
- 2. Visual inspection
 - a. RHR service water booster pump 1A skid
- 3. Magnetic particle examinations
 - a. Service water line 1-SW-199/100 manway. This included a review of welding activities.
 - b. North RHR heat exchanger support 1-E11HX-1A-SUP270-ATT

71111.11Q - Licensed Operator Regualification 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 Unit 1 reactivity manipulations while bypassing feedwater heaters in accordance with 0GP-13, "Increasing Unit Capacity at End of Core Cycle," Rev 58 on March 1, 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) RHR pump seal cooling heat exchanger commercial grade dedication program and replacement activities to address American Society of Mechanical Engineers (ASME) Code requirements on March 17, 2022

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) Elevated risk due to removal and replacement of the 1B CSW pump on January 20, 2022
- (2) Yellow shutdown risk due to reduced inventory prior to installing reactor vessel head on March 30, 2022

71111.15 - Operability Determinations and Functionality Assessments

Operability Determination or Functionality Assessment (IP Section 03.01) (3 Samples)

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

(1) 2D RHR pump vibration in the alert range (nuclear condition report (NCR) 2405169, NCR 2375859, and NCR 2369816)

- (2) 2A CSW pump non-conforming motor leads (NCR 2405551)
- (3) Unit 1 reactor building interior railroad door seal failure (NCR 2409831)

71111.18 - Plant Modifications

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

The inspectors evaluated the following temporary or permanent modifications:

(1) Temporary fire protection water supply (Engineering Change 420076). Temporary water supply was required during the extended cleaning of the fire protection water supply tank

71111.19 - Post-Maintenance Testing

Post-Maintenance Test Sample (IP Section 03.01) (2 Samples)

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

- (1) Relay functional testing following replacement of four Unit 1 'A' train standby gas treatment (SBGT) environmentally qualified relays 1-SGT-1A-RB-CR1, 1-SGT-1A-RB-CR2, 1-SGT-1A-RB-CR1-X-A, 1-SGT-1A-RB-CR1-X-B in accordance with work order (WO) 20381337
- (2) 1PT-24.1-1, "Service Water Pump and Discharge valve Operability Test," Rev 96 following the Unit 1 'B' conventional service water pump replacement in accordance with WO 13458095

71111.20 - Refueling and Other Outage Activities

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

- (1) The inspectors evaluated Unit 2 maintenance outage activities to locate and reduce drywell in-leakage as well as repair condenser tube leaks in the 'B' north and south condenser water boxes. Outage activities were conducted from January 28, 2022 through February 6, 2022.
- (Partial)
 The inspectors evaluated a Unit 1 refueling outage B1R24 from March 5, 2022 through the end of the inspection period.

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) (1 Sample)

(1) 0PT-12.2.D, "No.4 Diesel Generator Monthly Load Test," Rev. 126, on March 3, 2022

Inservice Testing (IP Section 03.01) (1 Sample)

(1) 1PT-24.1-1, "Service Water Pump and Discharge Operability Test," Rev. 97 associated with the Unit 1 'A' and 'B' nuclear service water pump quarterly operability test performed, on January 22, 2022

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

(1) Local leak rate testing (LLRT) on Unit 1 RHR shutdown cooling containment isolation valves 1-E11-F008 and 1-E11-F009, on March 16, 2022

71114.06 - Drill Evaluation

<u>Select Emergency Preparedness Drills and/or Training for Observation (IP Section 03.01) (1</u> <u>Sample)</u>

(1) The inspectors evaluated a quarterly emergency drill conducted on February 23, 2022. The emergency drill involved a loss of off site power (Notice of Unusual Event) followed by a loss of EDG-3 (Alert). A loss of the division II battery charger subsequently leads to a loss of both Unit 2 station DC batteries (Site Area Emergency) due to a lack of charging capability.

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) (3 Samples)

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

- (1) Workers exiting different Radiologically Controlled Areas and processing small items or articles.
- (2) Licensee performing surveys of potentially contaminated material leaving the RCA via the Hot Tool Room.
- (3) Licensee performing radiological surveys pursuant to shipment preparation activities.

Radiological Hazards Control and Work Coverage (IP Section 03.04) (5 Samples)

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

- (1) ALARA Plan 1503, CRDM Exchange Rev. 0, (B1R24)
- (2) ALARA Plan 1526, Reactor Reassembly Activities Rev. 0, (B1R24)
- (3) ALARA Plan 1558, Replace Valve 1-G31-F004 Rev. 0, (B1R24)
- (4) ALARA Plan 2503, CRD Exchange and Support Activities (B2R25, including inprogress-reviews and post-job review)
- (5) ALARA Plan 2526, Reactor Reassembly (B2R25, including in-progress and post-job review)

High Radiation Area and Very High Radiation Area Controls (IP Section 03.05) (5 Samples)

The inspectors evaluated licensee controls of the following High Radiation Areas and Very High Radiation Areas:

- (1) Unit 1 & 2, A & B Reactor Feed Pump Room (four doors)
- (2) Radwaste Building, 23' elevation, Unit 1 & 2, Regen Room doors
- (3) Radwaste Building , 3' elevation, Waste Storage Tank Room door
- (4) Unit 1, Tip Room (LHRA)
- (5) Unit 1, Reactor Building, 80' elevation Fuel Pool Cooling (LHRA)

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.

<u>71124.08 - Radioactive Solid Waste Processing & Radioactive Material Handling, Storage, &</u> <u>Transportation</u>

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) Inspectors evaluated the licensee's performance in controlling, labeling and securing radioactive materials in the low level radioactive waste building.
- (2) Inspectors evaluated the licensee's performance in controlling, labeling and securing radioactive materials in various areas outside the protected area including the CVan Storage Area (CVSA), and turbine rotor storage area.
- (3) Inspectors evaluated the licensee's performance in controlling, labeling and securing radioactive materials in various areas inside the protected area.

Radioactive Waste System Walkdown (IP Section 03.02) (2 Samples)

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

(1) Inspectors walked down and observed material condition of accessible portions of the solid radioactive waste systems and evaluated system configuration and functionality

of the resin transfer system.

(2) Inspectors walked down new event based liquid radwaste processing skid installed in the old drumming area located in the radwaste processing building.

Waste Characterization and Classification (IP Section 03.03) (2 Samples)

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

- (1) 2019 Brunswick Nuclear Plant 10 CFR 61 Station Report (AD-RP-ALL-5002) Change 1, 5/28/2020
- (2) 2021 Brunswick Nuclear Plant 10 CFR 61 Station Report DRAFT (AD-RP-ALL-5002), 2/20/2022

Shipment Preparation (IP Section 03.04) (1 Sample)

(1) The inspectors observed the shipment preparation of radioactive shipment # 22-028.

Shipping Records (IP Section 03.05) (5 Samples)

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

- (1) Shipment # 20-174, Class A Bead Resin in Liner Serial # 697645-2. Shipped LSA-II, RQ, Exclusive Use. 12/28/2020
- (2) Shipment # 21-057, 2 Sealand boxes Serial # ESUU200718 and CPIU 0519010. Shipped LSA-II, RQ, Exclusive Use. 4/6/2021
- (3) Shipment # 20-161, Class A Bead Resin in Liner Serial # 673545-1. Shipped LSA-II, RQ, Exclusive Use. 11/10/2021
- (4) Shipment # 22-017, Class A Bead Resin in Liner Serial # 703876-1. Shipped LSA-II, RQ, Exclusive Use. 2/1/2022
- (5) Shipment # 22-028, Class A Bead Resin in Liner Serial # 703876-10. Shipped LSA-II, Exclusive Use. 3/2/2022

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)

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

(1) Unit 1 & 2 (March 7, 2021 through February 7, 2022)

PR01: Radiological Effluent Technical Specifications/Offsite Dose Calculation Manual Radiological Effluent Occurrences (RETS/ODCM) Radiological Effluent Occurrences Sample (IP Section 02.16) (1 Sample)

(1) Unit 1 & 2 (January 1, 2021 through January 1, 2022)

71152A - Annual Follow-up Problem Identification and Resolution

Annual Follow-up of Selected Issues (Section 03.03) (1 Sample)

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

(1) 4160V Bus E3 inadvertently de-energized during maintenance activity (NCR 2408197)

71153 - Follow Up of Events and Notices of Enforcement Discretion

Event Followup (IP Section 03.01) (1 Sample)

(1) The inspectors evaluated a temporary loss of shutdown cooling event that occurred on Unit 1 while in reduced inventory as well as licensee's response on March 7, 2022. The inspectors subsequently evaluated this event in accordance with Management Directive (MD) 8.3 and determined that no reactive inspection was necessary. This event was further evaluated in Section 71111.20 of this inspection report.

Event Report (IP Section 03.02) (1 Sample)

The inspectors evaluated the following licensee event report (LER):

(1) LER 05000325/2021-001-00, Automatic Specified System Actuation due to Loss of Power to Emergency Bus E3 (Adams Accession No. ML22020A402). The inspectors determined that it was not reasonable to foresee or correct the cause discussed in the LER therefore no performance deficiency was identified. The inspectors did not identify a violation of NRC requirements. An NRC Observation associated with this LER is documented in this report under the Inspection Results Section.

Personnel Performance (IP Section 03.03) (1 Sample)

(1) The inspectors evaluated the licensee's performance regarding an event that occurred on January 4, 2022. The event was an invalid group 2 and 6 isolation and

was reported to the NRC on February 24, 2022, under event notification 55756. This 60-day notification was in lieu of a written LER as allowed by 10 CFR 50.73(a)(1). The group 6 actuation was considered invalid pursuant to 10 CFR 50.73(a)(2)(iv)(A) and 10 CFR 50.73(a)(2)(iv)(B). The operators responded to the event in accordance with required procedures.

INSPECTION RESULTS

Temporary Loss of Shutdown Cooling								
Cornerstone	Significance	Cross-Cutting	Report					
		Aspect	Section					
Mitigating	Green	[H.5] - Work	71111.20					
Systems	NCV 05000325/2022001-01	Management						
-	Open/Closed	-						

A self-revealing Green finding and associated Non-cited Violation (NCV) of 10 CFR 50.65.a(4), was identified for the licensee's failure to adequately assess the risk of simultaneously performing maintenance on two reactor vessel level transmitters on Unit 1 during a refueling outage. The maintenance ultimately resulted in a temporary loss of shutdown cooling while in a reduced inventory condition.

<u>Description</u>: At 0148, on March 7, 2022, with the unit in Mode 5 and in a refueling outage, a Unit 1 loss of coolant accident (LOCA) signal was received which caused an opening of the residual heat removal (RHR) heat exchanger bypass valve. This signal also resulted in a trip of the running RHR service water (RHRSW) pumps, a start of all four emergency diesel generators (EDGs), a Group 10 isolation, and a loss of cooling to the reactor building closed cooling water (RBCCW) heat exchanger. The latter resulted in a loss of cooling to the spent fuel pool. A loss of shutdown cooling (SDC) occurred as a result of the bypassing of the RHR heat exchanger as well as the tripping of the RHRSW pumps and thus the operators immediately implemented 0AOP15.0, "Loss of Shutdown Cooling," procedure.

The operators initially noted that earlier in the shift, Instrumentation and Control (I&C) technicians had been authorized to perform an as found calibration of level transmitters, B21-LT-N031A and B21-LT-N031C in accordance with WO 20429257. At 0040, an hour prior to the actual loss of SDC, an inadvertent high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) actuation signals were received in the control room. This resulted in an inadvertent cycling of a HPCI valve as well as a signal to a RCIC valve (breaker was opened and thus valve did not move). Operations suspected the cause of the actuations was the work authorized earlier on the two RCS level transmitters. Operations personnel then requested I&C to investigate the cause and restore the transmitters to service if necessary.

Following the loss of SDC, the operators quickly restarted the affected RHRSW pumps and reopened the RHR heat exchanger bypass valve to reestablish shutdown cooling at 0157, approximately nine minutes later. During this period, the reactor coolant system heated up from an initial temperature of 120 to 127 F or approximately 7 degrees. During this time, the I&C technicians had noted the level transmitter isolation valves may have leaked by and caused the system to "see" an invalid low level signal. I&C technicians were concurrently able to restore the transmitters to service and thus cleared the LOCA signal. This allowed the LOCA signal to be reset. At 0159, the operators entered 0AOP-38.0, "Loss of Fuel Pool Cooling" to address the loss RBCCW. At 0203, operators restored RBCCW and thus restored cooling to the spent fuel pool. The operators ultimately placed all four EDGs back

into standby by 0357.

Following this event, the site staffed a prompt investigation response team (PIRT) in order to address the root cause of this event and formulate any corrective actions or lessons learned.

Corrective Actions: The immediate corrective actions were to restore SDC as well as spent fuel pool cooling which was accomplished within 9 minutes and 15 minutes respectively. Follow-on corrective actions included the stoppage of all future RCS level transmitter work until the PIRT could perform its event analysis. Additionally, all future RCS level transmitter work was scheduled to be performed one instrument at a time to preclude future LOCA signals.

Corrective Action References: NCR 2418712 Performance Assessment:

Performance Deficiency: The licensee's failure to address appropriate risk insights to preclude meeting the LOCA actuation logic while working on RCS level transmitters was a performance deficiency.

Screening: The inspectors determined the performance deficiency was more than minor because it could reasonably be viewed as a precursor to a significant event.

Significance: The inspectors assessed the significance of the finding using Appendix G, "Shutdown Safety SDP." The finding was screened in accordance with IMC 0609, Attachment 4, "Initial Characterization of Findings," dated December 20, 2019, and using Table 3 - SDP Appendix Router, it was determined that IMC 0609, Appendix G, Shutdown Operations SDP was the correct screening path given the event occurred while the unit was shut down in Mode 5. The inspectors determined that a Phase 2 was required by using Appendix G, Attachment 1, Exhibit 2, - Initiating Events Screening Questions. Specifically, for question 7, if a loss of RHR occurred with the unit NOT flooded up, then a Phase 2 analysis would be required. In this particular case, the reactor head was removed and the water level was just below the reactor flange. At the time, the cavity was not flooded up. The guidance for a Phase 2 analysis is contained in IMC 0609 Appendix G, Attachment 3, "Phase 2 Significance Determination Process for BWR During Shutdown." This Phase 2 guidance states "If appropriate, a more detailed risk assessment may be performed in an SDP Phase 3 evaluation, especially if the analyst feels that the risk is not being properly assessed in the Phase 2 evaluation." Since the current Saphire model has shutdown accident sequences for the Brunswick plant, it was determined to be more beneficial to directly perform a Phase 3 analysis.

A regional senior reactor analyst (SRA) using SAPHIRE 8 Version 8.2.5 and the Brunswick Unit 1 & 2 SPAR model version 8.63 dated 4/25/2019 ran an Initiating Event Assessment for a Shutdown Loss of RHR in POS II Early initiating Event. Brunswick's SPAR model has Shutdown Event tree and can be used to directly model this event. The Plant was in POS II, early time window with a time to boil of 1.75 hours. The two applicable Shutdown Events SD-M4E-LOSDC, LOSS OF SDC IN MODE 4E WATER LEVEL NORMAL and SD-M5E-LOSDC, LOSS OF SDC IN M5E WATER LEVEL STEAM LINE were run separately with the initiating event (IE) set to true and all other IEs were set to false. During the event, primary system isolations occurred as expected and therefore did not impact the results of the assessment. The Conditional Core Damage Probability (CCDP) for this event is 1.21E-7 with the dominant accident sequence being operators failing to restore SDC prior to boiling and failing to restore low pressure injection (LPI) before core uncover and failures of LPI and Core Spray systems. All these systems functioned properly, and operators restored shutdown cooling in 9 minutes and RHR pump flow was never actually lost during the event only RHRSW pumps (Loss of heat sink). Since the CCDP was less than 1E-6, the issue was deemed to be Green, or of very low safety significance.

Cross-Cutting Aspect: H.5 - Work Management: The organization implements a process of planning, controlling, and executing work activities such that nuclear safety is the overriding priority. The work process includes the identification and management of risk commensurate to the work and the need for coordination with different groups or job activities. Enforcement:

Violation: 10 CFR 50.65(a)(4) states in part that "before performing maintenance activities, the licensee shall assess and manage the increase in risk that may result from the proposed maintenance activities."

Contrary to the above, on March 7, 2022, the licensee failed to address the increase in risk while simultaneously performing maintenance on two separate RCS level transmitters that happened to meet the LOCA signal logic. Specifically, the licensee failed to address the increased risk of working on multiple transmitters at once, the increased risk of selecting two transmitters that met the LOCA logic, and the increased risk of working on RCS transmitters with the unit in a reduced inventory condition (i.e., not flooded up)

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

Observation: 4160V Bus E4 Inadvertently Deenergized During Maintenance 71152A Activity

The inspectors conducted a detailed review of NCR 2408197, "4160V Bus E4 Inadvertently Deenergized During Maintenance Activity." The inspectors chose this sample because it dealt with a loss of a safety-related 4160V AC Bus. This caused the licensee to enter an 8-hour limiting condition of operation (LCO) action statement in accordance with technical specification LCO 3.8.7. This issue dealt with a loss of the E4 4160V bus as a result of a washer that was dislodged and fell from a support rod during the removal of an under-voltage (UV) relay to support plant maintenance. At the time of the event, the associated E3 EDG was under clearance and unavailable. The washer then inadvertently contacted the secondary of the UV relay (located below the relay) and actuated the UV logic. This ultimately resulted in stripping of the E3 bus as a result of the UV signal and its subsequent de-energization due to the fact that the E3 EDG was not available. Since the washer had presumably been installed since initial installation and was not described in the plant drawings, it was not reasonable to assume that the licensee should have predicted and precluded this event. Additionally, the washer was not present in previous similar maintenance activities on other EDGs and the washer was not easily visible when inspecting the relay prior to removal. Ultimately, the inspectors concluded that it was not reasonable to foresee or correct the cause of this event and thus no performance deficiency was identified. There were no findings of significance identified during this review.

The licensee assembled a problem Identification response team (PIRT) and used cause investigation checklists in order to assess the root cause as well as develop corrective

actions and lessons learned to address any deficiencies. The inspectors determined that the licensee's plan to address this issue was reasonably commensurate with the safety significance of the equipment that might be affected by this type of equipment anomaly.

EXIT MEETINGS AND DEBRIEFS

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

- On March 3, 2022, the inspectors presented the radiation protection inspection results to John A. Krakuszeski and other members of the licensee staff.
- On March 11, 2022, the inspectors presented the baseline inservice inspection results to John A. Krakuszeski and other members of the licensee staff.
- On May 4, 2022, the inspectors presented the integrated inspection results to Jay Ratliff and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection	Туре	Designation	Description or Title	Revision or
Procedure				Date
71111.04	Procedures	0PLP-01.2	Fire Protection system functionality, action, and Surveillance	57
			requirements	
		10P-43	Service Water System Operating Procedure	140
		OP-41	Fire Protection and Well Water System	148
		SD-41	Fire Suppression Systems	12
		SD-43	Service Water System	27
71111.05	Fire Plans	0PFP-013	General Fire Plan	54
		CSD-BNP-PFP-	Control Building Pre-Fire Plans	5
		0CB		
		CSD-BNP-PFP-	Turbine Building Prefire Plans	3
		1TB		
	Miscellaneous	FPIP-0121	RADIOLOGICAL RELEASE REVIEWS DURING FIRE	Rev 0
			FIGHTING OPERATIONS	
	Procedures	0FP-1213	Radioactive Release Performance Criteria	Rev 4
			Page 33-60	
71111.07A	Procedures	0ENP-2704	Administrative Control of NRC Generic Letter 89-13	25
			Requirements	
	Work Orders	WO 20482524 67	RI-ER HEAT EXCHANGER IA NC# 183263	03/20/2022
71111.08G	Drawings	C-24004 Sheet 1-	Inservice Inspection Isometric For Reactor Pressure Vessel	1
		1	Weld and Nozzle Location	
	Engineering	EC411734	B1R22 NOZZLE N4A and N4D FLAW EVALUATION	0
	Changes			
	Engineering	1800389.301	BSEP N4A Flaw Evaluation	0
	Evaluations			
	NDE Reports	210830	1-SW-199 Manway Weld Record	0
		220226	1-SW-100 Manway Weld Record	0
		350553	NDE Examiner Certification Review	0
		71779	Magnetic particle examination report 1-SW-199 SW Manway	0
		71809	Magnetic particle examination report 1-SW-100 SW Manway	0
		GTSM 0101-01	ASME Section IX Welding Procedure Specification Technical	10
			Sheet	
		MT-22-001	Magnetic Particle Examination report 1-E11HX-1A-SUP270-	0

Inspection	Туре	Designation	Description or Title	Revision or
Procedure	•••			Date
			ATT	
		UT-22-006	Ultrasonic examination Safe End Weld to Jet Pump Instrumentation	0
		VT-22-009	Visual Examination of RHRSW pump 1A skid	0
	Procedures	NDE-NE-ALL- 3101	Magnetic Particle Examination	4
		NDE-NE-ALL- 6102	Utilization of PDI-UT-2 Generic Procedure for the Ultrasonic Examination of Austenitic Pipe Welds	0
	Work Orders	20464005-22		
		20466107-26		
71111.11Q	Procedures	0GP-13	Increasing Capacity at the End of Core Cycle	58
		AD-OP-ALL-1000	Conduct of Operations	19
71111.12	Corrective Action Documents	NCR 2283081	RHR seal coolers do not meet ASME Code quality level requirements	07/22/2019
	Corrective Action Documents Resulting from Inspection	NCR 2420431	Discrepancy in RHR pump seal cooler heat exchanger replacement specification	3/17/2022
	Engineering Changes	EC 292725	Commercial grade dedication evaluation specification to support RHR pump seal cooler heat exchangers	7/25/2013
	Miscellaneous	0BNP-M-0047	Specification for RHR Pump Seal Cooler (replacement)	Rev. 0
		Brunswick Purchase Order 9527-01-258-4	RHR Pump Seal Coolers	9/24/1975
71111.13	Procedures	0AP-025	BNP Integrated Scheduling	60
		AD-OP-ALL-0201	Protected Equipment	9
		AD-WC-ALL-0200	On-Line Work Management	20
		AD-WC-ALL-0250	Work Implementation and Completion	14
		AD-WC-ALL-0410	Work Activity Integrated Risk Management	12
71111.15	Operability Evaluations	AD-OP-ALL-0105	Operability Determinations	6
71111.18	Procedures	PD-EG-ALL-1130	Engineering Change Program	0
71111.19	Procedures	0PLP-20	Post-Maintenance Testing Program	53
71111.20	Corrective Action	NCR 2418712	Invalid Low Level 3 Logic Signal	03/07/2022

Inspection	Туре	Designation	Description or Title	Revision or
Procedure				Date
	Documents			
	Procedures	0GP-05	Unit Shutdown	202
		0GP-06	Cold Shutdown to Refueling (Head Unbolted)	49
		0GP-07	Preparations for Core Alteration	66
		0GP-08	Refueling to Cold Shutdown	55
		0GP-15	RPV Water Inventory Control Guidance	3
71111.22	Procedures	0ENP-16.4	Use of Leak Test Equipment	Rev. 23
		0ENP-16.8	Containment Leakage Tracking	Rev. 31
		0PT-20.3-E11	Local Leak Rate Testing for Residual Heat Removal System	Rev. 17
	Work Orders	WO 20526614	Investigate/repair RHR shutdown cooling inboard CIV 1-E11- F009 after failed LLRT	3/16/2022
71114.06	Miscellaneous	BNP-QD-22-01	Brunswick 2nd Quarter 2022 Quarterly Drill Guide	02/23/22
		EP-ALL-EPLAN	Duke Energy Common Emergency Plan	1
	Procedures	AD-EP-ALL-0002	NRC Regulatory Assessment Performance Indicator Guideline	6
			Emergency Preparedness Cornerstone	
71124.01	Corrective Action Documents	CRs # 02405145, 02373871, 02376797, 02386623, 02388802, and 02411704	Corrective Action Documents	Various
	Corrective Action Documents Resulting from Inspection	AR 02417975	Leak test the NIU Cs-137 well source 83R001	03/01/2022
	Procedures	0E&RC-0040	Administrative Controls for High Radiation Areas, Locked High Radiation Areas, and Very High Radiation Areas	Rev. 46
		0E&RC-0241	Health Physics Coverage in the Drywells During Fuel and Irradiated Component Movement	Rev. 19
		0E&RC-0261	Drywell Entry	Rev. 31
		AD-RP-ALL-0002	Radiation and Contamination Surveys	Rev. 2
		AD-RP-ALL-0004	Radiological Posting and Labeling	Rev. 5
		AD-RP-ALL-0005	Access Controls for High and Locked High Radiation Areas	Rev. 1
		AD-RP-ALL-0006	Personnel Contamination Monitoring	Rev. 1

Inspection	Туре	Designation	Description or Title	Revision or
Procedure				Date
		AD-RP-ALL-0007	Control of Radioactive Material	Rev. 2
		AD-RP-ALL-0010	Radiological Job Coverage	Rev. 0
		AD-RP-ALL-2000	Preparation and Management of Radiation Work Permits (RWP)	Rev. 5
		AD-RP-ALL-2014	Work in Alpha Environments	Rev. 8
		AD-RP-ALL-2017	Access Controls to Very High Radiation Areas and Supplemental Access Controls for HRA and LHRA	Rev. 8
	Radiation Work Permits (RWPs)	RWPs #4007-1, 1500, 1507, 1513, 1523, and 1552	RWPs #4007 (task 1 only), 1500*, 1507*, 1513*, 1523*, 1552* (* Multiple Tasks)	Various
71124.08	Corrective Action Documents		NCRs 02332570, 02333210, 02338551, 02357992, 02365994, 02366896, 02380084, 02380648, 02388802, 02394177, 02406867, 02413919, and 02416190	Various
		PRR 2360886	Procedure Change Request of OPT-04.2.1, Turbine Building Vent Radiation Monitor Functional Test	05/26/2021
	Engineering Changes	EC 405673	Liquid Rad Waste Processing Equipment Installation - Event Based	Rev. 1
		EC 407452	Liquid Rad Waste Processing Equipment Installation - Event Based	Rev. 0
	Engineering Evaluations	EC 405273	Engineering Calculation to Remove Radwaste Trash Compactor in Support of LTAM BNP-16-0053	Rev. 002
	Miscellaneous		Memorandum: Duke Energy- Brunswick Nuclear Plant (BNP) Radiation Protection Review of NEI 14-02 and Compliance with 10 CFR 37 at BNP	03/18/2014
			Microsoft Excel Spreadsheet: Part 37 Activity Track	01/04/2022
		CO-FLT-RP- 10CFR37	Course Completion Status for RP Personnel - 10CFR37 Training for RP Personnel	03/03/2022
		TT0351-N	Course Completion Status - Radwaste Certification (CRAM)	03/03/2022
		TTC1722-N	Course Completion Status for Security Personnel - Physical Protection of Cat 1-Cat 2 Quantities of Radioactive Material	03/03/2022
	Procedures		Brunswick Nuclear Plant Process Control Program (PCP)	Revision 5
		0E-RC-0500	Inventory Control and Leak Testing of Radioactive Sources	Revision 28
		001-03.10	Transferring Spent Resins of Filter Media To The Radwaste Processing Area	Revision 13

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Inspection	Гуре	Designation	Description or Litle	Revision or
Procedure				Date
		00P-06.20	Ozone, Tubular Ultrafilter and Reverse Osmosis System	Revision 3
			Operating Procedure	
		0PT-04.2.1	0PT-04.2.1	Revision 46
			Turbine Building Exhaust Vent Radiation Monitor Channel	
			Functional Test	
		AD-RP-ALL-5000	Preparation and Shipment of Radioactive Material and	Revision 4
			Radioactive Waste	
		AD-RP-ALL-5002	10 CFR 61 Radioactive Waste Classification	Revision 2
		AD-RP-ALL-5003	Receipt of Radioactive Material	Revision 3
		AD-RP-ALL-5004	Vendor Cask Manuals	Revision 1
		AD-RP-ALL-5005	Radioactive Material Transportation Security Plan	Revision 3
		AD-RP-ALL-5006	10 CFR 37 Accountability for Category 1 and Category 2	Revision 1
			Radioactive Material Quantities of Concern	
		AD-RP-ALL-9006	Failed Fuel Action Plan	Revision 1
	Radiation Surveys	Survey # 012522-	Semi-Annual Sealed Source Leak Testing (January 2022)	01/25/2022
		005		
		Survey # 070721-	Semi-Annual Sealed Source Leak Testing (July 2021)	07/07/2021
		006		
	Self-Assessments	02362823-05	2021 Radioactive Material Management	08/12/2021
		2020-BNP-RPCH-	Nuclear Oversight - Audit Radiation Protection and Chemistry	06/04/2020
		01		
71151	Calculations	G-2021-0379	Radioactive Gas Release Permit - 12/28/2021 08:32:00	01/06/2022
			through 01/04/2022 08:16:00	
		G-2022-0054	Gaseous Radioactive Release Permit - 02/21/2022 23:32:00	03/02/2022
		0 2022 000 1	through 03/01/2022 08:28:00	00/02/2022
		1-2021-0307	Radioactive Liquid Release Permit - Unit 1 SWRT 12/31/2021	1/1/2022
			09:03:00 through 12/31/2021 12:49:00	11 11 2022
		L-2022-0038	Liquid Radioactive Release Permit - DDT A	02/26/2022
	Corrective Action	2 2022 0000	Condition Reports reviewed: NCR 02383875 02391988	Various
	Documents		02400045, 02406305, 02405145, and 02412788	
	Miscellaneous		Brunswick Nuclear Plant Gaseous Radioactive Release	02/15/2022
			Summary Report - January 1, 2021 through December 31	
			2021 Prunowiek Nuclear Diant Liquid Dadiaastiva Dalassa	02/15/2022
1		1	DI UNSWICK NUCLEAL MANL LIQUIU RAUIOACLIVE RELEASE	02/13/2022

Inspection	Туре	Designation	Description or Title	Revision or
Procedure				Date
			Summary Report - January 1, 2021 through December 31, 2021	
		Dose Alarm Report (03/01/21- 02/07/2022)	Dose Alarm Report	02/07/2022
		Dose Rate Alarm Report (03/07/21- 02/07/22)	Dose Rate Alarm Report (03/07/21-02/07/22)	02/07/2022
	Work Orders	WR 20206589	Work Request for repair of Radwaste Effluent Flow Recorder	08/01/2021
		WR 20210639	Work Request for changeout of Unit 2 Containment Particulate Radiation Monitor Filter Due to Alarm	10/01/2021
		WR 20212355	Discharge Canal flow indication (2-GC16-FIC-R039) unavailable	10/31/2021
71152A	Procedures	AD-PI-ALL-0100	Corrective Action Program	25
71153	Procedures	0AOP-36.1	Loss of Any 4160V Buses or 480V E-Buses	82