



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
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May 10, 2023

John A. Krakuszeski
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8470 River Road SE
M/C BNP04
Southport, NC 28461-0429

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT – INTEGRATED INSPECTION
REPORT 05000324/2023001 AND 05000325/2023001

Dear John A. Krakuszeski:

On March 31, 2023, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Brunswick Steam Electric Plant. On May 1, 2023, the NRC inspectors discussed the results of this inspection with you and other members of your staff. The results of this inspection are documented in the enclosed report.

No findings or violations of more than minor significance were identified during this inspection.

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,

A handwritten signature in black ink, appearing to read "Matthew S. Fannon".

Signed by Fannon, Matthew
on 05/10/23

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 05000324/2023001 AND 05000325/2023001 Dated May 10, 2023

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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: 05000324/2023001 and 05000325/2023001

Enterprise Identifier: I-2023-001-0019

Licensee: Duke Energy Progress, LLC

Facility: Brunswick Steam Electric Plant

Location: Southport, NC

Inspection Dates: January 01, 2023, to March 31, 2023

Inspectors: G. Smith, Senior Resident Inspector
C. Curran, Resident Inspector
J. Bell, Health Physicist
A. Nielsen, Senior Health Physicist
M. Schwieg, Senior Reactor 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

No findings or violations of more than minor significance were identified.

Additional Tracking Items

None.

PLANT STATUS

Unit 1 began the period at 100 percent rated thermal power (RTP) and operated there until March 17, 2023, when power was reduced to 60 percent RTP for a planned control rod sequence exchange. Following the sequence exchange, as well as two follow-on rod improvements, the unit was restored to full RTP on March 20, where the unit essentially operated for the remainder of the period.

Unit 2 began the period at essentially RTP, with the unit in a coast-down mode due to end-of-life reactor core properties. On January 6, with the unit at 97 percent RTP, power was reduced to 70 percent RTP in order to perform a rod improvement and a final feedwater temperature adjustment in order to establish an all-rods-out condition for the reactor end-of-life. On January 10, the unit was restored to RTP where it continued to operate until January 12, when power was reduced to 90 percent RTP in order to perform the second final feedwater temperature reduction. On January 13, power was restored to RTP where it continued to operate until January 19 when a slow coast-down into the refueling outage was commenced. On February 8, with the unit at 91 percent RTP, the unit was shut down for a refueling outage. Following completion of the refueling outage, the reactor was taken critical on March 6 and a plant startup was commenced. On March 8, the main generator output breaker was closed, and a power ascension was commenced. On March 9, power was stabilized at 30 percent RTP in order to perform condenser dimple plug testing to locate and plug any leaking water-box tubes. Following completion of dimple plug testing, power ascension was commenced, and Unit 2 reached RTP on March 21 following two rod improvements. Unit 2 continued to operate at RTP 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 2 nuclear service water (NSW) and conventional service water while the Unit 2 'B' NSW pump was out-of-service for motor replacement on March 16.

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

- (1) The inspectors completed an evaluation of system configuration as a result of a complete walkdown of the Unit 2 reactor core isolation cooling system on March 30.

71111.05 - Fire Protection

Fire Area Walkdown and Inspection Sample (IP Section 03.01) (5 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) Emergency diesel generator (EDG) building on January 24, 2023
- (2) Unit 1 reactor building 20' elevation on January 25
- (3) Unit 1 reactor building 50' elevation on January 26
- (4) Unit 2 reactor building -17' elevation (RHR and HPCI) on January 25
- (5) Unit 2 reactor building -17' elevation ('A' and 'B' core spray rooms) and 80' elevation on January 31.

Fire Brigade Drill Performance Sample (IP Section 03.02) (1 Sample)

- (1) The inspectors evaluated the onsite fire brigade training and performance during unannounced fire drills as indicated below:
 - Fire in the Unit 2 Caswell Beach transformer on January 20, 2023
 - Fire in the E-6 switchgear room on March 24

71111.07A - Heat Exchanger/Sink Performance

Annual Review (IP Section 03.01) (1 Sample)

The inspectors evaluated readiness and performance of:

- (1) Unit 2 'A' 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 verified that the following nondestructive examination and welding activities were performed appropriately:

- (1) The inspectors verified that the reactor coolant system boundary, reactor vessel internals, risk-significant piping system boundaries, and containment boundary are appropriately monitored for degradation and that repairs and replacements were appropriately fabricated, examined, and accepted by reviewing the following activities from February 21 to February 24:

03.01.a - Nondestructive Examination and Welding Activities.

- Visual inspection of restraint reactor protection unit (RPU) instrumentation
- Visual inspection of spring hanger RHR discharge to header
- Visual inspection of spring hanger reactor recirculation loop 'B'
- Magnetic particle examination of 2-SW-100 manway west
- Ultrasonic examination on pipe to branch connection reactor recirculation loop 'A'

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 following activities:
- Unit 2 reactivity manipulations during a down power and control rod sequence exchange on March 17
 - Unit 1 reactivity manipulations during a down power for a control rod improvement on March 20
 - Unit 2 reactivity manipulations during a down power for a control rod improvement on March 20

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

- (1) The inspectors observed and evaluated licensed operator continuing training in accordance with simulator guide on March 28th and 29th, 2023. Multiple scenarios were observed including an electrical Anticipated Transient Without Scram (ATWS) event.

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) Unit 1 failed emergency core cooling system (ECCS) inverter on March 2, 2023, nuclear condition report (NCR) 2460121.

71111.13 - Maintenance Risk Assessments and Emergent Work Control

Risk Assessment and Management Sample (IP Section 03.01) (4 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 the Unit 1 ECCS Inverter on February 2
 (2) Unit 2 elevated shutdown risk due to reactor vessel reduced inventory condition on February 10

- (3) Unit 1 and Unit 2 elevated on-line risk due to Unit 2 'B' NSW motor replacement on March 16
- (4) Emergent failure of 'C' EDG supply fan due to loss of control power on March 31

71111.15 - Operability Determinations and Functionality Assessments

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

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

- (1) Unit 2 'A' recirculation pump seal #2 pressure lowering (NCR 2450226)
- (2) Oil usage trend shows increased lube oil usage on EDG-3 (NCR 2451831)
- (3) Snubber 2-B21-58SS276 fluid level below nominal (NCR 2460845)
- (4) EDG-3 engine jacket water heater circulating pump abnormal noise (NCR 2465432)
- (5) Unit 2 division II nitrogen backup supply pressure loss of 50 psi per day (NCR 2464271).

71111.18 - Plant Modifications

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

The inspectors evaluated the following temporary or permanent modifications:

- (1) Change in recirculation seal types from concave to flat seating surfaces for Unit 2, engineering change (EC) 420507.

71111.20 - Refueling and Other Outage Activities

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

- (1) The inspectors evaluated Unit 2 refueling outage (B2R26) activities from February 7 to March 7, 2023, when the main generator was synchronized to the grid.

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:

Surveillance Testing (IP Section 03.01) (4 Samples)

- (1) EDG-4 fast start using OPT-12.2D, "No. 4 Diesel Generator Monthly Load Test," on February 3, 2023
- (2) 2MST-SCIS42R, "CAC PCIS Group 2/6 and SCIS Isolation Logic System Functional Test," Rev. 10 on February 2, in accordance with work order (WO) 20535917-01
- (3) EDG-2 slow start using OPT-12.2B, "No. 2 Diesel Generator Monthly Load Test," on February 4
- (4) Unit 2 LOOP/LOCA testing using OPT-12.1C, "No. 3 Diesel Generator LOOP/LOCA Loading Test," on March 22

Inservice Testing (IST) (IP Section 03.01) (1 Sample)

- (1) OPT-09.2, "Unit 1 HPCI System Operability Test," on January 30, 2023, in accordance with WO 20566486

Reactor Coolant System Leakage Detection Testing (IP Section 03.01) (1 Sample)

- (1) Unit 1 reactor coolant system (RCS) leakage IAW 00I-02.3, "Drywell Leakage Control," on January 30, 2023, due to RCS unidentified leakage tripping NRC Action Level III

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) Licensee surveys of potentially contaminated material leaving the radiologically controlled area.
- (2) Workers exiting the Unit 2 drywell during a 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) As low as reasonably achievable (ALARA) plan 2503, control rod drive mechanism
- (2) ALARA plan 2556, 2-E11-F050A body-to-bonnet repair
- (3) ALARA plan 2557, replace reactor water cleanup valve 2-G31-F001
- (4) Valve maintenance work in the Unit 2 main steam isolation valve pit.

High Radiation Area and Very High Radiation Area Controls (IP Section 03.05) (3 Samples)

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

- (1) Unit 2 drywell personnel and equipment hatches
- (2) Unit 1 condenser bay 70' elevation
- (3) Unit 2 reactor building, various locations

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.

71124.03 - In-Plant Airborne Radioactivity Control and Mitigation

Permanent Ventilation Systems (IP Section 03.01) (2 Samples)

The inspectors evaluated the configuration of the following permanently installed ventilation systems:

- (1) 2A Control Building Emergency Filter Train
- (2) 2B Control Building Emergency Filter Train

Temporary Ventilation Systems (IP Section 03.02) (2 Samples)

The inspectors evaluated the configuration of the following temporary ventilation systems:

- (1) Portable HEPA unit #1702 in place for Unit 2 heater drain deaerator tank work.
- (2) Portable charcoal bed #22452E in place for Unit 2 heater drain deaerator tank work.

Use of Respiratory Protection Devices (IP Section 03.03) (1 Sample)

- (1) The inspectors evaluated the licensee's use of respiratory protection devices.

Self-Contained Breathing Apparatus for Emergency Use (IP Section 03.04) (1 Sample)

- (1) The inspectors evaluated the licensee's use and maintenance of self-contained breathing apparatuses.

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, 2022, through December 31, 2022)
- (2) Unit 2 (January 1, 2022, through December 31, 2022)

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

- (1) Unit 1 (January 1, 2022, through December 31, 2022)

(2) Unit 2 (January 1, 2022, through December 31, 2022)

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

(1) Unit 1 (January 1, 2022, through December 31, 2022)

(2) Unit 2 (January 1, 2022, through December 31, 2022)

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

(1) March 4, 2022, through February 6, 2023

71152A - Annual Follow-up Problem Identification and Resolution

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

(1) NCR 2432619: Unit 2 Drywell Floor Drains Have Exceeded Action Level 1 Of 00I-02.3.

INSPECTION RESULTS

Observation: Unit 2 Drywell Floor Drains Have Exceeded Action Level 1 Of 00I-02.3 NCR 2432619	71152A
<p>The inspectors conducted a detailed review of NCR 2432619, "Unit 2 Drywell Floor Drains Have Exceeded Action Level 1 Of 00I-02.3." The inspectors chose this sample because it dealt with the barrier integrity cornerstone involving reactor coolant system (RCS) unidentified leakage. On April 9, 2022, operators noted that the drywell pump-out rate was 0.51 gallons per minute (gpm) which exceeded Duke Energy's Action Level I threshold of 0.5 gpm. The drywell pump-out rate is the value used to describe unidentified leakage as required by Technical Specification Limiting Condition for Operation (LCO) 3.4.4. Although the TS limit is 5 gpm, the licensee aggressively pursued a causal analysis in order to understand the potential sources of the RCS leakage.</p> <p>Specifically, the licensee utilized a support/refute matrix in order to identify the most likely causes of the drywell leakage. This analysis bounded the potential leakage source to 13 systems. These systems included the drywell coolers, reactor recirculation system, reactor water clean-up (RWCU) system, feedwater, control rod drive mechanisms (CRDM), reactor pressure vessel, standby liquid control (SLC), RHR, reactor building closed cooling water (RBCCW) system, core spray, main steam, high pressure coolant injection (HPCI), and RCIC. Chemistry sampling analysis results concluded the leak to contain RCS water including the Na-24 nuclide. This fact quickly eliminated several systems including drywell coolers, feedwater, CRDM, SLC, RHR, RBCCW, core spray, main steam, HPCI, and reactor core isolation cooling (RCIC). The licensee also used local radiation monitors and their corresponding radiation levels at various locations to infer potential leak locations. The support/refute matrix was very methodical and ultimately concluded the reactor recirculation system and the RWCU system were the most likely sources of the leak. The licensee continued to trend the unidentified leakage until the refueling outage in spring 2023 and noted a continued increase in RCS leakage which peaked at 1.64 gpm on January 30, 2023. On February 4, the unit was shut down for the refueling outage and the licensee commenced a leak search on that day while the unit was still pressurized at normal operating pressure. The leak search noted excessive seal leakage on the 'B' recirculation pump seal which was significantly contributing to the unidentified leakage. This was the expected result since the</p>	

licensee had been dealing with recirculation pump seal degradation issues during the last half of the most recent operating cycle. It should be noted that this search did not uncover any pressure boundary leakage. During the outage, both recirculation pump seals were replaced to preclude/reduce RCS leakage following the plant startup.

Overall, the inspectors concluded the correction actions and causal analysis utilized a conservative decision-making approach and provided reasonable assurance that the unidentified leakage would not significantly degrade nuclear safety.

EXIT MEETINGS AND DEBRIEFS

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

- On May 1, 2023, the inspectors presented the Integrated Inspection results to John A. Krakuszeski and other members of the licensee staff.
- On February 17, 2023, the inspectors presented the Radiation Protection Inspection results to John A. Krakuszeski and other members of the licensee staff.
- On February 24, 2023, the inspectors presented the Unit 2 In-Service Inspection results to John A. Krakuszeski and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71111.08G	Procedures	NDE-NE-ALL-6102	Utilization of PDI-UT-2 Generic Procedure for the Ultrasonic Examination of Austenitic Pipe Welds	3
		NDE-NE-ALL-7302	VT-3 VISUAL EXAMINATION OF COMPONENT SUPPORTS	3
71124.01	Corrective Action Documents Resulting from Inspection	NCR 02460633	Temporary Survey Tag Missing	
		NCR 02461050	Contamination Control	
	Procedures	AD-RP-ALL-0002	Radiation and Contamination Surveys	Revision 2
		AD-RP-ALL-0004	Radiological Posting and Labeling	Revision 7
71124.03	Corrective Action Documents Resulting from Inspection	NCR 02461159	Missing Reference for Correction Factors	
		NCR 02461187	SCBA Tamper Seals	
	Procedures	0E&RC-0292	SCBA Use and Maintenance	Revision 21
		0PT-21.2B	Control Building Emergency Filter Train 2B Test	Revision 1
71151	Corrective Action Documents	NCR 02422586	LHRA Key Unrecoverable	