



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**
REGION II
245 PEACHTREE CENTER AVENUE NE, SUITE 1200
ATLANTA, GEORGIA 30303-1257

July 29, 2015

Mr. William R. Gideon
Vice President
Duke Energy Progress, Inc.
Brunswick Steam Electric Plant
P.O. Box 10429
Southport, NC 28461

**SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT – NRC PROBLEM IDENTIFICATION
AND RESOLUTION INSPECTION REPORT 05000325/2015007 AND
05000324/2015007**

Dear Mr. Gideon:

On June 18, 2015, the U.S. Nuclear Regulatory Commission (NRC) completed a Problem Identification and Resolution biennial inspection at your Brunswick Steam Electric Plant Units 1 and 2. The enclosed report documents the inspection findings, which were discussed on June 18, 2015, with you and other members of your staff.

The inspection was an examination of activities conducted under your license as they relate to the identification and resolution of problems, and compliance with the Commission's rules and regulations and with the conditions of your operating license. Within these areas, the inspection involved examination of selected procedures and representative records, observations of plant equipment and activities, and interviews with personnel.

Based on the inspection sample, the inspection team concluded that the implementation of the corrective action program and overall performance related to identifying, evaluating, and resolving problems at Brunswick Steam Electric Plant Units 1 and 2 was adequate. Licensee identified problems were entered into the corrective action program at a low threshold. Problems were generally prioritized and evaluated commensurate with the safety significance of the problems. Corrective actions were generally implemented in a timely manner commensurate with their importance to safety and addressed the identified causes of problems. Lessons learned from industry operating experience (OE) were generally reviewed and applied when appropriate. Audits and self-assessments were generally used to identify problems and appropriate actions.

However, the enclosed inspection report discusses two NRC-identified findings of very low safety significance (Green) identified during this inspection. These findings were determined to involve violations of NRC requirements. The NRC is treating these violations as non-cited violations (NCV) consistent with Section 2.3.2.a of the Enforcement Policy.

If you contest these violations or the significance of these NCVs, 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, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC resident inspector at the Brunswick facility.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response, if any, will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Website at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

/RA/

Anthony D. Masters, Chief
Reactor Projects Branch 7
Division of Reactor Projects

Docket Nos.: 50-325, 50-324
License Nos.: DPR-71, DPR-62

Enclosure: Inspection Report 05000325/2015007 and 05000324/2015007
w/Attachment: Supplementary Information

cc: Distribution Via Listserv

W. Gideon

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Letter to William Gideon from Anthony D. Masters dated July 29, 2015.

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT – NRC PROBLEM IDENTIFICATION
AND RESOLUTION INSPECTION REPORT 05000325/2015007 AND
05000324/2015007

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U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.: 50-325, 50-324

License Nos.: DPR-71, DPR-62

Report No.: 05000325/2015007, 05000324/2015007

Licensee: Carolina Power and Light Company

Facility: Brunswick Steam Electric Plant, Units 1 & 2

Location: 8470 River Road, SE
Southport, NC 28461

Dates: May 4 – May 8, 2015
May 18 – May 21, 2015
June 15 – June 18, 2015

Inspectors: Ryan Taylor, Senior Project Inspector (Team Leader)
Aaron Armstrong, Reactor Operations Engineer
Mike Cain, Senior Resident Inspector (Vogtle)
Scott Freeman, Senior Risk Analyst
Dustin Retterer, Resident Inspector (Hatch)
Chad Oelstrom, Resident Inspector (Summer)
Necota Staples, Senior Project Inspector
Thomas Stephen, Resident Inspector (Browns Ferry)

Approved by: Anthony D. Masters, Chief
Reactor Projects Branch 7
Division of Reactor Projects

Enclosure

SUMMARY OF FINDINGS

IR 05000325/2015007, 05000324/2015007; May 4 – June 18, 2015; Brunswick Steam Electric Plant, Units 1 and 2; Biennial Inspection of the Problem Identification and Resolution Program.

The inspection was conducted by a construction engineer, reactor operations engineer, two resident inspectors, two senior project inspectors, a senior resident inspector, and a senior risk analyst (SRA). Two findings of very low safety significance (Green) were identified during this inspection. The significance of inspection findings are indicated by their color (i.e., greater than Green, or Green, White, Yellow, Red) and determined using IMC 0609, "Significance Determination Process," dated April 29, 2015. Cross-cutting aspects are determined using IMC 0310, "Aspects Within Cross Cutting Areas," dated December 4, 2014. All violations of NRC requirements are dispositioned in accordance with the NRC's Enforcement Policy dated January 28, 2013, and revised February 4, 2015. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 5.

Identification and Resolution of Problems

The team identified that the licensee was generally effective at identifying problems and entering them into the corrective action program (CAP) for resolution. However, the inspectors identified several issues that the licensee had not previously identified. The licensee effectively used risk in prioritizing the extent to which individual problems would be evaluated and in establishing schedules for implementing corrective actions. Corrective actions, when specified, were generally implemented in a timely manner. Generally, prioritization and evaluation of issues were adequate, formal root cause evaluations for significant problems were adequate, and corrective actions specified for problems were acceptable. Licensee audits and assessments were found to be effective.

Operating experience usage was also found to be effective. Self assessment results adequately identified problems. On the basis of interviews conducted during this inspection, in general, workers at the site felt free to input safety findings into the corrective action program.

NRC-Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

Green: An NRC-identified Green non-cited violation (NCV) of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B, Criterion XVI, Corrective Action, was identified for licensee failure to identify conditions adverse to quality during the evaluation of an emergency diesel generator (EDG) output breaker failure on March 16, 2015. Specifically, the licensee missed that an internal change made to a relay was a condition adverse to quality. Further, the licensee failed to reclassify a corrective action document to higher significance when information arose indicating that the event in question was a loss of safety function. The licensee documented these issues in their corrective action program, completed the necessary reviews for a condition adverse to quality, and reclassified the original event to Significance Level 1.

The inspectors determined that the finding was more than minor in accordance with Manual Chapter 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Screening," dated

September 7, 2012, because, if left uncorrected, additional unqualified relays would likely have been installed in the plant. Using Manual Chapter 0609, Appendix A, Exhibit 1, effective July 1, 2012, the finding screened as Green for each unit by answering “no” to the questions related to an actual loss of function of a system, a single train, non-technical specification equipment designated as high safety-significant in accordance with the licensee’s maintenance rule program for >24 hrs. The finding had a cross-cutting aspect for “Evaluation” in the area of Problem Identification & Resolution because the most likely cause of the missed conditions adverse to quality was a lack of thorough investigation during the evaluations (for cause and reportability) of the relay issue [P.2] (Section 4OA2.a.(3)(a))

Green: An NRC-identified Green NCV of 10 CFR Part 50, Appendix B, Criterion III, Design Control was identified for the licensee’s inadequate commercial grade dedication technical evaluation that resulted in non-conforming relays being installed in the control circuits for emergency diesel generator output breakers. This led to specification of a relay that was unsuitable for the application being installed in the control circuit for two emergency diesel generator output breakers and failure of one of those breakers to close. The licensee documented this issue in their corrective action program and performed corrective actions to mitigate the effects of the undetected changes on the relay.

The inspectors determined that the finding was more than minor in accordance with Manual Chapter 0612, “Power Reactor Inspection Reports,” Appendix B, “Issue Screening,” dated September 7, 2012, because, if the process for detecting commercial grade item changes using material evaluations was left uncorrected, additional undetected design or process changes would likely occur. Using Manual Chapter 0609, Appendix A, issued June 19, 2012, “The Significance Determination Process (SDP) for Findings At-Power,” the inspectors determined the finding required a detailed risk evaluation because the effect on two emergency diesel generators was considered a loss of function. For Unit 1, the regional Senior Reactor Analyst used demand data to adjust the probability that an emergency diesel generator would fail to start and ran a condition assessment on SAPHIRE. Because of limited exposure time, the finding was determined to be Green for Unit 1. For Unit 2, the conditions for exposure occurred during an outage with the reactor cavity filled, and both EDGs would be available. The SRA determined the significance to be bounded by the at power risk analysis performed for Unit 1. Because of the low exposure time, and the high likelihood of operators recovering the failure to start of the EDGs, this issue was Green for Unit 2. The inspectors did not identify a cross-cutting aspect associated with this finding because the original relay evaluation was done in 1999 and was not indicative of current licensee performance. (Section 4OA2.a.(3)(b))

REPORT DETAILS

4. OTHER ACTIVITIES

4OA2 Problem Identification and Resolution

a. Assessment of the Corrective Action Program

(1) Inspection Scope

The inspectors reviewed the licensee's corrective action program (CAP) procedures which described the administrative process for initiating and resolving problems primarily through the use of nuclear condition reports (NCR) and work requests (WR). To verify that problems were being properly identified, appropriately characterized, and entered into the CAP, the inspectors reviewed NCRs and WRs that had been issued between April 2013 and March 2015, including a detailed review of selected NCRs associated with the following risk-significant systems: emergency diesel generators, service water, high pressure coolant injection, and station batteries. Where possible, the inspectors independently verified that the corrective actions were implemented as intended. The inspectors also reviewed selected common causes and generic concerns associated with root cause evaluations to determine if they had been appropriately addressed. To help ensure that samples were reviewed across all cornerstones of safety identified in the NRC's Reactor Oversight Process, the inspectors selected a representative number of NCRs that were identified and assigned to the major plant departments, including operations, maintenance, engineering, health physics, chemistry, and security. These NCRs were reviewed to assess each department's threshold for identifying and documenting plant problems, thoroughness of evaluations, and adequacy of corrective actions. The inspectors reviewed selected NCRs, verified corrective actions were implemented, and attended meetings where NCRs were screened for significance to determine whether the licensee was identifying, accurately characterizing, and entering problems into the CAP at an appropriate threshold.

The inspectors conducted plant walkdowns of equipment associated with the selected systems and other plant areas to assess the material condition and to look for any deficiencies that had not been previously entered into the CAP. The inspectors reviewed NCRs, maintenance history, completed work orders for the systems, and reviewed associated system health reports. These reviews were performed to verify that problems were being properly identified, appropriately characterized, and entered into the CAP. Items reviewed generally covered a two-year period of time; however, in accordance with the inspection procedure, a five-year review was performed for selected systems for age-dependent issues.

Control Room walkdowns were also performed to assess the main control room deficiency list and to ascertain if deficiencies were entered into the CAP. Operator Workarounds and Operator Burden screenings were reviewed, and the inspectors verified compensatory measures for deficient equipment which were being implemented in the field.

The inspectors conducted a detailed review of selected NCRs to assess the adequacy of the root-cause and apparent-cause evaluations of the identified problems. The inspectors reviewed these evaluations against the descriptions of the problem described in the NCRs and the guidance in licensee procedure AD-PI-ALL-0100, "Corrective Action Program", Rev. 2. The inspectors assessed if the licensee had adequately determined the cause(s) of identified problems, and had adequately addressed operability, reportability, common cause, generic concerns, extent-of-condition, and extent-of-cause. The review also assessed if the licensee had appropriately identified and prioritized corrective actions to prevent recurrence.

The inspectors reviewed the effectiveness review performed for the apparent cause evaluation (ACE) documented in NCR 690721, "Apparent Cause for Notice of Violation, EA-14-048," as listed in the Reply to Notice of Violation, EA-14-048. As stated on the NOV, the licensee failed to promptly identify and correct conditions adverse to quality associated with flood protection of multiple safety-related buildings. The inspectors reviewed the documents to ensure that the full extent of the issue was identified, an appropriate effectiveness review was performed, and appropriate corrective actions were specified and prioritized. The inspectors also evaluated the ACE against the requirements of the licensee's specified procedure, AD-PI-ALL-0102, "Apparent Cause Evaluation," Rev. 0 and 10 CFR Part 50, Appendix B. Documents reviewed are listed in the attachment.

The inspectors reviewed selected industry operating experience (OE) items, including NRC generic communications to verify that they had been appropriately evaluated for applicability and that issues identified through these reviews had been entered into the CAP.

The inspectors reviewed site trend reports to determine if the licensee effectively trended identified issues and initiated appropriate corrective actions when adverse trends were identified.

The inspectors attended various plant meetings to observe management oversight functions of the corrective action process. These included NCR screening meetings, Performance Improvement Oversight Committee meetings, and Work Ownership Committee meetings.

Documents reviewed are listed in the Attachment.

(2) Assessment

Identification of Issues

The inspectors determined that the licensee was generally effective in identifying problems and entering them into the CAP for resolution via NCRs or WRs. This conclusion was based on a review of the requirements for initiating NCRs as described in licensee procedure AD-PI-ALL-0100, "Corrective Action Program," Rev. 2 and management's expectation that employees were encouraged to initiate NCRs for any reason. Based on reviews and walkdowns of accessible portions of the selected

systems, the inspectors determined that system deficiencies, in general, were being identified and placed in the CAP. However, inspectors identified a relatively high number of minor issues during system walkdowns related to housekeeping, transient combustibles, and equipment condition; which had not been previously identified by the licensee. The inspectors also determined that trending was generally effective in monitoring equipment performance, and site management was actively involved in the CAP and focused appropriate attention on significant plant issues.

The inspectors identified several performance deficiencies associated with the licensee's identification of issues. These issues were screened in accordance with Manual Chapter 0612, "Issue Screening," and were determined to be of minor significance and did not constitute violations of NRC regulatory requirements.

- Inspectors identified that the watertight door gasket for the south flood barrier door leading into the emergency diesel generator (EDG) 4-day tank vault was degraded i.e. weathered and cracking and also missing a section approximately five inches long. This issue was determined to be minor because the degraded areas of the gasket were located above the maximum predicted flood elevation. The licensee has documented this issue as NCR 747331.
- Inspectors identified that the watertight door gasket for the south entry door leading into the EDG building was degraded i.e. weathered and cracking and also contained gaps around the gasket approximately a half inch long. This issue was determined to be minor because the degraded areas of the gasket were located above the maximum predicted flood elevation. The licensee has documented this issue as NCR 747335.
- During the review of the Apparent Cause Evaluation for NCR 711341 that evaluated licensee's corrective actions for the continuing high pressure coolant injection (HPCI) steam admission valve leakage on Units 1 and 2, inspectors identified a performance deficiency for the failure to enter a condition adverse to quality into the corrective action program in a timely fashion. Contrary to licensee procedure, AD-PI-ALL-0100 Corrective Action Program step 5.2.1, a CR was not written within 24 hours of discovery of corrosion on the inside of the Unit 2 HPCI Electronic Governor Remote (EGR). The corrosion was a result of the steam admission valve leakage. The condition adverse to quality was recognized on August 14, 2014 and the CR was not written until Nuclear Oversight prompting on September 3, 2014. The issue was determined to be minor because the licensee was able to prove that the corrosion was minor in amount and the EGR was replaced shortly after the item was entered into the CAP. This issue was entered into the CAP as NCR 750412.
- During walkdown of both Unit 1 and 2 HPCI systems, the inspectors identified that the Unit 2 HPCI turbine gland Low Pressure leakoff pressure indicator was reading 1.5 in Hg (vacuum) while the corresponding gauge on Unit 1 was reading 0 psig. This issue was determined to be minor because this gauge is not used during normal or emergency operation of the HPCI system. This issue was documented in the corrective action program as AR 747610.

- During walkdown of the Unit 2 standby liquid control (SLC) system, the inspectors identified that there were boron crystals on the outside of the SLC storage tank outlet isolation valve. This issue was determined to be minor because the crystals were not excessive in amount and corrosion had not begun. This issue was documented in the corrective action program as WR 11672441.

Prioritization and Evaluation of Issues

Based on the review of NCRs sampled by the inspection team during the onsite period, the inspectors concluded that problems were generally prioritized and evaluated in accordance with the licensee's CAP procedures as described in the NCR severity level determination guidance AD-PI-ALL-0100, "Corrective Action Program," Rev. 2. The inspectors observed that each NCR/WR was assigned a severity level at the Work Ownership Committee meeting, and adequate consideration was given to system or component operability and associated plant risk. The inspectors determined that station personnel had conducted root cause and apparent cause analyses in compliance with the licensee's CAP procedures and assigned cause determinations were appropriate, considering the significance of the issues being evaluated.

Effectiveness of Corrective Actions

Based on a review of corrective action documents, interviews with licensee staff, and verification of completed corrective actions, the inspectors determined that overall, corrective actions were timely, commensurate with the safety significance of the issues, and effective, in that conditions adverse to quality were corrected and non-recurring. For significant conditions adverse to quality, the corrective actions directly addressed the cause and effectively prevented recurrence in that a review of performance indicators, NCRs, and effectiveness reviews demonstrated that the significant conditions adverse to quality had not recurred. Effectiveness reviews for CAPRs were sufficient to ensure corrective actions were properly implemented and were effective.

The inspectors reviewed the corrective actions for identifying and repairing flooding issues due to external events and structural assessments and repairs. As part of these corrective actions inspections of the facilities to identify areas for repairs were implemented or modified. The inspectors walked down the Service Water Pump building, the EDG building, and the 4 Day Fuel/ Oil Tank enclosure to determine if the corrective actions were effective and implemented in accordance with site procedures and the design basis. During the walkdowns the inspectors observed isolated areas where potential flooding and structural issues were not identified by the licensee. These included rebar corrosion staining on reinforced concrete beams and wood forms not removed during structural slab repairs adjacent to the Service Water pumps and pipe penetration seal repair that was ineffective in the EDG basement. The structural issues were determined to be minor because the corrosion staining and wood forms did not impact the structural integrity of the area supporting the Service Water pumps. The seal repair issue was determined to be minor because the ineffective seal allowed minimal leakage and the leakage was controlled by a floor drain. These items were entered into the CAP.

The inspectors verified that the licensee implemented the corrective actions identified in Reply to Notice of Violation, EA-14-048, and that those actions were appropriate. The following open corrective action items will be reviewed after completion in 2015:

- A review and update, as necessary, of the Brunswick design basis for high winds; and
- An effectiveness review performed for the root cause evaluation documented in AR 490292, "4 Day Fuel Oil Tank Enclosure Degradation."

(3) Findings

- (a) Introduction: An NRC-identified Green non-cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion XVI, Corrective Action, was identified for licensee failure to identify conditions adverse to quality during the evaluation of an emergency diesel generator output breaker failure on March 16, 2015.

Description: On March 16, 2015, the output breaker for EDG 3 failed to close during surveillance testing. The licensee initiated AR 00738272 on this incident and performed a quick cause evaluation and reportability review. The cause evaluation attributed the failure to Time-Delay Relay 2-DG3-RCR and concluded that the cause was electromagnetic kickback generated by Relay 2-DG3-RCR-X, which caused Relay 2-DG3-RCR to cycle and ultimately led to the failure of the EDG 3 output breaker to close. The cause evaluation also concluded that the manufacturer of the relay, Allen Bradley, replaced an obsolete part inside the relay timing circuit without notification and without changing the part number. The quick cause evaluation was marked complete in AR 00738272 on April 13, 2015.

The licensee's reportability review determined that, during surveillance testing, both EDG 3 & EDG 4 ran unloaded for 12 minutes with the output breaker controls susceptible to electromagnetic kickback. The review concluded this was a loss of safety function and thus reportable under 10 CFR 50.73. The review was marked complete in AR 00738272 on April 23, 2015. The licensee subsequently submitted licensee event report (LER) 05000325/2015-002 on May 20, 2015.

The inspectors reviewed the cause evaluation and reportability review to verify that it was conducted in accordance with Procedure AD-PI-ALL-0100, Corrective Action Program, Revision 2. The inspectors determined that the design change made to the timing circuitry of Relay 2-DG3-RCR constituted a condition adverse to quality (CAQ) as defined in Procedure AD-PI-ALL-0100. Additionally, the loss of safety function designation met the criteria for Significance Level 1 as described in Attachment 2 of the procedure. Based on these two criteria, the issue should have been reclassified by the licensee as a significant condition adverse to quality (SCAQ). Further, the inspectors concluded that the new information provided by these two items was sufficient to trigger a rescreening of AR 00738272 in accordance with Section 5.8 of Procedure AD-PI-ALL-0100, or to initiate a new AR in accordance with Section 5.2 of the procedure. The licensee subsequently determined that the loss of safety function was actually

Significance Level 1 and issued AR 00754934, on June 17, 2015, to document the issue and rescreen AR 00738272.

On May 1, 2015, the NRC received Event Notice 51030 whereby Nuclear Logistics, Inc. reported that a potentially unqualified component could be installed in Allen Bradley Model 700RTC Relays, the same model evaluated by AR 00738272. When questioned by the inspectors if this applied to the relay issue at Brunswick, the licensee initiated AR 00748309, on May 11, 2015, to address the operability and qualification issues associated with the relay design change.

Analysis: The inspectors determined that the licensee's failure to adequately classify the relay design change as a CAQ, and the subsequent loss of safety function as a SCAQ, as required by procedure AD-PI-ALL-0100 is a performance deficiency. The performance deficiency was more than minor because, if left uncorrected, additional unqualified relays would likely have been installed in the plant.

The inspectors screened this issue using Manual Chapter 0609, Attachment 4, Initial Characterization of Findings, and determined it affected the mitigating systems cornerstone for both Unit 1 and Unit 2. Because of the different operating modes for each unit, the inspectors used Manual Chapter 0609 Appendix A, for Unit 1 and Appendix G, for Unit 2 for significance determination.

For Unit 1 the finding screens as Green because it did not represent an actual loss of function of one or more non-Technical Specification trains of equipment. The inspectors answered 'no' to all of the screening questions associated with Manual Chapter 0609, Appendix A, Exhibit 2, Mitigating Systems Screening Questions (Questions A1-A4).

For Unit 2, which was shut down, the result was Green because the inspectors answered 'no' to all the questions associated with Manual Chapter 0609, Appendix G, Attachment 1, Exhibit 3, Mitigating Systems Screening Questions (Question 9).

The inspectors determined that the finding had a cross-cutting aspect for "Evaluation" in the Problem Identification & Resolution area because the most likely cause of the missed conditions adverse to quality was a lack of thorough investigation during the evaluations (for cause and reportability) of the relay issue. A more detailed evaluation, commensurate with safety, would have thoroughly evaluated the relay design change as well as how a non-conforming relay was installed in the plant [P.2].

Enforcement: Criterion XVI of 10 CFR Part 50, Appendix B, requires, in part, that measures shall be established to assure that conditions adverse to quality are promptly identified and corrected. Contrary to this, following a cause evaluation and reportability review of the EDG 3 output breaker failure on March 16, 2015, the licensee failed to identify two conditions adverse to quality, one of which was significant. From April 13, 2015, until May 11, 2015, a design change to a diesel generator output breaker relay, which met the definition of a condition adverse to quality, went unidentified. From April 23, 2015, until June 17, 2015, a loss of safety function determination resulting from the relay failure, which met the definition of a significant condition adverse to quality, subsequently went unidentified. This violation is being treated as an NCV, consistent

with Section 2.3.2.a of the Enforcement Policy. It was entered into the licensee's corrective action program as AR 00748309 and AR 00754934 (NCV 05000324/2015007-01; 05000325/2015007-01, Failure to Identify Conditions Adverse to Quality).

- (b) Introduction: An NRC-identified Green NCV of 10 CFR Part 50, Appendix B, Criterion III, Design Control was identified for the licensee's inadequate commercial grade dedication technical evaluation that resulted in non-conforming relays being installed in the control circuits for emergency diesel generator output breakers.

Description: On March 16, 2015, with Unit 1 operating at 100 percent rated thermal power (RTP) and Unit 2 in a refueling outage, the output breaker for EDG 3 failed to close during surveillance testing following governor replacement. The licensee suspended the testing and began troubleshooting the incident. The troubleshooting initially determined that the cause of the failure was related to two relays in the output breaker control circuitry. The licensee replaced these relays, completed the surveillance test, and returned EDG 3 to service on March 18, 2015. The licensee subsequently removed EDG 4 from service as part of planned maintenance and, as a precautionary measure, increased the work scope to replace the same relays in the output breaker control circuit. During post-maintenance testing of EDG 4 the output breaker exhibited the same cycling behavior as had occurred on EDG 3 except that the breaker did close. Further troubleshooting by the licensee revealed that electromagnetic kickback was causing the relays to oscillate such that they sent alternating open and close signals to the breaker resulting in the failure. The licensee further determined that EDG 3 remained susceptible to the same failure because the test equipment, which was left on during surveillance testing, masked the problem. As a result of these actions EDG 3 and EDG 4 were both susceptible to the breaker failing to close, and thus unavailable, for 12 minutes. The licensee installed a design change to disperse the electromagnetic kickback on EDG 3, reinstalled the original relays in the output breaker for EDG 4, and initiated AR 00738272 on the incident.

The inspectors reviewed AR 00738272 as a PI&R Annual Sample. In reviewing the cause evaluation the inspectors noted that the licensee had determined that an internal design change had been made to one of the affected relays that likely made it susceptible to the inductive kickback that caused the breaker close failure. Because the affected relay was purchased commercially and then dedicated under the licensee's QA program, the inspectors further reviewed the dedication aspects of the affected relay against the requirements of 10 CFR Part 50 Appendix B, and 10 CFR Part 21.

From this review the inspectors learned that relays similar to the failed relay for EDG 3 were installed in the output breaker control circuit for each emergency diesel generator at various times during 2008 and 2009. Further, these relays were purchased and dedicated using Material Evaluation 003763.01, Allen Bradley 700RTC Relays, Revision 1, which assessed the safety function, failure modes, and critical characteristics of the relay. In implementing that evaluation, which was done in 1999, the licensee relied on a dimensional and configuration check to ensure that no unforeseen design changes had occurred. The inspectors determined that this process was generally in agreement with

EPRI Standard NP-5652, Guideline for the Utilization of Commercial Grade Items in Nuclear Safety Related Applications, Revision 0, which the licensee invoked for commercial grade dedication in Procedure EGR-NGGC-0041, Procurement Engineering, Revision 3. However, the use of dimensional and configuration checks were insufficient to detect the internal design change made to the relays by the supplier, which was specifically designated as a possibility by EPRI-5652.

Analysis: The inspectors determined that Material Evaluation 003763.01 was inadequate to detect changes made by the manufacturer in the design of the affected relay. This was considered a performance deficiency because it led to specification of a relay that was unsuitable for the application, which was required by 10 CFR 50 Appendix B, Criterion III and expected by EPRI-5652. Because the licensee used EPRI-5652 as the standard for their commercial grade dedication program, it was within their ability to foresee and should have been prevented. The performance deficiency was more than minor because, if the process for detecting commercial grade item changes using material evaluations was left uncorrected, additional undetected design or process changes would likely occur. It was also similar to Example 5c of Manual Chapter 0612, Appendix E, in that a non-conforming relay was installed into the plant.

The inspectors screened this issue using Manual Chapter 0609, Attachment 4, Initial Characterization of Findings, and determined it affected the mitigating systems cornerstone for both Unit 1 and Unit 2. In doing this screen, the inspectors assumed that all four emergency diesels contained the susceptible relay because at the time of the inspection the licensee was unable to fully confirm that was not the case. The inspectors agreed with the licensee's conclusion that any given emergency diesel generator was susceptible only when running at rated speed and voltage, but unloaded. Therefore, each emergency diesel generator had only been susceptible to the relay issue during performance of diesel generator loading testing in an outage, which lasted for an average of three hours per year. All four EDGs are run concurrently for this test. Also, based on the Brunswick accident analysis and on the licensee evaluation of the event, the inspectors determined that the unavailability of both EDG 3 & 4 for 12 minutes constituted a loss of function that required a detailed risk evaluation. Because of the different operating modes for each unit, the inspectors used Manual Chapter 0609 Appendix A, SDP for Findings at Power, for the Unit 1 finding and used Appendix G, Shutdown Operations SDP, for the Unit 2 finding.

For Unit 1, the inspectors, in consultation with the regional senior reactor analyst (SRA), reviewed outage data back to the previous relay change out on each diesel generator. Based on this information, the SRA increased the start failure probability for each EDG by an additional $6.25\text{E-}02$, based on one failure in 16 demands for all of the EDGs. The SRA used this increased probability and the three hour exposure time to run a condition assessment for the issue in SAPHIRE. The result was a change in core damage frequency on that was several orders of magnitude less than the $1\text{E-}7$ LERF threshold, with the dominant sequences being from loss of off-site power with failure of one or more emergency diesel generators to start. The low exposure time contributed to the low significance of the finding. Operator actions could have recovered the EDG after the failure to start. Unit 1 was determined to be Green.

For Unit 2, the inspectors determined that each emergency diesel generator was susceptible to the relay issue during diesel loading tests conducted on March 16, 2015, for EDG 3 and on March 21, 2015, for EDG 4. During this time period Unit 2 was in Mode 5 with the refueling cavity filled. The regional SRA conducted an assessment for the Shutdown condition, by using the Unit 1 at power analysis as a bounding analysis, since all four EDGs are available at the time when an EDG is susceptible. The low exposure time, and the high chance of EDG recovery after a failure to start contributed to the low risk from the finding. This issue is Green.

The inspectors determined that no cross-cutting aspects applied because the original relay dedication package was drafted in 1999 and was not indicative of current licensee performance.

Enforcement: Criterion III of 10 CFR 50, Appendix B, requires, in part, that measures shall be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of structures, systems, and components. Contrary to this, during technical review for the dedication of Allen Bradley Relays, the licensee specified a relay for use in the diesel generator output breaker control circuit that was unsuitable for the application. From November 3, 2008, until March 23, 2015, a commercially dedicated relay installed in the control circuit for EDG 3 was susceptible to failure by electromagnetic kickback because the technical evaluation used for dedication failed to identify a design change in the timing circuit of the relay. This violation is being treated as an NCV, consistent with Section 2.3.2 of the Enforcement Policy. It was entered into the licensee's corrective action program as AR 00738272 and AR 00748309. (NCV 05000324/2015007-02; 05000325/2015007-02, Insufficient Material Evaluation of Commercially Dedicated Allen Bradley Relays)

b. Assessment of the Use of Operating Experience

(1) Inspection Scope

The inspectors examined licensee programs for reviewing industry OE, interviewed personnel, and reviewed licensee procedure AD-PI-ALL-0400. "OE Program," Rev. 1. In addition, the inspectors selected OE documents (e.g., NRC generic communications, 10 CFR Part 21 reports, licensee event reports, vendor notifications, and plant internal OE items, etc.), which had been issued since April 2011 to verify whether the licensee had appropriately evaluated each notification for applicability to the Brunswick plant, and whether issues identified through these reviews were entered into the CAP. Documents reviewed are listed in the Attachment.

(2) Assessment

Based on a review of documentation related to the review of OE issues, the inspectors determined that the licensee was generally effective in screening OE for applicability to the plant. Industry OE was evaluated by plant OE Coordinators and relevant information was then forwarded to the applicable department for further action or informational purposes. Operating experience issues requiring action were entered into the CAP for

tracking and closure. In addition, OE was included in all root cause evaluations in accordance with licensee procedure AD-PI-ALL-0400.

(3) Findings

No findings were identified.

c. Assessment of Self-Assessments and Audits

(1) Inspection Scope

The inspectors reviewed audit reports and self-assessment reports, including those which focused on problem identification and resolution, to assess the thoroughness and self-criticism of the licensee's audits and self assessments, and to verify that problems identified through those activities were appropriately prioritized and entered into the CAP for resolution in accordance with licensee procedure AD-PI-ALL-0300, "Self Assessment and Benchmark Programs," Rev. 1.

(2) Assessment

The inspectors determined that the scopes of assessments and audits were adequate. Self-assessments were generally detailed and critical, as evidenced by findings consistent with the inspector's independent review. The inspectors verified that NCRs were created to document all areas for improvement and findings resulting from the self-assessments, and verified that actions had been completed consistent with those recommendations. Generally, the licensee performed evaluations that were technically accurate. Site trend reports were thorough and a low threshold was established for evaluation of potential trends, as evidenced by the NCRs reviewed that were initiated as a result of adverse trends.

(3) Findings

No findings were identified.

d. Assessment of Safety-Conscious Work Environment

(1) Inspection Scope

The inspectors interviewed on-site workers regarding their knowledge of the corrective action program at Brunswick and their willingness to write NCRs or raise safety concerns. During technical discussions with members of the plant staff, the inspectors conducted interviews to develop a general perspective of the safety-conscious work environment at the site. The interviews were also conducted to determine if any conditions existed that would cause employees to be reluctant to raise safety concerns. The inspectors reviewed the licensee's Employee Concerns Program (ECP) and interviewed the ECP manager. Additionally, the inspectors reviewed a sample of ECP issues to verify that concerns were being properly reviewed and identified deficiencies were being resolved and entered into the CAP when appropriate.

(2) Assessment

Based on the interviews conducted and the NCRs reviewed, the inspectors determined that licensee management emphasized the need for all employees to identify and report problems using the appropriate methods established within the administrative programs, including the CAP and ECP. These methods were readily accessible to all employees. Based on discussions conducted with a sample of plant employees from various departments, the inspectors determined that, in general, employees felt free to raise issues, and that management encouraged employees to place issues into the CAP for resolution.

(3) Findings

No findings were identified.

4OA3 Follow-up of Events and Notices of Enforcement Discretion.1 (Closed) Licensee Event Report (LER) 05000325/1-2015-001-00 High Pressure Coolant Injection (HPCI) System Inoperable due to Auxiliary Oil Pump Failurea. Inspection Scope

LER 1-2015-001-00 High Pressure Coolant Injection (HPCI) System Inoperable due to Auxiliary Oil Pump Failure described the failure of the Unit 1 HPCI auxiliary oil pump failure that occurred on February 12, 2015. The inspectors reviewed the licensee event report, operability determination and causal analysis surrounding the event. The licensee event report associated with this event adequately documented the summary of the event including the cause of the event and potential safety consequences. The HPCI system did not exceed its technical specification allowed outage time. This LER is closed.

b. Findings

No findings were identified.

.2 (Closed) Licensee Event Report (LER) 05000325/2015-002-00, Emergency Diesel Generator Loss of Safety Functiona. Inspection Scope

On April 23, 2015, the licensee determined that during a period of 12 minutes on March 21, 2015, EDG 3 & 4 could potentially have been unable to tie to their respective emergency busses. This was due to relays in breaker control logic that were susceptible to electrical noise and was considered a loss of function of the onsite standby AC power source. This LER is closed.

b. Findings

The inspectors reviewed this event and the results are described in Sections 4OA2.a(3)(a)) and 4OA2.a.(3)(b)) of this report.

4OA6 Meetings, Including Exit

On June 18, 2015, the inspectors presented the inspection results to Mr. Gideon and other members of the site staff. The inspectors confirmed that all proprietary information examined during the inspection had been returned to the licensee.

ATTACHMENT: SUPPLEMENTARY INFORMATION

KEY POINTS OF CONTACT

Licensee personnel:

R. Gideon, Site Vice President
K. Krakuszeski, Plant General Manager
J. Peirce, Shift Operations Manager
B. Houston, Maintenance Manager
J. Nolin, Engineering Manager
R. Wiemann, Engineering Director
K. Allen, Design Engineering Director
F. Jefferson, Engineering Director
J. Johnson, Chemistry Manager
E. Neal, Radiation Protection Manager
L. Grzeck, Licensing Manager
M. Schultheis, Performance Improvement Manager
G. Galloway, Nuclear Oversight
J. Bryant, Regulatory Affairs
K. Brady, Performance Improvement
B. Jessup, Operations

NRC personnel:

M. Catts, Senior Resident Inspector
M. Orr, Resident Inspector
A. Masters, Chief, Branch 7, Division of Reactor Projects

LIST OF REPORT ITEMS

Opened and Closed

05000324,325/2015007-01	NCV	Failure to Identify Conditions Adverse to Quality (Section 4OA2.a.(3)(a))
05000324,325/2015007-02	NCV	Insufficient Material Evaluation of Commercially Dedicated Allen Bradley Relays (Section 4OA2.a.(3)(b))

Closed

05000325/1-2015-001-00	LER	High Pressure Coolant Injection (HPCI) System Inoperable due to Auxiliary Oil Pump Failure (Section 4OA3.1)
05000325/1-2015-002-00	LER	Emergency Diesel Generator Loss of Safety Function (Section 4OA3.2)

Discussed

None

LIST OF DOCUMENTS REVIEWED

Procedures

0MST-DG13R, DG-3 Loading Test. Rev. 14
0MST-DG13R, DG-3 Loading Test. Rev. 21
AD-OP-ALL-0202, Aggregate Operator Impact Assessment, Rev. 1
1A-AP-01 Annunciator Response Procedure for Panel A-01, Rev 56
2A-AP-01 Annunciator Response Procedure for Panel A-01, Rev 64
0AI-143 Component Identification, Rev 9
1OP-19 HPCI Weekly Inspection, Rev 93
OPS-NGGC-1305 Operability Determinations, Rev 11
0MMM-054 Temporary Power, Rev 1
0SMP-CMP500 Temporary Air Installation and Removal, Rev 4
0SMP-DMP002 Tie-in of Unit 1 Temporary Power Loads During Division 1 and Division 2 Bus Outages, Rev 2
2SMP-DMP002 Tie-in of Unit 2 Temporary Power Loads During Division 1 and Division 2 Bus Outages, Rev 1
CAP-NGGC-0205 Condition Evaluation and Corrective Action Process, Rev 18
CAP-NGGC-0200 Condition Identification and Screening Process, Rev 39
AD-PI-ALL-0100 Corrective Action Program, Rev 2
AD-PI-ALL-0101 Root Cause Evaluation, Rev 0
AD-PI-ALL-0102 Apparent Cause Evaluation, Rev 0
AD-PI-ALL-0104 Prompt Investigation Response Team, Rev 1
ADM-NGGC-0101 Maintenance Rule Program, Rev 24
AD-PI-ALL-0102, Apparent Cause Evaluation, Rev. 0
0SPP-CEM500, Installation of Concrete and Grout, Rev. 22
0ENP-54, Building Ventilation Pressure Control Program, Rev. 32
0BNP-TR-019, External Event Protection Features, Rev. 4
EGR-NGGC-0351, Condition Monitoring of Structures, Rev. 22
0AOP-13.0 OPERATION DURING HURRICANE, FLOOD CONDITIONS, TORNADO, OR EARTHQUAKE REV 62
0AOP-31.0 FLOODING IN TURBINE BUILDING CONDENSER PIT OR PIPE TUNNEL REV13
0PEP-02.2.1 EMERGENCY ACTION LEVEL TECHNICAL BASES, REV 7
0BNP-TR-034, License Renewal Buried Piping and Tanks, Inspection Program, Rev 1
0PFP-DG, Diesel Generator Building Pre-fire Plans, Rev 19
0BNP-TR-051. License Renewal Open Cycle Cooling water System Aging Management, Rev 2
AD-EG-ALL-1613, Buried Piping Integrity Program Implementation, Rev 1
0ENP-2704, Administrative Control of NRC Generic Letter 89-13 Requirements, Rev 23
0AI-86, Service/Circulating Water Strategic Plan, Rev 10
2PM-MEC505, Conventional Service Water Header Inspection, Rev 12
MNT-NGGC-0009, Application of Protective Coating, Rev 7
CPL-XXXX-W-005, Nuclear Power Plant Protective Coatings, Rev 13
CPL-XXXX-W-005, Nuclear Power Plant Protective Coatings, Rev 15
Procedure AD-PI-ALL-0100, Corrective Action Program, Rev 2
Procedure AD-PI-ALL-0103, Quick Cause Evaluation, Rev 1
Procedure 0MST-DG13R, DG-3 Loading Test, Rev 20
Action Request 00738272, DG 3 Output Breaker Failure, dated March 16, 2015

Action Request 00748309, Part 21 Notification for Allen Bradley 700RTC Relay, dated 5/11/2015

Action Request 00754934, EDG3 Relay Issue Not Screened as SCAQ, dated June 17, 2015

Nuclear Condition Reports (NCRs)

747572		
747389	673335	739513
747316	692923	739512
747315	694259	739511
747314	727629	739509
747234	732624	739506
746714	736697	739504
729025	739683	735820
746970	741228	580155
739129	741615	747893
736639	741872	747940
717634	702640	688613
567016	582572	693590
738272	706435	582572
151046	617843	607986
151101	621220	627708
140623	668499	580155
733423	722822	604452
732803	691087	582584
731399	691088	711625
730364	691089	747712
717163	691090	711625
705743	711912	406525
68735	616884	737942
612216	621489	738272
612970	747616	754934
633239	743072	748309
652820	739514	

Engineering Changes

EC-90074, EDG1 Load Temporarily Rose to 3877KW

Root Cause Evaluations

717634

613201

611601

673858

675404

641834

682668

621654

629064

673390

Self Assessments

SA 378547

Work Orders

2146702

2115847

2034155

2255503

2138322

2138344

13442338

13519970

1776265

Work Request

8936

Drawings:

D-02525, Reactor Building Residual Heat Removal System Piping Diagram, Sh. 1A, Rev. 51
 DWG D-25023 Sheet 1 for Unit 1 HPCI Piping, Rev 60
 DWG D-25023 Sheet 2 for Unit 1 HPCI Piping, Rev 53
 DWG D-02523 Sheet 1 for Unit 2 HPCI Piping, Rev 58
 DWG D-02523 Sheet 2 for Unit 2 HPCI Piping, Rev 53
 1OP-19 HPCI Weekly Inspection done on the Unit 1 HPCI from January 1, 2015 to February 5, 2015
 QDP-69 Qualification Data Package for HPCI Turbine, Rev 10
 F-01738, Service Water Intake Structure Reinforcement Plans, Rev. 5
 9527-F-1741, Service Water Intake Structure Units 1 & 2 Reinforcing Plan at El. 20'-0, Rev. 2
 FP-82429, Diesel Generator Building Rolling Fire Door
 D-02052, SW Chlorination System, Rev 1
 D-02041, SW Piping, Rev 1, Sht. 1-3

Other Documents:

Material Evaluation, ME No: 003763.01, 01/04/1999, Commercial Grade Dedication package for CP&L Part #: 739-409-18, Allen Bradley Solid State Relay Model # 700RTC
 NRC Event Notification #:51030, Nuclear Logistics Inc. Part 21 on Allen Bradlet 700RTC Solid State Relays
 Aggregate Operator Impact Assessment, Attachment 3, April 2015
 Aggregate Operator Impact Assessment, Attachment 3, May 2015
 BNP Unit 1 & 2 Operator Work Arounds (OWA) June 2013 – March 2015
 BNP Unit 1 & 2 Operator Burdens (OB) March 2015
 BNP Unit 1 & 2 Control Room Deficiencies (CRD) March 2015
 BNP Unit 1 & 2 Control Room Annunciators Lit/OOS March 2015
 North Anna OE 19273, Allen Bradley 700RTC Anomalous Behavior
 Calculation: PID-0149A-01 Standby Liquid Control Net Positive Suction Head Analysis, Rev 0
 Commercial Grade Dedication for the Unit 1 HPCI Auxiliary Oil Pump M-coil, dated February 19, 2015
 BNP-E-6.121 Electrical Analysis for Safety Related DC circuits, Rev 2
 Maintenance Rule Scoping Documents for: HPCI, Main Steam, Service Water, Emergency Diesel Generators, 250 VDC system, Storm Drains, Fuel Pool Cooling, Service Water Building, Reactor Building, and Emergency Diesel Generator Buildings as of April 28, 2015
 Plant Health Committee Meeting minutes from May 6, 2015
 LER 1-2015-001-00 High Pressure Coolant Injection (HPCI) System Inoperable due to Auxiliary Oil Pump Failure
 NUREG 1022 10 CFR 50.72 and 10 CFR 50.73 Reporting Criteria, Rev 3
 Brunswick Steam Electric Plant (BSEP) FSAR section 6.3 Emergency Core Cooling Systems, Rev 22
 BSEP Event Notification 50816 for Unit 1 HPCI Inoperability due to Auxiliary Oil Pump Failure
 High Pressure Coolant Injection System Health for Units 1 and 2 dated December 2014
 Maintenance Rule Systems in a(1) status action plans dated April 2015
 Maintenance Rule Functional Failure status as of April 2015
 DBD-20 Automatic Depressurization System, Rev 8
 DBD-19 High Pressure Coolant Injection System, Rev 23
 SD-20 Automatic Depressurization System (ADS), Rev 3
 SD-19 High Pressure Coolant Injection System, Rev 24

AR 150706-40 OCR, AR 150706 Operability Determination
NUREG-1801, Rev 2
NEI 09-14 Rev 3
Regulatory Guide 1.54
ESR 00-00224