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

October 16, 2019

Mr. John A. Krakuszeski
Site Vice President
Duke Energy Progress, LLC
Brunswick Steam Electric Plant
8470 River Rd. SE (M/C BNP001)
Southport, NC 28461

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT – DESIGN BASIS ASSURANCE INSPECTION (TEAMS) INSPECTION REPORT 05000324/2019011 AND 05000325/2019011

Dear Mr. Krakuszeski:

On September 13, 2019, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Brunswick Steam Electric Plant and 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.

Two findings of very low safety significance (Green) are documented in this report. Two of these findings involved violations of NRC requirements. We are treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2 of the Enforcement Policy.

If you contest the violations or significance or severity of the violations documented in this inspection report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region II; the Director, Office of Enforcement; and the NRC Resident Inspector at Brunswick.

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.

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 10 CFR 2.390, “Public Inspections, Exemptions, Requests for Withholding.”

Sincerely,

/RA/

James B. Baptist, Chief
Engineering Branch 1
Division of Reactor Safety

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 – DESIGN BASIS ASSURANCE INSPECTION (TEAMS) INSPECTION REPORT 05000324/2019011 AND 05000325/2019011 Dated October 16, 2019

DISTRIBUTION:
N. Simonian, NSIR
Dante Johnson, NSIR
Daryl Johnson, NSIR
D. Huyck, NSIR
D. Ditto, NMSS
J. Rubenstone, NMSS
B. Davis, RII, DRP
J. Dodson, RII, SPE
P. Niebaum, RII, SPE
D. Jackson, RII, PE
G. Smith, RII, SRI
J. Stewart, RII, RI
S. Price, ORA/RC
L. Gibson, RII, EICS
RIDSNRRDIRS
PUBLIC

ADAMS ACCESSION NUMBER: **ML19289B887**

X SUNSI Review	X Non-Sensitive ☐ Sensitive	X Publicly Available ☐ Non-Publicly Available

OFFICE	RGN II/ 10 1060	OFFSITE	RGN II/ 10 1079	OFFSITE	RGN II/ 10 1043	RGN II/ 10 1095
SIGNATURE		Via email	Via email	Via email	Via email	Via email
NAME	J Baptist	J Nicely	C Franklin	C Barron	J Montgomery	M Riley
DATE	10/16/2019	10/4/2019	10/9/2019	10/4/2019	10/7/2019	10/4/2019

OFFICIAL RECORD COPY

U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Numbers:	05000324 and 05000325
License Numbers:	DPR-62 and DPR-71
Report Numbers:	05000324/2019011 and 05000325/2019011
Enterprise Identifier:	I-2019-011-0007
Licensee:	Duke Energy Progress, LLC
Facility:	Brunswick Steam Electric Plant
Location:	Southport, NC
Inspection Dates:	August 19, 2019 to September 13, 2019
Inspectors:	C. Franklin, Reactor Inspector J. Montgomery, Senior Reactor Inspector G. Ottenberg, Senior Reactor Inspector M. Riley, Reactor Inspector C. Baron, Mechanical Contractor G. Nicely, Electrical Contractor
Approved By:	James B. Baptist, Chief Engineering Branch 1 Division of Reactor Safety

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting a design basis assurance inspection (teams) 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

Failure to Properly Size and Evaluate the Acceptability of MOV Thermal Overloads			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000324,05000325/2019011-01 Closed	None (NPP)	71111.21M
The team identified a Green finding and associated Non-cited Violation (NCV) of Title 10 of the *Code of Federal Regulations* Part 50 (10 CFR 50), Appendix B, Criterion III, "Design Control," for the licensee's failure to translate design basis MOV requirements into sufficient procedural guidance to size and evaluate motor-operated valve (MOV) thermal overloads (TOLs) properly. Specifically, the licensee's procedure for sizing and evaluating TOLs, EGR-NGGC-0106, "AC and DC Overcurrent Protection and Coordination" Revision 5, did not incorporate guidance to properly size or evaluate the MOV TOLs during all design basis conditions.			

Failure to Follow Calculation Control Process			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000324,05000325/2019011-02 Closed	[H.3] - Change Management	71111.21M
The inspectors identified a Green finding and associated Non-cited Violation (NCV) of Title 10 of the *Code of Federal Regulations* Part 50 (10 CFR 50), Appendix B, Criterion V, "Instructions, Procedures and Drawings," for the licensee's failure to follow their AD-EG-ALL-1117, Design Analyses and Calculations, procedure. Specifically, procedure AD-EG-ALL-1117, section 4.2, required the verifier to identify that the design inputs were accurate and complete, however, the licensee did not identify all design inputs for calculations 0BNP-TR-006, "MOV Design Basis Information GL89-10 & GL 96-05," and BNP-E-8.013/BNP-E-8.014, "Motor Torque Analysis for AC MOVs." As a result, the licensee failed to update the affected calculations following motor-operated valve (MOV) testing or maintenance, the results of which could change the results of the calculations.			

Additional Tracking Items

None.

INSPECTION SCOPES

Inspections were conducted using the appropriate portions of the inspection procedures (IPs) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at http://www.nrc.gov/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 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

71111.21M - Design Bases Assurance Inspection (Teams)

The inspectors evaluated the following components and listed applicable attributes, permanent modifications, and operating experience:

Design Review - Risk-Significant/Low Design Margin Components (IP Section 02.02) (4 Samples)

(1) E4 Bus – Division II Emergency Switchgear

- Material condition and configuration review performed during a visual non-intrusive inspection to assess material condition, the presence of hazards, and consistency of installed equipment with design documentation and analyses
- Normal, abnormal, and emergency operating procedures
- Breaker Maintenance effectiveness; Procedures for preventive maintenance, inspection, and testing to compare maintenance practices against industry and vendor guidance
- Component health reports, corrective maintenance records, and corrective action history
- Coordination and interface with the transmission system operator for plant voltage requirements and notification set points
- Electrical calculations:(Load flow, bus loading and voltage drop, Degraded and loss of voltage protection, Protective relay and breaker settings and coordination, Short circuit and breaker duty analysis)

(2) Motor-Operated Valve (MOV) 2-E11-F007B – RHR Minimum Flow Bypass Valve to the Suppression Pool (Electrical Interfaces)

- Calculations: (Motor Torque Determination, MOV Protection Thermal Overload Sizing and Evaluations, MOV motive and control power, available torque calculations)
- Adherence to vendor and industry maintenance and technical updates
- Material condition and configuration review performed during a visual non-intrusive inspection to assess material condition, the presence of hazards, and consistency of installed equipment with design documentation and analyses

(3) Unit 2 125V DC Distribution Panel 4-B

- Material condition and configuration reviewed performed during a visual non-intrusive inspection to assess material condition, the presence of hazards, and consistency of installed equipment with design documentation and analyses
- Procedures for maintenance and testing of breakers to compare practices against industry guidance
- Component health reports and corrective action history
- Calculations: (Bus loading and voltage drop, short circuit analysis, breaker coordination study)
- Surveillance testing of battery power supply attributes inspected (e.g., maximum available fault current)

(4) Unit 1 Reactor Core Isolation Cooling (RCIC) Pump, E51-C001

- Material condition and installed configuration (e.g., visual inspection/walkdown)
- Normal, abnormal, and emergency operating procedures
- Consistency among design and licensing bases and other documents/procedures
- System health report, maintenance effectiveness and records, and corrective action history
- Equipment/environmental controls and qualification
- Design calculations
- Surveillance testing and recent test results
- System and component level performance monitoring
- Equipment protection from fire, flood, and water intrusion or spray
- Heat removal cooling water and ventilation

Design Review - Large Early Release Frequency (LERFs) (IP Section 02.02) (1 Sample)

(1) Unit 1 Air-Operated Valve (AOV) 1-CAC-V216 - Hardened Wetwell Vent Line Isolation Valve

- Material condition and configuration review performed during a visual non-intrusive inspection to assess material condition, the presence of hazards, and consistency of installed equipment with design documentation and analyses
- Normal, abnormal and emergency operating procedures
- Maintenance effectiveness; Procedures for preventive maintenance, inspection, and testing to compare maintenance practices against industry and vendor guidance.
- Component health reports, corrective maintenance records, and corrective action history
- Calculations: (actuator output capability and margins, air supply and control power, required design basis capability, uncertainty assumptions)

Modification Review - Permanent Mods (IP Section 02.03) (4 Samples)

(1) EC 406293, Evaluation of Instrument Uncertainty Calculations not for Limiting Safety System Settings or Automatic Protective Functions
(2) EC 298197, Acceptability of Shaft to Bowl Bearing Clearance and Impeller Wear Ring Clearance for 2C CSW PUMP 2-SW-2C-CONV-PMP
(3) EC 412996, Replace the 1-E11-F048B-MO (1B RHR HX BYPASS VLV) with an Aluminum Rotor Motor
(4) EC 407321, Evaluation Of DC Load Profile And Battery Voltages Following The Restoration Of DC Battery Chargers To The DC System During A DBA (LOOP/LOCA)

Review of Operating Experience Issues (IP Section 02.06) (2 Samples)

(1) NRC Regulatory Issue Summary (RIS) 2011-12, Rev. 1, Adequacy of Station Electric Distribution System Voltages
(2) NRC Information Notice 2013-17, Significant Plant Transient Induced by Safety-Related Direct Current Bus Maintenance at Power

INSPECTION RESULTS

Failure to Properly Size and Evaluate the Acceptability of MOV Thermal Overloads			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000324,05000325/2019011-01 Closed	None (NPP)	71111.21M
The team identified a Green finding and associated Non-cited Violation (NCV) of Title 10 of the *Code of Federal Regulations* Part 50 (10 CFR 50), Appendix B, Criterion III, "Design Control," for the licensee's failure to translate design basis MOV requirements into sufficient procedural guidance to size and evaluate motor-operated valve (MOV) thermal overloads (TOLs) properly. Specifically, the licensee's procedure for sizing and evaluating TOLs, EGR-NGGC-0106, “AC and DC Overcurrent Protection and Coordination” Revision 5, did not incorporate guidance to properly size or evaluate the MOV TOLs during all design basis conditions.			
Description: TOLs are installed to protect MOV actuator motors from failure due to heating caused by prolonged exposure to high current. The TOLs trip to interrupt the current to the MOV motor, which prevents the valve from moving. In nuclear power plant applications, the criterion for establishing an MOV TOL trip set point should be for the valve to complete its safety function (e.g., drive the valve to its proper position to mitigate the effects of an accident) rather than to protect the motor from destructive heating. MOVs may be required to operate at the beginning of an accident when other large motors are also starting, which could result in bus voltage dropping low enough to stall the MOV until voltage recovers. If these voltage dips occur while power to the MOV is being supplied from the offsite power source, and voltage doesn’t recover quickly (generally within 5 seconds), then the MOV may continue to stall until the degraded voltage protection system time delay relay (described in TS 3.3.8.1) actuates. This causes the plant to disconnect from the offsite power source, and switch to the emergency diesel generators. During this time, the stalled MOVs could be experiencing high currents and generating excessive heat within both the actuator motor and the TOL, which can cause the TOL to actuate and trip the power to the MOV if not sized adequately to operate through the event without tripping. Similarly, MOVs may also have a			

jogging or throttling requirement during the accident which requires multiple starts of its motor within a short period of time. These demands would add additional heat to the MOV motor and TOL, which can also cause the TOL to actuate and trip the power to the MOV.

The inspection team reviewed Attachment F, “DVR and TOL Evaluation,” of calculations BNP-E-8.013 and BNP-E-8.014, Motor Torque Analysis for AC Motor Operated Valves, to evaluate how the licensee confirmed that the MOV TOLs were sized appropriately for degraded grid voltage conditions concurrent with accident conditions. During the team's review of the calculations, the team discovered several errors in the calculation methodology that were non-conservative and required the licensee to re-evaluate them. The licensee captured these errors in their corrective action program as action requests (ARs) 2289038 and 2289996. Once the licensee corrected the errors in their calculation, the team discovered that the TOLs for nine MOVs had the potential to trip before the valves performed their safety function, if the MOV was taken out of its normal position and the MOV received an accident signal to reposition back to its normal safety-function position.

Upon discovering that the TOLs were undersized, the inspection team reviewed the procedural guidance in BNP Standard Procedure EGR-NGGC-0106, AC and DC Overcurrent Protection and Coordination, Revision 5, which the licensee used to size various electrical protective devices.

The team observed that section 9.3.14, “Considerations for AC and DC Protective Device Selection,” described that protective devices must be adequately sized for the operating scenarios under consideration, such as during starting of other loads simultaneously or during a degraded voltage condition where the inrush current of a starting motor may continue until the voltage recovers to the point at which the devices can operate. However, section 9.6, “MOV Motor Circuit Protection,” which the licensee used for sizing MOV TOLs specifically, did not reference or include the guidance described in subsection 9.3.14. Additionally, in section 9.6 there was no specific guidance for various scenarios required by the station MOVs design bases, including:

- Considering a sustained degraded grid voltage and its associated 11 second maximum time delay allowed by the degraded grid voltage relay setpoints required by TS 3.3.8.1,
- The allowances given in Generic Letter 89-10, Supplement 1, and utilized by the station MOV program to delay starting of MOVs for approximately 5 seconds during upstream motor starting which may result in stall conditions for that time,
- Sizing TOLs for MOVs that have a jogging/throttling function post-event.
- Establishing the trip setpoint of the TOLs with all uncertainties resolved in favor of completing the safety-related action, rather than protecting the motor.

Because of the inadequate procedural guidance, the team determined that calculation BNP-E-2.002, 480V AC Auxiliary Safety-related MOV Electrical Protection, Rev. 16, which sized the TOLs for MOVs, did not ensure that the safety function of the MOVs would be met, as it did not account for the different operating scenarios described above. Several of the TOLs were undersized in favor of providing protection for the MOV motor, rather than ensuring the safety function would be completed. NCR 2291385 was generated to evaluate the procedural adequacy.

Corrective Actions: The licensee entered the issue into their corrective action program and evaluated the MOVs' capability to respond to accident conditions due to being in their normal

required position prior to the event. The licensee further initiated plans to improve the guidance in procedures for sizing and evaluating MOV TOLs.

Corrective Action References: NCRs 02289038 and 02291385 and NTM 2289996

Performance Assessment:

Performance Deficiency: The team determined the licensee's failure to translate design basis MOV requirements into sufficient procedural guidance in EGR-NGGC-0106 to size and evaluate the MOV TOLs properly was a performance deficiency.

Screening: The inspectors determined the performance deficiency was more than minor because it was associated with the Design Control attribute of the Mitigating Systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, nine MOVs were identified that had under-sized TOLs and had the potential to trip during an accident concurrent with a degraded voltage condition, and the improper TOL sizing challenges the capability of the MOVs during degraded grid voltage design conditions.

Significance: The inspectors assessed the significance of the finding using Appendix A, “The Significance Determination Process (SDP) for Findings At-Power.” The inspectors evaluated the finding in accordance with the NRC Inspection Manual Chapter (IMC) 0609, Attachment 4, "Initial Characterization of Findings," issued October 7, 2016, for Mitigating Systems, and IMC 0609, Appendix A, issued June 19, 2012, and determined the finding to be of very low safety significance (Green) because finding was a design deficiency and the affected SSCs maintained their operability. Specifically, the licensee justified the MOVs would be able to perform their safety function under predicted transient voltage conditions during a design basis accident, although they would be challenged under concurrent accident and degraded voltage scenarios.

Cross-Cutting Aspect: Not Present Performance. No cross cutting aspect was assigned to this finding because the inspectors determined the finding did not reflect present licensee performance.

Enforcement:

Violation: Title 10 CFR Part 50, Appendix B, Criterion III, “Design Control,” required, in part that “Measures shall be established to assure that applicable regulatory requirements and the design basis, …are correctly translated into specifications, drawings, procedures, and instructions.” Contrary to the above, since at least the last revision to procedure EGR-NGGC-0106 in April 2016, the licensee did not assure that applicable regulatory requirements and the design bases were correctly translated into procedures. Specifically, procedure EGR-NGGC-0106 did not incorporate guidance to properly evaluate the MOV TOLs during design basis accidents concurrent with degraded grid voltage design conditions allowed by the setpoints in plant technical specifications for the degraded grid voltage relays or other different MOV operating scenarios required by the station MOVs design bases.

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

Failure to Follow Calculation Control Process

Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000324,05000325/2019011-02 Closed	[H.3] - Change Management	71111.21M

The inspectors identified a Green finding and associated Non-cited Violation (NCV) of Title 10 of the *Code of Federal Regulations* Part 50 (10 CFR 50), Appendix B, Criterion V, "Instructions, Procedures and Drawings," for the licensee's failure to follow their AD-EG-ALL-1117, Design Analyses and Calculations, procedure. Specifically, procedure AD-EG-ALL-1117, section 4.2, required the verifier to identify that the design inputs were accurate and complete, however, the licensee did not identify all design inputs for calculations 0BNP-TR-006, "MOV Design Basis Information GL89-10 & GL 96-05," and BNP-E-8.013/BNP-E-8.014, "Motor Torque Analysis for AC MOVs." As a result, the licensee failed to update the affected calculations following motor-operated valve (MOV) testing or maintenance, the results of which could change the results of the calculations.

Description: The purpose of calculations BNP-E-8.013 and BNP-E-8.014 was to calculate available MOV motor torque during extreme bus voltages, and the purpose of calculation 0BNP-TR-006 was to document design basis information for Generic Letter (GL) 89-10 and GL 96-05 MOVs. Additionally, each motor-operated valve (MOV) included in the licensee's MOV program has an associated calculation that determines the margin available to operate the MOV during design basis scenarios. The individual MOV margin calculations get updated occasionally following Periodic Verification Testing (PVT) if the results of the testing indicate a change in a parameter that led to an increase or decrease in the calculated margin for the MOV. The margin calculations compare available MOV output thrust/torque to the thrust/torque required to make the valve change position. The determination of available thrust/torque is dependent on the voltage of the electrical source supplying power to the MOV motor; the determination of the required thrust/torque is dependent on mechanical properties of the valve and piping system including various parameters that add load to the valve.

The inspectors identified that calculations BNP-E-8.013, BNP-E-8.014, and 0BNP-TR-006 included assumptions based on MOV margins determined at a specific time, but they did not get revised and updated properly following results of MOV PVT that changed the assumed inputs into the calculations. Failing to update the calculations following changes to a MOV PVT margin can result in misidentifying that either the MOV will not stall (failing to begin to move or continue to change position) at all, or misidentifying the point at which an MOV has the potential of stalling during periods of transient voltages as a result of accident initiated load sequencing. This may result in failing to identify that a thermal overload (TOL) was insufficiently sized for the expected stall conditions during a degraded grid voltage condition. TOLs are included in the MOV electrical power path and can trip to interrupt the current being provided to the MOV motor to protect the motor from failure due to prolonged heating. However, if the TOL is not sized properly, the TOL could trip before the valve has moved to its required safety-function position.

Attachment 4 of 0BNP-TR-006 evaluated a list of MOVs subject to electrical transient voltages during an accident to determine whether or not the MOV would stall during the transient, but had not been updated due to changes in assumed loading or other MOV adjustments since November 15, 2016. Attachment F of BNP-E-8.013/-014 evaluated the acceptability of TOLs for safety-related MOVs during a degraded voltage concurrent with an accident and used MOV margins to determine the voltage at which the MOVs may stall as input to the analysis. The team observed the MOV PVT margins assumed in the calculations

had not been updated since Attachment F was added under revision 10 in 2014.

Section 5.2.7.i.(3) of procedure AD-EG-ALL-1117 required the licensee to clearly identify design inputs and associated reference sources in the body of the calculation. It also stated, "Refer to Attachment 18, Design Input Considerations, for the list of Design Input considerations." Consideration of electrical requirements and design inputs which could be invalidated by field activities were included in Attachment 18. The discovery of a parameter during PVT beyond that previously assumed, or the intentional adjustment of an MOV parameter (such as packing load adjustments) during implementation of field work on MOVs should have been considered as having the potential to impact a design input into calculations BNP-E-8.013, BNP-E-8.014, and 0BNP-TR-006. Also, sections 5.3.8 and 5.3.9, stated that the responsible Engineering Manager was to ensure “documents impacted by Calculation conclusions are identified and appropriate processes are initiated to track and implement required changes." Additionally, procedure AD-EG-ALL-1117 section 4.2, required the Design Verifier to identify that the design inputs were accurate and complete.

The inspectors determined that because calculations BNP-E-8.013, BNP-E-8.014, and 0BNP-TR-006 did not identify the MOV margin calculations as providing design inputs into the calculations, they were not being updated as required. Upon discovery by the inspection team, the licensee updated the affected calculations to reflect the current MOV margins reflected by PVT results and determined the MOVs remained capable of performing their safety functions.

Corrective Actions: The licensee generated NCRs 2290331 and 2289038 and updated the affected calculations to reflect the current MOV parameters from PVT results.

Corrective Action References: NCRs 2290331 and 2289038

Performance Assessment:

Performance Deficiency: The licensee's failure to follow their AD-EG-ALL-1117, "Design Analyses and Calculations" Rev. 5 procedure was a performance deficiency.

Screening: The inspectors determined the performance deficiency was more than minor because if left uncorrected, it would have the potential to lead to a more significant safety concern. Specifically, failing to update calculations 0BNP-TR-006 and BNP-E-8.013/8.014 following changes to MOV parameters could lead to failing to identify that a valve may stall during the predicted voltage transient or failing to identify that a TOL was insufficiently sized for the expected stall conditions during a degraded grid voltage condition.

Significance: The inspectors assessed the significance of the finding using Appendix A, “The Significance Determination Process (SDP) for Findings At-Power.” The inspectors evaluated the finding in accordance with the NRC Inspection Manual Chapter (IMC) 0609, Attachment 4, "Initial Characterization of Findings," issued October 7, 2016, for Mitigating Systems, and IMC 0609, Appendix A, issued June 19, 2012, and determined the finding to be of very low safety significance (Green) because the finding was a deficiency affecting the design or qualification of a mitigating structure, system or component (SSC) and the SSC maintained its operability or functionality. Specifically, the licensee updated the affected calculations to reflect current MOV periodic verification testing results and determined the MOVs would be capable of performing their safety functions.

Cross-Cutting Aspect: H.3 - Change Management: Leaders use a systematic process for evaluating and implementing change so that nuclear safety remains the overriding priority. In this case, the licensee did not use their established process for implementing calculation changes.
Enforcement: Violation: 10 CFR Part 50, Appendix B, Criterion V, required in part, "Activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings." Contrary to the above, Brunswick did not accomplish an activity affecting quality in accordance with their procedure. Specifically, procedure AD-EG-ALL-1117, section 4.2, required the verifier to identify that the design inputs were accurate and complete, and the licensee did not identify all design inputs for calculations 0BNP-TR-006, BNP-E-8.013, and BNP-E-8.014. Enforcement Action: This violation is being treated as an non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.

EXIT MEETINGS AND DEBRIEFS

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

- On September 13, 2019, the inspectors presented the design basis assurance inspection (teams) 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
71111.21M	Calculations	04KV-002	4.16kV Emergency Bus Degraded Grid Voltage Relay Setpoint Calc	Rev. 4
		0B21-0199	ECCS Analysis Results	Rev. 8
		0B21-0199	ECCS Analysis Results	Rev. 8
		0BNP-TR-006	MOV Design Basis Information GL-89-10 & GL-96-05	Rev. 6
		0E41-1001	High Pressure Coolant Injection System - Condensate Storage Tank Level Low Uncertainty and Setpoint Calculation (E41-LSL-N002(3) Loops)	Rev. 3
		0E41-1001	High Pressure Coolant Injection System - Condensate Storage Tank Level- Low Uncertainty And Setpoint Calculation (E41-LSL-N002(3) LOOPS)	Rev. 3
		0E51-0028	Reactor Core Isolation Cooling System - Condensate Storage Tank Level - Low Uncertainty And Scaling Calculation (E51-LSL-4463(4) LOOPS)	Rev. 3
		0EOP-WS-13.1	LPCI/RHR Vortex Limit (2 Pumps) Plus HPCI and RCIC Vortex Determination	Rev. 6
		0RNA-0001	Instrument Air Nitrogen Backup System Volume Requirements	Rev. 4
		9527-8-E41-06F	NPSH Requirements – RCIC and HPCI	Rev. 1
		ANP-3105NP	Brunswick Units 1 and 2 LOCA Break Spectrum Analysis for ATRIUM 10XM Fuel for MELLLA+ Operation	Rev. 1
		BNP-E-1.012	Safety Related AC Control Loop Voltage Analysis	Rev. 9
		BNP-E-2.002	480V AC Safety Related MOVs Electrical Protection	Rev. 16
		BNP-E-2.007	U2 480V Vital MCC Calculations	Rev. 19
		BNP-E-6.085	Unit 2 125/250V DC Coordination/Protection Calculation	Rev. 7
		BNP-E-6.093	Unit 1 125/250V DC Coordination/Protection Calculation	Rev. 6
		BNP-E-6.095	Unit 1 125/250V DC Coordination/Protection Calculation	Rev. 7
		BNP-E-6.120	125/250VDC System Battery Load Study	Rev. 12
		BNP-E-6.121	Electrical Analysis for Safety Related DC Circuits	Rev. 10
		BNP-E-7.002	AC Auxiliary Electrical Distribution System Voltage/Load Flow/Fault Current Study	Rev. 14
		BNP-E-8.010	AC Coordination Study	Rev. 23

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		BNP-E-8.010	AC Coordination Study	Rev. 24
		BNP-E-8.014	Motor Torque Analysis for AC MOVs	Rev. 18
		BNP-MECH-1-CAC-V216-AO	AOV Setup Calculation for 1-CAC-V216-AO	Rev. 1
		BNP-MECH-AOV-DP-CAC	Differential Pressure Calcualtions for 1/2-CAC-V7-AO, -V8-AO, -V216-AO Inboard Suppression Pool Purge Exhaust, Outboard Suppression Pool Purge Exhaust, and Hardened Wetwell Vent Isolation Air-Operated Valves	Rev. 0
		BNP-PSA-034, Appendix C	Operator Action Summary Reports	Rev. 17
		M-89-0021	HPCI/RCIC NPSH with Suction from the CST	Rev. 0
		SA-E51-739	Stress Analysis for RCIC Exhaust Pipe Due to Water Hammer Loads	Rev. 0
	Corrective Action Documents	02085737, 02086053, 627923-23, 02063268, 2105119, 2165651, 630621, 633538, 427745, 508592, 709200		
	Corrective Action Documents Resulting from Inspection	AR 02287837	0CM-PVT500	dated 08/20/2019
		AR 02288218	DBAI 2019 - BNP-E-1.012 & 1.013 Not updated for 7.002 Rev 14	dated 08/22/2019
		AR 02288751	NRC Identified: Typographical Error Found in UFSAR	dated 08/26/2019
		AR 02288836	MOV Hydraulic Lock Monitoring Program	dated 08/26/2019
		AR 02289038	DBAI 2019 – BNP-E-8.013 & 8.014, Att. F Errors	dated 08/27/2019
		AR 02289460	Revise BNP-E-7.002 Assumption 3.2.2.9	dated 08/29/2019

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		AR 02289996	Corrections to BNP-E-8.013 & BNP-E-8.014	dated 09/03/2019
		AR 02290331	2019 DBAI: 0BNP-TR-006 attachment 4 not updated	dated 09/04/2019
		AR 02290559	Administrative Update to UFSAR Section 6.3.3.3	dated 09/05/2019
		AR 02291132	2019 NRC DBAI: Conservatism in MOV motor torque methodology	dated 09/10/2019
		AR 02291159	HPCI and RCIC Overspeed Evaluation Discrepancies	dated 09/10/2019
		AR 02291174	2019 DBAI - BNP response to IN 2013-17 did not fully eval	dated 09/10/2019
		AR 02291176	2019 DBAI: Replacemnt of Program MOV sprng packs not timely	dated 09/10/2019
		AR 02291385	2019 NRC DBAI – Procedure Corrections - EGR-NGGC-0106 & 0101	dated 09/11/2019
		AR 02291396	2019 DBAI IST Program Document Issue	dated 09/11/2019
		AR 02291577	DBAI 2019 - BNP-E-8.013 & 8.014, Table G Errors	dated 09/12/2019
	Drawings	0-FP-84314	8" Class 300 Wafer A31A Valve Assemby and Bettis N721-SR80 Fail Close Actuator	Rev. B
		1-FP-05887, Sheet 2	Auto Depressurization System Elementary Diagram Unit 1	Rev. M
		D-02041	Service Water System Piping Diagram	Rev. 66
		D-02523 Sh. 1	Reactor Building High Pressure Coolant Injection System Piping Diagram	Rev. 59
		D-02523 Sh. 2	Reactor Building High Pressure Coolant Injection System Piping Diagram	Rev. 53
		D-02529 Sh. 1	Reactor Building Reactor Core Isolation Cooling System Piping Diagram	Rev. 64
		D-02529 Sh. 2	Reactor Building Reactor Core Isolation Cooling System Piping Diagram	Rev. 46
		D-02537	Reactor Building Service Water System Piping Diagram	Rev. 99

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		D-70029	Reactor Building Instrument Air Supply System Piping Diagram	Rev. C
		F-03000	Main One Line Diagram 230KV and 24KV Systems	Rev. 40
		F-03002	4160V System Switchgear One Line Diagram	Rev. 33
		F-03003	4160V Emergency System Switchgear E3 & E4 One Line Diagram	Rev. 19
		F-03026	Emergency Key One Line Diagram	Rev. 13
		F-03050	480V MCC 2XB One Line Diagram	Rev. 94
		FSP-27059	Reactor Building, Unit 1 Hardened Wetwell Vent Piping	Rev. 2
		LL-03024, Sht. 7	125-250 Volt DC System Control Building Distribution Panel 4B - "H24"	Rev. 28
		LL-90046	CAC System Hardened Wetwell Vent Valve V216 Control Wiring Diagram	Rev. 1
	Engineering Changes	400921	Long Term Division II Load Management	
		407321	Evaluation Of DC Load Profile And Battery Voltages Following The Restoration Of DC Battery Chargers To The DC System During A DBA (LOOP/LOCA)	
		411708	Reduce Loads On 125/250 VDC Switchboard 1B-1 and 1B-2 and Revise 1st Minute Test Load in MST for 1A-1 1A-2, 1B-1 and 1B-2 Batteries	
		EC 276098		
		EC 294259	Unit 1, Phase 1 & 2, Hardened Containment Vent System Upgrades in Repsonse to EA 12-109 (Mechanical)	Rev. 12
		EC 298197	Acceptability of Shaft to Bowl Bearing Clearance and Impeller Wear Ring Clearance for 2C CSW Pump 2-SW-2C-Conv-PMP	Rev. 0
		EC 299442		
		EC 406293	Evaluation of Instrument Uncertainty Calculations not for Limiting Safety System Settings or Automatic Protective Functions	Rev. 0
	Engineering Evaluations	ESR 96-00253	Service Water Pump Bearing Clearance Evaluation.	06/21/1999
	Miscellaneous		4KV Metal Clad Switchgear Template	Rev. 4
		03FSAR-041	Licensing Document Change Request	dated

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
				1/26/04
		04FSAR-017	Licensing Document Change Request	dated 7/14/04
		04TSB-04	Licensing Document Revision Request	Rev. 0
		238-044	Procurement of Product - Lubricated Service Water Pumps - AL6XN	Rev. 12
		5170	System Health Report, Medium Voltage AC Distribution	Q2-2019
		AR 102456	Operability Determination	dated 8/28/03
		CPL-01	TECHNICAL SPECIFICATION REVISION REQUEST DEGRADED VOLTAGE RELAYS	dated 06/29/1982
		CPL-02	ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEMS VOLTAGES	dated 11/23/1982
		CSD-EG-BNP-1720	BNP IST Program Plan – 5th Interval	Rev. 0
		DBD-51	DC Electrical System	Dated 6/7/2017
		Docket 50-325/50-324	Staff Positions Relative to Emergency Power Systems	dated 06/03/1977
		EC 280671 Att. O	HPCI and RCIC Pump Discharge Pressure Evaluation	Rev. 4
		EC 412996	1-E11-F048B-MO (1B RHR HX BYPASS VLV) with an Aluminum Rotor Motor	Rev. 0
		EC 46911	HPCI Function Update	Rev. 0
		EC 54587	Basis for the 1(2)-E41-LSL-N002 and 1(2)-E41-LSL-N003 Setpoints	Rev. 0
		FP-82508	Bettis General Operating and Maintenance Instructions for Pneumatic Rotary Valve Actuators	Rev. D
		FP-84867	Technical Manual for Installation, Operation and Maintenance of Johnston Pump Company 27CC - 2 Stage Service Water Pumps	Rev. D
		GD-79-3307	LESSONS LEARNED SHORT TERM REQUIREMENTS	dated 12/31/1979
		GD-79-612	ON- SITE EMERGENCY POWER SYSTEMS	dated 03/06/1979

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		JOG-TD-01	Spring Relaxation for Air Operators	Rev. 2
		LAP-83-551	REQUEST FOR ADDITIONAL INFORMATION ELECTRICAL DISTRIBUTION SYSTEM VOLTAGES	dated 11/30/1983
		NEDC-32973P	Safety Analysis Evaluations Relative to Measurement Uncertainties for the BWR/4	Rev. 0
		NLS-84-363	ELECTRICAL DISTRIBUTION SYSTEM VOLTAGES	dated 08/30/1984
		NLS-84-515	RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION: 1) ADEQUACY OF STATION ELECTRIC SYSTEM VOLTAGE 2) TECHNICAL SPECIFICATIONS OF DEGRADED VOLTAGE RELAYS	dated 01/18/1985
		NLS-85-321	AMENDMENT TO FACILITY OPERATING LICENSE	dated 05/23/1985
		NLS89072	Letter - SAFER/GESTR-LOCA Analysis	dated 3/29/89
		NLU-80-338	SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION SUPPORTING AMENDMENT NO. 28 TO FACILITY LICENSE NO. DPR-71 AND AMENDMENT NO. 51 TO FACILITY LICENSE NO. DPR-62	dated 06/11/1980
		NLU-83-70	PLANT SHIELDING MODIFICATIONS, NUREG-0737 ITEM II.B.2.2	dated 01/27/1983
		NO-80-1093	ADEQUACY OF STATION ELECTRICAL DISTRIBUTION SYSTEMS VOLTAGE	dated 07/24/1980
		NRC89401	Letter - SAFER/GESTR-LOCA Analysis	dated 6/1/89
		PMCR 2063268	Modify Existing 125VDC Panel PMs to include Breaker Testing	Dated 9/20/2016
		SPEC 248-164	Specification for Procurement of Class 2 Buttery Valve and Spare Parts for Hardened Wetwell Vent Containment Isolation.	Rev. 1
		TIA 2003-05	NRC Policy Questions on Technical Specification Adequacy and Related Technical Specification Operability	dated 1/16/04
	Procedures	0AOP-12.0	Loss of Uninterruptible Power Supply (UPS)	Rev. 26
		0AOP-39.0	Loss of DC Power	Rev. 47
		0AP-064	Time Critical Actions/Time Sensitive Actions Supplement	Rev. 5

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		0CM-PVT500	Disassembly and Rebuild: Service Water Pump, Johnston Pump Company	Rev. 35
		0ENP-646	Post Test Evaluation of AOV Diagnostics	Rev. 2
		0EOP-01-EDP	Emergency Depressurization	Rev. 6
		0EOP-01-SBO-15	Primary Containment Isolation	Rev. 1
		0EOP-01-SEP-01	Primary Containment Venting	Rev. 28
		0MST-ADS41BR	ADS Loop B Logic Sys Functional and Simulated Auto Actuation Test	Rev. 3
		0PM-BKR-001	ITE 4KV Breaker and Compartment Checkout	Rev. 54
		0PM-RLY-033	Functional Testing of Thermal Overload Relays	Rev. 24
		0PT-10.1.1	RCIC System Operability Test	Rev. 107
		0PT-10.1.3	RCIC System Operability Test - Flow Rates at 150 PSIG	Rev. 60
		0PT-20.3	Local Leakrate Testing	Rev. 86
		1MST-BAT11AR	125 VDC Battery 1A-1 Service Capacity Test	Rev. 8
		1OP-19	High Pressure Coolant Injection System Operating Procedure	Rev. 99
		1OP-24	Containment Atmosphere Control System	Rev. 110
		2EOP-01-RVCP	Reactor Vessel Control	Rev. 11
		2MST-BAT11DR	125 VDC Battery 2B-2 Service Capacity Test	Rev. 7
		2PT-24.1-2	Service Water Pump and Discharge	Rev. 86
		AD-EG-ALL-1117	Design Analyses and Calculations	Rev. 5
		AD-EG-ALL-1431	Air Operated Valve Scope and Categorization	Rev. 1
		AD-EG-ALL-1432	Air Operated Valve Design Basis Review	Rev. 0
		AD-EG-ALL-1433	Air Operated Valve Testing Requirements	Rev. 1
		AD-EG-ALL-1434	Air Operated Valve Tracking and Trending Requirements	Rev. 1
		CAP-NGGC-0202	Operating Experience and Construction Experience Program	Rev. 23
		EGR-NGGC-0101	Electrical Calculation of Motor Output Torque for AC/DC MOVs	Rev. 12
		EGR-NGGC-0106	AC/DC Overcurrent Protection and Coordination	Rev. 5
		EGR-NGGC-0205	Air Operated Valve Reliability Program	Rev. 10
		NGG-PMB-SOV-	NGG Equipment Reliability Template SOlenoid Operated	Rev. 0

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		01	Valves (SOV)	
		SORMC-NUC-050	System Operations Reference Manual Carolinas	Rev. 24
	Work Orders	12068756-01, 12068759-11, 12234502-01, 13503714-01, 1924561-01, 20022842-01, 20107653-03, 20107653-04, 20123051-01, 20255536-01, 20120570-01, 20120570-02, 20120570-03, 20120570-04, 20120570-08, 13522687-08, 20136720-01, 1895617-01, 20034690-01		