UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW, SUITE 23T85
ATLANTA, GEORGIA 30303-8931

December 21, 2005

Carolina Power and Light Company
ATTN: Mr. J. Scarola
Vice President
Brunswick Steam Electric Plant
P. O. Box 10429
Southport, NC 28461

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT - NRC SAFETY SYSTEM DESIGN AND PERFORMANCE CAPABILITY INSPECTION REPORT 05000325/2005007 AND 05000324/2005007

Dear Mr. Scarola:

On November 18, 2005, the U. S. Nuclear Regulatory Commission (NRC) completed the onsite portion of a safety system design and performance capability team inspection at your Brunswick Steam Electric Plant. The enclosed report documents the inspection findings which were discussed at an interim exit with you and members of your staff on November 18, 2005. Following completion of additional in office review, a final exit was held with Mr. Kitchen of your staff on November 30, 2005.

The inspection examined activities conducted under your licenses as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your licenses. The inspection team reviewed selected procedures and records, observed activities, and interviewed personnel.

This report documents one NRC-identified finding of very low safety significance (Green). This finding was also determined to involve a violation of NRC requirements. However, because of the very low safety significance and because it has been entered into your corrective action program, the NRC is treating this finding as a non-cited violation, consistent with Section VI.A.1 of the Enforcement Policy. If you contest this non-cited violation, 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 Steam Electric Plant.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document

Room or from the Publicly Available Records (PARS) component of the NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (The Public Electronic Reading Room).

Sincerely,

/RA/

Charles R. Ogle, Chief
Engineering Branch 1
Division of Reactor Safety

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

Enclosure: NRC Inspection Report 05000325/2005007 and 05000324/2005007
w/Attachment: Supplemental Information

cc w/encl: (See page 3)

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REGION II

Docket Nos.:	50-325, 50-324
License Nos.:	DPR-71, DPR-62
Report Nos.:	05000325/2005007 and 05000324/2005007
Licensee:	Carolina Power and Light (CP&L)
Facility:	Brunswick Steam Electric Plant, Units 1 & 2
Location:	8470 River Road SE Southport, NC 28461
Dates:	October 31 - November 4, 2005 November 14 - 18, 2005 November 28 - 30, 2005 (In-office)
Inspectors:	L. Mellen, Team Leader M. Scott, Senior Reactor Inspector C. Smith, Senior Reactor Inspector R. Taylor, Reactor Inspector R. Rodriguez, Reactor Inspector H. Anderson, Contractor
Accompanied by:	W. Lewis, Reactor Inspector (Trainee) S. Fowler, Reactor Inspector (Trainee) C. Peabody, Reactor Inspector (Trainee) M. Flanagan, Reactor Inspector (Trainee)
Approved by:	Charles R. Ogle, Chief Engineering Branch 1 Division of Reactor Safety

Enclosure

SUMMARY OF FINDINGS

IR 05000325/2005007 and 05000324/2005007; 10/31/2005 - 11/4/2005, 11/14-18/2005, 11/28-30/2005; Brunswick Steam Electric Plant, Units 1 and 2; Safety System Design and Performance Capability Inspection.

The inspection was conducted by a team of inspectors from the NRC's Region II office and one NRC contractor. One Green finding, which was a non-cited violation, was identified during this inspection. The significance of most inspection findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609 "Significance Determination Process" (SDP). Findings for which the SDP does not apply may be Green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. NRC-Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

- Green. A Green NRC identified, non-cited violation (NCV) of Technical Specification (TS) 5.4.1.a was identified for failure to establish written procedures to direct venting of the residual heat removal (RHR) system in response to increasing system pressure. Instead, system venting was directed through informal communications, such as e-mails and telephone calls. The licensee entered the deficiency associated with lack of procedural guidance into their Action Request Program for resolution.

  This finding is more than minor because it affected the ability of the licensee to properly control the venting of the RHR system and was associated with the Mitigating Systems Cornerstone and the respective attribute of procedure quality. The finding is of very low safety significance because there was no actual loss of safety function. A contributing cause of the finding is related to the cross-cutting element of problem identification and resolution. (Section 1R21.21)

B. Licensee-Identified Violations

None

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Mitigating Systems and Barrier Integrity

1R21 Safety System Design and Performance Capability (71111.21)

The team evaluated the capability of installed plant equipment to detect and respond to an initiation or malfunction of residual heat removal (RHR) and RHR service water (RHRSW). Procedures which direct the mitigating actions for these events were also evaluated.

A specific list of equipment and documents reviewed for each section is included in the Attachment to this report.

.1 System Needs

.11 Process Medium

b. Inspection Scope

The team verified by plant walkdowns; field observations; and through reviews of calculations and surveillances that a sufficient source of water is available to the RHR and RHRSW systems. The team evaluated the potential for blockage of RHR suction strainers as well as net positive suction head (NSPH) available for RHR and RHRSW pumps. The team also evaluated post-accident over-pressure contributions to NPSH, and vortex prevention to verify that the RHR and RHRSW systems would be available and unimpeded during accident/event conditions.

c. Findings

No findings of significance were identified.

.12 Energy Sources

a. Inspection Scope

The team reviewed voltage calculations that established the loss of voltage and degraded voltage relay set points at which the engineered safety feature sequencers actuate. Additionally, the team reviewed voltage calculations completed for selected motor operated valves (MOVs), as well as pump motors from the RHR system, the conventional service water system, and the RHRSW system.

The reviews were performed to verify that nominal trip set points delineated in the Technical Specification (TS) for undervoltage protection of the Class 1E electrical distribution system were supported by a calculation of record. Additionally, the reviews

were performed to demonstrate that the set points were being adequately implemented, and that operation of the Class 1E electrical distribution system was in accordance with the requirements of the plant's licensing bases. The team also reviewed voltage calculations of the selected components to verify that the terminal voltages of mitigating equipment had sufficient margin to ensure that the equipment could perform its design function when fed from either the unit auxiliary transformer or the startup transformer.

The team reviewed battery sizing calculations for the Unit 1, 125/ 250 volts direct current (VDC) battery, 125/ 250 VDC Class 1E electrical system one line diagrams, and the 125 VDC class 1E electrical system design basis documents (DBDs) in order to verify that the power supplies for a sample of process instruments were adequate based on vendor requirements and the DBDs.

The team reviewed test and design documents to verify that the 4160 volt alternating current (VAC) and 600 VAC power sources were adequate to meet minimum voltage specifications to support all modes of RHR and RHRSW.

The team performed an independent voltage drop calculation from selected motor control centers to associated MOVs to assess the adequacy of the licensee's voltage drop calculation. A review of design torque values for selected critical MOVs was performed to verify that the safety functions were adequately tested assuming minimum voltage.

b. Findings

No findings of significance were identified.

.13 Controls

a. Inspection Scope

The team reviewed selected instruments associated with the RHR and RHRSW systems. The team reviewed appropriate DBDs, TS, system flow diagrams, instrument uncertainty calculations, calibration procedures, and calibration test records to verify that selected level, flow, and pressure process instrumentation had the proper range and accuracy needed to perform their safety function.

The team reviewed the electrical control schematics for the RHR and RHRSW pump motors as well as their minimum flow bypass valves and RHR heat exchanger bypass valves to verify that the control logic satisfied the requirements of the Updated Final Safety Analysis Report (UFSAR), DBDs and TSs. The team also reviewed the electrical control schematics for the low pressure coolant injection mode of RHR’s initiation and operation to verify that the logic of operation satisfied the requirements of the UFSAR and DBD. The team reviewed vendor data demonstrating the operating characteristics for the RHR and RHRSW pump motors and compared it to the expected values to verify that sufficient margin was available for satisfactory operation under all postulated conditions. The team conducted field inspections of accessible instrument installations

to verify that the instrument tubing, sensors, and supports were in good material condition.

b. Findings

No findings of significance were identified.

.14 Operator Actions

a. Inspection Scope

The team reviewed selected plant operating instructions, including emergency operating procedures (EOPs), abnormal operating procedures, annunciator panel procedures, and operating procedures associated with the RHR and RHRSW systems. The team focused on installed equipment and operator actions that could be used to respond to the initiation or malfunction of RHR and RHRSW. The team also reviewed job performance measures and training lesson plans pertaining to identification and mitigation of an initiation or malfunction of RHR and RHRSW to confirm that training was consistent with the applicable operating instructions.

In addition, the team observed simulation of various scenarios involving initiation or malfunction of RHR and RHRSW on the plant specific simulator. The team also walked down portions of applicable instructions to verify that operator training, instruction guidance, and instrumentation were adequate to identify an initiation or malfunction of RHR and RHRSW event and allow implementation of the associated mitigation strategies. The manual operator action times for performance of initiation or malfunction of RHR and RHRSW mitigation activities were reviewed to verify consistency with accident analyses and operator training.

b. Findings

No findings of significance were identified.

.15 Heat Removal

a. Inspection Scope

The team reviewed the licensee's program to verify that heat removal is adequately accommodated through RHR, RHRSW, and interrelated systems. The team evaluated temperature monitoring for the intake canal and suppression pool. The team also reviewed surveillance and test records to verify RHR pump minimum flow requirements and walked down portions of the system to identify the potential for interaction between various minimum flow discharge path components. Additionally, the team reviewed surveillance and test records to verify the required performance of the RHR pump room ventilation system; RHR pump seal flows and RHR pump seal cooler flows; and RHRSW flows to the reactor building closed cooling water system heat loads were adequately demonstrated. The team reviewed the last two RHRSW system flow

balances to ensure that the results accurately represented observed system flows. The team reviewed TS surveillance monitoring for specific RHR and/or RHRSW flows to verify that adequate RHR flow could be achieved for specific modes of RHR system operation.

b. Findings

No findings of significance were identified.

.2 System Condition and Capability

.21 Installed Configuration

a. Inspection Scope

The team reviewed maintenance history and observed accessible equipment of the RHR and RHRSW system, such as: lubrication systems, drains, flood barriers, intake structure screens and traveling trash racks, dredging of the forebay, and common suction lines to RHR to verify the installed configuration will support system function under accident conditions and if any modifications have impeded functionality or accessibility. The team performed system walkdowns of portions of the RHR system and the RHRSW building to verify any temporary installation of hose or piping that could result in flood sources had been evaluated. The team reviewed maintenance work orders, engineering changes and operating procedures to verify component configurations have been maintained to be consistent with design assumptions.

The team performed a field inspection of the Class 1E 4160 VAC emergency buses and class 1E 480 VAC unit substations to verify that the installed configurations were consistent with design basis information delineated in the DBDs, one line diagrams, and electrical calculations of record. The team also performed a field inspection of the Unit 1 125/ 250 VDC distribution system including station batteries, battery chargers, and DC distribution and power panels to verify that the installed configuration was consistent with design basis information delineated in the DBDs, one-line diagrams, and electrical calculations of record. The field inspections were performed to ensure that the material condition of the inspected equipment was acceptable as demonstrated by the absence of unusual odors (i.e., burnt / charred insulation); damaged insulation as shown by discoloration and/or embrittlement; electric arc damage; fluctuating changes in motor drive currents; broken or missing light lenses; and missing ground straps or poor ground connections.

b. Findings

Introduction: A Green, NCV was identified by the inspectors for the failure of the licensee to establish written procedures for controlling RHR system operation as required by TS 5.4.1 and Reg Guide 1.33, November 1972. Specifically, no written procedures were established to direct venting of the RHR system in response to increasing system pressure. Instead, system venting was controlled through e-mails

and telephone conversations.

Description: The team determined that the licensee was venting RHR loops 1A and 2A in response to increasing RHR system pressure, most likely caused by in-leakage. In addition, the licensee had modified RHR loop 2B by installing a continuous venting system to control RHR pressure increases in that loop. The system engineer was aware of the increasing pressure and the discrepant condition had been entered into the licensee's corrective action program. The licensee's corrective actions included periodically opening system vents to reduce RHR system pressure; however, this venting to control pressure was not documented in formal plant procedures. Instead, the instructions were provided to operations personnel using e-mails or through telephone conversations with the system engineer. Based on interviews, the inspectors determined that the procedural expectations for venting the RHR loops as well as appropriate precautions were not fully understood by all licensed plant operators. Similarly, not all members of the training department were aware of this arrangement for RHR system pressure control. The inspectors review of this condition identified examples of these informal instructions as early as 2001.

A review of historical RHR system pressure traces by the inspectors revealed two instances where RHR system pressures in loop 2A exceeded the system engineer's informally recommended RHR system pressure limit of 236 psig. The inspectors questioned the impact of these pressure excursions on MOV operability and in particular, the ability of valves in the suppression pool cooling or suppression pool spray initiation pathway to open against the resulting differential pressure. Further review by the licensee indicated that the MOVs in loop 2A had a sufficient margin, and remained operable during these pressure increases. (However, similar valves in loops 1B and 2B may not have been operable if their RHR loops experienced a similarly sized pressure increase.) The inspectors noted that the two periods of elevated RHR pressure were not entered into the AR system. Although this RHR over pressurization problem has been occurring for several years, the licensee did not enter any of the other required system ventings into the AR program. This hampered the ability of the licensee to perform quantitative or qualitative analysis of system in-leakage through corrective action system entries.

The inspectors' review revealed the venting that did occur used portions of a procedure, 2-OP-17, which was written to remove non-condensible gasses from the RHR system. However, the inspectors concluded that this procedure was not designed to relieve the pressure from a water solid system. Precautions and limitations appropriate to a venting procedure used to control system pressure were not included in the procedure. Instead, based on e-mailed instructions, operators used the loop fill and air removal operations portions of the procedure for solid system pressure control.

Following the team's review, the licensee entered the control of the RHR system pressure into the corrective action program as ARs 176245 and 174997. The team also verified that at the conclusion of the inspection, the RHR system pressures for all four loops were within the expected system pressures.

Analysis: The inspectors determined that operating a safety-related system based upon informal guidance, and using portions of procedures not verified or validated to perform the specific function, was a performance deficiency and a finding. This finding is more than minor because it affected the ability of the licensee to properly control the venting of the RHR system and was associated with the Mitigating Systems Cornerstone and the respective attribute of procedure quality. The finding was evaluated using the Significance Determination Process and was of very low safety significance (Green) since there was no actual loss of safety function.

The finding involved the crosscutting aspect of problem identification and resolution in that it involved a failure to adequately evaluate or respond to a potentially significant problem involving the RHR system. Additionally, performance or trending data related to the underlying problem was not appropriately documented in the corrective action program.

Enforcement: TS 5.4.1.a requires that written procedures be established covering the applicable procedures recommended in Appendix "A" of Regulatory Guide 1.33, November 1972, including procedures for the operation of the RHR system. Contrary to the above, on November 18, 2005, the inspectors identified that the licensee failed to establish adequate procedural controls to perform venting of RHR loops 1A, 1B, and 2A to compensate for probable system in-leakage. Examples of this condition existed since 2001. This violation is associated with an inspection finding that is characterized by the Significance Determination Process as having very low risk significance (i.e., Green) and has been entered into the licensee's corrective action program as ARs 176245 and 174997. As such, the violation is being treated as a Non-Cited Violation (NCV), consistent with Section VI.A.1 of the NRC Enforcement Policy: NCV 05000325, 324/2005007-01, Inadequate Procedural Controls for RHR System Venting.

.22 Operations

a. Inspection Scope

The team reviewed selected portions of procedures used to respond to an initiation or malfunction of RHR and RHRSW to verify the licensee had included appropriate human factors considerations in the procedures and in the plant. This review included verification of labeling, lighting, noise, communications capabilities, and accessibility. The team also checked system alignments, and conducted field walkdowns of selected components related to the initiation or malfunction of RHR and RHRSW for which local operation or main control room operation was required. These reviews were conducted to verify consistency with design and licensing basis assumptions, and the TSs.

b. Findings

No findings of significance were identified.

.23 Design

a. Inspection Scope

The team reviewed the calculation of record for sizing the battery chargers to verify that each charger had sufficient capacity to recharge its respective battery from a design minimum charged state in approximately eight hours, while carrying the DC loads associated with normal plant operation. The team also reviewed the emergency diesel generator (EDG) static and dynamic loading analyses to verify that the EDGs were adequately rated for powering the mitigation loads for a design basis accident. The team reviewed selected inputs to the EDG static and dynamic loading analyses in order to verify that brake horsepower ratings were correctly incorporated for the RHR, RHRSW, and conventional service water pump motors, based on the mechanical load demand.

Additionally, the team reviewed EOPs and EOP bases documents to verify that design bases and design assumptions had been appropriately translated into procedures. Design bases reviewed included the post-accident temperature in RHR heat exchanger room and hydraulic analyses for the licensee's service water system. The team also reviewed the electrical requirements specified in the plant's DBDs for the RHR and RHRSW system pump motors to verify that allowance had been made through calculations and design for minimum flow and run out. The team also reviewed heat exchanger design and performance data to verify that suppression pool and containment cooling could be maintained within design limits. The team also verified that the instrument setpoint values were consistent with the plant's licensing bases as demonstrated by agreement with values delineated in the TS and UFSAR. The team reviewed selected instrument loop uncertainty calculations to verify that plant calibration procedures had correctly incorporated instrument loop inaccuracies.

b. Findings

No findings of significance were identified.

.24 Testing

a. Inspection Scope

The team reviewed calculations, engineering documents, and completed surveillance tests for tested parameters and interlocks to verify acceptance criteria for design, licensing bases, and TSs were being met. This included verifying TS surveillance tests associated with flow and developed head for the RHR, RHRSW, and booster pumps were being performed. The team reviewed individual tests and analyses to verify the RHR and RHRSW systems would operate under accident conditions. Completed calibration records for instrumentation used in the RHR and RHRSW systems were reviewed to verify setpoints and instrument scaling were consistent with instrument uncertainty and that the calculations related to them were appropriate.

b. Findings

No findings of significance were identified.

.3 Selected Components

.31 Component Degradation

a. Inspection Scope

The team conducted interviews, reviewed surveillance records and test results, and performed walkdowns to verify potential degradation of the RHR and RHRSW systems was being monitored or prevented. The team reviewed vendor recommendations to verify component replacement was consistent with in-service and equipment qualification life. The team also reviewed AR's and work orders to verify that components and underground pipes affected by chemical corrosion were being inspected and maintained. The team reviewed the calibration and preventive maintenance program records to verify instruments used to maintain the 125/ 250 VDC Class 1E station batteries were calibrated in accordance with the program's guidelines and that preventive maintenance was being performed. The team reviewed the licensee's preventive maintenance program records to verify the 4160 VAC feeder circuit breakers and motor control center combination motor starters for selected RHR and RHRSW loads were included in the program.

b. Findings

No findings of significance were identified.

.32 Equipment/Environmental Qualification

a. Inspection Scope

The team reviewed environmental qualification analyses documents to verify that equipment qualification was suitable for the environment the equipment could be exposed to during accident conditions. Also, the team performed walkdowns of systems and components in the RHR and RHRSW systems to verify components have not been significantly affected by salt water corrosion, temperature, humidity, radiation, pressure and vibration.

b. Findings

No findings of significance were identified.

.33 Equipment Protection

a. Inspection Scope

The team reviewed protective measures and procedures to verify RHR and RHRSW system components were adequately protected against storm surges, fire, flood, missiles, high energy line break, and freezing. The team performed walkdowns of the RHR and RHRSW systems to verify that appropriate component protective measures had been implemented.

b. Findings

No findings of significance were identified.

.34 Component Inputs/Outputs

a. Inspection Scope

The team reviewed component inputs and outputs to verify they were suitable for their applications and would be acceptable under accident conditions. The team reviewed electrical control schematics to verify logic used for system operation satisfied requirements of the UFSAR, DBD and TSs. The team also reviewed calculations and design documents to verify RHR and RHRSW pumps will be capable of delivering rated design flow under all expected voltage conditions. The team reviewed motor feeders of the RHRSW pumps powered by the 4160 VAC emergency buses to verify that the pumps would automatically trip upon loss of voltage. Additionally, the team reviewed AC auxiliary electrical distribution system calculations to verify that voltage acceptance criteria for selected pump motors were met. The team also reviewed revised voltage analyses for MOVs to verify that operation of the MOVs under degraded voltage conditions were acceptable.

b. Findings

No findings of significance were identified.

.35 Operating Experience

a. Inspection Scope

The team reviewed the licensee's operating experience (OE) reviews for several recent industry events industry issues related to RHR and RHRSW. This review included verification of assumptions, and screening methodology. The team conducted this review to verify that plant specific issues were appropriately identified and addressed. The team also reviewed the RHR system hydraulic model to verify that information gathered from the OE review had been incorporated into the model. The team conducted walkdowns of the system affected by the OE reviews to verify that any required modifications had been incorporated.

b. Findings

No findings of significance were identified.

.4 Identification and Resolution of Problems

a. Inspection Scope

The team reviewed the licensee's extent-of-condition reviews to verify the adequacy of the corrective actions for selected ARs. The team also reviewed calibration test records to verify that out of tolerance conditions were properly entered into the corrective action program for evaluation and disposition. The team reviewed corrective action documents for the AC Auxiliary Electrical Distribution System for Voltage / Load Flow / Fault Current Study to verify identified calculational errors were corrected. Additionally, the team reviewed documentation of individual ARs which were originated as a result of the team's inspection activities, including documentation of the status of each initial AR evaluation as it existed at the conclusion of the onsite inspection activities.

b. Findings

No findings of significance were identified.

4. OTHER ACTIVITIES

4OA6 Meetings, Including Exit

The lead inspector and W. Lewis (Trainee) presented an interim exit meeting on November 18, 2005, with Mr. Scarola and other members of the licensee's staff. Following additional in-office review, a final telephone exit was held on November 30, 2005, with Mr. Kitchen and Mr. Beller. All proprietary information reviewed during the inspection was returned to the plant staff prior to leaving the site and is not included in this report.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

J. Scarola, Site Vice President
M. Arcaro, Systems Engineer
L. Beller, Supervisor - Licensing/Regulatory Programs
T. Cleary, Director - Site Operations
P. Dubrouillet, BESS Systems Manager
C. Elberfeld, Lead Engineer - Technical Support
M. Grantham, BESS Design Manager
D. Griffith, Outage and Scheduling Manager
R. Kitchen, Engineering Manager
E. O'Neil, Manager - Site Support Services
R. Parmelee, BESS Engineering Supervisor
A. Pope, Manager - Operations
S. Rogers, NAS Manager
M. Williams, Manager - Operations Support
K. Ward, BESS Technical Service Manager
B. Waldrep, Plant General Manager

NRC Personnel

E. DiPaolo, Senior Resident Inspector
P. Fredrickson, Chief, Reactor Projects Branch 4, Division of Reactor Projects Region II
C. Ogle, Chief Engineering Branch 1, Division of Reactor Safety

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Open and Closed

05000325, 324/2005007-01	NCV	Inadequate Procedural Controls for RHR System Venting (Section 1R21.21)

LIST OF EQUIPMENT REVIEWED

Section 1R21.11a: Process Medium

Pumps
2A / 2B Nuclear Service Water pumps
COO1B / RHRSW Booster Pump 2B
COO1D / RHRSW Booster Pump 2D
E11-C002B / RHR Pump 2B
E11-C002D / RHR Pump 2D

Pressure Transmitter
2-PS-1175A (C)
2-PS-1176B (D)

Section 1R21.12a: Energy Sources

4160 VAC Emergency Buses E1 and E2
480 VAC Unit Substations E5 and E6
480 VAC MCCs 1XB and 1PA
4160-480 VAC, 1500 / 2000 KVA Transformer
Unit 1, Division 1, 125 / 250 VDC Battery 1A-1, and 1A-2
Unit 1, Division 2, 125 / 250 VDC Battery 1B-1, and 1B-2

Section 1R21.13a: Controls

1(2) SCW-LT-285, Intake Canal Level Transmitter

Section 1R21.14a: Operator Actions

E11-F010 RHR Divisional Cross-tie Valve

Section 1R21.15a: Heat Removal

Heat Exchangers
E11-B001A / RHR Heat Exchanger 2A
E11-B001B / RHR Heat

Section 1R21.21a: Installed Configuration

Unit 1-1A(B) / Unit 2-2A(B) Intake Service Water Traveling Screens
Nuclear Service Water Header / Piping
4160 VAC Emergency Buses E1, E2, E3 and E4
480 VAC Unit Substations E5, E6, E7 and E8
480 VAC MCCs 1XB and 1PA
Unit 1, Division 1, 125 / 250 VDC Battery 1A-1, and 1A-2.
Unit 1, Division 2, 125 / 250 VDC Battery 1B-1, and 1B-2.

Valves / Flow Orifices / Flow Indicators / Flow Elements
E11-F003A (B) RHR Heat Exchanger Discharge Valve
E11-F047A (B) RHR Heat Exchanger Inlet Valve
E11-F048A (B) RHR Heat Exchanger Bypass Valve
E11-F002A (B) RHR Heat Exchanger Service Water Outlet Valve
E11-F068A (B) RHR Heat Exchanger Service Water Discharge Valve
SWV-124 RHR Pump Room B Cooler Service Water Outlet Valve
SWV-129 RHR Pump Room A Cooler Service Water Outlet Valve
E11-FO24A (B) Suppression Pool Cooling Isolation Valve
E11-F027A (B) Suppression Pool Cooling Spray Isolation Valve
E11-FO28A (B) Suppression Pool Discharge Isolation Valve
E11-F007A (B) RHR Min-flow Valve
E11-F015A (B) LPCI Inboard Injection Valve
E11-F017A (B) LPCI Outboard Injection Valve
E11-F050A (B) LPCI Injection Check Valve
E11-F010 RHR Divisional Cross-tie Valve
E11-FO-D001B RHR min-flow Orifice
E11-FO-D001D RHR min-flow Orifice
E11-FEN014A (B) RHR forward Flow Element
E11-FI-R603A (B) (Panel P601) RHR forward flow indicator

Pressure Transmitters
SW-PS-129, SW-PS-3213, and SW-PS-3214

Section 1R21.22a: Operation

E11-F010 RHR Divisional Cross-tie Valve

Section 1R21.23a: Design

Service Water Trash Rack / Traveling Screen Configuration
Diesel Generator # 1
Diesel Generator # 2
Unit 1, Division 1, 125 / 250 VDC Battery Charger 1A-1, and 1A-2
Unit 1, Division 2, 125 / 250 VDC Battery Charger 1B-1, and 1B-2

Pump Motors
RHR Pumps 1A, 1B, 1C, and 1D
CSW Pumps Motors 1A, 1B , 1C and 1D
RHR SW Pumps 1A, 1B, 1C and 1D

Section 1R21.24a: Testing

Pumps
2A / 2B Nuclear Service Water pumps
COO1B / RHRSW Booster Pump 2B

COO1D / RHRSW Booster Pump 2D

Pressure Transmitter
2-PS-1175A (C) 2-PS-1176B (D)

Section 1R21.31a: Component Degradation

1A & 2B Residual Heat Removal (RHR) loops
Residual Heat Removal Service Water (RHRSW) Pumps
Underground Piping Cathodic Protection System

Valves
E11-F007A/B RHR Minimum Flow Valves

Section 1R21.32a: Equipment/Environmental Qualification

Heat Exchangers
E11-B001A / RHR Heat Exchanger 2A
E11-B001B / RHR Heat

Section 1R21.34a: Component Inputs/Outputs

Motor Operated Valves
SW-V3 and SW-V4
CSW MOV-V14 and V16
CSW MOV- V14 and V18
CSW MOV-V16 and V18
CSW MOV-V14, V16 and V18
E11-F048A and E11-F048B
E11-F024A and E11-F024B
E11-F028A and E11-F028B
E11-F0224A and E11-F028B
E11-F024B and E11-F028A
SW-F068A and SW-F068B
SW-V101 and SW-V105

Pump Motors
RHR Pumps 1A, 1B, 1C, and 1D
CSW Pumps Motors 1A, 1B , 1C and 1D
RHR SW Pumps 1A, 1B, 1C and 1D

Section 1R21.35a: Operating Experience

Diesel Jacket Water Cooler outlet valves V-206, V-207, V-208 and V-209
Piping downstream of above valves

LIST OF DOCUMENTS REVIEWED

Procedures

OAI-114, Housekeeping Standards, Work In-Progress, In-Plant Storage, Rev. 23
0ENP-2704, Service Water Safety Related Heat Exchanger Cleaning / Inspection, Rev. 8
0PM-STR500, R. P. Adams Self-Cleaning Strainers, Models VWS 10 through 40, Rev. 5
0PM-STU500, Service Water Intake Structure Inspection and Cleaning, Rev. 12
0PM-TWS501, FMS/Link Belt Circulating Water Traveling Screens Model 45A and Service Water Traveling Screens Model 4PV-0635-2B, Rev. 15
0PT-08.1.4b, RHR Service Water System Operability Test - Loop B, Rev. 51
0PT-08.2.2b, LPCI/RHR System Operability Test - Loop B, Rev. 66
0PT-24.1.2, Service Water Miscellaneous Valve Operability Test, Rev. 31
OPT-48.6, EOP Sound Powered Phone System Functional Test, Rev. 1
OPT-08.1.3d, LPCI-RHR Loop Crosstie Valve Verification, Rev. 2
2PT-24.1-2, Service Water Pump and Discharge Valve Operability Test, Rev. 49
0SP-96-009, Data Acquisition for LPCI/RHR System Resistance Test, Rev. 0
1OI-03.1, Control Operator Daily Surveillance Report, Revision 85
0OI-01.03, Non-Routine Activities, Rev. 24
2OI-03.2, Control Operator Daily Surveillance Report, Revision 88
2OI-03.4.1, Unit 2 Control Operator Daily Check Sheets, Revision
1OP-17, Residual Heat Removal System Operating Procedure, Revision
2OP-17, Residual Heat Removal System Operating Procedure, Revision 139
2OP-43, Service Water System Operating Procedure, Rev. 116
0EOP-01-LEP-01, Alternate Coolant Injection, Rev. 25
0EOP-01-RXFP, Reactor Flooding Procedure, Rev. 15
0EOP-01-LEP-03, Alternate Boron Injection, Rev. 24
0EOP-01-SEP-03, Suppression Pool Spray Procedure, Rev. 16
1EOP-01-RVCP, Reactor Vessel Control Procedure, Rev. 7
0AOP-32.0, Plant Shutdown From Outside Control Room, Rev. 40
0AOP-38.0, Loss of Fuel Pool Cooling, Rev. 13
0AOP-19.0 Conventional Service Water System Failure
0AOP-15.0, Loss of Shutdown Cooling, Rev. 16
0ASSD-02, Control Building Alternate Safe Shutdown Procedure, Rev. 28
0APP-DG-LP, Annunciator Procedure for Local Diesel Generator Panels, Rev. 15
CAP-NGGC-0200, Corrective Action Program, Rev. 16
CAP-NGGC-0206, Corrective Action Program Trending and Analysis, Rev. 1
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Calculations

BNP-MECH-E11-F028A/B, Mechanical Analysis and Calculations of 1 & 2 E11-F028A/B RHR Suppression Pool Discharge Isolation Valves, Rev. 3
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G0050A-12, BNP Unit No. 2 Service Water System Hydraulic Analysis, Rev. 6
G0050A-13, NSW and CSW Pressure Switch Setpoints for Pump Autostart, Rev. 0
G0050A-20, Hydraulic Analysis of Cooling Water Intake Canal and Pump Intake Structure, Rev. 0
89-0011, RHR Heat Exchanger Heat Transfer Calculations, Rev. 4
0EOP-WS-13.1, LPCI/RHR Vortex Limit (2 pumps) plus HPCI & RCIC Vortex Determination, Rev. 4
0E11-028, Determination of RHR and Core Spray NPSH Margins After Power Uprate, Rev. 3
0SW-0097, RHR and Core Spray Room Cooler Performance, Rev. 0
1SW-0096, Service Water Hydraulic Performance Test Results (1PT24.6.4) - Unit 1, Rev. 0
80-004-02, RHR Pumps Minimum Flow Bypass Line Flow, Rev. 2
EER 88-0295, Evaluation of Potential Safety-Related Pump Loss, Rev. 1
89-050-01, Minimum Set Point for RHR-SW Pump Suction Pressure Switches, Rev. 1
EER 90-0187, Perform Field Testing to Document Actual Minimum Flow Rate for the RCIC, RHR, & HPCI pumps, Rev. 0
EER 93-0612, Periodic Testing of RHR Pumps at Best Efficiency Point (8000 gpm), Rev. 1
Performance Contracting, Inc. Report No. PCI-NPD-CPL01, Head Loss Calculations for Bare Sure-Flow Suction Strainers at Brunswick 1 and 2 Nuclear Units, Rev. 2
0E11-0023, Power Uprated RHR Minimum Flow Rate Uncertainty and Scaling Calculation, Rev. 1
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0B21-0071, Power Uprated Reactor Water Level-Low Level 3 Setpoint Uncertainty and Scaling Calculation, Rev. 1
2SW-0062, Instrument Loop Accuracy Calculation for 2-SW-PS-3214, Rev. 1
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0E11-0023, Power Uprated RHR Minimum Flow Rate Uncertainty and Scaling Calculation, Rev. 1
2SW-0061, Instrument Scaling Calculation for 2-SW-PS-3213, Rev.1
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04KV-0001, 4.16 KV Emergency Bus (Loss of Voltage) Undervoltage and Time Delay Uncertainty and Set point Calculation (For 4 KV 1-E1 (E2) - AE7 (AG5) - 27 / 59E and 2 - E3 - (E4) A13 (AK0) - 27 / 59E), Rev. 1
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BNP-E-7.010, Emergency Diesel Generator Static and Dynamic Load Study, Rev. 3C
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00030302 01, Replace 2-SW-2B Nuc. Pump Strainer Vessel with New Strainer Vessel Reusing Existing Strainer Internals, 06/12/01

00399832 01, 2-E11-C002B-M: 18 Month Motor Lube Sample, Upper & Lower, 05/20/04
00611246 01, 2-E11-C002B-M: 18 Month Motor Lube Sample, Upper & Lower, 07/13/05
0013452704, Unit 2 Nuclear Service Water Piping: Disassemble & Inspect, 03/22/05
0013452706, Unit 2 B-Loop RHR Service Water & Discharge Piping Inspection, 03/22/05
00562468, 2-SW-V124 RHR Pump Room Cooler B Service Water - Replace 2-SW-V-124 filter-regulator, 11/01/2005
0059497401, Unit 2 Perform Annual Dredging of the Intake Canal, work authorized 04/27/05
AKPZ001, Perform Disassembly Inspection on 2-SW-2B- Nuc. Pump Strainer in accordance with 0PM-STR500, 09/06/97
96ABSS1, Disassemble, Inspect, and Repair 2-SW-124 (Valve Would Not Provide a Good Isolation), 09/18/97
99AHSI1, Adjust Valve Air Operator Stroke Time on 2-SW-124, 01/18/00
0041442601, Perform Calibration of the 1-E11-PDIS-N021B, 12/09/04
0017753301, Perform Calibration of the 1-E11-PDIS-N021B, 03/26/03
0012675501, Perform Calibration of the 1-E11-PDIS-N021A, 08/15/02
0032678501, Perform Calibration of the 1-E11-PDIS-N021A, 03/22/04
00653355 01, RHR LPCI ADS CS LL3, HPCI RCIC LL2 Div I Trip Chan Cal / Control Room Back Panels, 08/18/05
00643749 01, RHR LPCI ADS CS LL3, HPCI RCIC LL2 Div I Trip Chan Cal / Control Room Back Panels, 05/26/05
00643755 01, RHR CS LO Reactor Press Permissive Trip Unit Chan Cal, 07/21/05
00620324 01, RHR CS LO Reactor Press Permissive Trip Unit Chan Cal, 04/29/05
00653356 01, RHR LPCI ADS CS LL3, HPCI RCIC LL2 Div II Trip Chan Cal / Control Room Back Panels, 08/18/05
00643751 01, RHR LPCI ADS CS LL3, HPCI RCIC LL2 Div II Trip Chan Cal Control Room Back Panels, 05/26/05
00643754 01, RHR CS LO RX Press Permissive Trip Unit Chan Cal Control Room Back Panels, 07/21/05
00620323 01, RHR CS LO Reactor Press Permissive Trip Unit Chan Cal Control Room Back Panels, 04/29/05
00643750 01, RHR LPCI ADS CS LL3, HPCI RCIC LL2 Div II Trip Chan Cal / Control Room Back Panels, 06/22/05
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00643748 01, RHR LPCI ADS CS LL3, HPCI RCIC LL2 Div I Trip Chan Cal / Control Room Back Panels, 06/22/05
00125315 01, Calibrate the Conventional Header Pressure and Low Pressure Switches 2-SW-PS-129 and 2-SW-PS-3213, 08/12/04
00049452 01, Calibrate the Conventional Header Pressure and Low Pressure Switches 2-SW-PS-129 and 2-SW-PS-3213, 11/03/00
00050431 01, Perform PM on the Conv. Service Water Header and Lube Water Pressure Switches 1-SW-PS-129 and 1-SW-PS-3213, 09/28/01

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Adverse Condition Correct and Trend Form (CAT) AR 172848-03, Cathodic Protection System Summary and Timeline

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D-02274, Sht. 1 and Sht. 2, Piping Diagram Diesel Generator Service Water and Demineralized Water Systems, Unit 1 and 2, Rev 23.
D-02525, Sheet 1A, Reactor Building Piping Diagram - Residual Heat Removal System - Unit No. 2, Rev. 48
D-02525, Sheet 1B, Reactor Building Piping Diagram - Residual Heat Removal System - Unit No. 2, Rev. 59
D-02537, Sheet 1, Reactor Building Service Water Piping Diagram - Unit No. 2, Rev. 82
TC-3643, 2E11-C002B Byron Jackson Division, Borg-Warner (Canada) Limited Pump Test Data, 11/06/71 (Manufacturer Pump Curve - 2E11-C002B)
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9527-F-27048, Reactor Building Composite Piping, Lower Section "F-F" - East Half, Unit No. 1 - Sheet No. 24, Rev. 2
RH-1, Residual Heat Removal System Training Drawing, Rev. 0
2-FP-50017, Sh. 4, Elementary Diagram Residual Heat Removal System U2, Rev. T
2-FP-50017, Sh. 5, Elementary Diagram Residual Heat Removal System U2, Rev. H
2-FP-50017, Sh. 13, Elementary Diagram Residual Heat Removal System U2, Rev. C
2-FP-50017, Sh. 14, Elementary Diagram Residual Heat Removal System U2, Rev. J
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2-FP-50017, Sh. 16, Elementary Diagram Residual Heat Removal System U2, Rev. M
LL-92036, Sh. 75, RHR Heat Exchanger 1A Shell Side Bypass Valve 1-E11-F048A Control Wiring Diagram, Rev. 7
LL-09112, Sh. 35, 4160 Volt SWGR E2 Compartment AH5 RHR Pump 1D Control Wiring Diagram, Rev. 9
LL-09111, Sh. 41, 4160V SWGR "E1" Compt "AF9" Nuc Service Water Pump 1A Control Wiring Diagram, Rev. 12
LL-09111, Sh. 15, 4160 Volt Switchgear "E1" Compartment "AF0" RHR Pump 1C Control Wiring Diagram, Rev. 5
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F-03003, Units No. 1 & 2 Auxiliary One Line Diagram 4160 Volt Emergency System SWGR. E3 & E4, Rev. 10
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F-30005, Unit No. 1 Auxiliary One Line Diagram 480 Volt System Unit Substations 1E, 1F, E5, E6 and Common C, Rev. 24
F-03005, 480 Volt System Unit Substation 2E, 2F, E7, E8, 2SY & Common D Auxiliary One Line Diagram, Rev. 23
F-30006, Unit No. 1 Single Line Diagram 125 - 250 Volt D-C System Distribution Switchboards 1A & 1B, Rev. 36
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FP-55109, Unit 1 Nuclear Steam Supply Shutoff System Elementary Diagram, Sheet 5, Rev. P
FP-55109, Unit 1 Nuclear Steam Supply Shutoff System Elementary Diagram, Sheet 6, Rev. H

FP-55109, Unit 1 Nuclear Steam Supply Shutoff System Elementary Diagram, Sheet 10, Rev. L
FP-55109, Unit 1 Nuclear Steam Supply Shutoff System Elementary Diagram, Sheet 11, Rev. F

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Section 6.2, Containment System, Rev. 19
Section 6.3, Emergency Core Cooling Systems, Rev. 19
Section 9.2.1, Service Water, Rev. 19
Section 9.2.5, Ultimate Heat Sink, Rev. 19
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DBD - 50, AC Electrical System, Rev. 3
SD -51, DC Distribution System, Rev. 5
SD - 50.1, 4160 VAC Electrical Distribution System, Rev. 9
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Technical Specifications 3.7.2.2 Surveillance Requirement UHS Water Temperature
Technical Specifications 3.8.1 AC Sources - Operating
Technical Specifications 3.8.4, DC Sources - Operating
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ARs

AR 070787, Unit 2 Division II RHR Pressure
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AR 172848, Place Cathodic Protection System on Candidate List
AR 146226, AC Electrical Distribution System Modeling

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AR 174956, RHR Min-flow Setpoint
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AR 176346, DBD-17 Section 3.3.1.1.6 - Pump Runout Discussion Discrepancy
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AR 176565, Technical Specification Minimum Canal Level Does Not Consider Instrument Inaccuracy and Pressure Loss
AR 176573, Missing Input/Basis Information from SW Hydraulic Analyses
AR 176181, MR Scoping & Maintenance On EOP Components

AR 172848, Cathodic Protection Project
AR 175603, MR Database Errors
AR 175725, Inadequate Revision of Calculations BNP-E-7.002
AR 176146, SW-PS-3213 Calibration Tolerance Discrepancy
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