



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

November 9, 2016

Mr. Tom Ray  
Site Vice President  
Duke Energy Carolinas, LLC  
Oconee Nuclear Station  
7800 Rochester Highway  
Seneca, SC 29672

**SUBJECT: OCONEE NUCLEAR STATION - NRC INTEGRATED INSPECTION REPORT  
05000269/2016003; 05000270/2016003, 05000287/2016003**

Dear Mr. Ray:

On September 30, 2016, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Oconee Nuclear Station Units 1, 2, and 3. On October 10, 2016, the NRC inspectors discussed the results of this inspection with you and other members of your staff. The results of this inspection are documented in the enclosed report.

NRC inspectors documented one finding of very low safety significance (Green) in this report. The finding did not involve a violation of NRC requirements. Further, inspectors documented a licensee-identified violation which was determined to be of very low safety significance in this report. The NRC is treating this violation as a non-cited violation (NCV) consistent with Section 2.3.2.a of the Enforcement Policy.

If you contest the violation or significance of the NCV, 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 the Oconee Nuclear Station.

If you disagree with a cross-cutting aspect assignment or a finding not associated with a regulatory requirement 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 the Oconee Nuclear Station.

T. Ray

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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/*

Frank Ehrhardt, Chief  
Reactor Projects Branch 1  
Division of Reactor Projects

Docket Nos.: 50-269, 50-270, 50-287  
License Nos.: DPR-38, DPR-47, DPR-55

Enclosure:  
NRC Integrated Inspection Report  
05000269/2016003, 05000270/2016003,  
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Letter to Tom Ray from Frank Ehrhardt dated November 9, 2016

SUBJECT: OCONEE NUCLEAR STATION - NRC INTEGRATED INSPECTION REPORT  
05000269/2016003; 05000270/2016003, 05000287/2016003

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**U.S. NUCLEAR REGULATORY COMMISSION**

**REGION II**

Docket Nos.: 50-269, 50-270, 50-287

License Nos.: DPR-38, DPR-47, DPR-55

Report No.: 05000269/2016003; 05000270/2016003, and 05000287/2016003

Licensee: Duke Energy Carolinas, LLC

Facility: Oconee Nuclear Station, Units 1, 2, and 3

Location: Seneca, SC 29672

Dates: July, 1, 2016 through September, 30, 2016

Inspectors: E. Crowe, Senior Resident Inspector  
N. Childs, Resident Inspector  
J. Parent, Resident Inspector  
E. Powell, Resident Inspector  
M. Toth, Project Engineer  
J. Worosilo, Senior Project Engineer (4OA2)  
M. Riley, Reactor Inspector (1R17, 4OA5)  
N. Covert, Senior Construction Inspector (1R17, 4OA5)  
B. Davis, Senior Construction Inspector (1R17, 4OA5)  
M. Thomas, Senior Reactor Inspector (4OA5)

Approved by: Frank Ehrhardt, Chief  
Reactor Projects Branch 1  
Division of Reactor Projects

Enclosure

## SUMMARY

IR 05000269/2016003, 05000270/2016003, and 05000287/2016003, July 1, 2016, through September 30, 2016; Oconee Nuclear Station Units 1, 2, and 3; Evaluations of Changes, Tests and Experiments and Permanent Plant Modifications

The report covered a 3-month period of inspection by resident inspectors and six regional inspectors. There was one NRC identified finding (FIN) documented in this report. The significance of inspection findings are indicated by their color (i.e., greater than Green, or Green, White, Yellow, Red) and determined using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process," (SDP) dated April 29, 2015. The cross-cutting aspects are determined using IMC 0310, "Aspects within the Cross-Cutting Areas" dated December 4, 2014. All violations of NRC requirements are dispositioned in accordance with the NRC's Enforcement Policy dated August 1, 2016. The NRC's program for overseeing the safe operations of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 6.

### Cornerstone: Mitigating Systems

- Green. The NRC identified a finding for the licensee's failure to translate the limiting flow rate design requirement into station procedures used to start and operate the alternate reactor building cooling (RBC) system, in accordance with the Duke Energy Carolinas Topical Report, Quality Assurance Plan (QAP). Specifically, the licensee failed to translate the limiting flow rate of 170 gallons per minute (gpm) into Procedure AP/0/A/1700/051, "Alternate Reactor Building Cooling," Revision (Rev.) 2, to ensure prevention of waterhammer on the "A" reactor building cooling unit (RBCU) or connecting low pressure service water (LPSW) lines when starting the RBCU Hale pump. The licensee entered this issue into their corrective action program as Action Request (AR) 02049903 and revised Procedure AP/0/A/1700/051 to limit the RBCU Hale pump discharge flow to each affected unit to an initial fill rate of 120 gpm or less.

The performance deficiency was determined to be more than minor because it adversely affected the protection against external factors attribute of the mitigating systems cornerstone and adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, opening the RBCU Hale pump discharge valve four turns, as specified in the procedure, would have resulted in filling the alternate RBC system at approximately 600-700 gpm and exceeding the design flow rate of 170 gpm established to prevent equipment and piping damage as a result of waterhammer. This provided a reasonable doubt that the alternate RBC system had the capability to reliably perform its intended safety function and, in turn, that the protected service water (PSW) system had the capability to meet its 30-day mission time during a turbine building fire that resulted in a loss of offsite power. The finding was determined to be of very low safety significance (Green) because the finding would not have resulted in a fire that caused secondary fires outside of the originating fire area due to circuit issues and did not affect the ability to reach and maintain a stable plant condition within the first 24-hours of a fire event. The inspectors determined the finding was indicative of present licensee performance and was associated with the cross-cutting aspect of design margin, in the area of human performance. Specifically, the licensee failed to operate and maintain the alternate RBC system

equipment within design margins when they did not translate design requirements from Engineering Change (EC) 110008 and Calculation OSC-8107 into station procedures. [H.6] (Section 1R17)

Violations of very low safety significance that were identified by the licensee have been reviewed by the NRC. Corrective actions taken or planned by the licensee have been entered into the licensee's corrective action program. These violations and corrective action tracking numbers are listed in Section 4OA7 of this report.

## REPORT DETAILS

### Summary of Plant Status

Unit 1: Operated at approximately 100 percent rated thermal power (RTP) for the entire inspection period.

Unit 2: Operated at approximately 100 percent RTP for the entire inspection period.

Unit 3: Operated at approximately 100 percent RTP for the entire inspection period.

### 1. REACTOR SAFETY

Cornerstones: Initiating Events, Mitigating Systems, and Barrier Integrity

#### 1R04 Equipment Alignment (71111.04)

##### a. Inspection Scope

##### .1 Partial Walkdown

The inspectors verified that critical portions of the selected systems were correctly aligned by performing partial walkdowns. The inspectors selected systems for assessment because they were a redundant or backup system or train, were important for mitigating risk for the current plant conditions, had been recently realigned, or were a single-train system. The inspectors determined the correct system lineup by reviewing plant procedures and drawings. Documents reviewed are listed in the attachment.

The inspectors selected the following four systems or trains to inspect:

- Unit 1, low pressure injection (LPI) line-up, including pumps and valves during planned valve stroke testing of 1LP-21 (1A LPI borated water storage tank suction)
- Unit 1 and Unit 2, LPSW line-up, including pumps, valves, switches, and breakers during planned maintenance on the 'C' LPSW pump
- Unit 1, Unit 2, and Unit 3, feedwater (FDW) and emergency feedwater (EFW) pumps, valves, breakers, and switches; plant service water (PSW) building, pumps, and switches; Keowee (KHU) control room, switches, breakers, and battery rooms during safe shutdown facility (SSF) planned outage
- Unit 1, Unit 2, Unit 3 high pressure service water (HPSW) alignment including pumps and valves during planned maintenance on 1HPSW-75 (fire header 'A' to yard header 'A' block)

##### b. Findings

No findings were identified.



1R05 Fire Protection (71111.05AQ)a. Inspection Scope.1 Quarterly Inspection

The inspectors evaluated the adequacy of selected fire plans by comparing the fire plans to the defined hazards and defense-in-depth features specified in the fire protection program. In evaluating the fire plans, the inspectors assessed the following items:

- control of transient combustibles and ignition sources
- fire detection systems
- fire suppression systems
- manual firefighting equipment and capability
- passive fire protection features
- compensatory measures and fire watches
- issues related to fire protection contained in the licensee's corrective action program

The inspectors toured the following five fire areas to assess material condition and operational status of fire protection equipment. Documents reviewed are listed in the attachment.

- Unit 1 and Unit 2, control room air handling unit room, fire zone 119
- Unit 1, east penetration room, fire zone 108
- Unit 3, B/C LPI & 'B' reactor building spray (RBS) pumps, fire zone 49
- Unit 3, 3C high pressure injection (HPI) pump, fire zone 50
- Unit 3, 3A/B HPI, spent resin, waste tank, component drain pumps, fire zone 50A

b. Findings

No findings were identified.

1R11 Licensed Operator Requalification Program and Licensed Operator Performance (71111.11)a. Inspection Scope.1 Resident Inspector Quarterly Review of Licensed Operator Requalification

On August 9, 2016, the inspectors observed an evaluated simulator scenario administered to an operating crew and conducted in accordance with the licensee's accredited requalification training program.

The scenario involved the failure of 1A condenser cooling water pump, controlling Tave signal failing high, a steam generator tube leak and subsequent steam generator tube rupture, a main steam line rupture with a failure of the 1B motor driven emergency feedwater pump to start, and 1A letdown cooler valve 1HP-3 failing to close on an

engineered safeguards signal. Events progressed to a point where the crew entered an unusual event declaration.

The inspectors assessed the following:

- licensed operator performance
- the ability of the licensee to administer the scenario and evaluate the operators
- the quality of the post-scenario critique
- simulator performance

Documents reviewed are listed in the attachment.

.2 Resident Inspector Quarterly Review of Licensed Operator Performance in the Actual Plant/Main Control Room

The inspectors observed licensed operator performance in the Unit 1 main control room on August 10, 2016 during a response to a high temperature “hot spot” on the X phase of the 2TA load center. In response to the “hot spot” the licensee transferred the 6900 kV loads from the auxiliary transformer to the start-up transformer.

The inspectors observed licensed operator performance in the Unit 3 main control room on August 10, 2016 during a transfer of the operating LPSW Pump, from the 3A LPSW pump to the 3B LPSW pump.

The inspectors observed licensed operator performance in the Unit 1 main control room on August 17, 2016 during an HPI pump test.

The inspectors assessed the following:

- use of plant procedures
- control board manipulations
- communications between crew members
- use and interpretation of instruments, indications, and alarms
- use of human error prevention techniques
- documentation of activities
- management and supervision

Documents reviewed are listed in the attachment.

b. Findings

No findings were identified.

1R12 Maintenance Effectiveness (71111.12)a. Inspection Scope

The inspectors assessed the licensee's treatment of the one issue listed below to verify the licensee appropriately addressed equipment problems within the scope of the maintenance rule (10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants"). The inspectors reviewed procedures and records to evaluate the licensee's identification, assessment, and characterization of the problems as well as their corrective actions for returning the equipment to a satisfactory condition. In addition, the inspectors performed a review of the licensee's Quality Assurance Program to ensure licensee was in compliance with their program requirements. Additionally, the inspectors evaluated the licensee's commercial grade dedication process to ensure commercially available parts were properly evaluated and controlled during the installation in a safety-related system. Documents reviewed are listed in the attachment.

- Unit 0, 230KV switchyard/differential relays, maintenance activity to improve reliability of "Yellow" bus (QA sample)

b. Findings

No findings were identified.

1R13 Maintenance Risk Assessments and Emergent Work Control (71111.13)a. Inspection Scope

The inspectors reviewed the four maintenance activities listed below to verify that the licensee assessed and managed plant risk as required by 10 CFR 50.65(a)(4) and licensee procedures. The inspectors assessed the adequacy of the licensee's risk assessments and implementation of risk management actions. The inspectors also verified that the licensee was identifying and resolving problems with assessing and managing maintenance-related risk using the corrective action program. Additionally, for maintenance resulting from unforeseen situations, the inspectors assessed the effectiveness of the licensee's planning and control of emergent work activities. Documents reviewed are listed in the attachment.

- Unit 1, August 28, 2016, planned yellow risk due to LPI valve LP21 & LP22 stroke test
- Unit 2, July 13, 2016, planned yellow risk due to vital inverter (2DID) out of service for maintenance
- Unit 1 and Unit 2, July 19, 2016, planned yellow risk due to 'C' LPSW pump maintenance
- Unit 1, Unit 2, and Unit 3, July 26, 2016, planned yellow risk due to SSF planned outage

b. Findings

No findings were identified.

1R15 Operability Determinations and Functionality Assessments (71111.15)

a. Inspection Scope

.1 Operability and Functionality Review

The inspectors selected the five operability determinations or functionality evaluations listed below for review based on the risk-significance of the associated components and systems. The inspectors reviewed the technical adequacy of the determinations to ensure that technical specification operability was properly justified and the components or systems remained capable of performing their design functions. To verify whether components or systems were operable, the inspectors compared the operability and design criteria in the appropriate sections of the technical specification and updated final safety analysis report to the licensee's evaluations. Where compensatory measures were required to maintain operability, the inspectors determined whether the measures in place would function as intended and were properly controlled. Additionally, the inspectors reviewed a sample of corrective action documents to verify the licensee was identifying and correcting any deficiencies associated with operability evaluations. Documents reviewed are listed in the attachment.

- Unit 1, Unit 2, and Unit 3, Vendor Notification Part 21 Event Number 51915 Electroswitches used in the PSW system, NCR 02047400
- Unit 1, Unit 2, and Unit 3, SSF 'A' diesel engine overspeed trip testing outside procedurally allowed tolerance, NCR 02049786
- Unit 1, Unit 2, and Unit 3, power cables for auxiliary chilled water (AWC) exceed allowed bend radius, NCR 02049887
- Unit 1, 1C HPI pump degradation-adjusted bearing temperature not acceptable, NCR 02054523
- Unit 2, Through wall leak in pipe next to 2LPSW-948, NCR 02054562

b. Findings

No findings were identified.

1R17 Evaluation of Changes, Tests, and Experiments and Permanent Plant Modifications (71111.17T)

a. Inspection Scope

Evaluations of Changes, Tests, and Experiments: The inspectors reviewed one safety evaluation performed pursuant to Title 10, *Code of Federal Regulations* (CFR) 50.59, to determine if the evaluation was adequate and that prior NRC approval was obtained as appropriate. The inspectors also reviewed five screenings where licensee personnel

had determined that a 10 CFR 50.59 evaluation was not necessary. The inspectors reviewed these documents to determine if:

- the changes, tests, or experiments performed were evaluated in accordance with 10 CFR 50.59 and that sufficient documentation existed to confirm that a license amendment was not required;
- the safety issues requiring the changes, tests, or experiments were resolved;
- the licensee conclusions for evaluations of changes, tests, or experiments were correct and consistent with 10 CFR 50.59; and
- the design and licensing basis documentation used to support the change was updated to reflect the change.

The inspectors used, in part, Nuclear Energy Institute (NEI) 96-07, "Guidelines for 10 CFR 50.59 Implementation," Rev. 1, to determine acceptability of the completed evaluations and screenings. The NEI document was endorsed by the NRC in Regulatory Guide 1.187, "Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments," dated November 2000.

Permanent Plant Modifications: The inspectors reviewed three permanent plant modifications that had been installed in the plant during the last three years. The modifications reviewed are listed below:

- EC 110408, 4160VAC Distribution from PSW 4160 SWGR to AC Distribution and Chillers for PSW
- EC 110240, Install Chillers, Auxiliary Skid, and Piping for the Alternate Chilled Water System
- EC 110008, Supply Pump and Misc. Equipment for Non-QA Containment Cooling

The inspectors reviewed the modifications selected to determine if:

- the supporting design and licensing basis documentation was updated;
- the changes were in accordance with the specified design requirements;
- the test documentation as required by the applicable test programs had been updated; and
- post-modification testing adequately verified system operability and/or functionality.

The inspectors also used applicable industry standards to evaluate acceptability of the modifications and performed walk-downs of accessible portions of the modifications. Documents reviewed are listed in the attachment.

b. Findings

Failure to Translate Design Requirements to Prevent the Effects of Waterhammer

Introduction: The NRC identified a Green finding for the licensee's failure to translate the limiting flow rate design requirement into station procedures used to start and

operate the alternate RBC system, in accordance with the Duke Energy Carolinas Topical Report, QAP. Specifically, the licensee failed to translate the limiting flow rate of 170 gpm into Procedure AP/0/A/1700/051, "Alternate Reactor Building Cooling," Rev. 2, to ensure prevention of waterhammer on the "A" RBCU or connecting LPSW lines when starting the RBCU Hale pump.

Description: For a fire in the turbine building that causes a loss of offsite power (LOOP) event or station blackout, the PSW system was designed to provide a diverse means to achieve and maintain safe shutdown by providing secondary side decay heat removal, reactor coolant system (RCS) pump seal cooling, RCS primary inventory control, and RCS boration. Section 9.7.3.4.5 of the Updated Final Safety Analysis Report, Rev. 25, stated that alternate cooling water and power to the existing ventilation systems was provided to recover from the potential loss of normal auxiliary building (AB) and reactor building (RB) ventilation and to support extended PSW system operation to meet National Fire Protection Association (NFPA) 805 requirements. For alternate cooling to the reactor building, the alternate reactor building cooling (RBC) system used a series of portable pumps, including an RBCU Hale pump, and hoses connected to a pump skid to send cooling water from Lake Keowee to the "A" RBCU through existing LPSW piping.

Calculation OSC-10785, "Gothic Containment Analysis Utilizing the Protected Service Water (PSW) System," Rev. 3, stated in part, that the PSW system must be capable of cooling the reactor coolant system to 250 degrees Fahrenheit and maintaining this temperature for a 30-day mission time so that damage repairs could be implemented prior to proceeding to cold shutdown. For this analysis, the critical equipment required for the PSW system to perform its design function was located in the AB and RB. Calculation OSC-10785 also documented that at the 30-hour time period, when alternate RBC would be placed into service, reactor building containment temperature was projected to be above 212 degrees Fahrenheit. As a result, the inspectors determined that there was a potential for waterhammer in the existing RBCU or LPSW piping inside containment during the postulated fire event that required PSW operation for a mitigation strategy.

Engineering Change (EC) 110008, "Supply Pump and Miscellaneous Equipment for Non-QA Containment Cooling," Rev. 8, dated November, 3, 2015, stated "The fill and vent of the applicable piping must be done to prevent any waterhammer issues. Filling of the system shall occur at a flowrate less than 170 gpm." The inspectors noted that the reference document for this requirement was calculation OSC-8107, "Mechanical Design Inputs for NSM ON-X3107," Rev. 2, dated May 18, 2014. Calculation OSC-8107, a quality assurance (QA) Condition 1 calculation, documented that during re-establishment of the RBCU following a loss of power, the limiting fill rate to the cooling units was 173 gpm to prevent equipment and piping damage as a result of waterhammer.

For the starting and operation of the RBCU Hale pump, the inspectors noted that Step 13 of Enclosure 5.4 in Procedure AP/0/A/1700/051, "Alternate Reactor Building Cooling," Rev. 2, stated to open the RBCU Hale pump discharge valve to each affected unit four turns open. This would have resulted in filling the system at approximately 600-700 gpm, exceeding the established design flow rate of 170 gpm to prevent equipment and piping damage as a result of waterhammer. In addition, this would have adversely

affected the reliability and capability of the alternate RBC system to perform its intended safety function during extended PSW operation.

The inspectors noted that the alternate RBC system contained safety-related structures, systems, and components (SSCs), specifically the "A" RBCU and associated LPSW piping. However, these components did not perform a safety-related function during the post fire safe shutdown when PSW would be in operation as a mitigating strategy. As a result, these components were not required to meet the regulatory requirements set forth in Appendix B of Title 10 CFR Part 50. The inspectors noted, however, that the licensee had established self-imposed standards that items identified as QA Condition 1 would conform to the requirements set forth in 10 CFR Part 50, Appendix B.

The Duke Energy Topical Report, Amendment 41, stated that the topical report applies in its entirety to systems, components, items, and services identified as QA Condition 1 and that the topical report conforms to the requirements of 10 CFR Part 50, Appendix B. Title 10 CFR Part 50, Appendix B, Criterion III, "Design Control," required, in part, that measures be established to assure that applicable regulatory requirements and the design basis, as defined in § 50.2 and as specified in the license application, for those SSCs to which this appendix applies are correctly translated into specifications, drawings, procedures, and instructions. Contrary to the above, the licensee failed to translate the limiting fill rate of 170 gpm into Procedure AP/0/A/1700/051, "Alternate Reactor Building Cooling" to ensure prevention of waterhammer on the "A" RBCU or connecting LPSW lines during extended PSW operation.

The licensee generated AR 02049903 on July 29, 2016, and revised Procedure AP/0/A/1700/051 to limit the RBCU Hale pump discharge flow to each affected unit to an initial fill rate of 120 gpm or less, which included instrument uncertainty.

Analysis: The licensee's failure to translate the limiting flow rate design requirements of the alternate RBC system into station procedures, in accordance with the Duke Energy Carolinas Topical Report, QAP, was a performance deficiency. The performance deficiency was determined to be more than minor because it adversely affected the protection against external factors attribute of the mitigating systems cornerstone and adversely affected the cornerstone objective of ensuring the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, opening the RBCU Hale pump discharge valve four turns, as specified in the procedure, would have resulted in filling the alternate RBC system at approximately 600-700 gpm, exceeding the design flow rate of 170 gpm established to prevent equipment and piping damage as a result of waterhammer. This provided a reasonable doubt that the alternate RBC system had the capability to reliably perform its intended safety function and, in turn, that the PSW system had the capability to meet its 30-day mission time during a turbine building fire that resulted in a LOOP.

The finding was assessed using IMC 0609, Att. 4, "Initial Characterization of Findings," issued June 19, 2012, for the mitigating systems cornerstone, and the inspectors determined this finding affected the ability to reach and maintain safe shutdown in case of a fire, which required the use of IMC 0609 Appendix F, "Fire Protection Significance Determination Process," issued September 20, 2013. Using the Phase 1 "Qualitative Screening Approach," the inspectors determined this finding was associated with Table

1.4.5, “Post Fire Safe Shutdown,” because the function of the alternate RBC system was relied upon for post fire safe shutdown when PSW was in operation as a mitigating strategy. The finding was determined to be of very low safety significance (Green) because the finding would not have resulted in a fire that caused secondary fires outside of the originating fire area due to circuit issues and did not affect the ability to reach and maintain a stable plant condition within the first 24-hours of a fire event. This was because the alternate RBC system was not required to be placed into service until 30 hours after the fire event.

Since this issue was introduced on May 18, 2014, the inspectors determined the finding was indicative of present licensee performance and was associated with the cross-cutting aspect of design margin, in the area of human performance, per IMC 0310, “Aspects Within Cross Cutting Areas,” issued December 4, 2014. Specifically, the licensee failed to operate and maintain the alternate RBC system equipment within design margins when they did not translate design requirements from EC 110008, dated November, 3, 2015, and Calculation OSC-8107, a QA Condition 1 calculation, dated May 18, 2014, into station procedures to prevent potential damage of the “A” RBCU and associated LPSW piping as a result of waterhammer. [H.6]

Enforcement: The inspectors did not identify a violation of regulatory requirements associated with this finding. Because this finding does not involve a violation and is of very low safety significance, it is identified as a FIN. (FIN 05000269, 270, 287/2016003–01, “Failure to Translate Design Requirements to Prevent the Effects of Waterhammer”).

#### 1R19 Post-Maintenance Testing (71111.19)

##### a. Inspection Scope

The inspectors either observed post-maintenance testing or reviewed the test results for the seven maintenance activities listed below to verify the work performed was completed correctly and the test activities were adequate to verify system operability and functional capability.

- 20091934, Unit 3 C reactor building cooling unit running backwards in low speed, June 29, 2016
- 20041519, PM SSF generator regulator exciter, July 28, 2016
- 20079737, SSF ASW pump functional test, July 28, 2016
- 20080031, Unit 2 B motor-driven emergency feedwater pump test, August 8, 2016
- 20018977, PM CT4 underground lockout relay, August 9, 2016
- 20102988, I/R Hot Spot on 2TA-02, August 11, 2016
- 20030158, Refurbish/Install breaker 2TC-10, August 17, 2016

The inspectors evaluated these activities for the following:

- acceptance criteria were clear and demonstrated operational readiness
- effects of testing on the plant were adequately addressed
- test instrumentation was appropriate
- tests were performed in accordance with approved procedures



- equipment was returned to its operational status following testing
- test documentation was properly evaluated

Additionally, the inspectors reviewed a sample of corrective action documents to verify the licensee was identifying and correcting any deficiencies associated with post-maintenance testing. Documents reviewed are listed in the attachment.

b. Findings

One licensee-identified violation was identified and documented in Section 4OA7 of this report.

1R22 Surveillance Testing (71111.22)

a. Inspection Scope

The inspectors reviewed the six surveillance tests listed below and either observed the test or reviewed test results to verify testing adequately demonstrated equipment operability and met technical specification and current licensing basis. The inspectors evaluated the test activities to assess for preconditioning of equipment, procedure adherence, and equipment alignment following completion of the surveillance. Additionally, the inspectors reviewed a sample of related corrective action documents to verify the licensee was identifying and correcting any deficiencies associated with surveillance testing. Documents reviewed are listed in the attachment.

Routine Surveillance Tests

- PT/1/A/0152/012, Low Pressure Injection System Valve Stroke Test
- PT/1/A/0202/011, High Pressure Injection Pump Test
- PT/1/A/0251/001, Low Pressure Service Water Pump Test
- PT/2/A/0261/010, Essential Siphon Vacuum System Test

In-Service Tests (IST)

- PT/3/A/0203/006 A, Low Pressure Injection Pump Test – Recirculation

Containment Isolation

- PT/3/A/0151/011 B, Penetration 11B Leak Rate

b. Findings

No findings were identified.

## Cornerstone: Emergency Preparedness

### 1EP6 Drill Evaluation (71114.06)

#### a. Inspection Scope

The inspectors observed the emergency preparedness drill conducted on September 13, 2016. The inspectors observed licensee activities in the simulator to evaluate implementation of the emergency plan, including event classification, notification, and protective action recommendations. The inspectors evaluated the licensee's performance against criteria established in the licensee's procedures. Additionally, the inspectors attended the post-exercise critique to assess the licensee's effectiveness in identifying emergency preparedness weaknesses and verified the identified weaknesses were entered in the corrective action program. Documents reviewed are listed in the attachment.

#### b. Findings

No findings were identified.

## 4. OTHER ACTIVITIES

### 4OA1 Performance Indicator Verification (71151)

#### a. Inspection Scope

The inspectors reviewed a sample of the performance indicator (PI) data, submitted by the licensee, for the Unit 1, Unit 2 and Unit 3 PIs listed below. The inspectors reviewed plant records compiled between July 2015 and June 2016 to verify the accuracy and completeness of the data reported for the station. The inspectors verified that the PI data complied with guidance contained in Nuclear Energy Institute 99-02, "Regulatory Assessment Performance Indicator Guideline," and licensee procedures. The inspectors verified the accuracy of reported data that were used to calculate the value of each PI. In addition, the inspectors reviewed a sample of related corrective action documents to verify the licensee was identifying and correcting any deficiencies associated with PI data. Documents reviewed are listed in the attachment.

#### Cornerstone: Mitigating Systems

- safety system functional failures (3 units)
- heat removal system (3 units)

#### Cornerstone: Barrier Integrity

- reactor coolant system specific activity (3 units)

#### b. Findings

No findings were identified.

## 4OA2 Problem Identification and Resolution (71152)

### .1 Routine Review

The inspectors screened items entered into the licensee's corrective action program to identify repetitive equipment failures or specific human performance issues for follow-up. The inspectors reviewed problem identification program reports, attended screening meetings, or accessed the licensee's computerized corrective action database.

### .2 Annual Followup of Selected Issues

#### Safety Conscious Work Environment

##### a. Inspection Scope

NRC inspectors conducted an assessment of the Safety Conscious Work Environment (SCWE) in the major projects group and contractors at the Oconee site. NRC inspectors conducted interviews with staff, contractors, supervisors, and the Major Projects Manager. Specifically, the NRC interviewed fifty-four contractors and seven Duke supervisors/managers at the Oconee site. Forty-two of the contractors interviewed were from the major projects group.

During the inspection, inspectors were sensitive to areas and issues that would represent challenges to the free flow of information, such as areas where employees may be reluctant to raise concerns or report issues in the corrective action program.

##### b. Assessment

Based on the interviews, the inspectors determined that, overall, licensee management emphasized the need for all employees to identify and report problems using the appropriate methods established within the administrative programs, including the corrective action program, the employee concerns program, supervisors, and managers. Personnel interviewed knew that these methods were readily accessible to all employees.

The inspectors determined that employees felt free to raise issues, and that management encouraged employees to place issues into the corrective action program for resolution. The inspectors did not identify any reluctance on the part of the licensee staff, contractors, supervisors, or managers to report safety concerns.

Based on our review and assessment, the NRC concluded the safety conscious work environment in the major projects group and the contractors at the Oconee site is adequate to support nuclear safety.

#### 4OA3 Followup of Events and Notices of Enforcement Discretion (NOED)

##### .1 (Closed) LER 05000287/2016-001 Unit 3 Reactor Building Cooling Unit Inoperability Exceeds Technical Specification Completion Time

###### a. Inspection Scope

On June 28, 2016, anomalies were noted on 3C RBCU inlet temperature readings, which were reading low. Upon further investigation by maintenance and engineering, the licensee determined that the 3C RBCU fan was running in the reverse direction in slow speed, causing the 3C RBCU to be inoperable. The licensee determined that the reason for the 3C RBCU fan running in the reverse direction was due to the inadvertent "rolling" of the RBCU motor control center (MCC) contactor leads during maintenance performed during the spring 2016 refueling outage. The licensee entered this event into their corrective action program as NCRs 02038756, 02041479, 02041501, and 02041502. As part of the licensee's corrective actions, the licensee corrected the leads for the 3C RBCU fan, trained/counseled plant personnel and enhanced the associated procedures.

The inspectors reviewed this LER, the licensee's apparent cause evaluation, and corrective action documents to verify the accuracy of the LER and that corrective actions were identified and implemented to address the issue. LER 05000287/2016-001 is closed.

###### b. Findings

One licensee-identified violation was identified and documented in Section 4OA7 of this report.

##### .2 (Closed) LER 05000287/2013-001-01 Unit 3 Manual Reactor Trip Due to Main Feedwater Flow Oscillations

###### a. Inspection Scope

On October 24, 2013 control room operators manually tripped the Unit 3 reactor while it was operating at 100 percent RTP. The operators noted abnormal main feedwater oscillations. The licensee originally determined that an actuator O-ring was binding and prevented free movement of feedwater control valve 3FWD-32. On January 31, 2015, Unit 3 experienced abnormal main feedwater oscillations and control room operators tripped the reactor while operating at 100 percent RTP. The licensee determined the cause of feedwater control valve 3FWD-32 fluctuations was a faulty electronic-to-pneumatic (E/P) converter. The licensee replaced the E/P converter and restored the unit to 100 percent RTP. The licensee determined that the most likely cause of the October 24, 2013 event was the E/P converter instead of the degraded O-ring as previously noted. The licensee submitted a revised version of the original LER 05000287/2013-001-00 to provide the new information.

The inspectors reviewed the supplemental information provided in LER 05000287/2013-001-01, the original version of LER 05000287/2013-001-00; LER 05000287/2015-001-00

for the January 31, 2015 event; and the licensee's corrective action documents associated with the above LERs. The inspectors had considered this supplemental information in the closure of LER 0500287/2015-001-00 determining no issue of concern existed. The supplemental information also does not alter the NRC conclusions related to the closure of LER 05000287/2013-001-01. The inspectors determined the licensee's corrective actions were appropriate. LER 05000287/2013-001-01 is closed.

b. Findings

No findings were identified.

.3 (Closed) LER 05000269/2016-001-00 RPS Actuation – Unit 1 Reactor Trip Initiated by a Generator Lockout/Turbine Trip

a. Inspection Scope

On March 6, 2016 the "Y" power bushing of the Unit 1 main transformer developed an electrical short which physically damaged the bushing and resulted in a fire. The reactor protection system initiated a reactor trip due to the main turbine tripping from a main generator lockout caused by the damaged bushing. The licensee declared a "Notification of Unusual Event (NOUE)" at 15:20 and activated their emergency response organization. The licensee's fire brigade responded to the resultant fire and implemented proper firefighting techniques to the immediate area of the main transformer. The fire duration was sufficient to cause the central phase overhead power cable to the 230KV switchyard to fail and drop across the 230KV "Yellow" bus which resulted in all circuit breakers on that bus to open. The licensee declared an "Alert" condition following the de-energization of the 230KV switchyard bus.

The inspectors responded to the NOUE and Alert emergency declarations and evaluated the response of the plant, the licensee's actions, and the conditions of safety related equipment. The inspectors reviewed the licensee's root cause determination which acknowledged the failure of the bushing was a dielectric breakdown of the paper insulation inside the bushing resulting from oil contamination. The inspectors reviewed the licensee's corrective actions which were implemented or planned. LER 05000269/2016-001-00 is closed.

b. Findings

No findings were identified.

4OA5 Other Activities

.1 Operation of an Independent Spent Fuel Storage Installation (60855.1)

a. Inspection Scope

The inspectors performed a walkdown of the onsite independent spent fuel storage installation (ISFSI) and monitored the activities associated with the dry fuel storage campaign completed on July 14, 2016. The inspectors reviewed changes made to the

ISFSI programs and procedures, including associated 10 CFR 72.48, "Changes, Tests, and Experiments," screens and evaluations to verify that changes made were consistent with the license or certificate of compliance. The inspectors observed the loading activities to verify that the licensee recorded and maintained the location of each fuel assembly placed in the ISFSI. The inspectors also reviewed surveillance records to verify that daily surveillance requirements were performed as required by technical specifications. Documents reviewed are listed in the attachment.

b. Findings

No findings were identified.

2. Verification of Completion of Oconee Operating License Condition 3.D, Transition License Condition #1, Implementation Items

a. Inspection Scope

Oconee Transition License Condition #1 stated that the licensee shall complete the items described in Section 2.9, Table 2.9-1, "Implementation Items," in the NRC Safety Evaluation (SE) dated December 29, 2010, prior to January 1, 2013. The inspectors reviewed Oconee Operating License Condition 3.D and associated Transition License Conditions; NRC Safety Evaluation dated December 29, 2010 (ADAMS accession number ML103630612); Oconee Design Basis Specification for Fire Protection, OSS-0254.00-00-4008; licensee letter dated May 5, 2014 (ML14126A688); various calculations and procedures; to verify that the licensee's actions to complete selected implementation items were as discussed in Table 2.9-1 of the SE and the licensee's letter dated May 5, 2014, and were acceptable. The inspectors reviewed Table 2.9-1 Implementation Items listed below.

Table 2.9-1 Implementation Item 5: *"Appropriate station electrical specifications will be updated to specify only metal tray and metal conduits shall be used for electrical raceways. Thin wall metallic tubing shall not be used for power, instrumentation, or control cables."* This item was implemented with clarifications described in licensee correspondence to the NRC dated May 5, 2014 (ML14126A688). The NRC reviewed this item further and determined that the clarifications were acceptable and the May 5, 2014, letter was appropriate (in lieu of a license amendment request) to request the changes to the License Condition.

Table 2.9-1 Implementation Item 9: *"Pre-fire Plans will be updated to include any changes to equipment important to nuclear safety and other updates pertinent to the NFPA 805 Transition."* This item was implemented as written.

Table 2.9-1 Implementation Item 12: *"Validate hydraulics calculations for all required automatic or manual water-based suppression systems."* This item was implemented as written.

Table 2.9-1 Implementation Item 15: *"Revise Fleet Directive NSD-403 and Site Directive (SD) 1.3.5 with the definition of high(er) risk evolution (HRE) to address non-power operation (NPO) criteria, e.g., Plant Operating State (POS) 1B. Also, reconcile NSD-403*

*and SD 1.3.5 Thermal Margin Criteria with the criteria in FAQ 07-0040 as needed.*” This item was implemented with clarifications described in licensee correspondence to the NRC dated May 5, 2014. The NRC reviewed this item further and determined that the clarifications were acceptable and the May 5, 2014, letter was appropriate to request the changes to the License Condition.

Table 2.9-1 Implementation Item 19: *“Develop procedural controls for use of reactor coolant system (RCS) wide range pressure instruments (in lieu of RC Low Range Pressure) during HREs for the outage risk management procedures applicable to NPO key safety function (KSF).”* This item was implemented via alternate methods described in licensee correspondence to the NRC dated May 5, 2014. The NRC reviewed this item further and determined that the alternate methods were acceptable and the May 5, 2014, letter was appropriate to request the changes to the License Condition.

Table 2.9-1 Implementation Item 20: *“Develop procedural controls on the Train A Bleed Holdup Tank (BHUT) tank level monitoring for the outage risk management procedures.”* This item was implemented via alternate methods described in licensee correspondence to the NRC dated May 5, 2014. The NRC reviewed this item further and determined that the alternate methods were acceptable and the May 5, 2014, letter was appropriate to request the changes to the License Condition.

Table 2.9-1 Implementation Item 21: *“Ensure capability to access (i.e., an operator can be dispatched to manually throttle) motor-operated valves (MOVs) 1, 2, 3LP-21 where 1, 2, 3DHR-GF1&2 success paths are credited.”* This item was implemented via alternate methods described in licensee correspondence to the NRC dated May 5, 2014. The NRC reviewed this item further and determined that the alternate methods were acceptable and the May 5, 2014, letter was appropriate to request the changes to the License Condition.

Table 2.9-1 Implementation Item 22: *“Ensure capability to access (i.e., an operator can be dispatched to manually open and close, respectively) manual valves 1, 2, 3HP-363 and 1, 2, 3HP-78 where 1, 2, 3INVCTL3c success paths are credited.”* This item was implemented via alternate methods described in licensee correspondence to the NRC dated May 5, 2014. The NRC reviewed this item further and determined that the alternate methods were acceptable and the May 5, 2014, letter was appropriate to request the changes to the License Condition.

Table 2.9-1 Implementation Item 24: *“Develop procedure guidance for pre-emptive realignment of and the removal of power from the MOVs in the Unit specific gravity feed flow paths.”* This item was implemented via alternate methods described in licensee correspondence to the NRC dated May 5, 2014. The NRC reviewed this item further and determined that the alternate methods were acceptable and the May 5, 2014, letter was appropriate to request the changes to the License Condition.

Table 2.9-1 Implementation Item 25: *“Revise NSD-403, SD1.3.5, and ONS technical procedures to implement the recommendations in OSC-9313, Attachment 1, subject to resolution of open Items (i.e., Items 15 through 24).”* The inspectors reviewed this item further in conjunction with the resolution of implementation items 15-24 and determined that item 25 was acceptable.

Table 2.9-1 Implementation Item 34: *“Future acceptable cable construction qualifications will be included in the Power Generation Electrical Discipline Design Criteria Manual. A specific line item will be added that video/communication/data cables shall be plenum rated and/or tested in accordance with Institute of Electrical and Electronic Engineers (IEEE) 383-1974, IEEE 1202-1991, CSA 22.2 No. 0.3, NFPA 262, UL 44, UL 83, UL 1581, UL 1666, or UL 1685 as accepted in FAQ 06-0022. Electrical wiring, including video, phone, and communications, installed above a suspended ceiling shall be rated for plenum use, routed in metallic conduit, routed in cable tray with solid metal top and bottom covers, or armored cable.”* This item was implemented with clarifications described in Design Criteria 3.13 and the Fire Protection DBD. The inspectors determined that the clarifications were acceptable.

Table 2.9-1 Implementation Item 35: *“Appropriate directives will be updated to clearly indicate that only portable electric heaters are permitted to be used in plant areas with equipment important to nuclear safety or where there is the potential for radiological release due to fire. Portable fuel-fired heaters are not permissible in these areas.”* This item was implemented as written.

Table 2.9-1 Implementation Item 36: *“The fire brigade will develop a SOG for fighting a fire in the RB. Training is already performed on tactics for fighting fires of this nature but training will be reinforced with a new SOG. The Fire Brigade Administrator will review the Pre-Fire Plans to determine if enhancement is necessary.”* This item was implemented as written.

Table 2.9-1 Implementation Item 37: *“Develop instructions for the software program to collect availability and reliability data on SSCs in the Monitoring Program.”* This item was implemented as written.

Table 2.9-1 Implementation Item 38: *“Revise the B-2 Table to include additional clarification of alignment with the NEI guidance.”* This item was implemented as written.

Table 2.9-1 Implementation Item 39: *“Development and documentation of a long term SSD program including analysis, equipment reviews, recovery actions, modifications, and procedural guidance.”* The inspectors reviewed this item further and determined that the licensee had completed implementation of this item as written in the SE and the ONS Fire Protection DBD.

Table 2.9-1 Implementation Item 40: *“Complete activities needed to provide assurance that fire-induced open secondary circuits of current transformers will not impact the ability to achieve and maintain the fuel in a safe and stable condition.”* This item was implemented as written.

Table 2.9-1 Implementation Item 44: *“The breaker coordination study will be updated to include all new NFPA 805 SSD equipment list (SSEL)-related power supplies (i.e., PSW) for power and non-power operations, and additional plant modification will be defined if necessary to ensure that the assumptions of the Fire PRA and NSCA remain valid.”* This item was implemented with clarifications described in licensee correspondence to the NRC dated May 5, 2014. The NRC reviewed this item further and determined that



the clarifications were acceptable and the May 5, 2014, letter was appropriate to request the changes to the License Condition.

Table 2.9-1 Implementation Item 45: *“The ONS “Fire Protection Program Design Basis Document” and supporting documentation will be revised to incorporate NFPA 805 documents.”* This item was implemented as written.

Table 2.9-1 Implementation Item 46: *“Licensee agreed to eliminate the “10 minutes free of fire damage” assumption. The ONS FPP and supporting documentation (including the B-2 Table, B-3 Table, all applicable fire risk evaluations, Fire PRA, NSCA, and operator manual action(s) (OMA) feasibility calculations) will be revised to eliminate the assumptions. Compliance will be demonstrated consistent with NFPA 805, Section 4.2.4.2.”* This item was implemented with clarifications described in licensee correspondence to the NRC dated May 5, 2014. The NRC reviewed this item further and determined that the clarifications were acceptable and the May 5, 2014, letter was appropriate to request the changes to the License Condition.

Table 2.9-1 Implementation Item 47: *“Revised calculation OSC-9291, NFPA 805 Transition B-2 Table, Section 3.1.1.7 to reword the alignment basis to clearly state that offsite power is not credited for deterministic analysis and therefore not analyzed for its availability in the deterministic analysis. The licensee also states that alignment statement will be revised to ensure the proper relationship with the alignment basis.”* This item was implemented as written.

b. Findings

No findings were identified. The inspectors reviewed the 21 implementation items discussed above and determined them to be acceptable. The inspectors have reviewed 42 of the 47 implementation items discussed in Oconee SE Section 2.9, Table 2.9-1, and found them to be acceptable. The 21 implementation items previously reviewed (Items 1, 2, 3, 4, 6, 7, 8, 10, 11, 13, 14, 16, 17, 18, 26, 27, 28, 29, 30, 31, and 33) were documented as acceptable in NRC Inspection Report 05000269, 270, 287/2016007 (ML16124A845). The remaining five items (Implementation Items 23, 32, 41, 42, and 43) will be reviewed by the NRC during a subsequent inspection to review the licensee’s completion of Milestone 6 of the NRC Notice of Violation and Confirmatory Order dated July 1, 2013 (ML13114A928).

.3 Verification of Completion of Milestone 5 of Protected Service Water (PSW) Major Plant Modification

a. Inspection Scope

Milestone 5 of Confirmatory Order EA-13-010 dated July 1, 2013, (Accession No. ML 13114A928) states:

*“The licensee shall provide the capability to supply electrical power from the PSW building switchgear to those DC battery chargers that provide power to controls and instrumentation that allow PSW system control and monitoring from the control room for an extended period of time as prescribed by the NFPA-805 fire protection program*

*approved for Oconee. The licensee shall provide electrical power from the PSW building switchgear to at least 400 kW (nameplate rating) of pressurizer heaters for each unit, and provide the ability to select the PSW power source to those pressurizer heaters from the Auxiliary Building. The licensee shall provide Auxiliary Building and Reactor Building environments suitable for equipment operation. The licensee shall provide the ability to control and monitor the high-pressure injection equipment, the PSW equipment, and the steam generator heat removal equipment from the associated Oconee control rooms. This modification along with approved plant procedures and the completion of operator training necessary to accomplish this lineup, and a combination of testing and engineering evaluation in accordance with station procedures which verifies this capability, will be completed and operational no later than February 4, 2016.”*

The inspectors reviewed a sample of engineering modifications to verify the PSW system's electrical capability to supply the required power to each units' vital instrumentation and control system and the PSW system's electrical capability to supply at least 400kW to each unit's pressurizer heaters when safe shutdown operation is needed. The inspectors also reviewed a sample of engineering modifications to verify the licensee's capability to provide an auxiliary building environment and reactor building environment suitable for operation. The reviews of these modifications consisted of reviewing the electrical and mechanical capability of the alternate chilled water (AWC) system and the alternate RBC system. These systems were required to ensure the PSW equipment could reach and maintain safe shutdown. The inspectors reviewed the PSW, AWC, and alternate RBC system's response during a turbine building fire event only, and as a result, the conclusions stated in this section were made based solely upon that event.

The inspectors reviewed calculations, procedures, licensing documents, completed tests, drawings, and hydraulic flow modeling software and Gothic analyses, in relation to the capability of the PSW, AWC, and alternate RBC system's capability to perform their function during a fire event. The inspectors reviewed the licensee's fire analysis and AWC cable analysis to assess the licensee's strategy for mitigation of fire impacts in the turbine building. The inspectors also performed walk-downs of the turbine building and roof to verify the assumptions and ignition sources documented in the fire analysis. The inspectors reviewed a sample of corrective action documents that were written in relation to the PSW major project modification. This sample included a review of corrective actions associated with the seismic qualification of transformers CT6 and CT7, which supplies power to the PSW switchgear, and a review of the pressurizer pressure operated relief valve's capability to operate during a turbine building fire that required PSW as a mitigation strategy.

The inspectors performed walk-downs of the PSW, AWC, and alternate RBC system to assess the material condition of the equipment. The inspectors also performed a walk-down of the Unit 1, Unit 2, and Unit 3 control rooms to verify that the licensee had the capability to control and monitor equipment relied upon during the operation of the PSW system. The inspectors conducted interviews with the licensee's staff and with the contractors who performed the analysis to verify that the calculation model accurately reflected the as-built plant configuration. Final verification of completion of Milestone 5 is pending a review of the licensee's plant procedures and operator training.

b. Findings

No findings were identified.

4OA6 Meetings, Including Exit

On October 10, 2016, the resident inspectors presented the inspection results to Mr. Tom Ray and other members of the licensee's staff. The inspectors verified that no proprietary information was retained by the inspectors or documented in this report.

4OA7 Licensee-Identified Violations

The following violation of very low safety-significance (Green) was identified by the licensee and is a violation of NRC requirements which meets the criteria of the NRC Enforcement Policy, for being dispositioned as a Non-Cited Violation.

- Technical Specification (TS) 5.4.1., "Procedures," states, in part, written procedures shall be established, implemented, and maintained covering activities described in Regulatory Guide 1.33, Revision 2, Appendix A, February 1978. Procedure MP/0/A/3009/017, "Visual PM Inspection and Electrical Motor Tests" is used by the licensee during maintenance of electric motors. Contrary to the above, on April 25, 2016, the licensee did not adequately implement maintenance procedure MP/0/A/3009/017. Specifically, the licensee incorrectly wired the 3C RBCU motor control center contactor leads during maintenance causing 3C RBCU fan to operate in the reverse direction. On June 16, 2016, during an engineer walkdown, the engineer noted anomalies in the RBCU inlet temperature readings. On June 28, 2016, while investigating the temperature readings the licensee discovered that the 3C RBCU fan was operating in the reverse direction and declared the 3C RBCU inoperable. The 3C RBCU was inoperable when the plant entered Mode 4 on May 14, 2016 until June 28, 2016 when the 3C RBCU was repaired (approximately 45 days). Technical Specification 3.6.5, "Reactor Building Spray and Cooling Systems," requires all three trains of RBCU operable while in Modes 1, 2, 3, and 4. On May 14, 2016, Unit 3 was starting-up from the refueling outage and entered Modes 4 through 1 with one train of RBCU inoperable. This action of changing modes with the 3C RBCU inoperable is prohibited by TS 3.0.4. The licensee entered this condition into their corrective action program as NCR 02041501. The licensee also restored 3C RBCU operability, trained/counseled technicians, and incorporated a procedure change which will enhance configuration control for the lifted leads aspect in the maintenance procedure for this activity. This finding was assessed using IMC 0609, Phase 1 screening worksheet of Attachment 4, Appendix A, and Appendix H, and was determined to be of very low safety significance (Green).

ATTACHMENT: SUPPLEMENTAL INFORMATION

## **SUPPLEMENTAL INFORMATION**

### **KEY POINTS OF CONTACT**

#### **Licensee Personnel**

K. Alter, Design Basis Manager  
E. Anderson, PSW Engineering Director  
J. Black, FIN Supervisor  
T. Brown, PSW Licensing  
C. Dover, Civil Engineer  
D. Garland, Operations Training  
H. Harling, Mechanical Design Engineer  
L. Hawthorne, Mechanical Design Basis  
B. Lynch, PSW System Engineer  
J. Patterson, Project Management  
B. Shingleton, Regulatory Affairs  
C. Wasik, Regulatory Affairs Manager  
D. Wilson, Engineering Manager

#### **NRC Personnel**

E. Crowe, Senior Resident Inspector  
J. Parent, Resident Inspector  
E. Powell, Resident Inspector  
N. Childs, Resident Inspector

## LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

### Opened and Closed

05000269, 270, & 287/2016003-01 FIN Failure to Translate Design Requirements to Prevent the Effects of Waterhammer (Section 1R17)

### Closed

05000287/2016-001-00 LER Reactor Building Cooling Unit Inoperability Exceeds Technical Specification Completion Time (Section 4OA3)

05000287/2013-001-01 LER Unit 3 Manual Reactor Trip Due to Main Feedwater Flow Oscillations (Section 4OA3)

05000269/2016-001-00 LER RPS Actuation - Unit 1 Reactor Trip Initiated by a Generator Lockout/Turbine Trip (Section 4OA3)

## LIST OF DOCUMENTS REVIEWED

### **Section 1R04: Equipment Alignment**

#### Drawings

OFD-102A-1.1, Flow Diagram of Low Pressure Injection System (Borated Water Supply & LPI Injection), Rev. 068  
OFD-121D-2.1, Emergency Feedwater, Rev. 039  
OFD-124A-1.3, LPSW, Rev. 024  
OFD-124A-2.3, LPSW, Rev. 027  
OFD-124C-1.1, HPSW, Rev. 025  
OFD-124C-1.2, HPSW, Rev. 035  
OFD-124C-1.5, HPSW, Rev. 017  
OFD-124C-2.2, HPSW, Rev. 037

#### Documents

OSS-0254.00-00-1002, Design Basis Specification for High Pressure Service Water, Rev. 035  
PRT-1-16-1HPSW75 LEAK-0322  
SSS-LPW, Low Pressure Service Water, Rev. 023c

#### Procedures

AD-OP-ALL-0201, Protected Equipment, Rev. 001  
PT/1/A/0152/012, Low Pressure Injection System Valve Stroke Test, Rev. 039

### **Section 1R05: Fire Protection**

#### Documents

AD-EG-ALL-1117, Design Analyses and Calculations, Rev. 001  
OM-111-8, Fire Door R-25, Rev. N/A

#### Procedures

MP/0/A/1705/019, Fire Protection – SLC – Related Fire Doors – HELB Doors – Annual and Bi-Monthly Inspections, Rev. 026  
O-0-SOG-9000-020, Fire Brigade Guideline: 20 – Key Equipment List by Fire Zone, Rev. 000  
O-FS-1-AB-9809-001, Pre-Fire Plan for Unit 1 Auxiliary Bldg., Elev. 809' & 822', Rev. 001  
O-FS-1-AB-9838-001, Pre-Fire Plan for Unit 1 & 2 Auxiliary Bldg., Elev. 838', Rev. 001  
O-FS-3-AB-9758-001, Pre-Fire Plan for Unit 3 Auxiliary Bldg., Elev. 758', Rev. 001

### **Section 1R11: Licensed Operator Requalification**

#### Drawings

OFD-101A-1.1, High Pressure Injection System, Rev. 046  
OFD-101A-1.2, High Pressure Injection System, Rev. 043  
OFD-101A-1.3, High Pressure Injection System, Rev. 032  
OFD-101A-1.4, High Pressure Injection System, Rev. 046

#### Other

ASE-12, Active Simulator Exam, Rev. 01a

#### Procedures

AD-OP-ALL-1000, Conduct of Operations, Rev. 006

OP/3/A/1104/010, Low Pressure Service Water, Rev. 113  
OP/2/A/1107/002, Normal Power, Rev. 074  
PT/1/A/0202/011, High Pressure Injection Pump Test, Rev. 100  
RP/0/A/1000/001, Emergency Classification, Rev. 005

**Section 1R12: Maintenance Effectiveness**

Documents

EC 402911, C, CGI/OTH, PQL1, 210-A, Miniature Test Switches, States Production, Dated 4/18/2016

Procedures

AD-EG-ALL-1103, Procurement Engineering Products, Rev. 002

Work Orders/Requests

02145210

**Section 1R13: Maintenance Risk Assessments and Emergent Work Control**

Drawings

O-1705, 120VAC and 125VDC Station Aux Circuits Instrumentation Vital Buses, Rev. 087  
OFD-121D-2.1, Emergency Feedwater, Rev. 039

Documents

NSD-415, Nuclear Policy Manual, Rev. 008  
PRT-2-16-2DID INV OOS-0292, Clearance Tagout  
PRT-0-16-CLPSWPUOOS-0238, Clearance Tagout  
SSS-LPW, Low Pressure Service Water, Rev. 023c

Procedures

AD-EG-ALL-1004, Conduct of Probabilistic Risk Analysis, Rev. 001  
AD-NF-ALL-0501, Electronic Risk Assessment Tool (ERAT), Rev. 000  
AD-NF-ALL-0502, Probabilistic Risk Assessment (PRA) Model Technical Adequacy, Rev. 001  
AD-OP-ALL-0201, Protected Equipment, Rev. 001  
PT/1/A/0152/012, Low Pressure Injection System Valve Stroke Test, Rev. 039

**Section 1R15: Operability Evaluations**

Documents

Present Evaluations Supporting ES Electrical Equipment Operation during LOCA/LOOP scenarios (licensee white paper)  
Lee Combustion Turbines' (GE LM6000) Voltage Adequacy Justification (licensee white paper)  
NCR Preliminary ETAP Evaluation (licensee white paper)  
OSC-0474, LPSW Discharge Through Penetrations 22, 33, 34, and 35 including LP Cooler 2A Problem No. 4-14-04, Rev. 052  
OSC-10692, U1/2/3, Draft Keowee Underground Path Analysis, Rev. 001

Nuclear Condition Report

02047400; 02049786; 02049887; 02054523; 02054562; 02056895

Procedures

PT/1/A/0230/015, High Pressure Injection Motor Cooler Performance Test, Rev. 041

**Section 1R17: Evaluation of Changes, Tests, and Experiments and Permanent Plant Modifications**10 CFR 50.59 Evaluations

EC 91826, U1 PSW Power to Pressurizer Heaters and Vital I&C Battery Chargers, dated 6/24/2015

10 CFR 50.59 Screenings

EC 110222, Install Main headers for the AWC System, dated 03/24/2016

EC 110223, Install Class G AWC Branch Piping from AWC Main Headers Including Isolation, dated 09/29/2015

EC 110461, Provide Alternate PWR to the Low Speed Winding of the 2A RBCU, dated 12/12/2013

EC 111085, Catch All EC for Misc. AWC Chiller Support Components, dated 09/30/2015

EC 113084, Unit 1 Pressurizer Heater Distribution Panel Breaker Replacement, dated 02/10/2015

Permanent Plant Modifications

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EC 110240, Install Chillers, Auxiliary Skid, and Piping for the Alternate Chilled Water, dated 08/27/15

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OSC-5665, Reactor Building Cooling Units Performance Test (U1), Rev. 062

OSC-5666, Reactor Building Cooling Units Performance Test (U2), Rev. 061

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 Cooling Unit, dated 12/4/14  
 TT/0/A/0500/016, AWC Integrated Test, Rev. 003, completed 02/25/2015  
 TT/0/A/110408/000, Aux Bldg and Control Complex Cooling (Phase 1) Equipment Functional  
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 O-6708, Alternate Chill Water 4160/600V System, Rev. 003  
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 OFD-116Q-1.3 AWC Auxiliary Building Chiller No. 2 Main Headers, Rev. 006  
 OFD-116Q-1.4 Flow Diagram of AWC System Units 1&2 Cable Rooms, Rev. 002  
 OFD-124B-1.2, Flow Diagram of (U1) LPSW System RBCUs, Rev. 035  
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 EC 405345, Evaluate Waterhammer Potential When Filling the “A” RBCU, Rev. 0  
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 OMP 4-02, Verification and Validation Process for Aps, EOP, and Support Procedures, Rev. 013  
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### **Section 1R19: Post-Maintenance Testing**

#### Drawings

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 OP/0/A/1600/009, SSF Auxiliary Service Water System, Rev. 036  
 PT/0/A/0620/009, Keowee Hydro Operation, Rev. 051  
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 20079737; 20090744; 20091934; 20102988

#### **Section 1R22: Surveillance Testing**

##### Drawings

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 OFD-101A-1.2, High Pressure Injection System, Rev. 043  
 OFD-101A-1.3, High Pressure Injection System, Rev. 032  
 OFD-101A-1.4, High Pressure Injection System, Rev. 046  
 OFD-102A-1.1, Flow Diagram of Low Pressure Injection System (Borated Water Supply & LPI Injection), Rev. 068  
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 OFD-124A-1.2, Low Pressure Service Water System Turbine Building, Rev. 055  
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##### Documents

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#### Work Orders/Requests

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**Section 1EP6: Drill Evaluation**Documents

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Procedures

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**Section 40A1: Performance Indicator Verification**Documents

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Unit 1 Performance Limit Exceeded Derivation Report for Heat Removal System for May, 2016

Unit 1 Performance Limit Exceeded Derivation Report for Heat Removal System for June, 2016

Unit 1 Performance Limit Exceeded Derivation Report for Heat Removal System for July, 2016

Unit 1 Unavailability Index Derivation Report for Heat Removal System for April, 2016

Unit 1 Unavailability Index Derivation Report for Heat Removal System for May, 2016

Unit 1 Unavailability Index Derivation Report for Heat Removal System for June, 2016

Unit 1 Unavailability Index Derivation Report for Heat Removal System for July, 2016

Unit 1 Unreliability Index Derivation Report for Heat Removal System for April, 2016

Unit 1 Unreliability Index Derivation Report for Heat Removal System for May, 2016

Unit 1 Unreliability Index Derivation Report for Heat Removal System for June, 2016

Unit 1 Unreliability Index Derivation Report for Heat Removal System for July, 2016

Unit 2 Performance Limit Exceeded Derivation Report for Heat Removal System for April, 2016

Unit 2 Performance Limit Exceeded Derivation Report for Heat Removal System for May, 2016

Unit 2 Performance Limit Exceeded Derivation Report for Heat Removal System for June, 2016

Unit 2 Performance Limit Exceeded Derivation Report for Heat Removal System for July, 2016

Unit 2 Unavailability Index Derivation Report for Heat Removal System for April, 2016

Unit 2 Unavailability Index Derivation Report for Heat Removal System for May, 2016

Unit 2 Unavailability Index Derivation Report for Heat Removal System for June, 2016

Unit 2 Unavailability Index Derivation Report for Heat Removal System for July, 2016

Unit 2 Unreliability Index Derivation Report for Heat Removal System for April, 2016

Unit 2 Unreliability Index Derivation Report for Heat Removal System for May, 2016

Unit 2 Unreliability Index Derivation Report for Heat Removal System for June, 2016

Unit 2 Unreliability Index Derivation Report for Heat Removal System for July, 2016

Unit 3 Performance Limit Exceeded Derivation Report for Heat Removal System for April, 2016

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Unit 3 Performance Limit Exceeded Derivation Report for Heat Removal System for June, 2016

Unit 3 Performance Limit Exceeded Derivation Report for Heat Removal System for July, 2016

Unit 3 Unavailability Index Derivation Report for Heat Removal System for April, 2016

Unit 3 Unavailability Index Derivation Report for Heat Removal System for May, 2016

Unit 3 Unavailability Index Derivation Report for Heat Removal System for June, 2016

Unit 3 Unavailability Index Derivation Report for Heat Removal System for July, 2016

Unit 3 Unreliability Index Derivation Report for Heat Removal System for April, 2016

Unit 3 Unreliability Index Derivation Report for Heat Removal System for May, 2016

Unit 3 Unreliability Index Derivation Report for Heat Removal System for June, 2016

Unit 3 Unreliability Index Derivation Report for Heat Removal System for July, 2016

**Section 40A3: Follow-up of Events and Notices of Enforcement Discretion (NOED)**Drawings

0-2767-A1, Connection Diagram Reactor Building Penetrations Type 'B' & 'CB' Penetrations PENET. No. EC13, ED7, EF8, 9, 10 & 11, Rev. 010

OEE-338-15, Elementary Diagram, L.P. Service Water System, R.B. Cooling Unit Fan '3A', 3RBCAH0020A, Rev. 014

Documents

EC0000114294, Move 3ARBCU HI Speed Cables to Different Term. PTS in PEN EC13 LER 05000287/2016-001, Reactor Building Cooling Unit Inoperability Exceeds Technical Specification Completion Time, Rev. 000

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O-13-11963; O-14-13794; O-14-13860; 1905808; 1907317; 1935275; 02007812; 02033620; 02041479; 02041501; 02041502

Procedures

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Work Orders/Requests

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**Section 40A5: Other Activities**Calculations

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NRC Letter dated December 29, 2010 (ML103630612), Oconee Nuclear Station, Units 1, 2, and 3, Issuance of Amendments Regarding Transition to a Risk-Informed, Performance-Based Fire Protection Program in Accordance with 10 CFR 50.48(c) (TAC Nos. ME3844, ME3845, and ME3846)

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Procedures

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AD-EG-ALL-1117, Design Analyses and Calculations, Rev. 3  
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AD-EG-ALL-1502, Fire Protection Impact Screening for Plant Design Changes, Rev. 0  
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Loading and Storage, Rev 27  
MP/0/A/1500/032, Documentation of Fuel Assemblies and/or Component Shuffle within a Spent  
Fuel Pool, Rev 4  
NSD-403, Shutdown Risk Management (Modes 4, 5, 6, and No-Mode) per 10 CFR 50.65 (a)(4),  
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O-0-SOG-9000-018, Standard Operating Guideline, Rev. 0  
O-0-SOG-9000-020, Pre-Fire Plan: Oconee Key Equipment List by Fire Zone, Rev. 0  
PT/0/A/0120/33, Time Critical Action Verification, Rev. 5  
SD 1.3.5, Shutdown Protection Plan, Rev. 34

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on Non-Power Operations Clarification, dated 08/11/2008  
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Implementation Clarification and Commitment Change, dated 05/05/2014 (ML14126A688)

**Section 40A7: Licensee-Identified Violations**

Drawings

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PENET. No. EC13, ED7, EF8, 9, 10 & 11, Rev. 10  
OEE-338-15, Elementary Diagram, L.P. Service Water System, R.B. Cooling Unit Fan '3A',  
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Documents

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Rev. 0  
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Procedures

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Work Orders/Requests

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