



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

January 30, 2018

Mr. J. Ed Burchfield, Jr.  
Site Vice President  
Duke Energy Corporation  
Oconee Nuclear Station  
7800 Rochester Highway  
Seneca, SC 29672

**SUBJECT: OCONEE NUCLEAR STATION – NUCLEAR REGULATORY COMMISSION  
INTEGRATED INSPECTION REPORT 05000269/2017004, 05000270/2017004,  
AND 05000287/2017004**

Dear Mr. Burchfield:

On December 31, 2017, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Oconee Nuclear Station Units 1, 2, and 3. On January 23, 2018, 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.

The NRC inspectors documented two findings of very low safety significance (Green) in this report. These findings involved violations of NRC requirements. The NRC is treating these violations as non-cited violations (NCVs) consistent with Section 2.3.2.a of the Enforcement Policy.

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

If you disagree with a cross-cutting aspect assignment in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your disagreement, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001; with copies to the Regional Administrator, Region II; and the NRC resident inspector at the Oconee Nuclear Station.

J. Burchfield, Jr.

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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:  
IR 05000269/2017004, 05000270/2017004  
and 05000287/2017004 w/Attachment:  
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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.: 05000269/2017004, 05000270/2017004, and 05000287/2017004

Licensee: Duke Energy Carolinas, LLC

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

Location: Seneca, SC 29672

Dates: October 1, 2017 through December 31, 2017

Inspectors: E. Crowe, Senior Resident Inspector  
N. Childs, Resident Inspector  
J. Parent, Resident Inspector  
B. Collins, Reactor Inspector (Section 1R08)  
W. Loo, Senior Health Physicist (Section 2RS5)  
M. Meeks, Senior Operations Engineer (Section 1R11)  
A. Nielsen, Senior Health Physicist (Sections 2RS1, 2RS3, 4OA1)  
J. Panfel, Health Physicist (Sections 2RS2, 2RS4, 4OA1)  
R. Williams, Senior Reactor Inspector (Section 1R08)

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

Enclosure

## SUMMARY

IR 05000269/2017004, 05000270/2017004, and 05000287/2017004, October 1, 2017, through December 31, 2017; Oconee Nuclear Station, Units 1, 2, and 3; Followup of Events and Notices of Enforcement Discretion

The report covered a 3-month period of inspection by resident inspectors and regional inspectors. There were two self-revealing violations 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 were determined using IMC 0310, "Aspects within the Cross-Cutting Areas" dated December 4, 2014. All violations of NRC requirements were dispositioned in accordance with the NRC's Enforcement Policy dated November 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. A self-revealing Green non-cited violation (NCV) of Oconee Nuclear Station Technical Specification (TS), Section 5.4, "Procedures," was identified for the licensee's failure to identify sensitive equipment in a work area that warranted implementation of compensatory measures as required by station procedure AD-EG-ALL-1180, "Engineering Change (EC) Walkdowns." During the design and planning phase of a station modification, the licensee failed to identify sensitive components located in the subject work area and subsequently failed to implement adequate protective measures as defined in station procedures to prevent plant impacts during modification installation. The licensee entered this issue into their corrective action program (CAP) as nuclear condition report (NCR) 02131608 and implemented corrective actions to identify other positionable components required for emergency power source operability that would require the use of protective measures, as defined by AD-OP-ALL-0204, "Plant Status Control," in order to prevent inadvertent operation. The licensee created a formal Engineering department communication which included lessons learned from the event and familiarization with the EC walkdown checklist. The signs on the governor actuator cabinets were also revised to emphasize the sensitive nature of the equipment.

The licensee's failure to properly identify sensitive equipment and implement compensatory measures to prevent plant impacts as required by station procedure AD-EG-ALL-1180 was a performance deficiency. The performance deficiency was determined to be more than minor because it was associated with the human performance attribute of the mitigating systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the performance deficiency resulted in the loss of the emergency AC power path function for 11 hours and 31 minutes. The finding was assessed using IMC 0609, Attachment 4 and IMC 0609, Appendix A. Inspection Manual Chapter 0609, Appendix A required a detailed risk evaluation because the finding represented a loss of system and/or function. A regional senior reactor analyst (SRA) performed the detailed risk evaluation using SAPHIRE Version 8.1.6 and a modified Version 8.50 of the SPAR Model for Oconee. The SRA developed two change sets to model the total exposure time for the finding. The first simulated a common cause failure of both Keowee units with an exposure time of 7 hours. The second simulated the failure of both

Keowee units while the standby buses were energized by the Lee Station for 5 hours. The result was less than  $1E-6$  for each Oconee unit, which would be a finding of very low significance (Green). The inspectors utilized IMC 0310, "Aspects Within the Cross-Cutting Areas," dated December 4, 2014, and determined the finding had a cross-cutting aspect of work management in the area of human performance, in that the organization failed to implement a process of planning, controlling, and executing work activities such that nuclear safety is the overriding priority. The work process failed to include the identification and management of risk commensurate to the work and the need for coordination with different groups or job activities. (H.5) Section 4OA3

#### Cornerstone: Initiating Events

- Green. A self-revealing Green NCV of Oconee Nuclear Station TS, Section 5.4, "Procedures," was identified for the licensee's failure to identify and properly risk screen work within 2 feet of a single point vulnerability (SPV) component in accordance with procedure AD-OP-ALL-0201, "Protected Equipment." Specifically, the transmission and Oconee organizations failed to recognize that planned maintenance on a breaker in the 525 kilovolt (kV) switchyard was within 2 feet of an SPV component and, as a result, appropriate planning and oversight were not in place to prevent a plant trip during maintenance activities. The licensee entered this issue into their CAP as NCR 02138958. Corrective actions included revisions to station and transmission procedures to ensure inclusion of appropriate SPV program information, addition of the "SY" special emphasis code to all switchyard type work which require coordination of transmission resources, and the addition of the "T1" trip/transient risk special emphasis code to all breaker failure relays in the 230 kV and 525 kV switchyard cabinets containing SPV components.

The licensee's failure to identify and properly risk screen the planned maintenance on PCB-57 as work within 2 feet of an SPV component in accordance with AD-OP-ALL-0201 was a performance deficiency. The performance deficiency was determined to be more than minor because it was associated with the human performance attribute of the initiating events cornerstone and adversely affected the cornerstone objective to limit the likelihood of events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, human errors led to a Unit 3 main generator lockout, which resulted in a reactor trip. The finding was assessed using IMC 0609, Attachment 4 and IMC 0609, Appendix A. The inspectors determined the finding was of very low safety significance (Green) because the finding did not represent a transient initiator that caused both a reactor trip and the loss of mitigation equipment relied upon to transition the plant from the onset of the trip to a stable shutdown condition (i.e. loss of condenser, loss of feedwater). The inspectors utilized IMC 0310, "Aspects Within the Cross-Cutting Areas," dated December 4, 2014, and determined the finding had a cross-cutting aspect of work management in the human performance area, because the organization failed to implement a process of planning, controlling, and executing work activities such that nuclear safety is the overriding priority. The work process failed to include the identification and management of risk commensurate to the work and the need for coordination with different groups or job activities. (H.5) Section 4OA3

## REPORT DETAILS

### Summary of Plant Status

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

Unit 2: Operated at or near 100 percent RTP until October 28, 2017, when the unit was shut down for a refueling outage. The reactor was made critical on November 25, 2017, and the unit achieved 100 percent RTP on November 27, 2017. The unit operated at or near 100 percent RTP for the remainder of the inspection period.

Unit 3: Operated at or near 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

##### 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. The inspectors observed whether there was indication of degradation and, if so, verified the degradation was being appropriately managed in accordance with an aging management program and it had been entered into the licensee's CAP. Documents reviewed are listed in the attachment.

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

- Unit 2, 4160V safety-related distribution systems, 230 kV safety-related switchyard and main feeder buses during the swapping of station electrical loads between the Unit 2 startup transformer (CT-2) and the standby bus transformer (CT-5)
- Unit 2, low pressure injection (LPI) and low pressure service water (LPSW) systems in support of draining reactor vessel to 80 inches in support of reactor head removal
- Unit 2, LPI and LPSW systems in support of draining reactor vessel to 80 inches in support of reactor head reinstallation

##### b. Findings

No findings were identified.

1R05 Fire Protection (71111.05AQ)a. Inspection ScopeQuarterly 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 CAP

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

- Unit 1, turbine building elevation 775', fire zones 19, 20, 21, 21A, 22, 23, 24, 25
- Unit 2, reactor building, fire zone 123

b. Findings

No findings were identified.

1R08 Inservice Inspection Activities (71111.08)a. Inspection ScopeNon-Destructive Examination Activities and Welding Activities

From November 6, 2017, through November 10, 2017, the inspectors conducted an onsite review of the implementation of the licensee's inservice inspection (ISI) program for Unit 2. The ISI program is designed to monitor degradation of pressure retaining components in vital system boundaries. The scope of this program includes components within the reactor coolant system boundary, risk-significant piping boundaries, and containment system boundaries.

The inspectors either directly observed or reviewed the following non-destructive examination (NDE) activities. These activities were mandated by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code of Record: 2007 Edition with 2008 Addenda). The inspectors evaluated the NDE activities for compliance with the requirements in Section XI and Section V of the ASME Code. The inspectors also evaluated if any identified indications or defects were dispositioned in accordance with either the ASME Code or an NRC-approved alternative requirement.

Additionally, the inspectors reviewed the qualifications of the NDE technicians performing the examinations to determine if they were in compliance with ASME Code requirements.

- ultrasonic examination of component O2.R1.11.0012, pipe to pipe weld, ASME Class 1
- magnetic particle examination of component O2.C3.20.008, 14-inch attachment to pipe weld, ASME Class 2
- liquid penetrant examination of component NI1F617, pipe to pipe weld, ASME Class 1
- visual examination of 1-RPV-BMI-Nozzles, reactor pressure vessel bottom-mounted instrument penetrations

The inspectors either directly observed or reviewed the following welding activities. The inspectors evaluated these activities for compliance with site procedures and the requirements in Section IX and Section XI of the ASME Code. Specifically, the inspectors reviewed the work orders, repair or replacement plans, weld data sheets, welding procedures, procedure qualification records, welder performance qualification records, and NDE reports.

- Weld NI1F617, pipe to pipe weld, ASME Class 1

The inspectors reviewed the listing of non-destructive surface and volumetric examinations performed during the previous refueling outage. The inspectors verified that the licensee did not identify any relevant indications that were analytically evaluated and accepted for continued service.

#### Pressurized Water Reactor (PWR) Vessel Upper Head Penetration Inspection Activities

The inspectors performed the following activities to verify that the requirements of the ASME Code and applicable licensee procedures were being met for the Unit 2 reactor vessel upper head:

- Reviewed the effective degradation years and reinspection years calculations to determine if a volumetric examination or bare metal visual examination of the penetration nozzles was required during the current outage.
- Reviewed the final examination report for the bare metal visual examination of the upper head penetrations.
- Verified that the examinations were performed in accordance with the requirements of the ASME Code and that the frequency was consistent with ASME Code Case N-729-1.

The inspectors verified that the licensee did not identify any indications that were accepted for continued service. Additionally, the inspectors verified that the licensee did not perform any welding repairs to the upper head penetrations since the last Unit 2 refueling outage.

### Boric Acid Corrosion Control Inspection Activities

The inspectors reviewed the licensee's boric acid corrosion control program (BACCP) activities to determine if they were implemented in accordance with program requirements, applicable regulatory requirements, and industry guidance. Specifically, the inspectors performed the following activities:

- Reviewed applicable procedures and the results of the licensee's most recent containment walkdown inspection.
- Interviewed the BACCP owner.
- Conducted an independent walkdown of accessible areas of the Unit 2 reactor building containment pipe chase.
- Verified that degraded or non-conforming conditions, such as boric acid leaks, were properly identified and corrected in accordance with the licensee's BACCP and the CAP.
- Reviewed engineering evaluations of components with boric acid leakage which verified that minimum wall thickness of those components was maintained.

### Steam Generator Tube Inspection Activities

The inspectors reviewed the Unit 2 steam generator maintenance program. This inspection schedule was verified with the requirements of the ASME Code, the licensee's TS, and applicable industry guidance. For steam generators 2A and 2B, the inspectors performed the following activities to verify compliance with program requirements, regulatory requirements, and industry guidance:

- Reviewed the scope of the eddy current (ET) examinations, and the implementation of scope expansion criteria.
- Reviewed documentation for a sample of ET data analysts, probes, and testers to verify that personnel and equipment were qualified to detect the applicable degradation mechanisms.
- Reviewed a sample of site-specific examination technique specification sheets (ETSS).
- Reviewed the in-situ steam generator tube pressure testing screening criteria. The inspectors verified that the assumed NDE flaw sizing accuracy was consistent with data from the ETSS or other applicable performance demonstrations.
- Reviewed a sample of ET data for six steam generator tubes (2A-R16C68, 2A-R81C1, 2A-R136C66, 2B-R9C24, 2B-R127C86, and 2B-R136C62) with a qualified data analyst.
- Verified that recordable indications were detected and sized in accordance with vendor procedures.
- Reviewed ET indication reports to determine if steam generator tubes with relevant indications were appropriately screened for in-situ pressure testing.
- Compared the latest ET examination results with the last condition monitoring and operational assessment report to assess the licensee's prediction capability for maximum tube degradation.
- Verified that current examination results were bound by the operational assessment projections.
- Assessed the latest ET examination results to verify that new degradation mechanisms, if any, were identified and evaluated before plant startup.

- Reviewed the licensee's secondary side steam generator foreign object search and retrieval activities.
- Reviewed the steam generator tube plugging procedure and verified that appropriate tubes were selected for plugging based on the required plugging criteria.
- Observed plugging activities for two steam generator tubes (2B-R90C1, 2BR42C14).
- Reviewed a sample of primary-to-secondary leakage data for Unit 2 to confirm that operational leakage in each steam generator remained below the detection or action level threshold during the previous operating cycle.

#### Identification and Resolution of Problems

The inspectors reviewed a sample of ISI-related issues entered into the CAP. The inspectors evaluated if the licensee had appropriately described the scope of the problem and had initiated corrective actions. The review also included the licensee's consideration and assessment of operating experience events applicable to the plant.

#### b. Findings

No findings were identified.

### 1R11 Licensed Operator Regualification Program and Licensed Operator Performance (71111.11)

#### a. Inspection Scope

#### .1 Resident Inspector Quarterly Review of Licensed Operator Regualification

On October 11, 2017, the inspectors observed an evaluated simulator scenario administered to an operating crew conducted in accordance with the licensee's accredited requalification training program.

The scenario involved the Unit 1 turbine driven emergency feedwater pump tripping followed by the motor stator temperature of the 1C condensate booster pump (CBP) increasing which required the operators to swap CBPs. Group 6 control rod 6 dropped into the core which caused an asymmetric rod runback, during which 1A main feedwater pump (MFDWP) bearing vibration increased to the point where the 1A MFDWP had to be secured. 1B MFDWP tripped which caused the reactor to trip. No emergency feedwater was available which forced the operators to enter emergency operating procedure rule 3 and establish CBP feed to the once through steam generators. Afterwards, the CBPs were lost and high pressure injection forced cooling was initiated per emergency operating procedure rule 4, during which 1C high pressure injection (HPI) pump did not start, and the crew made an emergency plan alert 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

On October 30, 2017, the inspectors observed licensed operator performance in the main control room during the operation to drain the reactor vessel to 80 inches in support of reactor head removal. On November 14, 2017, the inspectors observed licensed operator performance in the main control room during testing of the 100 kV power supply from Lee Station and filling of the reactor coolant system to 80 inches following 2A2 reactor coolant pump replacement. On November 19, 2017, the inspectors observed licensed operator performance in the main control room during the performance of the emergency power switching logic functional test. On November 23, 2017, the inspectors observed entry into Hot Shutdown (Mode 4).

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.

.3 Annual Review of Licensee Requalification Examination Results

On March 31, 2017, the licensee completed the comprehensive biennial requalification written examinations and the annual requalification operating examinations required to be administered to all licensed operators in accordance with Title 10 of the *Code of Federal Regulations* 55.59(a)(2), "Requalification Requirements," of the NRC's "Operator's Licenses." During the week of December 25, 2017, the inspectors performed an in-office review of the overall pass/fail results of the individual operating examinations and the crew simulator operating examinations in accordance with Inspection Procedure (IP) 71111.11, "Licensed Operator Requalification Program." These results were compared to the thresholds established in Section 3.02, "Requalification Examination Results," of IP 71111.11.

b. Findings

No findings were identified.

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

The inspectors reviewed the two 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 CAP. 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 2, October 30, 2017, evaluated yellow risk during planned draining of reactor vessel to 80 inches in support of reactor head removal
- Unit 2, November 19, 2017, evaluated green risk during planned draining of reactor vessel to 80 inches in support of reactor head reinstallation

b. Findings

No findings were identified.

1R15 Operability Determinations and Functionality Assessments (71111.15)a. Inspection ScopeOperability 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 TS 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 TS 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.

- Keowee Hydroelectric Unit (KHU) 1, KHU 1 output breaker to overhead emergency AC power path (ACB-1) misaligned, NCR 02160893
- Unit 2, investigate the cause of the 86 lockout of the Unit 2 startup transformer (CT-2), NCR 02164850
- Unit 2, integrated control system oscillation during secondary plant startup, NCR 02167479

- Unit 2, main generator lockout during closure of generator output breaker PCB-23, NCR 02167543
- Unit 2, diode 2RCDI0001 may be under sized for CEMF voltage – 2RC-66 power operated relief valve, NCR 02166646

b. Findings

No findings were identified.

1R19 Post-Maintenance Testing (71111.19)

a. Inspection Scope

The inspectors either observed post-maintenance testing or reviewed the test results for the 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.

- Work Order (WO) 20148808, Replace 6", Class C, Buried SSF ASW Piping, September 22, 2017
- WO 20097326, 2A2 Reactor Coolant Pump (RCP) Post Modification Test, November 21, 2017

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

No findings were identified.

1R20 Refueling and Other Outage Activities (71111.20)

a. Inspection Scope

For the Unit 2 refueling outage from October 28, 2017, through November 24, 2017, the inspectors evaluated the following outage activities:

- outage planning
- shutdown, cooldown, refueling, heatup, and startup
- reactor coolant system instrumentation and electrical power configuration

- reactivity and inventory control
- decay heat removal and spent fuel pool cooling system operation
- containment closure

The inspectors verified that the licensee:

- considered risk in developing the outage schedule
- controlled plant configuration per administrative risk-reduction methodologies
- developed work schedules to manage fatigue
- developed mitigation strategies for loss of key safety functions
- adhered to operating license and TS requirements

The inspectors verified that safety-related and risk-significant structures, systems, and components not accessible during power operations were maintained in an operable condition. The inspectors also reviewed a sample of related corrective action documents to verify the licensee was identifying and correcting any deficiencies associated with outage activities. Documents reviewed are listed in the attachment.

b. Findings

No findings were identified.

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 TS 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/2/A/0150/048, 2LP-26 and 2LP-30 Leak Test
- PT/2/A/0610/006, 100 KV Power Supply From Lee Steam Station
- PT/3/A/0600/012, Turbine Driven Emergency Feedwater Pump Test

Containment Isolation Valve

- PT/2/A/0151/024, Penetration 24 Leak Rate Test (2PR-81)
- PT/2/A/0151/060, Penetration 60 Leak Rate Test (2PR-8)

In-Service Tests (IST)

- PT/2/A/0251/024, HPI Full Flow Test (2B HPI Pump)

b. Findings

No findings were identified.

2. RADIATION SAFETY [RS]

Cornerstones: Occupational Radiation Safety and Public Radiation Safety

2RS1 Radiological Hazard Assessment and Exposure Controls

a. Inspection Scope

Hazard Assessment and Instructions to Workers During facility tours, the inspectors directly observed radiological postings and container labeling for areas established within the radiologically controlled area (RCA) of the auxiliary building, Unit 2 reactor building, independent spent fuel storage installation, and radioactive waste (radwaste) processing and storage locations. The inspectors independently measured radiation dose rates or directly observed conduct of licensee radiation surveys for selected RCA areas. The inspectors reviewed survey records for several plant areas including surveys for airborne radioactivity, gamma surveys with a range of dose rate gradients, surveys for alpha-emitters and other hard-to-detect radionuclides, and pre-job surveys for upcoming tasks. The inspectors also discussed changes to plant operations that could contribute to changing radiological conditions since the last inspection. The inspectors attended pre-job briefings and reviewed radiation work permit (RWP) details to assess communication of radiological control requirements and current radiological conditions to workers.

Control of Radioactive Material The inspectors observed surveys of material and personnel being released from the RCA using gamma and beta sensitive detection instruments. The inspectors discussed equipment sensitivity, alarm setpoints, and release program guidance with licensee staff. The inspectors also reviewed records of leak tests on selected sealed sources and discussed nationally tracked source transactions with licensee staff.

Hazard Control The inspectors evaluated access controls and barrier effectiveness for selected high radiation area, locked high radiation area (LHRA), and very high radiation area (VHRA) locations and discussed changes to procedural guidance for LHRA and VHRA controls with radiation protection (RP) supervisors. The inspectors reviewed implementation of controls for the storage of irradiated material within the spent fuel pool. Established radiological controls, including airborne controls and electronic dosimeter (ED) alarm setpoints, were evaluated for selected Unit 2 End-of-Cycle 28 (2EOC28) tasks. In addition, the inspectors reviewed licensee controls for areas where dose rates could change significantly as a result of plant shutdown and refueling operations. The inspectors also reviewed the use of personnel dosimetry including extremity dosimetry and multi-badging in high dose rate gradients.

Radiation Worker Performance and RP Technician Proficiency Occupational workers' adherence to selected RWPs and RP technician proficiency in providing job coverage were evaluated through direct observations and interviews with licensee staff. Jobs observed during 2EOC28 included RCP maintenance, reactor vessel disassembly, and

fuel movement. The inspectors also evaluated worker responses to dose and dose rate alarms during selected work activities.

Problem Identification and Resolution The inspectors reviewed and assessed NCRs associated with radiological hazard assessment and control. The inspectors evaluated the licensee's ability to identify and resolve the issues. The inspectors also reviewed recent self-assessment results.

Inspection Criteria Radiation protection activities were evaluated against the requirements of TS Section 5.4, 10 CFR Part 20, and approved licensee procedures. Licensee programs for monitoring materials and personnel released from the RCA were evaluated against 10 CFR Part 20 and IE Circular 81-07, "Control of Radioactively Contaminated Material." Documents and records reviewed are listed in the attachment.

b. Findings

No findings were identified.

2RS2 Occupational As Low As Reasonably Achievable (ALARA) Planning and Controls

a. Inspection Scope

Work Planning and Exposure Tracking The inspectors reviewed work activities and their collective exposure estimates for the Unit 2 refueling outage (RO28). The inspectors reviewed ALARA planning packages for activities related to the following RO28 high collective exposure tasks: RCP motor maintenance, steam generator maintenance, and refueling/reactor head activities. For the selected tasks, the inspectors reviewed established dose goals and discussed assumptions regarding the bases for the current estimates with responsible ALARA planners. The inspectors evaluated the incorporation of exposure reduction initiatives and operating experience, including historical post-job reviews, into radiation work permit requirements. Day-to-day collective dose data for the selected tasks were compared with established dose estimates and evaluated against procedural criteria for additional ALARA review. Where applicable, the inspectors discussed changes to established estimates with ALARA planners and evaluated them against work scope changes or unanticipated elevated dose rates.

Source Term Reduction and Control The inspectors reviewed the collective exposure three-year rolling average from 2014 - 2016. Source term reduction initiatives, including cobalt reduction and zinc injection, were reviewed and discussed with RP staff. The inspectors also reviewed temporary shielding packages for the Unit 2 RO28.

Radiation Worker Performance In conjunction with IP 71124.01, the inspectors observed pre-job ALARA briefings and radiation worker performance for higher risk jobs that were performed during the inspection. While observing job tasks, the inspectors evaluated the use of remote technologies to reduce dose including teledosimetry and remote visual monitoring.

Problem Identification and Resolution The inspectors reviewed and discussed selected CAP documents associated with ALARA program implementation. The inspectors evaluated the licensee's ability to identify and resolve the issues. The inspectors also reviewed recent self-assessment results.

Inspection Criteria ALARA program activities were evaluated against the requirements of the Updated Final Safety Analysis Report Chapter 12, TS Section 5.4, 10 CFR Part 20, and approved licensee procedures. Documents reviewed are listed in the report attachment.

b. Findings

No findings were identified.

2RS3 In-Plant Airborne Radioactivity Control and Mitigation

a. Inspection Scope

Engineering Controls The inspectors reviewed the use of temporary and permanent engineering controls to mitigate airborne radioactivity during 2EOC28 job tasks. The inspectors observed the use of portable air filtration units for work in contaminated areas of the RCA and reviewed filtration unit testing certificates. The inspectors evaluated the alarm setpoints and effectiveness of continuous air monitors to provide indication of increasing airborne levels and the placement of air samplers in work area “breathing zones.”

Respiratory Protection Equipment The inspectors reviewed the use of respiratory protection devices to limit the intake of radioactive material. This included review of devices used for routine tasks and devices stored for use in emergency situations. The inspectors reviewed ALARA evaluations for the use of respiratory protection for 2EOC28 RCP maintenance activities. Selected self-contained breathing apparatus (SCBA) units and negative pressure respirators (NPR) staged for routine and emergency use in the main control rooms and other locations were inspected for material condition, SCBA bottle air pressure, number of units, and number of spare masks and availability of air bottles. The inspectors reviewed maintenance records for selected SCBA units for the past two years and evaluated SCBA and NPR compliance with National Institute for Occupational Safety and Health certification requirements. The inspectors also reviewed records of air quality testing for supplied-air devices and SCBA bottles.

The inspectors observed the use of powered air-purifying respirators during 2EOC28 Alloy 600 mitigation activities. The inspectors discussed training for various types of respiratory protection devices with licensee staff and interviewed RP technicians and main control room operators on use of the devices including SCBA bottle change-out and use of corrective lens inserts. The inspectors reviewed respirator qualification records for several main control room operators and emergency responder personnel. In addition, inspectors evaluated qualifications for individuals responsible for testing and repairing SCBA vital components.

Problem Identification and Resolution The inspectors reviewed and discussed selected NCRs associated with airborne controls and respiratory protection activities. The inspectors evaluated the licensee’s ability to identify and resolve the issues. The inspectors also reviewed recent self-assessment results.

Inspection Criteria Radiation protection program activities associated with airborne radioactivity controls were evaluated against details and requirements documented 10 CFR Part 20; Updated Final Safety Analysis Report Chapter 12; TS Section 5.4; RG 8.15, "Acceptable Programs for Respiratory Protection," and approved licensee procedures. Documents reviewed are listed in the attachment.

b. Findings

No findings were identified.

2RS4 Occupational Dose Assessment

a. Inspection Scope

Source Term Characterization The inspectors reviewed the plant radiation characterization (including gamma, beta, alpha, and neutron) being monitored and verified the use of scaling factors to account for hard-to-detect radionuclides in internal dose assessments.

External Dosimetry The inspectors reviewed National Voluntary Accreditation Program (NVLAP) certification data for the licensee's dosimetry processor for the current year for ionizing radiation dosimetry. The inspectors observed and evaluated onsite storage of thermoluminescent dosimeters (TLD). Comparisons between ED and TLD results, including correction factors, were reviewed and discussed. The inspectors also evaluated licensee procedures for unusual dosimetry occurrences. ED alarm logs were reviewed as part of IP 71124.01. The inspectors reviewed contamination logs and evaluated events with the potential for external dose.

Internal Dosimetry The inspectors reviewed and discussed the in vivo bioassay program with the licensee. Inspectors reviewed procedures that addressed methods for determining internal or external contamination, releasing contaminated individuals, and the assignment of dose. The inspectors evaluated the licensee's program for in vitro monitoring and reviewed in vivo bioassay results, and in vitro sample information, for personnel involved in recent diving activities. The inspectors also reviewed contamination logs and evaluated events with the potential for internal dose.

Special Dosimetric Situations The inspectors reviewed records for declared pregnant workers (DPW) from November 2015 through October 2017 and discussed guidance for monitoring and instructing DPWs. Inspectors reviewed the licensee's program for monitoring external dose in areas of expected dose rate gradients, including the use of multi-badging and extremity dosimetry. The inspectors evaluated the licensee's neutron dosimetry program including instrumentation used to perform neutron surveys. In addition, the inspectors reviewed the licensee's program for evaluation of shallow dose equivalent (SDE). The inspectors also reviewed contamination logs and evaluated events with the potential for SDE.

Problem Identification and Resolution The inspectors reviewed and discussed selected CAP documents associated with occupational dose assessment including self-assessments. The inspectors evaluated the licensee's ability to identify and resolve issues.

Inspection Criteria The licensee's occupational dose assessment activities were evaluated against the requirements of Updated Final Safety Analysis Report Chapter 12; TS Section 5.4; 10 CFR Parts 19 and 20; and approved licensee procedures. Documents reviewed are listed in the attachment.

b. Findings

No findings were identified.

2RS5 Radiation Monitoring Instrumentation

a. Inspection Scope

The inspectors reviewed the licensee's radiation monitoring instrumentation programs to verify the accuracy and operability of radiation monitoring instruments used to monitor areas, materials, and workers to ensure a radiologically safe work environment during normal operations and under postulated accident conditions.

Walkdowns and Observations During tours of the site areas, the inspectors observed installed radiation detection equipment including the following instrument types: area radiation monitors (ARM), continuous air monitors, personnel contamination monitors (PCM), small article monitors (SAM), and portal monitors (PM). The inspectors observed the calibration status, physical location, material condition and compared technical specifications for this equipment with updated final safety analysis report requirements. In addition, the inspectors observed the calibration status and functional checks of selected in-service portable instruments and discussed the bases for established frequencies and source ranges with radiation protection staff personnel. The inspectors reviewed periodic source check records for compliance with plant procedures and manufacturer's recommendation for selected instruments and observed the material condition of sources used.

Calibration and Testing Program The inspectors reviewed calibration data for selected ARMs, PCMs, PMS, SAMs, and laboratory instruments as well as the last calibration and methodology for the whole body counter. The inspectors reviewed calibration data, methodology used and the source certification for the containment high range monitor. The current output values for the portable instrument calibrator and the instrument certifications used to develop them were reviewed by the inspectors. The inspectors reviewed the licensee's process for investigating instruments that are removed from service for calibration or response check failures and discussed specific instrument failures with plant staff. In addition, the inspectors reviewed 10 CFR 61 data to determine if sources used in the maintenance of the licensee's radiation detection instrumentation were representative of radiation hazards in the plant and scaled appropriately for "hard to detect" nuclides.

Problem Identification and Resolution The inspectors reviewed and discussed selected CAP documents associated with radiological instrumentation including licensee sponsored assessments. The inspectors evaluated the licensee's ability to identify and resolve issues.

Inspection Criteria Operability and reliability of selected radiation detection instruments were reviewed against details documented in the following: 10 CFR Part 20; NUREG-0737, "Clarification of TMI Action Plan Requirements"; Updated Final Safety Analysis Report Chapters 11 and 12, TS Section 3, and applicable licensee procedures. 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 September 2016 and September 2017, 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

- residual heat removal system
- emergency AC power system

Occupational Radiation Safety Cornerstone The inspectors evaluated occupational exposure control effectiveness PI data from April 2016 through September 2017, and reviewed recent PI results. For the assessment period, the inspectors reviewed ED alarm logs and NCRs related to controls for exposure significant areas. Documents reviewed are listed in the attachment.

Public Radiation Safety Cornerstone The inspectors reviewed the radiological control effluent release occurrences PI results for the public radiation safety cornerstone and reviewed PI records generated between April 2016 and August 2017. For the assessment period, the inspectors reviewed cumulative and projected doses to the public contained in liquid and gaseous release permits and NCRs related to radiological effluent TS/offsite dose calculation manual (ODCM) issues. Documents reviewed are listed in the attachment.

b. Findings

No findings were identified.

## 4OA2 Problem Identification and Resolution (71152)

### .1 Routine Review

The inspectors screened items entered into the licensee's CAP to identify repetitive equipment failures or specific human performance issues for followup. The inspectors reviewed nuclear condition reports, attended screening meetings, or accessed the licensee's computerized corrective action database.

### .2 Semi-Annual Trend Review

#### a. Inspection Scope

The inspectors reviewed issues entered in the licensee's CAP and associated documents to identify trends that could indicate the existence of a more significant safety issue. The inspectors focused their review on repetitive equipment issues and human performance trends, but also considered the results of inspector daily nuclear condition report screenings, licensee trending efforts, and licensee human performance results. The review nominally considered the 6-month period of June 2017 through December 2017, although some examples extended beyond those dates when the scope of the trend warranted. The inspectors compared their results with the licensee's analysis of trends. Additionally, the inspectors reviewed the adequacy of corrective actions associated with a sample of the issues identified in the licensee's trend reports. The inspectors also reviewed corrective action documents that were processed by the licensee to identify potential adverse trends in the condition of structures, systems, and/or components as evidenced by acceptance of long-standing non-conforming or degraded conditions. Documents reviewed are listed in the attachment.

#### b. Findings and Observations

The inspectors identified a potential adverse trend in human performance which is supported by four observations which resulted in degraded plant equipment.

- In June 2017, the licensee replaced station vital battery 3CA with new battery cells and upgraded the battery stand to support larger cells. A technician attempted to reconnect the battery terminals during the restoration phase of this evolution and created a direct short between the positive and negative phases of the battery. The inspectors discovered that a torque wrench which was not electrically insulated was utilized by the technician. Station personnel had previously loosely connected the battery terminal wires to station wiring termination points. Quality Assurance (QA) personnel were not immediately available to verify the torque value of the connections. Therefore, craft personnel continued in their work process which connected the other end of the battery terminal wiring to the battery. Once QA personnel arrived, the technician proceeded to torque the connection point fasteners but failed to recognize the immediate condition of the battery. Therefore, appropriate station safety measures were not taken to protect personnel and plant equipment. The inspectors did not identify a performance deficiency for this event as the licensee was in the process of restoring the plant equipment and the equipment was allowed to be out of service by station technical specifications.

- In late June 2017, the licensee implemented cyber security measures for each of the three Oconee units' operator aid computers. Larger diameter electrical wiring was required by the implementation of the security measures. The limited space of the computer cabinet resulted in a challenge and created interference with cabinet doors. The latter stages of the modification required independent verification of the proper connection of wiring at connection points. Station personnel attempting to verify these proper connections failed to recognize the interference with the cabinet doors on the Unit 3 operator aid computer cabinets. The cabinet doors were closed which resulted in the momentary loss of compensated reactor power signal from the operator aid computer to the integrated control system. This resulted in a small reactor power change (0.01 percent change) as the unit's integrated control system properly responded to the loss of the compensated nuclear power signal. The inspectors evaluated the circumstances associated with this emergent issue. Additionally, the inspectors evaluated the licensee's corrective actions and did not identify a performance deficiency. The inspectors did recognize that appropriate barriers to prevent this event and the previous event were either not in place or overlooked.
- In June 2017, the licensee implemented cyber security measures for equipment located in the Keowee Hydroelectric Station. Station personnel implementing one aspect of this modification discussed their activities with Keowee Hydroelectric Station management but failed to identify the need to physically enter cabinets on each of the hydroelectric unit's governor auxiliaries cabinet. This oversight prevented the implementation of proper barriers and oversight during the work activities. The work activities inside the generator auxiliaries cabinet of KHU 1 resulted in inadvertent tripping of a circuit breaker which rendered KHU 1 incapable of starting upon a normal or emergency start signal. Once this work activity was complete, the station personnel moved to the generator auxiliaries cabinet of KHU 2. The work activities inside this generator auxiliaries cabinet also resulted in inadvertent tripping of the identical circuit breaker which rendered KHU 2 incapable of starting upon a normal or emergency start signal. The result of both hydroelectric units being incapable of starting was a loss of emergency AC power system function and caused the licensee to submit a license event report (LER) to the NRC. The inspectors reviewed the LER and identified a performance deficiency. The performance deficiency and event are further discussed in Section 4OA3 of this report.
- In July 2017, Duke Energy transmission personnel attempted to test proper operation of the Oconee 525 kV switchyard circuit breakers to a simulated circuit breaker fault condition. During the testing evolution, transmission personnel connected test equipment to an incorrect relay and generated a test signal. Oconee Unit 3 reactor tripped as a result of the incorrect test signal. The inspectors evaluated this event and discovered that transmission personnel were working within two feet of relay equipment identified as SPV equipment. The transmission personnel failed to notify appropriate Oconee station personnel of the proximity of their work to the single point vulnerable equipment as required by transmission and Oconee station procedures and guidance. Oconee station personnel failed to identify the SPV equipment during their pre-job brief with transmission personnel. This oversight by Oconee station personnel prevented proper evaluation of the risk associated with this activity. The

licensee reported this event as required by 10 CFR 50.72 and 10 CFR 50.73. The inspectors reviewed the LER and identified a performance deficiency. The performance deficiency and event are further discussed in Section 4OA3 of this report.

### .3 Annual Followup of Selected Issues

#### a. Inspection Scope

The inspectors conducted a detailed review of NCR 02153687, Protected Service Water (PSW) Power Path from Keowee.

The inspectors evaluated the following attributes of the licensee's actions:

- complete and accurate identification of the problem in a timely manner
- evaluation and disposition of operability and reportability issues
- consideration of extent of condition, generic implications, common cause, and previous occurrences
- classification and prioritization of the problem
- identification of root and contributing causes of the problem
- identification of any additional condition reports
- completion of corrective actions in a timely manner

Documents reviewed are listed in the attachment.

#### b. Findings and Observations

On September 17, 2017, the licensee unsuccessfully attempted to complete surveillance procedure PT/0/A/0500/020, "PSW Power Path Test." The licensee failed to demonstrate that both power paths from KHU 1 could be aligned to the PSW switchgear from the Oconee Unit 2 control room when PSW feeder breaker KPF-12 tripped during the test. The licensee performed troubleshooting activities over an eight-day period and, on September 25, 2017, made a second attempt to complete PT/0/A/0500/20, but experienced similar conditions to those on September 17, 2017. The licensee documented this second attempt on September 26, 2017, in NCR 02153687 and entered their immediate determination of operability (IDO) process governed by station procedure AD-OP-ALL-0105, "Operability Determinations and Functionality Assessments." The licensee reviewed the Oconee PSW licensing basis and determined the licensing basis only required a single power path to the PSW electrical buses. The licensee documented in NCR 02153687 that surveillance criteria (acceptance criteria) of PT/0/A/0150/020 was met and the PSW system was operable.

The inspectors reviewed the licensee's IDO for the events described above, associated station procedures, and license amendments related to implementation of the PSW system; interviewed station personnel; and evaluated the licensee's surveillance frequency control program required by Oconee technical specifications. The inspectors identified a discrepancy between the requirements of PSW electrical system power supplies established in the license amendments and the acceptance criteria listed in PT/0/A/0500/020. PT/0/A/0500/020 states in its acceptance criteria, "demonstrate PSW power path from Keowee Generator 1 can be aligned to both PSW switchgear from the

Unit 2 control room.” This station procedure identifies the surveillance requirements required by the Oconee TS Surveillance Frequency Control Program as outlined in administrative TS 5.5.21, “Surveillance Frequency Control Program.” The inspectors noted that PSW operability requirements described in the PSW license amendments included, “a PSW electrical system power path from the Keowee Hydroelectric Station.” Surveillance requirement (SR) 3.7.10.2 identified in the Oconee technical specifications states, “verify the required Keowee Hydroelectric Station power supply can be aligned to and power the PSW electrical system.” The inspectors identified the Oconee Nuclear Station licensing basis required only a single power source to the PSW electrical buses whereas the surveillance frequency control program required two individual power paths to the PSW electrical buses.

The inspectors reviewed the Confirmatory Order issued on July 1, 2013 (ADAMS Accession No. ML 13224A9190), which required Duke Energy to complete PSW system implementation in accordance with the milestones specified in that order. Milestones 1-3 of the Confirmatory Order required the licensee to provide the capability to supply offsite electrical power to the PSW building switchgear and from there to the Standby Shutdown Facility (SSF) switchgear; the capability to supply electrical power from each of the Keowee Hydro Units to the PSW building switchgear and from there to the SSF switchgear; and the capability to supply electrical power from the PSW building switchgear to simultaneously operate at least one high pressure injection pump per unit, and to operate the associated valves needed to align water flow to the reactor coolant pump seals and to inject water into the reactor coolant system. This requirement to supply electrical power to the SSF is captured in Oconee Selected License Commitment (SLC) 16.9.9, Protected Service Water System.

The PSW building electrical switchgear consists of electrical bus B6T and its associated transformer and electrical bus B7T and its associated transformer. Each transformer can receive electrical power from an offsite electrical source and from the Keowee Hydroelectric Station. Electrical bus B7T contains the power feeder breaker to the SSF switchgear OST1. When the Oconee Nuclear Station is operating under normal alignment, the bus tie breaker between B6T and B7T is open. The surveillance frequency control program captured this design feature which was included in station procedure PT/0/A/0500/020 and the design feature was incorporated into the procedure’s acceptance criteria.

The inspectors determined that station procedure PT/0/A/0500/020 adequately incorporated the PSW design criteria as described in each unit’s PSW implementation license amendments. However, the licensee failed to establish appropriate acceptance criteria in PT/0/A/0500/020 to clearly support that PSW surveillance requirements were satisfied. Specifically, not all of the acceptance criteria contained in PT/0/A/0500/020 were required to satisfy TS surveillance requirements for PSW operability. Additionally, not all of the acceptance criteria were required to satisfy SLC 16.6.9.

The inspectors noted the following deficiencies in licensee’s performance while evaluating this issue:

- The license’s IDO, which concluded only one power path was needed to satisfy the surveillance requirement, had the effect of modifying the acceptance criteria of PT/0/A/0500/020. This action circumvented the licensee’s formal process for modifying station procedures.

- Station procedure PT/0/A/0500/020 failed to adequately document the Oconee licensing basis and the station's operability requirements of the PSW power paths. Nonetheless, the licensee's IDO failed to document the need for a procedure change. The inspectors later discovered NCR 02155874 written on October 5, 2017, to capture the need for a procedure revision
- Oconee TS and station procedure AD-OP-0105 established a pre-determined administrative path to follow when acceptance criteria of a surveillance procedure is not met which is to declare the component/system inoperable. The licensee failed to reconcile this path with their IDO.

The licensee's failure to adequately translate current licensing basis into station procedure PT/0/A/0500/020 was a performance deficiency. The inspectors determined the finding was minor because PSW operability was maintained with one available power path. The licensee entered this issue into their CAP as NCR 02155874 and have revised station procedure PT/0/A/0500/020 to correctly reflect Oconee TS surveillance requirement criteria. This failure to comply with 10 CFR 50 Appendix B Criterion III constitutes a minor violation that is not subject to enforcement action in accordance with the NRC's Enforcement Policy dated November 1, 2016.

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

##### .1 (Closed) LER 0500269/270/287/2017-001, Loss of Both Keowee Hydroelectric Units Due to Human Error

###### a. Inspection Scope

Oconee TS 3.8.1, AC Sources – Operating requires in part that: “two Keowee Hydro Units (KHU) with one capable of automatically providing power through the underground emergency power path to both main feeder buses and the other capable of automatically providing power through the overhead emergency power path to both main feeder buses” in Modes 1, 2, 3, and 4. On June 16, 2017, both KHU 1 and KHU 2 were rendered incapable of starting in normal and emergency modes. The cause of the inoperable units was attributed to inadvertent bumping of a control circuit breaker in the generator auxiliaries cabinet for each KHU. The inability of both KHUs to start constituted a loss of safety function (i.e., loss of emergency AC power path). This condition was discovered by the licensee during a routine start of KHU 2 per the request of the Duke transmission system operator. The licensee performed troubleshooting activities which discovered the two circuit breakers open (one in each unit's generator auxiliaries cabinet). The circuit breakers were closed and a performance run was accomplished on each unit to restore the hydro unit to an operable condition.

The inspectors reviewed the LER, the licensee's evaluation, and corrective action documents to verify the accuracy of the LER and that corrective actions were identified and implemented to address the issue. The licensee entered this issue into their CAP as NCR 02131608 and submitted LER 0500269/270/287/2017-001. LER 0500269/270/287/2017-001 is closed.

b. Findings

Introduction: A self-revealing Green NCV of Oconee Nuclear Station TS, Section 5.4, "Procedures," was identified for the licensee's failure to identify sensitive equipment in a work area that warranted implementation of compensatory measures as required by station procedure AD-EG-ALL-1180, "Engineering Change (EC) Walkdowns." During the design and planning phase of a station modification, the licensee failed to identify sensitive components located in the subject work area and subsequently failed to implement adequate protective measures as defined in station procedures to prevent plant impacts during modification installation.

Description: On June 16, 2017, during implementation of EC 403976, "Cyber Lock and Alarm Security Cabinets with Digital Assets," maintenance technicians inadvertently contacted sensitive breakers within the KHU 1 and KHU 2 governor actuator cabinets, GAC1 and GAC2. EC 403976 included installation of tamper switches inside the cabinets that were to be placed in close proximity to governor control system breakers K1-GCS-BK001 and K2-GCS-BK001 for KHU 1 and KHU 2, respectively. Licensee personnel inadvertently contacted the governor control system breakers, resulting in the opening of K1-GCS-BK001 at 09:07 and K2-GCS-BK001 at 10:19 and rendering each KHU inoperable. TS 3.8.1, "AC Sources – Operating," requires both KHUs to be operable in Modes 1, 2, 3, and 4.

The licensee became aware of the issue when Keowee operators attempted to start KHU-2 for commercial generation and the unit failed to reach normal operating speed. Subsequent troubleshooting activities revealed that normally closed breakers K1-GCS-BK001 and K2-GCS-BK001 were in the open position. Upon discovery of this condition at 14:35, the licensee declared KHU 1 and KHU 2 inoperable and entered the appropriate TS 3.8.1 conditions. TS 3.8.1, Condition I, requires a dedicated power path from a Lee combustion turbine to be aligned to the standby buses within one hour of inoperability of both KHUs, which was completed by 17:15. The licensee completed activities to close the governor control system breakers and, following operability testing, declared KHU 1 and KHU 2 operable at 21:50 and 23:51 respectively on June 16, 2017. This event resulted in the loss of the emergency AC power path function for 11 hours and 31 minutes.

Station procedure AD-EG-ALL-1180, Attachment 1, "EC Walkdown Checklist," directs walkdown personnel to "Identify sensitive equipment in the area that may warrant compensatory measures to prevent plant impacts during installation of the modification." During the EC walkdown, licensee personnel did not open GAC1 and GAC2 and thus did not identify breakers K1-GCS-BK001 and K2-GCS-BK001 as sensitive equipment. As a result, the licensee did not plan adequate protective measures, commensurate with the sensitive nature of the breakers, for the modification installation as required by station procedure AD-OP-ALL-0204, "Plant Status Control." Instead, the licensee chose to use undedicated spotters during installation activities instead of more robust protective measures. The licensee entered this issue into their CAP as NCR 02131608.

Analysis: The licensee's failure to properly identify sensitive equipment and implement compensatory measures to prevent plant impacts as required by station procedure AD-EG-ALL-1180 was a performance deficiency. The performance deficiency was determined to be more than minor because it is associated with the human performance

attribute of the mitigating systems cornerstone and adversely affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences. Specifically, the performance deficiency resulted in the loss of the emergency AC power path function for eleven hours and thirty-one minutes. The finding was assessed using IMC 0609, Attachment 4, "Initial Characterization of Findings," dated October 7, 2016, and IMC 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," dated June 19, 2012. IMC 0609, Appendix A required a detailed risk evaluation because the finding represented a loss of system and/or function. A regional SRA performed the detailed risk evaluation using SAPHIRE Version 8.1.6 and a modified Version 8.50 of the SPAR Model for Oconee. The SRA developed two change sets to model the total exposure time for the finding. The first simulated a common cause failure of both Keowee units with an exposure of 7 hours. And the second simulated the failure of both Keowee units while the standby buses were energized by the Lee Station for 5 hours. The result was less than  $1E-6$  for each Oconee unit, which would be a finding of very low significance (Green). For the first 7 hours that both Keowee units were unavailable, the dominant sequences were related to loss of offsite power with failure to recover Keowee or offsite power. For the remaining 5 hours the dominant sequences were related to a stuck open relief valve with failure of decay heat removal and high pressure recirculation, which reflected the mitigating impact of the Lee Station energizing the standby buses. Therefore, the finding was determined to be of very low safety significance (Green).

The inspectors utilized IMC 0310, "Aspects Within the Cross-Cutting Areas," dated December 4, 2014, and determined the finding had a cross-cutting aspect of work management in the area of human performance, in that the organization failed to implement a process of planning, controlling, and executing work activities such that nuclear safety is the overriding priority. The work process failed to include the identification and management of risk commensurate to the work and the need for coordination with different groups or job activities. (H.5)

Enforcement: Oconee Nuclear Station TS 5.4, "Procedures," states, in part, that written procedures shall be established, implemented, and maintained covering the applicable procedures recommended in Regulatory Guide 1.33, Revision 2, Appendix A, February 1978. Regulatory Guide 1.33, "Quality Assurance Program Requirements," Section 9, "Procedures for Performing Maintenance," states in part that maintenance that can affect the performance of safety related equipment should be properly preplanned and performed in accordance with written procedures, documented instructions, or drawings appropriate to the circumstances. Oconee Nuclear Station procedure AD-EG-ALL-1180, Attachment 1, states, "Identify sensitive equipment in the area that may warrant compensatory measures to prevent plant impacts during installation of the modification." Contrary to the above, on June 16, 2017, the licensee did not properly implement procedure AD-EG-ALL-1180 by failing to identify sensitive equipment in the area during implementation of an EC. Maintenance technicians inadvertently opened each governor control system breaker during installation of EC 403976, resulting in inoperability of both KHUs and loss of the emergency AC power path function for 11 hours and 31 minutes. The licensee entered this issue into their CAP as NCR 02131608 and implemented corrective actions to identify other positionable components required for emergency power source operability that would require the use of protective measures, as defined by AD-OP-ALL-0204, in order to prevent inadvertent operation. The licensee created a formal Engineering department

communication which included lessons learned from the event and familiarization with the EC walkdown checklist. The signs on the governor actuator cabinets were also revised to emphasize the sensitive nature of the equipment. This finding was determined to be a violation of NRC requirements and is being treated as an NCV consistent with Section 2.3.2.a of the Enforcement Policy, dated November 1, 2016. (NCV 05000269,270,287/2017004-01, Failure to Identify Sensitive Equipment During Modification Results in Loss of Safety Function)

.2 (Closed) LER 0500287/2017-001, Unit 3 Reactor Protection System Actuation – Reactor Trip Due to Turbine Trip from Generator Lockout

a. Inspection Scope

On July 24, 2017, Duke Energy transmission department relay personnel entered the Oconee Nuclear Station 525 kV switchyard to test the circuit breaker fault relay on the Ashbury Newport transmission line feeder breaker to the red bus (PCB-57). Oconee operations personnel were notified of this activity as required by the Duke Energy Nuclear Switchyard Interface Agreement (CSD-EG-ALL-2000.1). The transmission department relay personnel attached their test equipment to a relay associated with one of the Oconee Unit 3 main generator output breakers which was immediately below the desired relay to be tested. The test equipment simulated a circuit breaker fault which resulted in both Oconee Unit 3 main generator output breakers opening, the actuation of the Unit 3 main generator lockout relay, a trip of the Unit 3 main turbine, and an automatic trip by the reactor protection system.

The inspectors reviewed the LER, the licensee's evaluation, and corrective action documents to verify the accuracy of the LER and that corrective actions were identified and implemented to address the issue. The licensee entered this issue into their CAP as NCR 02138958 and submitted LER 0500287/2017-001. LER 0500287/2017-001 is closed.

b. Findings

Introduction: A self-revealing Green NCV of Oconee Nuclear Station TS, Section 5.4, "Procedures," was identified for the licensee's failure to identify and properly risk screen work within 2 feet of an SPV component in accordance with procedure AD-OP-ALL-0201, "Protected Equipment." Specifically, the transmission and Oconee organizations failed to recognize that planned maintenance on a breaker in the 525 kV switchyard was within 2 feet of an SPV component and, as a result, appropriate planning and oversight were not in place to prevent a plant trip during maintenance activities.

Description: On July 24, 2017, transmission department relay personnel arrived onsite at the 525 kV transmission switchyard to perform breaker failure testing for the Asbury/Newport 525 kV feeder breaker (PCB-57). During the testing, the Unit 3 main generator experienced a lockout and both Unit 3 main generator breakers PCB-58 and PCB-59 opened, separating Unit 3 from the grid. The lockout generated a turbine trip which resulted in a reactor trip via the reactor protection system. Troubleshooting activities found that transmission personnel inadvertently connected their test equipment to the relay equipment for PCB-58, not PCB-57 as intended. The technicians generated a test signal with their equipment which caused actuation of Unit 3 lockout relays.

Transmission department relay personnel failed to use appropriate human performance tools to ensure work was performed on the intended component. In addition, neither the transmission nor Oconee organization recognized that the planned maintenance was taking place within 2 feet of an SPV component, PCB-58. Oconee station procedure AD-OP-ALL-0201, "Protected Equipment," states "scheduled or unscheduled (emergent) work on or within two feet of single point vulnerable components shall require a work order and have risk screening performed in accordance with AD-WC-ALL-0410, "Work Activity Integrated Risk Management." At Oconee, SPV components are classified in the equipment database such that any work orders generated against them are automatically flagged with a single point vulnerability special emphasis code, "SV", in the work management system. The special emphasis code is the trigger for station personnel to screen the risk of any associated maintenance in accordance with AD-WC-ALL-0410. The work on PCB-57 did not have a special emphasis code to indicate that maintenance was being performed within 2 feet of an SPV. Additionally, the Oconee Nuclear Station personnel did not recognize during their pre-job debrief with transmission personnel the scope of work would require additional activities by Oconee Nuclear Station personnel. Therefore, the station did not risk screen the planned maintenance and, as a result, the work activity did not receive the appropriate planning and oversight that may have prevented this event. The licensee entered this issue into their CAP as NCR 02138958. Corrective actions included revisions to station and transmission procedures to ensure inclusion of appropriate SPV program information, addition of the "SY" special emphasis code to all switchyard type work which require coordination of transmission resources, and the addition of the "T1" trip/transient risk special emphasis code to all breaker failure relays in the 230 kV and 525 kV switchyard cabinets containing SPV components.

Analysis: The licensee's failure to identify and properly risk screen the planned maintenance on PCB-57 as work within 2 feet of an SPV component in accordance with AD-OP-ALL-0201, "Protected Equipment," was a performance deficiency. The performance deficiency was determined to be more than minor because it was associated with the human performance attribute of the initiating events cornerstone and adversely affected the cornerstone objective to limit the likelihood of events that upset plant stability and challenge critical safety functions during shutdown as well as power operations. Specifically, human errors led to a Unit 3 main generator lockout, which resulted in a reactor trip. The finding was assessed using IMC 0609, Attachment 4, "Initial Characterization of Findings," dated October 7, 2016, and IMC 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," dated June 19, 2012. The inspectors determined the finding was of very low safety significance (Green) because the finding did not represent a transient initiator that caused both a reactor trip and the loss of mitigation equipment relied upon to transition the plant from the onset of the trip to a stable shutdown condition (i.e. loss of condenser, loss of feedwater). The inspectors utilized IMC 0310, "Aspects Within the Cross-Cutting Areas," dated December 4, 2014, and determined the finding had a cross-cutting aspect of work management in the human performance area, because the organization failed to implement a process of planning, controlling, and executing work activities such that nuclear safety is the overriding priority. The work process failed to include the identification and management of risk commensurate to the work and the need for coordination with different groups or job activities. (H.5)

Enforcement: Oconee Nuclear Station TS 5.4, "Procedures," states, in part, that written procedures shall be established, implemented, and maintained covering the applicable procedures recommended in Regulatory Guide 1.33, Revision 2, Appendix A, February 1978. Regulatory Guide 1.33, "Quality Assurance Program Requirements," Section 9, "Procedures for Performing Maintenance," states, in part, that maintenance that can affect the performance of safety-related equipment should be properly preplanned and performed in accordance with written procedures, documented instructions, or drawings appropriate to the circumstances. Oconee station procedure AD-OP-ALL-0201, "Protected Equipment," states, "scheduled or unscheduled (emergent) work on or within two feet of single point vulnerable components shall require a work order and have risk screening performed in accordance with AD-WC-ALL-0410, 'Work Activity Integrated Risk Management'." Contrary to the above, on July 24, 2017, the licensee did not properly implement Oconee station procedure AD-OP-ALL-0201, "Protected Equipment," by failing to generate a work order and have risk screening performed in accordance with AD-WC-ALL-0410, "Work Activity Integrated Risk Management." The licensee entered this issue into their CAP as NCR 02138958. Corrective actions included revisions to station and transmission procedures to ensure inclusion of appropriate SPV program information, addition of the "SY" special emphasis code to all switchyard type work which require coordination of transmission resources, and the addition of the "T1" trip/transient risk special emphasis code to all breaker failure relays in the 230 kV and 525 kV switchyard cabinets containing SPV components. This finding was determined to be a violation of NRC requirements and is being treated as an NCV consistent with Section 2.3.2.a of the Enforcement Policy, dated November 1, 2016. (NCV 05000287/2017004-002, Failure to Properly Risk Screen Work Within Two Feet of a Single Point Vulnerability Component)

#### 4OA6 Meetings, Including Exit

On January 23, 2018, the resident inspectors presented the inspection results to Mr. Ed Burchfield, Jr. 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.

ATTACHMENT: SUPPLEMENTAL INFORMATION

## **SUPPLEMENTAL INFORMATION**

### **KEY POINTS OF CONTACT**

#### **Licensee Personnel**

K. Brocklesby, Regulatory Affairs  
J. Burchfield, Site Vice President  
J. Dills, Plant Manager  
C. Dunton, Director of Nuclear Site Support  
T. Grant, Manager Engineering  
R. Meixell, Regulatory Compliance  
D. Robinson, Radiation Protection Manager  
C. Wasik, Regulatory Affairs Manager

#### **NRC Personnel**

E. Crowe, Senior Resident Inspector  
N. Childs, Resident Inspector  
J. Parent, Resident Inspector  
F. Ehrhardt, Branch Chief

## LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

### Opened and Closed

05000269,270,287/2017004-001	NCV	Failure to Identify Sensitive Equipment During Modification Results in Loss of Safety Function [Section 4OA3]
05000287/2017004-002	NCV	Failure to Properly Risk Screen Work Within Two Feet of a Single Point Vulnerability Component [Section 4OA3]

### Closed

05000269/270/287/2017-001	LER	Loss of Both Keowee Hydroelectric Units Due to Human Error [Section 4OA3]
05000287/2017-001	LER	Unit 3 Reactor Protection System Actuation – Reactor Trip due to Turbine Trip from Generator Lockout [Section 4OA3]

## LIST OF DOCUMENTS REVIEWED

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

#### Documents

AD-OP-ALL-0106, Conduct of Infrequently Performed Tests or Evolutions, Rev. 3

#### Drawings

OFD-101A-2.1, Flow Diagram of High Pressure Injection System (Letdown Section), Rev. 45

OFD-101A-2.2, Flow Diagram of High Pressure Injection System (Storage Section), Rev. 45

OFD-102A-2.1, Flow Diagram of Low Pressure Injection System (Borated Water Supply and LPI Pump Suction), Rev. 58

OFD-102A-2.2, Flow Diagram of Low Pressure Injection System (LPI Pump Discharge), Rev. 51

OFD-104A-1.1, Flow Diagram of Spent Fuel Cooling System, Rev. 59

OFD-106A-2.1, Flow Diagram of Coolant Treatment System (RC Bleed Holdup Tanks), Rev. 17

OFD-109A-1.1, Flow Diagram of Purification Demineralizers, Rev. 18

#### Procedures

OP/2/A/1102/015, Filling and Draining FTC, Rev. 077

OP/2/A/1103/011, Draining and Nitrogen Purging RCS, Rev. 098

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

#### Documents

O-0-SOG-9000-010, Equipment Locations, Rev. 00

O-0-SOG-9000-019, Fire Inside Containment, Rev. 00

O-0-SOG-9000-020, Key Equipment List by Fire Zone, Rev. 01

O-FS-1-TB-9775-001, Turbine Building Elevation 775'

O-FS-2-RB-9000-001, Unit 2 Reactor Building (Elevations 777'-861'), Rev. 001

SD 1.3.9, Containment Material Control, Rev. 17

#### Procedures

AD-EG-ALL-1520, Transient Combustible Control, Rev. 7

MP/2/A/1750/032J, Fire Hose Stations – Unit 2 – Reactor Building – SLC Related – Inspections, Rev. 1

#### Work Orders/Requests

020137042

### **Section 1R08: Inservice Inspection Activities**

#### Procedures

AD-EG-PWR-1611, Boric Acid Corrosion Control Program – Implementation, Rev. 2

AD-MN-ALL-0006, Fluid Leak Management, Rev. 0

MP/0/A/1800/132, Inspection, Assessment, and Cleanup of Boric Acid on Plant Materials, Rev. 9

NDE-25, Magnetic Particle Examination, Rev. 28

NDE-35, Liquid Penetrant Examination, Rev. 26

NDE-NE-ALL-6102, Utilization of PDI-UT-2 Generic Procedure for the Ultrasonic Examination of Austenitic Pipe Welds, Rev. 1

NDE-NE-ALL-7202, Visual Examination of PWR Reactor Pressure Vessel Upper Head Penetrations, Rev. 2

NDE-NE-ALL-7203, Visual Examination of PWR Reactor Pressure Vessel Bottom Mounted Instrument Penetrations, Rev. 2

PD-EG-PWR-1801, Steam Generator Management Program, Rev. 4  
 PDI-ISI-254-SE-NB, Remote Inservice Examination of Reactor Vessel Nozzle to Safe End, Nozzle to Pipe, and Safe End to Pipe Welds Using the Nozzle Scanner, Rev. 3  
 SM/0/A/8140/001, Welding of QA and Non-QA Piping, Valves, and Components, Rev. 42  
 WLD-EG-ALL-1624, Filler Material Control and Issuance, Rev. 0  
 WLD-EG-ALL-1630, Nuclear Welder and Fitter Handbook, Rev. 0  
 S000001-07-000015, Mechanical Rolled Tube Plug & Stabilizer Installation Field Procedure for Replacement Once-Through Steam Generators, Rev. 10

#### Calculations

OSC-4238, Steam Generator Condition Monitoring & Operability Assessment (CMOA) Evaluation for Unit 2, Rev. 6

#### Drawings

GBV-B2-40-0037, 4" fullport Sch. 10 butt weld ball valve with Auma gear operator, Rev. A  
 OM 245.-2108 001, 1-1/2"-800 lb Split Wedge Gate Valve Socket Ends, Rev. D

#### NDE Examiner Qualifications:

BWXT Certificate of Vision Examination (Aspelund), dated 4/13/2017  
 BWXT Certificate of NDE Personnel Qualification: ET LII (Aspelund), dated 19-Jul-2017  
 BWXT Certificate of Vision Examination (Crumpacker), dated 1/9/2017  
 BWXT Certificate of NDE Personnel Qualification: ET LII/QDA (Crumpacker), dated 12-Oct-2016

#### Other Documents

06-00000406-000, B&W 5/8" Mechanical Roll Plug Qualification Report for Oconee 1, 2, 3 and Crystal River 3 ROTSG's, Rev. 000  
 BWXT Roll Plugging Record: Tube R90C1, dated 11/06/2017  
 BWXT Roll Plugging Record: Tube R42C14, dated 11/06/2017  
 ETSS#1, BWXT Eddy Current Examination Technique Specification Sheet (Bobbin), Rev. 0  
 ETSS#2, BWXT Eddy Current Examination Technique Specification Sheet (Array), Rev. 0  
 Oconee Nuclear Station O2R28 Fall 2017 Analyst Training, file dated 11/8/2017  
 OISI-0169.10-0050, Oconee Nuclear Station - Fifth Inspection Interval Inservice Inspection NDE Plan – General Requirements Unit 1, 2 And 3, Rev. 13  
 O-1067-A-001, Reactor Building Sections & Details Basement Floor Slab Concrete, Rev. 4  
 PD-EG-PWR-1611, Boric Acid Corrosion Control Program, Rev. 1  
 Weld Doc No.: 170013, 170075  
 Welding Procedure Specification: GTSM0101-01 Rev. 8, GTSM0108-01, Rev. 8  
 Welding Procedure Qualification Record: L-133 Rev. 1, L-146D Rev. 0, L-104 Rev. 3, L-102E Rev. 0, 193A-DEP Rev. 2  
 Welder Performance Qualification Test Record for welders: H4538, G2061, A0204, A6231, A4977, I8275, O8835, C5272

#### Condition Reports

01974102, Boron on pipe next to 2PR-54  
 01974447, 2HP-934 leaking 1 dpm from relief port  
 02021825, 2LP-199 has an inactive boron leak at pipe cap  
 02041307, Request for BAC engineering evaluation for 2LP-154  
 02043095, 2A SS filter housing is leaking  
 02043222, 2HPI-IV-0007 active boron leak, 1 drop every 3 seconds  
 02058266, Request for BAC engineering evaluation for 2A LPI pump leak

02085344, 2B HPIP has wet active boron leak at seal  
 02093623, Active boric acid leak from 2CS-FE-1003  
 02145547, 2GWD-159 needs engineering boric acid control evaluation  
 02161178, O2R28 containment discovery WR during shutdown  
 02163498, LPSW-846 spill response

#### Work Orders (WO)/Work Requests (WR)

WO 20079847-11, Perform UT exam: O2.R1.11.0012 on Weld 2-51A-35-26  
 WO 20082974, EC-113879: Pre Fab LPSW Pipe & Valve Assembly

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

#### Documents

AD-OP-ALL-0106, Conduct of Infrequently Performed Tests of Evolutions, Rev. 3  
 Oconee Nuclear Station Technical Specifications, Revised 08/23/16  
 OP-OC-ASE-24, (ASE-24) Active Simulator Exam, Rev. 01

#### Drawings

OFD-101A-2.1, Flow Diagram of High Pressure Injection System (Letdown Section), Rev. 45  
 OFD-101A-2.2, Flow Diagram of High Pressure Injection System (Storage Section), Rev. 45  
 OFD-102A-2.1, Flow Diagram of Low Pressure Injection System (Borated Water Supply and LPI Pump Suction), Rev. 58  
 OFD-102A-2.2, Flow Diagram of Low Pressure Injection System (LPI Pump Discharge), Rev. 51  
 OFD-104A-1.1, Flow Diagram of Spent Fuel Cooling System, Rev. 59  
 OFD-106A-2.1, Flow Diagram of Coolant Treatment System (RC Bleed Holdup Tanks), Rev. 17  
 OFD-109A-1.1, Flow Diagram of Purification Demineralizers, Rev. 18

#### Nuclear Condition Report

01835200

#### Procedures

AP/1/A/1700/001, Unit Runback, Rev. 015  
 AP/1/A/1700/029, Rapid Unit Shutdown, Rev. 013  
 EP/1/A/1800/001 00, Unit 1 EOP Immediate Manual Actions and Subsequent Actions, Rev. 001  
 OP/1/A/1106/002 C, HWP and CBP Operation, Rev. 017  
 OP/1/A/1106/006, Emergency FDW System, Rev. 131  
 OP/2/A/1103/011, Draining and Nitrogen Purging RCS, Rev. 098  
 PT/2/A/0610/001 J, Emergency Power Switching Logic Functional Test, Rev. 050  
 RP/0/A/1000/001, Emergency Classification, Rev. 006

### **Section 1R13: Risk Assessments**

#### Documents

AD-EG-ALL-1004, Conduct of Probabilistic Engineering, Rev. 2  
 AD-EG-ALL-1520, Transient Combustible Control, Rev. 7  
 AD-NF-ALL-0501, Electronic Risk Assessment Tool (ERAT), Rev. 0  
 AD-NF-NGO-0502, Probabilistic Assessment (PRA) Model Technical Adequacy, Rev. 2  
 AD-OP-ALL-0106, Conduct of Infrequently Performed Tests or Evolutions, Rev. 3  
 S.D. 1.3.5 – Shutdown Protection Plan, Rev. 36

#### Drawings

OFD-101A-2.1, Flow Diagram of High Pressure Injection System (Letdown Section), Rev. 45  
 OFD-101A-2.2, Flow Diagram of High Pressure Injection System (Storage Section), Rev. 45

OFD-102A-2.1, Flow Diagram of Low Pressure Injection System (Borated Water Supply and LPI Pump Suction), Rev. 58  
 OFD-102A-2.2, Flow Diagram of Low Pressure Injection System (LPI Pump Discharge), Rev. 51  
 OFD-104A-1.1, Flow Diagram of Spent Fuel Cooling System, Rev. 59  
 OFD-106A-2.1, Flow Diagram of Coolant Treatment System (RC Bleed Holdup Tanks), Rev. 17  
 OFD-109A-1.1, Flow Diagram of Purification Demineralizers, Rev. 18

Nuclear Condition Report  
 01835200

Procedures  
 OP/2/A/1102/015, Filling and Draining FTC, Rev. 077  
 OP/2/A/1103/011, Draining and Nitrogen Purging RCS, Rev. 098

### **Section 1R15: Operability Evaluations**

Documents  
 OSS-0254.00-00-1039, Design Basis Specification for the Low Pressure Service Water System, dated 10/25/2016

Drawings  
 OEE-250-7, Elementary Diagram Pressurizer Relief Valve (2RV-67) 2RC66, Rev. 18

Nuclear Condition Reports  
 01838552; 02108912; 02160893; 02163498; 02164850; 02166089; 02166398; 02166646;  
 02167479; 02167543; 02167545

Work Orders/Requests  
 20137106

### **Section 1R19: Post-Maintenance Testing**

Documents  
 EC 407470, Replace 6", Class C, Buried SSF ASW Piping for Unit 1, Rev. 004  
 EC 111876, 2A2 RCP Post Modification Test Plant, Rev 14

Nuclear Condition Reports  
 01905083; 02152368; 02152396

Procedures  
 MP/0/A/1720/017, System Leakage Test Controlling Procedure, Rev. 003  
 OP/2/A/1103/006, RCP Operation, Rev 83

Work Orders/Requests  
 20097326; 20148808

### **Section 1R20: Refueling and Other Outage Activities**

Procedures  
 AD-OP-ALL-0106, Conduct of Infrequently Performed Tests or Evolutions, Rev. 3  
 AD-OP-ALL-0203, Reactivity Management, Rev. 6  
 AD-WC-ALL-0410, Work Activity Integrated Risk Management, Rev. 4  
 MP/0/A/3005/012, Containment Inspection/Close Out Procedure, Rev. 16  
 OP/0/A/1102/026, Operations IPTE Pre-Job Briefings, Rev. 030

OP/0/A/1108/001, Curves and General Information, Rev. 111  
 OP/2/A/1102/001, Controlling Procedure for Unit Startup, Rev. 274  
 OP/2/A/1102/004, Operation at Power, Rev. 121  
 OP/2/A/1102/010, Controlling Procedure for Unit Shutdown, Rev. 216  
 OP/2/A/1102/015, Filling and Draining FTC, Rev. 077  
 OP/2/A/1103/011, Draining and Nitrogen Purging RCS, Rev. 098  
 OP/2/A/1502/007, Operations Defueling/Refueling Responsibilities, Rev 82  
 PT/0/A/0711/001, Zero Power Physics Test, Rev. 071  
 PT/0/A/0750/017, Defueling Activities, Rev. 022  
 PT/0/A/0811/001, Power Escalation Test, Rev. 048  
 PT/0/A/1103/020, Power Maneuvering Predictions, Rev. 025  
 PT/2/A/1103/015, Reactivity Balance Procedure, Rev. 071

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

### Calculations

OSC-7292, Maintenance Rule Functional Failure Definition with Respect to Containment Isolation Leakage Testing, Rev. 0

### Documents

OSS-0254.00-00-1001, Design Basis Specification for the High Pressure Injection and Purification & Deborating Demineralizer Systems, Rev. 54  
 OSS-0254.00-00-1028, Design Basis Specification for Low Pressure Injection and Core Flood System, Dated 1/17/2017  
 PT/2/A/0150/048, 2LP-29 and 2LP-30 Leak Test, November 6, 2017  
 PT/2/A/0150/003A, Reactor Building Integrated Leak Rate Test, November 10, 2015 performance  
 PT/2/A/0150/006, Mechanical Penetration Leak Rate Data, December 17, 2013 performance  
 PT/2/A/0150/006, Mechanical Penetration Leak Rate Data, November 10, 2015 performance  
 PT/2/A/0151/024, Penetration 24 Leak Rate Test, December 9, 2013 performance  
 PT/2/A/0151/024, Penetration 24 Leak Rate Test, October 25, 2015 performance  
 PT/2/A/0151/024, Penetration 24 Leak Rate Test, October 31, 2017 performance  
 PT/2/A/0151/060, Penetration 60 Leak Rate Test, November 22, 2013 performance  
 PT/2/A/0151/060, Penetration 60 Leak Rate Test, November 10, 2015 performance  
 PT/2/A/0151/060, Penetration 60 Leak Rate Test, November 12, 2017 performance  
 PT/2/A/0251/024, HPI Full Flow Test, November 19, 2017 performance  
 Oconee Nuclear Station – ASME Inservice Testing Program Document, Rev. 28

### Drawings

OFD-102A-2.1, Rev 58  
 OFD-102A-2.2, Rev 51

### Nuclear Condition Reports

01844693; 02161777; 02161904; 02163164; 02164673; 02165220; 02165618; 02166754

### Other

OSS-0254.00-00-4001, Design Basis Document for Reactor Building Containment Isolation, Rev. 41

Procedures

PT/2/A/0150/048, 2LP-29 and 2LP-30 Leak Test, Rev 015

PT/2/A/0610/006, 100KV Power Supply From Lee Steam Station, Rev 007

PT/3/A/0600/012, Turbine Driven Emergency Feedwater Pump Test, Rev 91

Work Orders/Requests

2019386101; 20213877

**Section 2RS1: Radiological Hazard Assessment and Exposure Controls**Procedures, Guidance Documents, and Manuals

AD-PI-ALL-0100, CAP, Rev. 9

AD-RP-ALL-2001, Taking, Counting, and Recording Surveys, Rev. 3

AD-RP-ALL-2005, Posting of Radiological Hazards, Rev. 3

AD-RP-ALL-2006, Radiation Protection Risk Management Process, Rev. 4

AD-RP-ALL-2017, Access Controls for High, Locked High, and Very High Radiation Areas,  
Rev. 4

AD-RP-ALL-3001, Control of Radioactive Material and Use of Radioactive Material Labels,  
Rev. 1

AD-RP-ALL-3002, Unconditional Release of Material, Rev. 1

AD-RP-ALL-3003, Outside Radioactive Material Container Inventory and Control, Rev. 2

HP/0/B/1000/016, Radiological Protection Requirements for Steam Generator Maintenance,  
Rev. 39

HP/0/B/1000/054, Radiation Protection Periodic Routines, Rev. 47

TE-RP-ALL-4003, Placement of personnel Dosimetry for Non-Uniform Radiation Fields, Rev. 0

Records and Data

Air Sample Log, U2 Reactor Building, 10/29/17 – 10/31/17

Air Sample Results, Sample ID ON17111400047

Air Sample Results, Sample ID ON17103000019

Air Sample Results, Sample ID ON17103100028

Lapel Air Sample Results, Sample ID ON17111400005

National Source Tracking System Confirmation of Annual Inventory Reconciliation, 1/9/17

Outside RMA Storage Inspections (Monthly) per AD-RP-ALL-3003, October and November  
2017

Radiological Survey ONS-M-20171116-12, Independent Spent Fuel Storage Installation,  
11/16/17

Radiological Survey ONS-M-20171012-3, Independent Spent Fuel Storage Installation,  
10/12/17

Radiological Survey ONS-M-20171027-11, U2 Reactor Building Basement, 10/27/17

Radiological Survey ONS-M-20171108-8, U2 Reactor Building Basement, 11/8/17

Radiological Survey ONS-O-20170130-2, Sealed Source Leak Test Results, 1/30/17

Radiological Survey ONS-O-20170724-2, Sealed Source Leak Test Results, 7/24/17

Radiological Survey ONS-M-20170606-10, Unit 1/2 Spent Fuel Pool, 6/6/17

Radiological Survey ONS-M-20170607-13, Decon Pit at Grating level with Cask Lowered,  
6/7/17

Radiological Survey ONS-M-20171031-44, U2 "A" Hotleg, 10/31/17

Radiological Survey ONS-M-20171102-13, U2 "A" Hotleg, 11/2/17

Radiological Survey ONS-M-20171028-56, U2 Top of Rx Head with Bat Wings, 10/28/17

Radiological Survey ONS-M-20171106-26, Room 62 LPI and RBS Pumps, 11/6/17

Radiological Survey ONS-M-20171003-8, Room 62 LPI and RBS Pumps, 10/3/17

RWP 2152, Supervisor and Flagman – Remove/Install Plenum & Associated Activities – Posted  
LHRA, Rev. 17  
RWP 2022, U2 Rx Bldg – Alloy 600 Replacement, Rev. 6  
RWP 2157, U2 Rx Bldg Inspect CRDMs and CRDM Flanges, Rev. 18  
U1 and U2 Spent Fuel Pool Inventory, 1/25/17  
10 CFR Part 61 Radioactive Waste Classification, Dry Active Waste, 8/5/17

CAP Documents

AR 02042649  
AR 02064822  
AR 02114421  
AR 02129708  
AR 02164739  
AR 02166063  
AR 02166440  
Self-Assessment 02087716, Worker Adherence to Radiation Work Permit (RWP) Task  
Guidance, 2/9/17

**Section 2RS2: Occupational As Low As Reasonably Achievable (ALARA) Planning and Controls**

Procedures and Guidance Documents

AD-RP-ALL-1000, Conduct of Radiation Protection, Rev. 03  
AD-RP-ALL-9001, ALARA Planning, Rev. 04  
AD-RP-ALL-9000, ALARA Program, Rev. 08  
AD-RP-ALL-9007, Radiation Protection Source Term Review, Rev. 01

Records and Data

AD-RP-ALL-9000 Attachment 1, Special ALARA Committee Meeting Minutes, 07/2017-11/2017  
AD-RP-ALL-9001, Micro ALARA Plan, Replace U0 "A" SF Filter, 11/13/17  
Duke Energy Carolinas Long Range ALARA Plan 2017-2022: Oconee Nuclear Station,  
08/24/17  
Outage Status Reports, 10/31-11/03/17 and 11/13-11/16/17  
RWP #2022, U2 Rx Bldg – Alloy 600 – Replacement/Repairs, Rev. 06  
RWP #2190, All U2 Rx Bldg work except 2A2 RCP, Rev. 18  
RWP #2202, U2 Rx Bldg 2A2 RCP Activities, Rev. 03  
1EOC29 RP Outage Report  
2ECO27 RP Outage Report  
3EOC28 RP Outage Report  
2016-ONS-3-O-009, ALARA Plan, Steam Generators A & B Nozzle Dams  
2017-ONS-2-O-002, ALARA Plan, RCMU Pulsation Dampener Mod  
2017-ONS-2-O-004, ALARA Plan, Alloy 600 Small Nozzle Repair  
2017-ONS-2-O-006, ALARA Plan, 2A2 RCP Internals and Motor Stand Replacement  
2017-ONS-2-O-010, ALARA Plan, Eddy Current Testing  
2017-ONS-2-O-020, ALARA Plan, U2 Rx Bldg Move Plenum from FTC

CAP Documents

Quick Hitter Self-Assessment Report, 02117260-05, ALARA Assessment  
AR 01967013  
AR 02119669  
AR 02125188  
AR 02125201

**Section 2RS3: In-Plant Airborne Radioactivity Control and Mitigation**Procedures and Guidance Documents

AD-PI-ALL-0100, CAP, Rev. 9

AD-RP-ALL-6002, Inspections of Self-Contained Breathing Apparatus (SCBA) and Associated Equipment, Rev.0

AD-TQ-ALL-0083, Self-Contained Breathing Apparatus (SCBA) Training Program, Rev. 2

CSD-RP-ALL-6001, Justification for Single Fit Testing using the MSA UltraElite Model Respirator, Rev. 0

HP/0/B/1009/001, Emergency Equipment Inventory and Instrument Check, Rev. 46

PD-RP-ALL-6000, Radiological Respiratory Protection Program, Rev. 0

Records and Data Reviewed

Control Room Filter System Test, Unit 1/2 A Train, 2/4/15, 7/25/17

Control Room Filter System Test, Unit 1/2 B Train, 2/9/15, 7/25/17

HEPA Filter System Integrity Test Data, Unit ID Number SGME 4300, 10/17/17

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HEPA Filter System Integrity Test Data, Unit ID Number SG 01, 8/23/17

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

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### **Section 40A2: Problem Identification and Resolution**

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