



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

April 27, 2018

EA-18-036

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

**SUBJECT: OCONEE NUCLEAR STATION – NRC INSPECTION REPORT
05000269/2018013, 05000270/2018013, AND 05000287/2018013**

Dear Mr. Burchfield:

This letter discusses a finding and apparent violations of regulatory requirements identified during the closure of unresolved item (URI) 05000269, 270, 287/2014007-05 for which the NRC has not yet reached a preliminary significance determination. The finding and associated violations resulted from the implementation of plant modifications that included the re-configuration of electrical cables in electrical cable trench #3 between the Keowee Hydro Station (KHS) and transformer CT-4 at Oconee Nuclear Station (ONS) and the Protected Service Water (PSW) ductbank between CT-4 and the PSW building that did not comport with ONS design basis and applicable regulatory requirements of IEEE Std. 279-1968 and IEEE Std. 279-1971.

The unresolved item was initially identified in inspection report (IR) 05000269, 270, 287/2014007 (ML14178A535) during a component design basis inspection (CDBI) conducted at your facility. During the review of the Oconee emergency power start control for the Keowee Hydro-Units, the inspectors identified a plant configuration where Class 1E 125 volt direct current (Vdc) system cables were installed adjacent to various medium voltage-high energy alternating current (ac) power distribution cables for the offsite and onsite power systems. Using ONS single-line power feeder diagrams, control wiring interconnection diagrams, and control system elementary diagrams, the team determined that without proper segregation and separation, clear electrical pathways exist that could potentially, in the case of a power cable fault, transmit excessive voltages from the ac power systems onto the 125-Vdc safety system.

Because of questions regarding plant design and license requirements for Class 1E power systems at Oconee and a clear sensitivity to the potential for a backfit, the staff initiated a task interface agreement (TIA) with the NRC Office of Nuclear Reactor Regulation (NRR) on October 16, 2014. The TIA was written to request assistance in assessing the potential hazards and to gain clarity on whether the current licensing basis included specific design requirements to

minimize such hazards. On August 5, 2015, the conclusions of the task interface agreement were assessed and were confirmed by a peer review conducted by staff from the Nuclear Reactor Regulation Division of Engineering, Nuclear Regulatory Research, and other regional offices (ML15216A621). The NRC Committee to Review Generic Requirements (CRGR) reviewed and endorsed the staff position in the TIA response (ADAMS Accession No. ML17237C032) and found that the TIA response did not contain backfitting or new staff positions as documented in the CRGR memorandum dated February 13, 2018 (ADAMS Accession No. ML17289A542). On February 28, 2018, the TIA response ([ML16302A483](#)) was released publicly and confirmed that the as-modified configuration identified by the inspectors did not comply with the ONS licensing bases as it pertains to placing safety-related cables in close proximity to high energy power sources specifically in trenches and duct banks involved with the Protected Service Water and Tornado high energy line break modifications

The basis for the apparent violations contained herein are the NRC positions described in the TIA referenced above. For example, the TIA quotes IEEE Std. 279-1971 which states, in part, that any single failure within the protection system shall not prevent proper protective action at the system level when required. The single failure analysis for the Oconee modifications assumed a smaller fault than what could occur during normal plant operations.

The NRC recognizes that once these issues were identified by the inspectors in 2014, a number of modifications were implemented to address the protection system cable separation concerns associated with the subject plant modifications. Additional inspections of these corrective actions will be conducted as appropriate. In addition, for the limited areas where the concerns could not be addressed, on February 28, 2018 (ML18051B257) the NRC granted relief from the applicable Code and concluded that the proposed alternatives provided an acceptable level of quality and safety for the cable configurations and locations.

On March 12, 2018, staff from the NRC Region II office discussed the preliminary results of this assessment with you and other members of your staff. The results are documented in the enclosed report.

We intend to issue our final safety significance determination and enforcement decision, in writing, within 90 days from the date of this letter. The NRC's significance determination process (SDP) is designed to encourage an open dialogue between your staff and the NRC; however, neither the dialogue nor the written information you provide should affect the timeliness of our final determination. We ask that you promptly provide any relevant information that you would like us to consider in making our determination. We are currently evaluating the significance of this finding and will notify you in a separate correspondence once we have completed our preliminary significance review. You will be given an opportunity to provide additional information prior to our final significance determination unless our review concludes that the finding has very low safety significance (i.e., Green).

In addition, please be advised that the number and characterization of apparent violations described in the enclosed inspection report may change as a result of further NRC review. You will be advised by separate correspondence of the results of our deliberations on this matter.

For administrative purposes, this letter is issued as Inspection Report 05000269/2018013, 05000270/2018013, and 05000287/2018013 and the apparent violations are designated as AV 05000269, 270, 287/2018013-01, Failure to Translate Design and Licensing Basis Requirements and Verify Adequate Design, 05000269, 270, 287/2018013-02 and Failure to Submit for License Review and obtain a license amendment for a Modification. If you have any

question concerning this matter, please contact me at 404-997-4629.

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/

Marvin D. Sykes, Chief
Engineering Branch 1
Division of Reactor Safety

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

Enclosure:
Inspection Report 05000269/2018013,
05000270/2018013, and 05000287/2018013
w/Attachment: Supplementary Information

cc: Distribution via ListServ

SUBJECT: OCONEE NUCLEAR STATION – NRC INSPECTION REPORT
 05000269/2018013, 05000270/2018013, AND 05000287/2018013 dated
 April 27, 2018

* See previous page for concurrence

PUBLICLY AVAILABLE NON-PUBLICLY AVAILABLE SENSITIVE NON-SENSITIVE
 ADAMS: Yes ACCESSION NUMBER: **ML 18117A477** SUNSI REVIEW COMPLETE FORM 665 ATTACHED

OFFICE	RII:DRS	RII:DRS	RII:DRS	RII EICS	RII:DRS
SIGNATURE	TNF1	MDS1	ATG	MXK7	MDS1
NAME	T. FANELLI	M. SYKES	A. GODY	M. KOWAL	M. SYKES
DATE	4/ 27 /2018	4/ 27 /2018	4/ 27 /2018	4/ 27 /2018	4/ 27 /2018
E-MAIL COPY?	YES NO	YES NO	YES NO	YES NO	YES

OFFICIAL RECORD COPY DOCUMENT NAME: S:\DRS NEWENG BRANCH 1\BRANCH INSPECTION FILES\2017-2018-2019 CYCLE INSPECTION FOLDER FOR ALL SITES\OCONEE 2018013 SINGLE FAILURE REPORT FINAL.DOCX

**U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report**

Docket Numbers: 50-269, 50-270, and 50-287

License Numbers: DPR-38, DPR-47, DPR-55

Report Numbers: 05000269/2018013, 05000270/2018013, and 05000287/2018013

Enterprise Identifier: I-2018-013-0004

Licensee: Duke Energy Carolinas, LLC

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

Location: Seneca, SC 29672

Inspection Dates: March 7 - 12, 2018

Inspector: T. Fanelli, Senior Reactor Inspector

Approved By: Marvin D. Sykes, Chief
Engineering Branch 1
Division of Reactor Safety

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring Duke's performance through the use of internal NRC processes like the task interface agreement process which was established to resolve complex design and licensing issues. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to <https://www.nrc.gov/reactors/operating/oversight.html> for more information. NRC-identified findings and violations are summarized in the table below.

List of Findings and Violations

Failure to Translate Design and Licensing Basis Requirements and Verify Adequate Design			
Cornerstone	Significance To Be Determined	Cross-cutting Aspect	Report Section
Initiating Events	Apparent Violation AV 05000269, 270, 287/2018013-01 Open EA-18-036	None	71111.21 Component Design Basis Inspection
The NRC identified an Apparent Violation of Title 10 of the <i>Code of Federal Regulations</i> part 50, Appendix B, Criterion III, for the licensee's failure to adequately translate applicable regulatory requirements and design basis into specifications, drawings, procedures, and instructions and the failure to verify the adequacy of plant design changes for specific configuration of Class 1E electrical cables in trench #3 between the Keowee Hydro Station (KHS) and transformer CT-4 at Oconee Nuclear Station (ONS) and in the Protected Service Water (PSW) ductbank between CT-4 and the PSW building.			

Failure to Submit for License Review and Obtain a License Amendment for a Modification			
Cornerstone	Significance/Severity To Be Determined	Cross-cutting Aspect	Report Section
Initiating Events	Apparent Violation AV 05000269,270, 287/2018013-02 Open EA-18-036	None	71111.21 Component Design Basis Inspection
The team identified an Apparent Violation of Title 10 of the <i>Code of Federal Regulations</i> part 50.59(c)(2), "Changes, tests and experiments," for the failure to submit a plant modification for license review and obtain a license amendment for a change that resulted in more than a minimal increase in the likelihood of occurrence of protection system failures and a departure from methods for Class 1E protection system single failure analysis as described in the FSAR.			

INSPECTION SCOPE

Inspections were conducted using the appropriate portions of the inspection procedure (IP) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at <http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html>. The team reviewed selected procedures and records, observed activities, performed walk downs, and interviewed personnel to assess licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

REACTOR SAFETY

71111.21 – Component Design Bases Inspection (Team)

The team evaluated the following components, permanent modifications during the weeks of March 7 to March 12, 2018.

Component (1 Sample)

- (1) Keowee Emergency Start Logic
- (2) 125 volt direct current (Vdc) Vital I&C Batteries (Units 1, 2, and 3)

Permanent Modification (3 Samples)

- (1) Emergency Power Cable Replacement (Trench 3)
- (2) Protected Service Water (PSW) Modifications
- (3) Tornado High Energy Line Break (HELB) Modification

INSPECTION RESULTS

Failure to Translate Design and Licensing Basis Requirements and Verify Adequate Design			
Cornerstone	Significance To Be Determined	Cross-cutting Aspect	Report Section
Initiating Events	Apparent Violation AV 05000269, 270, 287/2018013-01 Open EA-18-036	None	71111.21 Component Design Basis Inspection
<p>The NRC identified an Apparent Violation of Title 10 of the CFR part 50, Appendix B, Criterion III, for the licensee's failure to adequately translate applicable regulatory requirements and design basis into specifications, drawings, procedures, and instructions and the failure to verify the adequacy of plant design changes for specific configuration of Class 1E electrical cables in trench #3 between the Keowee Hydro Station (KHS) and transformer CT-4 at Oconee Nuclear Station (ONS) and in the Protected Service Water (PSW) ductbank between CT-4 and the PSW building.</p>			
<p><u>Description:</u></p> <p>The licensee did not correctly translate site design and licensing bases into the site specifications and procedures for the design and installation of plant modifications that included the re-configuration of electrical cables in electrical cable trench #3 between the Keowee Hydro Station (KHS) and transformer CT-4 at Oconee Nuclear Station (ONS) and the Protected Service Water (PSW) ductbank between CT-4 and the PSW building. The specific requirements of IEEE 279-1968 and single failure sections of IEEE 279-1971 were not fully implemented. Contrary to this requirement, the licensee placed Class 1E 125Vdc system cables adjacent to various medium voltage-high energy alternating current (ac) power distribution cables for the offsite and onsite power systems and introduced credible single failure conditions with the potential for exposure of the onsite redundant Class 1E dc power distribution and control systems (dc systems) to possible damaging peak voltage from the offsite and onsite AC power systems.</p> <p>Corrective Actions: The licensee reported this as an unanalyzed condition to the NRC in accordance with 10 CFR 50.73(a)(2)(ii)(B) in Licensee Event Report 269/2014-01 entered this issue into their corrective action program. The licensee also performed immediate and prompt determinations of operability in which they concluded a reasonable expectation of operability existed on the basis that the consideration of the specific hazards was not required by the site licensing basis. A number of plant modifications were implemented to address the concerns. Additional inspections of these corrective actions will be conducted as appropriate. For the limited areas where the concerns could not be addressed, on February 28, 2018, (ML180051B257) the NRC granted relief from the applicable Code and concluded that the proposed alternatives provided an acceptable level of quality and safety for the cable configurations and locations.</p> <p>Corrective Action Reference: PIP O-14-03190, PIP O-14-05125, PIP O-14-03915, and PIP O-14-02965</p>			

Performance Assessment:

Performance Deficiency: The licensee did not design and install electrical cabling in trench #3 and PSW raceway for common Class 1E systems (power and control) in accordance with IEEE 279-1971.

Screening: The performance deficiency was determined to be more than minor because it was associated with the Design Control attribute of the Initiating Events Cornerstone and adversely affected the cornerstone objective of limiting the likelihood of events that upset plant stability and challenge critical safety functions. Specifically, the design change introduced new hazards that had not been analyzed.

Significance: The team evaluated the finding with Inspection Manual Chapter (IMC) 0609, Att. 4, "Initial Characterization of Findings," issued October 7, 2016, for Initiating Events, and IMC 0609, Appendix A, "The Significance Determination Process (SDP) for Findings At-Power," issued June 19, 2012, and determined the finding met the Support System Initiators screening criteria for requiring a detailed risk evaluation. The team determined that this issue increased the likelihood of the support system initiator site wide "loss of offsite power (LOOP)" in addition to the site wide loss of Class 1E DC systems. The finding could not be screened to Green and is pending a significance determination.

Cross Cutting Aspect: None.

Enforcement:

10 CFR Part 50, Appendix B, Criterion III, "Design Control," stated, in part, that measures shall be established to assure that applicable regulatory requirements and the design basis, as defined in § 50.2 and as specified in the license application, for those structures, systems, and components to which this appendix applies are correctly translated into specifications, drawings, procedures, and instructions, and that design control measures shall provide for verifying or checking the adequacy of design. Contrary to the above, since July 2013, the licensee failed to establish measures to assure that applicable regulatory requirements and the design basis, as defined in § 50.2 and as specified in the license application, for those structures, systems, and components to which this appendix applies are correctly translated into specifications, drawings, procedures, and instructions, and that design control measures were provided for verifying or checking the adequacy of design.

This finding closes URI 05000269, 270, 287/2014007-005, Potential Unanalyzed Condition Associated with Emergency Power System and LER 05000269, 270, 287/2014-001-00, Unanalyzed condition associated with the 13.8kV emergency power cables located in the underground trench.

Failure to Submit for License Review and NRC Approval.			
Cornerstone	Significance/Severity To Be Determined	Cross-cutting Aspect	Report Section
Not Applicable	Apparent Violation AV 05000269, 270, 287/2018013-02 Open EA-18-036	None	71111.21 Component Design Basis Inspection
<p>The team identified an Apparent Violation of Title 10 of the Code of Federal Regulations part 50.59(c)(2), "Changes, tests and experiments," for the failure to submit a plant modification for license review and obtain a license amendment for a change that resulted in more than a minimal increase in the likelihood of occurrence of protection system failures and a departure from methods for Class 1E protection system single failure analysis as described in the FSAR.</p> <p><u>Description:</u></p> <p>The licensee procedure Nuclear System Directive (NSD): 209 "10 CFR 50.59 Process," committed to using Nuclear Energy Institute (NEI) 96-07, "Guidelines for 10 CFR 50.59 Implementation.</p> <p>The guidance in Nuclear Energy Institute (NEI) 96-07 Section 4.3.2, specified that if a change in likelihood of occurrence of a malfunction increases by more than a factor of two would need NRC approval, because certain changes that satisfy the factor of two limit exceed the minimal increase standard for accident/transient frequency under criterion 10 CFR 50.59(c)(2)(i). The guidance in NEI 96-07 Section 4.3.8, specified that the use of new or different methods of evaluation that are not approved by NRC for the intended application," such as the methods identified in the "memo to File, ME Patrick (PJ North), dated 1/12/92, Single Failure Timing Licensing Basis, no file number given. (Note: Memo was actually written 1/12/93)," would need NRC approval, because it was considered a departure from a method of evaluation described in the UFSAR. Based on this guidance, the team determined that the modifications associated with engineering changes (ECs), EC91880, "Keowee Emergency Start Cable," revision 24 and EC91875, "Keowee AC Power Supply Tie-Ins," revision 15, and EC91874, "13.8 KV Feed To PSW System from 100 KV APS," revision 7 would require NRC approval in accordance with 10 CFR 50.59(c)(2)</p> <p>Corrective Actions: TBD</p> <p>Corrective Action References: TBD</p> <p><u>Performance Assessment:</u></p> <p>Significance: This violation was associated with a previously documented finding being assessed using the significance determination process which was documented under AV 05000269, 270, 287/2018013-01.</p> <p>Cross Cutting Aspect: None</p> <p><u>Enforcement:</u></p>			

Severity: The ROP significance determination process does not specifically consider the regulatory process impact in its assessment of licensee performance. Therefore, it is necessary to address this violation which impedes the NRC's ability to regulate using traditional enforcement to adequately deter non-compliance. The severity level of this violation will be informed by the SDP.

Violation: 10 CFR 50.59(c)(2), "Changes, tests and experiments," required, in part a licensee shall obtain a license amendment pursuant to Sec. 50.90 prior to implementing a proposed change, test, or experiment if the change, test, or experiment would result in more than a minimal increase in the likelihood of occurrence of protection system failures and a departure from methods for Class 1E protection system single failure analysis as described in the FSAR.

Contrary to the above, from June 2013 to present, the licensee failed to obtain a license amendment pursuant to Sec. 50.90 prior to implementing a proposed change that resulted in more than a minimal increase in the likelihood of occurrence of a malfunction of an SSC important to safety previously evaluated in the FSAR.

EXIT MEETINGS AND DEBRIEFS

On March 12, 2018, the NRC presented the results of this review to you and other members of your staff.

LIST OF DOCUMENTS REVIEWED

CALCULATIONS

KC-2190-004 Failure Mode and Effects Analysis (FMEA) for the Keowee 13.8 KV Switchgear (KPF) Power Feeds To Protected Service Water System (PSW) Switchgear (B6T B7T)
KC-2195-000, Keowee 13.8 KV Breaker Equipment Mounting and Cable Tray Supports Qualification
KC-2197-001, Keowee Hydro KPF-1 and KPF-2 13.8KV Switchgear Arc-Flash Analysis 6 16 2011
OSC-7729-003, Oconee-Keowee Underground Power Cable Replacement Calculations (for NSM ON-53065), Rev 3
OSC-9370, Units 123 PSW AC Power System Voltage and Short Circuit Analysis
KC-2217, Protective Relay Settings for Keowee 13.8 kV KPF Switchgear Rev 2
OSC-9831, Protective Relay Settings Associated with PSW Switchgear Rev 3
KC-2131, Electrical Design Input Calculation for NSM ON-53065 (Keowee Underground Cable Replacement)
OSC-7729, Oconee-Keowee Underground Power Cables Replacement Calculations Rev 3
OSC-5096, Keowee Single Failure Analysis, Rev 13
OSC-3716 Station Blackout Coping Study Rev 001

DRAWINGS

O-711-C, Unit 1 Connection Diagram Unit Control Board 1UB1, Rev 68
O-1711-C, Unit 2 Connection Diagram Unit Control Board 2UB1, Rev 64
O-2711-D, Unit 2 Connection Diagram Unit Control Board 3UB1, Rev 56
O-705, Unit 1 One Line Diagram 120 VAC & 125 VDC Station Aux. Circuits Instrumentation Vital Buses, Rev 98
O-1705, Unit 2 One Line Diagram 120 VAC & 125 VDC Station Aux. Circuits Instrumentation Vital Buses, Rev 82
O-2705, Unit 3 One Line Diagram 120 VAC & 125 VDC Station Aux. Circuits Instrumentation Vital Buses, Rev 80
O-753-L, Connection Diagram Keowee Emergency Start Panel - Rev 17G
O-1753-N - Connection Diagram Keowee Emergency Start Panel - Rev 9B
O-2753-N - Connection Diagram Keowee Emergency Start Panel - Rev 12B
K-904-B Sections and Details Trench #3 Power Cable Switchover, Rev 0
KEE 117, Elementary Diagram Remote Controls, Rev 6
KEE 217 Elementary Diagram Remote Controls KHU2, Rev 8
KEE-213 KHU2 Master control Start, Rev 25
OEE 120, Elementary Diagram Channel A Keowee Emergency Start, Rev 17
OEE 120-A, Elementary Diagram Channel A Keowee Emergency Start Contact Development, Rev 10
OEE 120-I, Elementary Diagram Channel B Keowee Emergency Start, Rev 17
OEE 120-A-I, Elementary Diagram Channel B Keowee Emergency Start Contact Development, Rev 10
O-799-A Interconnection Diagram Keowee-Oconee Interface Cabinet KOIC-A, Rev 28
O-799-B Interconnection Diagram Keowee-Oconee Interface Cabinet KOIC-B
O-799-C - Outline and Connection Diagram Terminal Cabinet KHU-1A, Rev 1
O-799-C-1- Outline and Connection Diagram Terminal Cabinet KHU-1B - Rev 0
O-799-D - Outline and Connection Diagram Terminal Cabinet KHU-2A - Rev J
O-799-D-1 - Outline and Connection Diagram Terminal Cabinet KHU-2B - Rev 0
O-2792-D, Connection Diagram Unit Control Terminal Cabinet UCTC 7, Rev 29
OEE-163-37, Elementary Diagram SSF RC Loop Hot Leg Temp, Rev 1

PROCEDURES

AP/0/A/2000/002, Keowee Hydro Station - Emergency Start, Rev 15

AP/0/A/2000/003, Keowee Hydro Station - Auxiliary Power Recovery, Rev 0

DESIGN BASIS DOCUMENTS

OSS-0254.00-00-2006, Design Basis Specification for the 125 VDC Vital Instrumentation and Control Power System, Rev 9

OSS-0254.00-00-2000, Design Basis Specification for the 4KV Essential Auxiliary Power System, Rev. 20

OSS-0254.00-00-2005, Design Basis Specification for the Keowee Emergency Power, Rev. 22

OSS-0254.00-00-4013, Design Basis Specification for the Oconee Single Failure Criterion, Rev. 4

PLANT MODIFICATIONS

NSM ON-53065, Replace Underground Power , Aux Power, & Control Cables from Keowee Hydro-Station to Oconee Nuclear Station, Rev 1

EC91880 - Keowee Emergency Start Cable, Rev 24

EC91876-OD500928, SSF 4.16KV Alternate Power Feed from PSW, rev 37

EC91875-OD500927, Keowee AC Power Supply Tie-Ins, Rev 15

EC91874-OD500923, 3.8 KV Feed To PSW System from 100 KV APS, rev 7

EC91873-OD500922, PSW Power Feed Installation, Rev 8

MISCELLANEOUS DOCUMENTS

Condition Reports Written Due to this Inspection

PIP O-14-02965 (PDO) Evaluation of Dynamic Loads from Cable Faults (Cable Whip)

PIP O-14-03190 (PDO) Single failure criteria associated with Keowee underground cable

PIP O-14-5125 Cable faults on the PSW 13.8 kV Fant power path needs to be evaluated, PDO updated 5-19-2014