



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

June 24, 2019

Ms. Tanya Hamilton
Site Vice President
Shearon Harris Nuclear Power Plant
Duke Energy Carolinas, LLC
5413 Shearon Harris Rd.
Mail Code HNP01
New Hill, NC 27562-9300

SUBJECT: SHEARON HARRIS NUCLEAR POWER PLANT – NRC TEMPORARY
INSTRUCTION 2515/194 INSPECTION REPORT 05000400/2019012

Dear Ms. Hamilton:

On May 16, 2019, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Shearon Harris Nuclear Power Plant and discussed the results of this inspection with Mr. J Dills and other members of your staff. The results of this inspection are documented in the enclosed report.

The NRC inspectors did not identify any finding or violation of more than minor significance.

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/

Christopher Even, Chief (Acting)
Construction Inspection Branch 2
Division of Construction Oversight

Docket No.: 05000400
License No.: NPF-63

Enclosure:
Inspection Report 05000400/2019012

cc w/ encl: Distribution via Listserv

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INSTRUCTION 2515/194 INSPECTION REPORT 05000400/2019012
June 24, 2019

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

Docket Number: 05000400

License Number: NPF-63

Report Number: 05000400/2019012

Enterprise Identifier: I-2019-012-0014

Licensee: Duke Energy Progress, LLC

Facility: Shearon Harris Nuclear Power Plant

Location: New Hill, NC 27562

Inspection Dates: May 13, 2019 to May 16, 2019

Inspectors: G. Crespo, Sr. Construction Inspector
J. Kent, Construction Inspector

Approved By: Christopher Even, Chief (Acting)
Construction Inspection Branch 2
Division of Construction Oversight

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring licensee's performance by conducting Temporary Instruction 2515/194, "Inspection of the Licensee's Implementation of Industry Initiative Associated with the Open Phase Condition Design Vulnerabilities in Electric Power Systems (NRC Bulletin 2012-01)," at Shearon Harris Nuclear Power Plant, in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to <https://www.nrc.gov/reactors/operating/oversight.html> for more information.

List of Findings and Violations

No findings were identified.

Additional Tracking Items

None.

INSPECTION SCOPE

This inspection was conducted using Temporary Instruction 2515/194 (ADAMS Accession No. ML17137A416), dated October 31, 2017. The inspectors reviewed the licensee's implementation of Nuclear Energy Institute (NEI) voluntary industry initiative (VII) in compliance with Commission guidance. The inspectors discussed the licensee's open phase condition system design and ongoing implementation plans with plant staff. The inspectors reviewed licensee documentation, vendor documentation, and performed system walkdowns to verify that the installed equipment was supported by the design documentation. These reviews were also made to determine if the licensee had completed the installation and testing of equipment, installed and tested alarming circuits both local and in the control room, and analyzed potential impacts associated with the design implementation on the current licensing basis. The inspectors reviewed the positioning of the control switches in the individual system cabinets to verify the status of the system tripping functions. These tripping functions of the system had not been activated, however they were wired and ready to be activated from the control switches in the front of the system cabinets.

OTHER ACTIVITIES – TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL

Temporary Instruction 2515/194 - Inspection of the Licensee's Implementation of Industry Initiative Associated With the Open Phase Condition Design Vulnerabilities In Electric Power Systems (NRC Bulletin 2012-01) (1 Sample)

The objective of Temporary Instruction 2515/194 is to verify that licensees have appropriately implemented the NEI VII (ADAMS Accession No. ML15075A454), dated March 16, 2015, including updating their licensing basis to reflect the need to protect against open phase conditions.

Temporary Instruction 2515/194-03.01 - VII (Part 1)

Shearon Harris Nuclear Power Plant selected the open phase detection system designed and manufactured by Power System Sentinel Technologies, LLC. At the end of this inspection, the system remained in the monitoring mode of operation to facilitate continued data gathering of grid perturbations for evaluation of alarm and trip setpoints. The equipment was installed on the start-up transformers (SUT)-1A and SUT-1B. The licensee is scheduled to transition the open phase detection system to full implementation (tripping functions enabled) by December 2019.

INSPECTION RESULTS

Based on discussions with the licensee staff, review of available design, testing, grid data trending results documentation, and walkdowns of installed equipment, the inspectors had reasonable assurance the licensee appropriately implemented the VII.

The inspectors determined:

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| Assessment | 2515/194 |
| <u>Detection, Alarms, and General Criteria; TI 2515/194-03.01 – VII (Part 1)</u> | |
| (1) Open phase conditions will be detected and alarmed in the control room on the common | |

annunciator panel.

(2) Detection circuits will be sensitive enough to identify an open phase condition for all credited loading conditions for installed equipment.

(3) No Class-1E circuits were being replaced with non-Class 1E circuits in the design.

(4) The updated final safety analysis report (UFSAR) has been updated to discuss the design features and analyses related to the effects of, and protection for, and open phase condition (OPC) design vulnerability.

Assessment

2515/194

Protective Actions Criteria; TI 2515/194-03.01 – VII (Part 1)

(1) Two transformers were susceptible to an open phase condition and the licensee had installed detection and mitigating equipment for both.

(2) With an open phase condition present and with or without an accident condition signal, the open phase design would not adversely affect the function of important-to-safety systems, structures, or components. The licensee's open phase condition design solution added two Power System Sentinel Technologies, LLC systems on the start-up transformer SUT-1A and SUT-1B. The tripping function, when enabled, will provide an additional input to the associated transformer lockout relays. The credited plant response is unaffected and will be the same regardless of the conditions that generated the lockout of the transformer.

The inspectors identified the following exceptions to the Temporary Instruction criteria resulting from the operating status of the design modifications:

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| Assessment | 2515/194 |
| <u>Detection, Alarms, and General Criteria Exceptions; TI 2515/194-03.01 – VII (Part 1)</u> | |
| <p>(1) The licensee’s design was operating in the monitoring mode with already established setpoints and gathering data to ensure the open phase condition design and protective schemes would minimize mis-operation, or spurious actions in the range of voltage unbalance normally expected in the transmission system. The licensee developed engineering calculations to demonstrate coordination of the OPC detection and tripping setpoints for the actuation circuit that does not result in lower overall plant operation reliability. This calculation was presented in HNP E5-0007, Open Phase Protection System Evaluation.</p> <p>(2) A draft of the UFSAR was available for the inspector’s review that included information related to open phase conditions. The licensee provided the inspectors with proposed changes to the licensing basis that discussed the system requirements related to the effects of, and protection for, any open phase condition design vulnerability.</p> | |

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| Assessment | 2515/194 |
| <u>Protective Actions Criteria Exceptions; TI 2515/194-03.01 – VII (Part 1)</u> | |
| <p>(1) The licensee’s open phase condition design solution uses Power System Sentinel Technologies, LLC to detect, alarm, and provide an input to the associated SUT transformer lockout relays. Upon transformer lockout, the existing undervoltage relays would operate as designed to initiate starting of the emergency diesel generator to restore power to the bus.</p> <p>The tripping function input to the transformer lockout relays remained deactivated during the onsite system implementation inspection and was not able to be demonstrated to perform the designed function. This action was being tracked in the design change package EC 402237, which provides for the final electrical terminations required to enable the open phase protection (OPP) system SUT lockout function. Once enabled, the OPP system will have the ability to isolate an affected SUT with a OPC detected on the high side of the SUTs.</p> <p>Due to the configuration of Shearon Harris Nuclear Power Plant’s electrical distribution system, a loss of phase on one transformer would only affect one train of equipment, and loads required to mitigate postulated accidents would be available on the non-affected train, ensuring that safety functions are preserved as required by the current licensing bases.</p> <p>(2) Periodic tests, calibrations, setpoint verifications or inspections (as applicable) have been established for any new protective features. The surveillance requirements have been maintained for the plant Technical Specifications (TSs) in compliance with the provisions of 10 CFR 50.36.</p> <p>The licensee has included preventive maintenance activities for the installed equipment as part of Work Orders 20139791-01 and 20139792 -01. Existing plant equipment will continue to be maintained according to the licensee’s current preventative maintenance program.</p> | |

The inspectors identified the following observation:

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| Observation | 2515/194 |
| <p>The inspectors identified a condition presented as an observation to the licensee's staff concerning the raceway used to route the high side neutral conductor from the H0 terminal post through the OPP system cabinets and finally to ground. This is a solidly grounded system on the transmission lines feeding the two startup transformers SUT-1A and SUT-1B primary side. The neutral ground connection cable is a 1/C 4/0 AWG Copper RSCC 600V 90 DEG C FIREWALL(R) III-J (UL) VW-1 SUN RES OIL RES II FOR CT USE TYPE RHH OR RHW-2 XLPE CSPE FMRC GP-1 P62-5093 as inscribed on the cable. This insulated cable is routed through a ferrous rigid galvanized 2" conduit that is not connected to this cable at either end of the run. The inspectors obtained information on the short circuit available current in the event of a phase to ground short in the primary feeder. The magnitude of the current from a line to ground short would exceed 26,000 amps. Since this is only a single conductor with current flow in only one direction at any time, it may inductively magnetize the conduit and present a choking type restriction to the current flow to ground. This choking type restriction may cause the system to be less sensitive to an open phase condition. An Action Request – 02253069 – 07 was generated to review and document this observation.</p> | |

EXIT MEETINGS AND DEBRIEFS

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

- On May 16, 2019, the inspector presented the NRC inspection results to Mr. J Dills and other members of the licensee staff.

DOCUMENTS REVIEWED

| Inspection Procedure | Type | Designation | Description or Title | Revision or Date |
|----------------------|-----------------------------|--------------------------------|---|------------------|
| 2515/194 | Calculations | HNP E5-0007 | Open Phase Protection System Setpoint Evaluation | 03 |
| | Corrective Action Documents | A/R 02253069 Assignment NBR 07 | Evaluate NRC Observation of the installation of the SUT high side neutral conductor being installed in ferrous conduit from the SUT Neutral to the OPPS cabinets | |
| | | EC 296261 A/R 01977405 | Screen to implement the 1st phase of the NEI initiative to mitigate the OPC design vulnerability on the offsite power system | |
| | | EC 402237 A/R 02079940 | Provides the final electrical terminations required to enable the OPP system SUT lockout function | |
| | | EC402237 A/R 02079940 | 10 CFR 50.59 Evaluation will physically connect the OPP system installed under EC 296261 to the corresponding SUT lockout relay. Once implemented, the OPP system will be capable of locking-out a SUT | |
| | | EC402237 A/R Number: 2090444 | Provides for the final electrical terminations required to enable the OPP system SUT lockout function. Once enabled, the OPP system will have the ability to isolate an affected SUT with a OPC detected on the high side of the SUTs | |
| | Drawings | CAR 2166 B-401 | Control Wiring Diagram – Spent Fuel Pool Instrumentation | 07 |
| | | HNP 1364-099317 S01 | Open Phase CH 1 Electrical Drawings | 00 |
| | | HNP 1364-099317 S02 | Open Phase CH 1 Electrical Drawings | 01 |
| | | HNP 1364-099317 S07 | Open Phase CH 1 Electrical Drawings | 01 |
| | | HNP 1364-099317 S13 | Open Phase CH 1 Electrical Drawings | 00 |
| | | HNP 1364-099318 S06 | Open Phase CH 2 Electrical Drawings | 00 |
| | | HNP 1364-099318 S07 | Open Phase CH 2 Electrical Drawings | 00 |
| | | HNP 6-B-401 1614 | Control Wiring Diagram “A” Start-up Transformers Protection Lockout Relay 86/STUA Sh. 1 | 18 |

| Inspection Procedure | Type | Designation | Description or Title | Revision or Date |
|----------------------|---------------------|--|--|------------------|
| | | HNP 6-B-401 1614A | "B" Start-up Transformers Protection Lockout Relay 86/STUB Sheet 1 | 17 |
| | | HNP 6-B-401 1617A | "B" Start-up Transformer Open Phase Protection System Control Cabinets | 01 |
| | | HNP 6-G-0029 | Main & 6900 Volt Auxiliary One Line Wiring Diagram | 28 |
| | | HNP CAR 2166 – G-040 | Start-up Transformer Protective Relaying & 6.9 KV Bus Transfer Logic Diagram Unit 1 | 05 |
| | | HNP PD5165-BC-01 | AC Power Distribution System Unit 1 | 15 |
| | Engineering Changes | EC 0000296261 | Installation of PSStech OPP System on Startup Transformer | 14 |
| | | EC 0000402237 | SUT Open Phase Fault Detection and Protection | 03 |
| | Miscellaneous | AD-LS-ALL-0005 | UFSAR Change Summary Form | 04 |
| | | AD-LS-ALL-0015 | EC 402237R3 TS Bases 3 / 4.8 | 05 |
| | | Attachment Z07 - IEGR-MN-317 | Open Phase Protection (OPP) System Operating and Maintenance Manual | 0.0.2 |
| | | Attachment Z08R002 – IEGR-DD-867 | Open Phase Protection (OPP) System – Non-Class 1E OPP Protection Settings, Harris Start-up Transformer | 0.0.5 |
| | | IER 17-5 | Simulator Training, Lesson IER-SIM-18.0 | 01 |
| | | NCP-E-0002 | CONTROL CABLE AND LOW VOLTAGE POWER CABLE | 00 |
| | | Power System Sentinel Technologies OPD | Power System Sentinel Technologies OPD Industry Training | 02/07/2017 |
| | | Required Reading OPS-JITI-12-25 | Required Reading OPS-JITI-12-25 | 10/25/2012 |
| | | Required Reading OPS-JITI-14-09 | IER2 12-14, Automatic Scram at Byron NPS | 03/13/2014 |
| | | Required Reading OPS-JITI-17-05 | Open Phase Protection System (EC 296261) | 07/24/2017 |
| | Procedures | AOP-039 | STARTUP AND UNIT AUXILIARY TRANSFORMER TROUBLE | 15 |
| | | AOP-039-BD | STARTUP AND UNIT AUXILIARY TRANSFORMER TROUBLE | 19 |

| Inspection Procedure | Type | Designation | Description or Title | Revision or Date |
|----------------------|-------------|-------------|---|------------------|
| | | APP-ALB-022 | MAIN CONTROL BOARD (Annunciator Panel Procedure) | 91 |
| | | APP-ALB-023 | AUXILIARY EQUIPMENT PANEL NO. 1 (Annunciator Panel Procedure) | 51 |
| | | OP-116 | FUEL POOL COOLING SYSTEM | 43 |
| | | OP-156.02 | AC ELECTRICAL DISTRIBUTION | 165 |
| | | OST-1023 | OFF SITE POWER AVAILABILITY VERIFICATION WEEKLY INTERVAL MODES 1, 2, 3, 4, 5, 6 | 34 |
| | Work Orders | 20139791 01 | EL, EC 407016, SUT-A, SUT OPEN PHASE FAULT DET & PROTECTION | 08/31/2017 |
| | | 20139792 01 | EL, EC 407017, SUT-B, SUT OPEN PHASE FAULT DET & PROTECTION | 08/15/2017 |