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

August 28, 2019

Mr. Charles Kharrl
Site Vice President
Southern Nuclear Operating Co., Inc.
7388 North State Highway 95
Columbia, AL 36319

SUBJECT: JOSEPH M. FARLEY NUCLEAR POWER PLANT – NRC 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) STAND-ALONE INSPECTION REPORT 05000348/2019012 & 05000364/2019012

Dear Mr. Kharrl:

On June 27, 2019, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Joseph M. Farley Nuclear Power Plant and discussed the results of this inspection with Mr. D. Komm, Plant Manger, and other members of your staff. Based upon additional information after the initial exit date, a re-exit was completed July 22, 2019 with Mr. Gene Surber, Licensing Manager. The results of this inspection are documented in the enclosed report.

The NRC inspectors did not identify any findings or violations 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, and Requests for Withholding."

Sincerely,

/RA/

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

Docket Nos.: 05000348 / 05000364
License No.: NPF-2 / NPF-8

Enclosure:
Inspection Report 05000348/2019012 & 05000364/2019012
w/ Attachment: TI 2515/194 Inspection
Documentation Request

cc w/ encl: Distribution via Listserv

SUBJECT: JOSEPH M. FARLEY NUCLEAR POWER PLANT – NRC TEMPORARY INSTRUCTION 2515/194 INSPECTION REPORT 05000348/2019012 & 05000364/2019012

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U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Number:	05000348 / 05000364
License Number:	NPF-2 and NPF-8
Report Numbers:	05000348/2019012 and 05000364/2019012
Enterprise Identifier:	I-2019-012-0014
Licensee:	Southern Nuclear Operating Company, Inc.
Facility:	Joseph M. Farley Nuclear Plant, Units 1 and 2
Location:	Columbia, AL
Inspection Dates:	June 24 to June 27, 2019
Inspectors:	G. Crespo, Sr. Construction Inspector C. Stancil, Sr. Resident Inspector
Approved By:	Christopher Even, Acting Chief 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 Joseph M. Farley 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 regulatory requirements and current licensing bases. The inspector discussed the licensee's OPC 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. The inspectors verified that the licensee had completed the installation and testing of equipment, installed and tested alarming circuits both local and in the control rooms, and analyzed potential impacts associated with the design implementation on the current licensing basis.

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 OPCs.

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)

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

Joseph M. Farley 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 was not in the monitoring mode. The OPC system was awaiting repairs and evaluation of operation settings by the manufacturer/installer prior to placing the system back into monitoring mode annunciating in the Main Control Rooms. The equipment was installed on the start-up transformers (SAT-1A, SAT-1B, SAT-2A and SAT-2B). The licensee's schedule to transition the open phase detection system to full implementation (tripping functions enabled) has not yet been defined.

INSPECTION RESULTS - OBSERVATIONS

Based on discussions with the licensee staff, review of available documentation, and walkdowns of installed equipment, the inspectors had reasonable assurance the licensee is appropriately implementing the voluntary industry initiative.

The inspectors identified:

Assessment	2515/194
Detection, Alarms, and General Criteria; TI 2515/194-03.01 – VII (Part 1)	

(1) OPCs could be detected in some of the system cabinets but additional adjustments were needed to reliably detect the OPC and avoid repeated nuisance alarms. Nuisance alarms resulted in the annunciator signals being blocked by operators for long periods of time. The transformer panel alarm modules must be unblocked (removed from the "off" position) to allow open phase indications to be alarmed on the main control room annunciator panels.

(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, any OPC design vulnerability for the monitoring function. However, the proposed trip function had not been enabled, but draft UFSAR changes had been prepared.

Assessment	2515/194

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

(1) Four transformers were susceptible to an open phase condition and the licensee had installed detection and mitigating equipment on all four.

(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 system channels on each start-up transformer SAT-1A, SAT-1B, SAT-2A and SAT-2B. The trip 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.

No findings were identified.

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

Assessment	2515/194

Detection, Alarms, and General Criteria Exceptions; TI 2515/194-03.01 – VII (Part 1)

(1) The licensee's OPC protection system could operate in the monitoring mode with calculated setpoints while gathering data to ensure the OPC design and protective schemes would minimize mis-operations, or spurious actions in the range of voltage imbalance normally expected in the transmission system. However, any monitoring alarms transmitted to the main control room were blocked at the transformer summary alarm panels located in the transformer yard due to numerous and repeated alarm signals coming from the Open Phase Detection panels.

(2) The inspectors identified several exceptions that were presented to the licensee's staff concerning existing conditions/alarms in the open phase protection (OPP) systems for all four

SAT transformers. These conditions prevented the open phase protection system from annunciating in the main control room for both Unit 1 & Unit 2. In addition, there were no routine operator rounds nor administrative compensatory measures required for the OPP panels. These concerns were placed into the licensee's corrective action program with the following condition reports:

1. CR 10623313: SAT 1A – OPP Channel 1 had a 50nDT neutral overcurrent alarm. Neutral current indicated 137.2 amps. Channel 2 indicated 0.8 amp for the same cable.

2. CR 10623322: SAT 1B – OPP Injection Abnormal current persisted after the March 2019 adjustment by PSSTech under previous CR 10508305.

3. CR 10623525: Two qualified system operators performing rounds were not familiar with OPP administrative tracking item (ATI) to perform daily OPP alarm checks, while local transformer alarm modules were in the off position (cutout, main control room notification blocked). ATI was updated per CR 10623717 below.

4. CR 10623755: Units 1 & 2 Operator rounds were not updated to include routine checks for open phase detection system. The licensee's original plan was pending the implementation of the OPP trip functions. This CR requests operator checks of the OPP prior to the trip function being enabled.

5. CR 10623717: Unit 1 ATI #216 was in place for monitoring transformer conditions associated with cutout alarm window D8, SU 1A Low Oil Level, but did not have an action to check the OPP panels. The ATI was updated to add the OPP checks.

Assessment	2515/194

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

(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 Start-up Auxiliary Transformer (SAT) 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. These open phase protection systems were installed under design change packages DCP SNC679759 for SAT-1A, DCP SNC679760 for SAT-1B, DCP SNC679761 for SAT-2A, and DCP SNC679762 for SAT-2B.

The trip 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. The OPP trip circuit was installed; however, this trip function will remain disabled until sliding links are closed under design change packages DCP SNC900664 for SAT-1A and SAT-1B, and DCP SNC900665 for SAT-2A and SAT-2B.

Due to the configuration of the Farley 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. (2) As of this inspection, periodic tests, calibrations, setpoint verifications or inspections (as applicable) had not been established for any new protective features. There are no changes to the surveillance requirements for the plant Technical Specifications (TSs) in compliance with the provisions of 10 CFR 50.36.

No findings were identified.

The inspectors identified the following observations:

Observation	2515/194
Inspectors identified conditions that do not deal directly with the protection functions of the OPP system include: 1. CR 10623319: SAT 1A OPP Channel 2 had high Temp Alarm. The air conditioning unit associated with this OPP cabinet was not operating. 2. CR 10623325: Unit 2 Low Voltage Switchyard alarm panel deficiencies, which included door hinge failing, door latch missing hardware, and 2A SAT label missing its respective alarm module grouping. 3. CR 10623348: The SAT 2B neutral conductor wire was not properly restrained, and therefore, sagging between the cooling fans and the transformer, potentially touching the transformer cooling fins and radiator fan. 4. CR 10623516/10623521: Procedure FNP-1(2)-ARP-5.0 required a revision for alarm windows C8 and D8 to add information/actions erroneously provided for windows C12 and D12. OPP field wiring is appropriately installed for windows C8 and D8 as evidenced by alarm testing witnessed by the inspectors.	

EXIT MEETINGS AND DEBRIEFS

On July 22, 2019, the inspector presented the NRC inspection results to Mr. D. Komm, Plant Manager, and other members of the licensee staff. Based upon additional in-office review after the initial exit date, a re-exit was completed via telephone on July 22, 2019 with Mr. Gene Surber, Licensing Manager. The inspectors verified no proprietary information was retained or documented in this report.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
2515/194	Calculations	SNC 900664J004	Farley Unit 1 Farley Nuclear Power Plant Open Phase Detection System PSSTech Setpoints and System Results Calculation (MPR-2380-0024-CALC-004 Farley Nuclear Power Plant Open Phase Detection System Results Calculation)	01
	Condition Report	CR 10623313	SAT 1A – OPP Channel 1 has a 50nDT neutral overcurrent alarm. (NRC identified)	6/25/2019
		CR 10623322	SAT-1B – OPP Injection Abnormal (NRC identified)	6/25/2019
		CR 10623525	SO Performing operator rounds was not familiar with the Admin Tracking Item (ATI) associated with OPP nor the required checks per ATI. (NRC identified)	6/25/2019
		CR 10623755	Unit 1 and Unit 2 Operator rounds are not updated to include checks of open phase panels. There is currently no formal tracking mechanism in place to ensure they are updated. (NRC identified)	6/26/2019
		CR 10623717	Unit 1 ATI Administrative Tracking Item 216 was in place for tracking and monitoring for OPP panels for Alarm (D8) SU 1A Low Oil Level did not have action to check OPP panel. ATI updated to add OPP. (NRC identified)	6/26/2019
		CR 10623319	SAT 1A – OPP Channel 2 has high Temp Alarm. (NRC identified)	6/25/2019
		CR 10623325	Unit 2 Low Voltage Switchyard alarm panel deficiencies, which included door hinge failing, door latch missing hardware, and 2A SAT label missing from the top of alarm column. (NRC identified)	6/25/2019
		CR 10623348	SAT-2B Neutral cable is sagging. (NRC identified)	6/25/2019
		CR 10623516 /10623521	Procedure FNP-1(2)-ARP-5.0 needs change for window C8 and D8 for information provided for windows C12 and D12. The panels in the field have OPP in windows C8 and D8. (NRC identified > 1 year since licensee identified with no action)	6/25/2019

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
	Drawings	D-172784	Farley Unit 1 – ELEM. DIAG. – Generator and Transformer Auxiliary Relays	4.0
		D-172852	Farley Unit 1 – Elementary Diagram – Start-UP Auxiliary Transformer 1A & 1B Controls	12.0
		D-172962	Farley Unit 1 – Wiring Diagram – Local Annunciator Cabinet Unit & Start-Up Auxiliary Transformer.	4.0
		D-202784	Farley Unit 2 – ELEM. DIAG. Generator and Transformer Auxiliary Relay.	9.0
		D-202852	Farley Unit 2 – Elementary Diagram – Start-UP Auxiliary Transformer 2A & 2B Controls	9.0
		D-356870	Farley Unit 1 – Connection Diagram Open Phase Protection (OPP) Panel N1R11NO501	1.0
		D-356877	Farley Unit 2 – Connection Diagram Open Phase Protection (OPP) Panel N2R11NO501	1.0
		U-736629	Farley Unit 1 - OPEN PHASE PROTECTION (OPP) SYSTEM, ELECTRICAL DRAWINGS, CHANNEL 1 & CHANNEL 2 (18 pages)	2.0
		U-736630	Farley Unit 1 - OPEN PHASE PROTECTION (OPP) SYSTEM, Panel Physical & Layout (8 pages)	2.0
		U-736670	OPEN PHASE PROTECTION (OPP) SYSTEM, NON-CLASS 1E OPP PROTECTION SETTINGS, STARTUP AUXILIARY TRANSFORMER FARLEY 1A,2A,1B AND 2B	1.0
		D-172700	Farley Unit 1 – Main Single Line Diagram Generator & 4160 Volt Transformer	21.0
		D-177000	Farley Unit 1 – Single Line – Electrical Auxiliary System (Normal – 4160V & 600V)	33.0
		D-177001	Farley Unit 1 – Single Line – Electrical Auxiliary System (Emergency – 4160V & 600V)	23.0
		D-202700	Farley Unit 2 – Main Single Line Diagram Generator & 4160 Volt Transformer	21.0
		D-207000	Farley Unit 2 – Single Line – Electrical Auxiliary System (Normal – 4160V & 600V)	26.0
		D-207001	Farley Unit 2 – Single Line – Electrical Auxiliary System (Emergency – 4160V & 600V)	22.0

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		D-356872	Farley Unit 2 – Block Diagram of OPP System Startup XFMR 2A (N2R11N0501) Sheet 1 of 2	1.0
		D-356872	Farley Unit 2 – Block Diagram of OPP System Startup XFMR 2B (N2R11N0501) Sheet 2 of 2	1.0
		D-513698	Farley Unit 1 – Block Diagram of OPP System Startup XFMR 1B (N1R11N0502) Sheet 2 of 2	1.0
		D-513698	Farley Unit 1 – Block Diagram of OPP System Startup XFMR 1A (N1R11N0502) Sheet 1 of 2	1.0
		D-207009	Farley Unit 2 – Single Line Protection and Metering 600V Load Center 2C	1.0
		D-207007	Farley Unit 2 – Single Line Protection and Metering 600V Load Center 2A	1.0
		D-177009	Farley Unit 1 – Single Line Protection and Metering 600V Load Center 1C	1.0
	Design Change Packages	SNC900664 (Trip Function)	Installation and functionally test Phase 1 of the OPP System panels for SAT-1A and SAT-1B	2
		SNC900665 (Trip Function)	Installation and functionally test Phase 1 of the OPP System panels for SAT-2A and SAT-2B	2
		SNC679759	Installation, Testing, and Commissioning of the OPP system for the Startup Auxiliary Transformer 1A	2.0
	Miscellaneous	FNP-FSAR	Section 8.2.1.3 Offsite Power Supply to Plant (page 8.2-3)	29
		FNP-FSAR (proposed)	Section 8.2.1.3 Offsite Power Supply to Plant (page 8.2-3), with trip function enabled	28, October/2018
		Tech Spec	Table 3.3.5-2 Loss of Power Diesel Generator Start Instrumentation	Amend 206 Unit 1 Amend 202 Unit 2
		SNC900665E205	Open Phase Protection (OPP) System, Non-Class 1E OPP Protection Settings, Startup Auxiliary Transformer Farley 1A, 2A, 1B, and 2B	2
	Procedures	FNP-1-ARP-1.12	Main Control Board Annunciator Panel M	71

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		FNP-1-ARP-5.0	Annunciator Response Procedure / Unit/Start-up Transformer Miscellaneous Alarm Panel	13
		FNP-1-SOP-36.1	Startup, Unit Auxiliary, and Main Transformers Preparation for Operation	38.4
		FNP-2-ARP-1.12	Main Control Board Annunciator Panel M	50.1
		FNP-2-ARP-5.0	Unit Aux/Start-up Transformers Miscellaneous Alarm Panel	10.1
	Work Orders	20139791 01	EL, EC 407016, SUT-A, SUT OPEN PHASE FAULT DET & PROTECTION	08/31/2017