



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 EAST LAMAR BOULEVARD
ARLINGTON, TEXAS 76011-4511

February 4, 2019

Mr. Eric Larson, Site Vice President
Entergy Operations, Inc.
Grand Gulf Nuclear Station
P.O. Box 756
Port Gibson, MS 39150

SUBJECT: GRAND GULF NUCLEAR STATION, UNIT 1 – NRC INSPECTION
OF TEMPORARY INSTRUCTION 2515/194, INSPECTION
REPORT 05000416/2019011

Dear Mr. Larson:

On January 10, 2019, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Grand Gulf Nuclear Station. On January 10, 2019, the NRC inspector 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 inspector 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/

Frances C. Ramírez, Acting Chief
Engineering Branch 2
Division of Reactor Safety

Docket: 50-416
License: NPF-29

Enclosure: Inspection Report 5000416/2019011
w/ Attachment: TI 2515/194 Inspection
Documentation Request

U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Number: 05000416

License Number: NPF-29

Report Number: 05000416/2019011

Enterprise Identifier: I-2019-011-0020

Licensee: Entergy Operations, Inc.

Facility: Grand Gulf Nuclear Station

Location: Port Gibson, Mississippi

Inspection Dates: January 8, 2019, to January 10, 2019

Inspector: S. Graves, Senior Reactor Inspector

Approved By: Frances C. Ramírez
Acting Chief, Engineering Branch 2
Division of Reactor Safety

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting Temporary Instruction 2515/194, "Inspection of the Licensees' Implementation of Industry Initiative Associated with the Open Phase Condition Design Vulnerabilities in Electric Power Systems (NRC Bulletin 2012-01)," at Grand Gulf Nuclear Station 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), effective November 1, 2017. The inspector reviewed the licensee's implementation of Nuclear Energy Institute's voluntary industry initiative in compliance with Commission guidance. The inspector discussed the licensee's open phase condition system design and ongoing implementation plans with plant staff. The inspector reviewed licensee and vendor documentation, and performed system walkdowns to verify that the installed equipment was supported by the design documentation. The licensee had recently completed the physical installation and the equipment was being operated in a monitoring mode with the trip functions disabled.

OTHER ACTIVITIES – TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL

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

The objective of Temporary Instruction 2515/194 is to verify that licensees have appropriately implemented the Nuclear Energy Institute Voluntary Industry Initiative (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 - Voluntary Industry Initiative (Part 1)

Entergy Operations Inc. selected the open phase detection system designed and manufactured by PCS2000 Solutions, LLC, as the design vendor for the open phase condition system at Grand Gulf Nuclear Station.

At Grand Gulf Nuclear Station, Service Transformer 11 (1R15S111) and Service Transformer 21 (2R15S121) provide power to normal plant loads and provide the preferred offsite power supply to the engineered safety features (ESF) busses. Engineered Safety Feature Transformer 12 (SR11S012) provides an alternate offsite power supply to the engineered safety features busses only. The open phase condition equipment was installed on both service transformers and the engineered safety features transformer 12. The equipment installation was completed in October 2018.

At the end of this inspection the PCS2000 system was in the "monitoring mode" of operation to facilitate continued data gathering of local bulk power system performance for evaluation and establishing alarm and trip setpoints. The licensee had originally scheduled transitioning the PCS2000 system to full implementation (tripping functions enabled) in December 2018, however the licensee submitted letter CNRO2018-00053 notifying the NRC of a schedule change to the open phase condition detection implementation. The revised implementation date, December 2019, is as described in the September 20, 2018 letter from the Nuclear Energy Institute to the NRC (ML18268A114) which, in part, allows for a period of up to 24 months for local bulk power system performance review prior to engaging the tripping function.

INSPECTION RESULTS – OBSERVATIONS/ASSESSMENT

Based on discussions with licensee staff, review of design and testing documentation, and walkdowns of installed equipment, the inspector had reasonable assurance the licensee is appropriately implementing, with noted exceptions discussed below, the voluntary industry initiative.

The inspector determined by design document review, walkdowns, staff discussions, and observation that:

Detection, Alarms and General Criteria	TI 2515/194-03.01 - Voluntary Industry Initiative (Part 1)
(1)	Open phase conditions will be detected and alarmed in the control room.
(2)	Detection circuits will be sensitive enough to identify an open phase condition for all credited loading conditions.
(3)	No Class-1E circuits were being replaced with non-Class 1E circuits in the design.

Protective Actions Criteria	TI 2515/194-03.01 - Voluntary Industry Initiative (Part 1)
(1)	The identified transformers were susceptible to an open phase condition and the licensee was implementing design changes to mitigate the effects.
(2)	With an open phase condition present and no accident condition signal, the PCS2000 system would not adversely affect the function of important-to-safety systems, structures, or components. The licensee's open phase condition design solution added a set of additional tripping inputs in parallel with existing transformer isolation controls. This addition added a new tripping condition (open phase) to the previously analyzed electrical faults which result in isolation of the transformers. The credited plant response was unaffected and would be the same regardless of the conditions that generated the isolation of the transformer.

No findings were identified.

The inspector identified the following exceptions to the Temporary Instruction criteria resulting from the incomplete design modifications:

Detection, Alarms and General Criteria Exceptions	TI 2515/194-03.01 - Voluntary Industry Initiative (Part 1)
<p>(1) The licensee's design installation was essentially complete on the three transformers, and the licensee had begun to gather data in a monitoring mode of operation to ensure the open phase condition design and protective schemes would minimize misoperation or spurious actions in the range of voltage unbalance normally expected in the local bulk power transmission system. As part of the system setpoint tuning process, open phase system alarms from the PCS2000 system were bypassed to limit control room operator burden due to frequent spurious alarms. Discussions with the licensee identified that all other transformer alarms were active. The licensee planned to engage the PCS2000 system alarms once appropriate setpoints were determined.</p> <p>Because actual demonstration of this criterion requires the system to be in operation with final trip setpoints established, the inspector was not able to fully verify this criterion. After discussions with licensee staff, walkdown of control room panels where the open phase condition alarm had been connected, review of alarm response instructions, and review of design documentation the inspector had reasonable assurance that the actuation circuit design would not result in lower overall plant operation reliability. The inspector did not identify any issues of concern.</p> <p>(2) The Updated Final Safety Analysis Report (UFSAR) had not been updated to include information related to open phase conditions at the conclusion of the onsite inspection. The licensee provided a copy of Condition Report CR-GGN-2019-00133, written to change the Updated Final Safety Analysis Report to reflect a credible design vulnerability in the electric power system presented by an open phase condition. The licensee expected to update their Updated Final Safety Analysis Report after completion of the final modifications to initiate the tripping function. The inspector did not identify any issues of concern.</p>	

Protective Actions Criteria Exceptions	TI 2515/194-03.01 - Voluntary Industry Initiative (Part 1)
<p>(1) With an open phase condition present and accident condition signal present, the PCS2000 system would not adversely affect the function of the Load Shedding and Sequencing (LSS) System to provide a means of automatically disconnecting and sequencing on loads on the Division I and II safety-related busses; only a new tripping condition (open phase) was being added to the electrical faults which result in isolation of the preferred or alternated offsite sources of power. A loss of voltage caused by isolation of either preferred offsite source or the alternated offsite source due to an open phase condition does not have an adverse effect on the availability of the other two offsite sources, or to the onsite emergency power source. While no changes to this configuration were planned due to the inclusion of the PCS2000 system, actual demonstration of this criterion requires the system to be in full operation. The inspector did not identify any issues of concern.</p> <p>(2) At the time of this inspection, the licensee had not finalized documentation for periodic tests, calibrations, setpoint verifications, or inspection procedures for open</p>	

phase protection system equipment. The inspector held discussions with licensee staff and identified that the vendor guidance, including periodic tests, setpoint verification, and equipment maintenance and inspection would be integrated into plant procedures and processes. The licensee had entered this issue into their corrective action program as Condition Report CR-GGN-2019-00135, to ensure recommended preventative maintenance tasks transition into model work orders, and ensure equipment is part of Maintenance Rule. The new equipment is also subject to the requirements of the North American Electric Reliability Corporation (NERC) protection and control standards for transmission and generation protection system maintenance and testing.

The licensee also captured inspector observations and questions related to inspection criteria for the transformer bushing current transformers to PCS2000 cabinet connection boxes and cables, conduits and seals. These issues were entered into the corrective action program as Condition Reports CR-GGN-2019-00195, -00197, and -00198. The inspector did not identify any issues of concern.

EXIT MEETINGS AND DEBRIEFS

On January 10, 2019, the inspector presented the Temporary Instruction 2515/194 inspection results to Mr. E. Larson, Site Vice President, and other members of the licensee staff. The inspector verified no proprietary information was retained or documented in this report.

DOCUMENTS REVIEWED

TEMPORARY INSTRUCTION 2515/194 - INSPECTION OF THE LICENSEES' IMPLEMENTATION OF INDUSTRY INITIATIVE ASSOCIATED WITH THE OPEN PHASE CONDITION DESIGN VULNERABILITIES IN ELECTRIC POWER SYSTEMS (NRC BULLETIN 2012-01)

Condition Reports (CR-GGN-)

2019-00131
2019-00133
2019-00134
2019-00135
2019-00163
2019-00164

Drawings Number	Title	Revision
E-0001	Main One Line Diagram	54
E-0105-002	R11 ESF XFMR Protection & Control ESF Transformer 12, Units 1 & 2	8
E-0105-007	R11 ESF XFMR Protection & Control ESF XFMR 12 Local & Cont. Rm. Computer & Annunciator, Units 1 & 2	8
E-0107-007	R27 Control Room Interface MOAB J3885, Units 1 & 2	8
E-0110-03	R21 4.16KV BOP System Incoming Breaker 152-1903, Units 1 & 2	7
E-0110-04	R21 4.16KV BOP System Incoming Breaker 152-1904, Units 1 & 2	7
E-0110-05	R21 4.16KV BOP System Incoming Breaker 152-1905, Units 1 & 2	7
E-1102-003	R15 Service Transformer Protection & Control Computer & Annunciator, Unit 1	3
E-2012-003	R15 Service XFMR 21 Protection & Control Annunciator & Computer, Unit 2	4
M3460146	Service Transformer ST-11 Backup Differential Lockout Relay	5
M3470D37	ST-21 Backup Differential DC Schematic Diagram	1

Design Documents Number	Title	Revision
EC 52500	Install Open Phase Detection Capability on Service Transformers 11 & 21 and Engineered Safety Features Transformer 12	0
EC 56728	Install Open Phase Detection on ST21	0
EC 56730	Service Transformer 11 Open Phase Detection System Installation	0
EC 56731	ESF Transformer 12 Full Open Phase Detection System Installation	0
EC-Q1111-15001	Open Phase Analysis	0
Miscellaneous Documents Number	Title	Revision
LBDCR 2018-106	Licensing Basis Document for UFSAR update	
SDC-16	System Design Criteria – Load Shedding and Sequencing System (R21-1)	0
Procedures Number	Title	Revision
04-S-02-SH13-P807	Alarm Response Instruction Panel No: SH13-P807	35
Vendor Documents Number	Title	Date
460004462	PCS2000 Open Phase Detection System User Manual	May 20, 2015
460004466	PCS2000 Open Phase Detection System Hardware Requirements Specification	June 30, 2014

TI 2515/194 Inspection Documentation Request

Please provide the following documentation (Items 1 – 8) to the lead inspector prior to the onsite inspection date, preferably no later than December 17, 2018. Whenever practical, please provide copies electronically. Please provide an index of the requested documents which includes a brief description of the document and the numerical heading associated with the request (i.e., where it can be found in the list of documents requested).

Sam Graves, Senior Inspector
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817-200-1102
Samuel.graves@nrc.gov

1. Copies of any calculations, analyses, and/or test reports performed to support the implementation of your open phase condition (OPC) solution. If, in your implementation, OPCs are not detected and alarmed in the control room please include documentation that:
 - a. Demonstrates the OPC will not prevent functioning of important-to-safety SSCs; AND
 - b. Detection of an OPC will occur within a short period of time (e.g., 24 hours).
2. Copies of any modification packages, including 10 CFR 50.59 evaluations if performed, used for or planned for the implementation of your OPC solution.
3. Copies of periodic maintenance, surveillance, setpoint calibration, and/or test procedures implemented or planned, for your OPC solution.
4. Copies of your licensing basis changes to Updated Final Safety Analysis Report (UFSAR) and/or Technical Specifications (TS), or equivalent, as applicable, which discuss the design features and analyses related to the effects of, and protection for, any open phase condition design vulnerability. If these documents have not been updated, provide documentation of your plans to do so.
5. Copies of any procurement specifications and acceptance testing documents related to the installation of your OPC solution.
6. Copies of any site training the inspector will need to accomplish to gain access to areas with, or planned, major electrical equipment used in your OPC solution (i.e. switchyard).
7. Provide documentation showing that with an OPC occurrence and no accident condition signal present, either:
 - a. An OPC does not adversely affect the function of important-to-safety SSCs, OR
 - b. TS LCOs are maintained or the TS actions are met without entry into TS LCO 3.0.3
AND
 - i. Important-to-safety equipment is not damaged by the OPC, AND
 - ii. Shutdown safety is not compromised

8. With OPC occurrence and an accident condition signal present:
 - a. Provide documentation showing that automatic detection and actuation will transfer loads required to mitigate postulated accidents to an alternate source and ensure that safety functions are preserved, as required by the current licensing bases, OR
 - b. Provide documentation showing that all design basis accident acceptance criteria are met with the OPC, given other plant design features. Accident assumptions must include licensing provisions associated with single failures. Typically, licensing bases will not permit consideration of the OPC as the single failure since this failure is a non-safety system.

Please provide the following documentation to the inspector when onsite. Whenever practical, please provide copies electronically, except for drawings. Drawings should be provided as paper copies of sufficient size (ANSI "C" or "D") such that all details are legible.

9. A brief presentation describing your electric power system design and typical electrical transmission and distribution system alignments; OPC design schemes installed to detect, alarm and actuate; bus transfer schemes; and maintenance and surveillance requirements. This presentation should be a general overview of your system. Please schedule the overview shortly after the entrance meeting.
10. Plant layout and equipment drawings for areas that identify: (a) the physical plant locations of major electrical equipment used in your open phase condition solution; (b) the locations of detection and indication equipment used in the open phase condition sensing circuits.
11. If OPC actuation circuits are required, provide documentation that demonstrates continued coordination with the other protective devices in both the offsite electrical system (within Grand Gulf's area of responsibility) and the onsite electrical systems.
12. Access to locations in which open phase condition equipment is installed or planned (i.e. switchyard, etc.)
13. Copies of documentation or testing that demonstrates your OPC solution minimizes spurious actuation or misoperation in the range of voltage imbalance normally expected in the transmission system that could cause undesired separation from an operable off-site power source.

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GRAND GULF NUCLEAR STATION, UNIT 1 – NRC INSPECTION OF TEMPORARY
INSTRUCTION 2515/194, INSPECTION REPORT 05000416/20190111– FEBRUARY 4, 2019

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