



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**

REGION IV
1600 EAST LAMAR BOULEVARD
ARLINGTON, TEXAS 76011-4511

January 7, 2020

Mr. Sergio Vazquez
Site Vice President
Entergy Operations, Inc.
17265 River Road
Killona, LA 70057

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 – TEMPORARY
INSTRUCTION 2515/194 (INSPECTION REPORT 05000382/2019011)

Dear Mr. Vazquez:

On December 11, 2019, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Waterford Steam Electric Station, Unit 3, and 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.

No findings or violations of more than minor significance were identified during this inspection.

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 Title 10 of the *Code of Federal Regulations* 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Nicholas H. Taylor, Chief
Engineering Branch 2
Division of Reactor Safety

Docket No. 05000382
License No. NPF-38

Enclosure:
As stated

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WATERFORD STEAM ELECTRIC STATION, UNIT 3 – TEMPORARY
INSTRUCTION 2515/194 (INSPECTION REPORT 05000382/2019011) -
JANUARY 7, 2020

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U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Number: 05000382

License Number: NPF-38

Report Number: 05000382/2019011

Enterprise Identifier: I-2019-011-0028

Licensee: Entergy Operations, Inc.

Facility: Waterford Steam Electric Station, Unit 3

Location: Killona, LA

Inspection Dates: December 10, 2019, to December 11, 2019

Inspector: S. Graves, Senior Reactor Inspector

Approved By: Nicholas H. Taylor, 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 at Waterford Steam Electric Station, Unit 3, 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 or violations of more than minor significance were identified.

Additional Tracking Items

None.

INSPECTION SCOPE

Inspections were conducted using the appropriate portions of the Temporary Instruction (TI) inspection in effect at the beginning of the inspection unless otherwise noted. Samples were declared complete when the TI requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program - Operations Phase." The inspector reviewed selected procedures and records, observed activities, and interviewed personnel to assess licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

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)

This inspection was conducted using Temporary Instruction 2515/194 (ADAMS Accession No. ML17137A416), effective November 1, 2017, 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. The inspector reviewed the licensee's implementation of Nuclear Energy Institute's voluntary industry initiative in compliance with Commission guidance. The inspector reviewed and discussed the licensee's open phase condition system design, installation, testing and maintenance plans with plant staff, and performed system walkdowns to verify that the installed equipment was supported by the design documentation.

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 - 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 Waterford Steam Electric Station, Unit 3.

During normal operations, auxiliary power for plant electrical loading is supplied by the unit's main generator through a unit auxiliary transformer for each redundant train. For unit startup and off-normal conditions, Waterford Steam Electric Station, Unit 3, has two Startup Transformers ST-EMT-A and ST-EMT-B, which are connected to the 230-kV switching yard and are normally operated in a standby condition. The startup transformers provide the preferred source of offsite power to the station's safety-related 4-kV power system. Both transformers have solidly grounded wye wound primary windings, which the licensee identified as susceptible to an open phase condition. Startup Transformer ST-EMT-A serves as the standby source for train A, Startup Transformer ST-EMT-B serves as the standby source for train B. The system is designed to fast transfer loads to a startup transformer following a turbine generator or reactor trip without a loss of auxiliary load. Each unit's engineered safety features buses are capable of being supplied from either the associated unit auxiliary transformer during normal operation or the associated startup transformer from offsite power.

Waterford Steam Electric Station, Unit 3, installed redundant open phase detection systems on each startup transformer and at the end of this inspection the PCS2000 system was operating normally with all functions enabled.

INSPECTION RESULTS

Observation: Temporary Instruction 2515/194-03.01 - Voluntary Industry Initiative (Part 1)	2515/194
<p>Based on discussions with licensee staff, review of design, installation and testing documentation, tour of the control room and discussions with operators, and walkdowns of installed equipment, the inspector had reasonable assurance that the licensee has appropriately implemented the voluntary industry initiative.</p> <p><u>Detection, Alarms, and General Criteria</u></p> <p>(1) Open phase conditions will be detected and alarmed in the control rooms.</p> <p>(2) Detection circuits are sensitive enough to identify an open phase condition for all credited loading conditions.</p> <p>(3) The PCS2000 system is designed and has been tuned to minimize misoperation or spurious action in the range of voltage unbalance normally expected in the transmission system that could cause separation from an operable offsite power source. The licensee had demonstrated that the actuation circuit design did not result in lower overall plant operation reliability.</p> <p>(4) No Class-1E circuits were replaced with non-Class 1E circuits in the design.</p> <p>(5) The licensee had updated the Final Safety Analysis Report and the Technical Specification Bases documents to discuss the design features and analyses related to the effects of, and protection for, any open phase condition vulnerabilities.</p> <p><u>Protective Actions Criteria</u></p> <p>(1) Startup Transformers ST-EMT-A and ST-EMT-B were identified as susceptible to an open phase condition and the licensee had implemented design changes to mitigate the effects.</p> <p>(2) With an open phase condition present and no accident condition signal present, 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 independent of the conditions that generated the isolation of the transformer.</p> <p>(3) With an open phase condition present and accident condition signal present, the PCS2000 system would not adversely affect the transfer of 4.16-kV engineered safeguards buses to the onsite emergency diesel generators as required by the current licensing bases; only a new tripping condition (open phase) was added to the electrical faults which result in isolation of the startup transformer. The 4.16-kV engineered safeguards buses are normally energized from the main generator through each train's unit auxiliary transformer and the non-</p>	

engineered safeguards buses. Upon loss of the normal power source, the engineered safeguards loads are automatically transferred to the selected startup transformer. Isolation of the startup transformer due to an open phase condition results in the engineered safeguards loads being automatically transferred and energized from the respective emergency diesel generator in the same manner as required by the current licensing bases.

(4) The inspector held discussions with licensee staff and identified that the vendor guidance, including periodic tests, setpoint verification, and equipment maintenance and inspections had been integrated into plant procedures and processes. The licensee had performed a pre-inspection self-assessment, documented in Condition Report LO-WLO-2019-00029 which documented, in part, the licensee's actions to determine if any of the open phase detection components needed to be included in the Maintenance Rule program and integrate previous operating experience from other Entergy inspections into the Waterford Steam Electric Station, Unit 3, program. The licensee was in the process of developing additional procedures and processes to inspect and maintain the PCS2000 equipment in addition to that recommended by the vendor, and to meet North American Electric Reliability Corporation standards.

EXIT MEETINGS AND DEBRIEFS

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

- On December 11, 2019, the inspector presented the Temporary Instruction 2515/194 results to Mr. S. Vazquez, Site Vice President, and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
2515/194	Calculations	ECE15-002	Coordination of Open Phase Detection Time Delay Trip Setting	0
	Corrective Action Documents	AR 264850	Create a new RQ under PMID-5234 and PMID-5235 to replace batteries for components installed in the Open Phase Detection System for ST-A and ST-B. Battery replacements must occur at or before 10 years.	12/16/2016
		CR-WF3-2019-06595, CR-WF3-2019-06597, CR-WF3-2019-06599		
	Corrective Action Documents Resulting from Inspection	CR-WF3-2019-08921		
	Drawings	5817-14365	SUT-A Start Up Transformer OPD Systems 1 & 2 Communication Block Diagram	
		5817-14375, Sheet 1	SUT-A Start Up Transformer OPD Systems 1 & 2 Plant Contacts Schematic Diagram	0
		5817-14376, Sheet 1	SUT-B Start Up Transformer OPD Systems 1 & 2 Plant Contacts Schematic Diagram	0
		B424, Sheet 2244	Startup Transf 3A Diff Relay and Open Phase Detection	4
		B424, Sheet 2245	Startup Transf 3A Lockout Relay	20
		B424, Sheet 3089	ST EMT-A Open Phase Detection Control Wiring Diagram	0
		B424, Sheet 3090	ST EMT-B Open Phase Detection Control Wiring Diagram	1
		G285	Main One Line Diagram	24
		G347	Transformer Yard Conduit & Grounding	13
	Engineering Changes	EC 52305	Design Change to Detect Open Phase Condition on Primary Side of Startup Transformers A and B (Byron Event) IER-L2-12-14, CR-WF-2012-932, SIPD 1630	000
		EC 52306	Startup Transformer A - Design Change to Detect Open Phase Condition (CHILD EC OF 52305)	0
		EC 62976	Activation of Trip Circuit on The PCS2000 Open Phase	000

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
			Detection System for Startup Transformers A and B (Byron Event) IER-L2-12-14, CR-WF3-2012-932 (PARENT)	
	Miscellaneous		Factory Acceptance Test - Waterford SUT A	9/2/2015
			Factory Acceptance Test - Waterford SUT B	9/3/2015
		LBDCR #16-066	LBDCR updates FSAR Section 8.2.1.6.4 and TS Bases 3/4.8.1 to include descriptions of the Open Phase Detection system trip capability for Startup Transformers ST EMTA and ST EMTB as a result of EC62977.	
		OPD ST-A PMTP CHILD EC62977 EC80850	Enable Open Phase Detection Trip Function – CHILD for ST EMTA	0
		PCS2000 Open Phase Detection System SAT	Waterford SUTB Site Acceptance Test	0
		Post Modification Test Plan for EC 52306 ECN61227	Startup Transformer A - Design Change to Detect Open Phase Condition (CHILD EC OF 52305)	
		Post Modification Test Plan for EC 52307 ECN61228	Startup Transformer B - Design Change to Detect Open Phase Condition (CHILD EC OF 52305)	
		Procedure Improvement Request to ME-004-071	Add A New Section to ME-004-071 for the Open Phase Detection System (OPD)	N/A
		Topic Notes EC No. 62976, Rev. No. 0	Enable Open Phase Detection Trip Function - PARENT EC	
		WF3-EE-17-00001	SUT-A & SUT-B Open Phase Detection Monitoring Period Report November 2015 - May 2016	0
		WF3-EE-17-00002	SUT-A & SUT-B Open Phase Detection Monitoring Period Report May 2016 - May 2017	0
	Procedures	OP-600-035	MT, UAT, SUT Local Panel (Section 4.3, SUT A(B) Open Phase Detection)	017
	Self-Assessments	LO-WLO-2019-	Self-Assessment NRC Inspection TI 2515/194	8/15/2019

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		00029		
	Work Orders	00397144	Perform Modification EC52306 on ST EMTA Open Phase	12/11/2015
		00441413	RF21-Complete Install of Open Phase Detect Sys for ST EMTA	3/11/2019
		00441419	RF21-Complete Install of Open Phase Detect Sys for ST EMTB	4/2/2019
		00524970	ST IC3089-A1, Retrieve OPD Computer Data	5/17/2019
		00524972	ST IC3090-B1, Retrieve OPD Computer Data	5/17/2019