



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**  
REGION I  
2100 RENAISSANCE BOULEVARD, SUITE 100  
KING OF PRUSSIA, PENNSYLVANIA 19406-2713

January 4, 2021

Mr. David P. Rhoades  
Senior Vice President  
Exelon Generation Company, LLC  
President and Chief Nuclear Officer  
Exelon Nuclear  
4300 Winfield Road  
Warrenville, IL 60555

SUBJECT: LIMERICK GENERATING STATION, UNITS 1 AND 2 – TEMPORARY  
INSTRUCTION 2515/194 INSPECTION REPORT 05000352/2020015 AND  
05000353/2020015

Dear Mr. Rhoades:

On December 10, 2020, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Limerick Generating Station, Units 1 and 2 and discussed the results of this inspection with Mr. Frank Sturniolo, Site Vice President 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,

X /RA/

---

Signed by: Glenn T. Dentel  
Glenn T. Dentel, Chief  
Engineering Branch 2  
Division of Reactor Safety

Docket Nos. 05000352 and 05000353  
License Nos. NPF-39 and NPF-85

Enclosure:  
As stated

cc w/ encl: Distribution via LISTSERV®

SUBJECT: LIMERICK GENERATING STATION, UNITS 1 AND 2 – TEMPORARY  
INSTRUCTION 2515/194 INSPECTION REPORT 05000352/2020015 AND  
05000353/2020015 DATED JANUARY 4, 2021

**DISTRIBUTION:**

DLew, RA (R1ORAMAIL Resource)  
 RLorson, DRA (R1ORAMAIL Resource)  
 DCollins, DRP (R1DRPMAIL Resource)  
 BPham, DRP (R1DRPMAIL Resource)  
 PKrohn, DRS (R1DRSMAIL Resource)  
 JGreives, DRP  
 LCasey, DRP  
 TCorcoran, DRP  
 AZiedonis, DRP, SRI  
 SHaney, DRP, RI  
 Nesch, DRP, AA  
 RSkokowski, RI OEDO  
 RidsNrrPMLimerick Resource  
 RidsNrrDorlLpl1 Resource  
 ROPreports Resource

DOCUMENT NAME: G:\DRS\Engineering Branch 2\Branch Open Phase Condition (OPC)\\_TI-194 Inspections (Region 1)\Limerick\Lim OPC IR 2020-015.docx

**ADAMS ACCESSION NUMBER: ML21004A133**

<input checked="" type="checkbox"/> SUNSI Review		<input checked="" type="checkbox"/> Non-Sensitive <input type="checkbox"/> Sensitive		<input checked="" type="checkbox"/> Publicly Available <input type="checkbox"/> Non-Publicly Available	
OFFICE	RI/DRS	RI/DRS	RI/DRP	RI/DRS	
NAME	LDumont	DWerkheiser	JGreives	GDentel	
DATE	01/04/2021	12/21/2020	12/21/2020	01/04/2021	

OFFICIAL RECORD COPY

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

Docket Numbers: 05000352 and 05000353

License Numbers: NPF-39 and NPF-85

Report Numbers: 05000352/2020015 and 05000353/2020015

Enterprise Identifier: I-2020-015-0003

Licensee: Exelon Generation Co., LLC

Facility: Limerick Generating Station, Units 1 and 2

Location: Sanatoga, PA 19464

Inspection Dates: December 7, 2020 to December 10, 2020

Inspectors: L. Dumont, Reactor Inspector  
D. Werkheiser, Senior Reactor Analyst

Approved By: Glenn T. Dentel, 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 a Temporary Instruction 2515/194 inspection at Limerick Generating Station, Units 1 and 2, 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 SCOPES

The inspection was conducted using Temporary Instruction 2515/194 (ADAMS Accession No. ML17137A416), effective November 1, 2017. The inspectors reviewed the licensee's implementation of the Nuclear Energy Institute's voluntary industry initiative in compliance with Commission guidance. The inspectors 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. Starting on March 20, 2020, in response to the National Emergency declared by the President of the United States on the public health risks of the coronavirus (COVID-19), inspectors were directed to begin telework. In addition, regional baseline inspections were evaluated to determine if all or portion of the objectives and requirements stated in the IP could be performed remotely. If the inspections could be performed remotely, they were conducted per the applicable IP. In some cases, portions of an IP were completed remotely and on site. The inspections documented below met the objectives and requirements for completion of the IP.

## OTHER ACTIVITIES – TEMPORARY INSTRUCTIONS, INFREQUENT AND ABNORMAL

### 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)

The inspectors reviewed the licensee's implementation of the "Nuclear Energy Institute Voluntary Industry Initiative," (ADAMS Accession No. ML19163A176) dated June 6, 2019. This included reviewing how the licensee updated their licensing basis to reflect the need to protect against open phase conditions.

### 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)

- (1) Exelon selected the open phase detection system designed and manufactured by Schweitzer Engineering Laboratories (SEL), as the design vendor for the open phase condition system at Limerick Generating Station.

Limerick Generating Station has two independent offsite sources (220 kV and 500 kV) which provide power via the station auxiliary buses to the appropriate 4 kV safeguard buses through the 101 and 201 safeguard transformers. The open phase protection system is designed to protect the 220 kV and 500 kV offsite power sources from a loss of phase scenario. Four SEL relays (260A104 & 105 and 260A204 & 205) were installed to monitor and alarm on each of the 4 offsite source transformers: the 10 station auxiliary transformer (220 kV), 20 regulating transformer (500 kV), and the 101 and 201 safeguard transformers. The relays are wired to provide annunciation if a loss of one or two phase conditions is detected. The loss of phase detection relays for each transformer include main control room annunciation for a trouble alarm associated with the station located relays. The associated substation control house also has annunciation window panels that provide trouble alarms for the relays.

Exelon uses the risk-informed method, which utilizes manual actions for protective action measures. At the end of this inspection the SEL system was monitoring and would alarm the control room if a loss of one or two phase conditions is detected.

## INSPECTION RESULTS

Observation: Temporary Instruction 2515/194-03.01 - Voluntary Industry Initiative	2515/194
<p>Based on discussions with Exelon staff, review of design and testing documentation, and walkdowns of installed equipment, the inspectors had reasonable assurance that Exelon is appropriately implementing the voluntary industry initiative at Limerick Generating Station. The inspectors verified the following criteria:</p> <p><u>Detection, Alarms and General Criteria</u></p> <ol style="list-style-type: none"><li>1. [03.01(a)(1)] Open phase conditions are detected and alarmed in the control room.</li><li>2. [03.01(a)(2)] In scenarios where automatic detection may not be possible due to very low or no load conditions, or when transformers are in a standby mode, automatic detection will occur as soon as loads are transferred to the standby source. Additionally, where automatic detection is not reliable, Exelon has established monitoring requirements on a per shift basis, to look for evidence of an open phase condition.</li><li>3. [03.01(a)(4)] No Class 1E circuits were being replaced with non-Class 1E circuits in this design.</li><li>4. [03.01(a)(5)] The Final Safety Analysis Report was updated to discuss the design features and analyses related to the effects of any open phase condition design vulnerability.</li><li>5. [03.01(a)(6)] The open phase condition detection and alarm components are maintained in accordance with Exelon's procedures or maintenance program, and periodic tests, calibrations setpoint verifications or inspections (as applicable) have been established.</li></ol> <p><u>Use of Risk-Informed Evaluation Method</u></p> <ol style="list-style-type: none"><li>1. [03.01(c)(1)] The plant configuration matched the changes made to the probabilistic risk assessment model to address an open phase condition, and the logic of the probabilistic risk assessment model changes is sound.</li><li>2. [03.01(c)(2)] The procedures which validate that the open phase condition alarm would identify the proper indication to validate the open phase conditions at all possible locations.</li><li>3. [03.01(c)(3)] Observations associated with procedure(s) and operator actions required to respond to an open phase condition alarm and potential equipment trip match the Human Reliability Analysis.</li><li>4. [03.01(c)(4)] Assumptions listed in the NEI 19-02 Appendix A evaluation and the sensitivity analyses listed in Section 5 of the evaluation were verified.</li><li>5. [03.01(c)(5)] Assumptions, procedures, operator actions, and Exelon's analyses specified above are consistent with the plant-specific design and licensing basis, including:<ol style="list-style-type: none"><li>a. Initiating events considered in the analysis</li><li>b. Boundary conditions specified in Attachment 1 of the NEI Voluntary Industry Initiative, Revision 3</li><li>c. Operating procedures for steps taken to recover equipment assumed tripped/locked out or damaged due to the open phase conditions (or use of alternate equipment)</li><li>d. Where recovery was assumed in the probabilistic risk assessment analysis for tripped electric equipment, restoration of the equipment was based on</li></ol></li></ol>	

analyses that demonstrate that automatic isolation trips did not result in equipment damage

No findings or exceptions were identified. Regarding the risk-informed evaluation method criterion 3, Exelon ensured operator actions were properly assessed in the human reliability analysis; however, the inspectors identified that periodic or simulator training were not being performed nor scheduled. Exelon documented this observation as CR-04389349 to evaluate recurring training or supplemental training (JPM and/or simulator).

## **EXIT MEETINGS AND DEBRIEFS**

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

- On December 10, 2020, the inspectors presented the NRC inspection results to Mr. Frank Sturniolo, Site Vice President, and other members of the licensee staff.

**DOCUMENTS REVIEWED**

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
2515/194	Corrective Action Documents	04286033		
	Corrective Action Documents Resulting from Inspection	04389403 04389349		
	Drawings	8031	Single Line Diagram Station	33
	Engineering Changes	0000618105		
	Engineering Evaluations	LM-MISC-033	Limerick Open Phase Condition Evaluation	0 and 1
	Procedures	6900E.05B	Determination of 4kV Switchgear Motor Protection	7
		ER-AA-200-1001	Equipment Classification	5
		GP-19, Appendix 4	Unit 2 Turbine Equipment Operator Activities	11
		SE-17	Loss of Single Phase From Offsite Source,	4
	Self-Assessments	04371769	Pre-NRC Inspection OPC Self-Assessment 2020	10/28/20