



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**

REGION I
2100 RENAISSANCE BOULEVARD, SUITE 100
KING OF PRUSSIA, PENNSYLVANIA 19406-2713

November 4, 2021

Mr. Brad Berryman
Senior Vice President and Chief Nuclear Officer
Susquehanna Nuclear, LLC
769 Salem Blvd., NUCSB3
Berwick, PA 18603

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2 –
TEMPORARY INSTRUCTION 2515/194 INSPECTION REPORT
05000387/2021011 AND 05000388/2021011

Dear Mr. Berryman:

On October 27, 2021, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Susquehanna Steam Electric Station, Units 1 and 2 and discussed the results of this inspection with Mr. Kevin Cimorelli, 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,

Glenn T. Dentel, Chief
Engineering Branch 2
Division of Operating Reactor Safety

Docket Nos. 05000387 and 05000388
License Nos. NPF-14 and NPF-22

Enclosure:
As stated

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SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2 –
 TEMPORARY INSTRUCTION 2515/194 INSPECTION REPORT
 05000387/2021011 AND 05000388/2021011 DATED NOVEMBER 4, 2021

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

Docket Numbers: 05000387 and 05000388

License Numbers: NPF-14 and NPF-22

Report Numbers: 05000387/2021011 and 05000388/2021011

Enterprise Identifier: I-2021-011-0020

Licensee: Susquehanna Nuclear, LLC

Facility: Susquehanna Steam Electric Station, Units 1 and 2

Location: 769 Salem Blvd., Berwick, PA

Inspection Dates: October 25, 2021 to October 27, 2021

Inspectors: A. Patel, Senior Reactor Inspector
F. Arner, Senior Reactor Analyst

Approved By: Glenn T. Dentel, Chief
Engineering Branch 2
Division of Operating 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 Susquehanna Steam Electric 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

Inspections were conducted using the appropriate portions of the inspection procedures (IPs) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at <http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html>. Samples were declared complete when the IP requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program - Operations Phase." 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 a 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. However, all the inspection activities were performed onsite. 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) Susquehanna Nuclear selected the open phase detection system designed and manufactured by PSSTech as the design vendor for the open phase condition system at Susquehanna Steam Electric Station. The open phase protection system is designed to protect the offsite power sources from a loss of phase condition. Startup Transformers T10 and T20 provide two 230 kV independent offsite power sources to the Susquehanna station from the bulk power system. Startup Transformers T10 and T20 provide offsite power for the Engineered Safeguard Auxiliary buses through 13.8kV Start Up Bus 10 (OA103) and Bus 20 (OA104). Four PSSTech open phase detection systems have been installed on the high side of Startup Transformers T10 and T20. The relays are wired to provide annunciation if a loss of phase condition is detected. Alarms from the open phase detection systems, including open phase condition alarms and panel trouble alarms, are annunciated in the control room at the "Start Up XFMR Trouble" alarm windows via the transformer's control panel. Additionally, the status of individual open phase detection system alarm conditions (including open phase detected, channel injection abnormal, and Injection source failure) are available on the plant process computer system.

In lieu of automatic open phase protective actions, Susquehanna Nuclear implemented an alarm only strategy which relies on proper operator actions to diagnose and respond to an open phase condition. At the end of this inspection the PSSTech relays were monitoring the associated power sources and would provide main control room annunciation if a loss of one or two phase conditions was detected or if a relay was non-functional.

INSPECTION RESULTS

Observation: Temporary Instruction 2515/194 - Section 03.01(a) and (c) Results	2515/194
<p>Based on discussions with Susquehanna Nuclear staff, review of design and testing documentation, and walkdowns of installed equipment, the inspectors had reasonable assurance that Susquehanna Nuclear is appropriately implementing the voluntary industry initiative at Susquehanna Steam Electric Station, Units 1 and 2. The inspectors verified the following criteria:</p>	
<p><u>Detection, Alarms and General Criteria</u></p>	
<ol style="list-style-type: none"> 1. [03.01(a)(1)] Open phase conditions are detected and alarmed in the control room. 2. [03.01(a)(2)] Open phase condition detection circuits are sensitive enough to identify an OPC for all credited transformer loading conditions (high and low loading). In addition, enhanced monitoring criteria have been proceduralized when automatic detection is out of service. 3. [03.01(a)(3)] The open phase condition design and protective schemes minimize misoperation or spurious action in the range of voltage unbalance normally expected in the transmission system that could cause separation from an operable off-site power source. Additionally, Susquehanna Nuclear has demonstrated that the actuation circuit design does not result in lower overall plant operation reliability. 4. [03.01(a)(4)] No Class-1E circuits were replaced with non-Class-1E circuits in this design. 5. [03.01(a)(5)] The Updated Final Safety Analysis Report was updated to discuss the design features and analyses related to the effects of any open phase condition design vulnerability. 6. [03.01(a)(6)] The open phase condition detection and alarm components are maintained in accordance with Susquehanna Nuclear's procedures or maintenance program, and periodic tests, calibrations setpoint verifications or inspections (as applicable) have been established. 	
<p><u>Use of Risk-Informed Evaluation Method</u></p>	
<ol style="list-style-type: none"> 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. 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 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. 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. 	

5. [03.01(c)(5)] Assumptions, procedures, operator actions and Susquehanna Nuclear's analyses specified above are consistent with the plant-specific design and licensing basis, including:
 - (a) Initiating events considered in the analysis
 - (b) Boundary conditions specified in Attachment 1 of the NEI Voluntary Industry Initiative, Revision 3
 - (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)
 - (d) Where recovery was assumed in the probabilistic risk assessment analysis for tripped electric equipment, restoration of the equipment was based on analyses that demonstrate that automatic isolation trips did not result in equipment damage

There were no findings or exceptions identified during the inspection.

EXIT MEETINGS AND DEBRIEFS

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

- On October 27, 2021, the inspectors presented the Temporary Instruction 2515/194 Inspection results to Mr. Kevin Cimorelli, 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 Resulting from Inspection	CR-2021-15357	Potential Knowledge Gap related to OPC	
		CR-2021-15358	Enhancement/Clarification for OPC Procedures	
		CR-2021-15359	AR-015-001 Simulator Alarm response was 3 revisions behind the current revision in NIMS	
	Engineering Evaluations	EC-RISK-0029	Open Phase Condition (OPC) Evaluation	Revision 1
	Procedures	AR-015-001	13.8/4kV Switchgear Distribution and Diesel Generators A, B, & C 0C653	Revision 59
		LA-0X103-001	0X103 Startup Transformer Local Alarm Responses	Revision 10
		LA-0X104-001	0X104 Startup Transformer Local Indicating Light Alarms	Revision 11