



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**

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

February 21, 2020

Mr. Brad Berryman
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
05000387/2020010 AND 05000388/2020010

Dear Mr. Berryman:

On February 5, 2020, 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,

/RA/

Glenn T. Dentel, Chief
Engineering Branch 2
Division of 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
 05000387/2020010 AND 05000388/2020010 DATED FEBRUARY 21, 2020

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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: 05000387/2020010 and 05000388/2020010

Enterprise Identifier: I-2020-010-0014

Licensee: Susquehanna Nuclear, LLC

Facility: Susquehanna Steam Electric Station, Units 1 and 2

Location: Berwick, PA

Inspection Dates: February 3, 2020 to February 5, 2020

Inspectors: S. Elkhiamy, Reactor Inspector
R. Pinson, Reactor Inspector

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 Temporary Instruction 2515/194 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

The inspection was conducted using Temporary Instruction 2515/194 (ADAMS Accession No. ML17137A416), effective November 1, 2017. The inspectors reviewed Susquehanna's implementation of the Nuclear Energy Institute's voluntary industry initiative in compliance with Commission guidance. The inspectors discussed Susquehanna's open phase condition system design and ongoing implementation plans with plant staff. The inspectors reviewed Susquehanna and vendor documentation, and performed system walkdowns to verify that the installed equipment was supported by the design documentation. Susquehanna had recently completed physical installation and the equipment was being operated in a monitoring mode with the trip functions disabled.

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. ML15075A454) dated March 16, 2015. 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 (OPD) systems have been installed on the high side of Startup Transformers 10 and 20 and are designed to trip the respective transformer T10 lockout relay 86A 1-10301 B or T20 lockout relay 86A 1-10401 B and initiate protective switching actions to restore power to the vital buses, upon detection of an open phase.

The relays are wired to provide annunciation and are configured to trip the associated power sources 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.

At the end of the inspection, the PSSTech system was in the "alarm only" mode of operation. The relay trip circuits were isolated from the lockout relays by leaving the

associated mode switches set to 'alarm only'. Susquehanna Nuclear plans to pursue an alternate implementation method (i.e. risk based with manual actions) for Unit 1 and Unit 2 to comply with the open phase detection initiative.

INSPECTION RESULTS

Temporary Instruction 2515/194-03.01 - Voluntary Industry Initiative	2515/194
<p>Based on discussions with Susquehanna staff, review of design and testing documentation, and walkdowns of installed equipment, the inspectors had reasonable assurance that the Susquehanna staff is appropriately implementing, with noted exceptions discussed below, the voluntary industry initiative at Susquehanna Station. The inspectors determined that:</p> <p><u>Detection, Alarms and General Criteria</u></p> <ol style="list-style-type: none"> 1. Detection circuits will be sensitive enough to identify an open phase condition for all credited loading condition. 03.01(a)(2) 2. No Class 1E circuits were being replaced with non-Class 1E circuits in this design. 03.01(a)(4) <p><u>Protective Actions Criteria</u></p> <ol style="list-style-type: none"> 1. The identified offsite power sources are susceptible to an open phase condition and the licensee was implementing design changes to mitigate the effects. 03.01(b)(1) 2. With an open phase condition present and no accident condition signal, the licensee determined there would be no adverse impact to important-to-safety equipment due to the open phase condition. The licensee performed an analysis demonstrating that during an open phase condition, important-to-safety equipment would remain powered at levels above current protective relaying setpoints and would not be damaged. 03.01(b)(2) <p>No findings were identified.</p>	

Detection, Alarms and General Criteria Exceptions	2515/194
<p>03.01(a)(1) The licensee has implemented (EPRI) – PSSTech design system which is used for detection, alarm, and actuation (mode switch in 'alarm-only'). Unit 2 Main Control Room alarm is currently non functional due to grounding and switching issues identified by the licensee (CRs 2018-14617 and 2018-14684). During the inspection, the inspectors identified that the compensatory measures on the startup bus associated with T20 were not being performed; specifically individual phase checks. CR 2020-01918 was written to address this condition. The local transformer panel alarms remained functional and operators performed daily rounds and would likely identify an open phase condition.</p> <p>03.01(a)(3) The licensee's design installation was essentially complete and was in the middle of completing a monitoring period with the alarms in 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 transmission system. During the monitoring phase, the licensee experienced spurious nuisance alarms (CR 2017-18224) and is working with the vendor to resolve, and establish new trip setpoints. The inspectors were unable to verify that the actuation circuit design does not result in lower overall plant operation reliability since this requires the system to be in operation with final trip setpoints established.</p>	

03.01(a)(5) The Updated Final Safety Analysis Report has been updated to include information related to open phase conditions; however the licensee has plans to pursue an alternate implementation method to comply with the open phase detection initiative, which will require further updates.

Protective Actions Exceptions	2515/194
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03.01(b)(3) Inspectors determined that with an open phase condition and an accident condition signal present, the open phase detection system would not adversely affect the function of the load shedding and sequencing system to provide a means of disconnecting and sequencing of loads on the safety-related buses. Features to automatically detect and isolate an open phase condition have been installed, but the automatic actuation of the system has been bypassed on both the T-10 and T-20 transformers while in the monitoring period.

03.01(b)(4) Periodic testing, preventive maintenance, and surveillance activities have not been established for the open phase protective features associated with the T-10 and T-20 transformers. The licensee has documented the need to evaluate for any required periodic testing or preventive maintenance activities in DI-2016-19710.

EXIT MEETINGS AND DEBRIEFS

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

- On February 5, 2020, the inspectors presented the NRC 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	CR 2017-18224		
		CR 2018-14617		
		CR 2018-14684		
		DI-2016-19710		
	Corrective Action Documents Resulting from Inspection	CR 2020-01901	Missing safety switch label plate	
		CR 2020-01904	Incorrect ON procedure reference for Alarm Response	
		CR-2020-01868	Failure to obtain properly closed out ODM IAW NDAP-QA-0333.	
		CR-2020-01918	Missing NPO documentation addressing SUB-20 phase current checks	
		CR-2020-01929	Exceptions Identified During NRC OPC Inspection	
	Engineering Changes	EC-003-1006	Evaluation of SSES Electrical Distribution System to Open Phase Conditions (Open Phase Study)	0
		EC-004-1031	Plant AC Loadflow Analysis	5
	Miscellaneous	AR1578080	ODM for offsite power source open circuit single event	5/24/2012
		CSD-OPD-006	Open Phase Detection System Basis of Design	11/18/2019
		IOM-1401	Open Phase Protection System Operating and Maintenance Manual	7/28/2017
		LDCN-5305	Open Phase Detection & Protection Alarm Only Enable for Startup Transformer T10	1
LDCN-5312		Open Phase Detection & Protection Alarm Only Enable for Startup Transformer T20	1	