



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**

REGION I
2100 RENAISSANCE BOULEVARD, SUITE 100
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September 30, 2021

Mr. Eric Carr
President and Chief Nuclear Officer
PSEG Nuclear, LLC
PO Box 236
Hancock's Bridge, NJ 08038

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNIT 1 & 2 – TEMPORARY
INSTRUCTION 2515/194 INSPECTION REPORT 05000272/2021011 AND
05000311/2021011

Dear Mr. Carr:

On September 22, 2021, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Salem Nuclear Generating Station, Unit 1 & 2 and discussed the results of this inspection with Mr. Richard DeSanctis Jr. 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. 05000272 and 05000311
License Nos. DPR-70 and DPR-75

Enclosure:
As stated

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SUBJECT: SALEM NUCLEAR GENERATING STATION, UNIT 1 & 2 – TEMPORARY INSTRUCTION 2515/194 INSPECTION REPORT 05000272/2021011 AND 05000311/2021011 DATED SEPTEMBER 30, 2021

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

Docket Numbers: 05000272 and 05000311

License Numbers: DPR-70 and DPR-75

Report Numbers: 05000272/2021011 and 05000311/2021011

Enterprise Identifier: I-2021-011-0018

Licensee: PSEG Nuclear, LLC

Facility: Salem Nuclear Generating Station, Unit 1 & 2

Location: Hancocks Bridge, New Jersey

Inspection Dates: September 20, 2021 to September 22, 2021

Inspectors: A. Patel, Senior Reactor Inspector
D. Werkheiser, 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 Salem Nuclear Generating Station, Unit 1 & 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) Salem Nuclear Generating Station, Units 1 and 2, has independent offsite sources (500kV) which provide power via the 500kv-13kV station power transformers to the 13kV-4kV station power transformers to the appropriate 4 kV safeguard buses. The open phase protection system is designed to protect the offsite power sources from a loss of phase scenario. The open phase protection system utilized at Salem Units 1 and 2 consists of a hybrid design with protection at both the 500 kV level and protection at the 13 kV level. At the 500 kV level, the open phase protection system utilizes the Power Systems Sentinel Technologies, LLC (PSSTech) design. At the 13 kV level, open phase protection is provided by SEL-751 multifunction negative sequence relays (59Q) that monitor each vital 4 kV bus infeed through potential transformers; eight relays total, four for each Salem Unit are installed.

In lieu of automatic open phase protective actions, PSEG 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 and SEL 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 PSEG staff, review of design and testing documentation, and walkdowns of installed equipment, the inspectors had reasonable assurance that PSEG is appropriately implementing, with a noted exception discussed below, the voluntary industry initiative at Salem Nuclear Generating 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, PSEG 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)(6)] The open phase condition detection and alarm components are maintained in accordance with PSEG'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 locations3. [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 PSEG's analyses specified above are consistent with the plant-specific design and licensing basis, including:<ol style="list-style-type: none">(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

Observation: Temporary Instruction 2515/194 - Section 03.01(a)(5) Exception	2515/194
<u>UFSAR not Updated to Reflect Current Open Phase Condition Detection and Protection Design</u>	
Criteria - [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.	
Exception - The Salem Nuclear Generating Station's Updated Final Safety Analysis Report was incorrectly updated to discuss the configuration of the open phase detection system (automatic isolation function enabled). The Updated Final Safety Analysis Report did not discuss the correct open phase detection and protection system configuration that was in place at the time of the inspection. A discussion of the analyses and design of the risk-based approach with manual operator actions in lieu of the automatic isolation function was not included.	
PSEG captured this deficiency in the corrective action program as Notification 20884545.	

EXIT MEETINGS AND DEBRIEFS

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

- On September 22, 2021, the inspectors presented the Temporary Instruction 2515/194 Inspection results to Mr. Richard DeSanctis, Jr. 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	20884545		
		20884559		
	Engineering Evaluations	SA-MISC-028	Salem Open Phase Condition (OPC) Evaluation	Revision 0
	Work Orders	80119154		