



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**

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

October 27, 2021

Ms. Maria Lacal, Executive Vice President  
and Chief Nuclear Officer  
Arizona Public Service Company  
P.O. Box 52034, MS 7602  
Phoenix, AZ 85072-2034

SUBJECT: PALO VERDE NUCLEAR GENERATING STATION – TEMPORARY  
INSTRUCTION 2515/194 REPORT 05000528/2021015 AND 05000529/2021015  
AND 05000530/2021015

Dear Ms. Lacal:

On September 20, 2021, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Palo Verde Nuclear Generating Station. On September 21, 2021, the NRC inspectors discussed the results of this inspection with Mr. Bruce Rash, Vice President Nuclear Engineering / Regulatory 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,

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

Docket Nos. 05000528 and 05000529 and 05000530  
License Nos. NPF-41 and NPF-51 and NPF-74

Enclosure:  
As stated

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SUBJECT: PALO VERDE NUCLEAR GENERATING STATION – TEMPORARY  
 INSTRUCTION 2515/194 REPORT 05000528/2021015 AND 05000529/2021015  
 AND 05000530/2021015- DATED OCTOBER 27, 2021

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

Docket Numbers: 05000528, 05000529 and 05000530

License Numbers: NPF-41, NPF-51 and NPF-74

Report Numbers: 05000528/2021015, 05000529/2021015 and 05000530/2021015

Enterprise Identifier: I-2021-015-0000

Licensee: Arizona Public Service Company

Facility: Palo Verde Nuclear Generating Station

Location: Tonopah, Arizona

Inspection Dates: September 13, 2021 to September 17, 2021

Inspectors: S. Makor, Reactor Inspector  
R. Deese, Senior Reactor Analyst

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 a Temporary Instruction 2515/194 at Palo Verde Nuclear Generating Station, 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 TIs with their attached revision histories are located on the public website at

<https://www.nrc.gov/reading-rm/doc-collections/insp-manual/temp-instructions/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 TI. In some cases, portions of an TI were completed remotely and on site. The inspections documented below met the objectives and requirements for completion of the TI.

## 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 Revision 3 to the "Nuclear Energy Institute Industry Initiative on Open Phase Condition," (ADAMS Accession No. ML19163A176) dated June 6, 2019. This review included the licensee's application of risk screening techniques to determine that the risk associated with an open phase condition (OPC) event is significantly reduced through the implementation of detection circuits and the use of operator manual actions in lieu of automatic trip functions. The inspectors also reviewed the updates to the PVNGS licensing basis to reflect the need to protect against open phase conditions.

Sections 03.01.a, "Detection, Alarms and General Criteria," and 03.01.b, "Protective Actions," were previously inspected and documented in Inspection Report (ADAMS Accession No. ML18103A157) 05000528; -529; -530/2018010 with noted exceptions. Because the licensee has chosen to demonstrate compliance with Revision 3 of the Open Phase Condition Initiative using the Risk Informed Evaluation Method in lieu of the designs automatic protective functions, section 03.01.c, "Use of Risk-Informed Evaluation Method" is inspected in this report.

### 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) 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)

Arizona Public Service (APS) Company selected the open phase detection system designed and manufactured by Power System Sentinel Technologies, LLC, (PSSTech) as the design vendor for the Palo Verde Nuclear Generating Station

(PVNGS). The licensee had installed an Open Phase Protection (OPP) on each Start-up transformer (SUT) that detects an Open Phase Condition (OPC) on the high voltage side of its applicable transformer from the offsite 525 kV transmission system. In total, the licensee installed six PSSTech open phase detection systems on three transformers.

The open phase condition equipment was installed on the SUTs AE-NAN-X01, AE-NAN-X02, and AE-NAN-X03 which provide power to station busses, including the station's six engineered safety feature (ESF) busses.

Each ESF bus is fed from a separate SUT connected to a common switchyard supplied by eight 525 kV offsite transmission lines. Each SUT is equipped with four windings: a primary, a tertiary and two secondary to transform 525 kV power into 13.8 kV power. During normal operations, each unit generates and delivers power to the 525-kV transmission system via the main generator through the Unit Auxiliary Transformer. The SUTs are normally lightly loaded, and the generator trip initiates a fast bus transfer of the non-1E loads to the SUT.

As part of the licensee's implementation of Revision 3 to the open phase initiative, the licensee used contractor services to model and evaluate the effects of open phase conditions (OPCs) on the PVNGS electrical distribution system and ESF/PRA-credited loads. The inspectors reviewed the contractor's report and assumptions and discussed the system distribution behavior under various open-phase scenarios with licensee staff.

Based on the licensee's analysis, PVNGS decided to not credit recovery and not enable the trip function.

## INSPECTION RESULTS

Observation: Temporary Instruction 2515/194-03.01 - Voluntary Industry Initiative	2515/194
<p>Based on discussions with PVNGS staff, review of design and testing documentation, and walkdowns of installed equipment, the inspectors had reasonable assurance that APS is appropriately implementing the voluntary industry initiative at PVNGS.</p> <p>The inspectors verified the following criteria:</p> <p>Detection, Alarms and General Criteria</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)] The team determined that detection circuits were sensitive enough to identify an open phase condition for all credited loading conditions.</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 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 Arizona Public Service Company procedures or maintenance program, and periodic tests, calibrations setpoint verifications or inspections (as applicable) have been established. The open phase equipment is covered under the</li> </ol>	

licensee's maintenance rule requirements.

Use of Risk-Informed Evaluation Method

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 matched 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 were verified.
5. [03.01(c)(5)] Assumptions, procedures, operator actions, and Arizona Public Service Company 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 from the effects of open phase conditions (or use of alternate equipment) was appropriate.
  - 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 didn't not result in equipment damage.

No findings or exceptions were identified.

**EXIT MEETINGS AND DEBRIEFS**

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

- On September 21, 2021, the inspectors presented the Temporary Instruction 2515/194 results to Mr. Bruce Rash, Vice President Nuclear Engineering / Regulatory and other members of the licensee staff.

## DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
2515/194	Corrective Action Documents		21-10239, 21-09803, 21-10368, 21-10509	
	Engineering Changes	2015-00400	Implement changes per DMWO 441244 - Installing OPP cabinets in Start-up yard	10/19/2018
	Engineering Evaluations	13-NS-B061	Event Tree Study	7
		17-12228-001	An evaluation was performed to determine the type and frequency of Preventative Maintenance (PM) for Open Phase Protection (OPP) cabinets and their Heating, Ventilation, and Air Conditioning (HVAC) units.	11/16/2020
		EE 20-02937-037	Perform a risk assessment in accordance with 81DP-0CC15 and NEI 19-02	09/05/2021
	Miscellaneous	13-NS-BS061	At-Power PRA Event Trees and Success Criteria	
		2015-00401	OPP Non-Class 1E OPP Protection Settings	1
		AE-NAN-C10A	Non-Class 1E Neutral Over -Current Relay Protecting Start-Up Transformer AE-NAN-X01 from "Open Phase" Conditions	06/21/2018
		AENANC10A*AC*ELECON	HVAC OPP cabinets	11/13/2020
		CDF Cutset Report 1	OPIS Automatic Trip Function Enabled	09/15/2021
		CDF Cutset Report 2	OPIS Automatic Trip Disabled	09/15/2021
		CDF Cutset Report 3	Differences - Trip Enabled versus Disabled	09/15/2021
		E003-00138	Open Phase Protection (OPP) System Operating and Maintenance Manual	0.0.1
		E003-00205	PSSTech Open Phase Protection System - Preventative Maintenance Guide	0.0.1
		IEGR-DD-184	Open Phase Protection (OPP System)	2
	Procedures	40AL-9MA01	Transformer Trouble Alarm Responses	49
		40AL-9MA01	Transformer Trouble Alarm Responses (TAPA)	49a
		40DP-9OPA9	Outside Area Operator Logs	19