10 CFR 50.73

BRUCE J. RASH
Vice President Nuclear
Engineering/Regulatory

Palo Verde
Nuclear Generating Station
5801 S Wintersburg Road
Tonopah, AZ 85354
Mail Station 7602
Tel 623 393 5102

102-08267-BJR/LMW
April 23, 2021

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS) Unit 2**
Docket No. STN 50-529 / License No. NPF 51
Licensee Event Report 2021-001-00

Enclosed please find Licensee Event Report (LER) 50-529/2021-001-00 that has been prepared and submitted pursuant to 10 CFR 50.73. This LER reports a Unit 2 reactor trip that occurred on February 26, 2021.

In accordance with 10 CFR 50.4, copies of this LER are being forwarded to the Nuclear Regulatory Commission (NRC) Regional Office, NRC Region IV, and the Senior Resident Inspector.

Arizona Public Service Company makes no commitments in this letter. If you have questions regarding this submittal, please contact Matthew Kura, Manager, Nuclear Regulatory Affairs, at (623) 393-5379.

Sincerely,

Rash, Bruce (Z77439)

Digitally signed by Rash, Bruce (Z77439)
DN: cn=Rash, Bruce (Z77439)
Date: 2021.04.23 10:48:33 -07'00'

BJR/LMW

Enclosure

cc: S. A. Morris NRC Region IV Regional Administrator
S. P. Lingam NRC NRR Project Manager for PVNGS
C. A. Peabody NRC Senior Resident Inspector for PVNGS

NRC FORM 366 (08-2020) | U.S. NUCLEAR REGULATORY COMMISSION | APPROVED BY OMB: NO. 3150-0104 | EXPIRES: 08/31/2023

LICENSEE EVENT REPORT (LER)

(See Page 3 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)

1. Facility Name	2. Docket Number	3. Page
Palo Verde Nuclear Generating Station (PVNGS) Unit 2	05000529	1 OF 5

4. Title

Automatic Actuation of the Reactor Protection System Resulting from a Loss of Reactor Coolant Pumps

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Rev No.	Month	Day	Year	Facility Name	Docket Number
										05000
02	26	2021	2021	- 001 -	00	04	23	2021	Facility Name	Docket Number
										05000

9. Operating Mode	10. Power Level
1	100

11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*

10 CFR Part 20	☐ 20.2203(a)(2)(vi)	☐ 50.36(c)(2)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(A)	**10 CFR Part 73**
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.69(g)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(4)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(i)	**10 CFR Part 21**	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(1)(i)
☐ 20.2203(a)(2)(ii)	☐ 21.2(c)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(i)
☐ 20.2203(a)(2)(iii)	**10 CFR Part 50**	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)	☐ 73.77(a)(2)(ii)
☐ 20.2203(a)(2)(iv)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)	
☐ 20.2203(a)(2)(v)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)	

☐ **Other** (Specify here, in Abstract, or in NRC 366A).

12. Licensee Contact for this LER

Licensee Contact	Phone Number (Include Area Code)
Matthew Kura, Manager, Nuclear Regulatory Affairs	623-393-5379

13. Complete One Line for each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable To IRIS	Cause	System	Component	Manufacturer	Reportable To IRIS
X	EA	HS	M302	Y					

14. Supplemental Report Expected	15. Expected Submission Date	Month	Day	Year
☒ No ☐ **Yes** (If yes, complete 15. Expected Submission Date)				

16. Abstract (Limit to 1560 spaces, i.e., approximately 15 single-spaced typewritten lines)

On February 26, 2021, at approximately 1033 Mountain Standard Time, a reactor trip of PVNGS Unit 2 occurred. A loss of power to the 13.8 kV non-class bus without a subsequent, expected fast bus transfer, caused two of four Reactor Coolant Pumps to trip. This resulted in an automatic, uncomplicated Unit 2 reactor trip when the Reactor Protection System generated trips on all four channels for low departure from nucleate boiling ratio and high local power density following a main turbine generator trip.

The event was initiated by inadvertent contact of a test switch in the Salt River Project switchyard. The probable cause of the failure to initiate a fast bus transfer was found to be surface debris and contaminants on the circuit contacts of the fast bus transfer auto/manual selector switch. The switch was replaced on February 27, 2021. Unit 2 entered Mode 1 on February 28, 2021.

No other Reactor Protection System actuation signals or actuations of plant engineered safety features systems occurred and all control element assemblies fully inserted into the reactor core. PVNGS Unit 1 and Unit 3 were operating at 100 percent power at the time of the event and were not impacted by the Unit 2 reactor trip.

Two previous similar events were reported by PVNGS in the last 3 years via Licensee Event Reports (LER) 05000529-2019-001-00 and 05000530-2018-001-00.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Palo Verde Nuclear Generating Station (PVNGS) Unit 2	05000-529	2021	- 001	- 00

NARRATIVE
All times are Mountain Standard Time and approximate unless otherwise indicated.

1. REPORTING REQUIREMENT(S):

This Licensee Event Report (LER) is being submitted pursuant to 10CFR 50.73(a)(2)(iv)(A) as an actuation of the Reactor Protection System (RPS) (EIIS: JC).

This event was reported to the NRC pursuant to 10 CFR 50.72 (b)(2)(iv)(B) on February 26, 2021 at 1524 ET, via the emergency notification system (EN 55114). This was a 4-Hr Non-Emergency report.

2. DESCRIPTION OF STRUCTURE(S), SYSTEM(S), AND COMPONENT(S):

SRP Switchyard Overview

The switchyard (EIIS: FK), which is owned and operated by the Salt River Project (SRP), is configured in a ring bus arrangement with redundant east and west buses. There are multiple distribution transmission line connections and unit generator output and start-up transformer connections. Each Palo Verde Nuclear Generation Station (PVNGS) unit's main generator connects to the SRP switchyard via two generator output breakers and one motor operated disconnect that allow the unit to remain connected to the grid in the event of a loss of one of the two switchyard buses (either east or west).

PVNGS Electrical Distribution System Overview

Three 525 kV tie lines supply power from the SRP switchyard to three start-up transformers (SUTs) located within the PVNGS switchyard. The three SUTs supply power to six 13.8 kV intermediate buses which ensure two physically independent circuits supply offsite (preferred) power to the onsite power system of each unit.

The PVNGS electrical distribution system provides electrical power to all non-safety related equipment via two non-class 1E alternating current (AC) 13.8 kV buses. During normal plant operations the 13.8 kV non-class 1E buses are powered via the unit auxiliary transformer.

The major loads supplied from these non-class 1E buses include the RCPs (EIIS: JC), circulating water pumps (EIIS: KE), support systems for the main feedwater pumps (EIIS: SJ), cooling water, and heating, ventilation, and cooling systems. The plant is designed such that the 13.8 kV non-class 1E buses can be powered from offsite power via the unit startup transformers through intermediate 13.8kV buses normally only used during startup, shutdown, and when the main generator (EIIS: TB) is offline. A fast bus transfer feature provides the ability to transfer power supply from the main turbine generator to offsite power via the SUT in the event of a main turbine generator trip to maintain power to all four RCPs.

Each startup transformer secondary winding is sized to start and carry one-half of the non-class 1E loads of one unit and two trains of Engineered Safety Feature (ESF) loads, one of which is from another unit, during unit trips or during startup/shutdown operation. Class 1E buses are normally supplied through ESF transformers via the startup transformers and intermediate 13.8 kV buses.

The main generator protection is provided by two 525 kV generator output breakers located in the SRP switchyard that function both as the generator output breakers and as a part of the SRP switchyard ring bus arrangement. A motor operated disconnect is an additional circuit interrupting device located between the main generator and the SRP output breakers.

SRP Main Generator Output Breaker Operation

The main generator output breakers are in the SRP switchyard and form a portion of the ring bus arrangement on the line side. They serve as circuit interrupting protective devices for both generator/plant side failures as well as SRP switchyard failures. For reliability and operating flexibility, the SRP 525 kV switchyard design includes a breaker and a half arrangement for each circuit along with breaker failure backup protection. Each breaker has two trip coils on separate, isolated direct current (DC) control circuits.

The two independent plant trip signals are sent to two independent SEL-387 relays designated as SRP Protection System (SPS) A and SPS B. The A and B protection systems are independent and redundant, where either of the two signals will trip open both generator output breakers. The SRP interface cabinet serves as the point of separation between the PVNGS power block and SRP switchyard for operation and maintenance of components.

Fast Bus Transfer

The Loss of Offsite Power following turbine trip and fast bus transfer function is described in the Accident Analysis section of the PVNGS Updated Final Safety Analysis Report, Section 15.0.2.4.

With the plant in normal plant operations, during a turbine trip or loss of supply from the unit auxiliary transformer, (not involving an electrical fault or under frequency) the sequence of events includes a fast bus transfer. A fast bus transfer would be initiated upon tripping of the unit auxiliary transformer output breakers, and the alternate supply breakers would close within a few cycles to connect the 13.8 kV buses to the startup transformers. Typically, the startup transformers supply buses during plant startup or at other times when the turbine generator or unit auxiliary transformer is out of service. Transfers of these buses can also be initiated by the plant operator from the control room.

In the event of a turbine trip during normal plant operations, not involving an electrical fault or under frequency, the turbine generator will remain synchronized to the extra high voltage transmission network until residual energy in the turbine is dissipated. The generator will motorize for a short period of time and will not trip until a sustained reverse power condition exists and the reverse power relay actuates. The reverse power relay actuation will initiate a sequential trip, which results in a fast bus transfer initiation. The reverse power relay actuation will simultaneously trip the generator exciter, the 525 kV breakers and the unit auxiliary transformer output breakers, thereby initiating a fast bus transfer.

Reactor Coolant System

The reactor coolant system (RCS) (EIIS: AB) is comprised of two main flow loops each of which includes two RCPs and one steam generator (EIIS: AB). The primary function of the RCPs is to provide the necessary head to maintain forced circulation of reactor coolant through the RCS during normal operations. Reactor coolant leaving the core of the reactor vessel enters two “hot legs”, one per loop, and flows to the Steam Generators (SG) (EIIS Code: AB). Critical operation of the reactor requires all four RCPs to be in operation to ensure adequate RCS flow. The RCPs are powered from non-class 1E 13.8 kV buses with two RCPs per bus. The fast bus transfer feature provides the ability to transfer power supply from the unit auxiliary transformer to offsite power via the SUT in the event of a main turbine generator trip (not involving an electrical fault or under frequency) to maintain power to all four RCPs.

Reactor Protection System

The Reactor Protection System (RPS) (EIIS Code: JC) consists of four independent, redundant channels and includes a number of sensors, calculators (including the core protection calculators (CPCs)(EIIS: JC)), logic circuits, and supporting equipment that monitor nuclear steam supply system (EIIS: AB) parameters. The RPS ensures the reactor is rapidly and

reliably shut down to protect the fission product barriers and assist the engineered safety features systems in accident mitigation. When all four channels of RPS are in service, a reactor trip is actuated when two of four channels generate trip signals.

The CPCs monitor the operation of the RCPs as inputs to the calculations of DNBR and LPD and send trip signals to the RPS when setpoints are exceeded. The RPS actuation then causes simultaneous trips of the four reactor trip switchgear breakers (EIIS: AA) which are aligned in a selective two of four configuration to de-energize the control element drive mechanisms (EIIS: AA) so that all control element assemblies (CEAs) (EIIS: AA) are released to insert into the reactor core (EIIS: AC) and shut down the reactor.

3. INITIAL PLANT CONDITIONS:

On February 26, 2021, PVNGS Unit 2 was in Mode 1 (Power Operation) at 100 percent power with the RCS at normal operating temperature and normal operating pressure. There were no inoperable structures, systems, or components at the time that contributed to this event.

4. EVENT DESCRIPTION:

On February 26, 2021, maintenance was being performed at the SRP switchyard.

At 1033, during the start-up transformer maintenance, an SRP employee's clothing inadvertently came in contact with a test switch, which resulted in opening of the Unit 2 generator output breakers and the Unit 2 auxiliary transformer output breakers. One of the two alternate supply breakers did not close to complete the fast bus transfer of alternate power from the start-up transformer, resulting in a loss of power to a 13.8 kV non-class bus which resulted in a loss of two out of four Reactor Coolant Pumps (RCPs). This caused a reactor trip on high linear power density (LPD) and low Departure from Nucleate Boiling Ratio (DNBR) following a main turbine generator trip.

No other RPS actuation signals or actuations of plant engineered safety features systems occurred and all control element assemblies fully inserted into the reactor core. Main Feedwater was established and continued to operate during the event and there was no actuation of the Auxiliary Feedwater System. Reactor decay heat was removed via the Steam Bypass Control system.

APS replaced the transfer auto/manual selector switch on February 27, 2021. Unit 2 entered Mode 1 on February 28, 2021 with the 13.8 kV non-class buses being supplied from the Auxiliary Transformer.

PVNGS Units 1 and Unit 3 were operating at 100 percent power at the time of the event and were not impacted by the Unit 2 reactor trip.

5. ASSESSMENT OF SAFETY CONSEQUENCES:

This event did not result in a challenge to fission product barriers or result in the release of radioactive materials. The event did not adversely affect the safe operation of the plant or health and safety of the public.

The RPS functioned as designed and initiated an automatic reactor trip that placed the plant in a safe condition. All required plant systems responded as expected and all CEAs fully inserted into the reactor core. Main Feedwater continued to operate during the event and there was no actuation of the Auxiliary Feedwater System. Reactor decay heat was removed via the Steam Bypass Control system. Automatic engineered safety features systems did not actuate, and the actuations were not required. The two remaining RCPs provided continued forced circulation of reactor coolant through the reactor.

The Unit 2 reactor trip did not result in a transient more severe than those already analyzed in the Updated Final Safety Analysis Report. Technical Specification safety limits were not exceeded or approached.

The event would not have prevented the fulfillment of any safety function of structures or systems as defined by 10CFR 50.73(a)(2)(v).

6. CAUSE OF THE EVENT:

The event was initiated by inadvertent contact being made with a test switch by an SRP employee, resulting in the opening of the Unit 2 generator output breakers and the Unit 2 auxiliary transformer output breakers.

The probable cause of the failure of the fast bus transfer to initiate, was found to be surface debris and contaminants on the fast bus transfer auto/manual selector switch. This resulted in high and erratic resistance across the switch, preventing the actuation of a fast bus transfer from the unit auxiliary transformer to the start-up transformer.

7. CORRECTIVE ACTIONS:

APS replaced the suspect fast bus transfer auto/manual selector switch. The fast bus transfer auto/manual selector switch is a Honeywell Micro Switch model number PTSBC202C.

The remaining fast bus transfer auto/manual selector switches in each of Units 1, 2, and 3 (total of five) will be replaced.

The activities within the switchyard are under the control of SRP, who performed their own root cause analysis and are not discussed in this report.

In the event additional information is received that results in substantial changes in the corrective actions planned, PVNGS will submit a supplement to this LER.

8. PREVIOUS SIMILAR EVENTS:

On August 16, 2019, an automatic reactor trip of PVNGS Unit 2 occurred when four RCPs lost power and the RPS generated a reactor trip following a main turbine generator trip. The event was attributed to the opening of main generator output breakers inside the Salt River Project (SRP) switchyard. The output breakers opened due to an invalid trip output signal initiated from a relay within the SRP switchyard protection system. The relay and cable from the Unit 2 main generator protection cabinet to the SRP interface cabinet were replaced. Opening of the main generator output breakers does not provide the electrical circuit logic needed to initiate a fast bus transfer of the non-class 1E 13.8 kV loads. This event was reported in LER 05000529-2019-001-00.

On February 15, 2018, an automatic reactor trip of PVNGS Unit 1 occurred when two of four RCPs lost power and the RPS generated trips following a main turbine generator trip. The cause of the Unit 1 main turbine generator and reactor trip has been attributed to the susceptibility of the Unit 1 excitation and voltage regulation system Exciter Auxiliary Interface Board to electrical noise which led to an excitation trip of the Unit 1 main turbine generator. The condition was corrected by replacing the Exciter Auxiliary Interface Board with an updated version that is less susceptible to electrical noise and thus reducing the possibility of a spurious turbine trip. The two RCPs lost power due to the fast bus transfer feature being blocked in support of planned maintenance activities on the start-up transformer. This event was reported in LER 05000530-2018-001-00.

The corrective actions from each listed similar event would not have prevented the subject 2021 event.