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102-07704-MLL/LMW  
May 9, 2018

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

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS) Unit 1**  
**Docket No. STN 50-528 / License No. NPF 41**  
**Licensee Event Report 2018-002-00**

Enclosed please find Licensee Event Report (LER) 50-528/2018-002-00 that has been prepared and submitted pursuant to 10 CFR 50.73. This LER reports an inoperable excore instrument channel that was not restored in accordance with Technical Specifications.

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, Department Leader, Nuclear Regulatory Affairs, at (623) 393-5379.

Sincerely,

A handwritten signature in black ink that reads "Maria Lecal".

MLL/LMW

Enclosure

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



**LICENSEE EVENT REPORT (LER)**

(See Page 2 for required number of digits/characters for each block)

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

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to [Infocollects.Resource@nrc.gov](mailto:Infocollects.Resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a

<b>1. Facility Name</b> Palo Verde Nuclear Generating Station (PVNGS) Unit 1	<b>2. Docket Number</b> 05000528	<b>3. Page</b> 1 OF 4
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**4. Title**  
Condition Prohibited by Technical Specification for Inoperable Excore Instrument Channel

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
04	20	2016	2018	- 002	- 00	05	14	2018		05000
									Facility Name	Docket Number
										05000

<b>9. Operating Mode</b> Defueled	<b>11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: (Check all that apply)</b>									
	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)						
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)						
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)						
<b>10. Power Level</b> 0	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)						
	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)						
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)						
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> 73.77(a)(1)						
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 73.77(a)(2)(ii)						
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 73.77(a)(2)(iii)						
		<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> Other (Specify in Abstract below or in NRC Form 366A)							

**12. Licensee Contact for this LER**

Licensee Contact Matt Kura, Department Leader, Nuclear Regulatory Affairs	Telephone Number (Include Area Code) 623-393-5379
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**13. Complete One Line for each Component Failure Described in this Report**

Cause	System	Component	Manufacturer	Reportable To ICES	Cause	System	Component	Manufacturer	Reportable To ICES
A	IG	CON	W120	Y					

<b>14. Supplemental Report Expected</b> <input type="checkbox"/> Yes (If yes, complete 15. Expected Submission Date) <input checked="" type="checkbox"/> No	<b>15. Expected Submission Date</b>	Month	Day	Year

Abstract (Limit to 1400 spaces, i.e., approximately 14 single-spaced typewritten lines)

On April 20, 2016, with Unit 1 Defueled, the channel C excore instrument preamplifier connection inside containment was discovered to be missing two o-rings required for the instrument to be environmentally qualified. The instrument had been in this condition since previous maintenance activities in May 2007. New o-rings were installed. The excore instrument channel was successfully tested on May 9, 2016, and Unit 1 was restarted on May 15, 2016. The cause of the event was attributed to an apparent human performance error during maintenance activities in 2007.

No previous similar events have been reported by PVNGS in the last 3 years.



**LICENSEE EVENT REPORT (LER)  
CONTINUATION SHEET**

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1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Palo Verde Nuclear Generating Station (PVNGS) Unit 1	05000-528	2018	- 002	- 00

**NARRATIVE**

**1. REPORTING REQUIREMENT:**

This Licensee Event Report (LER) is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B) to report a condition prohibited by the Technical Specifications (TS) Limiting Condition for Operation (LCO) 3.3.1, Reactor Protective System (RPS) Instrumentation – Operating and 3.3.2, RPS Instrumentation – Shutdown. The Unit 1, channel C, excore nuclear instrumentation system (EIS: IG) was found to be missing o-rings on two electrical connection interfaces on April 20, 2016, during a maintenance activity and had been in that condition since 2007. This condition was discovered on March 14, 2018, when an engineering evaluation identified the missing o-rings are required for the instrument to be environmentally qualified.

Inoperable RPS (EIS: JC) trip channels are required to be placed in bypass or trip within one (1) hour in accordance with Condition A of TS LCO 3.3.1 and 3.3.2. Condition E of TS LCO 3.3.1 requires the plant to be in Mode 3 (Hot Standby) within six (6) hours when required action and completion time are not met. Condition E of TS LCO 3.3.2 requires the opening of all reactor trip circuit breakers within one hour when required actions and completion time are not met. Additionally, the requirements of TS LCO 3.0.4 were not met for MODE changes or other specified conditions in accordance with TS LCO 3.3.1 and 3.3.2.

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

The RPS consists of four independent, redundant channels and includes a number of sensors, calculators [including the core protection calculators (CPCs)], logic circuits, and supporting equipment that monitor nuclear steam supply system (EIS: 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 excore nuclear instrumentation system provides a means of measuring reactor power level by monitoring neutron flux leakage which is proportional to reactor power. The equipment includes neutron detectors located around the reactor vessel, preamplifiers located both inside and outside of the containment building, signal processing drawers (located outside of the containment building), and remote indicators, recorders, and controls located in the main control room area and remote shutdown rooms.

Excore instrument outputs are provided for reactor control, reactor protection and for information display. Four safety excore instrument channels provide input to the RPS, including the CPCs, in order to monitor, alarm, and trip the reactor to ensure operation is within safety limits as well as to determine power distribution parameters.

The CPCs monitor the inputs to the calculations of low departure from nucleate boiling ratio and high local power density 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 (EIS: AA) which are aligned in a selective two of four configuration to de-energize the control element drive mechanisms so that all control element assemblies are released to insert into the reactor core and shut down the reactor.

The excore instruments specifically provide input for the RPS variable over power trip in Modes 1 and 2 (Power Operation and Start-up, respectively). They also provide input for the RPS high logarithmic power level trips in Mode 2, and Modes 3, 4 (Hot Shutdown), and Mode 5 (Cold Shutdown) when reactor trip circuit breakers are closed and any control element assembly is capable of being withdrawn.



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The safety channel excore nuclear instrumentation system neutron detector assemblies are composed of two major components; the detector assembly and the preamplifier-filter assembly. The channel A and B preamplifier-filter assembly is located in the Auxiliary Building and the channel C and D preamplifier-filter assembly is located inside the Containment Building. The preamplifier-filter assembly provides interconnection between the excore detector assembly and signal processing electronics. The safety C and D channel excore detector instruments are environmentally qualified in accordance with the requirements of 10 CFR 50.49 in order to ensure a reactor trip in the event of a Main Steam Line Break (MSLB) inside the Containment Building.

**3. INITIAL PLANT CONDITIONS:**

On April 20, 2016, PVNGS Unit 1 was Defueled during Unit 1 refueling outage 19.

**4. EVENT DESCRIPTION:**

On April 20, 2016, during replacement of the excore channel C preamplifier, a maintenance technician discovered missing o-rings on two electrical connection interfaces. New o-rings were installed, the system was retested on May 9, 2016 and placed back into service to support restart on May 15, 2016.

An evaluation of the missing o-rings was completed on March 14, 2018 and assessed the channel C preamplifier was not in its approved environmentally-qualified configuration and may not have been able to perform its corresponding safety function to trip the reactor in the event of a MSLB. The last time the preamplifier had been disconnected from the electrical connection interfaces was in May 2007. The conservative assumption is that the o-rings have been missing since that time.

During the three-year interval prior to completion of the engineering evaluation, at least two excore instrument channels remained OPERABLE when required. This was verified by review of maintenance records and control room logs.

**5. ASSESSMENT OF SAFETY CONSEQUENCES:**

This event did not result in a challenge to the fission product barriers or result in the release of radioactive materials to the environment. There were no actual safety consequences as a result of this event and it did not adversely affect the health and safety of the public.

The nuclear risk safety significance of the event was negligible. The excore detectors are credited in the probabilistic risk assessment (PRA) model to support operator actions associated with initiation of emergency boration following a failure of the control rods to insert in the core following a reactor trip. In the dominant accident sequences where emergency boration is required, no adverse environmental condition is assumed present up to the time when emergency boration is required. The likelihood other accident sequences where the control rods do not insert in the core and an adverse environmental condition is present impacting the associated excore channel (e.g., MSLB) are negligible.

The ability to trip the reactor during a MSLB remained intact because a minimum of two excore instrument channels remained OPERABLE when they were required. Therefore, this condition would not have resulted in the failure of a system required to prevent the fulfillment of a safety function as defined in 10 CFR50.73(a)(2)(v).

**6. CAUSE OF THE EVENT:**

The cause of the Unit 1 event is attributed to an apparent human performance error during maintenance activities in 2007. The work order for the 2007 maintenance required replacement of the o-rings and explicitly stated they were required for environmental qualification. The cause cannot be conclusively determined with the limited data available due to the



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passage of time. No other known contributors to the condition could be determined.

**7. CORRECTIVE ACTIONS:**

This condition was corrected on April 20, 2016, with the replacement of the missing o-rings on two connectors while replacing excore channel C preamplifier.

**8. PREVIOUS OCCURRENCES:**

No prior similar events resulting in the inoperability of excore instruments were identified.