10 CFR 50.73

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102-06708-DCM/DCE
June 7, 2013

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

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS) Units 1 and 2**
Docket No. STN 50-528 and STN 50-529
License No. NPF 41 and NPF 51
Licensee Event Report 2013-002-00

Enclosed please find Licensee Event Report (LER) 50-528/2013-002-00 that has been prepared and submitted pursuant to 10 CFR 50.73. This LER reports five events related to the failure of control relays installed in four different plant systems. The relay failures were due to a common cause which has been previously reported by Westinghouse pursuant to 10 CFR 21 (NRC Accession Number MLS13100A357). Each of the relay failures resulted in a condition prohibited by 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. If you have questions regarding this submittal, please contact Mark McGhee, Operations Support Manager, Regulatory Affairs, at (623) 393-4972.

Arizona Public Service Company makes no commitments in this letter.

Sincerely,

D.C. Mims

DCM/DCE/hsc

Enclosure

cc:	A. T. Howell, III	NRC Region IV Regional Administrator
	J. K. Rankin	NRC NRR Project Manager for PVNGS
	M. A. Brown	NRC Senior Resident Inspector for PVNGS

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NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

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 FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to 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 person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Palo Verde Nuclear Generating Station (PVNGS) Unit 1	05000528	1 OF 12

4. TITLE
Inoperable Systems Due to Defective Relays Reported under Part 21

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: PVNGS Unit 2	DOCKET NUMBER: 05000529
04	08	2013	2013	- 002 -	00	06	07	2013	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE: Defueled / 1

10. POWER LEVEL: 0 / 100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☒ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☒ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☒ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Mark McGhee, Operations Support Manager, Regulatory Affairs	623-393-4972

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	VI	RLY	C770	Y	B	VF	RLY	C770	Y

14. SUPPLEMENTAL REPORT EXPECTED		15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)*	☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines*

This LER reports the failure of components caused by a defect in ARD660UR control relays reported by Westinghouse, pursuant to 10 CFR 21, on April 8, 2013. The defect resulted in the failure of five normally energized control relays at PVNGS in two different systems in Unit 1 and two different systems in Unit 2. The relays were used in normally energized applications which are de-energized to position associated components to support the related safety function. The relays failed to change state when de-energized during testing.

The five failed relays were replaced. The cause was a change in the manufacturing process that occurred in May 2008. The defect was exhibited only on relays that failed in the manner described in the Westinghouse Part 21 report. An extensive testing program was completed to identify and replace ARD660UR relays installed at PVNGS that exhibited the described failure mode. Westinghouse has modified the ARD660UR relay plastic molding process to preclude this described failure mode. LER 05000529 / 2009-002-00 reported ARD660UR relay failures that exhibited a similar failure mode.

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

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13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUF-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUF-FACTURER	REPORTABLE TO EPIX
B	CB	RLY	C770	Y					

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

1. REPORTING REQUIREMENTS:

This Licensee Event Report (LER) is being submitted pursuant to 10 CFR 50.73 to report the related failures of five normally energized model ARD660UR control relays at Palo Verde Nuclear Generating Station (PVNGS). The relay failures are related due to a common cause which resulted from a manufacturing defect that was reported by Westinghouse in a revised Part 21 report, dated April 8, 2013. The publication date of the Part 21 report is the discovery date of the common cause condition for the five relay failures. The defect resulted in failures of the relays to immediately actuate upon demand during testing activities. The five demand failures occurred in a time span from January 22, 2012, through March 31, 2013.

The following reporting criteria are applicable, as described in the table below, to the conditions reported in this LER:

a. 50.73(a)(2)(i)(B), condition prohibited by Technical Specifications (TSs)
b. 50.73(a)(2)(ii)(B), unanalyzed condition
c. 50.73(a)(2)(v)(D), condition that could have prevented the fulfillment of a safety function needed to mitigate the consequences of an accident
d. 50.73(a)(2)(vii), inoperability of independent trains or channels due to a single cause

The following table relates each relay failure to the specific reporting criteria that apply. The listed relay failure numbers are referenced throughout the content of this LER.

Relay Failure #	Unit	Failure Date	Reporting Criteria	Actuated Components
1	2	1/22/2012	a, b, c, d	Control Building Train B Essential Electrical Equipment Room Ventilation Dampers
2	2	4/3/2012	a, d	Train A Auxiliary Building Cleanup Exhaust Isolation Damper
3	2	8/15/2012	a	Train A Auxiliary Building Cleanup Exhaust Isolation Damper
4	1	3/8/2012	a, d	Control Room Essential Filtration Isolation Dampers Closed by Train A Actuation Signals
5	1	3/31/2013	a, d	Reactor Coolant Pump Seal Bleed-off Containment Isolation Valve

Note: The event reporting criterion 50.73(a)(2)(vii), inoperability of independent trains or channels due to a single cause, does not apply to relay failure #3 because this relay was not inoperable simultaneously with other Unit 2 failed relays.

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

Control Relay Description

The five control relays that failed were Model ARD660UR 130 volts direct current (VDC) relays supplied by Westinghouse Electric Company, LLC. The ARD660UR relays discussed in this LER were configured to be normally energized when their associated components were in their normal operating positions. When energized, a moving core inside the energized coil assembly forces an armature crossbar assembly against an armature return spring to operate the relay contacts and cause the associated components to be positioned in their normal operating configuration. A demand signal, either from an automatic actuation or a handswitch, de-energizes the relay coil, which removes the force from the core/armature crossbar assembly and causes it to dropout (relay contacts change state). As a result, the associated components, controlled by the relay, move to their actuated position. This design causes the associated components to change to their actuated position during a loss of power to ensure performance of the safety function.

Description of the Systems Affected by the Five Control Relay Failures

Relay Failure #1

Unit 2 relay 2EZJBC01*HJX5 failed to actuate when tested on January 22, 2012. The relay controls five train B ventilation dampers that support the function of essential air handling units to provide supporting cooling for train B essential Class 1E electrical equipment rooms. Two of the dampers open to provide cooled air from train B essential air handling units (AHUs) (EIIS: VI) and three of the dampers close to isolate the essential ductwork from the normal (non-essential) ductwork. The cooling coils of the essential AHUs are provided with essential chilled water (EC) (EIIS: KM) to remove heat from the air. A safety injection actuation signal (SIAS) or a loss of power (LOP) signal actuate the essential AHUs and related dampers.

The essential Class 1E electrical equipment rooms house electrical switchgear, load centers, motor control centers, distribution panels, inverters, battery chargers and batteries. These components are located in their respective train-related rooms located in the 100 foot (ft.) elevation of the control building (EIIS: NA).

The following TSs Limiting Conditions for Operation (LCOs) apply to the Class 1E electrical equipment supported by the essential ventilation in the essential electrical equipment rooms:

- LCO 3.8.4 DC Sources – Operating, applicable in Modes 1 to 4
- LCO 3.8.7 Inverters - Operating, applicable in Modes 1 to 4
- LCO 3.8.9 Distribution Systems - Operating, applicable in Modes 1 to 4
- LCO 3.0.3 is applicable because two inverters are affected and LCO 3.8.7 does not provide a Required Action for two inoperable inverters

Relay Failure #2

Unit 2 relay 2EZAAC03*HAX2 failed to actuate when tested on April 3, 2012. This relay controls a ventilation damper that isolates the auxiliary building ventilation ductwork below the 100 ft. elevation from the common auxiliary building ventilation exhaust to the plant vent exhaust. The damper isolation function supports the Engineered Safety Feature (ESF) Pump Room Exhaust Air Cleanup System (PREACS) which filters air from the lower levels of the auxiliary building that contains active ESF components such as the High Pressure Safety Injection, Low Pressure Safety Injection, and Containment Spray pump rooms during the recirculation phase of a Loss of Coolant Accident (LOCA). The failed relay actuates the train A isolation damper to the common exhaust duct, which also includes a redundant upstream train B isolation damper. A safety injection actuation signal (SIAS) actuates the control relays for both trains which then close both isolation dampers.

TS LCO 3.7.13 requires two trains of PREACS to be OPERABLE in Modes 1 to 4. The Required Action for Condition A, for an inoperable PREACS train, is to restore the PREACS train to an OPERABLE status within a 7 day completion time.

Relay Failure #3

Unit 2 relay 2EZAAC03*HAX2 (same component as relay failure #2) failed to actuate when tested on August 15, 2012. The function of this relay is described under relay failure #2 above. This relay was the replacement relay that was installed in Unit 2 in response to relay failure #2, above.

Relay Failure #4

Unit 1 relay 1EZJAC01*HJX2 failed to actuate when tested on March 8, 2012. This relay controls the train A dampers that isolate train B control room essential filtration system (CREFS)(EIIS: VI) ductwork from the non-essential ductwork supplying ventilation to non-essential rooms adjacent to the control room. CREFS consists of redundant trains of essential air handling units (AHU) with high efficiency filters and charcoal adsorbers to process intake airflow and recirculate air flow to the control room envelope to maintain control room post-accident habitability. CREFS is actuated by a control room essential filtration actuation signal (CREFAS)(EIIS: JE), a SIAS, or a LOP.

The B train CREFS shares ductwork with the control room normal (non-essential) ventilation system which serves the inverter room and communication room on the control building 120 ft. level during non-emergency conditions. The non-essential supply and return ductwork for the inverter room and communication room are automatically isolated from the train B CREFS ductwork by a CREFAS, SIAS, or LOP actuation which close the redundant train A and train B isolation dampers. The two train A isolation dampers are actuated by control relay 1EZJAC01*HJX2.

TS LCO 3.7.11 requires two trains of CREFS to be OPERABLE in Modes 1 to 6 and during movement of irradiated fuel assemblies. The Required Action for Condition A, for one inoperable CREFS train, for reasons other than an inoperable control room envelope boundary, is to restore the CREFS train to an OPERABLE status within a 7 day completion time.

Relay Failure #5

Unit 1 Relay 1EZJBC03*CHX2 failed to actuate when tested on March 31, 2013. This relay controls one of the two normally open containment isolation valves (CIVs) for the reactor coolant pump (RCP) seal bleed-off line which routes seal bleed-off flow to the volume control tank. The two CIVs actuate closed upon receipt of a containment spray actuation signal (CSAS). The upstream CIV, CHA-UV-506, is located inside the containment building and the downstream CIV, CHB-UV-505, is located inside the auxiliary building. Control relay 1EZJBC03*CHX2 actuates CIV CHB-UV-505 upon receipt of a CSAS.

TS LCO 3.6.3 is applicable in Modes 1 to 4 and requires the RCP seal bleed-off line containment isolation valves to be OPERABLE. The Required Action Completion Time for Condition A of the LCO, for a single inoperable containment isolation valve in a penetration flow path, requires the affected penetration flow path to be isolated within 4 hours.

3. INITIAL PLANT CONDITIONS:

On the discovery date, April 8, 2013, the Unit 1 reactor was was defueled during a refueling outage and Unit 2 was in Mode 1 operating at approximately 100 percent power. The initial plant conditions prior to each of the failures are discussed below.

Relay Failure #1

On January 22, 2012, PVNGS Unit 2 was in Mode 1 operating at approximately 100 percent power. There were no other structures, systems, or components inoperable at the time of the event that contributed to the event.

Relay Failure #2

On April 3, 2012, PVNGS Unit 2 was in Mode 1 operating at approximately 100 percent power. There were no other structures, systems, or components inoperable at the time of the event that contributed to the event.

Relay Failure #3

On August 15, 2012, PVNGS Unit 2 was in Mode 1 operating at approximately 100 percent power. There were no other structures, systems, or components inoperable at the time of the event that contributed to the event.

Relay Failure #4

On March 8, 2012, PVNGS Unit 1 was in Mode 1 operating at approximately 100 percent power. There were no other structures, systems, or components inoperable at the time of the event that contributed to the event.

Relay Failure #5

On March 31, 2013, PVNGS Unit 1 was in Mode 5 at the beginning of a refueling outage. Reactor coolant system (RCS)(EIIS: AB) cold leg temperature was approximately 97 degrees Fahrenheit. The shutdown cooling system (EIIS: SB) was providing residual heat removal from the RCS. Reactor coolant pumps were not in-service. There were no other structures, systems, or components inoperable at the time of the event that contributed to the event.

4. EVENT DESCRIPTION:

The failure mode of each of the control relays described in this LER was the relay core/armature crossbar assembly did not immediately dropout when the control relay was de-energized. As a result, the associated components remained in their normal operating positions and did not immediately change to their actuated positions. However, during post-failure troubleshooting, the failed, de-energized relays were found to eventually dropout after a delay such that the associated components would then move to their actuated positions. A characteristic of the failure mode was that it was exhibited only on relays that had not been previously de-energized after extended in-service (energized) periods following initial installation and testing. During bench testing of new ARD660UR relays manufactured since 2008, failed relays were observed on several occasions to eventually dropout after being de-energized, often within 30 minutes.

Relay Failure #1

On January 22, 2012, while conducting engineered safety feature actuation system train B subgroup relay testing in Unit 2, five train B control building ventilation dampers that support the function of essential air handling units failed to change to their actuated positions because the associated control relay, 2EZJBC01*HJX5, failed to change state when de-energized.

The relay was replaced and testing was completed prior to restoring the associated dampers to their normal operating positions on January 22, 2013. As part of a plan to monitor the performance of potentially affected relays, the replaced relay was successfully tested twice after extended periods of energized operation.

The relay 2EZJBC01*HJX5 was previously replaced on September 8, 2011. Based on the Westinghouse Part 21 report, the control relay had potentially been in a non-functional state which would have caused the supported train B Class 1E electrical equipment to have been inoperable from September 29, 2011, through January 22, 2012. During that period, the redundant train A supported Class 1E electrical equipment was inoperable on 3 occasions:

- November 10, 2011 (131 minutes)
- December 8, 2011 (85 minutes)
- December 15, 2011 (8 minutes)

Relay Failure #2

On April 3, 2012, while conducting surveillance testing, the train A isolation damper to the common auxiliary building ventilation exhaust duct failed to change to its actuated position because the associated relay, 2EZAAC03*HAX2, failed to change state when de-energized. The relay had been installed since July 26, 2011.

The relay was replaced and testing was completed prior to restoring the associated damper to its normal operating position on April 4, 2012. As part of a plan to monitor the performance of potentially affected relays, the replaced relay was successfully tested twice after extended periods of energized operation.

The associated damper had potentially been inoperable from August 16, 2011, through April 3, 2012. The redundant train B damper remained operable during this period. Therefore, the safety function to isolate the auxiliary building areas below the 100 ft. elevation from the normal auxiliary building ventilation exhaust remained intact.

Relay Failure #3

On August 15, 2012, while conducting testing, the train A isolation damper to the common auxiliary building exhaust duct failed to change to its actuated position because the associated relay, 2EZAAC03*HAX2, failed to change state when de-energized. The relay had been installed since April 4, 2012. The testing was conducted as part of a plan to monitor the performance of potentially affected relays after the relay had been energized for extended periods.

The relay was replaced and testing was completed prior to restoring the associated damper to its normal operating position on August 16, 2012. As part of a plan to monitor the performance of potentially affected relays, the replaced relay was successfully tested twice after extended periods of energized operation.

The associated damper had potentially been inoperable from April 25, 2012, through August 16, 2012. The redundant train B damper remained operable during this period. Therefore, the safety function to isolate the auxiliary building areas below the 100 ft. elevation from the normal auxiliary building ventilation exhaust remained intact.

Relay Failure #4

On March 8, 2012, while conducting surveillance testing, the train A dampers that isolate train B control room essential filtration system ductwork failed to change to their actuated positions because the associated relay, 1EZJAC01*HJX2, failed to change state when de-energized. The relay had been installed since January 12, 2012.

The relay was replaced and testing was completed prior to restoring the associated dampers to their normal operating positions on March 9, 2012. As part of a plan to monitor the performance of potentially affected relays, the replaced relay was successfully tested twice after extended periods of energized operation.

The associated dampers had potentially been inoperable from February 22, 2012, through March 8, 2012. The redundant train B dampers remained operable during this period. Therefore, the safety function to ensure isolation of the control room envelope remained intact.

Relay Failure #5

On March 31, 2012, while conducting engineered safety feature actuation system testing of train B ESF actuation system, the RCP seal bleed-off line downstream containment isolation valve CHB-UV-505 failed to change to its actuated position during testing because the associated relay, 1EZJBC03*CHX2, failed to change state when de-energized. The relay had been installed since October 26, 2011.

The relay was replaced and testing was completed prior to restoring containment isolation valve CHB-UV-505 on April 12, 2013. The replacement relay was manufactured after December 2012 following correction of the manufacturing process and was not susceptible to the failure mode. Therefore, it was not included in the test plan to monitor potentially affected relays.

The valve had potentially been inoperable from November 16, 2011, through March 31, 2012. The upstream containment isolation valve, CHA-UV-506, remained operable during this period. Therefore, the containment isolation safety function for the RCP seal bleed-off penetration remained intact.

5. ASSESSMENT OF SAFETY CONSEQUENCES:

The conditions reported in this LER did not adversely affect plant safety or the health and safety of the public. There were no actual safety consequences as a result of this event and the condition did not result in any challenges to the fission product barriers or result in any releases of radioactive materials.

For relay failure #1, the concurrent inoperability of the redundant train A supported Class 1E electrical equipment during the time that relay 2EZJBC01*HJX5 was potentially non-functional represented a condition that could have prevented the fulfillment of a safety function to mitigate the consequences of an accident. The increase in core damage probability due to this event over the exposure period is less than 3.0E-8. This increase in risk is characterized as "very small" per NRC Regulatory Guide 1.174, *An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis.*

In addition, evidence identified during the investigations showed that the affected relays would eventually dropout after being de-energized. When crediting the actual dropout times of the subject relays after being de-energized, it can be concluded that the realistic increase in core damage probability may be less than the estimation above. This may be the case if the relays associated with HVAC dampers transitioned to their actuated position prior to loss of the front line system function modeled in the PVNGS probabilistic risk assessment (PRA).

The inoperability of systems related to relay failures #2 through #5 would not have prevented the fulfillment of a safety function to safely shutdown the reactor and did not result in a safety system functional failure as described by 10 CFR 50.73(a)(2)(v).

6. CAUSE OF THE EVENTS AND EXTENT OF THE CONDITION:

Investigations were performed by both PVNGS, who also engaged outside root cause laboratories, and Westinghouse engineering personnel to determine the cause of the failures. Westinghouse identified the cause which was published in a revised Part 21 report on April 8, 2013. The cause of the relays failing to change state when de-energized was a change in the manufacturing process in the plastic molding operation of the relay parts that occurred in May 2008 and continued until it was terminated in December 2012. The manufacturing process could cause some of the relays to develop an adhesive-like residue when energized for an extended period of time that then could cause the moving core to adhere to the inner diameter of the relay coil assembly. The scope of the Part 21 report applied to normally energized ARD660UR relays manufactured since May 2008 that had not been de-energized after extended periods of operation following installation.

During the Westinghouse investigation a sample of ARD660UR relays manufactured since May 2008 were tested. The testing simulated the relay heating that occurs when the relays remain energized for extended periods. After 21 days, the relays were de-energized. The result was a portion of the relays did not change state such that the core/armature crossbar assemblies did not drop out and the contacts did not open This failure mode is similar to the failure mode exhibited by the failed PVNGS relays. The adhesive-like residue was found on the relays that failed to cycle successfully. The adhesive-like residue was also subsequently found on three failed PVNGS relays that were returned to Westinghouse (relay failures #1, #2, and #4).

The scope of the Westinghouse Part 21 report applied to normally energized ARD660UR relays installed in safety-related applications at PVNGS. Twenty-eight of those control relays installed since February 2009 had not been cycled after being energized for at least 21 days following post-installation testing. PVNGS implemented a test plan to determine if the 28 control relays would de-energize upon demand by cycling them when plant conditions permitted. On April 16, 2013, the station completed the test plan that cycled the 28 relays by actuating the associated components to de-energize the relay. Two of the 28 relays failed during completion of that test plan. These are relay failures #3 and #5.

The test plan also repeated cycling of the successfully tested relays after additional extended in-service energized periods. Each of the relays that successfully changed state during the initial test also successfully changed state during subsequent tests.

Limited retesting was conducted by Westinghouse on the sample of ARD660UR relays manufactured since May 2008 that successfully de-energized during the initial test. The relays were subsequently re-energized for an extended period of time and then successfully cycled without failures. This was consistent with the results of the testing on the 28 installed relays at PVNGS that relays successfully cycled after being energized for an extended period were not susceptible to the failure mode.

A complete evaluation of the Westinghouse report is in progress. An LER supplement will be submitted if information develops that would substantially change that the conclusions of this report.

7. CORRECTIVE ACTIONS:

As discussed in the event descriptions above, immediate corrective actions were completed to replace the failed relays.

To prevent recurrence, each of the normally energized ARD660UR relays covered by the scope of the Part 21 report and installed in the plant in safety-related applications since February 2009 has been verified to actuate upon demand by either verifying they had been cycled during normal operations or testing. The testing of these relays has been performed repeatedly and within a time frame that verifies that the relays are not subject to the common cause failure mode.

To address the manufacturing problem, Westinghouse and their supplier modified the manufacturing process to eliminate the steps in the plastic molding process that caused the adhesive-like residue. Westinghouse modified testing to detect the failure mode described in this LER as part of the dedication process. PVNGS returned the existing warehouse inventories of ARD660UR relays manufactured under the prior process to Westinghouse.

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8. PREVIOUS SIMILAR EVENTS:

LER 05000529 / 2009-002-00 reported five failures of steam generator sample line containment isolation valves to close on demand between August 21, 2009, and October 5, 2009. The direct cause was the ARD660UR relay contacts failed to open when the relays de-energized upon receipt of the demand signals. On March 19, 2010, Westinghouse reported a defect that would prevent normally energized ARD660UR relays from changing state when de-energized. The relays affected by the previous cause were replaced and tested satisfactorily. The corrective actions related to the failures that occurred in 2009 would not have prevented the failures reported in this LER because the former cause analysis did not identify the formation of the adhesive-like residue that caused the moving core to adhere to the inner diameter of the relay coil assembly when the relay was energized for an extended period.