10 CFR 50.73

A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear Generating Station

Dwight C. Mims
Senior Vice President
Nuclear Regulatory and Oversight

Tel. 623-393-5403
Fax 623-393-6077

Mail Station 7605
P. O. Box 52034
Phoenix, Arizona 85072-2034

102-06421-DCM/DFH
October 05, 2011

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 2011-004-00

Enclosed please find Licensee Event Report (LER) 50-528/2011-004-00 that has been prepared and submitted pursuant to 10 CFR 50.73. This LER reports an automatic actuation of the reactor protection system that occurred as a result of a dropped control element assembly while performing a surveillance test to check the operability of control element assemblies.

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 Marianne Webb, Section Leader, Regulatory Affairs, at (623) 393-5730.

Arizona Public Service Company makes no commitments in this letter.

Sincerely,

D. C. Mims

DCM/MNW/DFH/gat

Enclosure

cc: E. E. Collins Jr. NRC Region IV Regional Administrator
L. K. Gibson NRC NRR Project Manager for PVNGS (electronic / paper)
J. R. Hall NRC NRR Senior Project Manager (electronic / paper)
M. A. Brown NRC Senior Resident Inspector for PVNGS

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NRR

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)

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4. TITLE

Unit 1 Reactor Trip Due to Reactor Protection System Actuation which Resulted from a Dropped CEA

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
8	6	2011	2011	- 004 -	00	10	05	2011	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

1

10. POWER LEVEL

100

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

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Marianne Webb, Section Leader, Regulatory Affairs	623-393-5730

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
X	AA	CON	CE	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On August 6, 2011, at approximately 1119 Mountain Standard Time, during the performance of surveillance test 40ST-9SF01, Control Element Assembly (CEA) Operability Checks, the Unit 1 reactor tripped due to an automatic actuation of the reactor protection system. The actuation occurred when CEA 37 of shutdown group B fully inserted causing a deviation of greater than 9.9 inches from other CEAs in its subgroup. This deviation generated a CEA calculator penalty factor and actuated the low departure from nucleate boiling ratio and the high local power density trips on all four core protection calculator channels. Following the reactor trip, plant operators observed CEA 16 of regulating group 5 did not indicate that it had fully inserted. While operators prepared to borate the reactor coolant system, full insertion indication for CEA 16 was received approximately 1.5 minutes following the reactor trip.

The cause for the reactor trip was determined to be a loose terminal lug on the CEA power switch assembly which developed a high resistance connection and led to the improper operation of the control element drive mechanism upper gripper coil. As an immediate corrective action, the terminal lug was replaced and retested satisfactorily. Troubleshooting of CEA 16 did not identify any problems. Unit 1 returned to service and entered Mode 1 at 2140 on August 10, 2011.

No similar conditions have been reported by Palo Verde in the past three years.

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NARRATIVE

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

1. REPORTING REQUIREMENT(S):

This LER is being submitted pursuant to 10 CFR 50.73 (a)(2)(iv)(A) as an automatic actuation of the reactor protection system (RPS) that occurred as a result of a dropped control element assembly (CEA) during the performance of CEA operability checks.

This event was reported to the Nuclear Regulatory Commission (NRC) on August 6, 2011, via the emergency notification system (EN 47133).

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

Control Element Drive Mechanism Control System

The control element drive mechanism control system (CEDMCS) (EIIS: AA) provides control signals and motive power to the coils of the magnetic jacks in the Control Element Drive Mechanisms (CEDMs) (EIIS: AA) which position and hold the 89 reactor CEAs (EIIS: AA).

Two motor/generator sets are connected in parallel to supply 240 VAC, 3 phase power through the reactor trip switchgear (RTSG) (EIIS: AA). The output from the RTSG is directed through power switch assemblies. The power switch assemblies contain silicon controlled rectifiers (SCRs) which convert the 3 phase, AC input voltage to a stepped DC output voltage. The conversion is controlled by electronic circuits in the power switch assembly and in the CEDMCS subgroup logic housing. These control circuits determine the sequence to supply power to the CEDM coils.

Each CEA is assigned to one of 22 CEA subgroups, with 4 assigned CEAs per subgroup, except for subgroup 8 which has five assigned CEAs. The CEDMs for the CEAs within a subgroup are provided power from a common power switch assembly. The subgroups are arranged into nine groups, including two shutdown, five regulating, and two part strength groups. CEAs within a group are moved together to minimize position deviations between the CEAs in a subgroup and between subgroups within a group. CEA 37 is assigned to one of the five subgroups that make up shutdown group B. CEA 16 is assigned to the one subgroup that makes up regulating group 5.

Core Protection Calculator/Control Element Assembly Calculator

The core protection calculator/control element assembly calculator (CPC/CEAC)(EIIS: JC) system monitors reactor core conditions to provide CEA withdrawal prohibit signals to the CEDMCS and provides an accurate, reliable means of initiating a reactor trip. The CPC/CEAC system is an integral part of the plant protective system in that it provides low departure from nucleate boiling ratio (Lo DNBR) and high local power density (Hi LPD) trip signals to the RPS

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(EIIS: JC). Trip signals are provided to the RPS whenever the calculated DNBR or LPD exceed setpoints during reactor operation.

Each CEAC receives reed switch position transmitter inputs for all CEAs. The CEACs compare the positions of all CEAs within each CEA subgroup and determine penalty factors based upon CEA deviations within a subgroup. When generated, a penalty factor is transmitted via fiber-optic data links to the CPCs. The CPCs also compute penalties for position deviations between subgroups within a group and for CEA group out-of-sequence deviations.

The RPS provides a rapid and reliable shutdown of the reactor to protect the core and the reactor coolant system pressure boundary from potentially hazardous operating conditions. Shutdown is accomplished by the generation of reactor trip signals. The trip signals open the RTSG breakers, which de-energizes the CEDM coils and allows all CEAs to drop into the core by the force of gravity.

3. INITIAL PLANT CONDITIONS:

On August 6, 2011, Palo Verde Unit 1 was in Mode 1 (Power Operation), at 100 percent power and at normal operating temperature and normal operating pressure. There were no structures, systems, or components inoperable at the time of the event that contributed to the event.

4. EVENT DESCRIPTION:

On August 6, 2011, at approximately 1119, during the performance of surveillance test 40ST-9SF01, CEA Operability Checks, the Unit 1 reactor tripped due to an automatic RPS actuation. The actuation occurred when CEA 37 of shutdown group B fully inserted which caused a deviation of greater than 9.9 inches from other CEAs in its subgroup. This deviation generated a CEAC penalty factor and actuated the Lo DNBR and the Hi LPD trips on all four CPC channels. Following the reactor trip, plant operators observed CEA 16 did not indicate that it had fully inserted. While operators prepared to borate the reactor coolant system, full insertion indication for CEA 16 was received approximately 1.5 minutes following the reactor trip.

5. ASSESSMENT OF SAFETY CONSEQUENCES:

This event did not result in a transient more severe than those already analyzed in the PVNGS Updated Final Safety Analysis Report Chapter 15. Because the primary and secondary system pressures were controlled below the respective safety valve opening setpoints, peak design pressures were not challenged.

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There were no inoperable structures, systems, or components at the time of the event that contributed to this event. The event did not result in any challenges to the fission product barriers or result in the release of radioactive materials. There were no actual safety consequences as a result of this condition. The condition did not result in a safety system functional failure as described by 10 CFR 50.73 (a)(2)(v).

6. CAUSE OF THE EVENT:

The event investigation team determined a loose terminal lug on the CEA power switch assembly created a high resistance connection and led to the improper operation of the CEDM upper gripper coil, resulting in the full insertion of CEA 37. Once CEA 37 deviated greater than 9.9 inches from the other CEAs in its subgroup, a CEAC penalty factor was generated. This penalty factor resulted in the valid actuation of the Lo DNBR and Hi LPD trips on all four CPC channels. The plant protection system functioned as expected by opening all four RTSG breakers.

To determine the cause of the delayed full insertion of CEA 16, a troubleshooting plan was developed which included input from the nuclear steam supply system (NSSS) vendor. This plan included steps to rigorously exercise CEA 16, evaluate CEDM coil performance, and perform multiple CEA drop time tests for CEA 16 and the other CEAs in its subgroup. No abnormal performance issues were identified during the troubleshooting and the cause was not determined.

7. CORRECTIVE ACTIONS:

As an immediate corrective action, the terminal lug for the power switch assembly which supplies power to the CEDM for CEA 37 was replaced and retested satisfactorily.

The following additional actions are planned:

- Accessible terminal and lug connections will be checked during the next refueling outage for all three Palo Verde units to verify the tightness of the connections.
- A periodic task to refurbish the power switch assemblies every tenth refueling cycle will be developed.
- A design modification will be evaluated to position the CEDM upper gripper in the hold position if a voltage imbalance is sensed between the phases of the power supply.

Since troubleshooting could not identify a cause for the delayed full insertion of CEA 16, an action was developed for increased testing of CEAs in accordance with 40ST-9SF01, CEA Operability Checks, until the Unit 1 refueling outage in the Fall of 2011. Additional troubleshooting actions are planned for the upcoming refueling outage and further actions, as necessary, will be added based on the ongoing investigation of the delayed insertion of CEA 16.

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Any additional corrective actions taken as a result of this event will be implemented in accordance with the PVNGS corrective action program. If information is subsequently developed that would significantly affect a reader's understanding or perception of this event, a supplement to this LER will be submitted.

8. PREVIOUS SIMILAR EVENTS:

No similar conditions have been reported by Palo Verde in the past three years.