10 CFR 50.73

A subsidiary of Pinnacle West Capital Corporation

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102-06223-DCM/RAB/DFH
July 21, 2010

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

Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)**
**Unit 3**
**Docket No: STN 50-530**
**License No. NPF 74**
**Licensee Event Report 2008-001-01**

Attached, please find Licensee Event Report (LER) 50-530/2008-001-01, which supplements a previously reported manual reactor trip when removing a degraded Control Element Drive Mechanism Motor Generator set from service. This supplement is being submitted to report a change to the root cause of the event and the associated corrective actions described in the initial report.

In accordance with 10 CFR 50.4, copies of this LER supplement are being forwarded to the NRC Regional Office, NRC Region IV and the Senior Resident Inspector. If you have questions regarding this submittal, please contact Ray E. Buzard, Section Leader, Regulatory Affairs, at (623) 393-5371.

Arizona Public Service Company makes no commitments in this letter.

Sincerely,

FOR D. C. MIMS

DCM/TNW/DFH/gat

Attachment

cc:
| | | |
|---|---|---|
| | E. E. Collins Jr. | NRC Region IV Regional Administrator |
| | J. R. Hall | NRC NRR Senior Project Manager - (send electronic and paper) |
| | L. K. Gibson | NRC NRR Project Manager |
| | R. I. Treadway | NRC Senior Resident Inspector for PVNGS |



IE22
NRR

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2010

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 Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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

Manual Reactor Trip when Removing a Degraded CEDM MG Set from Service

| 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 |
| 09 | 16 | 2008 | 2008 | - 001 - | 01 | 07 | 21 | 2010 | FACILITY NAME | DOCKET NUMBER 05000 |

9. OPERATING MODE: 1

10. POWER LEVEL: 60

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) |
|---|---|
| Ray E. Buzard, Section Leader, Regulatory Affairs | 623-393-5317 |

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 | MG | W040 | 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 September 16, 2008, Unit 3 Operations personnel identified Motor Generator (MG) set 'A' was showing indications of being motorized due to an over-excited condition on MG set 'B'. The Control Element Drive Mechanism (CEDM) MG sets A and B supply power to the CEDM bus and are normally operated in parallel in order to support Control Element Assembly (CEA) movement in group mode. During trouble shooting activities, the 'B' MG set was removed from service while MG set 'A' provided power to the CEDMs. Upon removal from service, an undervoltage condition occurred on the CEDM system that resulted in a main turbine trip and initiated a reactor power cutback. Consistent with contingency actions established in the trouble shooting plan, a manual reactor trip was initiated.

The direct cause of the MG set 'B' condition was the failure of a transistor on the excitation voltage power supply circuit board. One design-related root cause was identified for this event.

The MG set 'B' excitation voltage regulation and suppression circuit boards were replaced. A plant modification which allows operators to override a failed automatic voltage regulator circuit on a degraded MG set until the load is shifted to the other MG set has been approved and is scheduled to be installed in all three units.

Unit 3 was restarted on September 19, 2008.

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17. **NARRATIVE** *(If more space is required, use additional copies of NRC Form 366A)*

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

1. REPORTING REQUIREMENT(S):

This LER is being submitted pursuant to 10 CFR 50.73 (a)(2)(iv)(A) to report a manual actuation of the reactor protection system (EIIS: JC). Specifically, on September 16, 2008, at approximately 14:00 hours, Palo Verde Nuclear Generating Station (PVNGS) Unit 3 control room operators (licensed) manually tripped the reactor from approximately 60 percent rated thermal power. At 16:23 hours an Event Notification System (ENS) call was made to report the event (ENS 44496).

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

Motor Generator (MG) (EIIS Code: AA) sets 'A' and 'B' supply power to the Control Element Drive Mechanism (CEDM) (EIIS Code: AA) bus and normally operate in parallel in order to support Control Element Assembly (CEA) (EIIS Code: AA) movement in the group mode.

The two MG sets are connected in parallel to a common bus to supply 240 VAC, 3 phase power through two parallel sets of two reactor trip circuit breakers (see drawing on the last page). These four breakers and their controls make up the reactor trip switchgear (RTSG) (EIIS Code: AA). The output from the RTSG is directed through circuit breakers for subgroups of CEAs and downstream individual CEA circuit breakers (EIIS: 52) and then through power switch assemblies containing silicon controlled rectifiers (SCRs) converting the 3 phase, AC power to a smoothed DC output. This smoothed DC output is then divided and distributed throughout the CEDM cabinets for ultimate delivery to the CEDM coils for all 89 CEAs.

Each MG set consists of a motor-generator, two inertial flywheels, one on each end, and related control equipment. Each MG set has a local control panel and can be remotely controlled from the local control panel of the other MG set. Remote control is provided to allow the operator the ability to synchronize the MG sets during operation.

A voltage regulator maintains the generator output voltage at a preset level by automatically controlling the field current fed to the exciter. The voltage setpoint can be adjusted by the operator locally.

The Reactor Power Cutback System (RPCS) (EIIS Code: AA) is a control system that responds to large load rejections or the failure of either main feedwater pump by dropping pre-selected control element assemblies and initiating other necessary control actions to obtain a rapid reduction in reactor power. This rapid power cutback capability permits the plant to remain on-line during these events and significantly reduces the requirements for steam bypass valve and feedwater pump capacity.

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**17. NARRATIVE** *(If more space is required, use additional copies of NRC Form 366A)*

The main turbine trip circuit receives an input from the undervoltage relays for the CEDM output bus the actuation of which would be indicative of a reactor trip.

3. INITIAL PLANT CONDITIONS:

Palo Verde Unit 3 was in Operating Mode 1 (Power Operations) at approximately 100 percent power at the initiation of this event. There were no other major structures, systems, or components that were inoperable at the start of the event that contributed to the event.

4. EVENT DESCRIPTION:

On September 16, 2008, at 01:00 hours with Unit 3 at 100 percent power, the CEDM MG set 'A' was showing indications of being motorized (excessive amps for parallel condition with higher amps on MG set 'B'). Both MG set output voltages were higher than normal. At 01:30 hours an attempt was made to adjust MG set load control by normal means (with the automatic potentiometer) but had no affect on the MG sets voltage or amperage. At 06:51 hours, Operations placed the CEDM control system to Standby as required by procedure to preclude group CEA motion should one MG set fail.

At 07:42 hours an attempt to control MG set voltage using the manual potentiometer was also unsuccessful in changing the load on either machine. Subsequent CEA coil voltage readings and MG set control cabinet thermography readings were obtained at 13:00 hours. The MG 'B' excitation control card had indications of hot spots and CEA hold coil voltages were exceeding manufacturer recommended limits. High coil voltage could lead to coil insulation degradation and possible coil failure, leading to grounds with the possibility of dropping individual CEAs.

At 14:00 hours, MG set 'B' was manually shutdown by opening its output contactor. This resulted in a momentary undervoltage condition on the CEDM bus before the MG set 'A' restored voltage to normal. The undervoltage condition caused a Main Turbine trip signal via the Main Turbine Electro-Hydraulic Control (EHC) (EIIS Code: TG) system. This resulted in a reactor power cutback (RPCB).

Following the control room operators verification of the plant conditions, and consistent with contingency actions established in the trouble shooting plan, the Control Room Supervisor (CRS) directed a manual reactor trip. Unit 3 was manually tripped, approximately 17 seconds after the RPCB, from approximately 60 percent power and Operations personnel implemented procedure 40EP-9EO02, "Reactor Trip." The CRS diagnosed an uncomplicated reactor trip. The plant was stabilized in Mode 3 at 14:27 hours and control room personnel transitioned to procedure 40OP-9ZZ10, "Mode 3 to Mode 5 Operations." The NRC Resident Inspector was notified of the reactor trip, and a four hour event notification call was made to NRC Headquarters via the Event Notification System (ENS) at 16:23 hours (ENS 44496).

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

5. ASSESSMENT OF SAFETY CONSEQUENCES:

The plant remained within safety limits throughout the event. The primary system and secondary system pressure boundary limits were not approached and no violations of the specified acceptable fuel design limits (SAFDL) occurred. No Engineered Safety Feature (ESF) actuations occurred and none were required. 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. Therefore, there were no adverse safety consequences or implications as a result of this event and the event did not adversely affect the safe operation of the plant or health and safety of the public.

The condition would not have prevented the fulfillment of any safety function and did not result in a safety system functional failure as defined by 10 CFR 50.73(a)(2)(v).

6. CAUSE OF THE EVENT:

The direct cause of the MG set 'B' over-excitation condition was the failure of the Q4 transistor on the excitation voltage power supply board which resulted in maximum excitation applied to the MG set.

The root cause associated with this event was that Unit 3 plant operators were unable to remove the degraded MG set from service without causing a main turbine trip, and subsequent RPCB followed by a manual reactor trip, because the MG set design does not allow the operators to override a failed automatic voltage regulator circuit.

7. CORRECTIVE ACTIONS:

The MG set 'B' excitation voltage regulation and suppression circuit boards were replaced. Additional testing of the excitation voltage power supply board was performed at the PVNGS rework facility.

A plant modification which allows operators to override a failed automatic voltage regulator circuit on a degraded MG set until the load is shifted to the other MG set has been approved and is scheduled to be installed in all three units.

8. PREVIOUS SIMILAR EVENTS:

A similar failure of the Q4 transistor in the same circuit occurred on April 29, 2007, when Unit 3 was in Mode 3 during plant startup from a short notice outage. Trouble shooting efforts focused on repair of the direct cause and no subsequent investigation for apparent or root cause was performed.

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17. **NARRATIVE** *(If more space is required, use additional copies of NRC Form 366A)*

## CEDM Bus Simplified