



A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear  
Generating Station

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102-05680-RSB/SAB/DJS  
April 06, 2007

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 2006-001-01**

Attached please find Supplement Licensee Event Report (LER) 50-529/2006-001-01 prepared and submitted pursuant to 10 CFR 50.73. This LER reports a shutdown required by Technical Specifications (TS) based on the failure to complete repairs on an Auxiliary Feed Water (AFW) pump turbine steam supply valve within the 7 day TS action completion time.

In accordance with 10 CFR 50.4, copies of this LER are being forwarded to the NRC Regional Office, NRC Region IV and the PVNGS Senior Resident Inspector. If you have questions regarding this submittal, please contact James A. Proctor, Section Leader, Regulatory Affairs, at (623) 393-5730.

Arizona Public Service Company makes no commitments in this letter.

Sincerely,

RB/SAB/DJS/gt

Attachment

cc: B. S. Mallett      NRC Region IV Regional Administrator  
M. B. Fields      NRC NRR Project Manager  
G. G. Warnick      NRC Senior Resident Inspector for PVNGS

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**LICENSEE EVENT REPORT (LER)**

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

Estimated burden per response to comply with this mandatory collection request: 50 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.

<b>1. FACILITY NAME</b> Palo Verde Nuclear Generating Station (PVNGS) Unit 2	<b>2. DOCKET NUMBER</b> 05000529	<b>3. PAGE</b> 1 OF 7
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**4. TITLE**  
TS Required Reactor Shutdown on failure to complete repairs on an AFW valve within the 7 day completion time.

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	10	2006	2006	- 001 -	01	04	06	2007		05000
										05000

<b>9. OPERATING MODE</b> 1	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§:</b> (Check all that apply)									
	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)						
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)						
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)						
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)						
<b>10. POWER LEVEL</b> 91	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(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)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)						
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)						
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER						
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A						

**12. LICENSEE CONTACT FOR THIS LER**

FACILITY NAME James A. Proctor, Section Leader, Regulatory Affairs	TELEPHONE NUMBER (Include Area Code) 623-393-5730
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**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	BA	FSV	T020	Y					

<b>14. SUPPLEMENTAL REPORT EXPECTED</b>				<b>15. EXPECTED SUBMISSION DATE</b>		
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE)				<input checked="" type="checkbox"/> NO		
				MONTH	DAY	YEAR

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

All times listed in this event report are approximate and Mountain Standard Time (MST) unless otherwise indicated.

On April 3, 2006, at 10:41 MST, during the performance of the A train Auxiliary Feed Water (AFW) turbine driven pump "In-service" surveillance test, Unit 2 obtained inconsistent position indications for a steam admission valve (SG-138A). All plant indications/parameters indicated the valve was closed with the exception of its power supply breaker. The breaker's red light indicated open, however, the turbine driven pump was not rolling and all other indications showed the valve did close as it was expected to. Maintenance activities included: coil and fuse replacement, reed switch replacement, valve internals replacement, and then replacement of the entire valve. During the retest, valve position indication was again lost. Since the additional repairs could not be made within the TS 7 day allowed completion time permitted for restoration, a Reactor Shutdown was commenced as required.

On April 10, 2006 at 12:33 MST Palo Verde Unit 2 was in Mode 1 (Power Operations), operating at approximately 91 percent power, when Control Room personnel commenced a reactor shutdown required by Technical Specification 3.7.5 Condition C. At 14:38 MST Operations personnel manually tripped the reactor from approximately 23 per cent power and entered Mode 4 at 20:56 MST.

In the past three years, Palo Verde reported reactor shutdowns required by Technical Specifications but none associated with the same root cause.

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

NOTE: All times listed in this event report are approximate and Mountain Standard Time (MST) unless otherwise indicated.

1. REPORTING REQUIREMENT(S):

This LER (50-529/2006-001-00) is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(A), to report the completion of a reactor shutdown required by Technical Specifications. Specifically, on April 10, 2006 at 12:33 hours Mountain Standard Time (MST), Palo Verde Nuclear Generating Station (PVNGS) Unit 2 commenced a reactor shutdown required by Technical Specification 3.7.5, Condition C. Limiting Condition for Operations (LCO) 3.7.5 requires three Auxiliary Feed Water (AFW) (EIS: BA) trains to be Operable. Condition A of this LCO provides allowance for one steam supply to the turbine driven AFW to be inoperable for a 7 day period. The inoperable steam admission valve SGAUV138A (EIS: BA-FSV) was not restored to an operable condition within 7 days. Unit 2 was required to shutdown to Mode 3 (Hot Standby) in 6 hours and to Mode 4 (Hot Shutdown) in 12 hours, starting at 10:41 MST on April 10, 2006. At 14:38 MST Operations personnel manually tripped the reactor from approximately 23 per cent power and entered Mode 4 at 20:56 MST, satisfying the LCO requirements.

(Reference: ENS call # 42487)

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

The AFW system consists of one essential steam turbine driven pump (train "A") (EIS: BA, P, TRB), one essential motor driven AFW pump (train "B") (EIS: BA, P, MO), and one non-essential motor driven AFW pump (train "N") configured into three trains. The essential steam turbine-driven and motor-driven AFW pumps are located on the 80 ft level in the Main Steam Support Structure (EIS: NM) in separate rooms designed to seismic category I requirements. Each essential pump provides 100 percent of AFW flow capacity to the steam generators (EIS: AB, SG) as assumed in the accident analysis. The AFW system mitigates the consequences of any event with a loss of normal feedwater (EIS: SJ). The design basis of the essential AFW trains is to supply water to the steam generator to remove decay heat and other residual heat, by

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delivering at least the minimum required flow rate to the steam generators at pressures corresponding to 1270 psia at the entrance to the steam generators.

3. INITIAL PLANT CONDITIONS:

On April 10, 2006 Palo Verde Unit 2 was in Mode 1 (Power Operations), operating at approximately 91 percent power while repairs were ongoing on steam admission valve SGA-UV-138A (EIIS: BA-FSV). Valve 2JSGA-UV-0138A is a bolted bonnet, stainless steel, 125Vdc, dual pilot assisted solenoid operated valve (SOV) Model 76HH-008BB manufactured by Target Rock Corporation (TRC).

No other major structures, systems, or components were inoperable at the start of the event that contributed to the event.

4. EVENT DESCRIPTION:

On April 3, 2006 at 10:41 during performance of surveillance test 73ST-9AF02, "AFA-P01 - In-service Test", the Control Room received Safety Equipment Systems Status (SESS) and Safety Equipment Inoperable Status (SEIS) alarms (EIIS: IO) when valves 2JSGA-UV-0138 and 2JSGA-UV-0138A were closed. Operations performed a visual inspection of the Control Room light indication, remote shutdown panel light indication, local indication, Emergency Response Facility Data Acquisition Data System (ERFDADS) (EIIS: IP), and the power supply breaker. All plant indications/parameters indicated the valves were closed with the exception of the breaker. The breaker's red light indicated open, however, the steam driven turbine AFW pump was not rolling and all other indications showed the valves did close. The 2JSGA-UV-0138A valve was quarantined, down powered, manually isolated and a work mechanism was generated.

Based on reported indications, Valve Services Engineering (VSE) suspected the solenoid coil on 2JSGA-UV-0138A had failed and initiated an engineering plan for troubleshooting. Initial troubleshooting by Valve Services Maintenance (VSM) identified the coil as having been shorted and its fuse protection blown for the SG-138A valve. The coil showed indication of heat induced failure. The coil and fuse were replaced. Per maintenance

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expectations, the condition of associated components was inspected. The insulation on the reed switch wiring was found to be cracked and deteriorated from high temperature. The two in-service reed switches were replaced. Following this switch replacement, multiple position indication failures resulted in repeated attempts to optimize the reed switch adjustments.

Valve seating surfaces were also lapped despite some difficulty due to steam leakage past the upstream isolation valve. Following an unsuccessful attempt to optimize the valve position reed switch settings, the valve internals were replaced based on the symptoms seen during position switch optimization. Following internal rebuild, valve position indication problems persisted. Eventually VSM was successful in getting the indication to work properly. However, a subsequent attempt to stroke the valve during surveillance testing was unsuccessful, with indications that the valve was not opening. VSE identified that the valve internals were not functioning properly. Subsequent inspection showed newly installed parts had indication of foreign material intrusion (valve binding and deep scratches on internal parts). The decision was made to cut out and replace the entire valve. Only the recently installed coil and reed switches were utilized with this new valve. During the retest, SG-138A valve position indication was again lost. Since the repairs could not be made within the 7 day timeframe permitted for restoration (TS LCO 3.7.5), a Reactor Shutdown was commenced as required.

5. ASSESSMENT OF SAFETY CONSEQUENCES:

The Auxiliary Feedwater system is the most important plant system with respect to the Probabilistic Risk Analysis (PRA) Core Damage Frequency (CDF). There was no actual impact to the health and safety of the public that occurred during the time period when one of two steam supplies to the turbine driven Auxiliary Feed pump was not operable. The Unit was shut down in accordance with Technical Specifications when repairs and testing for valve SG-138A were not completed within the 7 days permitted by LCO 3.7.5 Condition A. There was no deviation from license conditions during 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.

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The event did not result in a transient more severe than those analyzed in the updated Final Safety Evaluation Report Chapters 6 and 15. The event did not have any nuclear safety consequences or personnel safety impact.

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). The class 'B' and non-class 'N' Auxiliary Feed pumps remained operable and available during the 7 day maintenance completion time.

## 6. CAUSE OF THE EVENT:

The direct cause was that troubleshooting, repair, and retest activities for the Target Rock solenoid valve 2JSG-UV-138A were not completed in the timeframe permitted for continued power operation.

The root cause was that a dedicated Response Team was not established to optimize success paths for emergent equipment restoration activities. Existing station processes (*Sensitive Issues Manual, Section VII*) did not provide guidance for parallel path trouble shooting and restoration contingencies necessary to increase the likelihood of restoring required equipment Operability prior to a required Technical Specification Shutdown.

The coil was last replaced on November 23, 2001 via corrective maintenance work order (CMWO) 2442645. The last internal rebuild was completed on May 10, 2002 via CMWO 2514064. The preventive maintenance (PM) frequency of two cycles (2C) or 36 months is specified in the PM basis for coil replacement. The coil for SG- 138A valve in Unit 2 should have been replaced during the spring outage of 2005 to meet this recommended frequency. When VSE found that coil replacement had not been included in the original outage scope, they initiated a corrective maintenance work order (CMWO). This CMWO was not approved for work during the outage with the comment that it could be worked online. Since it was not replaced as requested, the coil failed after being in service for more than 41 months.

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Contributing to the cause of the event were these factors:

- Station management was overly confident in the ability of Valve Services Maintenance and Engineering to successfully troubleshoot and repair equipment within the Technical Specification timeframes. A history of prior successes had conditioned station personnel to treat this failure as routine work despite the time critical shutdown condition.
- Although the use of Target Rock solenoid valves in high temperature carbon steel applications had been recognized as the root cause of continued failures with SG-138A at Palo Verde, coping strategies were accepted rather than eliminating this valve design from that application.
- The expected preventive maintenance (PM) frequency of coil replacement for SG-138A of 36 months (2C) was not met. This was due to failure to fully implement recommended preventive maintenance frequency changes.
- Although troubleshooting activities identified the need to replace reed switches, multiple replacement of the reed switches did not result in accurate position indication for 2-SGA-UV-0138A. This required additional troubleshooting and replacement time that delayed resolution of the position indication failures.

7. **CORRECTIVE ACTIONS:**

Valve SG-138A operability was restored by using the reed switch block assembly removed from Unit 3's SG-138A valve. Unit 3 was in a refueling outage at the time the reed switch block assembly was used to make repairs in Unit 2.

The Station Management team response for entry into time dependent Technical Specification Limiting Condition for Operation (LCOs) will be formalized to ensure troubleshooting and repair activities are completed within the permitted timeframes so that safe power operations may continue. This action will establish a formal protocol for ensuring organizational responsibility for implementing an effective equipment restoration plan.

Two reed switches were sent to Target Rock Corporation for testing and if necessary, destructive evaluation. PVNGS will also send a sample of suspected defective reed switches to Hi-Rel Laboratories for independent Equipment Root Cause of Failure

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Analysis (ERCFA). Valve Services Engineering (VSE) will evaluate the ERCFA analysis reports from both Target Rock and Hi-Rel Laboratories to determine if reed switches procured from the qualified vendor, Target Rock, are materially defective. If it is determined that the material is defective Target Rock Corporation will be contacted to evaluate any applicable Part 21 notifications.

## 8. PREVIOUS SIMILAR EVENTS:

In the past three years, Palo Verde reported reactor shutdowns required by Technical Specifications but none associated with the same root cause.

(LER) 50-528/2004-001-00 reported discovery of pressure boundary leakage and subsequent manual reactor shutdown required by technical specifications.

(LER) 50-528/2005-004-00 reported a shutdown required by Technical Specifications based on the inability to return "B" Emergency Diesel Generator to operable status following a failed routine surveillance test within the required action completion time.

(LER) 50-529/2005-004-00 reported a shutdown required by Technical Specifications based on the inoperability of all four channels of the Core Protection Calculators.

(LER) 50-528/2005-006-00 reported a shutdown required by Technical Specifications based on the inability to return "A" Emergency Diesel Generator to operable status following a failed routine surveillance test within the TS action completion time.

(LER) 50-529/2005-005-00 reported a shutdown required by Technical Specification LCO 3.0.3.a based on Unit 2 and Unit 3 declaring both trains of the Emergency Core Cooling Systems (ECCS) and Containment Spray Systems INOPERABLE due to the Refueling Water Tank (RWT) being INOPERABLE.