



*A subsidiary of Pinnacle West Capital Corporation*

Palo Verde Nuclear  
Generating Station

Cliff Eubanks  
Vice President  
Nuclear Operations

Tel (623) 393-6116  
Fax (623) 393-6077

Mail Station 7602  
PO Box 52034  
Phoenix, Arizona 85072-2034

102-05364-CE/CKS/DGM/DFH  
October 24, 2005

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 2005-005-00**

Attached, please find Licensee Event Report (LER) 50-528/2005-005 which reports an automatic Reactor Protection System (RPS) actuation and an Engineered Safety Feature (ESF) actuation.

In accordance with 10CFR50.4, a copy of this LER is being forwarded to the NRC Regional Office, NRC Region IV and the Resident Inspector. If you have questions regarding this submittal, please contact Daniel G. Marks, Section Leader, Regulatory Affairs, at (623) 393-6492.

Arizona Public Service Company makes no commitments in this letter. The corrective actions described in this LER are not necessary to maintain compliance with regulations.

Sincerely,

A handwritten signature in black ink, appearing to read "Cliff Eubanks", is written over the "Sincerely," text.

CE/CKS/DGM/DFH/ca

Attachment

cc: B. S. Mallett  
G. G. Warnick  
M. B. Fields

NRC Region IV Administrator  
NRC Senior Resident Inspector for PVNGS  
NRC NRR Project Manager

JE22

## 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](mailto: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.

1. FACILITY NAME PALO VERDE NUCLEAR GENERATING STATION UNIT 1	2. DOCKET NUMBER 05000528	3. PAGE 1 OF 5
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## 4. TITLE

Unplanned Reactor Trip and Engineered Safety Feature Actuation – Unit 1

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
08	26	2005	2005	005	00	10	24	2005	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE  2	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (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)						
10. POWER LEVEL  3	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input checked="" 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 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 Daniel G. Marks, Section Leader, Regulatory Affairs	TELEPHONE NUMBER (Include Area Code) 623-393-6492
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## 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

## 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 26, 2005 at approximately 18:24 (MST), Unit 1 reactor tripped during a plant startup. Main Feedwater had been placed in service and the digital feedwater control system (DFWCS) was in automatic. Uncomfortable with the system performance, the secondary control room operator attempted to maintain steam generator (SG) level by taking manual control of the DFWCS and adjusting the level. After several attempts selecting the DFWCS from automatic to manual, excessive feed rate increased the SG water level to near its trip setpoint before feeding was secured. As the cooler water expanded, the high SG level setpoint was reached resulting in an engineered safety feature (ESF) actuation of the Main Steam Isolation System (MSIS) and a Reactor Trip once the S/G reached 91.5 percent narrow range (NR) level. The high level trip was caused by a combination of individual and team human performance deficiencies and inadequate resolution of identified DFWCS issues. Operation's management removed affected personnel from shift duties until preliminary investigation determined extent of performance deficiencies and coached those individuals on personal accountability to ensure compliance with Operations Department Principles and procedures prior to resumption of shift duties.

No similar condition has been reported in the past three years.

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

**1. REPORTING REQUIREMENT(S):**

Arizona Public Service (APS) is reporting this condition pursuant to 10 CFR 50.73(a)(2)(iv)(A) for an automatic reactor trip caused from a Reactor Protection System (RPS) actuation and an Engineered Safety Feature (ESF) actuation from a Main Steam Isolation Signal.

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

DFWCS Single Element Control Functional Description

The Digital Feedwater Control System (DFWCS) is designed to provide automatic steam generator water level control from the time a main feedwater pump is placed into service at about 2% reactor power. In this low power mode the FWCS is in a Single Element Control Mode and uses Steam Generator (SG) narrow range level as the measurement for the developing the controller error relative to an Operator specified setpoint. To assist the level controller with anticipating load changes and the resulting shrink and swell of SG level, an output bias is added to the controller output processed from an impulse module signal developed from the Steam Bypass Master Controller Demand output and/or the Turbine Load Index output. To understand the responsiveness of the Single Element Control tuning, it is important to understand the impact of cold feedwater on the SG and that the controller is tuned adaptively from feedwater temperature. For a typical startup with feedwater temperature around 100°F, the responsiveness of the FWCS is tuned to be very slow. This is to compensate for the impact of the cold feedwater on the RCS and the amount of time it will take before the water will heat up and increase the SG level. As power is increased to about 11% and the main turbine is placed on line, feedwater temperature has increased to approximately 250°F and the tuning settings have become more responsive. At 14% reactor power, the FWCS shifts to Three Element Control.

To facilitate the Operators interface with the system, two methods of operating the system are provided. The Operator may chose from a graphical interface using a mouse for selecting and operating system features or the Operator may use an older style Auto/Manual Station interface. Both interfaces operate in parallel and reflect changes made on the other interface. Procedures 40OP-9FT01, *Feedwater Pump Turbine A*, and 40OP-9FT02, *Feedwater Pump Turbine B*, provide the guidance to smoothly transfer without system perturbation between manual and automatic by manually matching the controller output.

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## 3. INITIAL PLANT CONDITIONS:

On August 26, 2005, at approximately 18:26 Mountain Standard Time (MST), Unit 1 was in Mode 2 in preparation to enter Mode 1. Reactor power was at approximately 3 percent power and at normal operating temperature (NOT) and normal operating pressure (NOP).

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:

Following the transition from auxiliary feed to main feed in Unit 1 on 08/26/05, automatic steam generator feedwater level control was not smoothly established. The initial attempt at a transfer to automatic per step 4.3.13 of 40OP-9FT01, *Feedwater Pump Turbine A*, resulted in a no feed condition. Recognizing this was not the proper result of this step, the secondary control room operator (SO) returned to manual valve control briefly to re-establish feedflow and again attempted to establish automatic control. The result of the second evolution was an underfeed condition that set a trend of gradually lowering SG levels. Uncomfortable being lower than the 30 to 40% narrow range level band prescribed by the procedure, several increases to the level setpoint were made in an attempt to restore sufficient feedflow to restore SG levels within band. Uncomfortable with the continuing slow SG level decrease, the SO again returned to manual valve control to increase feedflow until SG level was observed to be increasing. The DFWCS was again briefly returned to automatic operation when it appeared to the SO to be underfeeding again. After a setpoint adjustment in manual, the DFWCS was again returned to automatic operation where the level rapidly increased to about 76% NR level, when the DFWCS was taken to manual and valve setpoint reduced and then closed. The resultant expansion as the feedwater temperature increased from about 100°F to nearly 565°F caused the level to swell to the main steam isolation signal (MSIS) setpoint of 91.5% NR level initiating a reactor trip. The investigation has determined this event occurred because personnel failed to implement expected requirements and good practices prescribed by their training and delineated in procedures.

## 5. ASSESSMENT OF SAFETY CONSEQUENCES:

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

The event experienced by Unit 1 did not result in a transient more severe than those previously analyzed in the Palo Verde Updated Final Safety Analysis Report (UFSAR), Chapter 15. No Specified Acceptable Fuel Design Limit (SAFDL) violations occurred and transient peak pressures were less than 110 percent of design pressures. All equipment and systems assumed in UFSAR, Chapter 15 were functional and performed as required.

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 Causes were individual and crew failures to implement expected requirements and good practices prescribed by their training and delineated in procedures.

Root Cause # 1: Consistent standards of performance by Unit 1 Operations Crew C were not sufficiently anchored.

Root Cause # 2: Inconsistent feedwater control system performance at low power levels has not been effectively resolved since the digital upgrade. This has led to acceptance of operational strategies to cope with perceived system instability at low power levels.

Contributing Cause # 1: Procedures 40DP-9FT01 & (2), *Feedwater Pump Turbine A(B)*, are not sufficiently human factored for all users, making them susceptible to performance error and resultant system perturbations.

Contributing Cause # 2: Common belief existed among licensed operators that the DFWCS can not reliably control SG level well at low power. This belief was not based on reviewing actual performance data and led to acceptance of the condition and mitigating strategies.

Contributing Cause # 3: Training was not commensurate with the difficulty of putting the DFWCS into auto operation given the current procedure detail and system design. This has resulted in improper operation of DFWCS components while in single element control.

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**7. CORRECTIVE ACTIONS:**

An independent investigation of this event was conducted in accordance with Palo Verde's corrective action program. Listed below are some of the corrective actions from the investigation that were taken or are scheduled in the future.

- Operation's management removed affected personnel from shift duties until preliminary investigation determined extent of performance deficiencies.
- Operation's management coached those personnel removed from shift on personal accountability to ensure compliance with Operations Departments Principles and procedures prior to resumption of shift duties.
- Just-in-time (JIT) training was conducted for the licensed Operator placing the first Main Feed Pump in service including placing the DFWCS into automatic prior to the Unit 1 power ascension above 3%.
- Operation's management will evaluate crew performance and composition to ensure optimal matching of personal strengths necessary to sustain a culture committed to improving performance within the License and Operation's Department Practices and implementing procedures.
- Engineering will modify the DFWCS for all three Units to improve SG level control under single element control at low power.
- Revise Operating Procedures to provide better guidance and human factors when transferring feedwater control from manual to automatic.

**8. PREVIOUS SIMILAR EVENTS:**

No similar condition has been reported in the past three years.

**9. ADDITIONAL INFORMATION:**

None.