



*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

102-05360-CE/CKS/REB  
October 18, 2005

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 2005-004-00**

Attached please find Licensee Event Report (LER) 50-529/2005-004-00 prepared and submitted pursuant to 10 CFR 50.73. This LER reports a shutdown required by Technical Specifications based on the inoperability of all four channels of the Core Protection Calculators.

In accordance with 10 CFR 50.73(d), copies of this LER 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 Daniel G. Marks, Section Leader, Regulatory Affairs, at (623) 393-6492.

Arizona Public Service Company makes no commitments in this letter.

Sincerely,

A handwritten signature in cursive script, appearing to read "Cliff Eubanks", is written over a horizontal line.

CE/CKS/REB/ca

Attachment

cc:	B. S. Mallett	NRC Region IV Regional Administrator
	M. B. Fields	NRC NRR Project Manager - (send electronic and paper)
	G. G. Warnick	NRC Senior Resident Inspector for PVNGS

JE22

NRC FORM 366 (6-2004)		U.S. NUCLEAR REGULATORY COMMISSION		APPROVED BY OMB: NO. 3150-0104		EXPIRES: 06/30/2007									
<b>LICENSEE EVENT REPORT (LER)</b>  (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.							
1. FACILITY NAME Palo Verde Nuclear Generating Station Unit 2						2. DOCKET NUMBER 05000529		3. PAGE 1 OF 6							
4. TITLE Technical Specification Required Shutdown Due to Core Protection Calculators Inoperable															
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 None		DOCKET NUMBER 05000				
08	22	2005	2005	- 004 -	00	10	18	2005	FACILITY NAME None		DOCKET NUMBER 05000				
9. OPERATING MODE  1		11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)													
10. POWER LEVEL  99		<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) <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) <div style="text-align: right; font-size: small;">Specify in Abstract below or in NRC Form 366A</div>													
12. LICENSEE CONTACT FOR THIS LER															
FACILITY NAME Daniel G. Marks, Section Leader, Regulatory Affairs								TELEPHONE NUMBER (Include Area Code) (623) 393-6492							
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	SB	JC	W351	Y											
14. SUPPLEMENTAL REPORT EXPECTED <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO								15. EXPECTED SUBMISSION DATE		MONTH	DAY	YEAR			
ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)  <p>On August 22, 2005 at approximately 1750 Mountain Standard Time (MST), Unit 2 completed a reactor shutdown required by the Technical Specifications. The shutdown was required due to all four channels of the Core Protection Calculators being declared inoperable on August 22 at 1326 MST based on information from the CPC vendor that software changes that had previously been implemented in Unit 2 CPCs changed the way the CPCs would operate for a failed sensor.</p> <p>The condition investigation is ongoing. Preliminary results indicate a CPC system requirement specification was not properly translated into the CPC software by the vendor. The Unit 2 software has been corrected.</p> <p>Although PVNGS has reported other Technical Specification required shutdowns in the last three years none were due to similar causes or equipment.</p>															

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

1. REPORTING REQUIREMENT(S):

This LER (50-529/2005-004-00) 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 August 22, 2005 at 1750 hours Control Room personnel completed a reactor shutdown (entered Mode 3, Hot Shutdown) to comply with Limiting Condition for Operation (LCO) 3.0.3 as a result of all four channels of the Core Protection Calculators (CPC) being declared inoperable at 1326 hours.

Note: all times in this report are approximate and Mountain Standard Time unless otherwise indicated.

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

The CPCs consist of four separate, redundant channels. Each channel is a computer system that continuously calculates thermal conditions and thermal limits. The CPC system is an integral part of the plant protective system (EIS:JC) in that it provides two trips to the reactor protection system (RPS) (EIS:JC); Departure from Nucleate Boiling Ratio (DNBR) and Local Power Density (LPD). Trip signals are provided to the RPS whenever the minimum departure from nucleate boiling ratio (DNBR) or fuel design limit Local Power Density is approached during reactor operation.

The four channels of CPCs are located inside the auxiliary protective cabinet where the channels are physically separated and isolated from each other. Each CPC channel provides contact outputs to its respective RPS channel. The following analog input sensors are processed in each CPC channel:

- 2 Cold Leg Temperatures
- 2 Hot Leg Temperatures
- 1 Pressurizer Pressure
- 3 Ex-core Neutron Flux Detectors

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In the event of a failure of one of the input sensors a trip signal for the applicable CPC channel should be generated.

Each input parameter is read by two separate analog input modules in a channel. One of the two redundant analog input modules is normally selected. In the event the normally selected module indicates a failure, the software will select the alternative module. In the event of a failure of both modules at the same time a trip signal for that channel should be generated.

Detectable CPC channel failures, resulting in a loss of protective function and channel inoperability, are required to generate CPC Fail indication and associated Low DNBR and High LPD channel trips. Input failures resulting in a sensor out of range affecting one or more CPC process inputs will result in a CPC Sensor Failure indication. In addition, since the CPC software limits the sensor value to the lower or upper range limit value, a CPC channel trip would be generated in most cases due to these extreme values.

## 3. INITIAL PLANT CONDITIONS:

On August 22, 2005 at 1326 hours Unit 2 was operating in Mode 1, Power Operation, at approximately 100 per cent power when control room personnel declared all four channels of the CPCs inoperable.

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

## 4. EVENT DESCRIPTION:

On May 18, 2005 Westinghouse personnel identified a potential problem with the installed version of the CPC software for Unit 2. It was discovered that the installed

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version (release 6.1) of the Unit 2 CPC software was not consistent with the system requirements regarding the system response to analog input module errors. When both analog input modules within a CPC channel indicate an error simultaneously the CPC uses the last known good value. However, the system requirements state that a channel trip should be initiated for this event. Software release 6.1 was installed into the Unit 2 CPCs in May 2005 and resulted in the CPCs not being able to generate this trip signal. On August 8, 2005 Westinghouse personnel completed an apparent cause analysis for the issue and concluded the issue was a nuclear safety concern.

At 0900 hours on August 22, 2005, during a weekly phone call, a Westinghouse engineer informed the Palo Verde Operations Computer System (OCS) section leader of the issue with the CPC software. The OCS section leader discussed the issue with the OCS department leader, an OCS engineer, OCS planner and a nuclear fuel analysis engineer and then performed a test in the shop that confirmed the problem. The OCS section leader informed the Unit 2 shift manager (SM) at 1300 on 8/22/05 of the issue.

The SM made the decision to enter Technical Specification LCO 3.0.3 at 1326 due to the installed CPC software not supporting Technical Specification Bases 3.3.1 which states:

"Those detectable channel failures resulting in a loss of protective function and channel inoperability will result in a CPC Fail indication and associated Low DNBR and High LPD trips".

Plant shutdown commenced at 1605 on 8/22/05 (reference ENS 41939) and LCO 3.0.3 was exited at 1750 when the unit entered Mode 3, Hot Standby.

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**5. ASSESSMENT OF SAFETY CONSEQUENCES:**

Palo Verde Unit 2 CPCs provide the reactor trip functions for Low DNBR and High LPD. The CPC system is a four channel system that uses a two out of four logic for reactor trip signal generation. Since a sensor failure most likely will occur as a result of a localized failure in one of four channels the CPC safety function will continue to be provided by the other three safety channels. Likewise, a failure of both analog input modules in more than one channel at the same time is not likely to occur. It should be noted that sensor failures involved in the identified condition would have to occur within approximately 50 milliseconds.

Both a sensor failure and an analog input module failure actuate contact output signals in the affected channel to the CPC Operator's Module Alarm and the plant annunciator alarm in the main control room which would alert the control room operators to the condition.

Plant Technical Specification LCO 3.3.1 requires that a failed channel be placed in bypass or trip within one hour. PVNGS alarm response procedure 42AL-2RK5A directs compliance with LCO 3.3.1 for a CPC sensor failure (alarm window 5A13B).

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 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.

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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 investigation into the cause of this event is ongoing. Preliminary results indicate the direct cause is that a CPC system requirement specification was not properly translated into the CPC software by the vendor. If the completed investigation report includes information which would substantively change the reader's perception of the event, an LER supplement will be submitted.

## 7. CORRECTIVE ACTIONS:

On August 25, 2005 activities were completed to install CPC software version 6.3 in all four channels of Unit 2 CPCs.

After the root cause investigation is completed any identified corrective actions, including actions to prevent recurrence, will be entered into the corrective action process.

## 8. ADDITIONAL INFORMATION

The CPCs in Unit 2 were upgraded in November 2003. Units 1 is scheduled to receive the upgraded CPC system in the refueling outage currently in progress and Unit 3 is scheduled to receive the upgraded CPC system in a future refueling outage. The problem identified in this LER is therefore limited to Unit 2. Changes will be made to Units 1 and 3 upgraded CPCs, prior to their installation, to correct the problem.

## 9. 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.