



A subsidiary of Pinnacle West Capital Corporation

10 CFR 50.73

Palo Verde Nuclear  
Generating Station

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102-06301-DCM/FJO  
December 29, 2010

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

Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)  
Units 1, 2, and 3  
Docket No. STN 50-528, STN 50-529, and STN 50-530  
License No. NPF 41, NPF 51, and NPF 74  
Licensee Event Report 2010-002-01**

Enclosed please find Licensee Event Report (LER) 50-528/2010-002-01, which supplements a previously reported Main Steam Isolation Bypass Valve calculation error that resulted in operation prohibited by technical specifications affecting all three units. This supplement is being submitted to report the results of the completed event investigation.

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

Arizona Public Service Company makes no commitments in this letter.

Sincerely,

  
FOR D.C. MIMS

DCM/RAB/TNW/FJO

Enclosure

cc: E. E. Collins Jr. NRC Region IV Regional Administrator  
J. R. Hall NRC NRR Project Manager (send electronic and paper)  
L. K. Gibson NRC NRR Project Manager (send electronic and paper)  
J. H. Bashore NRC Senior Resident Inspector (acting) 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: 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.

<b>1. FACILITY NAME</b> Palo Verde Nuclear Generating Station (PVNGS) Unit 1	<b>2. DOCKET NUMBER</b> 05000528	<b>3. PAGE</b> 1 OF 5
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**4. TITLE**  
Main Steam Isolation Bypass Valve Calculation Error Resulting in Operation Prohibited by Tech Spec

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
05	07	2010	2010	- 002 -	01	12	29	2010	PVNGS Unit 2	05000529
									FACILITY NAME	DOCKET NUMBER
									PVNGS Unit 3	05000530

<b>9. OPERATING MODE</b> 5 / 1 / 1	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§:</b> (Check all that apply)			
<b>10. POWER LEVEL</b> 0 / 100 / 100	<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 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 checked="" 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 Marianne Webb, 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>14. SUPPLEMENTAL REPORT EXPECTED</b>	<b>15. EXPECTED SUBMISSION DATE</b>	MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/> NO			

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

On May 7, 2010, Palo Verde discovered that a calculation used for the closing force required for Main Steam Isolation Bypass Valves (MSIBVs) was non-conservative. During the Component Design Basis Review (CDBR), it was determined that the closing force would be inadequate to fully close the MSIBVs upon the receipt of a Main Steam Isolation Signal when Steam Generator (SG) pressure is greater than 700 psi. This condition renders the MSIBVs inoperable when SG pressure is above 700 psi. At the time of discovery, Unit 1 was in Mode 5 and the MSIBVs were not required to be operable; Unit 2 and Unit 3 were in Mode 1, and the MSIBVs were required to be operable. Both Unit 2 and Unit 3 entered the applicable Technical Specification (TS) Limited Condition for Operation (LCO) 3.6.3, Containment Isolation Valves. As an immediate corrective action, Unit 2 and Unit 3 ensured the MSIBVs were closed, with their penetration flowpath isolated to comply with the conditions of TS LCO 3.6.3.

Administrative barriers that existed at the time of the calculation revision (December 2000) were unsuccessful in preventing the error due to ineffective reviews and the lack of a questioning attitude. Calculations with the potential for this error were reviewed and evaluated. The extent of condition evaluation determined the error was limited to safety-related Air Operated Valve (AOV) gate valves.

No similar events involving a non-conservative calculation for an AOV have been reported by PVNGS in the last three years.

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

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

1. REPORTING REQUIREMENT(S):

This Licensee Event Report (LER) is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B) as an operation prohibited by Technical Specifications (TS) Limiting Condition for Operation (LCO) 3.6.3, which requires containment isolation valves to be operable.

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

Each of Palo Verde's units contains two Steam Generators (SG) (EIS: SB / SG) which provide high pressure saturated steam to the main turbines through two 28 inch main steam lines (total of four per unit). Each of the main steam lines is isolated by a Main Steam Isolation Valve (MSIV) (EIS: SB / ISV): SG-UV170 and SG-UV180 for SG 1; and SG-UV171 and SG-UV181 for SG 2. The MSIVs close upon the receipt of a Main Steam Isolation Signal (MSIS). A common header connects each of the four main steam lines downstream of the MSIVs.

One main steam line from each SG contains a normally closed MSIV Bypass Valve (MSIBV) (EIS: SB / ISV). The MSIBV SG-UV169 bypasses MSIV SG-UV180 from SG 1 and MSIBV SG-UV183 bypasses MSIV SG-UV171 from SG 2. The valve and actuator are Flowserve / Anchor Darling Models 93-15199 and W30748 respectively.

The MSIBVs are 4 inch air operated flexible wedge gate valves. Air pressure opens the MSIBVs and spring force closes the MSIBVs when the air pressure is vented from the actuators. The MSIBVs close on an MSIS and fail closed on a loss of air pressure or control signal.

The MSIBVs may be opened to warm-up downstream piping and equalize pressure across the MSIVs to permit opening of the MSIVs during plant startup. The MSIBVs are stroked open and closed for surveillance testing requirements. The safety function of the MSIBV is to close upon receipt of an MSIS. The MSIS actuates to close the MSIVs and MSIBVs upon receipt of low steam generator pressure, high steam generator water level, and high containment pressure.

3. INITIAL PLANT CONDITIONS:

On May 7, 2010, Unit 1 was in Mode 5 (Cold Shutdown) following refueling, and Unit 2 and Unit 3 were at approximately 100 percent power in Mode 1 (Power Operations). There were

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no major structures, systems, or components that were inoperable that contributed to this event.

4. EVENT DESCRIPTION:

On May 7, 2010, during a review of a calculation for piston style Air Operated Valve (AOV) thrust and actuator sizing, Palo Verde identified a deficiency in the calculation. The calculation could not demonstrate the available closing force would fully close the MSIBVs (SG-UV169 and SG-UV183) when the SG pressure is above 700 psi. Further evaluation revealed the calculation error applies to all three units, and undersized valve actuators were installed during original plant construction.

Operations personnel declared the MSIBVs inoperable in all three units. Unit 2 and Unit 3 entered LCO 3.6.3, Containment Isolation Valves, and ensured the MSIBVs were closed with their penetration flowpath isolated to comply with the conditions of TS LCO 3.6.3. Unit 1 was in Mode 5 and the MSIBVs were not required to be operable.

5. ASSESSMENT OF SAFETY CONSEQUENCES:

The MSIBVs are not required to obtain safe shutdown, and are normally closed valves.

An initial evaluation was performed based on both MSIBVs open at the same time. The evaluation determined this condition was bounded by the existing Main Steam Line Break with an MSIV open. Therefore, the calculation error did not result in a condition more severe than those previously analyzed in the PVNGS UFSAR, Chapter 15, Accident Analysis.

The Engineering evaluation demonstrated the most limiting scenario was a Post Trip Steam Line Break (SLB) and a Mode 3 SLB with the failure of both of the MSIBVs to close. The results satisfied all acceptance criteria:

- Minimum Departure from Nucleate Boiling Ratio (mDNBR) remains above the Specified Acceptable Fuel Design Limit (SAFDL);
- Linear Heat Rate (LHR) is below the 21 kW/ft limit, demonstrating that fuel centerline melting does not occur;
- Reactor Coolant System (RCS) and Main Steam (MS) boundaries are not challenged by the increase in pressure or by the rate of change of pressure and temperature.

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).

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There was no actual impact to the health and safety of the public as a result of the inability of the MSIBVs to close with SG pressures above 700 psi. The condition did not result in any challenges to the fission product barriers or result in the release of radioactive materials. The 10 CFR 100 offsite dose criteria were never challenged or exceeded.

6. CAUSE OF THE EVENT:

The investigation found that administrative barriers were unsuccessful in preventing the calculation error due to ineffective reviews and the lack of a questioning attitude. Additionally, management of the AOV program did not consistently maintain adequate focus on engineering fundamentals in that the design basis limits were not clearly established and insufficient technical rigor introduced non-conservatisms into the valve design calculations.

7. CORRECTIVE ACTIONS:

The immediate corrective actions for Unit 2 and Unit 3 were to ensure the MSIBVs were closed with their penetration flowpath isolated to comply with the conditions of TS LCO 3.6.3. Following Unit 1's refueling outage, the MSIBVs were closed and isolated to comply with TS LCO 3.6.3 prior to the SG pressure reaching 700 psi.

Additionally, calculations with potential for this error were reviewed and evaluated. It was determined this type of error impacts Downcomer Feedwater Isolation and Steam Generator Blowdown Isolation valves.

The following corrective actions have been completed:

- Confirmatory Action Letter (CAL) actions that strengthened barriers to prevent errors in the area of the engineering fundamentals. Specifically, enhancements to the following two areas were developed and implemented to address this issue:
  - Engineering Training
    - Design and develop training on the use of Engineering Department Guide EDG-01, "Engineering Human Performance Tools", and EDG-02, "Engineering Human Performance Tools for Technical Task Risk / Rigor".
    - Develop an indoctrination course that introduces the documents that are core to understanding engineering standards, product quality and accountability.
    - Develop and implement Engineering excellence seminars to promote and instill engineering professionalism in three 2010 department improvement areas; Alignment, Proactive Focus, and Engineering Advocacy.

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o Engineering Tools

- Develop a Conduct of Engineering procedure with engineering principles and standards.
- Develop an Engineering Principles and Expectations handbook.
- Develop a procedure that describes the purpose, conduct, membership, criteria, and requirements for using an Engineering Quality Product Review Board.

The following additional corrective actions are currently in progress:

- Identify the Design Bases and limiting Design and Licensing Bases Accidents applicable to the MSIBVs, Downcomer Feedwater Isolation Valves and SG Blowdown Isolation Valves.
- Revise the affected licensing and design documents.

Engineering fundamentals and principles continue to be emphasized through ongoing efforts, such as Engineering Excellence seminars and continuing training.

8. PREVIOUS SIMILAR EVENTS:

No similar events involving a non-conservative calculation for an air operated valve have been reported by PVNGS in the last three years.