10 CFR 50.73

A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear Generating Station

Dwight C. Mims
Vice President
Regulatory Affairs and Plant Improvement

Tel. 623-393-5403
Fax 623-393-6077

Mail Station 7605
P. O. Box 52034
Phoenix, Arizona 85072-2034

102-05881-DCM/REB
August 08, 2008

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 2006-005-01

Attached, please find Licensee Event Report (LER) 50-528/2006-005-01 that has been prepared and submitted pursuant to 10 CFR 50.73. This LER supplements the previously submitted LER reporting the failure of a safety injection system check valve to properly seat.

In accordance with 10 CFR 50.4, 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 Ray E. Buzard, Section Leader, Regulatory Affairs, at (623) 393-5317.

Arizona Public Service Company makes no commitments in this letter.

Sincerely,

D. C. Mims

DCM/REB/gat

Attachment

cc: E. E. Collins Jr. NRC Region IV Regional Administrator
M. T. Markley NRC NRR Project Manager - (send electronic and paper)
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

Technical Specification Prohibited Condition due to Check Valve Not Seated

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
10	05	2006	2006	- 005 -	01	08	08	2008	FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE

3

10. POWER LEVEL

00

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	BP	V	B350	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 October 5, 2006, with Unit 1 in Mode 3, Hot Standby, a safety injection check valve failed to seat properly as indicated by surveillance testing. Safety injection check valve 1PSIEV134 (SI-134) was not in its fully seated position at the time of entry into a condition that required the valve to be OPERABLE.

The cause of the valve failure was frictional forces in excess of the gravitational forces acting on the disc assembly which prevented the valve disc from fully seating and sealing on its own. Contributing to this cause was the fact that SI-134 was not assembled by the supplying vendor in accordance with their assembly drawings. SI-134 was disassembled and inspected, a new bonnet/disc assembly was installed in the valve and the valve passed required testing. Preventive maintenance programs have been revised to prevent recurrence.

APS reported one similar check valve event within the past three years. Corrective actions for that event were scheduled, but had not been implemented for the valve identified in this event prior to occurrence of this failure.

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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 LER is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B) to report a condition prohibited by the Technical Specifications (TS).

Specifically, on October 5, 2006, at 1123 hours operations personnel increased reactor coolant system (RCS)(EIIS: AB) pressure to greater than 1837 psia with the plant in Mode 3, Hot Standby. The TS requires two trains of emergency core cooling systems (ECCS)(EIIS:BP BQ) to be OPERABLE in this condition. However, safety injection check valve 1PSIEV134 (SI-134)(EIIS: V) was not in its seated position at the time of the transition. Proper operation of the check valve is verified with RCS pressure greater than 1600 psia. The most recent successful test prior to this event was completed on October 8, 2005. Operations personnel were not aware of the status (and could not have known) of the check valve position until 1815 hours on October 5, 2006, when testing of the check valve was conducted and revealed that the valve was not seated.

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

The function of the ECCS is to provide core cooling and negative reactivity to ensure that the reactor core is protected after certain accidents. Two redundant, 100% capacity trains are provided. In MODES 1, 2, and 3, with pressurizer pressure (EIIS: PZR) greater than or equal to 1837 psia or with RCS cold leg temperature (Tc) greater than or equal to 485°F both trains are required to be OPERABLE with each train consisting of High Pressure Safety Injection (HPSI)(EIIS: BQ) and Low Pressure Safety Injection (LPSI)(EIIS: BP) subsystems. This ensures that 100% of the core cooling requirements can be provided in the event of a single active failure.

SI-134 is a Borg-Warner (B-W), Model 77790, 12 inch, 1500 lb, ASME Class 2, bonnet hung, swing check valve, located on the LPSI cold-leg injection piping inside containment on the 80 foot elevation. This check valve functions to protect from over-pressurization of the LPSI piping during HPSI pump operation. The check valve opens to allow safety injection and shutdown cooling flow to the RCS, closes to prevent diversion of HPSI flow and to provide isolation/protection of the LPSI discharge piping. This valve also functions as a containment isolation (EIIS: BD) valve that is open during

certain accident conditions and is not required to be type C tested in accordance with the Containment Leakrate Testing Program (Appendix J Program).

3. INITIAL PLANT CONDITIONS:

On October 5, 2006, Unit 1 was in MODE 3 and activities were in progress to return the plant to power operation following a forced outage to repair pressurizer heaters (EIIS: EHTR). There were no structures, systems, or components that were inoperable at the time of discovery that contributed to this condition.

4. EVENT DESCRIPTION:

On October 5, 2006, at 1708 hours Surveillance Test (ST) 73ST-9SI05, Leak Test of HPSI/LPSI Containment Isolation Check Valves, was being performed. During the performance of section 8.3 of the ST, check valve SI-134 failed to seal properly. This ST uses a high pressure safety injection (HPSI) pump to pressurize the piping downstream of SI-134 while monitoring leakage to piping upstream of the valve through a drain valve. During the test, the pressure and flow rate through the drain connection was unexpectedly high and the test conditions could not be established and a leak rate could not be determined.

At 1815 hours SI-134 was declared inoperable and control room personnel entered the applicable TS Required Actions for LCOs 3.0.3 (due to both HPSI trains inoperable), 3.5.3 conditions A and B (LPSI A train and HPSI A train inoperable), 3.6.3 condition A (SI-134 containment isolation function inoperable) and entered the required action for technical requirements manual (TRM) TLCO T3.5.201 condition A (shutdown cooling train A inoperable).

At 1852 hours TS LCOs 3.0.3 and 3.5.3 condition B (for the HPSI A train) were exited when motor operated containment isolation valve SIA-UV-635 (EIIS: INV) was deenergized in its closed position which isolated the piping upstream of SI-134. At 1859 hours TS LCO 3.5.3 condition B was exited for the HPSI B train system following system realignment.

Ultrasonic Test (UT) equipment was used to monitor SI-134 and indicated that the valve disc was in the closed orientation. The plant was cooled down and RCS pressure was

decreased to exit the conditions that required two operable ECCS trains and to allow low pressure safety injection (LPSI) A train pump to flush the check valve seat. As forward flow through the check valve was established, UT confirmed that the disc opened and then closed when flow was secured. This verified that the disc was not caught under the valve seat, which had been a previous operating experience concern. The UT did not confirm whether the disc was fully seated.

The unit was cooled down to Mode 4, Hot Shutdown, and on October 6 at 0731 hours TLCO T3.5.201 condition A was exited. Plant management decided to perform maintenance on SI-134 which required the plant to be placed in Mode 5, Cold Shutdown, which was achieved on October 6, 2006, at 1525 hours. TS LCO 3.6.3 was exited at that time.

5. ASSESSMENT OF SAFETY CONSEQUENCES:

The condition in which SI-134 did not seal on October 5, 2006 did not result in any challenges to fission product barriers or in any offsite releases. Therefore, there were no actual adverse safety consequences as a result of the valve failure to seal properly.

With SI-134 not in its fully seated position, pressurization of the LPSI piping upstream of SI-134 could occur during accident conditions or an inadvertent safety injection actuation. An engineering calculation has concluded that the affected LPSI piping is qualified for an internal pressure of 1950 psig per the requirements of ASME Section III Appendix F. This pressure bounds the in-service discharge pressure test data of the Unit 1 HPSI pumps taken in both August 2006 and November 2006.

The following additional evaluations were conducted by engineering personnel:

1) The effect of HPSI pressure on LPSI MOV operation was considered and determined that the A train Shutdown Cooling Heat Exchanger (SDCHX) Inlet and Outlet Isolation MOVs (SI-685 and SI-686) could have been pressure locked in the closed position. The B train SDCHX valves were unaffected by the leaking CV.

2) LPSI train A piping, which could have been exposed to HPSI pressure during an event, was reviewed for other components that could have been damaged by the high pressure. The only components other than piping and valves in the subject

section of piping are the LPSI Pump A Discharge Flow Transmitter, 1JSIAFT0306 (Rosemount Transmitter Model 1153DB) and Pressure Indicator, 1JSINPT0306 (Rosemount Transmitter Model 1152GP), both of which, per their Vendor Technical Documents, are hydrostatically tested at 150 percent of working pressure or 2000 psi, whichever is greater. In addition, there is a temperature element, installed in a thermal well, which equals or exceeds the piping pressure capabilities. Therefore, the over pressurization of the LPSI piping would not have catastrophically failed any components attached to the piping.

3) Pressurization of the LPSI discharge piping would have resulted in the lifting of thermal relief valves PSV-439 and PSV-161, which have a combined capacity flow of approximately 20 gpm. The effect of this 20 gpm flow into the Equipment Drain Tank (EDT) from LPSI relief valves was evaluated. The EDT volume is approximately 10,000 gallons and is equipped with a relief valve (CH-657) which is sized to pass 300 gpm when the tank is over pressurized. The EDT relief valve discharges to the non-ESF sump which is sufficiently sized to preclude flooding at inflows well in excess of 20 gpm. The EDT volume (even if starting half full) is considered to be adequate to provide Operators sufficient time to isolate the LPSI header. Therefore, Auxiliary Building flooding is not considered to be a significant issue.

4) The impact to HPSI injection flow rate was reviewed for diversion of 20 gpm of injection flow to the LPSI header relief valves with the check valve open. Calculation 13-MC-SI-0215 includes a 20 gpm margin, which bounds the injection flow loss while ensuring that the credited flow rates are delivered to maintain the core covered and to provide for long term cooling.

There were no other failures that rendered a train of a safety system inoperable. The condition would not have prevented the fulfillment of the safety function, and the condition did not result in a safety system functional failure as defined by 10 CFR 50.73(a)(2)(v).

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

6. CAUSE OF THE EVENT:

An investigation of this event was conducted in accordance with the PVNGS corrective action program. The root cause of the failure of check valve SI-134 to properly seat has been determined to be frictional forces in excess of gravitational forces acting on the disc assembly which prevented the valve disc from properly seating on its own. These frictional forces increased over time to the point that they eventually overcame the gravitational forces that were working to move the disc against the valve seat. The areas of friction include the disc to seat landing zone, the spherical bearing riding on raised areas on the disc/stud weld and the spherical bearing outside diameter surface against the bore of the swing arm.

SI-134 and other B-W check valves were received at PVNGS already assembled by the supplying vendor. However, these valves had not been assembled by the supplying vendor in accordance with their own assembly information. The vendor supplied assembly information indicates the stud to disk weld configuration should allow the spherical bearing to be in full contact with the valve disk, the stud to disk washer should be snug, and that there are established dimensional limits on the gap between the washer and the swing arm. This information was not consistent with the as-received assembly of the valves.

Contributing causes were determined to be:

1. Roughness of the valve seat.
2. A build up of film on the spherical bearing – CRUD/magnetite that collects in RCS low flow areas.
3. Indentations of disc stud threads on the ID of the spherical bearing and a spherical bearing rub mark on the disc stud weld.

No unusual characteristics of the work location (e.g., noise, heat, poor lighting) directly contributed to this event. No personnel or procedural errors have been identified that contributed to this event.

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7. CORRECTIVE ACTIONS:

SI-134 was disassembled and inspected. A new bonnet/disc assembly was installed in the valve and the valve passed required testing. Additional actions were taken to preclude recurrence of this condition, including:

1) The check valve maintenance procedure 31MT-9ZZ17 was revised to incorporate B-W assembly information and component clearance information.

2) The check valve predictive maintenance program was revised to require verification of freedom of movement of the disc, to assess the operational readiness of the valve and, for B-W valves, to test that the disc closes on its own to verify operational readiness.

3) Disassembly, inspection and correction of Unit 1 and Unit 3 B-W swing arm check valves (≥12" diameter) with known configuration discrepancies (or a lack of inspection data) relative to newly acquired B-W assembly information and clearances has been completed. These inspection activities for similar check valves in Unit 2 were completed during the most recent refueling outage (2R14).

4) The check valve predictive maintenance program inspection interval has been changed to a 12 year frequency for all 12" and larger B-W swing check valves (safety injection tank outlet check valves and RCS loop check valves). The valve affected by this event had not had preventive maintenance performed during its operating life in excess of 20 years.

8. PREVIOUS SIMILAR EVENTS:

LER 50-529/2000-006-01 reported a condition in which a safety injection tank (SIT)(EIIS: TK) discharge check valve did not seat properly. The root cause of that event was reported as a lack of preventive maintenance (PM) activities for the SIT discharge check valves sufficient enough to prevent the unacceptable buildup of contaminants on the spherical bearings and hinge arm joint. Corrective actions from that event were to inspect the 14 inch ECCS check valves however SI-134 is a 12 inch check valve and was not included in the scope. In 2005 the 12 inch check valves were incorporated into the inspection schedule and SI-134 was scheduled to be inspected during the Unit 1 refueling outage scheduled for the spring of 2007.