10 CFR 50.73

DWIGHT C. MIMS
Senior Vice President, Nuclear
Regulatory & Oversight

Palo Verde
Nuclear Generating Station
P.O. Box 52034
Phoenix, AZ 85072
Mail Station 7605
Tel 623 393 5403

102-06788-DCM/DCE
October 25, 2013

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 2012-002-01

Enclosed please find Licensee Event Report (LER) supplement 50-529/2012-002-01 that has been prepared and submitted pursuant to 10 CFR 50.73. This LER supplement provides additional information from the completed cause evaluation of the previously reported leakage on a Low Pressure Safety Injection pipe drain line outside of the Containment Building while in Mode 5.

In accordance with 10 CFR 50.4, copies of this LER are being forwarded to the Nuclear Regulatory Commission (NRC) Regional Office, NRC Region IV and the Senior Resident Inspector. If you have questions regarding this submittal, please contact Mark McGhee, Department Leader, Regulatory Affairs, at (623) 393-4972.

Arizona Public Service Company makes no commitments in this letter.

Sincerely,

FOR D.C. MIMS

DCM/DCE/hsc

Enclosure

cc: S. A. Reynolds — NRC Region IV Regional Administrator
J. K. Rankin — NRC NRR Project Manager for PVNGS
M. A. Brown — NRC Senior Resident Inspector for PVNGS

IE22
NRR

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

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 FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@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

Condition Prohibited by Technical Specification Due to Low Pressure Safety Injection System Drain Pipe Leak

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
10	07	2012	2012	- 002 -	00	10	25	2013	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

5

10. POWER LEVEL

0

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☒ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Mark McGhee, Department Leader, Regulatory Affairs	623-393-4972

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
D	BP	PSX	C490	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 8, 2012, at 13:30, when Unit 2 was in Mode 5 during refueling outage 2R17, Shutdown Cooling System (SDC) Train A was declared inoperable in accordance with Technical Specification 3.4.7 due to a leak on a Low Pressure Safety Injection (LPSI) system Train A drain pipe during SDC operation. The leakage source was a weld defect on the LPSI cold leg 1A injection pipe drain connection upstream of drain valve SIA-V908. The leakage was first discovered on October 7, 2012, at 22:00 when water on the floor adjacent to the LPSI cold leg 1A injection pipe was first found, but not identified as leakage through the drain pipe weld until insulation was removed on October 8, 2012.

A configuration control problem in the early 1990s allowed contact between the drain pipe and a pipe hanger when the SDC system was in operation. This resulted in a weld defect being introduced due to the high cyclic stresses from the pipe/hanger contact. The configuration control problem was corrected in May 1993; but, the weld defect propagated slowly during periods of SDC operations until the leak occurred in the 2R17 outage. The cause was determined to be inadequate guidance to ensure temporary fittings on safety-related fluid systems were removed prior to placing the system in service. To prevent recurrence, procedures were revised to require that systems with capped pipe ends be returned to their design configuration following maintenance.

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NARRATIVE

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) to report a condition prohibited by Palo Verde Nuclear Generating Station (PVNGS) Technical Specifications (TSs). Specifically, on October 8, 2012, Shutdown Cooling System (SDC) (EIIS: BP) Train A was declared inoperable per TS 3.4.7, Reactor Coolant System (RCS) Loops — MODE 5, Loops Filled, due to a through-wall weld defect that was found on a low pressure safety injection (LPSI) system (EIIS: BP) ASME Class 2 drain pipe.

Evidence that the weld defect existed prior to being identified was discovered on October 16, 2012, during investigation of this event. Radioactive water leakage onto the floor of the Auxiliary Building (EIIS: NF) West Piping Penetration Room, which led to the identification of the weld defect, had existed since October 7, 2012. Therefore, the defect penetrated the ASME Class 2 drain pipe wall by October 7. Operations personnel did respond in accordance with the requirements of the TS as soon as the condition was recognized on October 8, 2012; however, the Required Actions of TS 3.4.7 Condition B to immediately initiate actions to place one OPERABLE train of SDC into operation were not met when the defect penetrated the drain pipe wall on October 7, 2012.

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

The safety injection system (SI) is the emergency core cooling system (ECCS). The SI system consists of three distinct sub-systems, each with two redundant equipment trains:

- SI system, comprised of high pressure safety injection (HPSI) (EIIS: BQ), LPSI and the safety injection tanks (SITs) (EIIS: BP)
- Containment spray (CS) system (EIIS: BE)
- SDC system

The major components of the SI systems are located inside the Auxiliary Building (pumps, piping, heat exchangers and valves) and Containment Building (piping, check valves, RCS injection and suction nozzles, safety injection tanks, spray nozzles and recirculation sumps).

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Figure A provides a simplified functional diagram of the Train A SI systems and displays the leak location within the LPSI/SDC system.

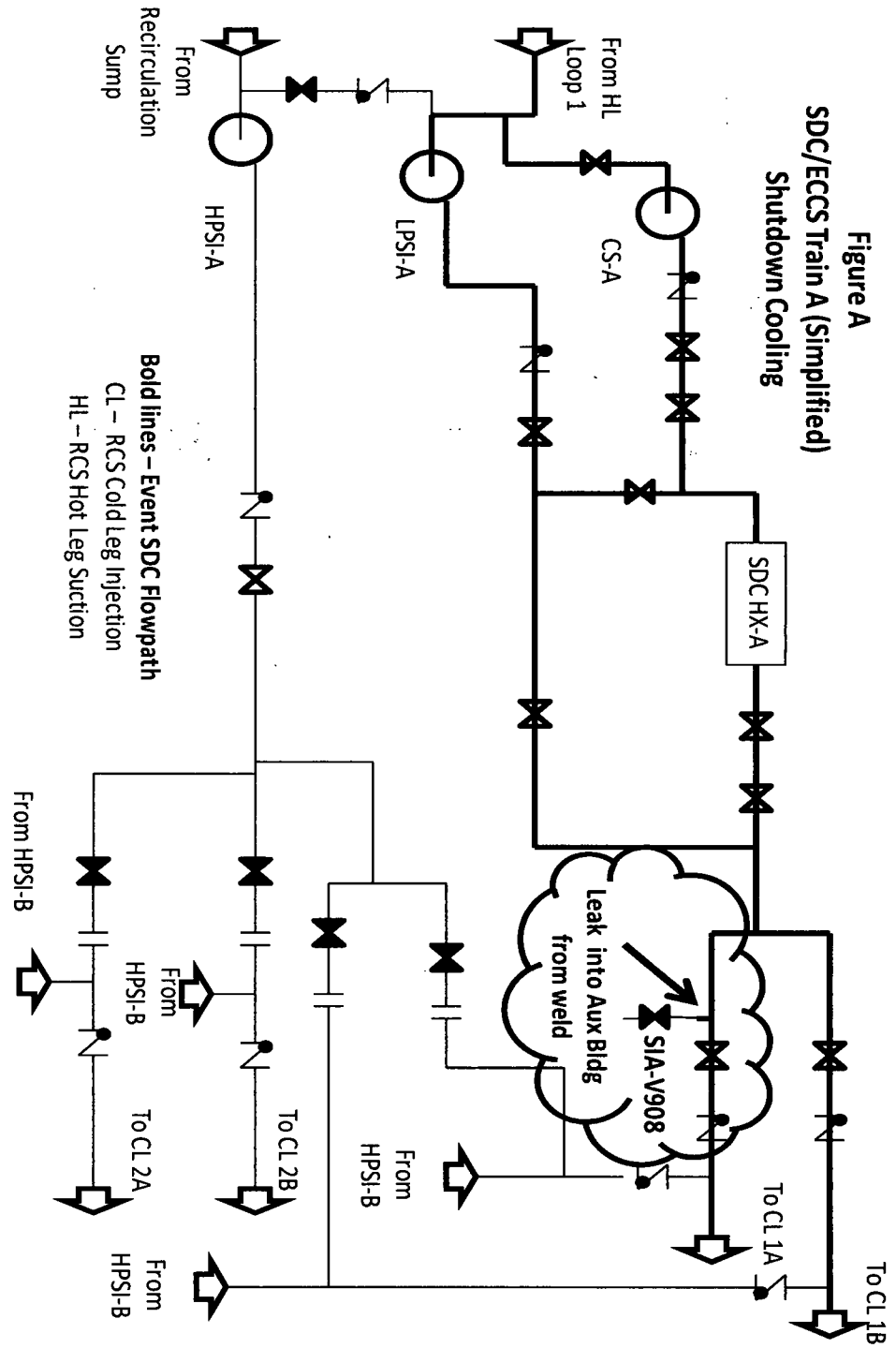

Figure A
SDC/ECCS Train A (Simplified)
Shutdown Cooling

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The SI system injects borated water into the reactor coolant system (RCS) (EIIS: AB) to flood and cool the core in the event of a loss of coolant accident (LOCA) to prevent a significant amount of cladding failure along with subsequent release of fission products into the containment. The SI system functions also include core heat removal for extended periods of time following a LOCA and injection of borated water into the RCS to increase shutdown margin following a rapid cooldown of the system due to a secondary steam line break accident (SLBA).

The CS system sprays borated water into the containment atmosphere in the event of a LOCA or a SLBA within the containment to reduce containment pressure and temperature and limit the leakage of airborne activity from the containment. Additionally, CS removes heat from containment following a LOCA by circulation of coolant from the recirculation sumps to the shutdown cooling heat exchangers and back to the containment spray nozzles.

The SDC system uses the LPSI and CS systems to re-circulate RCS coolant through a shutdown cooling heat exchanger in the auxiliary building to remove residual heat from the reactor during normal shutdown activities and to mitigate the consequences of an accident, such as a LOCA or SLBA. Each train of the SDC system consists of two pumps (LPSI and CS), a shutdown cooling heat exchanger and discharge piping with two injection headers which each connect to one of the RCS cold leg loops. Each SDC train includes a SDC suction header and SDC suction isolation valves which connect one of the RCS hot legs to the suction piping of the associated SDC pumps. A SDC train may be operated with one or two SDC pumps to meet operational needs.

The RCS circulates water in a closed cycle, removing heat from the reactor core and internals and transferring it to a secondary (steam generating) system. The steam generators (SGs) (EIIS: AB) provide the interface between the RCS and the main steam system (EIIS: SB). The major components of the RCS are the reactor vessel (EIIS: AB) and two parallel heat transfer loops, each containing one SG and two reactor coolant pumps (EIIS: AB). Each reactor coolant loop contains penetrations which include the pressurizer surge line in one reactor vessel outlet pipe (hot leg); the SI inlet nozzles, one in each reactor vessel inlet pipe (cold leg) and two outlet nozzles to the shutdown cooling system, one in each reactor vessel outlet pipe (hot leg). RCS piping and components are located in the Containment Building (EIIS: NH).

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During cold shutdown and refueling operations, the SDC trains are the principal means for decay heat removal. The number of pumps/trains in operation can vary to suit the operational needs. During MODE 5 operations with RCS loops filled, the Limiting Condition for Operation (LCO) for TS 3.4.7 requires one SDC train to be OPERABLE and in operation and either one additional SDC train to be OPERABLE or the secondary side water level of each SG to be greater than 25 percent. The intent of this LCO is to provide forced flow from at least one SDC train for decay heat removal and transport. The flow provided by one SDC train is adequate for decay heat removal. The other intent of this LCO is to require that a second path be available to provide redundancy for decay heat removal. Condition B of TS 3.4.7 applies when either a required SDC train is inoperable or no SDC train is in operation. Condition B required actions are to immediately suspend all operations involving reduction in RCS boron concentration and to immediately initiate actions to restore one SDC cooling train to an OPERABLE status and in operation.

Valve SIA-V908 is a one inch, ASME Class 2 globe valve connected to a low point elbow on the 12 inch LPSI pipe upstream of 1A cold leg LPSI injection valve in the Auxiliary Building West Piping Penetration Room. The 12 inch, motor operated 1A cold leg LPSI injection valve is a containment isolation valve and is located in the piping penetration room adjacent to containment. A butt weld is used to connect a 3 inch length of one-inch diameter, schedule 40, type 304, stainless steel drain pipe to a nozzle on the 12 inch LPSI pipe elbow. A socket weld connects the drain pipe to the inlet side of valve SIA-V908 and an elbow with a welded pipe nipple is welded to the outlet of the valve to provide an attachment point for temporary installation of drain hoses and testing apparatus. Valve SIA-V908 is normally closed and the downstream pipe nipple is capped.

3. INITIAL PLANT CONDITIONS:

On October 7, 2012, Palo Verde Unit 2 was in Mode 5 (Cold Shutdown), preparing for refueling activities. The RCS cold leg temperature was approximately 98 degrees Fahrenheit and RCS absolute pressure was approximately 110 pounds per square inch. SDC Train A was OPERABLE and in operation with CS A and LPSI A pumps running in parallel to provide SDC flow. RCS loops were filled with both SG secondary side water levels at approximately 80 percent full. There were no structures, systems, or components inoperable at the time of the event that contributed to the event.

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4. EVENT DESCRIPTION:

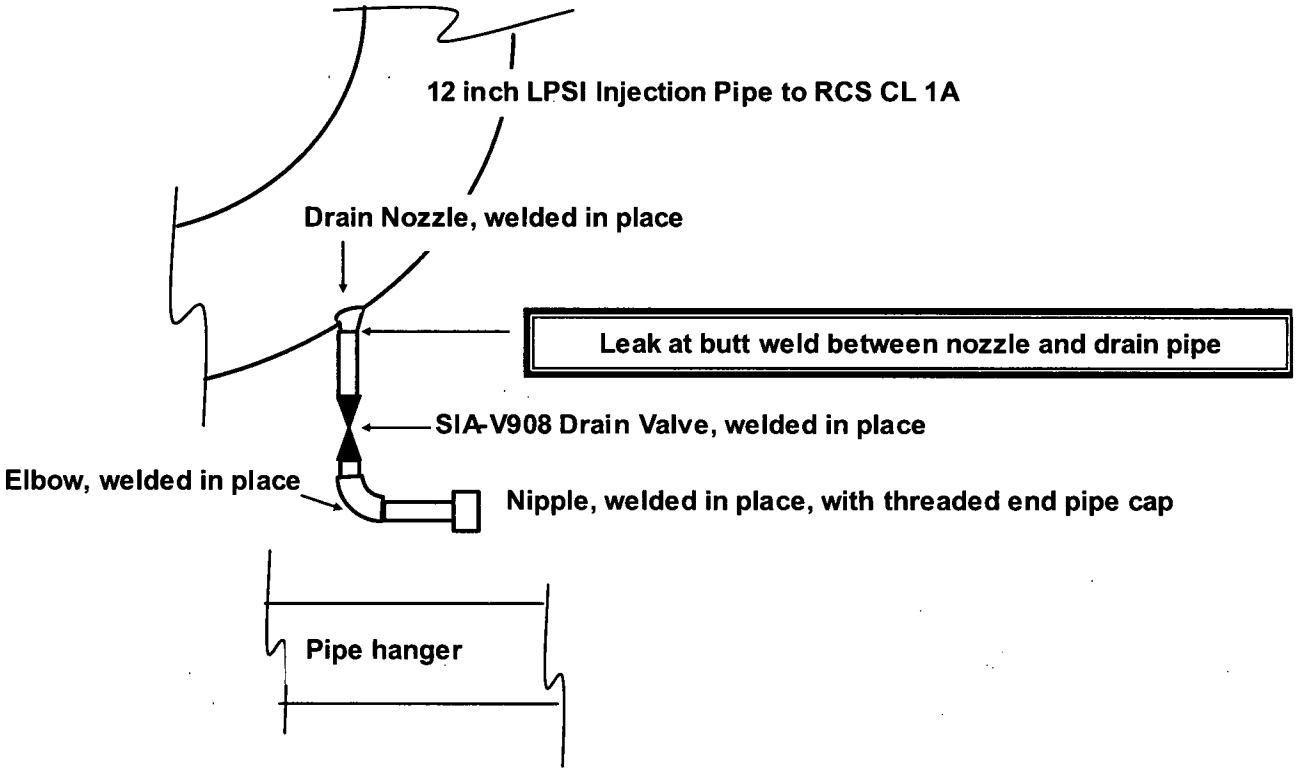
On October 7, 2012, at 22:00, while performing radiation protection surveys, plant personnel noted water on the floor of the 77 foot elevation of the Auxiliary Building West Piping Penetration Room, near the LPSI cold leg 1A injection pipe. At 03:33 on October 8, 2012, two personnel entered the room and subsequently, during personnel contamination monitoring prior to leaving the radiologically controlled area (RCA), found slight amounts of radioactive contamination on their shoes. This contamination was attributed to the water leakage on the floor near the LPSI cold leg 1A injection pipe. The source of the water leakage was initially characterized as packing leakage from drain valve SIA-V908 at 05:28 on October 8, 2012.

Subsequently, with the piping insulation removed, an examination of the drain pipe upstream of valve SIA-V908 identified a through-wall defect on the weld that attaches the drain pipe to the nozzle on the LPSI cold leg 1A injection pipe. The leak rate was estimated to be approximately 0.25 gallons per minute. Figure B provides a sketch of the drain pipe configuration.

When informed of the through-wall leak on the inlet pipe for valve SIA-V908, Operations personnel declared SDC Train A inoperable and entered TS 3.4.7 Condition B at 13:30 on October 8, 2012. Operations personnel verified no operations that involved reduction of RCS boron concentration were in progress and actions were initiated to place SDC Train B into operation as the OPERABLE SDC train. SDC Train B was placed in service and SDC Train A was secured and isolated. Condition B of TS 3.4.7 was exited at 16:39 on October 8, 2012, with SDC Train B OPERABLE and in operation and both SG secondary side water levels greater than 25 percent. No evolutions that would have reduced RCS boron concentration were conducted during the period from the first identification of water on the floor near valve SIA-V908 on October 7 through exit of TS 3.4.7 Condition B at 16:39 on October 8, 2012.

Figure B

LPSI Header 1A Injection Pipe and Drain Pipe / SIA-V908 Configuration on October 8, 2012



5. ASSESSMENT OF SAFETY CONSEQUENCES:

This event did not adversely affect the health and safety of the public and there were no actual safety consequences as a result of this event. The event did not result in any challenges to the fission product barriers. The personnel contaminations did not require assignment of additional radiation dose to the individuals and did not result in the spread of loose surface contamination outside the RCA. The leakage did not result in the release of airborne radioactive material above monitored baseline effluent activity.

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A completed structural evaluation of the affected weld concluded that the piping retained sufficient load carrying capability to withstand design basis loading conditions including Safe Shutdown Earthquake (SSE) loads. This indicates the weld would have maintained structural integrity given an SSE at the time the defect was identified.

The effect of the leakage on the performance of the required safety functions was evaluated, including the potential for crack growth during the LPSI system's 30-day mission time. The estimated leakage was minor with respect to margins in the related safety analyses and would not have resulted in a loss of the safety functions of the ECCS or the shutdown cooling systems, including requirements for long-term cooling and the radiological consequences of ECCS leakage outside containment.

This event would not have prevented the fulfillment of safety functions required to safely shutdown the reactor, remove residual heat, prevent the release of radioactive material, or mitigate the consequences of an accident; therefore, it did not result in a safety system functional failure as described by 10 CFR 50.73(a)(2)(v).

6. CAUSE OF THE EVENT:

The weld defect resulted from the installation of a temporary drain fitting which was left attached to the pipe nipple downstream of valve SIA-V908 when Train A SDC was returned to service following maintenance in December 1991. Piping thermal growth occurred when SDC was placed in operation which caused the SIA-V908 assembly to contact an adjacent pipe hanger (see Figure B) and act as a restraint to system vibrations that occur during operation. As a result, a defect was initiated in the weld due to abnormally high cyclic stresses induced when the SIA-V908 assembly was restrained by contact with the pipe hanger during SDC operations.

Prior to November 1991, insufficient clearance between valve SIA-V908 and the pipe hanger prevented installation of drain fittings. In November 1991, following installation of a new SIA-V908 valve, the clearance was increased which then allowed the installation of a temporary drain fitting during maintenance activities. The temporary drain fitting was left installed when the system was restored to service in December 1991 and remained until

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May 1993. During that time, SDC operations resulted in high cyclic stresses being imparted on the weld. In May 1993, the design of the outlet side of valve SIA-V908 was modified to install the current elbow and nipple configuration and correct the interference problem such that no further contact with the adjacent pipe hanger occurred. This design change modified only the outlet side of the valve such that the weld upstream of SIA-V908 (which contained the defect) was not worked on. During the time from May 1993 to October 2012, the defect propagated slowly from high cycle fatigue during normal system operations until the pipe wall was breached during Train A SDC operations in refueling outage 2R17.

The cause of this event was determined to be inadequate guidance to ensure temporary fittings on safety-related fluid systems were removed prior to placing the system in service.

7. CORRECTIVE ACTIONS:

To correct the weld defect, the subject drain pipe and valve SIA-V908 assembly was replaced and the weld repaired on October 11, 2012.

To evaluate the extent of condition, bare pipe weld visual examinations of the similar LPSI injection drain pipe locations were completed by qualified in-service inspection personnel in all three PVNGS units by October 10, 2012. The examinations did not identify any visually observable defects on the inspected components. Also, there were no indications of mechanical binding in any of these additional locations.

To prevent recurrence, procedures were revised to require that systems with capped pipe ends be returned to their design configuration with fittings removed and pipe caps tightened when maintenance activities are completed.

To address the extent of cause, additional piping system evaluations and walkdowns of safety-related systems were conducted to identify similar conditions in which vent or drain fittings and piping configuration may result in binding and subsequent potential impact on the pipe integrity. Two additional instances of potential thermal binding were identified on similarly configured LPSI injection header drain lines: one in Unit 1 and one in Unit 2. No deficiencies were identified on potentially affected welds for either of the two drain line connections during subsequent visual and liquid penetrant examinations.

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8. PREVIOUS SIMILAR EVENTS:

PVNGS reported a similar event under LER 50-528/2004-001-00 in which pressure boundary leakage was discovered on a Unit 1 HPSI recirculation drain pipe socket weld upstream of drain valve SIA-V056. The cause was vibration-induced, high cycle fatigue weld failure due to a pipe support that should have been removed during a prior pipe support modification. The modification was intended to resolve vibration-induced socket weld failures on RCS and SDC system branch pipes inside the Containment Building. The corrective actions to identify the extent of condition of the 2004 event were to inspect other SDC Train A suction line supports across the station to verify conformance with pipe support design to ensure a similar vibration-induced socket weld failure mechanism did not potentially exist.

The root cause of the 2004 event was not related to a failure to remove a temporary drain fitting and the extent of condition inspections would not have identified examples in which there were potential interference problems with temporary drain fittings left installed. Therefore, the corrective actions for the 2004 event would not have prevented the event reported in this LER.