LICENSEE EVENT REPORT (LER)

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Palo Verde Unit 1	05000528	1 OF 7

TITLE (4): Letdown Line Break Due To Pressure Transients

EVENT DATE (5) MONTH	DAY	YEAR	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	REPORT DATE (7) MONTH	DAY	YEAR	OTHER FACILITIES INVOLVED (8) FACILITY NAMES	DOCKET NUMBERS
05	20	98	98	- 007 -	01	09	25	98	N/A	
									N/A	

OPERATING MODE (9)	POWER LEVEL (10)
1	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

[ ] 20.402(b)	[ ] 20.405(c)	[ ] 50.73(a)(2)(iv)	[ ] 73.71(b)
[ ] 20.405(a)(1)(i)	[ ] 50.36(c)(1)	[ ] 50.73(a)(2)(v)	[ ] 73.71(c)
[ ] 20.405(a)(1)(ii)	[ ] 50.36(c)(2)	[ ] 50.73(a)(2)(vii)	[ ] OTHER (Specify in Abstract below and in Text, NRC Form 366A)
[ ] 20.405(a)(1)(iii)	[X] 50.73(a)(2)(i)	[ ] 50.73(a)(2)(viii)(A)	
[ ] 20.405(a)(1)(iv)	[ ] 50.73(a)(2)(ii)	[ ] 50.73(a)(2)(viii)(B)	
[ ] 20.405(a)(1)(v)	[ ] 50.73(a)(2)(iii)	[ ] 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (AREA CODE)
Daniel G. Marks, Section Leader, Regulatory Affairs	602 393-6492

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS
B	CB	PSP		YES					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
[ ] YES (If yes, complete EXPECTED SUBMISSION DATE)	[X] No				

On May 20, 1998, at approximately 0100 MST, Palo Verde Unit 1 was in Mode 1 (POWER OPERATION), operating at 100% power when control room personnel (utility licensed) observed flow and pressure perturbations on the Chemical and Volume Control System (CVCS) letdown system. Radiation monitor alert alarms from area monitors RU-9 and RU-8 were annunciated at approximately 0106 and 0109, respectively, indicating a potential letdown system leak in the Auxiliary Building. A subsequent walk-down of the letdown valve gallery area confirmed that a leak had developed on the 2" letdown line just upstream of the pressure relief valve PSV 345. Approximately 325 gallons of letdown flow was routed to the equipment drain tank via pressure relief valve (PSV-345) and 175 gallons of letdown flow was released into the valve gallery.

Prior to this evolution, at approximately 1259, Unit 1 was completing surveillance test (ST) 40ST-9CH06, *Charging Pump Operability* and started the "A" Charging Pump to restore from the ST, commencing two pump operation. Shortly after increasing letdown flow, operations noted abnormal flow and pressure perturbations. Control room personnel (utility licensed) isolated letdown at approximately 0123 using letdown isolation valve UV-515. Control room personnel (utility licensed) initiated entry into procedure 40AO-9ZZ05, *Loss of Letdown*. The plant remained operating in mode 1 at 100% power.

The subsequent evaluation of the event determined that the root cause of the Unit 1 letdown line failure was fatigue due to an improperly loaded spring can at hanger location 1CH037H00A. No previous similar events have been reported by Palo Verde pursuant to 10CFR50.73.

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1. REPORTING REQUIREMENT:

This LER supplement (528/98-007-01) is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B), operating in a condition prohibited by the plant's Technical Specifications (TS), where Unit 1 was required to enter TS 3.0.3.

Specifically, on May 20, 1998 at approximately 0100 MST, Unit 1 was in Mode 1 (POWER OPERATION) at normal operating temperature and pressure at approximately 100% power when control room personnel (utility licensed) determined that a leak had developed in the ASME Code Class 2 letdown line. The leak was isolated in accordance with abnormal operations procedure 40AO-9ZZ05, *Loss of Letdown*. The letdown piping (CB) failure resulted in control room personnel(utility licensed) entering Technical Specification LCO 3.4.9 for structural integrity of ASME Code Class 2 components. Specifically, LCO 3.4.9 action (b) was entered which requires restoration of structural integrity of the affected component(s) to within its limit or isolate the affected component(s) prior to increasing reactor coolant system temperature above 210°F.

Compliance with LCO 3.4.9 action(b) could not be achieved since Unit 1 was operating at 100% power with reactor coolant(AB) system temperature greater than 210°F therefore, control room personnel(utility licensed) subsequently entered Technical Specification LCO 3.0.3. Approximately 22 minutes into the event corrective measures were established by isolating letdown, which allowed control room personnel to exit LCO 3.0.3 and return to compliance with Technical Specification 3.4.9 action (b). Compliance with Technical Specifications was maintained throughout the event.

As described in the PVNGS UFSAR Chapter 5, Section 5.2.5.1.5, "Intersystem Leakage", CVCS leakage is not considered when determining operational RCS leakage in accordance with Technical Specification 3.4.5.2. If any leakage of reactor coolant exists outside of the RCS barrier (i.e., intersystem leakage), and it is capable of being isolated, then the leakage is not operational RCS leakage. Continued operation under Technical Specification 3.4.5.2 for RCS Leakage does not apply in this case.

2. EVENT DESCRIPTION:

On May 20, 1998 at approximately 0100 MST, Unit 1 was in Mode 1 operating at 100% power (POWER OPERATION) when indications of flow and pressure perturbations were observed on the Chemical and Volume Control System (CVCS) letdown system. Auxiliary Building Area Radiation monitor (RA) alert alarms from RU-9 and RU-8 were annunciated at 0106 and 0109, respectively, indicating a potential letdown leak in the Auxiliary Building.

TEXT

EVENT DESCRIPTION continued:

With assistance from Radiation Protection, an Auxiliary Operator (AO) (utility non-licensed) entered the 100' Aux. Bldg. and observed steam and water in the letdown valve gallery area.

Subsequent investigation determined that a leak had developed on the 2" letdown line piping as a result of a circular crack at a weld where a 1" pipe stanchion of a spring can support(SPP) was connected to the letdown line. Approximately 325 gallons of letdown flow was routed to the equipment drain tank(TK) via pressure safety valve(RV) (PSV-345) and approximately 175 gallons was released into the valve gallery room from the cracked letdown line.

Prior to this evolution, at approximately 1259, Unit 1 was completing quarterly surveillance test 40ST-9CH06, *Charging Pump Operability* and started the "A" Charging Pump (CB) to restore the plant to its normal two-pump operation. Letdown flow was increased using letdown level control valve (LCV) RCN-LIC-110 in manual.

Subsequently, operations observed indications of letdown flow mismatch and that PSV-345 may have lifted which resulted in perturbations in letdown flow and pressure. At 0106, RU-9 alert alarm was received. The backpressure control valve controller (PCV)(CHN-PIC-201) was placed in manual and demand increased to > 50%. This caused the perturbations to dampen. Controller CHN-PIC-201 was then placed back in auto. Approximately two minutes later, pressure oscillations began to recur. At 0109, RU-8 alert alarm was received and at 0110, RU-9 high alarm was annunciated. Operations suspected at this time that a valve-packing leak had developed in the Auxiliary Building. The appropriate alarm response procedures were used and an AO (utility non-licensed) was dispatched to walkdown the letdown system for any leaks or abnormalities.

The Control Room was notified by the Area Operator that steam and water were coming from the letdown valve gallery area. Subsequent to this notification, letdown was isolated at approximately 0123 using letdown isolation valve (ISV) CHB-UV-515. Procedure 40AO-9ZZ05, *Loss of Letdown*, was entered. The plant remained operating in mode 1 at 100% power.

The shift manager determined that no event declaration was required per the Emergency Plan classification criteria.

There were no safety system actuations and none were required.

TEXT

3. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATIONS OF THIS EVENT:

Although this event did result in a leak of approximately 175 gallons of reactor coolant in a radiologically controlled area, there were no challenges to fission product barriers. Therefore there were no adverse safety consequences or implications as a result of this event. This event did not adversely impact the safe operation of the plant or the health and safety of the public.

A safety assessment was conducted on May 21, 1998 to determine the safety implications of continued operation of Unit 1 with the letdown line isolated. The assessment concluded that the bounding safety analysis results would not be adversely impacted by operating the unit with letdown isolated, provided that no more than two charging pumps are simultaneously in service. Therefore, continued operation of Unit 1 with letdown isolated was allowed under Technical Specification 3.4.9(b).

An additional nuclear safety assessment was conducted to determine any impact the event may have caused on assumptions in the safety analysis. The assessment concluded that the consequences of the letdown line leak in Unit 1 were bounded by the consequences identified in UFSAR Chapter 15, specifically section 15.6.2.1, "Double-Ended Break Of A Letdown Line Outside Containment." The assessment also included an analysis of the letdown leak rate during the event. The investigation of the event determined that system leakage was approximately 175 gallons which, for the purpose of this safety assessment, was conservatively estimated to be approximately 12 gpm of system leakage over the duration of the event. This safety assessment considered off-site dose consequences based on a conservative leak rate. The calculated dose consequence for off-site was 0.4 Rem which was well within the 22.4 Rem reported in UFSAR 15.6.2. In addition a dose assessment was performed for the actual effluent release from the plant vent. Plant vent monitor (RU-143) data indicated no significant increase in dose rate to on-site or off-site personnel.

4. CAUSE OF THE EVENT:

The root cause of the event was determined to be an improperly loaded spring can at hanger location 1CH037H00A caused the Unit 1 letdown line fatigue failure. As described in the metallurgical analysis, the Unit 1 letdown line experienced a fatigue failure due to reverse bending (in the letdown line's lateral direction) at the stanchion to letdown line weld. (NOTE: Reverse bending involves cyclic tensile and compressive stresses, which induces a high delta stress). The investigation concluded that the reverse bending was due to torsional and/or lateral movement of the 2" letdown line caused by dynamic letdown pressure transients while the 1" inch stanchion was restrained in the lateral direction.

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TEXT

CAUSE OF THE EVENT continued:

The evaluation of the failed spring hanger determined that the loss of spring preload resulted in the loss of vibration dampening capacity, a change to the natural frequencies of the letdown piping system, and the transition of the spring hanger support into a frictional lateral restraint.

The lateral restraint resulted from the combination of the frictional resistance between the stanchion and the strap due to letdown piping thermal expansion, and friction from interference of the spring can components due to improper preload. A computer stress model, which incorporated the piping system changes due to the loss of spring load, revealed that the improperly loaded spring can was the critical element in translating the torsional/lateral movement of the letdown line into the reverse bending stresses.

5. STRUCTURES, SYSTEMS, OR COMPONENTS INFORMATION:

The affected portion of the letdown system piping and components are ASME Section III class 2 piping rated for 650 psi. Review of the data plots indicated a maximum pressure was reached in the system of 600.1 psig. Pressure relief valve PSV-345 is designed to lift at 600 psi and has a relieving capacity of 180 gpm. It was determined that the relief valve did not exceed the proper lift pressure setpoint and had sufficient capacity to keep pressure below the design pressure.

Effects of the event for impact on Equipment Qualification, RCP seal extended operation without seal injection and Appendix R considerations were reviewed by engineering. The conclusion of each evaluation determined that this event did not impact or have a significant affect on equipment operability nor jeopardize the ability to safely shutdown the unit during a postulated fire.

An evaluation of the letdown control system determined that the system functioned as designed.

There are no indications that any structures systems or components were inoperable prior to the event that contributed to this event.

TEXT

6. CORRECTIVE ACTIONS TO PREVENT RECURRENCE:

1. Because the three PVNGS Units have essentially identical letdown piping and control systems, the letdown line break event was determined to be transportable to Units 2 and 3. Subsequent inspection of Units 2 and 3 were completed and no system piping damage was identified.

   The subsequent inspection evaluated the spring preload at 1CH037H00A, to determine susceptibility of a loss of spring load.

   An inspection of the Unit 2 spring can at 1CH037H00A concluded that the spring is adequately compressed (about 3" compression). The inspection further concluded that the position of the spring can preload adjustment nut is such that a loss of spring preload is not credible.

   An inspection of the Unit 3 spring can at 1CH037H00A concluded that the spring is adequately compressed (approximate 3" compression). The inspection also concluded that no vibration loosening of the adjusting nut was evident, but that it is possible to lose spring preload due to vibration loosening of the adjusting nut. However, because the administrative measures taken to mitigate letdown perturbations, and the plan to replace the spring hanger with a similar design to that in Unit 1 during the next outage of sufficient duration, that the loss of spring preload is not credible.

   The as-found condition of the spring preload in both Unit 2 and 3 was acceptable.

2. The corrective actions will implement the Unit 1 completed piping and pipe support modification in Units 2 & 3. Because there is no indication of reverse bending, in either Unit, and the installation of the modifications require letdown to be isolated, the modification will be installed during the next refueling outage in each Unit.

3. A site-wide spring can transportability review will be performed through development of specific screening criteria and review/inspection of the identified spring can hangers. Expected completion for this review is May 30, 1999.

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CORRECTIVE ACTIONS TO PREVENT RECURRENCE continued:

4. Operating procedures were enhanced to minimize hydraulic transients. Procedure 4xOP-xCH01, *CVCS Normal Operations*, was revised to lower letdown backpressure to 200 to 300 psi, preferably as close to 200 psi as practical when starting additional charging pumps. Decreasing letdown backpressure to 200 psi was emphasized prior to starting the desired charging pump. Procedure 40OP-9CH13, *Charging Pump Pulsation Dampener Operation*, was revised to reference procedure 4xOP-xCH01, *CVCS Normal Operations*.

7. PREVIOUS SIMILAR EVENTS:

Although no other previous similar events have been reported at Palo Verde pursuant to 10 CFR 50.73 in the last three years, operating history indicates that previous concerns with the responsiveness of the backpressure control system have occurred and are under investigation.