

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Palo Verde Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 5 2 8	PAGE (3) 1 OF 8
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TITLE (4)
Letdown Line Break Due To Pressure Transients

EVENT DATE (5)			LER NUMBER (6)		REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)														
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES													
0	5	2	0	9	8	9	8	-	0	0	7	-	0	0	0	6	1	9	9	8	N/A	

OPERATING MODE (9) 1		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)									
POWER LEVEL (10) 1 0 0		20.402(b)		20.405(c)		50.73(a)(2)(v)		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)(ix)					

LICENSEE CONTACT FOR THIS LER (12) Daniel G. Marks, Section Leader, Regulatory Affairs		TELEPHONE NUMBER 6 0 2 3 9 3 - 6 4 9 2
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)									
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDs
B	C	B P S P		YES					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
<input checked="" type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE) <input type="checkbox"/> No			0	8	1 9 9 8

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 01:06 and 01:09, 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 01:23 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 apparent cause (preliminary) of the letdown line piping failure was determined to be cyclic fatigue due to dynamic pressure transients.

As an interim troubleshooting action, visual inspections were performed on selected portions of the letdown piping in Units one, two and three. The Unit 1 piping was replaced and the damaged piping section was sent off-site for analysis and no problems noted in unit's 2 and 3. No previous similar events have been reported by Palo Verde pursuant to 10CFR50.73.

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TEXT 1. REPORTING REQUIREMENT:

This LER (528/98-007-00) 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.

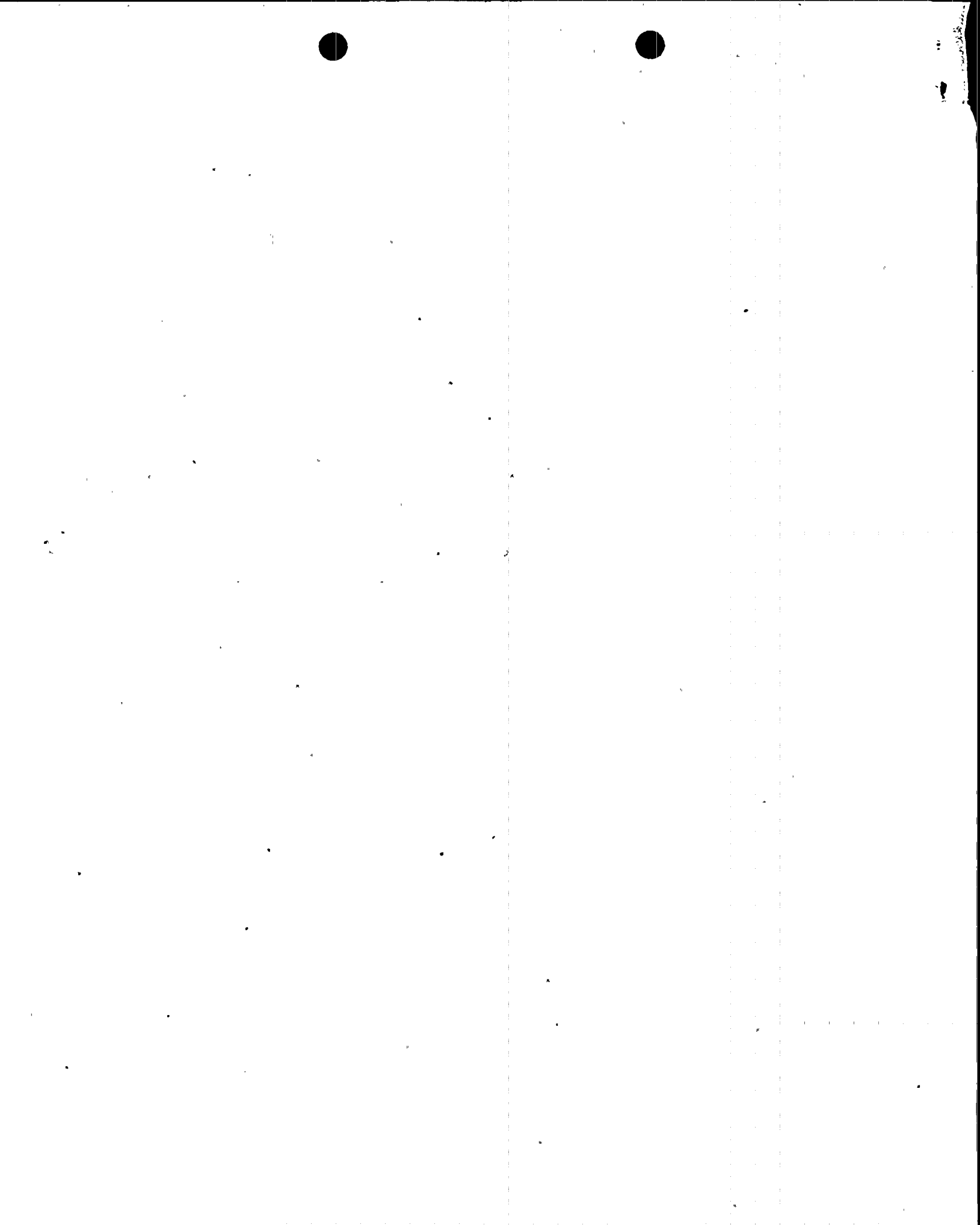
Specifically, on May 20, 1998 at approximately 0100 MST, Unit 1 was in Mode 1 (POWER OPERATION) at normal operating temperature and pressure at approximately 100% power when control room personnel (utility licensed) determined that a leak had developed in the ASME Code Class 2 letdown line and isolated the leak in accordance with abnormal operations procedure 40AO-92Z05, *Loss of Letdown*. The letdown piping 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 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 alert alarms from RU-9 and RU-8 were annunciated at 01:06 and 01:09, respectively, indicating a potential letdown leak in the Auxiliary Building.



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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 was connected to the letdown line. Approximately 325 gallons of letdown flow was routed to the equipment drain tank via pressure safety valve (PSV-345) and approximately 175 gallons was released into the valve gallery room from the cracked letdown line.

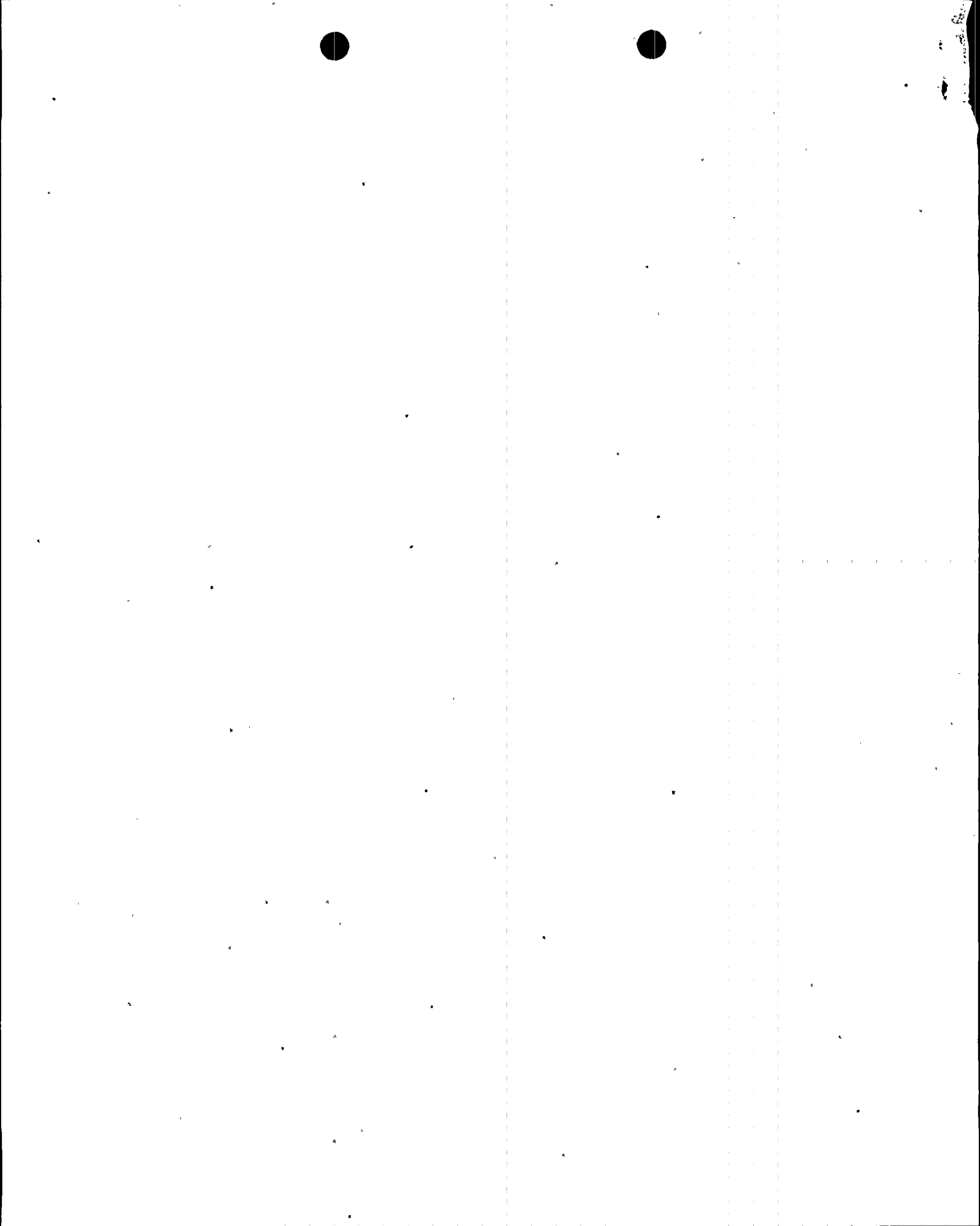
Prior to this evolution, at approximately 1259, Unit 1 was completing quarterly surveillance test 40ST-9CH06, *Charging Pump Operability* and started the "A" Charging Pump to restore the plant into its normal two-pump operation. Letdown flow was increased using letdown flow control RCN-LIC-110 in manual.

Subsequently, operations observed indications of letdown flow mismatch and that PSV-345 may have lifted which resulted in letdown flow and pressure perturbations. At 01:06, RU-9 alert alarm was received. The backpressure control valve controller (CHN-PIC-201) was placed in manual and demand increased to > 50%. This caused oscillations to dampen. Controller CHN-PIC-201 was then placed back in auto. Approximately two minutes later, pressure oscillations began to recur. At 01:09, RU-8 alert alarm was received and at 01:10, RU-9 high alarm was annunciated. Operations believed 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) dispatched to walkdown the letdown system for any leaks or abnormalities.

The Control Room was notified by the Area Operator that steam and water was coming from the letdown valve gallery area. Subsequent to this notification, letdown was isolated at approximately 01:23 using letdown isolation valve 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.



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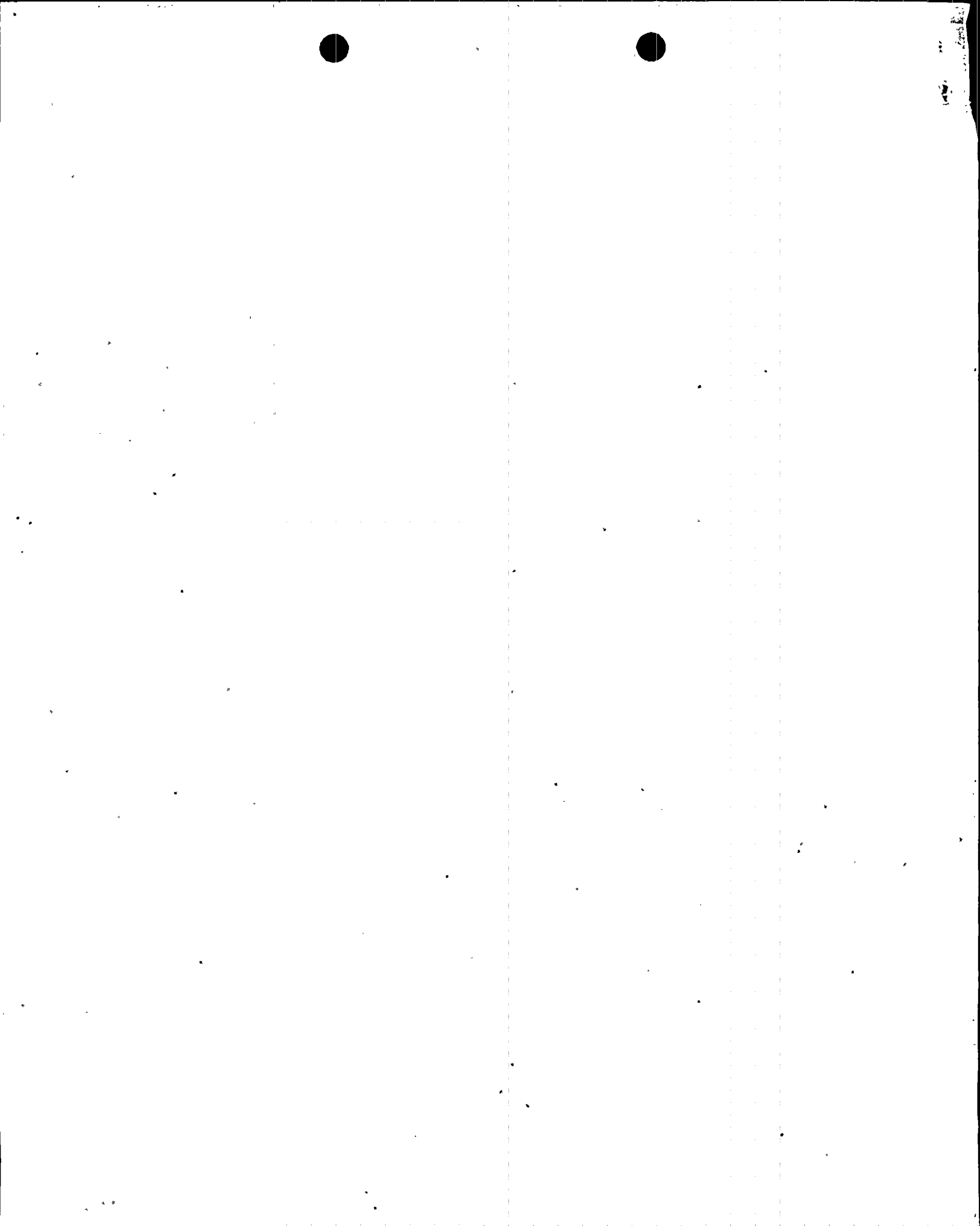
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TEXT 3. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATIONS OF THIS EVENT:

Although this event did result in an integrated leak of approximately 175 gallons of reactor coolant in a radiological 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 approximates to 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 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 effluent release from the plant vent. Plant vent monitor (RU-143) data indicated no significant increase in dose rate to on-site personnel as well as offsite.



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TEXT

4. CAUSE OF THE EVENT:

The root cause of the event is still under evaluation pending results from the metallurgical report from off-site laboratory analysis and from the development of hydraulic and I&C models. The investigation of this event has determined the apparent cause to be cyclic fatigue of the letdown piping due to dynamic pressure transients. The following contributing factors are under investigation and will be addressed by engineering during equipment root cause of failure (ERCFA) activities. The probable cause(s) listed below are factors that are believed to be potential contributors to the event.

1. System response to some transient conditions (Relative slow response of the backpressure control valve control loop and actuation of the relief valve)
2. Contribution of hanger design to increased stresses on system.
3. The rate that the letdown control valve is opened

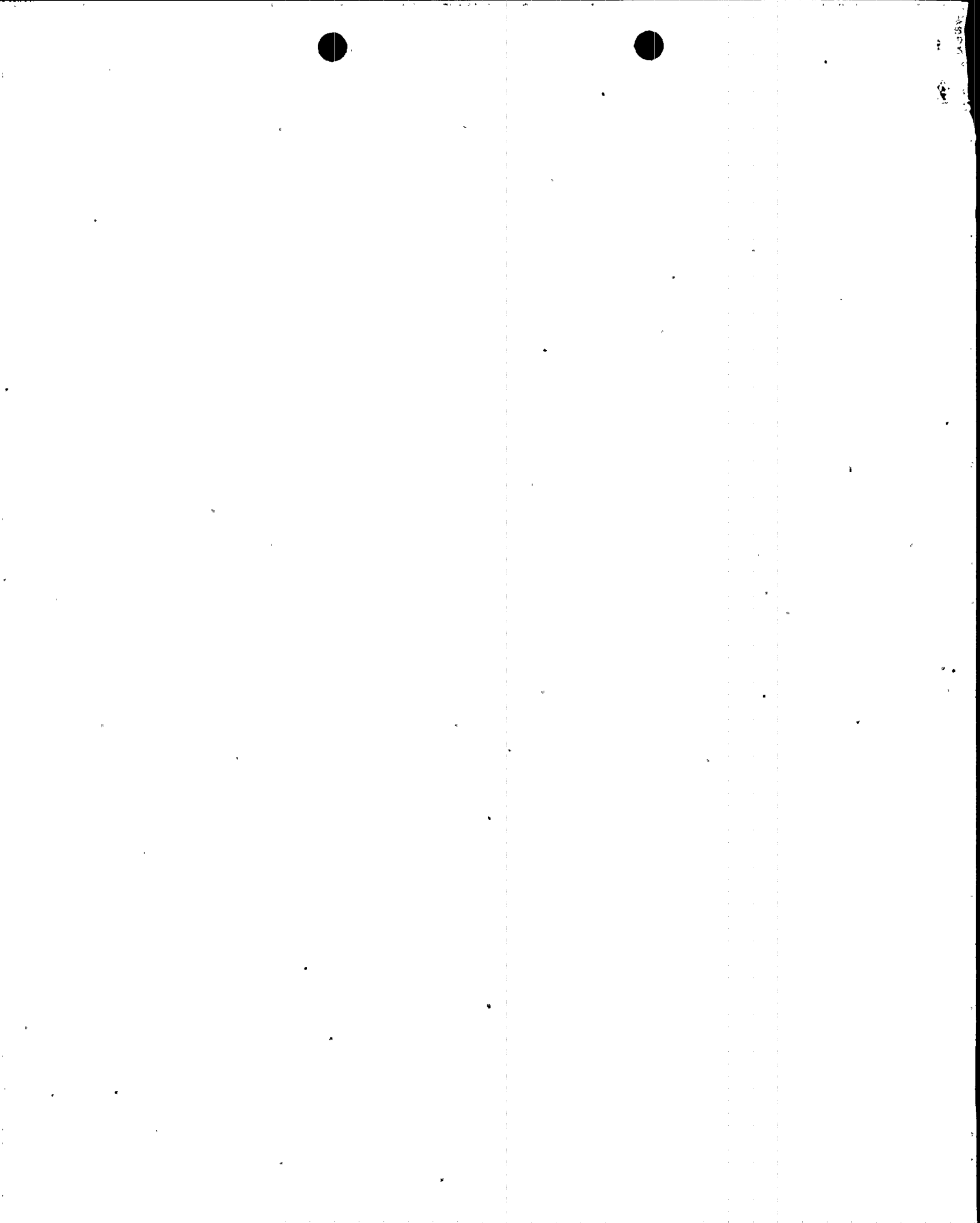
The final root cause will be submitted in a supplement to this LER.

5. STRUCTURES, SYSTEMS, OR COMPONENTS INFORMATION:

During this event, operations manually throttled the letdown control valve open to increase letdown flow with the backpressure control valve in auto to maintain backpressure at setpoint. Due to the delay in the backpressure control loop, a pressure spike was experienced in the letdown system, which rapidly increased backpressure, to the set pressure of the pressure relief valve PSV-345.

It is not known precisely when the letdown line failed, during the first pressure spike, or soon thereafter. Cycling of pressure relief valve PSV-345 is indicated as a potential contributing factor to the dynamic pressure transient experienced during this event.

Engineering has determined that the spring can pipe support with the 1" diameter stanchion connected to the letdown piping was not an optimal design for the estimated loading conditions during the event. Based on damage assessment, an enhanced pipe support design to account for all postulated loading (i.e., axial, lateral) was installed to provide additional piping integrity protection and eliminate the piping stanchion and associated high local stresses.



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TEXT

STRUCTURES, SYSTEMS, OR COMPONENTS INFORMATION Continued:

The affected portion of the letdown system piping and components are ASME Section III class 2 piping rated for 650psi. Review of the data plots indicated a maximum pressure was reached in the system of 600.1 psig. Pressure relief valve PSV-345 valve is designed to lift at 600psi 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 against 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 does not impact or have a significant affect on equipment operability nor jeopardize the ability to safely shutdown the unit during a postulated fire.

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

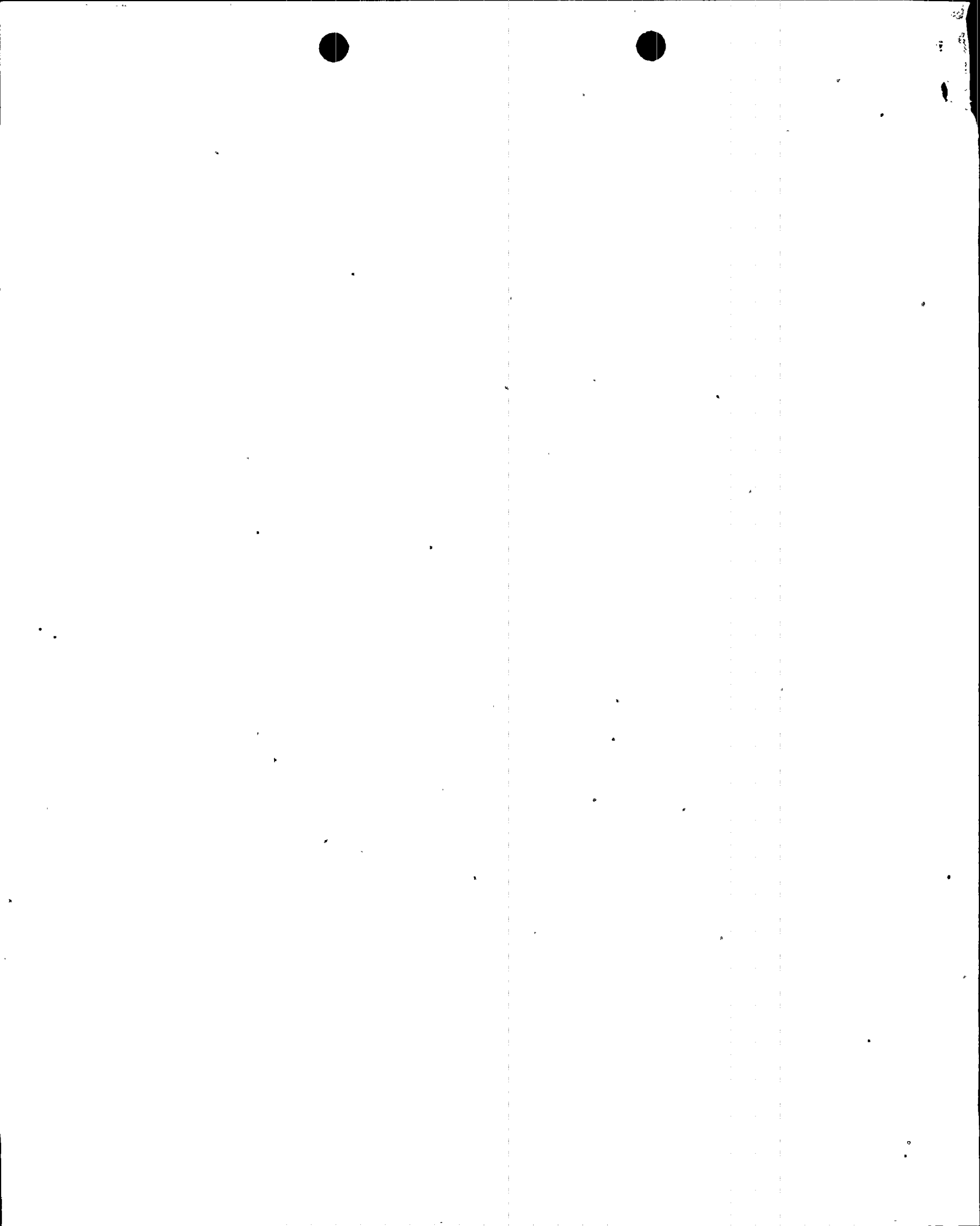
6. CORRECTIVE ACTIONS TO PREVENT RECURRENCE:

The following actions were taken as immediate and interim corrective action until final corrective actions are developed from the equipment root cause of failure.

1. Letdown was isolated using CHB-UV-515 on May 20, 1998.

2. A night order was issued to heighten operations personnel awareness of the Unit 1 event and to exercise precaution associated with activities that will possibly challenge the control characteristics of the backpressure control valves.

3. The Unit 1 letdown piping was replaced and the pipe support and hangers were optimized. The system was returned to service on May 22, 1998. The failed letdown line was cut out of the system and subsequently quarantined in the Hot Machine Shop. Inservice Inspection (ISI) engineers performed a visual examination of the support-to-pipe weld and determined the apparent cause to be cyclic overload of the line/hanger due to a dynamic pressure transient.



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TEXT

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 350 psi, preferably as close to 200 psi as practical. 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*.

5. Transportability has been evaluated for Units 2 and 3 to allow continued operation while root cause and final corrective actions are determined.

Walkdown of the piping system in Unit 1 revealed that the failed letdown line had apparently experienced a dynamic transient of sufficient magnitude to cause observable pipe support deformation.

Piping in the proximity of the dynamic failure, including fittings, supports and weld between the letdown line and stanchion, were inspected in all three units. Visual inspection of the affected letdown piping was performed in Units 2 and 3 without disturbing insulation. No damage or signs of cracking were observed. In addition to the above, high stress points in Unit 2 letdown piping, with all insulation removed, were also inspected. No deficiencies were identified.

6. Diagnostic testing of the in-service backpressure control valve (201P) was performed subsequent to this event. Test results indicate that the positioner was found to have a high zero (valve would initially open at approximately 6.5 ma control signal versus 4 ma) and that the stroke length was found to be slightly short at 0.6 inches, versus the nominal travel of 0.75 inches. Preliminary evaluation indicates that this was not a contributing factor to the event. However, the investigation team determined that this concern warrants further investigation.

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TEXT CORRECTIVE ACTIONS TO PREVENT RECURRENCE Continued:

Valve travel, bench set; spring rate and packing load for letdown control valve 110(Q) were all acceptable and consistent with the as-left test results following the Unit 1 refueling outage valve repack. The volume booster gain was also noted as not having excessive gain. The valve positioner was found to have a low zero (the valve may not fully close at the 4 ma control signal).

Calibration of the instrumentation loop for the Letdown Back Pressure Valve was verified on May 20, 1998. The components included pressure transmitter 1JCHNPT0201, indicator 1JCHNPI0201, controller 1JCHNPIC0201 and alarm cards 1JCHNPShL0210 (hi & low). All as found data was satisfactory. No adjustments were necessary.

It is expected that additional corrective actions will result from the laboratory analysis of the damaged pipe and final corrective actions along with the results from the equipment root cause of failure will be documented in a supplement to this LER.

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.

