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PG&E Letter DCL-08-070

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

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Power Plant Units 1 and 2
Licensee Event Report 1-2008-001-00
Potential Accumulator Drain Line Actuation Following an SBLOCA Due to Solenoid Valve Failure

Dear Commissioners and Staff:

In accordance with 10 CFR 50.73(a)(2)(v)(D), Pacific Gas and Electric Company (PG&E) is submitting the enclosed licensee event report regarding the potential for draining one or more safety injection system accumulators following a small break loss-of-coolant-accident due to a postulated solenoid valve malfunction.

PG&E makes no regulatory commitments (as defined by NEI 99-04) in this letter.

This event did not adversely affect the health and safety of the public.

Sincerely,

8/11/08
Kenneth Langdon for
James R. Becker

ddm/2246/A0731731
Enclosure
cc/enc: Elmo E. Collins, NRC Region IV
Michael S. Peck, NRC Senior Resident Inspector
Alan B. Wang, NRR Project Manager
INPO
Diablo Distribution

IE22
NRR

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 06/30/2007

Estimated burden per response to comply with this mandatory collection request: 50 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)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Diablo Canyon Unit 1	05000275	1 OF 7

4. TITLE

Potential Accumulator Drain Line Actuation Following a LOCA Due to Solenoid Valve Failure

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
06	11	2008	2008	- 001 -	00	08	11	2008	Diablo Canyon Unit 2	05000323

9. OPERATING MODE

1

10. POWER LEVEL

100

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)
Steven W. Hamilton – Senior Regulatory Services Engineer	(805) 545-3449

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	TV	A610	No					

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 June 11, 2008, at 14:05 PDT, with Units 1 and 2 in Mode 1 (Power Operation) at approximately 100 percent power, licensed plant operators entered Technical Specification (TS) 3.0.3 due to a potential solenoid valve failure mechanism that could initiate draining of the safety injection system (SIS) accumulators following a small break loss-of-coolant-accident (SBLOCA). Licensed plant operators made an eight-hour nonemergency event notification (EN 44287) in accordance with 10 CFR 50.72(b)(3)(v)(D) at 20:48 PDT.

Plant engineers identified four nonsafety-related solenoid valves that could malfunction due to a low minimum operating pressure differential (MOPD) following a SBLOCA. These valves could misposition in an intermediate position such that upon reestablishing supply air pressure they could open their associated safety-related valve resulting in a loss of SIS accumulator inventory. Emergency Operating Procedures (EOP) direct operators to reinstate the air supply to containment if isolated during a postulated SBLOCA scenario.

TEXT

I. Plant Conditions

Diablo Canyon Power Plant (DCPP) Units 1 and 2 were in Mode 1 (Power Operation) at approximately 100 percent power during the event.

II. Description of Problem

A. Background

During normal operation, the safety injection system (SIS)[BP] accumulator fill, vent, and drain system valves provide for control of accumulator water level via manual control switches located on the control operators console in the control room. Technical Specification (TS) 3.5.1, "Accumulators," requires, in part; that "Four ECCS accumulators shall be OPERABLE," with "borated water volume in each accumulator is greater than 814 ft^3 and less than 886 ft^3." Accumulator inventory can be decreased by opening the Drain Valves SI-1(2)-8876A, 8876B, 8876C, and 8876D for each of the four SIS accumulators. During normally operation, Valves SI-1(2)-8876A-D are maintained closed by de-energized nonsafety-related solenoid valves following a small break loss-of-coolant-accident (SBLOCA). 1(2)-SV-333, 342, 347, and 352 [LSV].

The containment air supply isolation Valve SI-2-8843 actuated by solenoid valve SV-527, provides isolation of the containment air supply pressure upon initiation of a containment isolation signal due to an SIS or manual safety injection (SI) initiation signal.

TS 3.6.1, "Containment," surveillance requirement (SR) 3.6.1.1, requires periodic testing in accordance with the Containment Leakage Rate Testing Program. Standard Temperature and Pressure (STP) M-7, "Integrated Leak Rate Test (ILRT) Type A," testing is performed in accordance with this program by isolating containment via closure of all automatically isolated penetrations and verification of manually isolated penetrations. The ILRT establishes containment air pressure of at least 45.12 psig ($0.96P_a$), in accordance with STP M-7. The ILRT performed during the Unit 2 fourteenth refueling outage (2R14) included isolation of SI-2-8843 (SV-527), and pressurizing the containment.

Following successful ILRT testing, operators proceeded to restore the containment air pressure supply. However, when operators went to open SI-2-8843 they found that the valve was in the open position with the control switch in the closed position.

TEXT

A failure mechanism exists in which solenoid valves could be susceptible to a demand failure if the supply air pressure were to decrease below the minimum operating pressure differential (MOPD) and then be reestablished. Four nonsafety-related solenoid valves were identified that could misposition in an intermediate position, due to this failure mechanism, such that upon reestablishing supply pressure they could open their associated safety-related valve resulting in a loss of SIS accumulator inventory. Emergency Operating Procedures (EOP) direct operators to reinstate the air supply to containment if isolated during a postulated SBLOCA scenario.

B. Event Description

On April 5, 2008, Action Request AR A0726408 identified a malfunction of solenoid valve (SV) SV-527, and its air-to-open containment Isolation Valve SI-2-8843, to maintain its intended position after restoration of the containment air supply pressure following completion of containment ILRT testing.

On June 6, 2008, AR A0731551, initiated an engineering review of the potential service conditions for nonsafety-related solenoid valves used as part of equipment restoration following postulated accidents.

On June 11, 2008, an evaluation identified four susceptible solenoid valves per unit that could malfunction due to MOPD resulting in the potential draining of one or more SIS accumulators following a SBLOCA.

On June 11, 2008, at 14:05 PDT, licensed plant operators entered TS 3.0.3 due to the potential solenoid valve malfunction that could initiate draining of one or more SIS accumulators following a SBLOCA.

Operations administratively cleared the instrument air to the subject SIS Accumulator Drain Valves SI-1(2)-8876A-D.

On June 11, 2008, at 16:06 PDT, Unit 2 plant operators verified that the manual isolation valves for the SIS accumulator drain lines were closed, exiting TS 3.0.3.

On June 11, 2008, at 16:10 PDT, Unit 1 plant operators verified that the manual isolation valves for the SIS accumulator drain lines were closed, exiting TS 3.0.3.

TEXT

On June 11, 2008, at 20:48 PDT, licensed plant operators made an eight-hour nonemergency event notification (EN 44287) in accordance with 10 CFR 50.72(b)(3)(v)(D) via the emergency notification system (ENS).

C. Status of Inoperable Structures, Systems, or Components that Contributed to the Event

None.

D. Other Systems or Secondary Functions Affected

None.

E. Method of Discovery

This condition was identified during a plant engineering component failure evaluation performed due to a malfunction of SV-527 following the 2R14 ILRT. An extent of condition evaluation identified a potential for a similar malfunction of the nonsafety-related solenoid valves controlling the drain valves of the SIS accumulators.

F. Operator Actions

Plant operators entered TS 3.0.3 due to failure to comply with TS 3.5.1 for the SIS accumulators and initiated actions to isolate the potentially affected drain lines. Upon verification that the drain lines were properly isolated, plant operators exited TS 3.03. At 20:48 PDT, June 11, 2008, licensed plant operators made a nonemergency event notification (EN 44287) in accordance with 10 CFR 50.72(b)(3)(v)(D).

G. Safety System Responses

None required.

III. Cause of the Problem

A. Immediate Cause

The initial evaluation of SV-527:

SV-527 is a 3-way pilot operated SV. When the SV coil is de-energized, the air operated valve (AOV) is ported to exhaust and the air supply port is closed, which closes (or maintains closed) the AOV. When the SV coil is

energized, the air supply is ported to the AOV actuator and the exhaust port is closed, which opens the AOV. The solenoid valve has a plunger (pilot seat cartridge and disc holder) that is actuated by the solenoid that directs the air to the appropriate port. The 3-way pilot operated SV requires that a minimum operating pressure differential (MOPD) be maintained between the pressure and exhaust ports to maintain proper position. During the 2R14 ILRT, the SV was de-energized so the exhaust port was aligned to the AOV actuator and the supply port of the SV was closed. In this configuration, the ILRT pressure would have been supplied to the pressure side of the AOV actuator through the SV exhaust port. It is believed that the ILRT pressure contributed to the movement of the plunger to an intermediate position.

The plunger failed to return to its normal position after the ILRT pressure was vented and the instrument air pressure was restored. It is believed that this was caused by age-related deterioration of the SV internal components. The SV had been in service over 23 years. Failure analysis found that the o-rings were hard and brittle, the diaphragms were stiff, and the plunger springs had taken a compression set. The SV malfunction occurred as result of the plunger being in an intermediate position with air being supplied to both the actuator and the exhaust port. When the exhaust port was blocked, the valve returned to its closed position. Subsequent operation of the valve was normal.

B. Cause

The cause of this SV malfunction was determined to be SV plunger movement due to insufficient MOPD in combination with age-related deterioration of the SV internal components. Were either condition not to have been present, the malfunction would not have occurred.

IV. Assessment of Safety Consequences

There were no safety consequences as a result of this event. Units 1 and 2 remained at full power and all systems were available to perform their intended safety function by isolation of the SIS accumulator drain valves that could have been adversely affected by the described condition. The limiting large break LOCA conditions are not adversely affected by the identified condition as the reactor coolant pressure decreases rapidly, with prompt accumulator actuation, before containment air supply pressure is restored in accordance with the EOPs.

Following a SBLOCA and isolation of the air supply to the containment, the pilot-operated SVs associated with the accumulator drain valves could experience a

TEXT

MOPD plunger misposition. Subsequent restoration of the air supply to the containment could result in inadvertently opening of the accumulator drain valves and the initiation of accumulator draindown. The accumulator level is monitored and displayed in the control room. Also, annunciator window PK-02-10 would alarm when the accumulator level reached 60.8 percent. One of the actions specified in response to an accumulator low-level alarm is to verify that the accumulator drain valves are closed. Given the restoration of air supply to the containment, it is anticipated that the SV would respond appropriately to a demand signal to close the accumulator drain valve using the switch in the control room.

The condition described is a low probability event involving a very specific set of SBLOCA conditions that would require several minutes between loss and restoration of air supply to the containment, but prior to SIS accumulator injection demand. PG&E has identified only one malfunction due to the combined insufficient MOPD / age-related failure mechanism. Thus, the simultaneous malfunction of multiple potentially affected solenoid valves in combination with the required SBLOCA conditions is considered an extremely low probability event.

Therefore, the event is not considered risk-significant and it did not adversely affect the health and safety of the public.

V. Corrective Actions

A. Immediate Corrective Actions

1. Plant operating and maintenance personnel entered containment and closed the SIS accumulator drain line manual isolation valves.

2. Plant personnel isolated the air supply to the four solenoid valves for the SIS accumulator drain valves in each unit and will maintain them under administrative clearance until the solenoid valves are replaced.

B. Planned Corrective Actions

1. PG&E plans to replace the suspect solenoid valves using a prioritized replacement plan that is under development.
Reference AR A0734863.

TEXT

VI. Additional Information

A. Failed Components

Commercial grade ASCO model 8316 pilot-operated solenoid valves purchased prior to commercial power operation.

B. Previous Similar Events

None.