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December 16, 2011

PG&E Letter DCL-11-134

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

10 CFR 50.73

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyons Unit 1 and Unit 2
Licensee Event Report 1-2011-002-02
Diablo Canyon Power Plant Units 1 and 2 Auxiliary Building Ventilation System Single Failure Vulnerability and Loss of Unit 2 Auxiliary Building Ventilation System

Dear Commissioners and Staff:

Pacific Gas and Electric Company (PG&E) submits the enclosed Revision 2 to Licensee Event Report (LER) 1-2011-002 regarding an event that occurred when the Diablo Canyon Power Plant Unit 2 auxiliary building ventilation system exhaust fans were simultaneously secured due to a previously unknown single failure vulnerability. This revision clarifies that only Unit 2 experienced the failure. PG&E is submitting this LER revision in accordance with 10 CFR 50.73(a)(2)(ii)(B) for Units 1 and 2, and 10 CFR 50.73(a)(2)(v)(C) and (D) for Unit 2 only.

There are no new or revised regulatory commitments in this report. This event did not adversely affect the health and safety of the public.

Sincerely,

James R. Becker

mlpy/50443326
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

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

Single Failure Vulnerability of Unit 1 and 2 Auxiliary Building Ventilation System

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
01	10	2011	2011	- 2 -	2	12	16	2011	Diablo Canyon Power Plant Unit 2	05000 323
									FACILITY NAME	DOCKET NUMBER
										05000

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)
- ☐ 20.2201(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)*
L. Mark Padovan, Regulatory Services Supervisor	(805) 545-4540

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
E	VF	DMP	A340	N					

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 January 10, 2011, at 1321 PST, Diablo Canyon Power Plant (DCPP), Unit 2, entered Technical Specification Limiting Condition of Operation (TS LCO) 3.0.3 when both trains of auxiliary building ventilation system (ABVS) [VF] became inoperable following closure of Damper M-4A [DMP] and the ensuing loss of both ABVS Exhaust Fans E-1 and E-2. TS LCO 3.0.3 was exited on January 10, 2011, at 1342 PST following a system reset and restart of Fan E-2. An 8-hour nonemergency report was made pursuant to 10 CFR 50.72(b)(3)(v) (reference ENS # 46531).

The cause of the loss of both trains of ABVS of Unit 2 was a nonconforming single failure vulnerability in the ABVS design. This design vulnerability existed as part of the original plant design for both DCPP Units 1 and 2 and was not identified and corrected when the ABVS control system was replaced. Corrective actions include modifying the design of both DCPP Units 1 and 2 ABVS to meet the single failure design criteria. This revision clarifies that only Unit 2 experienced an event that could have prevented fulfillment of its safety function.

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NARRATIVE

I. Plant Conditions

At the time of the event, Units 1 and 2 were in Mode 1 (Power Operation) at approximately 100 percent reactor power with normal operating reactor coolant temperature and pressure.

II. Description of Problem

A. Background

The function of the ABVS is to filter air from the area of the active emergency core cooling system (ECCS) components during the recirculation phase of a loss of coolant accident (LOCA). The ABVS also provides environmental control of temperature and humidity in the ECCS pump room areas as well as the general auxiliary building areas. The ABVS is designed, built, and installed as Design Class I and is required to meet single failure criteria. All dampers fail in the positions required for emergency conditions. If a damper failure position is normally open, two dampers are mounted in parallel. Conversely, if the damper failure position is normally closed, two dampers are mounted in series. The specific flowpaths established by the ABVS are dependent on the ventilation system's operating mode, which are defined as Building Only, Building and Safeguards, and Safeguards Only.

Building Only Mode: In this mode, supply air is provided by one of the two full capacity supply fans (whichever is selected to operate). Supply ventilation is routed to selected areas of the auxiliary building via the supply ducts. Exhaust air is collected by the nonsafeguards exhaust ducts and routed through Dampers M-4A and M-4B to the suction of one of the two full capacity exhaust fans.

Building and Safeguards Mode: With the ABVS System in the Building Only Mode, it will automatically shift to the Building and Safeguards Mode in the event that the system's control logic receives either a safety injection signal or an ECCS motor start signal. This mode may also be manually selected using a control switch on the main control board. In this mode, supply air is provided by both supply fans and is distributed to both general building areas and to the ECCS pump room areas. The general building area exhaust air is then collected by the nonsafeguards exhaust ducts and routed through Dampers M-4A and M-4B to the suction of both Exhaust Fans E-1 and E-2. The ECCS pump room areas exhaust air is collected by the safeguards ducts and routed through the engineered safety feature (ESF) filtration train containing charcoal adsorber (with "s" signal) or through the non-ESF filtration train (without "s" signal) to the suction of both full capacity exhaust fans.

Safeguards Only Mode: With the ABVS in the Building and Safeguards Mode, it will automatically shift to the Safeguards Only Mode in the event that a supply or exhaust fan has failed. In this mode, supply ventilation is provided by the operable supply fan. Supply ventilation is distributed to the ECCS pump room areas only. Exhaust ventilation is collected by the safeguards ducts and routed through the ESF filtration train containing charcoal adsorber (with "s" signal) or through the non-ESF filtration train (without "s" signal) to the suction of the operable exhaust fan.

Dampers M-4A and M-4B Function: Dampers M-4A and M-4B are series dampers in the nonsafeguards ducting that provide the exhaust flowpath from the general building areas. They are open in Building Only or Building and Safeguards Modes and closed in Safeguards Only Mode. The dampers are redundant to ensure that when safeguards system operation requires them to close, at least one will close. The control circuits for two dampers are redundant and separate to further ensure reliability.

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B. Event Description

On the morning of January 10, 2011, the Unit 2 ABVS was in Building Only Mode with Exhaust Fan E-1 in service. Both Supply Fans S-33 and S-34 were out of service for regularly scheduled maintenance. Removal of both ABVS supply fans is permitted by DCPP TS LCO 3.7.12 Bases. At 1140 PST, Operations Services commenced a routine quarterly pump test on Containment Spray Pump (CSP) 2-1. When CSP 2-1 was started, the ABVS automatically attempted to transition to Building and Safeguards Mode. However, sensing that both supply fans were out of service, the ABVS control system immediately aligned to Safeguards Only Mode as designed. During this transition, Dampers M-4A and M-4B closed to isolate the nonsafeguards flowpath. At approximately 1320 PST, Operations Services completed the pump test and secured CSP 2-1. Because the ABVS mode selector switch was still in Building Only Mode, the system automatically realigned to this mode upon securing CSP 2-1. At 1321 PST, the control room received an ABVS system alarm, indicating that Damper M-4A was not open as required for Building Only Mode. Approximately 35 seconds later, the control room received another alarm indicating that Exhaust Fan E-1 had shutdown, initiating entry into TS LCO 3.0.3 at 1321 PST. Sensing the loss of an exhaust fan, the ABVS control system attempted to autostart the standby Exhaust Fan E-2. At 1323 PST, the control room received a third alarm indicating that Fan E-2 had also shutdown. At that time, all Unit 2 ABVS supply and exhaust fans were not in service. The operators entered the annunciator response procedure, performed a status reset of the control logic in the control room, and selected ABVS Exhaust Fan E-2, resulting in the restart of ABVS Exhaust Fan E-2. TS LCO 3.0.3 was subsequently exited at 1342 PST. This event affected only the Unit 2 ABVS.

Following the event, PG&E investigated the cause of the failure and reviewed the design of the ABVS. The investigation revealed that the design of the ABVS control logic allowed the event that occurred on January 10, 2011, by tripping the operating exhaust fan when a suction damper is not fully opened. Sensing the loss of an exhaust fan, the ABVS control system attempts to autostart the standby exhaust fan but will block the standby exhaust fan when an M-4 suction damper is not fully opened. At this point, the control logic will be faulted and prevent both exhaust fans from starting and will not respond to an ESF pump start or safety injection signal until operators reset the control logic. Investigation also revealed that the single failure vulnerability existed only with the ABVS selected to the Building Only Mode.

The single failure vulnerability was determined to be part of the original plant design for both DCPP Units 1 and 2. Replacement of the control system, which was issued in 2009 for Unit 1 and 2008 for Unit 2, focused on maintaining identical control logic and consequently failed to identify and correct the single failure vulnerability. The Unit 2 ABVS Damper M-4A failure to fully open was determined to be due to leakage past the piston seal of the damper actuator.

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

Unit 2 ABVS Damper M-4A Actuator Piston Seal leaked.

D. Other Systems or Secondary Functions Affected

No additional safety systems were adversely effected by this event.

E. Method of Discovery

Control room alarms alerted operators to the loss of ABVS on Unit 2.

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F. Operator Actions

Selected the ABVS Safeguards Only Mode, reset the ABVS control logic, and selected ABVS Exhaust Fan E-2, restarting Fan E-2.

G. Safety System Responses

None.

III. Cause of the Problem

A. Immediate Cause

The Unit 2 ABVS failure occurred due to ABVS Damper M-4A failing to fully open upon a control system demand signal concurrent with the existence of a previously unrecognized single failure design vulnerability.

B. Cause

1. The apparent cause of the loss of both trains of ABVS was a nonconforming condition in the plant ABVS design. This portion of the ABVS system did not meet the single failure criteria.

2. DCPP's licensing basis allowing ABVS manual actions, when automatic action was not available, was not clear.

3. The apparent cause for the failure to identify and correct the single failure vulnerability when preparing the design of the replacement ABVS control system was that the DCPP design change process was limited to the modification and did not search for legacy issues while performing failure modes and effects analyses.

4. The apparent cause of the Unit 2 ABVS Damper M-4A leakage past the damper actuator piston seal is presumed to be use of the seal beyond its defined service life, contrary to requirements of the DCPP preventative maintenance program for this seal. PG&E left the seal in service beyond its defined service life due to a 2007 personnel error which incorrectly closed the maintenance order to replace the seal.

IV. Assessment of Safety Consequences

Based on a review of the event, the Unit 2 ABVS Exhaust Fans, E-1 and E-2, were not operable and available to automatically perform the required safety function. This event could have occurred on either unit due to the single failure vulnerability. The ABVS controls the release of radioactivity, mitigates the consequences of an accident by maintaining the ESF room temperatures below the design limits, and filters the ventilation exhaust stream. Although both DCPP Unit 2 ABVS exhaust fans were not operating for a very brief period of time, the ESF features for this system were capable of performing their design safety functions via manual operator initiation. ABVS control room alarms alert operators to problems with the ABVS. Operating procedures direct operators to reset the control logic and reestablish the ABVS operation at control panels located within the control room. Consequently, this brief loss of ABVS is not considered risk significant and would not have adversely effected the health and safety of the public.

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V. Corrective Actions

Plant operators selected the ABVS to Safeguards Only Mode, reset the ABVS control logic, and restarted ABVS Exhaust Fan E-2. A shift order was issued directing that the Units 1 and 2 ABVS be kept in either the Building and Safeguards Mode or the Safeguards Only Mode. By keeping the ABVS in the Building and Safeguards Mode or the Safeguards Only Mode, the single failure vulnerability is precluded. In addition, the actuator for damper M-4A was replaced.

B. Corrective Actions to Prevent Recurrence (CAPR)

1. Modified the ABVS system design such that it meets the single failure design requirements.

2. Revise licensing basis by clearly describing the ABVS and requirements to allow crediting manual operation if automatic actuation is unavailable.

3. Revise the design change process to include a design evaluation of new and old failure modes based on the current licensing and design bases.

4. The employee that incorrectly closed the order in 2007 was remediated on the maintenance order closure procedural requirements.

VI. Additional Information

A. Failed Components

Unit 2 ABVS Damper M-4A Actuator Piston Seal

B. Previous Similar Events

None

C. Industry Reports

None