



**Pacific Gas and  
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July 2, 2010

PG&E Letter DCL-10-069

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 Canyons Unit 1 & Unit 2  
Licensee Event Report 1-2010-002-01  
Potential Loss of Safety-Related Pumps due to Degraded Voltage During  
Postulated Accidents

Dear Commissioners and Staff:

Pacific Gas and Electric Company submits the enclosed supplemental licensee event report (LER) regarding a vulnerability during postulated degraded grid voltage conditions concurrent with accidents. This LER was originally submitted in accordance with 10 CFR 50.73(a)(2)(ii)(B). The supplement adds reporting criteria 50.73(a)(2)(v), safety system functional failure, 50.73(a)(2)(i)(B), an operation or condition prohibited by Technical Specifications, and specifies corrective actions.

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

Sincerely,



James R. Becker

Imp/2246/50302031

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

**LICENSEE EVENT REPORT (LER)**(See reverse for required number of  
digits/characters for each block)

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.

<b>1. FACILITY NAME</b> Diablo Canyon Unit 1	<b>2. DOCKET NUMBER</b> 05000275	<b>3. PAGE</b> 1 OF 7
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<b>4. TITLE</b> Potential Loss of Safety-related Pumps due to Degraded Voltage During Postulated Accidents
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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
03	09	2010	2010	- 002 -	01	07	02	2010	Diablo Canyon Unit 2	05000323
									FACILITY NAME	DOCKET NUMBER

<b>9. OPERATING MODE</b>  1	<b>11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)</b>									
	<input type="checkbox"/> 20.2201(b) <input type="checkbox"/> 20.2201(d) <input type="checkbox"/> 20.2203(a)(1) <input type="checkbox"/> 20.2203(a)(2)(i) <input type="checkbox"/> 20.2203(a)(2)(ii) <input type="checkbox"/> 20.2203(a)(2)(iii) <input type="checkbox"/> 20.2203(a)(2)(iv) <input type="checkbox"/> 20.2203(a)(2)(v) <input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 20.2203(a)(3)(i) <input type="checkbox"/> 20.2203(a)(3)(ii) <input type="checkbox"/> 20.2203(a)(4) <input type="checkbox"/> 50.36(c)(1)(i)(A) <input type="checkbox"/> 50.36(c)(1)(ii)(A) <input type="checkbox"/> 50.36(c)(2) <input type="checkbox"/> 50.46(a)(3)(ii) <input type="checkbox"/> 50.73(a)(2)(i)(A) <input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(i)(C) <input type="checkbox"/> 50.73(a)(2)(ii)(A) <input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B) <input type="checkbox"/> 50.73(a)(2)(iii) <input type="checkbox"/> 50.73(a)(2)(iv)(A) <input type="checkbox"/> 50.73(a)(2)(v)(A) <input checked="" type="checkbox"/> 50.73(a)(2)(v)(B) <input type="checkbox"/> 50.73(a)(2)(v)(C) <input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)	<input type="checkbox"/> 50.73(a)(2)(vii) <input type="checkbox"/> 50.73(a)(2)(viii)(A) <input type="checkbox"/> 50.73(a)(2)(viii)(B) <input type="checkbox"/> 50.73(a)(2)(ix)(A) <input type="checkbox"/> 50.73(a)(2)(x) <input type="checkbox"/> 73.71(a)(4) <input type="checkbox"/> 73.71(a)(5) <input type="checkbox"/> OTHER Specify in Abstract below or in NRC Form 366A						
<b>10. POWER LEVEL</b>  100										

**12. LICENSEE CONTACT FOR THIS LER**

<b>FACILITY NAME</b> Larry M. Parker – Regulatory Services Supervisor	<b>TELEPHONE NUMBER (Include Area Code)</b> (805) 545-3386
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**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

**14. SUPPLEMENTAL REPORT EXPECTED**☒ YES (If yes, complete 15. EXPECTED SUBMISSION DATE)☐ NO**15. EXPECTED SUBMISSION DATE**

MONTH	DAY	YEAR
08	07	2010

**ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)**

On March 9, 2010, while analyzing the consequences of a postulated sustained degraded grid voltage, PG&E concluded both Units 1 and 2 were in an unanalyzed condition. On March 9, 2010, at 23:39 (EST), PG&E reported this unanalyzed condition to the NRC in accordance with 50.72(b)(3)(ii)(B) (reference NRC Event Notification Number 45754).

The postulated sustained degraded voltage condition could have resulted in normally operating safety-related pump motors tripping overcurrent relays. As a result, these pumps would not be immediately available to mitigate a postulated accident and is considered a safety system functional failure.

PG&E had not considered this postulated worst case degraded voltage condition credible, and had therefore not analyzed for it. As a result, technical specification (TS) surveillance requirement (SR) 3.3.5.3 values are nonconservative, and several TS Actions were not met.

The immediate compensatory measure was to raise the first level undervoltage relay setpoints on the vital buses of both Units 1 and 2, thus transferring loads to emergency diesel generators prior to tripping operating motors on overcurrent. PG&E will submit a license amendment request to establish conservative TS SR 3.3.5.3 undervoltage relay settings.

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TEXT

## I. Plant Conditions

At the time of discovery, Units 1 and 2 were in Mode 1 (Power Operation) at approximately 100 percent reactor power with normal grid voltage.

## II. Description of Problem

### A. Background

Each Diablo Canyon Power Plant (DCPP) unit has three 4kV vital buses [EA]. The 4kV vital buses are normally powered from auxiliary power transformers from the main generator. Normally operating safety-related loads powered by the 4kV vital buses include two of three available component cooling water (CCW)[BI] pumps and one of two available auxiliary saltwater (ASW)[BS] pumps. In addition, the charging function [CB], while normally supplied by a nonsafety-related pump is occasionally provided by one of two safety-related pumps. Pump motors have overcurrent relays [51] to protect them from damage due to heating (i.e., from sustained undervoltage operation).

To protect the safety-related loads, the 4kV vital buses are provided with loss of voltage and low/degraded undervoltage [27] protection that initiates transfer to the onsite emergency diesel generators (EDG)[EK]. The EDGs provide emergency power to mitigate an accident and safely shutdown the unit when offsite power is unavailable.

The first level undervoltage relays (FLURs) provide loss of voltage and low voltage protection for each 4kV vital bus while connected to an offsite power source. These relays have inverse time characteristics that actuate more quickly in response to more severe undervoltage conditions, with less than or equal to a 4 second delay upon complete voltage failure.

The second level undervoltage relays (SLURs) provide sustained undervoltage protection for degraded bus voltage conditions. The SLURs actuate at greater than or equal to 3785 volts. Both of the SLURs on a bus must actuate to initiate EDG start and load shed timers for the associated bus. If voltage remains below the reset voltage for 10 seconds, the associated EDG will receive a start signal. If voltage remains below the reset voltage for 20 seconds, loads are shed from the bus and the bus is separated from offsite power in preparation for load sequencing onto the EDG. If voltage recovers prior to these time limits, the SLURs reset. The FLURs and SLURs are designed to protect safety-related loads from damage on loss or degradation of 4kV vital bus voltage.

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TEXT

Technical Specification (TS) 3.3.5 "Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation" Surveillance Requirement (SR) 3.3.5.3 specifies the FLUR and SLUR setpoints and time delays.

Surveillance Test Procedure (STP) M-75 "4kV Vital Bus Undervoltage Relay Calibration" ensures the relays meet the setpoint and time delay values specified in TS SR 3.3.5.3.

The following TS systems were impacted by this event:

- TS 3.5.2, "Emergency Core Cooling Systems (ECCS) [BQ] – Operating," permits operation with one or more trains inoperable up to 72 hours.
- TS 3.7.7, "Vital Component Cooling Water (CCW) System," permits operation with one CCW loop inoperable up to 72 hours.
- TS 3.7.8, "Auxiliary Saltwater (ASW) System," permits operation with one ASW train inoperable up to 72 hours.

### B. Event Description

On March 9, 2010, PG&E analyzed the consequences of accidents with subsequent degraded grid voltage for a nonconforming condition, second level undervoltage time delay relay not reflected in accident analyses. As a result, PG&E discovered both units could operate in an unanalyzed condition. The postulated condition as a sustained degraded grid voltage condition of 4kV voltage remaining below the SLUR setpoint and slightly above the FLUR setpoint, resulting in the vital buses experiencing the degraded voltage condition until the SLUR time delays are completed. This condition could have resulted in normally operating safety-related pump motors tripping their overcurrent relays [51]. As a result, these pumps may not have been immediately available to mitigate a postulated accident as credited in accident analyses.

On March 9, 2010, at 20:39 (PST), PG&E reported this as an unanalyzed condition (8-hour report) to the NRC in accordance with 50.72(b)(3)(ii)(B) (reference EN45754).

PG&E implemented interim compensatory measures via Shift Orders to prevent auto transfer to startup of one vital 4kV bus per unit. As a result, offsite startup power was considered inoperable in both Units 1 and 2.

On March 9, 2010, at 21:58 (PST for Unit 1, 21:57 for Unit 2), in response to the above interim compensatory measures, operators declared startup power inoperable and entered 72-hour TS 3.8.1, Action A.2 for one inoperable offsite power source.

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TEXT

Unit 2 CCW pump 2-2 was removed from service for maintenance at the time the interim compensatory measures were taken. The interim compensatory measure only ensured CCW pump 2-1 would be transferred directly to the diesel power supply, leaving CCW pump 2-3 vulnerable to overcurrent trip as described above. With potentially only one CCW pump available following a reactor trip with sustained degraded voltage on the startup power source, entry into limiting condition of operation (LCO) 3.0.3 was required but not recognized. The transfer to startup was prevented for the running CCW pump 2-3 at 08:58 on March 10, 2010. The time from 21:57, March 9 until 08:58, March 10 exceeds the LCO 3.0.3 required time of 7 hours to place the unit in Mode 3.

In order to exit the TS Action, PG&E implemented a temporary modification (compensatory measure) that raised the first level undervoltage relay setpoints on the vital buses of both Units 1 and 2, thus allowing transfer of loads to EDGs prior to tripping on overcurrent.

On March 12, 2010, at 13:17 (PST for Unit 1, 13:18 for Unit 2), following adjustment of FLUR setpoints, completion of STP M-75, and elimination of the previously established compensatory measures, operators exited the 72-hour TS action for an inoperable offsite startup power supply.

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

None

D. Other Systems or Secondary Functions Affected

No additional safety systems were adversely affected by this event.

Analysis of safety related loads that could be sequence onto a degraded voltage bus and potentially experience an overcurrent trip is not complete. This LER will be supplemented to report the results of that analysis.

E. Method of Discovery

During a Component Design Basis Inspection (CDBI), NRC inspectors asked PG&E to evaluate various postulated sustained degraded 4kV voltage scenarios. As a result of the evaluation, this issue was identified.

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TEXT

## F. Operator Actions

Interim compensatory measures were implemented to protect normally operating safety-related pumps from postulated degraded voltage. Operators declared startup power inoperable and complied with 72-hour TS 3.8.1, Action A.2 until the FLUR setpoints could be raised on the vital buses to higher values.

## G. Safety System Responses

None

## III. Cause of the Problem

### A. Immediate Cause

The immediate cause of the unanalyzed condition was that PG&E had not considered this postulated worst case degraded voltage condition credible, and had therefore not analyzed for it. As a result, TS SR 3.3.5.3 values are nonconservative.

### B. Cause

A cause analysis has been completed. This LER will be supplemented to include a description of the cause and corrective actions.

## IV. Assessment of Safety Consequences

The postulated sustained degraded voltage of less than 70 percent for over ten seconds could cause normally operating safety-related motors (two CCW pump motors and one ASW pump motor) to trip on overcurrent. The condition was considered reportable because accident analyses assumed normally running safety-related loads would automatically transfer to an EDG. Therefore this event is considered unanalyzed.

Accident analyses require two CCW pumps to operate, and this condition could result in two of the three CCW pumps tripping. Similarly, this condition could have resulted in loss of the ASW function during maintenance periods when an ASW pump was removed from service. This vulnerability has existed for the life of the plant, and during that time, safety-related charging pumps have been used for normal charging function when a nonsafety-related charging pump was removed from service for maintenance. As a result, this scenario could have prevented fulfillment of the safety functions performed by ASW, CCW, and

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TEXT

charging (ECCS). Therefore, this is considered a safety system functional failure (SSFF) to remove residual heat and mitigate the consequences of an accident per 50.73(a)(2)(v)(B) and (D).

With the above scenario having the potential to render operating safety-related pumps inoperable in the past, the TS for the ECCS (TS 3.5.2), CCW (TS 3.7.7), ASW (TS 3.7.8) systems and LCO 3.0.3 have not been met for both Units 1 and 2, which is reportable per 50.73(a)(2)(i)(B).

While this scenario is considered a SSFF, it is not considered safety significant because it would require simultaneous occurrence of two unrelated and highly improbable events: (1) the sustained undervoltage of the offsite power system and (2) an event which results in a plant trip. Evaluation of the offsite power system has shown there is no credible means of creating a sustained degraded voltage condition of less than 70 percent on the startup power supply. Evaluation has also shown that accident loadings on the bus will not result in a sustained degraded voltage condition when the "immediately available" startup power source functions as designed. Furthermore, the individual motor overcurrent relays would protect the pump motors from damage and operators would be expected to restart the motors. The DCPD 4kV motor overcurrent relays can be reset by Operators using controls in the DCPD Control Room.

DCPD has over ten years experience with automatic load tap changers on the startup transformers, and has never observed a sustained degraded voltage condition similar to what is being postulated. A probabilistic risk assessment (PRA) analyses conducted for this scenario demonstrated that this event was not risk significant.

Based on the foregoing, this event did not adversely affect the health and safety of the public.

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TEXT

## V. Corrective Actions

### A. Immediate Corrective Actions

PG&E implemented compensatory measures by changing the FLUR setpoints on the vital buses of both Units 1 and 2, thus protecting operating safety-related motors from tripping on overcurrent during postulated sustained degraded voltage conditions. Specifically, the FLUR delay time was shortened such that load shedding and bus transfer would be initiated prior to overcurrent tripping of the individual loads.

### B. Corrective Actions to Prevent Recurrence (CAPR)

1. PG&E will submit a license amendment request to establish conservative TS SR 3.3.5.3 undervoltage relays settings.

Other corrective actions to prevent recurrence may be identified and included in a supplemental LER following completion of the cause analysis.

## VI. Additional Information

### A. Failed Components

None

### B. Previous Similar Events

None.

### C. Industry Reports

NRC Event Notification EN45754