



**Pacific Gas and  
Electric Company®**

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December 3, 2015

PG&E Letter DCL-15-145

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

10 CFR 50.73

Docket No. 50-275, OL-DPR-80  
Diablo Canyon Power Plant, Unit 1  
Licensee Event Report 1-2015-002-00, Environmental Qualification of Wide Range  
Resistance Temperature Detectors Wiring Exceeded

Dear Commissioners and Staff,

Pacific Gas and Electric Company (PG&E) submits the enclosed Licensee Event Report (LER) regarding exceeding the Environmental Qualification of the wiring on the Unit 1 Reactor Coolant System Wide Range Resistance Temperature Detectors. PG&E is submitting this LER in accordance with 10 CFR 50.73(a)(2)(i)(B), as an operation or condition prohibited by Technical Specifications and 10 CFR 50.73(a)(2)(vii), as a common cause inoperability of independent trains or channels.

PG&E makes no new or revised regulatory commitments (as defined by NEI 99-04) in this report. All corrective actions identified in this letter have been implemented in accordance with the Diablo Canyon Power Plant Corrective Action Program.

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

Sincerely,

James M. Welsch

BNSM/4540/50808493

Enclosure

cc/enc: Marc L. Dapas, NRC Region IV Administrator  
Thomas R. Hipschman, NRC Senior Resident Inspector  
Siva P. Lingham, NRR Project Manager  
INPO  
Diablo Distribution





## LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of  
digits/characters for each block)

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 and Information Collections Branch (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.

## 1. FACILITY NAME

Diablo Canyon Power Plant, Unit 1

## 2. DOCKET NUMBER

05000 275

## 3. PAGE

1 OF 5

## 4. TITLE

Environmental Qualification of Wide Range Resistance Temperature Detectors Wiring Exceeded

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
10	05	2015	2015	002	00	12	03	2015	FACILITY NAME	DOCKET NUMBER
										05000
9. OPERATING MODE			11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)							
5			<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)		<input type="checkbox"/> 50.73(a)(2)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(viii)(A)		
			<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)		<input type="checkbox"/> 50.73(a)(2)(ii)(B)		<input type="checkbox"/> 50.73(a)(2)(viii)(B)		
			<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)		<input type="checkbox"/> 50.73(a)(2)(iii)		<input type="checkbox"/> 50.73(a)(2)(ix)(A)		
			<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)		<input type="checkbox"/> 50.73(a)(2)(iv)(A)		<input type="checkbox"/> 50.73(a)(2)(x)		
10. POWER LEVEL  000			<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(v)(A)		<input type="checkbox"/> 73.71(a)(4)		
			<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)		<input type="checkbox"/> 50.73(a)(2)(v)(B)		<input type="checkbox"/> 73.71(a)(5)		
			<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)		<input type="checkbox"/> 50.73(a)(2)(v)(C)		<input type="checkbox"/> 73.77(a)(1)		
			<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)		<input type="checkbox"/> 50.73(a)(2)(v)(D)		<input type="checkbox"/> 73.77(a)(2)(i)		
			<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)		<input checked="" type="checkbox"/> 50.73(a)(2)(vii)		<input type="checkbox"/> 73.77(a)(2)(ii)		
			<input type="checkbox"/> 50.73(a)(2)(i)(C)		<input type="checkbox"/> OTHER		Specify in Abstract below or in NRC Form 366A			

## 12. LICENSEE CONTACT FOR THIS LER

## LICENSEE CONTACT

Brandy Lopez, Regulatory Services Engineer

## TELEPHONE NUMBER (Include Area Code)

(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
D	IP	TI	Conax	N	N/A	N/A	N/A	N/A	N/A

## 14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO15. EXPECTED  
SUBMISSION  
DATE

MONTH	DAY	YEAR

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

As part of an apparent cause evaluation, Pacific Gas and Electric Company (PG&E) identified an incorrect insulation configuration, installed in 2010, on the thermal extension piping that houses the wires for the wide range (WR) reactor coolant system (RCS) resistance temperature detectors (RTDs). The insulation configuration, as installed, trapped heat inside the thermal extension piping and overheated the wires. The cause of the incorrect configuration of the insulation was insufficient guidance in the associated work package instructions.

An engineering analysis completed on October 5, 2015, determined that the eight WR RCS RTDs had either failed or were operating outside the environmental qualification temperature range. As a result, on October 5, 2015, PG&E determined that the required number of WR RTDs would not have been operable and therefore a violation of Technical Specification 3.3.3, "Post Accident Monitoring (PAM) Instrumentation," had occurred.

As part of the corrective actions, PG&E replaced all eight WR RTDs, restored the insulation per the design requirements, revised the drawings for Unit 1 WR RTDs to provide adequate level of detail, and revised the work order to include the correct drawing and level of details for proper installation of all WR RTDs. This event did not adversely affect the health or safety of the public.



NRC FORM 366A  
(11-2015)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104

EXPIRES: 10/31/2018



## LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

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 and Information Collections Branch (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.

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER			
Diablo Canyon Power Plant, Unit 1	05000-	275	YEAR	SEQUENTIAL NUMBER	REV NO.
			2015	002	00

### NARRATIVE

#### I. Reportable Event Classification

This event is reportable pursuant to the following criteria:

- 10 CFR 50.73(a)(2)(i)(B), an operation or condition prohibited by Technical Specifications
- 10 CFR 50.73(a)(2)(vii), a common cause inoperability of independent trains or channels

#### II. Plant Conditions

At the time the condition was identified, Unit 1 was in Mode 5 (Cold Shutdown).

#### III. Problem Description

##### A. Background

Each of the four reactor coolant system (RCS) [AB] loops has one hot leg wide range (WR) resistance temperature detector (RTD) [TI] and one cold leg WR RTD. The RCS RTDs are part of the post-accident monitoring (PAM) [IP] Instrumentation. The primary purpose of the PAM instrumentation is to display unit variables that provide information required by the control room operators during accident situations.

The WR RTDs provide the ability to monitor core differential temperature and subcooling margin using RCS hot (outlet) and cold (inlet) leg temperatures. RCS cold leg temperature is used in conjunction with RCS hot leg temperature to verify the unit conditions necessary to establish natural circulation in the RCS. RCS hot leg temperature also provides a temperature compensating signal for the reactor vessel level instrumentation system. The RCS cold leg temperature also provides a temperature input signal for the low temperature overpressure protection system.

##### B. Event Description

Pacific Gas and Electric Company (PG&E) identified repeated failures of the Unit 1 RCS WR RTD (Make: Conax, Model: 7K45-10000 or 7K46-10000) elements and initiated an apparent cause evaluation (ACE). The ACE determined that the cause of the failures was an incorrect insulation configuration installed in 2010 on the thermal extension piping that housed the wires for the RTDs. The insulation configuration as installed trapped heat inside the thermal extension piping and overheated the wires, which caused the RTDs to fail. The cause of the incorrect configuration of the insulation was insufficient guidance in the associated work package instructions.

The extent of condition evaluation required verification of the installed insulation configuration and normal service temperatures of all Unit 1 WR RTDs. A walkdown performed in Mode 3 on October 4, 2015, during the Unit 1 Nineteenth Refueling Outage, found that the service temperature of six of the eight WR RTDs was in excess of the maximum expected 190 degree Fahrenheit operating temperature for the wiring. The measurements were taken for RTDs TE-413A/B, TE-423A/B and TE-443A/B. Measurements were not taken on TE-433A/B because TE-433B was inaccessible and TE-433A had failed. However, the local temperature and insulation configurations for TE-433A/B were consistent with the other six RTDs.

An engineering analysis was completed on October 5, 2015, which determined that the eight WR RCS RTDs had either failed or were operating outside the environmental qualification (EQ) temperature range prior to October 4, 2015, when the high temperatures were discovered.



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		2015	002	00

Since the incorrect installation of insulation on the wiring for the eight RTDs in 2010, the minimum required RTDs were functioning and providing accurate temperature indication. However, due to the elevated temperature on the associated wiring, the RTDs had either failed or were operating outside the EQ temperature range. Therefore, PG&E determined the minimum required WR RTDs would not have been considered operable under post-accident conditions associated with Technical Specification (TS) 3.3.3, "Post Accident Monitoring (PAM) Instrumentation," following the 2010 installation of the insulation. As a result, on October 5, 2015, PG&E identified a violation of TS 3.3.3.

### C. Status of Inoperable Structure, Systems, or Components That Contributed to the Event

There were no other structures, systems or components that contributed to the event.

### D. Other Systems or Secondary Functions Affected

No other systems or secondary functions were affected.

### E. Method of Discovery

Multiple failures of the Unit 1 WR RTDs led to the performance of an ACE. A plant walkdown on October 4, 2015, completed as part of the extent of condition for the ACE identified the incorrect insulation configuration on the Unit 1 WR RTDs and the elevated temperatures on the wiring associated with the WR RTDs.

### F. Operator Actions

When this condition was identified, Unit 1 was in Mode 5. TS 3.3.3 is only applicable in Modes 1, 2, and 3 and therefore no operator action was required.

### G. Safety System Responses

None.

### III. Cause of the Problem

#### A. Apparent Cause Evaluation:

PG&E completed an ACE and determined that the cause of the failures was insufficient guidance in the work package instructions which led to an incorrect insulation configuration on the wiring associated with the RTDs. The insulation configuration as installed trapped heat inside the thermal extension piping that housed the wiring associated with the RTDs. The wires overheated inside the thermal extension piping, which caused the failures. As part of the extent of condition evaluation for the failed RTDs, it was determined that the RTDs had either failed or were operating outside the EQ temperature range.

### IV. Assessment of Safety Consequences

The WR RCS RTDs are not explicitly modeled in the Probabilistic Risk Assessment (PRA). However, some of the modeled operator actions use WR RCS indications to determine the need for certain actions. In these cases, there were redundant narrow range RTDs that could be used. In addition, other diverse instrumentation was available for verification of core cooling, RCS subcooling margin, and decay heat removal function via steam generators. Due to the redundancy and diversity of instrumentation and the fact that the WR RCS RTDs are not directly modeled in PRA, the impact on core damage frequency is determined to be minimal. Therefore, this event did not adversely affect the health or safety of the public and did not significantly degrade plant safety.

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## **V. Corrective Actions**

1. Revised the work order to include the correct drawing and level of details for proper installation of all WR RTDs.
2. Revised the drawings for Unit 1 WR RTDs to provide adequate level of detail for proper insulation configuration installation on all WR RTDs.
3. Installed the correct insulation configuration on all Unit 1 WR RTDs.
4. Replaced all Unit 1 WR RTDs.

## **VI. Additional Information**

### **A. Failed Components**

At the time of discovery on October 5, 2015, the following WR RTDs had either failed or were operating outside the EQ temperature range:

- TE-413A (Loop 1, Hot Leg)
- TE-413B (Loop 1, Cold Leg)
- TE-423A (Loop 2, Hot Leg)
- TE-423B (Loop 2, Cold Leg)
- TE-433A (Loop 3, Hot Leg)
- TE-433B (Loop 3, Cold Leg)
- TE-443A (Loop 4, Hot Leg)
- TE-443B (Loop 4, Cold Leg)

### **B. Previous Similar Events**

A review of the past WR RTD failures or anomalies, since the incorrect insulation configurations were installed, identified the following events:

Past events:

- Unit 1 1-TE-423A failed low on February 11, 2010, and was replaced in November 2010
- Unit 1 TE-413A failed low on June 6, 2013 and was replaced during the Unit 1 Eighteenth Refueling Outage in March of 2014
- Unit 1 TE-433A erratic on July 20, 2013, and was replaced during the Unit 1 Eighteenth Refueling Outage in March of 2014



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- Unit 1 TE-413A failed low on March 26, 2014, and was replaced during the Unit 1 Nineteenth Refueling Outage in October of 2015
- Unit 1 TE-433A failed low May 21, 2015, and was replaced during the Unit 1 Nineteenth Refueling Outage in October of 2015

## **C. Industry Reports**

None.