



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION IV  
1600 E. LAMAR BLVD.  
ARLINGTON, TX 76011-4511

December 15, 2014

Mr. Edward D. Halpin  
Senior Vice President  
and Chief Nuclear Officer  
Pacific Gas and Electric Company  
Diablo Canyon Power Plant  
P.O. Box 56, Mail Code 104/6  
Avila Beach, CA 93424

SUBJECT: DIABLO CANYON POWER PLANT – NRC FOCUSED BASELINE INSPECTION  
REPORT 05000275/2014008 AND 05000323/2014008

Dear Mr. Halpin:

On November 13, 2014, the U.S. Nuclear Regulatory Commission (NRC) completed a focused baseline inspection at your Diablo Canyon Power Plant Units 1 and 2, relative to the operability determination completed by your staff associated with Pacific Gas and Electric's submission of the "Central Coastal California Seismic Imaging Project" (CCCSIP) report to the State of California and the NRC. Your staff submitted the CCCSIP report to the NRC consistent with the guidance previously provided in our October 12, 2012, letter to you (ADAMS Accession Number ML120730106), which stated in part:

The NRC staff understands that the seismic evaluations described in the March 12, 2012, request for information are currently in progress at DCP, and PG&E plans to acquire new offshore and onshore two-and three-dimensional seismic reflection data to identify and characterize faults in the vicinity of DCP. If during the collection of the data, new faults are discovered or information is uncovered that would suggest the Shoreline fault is more capable than currently believed, the staff expects that the licensee will provide the NRC with an interim evaluation that describes actions taken or planned to address the higher seismic hazard relative to the design basis, as appropriate, prior to completion of the evaluations requested in the NRC staff's March 12, 2012, request for information.

On December 4, 2014, the NRC inspectors discussed the results of this inspection with you and other members of your staff. The results of this inspection are documented in the enclosed inspection report.

The NRC inspectors did not identify any findings or violations of more than minor significance.

In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 2.390, "Public Inspections, Exemptions, Requests for Withholding," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC's Public

E. Halpin

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Sincerely,

**/RA/**

Wayne C. Walker, Chief  
Project Branch A  
Division of Reactor Projects

Docket Nos. 05000275, 05000323  
License Nos. DPR-80, DPR-82

Enclosure:  
Inspection Report 05000275/2014008  
and 05000323/2014008  
w/ Attachment: Supplemental Information

cc w/ enclosure: Electronic Distribution

E. Halpin

- 2 -

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Letter to Edward D. Halpin from Wayne C. Walker dated December 15, 2014

SUBJECT: DIABLO CANYON POWER PLANT – NRC FOCUSED BASELINE INSPECTION  
REPORT 05000275/2014008 and 05000323/2014008

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**U.S. NUCLEAR REGULATORY COMMISSION**

**REGION IV**

Docket: 05000275; 05000323

License: DPR-80; DPR-82

Report: 05000275/2014008; 05000323/2014008

Licensee: Pacific Gas and Electric Company

Facility: Diablo Canyon Power Plant, Units 1 and 2

Location: 7 ½ miles NW of Avila Beach  
Avila Beach, CA

Dates: September 10 through November 13, 2014

Inspectors: R. Alexander, Senior Project Engineer  
T. Hipschman, Senior Resident Inspector

Supporting Technical Staff: K. Manoly, Sr. Level Advisor for Structural Mechanics, Office of Nuclear Reactor Regulation  
J. Ake, Sr. Technical Advisor for Geological Engineering, Office of Research  
B. Hill, Sr. Technical Advisor for Repository Science, Office of New Reactors  
Y. Li, Sr. Geophysicist, Office of Nuclear Reactor Regulation

Approved By: Wayne Walker, Chief  
Chief, Project Branch A  
Division of Reactor Projects

## SUMMARY

IR 05000275/2014008, 05000323/2014008; 03/22/2014 – 06/30/2014; Diablo Canyon Power Plant; Focused Baseline Inspection

The inspection activities described in this report were performed between September 10 and November 13, 2014, by NRC resident inspectors at Diablo Canyon Power Plant and by inspectors from the NRC's Region IV office. The significance of inspection findings is indicated by their color (Green, White, Yellow, or Red), which is determined using Inspection Manual Chapter 0609, "Significance Determination Process." Their cross-cutting aspects are determined using Inspection Manual Chapter 0310, "Components Within the Cross-Cutting Areas." Violations of NRC requirements are dispositioned in accordance with the NRC Enforcement Policy. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process."

No findings were identified.

## REPORT DETAILS

### 1. REACTOR SAFETY

#### Cornerstones: Initiating Events, Mitigating Systems, Barrier Integrity, and Emergency Preparedness

#### 1R15 Operability Determinations and Functionality Assessments (71111.15)

##### a. Background

California Assembly Bill 1632 (Blakeslee, Chapter 722, Statutes of 2006), directed the California Energy Commission to assess the potential vulnerability of California's largest base-load power plants, including Diablo Canyon Power Plant (DCPP), to a major disruption due to a seismic event or plant aging; to assess the impacts of such a disruption on system reliability, public, safety, and the economy; to assess the costs and impacts from nuclear waste accumulating at these plants; and to evaluate other major issues related to the future role of these plants in the state's energy portfolio.

Based on the California Assembly Bill, the California Energy Commission compiled a report in 2008 which included the recommendation that Pacific Gas & Electric (PG&E) perform additional seismic studies to supplement the original and ongoing seismic studies performed as part of the licensee's Long Term Seismic Program (LTSP), and that those studies be conducted using advanced technologies such as three-dimensional seismic-reflection mapping. From 2010 through 2014, the licensee conducted the recommended studies, performed further data analysis, and compiled a report titled the "Central Coastal California Seismic Imaging Project" (CCCSIP). Based upon new seismic information contained within the report, the licensee performed a subsequent operability determination evaluation that was completed on August 21, 2014.

On September 10, 2014, the licensee formally submitted the CCCSIP Report to the State of California. On the same date, PG&E provided a copy of the CCCSIP Report to the NRC consistent with guidance previously provided to the licensee in an NRC letter dated October 12, 2012. The copy of the CCCSIP Report provided to the NRC is available in ADAMS, Accession Number ML14260A106.

##### b. Inspection Scope

The inspectors reviewed the licensee's operability determination dated August 21, 2014, entitled "Preliminary New Seismic Information," for the potentially unanalyzed condition, and/or degraded or nonconforming structures, systems, or components (SSCs). The inspectors reviewed the timeliness and technical adequacy of the licensee's evaluation, including the associated technical report (the CCCSIP Report), relative to the current seismic licensing basis for the station.

Specifically, the licensee's operability determination documented that while seismic study results determined that the Shoreline Fault Zone may be more capable than summarized in the 2011 Shoreline Fault Zone, the deterministic response spectra developed in the CCCSIP Report are still bounded by those of the Hosgri fault and those that are analyzed in the licensee's Long Term Seismic Program (which are described in the

current licensing basis). Therefore, the licensee concluded that all seismically qualified SSCs in the plant remain operable relative to the newly developed seismic information.

These activities constitute completion of one operability and functionality review sample, as defined in Inspection Procedure 71111.15.

c. Inspection Methodology

Given the extensive nature of the CCCSIP report, which supported the licensee's operability determination, the inspectors obtained the expertise of NRC seismologists in the Office of Nuclear Reactor Regulation/Division of Engineering, Office of New Reactors/Division of Site Safety and Environmental Analysis, and the Office of Nuclear Regulatory Research/Division of Engineering. The NRC technical staff evaluated the licensee's assumptions, methodologies, and conclusions in the CCCSIP Report, and in consideration of the licensee's seismic design and licensing bases, provided input to the inspectors' activities.

d. Assessment and Results

As described in detail by the licensee in the CCCSIP Report, and addressed in previous NRC inspection and technical reports (e.g., Research Information Letter 2012-01, Inspection Report 2011-005), there are four geological faults/fault zones in the area surrounding DCPD which have been the focus of continuing evaluation and study under the licensee's LTSP. These are commonly known as the Hosgri, Shoreline, Los Osos, and San Luis Bay faults.

PG&E described, in the CCCSIP Report, that the Shoreline fault was found to potentially extend an additional 22 km to the south, thereby increasing the fault length from 23 km used in the 2011 Shoreline Fault Zone Report to 45 km. With this increased length, the corresponding potential maximum magnitude of the Shoreline fault increased from 6.5 to 6.7. In addition, PG&E evaluated the potential for the Shoreline fault to cause a magnitude 7.3 earthquake by assuming that the Shoreline fault is linked to the Hosgri fault extending further north to include the San Simeon fault. For the Los Osos fault, PG&E described a steeper dip in the fault as compared to what was identified in PG&E's 2011 Shoreline Fault Zone Report, resulting in a reduction in the potential maximum magnitude Los Osos earthquake from 6.8 to 6.7. Finally, for the San Luis Bay fault, which provides the largest ground motion at the DCPD site in PG&E's 2011 Shoreline Fault Zone report, the CCCSIP study did not provide new information on the length or dip of the fault. Using the same length and dip from the 2011 Report leads to a potential maximum magnitude 6.4 earthquake for the San Luis Bay fault.

To determine operability of the applicable DCPD structures, systems, and components (SSCs), PG&E calculated response spectra for several deterministically-based (i.e., without considering their likelihood) earthquake scenarios occurring on local faults, including the Shoreline and Hosgri faults, for comparison with the 1977 Hosgri response spectrum. (The response spectrum is an acceleration versus frequency plot reflecting the maximum response of a series of oscillators with various natural frequencies to earthquake motions.) Consistent with the approach used for the 2011 Shoreline Fault Zone report, PG&E developed the response spectra from these earthquake scenarios using the "single-station-sigma-correction" (SSSC) method, which directly incorporates the actual conditions at the DCPD into the evaluation rather than using more generic



adjustment factors for differences in site properties. Based on the implementation of this method, PG&E calculated response spectra for the earthquake scenarios which resulted in spectra enveloped by the 1977 Hosgri response spectrum. However, the use of SSSC method employed by the licensee was based on only two earthquake recordings (2003 San Simeon earthquake and 2004 Parkfield earthquake) at DCPD.

Therefore, similar to the approach used in 2012 for the Research Information Letter, the NRC staff developed response spectra for the various fault scenarios using the more traditional and widely used "Ergodic" approach. The Ergodic approach addresses the uncertainties utilizing mixed data from different regions of the world rather than using the limited site specific information available. In this case, the Ergodic approach provides a more conservative estimate of ground motion than the SSSC approach for the DCPD site. The response spectra for the various scenario earthquakes using the Ergodic approach fall below the 1977 Hosgri spectrum in the lower frequency range and slightly exceed it in the higher frequency range above 10 Hz.

The NRC staff noted that various alternative models may be considered to estimate the site response amplification at the DCPD site in order to develop response spectra. The NRC staff considers the implementation of the Ergodic approach and SSSC method to likely encompass the range in site response behavior at the DCPD site and, as such, the response spectra for the deterministic scenario events are most likely somewhere between the spectra calculated by PG&E and the NRC staff and will most likely fall below the 1977 Hosgri spectrum.

The staff noted that, in addition to the Hosgri earthquake spectrum, the seismic design basis for DCPD also includes the Double Design Earthquake (DDE). Because of conservative assumptions used in the design calculations, the DDE represents higher calculated loads than the Hosgri scenarios for some SSCs. The DDE tends to pose the limiting loads on the SSCs with natural frequencies in the lower range, whereas the Hosgri earthquake spectrum poses the limiting loads on the SSCs with natural frequencies in the higher range. Therefore, the Hosgri earthquake spectrum is the appropriate spectrum for comparison with the response spectra calculated using either the Ergodic approach or the SSSC method because neither method indicated any exceedance for the lower frequency range, as discussed above.

DCPD safety-related SSCs were evaluated against the Hosgri spectrum prior to licensing of the plant. In addition, the licensee conducted the LTSP and Individual Plant Examination of External Events in which the performance of SSCs was examined at and beyond design levels. This included plant equipment such as electrical relays and switches that may potentially be impacted at these higher frequencies. The evaluation was further expanded in licensee's evaluation performed to support a License Amendment Request (LAR) that was submitted in 2011. Although the LAR was subsequently withdrawn, the evaluation performed by the licensee remains pertinent. These past evaluations of the Hosgri spectrum indicate considerable design margin for functionality of SSCs, and satisfies the provisions for operability as described in NRC Inspection Manual Chapter 0326.

In addition to the CCCSIP Report, PG&E is currently performing its seismic hazard reevaluation in conjunction with the NRC's 10 CFR 50.54(f) request for information (ADAMS No. ML12053A340). This effort entails the use of the more comprehensive Probabilistic Seismic Hazard Approach (PSHA) in accordance with the current NRC guidance for developing a state-of-the-art estimate of seismic hazard. As part of its

evaluation, PG&E will use a logic tree approach to incorporate alternative models and parameters to determine the local site amplification for the DCPD site. In addition, the PSHA will also develop hazard curves that factor in the activity rates of all potential earthquakes on each of the local faults, which are not considered for a deterministic analysis. PG&E is scheduled to complete its reevaluation in March 2015. The hazard curves from the PSHA can then be used to evaluate the plant risk, as needed.

e. Findings

No findings were identified.

**40A6 Meetings, Including Exit**

Exit Meeting Summary

On December 4, 2014, the inspectors presented the inspection results to Mr. Ed Halpin, Senior Vice President and Chief Nuclear Officer, and other members of the licensee staff. The licensee acknowledged the issues presented. The licensee confirmed that any proprietary information reviewed by the inspectors had been returned or destroyed.

**SUPPLEMENTAL INFORMATION**

**KEY POINTS OF CONTACT**

Licensee Personnel

N. Abrahamson, Geosciences  
T. Baldwin, Director, Site Services  
K. Ferre, Manager, Geosciences  
E. Halpin, Chief Nuclear Officer  
N. Jahangir, Manager  
J. Loya, Supervisor, Regulatory Services Compliance  
J. Morris, Senior Advising Engineer, Regulatory Services  
S. Nishenko, Geosciences  
P. Soenen, Acting Manager, Regulatory Services  
J. Summy, Senior Director, Engineering & Tech Services  
J. Welsch, Station Director

NRC Personnel

T. Lupold, Branch Chief, Office of Nuclear Reactor Regulation

**LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED**

Opened

None

**LIST OF DOCUMENTS REVIEWED**

**Section 1R15: Operability Determinations and Functionality Assessments**

Notification

<u>Number</u>	<u>Title</u>	<u>Date</u>
50652361	Preliminary new seismic information	August 21, 2014

Reports

<u>Number</u>	<u>Title</u>	<u>Revision Date</u>
	Diablo Canyon Power Plant Units 1 & 2 FSAR Update, Revision 21 (ADAMS No. ML13280A390)	September 2013
CEC-100-2008-009-CMF	An Assessment of California's Nuclear Power Plants: AB 1632 Commission Report ( <a href="http://www.energy.ca.gov/2008publications/CEC-100-2008-009/CEC-100-2008-009-CMF.PDF">http://www.energy.ca.gov/2008publications/CEC-100-2008-009/CEC-100-2008-009-CMF.PDF</a> )	November 20, 2008

NUREG-0675, Supplement 7	Evaluation Report Related to the Operation of Diablo Canyon Power Plant, Units 1 and 2 (ADAMS No. ML14279A129)	May 1978
NUREG-0675, Supplement 34	Safety Evaluation Report Related to Operation of Diablo Canyon, Units 1 & 2 (ADAMS No. ML14279A124)	June 1991

Letters

<u>NUMBER</u>	<u>TITLE</u>	<u>DATE</u>
	Becker, James R., Pacific Gas and Electric, letter to U.S. Nuclear Regulatory Commission, "Report on the Analysis of the Shoreline Fault Zone, Central Coastal California" (ADAMS No. ML110140431)	January 7, 2011
	Becker, James R., Pacific Gas and Electric, letter to U.S. Nuclear Regulatory Commission, "License Amendment Request 11-05, 'Evaluation Process for New Seismic Information and Clarifying the Diablo Canyon Power Plant Safe Shutdown Earthquake'" (ADAMS No. ML11312A166)	October 11, 2011
	Allen, B.S., Pacific Gas and Electric Co., letter to Nuclear Regulatory Commission, "Withdrawal of License Amendment Request 11-05" (ADAMS No. ML12300A105)	October 25, 2012
DCL-92-087	Diablo Canyon Units 1 & 2, Response to Generic Letter 88-20, Supplement 4, "Individual Plant Examination of External Events for Severe Accident Vulnerabilities"	April 14, 1992
DCL-14-081	Central Coastal California Seismic Imaging Project, Shoreline Fault Commitment (ADAMS No. ML14260A106)	September 10, 2014
RIL 12-01	Research Information Letter (RIL) 12-01 – Confirmatory Analysis of Seismic Hazard at the Diablo Canyon Power Plant from the Shoreline Fault Zone (ADAMS No. ML121230035)	September 2012