

July 16, 2015

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the matter of
Pacific Gas and Electric Company
Diablo Canyon Nuclear Power Plant
Units 1 and 2

Docket Nos. 50-275-LR
50-323-LR

**SAN LUIS OBISPO MOTHERS FOR PEACE'S
MOTION TO CORRECT FALSE INFERENCE RAISED BY
A MISLEADING STATEMENT OF
MATERIAL FACT BY PACIFIC GAS & ELECTRIC CO.**

I. INTRODUCTION

Pursuant to 10 C.F.R. §§ 2.323, San Luis Obispo Mothers for Peace (“SLOMFP”) seeks leave to correct a false inference raised by a material and misleading statement of fact by Pacific Gas & Electric Company (“PG&E”) regarding SLOMFP’s Contention C (Inadequate Consideration of Seismic Risk in SAMA Analysis). The statement was made during oral argument before the Atomic Safety and Licensing Board (“ASLB”) on July 9, 2015. By claiming to have installed earthquake monitoring equipment west of the Shoreline Fault several years ago, without also acknowledging that the monitoring equipment did not function, PG&E has raised a false inference that PG&E collected and considered earthquake data from west of the Shoreline Fault. This false inference should be corrected because it undermines a material statement of fact in SLOMFP’s Contention C, and because it improperly impugns the competence and professionalism of SLOMFP’s expert, Dr. David D. Jackson.

II. FACTUAL BACKGROUND

The gravamen of SLOMFP’s Contention C is that PG&E’s Severe Accident Mitigation (“SAMA”) Analysis is inadequate to satisfy the National Environmental Policy Act (“NEPA”) because PG&E’s evaluation of potential mitigation measures is not based on a sufficiently

rigorous or up-to-date analysis of seismic risks. San Luis Obispo Mothers for Peace's Motion to File New Contentions Regarding Adequacy of Severe Accident Mitigation Alternatives Analysis for Diablo Canyon License Renewal Application at 6 (Apr. 15, 2015) ("SLOMFP Motion"). In the statement of basis for Contention C, SLOMFP asserts, *inter alia*, that "the seismic stations used to locate earthquakes on the Shoreline Fault are all onshore, east of the fault, so that the fault's east-west location is highly uncertain." *Id.* SLOMFP based this assertion on the expert opinion of Dr. David D. Jackson, who reviewed PG&E's report of its Seismic Source Characterization¹ and other documents prepared by PG&E to evaluate the earthquake risk for the Diablo Canyon Nuclear Power Plant. Declaration of Dr. David D. Jackson in Support of San Luis Obispo Mothers for Peace's Motion to File New Contention, Etc. (Apr. 15, 2015), attached to SLOMFP Motion. Because PG&E promised to "update" its 2010 SAMA Analysis with the results of the SSC, the lack of adequate data in the SSC Report affects the reasonableness and reliability of the SAMA Analysis. SLOMFP Motion at 2-3. SLOMFP contends that PG&E should account for the lack of adequate data regarding the location of the Shoreline Fault, either by collecting data from the west side of the fault or by considering "both nearer and farther locations of the Shoreline fault with realistic weights that reflect the fault location uncertainty." *Id.* at 6.

During the July 9, 2015 oral argument before the ASLB, undersigned counsel for SLOMFP repeated Contention C's assertion that:

PG&E has put seismic monitoring stations only on the east side, or at least the report only represents results from locating earthquakes on the east side of the fault, and not on the west side. Apparently, PG&E plans to install additional monitors, but that should have been done. That is not enough data to locate the fault.

¹ Seismic Source Characterization for the Diablo Canyon Nuclear Power Plant, San Luis Obispo County, California; report on the results of a SSHAC level 3 study (Rev. A, March 2015) ("SSC Report").

Oral argument transcript (“tr.”) at 813 (Curran). Counsel for PG&E responded that PG&E had indeed installed earthquake monitors west of the Shoreline Fault and that they “have been there for several years.” Tr. at 889 (Repka).²

While Mr. Repka appears to be correct that offshore earthquake monitors were installed and “have been there for several years,” he failed to add the critical information that the monitors did not work and therefore had to be replaced with temporary monitors in late 2014:

The OBS [ocean bottom seismometer] system, soon after deployment in late 2013, *stopped functioning due to underwater cable damage*. To mitigate this problem, four temporary OBS units were deployed on November 4, 2014.

Request for Major Project Contingency Release (2014) (emphasis added) (Attachment 1).³ See also SSC Report at 7-12 (referring to “recordings from ocean bottom seismometers recently

² The full text of the relevant colloquy is as follows:

MR. REPKA: I feel duty-bound to point out, I think there has been -- representations were made that there is no monitoring west of the site. And as part of the Central Coastal Seismic Imaging Project, PG&E does have monitors, ocean bottom seismometers west of the site, so just to make sure the record is very clear on that.

MS. CURRAN: Could I ask a question about that?

JUDGE ARNOLD: Go ahead.

MS. CURRAN: Because it's my understanding that that monitoring has -- is something more recent than what is reported in the seismic characterization report.

MR. REPKA: I don't want to get into that further. I just want to point out that certainly as a going forward basis, that that is the case.

MS. CURRAN: Right. It's my understanding, too, that starting now or soon in the future, PG&E are to install monitoring devices on the west side of the fault, but that didn't get done for this report that was submitted.

MR. REPKA: *Mr. Strickland points out to me that the monitors in fact have been there for several years.*

Tr. at 889-90 (emphasis added).

³ The Request for Major Project Contingency Release is an internal PG&E document, released by PG&E during discovery in California Public Utilities Commission (“CPUC”) proceeding No. A.15-02-023.

installed by PG&E” as “[p]ossible future data”) (Attachment 2). Mr. Repka did not assert, nor is there any evidence in the record, that the SSC Report includes even the limited amount of OBS earthquake monitoring data collected after November 4, 2014.

III. ARGUMENT

SLOMFP respectfully submits that PG&E’s misleading representation during the oral argument raises the false inference that PG&E collected data from offshore OBS monitoring stations west of the Shoreline Fault for several years and that this data was considered in the SSC Report. The ASLB should order the correction of the record for two reasons.

First, correction of the record is necessary because the lack of earthquake monitoring data from the west side of the Shoreline Fault is material to Contention C. As a result of PG&E’s failure to collect earthquake monitoring data west of the Shoreline Fault, PG&E’s assertions regarding the location of the fault are not reasonable or reliable. In fact, the fault could be closer to the Diablo Canyon nuclear power plant than assumed by PG&E. SLOMFP Motion at 6.

Second, correction of the record is necessary to ensure that Dr. Jackson is given due credit for his high level of expertise and his thoroughness in reviewing PG&E’s SSC Report and related documents. Dr. Jackson has extensive experience in the fields of geophysics and seismology, including forty-six years as a professor at the University of California and longstanding membership in many high-level professional organizations and scientific panels. His considerable expertise and professionalism are reflected in Contention C. The record should be corrected to remove the false inference raised by PG&E that Dr. Jackson lacked the competence or care to correctly identify or interpret key data in PG&E’s seismic documents. PG&E has provided no basis to discredit or even question Dr. Jackson’s expertise or his correct observation that no OBS data is relied on in the SSC Report to locate the Shoreline Fault.

IV. CONCLUSION

For the foregoing reasons, the ASLB should grant SLOMFP's motion and order the correction of the false inference, raised by PG&E's unqualified statement regarding the existence of offshore earthquake monitoring devices, that the SSC Report considers earthquake monitoring data from the west side of the Shoreline Fault.

V. CERTIFICATION REGARDING CONSULTATION

Pursuant to 10 C.F.R. § 2.323(b) undersigned counsel for SLOMFP certifies that on July 16, 2015, she contacted counsel for PG&E and the NRC Staff to seek their consent to the filing of this motion. Counsel for PG&E stated that PG&E does not take a position on the merits of SLOMFP's motion at this time, and may respond in due course. Counsel for the NRC Staff stated that the Staff has no objection to the filing of the motion.

Respectfully submitted,

[Electronically signed by]

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July 16, 2015

ATTACHMENT 1

Request for Major Project Contingency Release

Completed documents must follow the appropriate approval procedures per the link below:
[Major Project Contingency Release / Advanced Authorization Routing Guidelines](#)

Project Name: Diablo Canyon Power Plant – AB-1632 Seismic Study	
Executive Sponsor: Ed Halpin	Project Number (WBS#): P.04189
Business Owner: Jeff Summy	Project Manager: Kent Ferre
Project Start Date: 12/01/2010	Project Completion Date: 12/31/2015
Major Work Categories:	EPC Authorization Date: 03/28/2013

EPC Authorized Amount: \$51.6M	EPC Authorized Contingency: \$1.6M
Costs Incurred To Date: \$51.3M	Estimate At Completion (EAC): \$64.3M
Contingency Release Request: \$0.5M	Remaining Contingency (Post-Release): \$0.0
% of Contingency Request in Budget/Operating Plan: 100%	

A) Project Objective Statement

The objective of the Central Coastal California Seismic Imaging Project (aka AB-1632 Seismic Study) is to increase understanding of the seismic hazard at DCPD using 3-D seismic reflection mapping and other advanced techniques.

B) Project Description

This project uses low and high energy 3-D seismic reflection to acquire data, and state-of-the-art techniques to process and interpret these data to image onshore and offshore earthquake faults at depth. The project also includes the procurement and installation of a four-ocean bottom seismometer (OBS) cabled system. The OBS system is used to measure earthquake intensities and sense of slip (e.g., strike slip, reverse) on the ruptured fault, and to constrain onshore and offshore earthquake locations. This project is mandated by the California Public Utilities Commission through Assembly Bill 1632.

C) Reason for Contingency Release

The contingency release is required for additional charges associated with OBS deployment and operability issues. The OBS system, soon after deployment in late 2013, stopped functioning due to underwater cable damage. To mitigate this problem, four temporary OBS units were deployed on November 4, 2014. The cost for the temporary units is covered under warranty. The longer term mitigation is to redesign the OBS system using an enhanced (thicker and more armored) cable to withstand sea floor abrasions. The preliminary costs for the enhanced OBS system will be shared by the manufacturer of the OBS system, Guralp (under warranty) and PG&E from this contingency request.

Through October 2014, costs were within the \$1.1M approved contingency release (\$51.1M total authorized). However with PG&E internal labor costs accruing in November and December and truing up accruals before year end, authorized amounts will be exceeded by \$0.5M. By the end of December costs are forecasted to be \$51.6M.

Details of the costs since inception by major scope items are shown below:

The major scope items with end-of-year forecast is shown below:

- *Seismic Survey Design - \$0.8M*
- *Offshore High Energy Seismic Survey - \$8.4M*
- *Offshore Low Energy Seismic Survey - \$14.9M*
- *Onshore Seismic Survey - \$19.7M*
- *Ocean Bottom Seismometer - \$2.6M*
- *Project Management - \$5.2M*
- *Total - \$51.6M*

In addition to the increase in costs for the OBS system as described above (covered by this contingency request) costs for the onshore data processing and data interpretation (covered by the already released \$1.1M contingency) increased due to the complexity and uniqueness of the data acquired.

Reauthorization will be requested in early January for an amount up to the CPUC authorized amount of \$64.3M. This amount will cover the completion of the enhanced OBS system plus potential requests by the CEC appointed Independent Peer Review Panel (IPRP) to conduct additional data collection and/or data processing and interpretation. This potential cost increase is currently unknown. The IPRP is reviewing the final AB1632 Report and will provide comments and recommendations by late January 2015. The reauthorization sought in early January 2015 will include this potential work as a contingency. To the extent possible, charges to this project will be minimized until a reauthorization is approved.

Although not expected the IPRP may recommend in their report, a reattempt at conducting the offshore High Energy Seismic Survey (which was denied by the California Coastal Commission in November 2012). If this work is conducted, the overall completion date will be revised and a separate authorization will be required by the EPC.

D) Lessons Learned / Corrective Action

- *Do not rely on designs by others/establish a design review process for third party designs. Guralp is providing various options for the proposed cable with associated cost-benefits. A formal design review will be conducted using outside experts, PG&E personnel, and Guralp to select the optimum product considering various criteria such as cost, ruggedness, flexibility, ease of deployment, etc.*

E) Budget Impact / Funding Source

The CPUC authorized spending up to \$64.25 million to conduct the AB1632 studies. The costs are placed into a balancing account and are recovered through the Electric Resource Recovery Account (ERRA) in annual CPUC proceedings.

ATTACHMENT 2

Seismic Source Characterization for the Diablo Canyon Power Plant, San Luis Obispo County, California

Report on the results of a SSHAC level 3 study, conducted in partial compliance with the request for information pursuant to Title 10 of the Code of Federal Regulations 50.54(f) regarding Fukushima near-term task force recommendation 2.1: Seismic

Report prepared for:

Pacific Gas and Electric Company
San Francisco, California

Report prepared by:

SSHAC Level 3 Technical Integration (TI) Team

March 2015
Rev. A

7.3.1 *Fault Location Adjacent to the DCP*

Mapping of the HFZ has evolved over time as additional data sets, primarily seismic-reflection survey and improved MBES bathymetry data, have become available (Figure 7-5). The following interpretations for the reach of the HFZ adjacent to the DCP were examined to evaluate the location and closest approach of the HFZ:

- Willingham et al. (2013): This publication presents the general interpretation of the geometry and location of the HFZ that was presented by PG&E (1988, 1991) based on analysis of high- and low-energy seismic-reflection data from numerous surveys collected for different purposes from the 1970s to 1980s. Faults are mapped as “structural trends” representing a combination of shallow and deep (~2 km) faults.
- Johnson and Watt (2012): This publication presents an interpretation of the near-surface location of traces of the HFZ based on interpretation of high-resolution 2D Sparker seismic-reflection data (800 m spacing) and bathymetry. The faults were mapped at a scale suitable for publication on a 1:35,000 scale map (Watt et al., in preparation), although they were presented at a much smaller scale by Johnson and Watt (2012): Digital fault traces were provided electronically to PG&E as part of a draft offshore geologic map (J. Watt, pers. comm. to H. Abramson Ward, Dec. 10, 2013; see *Section 4.3.2.1* for more detailed description of data sets).
- PG&E (2011): A preliminary interpretation of the near-surface traces of the HFZ, based on the 2D seismic-reflection data and bathymetry sets used by Johnson and Watt as described above, was completed as part of the assessment of the Shoreline fault zone.
- PG&E (2014, Chapter 3): A more comprehensive map of the HFZ is compiled from the mapping performed in conjunction with development of a seismic stratigraphic framework based on analysis of the USGS high-resolution 2D seismic-reflection data released by Sliter et al. (2010; PG&E, 2013a) and interpretation of new 3D and 2D seismic-reflection data collected for PG&E (PG&E, 2014, Chapters 2 and 3).

Several observations pertinent to the assessment of the location and closest distance of the Hosgri fault to the DCP are made based on the evaluation of these data sets and interpretations:

- The HFZ is the best-imaged and most continuous fault zone in the DCP site area. In all of the studies, the HFZ near the site is mapped as a distributed zone of faults.
- Locally, strands of the fault zone exhibit seafloor expression, either as erosional fault-line scarps, which generally occur where bedrock is juxtaposed against sediment by the fault, or possibly also as tectonic scarps within young sediment, which are inferred to represent displacement during relatively recent faulting events that ruptured the seafloor. Multiple strands show evidence for Quaternary activity (Figure 7-6).

- The 3D/2D LESS data set shows that the HFZ is more complex near the surface (at depths less than ~400 m) than previously mapped (PG&E, 1988; PG&E, 2011b).
- Despite variations in complexity, most maps of the HFZ show fault traces aligning in three primary zones within the reach directly offshore of the DCP (Figure 7-7).

We recognize that future earthquakes on the HFZ could occur on any of the three primary fault strands that are mapped in the near surface. In order to capture this aleatory variability in the location of future HFZ ruptures, three near-surface traces are modeled, referred to as the eastern, central, and western traces, which are at distances of 4 km, 5 km, and 6 km, respectively, from the DCP as shown on Figure 7-7.

7.3.2 Fault Dip

The geometry of the fault zone at depth is inferred primarily from seismicity data. Hardebeck (Workshop 2 presentation, 2012c; 2013) evaluated fault dip from first-motion polarity (Figure 7-8). Evaluations were made using the OADC algorithm and seismicity from the Hardebeck (2010) earthquake catalog. As described in *Appendix F*, alternative earthquake locations were calculated from two different double-difference relocation algorithms, hypoDD (Waldhauser and Ellsworth, 2000) and tomoDD (Zhang and Thurber, 2003). The hypoDD locations were shown to be incompatible with composite first-motion polarities using the OADC algorithm (Figure 7-8a). The analysis using the tomoDD locations did provide a compatible mean solution with a dip of 76° – 89° NE. The rake derived from the fit of focal mechanism data is $180^{\circ} \pm 24^{\circ}$ (Figure 7-8b; Hardebeck, 2013).

Previous studies (McLaren and Savage, 2001; Hanson et al., 2004; PG&E, 2011) concluded that microseismicity interpreted to be associated with the HFZ is consistent with a steeply dipping to vertical fault to seismogenic depth (e.g., Figure 5-17). Modeling of gravity and magnetic data presented by J. Watt at Workshop 2 also supports a vertical to steeply east-dipping fault in the shallow crust (≤ 15 km; Watt, 2012). A near-vertical to steeply east-dipping fault was also interpreted by Willingham et al. (2013) based on interpretation of high-energy 2D seismic-reflection data, which images the upper 2–4 km of crust.

For the three Hosgri FGMs, the Hardebeck (2010) tomoDD locations and Hardebeck (2014a) catalog were used to evaluate possible geometries of the three fault traces at depth. To support this evaluation, the TI Team attempted to separate seismicity beneath the surface traces of the Hosgri fault from seismicity to the east. Within San Luis Obispo Bay, seismicity beneath the surface traces of the Hosgri fault forms a near-vertical cloud extending from the surface to approximately 12 km depth. To the north faults within the SLBP merge with the Hosgri (e.g., the Shoreline and Los Osos faults, and seismicity associated with the SLBP overlaps with Hosgri fault seismicity. Figure 7-9 shows seismicity within the DCP vicinity projected onto a plane perpendicular to the strike of the HFZ. Earthquake hypocenters are shown in color, classified by depth, surrounded by

circles or diamonds that illustrate the approximate uncertainty in hypocentral location. Colored dots are part of the cloud beneath the surface traces of the Hosgri fault and to the west. Diamonds are hypocenters that are:

- part of the Shoreline seismicity alignment (Hardebeck, 2010, 2013) located farther than 2.5 km east of the nearest trace of the Hosgri fault,
- part of the seismicity lineaments within Estero Bay that were discussed by Hardebeck at the Diablo Canyon SSHAC Workshop 3, and associated with strike-slip focal mechanisms (Hardebeck, 2014b), or
- diffuse seismicity to the east.

Plus symbols are hypocenters that do not clearly underlie surface traces of the Hosgri fault (i.e., they are located at relatively shallow depth and more than approximately 1 km east of the nearest Hosgri surface trace, but are located west of the seismicity lineaments described above.

Three alternative geometries are drawn relative to the seismicity beneath the surface traces of the HFZ, as shown on Figure 7-10. These alternative geometries are intended to capture the following information:

- The range of uncertainty indicated by the scatter of hypocenters in the current catalogs.
- The stated uncertainties in hypocentral locations.
- The possibility that systematic errors in hypocentral locations may exist within the current catalogs because of both uncertainty in the crustal velocity model and poor azimuthal coverage (the recordings of these earthquakes come only from onshore).

Figure 7-11 compares the three alternatives and supporting arguments for each. The weights assigned to the three models in the SSC logic tree reflect the judgment of the TI Team regarding the likely geometry of the three surface traces at depth. The preferred model (H85) is given a weight of 0.6 because it provides a reasonable fit to the seismicity and is consistent with the common depth point (CDP) seismic profiles (e.g., Figure 5-17) that show evidence of flower structures along this reach of the HFZ (Willingham et al., 2013). This dip is also most consistent with the mean dip inferred from the tomoDD OADC planar solutions (Hardebeck, 2012c; 2013) (Figure 7-8b). The alternative downdip geometries (H75 and H90), which are each given a weight of 0.2, represent end-member cases that cannot be precluded based on available data. The H75 Model allows for the possibility that there may be a systematic offset of hypocenters from the fault such that the HFZ could lie slightly east of the seismicity that defines the fault zone at depth. Possible future data, such as recordings from ocean bottom seismometers recently installed by PG&E (PG&E, 2014, Chapter 5), could potentially reveal such a systematic offset. In the TI Team evaluation, shallower dips to the HFZ are not consistent with the seismicity data, magnetic data, or seismic-reflection data and are not considered to be technically defensible. The H90 Model represents the opposite end member. This model fits the seismicity data, and approximately corresponds with the maximum dip indicated from the OADC algorithm (Hardebeck, 2012c). It is also less consistent with

interpretation of high-energy seismic-reflection data the fault dips steeply to the east, and that the fault traces at the surface generally converge to a single trace at depth (Willingham et al., 2013).

7.3.3 Fault Length

The Hosgri FGM has one length. The fault extends from the south end of the HFZ as previously mapped by PG&E (1988) and Willingham et al. (2013) north to a point offshore of Cambria where the name changes to the San Simeon fault. The HFZ is directly linked to the San Simeon, San Gregorio, and San Andreas faults to the north, and the north end of the Hosgri FGM is the Mendocino Triple Junction, at the north end of the San Andreas Fault (Figure 7-3). Possible boundaries that would influence rupture propagation on the HFZ and the estimated M_{\max} and M_{char} distributions for the HFZ are discussed in *Chapters 9 and 10*, respectively.

7.4 San Luis–Pismo Block Fault Geometry Models

Three alternative FGMs were developed for faults within and bordering the SLPB. These are illustrated in a series of four cross sections developed for each model. The locations of the cross sections, which are drawn perpendicular to the axis of the San Luis Range, were designed to cross key areas of surface data constraints, as numbered on Figure 7-12. The key data constraints are as follows:

1. North end of marine terrace flight (Hanson et al., 1994): The juxtaposition of this evidence for active uplift against evidence for active subsidence beneath Morro Bay, directly to the north, was used by Lettis and Hall (1994) to define the location and slip rate of the Los Osos fault.
2. Memorial Park surface (PG&E, 2013b) and ONSIP Vibroseis Line 204 North (PG&E, 2014, Chapter 7): The Memorial Park surface is a gently sloping terrace of marine or alluvial origin has a very thick soil developed on the surface, suggesting significant antiquity. Where it crosses the approximate projection of the Los Osos fault as mapped by Lettis and Hall (1994) there is no pronounced surface scarp, but the terrace may be warped, suggesting possible deformation by a blind fault (*Section 8.2.2.3*). The ONSIP Vibroseis Line 204 images reflectors within the upper 10,000 ft (~3 km) beneath the northern range front of the Irish Hills and Los Osos Valley beneath the Memorial Park surface. Alignments of truncated reflectors were interpreted by the ONSIP team as possible blind traces of the Los Osos fault, which dip approximately 60° or 75° to the south (Figure 7-14).
3. Bedrock ridge (PG&E, 2014, Chapter 9): A ridge of chert extends northward from the body of the Irish Hills and crosses the zone of faults and lineaments mapped by Lettis and Hall (1994) as the Los Osos fault, indicating the absence of a pronounced active range-front fault.
4. LiDAR analysis of stream channels (PG&E, 2014, Chapter 9): Analysis of streams that cross the range front on the north side of the Irish Hills indicates

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Docket Nos. 50-275-LR
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**SAN LUIS OBISPO MOTHERS FOR PEACE
CERTIFICATE OF SERVICE**

I certify that on July 16, 2015, I posted on the NRC's Electronic Information Exchange SAN LUIS OBISPO MOTHERS FOR PEACE'S MOTION TO CORRECT FALSE INFERENCE RAISED BY A MISLEADING STATEMENT OF MATERIAL FACT BY PACIFIC GAS & ELECTRIC CO. It is my understanding that as a result, the NRC Commissioners, Atomic Safety and Licensing Board, and parties to this proceeding were served.

Respectfully submitted,

Electronically signed by

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