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ABBREVIATIONS AND ACRONYMS

2D	two-dimensional
3D	three-dimensional
AB 1632	Assembly Bill 1632
AWD	accelerated weight drop
CCCSIP	Central Coastal California Seismic Imaging Project
CDP	common depth point
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CPUC	California Public Utilities Commission
CRADA	cooperative research and development agreement
CT	computed axial tomography
DCPP	Diablo Canyon Power Plant
HESS	high-energy seismic survey
HFZ	Hosgri Fault Zone
IPRP	Independent Peer Review Panel
LESS	low-energy seismic survey
LTSP	Long Term Seismic Program
MBES	multibeam echosounder
NGA	Next Generation Attenuation
NQA	Nuclear Quality Assurance
NRC	U.S. Nuclear Regulatory Commission
PEER	Pacific Earthquake Engineering Research
PG&E	Pacific Gas and Electric Company
QA	quality assurance
SSC	seismic source characterization
SSHAC	Senior Seismic Hazard Analysis Committee
USGS	U.S. Geological Survey
V_P	compressional-wave velocity
V_S	shear-wave velocity
V_{S30}	shear-wave velocity for the upper 30 meters

1.0 INTRODUCTION

Between 2010 and 2012, the Pacific Gas and Electric Company (PG&E) performed a series of three-dimensional (3D) and two-dimensional (2D) seismic-reflection surveys, along with other geophysical investigations, to explore fault zones near the Diablo Canyon Power Plant (DCPP) as recommended in the 2008 report of the California Energy Commission (CEC), “An Assessment of California’s Nuclear Power Plants: AB 1632 Report” (referred to herein as the “AB 1632 Report”). In this report, the “Central Coastal California Seismic Imaging Project Report” (“CCCSIP Report”), PG&E documents its activities between 2010 and 2014 that were performed in accordance with the CEC recommendation, comparing the results with the deterministic seismic hazard assessment presented in the Shoreline Fault Zone Report (PG&E, 2011a).

This CCCSIP Report draws on an extensive base of geologic and geophysical data collected by PG&E and its contractors in the last 30 years. These data include geologic and geophysical data collected in the 1980s for the Long Term Seismic Program (LTSP; PG&E, 1988, 1989) and publications that resulted from these studies (Hanson et al., 1994; Lettis and Hall, 1994; Lettis et al., 1994, 2004; Page et al., 1998; McLaren and Savage, 2001; Willingham et al., 2013). The recent (2009–2012) data collected and interpreted in this report incorporated information collected and analyzed by PG&E (PG&E, 2011a) and the U.S. Geological Survey (USGS; Hardebeck, 2010, 2013; Johnson and Watt, 2012; Langenheim et al., 2013; Langenheim, 2014) as part of a cooperative research and development agreement (CRADA) between a private company and a government agency.

1.1 Geologic Setting

The DCPP is located on the Central California coast near the city of San Luis Obispo. The plant is on the southwestern margin of the Irish Hills, an area of moderate relief bordered by Point Buchon on the northwest, Point San Luis and San Luis Obispo Bay on the south, San Luis Obispo Creek on the east, Los Osos Valley on the northeast, and Morro Bay on the north. The Irish Hills are the northwestern part of the San Luis Range, which trends approximately west-northwest/east-southeast and separates the coastal town of Pismo Beach and the Santa Maria River Valley to the south from the Edna Valley to the north.

The DCPP is located within a tectonic region of distributed transpressional dextral shear bordering the eastern margin of the Pacific Plate. The San Andreas Fault Zone, located approximately 80 kilometers (km) northeast of the DCPP, accommodates most of the relative motion between the Pacific Plate and the Sierra Nevada–Great Valley microplate. West of the San Andreas Fault Zone, an additional component of relative Pacific–Sierra Nevada plate motion is accommodated by slip on various Quaternary faults bounding crustal blocks and, to a lesser extent, by deformation within the blocks.

In the DCPP site vicinity, the San Luis Range and adjacent valleys and ranges are underlain by crustal blocks that together make up a larger tectonic element called the Los Osos domain (see Figure 1-1; Lettis et al., 2004). The Los Osos domain is a triangular structural region bounded by three Quaternary faults: the northwest-striking right-lateral oblique Oceanic–West Huasna fault zone on the east; the west-striking left-lateral oblique Santa Ynez River fault on the south; and the north-northwest-striking right-lateral Hosgri–San Simeon fault zone on the west.

Individual blocks within the Los Osos domain are bounded by northwest-striking reverse, oblique, and strike-slip fault zones. Crustal shortening within the Los Osos domain is accommodated primarily by reverse faulting along the block margins, producing alternating uplifted and down-dropped blocks (Lettis et al., 1994, 2004). Additional crustal shortening and dextral shear is accommodated by a combination of reverse, oblique, and strike-slip faulting between and within blocks and by block rotation. The DCPP is located within the San Luis–Pismo block, which is topographically expressed by the San Luis Range. The San Luis–Pismo block is bounded by the Los Osos fault zone on the north, by the faults of the "southwest boundary zone" (including the San Luis Bay, Wilmar Avenue, Los Berros, and Oceano fault zones) on the south, and by the Hosgri Fault Zone (HFZ) on the west.

Following the initial identification of the Shoreline fault offshore of the DCPP in 2008 (PG&E, 2010), PG&E conducted an extensive program in 2009 and 2010 to acquire, analyze, and interpret new geologic, geophysical, seismologic, and bathymetric data as part of the ongoing PG&E LTSP Update (PG&E, 2011a). These studies focused on reducing uncertainty in the four main parameters needed for a seismic hazard assessment: geometry (fault length, fault dip, downdip width), segmentation, distance offshore from the DCPP, and slip rate.

The HFZ is recognized as the largest contributor to seismic hazard at the DCPP, with significant contributions from the Los Osos, Shoreline, and San Luis Bay faults (PG&E, 2011a). Deterministic seismic hazard analyses for these faults, using conservative estimates of fault geometry, indicate that the 84th percentile ground motions fall below the 1977 Hosgri earthquake design spectrum and the 1991 LTSP/SSER34 spectrum for which the plant had been evaluated and shown to have adequate margin (NRC, 1991). In 2012, the U.S. Nuclear Regulatory Commission (NRC) conducted an independent study of the potential impacts of the Shoreline fault zone on the DCPP and concluded that there was adequate seismic margin (NRC, 2012a).

1.2 CCCSIP Project Selection

Geologic and geophysical surveys conducted by PG&E as part of the CCCSIP between 2010 and 2012 provided new geologic and geophysical data to reduce uncertainty and further improve the seismic source characterization (SSC) parameters for the Hosgri, Los Osos, San Luis Bay, and Shoreline fault zones. A list of the SSC studies, along with the primary technical issue to be addressed by the data collection and a hazard sensitivity to inform the potential impacts on seismic hazard at the DCPP, was provided to the California Public Utilities Commission (CPUC) Independent Peer Review Panel (IPRP) for review and discussion before the 2011 field studies began (see Table 1-1 and PG&E, 2011b). The list also identified LTSP onshore geologic studies that complemented the CCCSIP objectives.

Marine and land seismic survey activities were selected with input from the IPRP (2012) using two criteria:

- The key seismic source parameters had a significant impact to hazard at the DCPP site.
- The overall likelihood that information from the proposed survey would reduce the uncertainty associated with that parameter.

The following hazard-significant parameters were considered for investigation:

- HFZ slip rate
- HFZ dip
- Shoreline fault zone slip rate
- Hosgri–San Simeon fault zone step-over
- Los Osos fault zone dip
- Los Osos fault zone sense of slip
- Los Osos fault zone slip rate
- Hosgri/ Shoreline fault zone rupture
- Shoreline fault zone southern end
- Shoreline fault zone segmentation

The sensitivity of the hazard to uncertainty in these source parameters was determined with respect to the total hazard using the source and ground-motion models described in the Shoreline Fault Zone Report (PG&E, 2011a). For each case, the ratio of the 5 hertz (Hz) spectral acceleration, which is representative of the key frequency band 3–8.5 Hz used for the ground-motion measure in the fragility models for the DCPP, was compared to a reference hazard with an annual frequency of exceedance of 10^{-4}. The tornado diagram on Figure 1-2 ranks these source parameters by their overall hazard sensitivity. The IPRP evaluated and commented on these study plans (IPRP, 2011, 2012) in terms of their overall priority and status (i.e., scheduling).

1.3 Organization of This Report

This report presents the results of the four-year (2010–2014) CCCSIP effort, as follows:

- Improved resolution of key seismic source parameters for the Hosgri, Shoreline, and Los Osos faults and the Southwestern Boundary fault zone (San Luis Bay, Oceano, and Los Berros faults), including fault slip rate, fault geometry (strike, dip, sense of motion), and interactions with other fault zones in the study area.
- An updated evaluation of the seismotectonic characteristics of the Irish Hills and the region surrounding the DCPP based on 3D/2D seismic-reflection surveys, seismic tomography, potential field, and geologic mapping.
- 3D constraints on shear-wave velocity at the DCPP site.
- Comparison with deterministic ground motions in PG&E (2011a, 2011b).

Individual CCCSIP reports are arranged by chapter. The first 12 chapters are presented by thematic area, as follows:

- Marine seismic surveys and earthquake monitoring (Chapters 2–6).
- Land seismic surveys (Chapters 7–9).
- Geotechnical investigations (Chapters 10 and 11), including PG&E response to Dr. Hamilton's testimony before the CPUC (Chapter 12).

Chapter 13 evaluates the sensitivity of deterministic ground motions presented in the Shoreline Fault Zone Report (PG&E, 2011a) to the new seismic source characterizations for the Shoreline and Hosgri faults and new ground-motion models developed as part of the Pacific Earthquake Engineering Research (PEER) Center's Next Generation Attenuation (NGA) program. The CCCSIP Report findings and conclusions are presented in Chapter 14.

2.0 THEMED REPORTS

The following subsections summarize the individual CCCSIP investigations presented in this report.

2.1 Marine Studies

The AB 1632 Report commented on a number of keys issues during the CEC's evaluation of the seismic vulnerability of the DCPP. The primary observation concerning the HFZ states:

> The Hosgri fault zone, 4.5 kilometers west of Diablo Canyon, creates the primary seismic hazard at the plant site. Over the years, there has been uncertainty regarding the tectonic setting of this fault zone, and the characterization of the Hosgri as either a lateral strike-slip fault or as a thrust fault. Current published geologic and seismologic research literature, much of which has been developed through PG&E's Long Term Seismic Program (LTSP) supports the interpretation that the Hosgri fault is predominantly characterized by strike-slip faulting.

Chapter 2, *DCPP 3D/2D Seismic-Reflection Investigation of Structures Associated with the Northern Shoreline Seismicity Sublineament of the Point Buchon Region*, reports on the 3D/2D low-energy seismic survey (LESS) mapping of the Hosgri, Shoreline, and Point Buchon (the "N40°W fault" in PG&E, 2011a) fault systems and describes the shallow fault-and-fold geometry in the zone of convergence between these three fault systems.

Chapter 3, *Offshore Low-Energy Seismic-Reflection Studies in Estero Bay, San Luis Bay, and Point Sal Areas*, describes the results from 2011 and 2012 3D/2D LESS studies that imaged the Hosgri fault near Point Sal and in Estero Bay, and the Shoreline fault in San Luis Obispo Bay. Geomorphic features (fluvial and submarine channels, buried shorelines) offset by faulting are mapped and used to estimate long-term fault slip rates. The southern extension of the Shoreline fault in San Luis Obispo Bay was identified and mapped using 3D LESS data, as well as recent 2D LESS and older deep-penetration, common-depth-point (CDP) marine seismic-reflection records.

Chapter 4, *Interpretation of Seismic-Reflection Data, Point Buchon to San Simeon Point*, presents a review of existing LESS and older deep-penetration (CDP) marine seismic-reflection data north of the DCPP in the offshore area between Point Buchon and San Simeon Point. Key issues addressed in this review include the connectivity between the Hosgri and San Simeon fault zones and the identification of a zone of faulting and folding in southern Estero Bay, offshore of the Irish Hills and south of the Los Osos fault zone.

Chapter 5, the *Point Buchon Ocean Bottom Seismometer Project*, discusses the real-time array of four three-component broadband ocean bottom seismometers and accelerometers that were installed offshore of the DCPP in 2013 to improve the detection capability of smaller ($M < 3$) earthquakes and provide on-scale recordings of larger ($M > 3$) events. The improved azimuthal station coverage, and thus improved earthquake locations and focal mechanisms, in the region offshore of the DCPP will be used to further constrain the geometry and sense of slip of the Hosgri and Shoreline faults offshore of Point Buchon.

Chapter 6, *Geophysical Surveys of the Hosgri Fault*, reviews the geologic and geophysical data that have been collected or published since the LTSP Report (PG&E, 1988) was issued to better constrain the tectonic setting, geometry, and sense of motion of the HFZ. The HFZ is recognized as the largest contributor to seismic hazard at the DCPP. A 3D high-energy seismic survey (HESS) was proposed by PG&E to collect additional information related to the geometry of the Hosgri and Shoreline fault zones. The California State Lands Commission granted the Geophysical Survey Permit needed to conduct HESS activities in state waters; however, the California Coastal Commission denied PG&E's application due to concerns about the environmental impact of these studies.

2.2 Land Studies

The AB 1632 Report also addressed seismic hazards related to onshore faulting, specifically stating that

> The deep geometry of faults that bound the San Luis–Pismo structural block, where Diablo Canyon sits, is not understood sufficiently to rule out a San Simeon-type earthquake directly beneath the plant. It is necessary to better define the deep geometry of bounding faults of the San Luis–Pismo block to better understand the lateral continuity of these fault zones.

Chapter 7, the *Onshore Seismic Interpretation Project (ONSIP) 2011 Data Report*, and Chapter 8, the *2012 3D Onshore Seismic Survey Report*, present the interpretations of 3D/2D seismic-reflection profiling and tomography data collected in the Irish Hills in 2011. Both high-resolution, shallow-penetration (low-energy) and deep-penetration (high-energy) seismic data were collected to evaluate the geometry of the Los Osos, San Miguelito, and San Luis Bay faults, as well as illuminate the deeper structure of the Pismo Syncline and the Edna fault system within the central Irish Hills.

The AB 1632 Report also notes that "*direct imaging of the subsurface structure at Diablo Canyon could determine if faults exist near the site that do not break to the surface…*" Chapter 8 presents the interpretation of shallow high-resolution 3D seismic-reflection, 3D tomography, and potential field data collected within an approximately 1 km radius of the

DCPP. In addition to imaging the crustal structure beneath the plant site, these data were used as input into the shear-wave-velocity (V_{S30}) model presented in Chapter 10. Data from the coastal terrace southeast of the DCPP were used to map structural relationships between the Shoreline and San Luis Bay faults. The wave-cut bedrock surface beneath the marine terrace deposits was used as a strain marker to examine Quaternary deformation associated with these faults. Seismic interpretations presented in Chapters 7 and 8 reference the surface geologic mapping and well data presented in Chapter 9, *Geologic Mapping and Data Compilation for the Interpretation of Onshore Seismic-Reflection Data*, to provide a “top to bottom” (i.e., surface to depth) approach to interpreting the geologic structure of the study area.

2.3 Geotechnical Studies

Chapter 10, the *CCCSIP DCPP P- and S-Wave Foundation Velocity Report*, provides a 3D shear-wave velocity (V_S) model for the DCPP foundation area in response to IPRP Report #6 (IPRP, 2013). Both 3D acoustic compressional-wave velocity (V_P) models and one-dimensional V_S-depth profiles constrained by surface-wave dispersion were developed within the DCPP site. These data indicate that there is significant spatial variability in V_{S30} throughout the DCPP site due to variations in near surface geology. The shear-wave-velocity model is used as input into the *Site Conditions Evaluation* report in Chapter 11.

Chapter 12, the *Response to Administrative Law Judge’s Decision Number D.12-09-008 Regarding Dr. Hamilton’s Concerns*, addresses testimony included in D.12-09-008 from the Alliance for Nuclear Responsibility and Dr. Douglas Hamilton concerning two postulated faults: the Diablo Cove and the San Luis Range/Inferred Offshore faults.

2.4 Limitations and Recommendations

The individual reports present the analysis and interpretation of data collected by the CCCSIP. These interpretations and analyses are acceptable for use in the development of the deterministic seismic hazard plots shown in Chapter 13, “Hazard Sensitivity and Impact Evaluation” and as input to the seismic source characterization (SSC) SSHAC process. The Limitations and Recommendations sections contained in the individual reports note the limitations of the data and their interpretations when used in seismic hazard updates, and are not meant to imply that the results are unacceptable for use. The results from the individual reports will be assessed by the SSHAC process and integrated with other available data to develop the updated SSC logic trees for input into the probabilistic seismic hazard analysis due to the NRC in March 2015.

3.0 CONCLUSIONS

As part of the report's conclusions, Chapter 13, *Hazard Sensitivity and Impact Evaluation*, evaluates the sensitivity of deterministic ground motions developed in the 2011 Shoreline Fault Zone Report (PG&E, 2011a) to the new seismic source characterizations for the Shoreline and Hosgri faults and new ground-motion models developed as part of the PEER NGA program.

In addition to addressing the CEC's recommendation to conduct 3D seismic-reflection studies, CPUC Decision D.12-09-008 also discussed the CEC recommendation to "*assess the implications of a San Simeon–type earthquake beneath Diablo Canyon. This assessment should include expected ground motions and vulnerability assessments for safety-related and non-safety-related plant systems and components that might be sensitive to long-period motions in the near field of an earthquake rupture*." The Shoreline Fault Report (2011) included a San Simeon-type earthquake beneath the Irish Hills and the DCPP where the San Luis Bay fault (dipping 50° -80° N) and the Los Osos fault (dipping 45° to 75° SW) intersect at depth. The SSC SSHAC logic trees will consider various fault models to explain the uplift of the Irish Hills, including a San Simeon-type earthquake model.

Data from the CCCSIP Report will also be provided to the PG&E SSC Level 3 Senior Seismic Hazard Analysis Committee (SSHAC) process for the development of an updated SSC model as input into the NRC-requested March 2015 probabilistic seismic hazard update for the DCPP (NRC, 2012b). .

Chapter 14, *Report Findings and Conclusions*, discusses the report findings and conclusions in greater depth and updates the hazard sensitivities presented on Figure 1-2 using the new hazard-significant parameters presented in this report. In particular, there is a significant reduction in uncertainty due to the improved constraints on the Hosgri slip rate, Hosgri dip, Shoreline slip rate, and Los Osos dip.

4.0 REPORT BACKGROUND

The following subsections introduce the various types of seismic imaging used in the CCCSIP to investigate fault zones near the DCPP.

4.1 Seismic Imaging

The CEC recommendation to "*use three-dimensional geophysical seismic reflection mapping and other advanced techniques to explore fault zones near Diablo Canyon*" (CEC, 2008, p. 6) was broad in scope and complexity from both a regulatory and technical perspective.

Significant advances in geophysical data collection and processing have occurred since the LTSP Report was issued (PG&E, 1988). The advent of 3D seismic-reflection acquisition and processing techniques has revolutionized subsurface geologic investigations. 3D seismic-reflection mapping provides a more detailed picture of subsurface conditions than conventional 2D seismic surveys. The 2D surveys use a line of sensors and sources to show a single slice or cross section through the earth, much like a medical x-ray. The 3D surveys use a grid of sensors and sources to gather seismic data over an area and range of angles to show geologic structure within a volume of the earth. The resulting 3D seismic volume can be viewed and evaluated from a number of different orientations, much like a medical computerized tomography (CT) scan. The 3D seismic-reflection images velocity *heterogeneit*y (acoustic impedance contrasts) in the crust, while 3D P-wave tomography images the velocity *structure* of the crust. Both techniques help constrain both the stratigraphic and structural interpretation of seismic data.

PG&E initiated necessary steps to implement both high-energy and low-energy 3D seismic-reflection surveys both on land and offshore in 2010 following the issuance of CPUC D. 10-08-003. The CCCSIP goal to image crustal structure from "top to bottom" (i.e., from the surface to as deep as possible) makes use of surface geologic mapping, high-resolution 2D and 3D shallow seismic-reflection profiling to image recent faulting, and deeper 2D and 3D seismic-reflection and tomographic profiling to address the larger-scale issues of crustal structure and fault geometry. Survey results are combined with seismicity and potential field (i.e., gravity and magnetic) data to address the CCCSIP target studies shown in Table 1-1 and Figure 1-2.

4.2 Marine Seismic Surveys

Within California state waters, marine seismic surveys are classified based on the strength of the acoustic source used: low-energy (<2 kilojoule [kJ]) seismic surveys (LESS) or high-energy (≥2 kJ) seismic surveys (HESS). LESS acoustic sources (e.g., sparkers or boomers) provide high-resolution shallow crustal penetration (approx. hundreds of meters), while HESS acoustic sources (e.g., air guns and water guns) provide deeper crustal penetration (3–5 km). The California State Lands Commission Offshore Geophysical Permit Program regulates the use of LESS electromechanical and sparker equipment as seismic sources for geophysical research. State permits to conduct LESS investigations were obtained by the CCCSIP's primary contractor, Fugro Consultants, Inc.

The CCCSIP conducted a series of 2D and 3D LESS investigations between 2010 and 2012 to image offshore faulting and provide constraints on slip rates for the Hosgri and Shoreline fault zones. The LESS acoustic source (triple-plate boomer), coupled with a 4-streamer array (2010–2011) and, later, a 12- to 14-streamer P-Cable array (2011–2012), provided high-resolution shallow-penetration (approx. hundreds of meters) 3D amplitude data. The 3D amplitude data were further processed using signal attributes to evaluate offsets of recent geologic features.

In addition to imaging the shallow crustal structure offshore of the DCPP, the CCCSIP explored the use of HESS acoustic sources (e.g., air guns), as well as potential field data, to provide deeper crustal penetration in order to evaluate larger-scale crustal structure and the geometry of the Hosgri, Shoreline, and Los Osos fault zones at depth. The proposed HESS survey area overlapped state and federal jurisdictions and thus required federal and state agency review (Table 1-2; High Energy Seismic Survey Team, 1999). The use of high-energy seismic sources with California state waters (3 miles offshore) requires specific environmental analysis under the California Environmental Quality Act (CEQA). PG&E applied for and was granted an Offshore Geophysical Permit to conduct HESS studies by the State Lands Commission in 2012, but was subsequently (November 2012) denied a Coastal Consistency Certification from the California Coastal Commission. While no new deep-penetration offshore HESS data were collected as part of the CCCSIP, older moderate- to high-energy deep-penetration (CDP) marine seismic-reflection profiles (Willingham et al., 2013) as well as other geophysical survey data that have been collected or published since the LTSP Report (PG&E, 1988), were used extensively to constrain the key interpretations presented in this report. The need to pursue conducting the 3D HESS offshore study is addressed in the Technical Summary section under *Geophysical Surveys of the Hosgri Fault Zone* and in Chapter 6, Geophysical Data for the Hosgri Fault Zone.

4.3 Land Seismic Surveys

Both low energy (shallow-penetration) and high energy (deep-penetration) 3D and 2D seismic surveys were conducted onshore in 2011 and 2012. The 2011 3D/2D program covered the northern Irish Hills, Los Osos Valley, and Clark Valley. Acquisition was designed to acquire deeper crustal and regional-scale seismic information across the Pismo syncline to evaluate the geometries of major surface faults (Los Osos, San Miguelito, Edna, and San Luis Bay) and to identify other buried or blind fault structures that may be in the region. The 2011 survey used Vibroseis and accelerated-weight-drop (AWD) sources. The AWD sources provide high-resolution shallow-penetration (<1 km) imaging. These data were used with surface geologic mapping and open-hole logs from oil exploration wells to constrain shallow subsurface structure. The effective maximum imaging depths of the 2011 Vibroseis data range from 4 to 6 km due to limits on available resolution of seismic velocities below 6 km and source-receiver offsets. Limited access within the rugged terrain of the Irish Hills required the use of both 3D seismic-reflection and 3D P-wave tomography to enhance interpretations and provide more comprehensive imaging of the Irish Hills region.

The 2012 3D/2D seismic program was designed to acquire shallow, more detailed, and higher-resolution data for the DCPP foundation area (target depth: 0–1 km) and proximal marine terraces (target depth: 0–0.25 km). The 2012 seismic travel-time data were combined with the 2011 data and gravity constraints to construct a high-resolution 3D V_P tomography model from the near surface to approximately 2.5 km (~8,000 ft) below sea level. The 3D tomography was further refined to provide the highest resolution in the depth range from the near surface to 0.3 km (~1,000 ft) below sea level, having vertical resolution comparable to or exceeding 3D seismic-reflection resolution of subsurface velocity discontinuities. The V_P tomography and surface-wave dispersion data were used to construct a 3D shear-wave (V_S) model of the DCPP foundation area to better constrain the site response analysis presented in Chapters 10 and 11.

5.0 NUCLEAR QUALITY ASSURANCE PROGRAM

The CCCSIP project was conducted under the PG&E DCPP Quality Assurance (QA) program, in compliance with 10CFR50 Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants”. The acquisition and processing of 3D/2D marine and land seismic data, as well as the validation of the 3D and 2D seismic processing and interpretation software, was performed under Fugro Consultants, Inc. Nuclear Quality Assurance (NQA) program, under NQA-1 with oversight by the PG&E DCPP QA program. The Fugro QA program is on the DCPP Qualified Service List. Calculations and technical reports were written, reviewed, and approved under the PG&E DCPP QA program following Geosciences procedures CF3.GE1, “Quality Related Calculations” and CF3.GE2, “Quality Related Technical Reports”.

6.0 DATA DISTRIBUTION

All data from the CCCSIP Report will be provided to the PG&E SSC Level 3 SSHAC process for the development of an updated SSC model as input into the NRC-requested March 2015 probabilistic seismic hazard update for the DCPP (NRC, 2012b). More information about SSHAC-related meetings and presentations can be found at www.pge.com/mybusiness/edusafety/systemworks/dcpp/SSHAC/.

2D and 3D marine seismic data are available from the USGS National Archive for Marine Seismic Surveys at http://walrus.wr.usgs.gov/NAMSS/.

2D and 3D land seismic data are available from the Data Management Center of the Incorporated Research Institutions for Seismology at www.iris.edu/dms/nodes/dmc/.

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Table 1-1. List of Target Regions for Onshore and Offshore Geophysical Studies

Target Region	Technical Issue	Method
1. Hosgri–San Simeon Step-Over	Geometry of step-over: Is it a segmentation point?	Low-energy 2D High-energy 3D
2. Hosgri–Shoreline Intersection Area	Relation between Shoreline fault and Hosgri Fault	Low-energy 2D/ 3D High-energy 3D
3. Hosgri Fault Offshore DCPP	a. Slip rate of the Hosgri fault	Low-energy 2D/ 3D
	b. Dip of the Hosgri fault	High-energy 3D Regional geophysical studies
4. Shoreline Fault	a. Northern geometry of the Shoreline fault (follow N40°W fault or the seismicity)	Low-energy 2D/ 3D High-energy 3D
	b. Existence of segment boundaries at depth (>½ km)	High-energy 3D surveys may or may not cross the north-central segment boundary (dependent on water depth)
	c. Slip rate of the Shoreline fault—identify offset old stream channels at south end near Point San Luis for use in estimating slip rate	Low-energy 3D
5. South of Shoreline Fault	Southern extent of the Shoreline fault	Low-energy 2D/ 3D
6. Irish Hills (E)	a. Dip of the Los Osos/ fault	Onshore 2D
	b. Sense of slip of the Los Osos fault	Onshore 2D & onshore geologic studies (LTSP Program)
	c. Slip rate of the Los Osos/ fault	Onshore geologic studies (LTSP Program)
	d. Tectonic model for the Irish Hills (including Edna fault)	Onshore 2D & onshore geologic studies (LTSP Program)
7. Irish Hills (W)	a. Geometry of the Southwestern Boundary zone (San Luis Bay/ Rattlesnake/ Olson/ San Miguelito faults)	Onshore 2D
	b. Sense of slip of the Southwestern Boundary zone	Onshore 2D & onshore geologic studies (LTSP Program)
	c. Slip rate for the Southwestern Boundary zone	Onshore 2D & onshore geologic studies (LTSP Program)

Table 1-2. Federal and State Agency Coordination and Permit Requirements for the CCCSIP HESS Project

Agencies	Anticipated Approvals, Authorizations, and/or Regulatory Requirements
Federal Agencies	
U.S. Army Corps of Engineers	Clean Water Act section 404 Authorization (Nationwide Permit #5)
National Science Foundation	Authorization for use of the R/V *Marcus G. Langseth*
National Oceanic and Atmospheric Administration Fisheries (also known as the National Marine Fisheries Service)	Marine Mammal Protection Act section 101, subdivision (a)(5) Incidental Harassment Authorization Federal Endangered Species Act section 7 consultation. Magnuson-Stevens Fishery Conservation and Management Act (§ 305 subd. (b)) Essential Fish Habitat consultation
U.S. Fish and Wildlife Service	Federal Endangered Species Act section 7 consultation
U.S. Coast Guard	Request Coast Guard to Issue Notice to Mariners
State and Local Agencies	
California State Lands Commission	Geophysical Survey Permit
California Coastal Commission	Coastal Development Permit Coastal Zone Management Act Federal Consistency Determination
California Regional Water Quality Control Board, Central Coast Region	Clean Water Act section 401 Certification of Waiver
State Historical Preservation Office	National Historic Preservation Act section 106 review
California Department of Parks and Recreation	Right of Entry Permit
California Department of Fish and Game	Fish & Game Code section 2080.1 consistency determination, or section 2081, subdivision (b) incidental take permit (possible) Scientific Collecting Permit Authorization for use of a Marine Protected Area
California Department of Transportation	Encroachment Permit
San Luis Obispo County	Encroachment Permit Air Pollution Control District would require use of best available control technology if project emissions exceed the District's significance thresholds
Port San Luis Harbor District	Use Permit for mooring of support vessels at Port San Luis, as needed Use Permit for use of onshore Port property for AWD/ Vibroseis seismic survey activities, as needed Use Permit for placement of survey equipment within State Tidelands governed by the Port

Source: Adapted from PG&E (2011b).