Pacific Gas and Electric Company's Response to CPUC Independent Peer Review Panel Response to Pacific Gas and Electric Company's 2024 Updated Seismic Assessment for Diablo Canyon Power Plant

INTRODUCTION

This letter responds to three requests made by the California Public Utility Commission (CPUC) Independent Peer Review Panel (IPRP) after reviewing Pacific Gas and Electric's (PG&E's) response (PG&E, 2025) to the IPRP's Report No. 16 (IPRP, 2024). This report presented an initial review by the IPRP of PG&E's 2024 seismic assessment report (PG&E, 2024). PG&E performed the 2024 assessment in response to California State Senate Bill 846 (SB-846), which was passed in September 2022 to extend operation of the Diablo Canyon Nuclear Power Plant (DCPP) and included a covenant to perform an updated seismic assessment. In satisfaction of the covenant, PG&E completed the seismic assessment update report in February 2024, which is hereafter referred to as the 2024 seismic assessment,

The IPRP's Report No. 16 (IPRP, 2024) provided a review of the 2024 seismic assessment and asked PG&E to consider several recommendations, including the following: (1) provide an assessment of recent research on the Hosgri fault and Casmalia fault that was not discussed in the 2024 seismic assessment, (2) use a different weighting scheme for the Hosgri fault slip rate sites to define a target slip rate for the Hosgri fault source, (3) perform and document additional research to reduce uncertainty on fault geometry models for faults beneath the Irish Hills, (4) provide an assessment of a recently published slip rate and fault geometry model for the Casmalia fault, (5) perform additional work to improve the DCPP site characterization, including study of uncertainty in empirical site factors, and (6) perform an updated sensitivity analysis. PG&E issued a detailed response (PG&E, 2025) that addressed the IPRP's recommendations, while noting that the 2024 seismic assessment is a stand-alone report that fully addresses the requirements of SB-846. PG&E notes that any additional documentation would occur in formal response letters to the IPRP and any studies or assessments would be performed under the existing Long Term Seismic Program (LTSP). Potential updates to fault parameters would be assessed through sensitivity studies and considered during future comprehensive seismic updates.

In response to PG&E (2025), the IPRP issued three specific requests to PG&E for additional documentation, clarifications, or considerations in response to Report No. 16. The three specific IPRP requests and supporting information are presented below, followed by PG&E

responses. Figures and tables that support the response are numbered for each request, in some cases retaining numbering from a referenced report.

IPRP REQUEST 1

"We request that PG&E provide documentation of the Ground Motion Response Spectrum (GMRS) based on their evaluation of the impact of using the Hosgri fault slip rate of 2.6 mm/yr +-0.9 mm/yr (Kluesner et al, 2023, and further supported by: Johnson et al., 2014, Medri et al. 2022)."

As part of this request, the IPRP specifically asks *PG&E "to provide the results of a sensitivity analysis mentioned at a February 19-20, 2025, Diablo Canyon Independent Safety Committee Meeting where 100% weight was put on the Cross Hosgri slope slip rate."* They also ask that *"given the growing body of published information, developed, but not necessarily available during the Update process, that supports higher slip rate along the Hosgri fault (e.g. Nishenko et al., 2025), PG&E provide a statement of the implications of this higher slip rate on their seismic hazard assessment for the safety and operational reliability of the DCPP."*

PG&E RESPONSE TO REQUEST 1

Introduction

The 2024 seismic assessment updated the slip rates for the Hosgri and Los Osos fault sources and the time-dependent scale factor (equivalent Poisson hazard ratio, or EPHR) for the Hosgri fault based on new information published since the last update in 2015. The changes in seismic hazard due to the changes in slip rate and EPHR were implemented by multiplying the 2015 hazard curves for the Hosgri and Los Osos fault sources by scale factors based on the linear relationship between changes in hazard and changes in the rate of activity of a fault (e.g., through changes in slip rate and EPHR). Given the IPRP's interest in the hazard impact of putting 100% weight on the slip rate at the cross-Hosgri slope (CHS) site, PG&E performed an informal sensitivity using the scaling approach. Preliminary results of the change in hazard from using the CHS slip rate site only for the Hosgri fault source to scale hazard were summarized at the February 19-20 2025 DCISC meeting.

After receiving the IPRP's Request 1 in February 2026, PG&E conducted a formal sensitivity analysis that explores the impact on ground motions at DCPP from changing the modeled slip rate for the Hosgri fault source in a full probabilistic seismic hazard analysis (PSHA) calculation rather than using the scaling approach. The formal Cross Hosgri Slope slip rate

sensitivity analysis considered the changes to both the target slip rate and the EPHR. Specifically, the sensitivity compares ground motions calculated using the slip rate from the CHS slip rate site for the Hosgri fault source (the sensitivity case) to ground motions calculated based on a weighted average slip rate uncertainty distribution from four sites on the Hosgri fault developed as part of the 2024 seismic assessment and 2025 PSHA (the basecase). The basecase is a full PSHA calculation performed in 2025 that includes model updates from the 2024 seismic assessment.

The CHS slip rate sensitivity analysis results were calculated for the reference rock horizon and compared to ground motions from the PG&E's 2025 PSHA. In this response, the sensitivity results are presented as a hazard curve at a spectral frequency of 5 Hz, plots of uniform hazard spectra (UHS), spectral ratios of the UHS, and comparison of the ground motion response spectrum (GMRS) for the reference rock horizon. Additional detail is presented below on how the CHS slip rate was incorporated in the DCPP seismic source characterization (SSC) model for the sensitivity analysis.

Seismic Source Characterization Overview

The implementation of the Hosgri slip rate sensitivity analysis requires an understanding of the current SSC model for DCPP (PG&E, 2015; 2024). The SSC model defines two groups of fault sources in the direct vicinity of DCPP: the Hosgri group and the San Luis-Pismo Block (SLPB) group. The Hosgri group consists of mostly offshore faults including the Hosgri, San Simeon, and San Gregorio fault zones (the Hosgri-San Gregorio fault system) and the branching Piedras Blancas anticlinorium. The SLPB group consists of faults located east of the Hosgri fault zone and includes the Los Osos, San Luis Bay, Shoreline, Foxen Canyon, Little Pine, Nipomo, Oceano, San Miguelito (offshore only), and Wilmar Avenue – Los Berros faults. Instead of modeling each named fault as a separate *fault source*, the SSC model defines maximum earthquake ruptures that may occur over the network of faults as *rupture sources*. The SSC model consists of sets of rupture sources for the Hosgri and SLPB groups. Together, these sets of ruptures produce the earthquake magnitude-frequency distributions that are modeled in the PSHA. Separate fault geometry models (FGM) are defined for the Hosgri and SLPB groups to capture epistemic uncertainty in fault location and geometry in the SSC logic tree. Each FGM has a corresponding rupture model which describes a set of rupture sources. Alternative FGMs and their corresponding rupture model (i.e., set of rupture sources) are modeled with logic tree branches (i.e., epistemic alternatives), but individual rupture sources within a rupture model represent aleatory variability.

Fault source slip rates, which are calculated for each named fault, are not directly implemented in the SSC model because of the rupture source construct. Instead of directly using fault slip rates in the SSC, fractions of the fault slip rates are allocated among various rupture sources for a given rupture model. The slip rate allocation is developed so that the sum of rupture source slip rates involving any particular named fault equals the target fault source slip rate. Epistemic uncertainty in rate is captured in the assigned slip rates for each rupture source, with high, central, and low branch alternatives. Collectively, logic tree branch combinations of rupture source slip rates will closely approximate the mean and uncertainty distributions for each fault source slip rate. For the Hosgri group, aggregating and correlating the impact of alternative branch slip rates for Hosgri rupture sources provides a very good approximation of the impact the Hosgri slip rate has on ground motion uncertainty.

Hosgri Fault Source Slip Rate and Cross-Hosgri Slope Slip Rate Site

The target slip rate for the Hosgri fault source in the 2024 seismic assessment and 2025 PSHA is based on a weighted average of the Hosgri slip rate measured at four separate sites spread over a distance of about 95 km along the fault (PG&E, 2024). The slip rate and its uncertainty at each site are represented by cumulative distribution functions (CDFs) developed based on Monte Carlo simulations that draw from uncertainty distributions of offset amount and age of offset feature (Figure 1-1). A final target slip rate CDF is developed based on weighting of each slip rate site, with the weights based on the likelihood that the slip rate site captures the "correct" Hosgri slip rate for use in the PSHA. Criteria for weighting of the four slip rate sites is based on an assessment of the applicability of the offset feature age, the slip rate site location relative to the DCPP, and the confidence in the site interpretation (PG&E, 2024). The weighting values were developed by the SSHAC TI team and reviewed by the PPRP and third-party external reviewers considering the best available information and uncertainties on the fault at the four sites. The four slip rate sites and their weights [in square brackets] used to develop the target slip rate CDF for the Hosgri fault used in the 2024 seismic assessment and 2025 PSHA are:

- San Simeon site [0.25]
- Cross-Hosgri Slope (CHS) site [0.5]
- Southern Estero Bay site [0.2]
- Point Sal site [0.05]

This weighting results in a target slip rate CDF that has a mean of 2.14 mm/yr and an uncertainty range from 0.90 mm/yr (0.05 cumulative probability) to 3.64 mm/yr (0.95

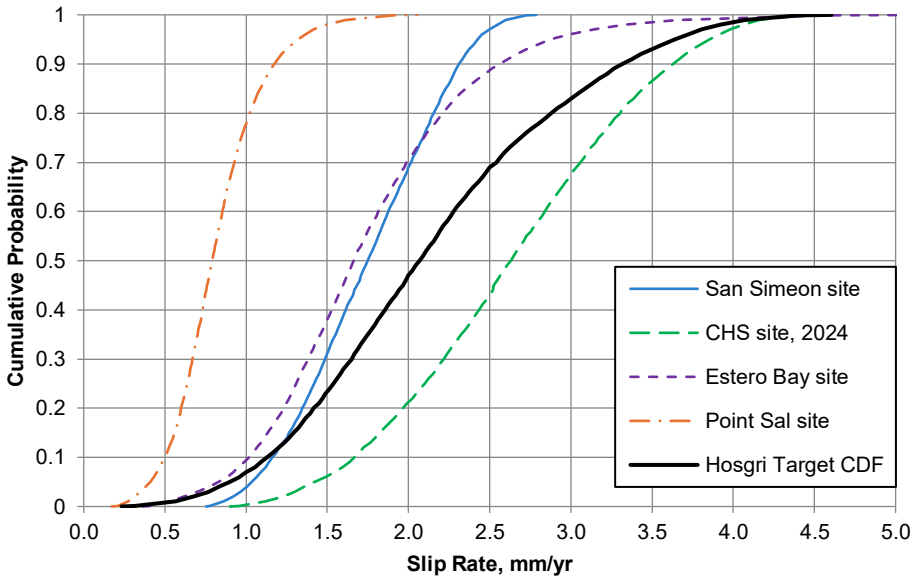


Figure 1-1. Hosgri fault slip rate CDFs for individual slip rate sites and the weighted Hosgri target slip rate CDF used in the 2024 seismic assessment and 2025 PSHA.

cumulative probability) (PG&E, 2024). The target slip rate CDF is shown as the solid black line in Figure 1-1.

The sensitivity analysis replaces the weighted Hosgri slip rate CDF described above with the CHS site slip rate CDF only (dashed green line in Figure 1-1 and solid green line in Figure 1-2). The basis for the CHS site slip rate CDF is the work published by Johnson et al. (2014) and Kluesner et al. (2023a) as interpreted by PG&E (2024). PG&E (2024) considered broader uncertainties in both offset amount and age of the offset feature than the publications. The CHS slip rate CDF has a mean of 2.64 mm/yr and an uncertainty range of 1.42 (0.05 cumulative probability) to 3.85 (0.95 cumulative probability). This is comparable to but broader than the slip rate interpreted by Kluesner et al. (2023a), who calculate a slip rate of 2.6 ± 0.8 mm/yr (2 standard deviations), which is equivalent to a range of 1.94 (0.05 cumulative probability) to 3.26 (0.95 cumulative probability) (Figure 1-2).

As discussed above in the Seismic Source Characterization Overview, the SSC model requires allocating the target Hosgri slip rate among the rupture sources that include the Hosgri fault. For the sensitivity, the CHS site slip rate CDF was accommodated in the SSC through increases in the slip rate allocation to rupture sources H-01, H-02, and H-03, relative to the 2025 PSHA. The H-01, H-02, and H-03 rupture sources are present in all three Hosgri group FGMs (PG&E, 2015). These three rupture sources host large to great earthquakes along the entire Hosgri-San Gregorio fault system from the southern end of

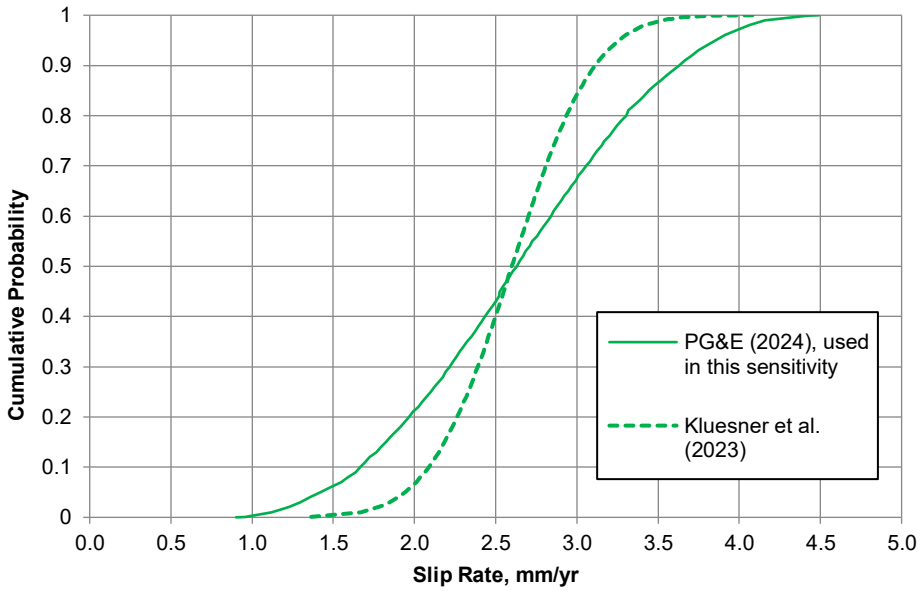


Figure 1-2. Hosgri fault slip rate CDFs for the CHS site. Dashed line from Kluesner et al. (2023a); solid line from PG&E (2024). The solid line CDF is used in the CHS slip rate sensitivity analysis.

the Hosgri fault zone offshore Point Arguello north to Bolinas Bay where the northern San Gregorio fault branches with the northern San Andreas fault. In detail, the rupture sources continue north along the northern San Andreas fault to the Mendocino Triple Junction.

All three rupture sources pass through the CHS slip rate site and are located directly opposite the DCPP (PG&E, 2015). The differences between the rupture sources are in the specific strand of the Hosgri fault zone offshore the Irish Hills and DCPP: H-01 represents ruptures on the central strand, H-02 represents ruptures on the western strand, and H-03 represents ruptures on the eastern strand (PG&E, 2015). Collectively, these three rupture sources account for 89% of the target slip rate of the Hosgri fault opposite the DCPP in the 2015 model (PG&E, 2015), 92% of the target Hosgri fault slip rate opposite the DCPP in the 2025 PSHA, and 93% of the target Hosgri fault slip rate opposite the DCPP in the CHS sensitivity analysis. The remaining part of the target Hosgri slip rate is allocated to two other rupture sources that involve the Hosgri fault opposite the DCPP. These allocated slip rates have been left unchanged from the 2015 SSC model because the allocated slip rates are a function of either the offshore Piedras Blancas slip rate (H-04) or the Shoreline slip rate (H-05).

The 2025 PSHA and CHS sensitivity slip rates for H-01, H-02, and H-03 rupture sources are listed in Table 1-1. The allocated slip rates result in logic tree branch combinations that approximately sample the target sensitivity slip rate CDF and have the same target mean slip rate of 2.64 mm/yr. Table 1-2 lists the weighted mean slip rates for each Hosgri group rupture source that passes directly opposite the DCPP and shows that the total mean slip rate equals the CHS slip rate sensitivity mean slip rate of 2.64 mm/yr.

The mean slip rate in the sensitivity analysis (2.64 mm/yr) is 23% greater than the mean slip rate used in the 2024 seismic assessment and 2025 PSHA (2.14 mm/yr). In the SSC model, the EPHR for the Hosgri fault is correlated with the mean slip rate (PG&E, 2015; Biasi and Thompson, 2018). The mean EPHR for a slip rate of 2.64 mm/yr is 1.28, which is a 3% increase over the mean EPHR of 1.24 used in the 2024 seismic assessment and 2025 PSHA based on the weighted mean Hosgri slip rate of 2.14 mm/yr (PG&E, 2024). The EPHR values, which are listed in Table 1-3, represent a scale factor (a multiplier) on the rate of Hosgri ruptures in the PSHA. The total increase in the rate of Hosgri group events (combining the impacts of the increase in mean slip rate and EPHR) is about 27%.

Table 1-1. Hosgri rupture source slip rates modified for the CHS sensitivity analysis

Rupture Source Number[†]	Logic Tree Branch	PG&E 2025 PSHA Slip Rate (mm/yr)	CHS Slip Rate Sensitivity Slip Rate (mm/yr)	Weight
H-01	High	2.34	2.51	0.185
	Central	1.05	1.39	0.630
	Low	0.47	0.77	0.185
H-02	High	1.50	1.57	0.185
	Central	0.53	0.72	0.630
	Low	0.19	0.33	0.185
H-03	High	0.46	0.50	0.185
	Central	0.08	0.12	0.630
	Low	0.01	0.03	0.185

Note: [†]Applies to all three FGMs in the Hosgri group (H90, H85, and H75).

Table 1-2. Hosgri group rupture sources that are located directly opposite the DCPP and comparison of weighted mean to target mean slip rates, CHS slip rate sensitivity analysis

Rupture Source Number†	CHS Slip Rate Site Sensitivity Mean Slip Rate (mm/yr)
H-01	1.48
H-02	0.81
H-03	0.17
H-04	0.10
H-05	0.08
Total, Rupture Sources	**2.64 mm/yr**
Target, CHS Site	**2.64 mm/yr**

Note: †Applies to all three FGMs in the Hosgri group (H90, H85, and H75).

Table 1-3. Equivalent Poisson hazard ratios (EPHRs) for the Hosgri fault source in the 2025 SSC model and CHS slip rate sensitivity analysis

Fault Source	Logic Tree Branch	PG&E 2025 PSHA EPHR	CHS Slip Rate Sensitivity EPHR	Weight
Hosgri (H90, H85, H75)	High	1.95	1.90	0.25
	Central	1.34	1.32	0.50
	Low	0.32	0.58	0.25
Weighted Mean:		1.24	1.28	

Cross Hosgri Slope Slip Rate Sensitivity Results

The CHS slip rate sensitivity analysis included calculation of full PSHA results for the SSC model modifications implementing the modifications to the Hosgri group rupture source slip rates and EPHR values based on the CHS slip rate (Tables 1-1 to 1-3) (sensitivity case) and a comparison with the 2025 PSHA (basecase) results. The full GMC model is implemented in the calculations to be consistent with the 2025 basecase analysis. In addition, all other sources in the full SSC model are included without modification to be consistent with the 2025 basecase. Given the increase in the slip rate and EPHR for the Hosgri fault source, the resulting PSHA sensitivity results show an increase compared to the 2025 results. The quantification of this increase is presented in the following graphs.

The sensitivity results are shown as mean total hazard curves and individual hazard curves for the Hosgri fault source in Figure 1-3 for the spectral frequency of 5 Hz. The CHS slip rate sensitivity results (i.e., "Total CHS" and "Hosgri CHS") are plotted with solid lines and the 2025 basecase results (labeled "Total" and "Hosgri") are plotted as dashed lines. Visually, the CHS slip rate sensitivity hazard curves show a slight increase compared to the 2025 basecase hazard curves, with the Hosgri fault source curves showing more separation compared to the total hazard curves.

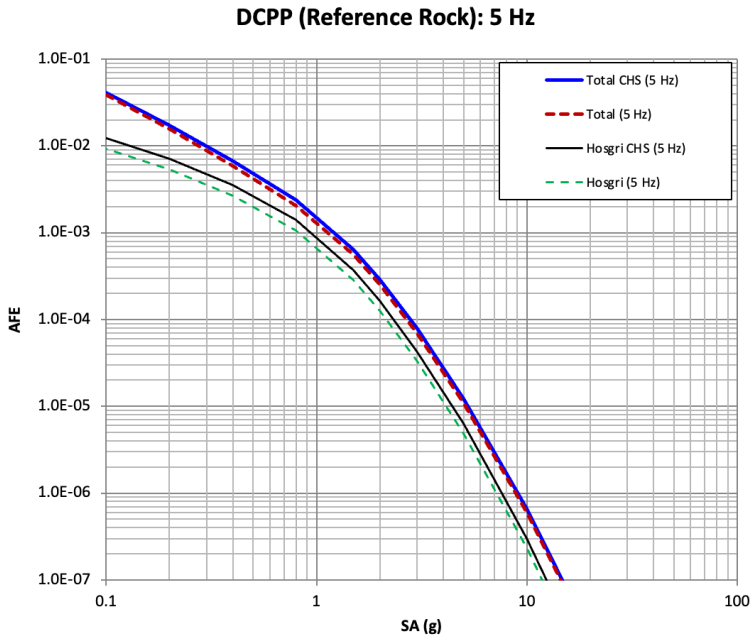


Figure 1-3. Comparison of mean total hazard curves and the individual Hosgri hazard curves for 5 Hz for DCPP, reference rock horizon. Solid lines represent the CHS slip rate sensitivity case, and dashed lines represent the 2025 basecase.

The corresponding UHS for the CHS slip rate sensitivity case and 2025 basecase for the hazard levels of $1x10^{-4}$, $1x10^{-5}$, and $1x10^{-6}$ AFE are plotted in Figure 1-4. The CHS slip rate sensitivity results (colored, solid lines) show an increase at all spectral frequencies relative to the 2025 basecase (dashed and dotted lines). The spectral ratios (i.e., CHS slip rate sensitivity case divided by the 2025 basecase) are plotted in Figure 1-5. The results indicate an increase in reference rock horizon ground motions of approximately 2–4% for frequencies greater than about 3 Hz. Frequencies less than 3 Hz have larger increases, which are up to approximately 7% at the $1x10^{-4}$ AFE hazard level for the spectral frequency of 0.33 Hz. The frequency range of interest for Structures, Systems and Components at DCPP is between 3Hz and 10Hz.

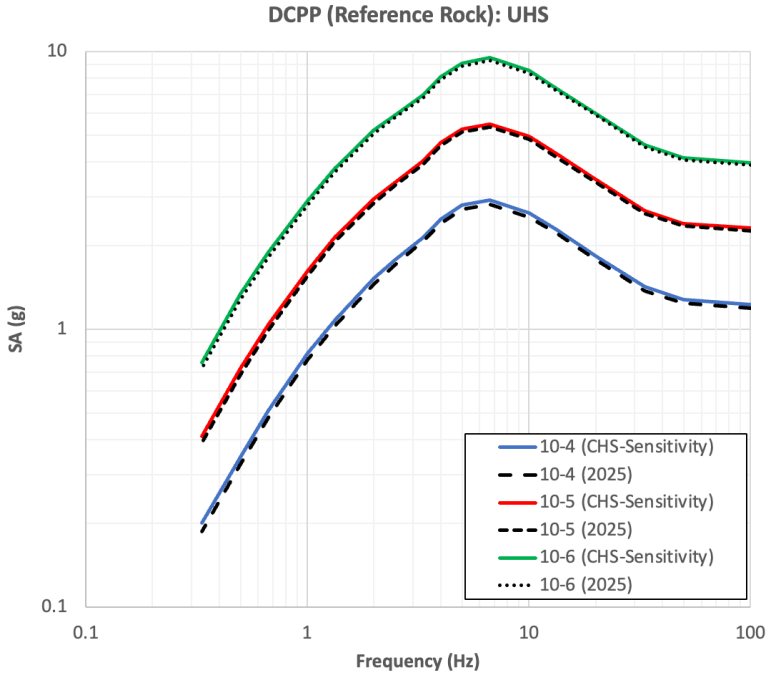


Figure 1-4. Comparison of UHS for the reference rock horizon for the three hazard levels of $1x10^{-4}$, $1x10^{-5}$, and $1x10^{-6}$ AFE from the CHS slip rate sensitivity case (solid lines) and 2025 basecase results (dashed and dotted lines).

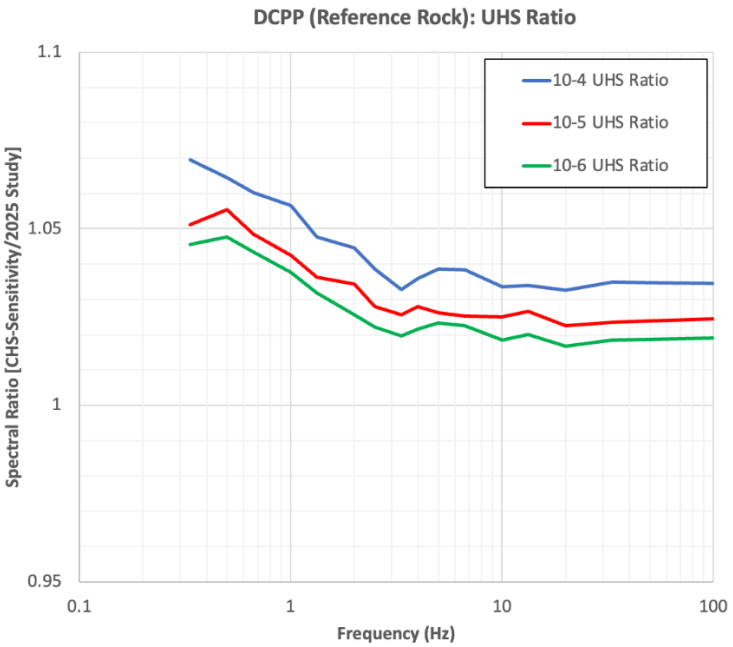


Figure 1-5. Spectral ratios (sensitivity case / basecase) of mean UHS for the three hazard levels of $1x10^{-4}$, $1x10^{-5}$, and $1x10^{-6}$ AFE, reference rock horizon.

Based on the UHS results for the reference rock horizon, the corresponding ground motion response spectrum (GMRS) was computed for both the 2025 basecase and the CHS slip rate sensitivity. The GMRS values are plotted in Figure 1-6. The spectral ratio for these two GMRS is also plotted in Figure 1-7. Consistent with the UHS ground motion spectral ratios, the GMRS ground motion spectral ratios show an increase for the CHS slip rate sensitivity compared to the 2025 basecase results. The increase is on the order of approximately 3–4% for frequencies equal to and greater than 3 Hz and up to almost 6% for shorter spectral frequencies.

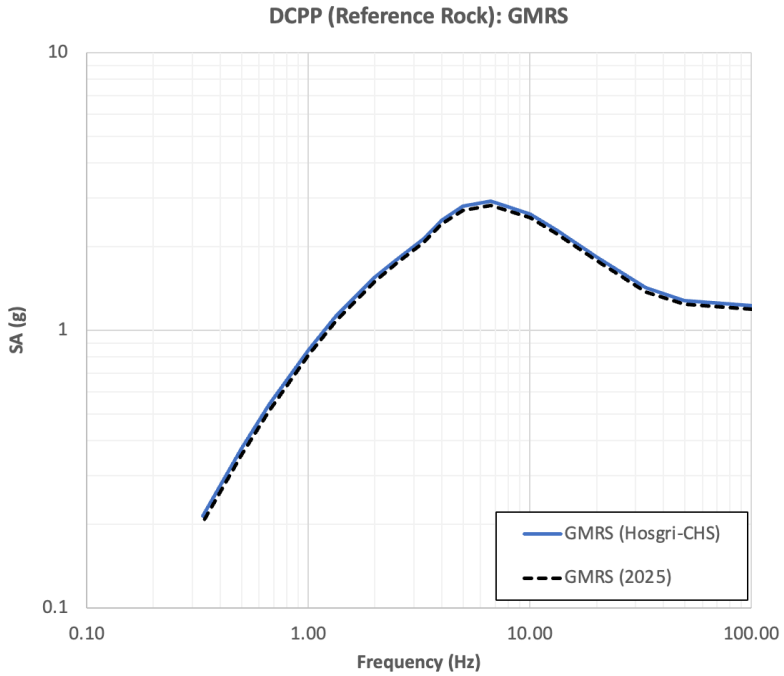


Figure 1-6. Comparison of GMRS from the CHS slip rate sensitivity (solid line) and the 2025 basecase (dashed line) for the reference rock horizon.

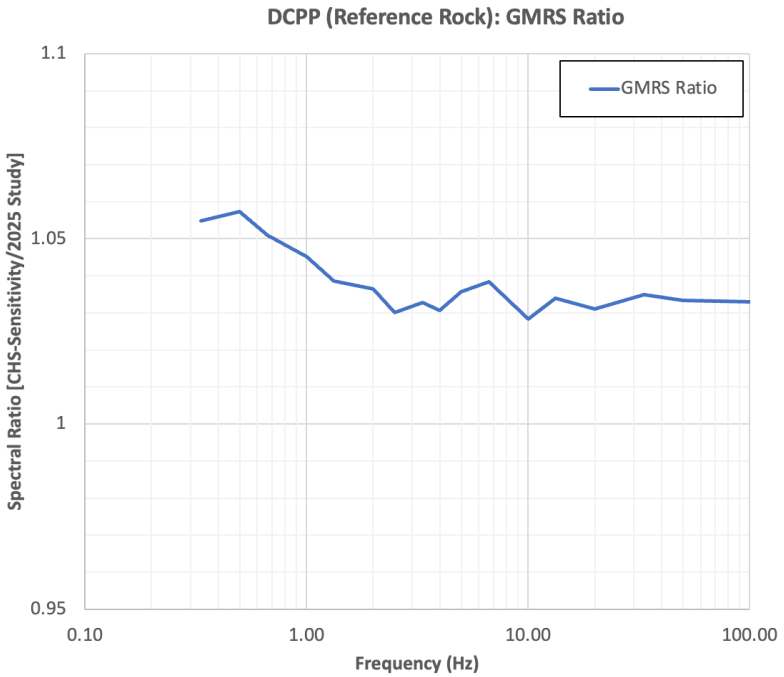


Figure 1-7. GMRS spectral ratio (sensitivity case / basecase) for the reference rock horizon.

The increases in ground motions for the UHS (~2–7%) and GMRS (~3–6%) are much lower than the increase in the rate of Hosgri earthquakes (~27%) due to a combination of factors, including (1) the Hosgri fault source is only one of many contributors to total hazard, and (2) the slope of the mean hazard curves are steep through the hazard levels of interest. A back-of-the envelope calculation demonstrates these effects. Given that the Hosgri fault source contributes about 50% of the total hazard to the DCPP, a 27% increase in the rate of Hosgri earthquakes translates into a (27% × ~50% =) ~13.5% increase in hazard for a particular ground motion. And given that the slope of the mean hazard curve is on the order of 3 through the hazard levels of interest, a ~13.5% increase in rate translates to a (~13.5% × ~1/3 =) ~4.5% increase in ground motions. The greater increase in ground motions observed at lower frequencies (Figure 1-7) is consistent with the finding that the Hosgri fault source has a larger contribution to the total hazard at lower frequencies compared to higher frequencies.

Summary of Cross Hosgri Slope Slip Rate Sensitivity

PSHA results for DCPP for the reference rock horizon were computed most recently in 2025 based on review and updates of the 2015 SSC and GMC models performed as part of the 2024 seismic assessment for SB-846 (PG&E, 2024). The 2025 PSHA results represent the basecase against which sensitivities can be compared. For this sensitivity study, the SSC model was modified based on a target Hosgri fault slip rate from the Cross-Hosgri slope (CHS) slip rate site (mean slip rate of 2.64 mm/yr) instead of the basecase target Hosgri fault slip rate derived from a weighted distribution of four slip rate sites used in the 2024 and 2025 studies (mean slip rate of 2.14 mm/yr). The CHS slip rate sensitivity was implemented in the SSC model by increasing the slip rate values for three rupture sources (H-01, H-02, and H-03) that host large to great earthquakes on the Hosgri-San Gregorio fault system and by increasing the EPHR for the Hosgri fault from 1.24 to 1.28. The combined changes to the SSC model for the sensitivity analysis reflect an increase in the rate of Hosgri fault earthquakes of about 27% compared to the rate of earthquakes in the basecase 2025 analysis.

PSHA results for the CHS slip rate sensitivity were computed using this revised SSC model and the full GMC model implemented for the 2025 PSHA for the reference rock horizon. Mean hazard curves and ground motions for the UHS at three hazard levels of interest (1×10^{-4}, 1×10^{-5}, and 1×10^{-6} AFE) along with the resulting GMRS are computed and compared to a basecase hazard calculated in 2025. The sensitivity results show an increase in the GMRS of 3–4% for spectral frequencies of approximately 3 Hz and greater.

Implications of Sensitivity Results

The CHS slip rate sensitivity results in relatively small increases in DCPP ground motions at returns periods of interest. The hypothetical increases in ground motions do not have an adverse impact within the NRC acceptance criteria and do not put the plant in a higher risk category. These hypothetical increases are not expected to have a significant impact on reliability of non-safety related components.

IPRP REQUEST 2

We request that PG&E provide additional documentation regarding the inputs used for the Hosgri fault slip rate and slip rate weighting. We further request that PG&E consider revision of the Hosgri fault slip rate in the context of all available studies, including those not considered in the Update, and the issues described below.

PG&E RESPONSE

PG&E provided documentation regarding inputs used for the Hosgri fault slip rate and slip rate weighting in the 2024 seismic assessment (PG&E, 2024) and clarifying information as part of its response to IPRP's Report No. 16 (PG&E, 2025). Per IPRP's Request 2, PG&E provides additional documentation on the following topics: relevance of studies not considered in the 2024 seismic assessment, apparent legacy bias, appropriate slip rate time frame for PSHA, and adjustments to published slip rates.

Relevance of Studies Not Considered in the 2024 Seismic Assessment

The IPRP cites two studies between 2015 and 2024 that are not discussed in the 2024 seismic assessment: a Hosgri slip rate study by the Center for Nuclear Waste and Regulatory Analysis (CNWRA) (McGinnis at al., 2016) and a Casmalia fault slip rate study (McGregor and Onderdonk, 2021). Additional information on the CNWRA study is provided in this section. The McGregor and Onderdonk (2021) study is discussed in the response to IPRP's Request 3.

PG&E's response to IPRP's Report No. 16 noted that the CNWRA study was not used in the 2024 seismic assessment because it has many simplifying assumptions and sources of uncertainty that would need to be evaluated before integration into the PG&E model. The TI Team viewed it as a preliminary check or verification of the rate used in the 2015 study (PG&E, 2025). This was also the stated purpose of the CNWRA analysis on behalf of the NRC (McGinnis et al., 2016).

In its response, the IPRP suggested that this reason for exclusion was inconsistent with PG&E's stated motivation to *"…review the center, body and range of technically defensible interpretations of both new, and previously available data, models and methods*." PG&E stated that the CNWRA study has not been evaluated to this standard and the 2024 seismic assessment does not document why it should be excluded from the Update.

Additional documentation on the reason for the exclusion and lack of documentation is provided here. Given the uncertainty in the CNWRA analysis, the TI Team's opinion was that the site was not a good independent slip rate site without additional evaluation and analysis. Given that the SSHAC 1 scope and schedule precluded a detailed evaluation of the CNWRA study (e.g., a critical review of the methodology and assumptions and interviews with the project team), the site was excluded during early project discussions. While this was not documented in the 2024 report, PG&E views the response to IPRP's Report No. 16 and this response as supplemental documentation to the 2024 report that addresses the IPRP's question of how the CNWRA study was considered.

After the 2024 seismic assessment, PG&E tasked Lettis Consultants International (LCI) to review the CNWRA study (LCI, 2026). The complete summary and recommendations from the report are excerpted below:

"We reviewed the independent slip rate analysis performed by McGinnis et al. (2016) and provided additional analysis of some of the parameter uncertainties that were not fully explored in that study. Overall, we find that the analyses performed as part of the 2016 CNWRA study are consistent with the goals of the original study. While their results, constrained by the data available and scope of work, are an honest and reasonable outcome to these analyses, two key questions arose from our review:

• Is the tectonic and kinematic model for the Half Graben fault, presented by McGinnis et al. (2016), correct and are there alternative plausible models that are supported by available information?

• What are the implications for calculated slip rates given new age model information and general assessments of parameter uncertainties?

We find that the kinematic model presented by McGinnis et al. (2016) is consistent with prior studies (DiSilvestro et al., 1990, Lettis et al., 1990; PG&E, 2014a) and fits observations from seismic reflection profiles. An alternative model representing the Half Graben fault as a throughgoing strike-slip fault with a double bend that results in local extension (e.g.,

Johnson and Watt, 2012; PG&E, 2013) we find to be well supported by: 1) local seismicity, 2) focal mechanisms, 3) seismic reflection profiles, and 4) analysis of the cross-Hosgri slope site, where a right-lateral motion is interpreted (Johnson et al., 2014; Kluesner et al., 2023a).

Each of the parameters used in McGinnis et al. (2016) to calculate Hosgri-parallel displacement and slip rate (e.g., fault dip, unconformity age, displacement magnitude) is associated with uncertainty that has cumulative implications for estimates of slip rate through time. Alternative age model realizations show that slip rates may decrease by 46-85% for the minimum age model and 70-90% for the maximum age model. In addition, there is a pattern of slip rate change through time that suggests an apparent decrease in the interpreted Hosgri-parallel slip rates through the middle to late Quaternary.

In addition to unconformity age, slip rate is also predicated on assumptions of fault throw, fault dip, and intersection angle (α). Confidence in these variables relies on accurate understanding of the initial elevation of the unconformity at the fault (estimated using their interpreted "regional line"), hanging-wall cutoff, and fault location. Artifacts in the seismic-reflection data and data noise have the effect of obscuring features needed to constrain these locations. Uncertainties in corresponding estimates of throw and fault dip are likely considerable. A simple analysis of the variables shows that changes in single parameters produce an uncertainty range of 0.6 to 2.7 mm/yr, which is a factor of 4.5. It is not possible to further constrain the slip rate uncertainty range presented with the available data and we agree with McGinnis et al. (2016) that these parameter uncertainties are largely inherent in the nature of the data.

Although the analysis of the Half Graben fault following the approach of McGinnis et al. (2016) may be valuable as a first order check on the Hosgri fault slip rate, our exploration of parameter uncertainties and alternative interpretations suggests that it may not provide a useful independent estimate of slip rate for the Hosgri seismic source in seismic hazard models for the DCPP. The main reason for this is the presence of the cross-Hosgri slope slip rate site on the Half Graben fault. The cross-Hosgri slope slip rate site is well constrained in terms of style of faulting and age of the geomorphic feature (Johnson et al., 2014; Kluesner et al., 2023a) and currently has the highest weight of four alternative slip rate sites in the PG&E source model."

In short, LCI's main conclusion regarding the CNWRA study is that its slip rate estimates rely on a geometric and kinematic interpretation of a local strand of the Hosgri fault that directly conflicts with the geometric and kinematic interpretation underlying the CHS slip

rate site. The CNWRA study refers to this key local fault strand as the "Half Graben fault" and interprets it as a listric normal fault within a right step in a strike-slip fault system (McGinnis et al., 2016) (see Figure 2-1 below under subheading, *Appropriate slip rate time frame for PSHA*). The CNWRA study slip rates are only valid under this kinematic interpretation. LCI's analysis points out that this kinematic interpretation is consistent with earlier studies (DiSilvestro et al., 1990, Lettis et al., 1990; PG&E, 2014a). In contrast, the very same fault strand is interpreted by other studies as a steeply dipping strike-slip fault within a double bend (Johnson and Watt, 2012; PG&E, 2013; Johnson et al., 2014; Kluesner et al., 2023a). This strike-slip interpretation is consistent with the interpretation of the CHS site as a right-laterally offset shoreface. The CNWRA Half Graben fault slip rates and CHS site slip rates, therefore, represent incompatible epistemic alternatives, where belief in the basic interpretation by Johnson et al. (2014) and Kluesner et al. (2023a) is incompatible with the basic assumptions and interpretations of the CNWRA study. The CNWRA study results represent a check on the Hosgri fault slip rate in that, under a different kinematic interpretation of the Hosgri fault zone in this particular location, the estimated slip rate is generally consistent with the Hosgri slip rate CDF used in the PSHA. Additional notes regarding apparent slip rates estimated in the CNWRA study are discussed below under the response subsection, *Appropriate slip rate time frame for PSHA*.

The 2024 seismic update does not express any uncertainty or disbelief in the basic interpretation of the CHS site as a relict shoreface offset right-laterally along a strike-slip strand of the Hosgri fault (PG&E, 2024). The weight given to the CHS slip rate in the 2024 seismic update reflected instead the confidence that the slip rate CDF for the CHS site is the correct representation of the Hosgri slip rate CDF to use in the PSHA for DCPP (Figure 1-1). Future LTSP updates can consider and document whether the alternative, listric stepover interpretation of the Half Graben fault is technically defensible and, if so, how the Hosgri slip rate should be characterized under this alternative model.

<u>Apparent Legacy Bias</u>

The IPRP recommends that certain slip rate sites that are model driven or have large uncertainties be used as a second order validation or "check" on rates from higher confidence sites rather than as direct inputs into the slip rate model. PG&E agrees that this could be a consideration for results that have not been vetted in depth, as with the CNWRA study. As noted above, the CNWRA study was performed as an independent evaluation of the Hosgri fault slip rate to check the general findings of the 2015 SSC SSHAC model for the NRC (McGinnis et al., 2016). With this understanding, the study was not considered by the TI Team to have undergone a robust exploration of uncertainties at the time of the 2024 seismic assessment.

In contrast, the four Hosgri slip rate sites included in the 2015 and 2024 assessments underwent a thorough exploration of uncertainties as part of the 2015 SSC SSHAC study (PG&E, 2015). The four sites are located on different sections of the Hosgri fault and the measured slip rates are averaged over different time intervals. The uncertainties at all four sites were explored and documented in the 2015 SSC SSHAC study (PG&E, 2015), and were revisited for the 2024 seismic update (PG&E, 2024). Important to the TI Teams in the SSHAC evaluations was that each site represented an independent analysis of the Hosgri slip rate (best estimate and uncertainty) that may best represent the appropriate uncertainty distribution for use in seismic hazard analysis for DCPP. All four slip rate site analyses were interpreted to be technically defensible in the 2015 SSC SSHAC study, which followed the process for a SSHAC Level 3 study with a full TI Team and PPRP. The traits common to the slip rate sites were that the amounts of offset and ages of the offset features could be constrained with technically defensible uncertainty distributions such that the uncertainty distributions from each site were understood and incorporated in the analysis. Instead of treating the four locations as true epistemic alternatives—that only one of the four sites could be "correct" and the others "incorrect", the TI Team took the approach of considering the relative merits of each site to derive a weighted slip rate uncertainty distribution (e.g., the process in Figure 1-1). This methodology acknowledges that each slip rate site is likely to have uncertainties that are either not captured or are incorrectly captured in the analysis. Higher weighted sites reflect a higher confidence that the slip rate distributions are more likely to capture the "correct" uncertainty distribution for hazard. The inclusion of slip rate information from all four sites in a weighted scheme represents a hedge that collectively the four sites can capture uncertainties in the parameter of interest (correct slip rate for the Hosgri fault for hazard at DCPP) better than any one site alone. This approach to weighting slip rate sites on the Hosgri was also discussed in PG&E (2025):

"The TI Team's approach is to evaluate each technically defensible site as a possible correct representation of the long-term slip rate in the current tectonic regime, and weight that site by its relative likelihood of being "correct." The philosophy is that including more information that is technically reasonable in the analysis has a better chance of approaching the correct result. Attaching zero weight to alternative locations is a very strong statement and would require that the data or method used to develop the slip rate at the site is technically not defensible, or that the rate is demonstrably wrong. The process does not substitute what is "preferred" given the available data with what provides the possible "correct" answer."

During the 2024 seismic assessment, which was performed under a more limited SSHAC Level 1 process that in part assessed whether there is justification to update the existing SSHAC Level 3 study, the TI Team and IPRP specifically discussed whether any of the sites deserved a weight of zero. Because there were no new data for the San Simeon and Point Estero sites that would discount their weight to zero at the time of the study, and because all four sites were being considered individually, all sites received weights greater than zero.

Ongoing studies could impact the weighting for each site in future assessments. An updated sequence stratigraphy model is being developed that incorporates sparker geophysical data reprocessed by the USGS, new chirp geophysical data collected by the USGS in 2025, and new age dating. The onshore Hosgri fault is also being evaluated by Dr. Kim Blisniuk from San Jose State University.

Appropriate Slip Rate Time Frame for PSHA

The IPRP argues that because faults can have temporally variable slip rates a PSHA should include the selection of a time frame for slip rates that best represents the current seismic hazard regime. The IPRP proposes that there is evidence to suggest that the Hosgri slip rate has increased through late Quaternary time, and this evidence should be considered by PG&E. The IPRP suggests that a slip rate increase is supported by 1) the Hosgri slip rate data used in the 2024 seismic assessment, and 2) the CNWRA study results.

Of the four slip rate sites and slip rate distributions used in the 2015 and 2024 studies, three of the slip rate sites (the onshore San Simeon fault site and the offshore Estero Bay and Point Sal sites) have slip rates averaged over hundreds of thousands of years and one of the sites (the CHS site) is averaged over the past ~12 thousand years. The average (e.g., median) slip rates from the three longer term slip rate sites are lower than the CHS site average slip rate, but all four sites have uncertainty ranges that overlap within the uncertainty bounds (Figure 1-1). There is, in fact, a large area of overlap among the four slip rate sites, and therefore the evidence for any increase in slip rate through time from the Hosgri slip rate sites is not statistically meaningful.

Under the presumption that the Hosgri slip rate averaged over ~12 thousand years is higher than the slip rate averaged over hundreds of thousands of years, it is not certain that the higher slip rate measured over a shorter time frame is the correct slip rate to use in the PSHA. A model discussed during the SSHAC Level 1 study between the TI Team and PPRP is that the CHS slip rate may be elevated due to temporal clustering of large earthquakes (possibly related to rapid sea-level rise) that is not representative of the long-term average

rate of earthquakes in the current tectonic regime. In this case, both higher and lower slip rate estimates from alternative slip rate sites would capture uncertainty in the correct rate to use given the absence of information on whether the Hosgri is currently in a period of clustered activity, quiescence, or average rates of recurrence. Including weight on slip rates averaged over different time periods, therefore, also has the effect of incorporating alternative models of earthquake recurrence appropriate for the Hosgri fault source beyond the time-dependent uncertainty captured in the EPHR.

Ongoing research by the USGS can potentially test the consistency of Hosgri fault slip rates over time. One effort focuses on developing paleoseismic event records for multiple pull-apart basins along the Hosgri fault near DCPP. If successful, this study could test whether there were earthquake clusters over the last ~12 thousand years. Another potential study focuses on dating offset post MIS-2 channels near Point Sal. Slip rates from these channels could be compared to rates from older channels documented in Nishenko et al. (2025) to test the consistency or variability of slip rates through time.

Regarding the evidence for an increase in Hosgri slip rate interpreted in the CNWRA study, we discuss above (as part of the response subsection, *Relevance of studies not considered in the 2024 seismic assessment*) that the CNWRA study slip rates rely on kinematic interpretations that are incompatible with the CHS site slip rate. Due to this incompatibility alone, the evidence for an increase in the Hosgri slip rate documented in the CNWRA study is not considered to be strong. Further, we summarize below findings from the LCI report (LCI, 2026) that suggest the evidence used to interpret a slip rate *increase* through time is better interpreted as a slip rate *decrease* based on interpretation of recently reprocessed seismic reflection data and recently available age information.

LCI's review of the CNWRA study interpreted new data collected by the USGS to reevaluate key interpretations and assumptions used to develop the slip rate estimates (LCI, 2026). The USGS data include reprocessed seismic reflection data and new geophysical and geochronological analysis of an isolated Quaternary basin directly east of the Half Graben fault (Figure 2-1). We note that the term Half Graben fault is used hereafter to refer to this particular reach of fault and is not used to indicate a particular kinematic interpretation. This isolated Quaternary basin is referred to as the intra-shelf basin in LCI (2026). USGS geophysical lines collected in 2008 and 2009 were reprocessed in 2019 to improve their resolution. LCI found that processing approaches by Kluesner et al. (2019, 2023b) led to improvements in vertical resolution and reflection coherency. LCI also found that the accuracy of interpretations has been improved in the new dataset through 1) correction of static variations; 2) removal of misleading reflections from multiples; and 3) unmasking of

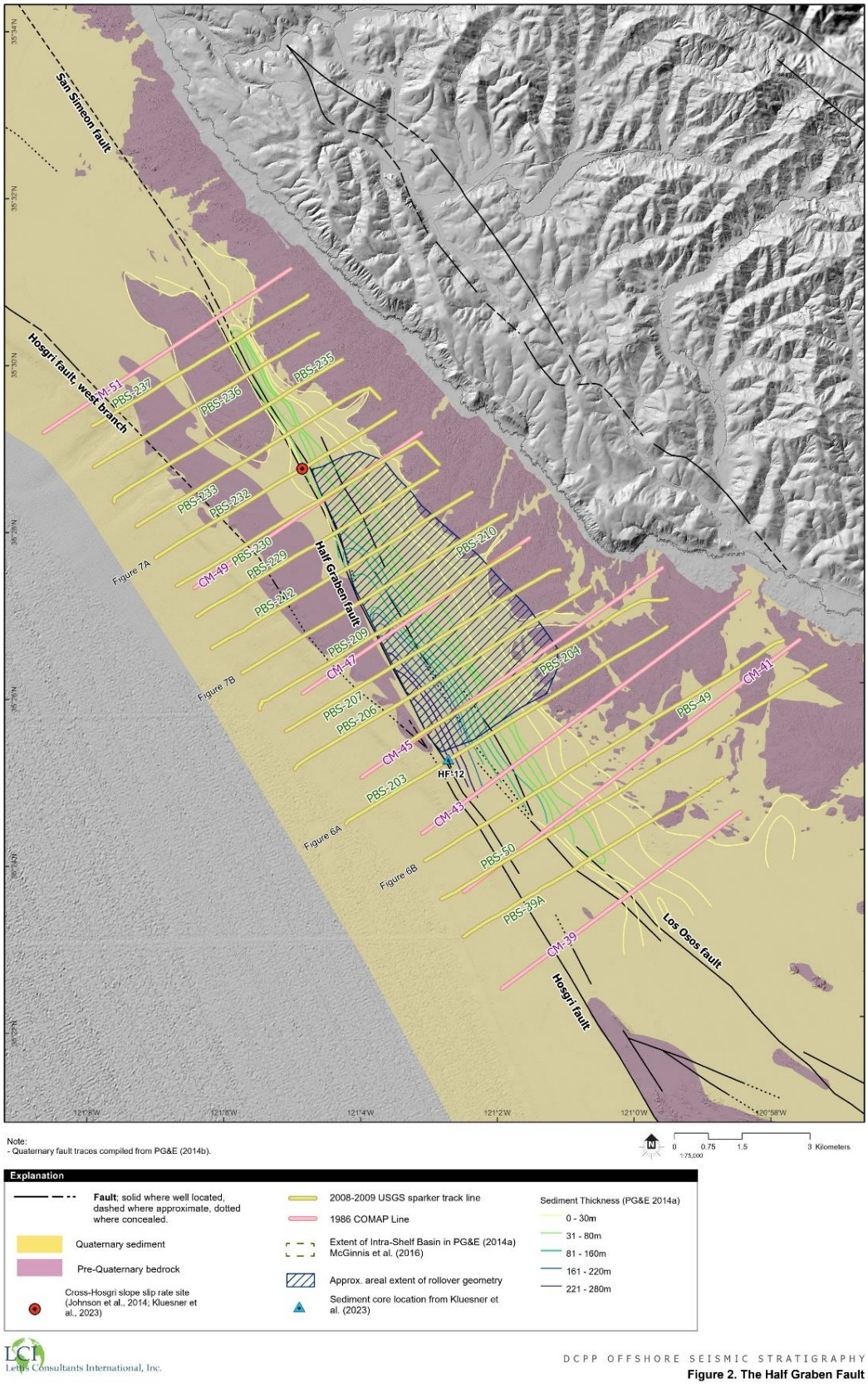
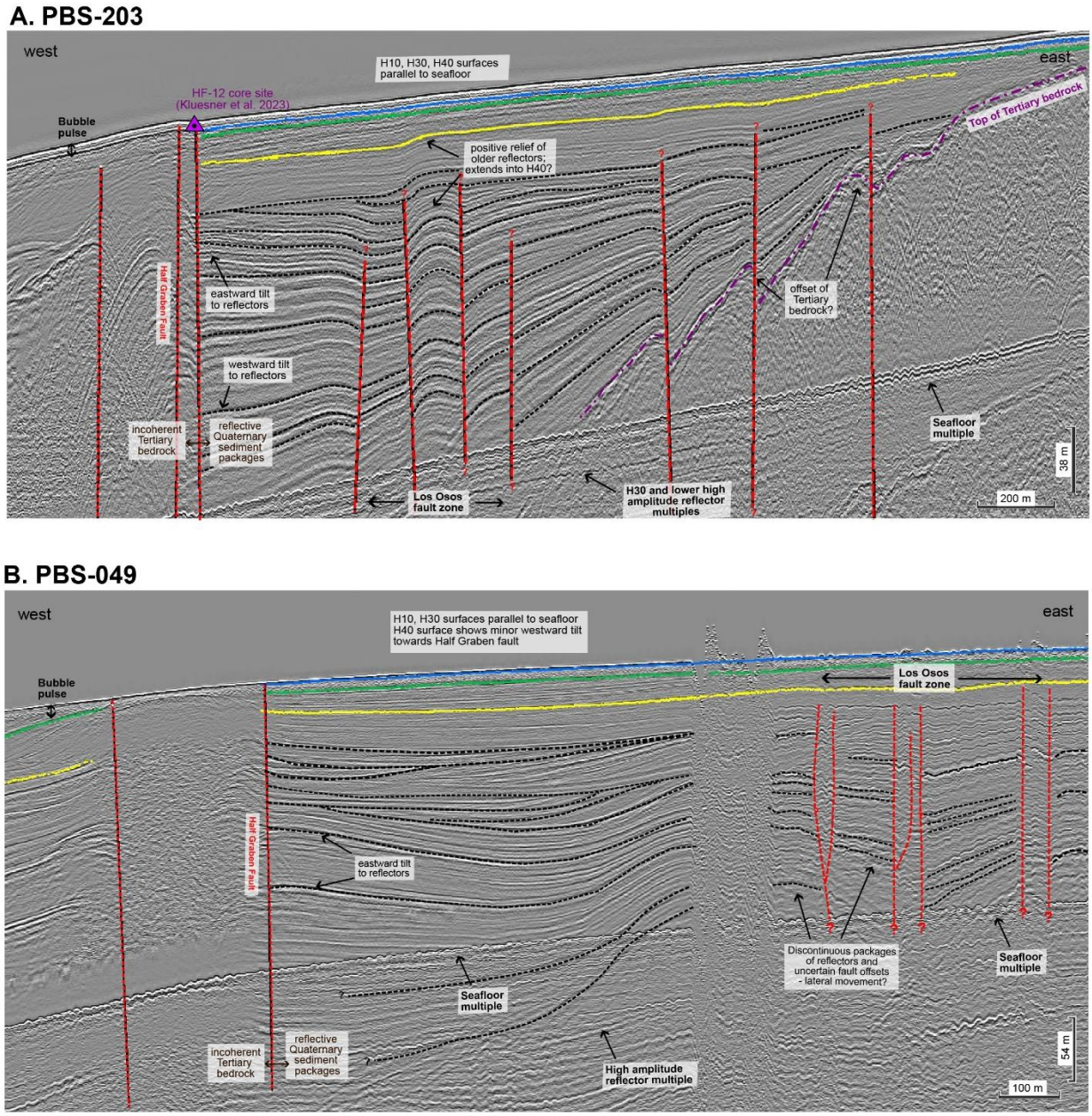


Figure 2-1 The Half Graben fault, CNWRA study area and Cross Hosgri Slope site.

fine-scale geologic contacts. LCI used these data to re-interpret structures and Quaternary stratigraphic features along the Half Graben fault interpreted previously by PG&E (2013) (Figures 2-2 and 2-3). In addition to the reprocessed sparker data, LCI also evaluated older versions of the sparker data and selected COMAP86 higher energy seismic lines to better understand data resolution and uncertainties in defining fault geometry and the mapping of unconformities into the Half Graben fault.

LCI (2026) also evaluated chirp profiles, sedimentological analysis of sediment cores, and radiometric dating of core samples that were used along with previously collected multibeam bathymetry to reassess the slip rate of the Half Graben fault at the CHS slip rate site (Johnson et al., 2014; Medri et al., 2023; Kluesner et al., 2023a). LCI found that new data obtained from chirp seismic reflection profiles and shallow sediment cores in the intra-shelf basin have a direct bearing on two important aspects of the CNWRA model: the kinematic interpretation of the Half Graben fault (discussed above in the response subsection, *Relevance of studies not considered in the 2024 seismic assessment*) and the age of the late Quaternary unconformities. LCI highlights that the CHS slip rate site coincides approximately with the intersection of line PBS-232 with the Half Graben fault (Figure 2-3B), where relict shoreface morphology imaged in multibeam data crosses the fault at a high angle, and the break-in-slope at the base of the feature is used as a linear feature to estimate fault offset. At this site, the Half Graben fault is interpreted to be the primary, strike-slip strand of the Hosgri fault zone (Johnson and Watt, 2012; PG&E, 2013; Johnson et al., 2014; Kluesner et al., 2023a) and not a normal fault within a right releasing stepover as interpreted by PG&E (2014a) and McGinnis et al. (2016).

The second finding of the recent work is that the horizon mapped as H10 by PG&E (2013; 2014b) within the intra-shelf basin is below the post-LGM transgressive surface of erosion and therefore is older than previously thought. One piston core (HF-12) collected from near the southern end of the basin penetrated the post-LGM transgressive surface of erosion at a depth of about 80-85 cm below the seafloor. The lateral extent of this unconformity was traced on newly acquired, very high-resolution chirp profiles, and the age was defined from sedimentological interpretations of the core, and radiocarbon and OSL dates (Kluesner et al., 2023a). The site is located directly east of the Half Graben fault near line PBS-203 (Figures 2-1 and 2-2B). The location of the post-LGM unconformity identified by Kluesner et al. (2023a) is several 10s of meters shallower than the horizon mapped as H10 by PG&E (2013; 2014b) using the USGS sparker data.



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Figure 6. Re-processed Seismic Reflection Profiles PBS-049 and PBS-203

Figure 2-2 Re-processed Seismic Reflection Profiles PBS-049 and PBS-203. From LCI (2026).

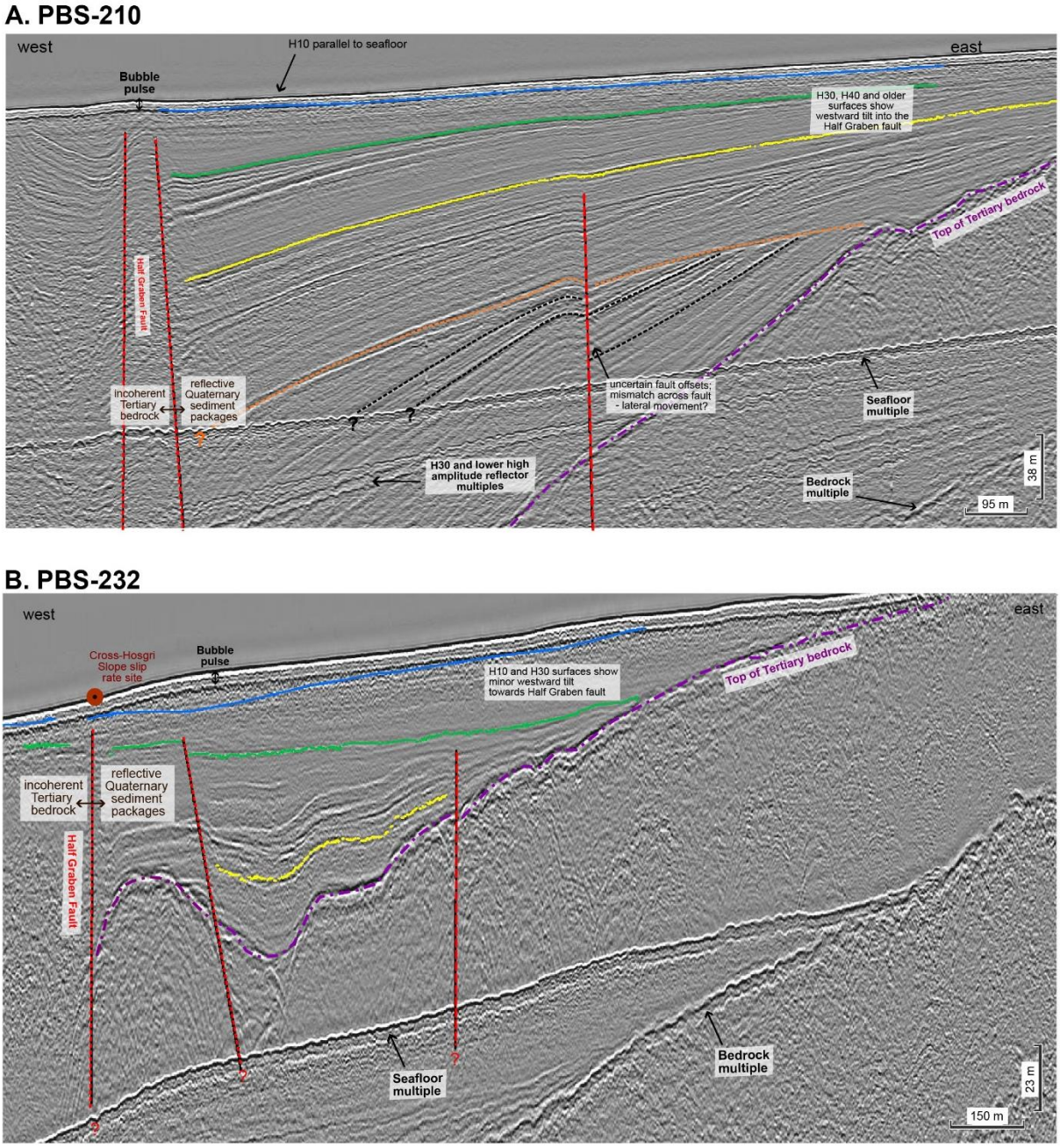


Figure 2-3 Re-processed Seismic Reflection Profiles PBS-210 and PBS-232. From LCI (2026).

The chirp seismic data used by Kluesner et al. (2023a) focuses on the upper 20 m of the subseafloor and some of these very high-resolution data were reviewed for LCI's assessment. LCI (2026) found that the post-LGM transgression surface is relatively continuous and well-imaged as a high amplitude reflection in the chirp data that separates and truncates weakly reflective material below (acoustically transparent) and high amplitude, but discontinuous reflections showing depositional bedforms above. This horizon is not resolvable within much of the intra-shelf basin in the USGS sparker data used in the PG&E (2013; 2014a; 2014b) analyses as it is within the bubble pulse. Initial review of the chirp and reprocessed sparker data suggests that the horizon mapped previously as H10 likely represents the penultimate major transgressive surface of erosion, or the MIS 6 to MIS 5 transition approximately 135–125 ka (LCI, 2026). Similarly, the horizon previously mapped as H30 likely represents a prior major glacial-interglacial transition, either the MIS 8 to MIS 7 transition approximately 250 ka, or the MIS 10 to MIS 9 transition approximately 340 ka. The horizon previously mapped as H40 likely represents a major transgressive surface of erosion between approximately 340 ka (MIS 10 to MIS 9) and approximately 625 ka (MIS 16 to MIS 15). Whether this new interpretation is restricted to the intra-shelf basin or whether it applies also to the previous interpretation of the outer shelf by PG&E (2013; 2014b) is the subject of a separate, ongoing evaluation.

The reanalysis of the reprocessed sparker seismic-reflection data and the core analysis and age dating by Kluesner et al. (2023a and 2023b) results in recognition that the post-LGM transgressive surface of erosion (by definition the H10 horizon) is shallower than recognized previously by PG&E (2013). This finding requires a reassessment of the interpreted ages of the three mapped unconformities within the Quaternary sediments of the intra-shelf basin and a corresponding reassessment of the interpreted slip rates through time in the CNWRA study. Table 2-1 illustrates the impact of age uncertainties of the horizons on slip rate calculated for seismic line PBS-210 (Figure 2-3A), which is the line that produced the maximum slip rates in the McGinnis et al. (2016) analysis. The table shows three alternative model realizations: The CNWRA study (McGinnis et al., 2016), a minimum age model from LCI (2026), and a maximum age model from LCI (2026). For each realization, Table 2-1 lists the interpretation of the three unconformities mapped by PG&E (2013) in the intra-shelf basin within the upper portion of the Quaternary sediments.

These are recognized from the seafloor down as the first, second, and third unconformities. In PG&E (2013) and McGinnis et al. (2016), these are interpreted as horizons H10, H30, and H40, respectively. In the reanalysis for this study, these are interpreted as H30, H40, and an unnamed horizon below H40, respectively (Table 2-1; Figures 2-2 and 2-3).

Table 2-1. Uncertainty Analysis of Age Model Using Example of Line-210 (From LCI, 2026)

Table 2. Uncertainty Analysis of Age Model Using Example of Line PBS-210

REALIZATION	UNCONFORMITY ORDER:	FIRST	SECOND	THIRD
CNWRA study (McGinnis et al., 2016)	Horizon Name	H10	H30	H40
	Sea-Level Transgression	MIS 2-1	MIS 6-5	MIS 16-15
	Model Age (ka)	20	135	625
	Model Slip Rate (mm/yr)	4.54	3.36	1.21
This study, minimum age model	Horizon Name	H30	H40	n/a
	Sea-Level Transgression	MIS 6-5	MIS 8-7	MIS 10-9
	Model Age (ka)	135	250	340
	Model Slip Rate (mm/yr)	0.67	1.81	2.22
	Percent change from 2016 CNWRA	**-85%**	**-46%**	**84%**
This study, maximum age model	Horizon Name	H30	H40	n/a
	Sea-Level Transgression	MIS 8-7	MIS 12-11	MIS 16-15
	Model Age (ka)	250	430	625
	Model Slip Rate (mm/yr)	0.36	1.05	1.21
	Percent change from 2016 CNWRA	**-92%**	**-69%**	**0%**

At line PBS-210, the CNWRA study interpretation results in Hosgri fault-parallel slip rates of 4.54, 3.36, and 1.21 mm/yr for the first, second, and third unconformities, respectively (Table 2-1). This result, along with the lower slip rate estimated using UNCON2, led to a result of an apparent increase in slip rate over the Quaternary. McGinnis et al. (2016) speculated that this apparent increase in slip rate may represent either an increase in slip rate on the Hosgri and San Simeon faults, or an increase in linkage between the two faults recorded by the Half Graben fault. The results of LCI's re-analysis show the sensitivity of the slip rate results to the age model used. Recognition that the first unconformity mapped by PG&E (2013) is H30 instead of H10 significantly changes both the magnitude of the slip rates and the slip rate pattern. Using a minimum age model, the ages of the first, second, and third unconformities are about 135, 250, and 340 ka, respectively. These ages change the calculated Hosgri fault-parallel slip rate interpreted on line PBS-210 to be, from

youngest to oldest, 0.67, 1.81, and 2.22 mm/yr, respectively. The percent change in slip rate is substantial: the updated age model for the first unconformity results in a -85% change in slip rate (from 4.54 mm/yr to 0.67 mm/yr) and a reassessment of the third unconformity results in a 84% increase in slip rate (from 1.21 to 2.22 mm/yr). Not only do the horizon slip rates change, but the pattern of slip rate change through time reverses: under the new interpretation, the interpreted Hosgri-parallel slip rates appear to *decrease* through the middle to late Quaternary (Table 2-1). Using a maximum age model, the first mapped unconformity plausibly represents the MIS 8-7 transgression that is about 250 ka. This would result in a Hosgri-parallel slip rate of 0.36 mm/yr (Table 2-1). Work is ongoing to assess whether the new USGS data will change the age model for the Estero Bay site.

Adjustments to Published Slip Rates

The IPRP requests detailed documentation justifying setting the offset limits at the CHS site to 10 m beyond the ± 2 standard deviation values from the Johnson et al. (2014) analysis. The IPRP also requests that PG&E vet adjustments with the authors of Kluesner et al. (2023a).

Section 5.2.2 of the 2024 seismic assessment (PG&E, 2024) and the response to IPRP report 16 (PG&E, 2025) provide in detail the basis for increasing the uncertainty from Johnson et al (2014) and Kluesner (2023a). The 2024 seismic assessment uses the preferred offset interpretation of Johnson et al. (2014) directly from the USGS analysis (see preferred min and preferred max on Table 5-13 in PG&E (2024). In terms of the center, body and range, these values represent the body. The limits represent the potential full uncertainty range and considers that the USGS range may not be broad enough given additional sources of uncertainty not captured in the calculation. Examples of additional sources of uncertainty include: (1) Johnson et al (2014) used only a subset of survey data points from the bottom break-in-slope to estimate offset, and other combinations of survey points would produce different offset amounts, and (2) the findings from Medri et al. (2023), Kluesner et al. (2023a), and a geomorphic assessment of the shoreface by PG&E (2015) that demonstrated post-formation modification of the lower break-in-slope due to slumping and deposition of remobilized sediment off the shoreface. PG&E (2024) noted that the high-resolution chirp profiles crossing the shoreface demonstrate the potential for additional uncertainties in the use of the lower break in slope to represent the offset of the base of the shoreface not included in the analysis by Johnson et al. (2014). The number of chirp profiles crossing the shoreface, however, are insufficient to characterize the variability in the spatial relationship between the lower slope break on the seafloor and the top of the shoreface deposit representing the offset feature. Assuming the variability is negligible and the lower slope break is a precise proxy for the offset shoreface does not

seem justified given the available information. The ±10 m value given to represent the additional uncertainty due to post-shoreface modification of the seafloor is not a quantitative measurement based on data analysis, but rather an estimate of the potential additional uncertainty due to information that has not been collected and assessed. This additional uncertainty used to define a broader range of possible slip rates at the site is included as part of the principle that uncertainties that are recognized but may not be precisely measurable should not be treated as zero.

PG&E has discussed the increase in uncertainty limits at the site and asked the USGS to further evaluate offset measurements at the site. This led the USGS to collect additional chirp lines across the CHS slope in 2025 and plan for additional data collection and analysis in 2026. This work is ongoing.

Adjustments to Modelled Hosgri Slip rate

The Hosgri fault slip rate used in the 2024 seismic assessment reflects the data considered in the assessment, and weighting based on the judgement of the TI Team, which was reviewed by the PPRP. The mean rate and uncertainty range is consistent with the slip rates published by Nishenko et al. (2025) for the Point Sal site after the 2024 seismic assessment was completed. The Hosgri slip rate sensitivity indicates that there is no meaningful impact to plant safety even if the higher CHS slip rate is applied exclusively.

IPRP REQUEST 3

We request PG&E evaluate the implications of a Casmalia fault study (McGregor and Onderdonk. 2021) that reports an order of magnitude increase in slip rate over previous estimates to a reported rate of 5.6 - 6.7 mm/yr and assess potential kinematic linkages and fault interactions with the Hosgri fault. This evaluation should be part of the seismic hazard Update regardless of planned future work that is part of the LTSP or whether the fault is considered a stand-alone seismic source.

The IPRP request relates to kinematic models of slip transfer between the Hosgri and nearby faults described in the 2015 SSC model (PG&E, 2015) that potentially explain an apparent southward decrease in Hosgri fault slip rate due potential kinematic linkages with nearby, branching faults. The IPRP notes that the model is speculative because few branching structures along the Hosgri have quantitative slip rate estimates. The slip rate calculated for the Casmalia fault by McGregor and Onderdonk (2021) is an exception. Because the possible slip rate gradient is one of the factors used to weight slip rate sites

along the Hosgri fault (PG&E, 2015; 2024), the IPRP argues that the McGregor and Onderdonk (2021) study should have been discussed in the 2024 seismic assessment.

As noted in PG&E (2025), and acknowledged by the IPRP in its response to PG&E (2025), the 2024 seismic assessment focused on hazard-significant fault sources near the plant. Sensitivity studies from the 2015 SSC report indicated that the distant faults such as the Casmalia fault are too far from the plant to have a significant impact on hazard. The implications of the McGregor and Onderdonk study on slip transfer were not discussed in the 2024 seismic assessment and are discussed here.

McGregor and Onderdonk (2021) calculated a dip-slip rate of 5.6–6.7 mm/yr on the Casmalia fault in the Santa Maria Basin. The slip rate was calculated using a late Pleistocene sedimentary deposit in the Santa Maria Basin—the Orcutt Formation—as a strain marker. Reconstructions of the basal contact of this unit and forward kinematic modeling were used to estimate tectonic shortening and dip slip displacement, and the age of the basal contact of the Orcutt Formation was estimated from luminescence dating. The results of the study indicate a relatively high rate of shortening across the Santa Maria Basin, which the authors attribute primarily to continued clockwise rotation of the western Transverse Ranges into late Quaternary time.

McGregor and Onderdonk (2021) discuss implications of their findings for regional active tectonics. They note that the style and rate of deformation in the basin is consistent with other studies that suggest the Santa Maria Basin is a transition zone between the southern Coast Ranges and Western Transverse Ranges, containing elements of both tectonic domains. More westerly striking faults such as the Casmalia fault have high rates of shortening similar to faults in the Transverse Ranges. More northerly striking and basin-bounding faults such as the Hosgri and Foxen Canyon dip more steeply and accommodate transpression indicative of some faults in the southern Coast Ranges. McGregor and Onderdonk (2021) note that their results fit models that attribute shortening to vertical axis rotation of the western Transverse Ranges. Their interpretations are also compatible with a southward decrease in right-lateral slip on the Hosgri fault by transferring right-lateral shear into shortening in the Western Transverse Ranges, which they argue could be accommodated by variations in dip-slip displacement along strike of reverse faults in the basin.

McGregor and Onderdonk's (2021) findings qualitatively support a southward decrease in slip on the Hosgri fault, although their publication does not attempt to quantify the exact kinematics and amount of decrease. The contribution from western Transverse Ranges

rotation is also not quantified other than to use estimates of shortening across the Santa Maria Basin to provide first-order constraints on the total post-Miocene offset on the southern Hosgri fault. Lastly, McGregor and Onderdonk (2021) postulate that slip was also siphoned off the Hosgri fault somewhere north of the Santa Maria Basin and transferred onto the West Huasna-Foxen Canyon-Little Pine fault trend between mid-Miocene and early Pleistocene time.

Since PG&E's 2024 seismic assessment, a publication by Nishenko et al. (2025) offers a reanalysis of offset channels west of Point Sal that yields a range of slip rates consistent with either a northward increase in slip rates or relatively stable slip rates between Point Sal and the Cross Hosgri Slope site. This work, any new information from ongoing research on the timing, rate and kinematics of deformation in the Santa Maria Basin and planned research on slip rates from offset Late Pleistocene to Holocene channels offshore Point Sal will be considered during ongoing LTSP research.

REFERENCES

Biasi, G.P. and Thompson, S.C., 2018. Estimating time-dependent seismic hazard of faults in the absence of an earthquake recurrence record. *Bulletin of the Seismological Society of America*, 108 (1): 39-50.

DiSilvestro et al., 1990. The San Simeon/Hosgri Pull-Apart Basin, South-Central Coastal California, EOS Transactions of the American Geophysical Union. 71 (43). p. 1,632.

Independent Peer Review Panel (IPRP), 2024. Initial Review of the PG&E "Updated Seismic Assessment, February 2024" by the Independent Peer Review Panel for Seismic Hazard Studies of the Diablo Canyon Nuclear Power Plant: IPRP Report No. 16, dated August 26, 2024, 44 pages.

Independent Peer Review Panel (IPRP), 2026. Independent Peer Review Panel Response to PG&E's 2024 Updated Seismic Assessment dated February 19, 2026, 12 pages.

Johnson, S.Y., Hartwell, S.R., and Dartnell, P., 2014. Offset of latest Pleistocene shoreface reveal slip rate on the Hosgri strike-slip fault, offshore central California: *Bulletin of the Seismological Society of America,* 104 (4): 1650–1662.

Kluesner, J., Brothers, D., Hart, P., Miller, N. and Hatcher, G., 2019. Practical approaches to maximizing the resolution of sparker seismic reflection data. *Marine Geophysical Research*, 40(3): 279-301.

Kluesner, J.W., Johnson, S.Y., Nishenko, S.P., Medri, E., Simms, A.R., Greene, H.G., Gray, H.J., and 5 others, 2023a. High-resolution geophysical and geochronological analysis of a relict shoreface deposit offshore central California: Implications for slip rate along the Hosgri fault: *Geosphere,* 19 (6): 1788–1811, doi:10.1130/GES02657.1.

Kluesner, J.W., Balster-Gee, A.F., Johnson, S.Y. 2023b. Reprocessed single channel sparker seismic reflection data offshore central California from USGS field activities S-6-08-SC and S-6-09-SC. Published: Nov. 7, 2023.

Lettis, W.R., L. DiSilvestro, K.L. Hanson, and G.I. Shiller, 1990. The San Simeon/Hosgri Pull-Apart Basin; Implications for Late Quaternary Activity on the Hosgri Fault Zone, in W.R. Lettis, K.L. Hanson, K.I. Kelson, and J.R. Wesling, eds. Neotectonics of the South-Central Coastal California: Friends of the Pleistocene. Pacific Cell. 1990 Fall Field Trip Guidebook. pp. 91–138.

Lettis Consultants International (LCI), 2026. Review of the 2016 Center for Nuclear Waste Regulatory Analyses (CNWRA) analysis of the Half Graben fault (Hosgri fault zone), Report to PG&E, dated January 8, 2026.

McGinnis, R.N., Morris, A.P., Ferrill, D.A., Smart, K.J., Stamatakos, J.A., Juckett, M.R., 2016. Independent Evaluation of the Hosgri Fault Slip Rate Based on a Structural Analysis of the Pull-Apart Basin Linking the Hosgri and San Simeon Fault Systems. Unpublished report prepared by the Center for Nuclear Waste Regulatory Analyses (CNWRA), San Antonio, Texas, for the US Nuclear Regulatory Commission. August.

McGregor, I.S., and Onderdonk, N.W., 2021. Late Pleistocene rates of rock uplift and faulting at the boundary between the southern Coast Ranges and the western Transverse Ranges in California from reconstruction and luminescence dating of the Orcutt *Formation: Geosphere,* 17, no. 3, pages 932-956, https://doi.org /10.1130/GES02274.1.

Medri, E., Nishenko, S.P., Simms, A.R., Kluesner, J., Johnson, S.Y., Greene, H.G., and Conrad, J. E., 2023. Subaqueous clinoforms created by sandy wave supported gravity flows: Lessons from the central California shelf: *Marine Geology,* 456: 106977, 13 pages, doi:10.1016/j.margeo.2022.106977.

Nishenko, S., Greene, H. G., Bergkamp, B., & Hogan, P. J., 2025. High-resolution three-dimensional seismic imaging reveals structure and slip rate of the Hosgri fault zone offshore Point Sal, California, United States. *Geosphere*, 21(4), 720-752. doi:10.1130/GES02706.1.

Pacific Gas and Electric Company (PG&E), 2013. Stratigraphic Framework for Assessment of Fault Activity Offshore of the Central California Coast Between Point San Simeon and Point Sal. PG&E Technical Report GEO.DCPP.TR.13.01. 76p.

Pacific Gas and Electric Company (PG&E), 2014a. Interpretation of Seismic Reflection Data, Point Buchon to San Simeon Point. PG&E Technical Report, GEO.DCPP.TR.14.05.

Pacific Gas and Electric Company (PG&E), 2014b. Offshore Low-Energy Seismic Reflection Studies in Estero Bay, San Luis Obispo Bay, and Point Sal Areas. PG&E Technical Report, GEO.DCPP.TR.14.02.

Pacific Gas and Electric Company (PG&E), 2015. Seismic Source Characterization for the Diablo Canyon Power Plant, San Luis Obispo County, California; report on the results of SSHAC level 3 study, Revision A, March.

Pacific Gas and Electric Company (PG&E), 2024. Diablo Canyon Updated Seismic Assessment, Response to Senate Bill 841, unpublished technical report, dated February 1, 2024, 392 pages.

Pacific Gas and Electric Company (PG&E), 2025. Pacific Gas and Electric Company's Response to California Public Utility Commission Independent Peer Review Panel Report No. 16, dated January 14, 2025, Letter DCL-25-003, 30 pages.