Alan Morris

From:Alan Morris
Sent:28 May 2015 19:08:23 +0000
To:Ronald McGinnis;Kevin Smart;David Ferrill;Sarah Wigginton
Subject:Diablo Canyon IMHO
For what it's worth:

As far as I can tell from the reports and presentations available to us, the Central Coastal California Seismic Imaging Project from Pacific Gas & Electric seems fine, that is:
(1) I think they characterized the kinematics of the area/region accurately
(2) The fault model choices seem logical, although not very broad in scope
(3) Without working through a complete example with the data, it seems that their slip rates and fault kinematic models are reasonable and therefore...
(4) The hazard conclusions are probably also reasonable

Another caveat:
There are clearly normal faults along parts of the Hosgri fault zone and it is not obvious how they have been incorporated into the kinematic model(s).

With respect to displacement on the Hosgri fault zone as measured by displaced channels, I feel the need to work through this from data to hazard curve. The relevant data seems to be the 2D/3D low-energy seismic surveying (LESS) discussed in chapter 3 of the Central Coastal California Seismic Imaging Project report. I think the data were collected by Fugro in 2011 - 2012, we probably don't want the raw data, but the final cut together with their interpretations in seg-y form for import into both Petrel and Move.

Another dataset that would be nice is the USGS (Jeanne Hardebeck's) re-calculated hypocenter data, she sent us the older set a while back, but I think she has both new events and a newly calculated set of hypocenters.

There may be other things but that's my $0.02.

Alan

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John Stamatakos

From:John Stamatakos
Sent:27 Mar 2015 20:00:44 +0000
To:Ronald McGinnis;David Ferrill;Amy Minor;Kevin Smart
Cc:Miriam R. Juckett
Subject:Diablo Canyon Review
I've place most of my Diablo Canyon files on the DEMPS server (Demps\regios).

There are a series of reports that Pacific Gas & Electric (POG&E) produced over the last few years.

1. **Shoreline and RIL**: The Shoreline report was submitted by PG&E in 2011 and we (with NRC review if in 2012). The Regulatory Information Letter (RIL 12-01) is that review. This report and review focused on the Shoreline fault and potential implications to the Licensing Basis for the plant. But the reports offer some good general background information. Other files in this folder are related to the Shoreline Report and the RIL.
2. **DCPP Shoreline and Thrust Fault Allegation**: In addition to the Shoreline Report, NRC had us look at an allegation made by (b)(6) [redacted] about other possible faults and the plant. Alan helped me on one of the allegations (possible blind thrust beneath the plant site).
3. **Central Coastal California Seismic Imaging Project**: The California state legislature passed a bill after the Shoreline Report authorizing PG&E to collect boat load of new seismic imaging data. This report is essentially a data dump of that work, and it has the bulk of what I would like you all to look at.
4. **LTSP**: This is an old PG&E report (1991) that may also be useful as background.
5. **NTTF DCCP PSHA Review**: This is the actual new seismic hazard study that we are reviewing. We will need to cross reference the conclusions about faults (do they exist, their geometry, slip rate, length and area, etc.) based on seismic imaging to the data in the CCCSIP report.
6. **Diablo Canyon ISFSR SER** : This was our review of the site back in early 2000's for the Independent Spent Fuel Storage Installation (ISFSI). May be useful as background information.
7. **Figure**: is a folder I use to put in various figures and some of my Diablo Presentations and related images.

For reference: http://www.pge.com/en/safety/systemworks/dcpp/seismicsafety/index.page

This link gets you to most of these reports on line.

Work Scope:

I have five progressive tasks in mind.

1. Look through the CCCSIP documents and develop a summary (catalog) of all the seismic imaging data that's there. Identify the who, what and where and assess its quality and possible usefulness to the PSHA. I think we can do this relatively quickly. We can even bring on a temp/student if available and willing to work on this. NRC wants to be able to say that they are familiar with all the data and have looked it over as part of the review. I would like to have a very quick deliverable on this (couple of pages?) relatively soon.

2. Identify which data in the CCCSIP report is actually relied on to develop conclusions in the new PSHA. Assess the validity of the structural/seismic interpretations from the quality of the seismic imaging data. This may take a bit longer than task 1, but I hope we can do this relatively quickly.
3. Identify potential faults in the data sets that may have been overlooked by the PSHA technical team. I am **not** suggesting we identify any vague targets, but if you see images that in your view (and based on your experience) are very likely significant faults, we should tag them and assess their potential to influence the seismic hazard at the site.
4. For those critical data sets identified in task 2, complete a technical review of the data and the interpretations. This will be included in our write up for the overall PSHA assessment.
5. Review the 3D data collected in the Irish Hills to reassess the blind thrust fault model (I think it is now referred to as the San Luis Range Thrust).

I'll walk you all through this again next week and provide some more background on the PSHA and how we can assess whether fault sources can be important to the PSHA next week.

Thanks,

John

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John Stamatakos

From:John Stamatakos
Sent:12 May 2015 20:11:18 +0000
To:Debashis Basu;Kaushik Das
Subject:Diablo Matlab work
OK, I put everything in S:\John Stamatakos\Diablo Files

It includes chapter 8 from the PG&E report, all the figures that uses these PDFs and CDFs in the analysis, the email from George and Osvaldo helping with the formula, and my Excel Spread sheet.

The question is, can we code up MATLAB to make these distribution?

Thanks

John

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John Stamatakos

From:John Stamatakos
Sent:29 Apr 2015 19:45:20 +0000
To:Giacinto, Joseph (Joseph.Giacinto@nrc.gov);Plaza-Toledo, Meralis (Meralis.Plaza-Toledo@nrc.gov)
Subject:Diablo SSC

I had a good call with the San Antonio folk. I can meet after the Columbia meeting to talk through some of the early observations.

Thanks,

John

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Informal review of The Central Coastal California Seismic Imaging Project (CCCSIP) report (Pacific Gas and Electric Company)

By

GED

April 2015

The Central Coastal California Seismic Imaging Project (CCCSIP) report was produced by the Pacific Gas and Electric Company (PG&E) in response to a 2008 recommendation by the California Energy Commission (CEC). The California Energy Commission's 2008 report "An Assessment of California's Nuclear Power Plants: AB 1632 Report", also known as the "AB 1632 Report", recommended that Pacific Gas and Electric perform a series of geophysical investigations to explore fault zones near the Diablo Canyon Power Plant (DCPP). A primary goal of the investigations was to improve understanding of the seismic risk to the Diablo Canyon Power Plant, specifically:

- Hosgri Fault Zone slip rate
- Hosgri Fault Zone dip
- Hosgri–San Simeon fault zone step-over (i.e., are these faults linked so that will rupture in unison?)
- Los Osos fault zone slip rate
- Los Osos fault zone dip
- Los Osos fault zone sense of slip
- Hosgri–Shoreline fault zone rupture (i.e., are these faults linked so that will rupture in unison?)
- Shoreline fault zone slip rate
- Shoreline fault zone southern extent
- Shoreline fault zone segmentation

These issues were chosen because of their importance in choosing seismic source parameters used to model the seismic hazard for the Diablo Canyon Power Plant, and because of the uncertainty associated with them. Hazard is expressed as probability of ground motion acceleration exceeding 2 g at the key frequency of 5 hertz.

Three areas of study were specifically prescribed by the AB1632 report:

(1) PG&E should use three-dimensional geophysical seismic reflection mapping and other advanced techniques to explore fault zones near Diablo Canyon.
(2) As ground motion models are refined to account for a greater understanding of the motion near an earthquake rupture, it will be important for PG&E to consider whether the models indicate larger than expected seismic hazards at Diablo Canyon and if so, whether the plant was built with sufficient design margins to continue operating reliably after experiencing these large ground motions.

(3) PG&E should 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.

A range of data is presented and analyzed in the Central Coastal California Seismic Imaging Project report, most of it collected between 2009 and 2014, but including and drawing upon a variety of work performed over the previous 30 years. Work incorporated in the report was performed by PG&E, its contractors, and by the United States Geological Survey. The report is organized into the following sections:

Marine seismic reflection surveys (including analysis of natural seismicity data)

Chapters 2 and 4 – 2D/3D low-energy seismic surveying (LESS) to map the Hosgri, Shoreline and Point Buchon fault zones and associated folding west, northwest and north of Diablo Canyon Power Plant. Chapter 4 includes older, deep-penetration seismic data to investigate linkage between Hosgri and San Simeon fault zones and folding offshore and south of the Los Osos fault zone.

Important conclusions, chapter 2:

- "The main structural elements mapped in the study area are the Hosgri fault zone (HFZ), the Point Buchon fault zone, and a prominent syncline that deforms Tertiary strata in the southern two thirds of the study area."
- "The Hosgri fault zone consists of numerous fault strands and is the best imaged and most continuous and complex fault zone in the region."
- "... the local style of faulting changes along strike of the Hosgri fault zone. Graben A, bounded by right-stepping strands of the Hosgri fault zone in the north, indicates extensional strike slip faulting. A single fault strand characterizes the fault zone in the center of the study area. Numerous, relatively short strands fan out to the southeast and are associated with folds in the south, indicating compressional strike-slip faulting."
- "The Point Buchon fault zone, northwest of the central segment of the Shoreline fault zone, is a northwest-trending fault that disrupts Tertiary strata east of the HFZ"
- "... the Point Buchon fault zone may connect to the central segment of the Shoreline fault zone and associated structures"
- "Graben B is associated with the northern end of the Point Buchon fault zone"
- "...the structural relationship between the two grabens [A and B] and structures within Estero Bay to the north of the study area needs to be further evaluated"
- Because "the 3D/2D data are restricted to the shallow subsurface, the mapped surficial faults cannot be confidently extended to the earthquake hypocentral depths. Therefore, no conclusion can be made in regard to these faults being the source of the earthquakes that constitute the northern Shoreline seismicity sublineament"

Important conclusions, chapter 4:

- "...we were unable to observe any clear evidence in the seismic-reflection data for a recent fault connecting the San Simeon fault zone with the Hosgri fault zone. Our interpretations do not preclude the existence of a fault at depth or the possibility of a future rupture along this fault at depth, including propagation to the surface."
- "...we map the newly named Half Graben fault zone, a series of faults along which a half graben has formed, down-dropped on the east and tilted to the west ... The half graben is narrow in the north... To the south, the half graben widens considerably and appears to end near .... the Los Osos fault zone"

Chapter 3 – 2D/3D low-energy seismic surveying (LESS) to identify the southern extent, geometry, connectivity, and slip rate of the Shoreline fault, and the slip rate on the Hosgri fault zone. Older deep penetration data are also used.

Important conclusions:

- "Piercing points identified for constraining offsets along the Shoreline, Oceano, and Hosgri fault zones were identified ... buried paleochannels and paleoshorelines (paleostrandlines) were the best geomorphic features to use in evaluating offsets."
- "These studies reveal a more complex [Hosgri] fault zone than had previously been mapped".
- "...strands of the Hosgri fault zone [in the Estero Bay area] are generally steeply dipping to vertical..."
- "...sense of vertical separation across the Hosgri fault zone [in the Estero Bay area] is dominantly down to the west..."
- "Channel offsets and their interpreted ages yield a preferred lateral slip rate for the Hosgri fault zone in Estero Bay of approximately 1.6 ± 0.8 mm/yr within a high (90%) confidence interval. Accounting for uncertainties in ages and offset estimates, the range in lateral slip rate is between approximately 0.2 mm/yr and 3.6 mm/yr."
- [In the Point Sal Area] "The new mapping ... shows that from south to north, the Hosgri fault zone splits from a single strand with little or no vertical separation to multiple splays with substantial vertical and dextral shear, which converge to form a single strand once more. ... with transtension in the south and transpression in the north. There is an approximate 6-degree change in the strike of the Hosgri fault zone..."
- "Channel Complex F provides the preferred piercing points for estimating slip rates on the Hosgri fault zone in the Point Sal area."
- "a minimum estimated slip rate of 0.39 mm/yr (1.4 Ma at 550 m minimum offset) and a maximum estimated slip rate of 5.07 mm/yr (138 ka at 700 m maximum offset) is calculated for the Hosgri fault zone at Point Sal"

Chapter 5 – Deployment and monitoring of ocean bottom seismographs (OBS)

Important conclusions:

- "offshore events close to but outside the ocean bottom seismographs stations will have improved depth control; however, these events are still subject to uncertainty, particularly with regard to the focal mechanisms."

Chapter 6 – Characterization of the Hosgri fault zone using primarily post 1988 seismic reflection data but also some gravity and magnetic surveys. A 3D high-energy seismic survey (HESS) was proposed by PG&E, however, the California Coastal Commission denied PG&E's application due to concerns about the environmental impact of these studies.

Important conclusions:

- "Earlier models ... that identified the Hosgri fault zone as a major thrust fault underlying the Coast Ranges are not supported by the (older) high-energy marine 2D seismic-reflection data acquired during the Long Term Seismic Program (LTSP); nor are they supported by potential field and seismicity data collected during the Long Term Seismic Program Update and Central Coastal California Seismic Imaging Project [that's this one] program."
- "Geologic observation, seismicity data, and geophysical data all demonstrate that the Hosgri fault zone is a right-lateral strike-slip fault that dips steeply (75°–90°) northeast to a depth of 12–14 km in the vicinity of the Diablo Canyon power plant."
- "evidence for recent fault rupture between the Hosgri and San Simeon fault zones is not well imaged in some locations, [although] the data do not preclude the existence of fault linkage at seismogenic depths"
- "Chapter 13 presents a ground-motion hazard sensitivity analysis for the linkage of the Hosgri and San Simeon faults, and a combined rupture of the Hosgri–San Simeon and Shoreline faults"

<u>Land seismic surveys</u>

Chapter 7 – Description of the Geologic Mapping Project conducted by PG&E and also reported separately, well data from Honolulu-Tidewater #1, and introduction of natural seismicity, gravity and magnetic data, although the primary data presented in the chapter is 2D accelerated weight-drop (AWD) and a small vibro-seis 3D(?) volume of seismic reflection data. Several cross sections are drawn and the Pismo Syncline is described. The purpose was 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.

Important conclusions:

- "The Pismo syncline in the central and southern Irish Hills is the deformed remnant of a Neogene extensional basin."
- The basin was bounded on the north by the Edna fault zone(s), fairly large basin bounding normal faults. The southern margin of the basin (now the southern limb of the Pismo Syncline) was formed by several smaller north-dipping normal faults, which have been inverted to reverse faults during synclinal folding. Many of these faults are "blind", i.e. are not exposed at the surface and are interpreted from seismic data.

- Folds are mappable at the surface.
- The overall interpretation is one of a negative flower structure that formed during a transtensional phase of slip, and that was later inverted during transpressional slip.
- All faults are interpreted as steeply dipping.

Chapter 8 – 3D seismic reflection survey confined to an onshore area around the Diablo Canyon Power Plant about 3 x 5 km ("Phase 1"), and a small shoreline strip southeast of the power plant about 3 km long by 0.5 km wide including the Rattlesnake fault at the shoreline ("Phase 2"). Data collected and analyzed by Fugro. Detailed geologic map of the area around the power plant. The goal was to identify structures that might be significant to seismic hazard analysis of the power plant, and provide input data for ground motion modeling at the power plant site.

Important conclusions:

- "... folding in buried reflector packages consistent with out-of-syncline parasitic folding that discordantly detached and shortened Obispo volcaniclastic strata off of stiffer, relatively undeformed diabase bodies... folding event is old and no longer active, and took place during the compressional uplift event that inverted the ancestral Pismo Basin into the deeply eroded Pismo syncline."
- "Despite differences in elevation between time-correlated uplifted terraces, the terraces themselves remain horizontal, indicating that the style of late Quaternary deformation of the western Irish Hills is characterized by rigid block uplift with little or no rotation."
- ...[in Phase 1 area] "no throughgoing steep or vertical reflector truncations were observed that would indicate the presence of a significant steep fault offset. ... Any throughgoing faulting in the reflective depth range of 0 to 0.3 km would have to follow shallow to flat unconformities."
- [The updated surface mapping] "shows steep, generally north dipping Obispo volcaniclastic strata exposed along Discharge Cove. The tomography indicates that these steeply dipping strata are underlain by a shallowly north-dipping diabase intrusive. Future efforts that would consider the construction of a stratigraphic cross section through the Phase 1 area must be very wary of using only the surface dip data, and should honor the nearly flat-lying subsurface velocity structure as well."
- "Three lineaments mapped on the bedrock surface beneath the marine terrace sediments in the Phase 2 area merit investigation as potential faults. In order to directly examine the potential fault plane, ground-based investigations of the bedrock platform surface and the overlying Quaternary sediments would be required"

Chapter 9 – Results of Geologic Mapping Project, intended to help interpretation of onshore seismic reflection data. Data presented includes previously published and unpublished geologic maps plus new data collected in this study. There is a section dedicated to the Los Osos fault zone. One conclusion is: "new mapping in the vicinity of the Edna, Los Osos, San Luis Bay, San Miguelito, and Shoreline fault zones does not introduce any new hard constraints on fault location, dip, slip direction, or slip rate". Data presented in this chapter is also used in chapters 7 and 8.

Appendices contain daily field reports, photographs, sample catalogue, an Arc GIS catalogue of shapefiles and other information relating to data acquisition and geologic mapping in the Irish Hills, and a compilation of (primarily) stratigraphic data from 18 of 34 wells (26 oil and 8 hydrogeologic).

Important conclusions:

- "Edna and San Miguelito fault zones—minor changes to the geologic units adjacent to the faults."
- "Los Osos fault zone—minor changes to the geologic units adjacent to the fault zone, and changes to the depiction of the fault zone along the northern margin of the Irish Hills (including removal of the concealed, northwest-trending fault across southern Morro Bay)."
- "Shoreline fault zone—minor changes to the geologic units and bedrock faults adjacent to the fault zone for the reaches opposite Olson Hill and the Diablo Canyon power plant."
- "San Luis Bay fault zone—minor changes to the geology adjacent to the fault zone along the outer coast from Olson Hill to Rattlesnake Creek, and the addition of a generalized, concealed, and locally queried trace in San Luis Obispo Bay and on the outer coast between the Rattlesnake fault and the Olson Hill deformation zone."

<u>**Geotechnical studies**</u>

Chapter 10 – provides a 3D shear-wave velocity (V_S) model for the Diablo Canyon power plant foundation area. 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 Diablo Canyon power plant site.

Important conclusions:

- There is significant spatial variability in $V_{S\text{-}30}$ [shear-wave velocity in the top 30 meters] throughout the Diablo Canyon power plant 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 11 – Site conditions evaluation as relevant to the modeling of ground motion at the Diablo Canyon power plant site.

Chapter 12 – Addresses testimony from Dr. Douglas Hamilton concerning two postulated faults: the Diablo Cove and the San Luis Range/Inferred Offshore faults. In addition to using selected data from Hamilton, a variety of other PG&E reports, and published literature, this chapter uses data from chapters 2, 4, 7, 8, and 9 in Central Coastal California Seismic Imaging Project (this) report.

Important conclusions: Essentially they conclude that the Diablo Cove fault is a non-issue, and that the San Luis Range/Inferred Offshore fault – although not there – will be accounted for in their new seismic source characterization [hmmm].

- "We conclude that the Diablo Cove fault does not represent a seismic hazard to the Diablo Canyon power plant, and there is no basis for considering the Diablo Cove fault as proposed by Hamilton ... to be either a fault displacement hazard or a seismic source of strong ground motions. We make this conclusion based on the following key points:
- Trench and excavation mapping conducted prior to construction of the Diablo Canyon power plant documented that the fault zone is discontinuous, is associated with minimal offset, and does not displace marine terrace deposits that are 120 ka. Thus, the faulting where observed directly is minor and inactive in the late Pleistocene.
- Geologic mapping and interpretation of multibeam echo sounder imagery do not support connecting the Diablo Cove fault offshore to the Shoreline fault zone.
- There is no basis for correlating seismicity with the Diablo Cove fault based on an evaluation of microearthquake locations and consideration of their location uncertainty.
- The short length of the Diablo Cove fault zone—probably less than half a kilometer—is not consistent with a down-dip width of several kilometers that would extend the fault to seismogenic depths.
- Structural analysis of geologic data and high-resolution 3D land seismic data at the Diablo Canyon power plant supports an interpretation, shared by the original mappers of the faults, that the faulting is related to shallow fold deformation and shortening that predates the late Quaternary and probably dates to the Miocene or Pliocene. The faulting may or may not be related to a Miocene diabase intrusion imaged directly north of the north-dipping Diablo Cove fault at shallow depths. Based on this interpretation, the fault extends to only a few tens to hundreds of meters depth."
- We conclude that there is no clear evidence in the available data to support the presence of [the San Luis Range/Inferred Offshore thrust fault], and there is evidence that precludes its presence. Accordingly, there is no basis for considering the San Luis Range/Inferred Offshore thrust to be a seismic hazard to the Diablo Canyon power plant as proposed by Hamilton. We make this conclusion based on the following key points:
- Analyses of multibeam echo sounder bathymetry data and seismic-reflection data do not support the interpreted uplift rate boundary across the San Luis Range/Inferred Offshore thrust fault proposed by Hamilton. Instead, interpretations of the data are consistent with a very low or negligible change in uplift rate where the San Luis Range/Inferred Offshore thrust fault is interpreted to impinge on the Shoreline fault zone and where the SLRF is interpreted to diverge from the Shoreline fault zone south of Point Buchon. Interpretations of coastal marine terrace data and offshore marine terraces are consistent with uplift rate boundaries that instead coincide with other structures considered by PG&E in past seismic hazard analyses.
- We disagree with the assertion by Dr. Hamilton that the San Luis Range/Inferred Offshore thrust fault interpretation is required to fit the observed pattern of coastal terrace uplift and instead suggest the observed pattern of coastal uplift may be matched by several proposed fault geometries, including those proposed by PG&E in past seismic hazard analyses.

- We disagree with the assertion by Dr. Hamilton that the seismicity data beneath the Irish Hills show a clear alignment supporting the San Luis Range/Inferred Offshore thrust fault at depth. The seismicity data can be interpreted in different ways to support many different fault models.
- Interpretation of land seismic-reflection data do not show evidence for a gently to moderately dipping San Luis Range/Inferred Offshore thrust fault beneath the southern Irish Hills in the general location proposed by Hamilton. Instead, interpretations of the seismic-reflection data show steeply north-dipping structures down to approximately 7 km depth or deeper that coincide with recognized faults (the Irish Canyon and San Luis Bay) at the surface. The interpretation of these steeply dipping structures to depth precludes the presence of the San Luis Range/Inferred Offshore thrust fault.
- Although the specific San Luis Range/Inferred Offshore thrust fault interpretation by Hamilton is not well supported by the available data, and by no means can be held up as a unique or preferred interpretation, the general solution of a primary, north- or north-northeast-dipping fault beneath the Irish Hills is consistent with several observations, and is a possible fault model that should be considered for seismic hazard analysis to the Diablo Canyon power plant. We note that the interpretations by Hamilton are being considered for evaluation and integration with other available data following the Senior Seismic Hazard Analysis Committee Level 3 process. The Senior Seismic Hazard Analysis Committee program for the Diablo Canyon power plant, which is being performed under regulatory review by the NRC, is creating a new seismic source characterization model.

Chapter 13 – Evaluation of sensitivity of the deterministic ground motions that were presented in the PG&E Shoreline Fault Zone Report (2011) to the seismic source characterizations for the Shoreline and Hosgri faults, using new ground motion models developed by the Pacific Earthquake Engineering Research (PEER) center as part of their "Next Generation Attenuation" program.

Important conclusion:

- "For all the cases considered in this sensitivity study, the 84th percentile ground motions for the power-block and turbine-building foundation levels are bounded by the 1977 Hosgri spectrum."

[In other words, their former analysis is not affected by any of the new data/interpretations.]

Chapter 14 – The findings and conclusions of the Central Coastal California Seismic Imaging Project report [this one].

Important conclusion:

- "These studies confirm previous analyses that the plant and its major components are designed to withstand—and perform their safety functions during and after—a major seismic event."

John Stamatakos

From:John Stamatakos
Sent:13 Apr 2015 15:00:17 +0000
To:Miriam R. Juckett
Subject:DiabloCanyonPowerPlant - seismic risk data survey April 2015
Attachments:DiabloCanyonPowerPlant - seismic risk data survey April 2015.docx

Can you look this over quickly?

I want to hand out at today's meeting.

J

Sarah Wigginton

From:Sarah Wigginton
Sent:8 Apr 2015 19:21:56 -0500
To:Ronald McGinnis;David Ferrill
Cc:Alan Morris
Subject:Document Catalogue
All,

Here is a link to the completed portion of the Document Catalogue for Diablo Canyon.
Z:\Diablo_Canyon\Diablo Canyon\Document_Catalog_COMPLETE.xlsx

I have about 300 more pages to go in the very last PDF, but I'll be doing that work in a separate excel file (\\REGIOS\Demps\Diablo_Canyon\Diablo Canyon\Document_Catalogue_IN_PROGRESS.xlsx) so it won't interfere with any work you all do on the completed portion.

Best,
Sarah

Sarah Wigginton
Department of Earth, Material, and Planetary Sciences
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Osvaldo Pensado

From:Osvaldo Pensado
Sent:30 Apr 2015 18:22:54 -0500
To:John Stamatakos
Subject:Function for excel
Okay John.

What is the charge number?

Doing your problem in Mathematica is quite simple. In Excel ... not so much. I give you instructions to get the trapezoidal function in Excel.

For the trapezoidal function for the offset:

a=15
b=26
c=35
d=43

p is a random number uniformly sampled between 0 an 1.. It can be sampled with Excel using p=Rand().

Apply it to randomly sampled values of p=Rand() in Excel.

The formula is a big sausage with nested if-then statements. At least it is a closed formula. There is a high chance to make a typographical error, though.

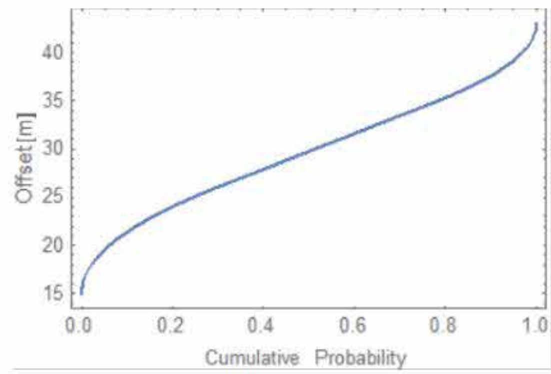
You should consider programming the formula in a macro.

$$\text{trapezCDFInv[p\_, a\_, b\_, c\_, d\_]} := \text{If}[0 \leq p \,\&\, p < \frac{b-a}{-a-b+c+d}, a + \sqrt{a^2p - b^2p - acp + bcp - adp + bdp},$$

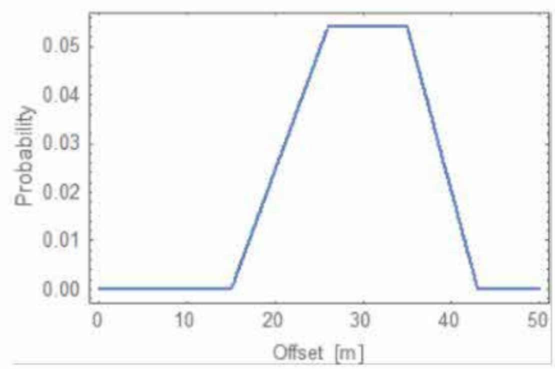
$$\text{ElseIf}[\frac{b-a}{-a-b+c+d} \leq p \,\&\, p < \frac{a+b-2c}{a+b-c-d}, \frac{1}{2}(a+b-ap-bp+cp+dp),$$

$$\text{ElseIf}[\frac{a+b-2c}{a+b-c-d} \leq p \,\&\, p \leq 1, d - \sqrt{ac+bc-c^2-ad-bd+d^2-acp-bcp+c^2p+adp+bdp-d^2p}]]]$$

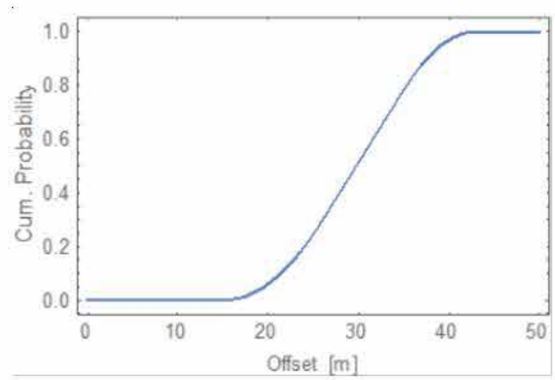
This is the plot of the trapezCDFInv function



I derived the formula from the following trapezoid:



This is the CDF: parabola segment, followed by a straight line, ending in another parabola segment.



I felt like programming the formula in Excel for you, but I changed my mind when I saw the sausage. I can do the Monte Carlo in no time in Mathematica. I do not feel like touching the sausage.

For a Triangular function the formula to use is cdfTriangInv[p_, a_, b_, c_]: = If[$p \leq (b-a)/(c-a)$, $a + \text{Sqrt}[(b-a)*(c-a)*p]$, $c - \text{Sqrt}[(c-a)*(c-b)*(1-p)]$]];

again, p=Rand()

To give you an idea on how simple the problem is in Mathematica, this would be the Latin hypercube sampling program (which will be better than random sampling you will do in Excel):

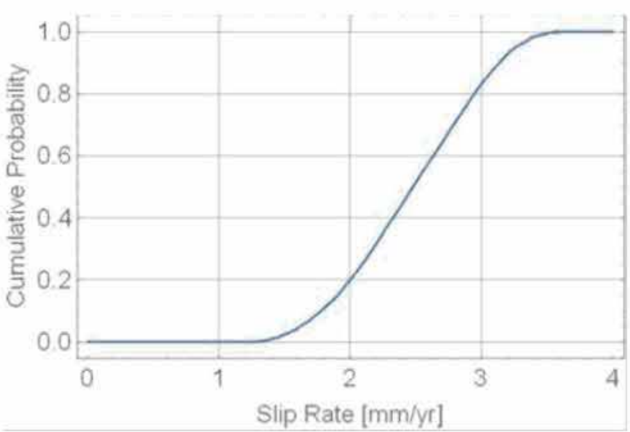
```
shuffle[datos_]:=Module[{piv1,piv2={},ind1},piv1=datos;
      While[Length[piv1]>0,ind1=Random[Integer,{1,Lengt
h[piv1]}];
      AppendTo[piv2,piv1[[ind1]]];
      piv1=Drop[piv1,{ind1,ind1}];];
 Return[piv2]];

pvec=shuffle[Table[i,{i,0,1,1.0/5000}]];
age1=cdfTriangInv[#,11.5, 12, 12.5]&/@ pvec;
pvec=shuffle[pvec];

offset1=trapezCDFInv[#,15, 26, 35, 43]&/@ pvec;
d1=EmpiricalDistribution[offset1/age1];
```

And the slip rate is

Plot[CDF[d1, x], {x, 0,4}, Frame → True, BaseStyle → 14, GridLines → Automatic, FrameLabel → {"Slip Rate [mm/yr]", "Cumulative Probability"}]



Dr. Osvaldo Pensado

Group Manager, *Risk Analysis and Performance Assessment*
Geosciences and Engineering Division
(210) 522-6084
opensado@swri.org

Sent:29 Apr 2015 16:07:18 +0000
To:Violeta Gonzales
Subject:FW: Diablo Canyon
Are you familiar with the bridge line procedure for phone calls?

From: John Stamatakos
Sent: Wednesday, April 29, 2015 11:06 AM
To: Ronald McGinnis
Subject: RE: Diablo Canyon

We have one we use for management meetings .. ask Violet.

From: Ronald McGinnis
Sent: Wednesday, April 29, 2015 12:05 PM
To: John Stamatakos
Subject: RE: Diablo Canyon

I have no idea. Never used one. I will ask.

From: John Stamatakos
Sent: Wednesday, April 29, 2015 11:04 AM
To: Ronald McGinnis
Subject: RE: Diablo Canyon

Ronnie, do we have a bridge line we can use?

John

From: Ronald McGinnis
Sent: Wednesday, April 29, 2015 10:37 AM
To: John Stamatakos
Subject: RE: Diablo Canyon

Sounds good.

From: John Stamatakos
Sent: Wednesday, April 29, 2015 9:35 AM
To: Ronald McGinnis
Subject: RE: Diablo Canyon

Office ... or we may use a bridge if I want to bring in NRC.

From: Ronald McGinnis
Sent: Wednesday, April 29, 2015 10:33 AM
To: John Stamatakos
Subject: RE: Diablo Canyon

We will call you. Office or cell?

From: John Stamatakos
Sent: Wednesday, April 29, 2015 9:16 AM
To: Ronald McGinnis
Subject: RE: Diablo Canyon

OK

From: Ronald McGinnis
Sent: Wednesday, April 29, 2015 10:00 AM
To: John Stamatakos
Subject: RE: Diablo Canyon

John,

How about 2:00 our time?

-Ronny

From: Ronald McGinnis
Sent: Tuesday, April 28, 2015 1:55 PM
To: John Stamatakos
Subject: RE: Diablo Canyon

Should work. I will get a time and let you know.

From: John Stamatakos
Sent: Tuesday, April 28, 2015 1:53 PM
To: Ronald McGinnis
Subject: RE: Diablo Canyon

I am in a Diablo meeting right now. We should have a call tomorrow.

I'll have to look at my schedule but could you ask your folks so we can set up a good time?

John

From: Ronald McGinnis
Sent: Tuesday, April 28, 2015 1:35 PM
To: John Stamatakos
Subject: RE: Diablo Canyon

John,

We just got back in the office from two weeks of travel. David and I are in the office this week and then gone again next week. How did the meeting with NRC go? I got your voicemail asking about the GIS file but I didn't get it until yesterday.

Do we have the go ahead for Phase 2? If so, we may want to have a phone call this week to go over the details.

Thanks,
Ronny

From: John Stamatakos
Sent: Friday, April 10, 2015 3:04 PM
To: Ronald McGinnis
Cc: David Ferrill; Alan Morris (b)(6)); Kevin Smart; Sarah Wigginton; Miriam R. Juckett
Subject: RE: Diablo Canyon

I mean Ronny ... sorry I know better

From: John Stamatakos
Sent: Friday, April 10, 2015 4:02 PM
To: Ronald McGinnis
Cc: David Ferrill; Alan Morris (alanmrrs0@gmail.com); Kevin Smart; Sarah Wigginton; Miriam R. Juckett
Subject: RE: Diablo Canyon

Thanks Ronnie,

Outstanding job. I am very pleased with the progress so far.

john

From: Ronald McGinnis
Sent: Friday, April 10, 2015 3:58 PM
To: John Stamatakos
Cc: David Ferrill; Alan Morris (b)(6) ; Kevin Smart; Sarah Wigginton
Subject: RE: Diablo Canyon

John,

We are not quite finished with the data quality tab in the spreadsheet so that will have to continue, but all the data has been reviewed and is represented by a row in the following linked spreadsheet.
Y:\Diablo_Canyon\Diablo Canyon\Document_Catalog_COMPLETE.xlsx

Also, we are working on an ArcGIS project that helps to organize the seismic data. It should be finished by COB today. That link is at Y:\Diablo_Canyon\Diablo Canyon\ArcGIS_GED\Diablo_Canyon_March_2015.mxd

The review document is at T:\Diablo_Canyon\Diablo Canyon\CNWRA report April 2015\DiabloCanyonPowerPlant - seismic risk data survey April 2015.docx

All the rest of the files are in the Diablo Canyon folder on regios.

Let us know if you have any questions.

-Ronny

From: John Stamatakos
Sent: Friday, April 10, 2015 2:48 PM
To: Ronald McGinnis
Subject: Diablo Canyon

Can I review all the files so I can present at NRC on Monday?

John

Dr. John Stamatakos
Director of Technical Programs
Center for Nuclear Waste Regulatory Analyses (CNWRA)
Southwest Research Institute
1801 Rockville Pike, Rockville, MD 20852
301-881-0290

jstamatakos@swri.org

Sent:27 Mar 2015 20:19:55 +0000
To:Alan Morris;Alan Morris ((b)(6) [redacted])
Subject:FW: Diablo Canyon Review
Not sure why you weren't copied...

From: John Stamatakos
Sent: Friday, March 27, 2015 3:01 PM
To: Ronald McGinnis; David Ferrill; Amy Minor; Kevin Smart
Cc: Miriam R. Juckett
Subject: Diablo Canyon Review

I've place most of my Diablo Canyon files on the DEMPS server (Demps\regios).

There are a series of reports that Pacific Gas & Electric (POG&E) produced over the last few years.

1. **Shoreline and RIL**: The Shoreline report was submitted by PG&E in 2011 and we (with NRC review if in 2012). The Regulatory Information Letter (RIL 12-01) is that review. This report and review focused on the Shoreline fault and potential implications to the Licensing Basis for the plant. But the reports offer some good general background information. Other files in this folder are related to the Shoreline Report and the RIL.
2. **DCPP Shoreline and Thrust Fault Allegation**: In addition to the Shoreline Report, NRC had us look at an allegation made by a former PG&E consultant about other possible faults and the plant. Alan helped me on one of the allegations (possible blind thrust beneath the plant site).
3. **Central Coastal California Seismic Imaging Project**: The California state legislature passed a bill after the Shoreline Report authorizing PG&E to collect boat load of new seismic imaging data. This report is essentially a data dump of that work, and it has the bulk of what I would like you all to look at.
4. **LTSP**: This is an old PG&E report (1991) that may also be useful as background.
5. **NTTF DCCP PSHA Review**: This is the actual new seismic hazard study that we are reviewing. We will need to cross reference the conclusions about faults (do they exist, their geometry, slip rate, length and area, etc.) based on seismic imaging to the data in the CCCSIP report.
6. **Diablo Canyon ISFSR SER** : This was our review of the site back in early 2000's for the Independent Spent Fuel Storage Installation (ISFSI). May be useful as background information.
7. **Figure**: is a folder I use to put in various figures and some of my Diablo Presentations and related images.

For reference: http://www.pge.com/en/safety/systemworks/dcpp/seismicsafety/index.page

This link gets you to most of these reports on line.

Work Scope:

I have five progressive tasks in mind.

1. Look through the CCCSIP documents and develop a summary (catalog) of all the seismic imaging data that's there. Identify the who, what and where and assess its quality and possible

usefulness to the PSHA. I think we can do this relatively quickly. We can even bring on a temp/student if available and willing to work on this. NRC wants to be able to say that they are familiar with all the data and have looked it over as part of the review. I would like to have a very quick deliverable on this (couple of pages?) relatively soon.

2. Identify which data in the CCCSIP report is actually relied on to develop conclusions in the new PSHA. Assess the validity of the structural/seismic interpretations from the quality of the seismic imaging data. This may take a bit longer than task 1, but I hope we can do this relatively quickly.
3. Identify potential faults in the data sets that may have been overlooked by the PSHA technical team. I am **not** suggesting we identify any vague targets, but if you see images that in your view (and based on your experience) are very likely significant faults, we should tag them and assess their potential to influence the seismic hazard at the site.
4. For those critical data sets identified in task 2, complete a technical review of the data and the interpretations. This will be included in our write up for the overall PSHA assessment.
5. Review the 3D data collected in the Irish Hills to reassess the blind thrust fault model (I think it is now referred to as the San Luis Range Thrust).

I'll walk you all through this again next week and provide some more background on the PSHA and how we can assess whether fault sources can be important to the PSHA next week.

Thanks,

John

Dr. John Stamatakos
Director of Technical Programs
Center for Nuclear Waste Regulatory Analyses (CNWRA)
Southwest Research Institute
1801 Rockville Pike, Rockville, MD 20852
301-881-0290

jstamatakos@swri.org

Sent:28 Apr 2015 18:56:06 +0000
To:David Ferrill;Alan Morris;Kevin Smart;Sarah Wigginton
Subject:FW: Diablo Canyon
Is there a particular time that works for you all? I am good any time.

From: John Stamatakos
Sent: Tuesday, April 28, 2015 1:53 PM
To: Ronald McGinnis
Subject: RE: Diablo Canyon

I am in a Diablo meeting right now. We should have a call tomorrow.

I'll have to look at my schedule but could you ask your folks so we can set up a good time?

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John,

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Thanks,
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John,

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The review document is at T:\Diablo_Canyon\Diablo Canyon\CNWRA report April 2015\DiabloCanyonPowerPlant - seismic risk data survey April 2015.docx

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Let us know if you have any questions.

-Ronny

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Sent: Friday, April 10, 2015 2:48 PM
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Subject: Diablo Canyon

Can I review all the files so I can present at NRC on Monday?

John

Dr. John Stamatakos
Director of Technical Programs
Center for Nuclear Waste Regulatory Analyses (CNWRA)
Southwest Research Institute
1801 Rockville Pike, Rockville, MD 20852
301-881-0290

jstamatakos@swri.org

John Stamatakos

From:John Stamatakos
Sent:22 Apr 2015 02:20:23 +0000
To:Miriam R. Juckett
Subject:FW: diablo scenario events

From: Munson, Clifford [mailto:Clifford.Munson@nrc.gov]
Sent: Tuesday, April 21, 2015 11:46 AM
To: Ake, Jon; John Stamatakos; Graizer, Vladimir
Cc: Heeszel, David
Subject: diablo scenario events

John,

Would you come up with some plausible scenario events for Hosgri in terms of the parameters listed below (as a spreadsheet?). I coded the SWUS GMM for T=1 sec. There are 31 median models each with a unique set of 10 coefficients. I just read in their electronic file as a 31 by 10 matrix to avoid typing errors. I also coded up the total sigma (3 branches with 2 coefficients for each branch).

The input parameters are:

1. Magnitude (mag)
2. Depth to top of rupture (ztor) in km
3. Rupture distance (rrup) in km
4. Joyner-Boore distance (rjb) in km
5. Fault dip angle (dip) in degrees
6. Down-dip rupture width (ddrw) in km
7. Horizontal distance from top of rupture measured perpendicular to strike (Rx) in km
8. Fault type (REV,NRM, or SS) – depending on rake angle

I will proceed to code T=0.1 sec and maybe some more periods if I have time.

I would like to verify our results somehow before we merge these codes with Roland's.

Thanks,
Cliff

John Stamatakos

From:John Stamatakos
Sent:22 Apr 2015 02:21:53 +0000
To:(b)(6) [redacted]
Subject:FW: diablo scenario events

From: Munson, Clifford [mailto:Clifford.Munson@nrc.gov]
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7. Horizontal distance from top of rupture measured perpendicular to strike (Rx) in km
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I will proceed to code T=0.1 sec and maybe some more periods if I have time.

I would like to verify our results somehow before we merge these codes with Roland's.

Thanks,
Cliff

John Stamatakos

From:John Stamatakos
Sent:4 May 2015 18:01:22 +0000
To:Stovall, Scott (Scott.Stovall@nrc.gov)
Subject:FW: Diablo SSC
Attachments:Diablo Canyon Seismic Source Characterization Review 1.pdf

From: John Stamatakos
Sent: Monday, May 4, 2015 9:37 AM
To: Graizer, Vladimir (Vladimir.Graizer@nrc.gov)
Subject: FW: Diablo SSC

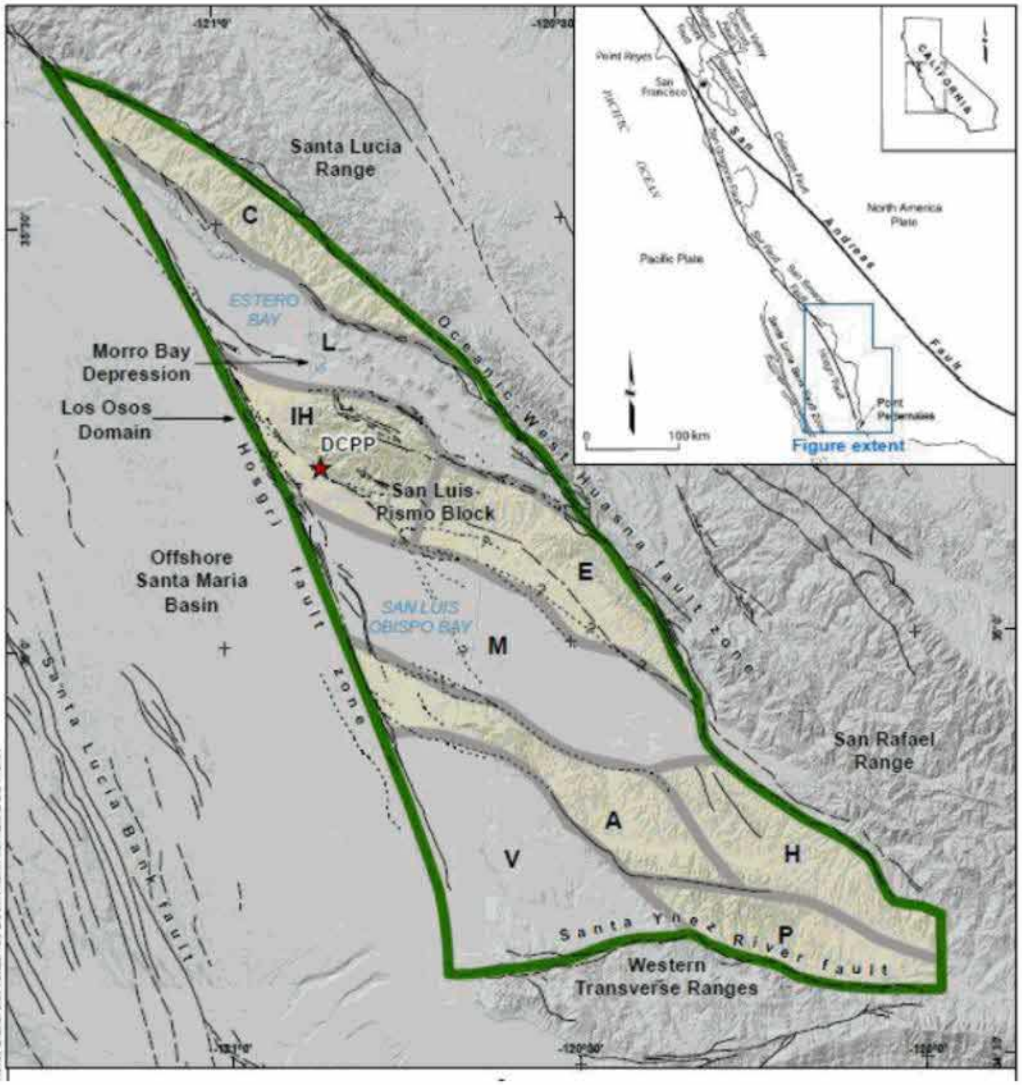
From: John Stamatakos [mailto(b)(6) [redacted]
Sent: Monday, May 4, 2015 9:33 AM
To: John Stamatakos
Subject: Diablo SSC

Diablo Canyon Seismic Source Characterization Review

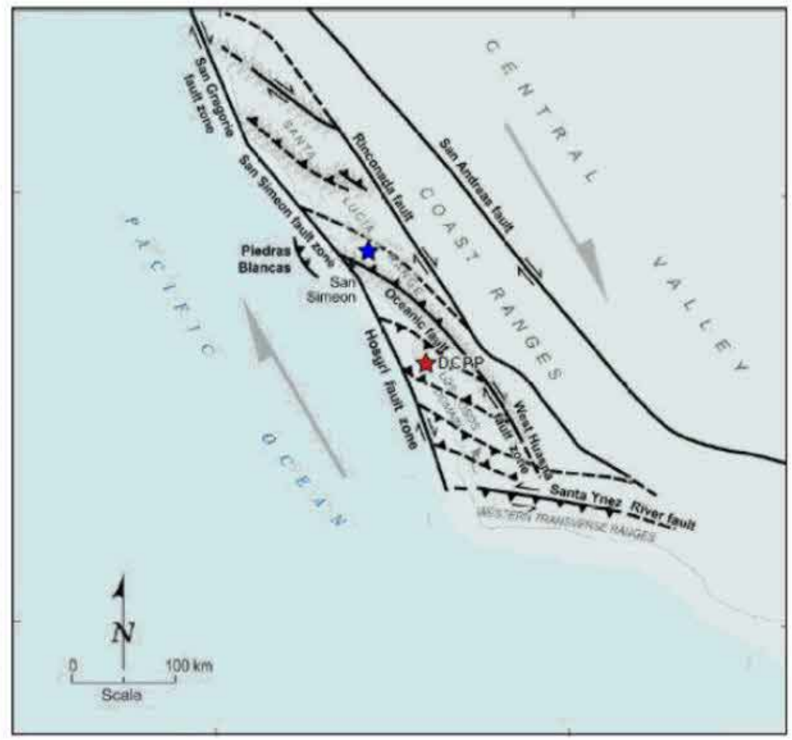
John Stamatakos

5/4/2015

CONTEMPORARY TECTONIC SETTING



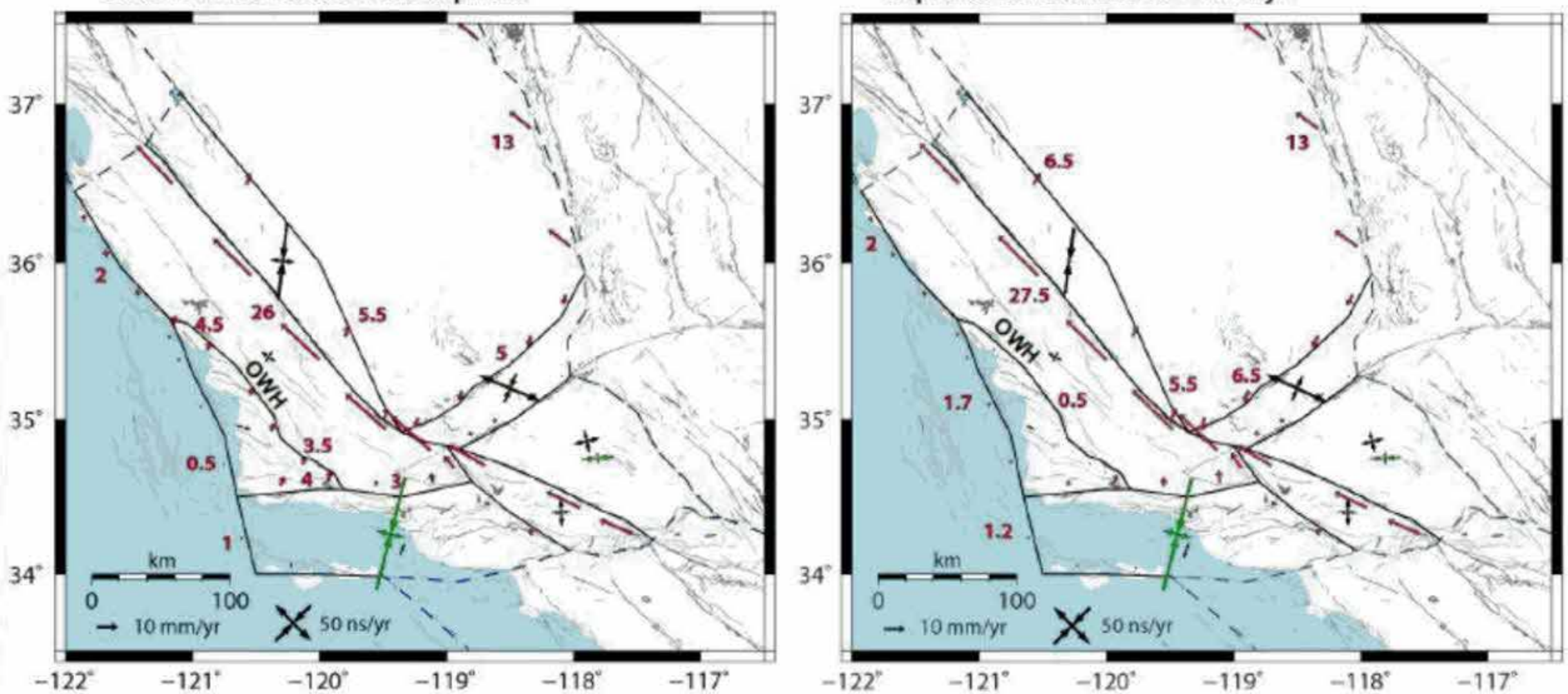
Dextral strike-slip plate boundary with transpression



GPS STRAIN RATES

(a) Model 3 from Murray (2012): No Constraints on the Oceanic-West Huasna Fault Slip Rate

(b) Model 4 from Murray (2012): Oceanic-West Huasna Fault Slip Rate Constrained to < 1 mm/yr



EXPLANATION

- – – Freely-slipping boundary
- —— Boundary on which locking is estimated
- OWH Oceanic-West Huasna fault

Note: Red numbers are slip rate in mm/yr. Sets of green arrows are estimated strain rate tensors. Sets of black arrows are residual strain rate tensors.

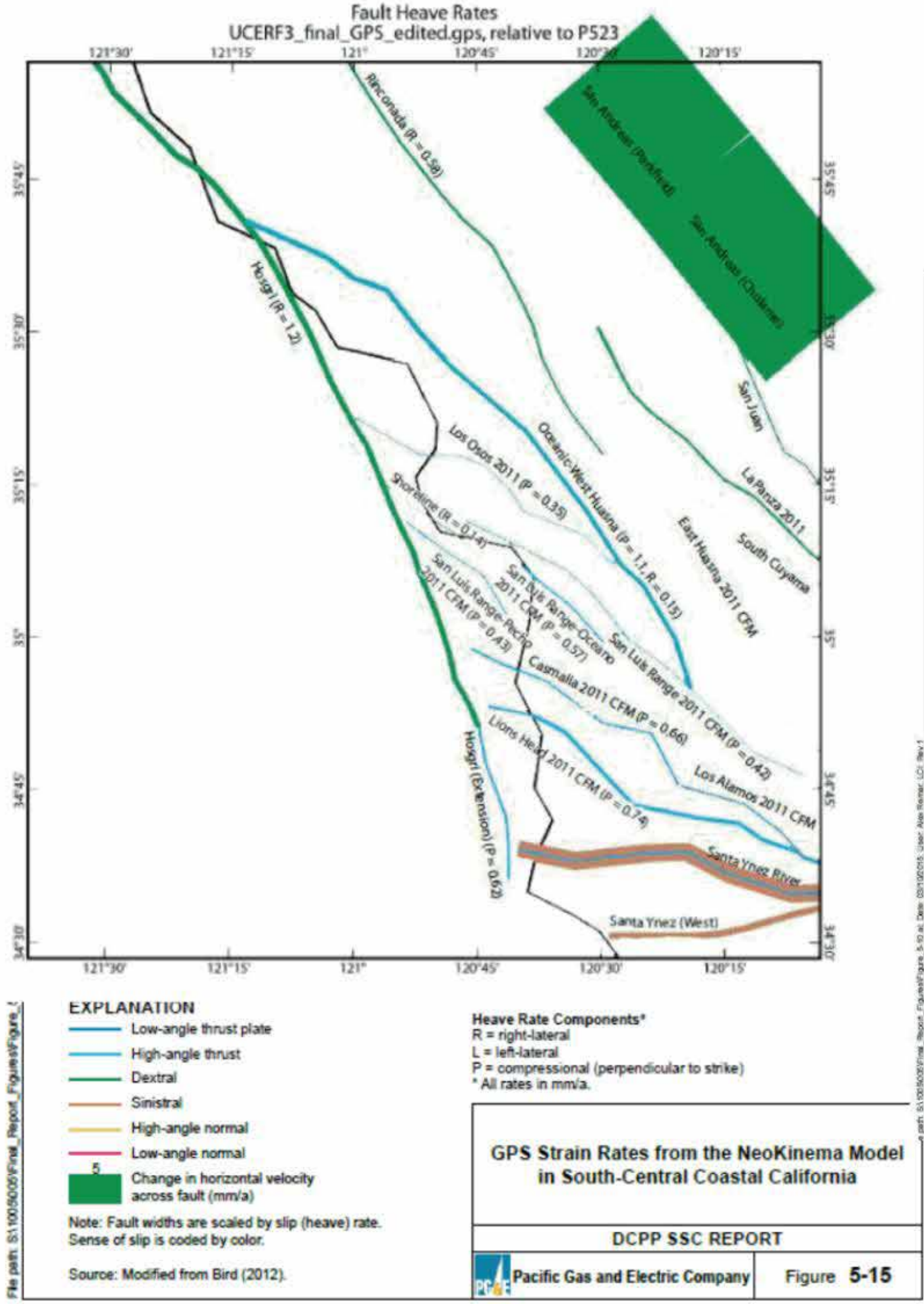
Source: Modified from Murray (2012).

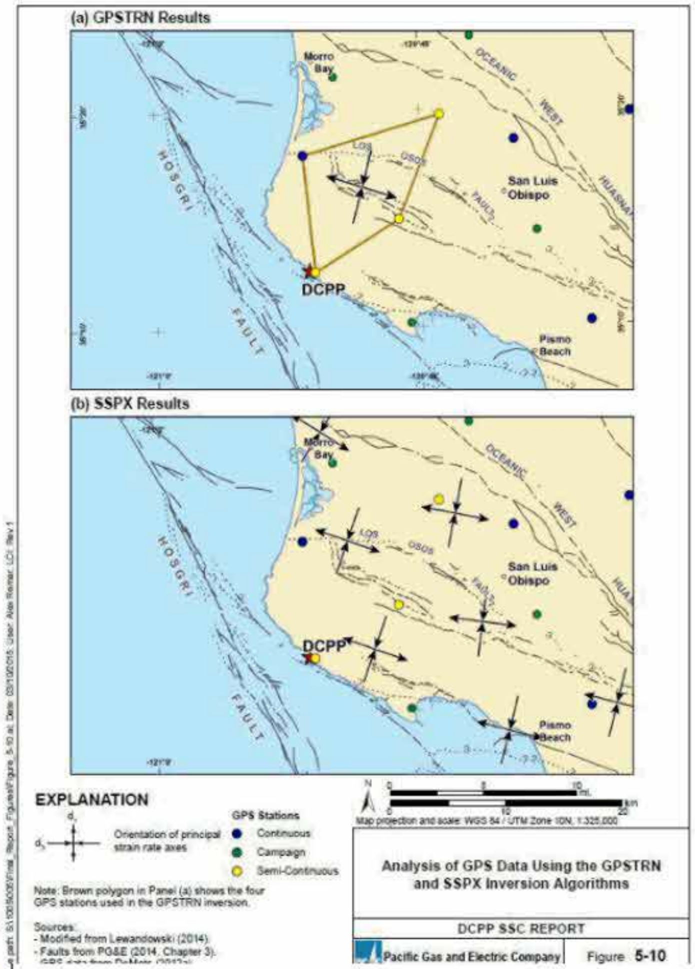
Resolved GPS Strain Rates on Tectonic Block Boundaries

DCPP SSC REPORT

Pacific Gas and Electric Company | Figure 5-14

More Strains

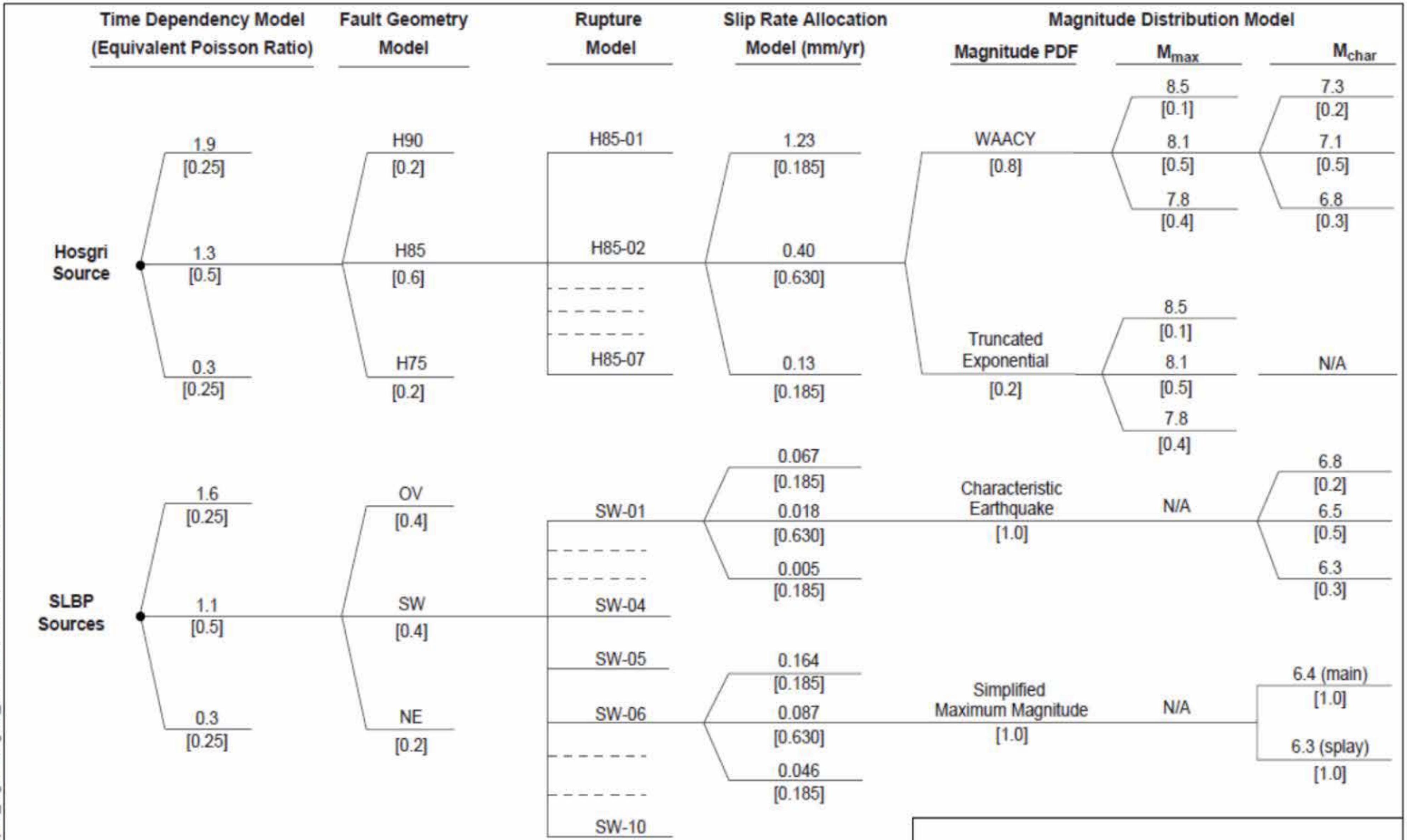




FAULT SOURCES

- Geometry
- Faulting Style (SS, Reverse, Composite)
- Ruptures and Rupture Segments
- Slip Rate
- Slip Rate Allocation (on ruptures)
- Magnitude Distribution Models
- Time Dependency

Areal Sources and Distant Fault Sources … another day



Notes: In the example tree, rupture source H85-02 is a longer *linked* rupture source, so the WAACY and truncated exponential magnitude PDF models are considered. Rupture source SW-01 is a *characteristic* rupture source, so only the Youngs and Coppersmith (1985) characteristic earthquake magnitude PDF is considered. Rupture source SW-06 is a *splay* rupture source, so only the simplified maximum magnitude earthquake magnitude PDF model is considered. See text.

Logic Tree Structure for the Primary and Connected Fault Sources

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Pacific Gas and Electric Company | Figure **6-1**

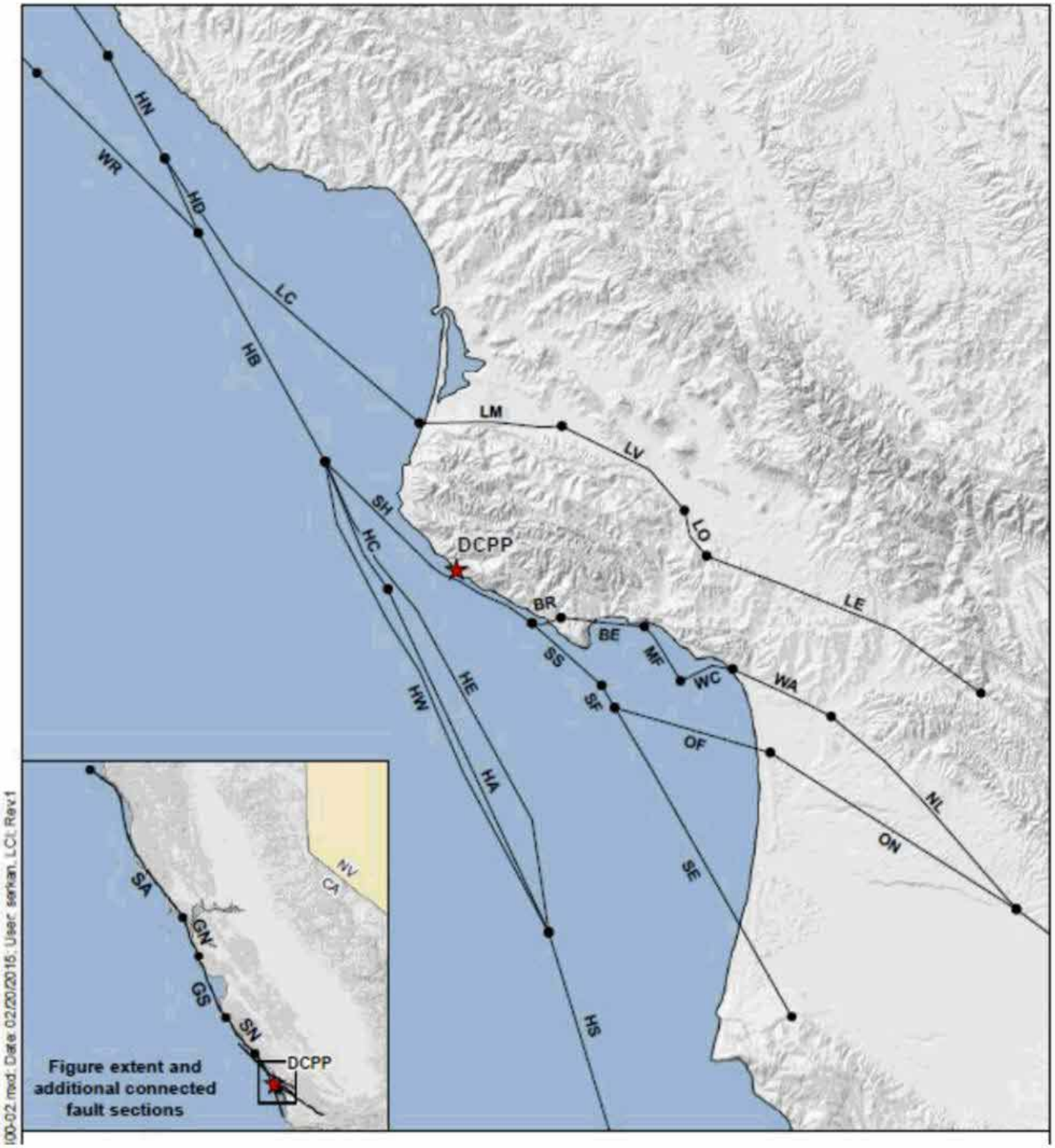
Fault Geometry Models (FGM)

- Three Hosgri FGMs
- Three San Luis–Pismo Block (SLPB) FGMs

Table 6-4. Fault Geometry Models (FGMs) and Logic Tree Combinations

	SLPB FGMs		
Hosgri FGMs	Outward-Vergent (OV)	Southwest-Vergent (SW)	Northeast-Vergent (NE)
Hosgri 90 (H90)	H90/ OV	H90/ SW	H90/ NE
Hosgri 85 (H85)	H85/ OV	H85/ SW	H85/ NE
Hosgri 75 (H75)	H75/ OV	H75/ SW	H75/ NE

- About 40 rupture segments
  - Three sets of rupture segments (for the three SLPB FGMs)

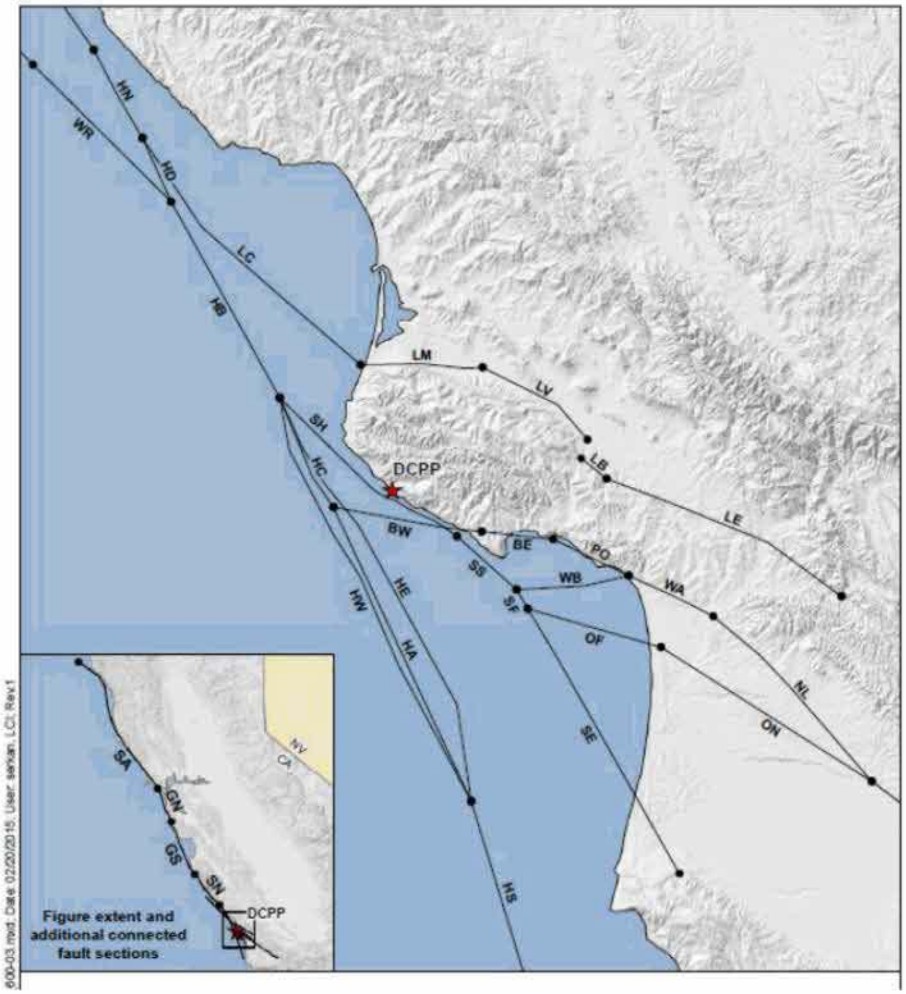


Rupture Segments

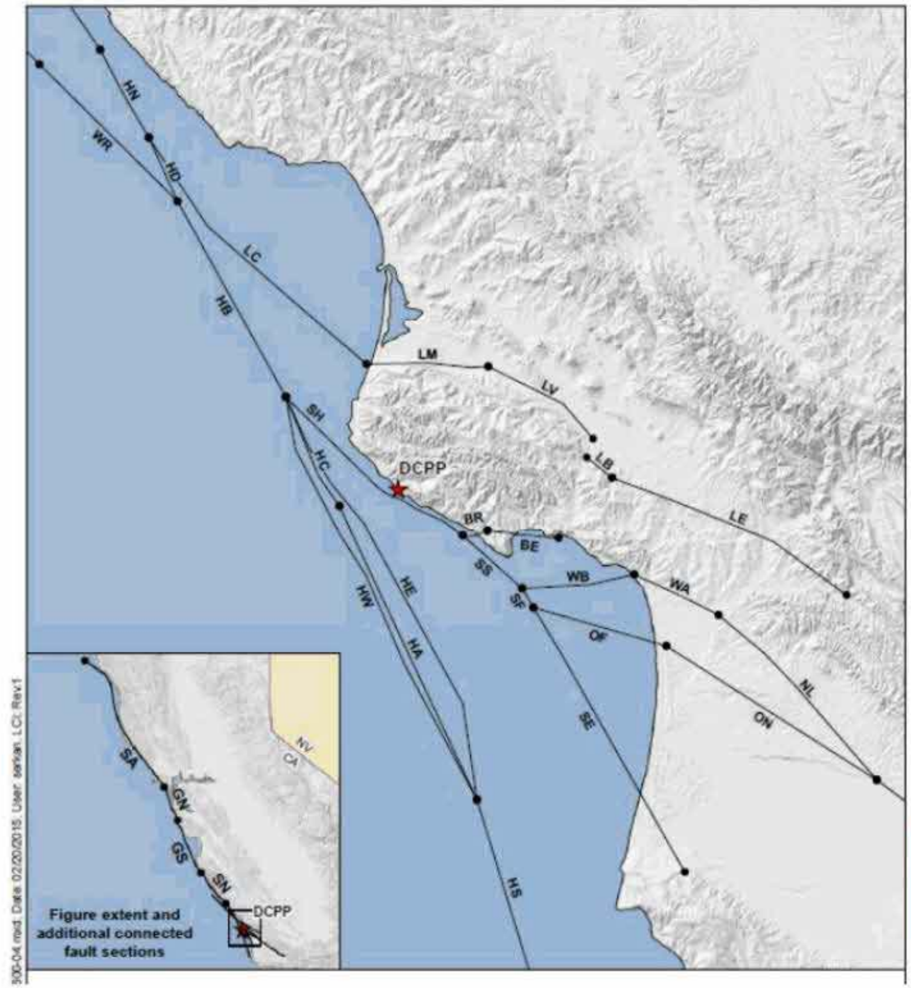
- Outward-Vergent

MORE RUPTURE SEGMENTS

SW-Vergent



NE-Vergent



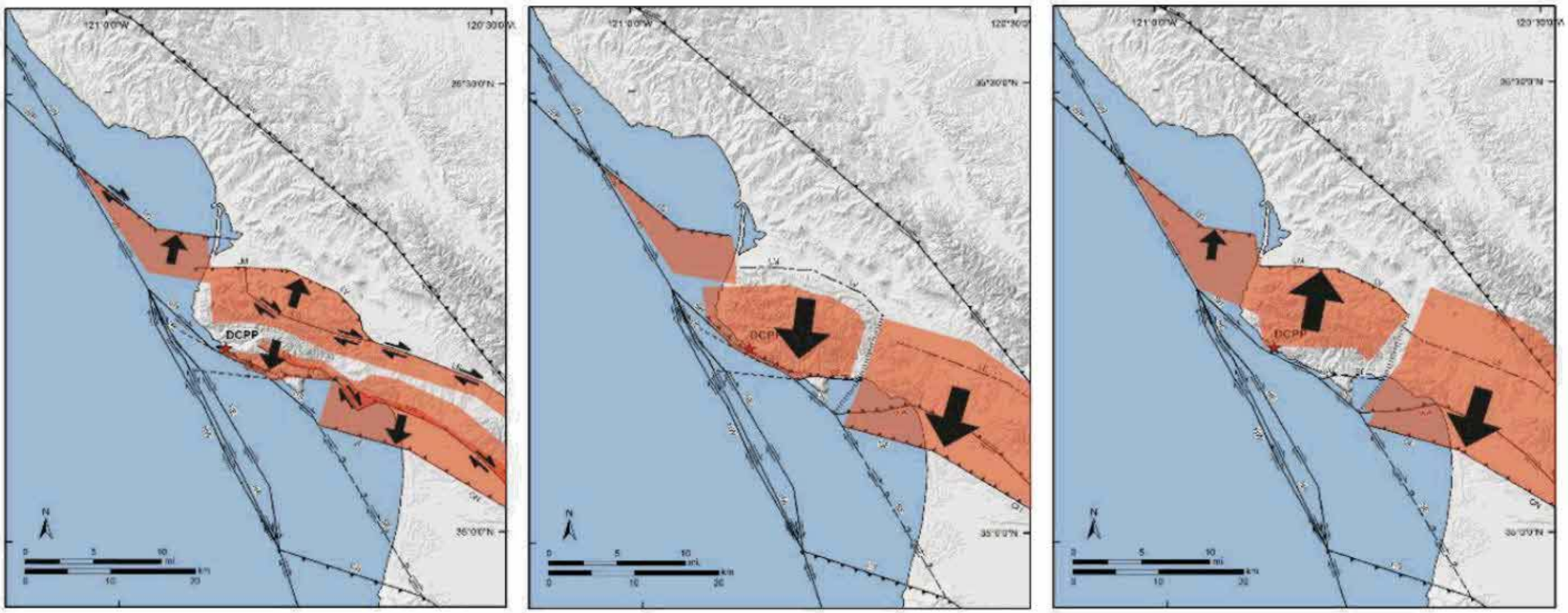
EXAMPLE: HOSGRI FAULT RUPTURE MODELS

Table 9-3. Hosgri Fault Rupture Model

Rupture Source Number	Type	Description	Fault Sections[1] (closest section to the DCPP in bold)	Sense of Slip
H-01	Linked	Hosgri (Central trace) to MTJ[2]	HS+**HA**+HC+HB+HD+HN+SI+SN+GS+GN+SA	Strike slip
H-02	Linked	Hosgri (West trace) to MTJ	HS+**HW**+HB+HD+HN+SI+SN+GS+GN+SA	Strike slip
H-03	Linked	Hosgri (East trace) to MTJ	HS+**HE**+HB+HD+HN+SI+SN+GS+GN+SA	Strike slip
H-04	Complex	Hosgri (Central trace) with Piedras Blancas	HS+**HA**+HC+HB+WR (primary fault); PB (secondary fault)	Primary = strike slip Secondary = reverse
H-05	Splay	Shoreline with Hosgri (Central trace) to Bolinas	HS+**HA**+HC+HB+HD+HN+SI+SN+GS+GN (main fault); SE+SS+**SH** (splay fault)	Strike slip
H-06[3]	Linked	Hosgri north of the Shoreline fault intersection	**HB**+HD+HN+SI+SN+GS+GN+SA	Strike slip
H-07[3]	Linked	Hosgri north of the Los Osos fault intersection	**HN**+SI+SN+GS+GN+SA	Strike slip
H-08[3]	Characteristic	Piedras Blancas	**PB**	Reverse

[1] Two-letter codes are explained in Table 6-5 and on Plate 9-1.
[2] MTJ = Mendocino Triple Junction
[3] Same downdip geometry is used for all three Hosgri FGMs.

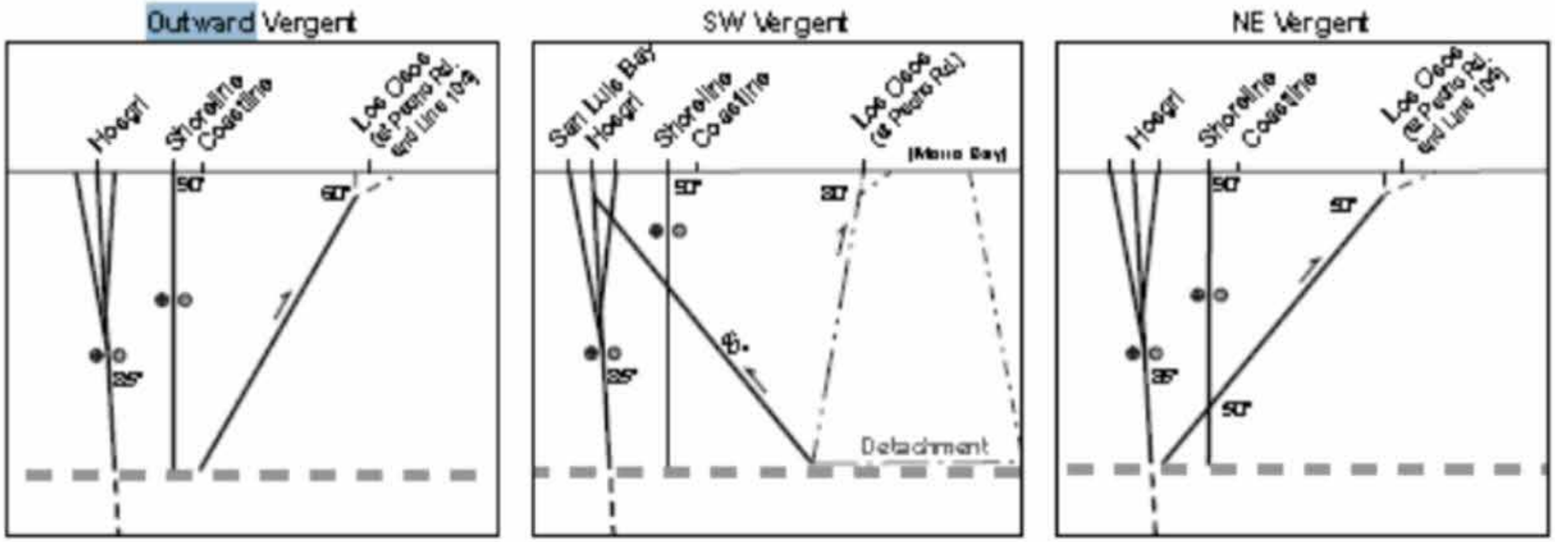
THREE SLPM FGMS



THREE SLPB FGMS

Parameter Values, Los Osos Fault

Model	Outward Vergent Weight: 0.4	SW Vergent Weight: 0.4	NE Vergent Weight: 0.2	Range		Weighted mean
Los Osos	LC+LM+LV+LE	LC+LM+LV+LE	LC+LM+LV+LE	Summary		
Dip	60	80	50	50	80	66
Dip Direction	SW	SW	SW			
Style of faulting	RL/R-O	R	R			
Depth to top	1	1	1	1	1	1
Width	13	11	14	11	14	12.4



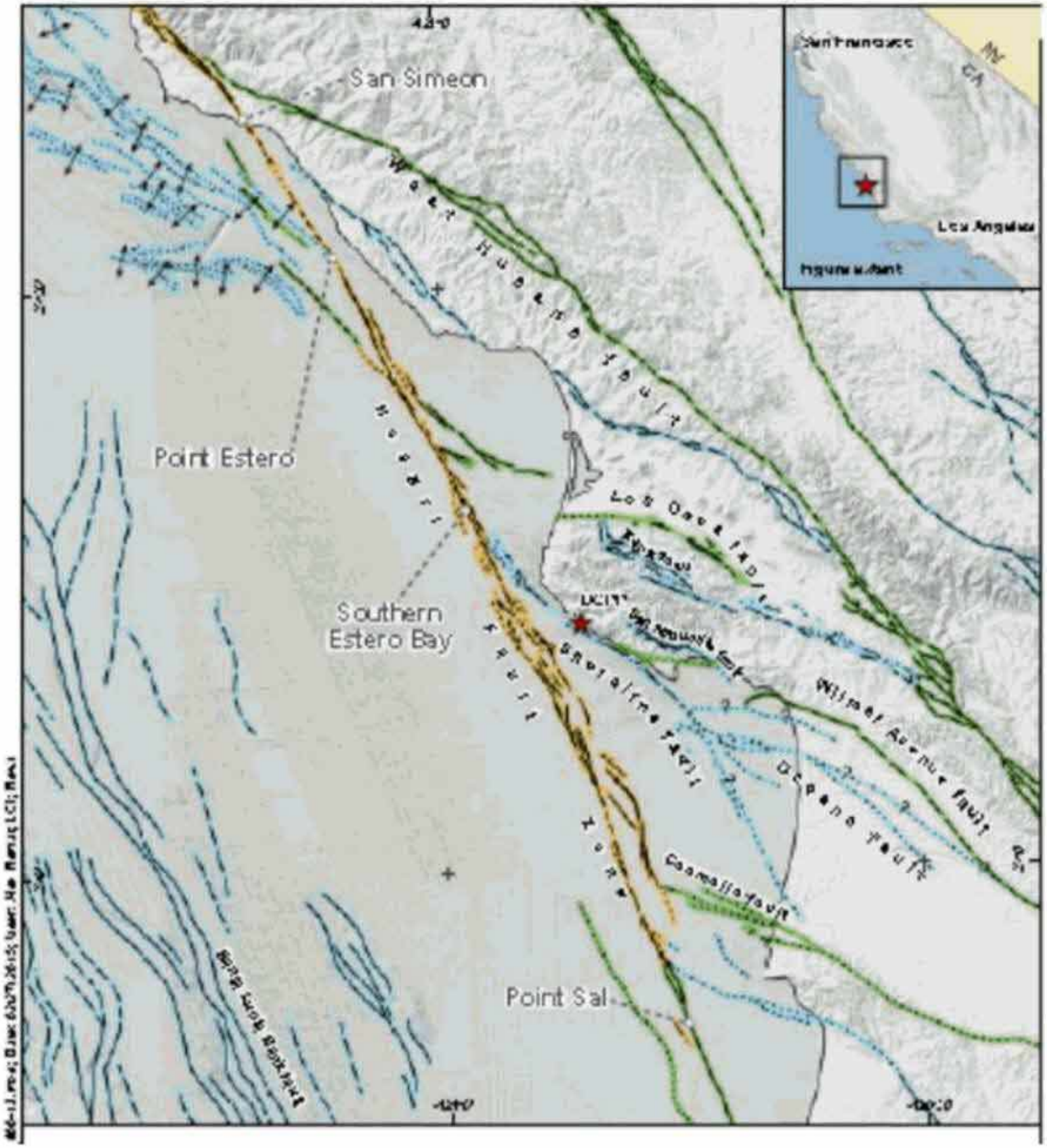
Note: Cross section D-D' shown to illustrate LM section of Los Osos fault, the closest section to the DCPP.

Los Osos Fault Parameter Values

DCPP SSC REPORT

Pacific Gas and Electric Company | Figure 7-29

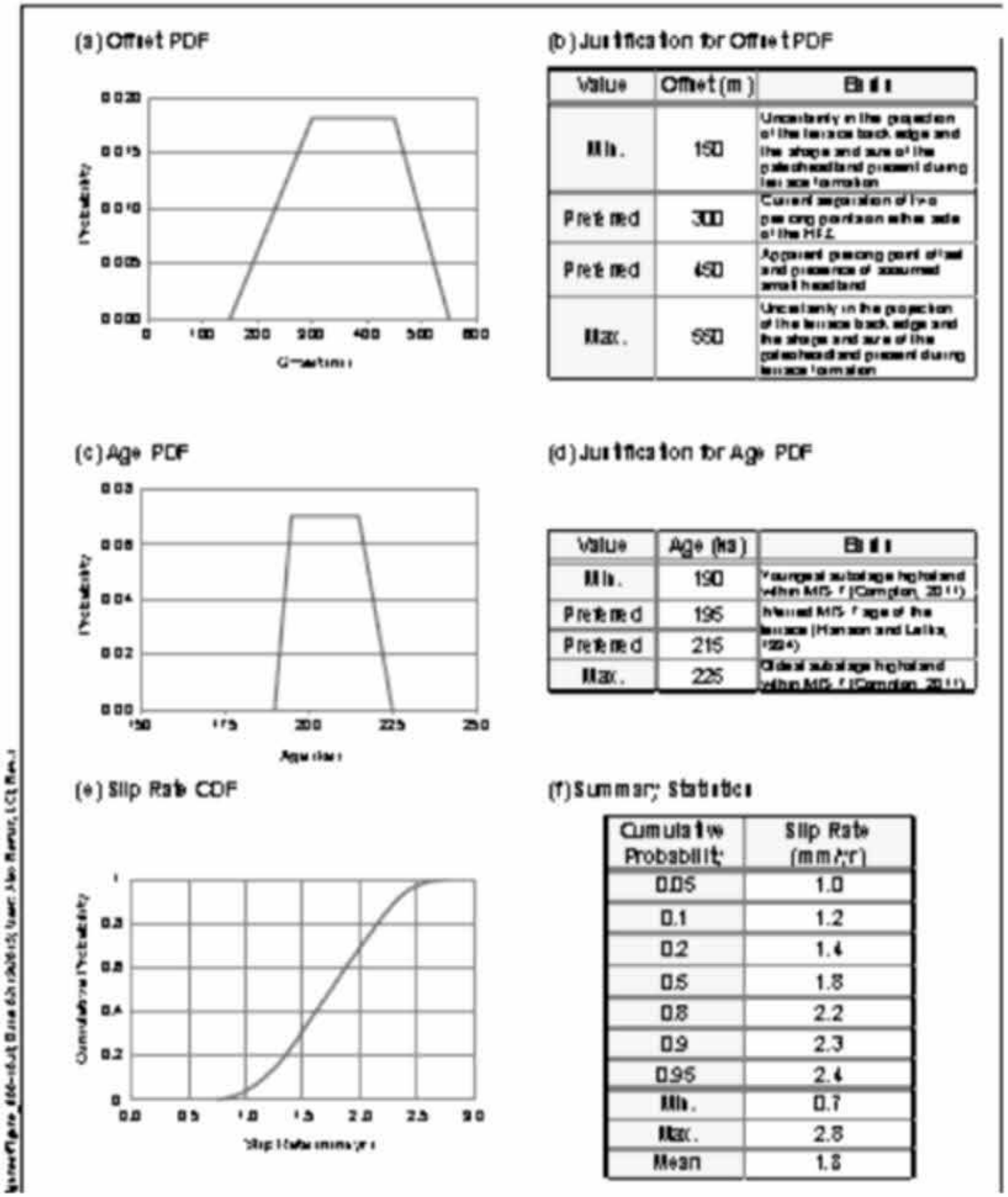
HOSGRI FAULT SLIP RATE



Slip Rate determined from four points

- San Simeon
- Point Estero
- Estero Bay
- Pont Sal

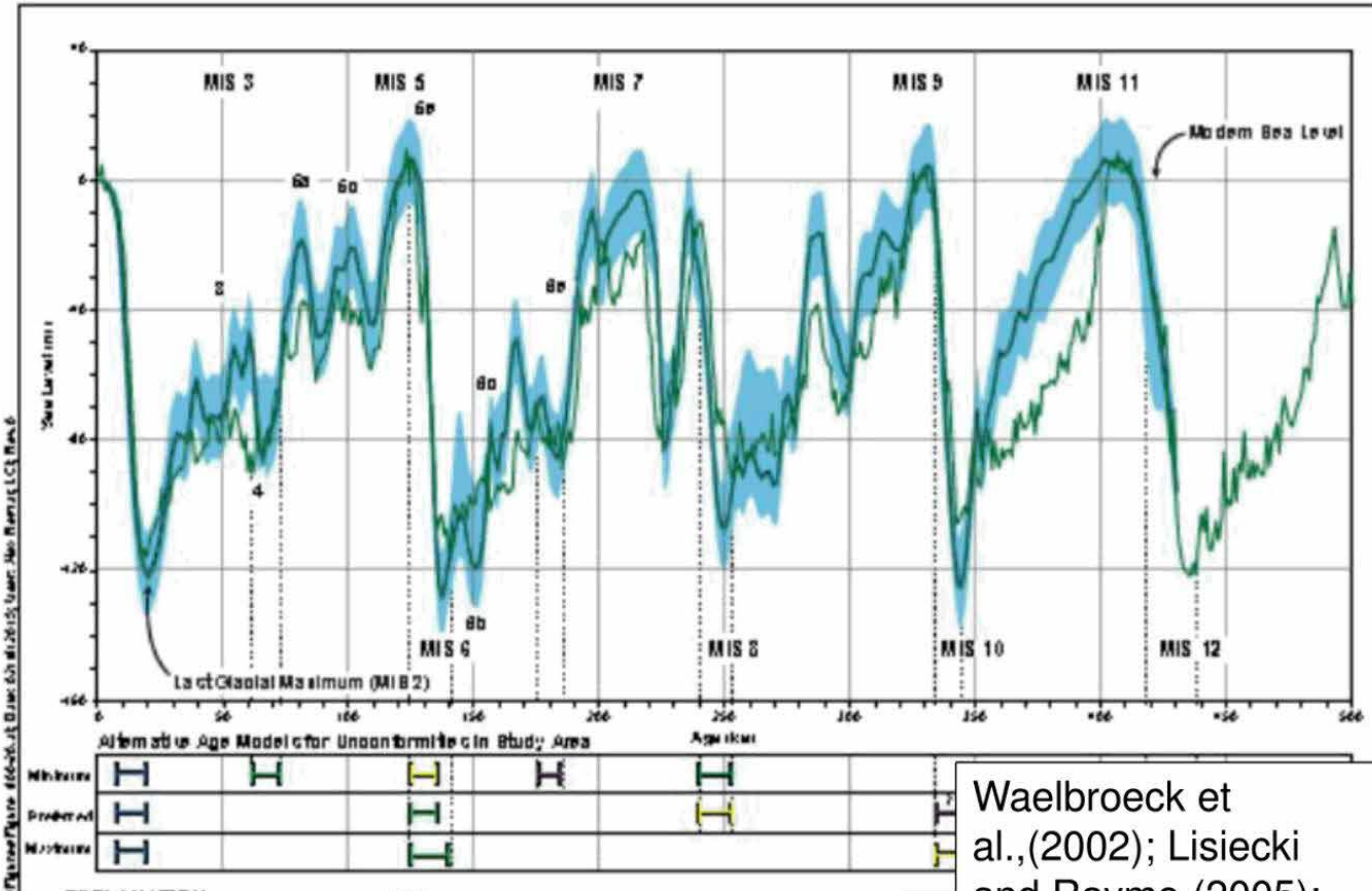
SLIP RATE ESTIMATES



Slip Rates estimates are derived from probability distribution functions (triangle or trapezoidal distributions) for measured slip and estimated of offset age

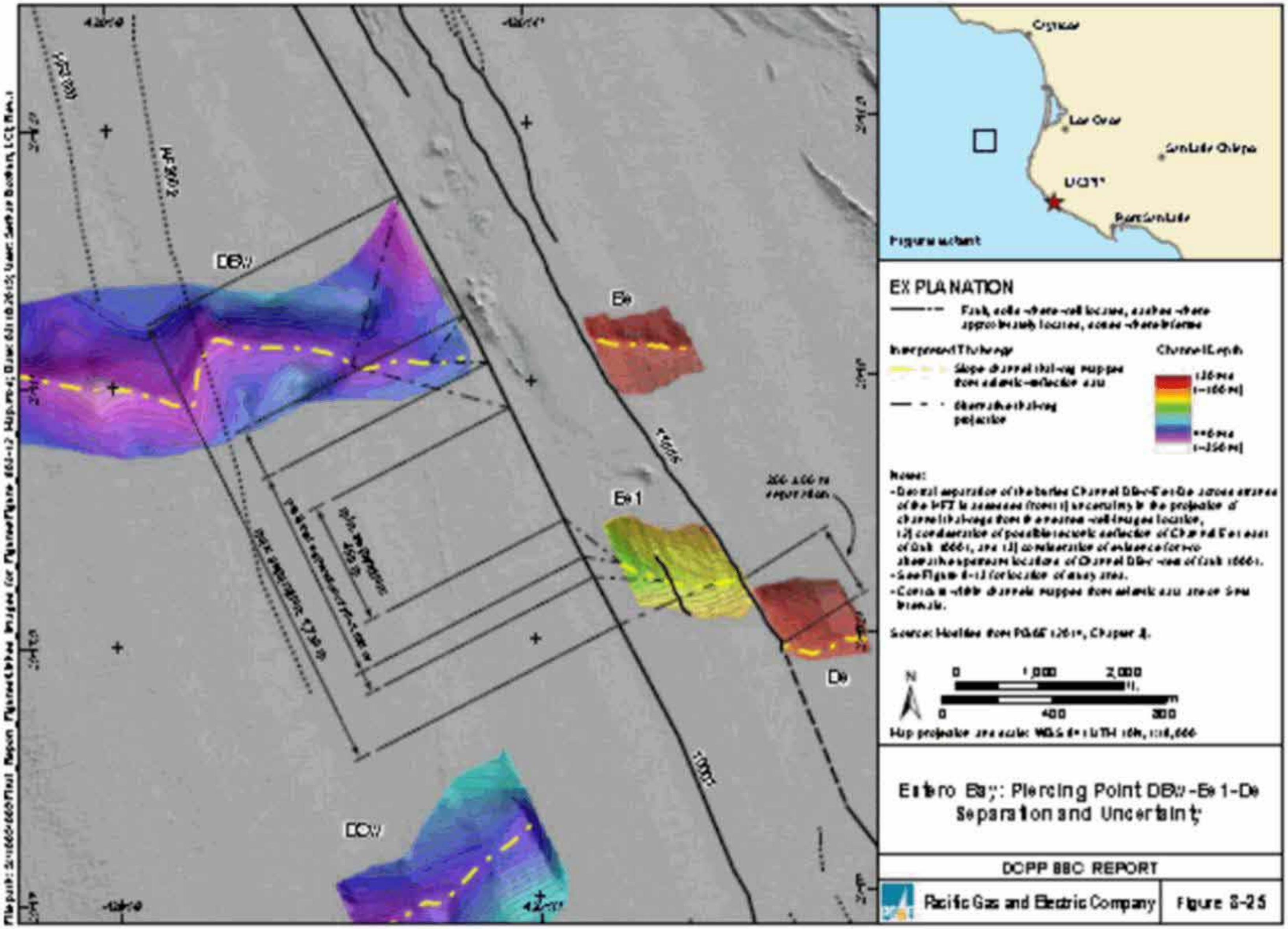
We are developing an Excel spreadsheet to test variations In these models.

OXYGEN ISOTOPE SEA LEVEL CURVES

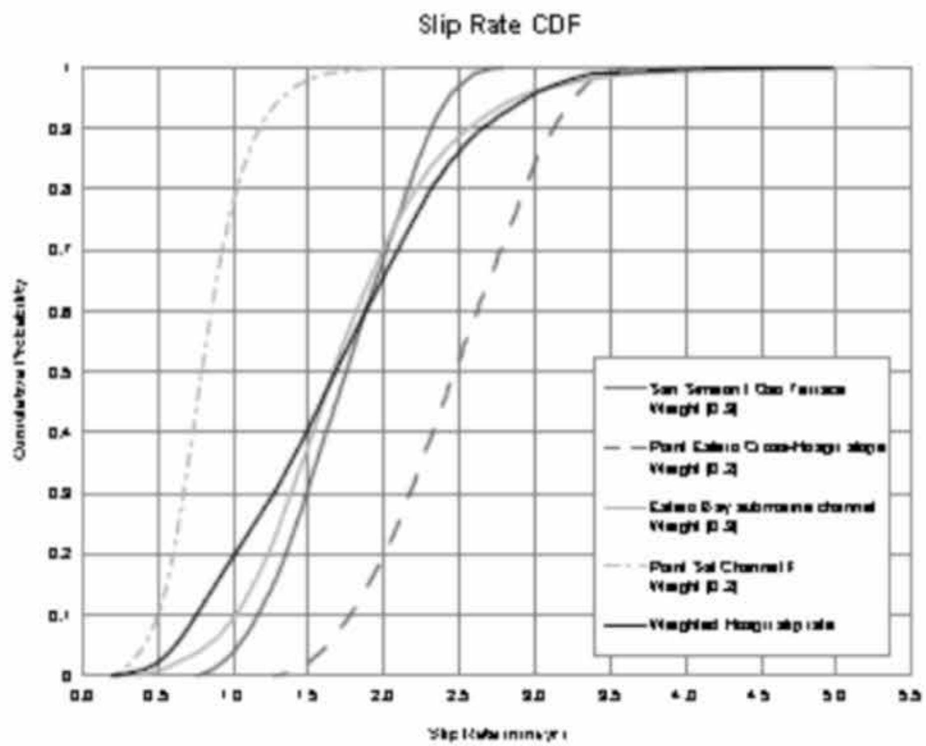


Waelbroeck et al.,(2002); Lisiecki and Raymo (2005); Carlson (2008).

Slip Based on Offset Markers Imaged in Offshore Seismic Reflection Data



MEAN CDF FOR HOSGRI SLIP RATE



Note: The Hosgri slip rate CDF is calculated from the weighted combination of slip rate CDFs developed for each of the four Hosgri slip rate sites.

5-Point Distribution		
Percentile	Slip Rate (mm/yr)	Weight
0.034893	0.6	0.101
0.211702	1	0.244
0.5	1.7	0.309
0.788298	2.3	0.244
0.965107	3.1	0.101
Weighted Mean	1.7	

Hosgri Slip Rate CDF Compilation and Selection of 5-Point Distribution

DCPP SSC REPORT

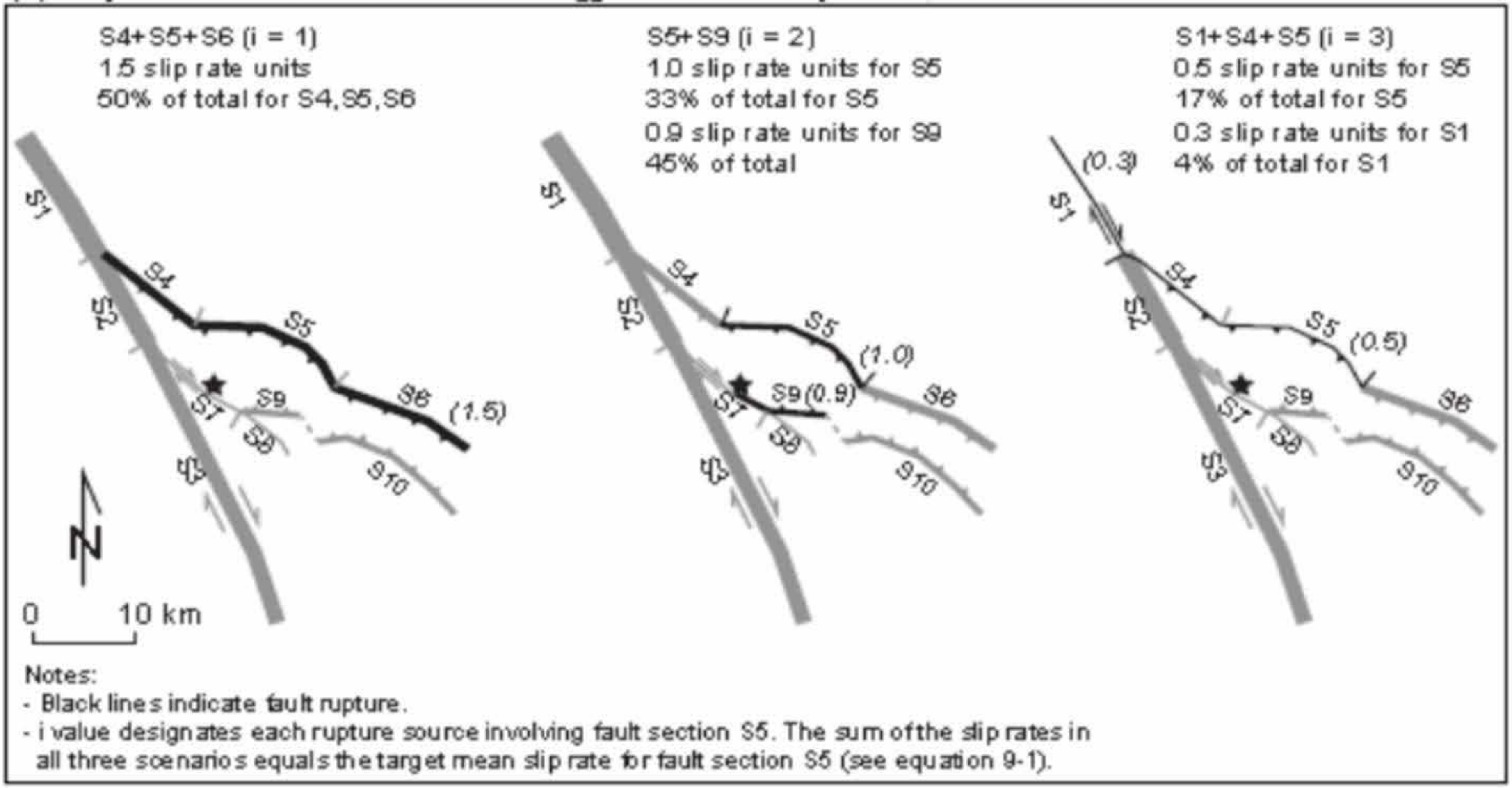
Pacific Gas and Electric Company | Figure 8-33

Slip Rate Allocation Models

- "A Slip Rate Allocation Model describes the slip rate allocated to individual rupture sources in a single Rupture Model. Accordingly, there is one Slip Rate Allocation Model for the Hosgri Rupture Model (that applies to all three Hosgri FGMs) and three Slip Rate Allocation Models for the SLPB Rupture Models—one each for the OV, SW, and NE Rupture Models."

- "The Slip Rate Allocation Model creates a slip rate for each rupture source such that, when the contributions from all rupture sources including a particular fault are summed, the combined slip rate equals the target slip rate budget for that particular fault for that particular Rupture Model."

(b) Slip Rate Allocation Methodology for Mean Slip Rate, Fault Section S5



EXPLANATION

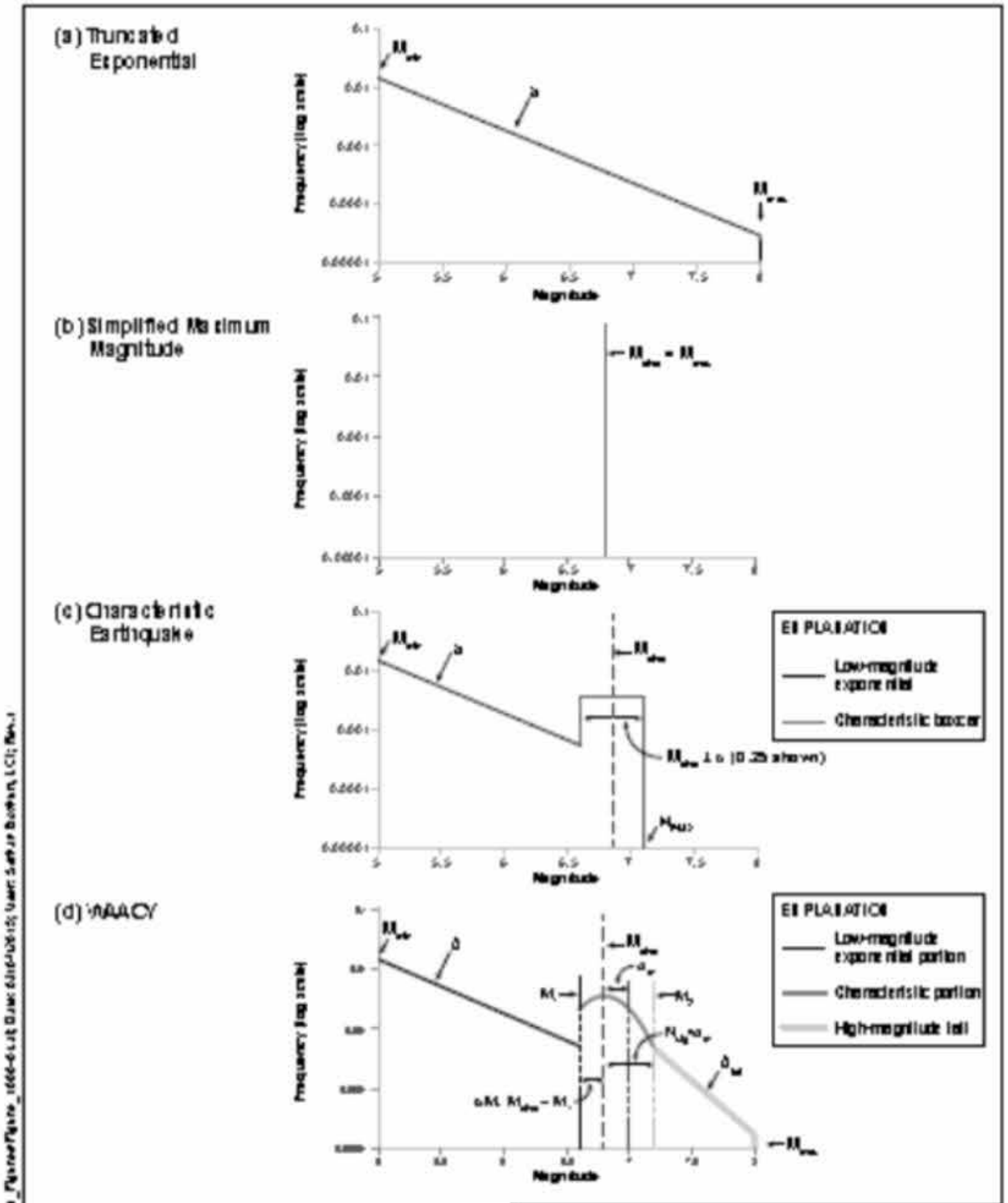
- Site
- Fault sections: strike-slip (left), reverse (right)
- Fault section slip rate, with the value in parentheses, and the width of the line proportional to the slip rate.
- Fault section IDs and section boundary

Slip Rate Allocation Model Concept

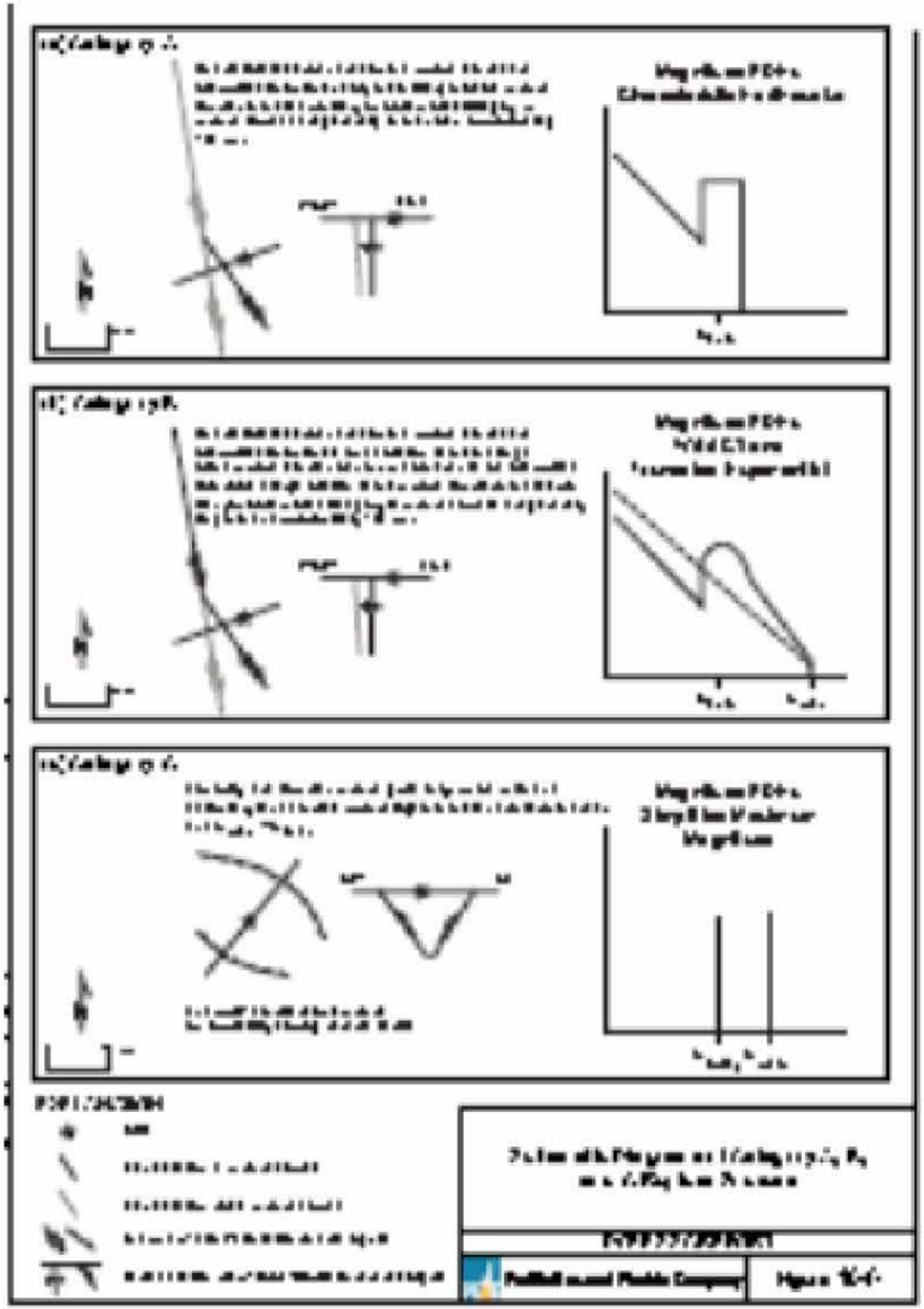
DCPP SSC REPORT

Pacific Gas and Electric Company | Figure **9-9**

MAGNITUDE DISTRIBUTION MODELS



Schematic Diagrams of Magnitude Probability Density Functions Used in the Diablo Canyon SSC Model



Each Rupture Source Assigned to one of Three MDMs

Time Dependency Model

- For another time ….

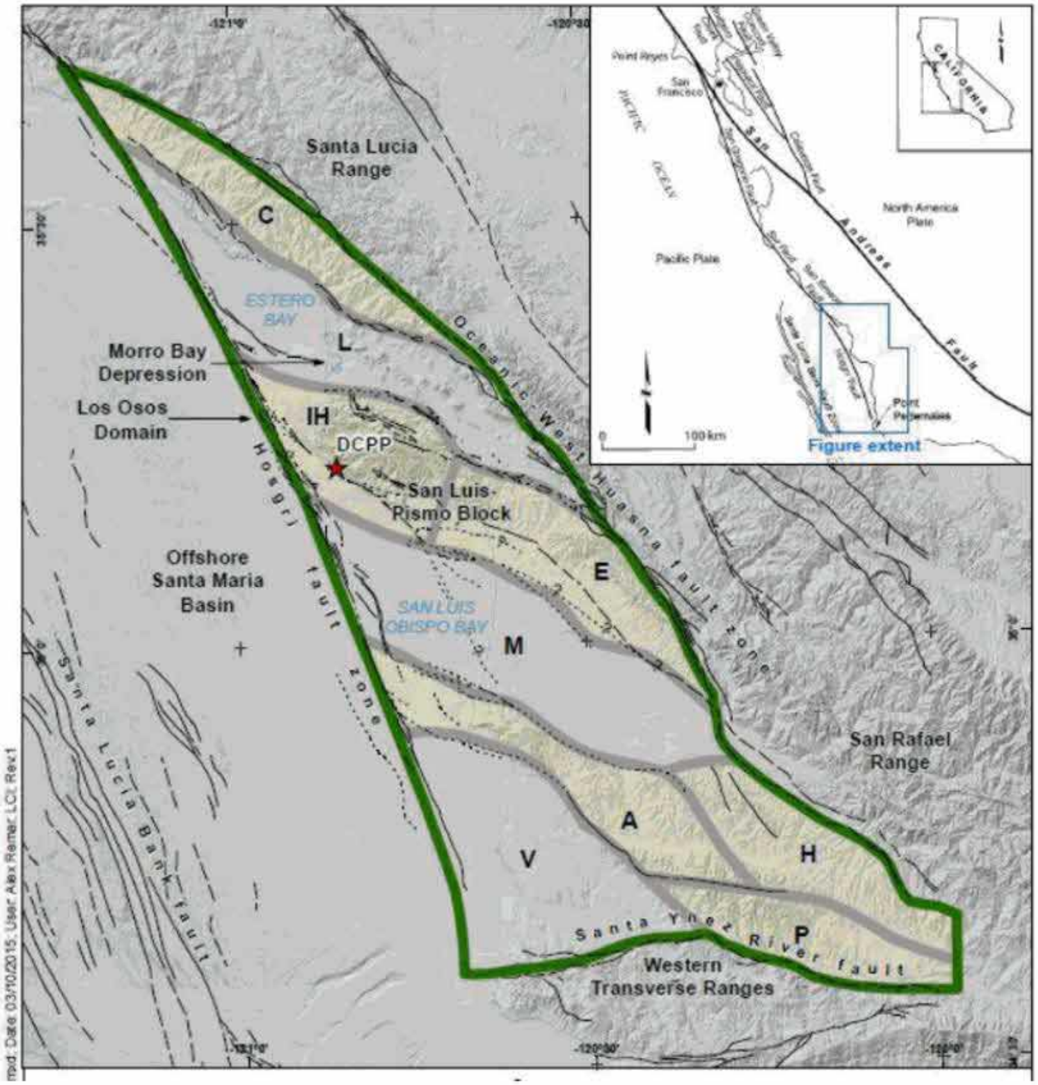
Diablo Canyon Seismic Source Characterization Review

John Stamatakos

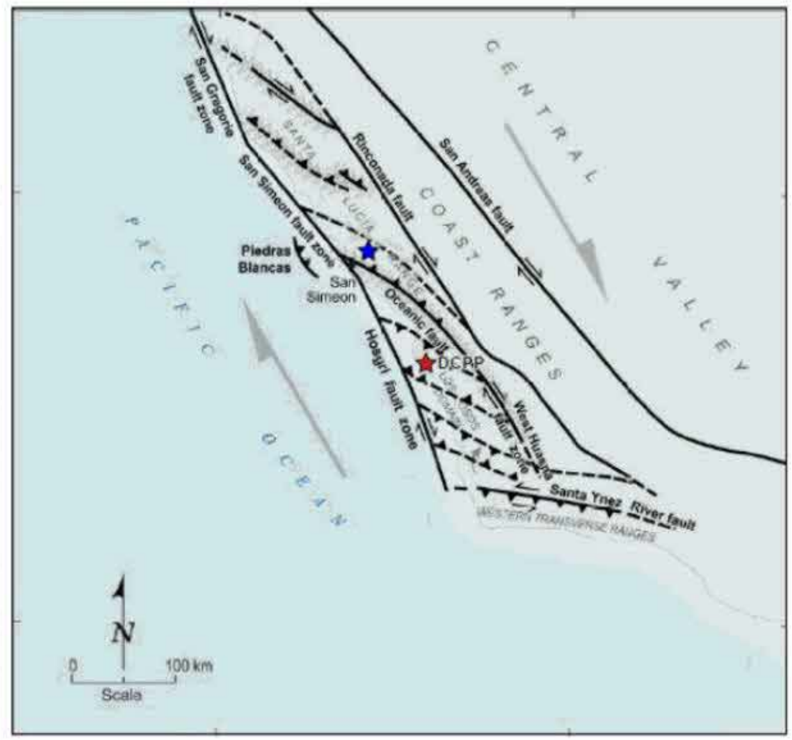
5/4/2015

This slide presentation (60-81/800)is a duplicate of slide presentation in this file, pages 37-58.

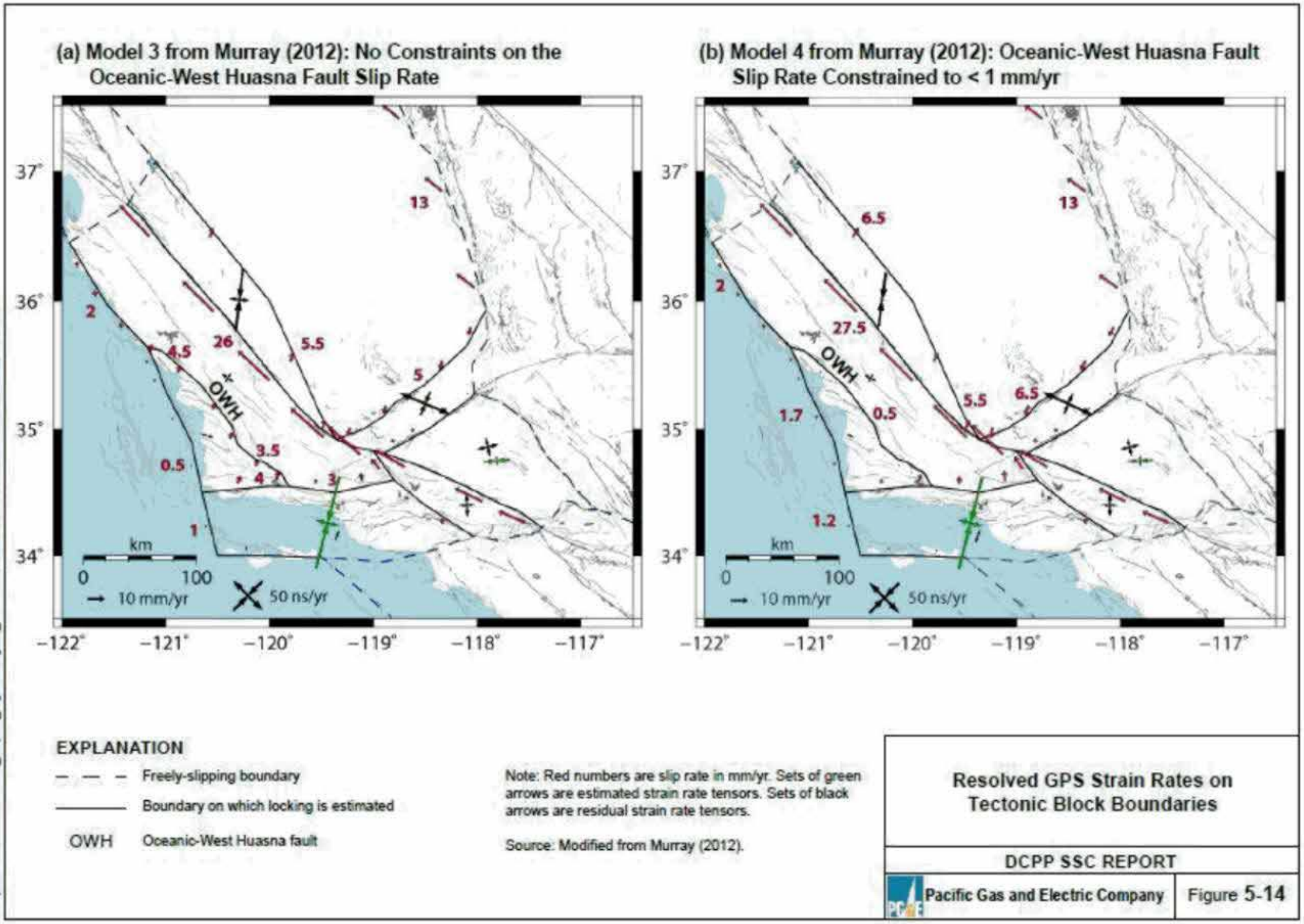
CONTEMPORARY TECTONIC SETTING



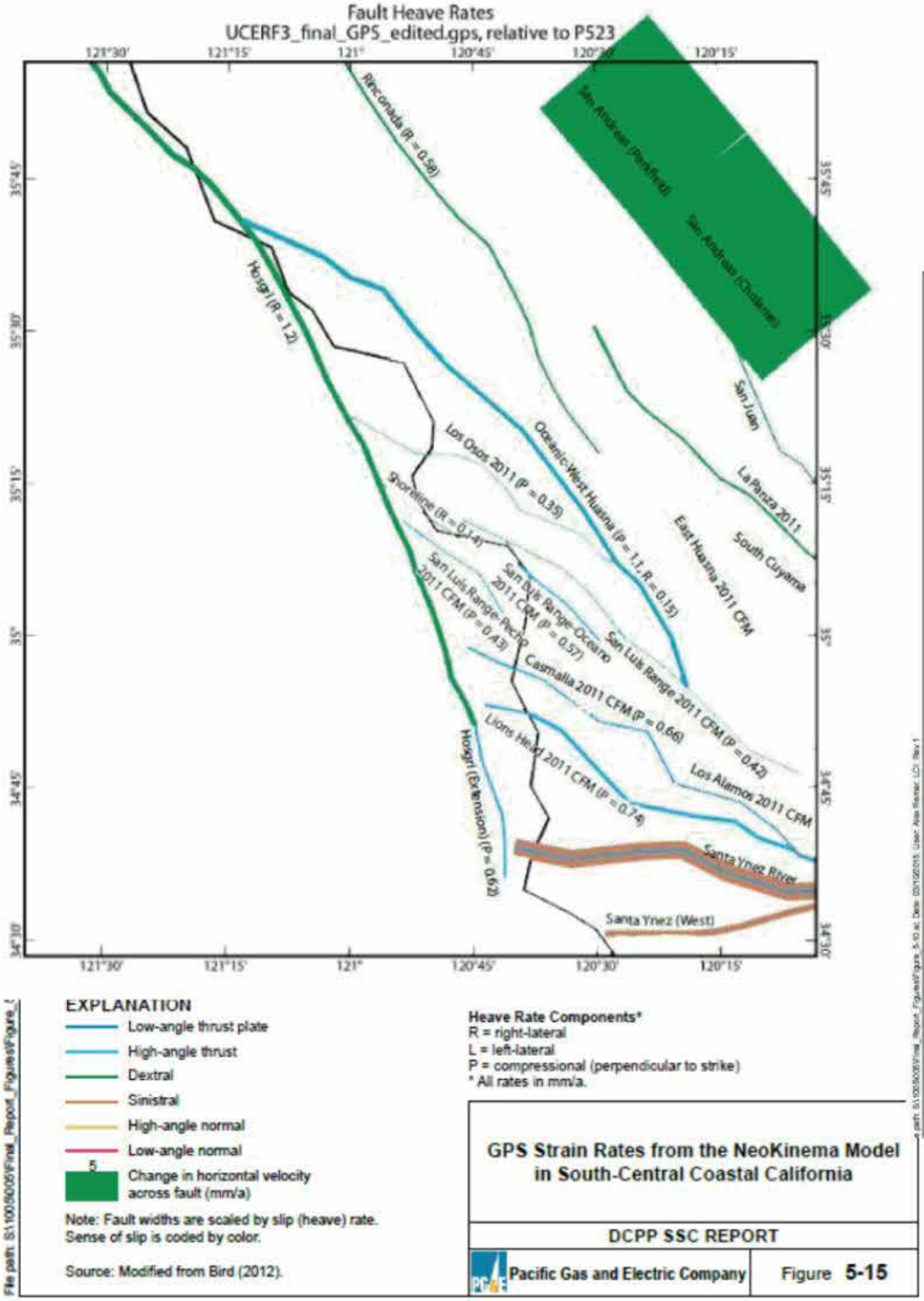
Dextral strike-slip plate boundary with transpression

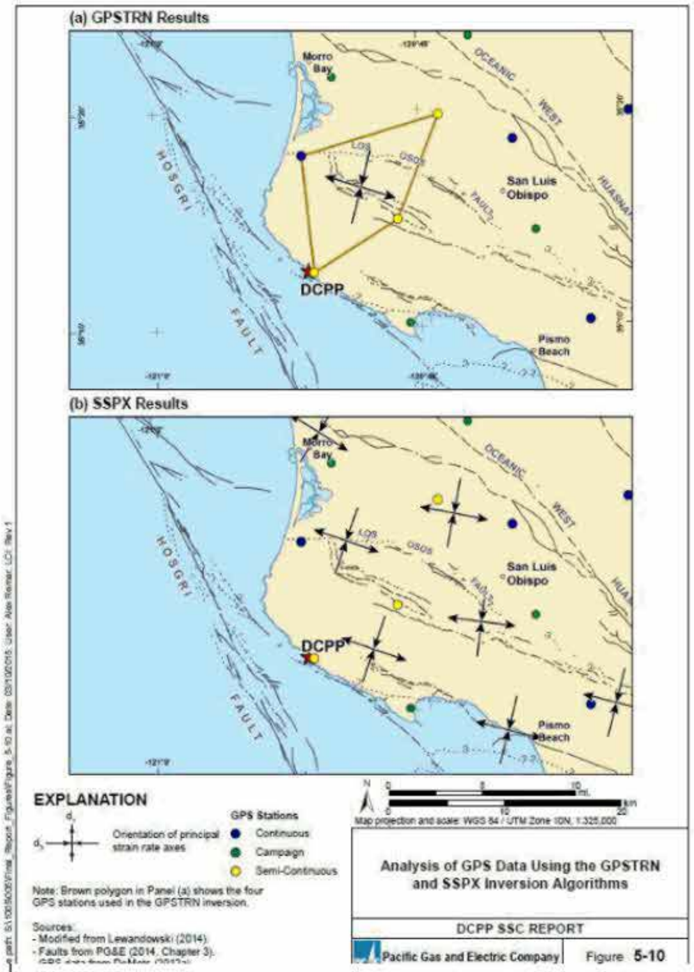


GPS STRAIN RATES



MORE STRAINS

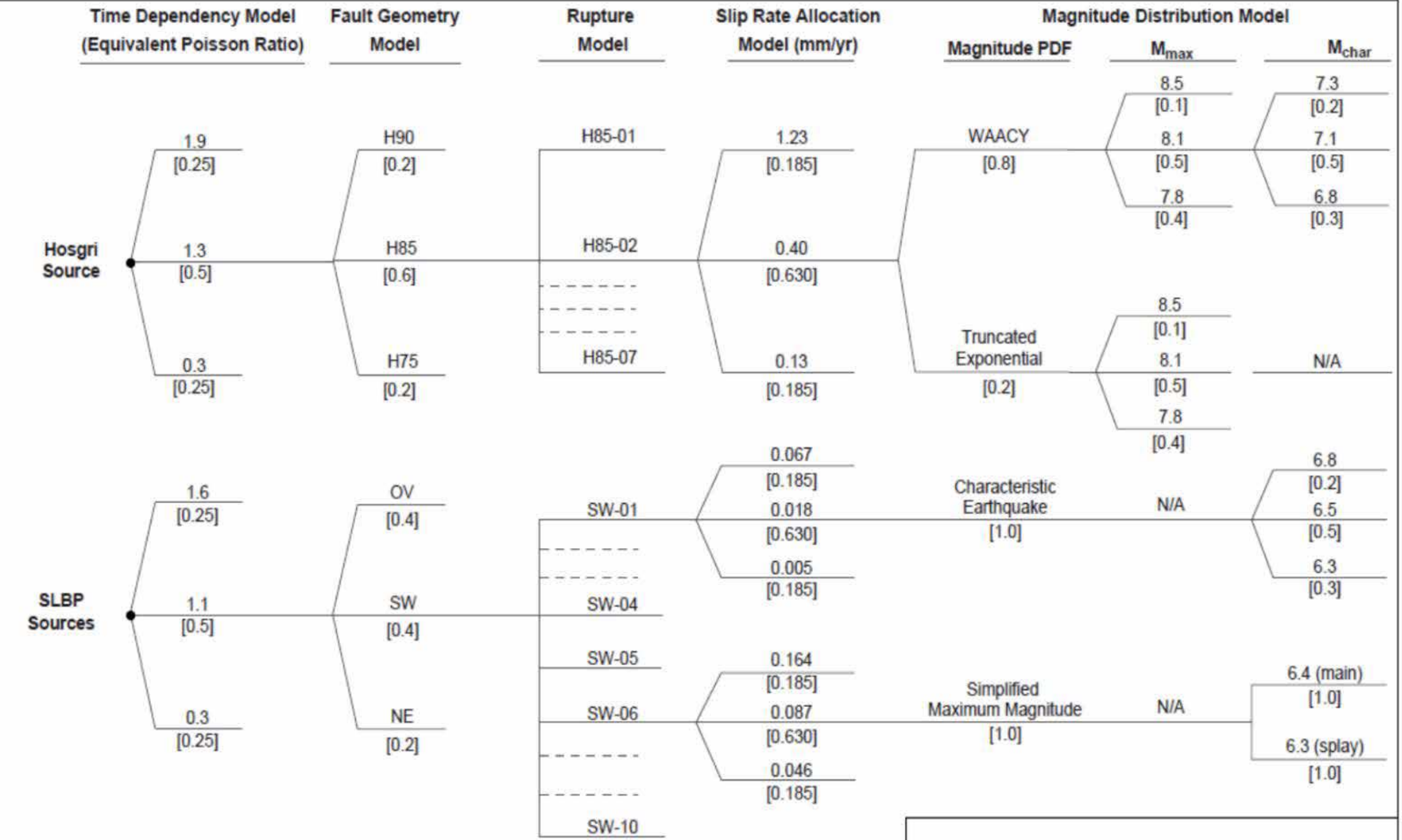




Fault Sources

- Geometry
- Faulting Style (SS, Reverse, Composite)
- Ruptures and Rupture Segments
- Slip Rate
- Slip Rate Allocation (on ruptures)
- Magnitude Distribution Models
- Time Dependency

***Areal Sources and Distant Fault Sources … another day**



Notes: In the example tree, rupture source H85-02 is a longer *linked* rupture source, so the WAACY and truncated exponential magnitude PDF models are considered. Rupture source SW-01 is a *characteristic* rupture source, so only the Youngs and Coppersmith (1985) characteristic earthquake magnitude PDF is considered. Rupture source SW-06 is a *splay* rupture source, so only the simplified maximum magnitude earthquake magnitude PDF model is considered. See text.

Logic Tree Structure for the Primary and Connected Fault Sources

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Pacific Gas and Electric Company

Figure **6-1**

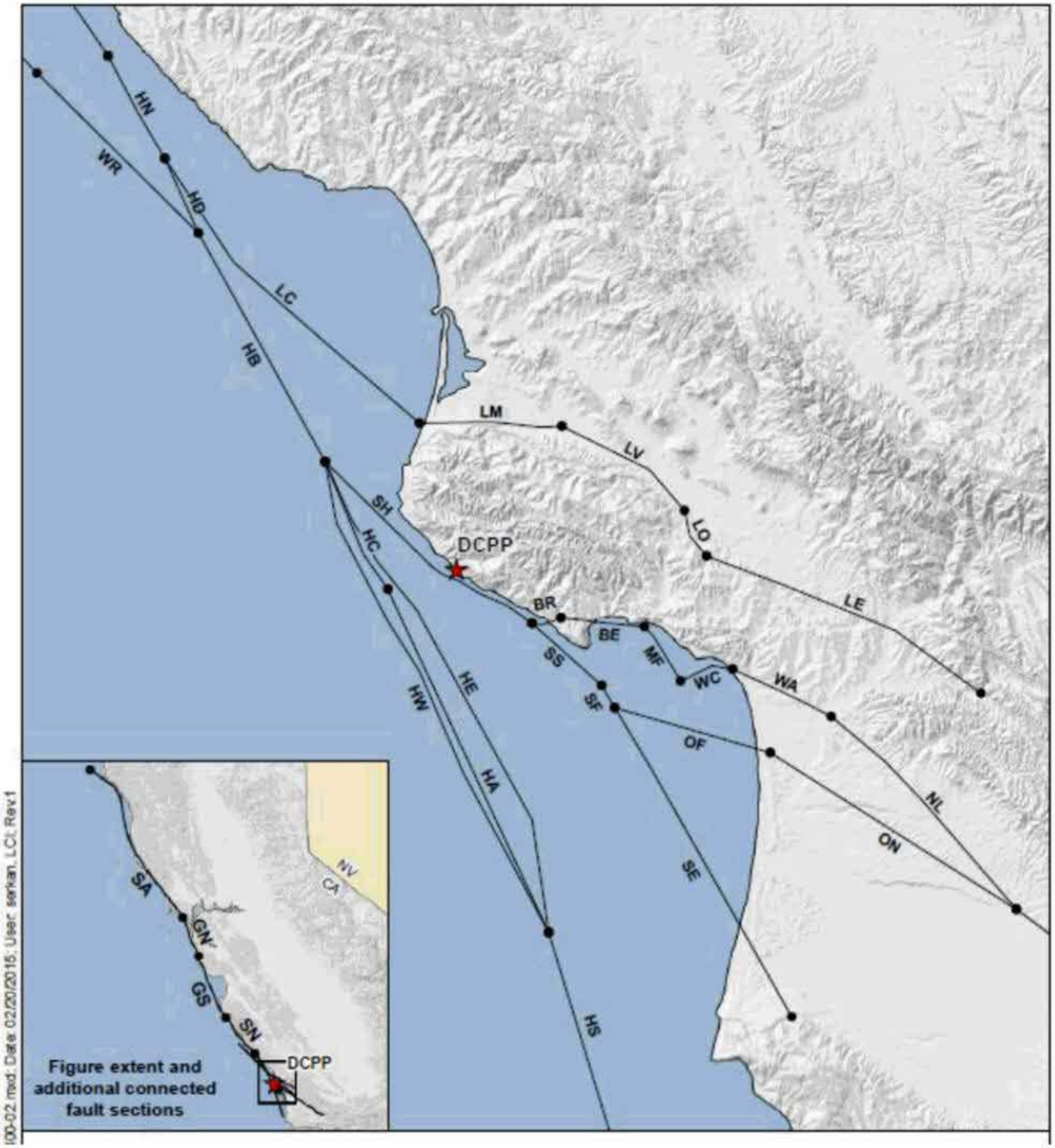
Fault Geometry Models (FGM)

- Three Hosgri FGMs
- Three San Luis–Pismo Block (SLPB) FGMs

Table 6-4. Fault Geometry Models (FGMs) and Logic Tree Combinations

Hosgri FGMs	SLPB FGMs		
	Outward-Vergent (OV)	Southwest-Vergent (SW)	Northeast-Vergent (NE)
Hosgri 90 (H90)	H90/ OV	H90/ SW	H90/ NE
Hosgri 85 (H85)	H85/ OV	H85/ SW	H85/ NE
Hosgri 75 (H75)	H75/ OV	H75/ SW	H75/ NE

- About 40 rupture segments
  - Three sets of rupture segments (for the three SLPB FGMs)

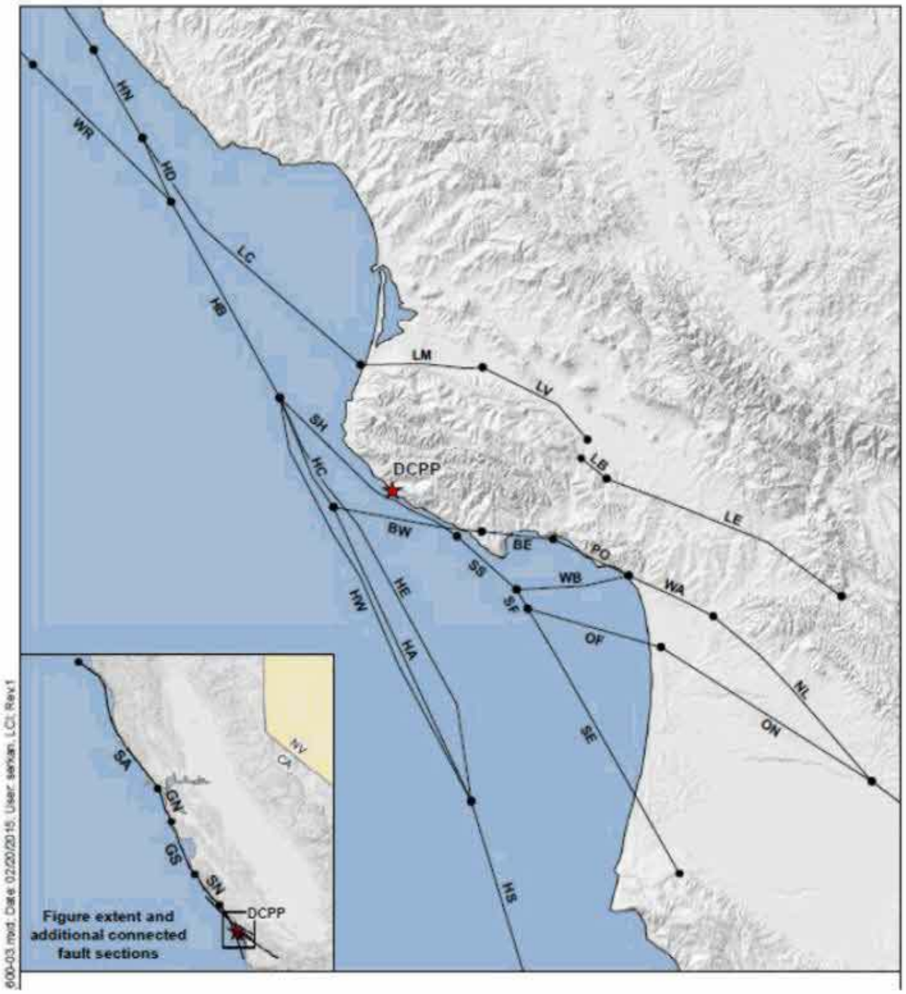


Rupture Segments

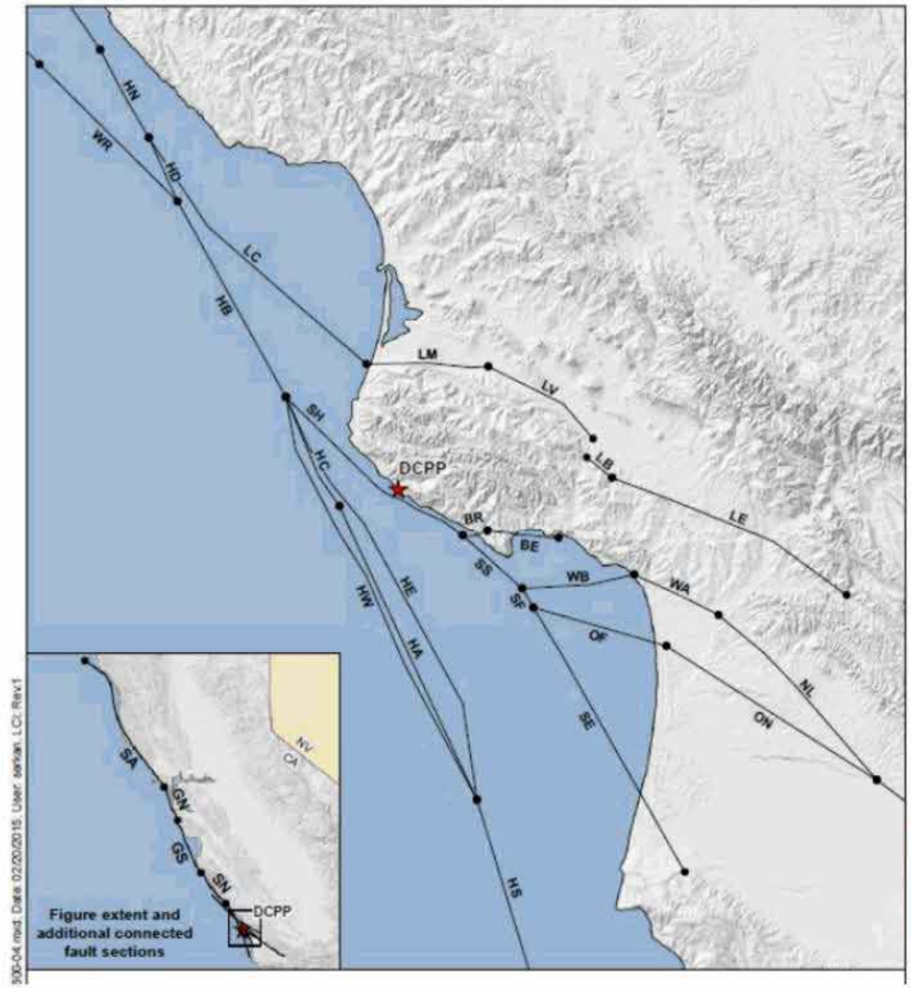
- Outward-Vergent

More Rupture Segments

SW-Vergent



NE-Vergent



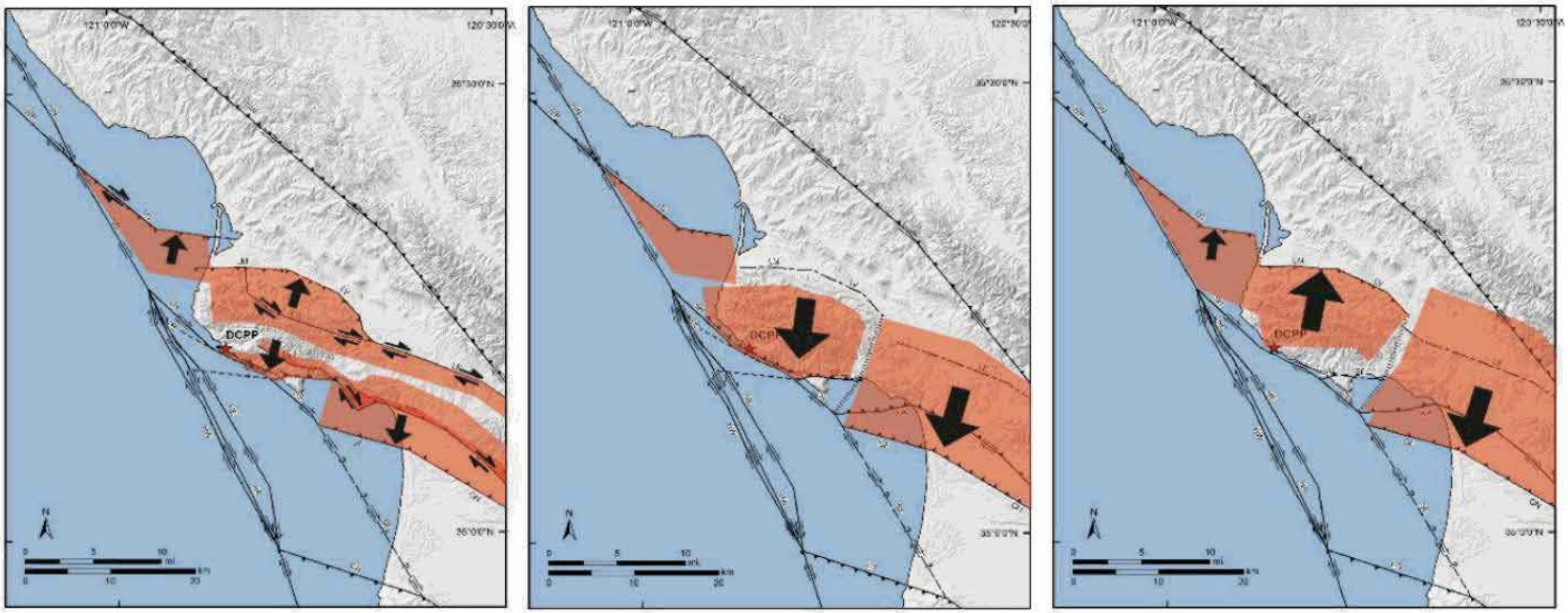
EXAMPLE: HOSGRI FAULT RUPTURE MODELS

Table 9-3. Hosgri Fault Rupture Model

Rupture Source Number	Type	Description	Fault Sections[1] (closest section to the DCPP in bold)	Sense of Slip
H-01	Linked	Hosgri (Central trace) to MTJ[2]	HS+**HA**+HC+HB+HD+HN+SI+SN+GS+GN+SA	Strike slip
H-02	Linked	Hosgri (West trace) to MTJ	HS+**HW**+HB+HD+HN+SI+SN+GS+GN+SA	Strike slip
H-03	Linked	Hosgri (East trace) to MTJ	HS+**HE**+HB+HD+HN+SI+SN+GS+GN+SA	Strike slip
H-04	Complex	Hosgri (Central trace) with Piedras Blancas	HS+**HA**+HC+HB+WR (primary fault); PB (secondary fault)	Primary = strike slip Secondary = reverse
H-05	Splay	Shoreline with Hosgri (Central trace) to Bolinas	HS+**HA**+HC+HB+HD+HN+SI+SN+GS+GN (main fault); SE+SS+**SH** (splay fault)	Strike slip
H-06[3]	Linked	Hosgri north of the Shoreline fault intersection	**HB**+HD+HN+SI+SN+GS+GN+SA	Strike slip
H-07[3]	Linked	Hosgri north of the Los Osos fault intersection	**HN**+SI+SN+GS+GN+SA	Strike slip
H-08[3]	Characteristic	Piedras Blancas	**PB**	Reverse

[1] Two-letter codes are explained in Table 6-5 and on Plate 9-1.
[2] MTJ = Mendocino Triple Junction
[3] Same downdip geometry is used for all three Hosgri FGMs.

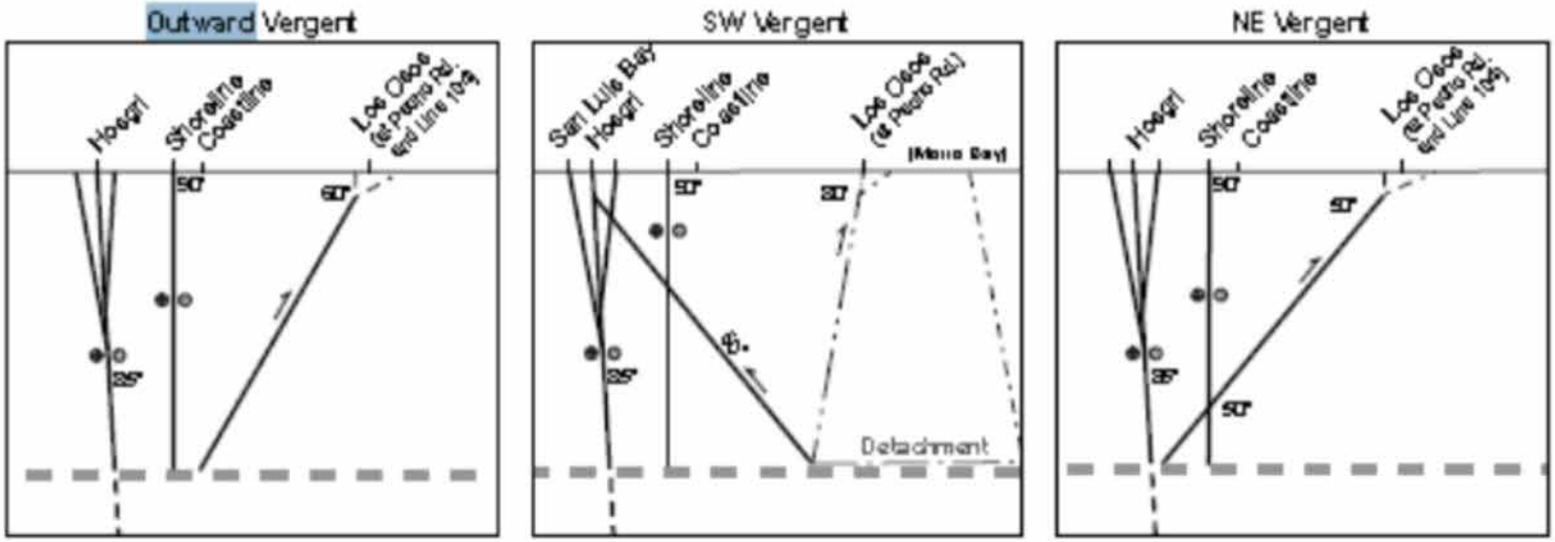
THREE SLPM FGMS



THREE SLPB FGMS

Parameter Values, Los Osos Fault

Model	Outward Vergent Weight 0.4	SW Vergent Weight: 0.4	NE Vergent Weight 0.2	Range		Weighted mean
Los Osos	LC+LMP+LV+LE	LC+LMP+LV+LE	LC+LMP+LV+LE	Summary		
Dip	60	80	50	50	80	66
Dip Direction	SW	SW	SW			
Style of faulting	RL/R-O	R	R			
Depth to top	1	1	1	1	1	1
Width	13	11	14	11	14	12.4



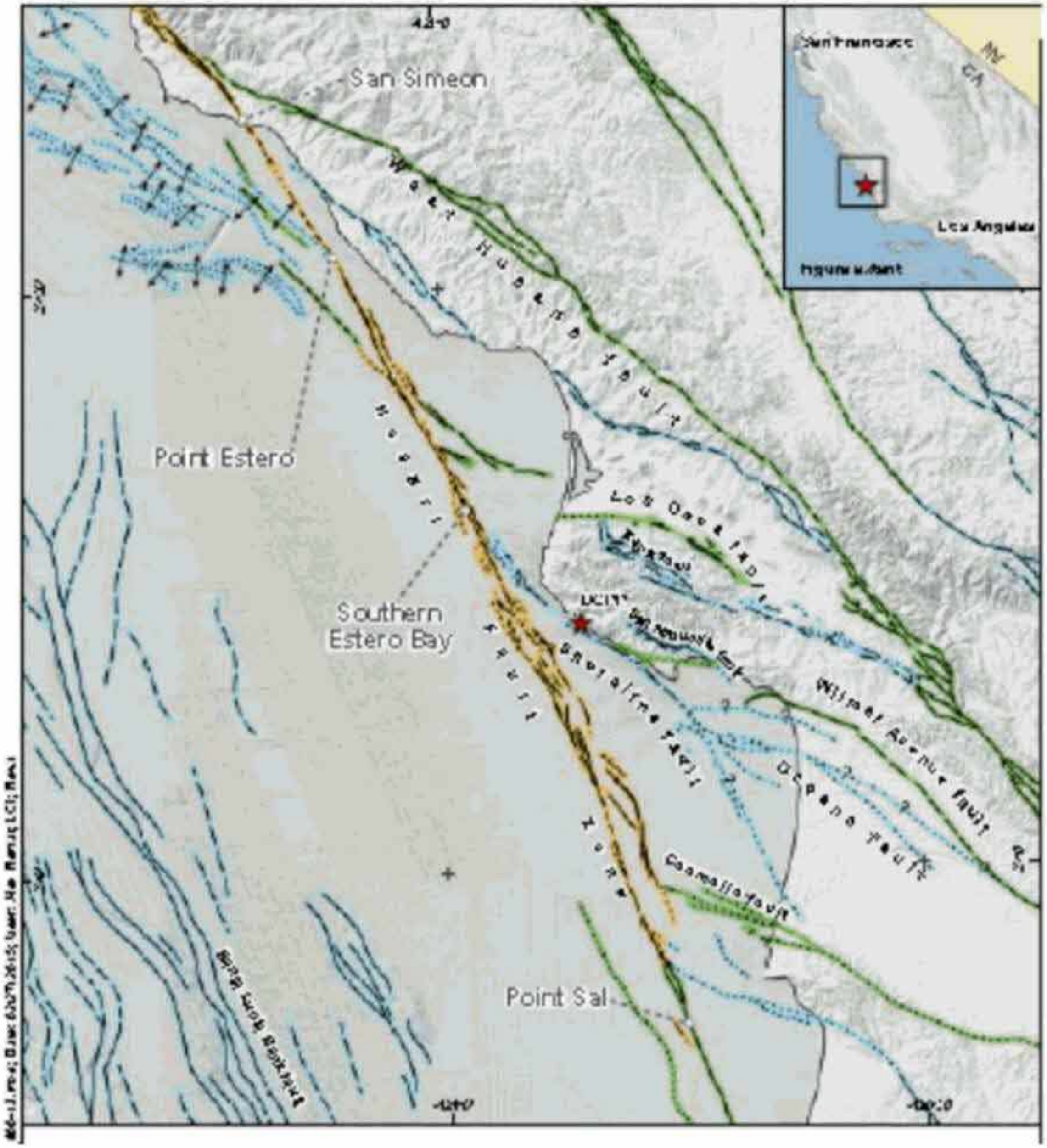
Note: Cross section D-D' shown to illustrate LM section of Los Osos fault, the closest section to the DCPP.

Los Osos Fault Parameter Values

DCPP SSC REPORT

Pacific Gas and Electric Company | Figure 7-29

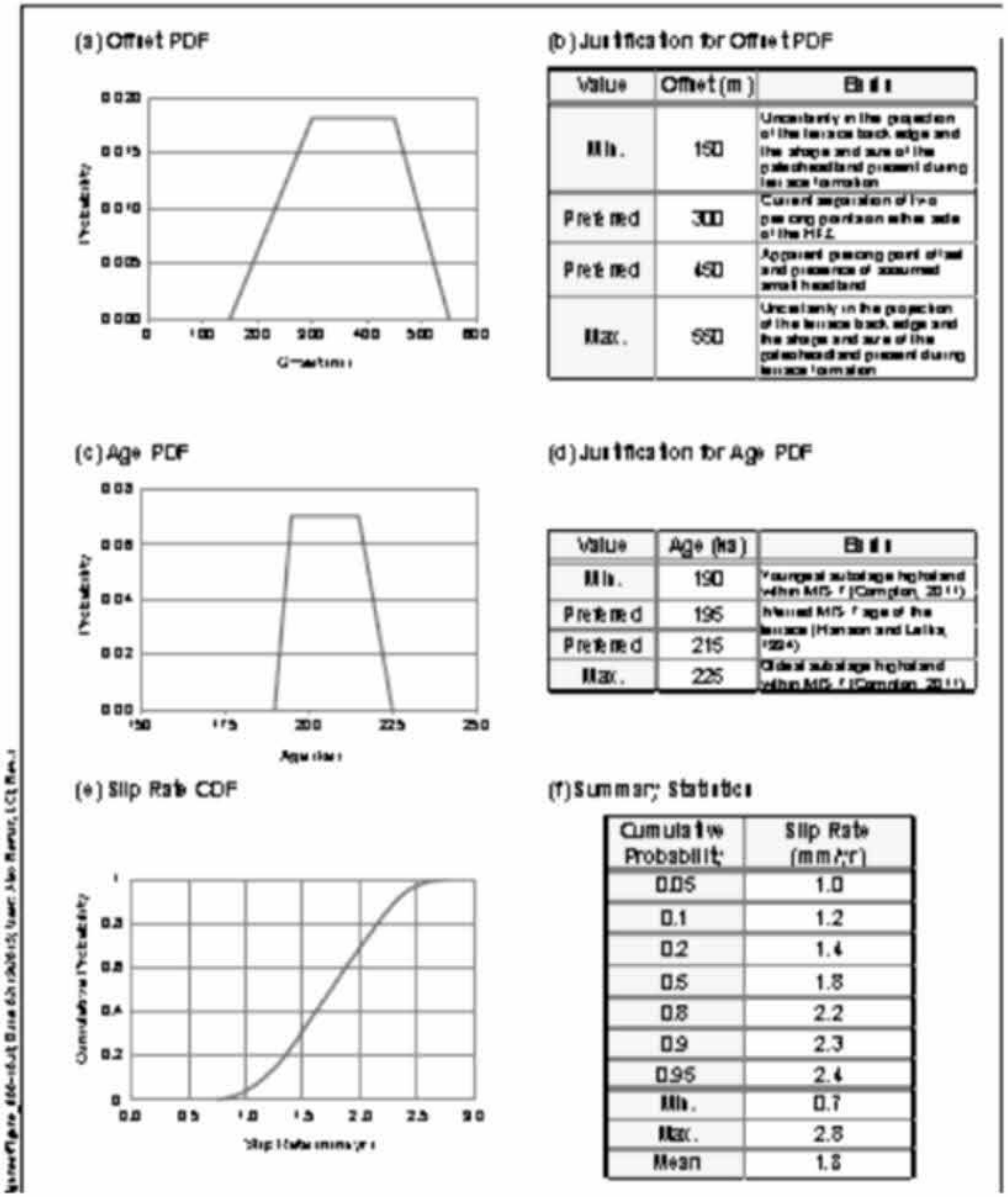
HOSGRI FAULT SLIP RATE



Slip Rate determined from four points

- San Simeon
- Point Estero
- Estero Bay
- Pont Sal

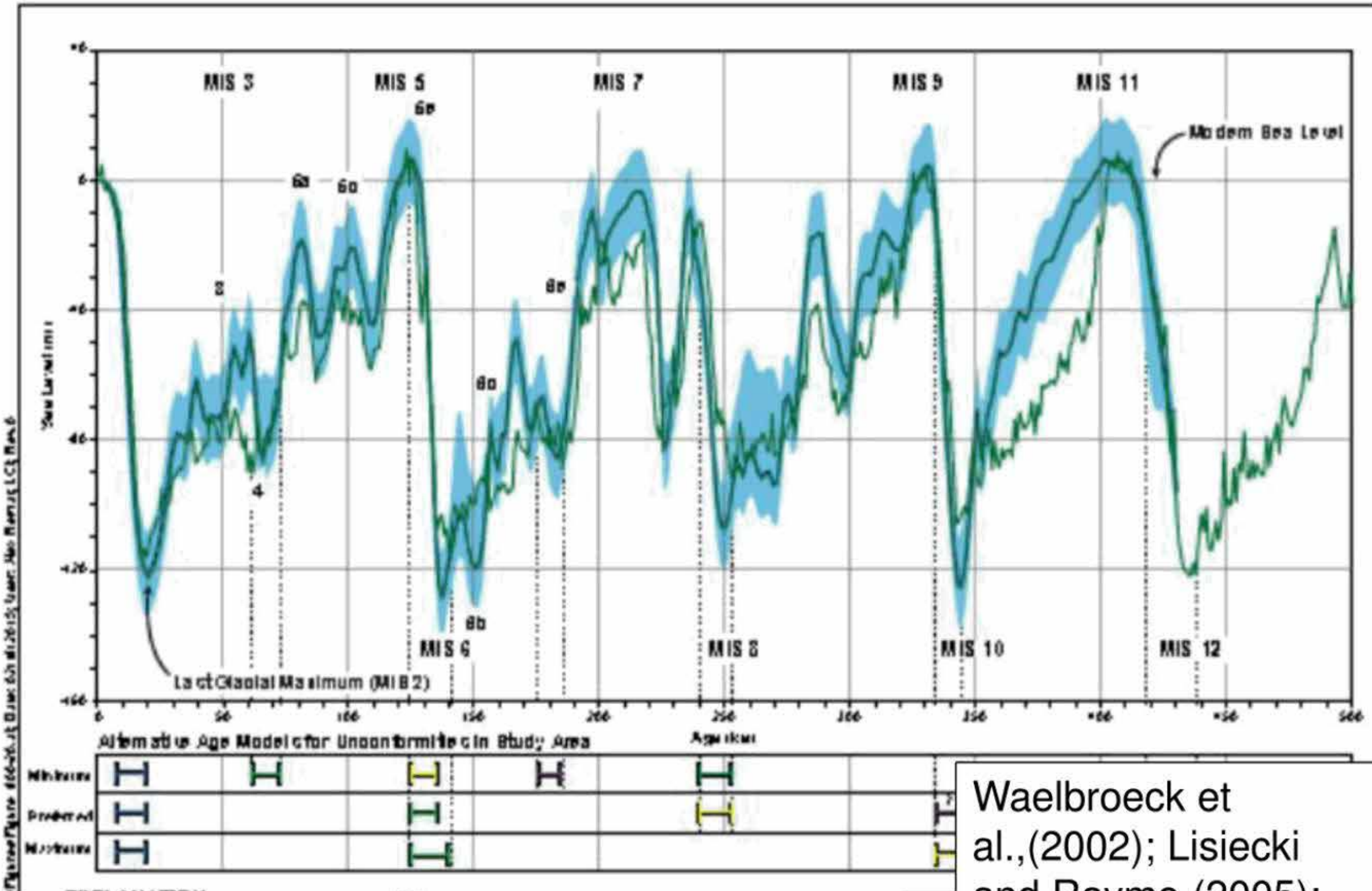
Slip Rate Estimates



Slip Rates estimates are derived from probability distribution functions (triangle or trapezoidal distributions) for measured slip and estimated of offset age

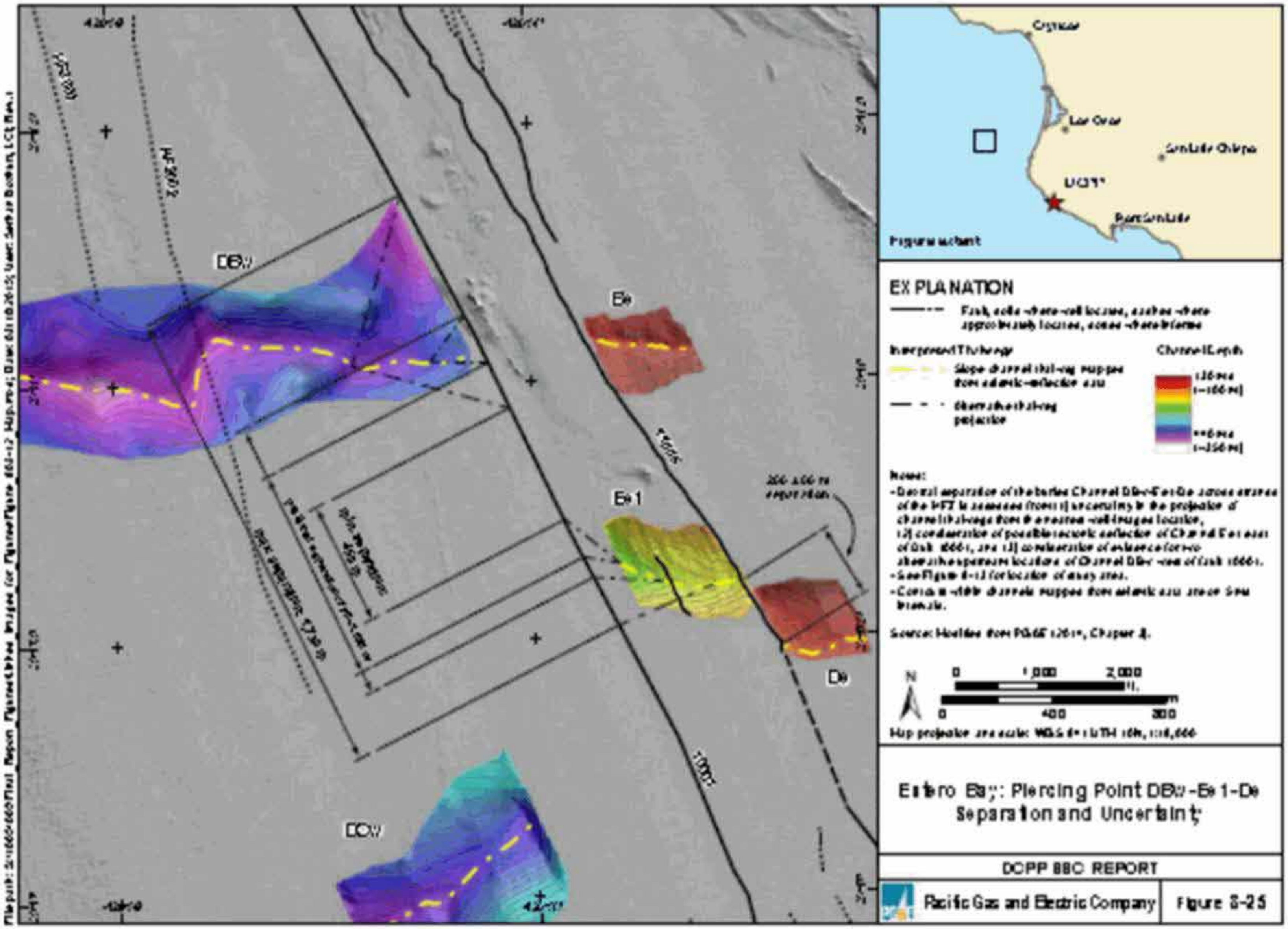
We are developing an Excel spreadsheet to test variations In these models.

Oxygen Isotope Sea Level Curves

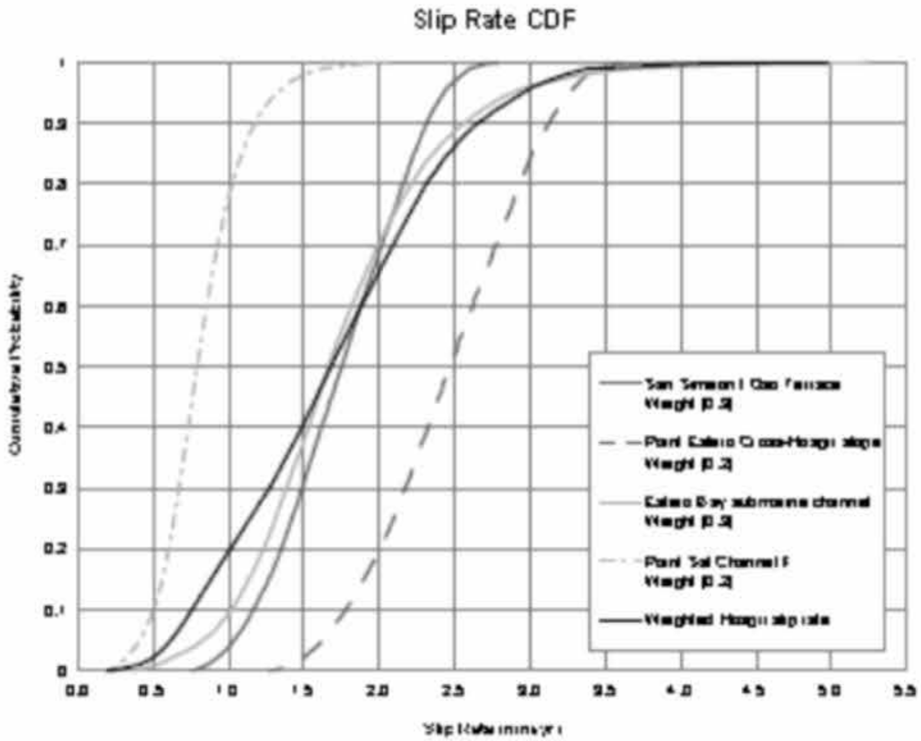


Waelbroeck et al.,(2002); Lisiecki and Raymo (2005); Carlson (2008).

Slip Based on Offset Markers Imaged in Offshore Seismic Reflection Data



MEAN CDF FOR HOSGRI SLIP RATE



5-Point Distribution		
Percentile	Slip Rate (mm/yr)	Weight
0.034893	0.6	0.101
0.211702	1	0.244
0.5	1.7	0.309
0.788298	2.3	0.244
0.965107	3.1	0.101
Weighted Mean	1.7	

Hosgri Slip Rate CDF Compilation and Selection of 5-Point Distribution

DCPP SSC REPORT

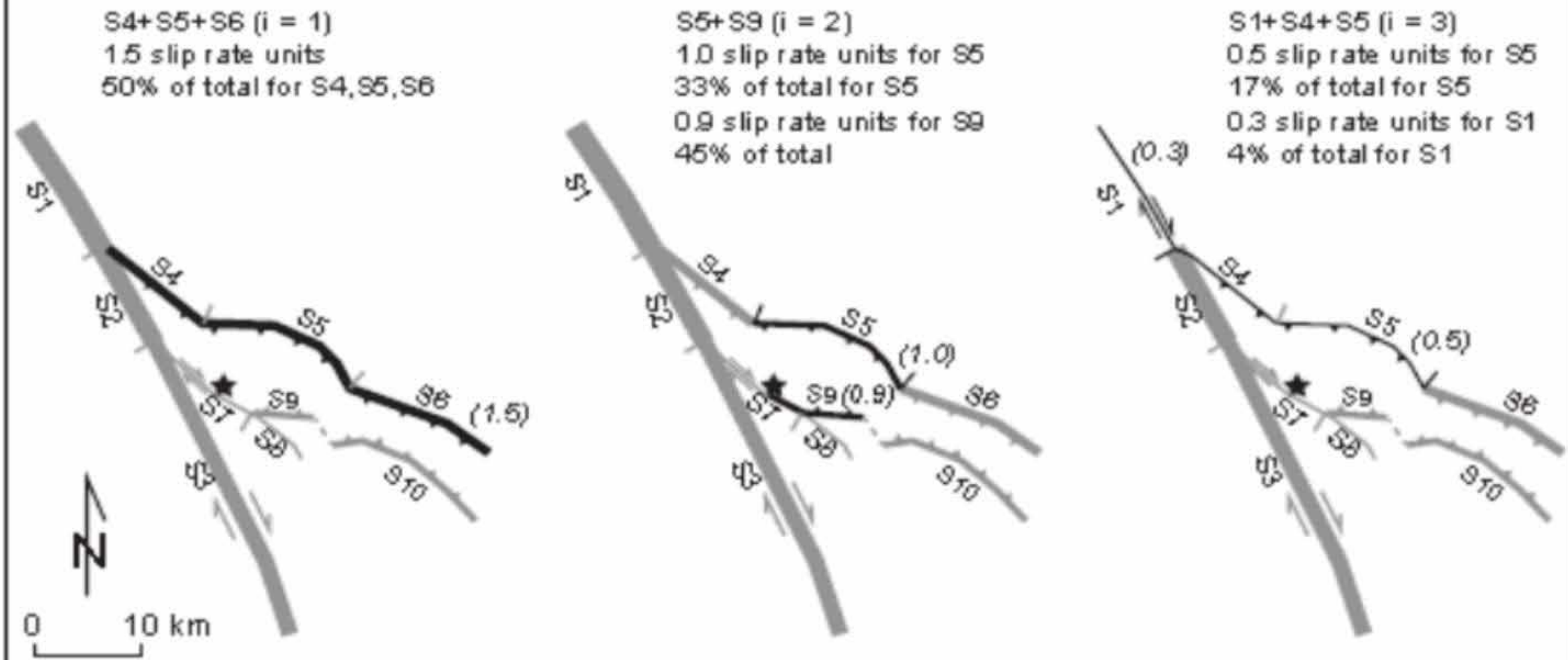
Pacific Gas and Electric Company | Figure 8-33

SLIP RATE ALLOCATION MODELS

- "A Slip Rate Allocation Model describes the slip rate allocated to individual rupture sources in a single Rupture Model. Accordingly, there is one Slip Rate Allocation Model for the Hosgri Rupture Model (that applies to all three Hosgri FGMs) and three Slip Rate Allocation Models for the SLPB Rupture Models—one each for the OV, SW, and NE Rupture Models."

- "The Slip Rate Allocation Model creates a slip rate for each rupture source such that, when the contributions from all rupture sources including a particular fault are summed, the combined slip rate equals the target slip rate budget for that particular fault for that particular Rupture Model."

(b) Slip Rate Allocation Methodology for Mean Slip Rate, Fault Section S5



Notes:
- Black lines indicate fault rupture.
- i value designates each rupture source involving fault section S5. The sum of the slip rates in all three scenarios equals the target mean slip rate for fault section S5 (see equation 9-1).

EXPLANATION

★ Site

Fault sections: strike-slip (left), reverse (right)

Fault section slip rate, with the value in parentheses, and the width of the line proportional to the slip rate.

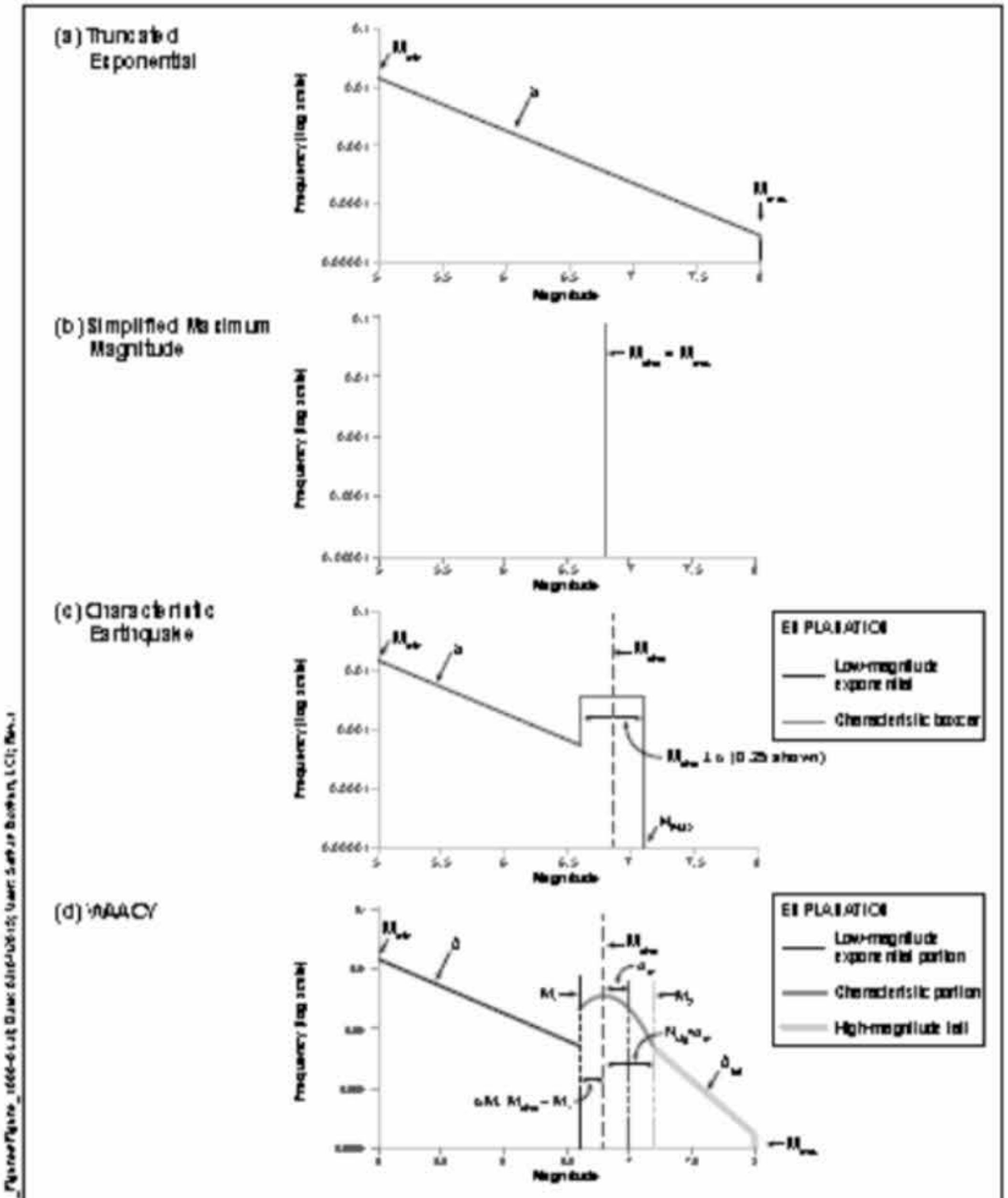
Fault section IDs and section boundary

Slip Rate Allocation Model Concept

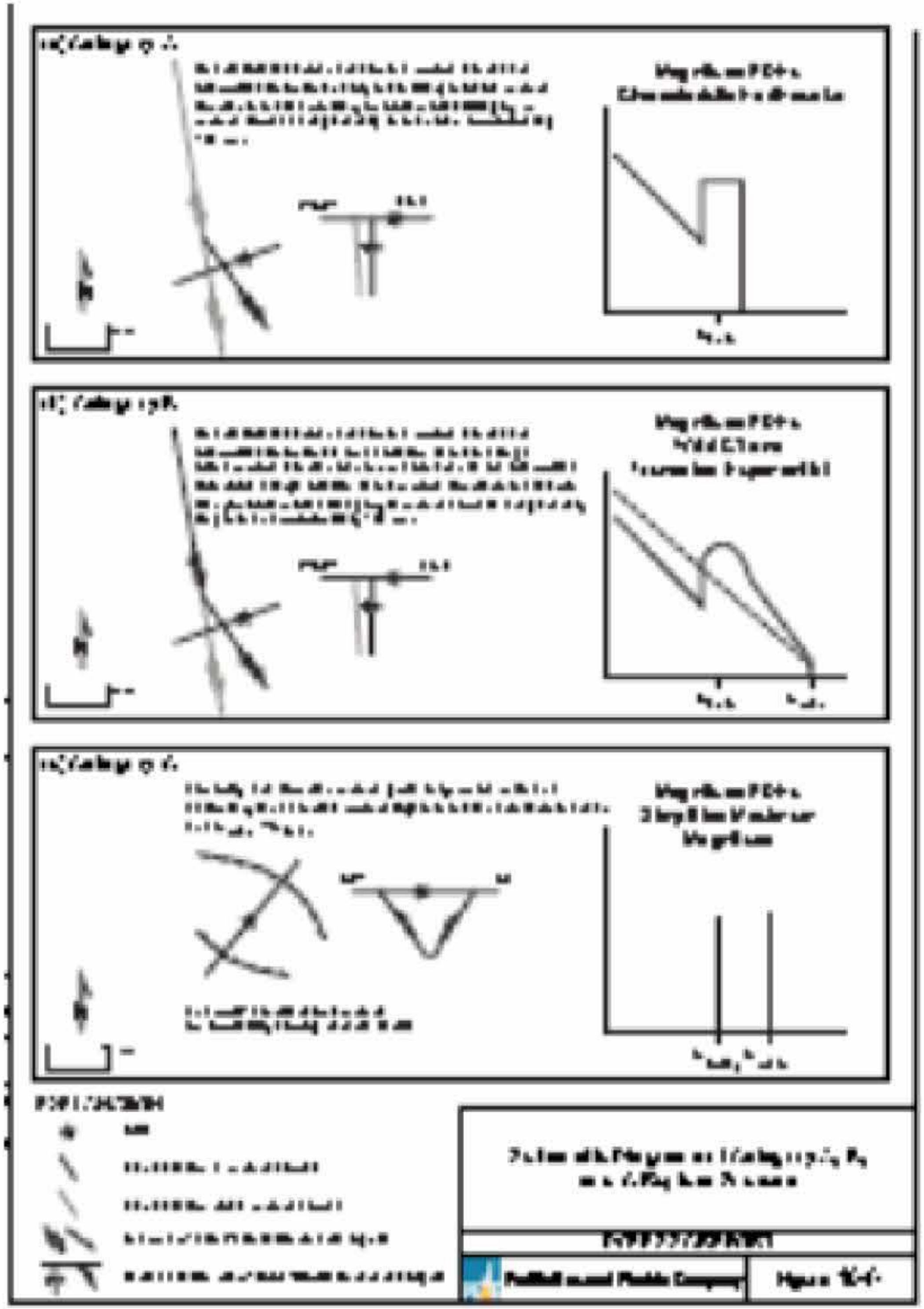
DCPP SSC REPORT

Pacific Gas and Electric Company | Figure **9-9**

MAGNITUDE DISTRIBUTION MODELS



Schematic Diagrams of Magnitude Probability Density Functions Used in the Diablo Canyon SSC Model



Each Rupture Source Assigned to one of Three MDMs

Time Dependency Model

- For another time ….

John Stamatakos

From:John Stamatakos
Sent:4 May 2015 18:03:37 +0000
To:Giacinto, Joseph (Joseph.Giacinto@nrc.gov);'Miriam R. Juckett'
Subject:FW: Diablo SSC
Attachments:Diablo Canyon Seismic Source Characterization Review 1.pdf

---

From: John Stamatakos
Sent: Monday, May 4, 2015 2:01 PM
To: Stovall, Scott (Scott.Stovall@nrc.gov)
Subject: FW: Diablo SSC

From: John Stamatakos
Sent: Monday, May 4, 2015 9:37 AM
To: Graizer, Vladimir (Vladimir.Graizer@nrc.gov)
Subject: FW: Diablo SSC

From: John Stamatakos [mailto:john.stamatakos@gmail.com]
Sent: Monday, May 4, 2015 9:33 AM
To: John Stamatakos
Subject: Diablo SSC

John Stamatakos

From:John Stamatakos
Sent:6 Apr 2015 19:45:53 +0000
To:Ake, Jon (Jon.Ake@nrc.gov);Munson, Clifford (Clifford.Munson@nrc.gov);Graizer, Vladimir (Vladimir.Graizer@nrc.gov)
Subject:FW: Password for Secured PDF Files

From one of my staff working on the Diablo SSC reports.

John

From: Sarah Wigginton
Sent: Monday, April 6, 2015 3:31 PM
To: John Stamatakos
Cc: Ronald McGinnis
Subject: Password for Secured PDF Files

John,

I'm working on finishing up the Diablo Canyon Document Catalog and I've noticed that some of PDF files are "secured" so I am unable to copy any of the material (titles, sources, etc.). Working with an un-secured version would greatly speed up the process of cataloging the figures!

Would it be possible to get my hands on a password for the "DCPP SSC Report Rev A"?

Best,
Sarah

Sarah Wigginton
Department of Earth, Material, and Planetary Sciences
Geosciences and Engineering Division
Southwest Research Institute
6220 Culebra Road, San Antonio, TX 78238, USA

John Stamatakos

From:John Stamatakos
Sent:4 May 2015 12:40:07 +0000
To:John Stamatakos
Subject:FW: PG&E: Diablo Canyon Public Meeting on April 28
Attachments:NRC Public Meeting 4-28 Seismic Final.pdf

From: John Stamatakos
Sent: Monday, May 4, 2015 8:39 AM
To: John Stamatakos
Subject: FW: PG&E: Diablo Canyon Public Meeting on April 28

From: DiFrancesco, Nicholas [mailto:Nicholas.DiFrancesco@nrc.gov]
Sent: Sunday, April 26, 2015 10:42 PM
To: Munson, Clifford; Ake, Jon; John Stamatakos; Brittain Hill; Graizer, Vladimir
Cc: Jackson, Diane; Shams, Mohamed; Vega, Frankie; Walker, Wayne; Alexander, Ryan; Moreno, Angel; Uselding, Lara; Burnell, Scott; Kock, Andrea; Scott Flanders; Maier, Bill; Roth(OGC), David; Lindell, Joseph; Uttal, Susan; Markley, Michael; Lingam, Siva; Hipschman, Thomas; Wyman, Stephen
Subject: PG&E: Diablo Canyon Public Meeting on April 28

Folks,

Attached are the PG&E slides in support of the Tuesday public meeting. NRC slides will be available tomorrow morning.

Please forward to those I may have missed.

Thanks,
Nick

From: Jahangir, Nozar [mailto:NxJ1@pge.com]
Sent: Sunday, April 26, 2015 7:58 PM
To: DiFrancesco, Nicholas; Soenen, Philippe R
Cc: Strickland, Jearl
Subject: Diablo Canyon Public Meeting on April 28

Philippe;
Attached is the DCPP presentation for the subject meeting. I will also take 30 hardcopies with me, as well. I will be travelling on Monday and will be in Rockville on Monday night.
We also need the Web access number and passcode for Technical PG&E staff that will be calling in support of the presentation.
Thanks

Nozar Jahangir P.E.
Manager, Technical Services
Diablo Canyon Seismic Engineering
805-545-6512
(b)(6) (cell)
nxj1@pge.com

From: DiFrancesco, Nicholas [mailto:Nicholas.DiFrancesco@nrc.gov]
Sent: Thursday, April 23, 2015 10:33 AM
To: Soenen, Philippe R
Cc: Jahangir, Nozar; Vega, Frankie; Shams, Mohamed; Jackson, Diane
Subject: NRC Technical Focus Areas for Support of Public Meeting on April 28

Mr. Soenen,

In support of the public meeting scheduled for April 28, 2015, the NRC staff would like to gain additional technical understanding in several areas to support productive public meeting discussions. In addition to providing a general overview of the SSC and GMC SSHAC Reports and March 2015 50.54(f) response for DCPP, please provide additional clarification on the following topics.

Seismic Source Characterization

1. Summarize the key data used to constrain the slip rate of the Hosgri fault, including associated uncertainties.

2. Clarify how elements of the thrust/reverse interpretation for the San Luis Range Thrust are incorporated into the SSC.

3. Clarify how the rupture models are derived from the fault source geometry models.

4. Summarize the methodology used to define the equivalent Poisson rates.

Ground Motion Characterization

1. Provide additional detail on the criteria used for the selection of the candidate ground motion prediction equations (GMPEs) for development of the common form median ground motion models for DCPP. Specifically, please elaborate on the basis for including GMPEs based on datasets other than NGA-West2.

2. Provide additional detail on development of the common functional form used to fit the candidate GMPEs. Specifically, please discuss how model parameters such as depth to Vs=1 km/s and 2.5 km/s (which are present in some of the candidate GMPEs) are accounted for in the functional form.

3. Provide additional detail on the approach for weighting the selected common form models as well as the criteria used to verify the physicality of the final models.

4. Provide additional detail on how the continuous distribution for total sigma (σ_{SS}) was developed by combining the between-event and within-event aleatory variabilities.

Site Response

1. Section 2.3.2.1 of the 50.54(f) submittal states that shear modulus and damping curves are not directly applicable to DCPP since analytical modeling is not used and that non-linear site effects are implicitly included in the empirical GMPEs for Vs30=760 m/s. However, the NGA-West2 database has a limited amount of data for sites with Vs30 near 760 m/s and for earthquakes with magnitudes and source-to-site distances similar to those dominating the hazard for DCPP. Please provide additional information on how these limitations in the NGA-West2 database are accounted for in the site response model for DCPP.

2. Section 2.3.6 of the 50.54(f) submittal describes the development of the site term for DCPP. For the calculations of between-event residuals, provide additional information on the criteria used to determine the appropriate distance range (+ and - Rrup) to the sample station. Please discuss the sensitivity of this distance range on between-event residual values. Please provide an example calculation that uses site-specific values to determine the values for ϕ_{S2S}, including the epistemic uncertainty in the site term.

Please let me know if you have any questions on the above focus areas.

Thanks,

Nick DiFrancesco

Senior Project Manager - Seismic Reevaluation Activities
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Japan Lesson Learned Project Division
nicholas.difrancesco@nrc.gov | Tel: (301) 415-1115

Hill, Brittain

From:Hill, Brittain
Sent:18 Mar 2015 13:47:22 -0400
To:John Stamatakos;Miriam R. Juckett
Subject:FW: Plan updated!
Some updates added recently for WUS topics, and current status of different plants (Regional sections at end)

Britt

From: Gibson, Lauren
Sent: Wednesday, May 21, 2014 2:41 PM
To: DiFrancesco, Nicholas; Burnell, Scott; Hill, Brittain
Subject: Plan updated!

Thank you for your help. The ADAMS version of the Communication Plan has been updated. I've sent it to the State Liaison Officer Program contact.

View ADAMS P8 Properties ML14083A619
Open ADAMS P8 Document (5/21/2014, Communication Plan for Seismic Hazard Re-Evaluation Submittals in Response to NTTF Recommendation 2.1, Seismic)

Lauren

Sent:9 Apr 2015 20:50:07 +0000
To:David Ferrill;Sarah Wigginton;Kevin Smart;Alan Morris;Alan Morris
(b)(6) [redacted])
Subject:FW: Work in progress...

FYI.

Many thanks Sarah!!

From: Ronald McGinnis
Sent: Thursday, April 09, 2015 3:49 PM
To: John Stamatakos
Cc: Miriam R. Juckett
Subject: RE: Work in progress...

John,

Thanks John. I will send you the link to the spreadsheet and an ArcGIS project tomorrow.

David, Alan, and I are on travel May 4-8. The calendar shows Kevin and Sarah being here.

I will pass along your thanks.

-Ronny

From: John Stamatakos
Sent: Thursday, April 09, 2015 3:43 PM
To: Ronald McGinnis
Cc: Miriam R. Juckett
Subject: RE: Work in progress...

I have looked it over and I think it's a good summary. I don't have any changes now. I have not seen the data catalog, but sounds like you are working on it. I would like to have them tomorrow, so I can go through them and present them to the NRC team on Monday.

Tell the team, especially Sarah, many thanks from me.

Also, it looks like one of the NRC seismologists, Jon Ake, may be in San Antonio for a kickoff of another project in early May (4-6). Are you around then?

John

From: Ronald McGinnis
Sent: Thursday, April 9, 2015 4:29 PM
To: John Stamatakos
Cc: Alan Morris; David Ferrill; Sarah Wigginton; Alan Morris ((b)(6) [redacted]); Kevin Smart
Subject: RE: Work in progress...

John,

Have you had a chance to look at the document Alan sent? If you get a chance can you let us know what you think and if any changes are needed? Just so you are aware, Kevin and Alan are leading a field seminar in Death Valley and Owens Valley returning Thursday of next week. David and I are leading one all next week to West Texas. The week after that (April 20-24) we all will be in the field in West Texas (including Sarah).

Sarah finished the data catalog and I am going through it now evaluating the data quality. There are 1300 rows!!

David, Sarah, and I are all in tomorrow if we need to discuss anything.

Thanks,

Ronny

****

Ronald N. McGinnis

rmcginnis@swri.org

Senior Research Scientist

Department of Earth, Material, and Planetary Sciences Southwest Research Institute

6220 Culebra Road

San Antonio, Texas 78238-5166

Office: 210-522-5825

Mobile: (b)(6) [redacted]

From: Alan Morris
Sent: Monday, April 06, 2015 3:06 PM
To: Ronald McGinnis; David Ferrill; Sarah Wigginton; Kevin Smart

Cc: John Stamatakos
Subject: RE: Work in progress...

OK, it's 8 pages, and maybe too long, but for some reason these reports are always prolix.

Is this what we need?

Does it need pruning?

Does it need analysis?

Does it need anything?

Alan

Alan Morris
Department of Earth, Material, and Planetary Sciences
Geosciences and Engineering Division
Southwest Research Institute
6220 Culebra Road, San Antonio, TX 78238, USA
Tel: 210.522.6743
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From: Alan Morris
Sent: Friday, April 03, 2015 4:51 PM
To: Ronald McGinnis; David Ferrill; Sarah Wigginton; Kevin Smart
Cc: John Stamatakos
Subject: Work in progress...

T:\Diablo_Canyon\Diablo Canyon\CNWRA report April 2015\DiabloCanyonPowerPlant - seismic risk data survey April 2015.docx

I was planning to cycle back through adding important conclusions for every chapter, but any of us could do that...

Chapter 1 is very useful in giving summaries of the data and goals for each of the subsequent chapters.

For the tornado diagram, equations 1-1 and 1-2 in chapter 13 are the key.

Gotta check posters for next week...

Happy Easter

Alan

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BEFORE THE
PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of Pacific Gas and Electric Company for Compliance Review of Utility Owned Generation Operations, Electric Energy Resource Recovery Account Entries, Contract Administration, Economic Dispatch of Electric Resources, Utility Retained Generation Fuel Procurement, and Other Activities for the Period January 1 through December 31, 2013. (U 39 E)	)	Application 15-02-023 (Filed February 27, 2015)

ALLIANCE FOR NUCLEAR RESPONSIBILITY'S PROTEST

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ALLIANCE FOR NUCLEAR RESPONSIBILITY

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I. INTRODUCTION.

Pursuant to Rule 2.6 of the Rules of Practice and Procedure of the California Public Utilities Commission ("Commission" or "CPUC"), the Alliance for Nuclear Responsibility ("A4NR") files its Protest to a portion of the 2014 Energy Resource Recovery Account Compliance ("ERRA Compliance") application filed by the Pacific Gas and Electric Company ("PG&E"). A4NR objects to PG&E's recovery of certain balances recorded in the Diablo Canyon Seismic Studies Balancing Account ("DCSSBA") for 2014 costs which fail to comply with D.12-09-008 and D.10-08-003 and, consequently, were not reasonably incurred. Additionally, D.14-08-032 directed PG&E to transfer funding for its Long Term Seismic Program ("LTSP"), including the Senior Seismic Hazard Analysis Committee ("SSHAC") process, to the DCSSBA effective January 1, 2014, subject to reasonableness review in the ERRA Compliance process.[1] A4NR protests recovery of certain LTSP amounts as well.

A4NR's Protest focuses on PG&E's continued evasion of the Independent Peer Review Panel ("IPRP") established by the Commission to assist in the oversight of the ratepayer-funded AB 1632 seismic studies. The legal and factual grounds for the 2014 Protest are similar to those cited in A4NR's protest of PG&E's still-pending 2013 ERRA Compliance application, A.14-02-008, broadened to include the LTSP to the extent that non-compliant avoidance of IPRP review has contaminated core assumptions used in PG&E's SSHAC reports. Sadly, the 2013 evidence cited in A4NR's opening and reply briefs in A.14-02-008 has been augmented by increasingly brazen defiance by PG&E of D.12-09-008 and D.10-08-003, as outlined herein.

[1] D.14-08-032, OP 29 a. The Commission stated, *"We find this disposition to be a reasonable approach to improving oversight of the LTSP costs,"* (*Id.*, p. 411) and, *"We find this disposition to be a reasonable approach to assure the proper integration of Assembly Bill (AB) 1632 seismic studies with the LTSP and the SSHAC process."* (*Id.*, p. 412)

II. CHERRY-PEEVEY EMAILS REVEAL POST-FUKUSHIMA PR PLOY.

A4NR's Protest coincidentally follows the recent revelation of unreported ex parte communications in 2011 between PG&E Vice President Brian Cherry and Commission President Michael Peevey concerning PG&E's A.10-01-022, which sought ratepayer funding for the relicensing of the Diablo Canyon Nuclear Power Plant ("DCNPP"). Five days after the Fukushima accident, ALJ Robert Barnett had taken the A.10-01-022 evidentiary hearing scheduled for April 13, 2011 off calendar. On April 11, 2011 – just one month after the Japanese meltdown -- PG&E ceremoniously announced it would accelerate completion of the AB 1632 seismic studies and requested the U.S. Nuclear Regulatory Commission ("NRC") *"to delay final action on the utility's on-going license renewal application until PG&E submits the findings."*[2]

That same day, Mr. Cherry and President Peevey had the following exchange:[3]

From: Cherry, Brian K [mailto:BKC7@pge.com]
Sent: Mon 4/11/2011 2:49 PM
To: Peevey, Michael R.
Subject: FW: Diablo Canyon License Renewal

Attached is the letter mentioned in the press release.

From: Peevey, Michael R. [mailto:michael.peevey@cpuc.ca.gov]
Sent: Monday, April 11, 2011 4:34 PM
To: Cherry, Brian K
Subject: RE: Diablo Canyon License Renewal

Very good. Prudent thing to do and should reduce some fears, concerns.

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[2] "PG&E Commits to Finishing 3-D Seismic Studies Related to Diablo Canyon Before Seeking Final Issuance of Renewed Licenses," news release from PG&E External Communications, April 11, 2011. The release quoted John Conway, Senior Vice President of Energy Supply and Chief Nuclear Officer: *"We recognize that many in the public have called for this research to be completed before the NRC renews the plant's licenses,"* said Conway. *"We are being responsive to this concern by seeking to expeditiously complete the 3-D seismic studies and provide those findings to the commission and other interested parties so that they may have added assurance of the plant's seismic integrity."*

[3] Accessible at ftp://ftp2.cpuc.ca.gov/PG&E20150130ResponseToA1312012Ruling/2011/04/SB_GT&S_0001262.pdf

From: Cherry, Brian K [mailto:BKC7@pge.com]
Sent: Mon 4/11/2011 4:47 PM
To: Peevey, Michael R.
Subject: RE: Diablo Canyon License Renewal

...and resurrect our application and get it back on track ?

From: Peevey, Michael R. [mailto:michael.peevey@cpuc.ca.gov]
Sent: Monday, April 11, 2011 5:04 PM
To: Cherry, Brian K
Subject: RE: Diablo Canyon License Renewal

Yep. I will have Carol talk to Barnett.

From: Cherry, Brian K [mailto:BKC7@pge.com]
Sent: Mon 4/11/2011 5:05 PM
To: Peevey, Michael R.
Subject: RE: Diablo Canyon License Renewal

Thanks. The sooner the better.

From: Peevey, Michael R. [mailto:michael.peevey@cpuc.ca.gov]
Sent: Monday, April 11, 2011 5:08 PM
To: Cherry, Brian K
Subject: RE: Diablo Canyon License Renewal

May.

From: Cherry, Brian K
Sent: 4/11/2011 5:09:40 PM
To: 'Peevey, Michael R.' (michael.peevey@cpuc.ca.gov)
Cc:
Bcc:
Subject: RE: Diablo Canyon License Renewal

Great. And thanks again.

III. AB 1632 PROGRAM'S REVIEW SAFEGUARDS WERE BREACHED.

A4NR relied upon the establishment of the IPRP by the Commission in D.10-08-003 to ensure that the AB 1632 studies were conducted as robust scientific inquiry and not as a public relations exercise. As ALJ Barnett made clear in that proceeding:

> *And I say this, and I'll say it on the record, that part of this is because I don't want the Commission to be in a position of just accepting what the utilities tell us without looking at it. We've gotten in that position too many times, and I feel that the way to avoid that problem that we are just taking the utility at its word without the expertise to determine the reasonableness of that. That is why I think the IPRP is valuable, and why they should have an expert witness to review this stuff.*[4]

The protocols for IPRP-PG&E interactions articulated in IPRP Report No. 2,[5] repeated verbatim in IPRP Report No. 3,[6] and reinforced by the admonition in D.12-09-008 (*"We expect PG&E to*

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[4] A.10-11-015 Transcript, p. 263.

[5] IPRP Report No. 2, September 7, 2011, pp. 8 – 9: *"The IPRP expects that:*

- *PG&E will provide its study plans and draft completed study findings to the IPRP for review. These include studies summarized in CPUC Decision 10-08-003 including off-shore, on-shore, and ocean bottom studies, and seismic studies recommended in the AB 1632 Report.*
- *The IPRP, coordinated by the California Geological Survey (CGS), will review and provide comments on PG&E's study plans. The goal will be, if possible, to provide comments within 30 days of receipt.*
- *The IPRP, coordinated by the CGS, will review and provide comments on PG&E's draft completed study findings to the CPUC. The goal will be to provide comments as promptly as possible.*
- *PG&E will review and, if possible, within 30 days incorporate the IPRP's recommendations and comments in PG&E's revised study plans and revised completed study findings and prepare for the IPRP a 'Response to Comments' for the IPRP to document scientifically why PG&E accepted or rejected the IPRP's comments.*
- *PG&E and the IPRP will participate in quarterly meetings/briefings to review the status of PG&E's seismic studies, any changes in the study plans, and any preliminary study findings.*
- *PG&E and the IPRP will prepare a master schedule incorporating the major milestones for the IPRP's review process and will include these milestones in PG&E's monthly progress reports and schedule to the NRC and the Atomic Safety and Licensing Board.*
- *The CPUC and CEC will address any major scientific or technical issues that have not been resolved informally between the IPRP and PG&E. CPUC Decision 10-08-003 states that, 'Should a dispute arise it should be resolved informally but if that is not attainable the Commission has authority to halt the associated rate recovery.' In addition, the CEC may report on any seismic issues and updates through its IEPR process. However, we anticipate that any major scientific or technical issue that may arise can be addressed and resolved informally.*

The quarterly briefings/meetings mentioned above will allow PG&E to report on its progress and help facilitate a productive informal exchange of scientific viewpoints."

continue to meet with the IPRP to present and review changes to the seismic study plans, to provide process updates to the IPRP regarding implementation of the studies, and to receive IPRP comments."[7]), offered at least theoretical protection from the PG&E misconduct which surfaced in 2013 and worsened in 2014.

IV. PG&E SENT 'FINAL' REPORT TO THE NRC WITH NO IRPR REVIEW.

PG&E submitted what it labeled the *"final"* AB 1632 report to the NRC on September 10, 2014, six days after the evidentiary hearing in A.14-02-008, and without providing even a draft of the submittal to the IPRP. As the Director of PG&E's Geosciences Department explained at the A.14-02-008 hearing, PG&E had decided that the IPRP was only entitled to receive *"finalized"*[8] results of the studies after PG&E had issued a *"final"*[9] report to the U.S. Nuclear Regulatory Commission.[10]

As described in the evidentiary record of A.14-02-008, the extensive criticism of PG&E's ground motion assumptions at the July 11, 2013 IPRP meeting, followed by the eviscerating IPRP Report No. 6, appears to have significantly chilled relations between PG&E and the IPRP. One month after publication of IPRP Report No. 6, PG&E regulatory affairs personnel were complaining to CPUC staff about self-initiated reports by the IPRP and questioning whether the IPRP could be *"decommissioned"* after submittal of the *"final"* report.[11]

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[6] IPRP Report No. 3, April 6, 2012, pp. 8 – 9.
[7] D.12-09-008, p. 16.
[8] Richard Klimczak, PG&E, A.14-02-008 Transcript, p. 139, ln. 16; p. 141, ln. 14.
[9] *Id.*, p. 140, ln. 21; p. 141, ln. 22.; p. 142, ln. 7.
[10] *Id.,* p. 140, ln. 25.
[11] A4NR Opening Brief, A.14-02-008, pp. 27 – 29 citing three internal PG&E emails dated September 16, 2013.

It had taken more than six months of repeated requests by IPRP chair Chris Wills to obtain PG&E's documentation of its V_s measurements at the DCNPP plant site, and his efforts established that PG&E's V_s assumptions had a 50% greater impact on the seismic hazard calculation than the slip rate on the Hosgri Fault, previously labeled the top uncertainty in the PG&E model. And IPRP Report No. 6 was unsparing in its criticism of PG&E's assumptions:

- To prioritize the main targets of the AB 1632 onshore and offshore geophysical studies, the IPRP earlier asked PG&E for sensitivity analyses of the probabilistic hazards. PG&E's 2011 response ranked uncertainty in the slip rate of the Hosgri Fault as clearly the most significant, with a *"calculated ground motion hazard that varies by a factor of nearly 2."*[12]

- Changing PG&E's base case ground motion characterization of V_{S30} of 1200 m/s to a generic site with a V_{S30} of 760 m/s (*"more consistent with other soft rock sites in California"*[13]) *"increases the hazard by more than a factor of 3"*[14] and changing PG&E's assumed site condition to a generic site with a V_{S30} of 1000 m/s *"increases hazard by a factor of 2."*[15]

- *"Compared to traditional approaches, the PG&E method resulted in lower ground motion hazard estimates, particularly in the spectral period range important to* [Diablo Canyon] ... " In contrast, *"(a) lower V_{S30} brings the estimated ground motion hazards beyond the original design level when used in typical, state-of-the-practice seismic hazard analysis..."* [16]

- The IPRP questioned whether PG&E's approach adequately captured shear wave velocities at different depths beneath the plant: *"With only three profiles, it is unlikely that one of them represents the lowest velocity material underlying the plant. Some of the variability seen in the 1978 data may reflect poor quality of the V_S measurements made 35 years ago. Interpretations of that data, however, appear to include unconservative assumptions of velocity in boreholes where no velocity was recorded..."*[17]

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[12] IPRP Report No. 6, p. 17.
[13] *Id.*, p. 3.
[14] *Id.*, p. 18.
[15] *Id.*
[16] *Id.*, p. 3.
[17] *Id.*, p. 6.

- Nor was newer data from the ISFSI[18] site without problem: *"these two profiles do not give consistent V_s measurements at given depths. Considerable variability exists at some depth ranges ... they do not help constrain the lower bound or range of velocity at the plant site."* [19]

- *"A complete consideration of site conditions across the plant footprint requires additional V_s measurements using modern technology to constrain the uncertainty and yield more reliable site V_s values."*[20]

V. PG&E's 2014 'FINAL' REPORT STONEWALLED IPRP 2013 CRITIQUE.

Despite written assurances to the CPUC staff in response to IPRP Report No. 6 that *"PG&E understands the scientific findings and will conduct the further studies noted,"*[21] and internal acknowledgment within PG&E's Geosciences Department that *"The recommended tasks described in the conclusion are reasonable and we plan to address them as part of our own updated site response evaluation,"*[22] the so-called *"final"* report submitted to the NRC on September 10, 2014 is willfully unresponsive. As summarized in the IPRP's belated review of the ground motion chapters of the 2014 *"final"* AB 1632 report:

- *IPRP Report No. 6 noted that 'V_s data at the DCPP site indicate significant variability /uncertainty' and that* ***PG&E's estimates "appear to include unconservative assumptions of velocity in boreholes'****. IPRP recommended additional studies to determine the V_s beneath DCPP and the variability of V_s.*[23] (emphasis added)

- *IPRP Report No. 6 recommended that PG&E 'demonstrate that the low site amplification seen at the DCPP site is due to site effects,* ***not specific to the azimuths and distances traveled by the recorded ground motions at the site from the two earthquakes used'***

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[18] "ISFSI" is an acronym for Independent Spent Fuel Storage Installation.
[19] IPRP Report No. 6, pp. 6 – 7.
[20] *Id.*, p. 6.
[21] A4NR Opening Brief, A.14-02-008, p. 30, citing PG&E's October 10, 2013 written response to IPRP Report No. 6.
[22] A4NR Opening Brief, A.14-02-008, p. 31, citing September 9, 2013 email from Dr. Norman Abrahamson to Richard Klimczak.
[23] IPRP Report No. 9, pp. 2 – 3.

and 'justify the adequacy of using only two earthquakes to characterize site amplification'.[24] (emphasis added)

- *In response, PG&E confirmed in a letter to CPUC (PG&E, 2013) that it would conduct further studies to improve the quantification of site conditions and amplification. These studies would: (1) use new data from on-land exploration geophysics surveys to develop a 3D model of shear wave velocity beneath the plant site; (2) analyze broad band ground motion data and ground motions from small earthquakes to better quantify site-specific amplification terms; and (3) evaluate site amplification using analytical approaches in which seismic waves are propagated through a velocity model. The CCCSIP report addressed the first study as discussed in detail in the remainder of this IPRP report,* ***but not the second and third studies***.[25] (emphasis added)

- *The high-resolution tomographic model of the area near DCPP presented in the CCCSIP report shows details of the variation in interpreted velocity. Important elements of this detailed model include: relatively low near-surface velocities in areas with remaining natural soil; relatively high near-surface velocities underlying much of the plant itself; highly variable estimates of V_{S30}; and irregularly shaped subsurface regions interpreted to have high velocity.*[26]

- *While each of these features of the tomographic model may represent improved understanding of the 'site conditions' at DCPP and may lead to decreased uncertainty in seismic hazard estimates, PG&E has not confirmed the uncertainties in these velocity estimates. Moreover, the CCCSIP report has an extensive discussion of* ***the difficulty of gaining accurate tomographic results at shallow depths, given the constrained source-receiver locations.*** [27] (emphasis added)

- *Differences between V_S profiles measured in 1978 and profiles derived from the tomographic model may reflect poor data or poor resolution in the 1978 profiles. If the 1978 downhole velocity surveys represent 'ground truth', however, it appears that the tomographic model does not show some shallow high velocity layers up to 50' thick or low velocity layers up to 100' thick.* ***The lack of correspondence between measured V_S***

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[24] *Id.*, p. 3.
[25] *Id.* The "*final*" AB 1632 Report is also referred to as the "*CCCSIP*" report, an acronym for Central Coastal California Seismic Imaging Project.
[26] *Id.*, p. 4.
[27] *Id.*

profiles and V_S profiles estimated from the tomographic model suggests significant uncertainty remains in estimates of "site conditions" at DCPP. [28] (emphasis added)

- *The IPRP cannot determine if these differences reflect poor data or analysis in one or both measurements of VS or if both surveys are essentially correct, but have differing levels of spatial resolution.* ***Certainly, the differences between VS profiles from the tomographic model and previously measured VS profiles should have been addressed in the CCCSIP report.*** [29] (emphasis added)

- *For the DCPP site, the use of single station sigma with site-specific term appears to be* ***the key factor that brings the deterministic spectra below the original design spectra.*** [30] (emphasis added)

- *While the single station sigma assumption and especially the site term have a significant effect on hazard,* ***the site term is based on the observations of only two earthquakes.*** [31] *As described in IPRP Report No. 6,* ***the IPRP is not convinced that the 'site term' reflects some property of the site that would affect all earthquakes recorded at DCPP****. The alternative hypothesis that additional factors related to the particular source or paths of those two earthquakes remains at least as plausible.* [32] (emphasis added)

- *The CCCSIP report does not include any additional studies to address this issue.* ***The 3D site response analyses proposed by PG&E will not address whether single station sigma model is more reasonable than the ergodic assumption, nor will it reduce uncertainty in the site specific term that is calculated based on two recorded earthquakes.*** [33] (emphasis added)

- *Figure 6 compares deterministic spectra for the CCCSIP sensitivity scenario assuming linked co-seismic rupture of the Shoreline, Hosgri, and San Simeon Faults (M7.3). It shows that deterministic ground motion increases across the spectrum as magnitude for the Shoreline Fault rupture increases from 6.7 to 7.3. This figure also shows increased ground motion as V_S30 decreases from 1200 m/s [at the power block foundation level] to*

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[28] *Id.*, p. 5.
[29] *Id.*, pp. 5 – 6.
[30] *Id.*, p. 12.
[31] The NRC staff noted this same limitation in its 2012 assessment of PG&E's single-station-sigma adjustment at DCNPP, observing, *"Generally a larger number of earthquakes would be needed to develop confidence in the correction factor."* RIL 12-01, p. 59.
[32] IPRP Report No. 9, p. 12.
[33] *Id.*

760 m/s. ***More significantly, the figure shows, once again, that the most influential factor affecting deterministic ground motion estimates is the single station sigma assumption and the site term.***[34] (emphasis added)

- ***The 3D response analysis cannot, however, address issues associated with the site-specific term.*** *IPRP previously expressed its concern regarding the adequacy of using only two earthquakes in estimating the site-specific term and made recommendations to gain confidence in the PG&E site-specific approach, including analyzing broad band ground motion data and ground motions from small earthquakes to better quantify the site-specific term.* ***PG&E has not addressed these recommendations.***[35] (emphasis added)

- *The "site term" based on two recorded earthquakes may represent other factors, rather than site conditions.* ***IPRP is not convinced that this factor is adequately constrained for use in ground motion calculations.***[36] (emphasis added)

The IPRP, impeded from performing its duties by PG&E's extended embargo from mid-2013 until the AB 1632 report was "*finalized*" in September 2014, was also critical of certain aspects of PG&E's seismic source characterization when it eventually gained access to the document. IPRP Report No. 8 is particularly pointed in its assessment of PG&E's analysis of onshore faults:

- ***The IPRP is not convinced that the interpretations of the down-dip extensions of faults are well constrained, even in the case of well-documented surface faults.*** *Similarly, faults interpreted from the seismic sections, but not corroborated by surface mapping, (e.g. faults interpreted between the San Miguelito and Edna faults) are possible, but are by no means unique interpretations of the data.* ***Overall, the IPRP is not convinced that projections of faults beyond the very shallow subsurface represented unique interpretations of the data.***[37] (emphasis added))

- ***Projections of faults to depth in 'basement' rocks of the Franciscan complex appear to be even more problematic.*** *As discussed at the IPRP meeting on November 17, 2014, the Franciscan complex is known to be a mixture of different rock types pervasively*

[34] *Id.*
[35] *Id.*, p. 15.
[36] *Id.*
[37] IPRP Report No. 8, p. 5.

sheared at a variety of scales and is not expected to produce reflectors that are extensive over broad areas. The majority of seismic sections, (e.g. AWD line 150 as presented on Chapter 7, Figure 5-25) show prominent, continuous reflectors at relatively great depths in material that is assumed to be bedrock of the Franciscan complex.[38] (emphasis added)

- *Most deep reflectors shown on Figure 5-25, and in many other sections are arranged in groups of concave-upward, gently curved reflectors. These reflectors are interpreted in the CCCSIP report as representing geological structure.* ***The IPRP, however, regards this pattern of concave-upward sets of reflectors as difficult to explain geologically, but not difficult to envision as artifacts from the data processing. If the continuous reflectors in Franciscan complex bedrock are artifacts of data processing, rather than representing geologic structure, then the seismic reflection surveys provide no constraint on the down-dip geometry of faults in the Franciscan Complex****.*[39] (emphasis added)

- *The Los Osos fault, in particular, is entirely within Franciscan Complex rocks from very shallow depths.* ***If the reflection surveys do not show real geologic structure along the down-dip extension of this fault, then dip of the fault remains essentially unconstrained.***[40] (emphasis added)

- *Since the Franciscan complex is known to be a mixture of different rock types pervasively sheared at a variety of scales, continuous, gently dipping layers are not expected.* ***The overall arrangement of the gently dipping 'reflectors' also raises questions that are not addressed in the report. In several sections, the arrangement of reflectors does not resemble a cross-section of folded or faulted rock.*** *The pattern of concave-upward sets of reflectors seen in many sections does not have an obvious geological explanation,* ***leading the IPRP to question whether they represent real geologic structure****.*[41] (emphasis added)

- *Even if all reflectors shown in the seismic sections are images of geologic features,* ***the interpretations of various faults are inconsistent and not unique****: 1) In many cases, faults are interpreted based on a series of truncated reflectors, but are shown to pass through other reflectors that are not truncated; 2)* ***In some seismic sections, it appears that additional faults are permitted by the data. It is not clear how the stated interpretation methodology allowed the interpretation team to draw some faults and not others****; and 3) Alternate interpretations of the dip of most faults are possible.*[42] (emphasis added)

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[38] *Id.*, p. 6.
[39] *Id.*
[40] *Id.*
[41] *Id.*, p. 7.
[42] *Id.*, pp. 7 – 8.

- *This concern applies to the dip of the Los Osos fault. Alternate dips, including relatively low-angle dips, of the Los Osos fault appear to be possible through sections 138-149 and 150 as shown on Figures 5-24 and 5-25 of the CCCSIP report. The reduction in uncertainty in seismic hazard depicted on the 'tornado diagram' for dip of the Los Osos fault appears to be based on the CCCSIP report conclusion that the new data precludes low-angle dips.* ***<u>The IPRP does not concur that low-angle dips are precluded by this new data and therefore does not believe that these studies have resulted in reduced uncertainty in seismic hazard related to this parameter</u>***. [43](emphasis added)

- *Although surface faults recognized to date appear to be consistent with strike-slip faulting on the Shoreline fault, rather than thrusting on the SLRF, the possibility of thrust faults in the subsurface is not ruled out by on-land seismic survey data.* ***<u>The interpretation of the ONSIP data is far from unique and allows one to interpret a low angle reverse fault at the proposed location, contrary to what is stated in the CCCSIP report (p.70 Figure 6-54). The CCCSIP interpretation criteria are not clearly defined and do not appear consistent in terms of selections made when seismic reflections are truncated</u>***.[44] (emphasis added)

IPRP Report No. 8 emphasizes the curtailed nature of its after-the-fact review,[45] and points out that proper evaluation of PG&E's seismic data acquisition and processing would require the retention of outside consulting services – an authority expressly granted to the IPRP by D.10-08-003[46] and D.12-09-008,[47] and first promised at the IPRP's initial meeting on August 31, 2010,[48] but still unfulfilled as of the date of this Protest. Unsurprisingly, it was the very fear of this predictable IPRP focus on data acquisition and processing that dominated PG&E management's 2013 internal *"risk"* evaluation of a scenario labeled *"IPRP Review"*:

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[43] *Id.*, p. 8.
[44] *Id.*, p. 10.
[45] *"IPRP review of the tectonic model is based on the CCCSIP report and presentation. The IPRP has not had time, to review the seismic data processing in detail."* IPRP Report No. 8, p. 7.
[46] D.10-08-003, p. 11.
[47] D.12-09-008, p. 23.
[48] IPRP Report No. 1, p. 5.

IPRP recommends additional processing of data or interpretations after their review of project results. *The project results and conclusions are to be provided to the Independent Peer Review Panel (IPRP) as a condition of authorized CPUC funding for this project.* ***They could recommend additional processing methods be applied or other interpretation techniques be utilized***. *The IPRP make-up does not have members who are experienced in processing and interpretation, but* ***they could seek an independent review by others***.[49] (emphasis added)

IPRP Report No. 9 also describes more recent obstruction to its review of PG&E's ground motion assumptions:

Following the public meeting on January 8, 2015, the IPRP had a number of additional questions regarding the velocity model described in Chapter 10 and requested an additional meeting with PG&E. ***PG&E declined to meet again with IPRP***. *As a result, this report only covers aspects of those models described in the CCCSIP report and the public meeting.*[50] (emphasis added)

PG&E's successful strategy to circumvent meaningful IPRP review, originally formulated in 2013 and implemented as a reaction to the devastating IPRP Report No. 6, culminated with submittal of a deeply flawed *"final"* AB 1632 Report to the NRC in 2014. As of the date of this Protest, A4NR has had insufficient time to determine the degree to which adulterated assumptions from the inadequately reviewed AB 1632 Report have driven the conclusions of the LTSP's recent SSHAC Report. The cynical fashion in which PG&E's recent publicity offensive has invoked the hamstrung IPRP review to promote the rosy conclusions of the SSHAC Report leaves little room for doubt:

[49] A4NR Opening Brief, A.14-02-008, p. 4, quoting a March 28, 2013 submittal to PG&E's Executive Project Committee by Ed Halpin, Jeff Summy, and Richard Klimczak.
[50] IPRP Report No. 9, p. 2.

- *Independent experts also included an evaluation of the advanced seismic studies recently performed near Diablo Canyon,* ***as well as feedback on the research provided from a state-appointed independent peer review panel****.*[51] (emphasis added)

- *Their work also utilized insight gained from the advanced seismic studies recently completed near Diablo Canyon.* ***In addition, input on the advanced seismic studies provided by the California Public Utilities Commission's Independent Peer Review Panel was considered in the seismic hazard re-evaluation process****.*[52] (emphasis added)

- [This] *work also included an evaluation of the advanced seismic studies recently performed near Diablo Canyon,* ***as well as feedback on the research provided from a state-appointed independent peer review panel****.*[53] (emphasis added)

VI. DR. BLAKESLEE SPOTLIGHTS PG&E's DECEPTIVE PATTERN.

Leave it to the author of AB 1632, Dr. Sam Blakeslee, the former Exxon geophysicist who served as Republican Minority Leader of the California State Assembly, to assess the degree to which the $64.25 million ratepayer-funded seismic studies have been subverted. As Dr. Blakeslee observed in December 3, 2014 testimony to the U.S. Senate Environment and Public Works Committee, over several decades PG&E has discovered more faults in close proximity to the plant, attributed greater capability to the faults which it has acknowledged, yet consistently proclaimed the seismic risk at the plant to be diminishing: *"The potential earthquakes affecting the plant have increased with each major study. But what's equally striking is that the shaking*

[51] *"Confirming Diablo Canyon Plant's Safety,"* Ed Halpin, Lompoc Record, March 14, 2015.
[52] *"Seismic and tsunami safety a priority for Diablo Canyon,"* Ed Halpin, San Luis Obispo Tribune, March 19, 2015.
[53] *"Op/ed: PG&E exec answers critics, says Diablo Canyon is safe, secure,"* Ed Halpin, Pacific Coast Business Times, March 20, 2015.

predicted by PG&E for these increasing threats has systematically decreased as PG&E adopted less and less conservative analytical methodologies..." [54]

Dr. Blakeslee was especially critical of PG&E's debased *"final"* AB 1632 Report:

> *... in a seeming contradiction, rather than finding that larger or closer faults produce greater shaking and therefore a greater threat, PG&E argues in the Report that ground motion will be lower than the levels previously estimated. In other words, these newly discovered and re-interpreted faults are capable of producing shaking that exceeds the shaking from the Hosgri, yet that shaking threat would be much reduced from prior estimates.*
>
> *Though discussed only in passing in the Report, the reason for this seeming contradiction is quite important when assessing whether or not the plant is safe or whether it is operating within its license conditions. The reason the earthquake threat purportedly went down when new faults were discovered is because the utility adopted significant changes to the methodology utilized for converting earthquakes (which occur at the fault) into ground motion (which occurs at the facility). This new methodology, which is less-conservative than the prior methodology, essentially "de-amplifies" the shaking estimated from any given earthquake relative to the prior methodology used during the licensing process.* [55]

PG&E's *"final"* AB 1632 Report artfully avoids an apples-to-apples comparison which would isolate the influence of its continuously evolving ground motion prediction methodology. The charts on pages 13 – 15 of the Technical Summary, attached to this Protest as Appendix A, purport to contrast the spectra derived from the AB 1632 studies against the 1977 Hosgri evaluation and the 1991 LTSP analysis. Neglecting to reveal the radically different methods for predicting ground motions between cases has the same power of deception as assembling a financial spreadsheet mixing different vintages of dollars without disclosure. To the extent

[54] Written Statement by Sam Blakeslee, Ph.D, to the Senate Committee on Environment and Public Works, December 3, 2014, p. 3. Dr. Blakeslee's complete statement is accessible at http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=42d07682-cad9-49f4-bbf1-fc9757f624c9

[55] *Id.*, p. 5.

that PG&E intended anyone to rely upon the misrepresentations-by-omission contained in these charts, and such reliance were to occur, the common law uses a certain f-word to describe such conduct.

VII. PG&E's POST-CCCSIP CONTEMPTUOUS DISCLOSURE.

Having successfully circumvented the IPRP before submitting its *"final"* report to the NRC, and choosing to absorb the criticism of IPRP Report No. 8 without response, the PG&E Geosciences Department could not resist engaging in its own form of end-zone dance at the January 8, 2015 meeting of the IPRP. With peculiar aplomb, Dr. Norman Abrahamson blithely distributed a new hazard sensitivity chart, attached to this Protest as Appendix B, and acknowledged that the six highest ranked uncertainties (each relating to earthquake-induced ground motions at the plant) had never before been presented to the IPRP. Despite admitting that PG&E's void of site-specific ground motion data dominates Diablo Canyon's probabilistic seismic hazard, Dr. Abrahamson nonchalantly suggested this deficiency be addressed in PG&E's 2025 update. There was no mention of the staggering difference in magnitude between the six newly identified uncertainties and the ones which had been selected for the AB 1632 studies.[56]

His unmistakable message: having feasted on a $64.25 million authorization for ratepayer-funded studies, we never addressed the most significant issues or even told you what they were. But now we've run out the clock. Too bad, chumps.

---

[56] Dr. Abrahamson's discussion of the new hazard sensitivity chart runs from 1:51:27 to 2:03:25 in the video of the January 8, 2015 IPRP meeting, accessible at http://youtu.be/hXu_vn5gxMU

VIII. TO LIVE OUTSIDE THE LAW YOU MUST BE HONEST.

The light-handed oversight previously afforded PG&E in the conduct of its AB 1632 studies appears to be a legacy of the Commission's discredited, pre-San Bruno voluntary compliance era. As Executive Director Paul Clanon memorably testified to a California Senate committee, *"That can be characterized as 'self-reporting,' but a better way to look at it is creating a safety culture at the utility."*[57] He later explained that, in lieu of fines, *"a better way to ensure safety is to make sure that a utility sees violations on its own has every incentive to report them."*[58] As Mr. Clanon told a post-explosion community meeting in San Bruno, fines might *"discourage the utilities to come forward when they see a problem. A utility doesn't want their pipelines to be unsafe."*[59]

A4NR does not contend that PG&E **wants** DCNPP to be seismically unsafe. Rather, the accumulated record of PG&E's performance of its AB 1632 seismic studies documents a furtive, thumb-on-the-scale approach designed primarily to quell public apprehension and forestall pressure to close the plant. PG&E has received special dispensation from the NRC since October 12, 2012 to defer application of the Double Design Earthquake ("DDE") standard to the Shoreline Fault until submittal of the DCNPP SSHAC analysis -- despite the NRC's acknowledgment that *"using the DDE as the basis of comparison will most likely result in the Shoreline fault and the Hosgri earthquake being reported as having greater ground motion"*

[57] "PG&E Hammered Over Safety Issues," San Mateo Times, October 19, 2010.
[58] "State's gas pipeline inspections found to lag," San Francisco Chronicle, November 14, 2010.
[59] "San Bruno blast victims skeptical of PUC oversight," San Francisco Chronicle, December 8, 2010.

than the plant's Safe Shutdown Earthquake.[60] This remarkable prediction was repeated by Dr. Cliff Munson, an NRC seismologist, in testimony to a June 19, 2013 California Energy Commission workshop.[61] The indifference with which California state agencies have, at least publicly, accepted this revelation has been alarming but the financial bottom line is undeniable: significant seismic retrofit requirements seem likely to be required.[62]

A4NR does not expect the CPUC to involve itself in questions of the seismic licensing basis of DCNPP or the prudence of the manner in which the NRC has addressed the seismic licensing basis issue.[63] Instead, A4NR expects the Commission to be diligent in its application of traditional ratemaking authority to protect California's economic interest and electricity reliability interest in accurately understanding the seismic challenges facing the plant. The Commission would be derelict in meeting this responsibility by relying exclusively on PG&E's good faith or commitment to scientific objectivity.

---

[60] Letter to Edward D. Halpin from Joseph M. Sebrosky, NRC Senior Project Manager for Plant Licensing Branch IV, Division of Operating Reactor Licensing, Office of Nuclear Reactor Regulation, October 12, 2012, accessible at http://pbadupws.nrc.gov/docs/ML1207/ML120730106.pdf

[61] Lead Commissioner Workshop on California Nuclear Power Plant Issues, Docket No.13-IEP-1J, June 19, 2013, Transcript, p. 89, accessible at http://www.energy.ca.gov/2013_energypolicy/documents/2013-06-19_workshop/2013-06-19_nuclear_workshop_transcript.pdf

[62] The severity of any such requirement is suggested by PG&E's 2012 submittal to the NRC of a 331-page list of DCNPP deviations from the *"new plant"* criteria Dr. Munson testified will be applied: "*"The thing I want to emphasize is that the hazard evaluations are based on current practices for new reactors."* *Id.,* p. 81. PG&E's 331-page list of deviations is accessible at http://pbadupws.nrc.gov/docs/ML1134/ML11342A238.pdf

[63] The Union of Concerned Scientists reported in 2013 that, of the 100 reactors currently operating in the U.S., the two at Diablo Canyon top the NRC's list as being most likely to experience an earthquake larger than they are designed to withstand, using NRC data to calculate the probability of such an event as more than 10 times greater than the nuclear fleet average. "Seismic Shift: Diablo Canyon Literally and Figuratively on Shaky Ground," Union of Concerned Scientists, November 2013, p. 7, accessible at http://www.ucsusa.org/sites/default/files/legacy/assets/documents/nuclear_power/diablo-canyon-earthquake-risk.pdf

PG&E is the only NRC power plant licensee in the history of the commercial nuclear power industry to face criminal indictment for safety-related violations by the U.S. Department of Justice. While the 27 safety-related felony counts in PG&E's federal grand jury indictment are focused on the company's gas division, it strains credulity to believe that DCNPP has been somehow immunized from the corporate culture rot that recently prompted Commission President Michael Picker to acknowledge during a California Senate oversight hearing that, "*I think there's a very clear case that in some places, the utility did divert dollars that we approved for safety purposes for executive compensation.*"[64] And the obstruction of justice felony count which leads PG&E's federal indictment emphatically addresses management as a whole:

> *"On or about September 10, 2010, and continuing through on or about September 30, 2011, in the Northern District of California, the defendant, PACIFIC GAS AND ELECTRIC COMPANY, **did corruptly influence, obstruct, and impede**, and did endeavor to influence, obstruct, and impede **the due and proper administration of the law** under which a pending proceeding was being had before a department and agency of the United States ..."*[65] (emphasis added)

Although perhaps not a matter of familiarity to utility regulators, the term *"RAP sheet"* is derived from the Federal Bureau of Investigation's Record of Arrests and Prosecutions. Actual conviction is not a prerequisite. A4NR is unaware of any other California electric utility with a RAP sheet. While PG&E is certainly entitled to its day(s) in court to defend itself from the federal charges, its status as a criminal defendant and the nature of its alleged crimes should

---

[64] President Picker's statement is at 36:56 of the video of the March 25, 2015 oversight hearing conducted by the California Senate Committee on Energy, Utilities and Communications, accessible at http://calchannel.granicus.com/MediaPlayer.php?view_id=7&clip_id=2682

[65] United States of America v. Pacific Gas and Electric Company, United States District Court for the Northern District of California, Case 3:14-cr-00175-THE, Superseding Indictment, July 29, 2014, p. 18.

discourage the Commission from extending any presumption of veracity to the representations in PG&E's AB 1632 Report without corroboration by the most rigorous scrutiny.

IX. WHY A4NR PROTESTS.

Building upon key decisions made and implemented by PG&E in 2013, the utility intensified its efforts in 2014 to subvert what was originally conceived by the Commission as a robust re-evaluation of DCNPP's seismic setting. If PG&E is allowed to recover the costs of such subterfuge, the effect on A4NR and all PG&E customers will be electricity rates rendered both unreasonable and unjust by Commission reward of unmistakable perfidy. The consequences for A4NR members (and others) living in communities near the plant stemming from unknowing acceptance of PG&E's defective seismic analysis could, in some circumstances, be much worse than that – with incalculable financial impact on California.

A4NR requests evidentiary hearings and will conduct discovery and sponsor testimony elaborating on the facts contained in this Protest, as well as the extent to which PG&E's LTSP and SSHAC expenditures in 2014 were similarly tainted. Assuming timely responsiveness by PG&E to legitimate discovery requests, A4NR has no objection to the schedule proposed in PG&E's application.

The undersigned will be the A4NR's principal contact in this proceeding, but A4NR also asks that the following two individuals be placed in the *"information only"* category of the Service List:

Rochelle Becker	David Weisman
rochelle@a4nr.org	david@a4nr.org

Respectfully submitted,

By: /s/ John L. Geesman

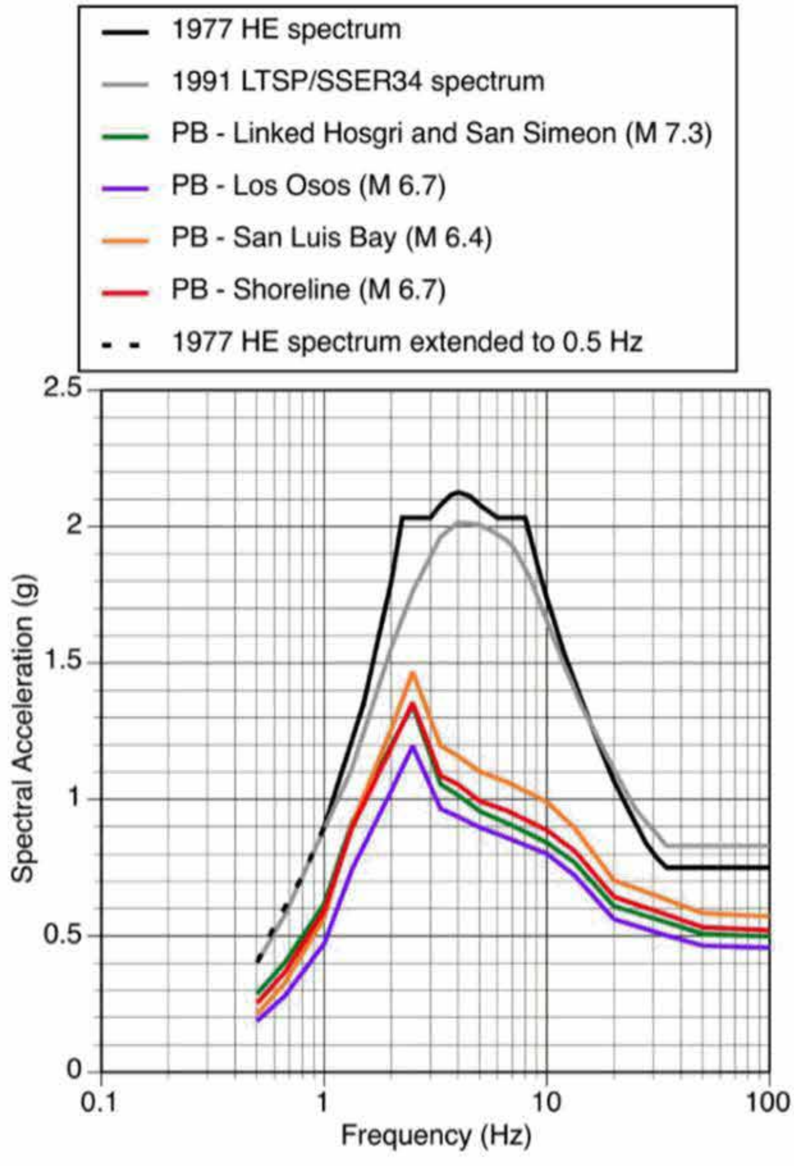
JOHN L. GEESMAN
DICKSON GEESMAN LLP

Date: April 3, 2015

Attorney for
ALLIANCE FOR NUCLEAR RESPONSIBILITY

APPENDIX A

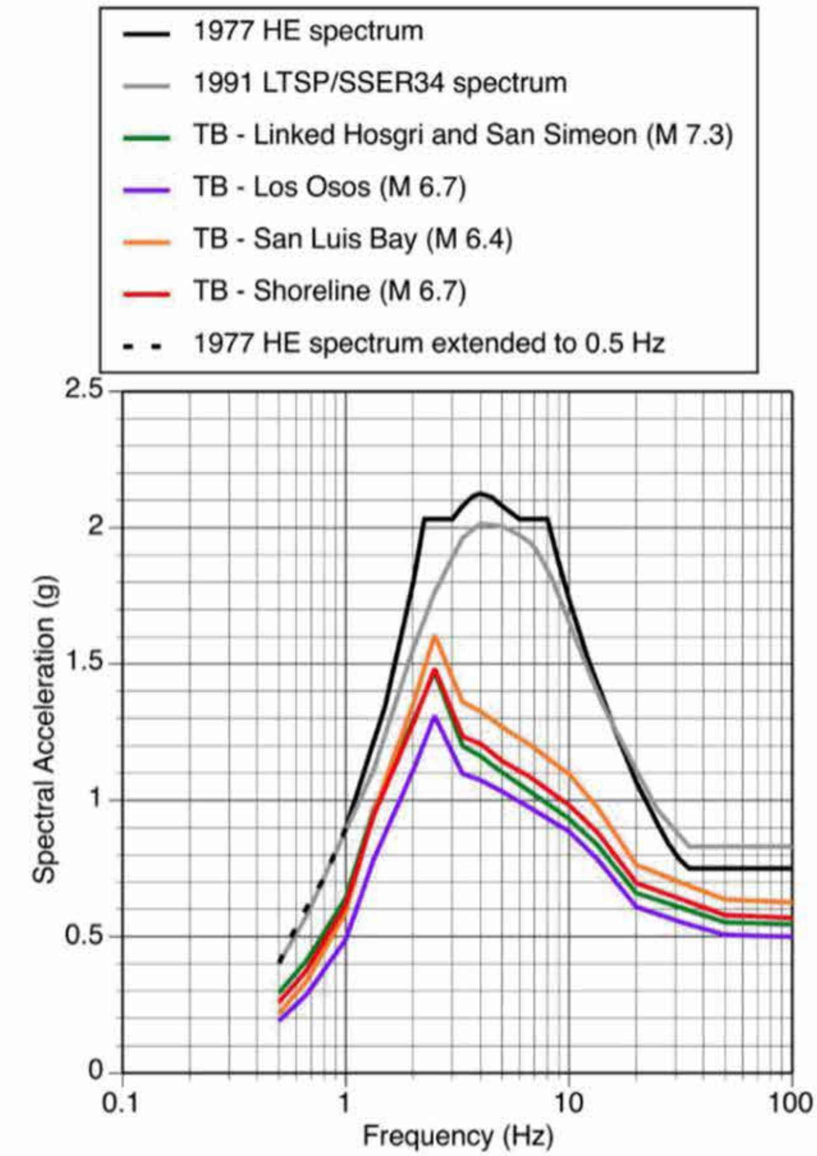
PG&E SPECTRA CHARTS FROM CCCSIP REPORT



The 84th Percentile Deterministic Ground Motions for Four Fault Scenarios Compared to the 1977 Hosgri Earthquake (HE) and the 1991 LTSP/SSER 34 Spectra for the DCPP Power Block

CCCSIP REPORT

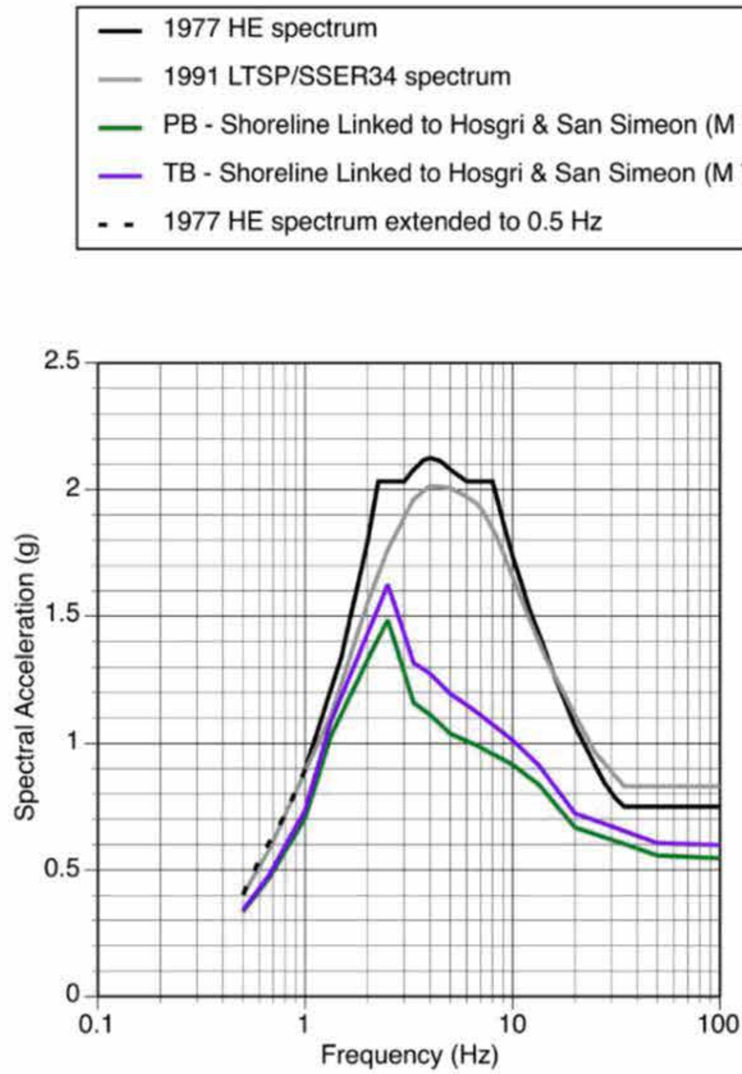
Pacific Gas and Electric Company | Figure **1-1**



The 84th Percentile Deterministic Ground Motions for Four Fault Scenarios Compared to the 1977 Hosgri Earthquake (HE) and the 1991 LTSP/SSER 34 Spectra for the DCPP Turbine Building

CCCSIP REPORT

Pacific Gas and Electric Company | Figure **1-2**



The 84th Percentile Deterministic Ground Motions for Joint Shoreline and Hosgri-San Simeon Fault Rupture Compared to the 1977 Hosgri Earthquake and the 1991 LTSP/SSER 34 Spectra for the DCPP Power Block and Turbine Buildings

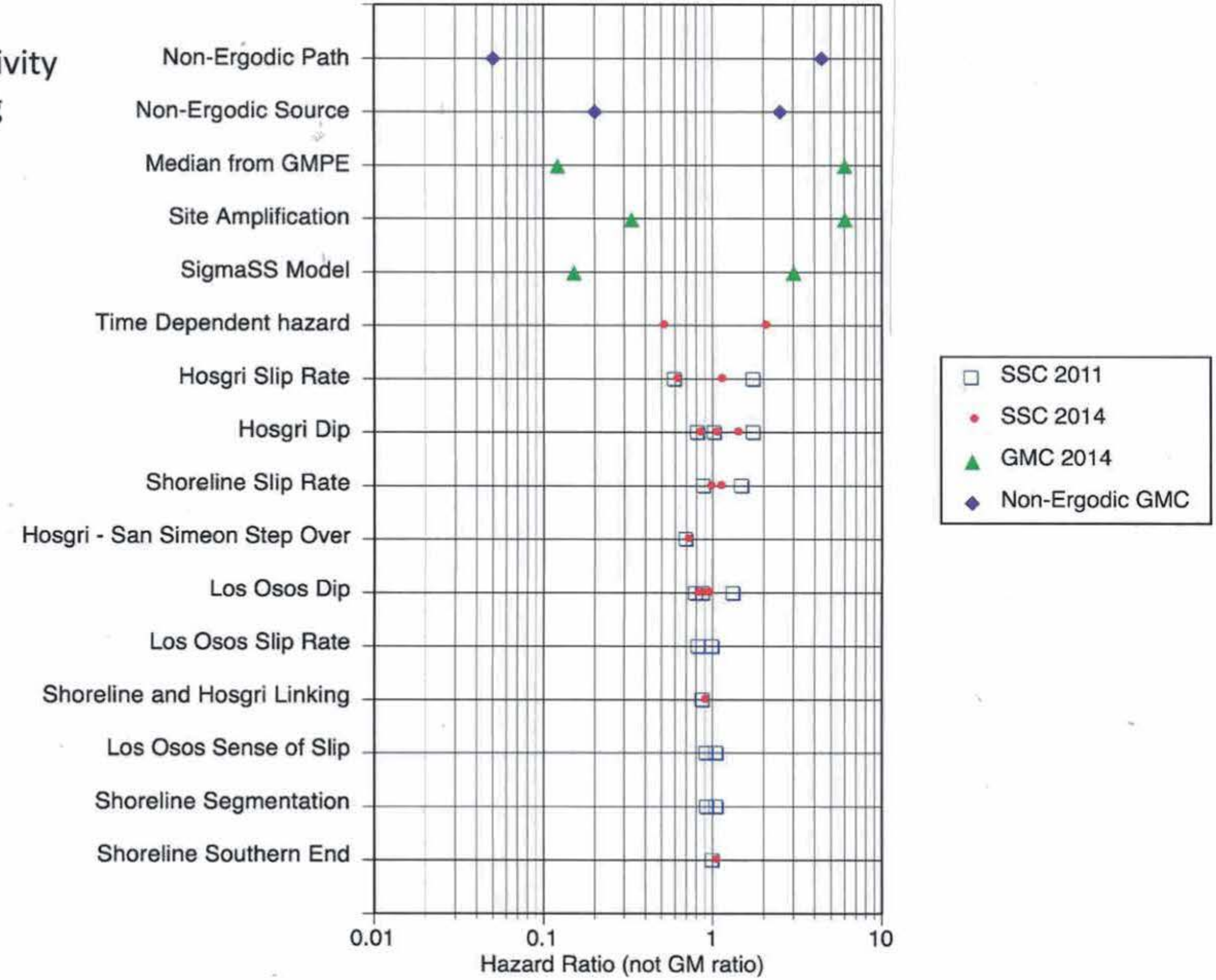
CCCSIP REPORT

Pacific Gas and Electric Company | Figure **1-3**

APPENDIX B

PG&E LATE-DISTRIBUTED HAZARD CHART

Hazard Sensitivity
5 Hz, PSA = 2g



John Stamatakos

From:John Stamatakos
Sent:12 May 2015 20:14:25 +0000
To:Miriam R. Juckett
Subject:FW: Written concerns - April 28th, 2015 webcast meeting with PG&E
Attachments:IPRP Report No 6-1.pdf, IPRP Report No 8.pdf, IPRP Report No 9-1.pdf, 040315 A4NR Protest-023.pdf, 051215 Rochelle Becker-NRC staff.pdf

Attachments are already publicly available as ML15134A258.

FYI

From: Rochelle Becker [mailto:rochellea4nr@gmail.com]
Sent: Tuesday, May 12, 2015 4:09 PM
To: njd2@nrc.gov
Cc: Markley, Michael; Richard.Plasse@nrc.gov; Michael.Wentzel@nrc.gov; Wayne.Walker@nrc.gov; Ryan.Alexander@nrc.gov; Thomas Hipschman; Bill Maier; Yong.Li@nrc.gov; Nilesh.Chokshi@nrc.gov; Jim.Xu@nrc.gov; Kamal.Manoly@nrc.gov; P.Y.Chen@nrc.gov; John.Burke@nrc.gov; Clifford.Munson@nrc.gov; Gerry Stirewalt; Timothy.Lupold@nrc.gov; John Stamatakos; Siva.Lingam@nrc.gov; Chris.Miller@nrc.gov; Bill.Dean@nrc.gov; Brian.Holian@nrc.gov; Marc.Dapas@nrc.gov; Michael.Johnson@nrc.gov; jon.ake@nrc.gov
Subject: Written concerns - April 28th, 2015 webcast meeting with PG&E

Dear Mr DiFrancesco,

Please see attached letter. There are four referenced attachments as pdf files as well.

Thank you
Rochelle

Rochelle Becker, Executive Director
Alliance for Nuclear Responsibility
PO 1328
San Luis Obispo, CA 93406
www.a4nr.org

Jackson, Diane

From:Jackson, Diane
Sent:28 May 2015 09:43:04 -0400
To:Munson, Clifford
Cc:Graizer, Vladimir;John Stamatakos;Ake, Jon;Plaza-Toledo, Meralis;Giacinto, Joseph;Stovall, Scott;Brittain Hill;Li, Yong
Subject:FYI: Reminder sent to Diablo for Information Request
Nick sent a reminder.

Diane

From: DiFrancesco, Nicholas
Sent: Thursday, May 28, 2015 9:16 AM
To: Philippe Soenen (Pns3@pge.com); Jahangir, Nozar
Cc: Michael Richardson (mjrm@pge.com); Strickland, Jearl; Shams, Mohamed; Jackson, Diane; Vega, Frankie
Subject: Reminder on Diablo Information Request

Philippe, et, al

Just a reminder that the staff is interested in the following references to support NRC review:

1) Benchmark files for SWUS-DCPP median ground motion models.
2) ESTA 27 and 28 recordings of Parkfield and San Simeon earthquakes
    a. Time histories
    b. Response spectra
    c. Response spectra adjusted for Vs30
3) Engineering reports describing development of velocity profiles for stations ESTA 27 and 28.
4) Paper describing WAACY Magnitude PDF by Wooddell and others.

Please let me know when the references will be available.

Thanks,

Nick

Senior Project Manager - Seismic Reevaluation Activities
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Japan Lesson Learned Project Division
nicholas.difrancesco@nrc.gov | Tel: (301) 415-1115

John Stamatakos

From:John Stamatakos
Sent:29 Apr 2015 15:52:32 +0000
To:Giacinto, Joseph (Joseph.Giacinto@nrc.gov);Plaza-Toledo, Meralis (Meralis.Plaza-Toledo@nrc.gov)
Cc:Munson, Clifford (Clifford.Munson@nrc.gov);Ake, Jon (Jon.Ake@nrc.gov);Jackson, Diane (Diane.Jackson@nrc.gov);Stirewalt, Gerry (Gerry.Stirewalt@nrc.gov);Seber, Dogan (Dogan.Seber@nrc.gov);Miriam R. Juckett;Graizer, Vladimir (Vladimir.Graizer@nrc.gov);Hill, Brittain (Brittain.Hill@nrc.gov)
Subject:Hosgri Slip Rates

Joe and Meralis,

One of the more interesting, and more hazard sensitive, aspects of the Diablo canyon SSC is the Hosgri slip rate CDF. I suggest we focus our initial reviews on that aspect of the SSC. Dogan made a critical observation yesterday in our discussions, namely how can the lower tail of the CDF be justified. In thinking through the question last night I have a few suggestions.

1. We should look at the seismic imaging data from the CCCSIP that PG&E uses to constrain the slip (interpretations of offset paleo-channels). There are 4 piercing points that PG&E uses to develop the composite slip rate CDF for the Hosgri fault. The slip rate data used for these 4 points is summarized in:
    a. San Simeon/Oso Terrace – Figure 8-16
    b. Point Estero Cross-Hosgri Slope - Figure 8-18
    c. Estero Bay Submarine Channel – Figure 8.28
    d. Point Sal Channel F – Figure 8.32

   For each of these we should understand how the cumulative slip was determined (and uncertainty) and how the offset age was determined (and uncertainty).

   1. Age: For San Simeon, the age is based on the interpretation that the unconformity overlying the buried geomorphic featured tied to the Younger Dryas, so this one is rather straightforward. But the other three, especially Estero Bay and Point Sal, ages are based on interpretations of age ranges from the seal level curves. So we will need to understand how the TI team interpreted the offset parkers in terms of these curves and whether other interpretations outside the ones provided are permissible.
   2. Slip: All the slip estimates are based on interpretations of the 2D and 3D seismic images and detailed sea floor bathymetry. I am going to ask my San Antonio team to look over these images from Chapter 8 of the SSC report to help us understand how the images were interpreted and to assess the overall quality of the interpretations. I am also interested in understanding whether the full range of uncertainty is included in the TI team's interpretations.

We could also ask Cliff and Jon to some sensitivity studies to constrain the limits of what we are looking for. I think it might be helpful here to know how far the current slip rate estimates would have to be different from those used in the study to move the hazard needle. For example, what if the TI team were off by a single Marine Oxygen Isotope Stage (MIS)? For most of these my very preliminary guesstimate is that would correspond to about a 25% increase in the slip rates. Would such an increase in rates be significant?

I am going to have a call with my San Antonio team this afternoon, and would be happy to have you both on the call. Right now the call is set for 3:00 this afternoon, but it can adjusted to meet your schedules.

Thanks,

John

Dr. John Stamatakos
Director of Technical Programs
Center for Nuclear Waste Regulatory Analyses (CNWRA)
Southwest Research Institute
1801 Rockville Pike, Rockville, MD 20852
301-881-0290

jstamatakos@swri.org

John Stamatakos

From:John Stamatakos
Sent:10 Apr 2015 20:01:06 +0000
To:Graizer, Vladimir (Vladimir.Graizer@nrc.gov);Stirewalt, Gerry (Gerry.Stirewalt@nrc.gov);Plaza-Toledo, Meralis (Meralis.Plaza-Toledo@nrc.gov);Miriam R. Juckett
Cc:Ake, Jon (Jon.Ake@nrc.gov);Hill, Brittain (Brittain.Hill@nrc.gov);Munson, Clifford (Clifford.Munson@nrc.gov);'lisa.walsch@nrc.gov';Li, Yong (Yong.Li@nrc.gov)
Subject:Monday Diablo Meeting

Vlad,

For Monday, I can walk everyone through the draft summary report we have on the seismic imagining data and searchable image table.

John

Dr. John Stamatakos
Director of Technical Programs
Center for Nuclear Waste Regulatory Analyses (CNWRA)
Southwest Research Institute
1801 Rockville Pike, Rockville, MD 20852
301-881-0290

jstamatakos@swri.org

Sarah Wigginton

From:Sarah Wigginton
Sent:6 Apr 2015 14:30:46 -0500
To:John Stamatakos
Cc:Ronald McGinnis
Subject:Password for Secured PDF Files

John,

I'm working on finishing up the Diablo Canyon Document Catalog and I've noticed that some of PDF files are "secured" so I am unable to copy any of the material (titles, sources, etc.). Working with an un-secured version would greatly speed up the process of cataloging the figures!

Would it be possible to get my hands on a password for the "DCPP SSC Report Rev A"?

Best,
Sarah

Sarah Wigginton
Department of Earth, Material, and Planetary Sciences
Geosciences and Engineering Division
Southwest Research Institute
6220 Culebra Road, San Antonio, TX 78238, USA

John Stamatakos

From:John Stamatakos
Sent:22 Apr 2015 02:17:55 +0000
To:'Jackson, Diane'
Subject:RE: DCPP, Palo Verde, and Columbia Audit Information: SSHAC Documentation from PPRP-IT Team

Ok thanks

I am working on some Diablo inputs for Cliff.

John

From: Jackson, Diane [mailto:Diane.Jackson@nrc.gov]
Sent: Tuesday, April 21, 2015 7:27 PM
To: John Stamatakos; Spence, Jane
Subject: Re: DCPP, Palo Verde, and Columbia Audit Information: SSHAC Documentation from PPRP-IT Team

Jane, any chance u can get these on a CD?
John, no Columbia tomorrow. Diane

Sent from an NRC blackberry
Diane Jackson
(b)(6)

From: John Stamatakos [mailto:jstam@swri.org]
Sent: Tuesday, April 21, 2015 04:25 PM
To: Munson, Clifford; DiFrancesco, Nicholas; Ake, Jon
Cc: Jackson, Diane; Shams, Mohamed; Vega, Frankie; Graizer, Vladimir; Hill, Brittain; Seber, Dogan; Vega, Frankie; Stirewalt, Gerry
Subject: RE: DCPP, Palo Verde, and Columbia Audit Information: SSHAC Documentation from PPRP-IT Team

I can't get to the NRC drive so I'll get copies I am at NRC.

Thanks

John

From: Munson, Clifford [mailto:Clifford.Munson@nrc.gov]
Sent: Tuesday, April 21, 2015 4:14 PM
To: DiFrancesco, Nicholas; Ake, Jon
Cc: Jackson, Diane; Shams, Mohamed; Vega, Frankie; Graizer, Vladimir; John Stamatakos; Brittain Hill; Seber, Dogan; Vega, Frankie; Gerry Stirewalt
Subject: RE: DCPP, Palo Verde, and Columbia Audit Information: SSHAC Documentation from PPRP-IT Team
Importance: High

Nick,

We took a quick look at the contents of the information for DCPP and PVNGS. The DCPP folder contains the PPRP-TI correspondence and interactions on the source model and ground motion model SSHACs. However, the PVNGS only has the ground motion model SSHAC PPRP-TI team material and not for the Source model. Please let us know when we can get the source model PPRP-TI team documentation.

Thanks,
Cliff

From: DiFrancesco, Nicholas
Sent: Tuesday, April 21, 2015 1:25 PM
To: Munson, Clifford; Ake, Jon
Cc: Jackson, Diane; Shams, Mohamed; Vega, Frankie; Graizer, Vladimir; John Stamatakos <jstam@swri.org> (jstam@swri.org); Hill, Brittain; Seber, Dogan; Vega, Frankie; Stirewalt, Gerry
Subject: DCPP, Palo Verde, and Columbia Audit Information: SSHAC Documentation from PPRP-IT Team

Folks,

Please control distribution to the designated review team member for the following references.

Following your audit review, please advise if information reviewed should be docketed to support development of the hazard staff assessment or RAIs.

DC Audit Information
S:\Diablo Canyon R2.1 Seismic Information\SSHAC Documentation of PPRP-TI Team

Palo Verde Audit Information
S:\Palo Verde R2.1 Seismic Information\SSHAC Documentation of PPRP-TI Team

Columbia
Information is on ePortal (PM action to work through access controls). Also, licensee plans to work with PNNL to post information on public website.

Thanks,
Nick

From: Soenen, Philippe R [mailto:PNS3@pge.com]
Sent: Tuesday, April 21, 2015 10:49 AM
To: DiFrancesco, Nicholas
Cc: Jahangir, Nozar
Subject: DCPP information on Certrec

Nick,

We have uploaded the PPRP information onto Certrec IMS and granted access to Vladimir Grazier, John Stamatakos, and yourself. Here is how you get to the PPRP information in Certrec:

- Login to ims.certrec.com
- Click on "Inspections"
- Set status to "In Progress" and Plant to "Diablo Canyon"
- Click "Search" button.
- Click link to "Self-Assessment / Audit – Review of PPRP Comments and TIT Resolution"
- Click on the "NRC Requests" tab
- Click on what you would like to see.

Please let me know if you have any questions.

Regards,

Philippe Soenen

Regulatory Services
Office - 805.545.6984
Cell (b)(6)

Alan Morris

From:Alan Morris
Sent:15 May 2015 19:06:33 +0000
To:John Stamatakos
Cc:David Ferrill
Subject:RE: Diablo Canyon

Not the version I am looking at - did you place it somewhere other than on Regios?
Alan

Alan Morris
Department of Earth, Material, and Planetary Sciences
Geosciences and Engineering Division
Southwest Research Institute
6220 Culebra Road, San Antonio, TX 78238, USA
Tel: 210.522.6743
Fax: 210.522.5155
Web page: http://www.swri.org/4org/d20/geosci/structur.htm
http://3dstress.swri.org/

From: John Stamatakos
Sent: Friday, May 15, 2015 2:03 PM
To: Alan Morris
Cc: David Ferrill
Subject: RE: Diablo Canyon

I did unlock that one I think?

I do want to chat about this work next week when I am back in the office.

John

From: Alan Morris
Sent: Friday, May 15, 2015 1:50 PM
To: John Stamatakos
Cc: David Ferrill
Subject: Diablo Canyon

John,

Did I understand you to have said that we might be able to see unlocked versions of some of the relevant documents?

If so, then I would like to be able to see all the parts of "NTTF DCCP PSHA Review", which seems to have some very good stuff in it, and it is not easy to read and annotate as it currently stands.

Thanks
Alan

Alan Morris
Department of Earth, Material, and Planetary Sciences
Geosciences and Engineering Division
Southwest Research Institute
6220 Culebra Road, San Antonio, TX 78238, USA
Tel: 210.522.6743
Fax: 210.522.5155
Web page: http://www.swri.org/4org/d20/geosci/structur.htm
http://3dstress.swri.org/

Alan Morris

From:Alan Morris
Sent:28 Apr 2015 19:49:58 +0000
To:Ronald McGinnis;David Ferrill;Kevin Smart;Sarah Wigginton
Subject:RE: Diablo Canyon

After 9:30 am is good for me --Alan

Alan Morris
Department of Earth, Material, and Planetary Sciences
Geosciences and Engineering Division
Southwest Research Institute
6220 Culebra Road, San Antonio, TX 78238, USA
Tel: 210.522.6743
Fax: 210.522.5155
Web page: http://www.swri.org/4org/d20/geosci/structur.htm
http://3dstress.swri.org/

From: Ronald McGinnis
Sent: Tuesday, April 28, 2015 1:56 PM
To: David Ferrill; Alan Morris; Kevin Smart; Sarah Wigginton
Subject: FW: Diablo Canyon

Is there a particular time that works for you all? I am good any time.

From: John Stamatakos
Sent: Tuesday, April 28, 2015 1:53 PM
To: Ronald McGinnis
Subject: RE: Diablo Canyon

I am in a Diablo meeting right now. We should have a call tomorrow.

I'll have to look at my schedule but could you ask your folks so we can set up a good time?

John

From: Ronald McGinnis
Sent: Tuesday, April 28, 2015 1:35 PM
To: John Stamatakos
Subject: RE: Diablo Canyon

John,

We just got back in the office from two weeks of travel. David and I are in the office this week and then gone again next week. How did the meeting with NRC go? I got your voicemail asking about the GIS file but I didn't get it until yesterday.

Do we have the go ahead for Phase 2? If so, we may want to have a phone call this week to go over the details.

Thanks,
Ronny

From: John Stamatakos
Sent: Friday, April 10, 2015 3:04 PM
To: Ronald McGinnis
Cc: David Ferrill; Alan Morris ((b)(6) [redacted]); Kevin Smart; Sarah Wigginton; Miriam R. Juckett
Subject: RE: Diablo Canyon

I mean Ronny ... sorry I know better

From: John Stamatakos
Sent: Friday, April 10, 2015 4:02 PM
To: Ronald McGinnis
Cc: David Ferrill; Alan Morris (b)(6) [redacted]); Kevin Smart; Sarah Wigginton; Miriam R. Juckett
Subject: RE: Diablo Canyon

Thanks Ronnie,

Outstanding job. I am very pleased with the progress so far.

john

From: Ronald McGinnis
Sent: Friday, April 10, 2015 3:58 PM
To: John Stamatakos
Cc: David Ferrill; Alan Morris ((b)(6) [redacted]); Kevin Smart; Sarah Wigginton
Subject: RE: Diablo Canyon

John,

We are not quite finished with the data quality tab in the spreadsheet so that will have to continue, but all the data has been reviewed and is represented by a row in the following linked spreadsheet.
Y:\Diablo_Canyon\Diablo Canyon\Document_Catalog_COMPLETE.xlsx

Also, we are working on an ArcGIS project that helps to organize the seismic data. It should be finished by COB today. That link is at Y:\Diablo_Canyon\Diablo Canyon\ArcGIS_GED\Diablo_Canyon_March_2015.mxd

The review document is at T:\Diablo_Canyon\Diablo Canyon\CNWRA report April 2015\DiabloCanyonPowerPlant - seismic risk data survey April 2015.docx

All the rest of the files are in the Diablo Canyon folder on regios.

Let us know if you have any questions.

-Ronny

From: John Stamatakos
Sent: Friday, April 10, 2015 2:48 PM
To: Ronald McGinnis
Subject: Diablo Canyon

Can I review all the files so I can present at NRC on Monday?

John

Dr. John Stamatakos
Director of Technical Programs
Center for Nuclear Waste Regulatory Analyses (CNWRA)
Southwest Research Institute
1801 Rockville Pike, Rockville, MD 20852
301-881-0290

jstamatakos@swri.org

John Stamatakos

From:John Stamatakos
Sent:29 Apr 2015 16:03:59 +0000
To:Ronald McGinnis
Subject:RE: Diablo Canyon

Ronnie, do we have a bridge line we can use?

John

From: Ronald McGinnis
Sent: Wednesday, April 29, 2015 10:37 AM
To: John Stamatakos
Subject: RE: Diablo Canyon

Sounds good.

From: John Stamatakos
Sent: Wednesday, April 29, 2015 9:35 AM
To: Ronald McGinnis
Subject: RE: Diablo Canyon

Office ... or we may use a bridge if I want to bring in NRC.

From: Ronald McGinnis
Sent: Wednesday, April 29, 2015 10:33 AM
To: John Stamatakos
Subject: RE: Diablo Canyon

We will call you. Office or cell?

From: John Stamatakos
Sent: Wednesday, April 29, 2015 9:16 AM
To: Ronald McGinnis
Subject: RE: Diablo Canyon

OK

From: Ronald McGinnis
Sent: Wednesday, April 29, 2015 10:00 AM
To: John Stamatakos
Subject: RE: Diablo Canyon

John,

How about 2:00 our time?

-Ronny

From: Ronald McGinnis
Sent: Tuesday, April 28, 2015 1:55 PM
To: John Stamatakos
Subject: RE: Diablo Canyon

Should work. I will get a time and let you know.

From: John Stamatakos
Sent: Tuesday, April 28, 2015 1:53 PM
To: Ronald McGinnis
Subject: RE: Diablo Canyon

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I'll have to look at my schedule but could you ask your folks so we can set up a good time?

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Cc: David Ferrill; Alan Morris (b)(6) [redacted]); Kevin Smart; Sarah Wigginton; Miriam R. Juckett
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Cc: David Ferrill; Alan Morris (b)(6)); Kevin Smart; Sarah Wigginton; Miriam R. Juckett
Subject: RE: Diablo Canyon

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Cc: David Ferrill; Alan Morris ((b)(6)); Kevin Smart; Sarah Wigginton
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The review document is at T:\Diablo_Canyon\Diablo Canyon\CNWRA report April 2015\DiabloCanyonPowerPlant - seismic risk data survey April 2015.docx

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Subject: Diablo Canyon

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John

Dr. John Stamatakos
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Southwest Research Institute
1801 Rockville Pike, Rockville, MD 20852

301-881-0290

jstamatakos@swri.org

John Stamatakos

From:John Stamatakos
Sent:15 May 2015 19:16:16 +0000
To:Alan Morris
Subject:RE: Diablo Canyon
No but Ill check again.

From: Alan Morris
Sent: Friday, May 15, 2015 3:07 PM
To: John Stamatakos
Cc: David Ferrill
Subject: RE: Diablo Canyon

Not the version I am looking at - did you place it somewhere other than on Regios?
Alan

Alan Morris
Department of Earth, Material, and Planetary Sciences
Geosciences and Engineering Division
Southwest Research Institute
6220 Culebra Road, San Antonio, TX 78238, USA
Tel: 210.522.6743
Fax: 210.522.5155
Web page: http://www.swri.org/4org/d20/geosci/structur.htm
http://3dstress.swri.org/

From: John Stamatakos
Sent: Friday, May 15, 2015 2:03 PM
To: Alan Morris
Cc: David Ferrill
Subject: RE: Diablo Canyon

I did unlock that one I think?

I do want to chat about this work next week when I am back in the office.

John

From: Alan Morris
Sent: Friday, May 15, 2015 1:50 PM
To: John Stamatakos
Cc: David Ferrill
Subject: Diablo Canyon

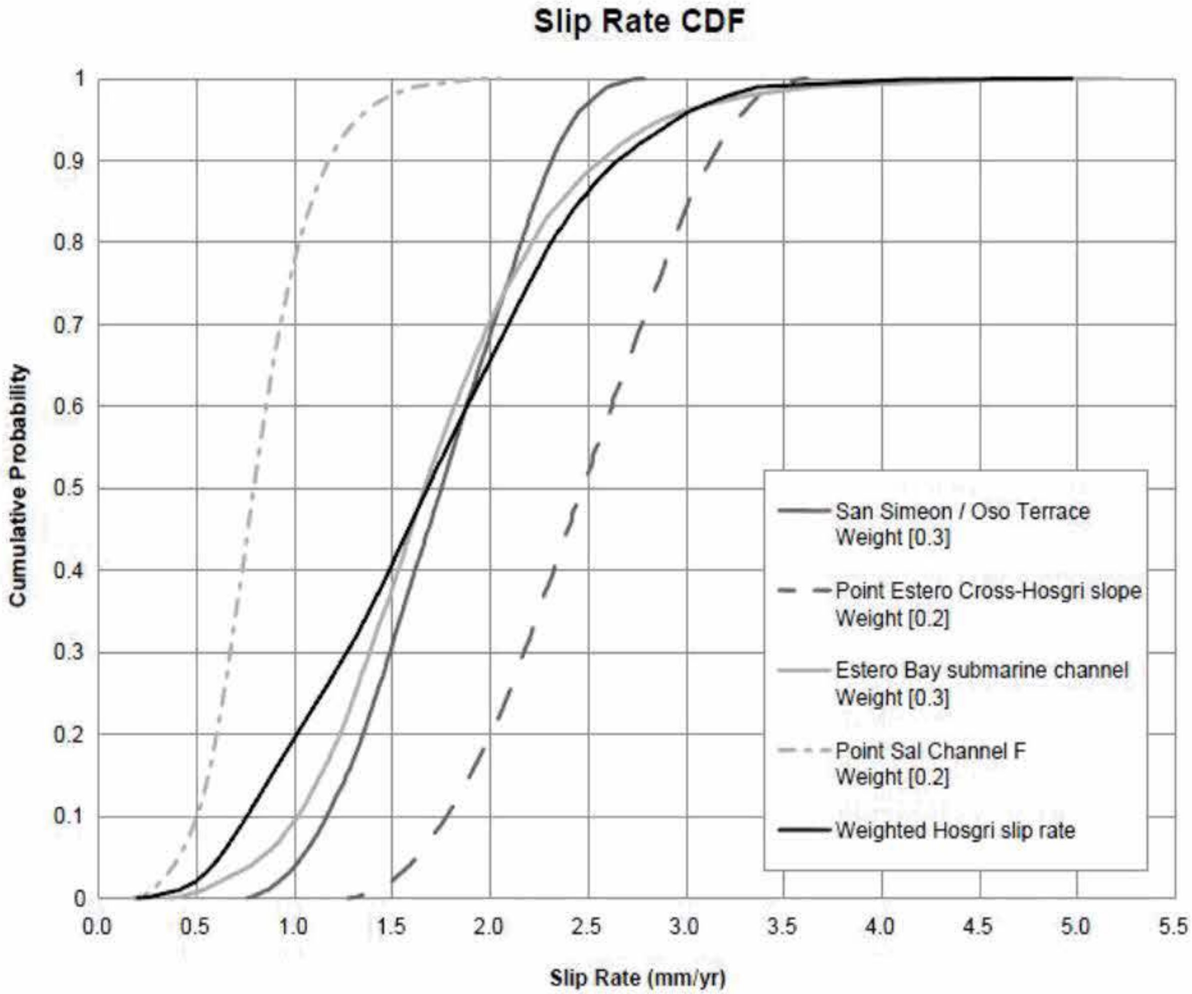
John,

Did I understand you to have said that we might be able to see unlocked versions of some of the relevant documents?

If so, then I would like to be able to see all the parts of "NTTF DCCP PSHA Review", which seems to have some very good stuff in it, and it is not easy to read and annotate as it currently stands.

Thanks
Alan

Alan Morris
Department of Earth, Material, and Planetary Sciences
Geosciences and Engineering Division
Southwest Research Institute
6220 Culebra Road, San Antonio, TX 78238, USA
Tel: 210.522.6743
Fax: 210.522.5155
Web page: http://www.swri.org/4org/d20/geosci/structur.htm
http://3dstress.swri.org/



5-Point Distribution		
Percentile	Slip Rate (mm/yr)	Weight
0.034893	0.6	0.101
0.211702	1	0.244
0.5	1.7	0.309
0.788298	2.3	0.244
0.965107	3.1	0.101
Weighted Mean	**1.7**	

Note: The Hosgri slip rate CDF is calculated from the weighted combination of slip rate CDFs developed for each of the four Hosgri slip rate sites.

Hosgri Slip Rate CDF Compilation and Selection of 5-Point Distribution

DCPP SSC REPORT

Pacific Gas and Electric Company | Figure 8-33

John Stamatakos

From:John Stamatakos
Sent:29 Apr 2015 15:59:39 +0000
To:Ronald McGinnis;Alan Morris;David Ferrill;Kevin Smart;Sarah Wigginton
Cc:Miriam R. Juckett
Subject:RE: Diablo Canyon
Attachments:Composite Hosgri SR PDF.JPG

Ronnie,

For the call this afternoon.

I want to look at the seismic imaging data from the CCCSIP that PG&E uses to constrain the slip (interpretations of offset paleo-channels) for the Hosgri Fault. There are 4 piercing points that PG&E uses to develop the composite slip rate CDF for the Hosgri fault. The slip rate data used for these 4 points is summarized in the SSC report in Chapter 8:

a. San Simeon/Oso Terrace – Figure 8-16
b. Point Estero Cross-Hosgri Slope - Figure 8-18
c. Estero Bay Submarine Channel – Figure 8.28
d. Point Sal Channel F – Figure 8.32

For each of these we should understand how the cumulative slip was determined (and uncertainty) and how the offset age was determined (and uncertainty).

1. Age: For San Simeon, the age is based on the interpretation that the unconformity overlying the buried geomorphic featured tied to the Younger Dryas, so this one is rather straightforward. But the other three, especially Estero Bay and Point Sal, ages are based on interpretations of age ranges from the seal level curves. So we will need to understand how the TI team interpreted the offset parkers in terms of these curves and whether other interpretations outside the ones provided are permissible.

2. Slip: All the slip estimates are based on interpretations of the 2D and 3D seismic images and detailed sea floor bathymetry. The summary figures from the CCCISP are also in Chapter 8 of the SSC Report.

Thanks,

John

FYI I replaced the locked DCPP SSC Report Rev A in the folder with an unlocked pdf version so search and rescue is much easier now.

From: Ronald McGinnis
Sent: Wednesday, April 29, 2015 10:00 AM

Sent:26 Mar 2015 15:35:53 +0000
To:David Ferrill;'Alan Morris';Kevin Smart
Cc:Alan Morris
Subject:RE: Diablo Canyon data review for NRC

John is going to be here Tuesday morning. The plan is for Alan, Kevin (if you are here), and me to go over the project with him that morning and figure out a schedule. I am out most of the day on Wednesday for (b)(6) [redacted], so Thursday may be the day we can spend the most time with John on this. Unless David and Alan can do some on Wednesday while I am out.

-Ronny

From: Ronald McGinnis
Sent: Tuesday, March 24, 2015 9:08 AM
To: David Ferrill; 'Alan Morris'; Kevin Smart
Cc: Alan Morris
Subject: RE: Diablo Canyon data review for NRC

Just got off the phone with John. We are set for next week April 1-2 (Wednesday and Thursday). I will get the conference room next to Violet reserved and I will get John set up on Regios so he can start loading data in advance of the meeting.

-Ronny

From: David Ferrill
Sent: Monday, March 23, 2015 10:12 PM
To: 'Alan Morris'; Ronald McGinnis
Cc: Alan Morris; Kevin Smart
Subject: RE: Diablo Canyon data review for NRC

Ronny,

This sounds like an interesting project!

Please let John know that I have been out of cell phone range for the last few days in Big Bend and just resurfaced today, and I did get his message and was planning to call him tomorrow morning.

I will be cleansing and having a colonoscopy Monday and Tuesday of next week, so those days are out for me. I expect/hope to be in on Wednesday and Thursday April 1-2, but will be taking off April 3rd for vacation. So, to me the best dates next week for meeting on this appear to by April 1-2, 2015.

David
From: Alan Morris [mailto:(b)(6) [redacted]
Sent: Monday, March 23, 2015 9:58 PM
To: Ronald McGinnis
Cc: David Ferrill; Alan Morris; Kevin Smart
Subject: Re: Diablo Canyon data review for NRC

Next week is open, this week is not good for me, I am only planning to be in on Wednesday
Alan

On Mon, Mar 23, 2015 at 10:47 AM, Ronald McGinnis <rmcginnis@swri.org> wrote:

Guys,

I just got off the phone with John Stamatakos regarding a project that has been funded that he wants our help with. Diablo Canyon has acquired a very large seismic data set (2d, 3d over the plant site, extensive shallow seismic, and some off shore) something in the neighborhood of $60 million worth of data. Some is newly acquired and all the new stuff has been merged with the old stuff.

There are 400 hours dedicated to this project. There would be two phases to this project. Phase I would be a high level review of the data and would be due in the next 45 days. Basically organize the data to see what they even have, perform a basic QA to see if the seismic is even useful, and provide a 2-3 page report outlining the data and our observations. Phase 2 would be full-scale characterization (PETREL model) pending that we can prove from Phase I that the data is useful.

John wants to come in next week to meet with us and look at the data for a couple days. Alan and David, can you offer two consecutive days that would work so I can let John know? I am available any day and Kevin said he could be available in the morning.

Hope the trip is going well.

Thanks,

Ronny

****

Ronald N. McGinnis

rmcginnis@swri.org

Senior Research Scientist

Department of Earth, Material, and Planetary Sciences Southwest Research Institute

6220 Culebra Road

San Antonio, Texas 78238-5166

Office: 210-522-5825

Mobile: (b)(6)

John Stamatakos

From:John Stamatakos
Sent:1 Jun 2015 12:00:29 +0000
To:'Munson, Clifford'
Subject:RE: Diablo Canyon Mtg - Topic for this week

Cliff,

I don't have anything to present this week. But wasn't the meeting moved to Wednesday?

John

From: Munson, Clifford [mailto:Clifford.Munson@nrc.gov]
Sent: Monday, June 1, 2015 7:47 AM
To: Ake, Jon; John Stamatakos; Graizer, Vladimir; Plaza-Toledo, Meralis; Stovall, Scott
Cc: Jackson, Diane
Subject: Diablo Canyon Mtg - Topic for this week

We will discuss magnitude recurrence and activity rates assuming constant seismic moment rate as opposed to constant seismicity. I have a presentation but it will probably not take more than half of our allotted time of 2 hrs. Does anyone else have something to present? I will get the projector and laptop.

Cliff

Munson, Clifford

From:Munson, Clifford
Sent:28 May 2015 11:40:45 -0400
To:John Stamatakos;Graizer, Vladimir;Stovall, Scott;Ake, Jon;Brittain Hill;Plaza-Toledo, Meralis
Cc:Jackson, Diane;DiFrancesco, Nicholas
Subject:RE: Diablo Canyon RAI

Thanks John. They don't define site profiles in terms of the layering, properties, etc. because they do the empirical approach.

Cliff

From: John Stamatakos [mailto:jstam@swri.org]
Sent: Thursday, May 28, 2015 10:28 AM
To: Munson, Clifford; Graizer, Vladimir; Stovall, Scott; Ake, Jon; Hill, Brittain; Plaza-Toledo, Meralis
Cc: Jackson, Diane; DiFrancesco, Nicholas
Subject: RE: Diablo Canyon RAI

Cliff,

I have a comment/question in the RAI.

Thanks,

John

From: Munson, Clifford [mailto:Clifford.Munson@nrc.gov]
Sent: Thursday, May 28, 2015 9:21 AM
To: Graizer, Vladimir; Stovall, Scott; John Stamatakos; Ake, Jon; Brittain Hill; Plaza-Toledo, Meralis
Cc: Jackson, Diane; DiFrancesco, Nicholas
Subject: Diablo Canyon RAI

First draft of DCPP RAI on site response. Please take a look and let me know if you have any comments.

Thanks,
Cliff

Sent:27 Mar 2015 21:21:41 +0000
To:John Stamatakos
Subject:RE: Diablo Canyon Review

John,

Thank you. This is helpful. I assume you meant to send this to Alan instead of Amy so I forwarded it to him. Also, what is the charge number for this?

Have a good trip and see you Tuesday.

-Ronny

From: John Stamatakos
Sent: Friday, March 27, 2015 3:01 PM
To: Ronald McGinnis; David Ferrill; Amy Minor; Kevin Smart
Cc: Miriam R. Juckett
Subject: Diablo Canyon Review

I've place most of my Diablo Canyon files on the DEMPS server (Demps\regios).

There are a series of reports that Pacific Gas & Electric (POG&E) produced over the last few years.

1. **Shoreline and RIL**: The Shoreline report was submitted by PG&E in 2011 and we (with NRC review if in 2012). The Regulatory Information Letter (RIL 12-01) is that review. This report and review focused on the Shoreline fault and potential implications to the Licensing Basis for the plant. But the reports offer some good general background information. Other files in this folder are related to the Shoreline Report and the RIL.
2. **DCPP Shoreline and Thrust Fault Allegation**: In addition to the Shoreline Report, NRC had us look at an allegation made by (b)(6) [redacted] about other possible faults and the plant. Alan helped me on one of the allegations (possible blind thrust beneath the plant site).
3. **Central Coastal California Seismic Imaging Project**: The California state legislature passed a bill after the Shoreline Report authorizing PG&E to collect boat load of new seismic imaging data. This report is essentially a data dump of that work, and it has the bulk of what I would like you all to look at.
4. **LTSP**: This is an old PG&E report (1991) that may also be useful as background.
5. **NTTF DCCP PSHA Review**: This is the actual new seismic hazard study that we are reviewing. We will need to cross reference the conclusions about faults (do they exist, their geometry, slip rate, length and area, etc.) based on seismic imaging to the data in the CCCSIP report.
6. **Diablo Canyon ISFSR SER** : This was our review of the site back in early 2000's for the Independent Spent Fuel Storage Installation (ISFSI). May be useful as background information.
7. **Figure**: is a folder I use to put in various figures and some of my Diablo Presentations and related images.

For reference: http://www.pge.com/en/safety/systemworks/dcpp/seismicsafety/index.page

This link gets you to most of these reports on line.

Work Scope:

I have five progressive tasks in mind.

1. Look through the CCCSIP documents and develop a summary (catalog) of all the seismic imaging data that's there. Identify the who, what and where and assess its quality and possible usefulness to the PSHA. I think we can do this relatively quickly. We can even bring on a temp/student if available and willing to work on this. NRC wants to be able to say that they are familiar with all the data and have looked it over as part of the review. I would like to have a very quick deliverable on this (couple of pages?) relatively soon.
2. Identify which data in the CCCSIP report is actually relied on to develop conclusions in the new PSHA. Assess the validity of the structural/seismic interpretations from the quality of the seismic imaging data. This may take a bit longer than task 1, but I hope we can do this relatively quickly.
3. Identify potential faults in the data sets that may have been overlooked by the PSHA technical team. I am **not** suggesting we identify any vague targets, but if you see images that in your view (and based on your experience) are very likely significant faults, we should tag them and assess their potential to influence the seismic hazard at the site.
4. For those critical data sets identified in task 2, complete a technical review of the data and the interpretations. This will be included in our write up for the overall PSHA assessment.
5. Review the 3D data collected in the Irish Hills to reassess the blind thrust fault model (I think it is now referred to as the San Luis Range Thrust).

I'll walk you all through this again next week and provide some more background on the PSHA and how we can assess whether fault sources can be important to the PSHA next week.

Thanks,

John

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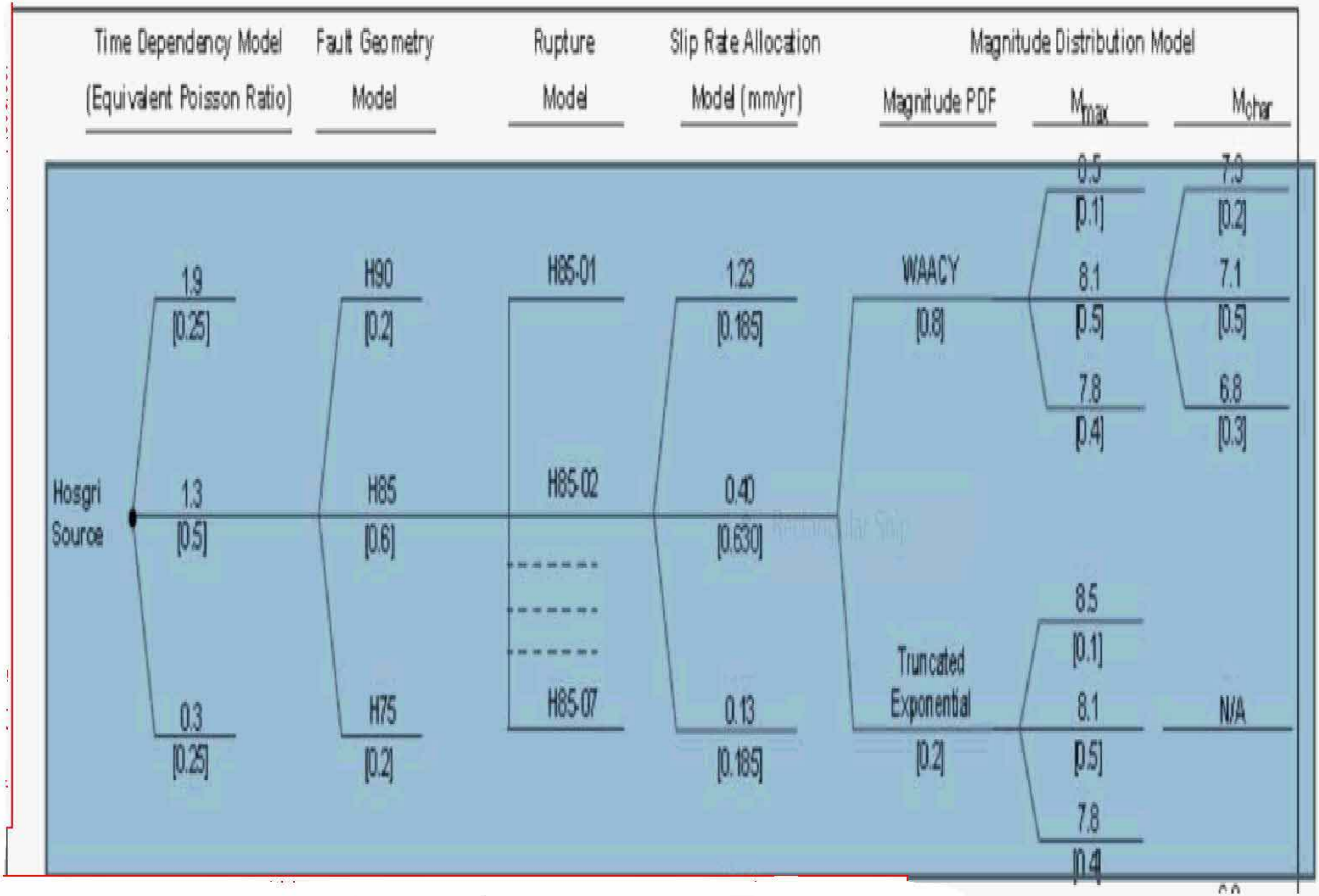

Time Dependency Model
(Equivalent Poisson Ratio)
Fault Geometry
Model
Rupture
Model
Slip Rate Allocation
Model (mm/yr)
Magnitude Distribution Model
Magnitude PDF
M_{max}
M_{char}
Hosgri
Source
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1.3
[0.5]
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H85
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Exponential
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[0.5]
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7.1
[0.5]
6.8
[0.3]
8.5
[0.1]
8.1
[0.5]
7.8
[0.4]
N/A

Information (page 495/800) is duplicate.

From:John Stamatakos
Sent:21 Apr 2015 16:39:41 +0000
To:'Munson, Clifford'
Subject:RE: diablo scenario events
Will do

From: Munson, Clifford [mailto:Clifford.Munson@nrc.gov]
Sent: Tuesday, April 21, 2015 11:46 AM
To: Ake, Jon; John Stamatakos; Graizer, Vladimir
Cc: Heeszel, David
Subject: diablo scenario events

John,

Would you come up with some plausible scenario events for Hosgri in terms of the parameters listed below (as a spreadsheet?). I coded the SWUS GMM for T=1 sec. There are 31 median models each with a unique set of 10 coefficients. I just read in their electronic file as a 31 by 10 matrix to avoid typing errors. I also coded up the total sigma (3 branches with 2 coefficients for each branch).

The input parameters are:

1. Magnitude (mag)
2. Depth to top of rupture (ztor) in km
3. Rupture distance (rrup) in km
4. Joyner-Boore distance (rjb) in km
5. Fault dip angle (dip) in degrees
6. Down-dip rupture width (ddrw) in km
7. Horizontal distance from top of rupture measured perpendicular to strike (Rx) in km
8. Fault type (REV,NRM, or SS) – depending on rake angle

I will proceed to code T=0.1 sec and maybe some more periods if I have time.

I would like to verify our results somehow before we merge these codes with Roland's.

Thanks,
Cliff

John

From: Munson, Clifford [mailto:Clifford.Munson@nrc.gov]
Sent: Tuesday, April 21, 2015 11:46 AM
To: Ake, Jon; John Stamatakos; Graizer, Vladimir
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I would like to verify our results somehow before we merge these codes with Roland's.

Thanks,
Cliff

Osvaldo Pensado

From:Osvaldo Pensado
Sent:1 May 2015 09:28:17 -0500
To:John Stamatakos
Subject:RE: Function for excel

And you wanted to become a manager ... he, he ;)

From: John Stamatakos
Sent: Friday, May 01, 2015 9:26 AM
To: Osvaldo Pensado
Subject: RE: Function for excel

I think so. I am going to see if I can reproduce some of the Licensee results first. Right now I am knee deep in administrvia.

John

From: Osvaldo Pensado
Sent: Friday, May 1, 2015 10:22 AM
To: John Stamatakos
Subject: RE: Function for excel

Will the closed form formula for the trapezoidal sampling help you?

From: John Stamatakos
Sent: Friday, May 01, 2015 9:13 AM
To: Osvaldo Pensado
Subject: RE: Function for excel

20.17752.01.012

Thanks so much

John

From: Osvaldo Pensado
Sent: Thursday, April 30, 2015 7:23 PM
To: John Stamatakos
Subject: Function for excel

Okay John.

What is the charge number?

Doing your problem in Mathematica is quite simple. In Excel ... not so much. I give you instructions to get the trapezoidal function in Excel.

For the trapezoidal function for the offset:

a=15
b=26
c=35
d=43

p is a random number uniformly sampled between 0 an 1. It can be sampled with Excel using p=Rand().

Apply it to randomly sampled values of p=Rand() in Excel.

The formula is a big sausage with nested if-then statements. At least it is a closed formula. There is a high chance to make a typographical error, though.

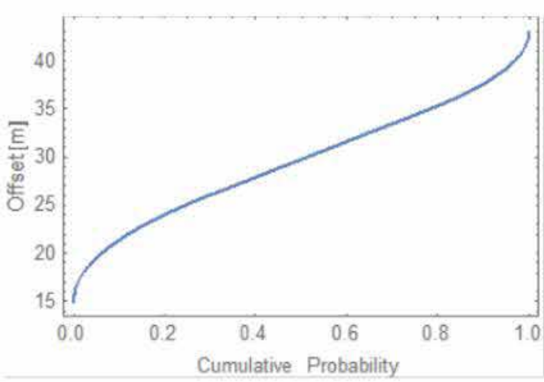
You should consider programming the formula in a macro.

$$\text{trapezCDFInv[p\_, a\_, b\_, c\_, d\_]} := \text{If}[0 \leq p \,\&\, p < \frac{b-a}{-a-b+c+d}, a+\sqrt{a^2p-b^2p-acp+bcp-adp+bdp},$$

$$\text{ElseIf}[\frac{b-a}{-a-b+c+d} \leq p \,\&\, p < \frac{a+b-2c}{a+b-c-d}, \frac{1}{2}(a+b-ap-bp+cp+dp),$$

$$\text{ElseIf}[\frac{a+b-2c}{a+b-c-d} \leq p \,\&\, p \leq 1, d-\sqrt{ac+bc-c^2-ad-bd+d^2-acp-bcp+c^2p+adp+bdp-d^2p}]]]$$

This is the plot of the trapezCDFInv function



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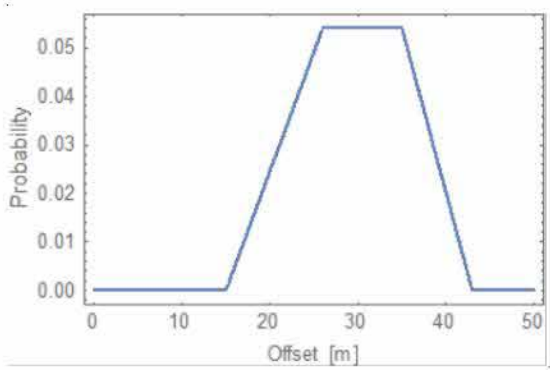
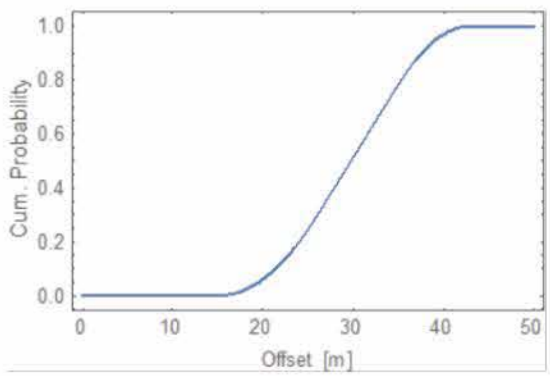


This is the CDF: parabola segment, followed by a straight line, ending in another parabola segment.



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For a Triangular function the formula to use is

$$\text{cdfTriangInv}[p\_, a\_, b\_, c\_] := \text{If}[p \leq (b-a)/(c-a), a + \text{Sqrt}[(b-a)*(c-a)*p], c - \text{Sqrt}[(c-a)*(c-b)*(1-p)]];$$

again, p=Rand()

To give you an idea on how simple the problem is in Mathematica, this would be the Latin hypercube sampling program (which will be better than random sampling you will do in Excel):

```
     shuffle[datos_]:=Module[{piv1,piv2={},ind1},piv1=datos;
          While[Length[piv1]>0,ind1=Random[Integer,{1,Lengt
h[piv1]}];
          AppendTo[piv2,piv1[[ind1]]];
          piv1=Drop[piv1,{ind1,ind1}];];
```

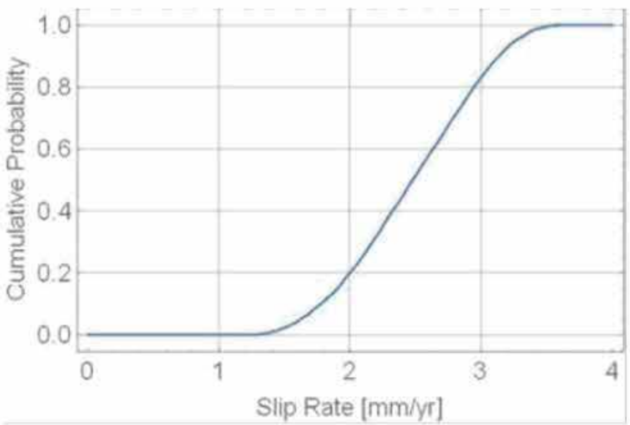
```
Return[piv2]];

pvec=shuffle[Table[i,{i,0,1,1.0/5000}]];
age1=cdfTriangInv[#,11.5, 12, 12.5]&/@ pvec;
pvec=shuffle[pvec];

offset1=trapezCDFInv[#,15, 26, 35, 43]&/@ pvec;
d1=EmpiricalDistribution[offset1/age1];
```

And the slip rate is

```
Plot[CDF[d1, x], {x, 0,4}, Frame → True, BaseStyle → 14, GridLines → Automatic, FrameLabel
    → {"Slip Rate [mm/yr]", "Cumulative Probability"}]
```



Dr. Osvaldo Pensado
Group Manager, *Risk Analysis and Performance Assessment*
Geosciences and Engineering Division
(210) 522-6084
opensado@swri.org

George Adams

From:George Adams
Sent:1 May 2015 16:11:37 -0500
To:John Stamatakos
Subject:RE: Function for excel
Attachments:CDFINV.xlsm

John,

I developed the spreadsheet attached with the macro written in Visual Basic (and shown below). Please let me know if this is what you needed or if an addition to it is needed.

George

```
Option Explicit

Function getTrapezCDFInv(p As Double, a As Double, b As Double, c As Double, d As Double) As Double
On Error GoTo errhandler

 getTrapezCDFInv = 0#

 If 0 <= p And p < ((b - a) / (-a - b + c + d)) Then
  getTrapezCDFInv = a + Sqr(a ^ 2 * p - b ^ 2 * p - a * c * p + b * c * p - a * d * p + b * d * p)
 ElseIf ((b - a) / (-a - b + c + d)) <= p And p < ((a + b - 2 * c) / (a + b - c - d)) Then
  getTrapezCDFInv = 0.5 * (a + b - a * p - b * p + c * p + d * p)
 ElseIf ((a + b - 2 * c) / (a + b - c - d)) <= p And p <= 1 Then
  getTrapezCDFInv = d - Sqr(a * c + b * c - c ^ 2 - a * d - b * d + d ^ 2 - a * c * p - b * c * p + c ^ 2 * p + a *
d * p + b * d * p - d ^ 2 * p)
 Else
  getTrapezCDFInv = -999
 End If

Exit Function
errhandler:
MsgBox "Error in getTrapezCDFInv: " & a & b & c & d

End Function

Function getTriangCDFInv(p As Double, a As Double, b As Double, c As Double) As Double
On Error GoTo errhandler

 getTriangCDFInv = 0#

 If p <= ((b - a) / (c - a)) Then
  getTriangCDFInv = a + Sqr((b - a) * (c - a) * p)
 ElseIf p <= 1 Then
  getTriangCDFInv = c - Sqr((c - a) * (c - b) * (1 - p))
```

```
 Else
  getTriangCDFInv = -999
 End If

Exit Function
errhandler:
MsgBox "Error in getTriangCDFInv: " & a & b & c

End Function
```

From: John Stamatakos
Sent: Friday, May 01, 2015 2:05 PM
To: George Adams
Subject: FW: Function for excel

20.17752.01.012 is the charge number

See attached plot

From: Osvaldo Pensado
Sent: Thursday, April 30, 2015 7:23 PM
To: John Stamatakos
Subject: Function for excel

Okay John.

What is the charge number?

Doing your problem in Mathematica is quite simple. In Excel ... not so much. I give you instructions to get the trapezoidal function in Excel.

For the trapezoidal function for the offset:

a=15
b=26
c=35
d=43

p is a random number uniformly sampled between 0 an 1. It can be sampled with Excel using p=Rand().

Apply it to randomly sampled values of p=Rand() in Excel.

The formula is a big sausage with nested if-then statements. At least it is a closed formula. There is a high chance to make a typographical error, though.

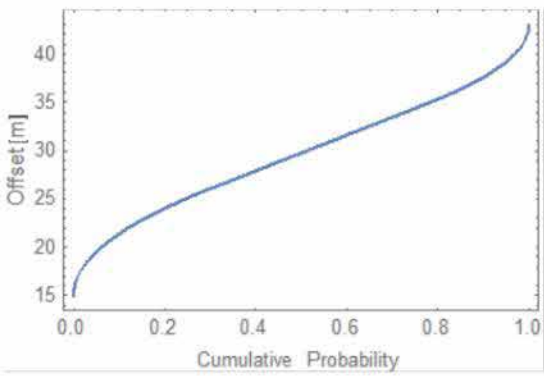
You should consider programming the formula in a macro.

$$\text{trapezCDFInv}[\text{p\_}, \text{a\_}, \text{b\_}, \text{c\_}, \text{d\_}] := \text{If}[0 \leq p \,\&\, p < \frac{b-a}{-a-b+c+d}, a + \sqrt{a^2p - b^2p - acp + bcp - adp + bdp},$$

$$\text{ElseIf}[\frac{b-a}{-a-b+c+d} \leq p \,\&\, p < \frac{a+b-2c}{a+b-c-d}, \frac{1}{2}(a + b - ap - bp + cp + dp),$$

$$\text{ElseIf}[\frac{a+b-2c}{a+b-c-d} \leq p \,\&\, p \leq 1, d - \sqrt{ac + bc - c^2 - ad - bd + d^2 - acp - bcp + c^2p + adp + bdp - d^2p}]]]$$

This is the plot of the trapezCDFInv function



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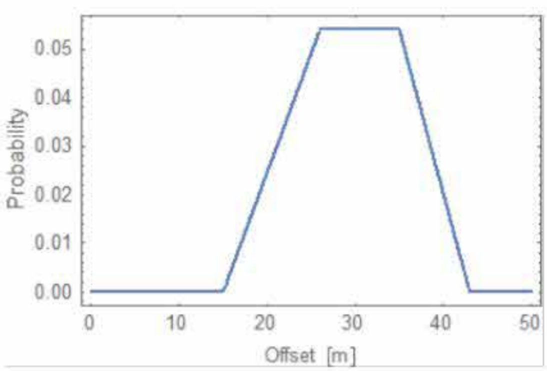

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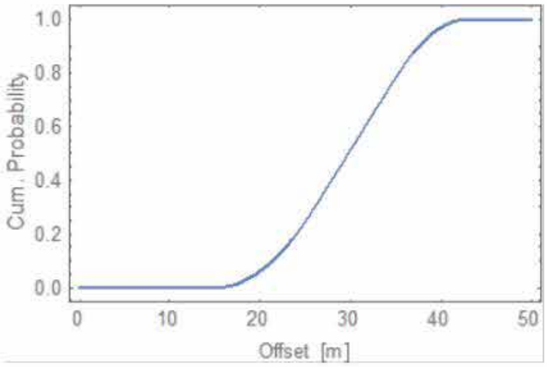

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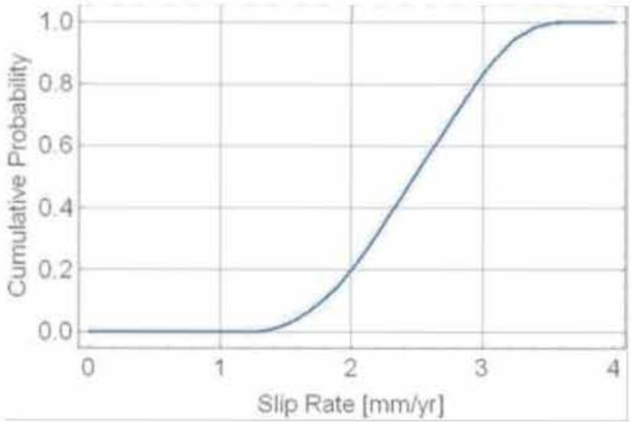
h[piv1]}];
          AppendTo[piv2,piv1[[ind1]]];
          piv1=Drop[piv1,{ind1,ind1}];];
      Return[piv2]];

     pvec=shuffle[Table[i,{i,0,1,1.0/5000}]];
     age1=cdfTriangInv[#,11.5, 12, 12.5]&/@ pvec;
     pvec=shuffle[pvec];

     offset1=trapezCDFInv[#,15, 26, 35, 43]&/@ pvec;
     d1=EmpiricalDistribution[offset1/age1];
```

And the slip rate is

$$\text{Plot}[\text{CDF}[\text{d1}, x], \{x, 0, 4\}, \text{Frame} \to \text{True}, \text{BaseStyle} \to 14, \text{GridLines} \to \text{Automatic}, \text{FrameLabel} \to \{\text{"Slip Rate [mm/yr]"}, \text{"Cumulative Probability"}\}]$$



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John Stamatakos

From:John Stamatakos
Sent:29 Apr 2015 16:25:39 +0000
To:'Giacinto, Joseph'
Subject:RE: Hosgri Slip Rates
Ok thanks

From: Giacinto, Joseph [mailto:Joseph.Giacinto@nrc.gov]
Sent: Wednesday, April 29, 2015 12:06 PM
To: John Stamatakos; Plaza-Toledo, Meralis
Subject: RE: Hosgri Slip Rates

Sounds good to me – thanks.

Also, I have your flash drive – you can pick it up (I will leave in the rock ashtray outside my T7C30 office on top of the file cabinet) or I'll give to you next time I see you.

Joe

From: John Stamatakos [mailto:jstam@swri.org]
Sent: Wednesday, April 29, 2015 12:03 PM
To: Giacinto, Joseph; Plaza-Toledo, Meralis
Subject: RE: Hosgri Slip Rates

How about I talk with San antonio today and we can meet tomorrow morning? We can set up a follow up call with them if needed.

John

From: Giacinto, Joseph [mailto:Joseph.Giacinto@nrc.gov]
Sent: Wednesday, April 29, 2015 12:00 PM
To: John Stamatakos; Plaza-Toledo, Meralis
Subject: RE: Hosgri Slip Rates

John, can we have the call tomorrow – say late morning?

Joe

From: John Stamatakos [mailto:jstam@swri.org]
Sent: Wednesday, April 29, 2015 11:53 AM
To: Giacinto, Joseph; Plaza-Toledo, Meralis
Cc: Munson, Clifford; Ake, Jon; Jackson, Diane; Stirewalt, Gerry; Seber, Dogan; Miriam R. Juckett; Graizer, Vladimir; Hill, Brittain
Subject: Hosgri Slip Rates

Joe and Meralis,

One of the more interesting, and more hazard sensitive, aspects of the Diablo canyon SSC is the Hosgri slip rate CDF. I suggest we focus our initial reviews on that aspect of the SSC. Dogan made a critical observation yesterday in our discussions, namely how can the lower tail of the CDF be justified. In thinking through the question last night I have a few suggestions.

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    For each of these we should understand how the cumulative slip was determined (and uncertainty) and how the offset age was determined (and uncertainty).

    1. Age: For San Simeon, the age is based on the interpretation that the unconformity overlying the buried geomorphic featured tied to the Younger Dryas, so this one is rather straightforward. But the other three, especially Estero Bay and Point Sal, ages are based on interpretations of age ranges from the seal level curves. So we will need to understand how the TI team interpreted the offset parkers in terms of these curves and whether other interpretations outside the ones provided are permissible.
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301-881-0290

jstamatakos@swri.org

John Stamatakos

From:John Stamatakos
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To:'Giacinto, Joseph';Plaza-Toledo, Meralis
Subject:RE: Hosgri Slip Rates

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Cc: Munson, Clifford; Ake, Jon; Jackson, Diane; Stirewalt, Gerry; Seber, Dogan; Miriam R. Juckett; Graizer, Vladimir; Hill, Brittain
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1801 Rockville Pike, Rockville, MD 20852
301-881-0290

jstamatakos@swri.org

John Stamatakos

From:John Stamatakos
Sent:29 Apr 2015 16:02:21 +0000
To:'Plaza-Toledo, Meralis'
Cc:Giacinto, Joseph
Subject:RE: Hosgri Slip Rates
OK

Ill get a bridge

From: Plaza-Toledo, Meralis [mailto:Meralis.Plaza-Toledo@nrc.gov]
Sent: Wednesday, April 29, 2015 11:59 AM
To: John Stamatakos
Cc: Giacinto, Joseph
Subject: RE: Hosgri Slip Rates

John,
I have some meetings in the afternoon but I will try to join the call, it may be a bit late though.
Meralis

From: John Stamatakos [mailto:jstam@swri.org]
Sent: Wednesday, April 29, 2015 11:53 AM
To: Giacinto, Joseph; Plaza-Toledo, Meralis
Cc: Munson, Clifford; Ake, Jon; Jackson, Diane; Stirewalt, Gerry; Seber, Dogan; Miriam R. Juckett; Graizer, Vladimir; Hill, Brittain
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1801 Rockville Pike, Rockville, MD 20852
301-881-0290

jstamatakos@swri.org

John Stamatakos

From:John Stamatakos
Sent:29 Apr 2015 17:11:17 +0000
To:'Seber, Dogan'
Subject:RE: Hosgri Slip Rates

Absolutely. Let me get Joe and Meralis up to speed on the data and some also get some high-level assessments of the seismic images from my guys. Then we can get together to comb through the details a bit and talk about what we should do next. Your insights would be very helpful and appreciated. I'll keep you posted.

Thanks,

John

From: Seber, Dogan [mailto:Dogan.Seber@nrc.gov]
Sent: Wednesday, April 29, 2015 1:07 PM
To: John Stamatakos
Subject: RE: Hosgri Slip Rates

John,

Thanks for pursuing this. Since I am not part of the Diablo Canyon review team, I have not looked at any of the issues in detail. However, having seen some of the presentations at the SSA meeting last week in Pasadena and seeing what the licensee is doing with slip rates yesterday, I really think there needs to be a special focus in NRC reviews to figure out whether adequate slip rates (not just the PG&E contractors, but also other efforts by USGS etc) are utilized in PG&E PSHA study. As you know, this directly impacts the PSHA results. I am always happy and ready to talk with anyone in more detail, if there is any need.

Best,

Dogan Seber, PhD
Senior Geophysicist
Geosciences and Geotechnical Engineering Branch 1
Division of Site Safety and Environmental Analysis
Office of New Reactors
U.S. Nuclear Regulatory Commission
☎ 301-415-0212

From: John Stamatakos [mailto:jstam@swri.org]
Sent: Wednesday, April 29, 2015 11:53 AM
To: Giacinto, Joseph; Plaza-Toledo, Meralis
Cc: Munson, Clifford; Ake, Jon; Jackson, Diane; Stirewalt, Gerry; Seber, Dogan; Miriam R. Juckett; Graizer, Vladimir; Hill, Brittain
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301-881-0290

jstamatakos@swri.org

Munson, Clifford

From:Munson, Clifford
Sent:8 Jun 2015 13:32:28 +0000
To:Graizer, Vladimir;Ake, Jon;John Stamatakos;Stovall, Scott;Brittain Hill;Weaver, Thomas;Devlin-Gill, Stephanie;Walsh, Lisa;Seber, Dogan
Cc:Jackson, Diane
Subject:RE: presentation for DCPP on Diablo site term

Great. We will have you present after John.
Cliff

From: Graizer, Vladimir
Sent: Friday, June 05, 2015 3:29 PM
To: Munson, Clifford; Ake, Jon; John Stamatkos; Stovall, Scott; Hill, Brittain; Weaver, Thomas; Devlin-Gill, Stephanie; Walsh, Lisa; Seber, Dogan
Cc: Jackson, Diane
Subject: presentation for DCPP on Diablo site term

I used alternative approach to estimation of Diablo site term.
I can present my calcs comparing with theirs at our Wednesday, June 10th meeting.
Vladimir

Munson, Clifford

From:Munson, Clifford
Sent:28 May 2015 10:00:37 -0400
To:Graizer, Vladimir;Jackson, Diane
Cc:John Stamatakos;Ake, Jon;Plaza-Toledo, Meralis;Giacinto, Joseph;Stovall, Scott;Brittain Hill;Li, Yong
Subject:RE: Reminder sent to Diablo for Information Request

Thanks Vlad. We will ask for this in the next batch of requests to DCPP.
Cliff

From: Graizer, Vladimir
Sent: Thursday, May 28, 2015 9:54 AM
To: Jackson, Diane; Munson, Clifford
Cc: John Stamatakos; Ake, Jon; Plaza-Toledo, Meralis; Giacinto, Joseph; Stovall, Scott; Hill, Brittain; Li, Yong
Subject: RE: Reminder sent to Diablo for Information Request

Diane and Cliff,
I don't know if it is considered an RAI, but as I mentioned at one of the Diablo meetings I need the following info:

Section 8.4.1 of the SWUS report discusses evaluation of median base models and their range. Please provide Excel files of the plots shown on Figures 8.4-17 and 8.4-18 showing comparisons of hazard curves for frequencies of 5 and 0.5 Hz.
In addition, please provide similar files for the frequencies of 10 and 1 Hz.

Vladimir Graizer, Ph.D.
Seismologist
Office of New Reactors
Mail Stop: T-7F3
Washington, DC 20555-0001

From: Jackson, Diane
Sent: Thursday, May 28, 2015 9:43 AM
To: Munson, Clifford
Cc: Graizer, Vladimir; John Stamatakos; Ake, Jon; Plaza-Toledo, Meralis; Giacinto, Joseph; Stovall, Scott; Hill, Brittain; Li, Yong
Subject: FYI: Reminder sent to Diablo for Information Request

Nick sent a reminder.

Diane

From: DiFrancesco, Nicholas
Sent: Thursday, May 28, 2015 9:16 AM
To: Philippe Soenen (Pns3@pge.com); Jahangir, Nozar
Cc: Michael Richardson (mjrm@pge.com); Strickland, Jearl; Shams, Mohamed; Jackson, Diane; Vega,

Frankie
Subject: Reminder on Diablo Information Request

Philippe, et, al

Just a reminder that the staff is interested in the following references to support NRC review:

1) Benchmark files for SWUS-DCPP median ground motion models.
2) ESTA 27 and 28 recordings of Parkfield and San Simeon earthquakes
    a. Time histories
    b. Response spectra
    c. Response spectra adjusted for Vs30
3) Engineering reports describing development of velocity profiles for stations ESTA 27 and 28.
4) Paper describing WAACY Magnitude PDF by Wooddell and others.

Please let me know when the references will be available.

Thanks,

Nick

Senior Project Manager - Seismic Reevaluation Activities
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Japan Lesson Learned Project Division
nicholas.difrancesco@nrc.gov | Tel: (301) 415-1115

Hill, Brittain

From:Hill, Brittain
Sent:18 Mar 2015 14:33:09 -0400
To:Miriam R. Juckett;John Stamatakos
Subject:RE: Seismic Communications Plan
Attachments:IBMgetContent.docx
Here ya go – same nonpublic restrictions apply as usual.

Britt

From: Juckett, Miriam R. [mailto:miriam.juckett@swri.org]
Sent: Wednesday, March 18, 2015 2:02 PM
To: Hill, Brittain
Subject: RE: Seismic Communications Plan

Britt-
Unfortunately, I can't access non-public ADAMS. Can you send me/John a copy separately?
Thanks!
Miriam

From: Hill, Brittain [mailto:Brittain.Hill@nrc.gov]
Sent: Wednesday, March 18, 2015 12:56 PM
To: Jackson, Diane; Munson, Clifford; Ake, Jon; Graizer, Vladimir; Seber, Dogan; Stieve, Alice; Plaza-Toledo, Meralis; Devlin-Gill, Stephanie; Weaver, Thomas; Stovall, Scott; Gerry Stirewalt; Li, Yong; Walsh, Lisa; Heeszel, David; DiFrancesco, Nicholas; John Stamatakos; Miriam R. Juckett
Cc: Karas, Rebecca
Subject: Seismic Communications Plan

We recently updated the Communications Plan for 2.1 seismic to give some Q&A's for WUS topics, including why the review process is a bit different than for the CEUS plants. Many folks (including OPA) have contributed to writing, refining, and agreeing to the answers for these questions, including JLD and DSEA management.

Nevertheless, please note that this is an internal use document and not publically available on ADAMS.

View ADAMS P8 Properties ML14083A619
Open ADAMS P8 Document (5/21/2014, Communication Plan for Seismic Hazard Re-Evaluation Submittals in Response to NTTF Recommendation 2.1, Seismic)

Thanks-
Britt

Sent:17 Apr 2015 03:32:30 +0000
To:Munson, Clifford
Cc:Ake, Jon
Subject:RE: Source Questions for DCPP visit?
Here are some preliminary questions.

There is no question that every part of this approach is unique.

Diablo Canyon Questions
1. Hosgri fault: Summarize the key seismic imaging , earthquake, geophysical, or geological information used to constrain the slip rate of the Hosgri fault.
2. Thrust faulting: Although the proposed San Luis Range Thrust is not explicitly modeled in the logic tree, can you clarify how elements of the thrust/reverse interpretation are incorporated into the SSC?
3. Fault Slip Rate Model: Can you clarify (maybe by an example) how you extract the "target slip rate budget" from the slip rate CDF, and use it to assign fractional fault slip rates to the multiple fault segments in the fault geometry model (FMG).
4. Further to Q3, can you clarify (again by example) how the slip rate allocation is accomplished among the four different types rupture sources (characteristic, linked, complex, and splay).
5. Rupture Models: Can you clarify how rupture models are derived from the FMGs. The approach seems to be that because reasonable rupture combinations within a rupture model are included in the logic tree, aleatory variability with a given FGM is then accounted for? But is there additional epistemic uncertainty in how you constructed the FMGs?
6. Magintude-frequency: Explain how the four different magnitude-frequency distribution functional forms were derived and how they are used in reference to the characteristic and maximum magnitude distributions?
7. Recurrence: Can you summarize the methodology used to define the equivalent Poisson rates?

From: Munson, Clifford [Clifford.Munson@nrc.gov]
Sent: Thursday, April 16, 2015 2:28 PM
To: John Stamatakos
Cc: Ake, Jon
Subject: Source Questions for DCPP visit?

John,

Do you have some source questions that we PG&E to cover other than a basic overview of the SSHAC report?

Thanks,
Cliff

Sent:6 Apr 2015 21:27:00 +0000
To:Alan Morris;Ronald McGinnis;David Ferrill;Sarah Wigginton
Cc:John Stamatakos
Subject:RE: Work in progress...

Looks pretty good to me. I think is will couple nicely to the mega data table.

I'd vote to keep everything for now and only start pruning if/when we absolutely have to.

--Kevin

From: Alan Morris
Sent: Monday, April 06, 2015 3:06 PM
To: Ronald McGinnis; David Ferrill; Sarah Wigginton; Kevin Smart
Cc: John Stamatakos
Subject: RE: Work in progress...

OK, it's 8 pages, and maybe too long, but for some reason these reports are always prolix.

Is this what we need?

Does it need pruning?

Does it need analysis?

Does it need anything?

Alan

Alan Morris
Department of Earth, Material, and Planetary Sciences
Geosciences and Engineering Division
Southwest Research Institute
6220 Culebra Road, San Antonio, TX 78238, USA
Tel: 210.522.6743
Fax: 210.522.5155
Web page: http://www.swri.org/4org/d20/geosci/structur.htm
http://3dstress.swri.org/

From: Alan Morris
Sent: Friday, April 03, 2015 4:51 PM
To: Ronald McGinnis; David Ferrill; Sarah Wigginton; Kevin Smart
Cc: John Stamatakos
Subject: Work in progress...

T:\Diablo_Canyon\Diablo Canyon\CNWRA report April 2015\DiabloCanyonPowerPlant - seismic risk data survey April 2015.docx

I was planning to cycle back through adding important conclusions for every chapter, but any of us could do that...

Chapter 1 is very useful in giving summaries of the data and goals for each of the subsequent chapters.

For the tornado diagram, equations 1-1 and 1-2 in chapter 13 are the key.

Gotta check posters for next week...

Happy Easter

Alan

Alan Morris
Department of Earth, Material, and Planetary Sciences
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Tel: 210.522.6743
Fax: 210.522.5155
Web page: http://www.swri.org/4org/d20/geosci/structur.htm
http://3dstress.swri.org/

John Stamatakos

From:John Stamatakos
Sent:14 Apr 2015 16:01:32 +0000
To:David Ferrill;Alan Morris;Kevin Smart;Ronald McGinnis;Wesley Patrick;Gordon Wittmeyer;Miriam R. Juckett
Subject:Sarah Wigginton

David,

Just wanted to let you know that the Diablo Canyon work is moving along very well. Many thanks so far to the DEPMs team for your inputs. They have been very helpful. I am especially grateful for Sarah's work. I've had a few follow-up calls with her and I am so impressed with her and her abilities. We should do all we can to retain her. She is clearly outstanding.

Thanks,

John

Dr. John Stamatakos
Director of Technical Programs
Center for Nuclear Waste Regulatory Analyses (CNWRA)
Southwest Research Institute
1801 Rockville Pike, Rockville, MD 20852
301-881-0290

jstamatakos@swri.org

Munson, Clifford

From:Munson, Clifford
Sent:1 Jun 2015 17:23:37 +0000
To:Ake, Jon;John Stamatakos;Brittain Hill;Stovall, Scott
Cc:Jackson, Diane
Subject:See added sentence in yellow - thanks!
Attachments:DCPP RAI (draft 3).docx

Let me know if I captured this correctly.

Thanks,
Cliff

George Adams

From:George Adams
Sent:7 May 2015 11:12:17 -0500
To:John Stamatakos
Subject:SPREADSHEET
John,

I found the error just after you left. The worksheet was renamed. It had a few characters following the normal text. The name of the worksheet Hardcoded in the macro and shown in fluorescent green below didn't match the worksheet name.

Worksheets("Oso Terrace Hosgri Slip Rate").UsedRange.Columns("E:H").Calculate

-George -

Information (602-669/800) is in scope of FOIA and should be released.

Alan Morris

From:Alan Morris
Sent:22 May 2015 14:50:52 +0000
To:Kevin Smart;Ronald McGinnis;David Ferrill;Sarah Wigginton
Subject:Stuff I have done for Diablo Canyon

Most of what I have done is in the realm of self-education:

T:\Diablo_Canyon\APM's stuff\Diablo Canyon-overview-APM.ppt - a work in progress...

T:\Diablo_Canyon\Diablo Canyon - Workshop presentations - selected presentations downloaded from:
http://www.pge.com/mybusiness/edusafety/systemworks/dcpp/SSHAC/workshops/index.shtml

Also, this document is very useful:

T:\Diablo_Canyon\Diablo Canyon_NRC\NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf

That's all folks --Alan

Alan Morris
Department of Earth, Material, and Planetary Sciences
Geosciences and Engineering Division
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6220 Culebra Road, San Antonio, TX 78238, USA
Tel: 210.522.6743
Fax: 210.522.5155
Web page: http://www.swri.org/4org/d20/geosci/structur.htm
http://3dstress.swri.org/

George Adams

From:George Adams
Sent:4 May 2015 16:54:59 -0500
To:John Stamatakos
Subject:UPDATE

John,

I placed an update to the spreadsheet at: S:\John Stamatakos\Slip and Age Distributions GA.xlsm

You can change the parameters and hit the calculate button. It does everything: copy, calculate, and sort. I set the calculate options to "Manual" Hitting F9 will force calculate

I added pdf plots (not certain about these though, please check)

George

Alan Morris

From:Alan Morris
Sent:3 Apr 2015 21:51:07 +0000
To:Ronald McGinnis;David Ferrill;Sarah Wigginton;Kevin Smart
Cc:John Stamatakos
Subject:Work in progress...
T:\Diablo_Canyon\Diablo Canyon\CNWRA report April 2015\DiabloCanyonPowerPlant - seismic risk data survey April 2015.docx

I was planning to cycle back through adding important conclusions for every chapter, but any of us could do that... Chapter 1 is very useful in giving summaries of the data and goals for each of the subsequent chapters.

For the tornado diagram, equations 1-1 and 1-2 in chapter 13 are the key.

Gotta check posters for next week...

Happy Easter
Alan

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Informal review of The Central Coastal California Seismic Imaging Project (CCCSIP) report (Pacific Gas and Electric Company)

By

GED

April 2015

The Central Coastal California Seismic Imaging Project (CCCSIP) report was produced by the Pacific Gas and Electric Company (PG&E) in response to a 2008 recommendation by the California Energy Commission (CEC). The California Energy Commission's 2008 report "An Assessment of California's Nuclear Power Plants: AB 1632 Report", also known as the "AB 1632 Report", recommended that Pacific Gas and Electric perform a series of geophysical investigations to explore fault zones near the Diablo Canyon Power Plant (DCPP). A primary goal of the investigations was to improve understanding of the seismic risk to the Diablo Canyon Power Plant, specifically:

- Hosgri Fault Zone slip rate
- Hosgri Fault Zone dip
- Hosgri–San Simeon fault zone step-over (i.e., are these faults linked so that will rupture in unison?)
- Los Osos fault zone slip rate
- Los Osos fault zone dip
- Los Osos fault zone sense of slip
- Hosgri–Shoreline fault zone rupture (i.e., are these faults linked so that will rupture in unison?)
- Shoreline fault zone slip rate
- Shoreline fault zone southern extent
- Shoreline fault zone segmentation

These issues were chosen because of their importance in choosing seismic source parameters used to model the seismic hazard for the Diablo Canyon Power Plant, and because of the uncertainty associated with them. Hazard is expressed as probability of ground motion acceleration exceeding 2 g at the key frequency of 5 hertz.

Comment [a1]: I think this is the frequency that is most damaging to human structures, and it is part of the NRC's seismic hazard regulation.

Three areas of study were specifically prescribed by the AB1632 report:

(1) PG&E should use three-dimensional geophysical seismic reflection mapping and other advanced techniques to explore fault zones near Diablo Canyon.
(2) As ground motion models are refined to account for a greater understanding of the motion near an earthquake rupture, it will be important for PG&E to consider whether the models indicate larger than expected seismic hazards at Diablo Canyon and if so, whether the plant was built with sufficient design margins to continue operating reliably after experiencing these large ground motions.

(3) PG&E should 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.

Comment [KJS2]: Does this need to be defined/described somewhere or some reference citation provided?

A range of data is presented and analyzed in the Central Coastal California Seismic Imaging Project report, most of it collected between 2009 and 2014, but including and drawing upon a variety of work performed over the previous 30 years. Work incorporated in the report was performed by PG&E, its contractors, and by the United States Geological Survey. The report is organized into the following sections:

Marine seismic reflection surveys (including analysis of natural seismicity data)

Chapters 2 and 4 – 2D/3D low-energy seismic surveying (LESS) to map the ~~the~~ Hosgri, Shoreline and Point Buchon fault zones and associated folding west, northwest and north of Diablo Canyon Power Plant. Chapter 4 includes older, ~~deep~~ deep-penetration seismic data to investigate linkage between Hosgri and San Simeon fault zones and folding offshore and south of the Los Osos fault zone.

Important conclusions, chapter 2:

- "The main structural elements mapped in the study area are the Hosgri fault zone (HFZ), the Point Buchon fault zone, and a prominent syncline that deforms Tertiary strata in the southern two thirds of the study area."
- "The Hosgri fault zone consists of numerous fault strands and is the best imaged and most continuous and complex fault zone in the region."
- "... the local style of faulting changes along strike of the Hosgri fault zone. Graben A, bounded by right-stepping strands of the Hosgri fault zone in the north, indicates extensional strike slip faulting. A single fault strand characterizes the fault zone in the center of the study area. Numerous, relatively short strands fan out to the southeast and are associated with folds in the south, indicating compressional strike-slip faulting."
- "The Point Buchon fault zone, northwest of the central segment of the Shoreline fault zone, is a northwest-trending fault that disrupts Tertiary strata east of the HFZ"
- "... the Point Buchon fault zone may connect to the central segment of the Shoreline fault zone and associated structures"
- "Graben B is associated with the northern end of the Point Buchon fault zone"
- "...the structural relationship between the two grabens [A and B] and structures within Estero Bay to the north of the study area needs to be further evaluated"
- Because "the 3D/2D data are restricted to the shallow subsurface, the mapped surficial faults cannot be confidently extended to the earthquake hypocentral depths. Therefore, no conclusion can be made in regard to these faults being the source of the earthquakes that constitute the northern Shoreline seismicity sublineament"

Important conclusions, chapter 4:

- "...we were unable to observe any clear evidence in the seismic-reflection data for a recent fault connecting the San Simeon fault zone with the Hosgri fault zone. Our interpretations do not preclude the existence of a fault at depth or the possibility of a future rupture along this fault at depth, including propagation to the surface."
- "...we map the newly named Half Graben fault zone, a series of faults along which a half graben has formed, down-dropped on the east and tilted to the west ... The half graben is narrow in the north... To the south, the half graben widens considerably and appears to end near ... the Los Osos fault zone"

Chapter 3 – 2D/3D low-energy seismic surveying (LESS) to identify the southern extent, geometry, connectivity, and slip rate of the Shoreline fault, and the slip rate on the Hosgri fault zone. Older deep penetration data are also used.

Important conclusions:

- "Piercing points identified for constraining offsets along the Shoreline, Oceano, and Hosgri ~~faulft~~ fault zones were identified ... buried paleochannels and paleoshorelines (paleostrandlines) were the best geomorphic features to use in evaluating offsets."
- "These studies reveal a more complex [Hosgri] fault zone than had previously been mapped"
- "...strands of the Hosgri fault zone [in the Estero Bay area] are generally steeply dipping to vertical..."
- "...sense of vertical separation across the Hosgri fault zone [in the Estero Bay area] is dominantly down to the west..."
- "Channel offsets and their interpreted ages yield a preferred lateral slip rate for the Hosgri fault zone in Estero Bay of approximately 1.6 ± 0.8 mm/yr within a high (90%) confidence interval. Accounting for uncertainties in ages and offset estimates, the range in lateral slip rate is between approximately 0.2 mm/yr and 3.6 mm/yr."
- [In the Point Sal Area] "The new mapping ... shows that from south to north, the Hosgri fault zone splits from a single strand with little or no vertical separation to multiple splays with substantial vertical and dextral shear, which converge to form a single strand once more. ... with transtension in the south and transpression in the north. There is an approximate 6-degree change in the strike of the Hosgri fault zone..."
- "Channel Complex F provides the preferred piercing points for estimating slip rates on the Hosgri fault zone in the Point Sal area."
- "a minimum estimated slip rate of 0.39 mm/yr (1.4 Ma at 550 m minimum offset) and a maximum estimated slip rate of 5.07 mm/yr (138 ka at 700 m maximum offset) is calculated for the Hosgri fault zone at Point Sal"

Comment [a3]: Can you spell r-e-l-a-y?

Chapter 5 – Deployment and monitoring of ocean bottom seismographs (OBS)

Important conclusions:

- "offshore events close to but outside the ocean bottom seismographs stations will have improved depth control; however, these events are still subject to uncertainty, particularly with regard to the focal mechanisms."

Chapter 6 – Characterization of the Hosgri fault zone using primarily post 1988 seismic reflection data but also some gravity and magnetic surveys. A 3D high-energy seismic survey (HESS) was proposed by PG&E, however, the California Coastal Commission denied PG&E's application due to concerns about the environmental impact of these studies.

Important conclusions:

- "Earlier models ... that identified the Hosgri fault zone as a major thrust fault underlying the Coast Ranges are not supported by the (older) high-energy marine 2D seismic-reflection data acquired during the Long Term Seismic Program (LTSP); nor are they supported by potential field and seismicity data collected during the Long Term Seismic Program Update and Central Coastal California Seismic Imaging Project [that's this one] program."
- "Geologic observation, seismicity data, and geophysical data all demonstrate that the Hosgri fault zone is a right-lateral strike-slip fault that dips steeply (75°–90°) northeast to a depth of 12–14 km in the vicinity of the Diablo Canyon power plant."
- "evidence for recent fault rupture between the Hosgri and San Simeon fault zones is not well imaged in some locations, [although] the data do not preclude the existence of fault linkage at seismogenic depths"
- "Chapter 13 presents a ground-motion hazard sensitivity analysis for the linkage of the Hosgri and San Simeon faults, and a combined rupture of the Hosgri–San Simeon and Shoreline faults"

Comment [a4]: It does, however, have significant evidence of both shortening (where it's strike is more EW than "average") and extension (where it's strike is more NS than "average"). See, for example, other conclusion bullets in this document – Chapters 2 and 4 especially.

Land seismic surveys

Chapter 7 – Description of the Geologic Mapping Project conducted by PG&E and also reported separately, well data from Honolulu-Tidewater #1, and introduction of natural seismicity, gravity and magnetic data, although the primary data presented in the chapter is 2D accelerated weight-drop (AWD) and a small vibro-seis 3D(?) volume of seismic reflection data. Several cross sections are drawn and the Pismo Syncline is described. The purpose was 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.

Important conclusions:

- "The Pismo syncline in the central and southern Irish Hills is the deformed remnant of a Neogene extensional basin."
- The basin was bounded on the north by the Edna fault zone(s), fairly large basin bounding normal faults. The southern margin of the basin (now the southern limb of the Pismo Syncline) was formed by several smaller north-dipping normal faults, which have been inverted to reverse faults during synclinal folding. Many of these faults are "blind", i.e. are not exposed at the surface and are interpreted from seismic data.

- Folds are mappable at the surface.
- The overall interpretation is one of a negative flower structure that formed during a transtensional phase of slip, and that was later inverted during transpressional slip.
- All faults are interpreted as steeply dipping.

Chapter 8 – 3D seismic reflection survey confined to an onshore area around the Diablo Canyon Power Plant about 3 x 5 km ("Phase 1"), and a small shoreline strip southeast of the power plant about 3 km long by 0.5 km wide including the Rattlesnake fault at the shoreline ("Phase 2"). Data collected and analyzed by Fugro. Detailed geologic map of the area around the power plant. The goal was to identify structures that might be significant to seismic hazard analysis of the power plant, and provide input data for ground motion modeling at the power plant site.

Comment [a5]: good exposures of the Obispo Fm and Cretaceous sandstone in the cliffs

Important conclusions:

- "... folding in buried reflector packages consistent with out-of-syncline parasitic folding that discordantly detached and shortened Obispo volcaniclastic strata off of stiffer, relatively undeformed diabase bodies... folding event is old and no longer active, and took place during the compressional uplift event that inverted the ancestral Pismo Basin into the deeply eroded Pismo syncline."
- "Despite differences in elevation between time-correlated uplifted terraces, the terraces themselves remain horizontal, indicating that the style of late Quaternary deformation of the western Irish Hills is characterized by rigid block uplift with little or no rotation."
- ...[in Phase 1 area] "no throughgoing steep or vertical reflector truncations were observed that would indicate the presence of a significant steep fault offset. ... Any throughgoing faulting in the reflective depth range of 0 to 0.3 km would have to follow shallow to flat unconformities."
- [The updated surface mapping] "shows steep, generally north dipping Obispo volcaniclastic strata exposed along Discharge Cove. The tomography indicates that these steeply dipping strata are underlain by a shallowly north-dipping diabase intrusive. Future efforts that would consider the construction of a stratigraphic cross section through the Phase 1 area must be very wary of using only the surface dip data, and should honor the nearly flat-lying subsurface velocity structure as well."
- "Three lineaments mapped on the bedrock surface beneath the marine terrace sediments in the Phase 2 area merit investigation as potential faults. In order to directly examine the potential fault plane, ground-based investigations of the bedrock platform surface and the overlying Quaternary sediments would be required"

Chapter 9 – Results of Geologic Mapping Project, intended to help interpretation of onshore seismic reflection data. Data presented includes previously published and unpublished geologic maps plus new data collected in this study. There is a section dedicated to the Los Osos fault zone. One conclusion is: "new mapping in the vicinity of the Edna, Los Osos, San Luis Bay, San Miguelito, and Shoreline fault zones does not introduce any new hard constraints on fault location, dip, slip direction, or slip rate". Data presented in this chapter is also used in chapters 7 and 8.

Appendices contain daily field reports, photographs, sample catalogue, an Arc GIS catalogue of shapefiles and other information relating to data acquisition and geologic mapping in the Irish Hills, and a compilation of (primarily) stratigraphic data from 18 of 34 wells (26 oil and 8 hydrogeologic).

Important conclusions:

- "Edna and San Miguelito fault zones—minor changes to the geologic units adjacent to the faults."
- "Los Osos fault zone—minor changes to the geologic units adjacent to the fault zone, and changes to the depiction of the fault zone along the northern margin of the Irish Hills (including removal of the concealed, northwest-trending fault across southern Morro Bay)."
- "Shoreline fault zone—minor changes to the geologic units and bedrock faults adjacent to the fault zone for the reaches opposite Olson Hill and the Diablo Canyon power plant."
- "San Luis Bay fault zone—minor changes to the geology adjacent to the fault zone along the outer coast from Olson Hill to Rattlesnake Creek, and the addition of a generalized, concealed, and locally queried trace in San Luis Obispo Bay and on the outer coast between the Rattlesnake fault and the Olson Hill deformation zone."

Geotechnical studies

Chapter 10 – provides a 3D shear-wave velocity (V_S) model for the Diablo Canyon power plant foundation area-. 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 Diablo Canyon power plant site.

Important conclusions:

- There is significant spatial variability in $V_{S\text{-}30}$ [shear-wave velocity in the top 30 meters] throughout the Diablo Canyon power plant 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 11 – Site conditions evaluation as relevant to the modeling of ground motion at the Diablo Canyon power plant site.

Chapter 12 – Addresses testimony from Dr. Douglas Hamilton concerning two postulated faults: the Diablo Cove and the San Luis Range/Inferred Offshore faults. In addition to using selected data from Hamilton, a variety of other PG&E reports, and published literature, this chapter uses data from chapters 2, 4, 7, 8, and 9 in Central Coastal California Seismic Imaging Project (this) report.

Comment [a6]: This is a pretty important chapter that pulls together a number of strands to refute Hamilton's ideas – whether correctly or incorrectly I know not at this point...

Important conclusions: Essentially they conclude that the Diablo Cove fault is a non-issue, and that the San Luis Range/Inferred Offshore fault – although not there – will be accounted for in their new seismic source characterization [hmmm].

- "We conclude that the Diablo Cove fault does not represent a seismic hazard to the Diablo Canyon power plant, and there is no basis for considering the Diablo Cove fault as proposed by Hamilton ... to be either a fault displacement hazard or a seismic source of strong ground motions. We make this conclusion based on the following key points:
- Trench and excavation mapping conducted prior to construction of the Diablo Canyon power plant documented that the fault zone is discontinuous, is associated with minimal offset, and does not displace marine terrace deposits that are 120 ka. Thus, the faulting where observed directly is minor and inactive in the late Pleistocene.
- Geologic mapping and interpretation of multibeam echo sounder imagery do not support connecting the Diablo Cove fault offshore to the Shoreline fault zone.
- There is no basis for correlating seismicity with the Diablo Cove fault based on an evaluation of microearthquake locations and consideration of their location uncertainty.
- The short length of the Diablo Cove fault zone—probably less than half a kilometer—is not consistent with a down-dip width of several kilometers that would extend the fault to seismogenic depths.
- Structural analysis of geologic data and high-resolution 3D land seismic data at the Diablo Canyon power plant supports an interpretation, shared by the original mappers of the faults, that the faulting is related to shallow fold deformation and shortening that predates the late Quaternary and probably dates to the Miocene or Pliocene. The faulting may or may not be related to a Miocene diabase intrusion imaged directly north of the north-dipping Diablo Cove fault at shallow depths. Based on this interpretation, the fault extends to only a few tens to hundreds of meters depth."

- We conclude that there is no clear evidence in the available data to support the presence of [the San Luis Range/Inferred Offshore thrust fault], and there is evidence that precludes its presence. Accordingly, there is no basis for considering the San Luis Range/Inferred Offshore thrust to be a seismic hazard to the Diablo Canyon power plant as proposed by Hamilton. We make this conclusion based on the following key points:
- Analyses of multibeam echo sounder bathymetry data and seismic-reflection data do not support the interpreted uplift rate boundary across the San Luis Range/Inferred Offshore thrust fault proposed by Hamilton. Instead, interpretations of the data are consistent with a very low or negligible change in uplift rate where the San Luis Range/Inferred Offshore thrust fault is interpreted to impinge on the Shoreline fault zone and where the SLRF is interpreted to diverge from the Shoreline fault zone south of Point Buchon. Interpretations of coastal marine terrace data and offshore marine terraces are consistent with uplift rate boundaries that instead coincide with other structures considered by PG&E in past seismic hazard analyses.
- We disagree with the assertion by Dr. Hamilton that the San Luis Range/Inferred Offshore thrust fault interpretation is required to fit the observed pattern of coastal terrace uplift and instead suggest the observed pattern of coastal uplift may be matched by several proposed fault geometries, including those proposed by PG&E in past seismic hazard analyses.

- We disagree with the assertion by Dr. Hamilton that the seismicity data beneath the Irish Hills show a clear alignment supporting the San Luis Range/Inferred Offshore thrust fault at depth. The seismicity data can be interpreted in different ways to support many different fault models.
- Interpretation of land seismic-reflection data do not show evidence for a gently to moderately dipping San Luis Range/Inferred Offshore thrust fault beneath the southern Irish Hills in the general location proposed by Hamilton. Instead, interpretations of the seismic-reflection data show steeply north-dipping structures down to approximately 7 km depth or deeper that coincide with recognized faults (the Irish Canyon and San Luis Bay) at the surface. The interpretation of these steeply dipping structures to depth precludes the presence of the San Luis Range/Inferred Offshore thrust fault.
- Although the specific San Luis Range/Inferred Offshore thrust fault interpretation by Hamilton is not well supported by the available data, and by no means can be held up as a unique or preferred interpretation, the general solution of a primary, north- or north-northeast-dipping fault beneath the Irish Hills is consistent with several observations, and is a possible fault model that should be considered for seismic hazard analysis to the Diablo Canyon power plant. We note that the interpretations by Hamilton are being considered for evaluation and integration with other available data following the Senior Seismic Hazard Analysis Committee Level 3 process. The Senior Seismic Hazard Analysis Committee program for the Diablo Canyon power plant, which is being performed under regulatory review by the NRC, is creating a new seismic source characterization model.

Chapter 13 – Evaluation of sensitivity of the deterministic ground motions that were presented in the PG&E Shoreline Fault Zone Report (2011) to the seismic source characterizations for the Shoreline and Hosgri faults, using new ground motion models developed by the Pacific Earthquake Engineering Research (PEER) center as part of their "Next Generation Attenuation" program.

Important conclusion:

- "For all the cases considered in this sensitivity study, the 84th percentile ground motions for the power-block and turbine-building foundation levels are bounded by the 1977 Hosgri spectrum.".

[In other words, their former analysis is not affected by any of the new data/interpretations.]

Chapter 14 – The findings and conclusions of the Central Coastal California Seismic Imaging Project report [this one].

Important conclusion:

- "These studies confirm previous analyses that the plant and its major components are designed to withstand—and perform their safety functions during and after—a major seismic event."

Evaluation of the Constraints for the Hosgri Fault Slip Rate

Stress Conditions in the Irish Hills Region:

- Transpressional with north-northeast orientation of maximum compression
- Faults in the region with a northwest strike typically have dextral slip
- Faults in the region with an easterly strike (or perpendicular to maximum compression) typically have a reverse sense of slip
- Strike-slip faults have a rake of ≤30°
- Reverse and reverse oblique faults have a rake of 90°±60°

Hosgri Fault Zone:

First studied by Wolf and Wagner (1970) and Hoskins and Griffith (1971). It is part of the larger San Gregorio-San Simeon-Hosgri fault system (410 km long). The Hosgri segment is approximately 110 km long and was mapped using multichannel seismic-reflection (O&G) data to a depth of 1.5-3 km (Willingham et al., 2013). Offshore from Diablo Canyon, the Hosgri was remapped using single-channel, high resolution USGS sparker data (Johnson and Watt, 2012) in order to provide better near-surface resolution of the fault trace. At its northern tip the Hosgri is linked to the San Simeon fault across a poor seismically imaged region interpreted to be either (i) a zone of transtensional normal faults in a right-releasing step-over (PG&E, 1988) or (ii) the Hosgri bends westward at this point and steps over the San Simeon fault across a zone of northwest-trending faults to the north (PG&E, 2014).

Fun Facts:

- Convergent right-lateral (transpressional) fault with late Quaternery slip rate of 1-3 mm/year
- Johnson and Watt (2012) confirmed this sense of motion on the Hosgri in the current stress regime
- Fault zone is up to 2.5 km wide directly offshore of Diablo Canyon.
- The fault trends N25°W to N30°W and is locally coincident with the shelf break.
- Fault dip varies from vertical to steeply dipping in the near surface data and in the multi-channel data it dips steeply at a depth of ~1 km.
- Focal mechanisms along the Hosgri show nearly pure strike-slip on a near-vertical to steeply east-dipping (~75°) fault at a depth of 12 km (McLaren and Savage, 2001).
-

Constraints on the Hosgri:

- Deformed marine terraces on the **San Simeon fault** (onshore) are used to constrain the assessment of horizontal slip on the Hosgri.
- The **Cross-Hosgri slope** was identified to estimate the Pleistocene-Holocene slip on rate on the Hosgri.
- **Offset channels** in the southern **Estero Bay** were used to constrain slip rates on the northern end of the Hosgri

- **Offset channels** in southern **Point Sal** were used to constrain slip rates on the southern end of the Hosgri

These constraints have provided an estimate of 2 mm/year of right-lateral slip, which is consistent with regional geodetic data showing ~ 2 mm/year of plate-margin lateral shear in the region (DeMets et al., 2014). In addition, the slip rate should vary north to south (Hanson et al., 2004; Johnson et al., 2014) depending on the number of fault intersections along its trace. The northern and middle sections of the Hosgri should have a higher slip rate than the southern due to fewer faults intersecting the Hosgri as you move south along its trace.

San Simeon Fault Slip Rate:

The San Simeon projects into the Hosgri and the offset and slip rate on that fault are considered representative of the Hosgri. Field mapping of terraces on either side of the San Simeon fault and over 100 boreholes, numerous trenches, and soil pit excavations were used to delineate altitude and distribution of terrace remnants (Hall et al., 1994; Hanson and Lettis, 1994). This was performed in order to constrain the style and slip rate of deformation along the onshore San Simeon fault zone.

Cross-Hosgri Slope Slip Rate:

To be added

Estero Bay Slip Rate:

Estero Bay contains two dominate strands of the Hosgri Fault zone (Figure 8-24 in 2014 PG&E report). The Hosgri in this area marks the boundary between active tectonics to the eat and minor subsidence to the west. PG&E identified (Chapter 3 in 2014 PG&E report) multiple channel segments in upper continental slope sediments. Of all the channels PG&E identified only the Channel Complex De as a viable strain marker because it seems to correlate across the Hosgri to Channel Ee1 (Figure 8-25 and Plate 3 in Chapter 3 in 2014 PG&E report). Based on these markers, it was estimated that right-lateral separation was 260±60 m and vertical separation was 40±8 m down to the west.

Point Sal Slip Rate:

To be added

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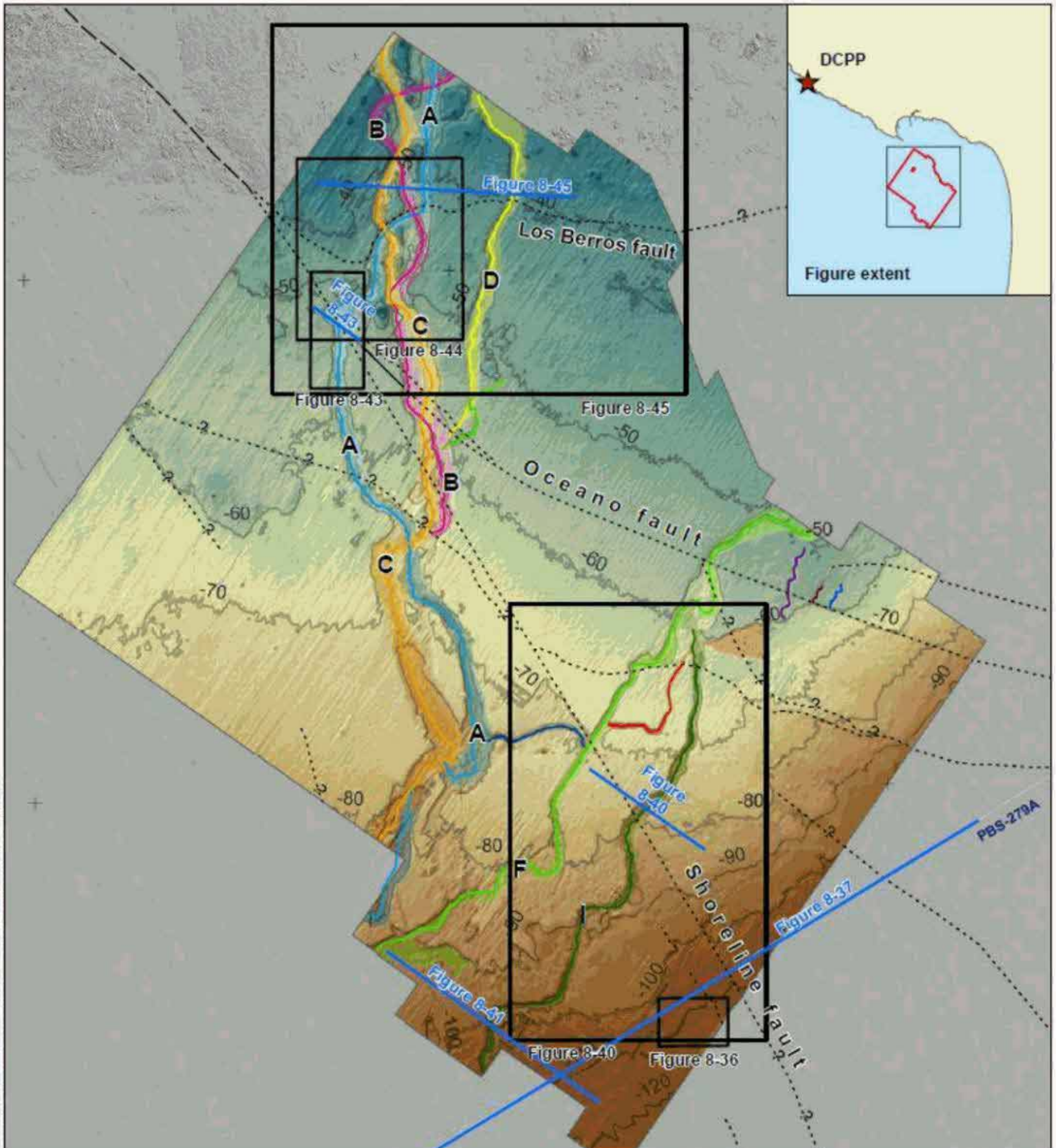
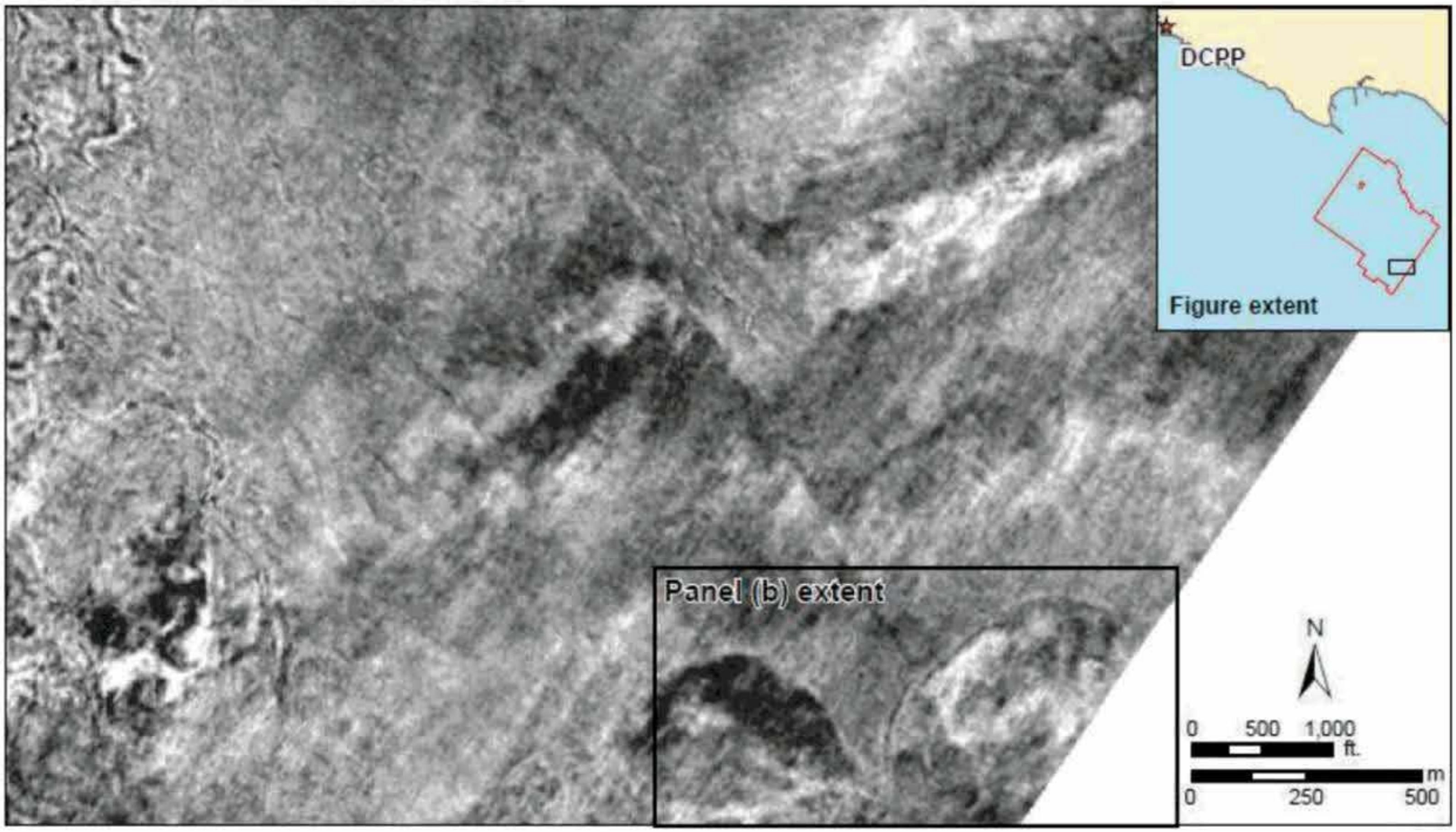
Wolf, S.C., and Wagner, H.C., 1970. Preliminary Reconnaissance Marine Geology of Area Between Santa Lucia Escarpment and Point Buchon, California, unpublished U.S. Geological Survey administrative report, 5 pp.



DCPP
Figure extent
Figure 8-45
Los Berros fault
Figure 8-43
Figure 8-44
Oceano fault
Figure 8-40
Figure 8-41
Figure 8-37
PBS-279A
Figure 8-36
Shoreline fault
A
B
C
D
F
-50
-60
-70
-80
-90
-100
-120

(a) Amplitude Time Slice at 119.3 ms



Document Title	Figure/Sub-Document	Document Type	Page	Data Quality	Link to Document	Date	Source	Summary
8-Stamatakos-Fukushima Seismic and Flooding		PowerPoint		na (no data)	Figures\8-Stamatakos-Fukushima Seismic and Flooding.pptx	December 4, 2013	Presented by: John A. Stamatakos NRC Contracting Officer: Lisa Kauffmann NRC Contracting Officer Representative: Gerry Stirewalt CNWRA Program Manager: Lane Howard	Fukushima Near Term Task Force Seismic and Flooding Assessments
10-Stamatakos-Fukushima Seismic and Flooding		PDF		na (no data)	Figures\10-Stamatakos-Fukushima Seismic and Flooding.pdf	12/09/2014	Presented by: John A. Stamatakos NRC Contracting Officers: Sharlene McCubbin and Hugo Alcantara NRC Contracting Officer Representatives: Gerry Stirewalt and Barbara Hayes CNWRA Program Managers: Lane Howard and Miriam Juckett	FUKUSHIMA NEAR TERM TASK FORCE SEISMIC AND FLOODING ASSESSMENTS
Attachment_C-01_Primary_Linked_Sections_BuildPoints		Excel Doc		good	NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-01_Primary_Linked_Sections_BuildPoints			Faults?
Attachment_C-02_Hosgri_RuptureModels_InputFiles		Excel Doc		good	NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-02_Hosgri_RuptureModels_InputFiles			Hosgri Fault, Rupture model data
Attachment_C-03_OV_RuptureModel_InputFiles		Excel Doc		good	NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-03_OV_RuptureModel_InputFiles			Outward Vergent Faults, Rupture model data
Attachment_C-04_SW_RuptureModel_InputFiles		Excel Doc		good	NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-04_SW_RuptureModel_InputFiles			Southwest Vergent Faults, Rupture model data
Attachment_C-05_NE_RuptureModel_InputFiles		Excel Doc		good	NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-05_NE_RuptureModel_InputFiles			Northeast Vergent Faults, Rupture model data
Attachment_C-06_SAFZ_InputFile		Text Document		good	NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-06_SAFZ_InputFile		UCERF3 Mean Branch Average Solution file	The San Andreas Fault source hazard input files
Attachment_C-07_UCERF3_RegionalFaults_InputFile		Text Document		good	NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-07_UCERF3_RegionalFaults_InputFile		UCERF3 Mean Branch Average Solution file	UCERF3 Mean Branch Average Solution files
Attachment_D-1 Rev_A		PDF		na (analysis)	NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-1 Rev_A.pdf	11/29/2011	Katheryn Wooddell and Nick Gregor	Sensitivity studies. LTSP SSHAC Level three Update WSI. Contains graphs of annual probability of Exceedance, spectral acceleration, Sensitivity to Mean Char. Rupture length, Sensitivity to slip rate, sensitivity to dip, sensitivity to joint ruptures, Sensitivity it location, sensitivity to fault length, sensitivity to crustal thickness, sensitivity to ground motion prediction equation, sensitivity to Ergodic Assumption, sensitivity it hanging wall factor, sensitivity to sigma model, sensitivity to sigma truncation, sensitivity to directivity
Attachment_D-2 Rev_A		PDF		Good (all graph data)	NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-2 Rev_A.pdf	11/06/2012	Nick Gregor	Diablo Canyon SSHAC Level 3 Study on SSC Sensitivity results.
	SSC Sensitivity -Base Case, PGA	Graph	3		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-2 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	SSC Sensitivity -Base Case, 5 Hz	Graph	4		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-2 Rev_A.pdf			Annual Probability of Exceedance over SA (g) for large faults.
	SSC Sensitivity -Base Case, Example	Graph	8		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-2 Rev_A.pdf			Annual Probability of Exceedance over SA (g) for large faults.
	SSC Sensitivity Tornado Diagram-Hosgri 5 Hz	Graph	9		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-2 Rev_A.pdf			Tornado Diagram

	SSC Sensitivity Tornado Diagram-Los Osos 5 Hz	Graph	10		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-2 Rev_A.pdf			Tornado Diagram
	SSC Sensitivity Tornado Diagram-Shoreline 5 Hz	Graph	11		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-2 Rev_A.pdf			Tornado Diagram
	SSC Sensitivity Tornado Diagram-San Luis Bay 5 Hz	Graph	12		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-2 Rev_A.pdf			Tornado Diagram
	SSC Sensitivity Tornado Diagram-PGA	Graph	13		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-2 Rev_A.pdf			Tornado Diagram
	SSC Sensitivity Tornado Diagram-5 Hz	Graph	14		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-2 Rev_A.pdf			Tornado Diagram
	SSC Sensitivity Tornado Diagram-.5 Hz	Graph	15		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-2 Rev_A.pdf			Tornado Diagram
Attachment_D-3 Rev_A		PDF		**Good (graph data)**	NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf	03/25/2014	Nick Gregor. Hazard Sensitivity, DCPP SSC Workshop	Hazard Sensitivity, DCPP SSC Workshop
	DCPP: 5 Hz by Fault Sources	Graph	4		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: 1 Hz by Fault Sources	Graph	4		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: OV, 5Hz, (10-4) Desegregation	Graph	5		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Magnitude v distance v percentage contribution to hazard
	DCPP: Shoreline (2011), 5Hz, (10-4) Desegregation	Graph	5		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Magnitude v distance v percentage contribution to hazard
	DCPP: OV, 1Hz, (10-4) Desegregation	Graph	6		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Magnitude v distance v percentage contribution to hazard
	DCPP: Shoreline (2011), 1Hz, (10-4) Desegregation	Graph	6		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Magnitude v distance v percentage contribution to hazard
	DCPP: Fractile (OV, 1Hz)	Graph	7		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Tectonic Models 5Hz	Graph	7		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Tectonic Models 1Hz	Graph	8		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Additional Faults 5Hz	Graph	8		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Additional Faults .5Hz	Graph	9		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Hosgri Slip Rate 1Hz	Graph	9		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Hosgri Dip 1Hz	Graph	10		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Hosgri Location 1Hz	Graph	10		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Shoreline Slip Rate 1Hz	Graph	11		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Los Osos Slip Rate 1Hz	Graph	11		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: SLB Slip Rate 1Hz	Graph	12		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Other Fault Slip Rate 1Hz	Graph	12		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Los Osos Slip Rate NE 1Hz	Graph	13		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: SLB Slip Rate SW 1Hz	Graph	13		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Maximum Magnitude	Graph	14		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Characteristic maximum Magnitude	Graph	14		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.

	DCPP: WAACY Model	Graph	15		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Background	Graph	15		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Recurrence (Time Dependent)	Graph	16		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Annual Probability of Exceedance over PGA (g) for large faults.
	DCPP: Tornado Plot Ratios	Graph	16		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Tornado Diagram
	DCPP: Tornado 5 Hz	Graph	17		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Tornado Diagram
	DCPP: Tornado 1 Hz	Graph	17		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Tornado Diagram
	DCPP: Tornado 5 Hz	Graph	18		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Tornado Diagram
	DCPP: Tornado 1 Hz	Graph	18		NTTF DCCP PSHA Review\Appendix D WS Summaries Attachments\Attachment_D-3 Rev_A.pdf			Tornado Diagram
Attachment_F-1		Text Documents		good	NTTF DCCP PSHA Review\Appendix F EQ Catalogs Attachments\Attachment_F-1.txt		Hardebeck (2010) and N. Lewandowski	Tab delimited earthquake data.
Attachment_F-2		Text Documents		good	NTTF DCCP PSHA Review\Appendix F EQ Catalogs Attachments\Attachment_F-2.txt		Northern California Earthquake Data Center (NCEDC) website	Tab delimited earthquake data.
Attachment_F-3		Text Documents		good	NTTF DCCP PSHA Review\Appendix F EQ Catalogs Attachments\Attachment_F-3.txt		PG&E Seismicity Catalog	Tab delimited earthquake data.
Attachment_F-4		Text Documents		na (no data)	NTTF DCCP PSHA Review\Appendix F EQ Catalogs Attachments\Attachment_F-4_README.txt		UCERF3	Tab delimited earthquake data.
Attachment G-1_Rev_A		PDF		Good (graph data)	NTTF DCCP PSHA Review\Appendix G WAACY Attachment\Attachment G-1_Rev_A.pdf			
	Figure 1	graph	3		NTTF DCCP PSHA Review\Appendix G WAACY Attachment\Attachment G-1_Rev_A.pdf		Youngs and Copersmith	Annual number of earthquakes v Magnitude, comparison of different models
	Figure 2	graph	5		NTTF DCCP PSHA Review\Appendix G WAACY Attachment\Attachment G-1_Rev_A.pdf		Youngs and Copersmith	General form and parameters of the Youngs and Coppersmith (1985) MFD.
	Figure 3	graph	6		NTTF DCCP PSHA Review\Appendix G WAACY Attachment\Attachment G-1_Rev_A.pdf			General form and parameters of the WAACY model.
	Figure 4	graph	8		NTTF DCCP PSHA Review\Appendix G WAACY Attachment\Attachment G-1_Rev_A.pdf			Comparison of three models for the scaling of magnitude with average surface slip.
	Figure 5a	graph	9		NTTF DCCP PSHA Review\Appendix G WAACY Attachment\Attachment G-1_Rev_A.pdf		Hecker et al. (2013).	Results for WC94 magnitude displacement scaling. The black dashed lines show the range of acceptable CV values based on Hecker et al. (2013).
	Figure 5b	graph	10		NTTF DCCP PSHA Review\Appendix G WAACY Attachment\Attachment G-1_Rev_A.pdf		Hecker et al. (2013).	Results for HEA13 magnitude displacement scaling. The black dashed lines show the range of acceptable CV values based on Hecker et al. (2013).
	Figure 5c	graph	11		NTTF DCCP PSHA Review\Appendix G WAACY Attachment\Attachment G-1_Rev_A.pdf		Hecker et al. (2013).	Results for S11 magnitude displacement scaling. The black dashed lines show the range of acceptable CV values based on Hecker et al. (2013).
Attachment_C-09_LocalSoureZone_InputFile		Excel Doc		good	NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-09_LocalSoureZone_InputFile			Fault input files for VF (virtual faults) SS, Reverse and geometry files.
Annual Review Diablo Canyon 2002		PowerPoint		na (no data)	Figures\Annual Review Diablo Canyon 2002.ppt	December 3-5, 2002	Presented by: John Stamatakos Participants: A.H. Chowdhury, B. Dasgupta, D. S. Dunn, A. Ghosh, D. G. Gute, S. M. Hsiung, P. C. Mackin, C. Manepally, G. I. Ofoegbu, D. J. Pomerening, O. Povetko, B. Russell, M. Smith, and R. T. Sewell (Consultant).	Diablo Canyon Independent Spent Fuel Storage Installation
Annual Review Diablo Canyon 2003		PowerPoint		na (no data)	Figures\Annual Review Diablo Canyon 2003.ppt	November 18-20, 2003	Presented by: John Stamatakos Participants: A.H. Chowdhury, B. Dasgupta, D. S. Dunn, A. Ghosh, D. G. Gute, S. M. Hsiung, P. C. Mackin, C. Manepally, G. I. Ofoegbu, D. J. Pomerening, O. Povetko, B. Russell, M. Smith, and R. T. Sewell (Consultant).	Diablo canyon Independent spent fuel storage installation
Appendix C HID_Rev_A		PDF		Good (table data)	NTTF DCCP PSHA Review\Appendix C HID_Rev_A.pdf			
	Figure C-2	map	38	na (fault traces)	NTTF DCCP PSHA Review\Appendix C HID_Rev_A.pdf	03/04/2015	DCPP SSC Report (PG&E)	Map of Primary and connected Fault sections in the Hosgri and Outward-Vergent (OV) fault geometry Model, DCPP Vicinity
	Figure C-3	map	39	na (fault traces)	NTTF DCCP PSHA Review\Appendix C HID_Rev_A.pdf	03/04/2015	DCPP SSC Report (PG&E)	Map of Primary and connected Fault sections in the Hosgri and Southwest-Vergent (SW) fault geometry Model, DCPP Vicinity
	Figure C-4	map	40	na (fault traces)	NTTF DCCP PSHA Review\Appendix C HID_Rev_A.pdf	03/04/2015	DCPP SSC Report (PG&E)	Map of Primary and connected Fault sections in the Hosgri and Northeast-Vergent (NE) fault geometry Model, DCPP Vicinity

	Figure C-5	map	41	na (fault traces)	NTTF DCCP PSHA Review\Appendix C HID_Rev_A.pdf	03/04/2015	DCPP SSC Report (PG&E)	Primary and Connected fault sections in the fault geometry models, southern region.
	Figure C-6	map	42	na (fault traces)	NTTF DCCP PSHA Review\Appendix C HID_Rev_A.pdf	03/04/2015	DCPP SSC Report (PG&E)	Primary and Connected fault sections in the fault geometry models, Northern region.
	Figure C-9	map	45	na (fault traces)	NTTF DCCP PSHA Review\Appendix C HID_Rev_A.pdf	03/03/2015	DCPP SSC Report (PG&E)	UCERF3 Regional Fault Sources
	Figure C-10	map	46	na (fault traces)	NTTF DCCP PSHA Review\Appendix C HID_Rev_A.pdf	03/03/2015	DCPP SSC Report (PG&E)	Non-UCERF3 Regional Fault Sources
	Figure C-11	map	47	na (fault traces)	NTTF DCCP PSHA Review\Appendix C HID_Rev_A.pdf	03/04/2015	DCPP SSC Report (PG&E). Grid from 20008 National Seismic Hazard Mapping Project (Petersen et al, 2008)	Areal Source Zones Used in the Diablo Canyon SSC Model
	Figure C-12	map	48	na (fault traces)	NTTF DCCP PSHA Review\Appendix C HID_Rev_A.pdf	03/03/2015	DCPP SSC Report (PG&E)	Local Areal Source Zone and Virtual Faults
	Figure C-14	map	50	Good	NTTF DCCP PSHA Review\Appendix C HID_Rev_A.pdf	03/04/2015	DCPP SSC Report (PG&E). Grid from 20008 National Seismic Hazard Mapping Project (Petersen et al., 2008)	Regional Areal Source Zone Showing .1 degree gridded seismicity rates from 2008 NSHMP
	Figure C-15	map	51	Good	NTTF DCCP PSHA Review\Appendix C HID_Rev_A.pdf	03/04/2015	DCPP SSC Report (PG&E). Grid from 20008 National Seismic Hazard Mapping Project (Petersen et al, 2008)	Vicinity Areal Source zone showing .1 degree and finer .02 degree gridded seismicity rates based on the 2008 NSHMP
Appendix F EQ Catalogs_Rev_A				Good (table data)	NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf			
	Figure F-1	map	14	Good (earthquake event locations)	NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/23/2015	Hardebeck 2014a. DCPP SSC Report (PG&E)	Hardebeck (2014a) Seismicity Catalogue. 1987 through 2013
	Figure F-2	graph	15	Good (earthquake event locations)	NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/13/2015	Hardebeck 2014a and 2010. DCPP SSC Report (PG&E)	Earthquake location difference statistics between Hardebeck 2010 and 2014a in the San Luis Obispo Sub region
	Figure F-3	map	16	Good (earthquake event locations)	NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/27/2015	DCPP SSC Report (PG&E)	PG&E seismicity catalogue developed for seismic Hazard evaluation for the DCPP, 1984 through February 2009
	Figure F-4	map	17	Good (earthquake event locations)	NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/26/2015	DCPP SSC Report (PG&E)	Updated UCERF3 seismicity catalog 1984 through January 2014
Appendix G WAACY Magnitude PDF_Rev_A				Good (graph data)	NTTF DCCP PSHA Review\Appendix G WAACY Magnitude PDF_Rev_A.pdf			
	Figure G-2	graph	13		NTTF DCCP PSHA Review\Appendix G WAACY Magnitude PDF_Rev_A.pdf	03/05/2015	DCPP SSC Report (PG&E)	CV Versus btail, grouped by magnitude-displacement relation and showing WAACY Model variables Examined in the Parametric study
	Figure G-3	graph	14		NTTF DCCP PSHA Review\Appendix G WAACY Magnitude PDF_Rev_A.pdf	03/05/2015	DCPP SSC Report (PG&E)	CV Versus btail for HEA13 Relation. Evaluating Logic Tree groupings of Mchar-Mmax pairs for implementation of the WAACY model
	Figure G-4	graph	15		NTTF DCCP PSHA Review\Appendix G WAACY Magnitude PDF_Rev_A.pdf	03/05/2015	DCPP SSC Report (PG&E)	CV Versus F1 for HEA13 Relation. Evaluating Logic Tree groupings of Mchar-Mmax pairs for implementation of the WAACY model
Appendix H EPR Method_Rev_A				Good (graph data)	NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf			
	Figure H-1	graph	21		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	Conditional Probability calculation illustrated for exponential and lognormal earthquake probability distributions
	Figure H-2	graph	22		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	conditional probability ratio.
	Figure H-3	graph	23		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	Displacement per event models for the Hosgri and Los Osos or San Luis Bay faults
	Figure H-4	graph	24		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	Two probability distribution of coefficient of variation values
	Figure H-5	graph	25		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/25/2015	DCPP SSC Report (PG&E)	Lognormal PDF, Survivor function, 30 year conditional probability, and 30 year conditional probability ratio for three values of long-term mean.
	Figure H-6	graph	26		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	Conditional probability surface for the lognormal Model
	Figure H-7	graph	27		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	LTM-tMRE joint probability surface used to select regions in the conditional probability ratio
	Figure H-8	graph	28		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	Sorted equivalent Poisson Ratio corresponding cumulative weight
	Figure H-9	graph	29		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	Conditional Probability ratios for four values of historical constraint Tmin
	Figure H-10	graph	30		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	Weighted Mean Equivalent Poisson ratio estimates by coefficient of variation for lognormal model and three fault slip rates.
	Figure H-11	graph	31		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	Three-point distribution equivalent Poisson ratio values for the lognormal model and three fault slip rates.
	Figure H-12	graph	32		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/25/2015	DCPP SSC Report (PG&E)	Survivor Functions and conditional probability ratios compared for the lognormal, BPT, and Weibull distribution and Five Coefficient of variation values.
	Figure H-13	graph	33		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	Pre-coefficient of variation equivalent Poisson ratio using the Weibull recurrence distribution for three fault slip rates
	Figure H-14	graph	34		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	Coefficient of variation weighted equivalent Poisson ratio distribution points for lognormal, BPT, and Weibull recurrence distributions
	Figure H-15	graph	35		NTTF DCCP PSHA Review\Appendix F EQ Catalogs_Rev_A.pdf	02/24/2015	DCPP SSC Report (PG&E)	San Andreas Fault Equivalent Poisson ratio estimation comparing known MRE= 1857 to a Bounded MRE> 1857
Beach_balls		TIFF		Poor (no reference for magnitudes)	Figures\Beach_balls.tif			Focal Mechanisms along the Hosgri Fault zone, Los Osos Fault Zone, and extending north to the Ragged Point Earthquake
California_Tsunami_CSSC		PDF		na (no data)	Figures\California_Tsunami_CSSC.pdf	December 2005	State of California Seismic Safety Commission	THE TSUNAMI THREAT TO CALIFORNIA: FINDINGS AND RECOMMENDATIONS ON TSUNAMI HAZARDS AND RISKS
Central Coastal California Seismic Imaging Project								
Ch1.Introduction_Figures.(1)		PDF			Central Coastal California Seismic Imaging Project\Ch1 Introduction_Figures (1).pdf			
	Figure 1-1	Map	1	Good (context for Los Osos,DCCP, and the shorline fault)	Central Coastal California Seismic Imaging Project\Ch1 Introduction_Figures (1).pdf	07/29/2014	PG&E CCCSIP Report	Map showing faults and structural blocks within the Los Osos domain

	Figure 1-2	Map	2	**Good (graph data)**	Central Coastal California Seismic Imaging Project\Ch1.Introduction_Figures (1).pdf	07/30/2014	PG&E CCCSIP Report	2011 Tornado Diagram Showing the Ranking of Hazard Sensitivity with Respect to the CCCSIP Source Characterization Studies (Graph showing sensitivity Hazard /1E-4 (at 2g), Shoreline, Los Osos, Hosgri faults)
Ch2.GEO.DCPP.TR.12.01_R1_AppA		PDF			Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf			
	Figure 1	Map	9	**Good (Seismic location map)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf	06/05/2012		2010-2011 3D Survey Areas. Shows bathymetry, faults, and 2D and 3D seismic survey areas.
	Figure 2	Map	11	**Good (Details integrated seismic)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		Fugro Seismic Imaging contracted by PG&E. Processed by FSI (green) with the USGS (Sliter et al., 2009, 2010) PBS 2D Lines (Red).	3D and 2D seismic lines. 2010/2011 3D Seismic Survey
	Figure 3a	Bathymetry and Seismic	14	**Poor (unreadable bathymetric scale)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		MBES data from the California Seafloor Mapping Program (CSMP) and the 2010/2011 3D Survey by Fugro Seismic Imaging contracted by PG&E.	Central Coast MBES time converted data with the 2010/2011 PG&E 3D seismic survey seafloor times displayed.
	Figure 3b	Bathymetry and Seismic	14	**Poor (unreadable bathymetric scale)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		MBES data from the California Seafloor Mapping Program (CSMP) and the 2010/2011 3D Survey by Fugro Seismic Imaging contracted by PG&E.	Central Coast/South of Morro Bay-Avila Bay Blocks A-B MBES converted time data surrounding 2010/2011 PG&E 3D seismic survey.
	Figure 3c	Bathymetry and Seismic	15	**Poor (unreadable bathymetric scale)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		MBES data from the California Seafloor Mapping Program (CSMP) and the 2010/2011 3D Survey by Fugro Seismic Imaging contracted by PG&E.	2010/2011 3D seismic survey seafloor time highlighted within MBES Data water-bottom time. MBES bathymetry data has been shaded
	Figure 3d	Bathymetry and Seismic	15	**Poor (unreadable bathymetric scale)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		MBES data from the California Seafloor Mapping Program (CSMP) and the 2010/2011 3D Survey by Fugro Seismic Imaging contracted by PG&E.	Variations of sea floor time between the MBES and the 2010/2011 3D Survey
	Figures 4-8	Seismic	16-18	**Average (reflectors are overprinted, noisy)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		MBES data from the California Seafloor Mapping Program (CSMP) for the bathymetry horizons and 3D seismic lines from the 2010/1011 survey (Fugro Seismic Imaging contracted by PG&E)	The 3D seismic survey profiles were displayed in Uniseis and the bathymetry data was displayed as a horizon above the water bottom of the seismic data. Several 3D seismic volume survey in-lines were extracted as 2D lines in order to view the horizon in vertical section (Figures 4 through 8).
	Table 2		19	**Good (data table)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf			Difference of MBES depths Converted to Time (ms) and the 3D Survey Seafloor Time (ms).
	Table 1		13	**Good (data table)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf			Horizontal and Vertical Datum Information for the different surveys
	Figure 9-14	Seismic	21-23	**Poor (unreadable amplitude scale)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		Fault structure shape files from the California Geologic Survey Quaternary Faults. Seismic area from 2010/1011 survey (Fugro Seismic Imaging contracted by PG&E)	Un-Named Q-Fault locations (in Red) mapped across northern portion of the 3D volume. Data has been displayed using the Batik program in Uniseis.
	Figure 15		24	**Good (seismic processing)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		Several in-lines from the PG&E 3D Survey (2010/2011 by FSI) were extracted as 2D lines to compare with the USGS 2D dataset	USGS 2D LinePBS-30 in wiggle mode & 3D in-Line 12440 in wiggle mode. Different Acquisition sources construct dissimilar phase and pulse of the two data sets.
	Figure 16		25	**Good (seismic processing)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		Several in-lines from the PG&E 3D Survey (2010/2011 by FSI) were extracted as 2D lines to compare with the USGS 2D dataset	Amplitude Spectrum of USGS 2D Line 30, the Peak Frequency is 1291 Hz (taken from CDP's4935-4891); the 3D In-Line 12440 Amplitude Spectrum show a peak frequency at 189 Hz (taken from CDP's 12689-12644). Image shows that data sets show large differences in source volume and peak frequencies.
	Figure 17		26	**Good (seismic integration)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		Lines from the PG&E 3D Survey (2010/2011 by FSI) and 2D lines from the USGS 2D dataset	Intersection display of 3D Line 12969 and USGS 2D Line PBS-28. Time shifts were calculated in order to match the 3D dataset with the 2D data.
	Figure 18		26	**Good (seismic integration)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		Lines from the PG&E 3D Survey (2010/2011 by FSI) and 2D lines from the USGS 2D dataset	Intersections of 2010/2011 3D Seismic Survey Cross-Line 13211 and USGS 2D Line PBS-22. Several intersections were used to calculate time shifts needed to match the 3D Seismic Data set with the 2D Seismic data.
	Figure 19		27	**Good (seismic integration)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		Lines from the PG&E 3D Survey (2010/2011 by FSI) and 2D lines from the USGS 2D dataset	3D extracted In-Line 12210 is displayed with USGS 2D Line PBS-23. Line separation distances average 16 to 1 meter.
	Figure 20	Seismic	27	**Average (reflectors are overprinted, noisy)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		Lines from the PG&E 3D Survey (2010/2011 by FSI) and 2D lines from the USGS 2D dataset	Side-by-Side comparison of 2D Line PBS-23 and 3D extracted In-Line 12210. 3D processing is comparable but has improved imaging when compared to the USGS 2D data. Displays are zoomed in 10-200ms; approximately 2km in cross-section.

	Figure 21		28	**Good (seismic integration)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		Lines from the PG&E 3D Survey (2010/2011 by FSI) and 2D lines from the USGS 2D dataset	3D extracted In-Line 12440 and USGS 2D Line PBS-30. Line separation distances average 25 to 35 meters.
	Figure 22		28	**Average (reflectors are overprinted, noisy)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		Lines from the PG&E 3D Survey (2010/2011 by FSI) and 2D lines from the USGS 2D dataset	Side-by-Side Comparison of USGS 2S Line PBS-30 with 3D extracted In-Line 12440. Geologic features such as dipping beds are comparable but enhanced in the 3D dataset. Vertical profiles used to compare the datasets are approximately 2km.
	Figure 23		29	**Good (seismic integration)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		Lines from the PG&E 3D Survey (2010/2011 by FSI) and 2D lines from the USGS 2D dataset	3D extracted survey In-Line 12960 and USGS 2D Line PBS-28. Line separation distances average 2 to 35 meters across.
	Figure 24	Seismic	29	**Average (reflectors are overprinted, noisy)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf		Lines from the PG&E 3D Survey (2010/2011 by FSI) and 2D lines from the USGS 2D dataset	Side-by-Side comparison of USGS 2D Line 28 with 3D extracted In-Line 12960. Similar geologic features are imaged in both the 2D and 3D datasets but the 3D dataset contains more detailed impedance contrasts. The section of data used for comparison is approximately 2km in cross-section.
	Table 3		25	**Good (Seismic shift table)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf			Time Shifts Calculated to Match the 2009/2010 Mini-Sparker 2D Dataset to the 3D Dataset
	SOFTWARE VALIDATION & VERIFICATION OF UNISEIS		33-65	**na (software validation)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf	2011	Fugro Seismic Imaging	The processing will be performed using Fugro Seismic Imaging's proprietary seismic processing software UNISEIS. Prior to performing this work, a Software Validation and Verification of UNISEIS was performed. This report summarizes the Software Validation and Verification effort.
	Software Validation for Seismic Processing Workshop and Qualification of 20120-2011 2d High resolution Seismic Reflection data		66-111	**na (software validation)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_AppA.pdf	2012	Fugro Seismic Imaging	In order to validate that UNISEIS is functioning properly during QC data processing, Fugro proposes to generate 2D Brute Stacks of two seismic lines acquired during the previous 2010/2011 survey campaign near the proposed survey area.
Ch2.GEO.DCPP.TR.12.01_R1_Figure		PDF			Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf			
	Structural Blocks and Faults in the DCPP Area (figure 1-2)	Map	2	**Good (context for Los Osos,DCCP, and 3d/2d seismic)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	08/04/2015	DCPP 3D/2D Seismic Reflection investigation (PG&E) (Modified from PG&E, 1988)	Structural blocks are faults in the DCPP areas, also shows 2D and 3D seismic areas
	Figure 1-3	Graph	3	**Good (Seismic paramter graph)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Frequency Spectrum from 3D/2D Seismic-Reflection Data Set Showing Dominant(Fundamental) Frequency of 200–225 Hz and Calculation Using 1,600–1,650 m/s to Determine Vertical Resolution (2.00–2.06 and 1.78–1.83 m)
	Figure 2-2	Map	5	**Good (context for 2d tracklines and 3d domain)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E). MBES data source: CSUMB Seafloor Mapping Lab	Trackline Map of 2D Seismic-Reflection Lines and Boundary of 3D Survey Area. Shows 100m spacing of seismic lines (2D) and 3D seismic area
	Figure 2-3		6	**Good (Seismic aquisisiton diagram)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Schematic Diagram of Streamer Array Showing Navigation Positioning Accuracy During 3D/2D Seismic-Reflection Survey
	Figure 2-5	seismic	8	**Good (CPM)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	08/04/2015	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Example of "Bubble Pulse" Recorded During 3D/2D Seismic-Reflection Survey Showing ~5 ms (~4 m) Thick Shallow Subsurface Section Not Resolvable due to Masking of Legitimate Reflectors by Pulse Width
	Figure 2-6	Chart	9	**na (flow chart)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Flow Chart Showing Procedures and Steps Undertaken in the Processing of the 3D Data
	Figure 3-1	Seismic	10	**Average (reflectors are overprinted, noisy)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	08/04/2015	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Examples of Data Quality (Interpretability) Shown in (a,b) 3D Seismic-Reflection Profile Line 12120 and on (c) Amplitude Time Slice at 150 ms (TWTT). Slices from 3D seismic
	Figure 4-1	Map	11	**Good (correlation of bathymetry and 3d amplitude)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E) and MBES bathymetry data	MBES Bathymetry Overlain on 3D Amplitude Time Slice at 138 ms (TWTT) Showing a Good Correlation Between the Two Data Sets
	Figure 6-1	Seismic	12	**Average (reflectors are overprinted, noisy)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/29/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Example of a Wave-Cut Platform and Shoreline Angles Illustrated in 3D Seismic-Reflection Profile 13340 and Showing Bedding Artifacts. Slices from 3D seismic
	Figure 6-2	Seismic	13	**Good (correlation of bathymetry and 3d slice)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E). MBES bathymetric data	Illustrations of Mobile Sand Sheets Shown in (a, b) 3D Seismic-Reflection Profile 12120 and on (c) MBES Shaded Relief Bathymetry Map. Slices from 3D seismic.
	Figure 6-3	map	14	**Good (context for bedrock, earthquake data, and 3d/2d seimic)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	DEM of Bedrock Surface with Sediment Removed in the Point Buchon Study Area. Earthquake data differentiated by depth and magnitude overlain.
	Figure 6-4	Seismic	15	**Average (reflectors are overprinted, noisy)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E). MBES bathymetric data	Vertical and Horizontal Geometry of Hosgri Fault Zone Strands in (a, b) 3D Seismic-Reflection Profile 11180 and on (c) MBES Bathymetry Map Within Northern Part of Survey Area
	Figure 6-5	Seismic	16	**Good**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/29/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Amplitude Time-Slice Maps at 95 ms (TWTT) in Southern Part of 3D Study Area Showing (a) Uninterpreted and (b) Interpreted Strands of the Point Buchon Fault Zone
	Figure 6-6	Seismic	17	**Average (noisy similarity data)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Fault Strands Associated with Fault Intersection of Point Buchon Fault Zone Shown in (a) Uninterpreted and (b) Interpreted Similarity Time Slices at 74 ms (TWTT)
	Figure 6-7	Seismic	18	**Average (reflectors are overprinted, noisy)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Graben at Northern End of Point Buchon Fault Zone Shown on (a, b) 2D Seismic-Reflection Profile 1120 and (c) MBES Bathymetry
	Figure 6-8	Seismic	19	**Average (reflectors are overprinted, noisy)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Structure Associated with Northern Part of Point Buchon Fault Zone Shown in (a, b) 3D Seismic-Reflection Profile 11820 and (c) Amplitude Time Slice at 150 ms (TWTT)
	Figure 6-9	Seismic	20	**Average (reflectors are overprinted, noisy)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Principal Structural Elements in Northern Part of Study Area Showing Faults and Folds in (a, b) 2D Seismic-Reflection Profile 1399 and on (c) Amplitude Time-Slice Map at 150 ms (TWTT)

	Figure 6-10	map	21	**Good (correlation of seismicity and focal mechanisms)**	Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/18/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E). Earthquakes from Hardebeck, 2010 (HASH; Hardebeck and Shearer, 2002), (FPFIT; Reasenberg and Oppenheimer, 1985)	Seismicity and Focal Mechanisms in the Study Area. Earthquakes overlain on fold map (differentiated by depth and magnitude). Beach balls (focal mechanisms) differentiated by magnitude
	Figure 7-1	Seismic	22		Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	08/04/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E). Earthquake relocations from Hardebeck (2010).	Seismicity in Relation to Depth of 3D/2D Seismic Reflection and Potential Field Imaging. Cross Section of the Hosgri Fault zone. Overlain with earthquakes and focal mechanisms (differentiated by magnitude)
	Foldout A	Seismic	23		Central Coastal California Seismic Imaging Project\Ch2-GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Comparison of Amplitude and Similarity Time Slices at 150 ms Showing Uninterpreted Data (a and b) and Interpreted Maps (c and d)
	Foldout B	Seismic	24		Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/17/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Marker Horizons Identified in (a) User-Selected 3D Strike Line and (b) Mapped on Amplitude Time Slice at 150 ms (TWTT)
	Foldout C	Seismic	25		Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	07/29/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Graben Associated with Hosgri Fault Zone: (a) 2D Seismic-Reflection Profile 1039 Showing Fault Boundaries and Sediment Fill and (b) Map View Showing Faults, Graben, and MBES Bathymetry
	Foldout D	Seismic	26		Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Figure.pdf	08/40/2014	DCPP 3D/2D Seismic Reflection investigation (PG&E)	Relationship of the Hosgri and Point Buchon Fault Zones in Northern Part of Survey Area: (a) Uninterpreted and (b) Interpreted 3D Profile 11200; (c) Uninterpreted and (d) Interpreted Amplitude Time Slice at 150 ms (TWTT)
Ch2.GEO.DCPP.TR.12.01_R1_Plates		PDF			Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Plates.pdf			
	Plate 1	map	1		Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Plates.pdf	07/03/2012	FROM 2011 Shoreline Fault Zone Report (PG&E 2011b).	Geology of Interpreted Offshore Structures. Shows units, structures, earthquakes, and seismic survey boundaries
	Plate 2	map	2		Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Plates.pdf	07/03/2012	Base map is hillshade image developed from MBES bathymetry, taken from Shoreline Fault Zone Report, the PG&E (2010) coastal LIDAR survey, and the San Luis Obispo County 5 m DEM.	Structure Map Based on Low Energy 3D/2D Seismic-Reflection Data.
	Plate 3(a and b)	map	3		Central Coastal California Seismic Imaging Project\Ch2.GEO.DCPP.TR.12.01_R1_Plates.pdf	07/03/2012	FROM 2011 Shoreline Fault Zone Report (PG&E 2011b). Base map is hillshade from PG&E (2011b) project DEM. The DEM includes 1m multibeam bathymetry data, 1 m near-shore LiDAR topography data, and 5 m InSAR data.	Comparison of Interpreted Offshore Structures. Shows earthquakes differentiate by magnitude and depth as well.
Ch3.GEO.DCPP.TR.14.02_R0_App_A_Figures		PDF			Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_App_A_Figures.pdf			
	A-1	seismic	2		Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_App_A_Figures.pdf	07/27/2014	OFFSHORE LESS STUDIES, seismic from Fugro?	Seismic Interpretation. 1980 GSI Line 201, Offshore Point Sal
	A-2	seismic	3		Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_App_A_Figures.pdf	07/27/2014	OFFSHORE LESS STUDIES, seismic from Fugro?	Seismic Interpretation, 1979 Line W-22-2024, Offshore Point Sal
	A-3	seismic	4		Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_App_A_Figures.pdf	07/27/2014	OFFSHORE LESS STUDIES, seismic from Fugro?	Inlines 1370 and 1020 Showing Structure and Stratigraphy East and West of HFZ, Offshore Point Sal
	A-4	seismic	5		Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_App_A_Figures.pdf	07/17/2014	OFFSHORE LESS STUDIES, seismic from Fugro?	GSI 1985 Line SM-201 Showing Regional Structure Between HFZ and Casmalia Faults, Offshore Point Sal
	A-5	seismic	6		Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_App_A_Figures.pdf	07/17/2014	OFFSHORE LESS STUDIES, seismic from Fugro?	Line SM-5A, Onshore Nipomo Mesa and Santa Maria River Valley
	A-6	map	7		Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_App_A_Figures.pdf	07/27/2014	OFFSHORE LESS STUDIES	3D Perspective View of Paleoshoreline and Bedrock Surface, San Luis Obispo Bay
	A-7	map	8		Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_App_A_Figures.pdf	07/17/2014	OFFSHORE LESS STUDIES. image showing Guadalupe Oil Field Top Sisquoc Structure originally published by the California Division of Oil, Gas, and Geothermal Resources (1992).	Southern Extent Shoreline Fault near Guadalupe, San Luis Obispo Bay. Structural map
	A-8	map	9		Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_App_A_Figures.pdf	07/17/2014	OFFSHORE LESS STUDIES. Depth of formation and tiff from CDOGGR, 1992)	Plan and Perspective View of Top of Sisquoc Formation and Shoreline Fault near Guadalupe, San Luis Obispo Bay. Shows depth of the Sisquoc Formation
Ch3.GEO.DCPP.TR.14.02_R0_Figures		PDF			Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf			
	Figure 1-1	map	1		Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. Fault locations from Jennings and Bryant (2010) and PG&E (2011). PG&E DEM compilation v2013.07	Regional Map of 3D LESS Survey Areas. Shows structures and survey extents.

Figure 1-2	map	2	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. PG&E (1988, 2011, 2013). Regional tectonic sketch map from Hanson et al. (2004). AMEC (2011)	Tectonic Setting. Shows structure
Figure 1-3	map	3	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. Relocated earthquake data from Hardebeck (2012). Project DEM compilation v2013.01. Note: Quaternary fault traces compiled from Lettis and Hall (1994), Lettis et al. (2004), AMEC (2011), PG&E (2013), and this study.	Regional Seismicity. Shows magnitude and depth of earthquakes
Figure 1-4	map	4	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. DEM Source: NGC Coastal Relief Model Vol. 06 Shaded Relief Images (2003)	Regional Physiography Map Showing Boundaries of Watersheds That Drain into San Luis Obispo and Estero Bays
Figure 1-5	Stratigraphy	5	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. - Stratigraphic columns for Santa Maria Basin from Willingham et al. (2013). - Stratigraphic column for Pismo Basin from PG&E (2011) and Hall (1973).	Generalized Stratigraphic Columns for the Project Study Areas
Figure 1-6	graph	6	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies.	Age Model for Quaternary Unconformities in Study Areas
Figure 1-7	Seismic	7	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. -USGS seismic-reflection data (Sliter et al., 2009). -Fugro 3D and 2D seismic-reflection data (2012). -Project DEM compilation v2013.01	Excerpt of Profile PBS-23 Showing Key Regional Unconformities Offshore of Point Buchon. Seismic Lines
Figure 1-9	seismic	9	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. 2012 Point Sal 3D high-resolution survey	Example of Nested Channels. Seismic lines
Figure 1-10	map	10	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. PG&E DEM compilation v2013.07.	Regional Trackline Map from Legacy Archive Data
Figure 1-11	map	11	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. Fault locations from Jennings and Bryant (2010) and PG&E (2011). PG&E DEM compilation v2013.07	Magnetic Data
Figure 2-2	Graph	13	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies.	Frequency Spectrum for 2D/3D Seismic Source
Figure 2-5	seismic	16	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. 2011/2012 San Luis Obispo Bay 3D high-resolution survey	Comparison Plot of Seismic Amplitude and Smoothed Similarity Time Slices at 0.08 s TWTT
Figure 2-6	seismic	17	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. 2011/2012 San Luis Obispo Bay 3D high-resolution survey	Comparison Plot of Seismic Amplitude and Smoothed Dip of Maximum Similarity Time Slices at 0.08 s TWTT
Figure 6-1a	seismic	18	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. - USGS seismic-reflection data (Sliter et al., 2009). - Fugro 2D and 3D seismic-reflection data (2012).	Excerpt of Profile PBS-36 Showing Transition from Continental Slope to Continental Shelf Environment
Figure 6-1b	seismic	19	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. USGS seismic-reflection data (Sliter et al., 2009). - Fugro 2D and 3D seismic-reflection data (2012).	Excerpt of Profile PBS-36 Showing Transition from Continental Slope to Continental Shelf Environment
Figure 6-2	graph	20	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	May-14	Offshore LESS Studies. Lisiecki and Raymo (2005) use 57 globally distributed 18O records to compile a 5.3 Myr record of sea-level fluctuations. Timing of mid-Pleistocene transition from Bintanja and van de Wal (2008).	Age Model for Unconformity T05 and Channel DBw-Ee1-De
Figure 6-3	seismic	21	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. Project DEM compilation v2013.07. - Traces of Point Buchon fault from PG&E (2012). 0 1	Migration of the Shelf Break Through Time
Figure 6-4	map	22	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies -Project DEM compilation v2013.07. -Traces of Point Buchon fault from PG&E (2012). -USGS seismic-reflection data (Sliter et al., 2009). -Fugro 2D and 3D seismic-reflection data (2012).	Structure Contour Map of the Top of Pre-Quaternary Bedrock

Figure 6-5	seismic	23	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. - Fugro 2D and 3D seismic-reflection data (2012). - USGS seismic-reflection data (Sliter et al., 2009).	Excerpt of Profile EB9-S14 Showing Relationship Between Regional Unconformities and Reflections in 3D Volume East of the HFZ
Figure 6-6	seismic	24	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. - USGS seismic-reflection data (Sliter et al., 2009). - Fugro 3D and 2D seismic-reflection data (2012).	Excerpt of Line PBS-T1A Showing Channels in Embayment North of 3D Volume
Figure 6-7	seismic	25	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. - USGS seismic-reflection data (Sliter et al., 2009). - Fugro 3D and 2D seismic-reflection data (2012).	Excerpt of Line PBS-T1A Showing Channel Fe
Figure 6-8	map	26	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies - USGS seismic-reflection data (Sliter et al., 2009). - Fugro 2D and 3D seismic-reflection data (2012). - Project DEM compilation v2013.07.	Fault Map Comparison between old and revised study
Figure 6-9a	Seismic	27	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. - 3D seismic reflection data from Fugro (2013). - Project DEM compilation v2013.07.	Uninterpreted Profiles and Time Slice at 155 ms Showing Localization of Folding Adjacent to Minor Bend in Eastern Trace of HFZ
Figure 6-9b	Seismic	28	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. - 3D seismic reflection data from Fugro (2013). - Project DEM compilation v2013.07.	Interpreted Profiles and Time Slice at 155 ms Showing Localization of Folding Adjacent to Minor Bend in Eastern Trace of HFZ
Figure 6-10a	Seismic	29	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. - 3D seismic reflection data from Fugro (2013). - Project DEM compilation v2013.07.	Uninterpreted Time Slice at 155 ms and Inline 7500 Showing Shallow Channels East of HFZ
Figure 6-10b	Seismic	30	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. - 3D seismic reflection data from Fugro (2013). - Project DEM compilation v2013.07.	Interpreted Time Slice at 155 ms and Inline 7500 Showing Shallow Channels East of the HFZ
Figure 6-11	Seismic	31	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. - USGS seismic-reflection data (Sliter et al., 2009). - Project DEM compilation v2013.07. - 3D seismic-reflection data from Fugro (2012). - Traces of Point Buchon fault from PG&E (2012).	Fence Diagram Showing Correlation of Channels De and Ee
Figure 6-12	Seismic	32	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. - 2D and 3D seismic-reflection data from Fugro (2012). - Project DEM compilation v2013.07. Bathymetric contour interval is 10 m. Heavy contours are 50 m isobaths.	Excerpt of Inline 7415 Showing Deformed Channel Sequence Ee Between Strands of the HFZ
Figure 6-13	Seismic	33	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. - USGS seismic-reflection data (Sliter et al., 2009). - 2D and 3D seismic-reflection data from Fugro (2012). - Project DEM compilation v2013.01. Bathymetric contour interval is 10 m. Heavy contours are 50 m isobaths. - Traces of Point Buchon fault from PG&E (2012).	Excerpt of 2D Profile EB14-S14 Showing Stratigraphic Context of Possible Channels West of the HFZ
Figure 6-14a	Seismic	34	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. - USGS seismic-reflection data (Sliter et al., 2009). - Project DEM compilation v2013.07. - Fugro 3D seismic-reflection data (2012). - Traces of Point Buchon fault from PG&E (2012).	Uninterpreted Fence Diagram Showing Channel DBw West of the HFZ
Figure 6-14b	Seismic	35	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. - USGS seismic-reflection data (Sliter et al., 2009). - Project DEM compilation v2013.07. - 3D seismic-reflection data from Fugro (2012). - Traces of Point Buchon fault from PG&E (2012).	Interpreted Fence Diagram Showing Channel DBw West of the HFZ
Figure 6-15	map	36	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. -Project DEM compilation v2013.07. -Traces of Point Buchon fault from PG&E (2012).	Map of Channels, Flow Pathways, and Potential Sediment Sources on Shelf
Figure 6-16	map	37	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS Studies. Project DEM compilation v2013.07.	Piercing Point DBw-Ee1-De Separation and Uncertainty
Figure 6-17	map	38	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. -Project DEM compilation v2013.07. -Traces of Point Buchon fault from PG&E (2012).	Palinspastic Restoration Illustrating Alternative Channel Correlations Across the HFZ
Figure 6-18	map	39	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. -Well locations from Willingham et al. (2013). -Project DEM compilation v2013.01.	Legacy Archive Well Tie Lines, Offshore Point Sal
Figure 6-19	seismic	40	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS Studies. Modified from Willingham et al. (2013, Figure 7).	Migrated Seismic Reflection Record Showing Near Top of Neogene Unconformity Mapped in This Study

Figure 6-20	seismic	41	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Jul-14	Offshore LESS studies, seismic from Furgo?	Seismic Interpretation. GSI Line 203 (1985)
Figure 6-21	map	42	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey	Distribution of Mapped ELP/NTN Unconformity and H10 and H30 Horizons, Point Sal
Figure 6-22	seismic	43	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey	Line 1083, West of HFZ Showing ELP/NTN Unconformity and H10 and H30 Horizons
Figure 6-23	seismic	44	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey	Time Slice at 150 ms in Southern Part of Point Sal Study Area
Figure 6-24	seismic	45	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey	Time Slice at 180 ms in Northern Part of Point Sal Study Area
Figure 6-25	seismic	46	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey	Time Slice at 213 ms in Northern Part of Point Sal Study Area
Figure 6-26	seismic	47	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey	Line 1240 Showing ELP/NTN and H10 and H30 Unconformities and Channel Deposits
Figure 6-27	seismic	48	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey	Amplitude and Similarity Time Slices at 160 ms, Point Sal
Figure 6-28	map	49	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey. PG&E DEM compilation v2013.07 Willingham et al. (2013) and Lettis et al. (2004)	Point Sal Fault Map Comparison
Figure 6-29	seismic	50	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey	Inline 1370 East of the HFZ, Uninterpreted and Interpreted Showing ELP/ NTN Unconformity, Point Sal
Figure 6-30	seismic	51	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey	Inline 1020 West of the HFZ, Uninterpreted and Interpreted, Showing ELP/NTN Unconformity and Faults
Figure 6-31	seismic	52	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey. Project DEM Compilation v2013.07.	Crossline 8200, Uninterpreted and Interpreted, with H30 Surface, Point Sal
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Figure 6-35	seismic	56	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey.	Arbitrary Amplitude Section Showing Channels A-G, Uninterpreted and Interpreted, with Labeled Channels
Figure 6-36	map	57	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey. Project DEM compilation v2013.01.	Gridded (Time) Paleochannels with Piercing Point Figure Locations
Figure 6-37	seismic	58	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey.	Line 1075 Syncline/Channel A Amplitude Section Central Block of Hosgri, Uninterpreted and Interpreted, with Labeled Channels
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Figure 6-42	seismic	63	Central Coastal California Seismic Imaging Project\Ch3.GEO.DCPP.TR.14.02_R0_Figures.pdf	Apr-14	Offshore LESS studies. 2012 Point Sal 3D high-resolution survey.	Channel B Time Slice at 146 ms Central Block, Uninterpreted and Interpreted, with Labeled Channels
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Figure 4.1-3	seismic	11	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2008 Seismic Survey, Line PBS-08. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Hosgri Fault Zone —Multiple Fault Traces. Seismic Line
Figure 4.1-4	seismic	12	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-230. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Hosgri Fault Zone — Adjacent, Kink Fold. Seismic Line
Figure 4.1-5	seismic	13	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-235. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Hosgri Fault Zone —No Apparent Fault. Seismic Line
Figure 4.1-6	seismic	14	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-237. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Hosgri Fault Zone — Northern Area. Seismic Line
Figure 4.1-7	seismic	15	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Hosgri Fault Zone— Slope Failure Feature. Seismic Line.
Figure 4.2-1	seismic	16	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-258. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Hosgri Fault— Northwest End. Seismic line
Figure 4.2-2	seismic	17	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-247. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Structures 6 km North of Hosgri Fault. Seismic line.
Figure 4.2-3	seismic	18	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-242. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Unassigned Fault Traces North and Parallel to Hosgri Trend, 5 km South of San Simeon Point. Seismic line
Figure 4.2-4	seismic	19	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-227. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Shallow Folds and Faults on Southwest Flank of Piedras Blancas Antiform, 4 to 6 km Southwest of San Simeon Point. Seismic line.
Figure 4.2-5	seismic	20	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-224 SW End, Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Piedras Blancas Fault and Fold Belt, Southwest Flank of Antiform. Seismic Line.
Figure 4.2-6	seismic	21	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-224 NE End., Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Piedras Blancas Fault and Fold Belt, Northeast of Figure 4.2-5. Seismic Line
Figure 4.3-1	seismic	22	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2008 Seismic Survey, Line PBS-36. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Los Osos Fault—South eastern Section. Seismic line.

	Figure 4.3-2	seismic	23	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2008 Seismic Survey, Line PBS-43. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Los Osos Fault—Central Section. Seismic line.
	Figure 4.3-3	seismic	24	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2008 Seismic Survey, Line PBS-39A. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Los Osos Fault—Northern Section. Seismic line.
	Figure 4.4-1	seismic	25	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	Jun-14	USGS 2009 Seismic Survey, Line PBS-209. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Half Graben Fault— South End LESS Record Example. Seismic line
	Figure 4.4-2	seismic	26	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	COMAP Seismic Survey, Line CM-47. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Half Graben Fault— South End CDP Record Example. Seismic line
	Figure 4.4-3	seismic	27	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-230. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Half Graben Fault—Central Area. Seismic line
	Figure 4.4-4	seismic	28	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-233. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Half Graben Fault—South End of Scarp. Seismic line
	Figure 4.4-5	seismic	29	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-236. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Half Graben Fault—Center of Scarp. Seismic line
	Figure 4.4-6	seismic	30	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-261. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Half Graben Fault—North End of Scarp. Seismic line
	Figure 4.5-1	seismic	31	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-256. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	San Simeon –Cambria Gap Area— 2.5 km North of Half Graben Fault. Seismic line
	Figure 4.5-2	seismic	32	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-253. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	San Simeon– Cambria Gap Area— 4 km North of Half Graben Fault. Seismic line
	Figure 4.5-3	seismic	33	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-251. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	San Simeon– Cambria Gap Area— 5.5 km North of Half Graben Fault. Seismic line
	Figure 4.5-4	seismic	34	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-250. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	San Simeon– Cambria Gap Area—6.5 km North of Half Graben Fault. Seismic line
	Figure 4.5-5	seismic	35	Central.Coastal California Seismic.Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-245. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	San Simeon Fault—South End. Seismic line
	Figure 4.5-6	seismic	36	Central.Coastal California Seismic.Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2009 Seismic Survey, Line PBS-239. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	San Simeon Fault—North End. Seismic line
	Figure 4.5-7	seismic	37	Central.Coastal California Seismic.Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Figures.pdf	May-14	USGS 2008 Seismic Survey, Line PBS-36. Interpretation of seismic reflection data point buchon to san simeon point (PG&E)	Unassigned Faults Offshore of Irish Hills. Seismic line
Ch4.GEO.DCPP.TR.14.05_R0_Plates		PDF		Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Plates.pdf			
	Plate 1	map	1	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Plates.pdf		Interpretation of Seismic reflection data point Buchon to San Simeon (PG&E)	Regional Bathymetry
	Plate 2	map	2	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Plates.pdf		Interpretation of Seismic reflection data point Buchon to San Simeon (PG&E)	Regional Structural Trends and Marine Magnetic Anomalies
	Plate 3	map	3	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Plates.pdf		Interpretation of Seismic reflection data point Buchon to San Simeon (PG&E)	Limited data areas on seismic surveys
	Plate 4	map	4	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Plates.pdf		Interpretation of Seismic reflection data point Buchon to San Simeon (PG&E)	Southern Area Structural Trends
	Plate 5	map	5	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Plates.pdf		Interpretation of Seismic reflection data point Buchon to San Simeon (PG&E)	Central Area Structural Trends
	Plate 6	map	6	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Plates.pdf		Interpretation of Seismic reflection data point Buchon to San Simeon (PG&E)	Northern Area Structural Trends
	Plate 7	map	7	Central Coastal California Seismic Imaging Project\Ch4.GEO.DCPP.TR.14.05_R0_Plates.pdf		Interpretation of Seismic reflection data point Buchon to San Simeon (PG&E)	Sediment Thickness Along Half Graben Fault

Ch5.GEO.DCPP.TR.14.04_R0_App_A-G_Figure		PDF		Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_App_A-G_Figure.pdf			
	Figure 1 through 3	map	5 through 7	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_App_A-G_Figure.pdf		Dr. Felix Waldhauser	Part of the Sensitivity Study for Optimum OBS Station Locations. Figures dictate the best locations for ocean bottom seismometers.
	Figure 4	map	8	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_App_A-G_Figure.pdf		Dr. Felix Waldhauser	Suggested OBS locations and their corresponding errors from HYPOINVERSE for synthetic events recorded at stations within 20 km (top) and 55 km (bottom).
	Figure 1	map	125	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_App_A-G_Figure.pdf	Jan-14	Padre Associates, Inc.	A map of region and site seafloor habitats with installed OBS and Cable Locations.
	Figure 2	map	126	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_App_A-G_Figure.pdf	Jan-14	Padre Associates, Inc.	Map of Installed OBS and Cable Locations with Marine Protected area
	Figure 3	map	127	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_App_A-G_Figure.pdf	Jan-14	Padre Associates, Inc.	Map of OBS and Cable as Laid Locations with NOAA Nautical chart,
	Figure 1	map	133	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_App_A-G_Figure.pdf		Tenera Environmental	OBS cable nearshore section through the DCPP intake cove showing the as-built alignment (green) and planned alignment (red) and divided into three segments based on substrate habitats crossed.
Ch5.GEO.DCPP.TR.14.04_R0_Figures		PDF		Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf			
	Figure 1-1	map	1	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	May-14	Point Buchon OBS Project (PG&E)	Map of Central Coast Region Seismic Networks
	Figure 1-2	map	2	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	May-14	Point Buchon OBS Project (PG&E). Seismicity (J. Hardebeck, pers. comm., 2014)	Map of OBS and On-Land Seismic Stations with Seismicity
	Figure 2-1	map	3	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	May-14	Point Buchon OBS Project (PG&E), Dr. Felix Waldhauser	Map pf Sensitivity Analysis for Optimum OBS Station Locations
	Figure 2-2	map	4	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	May-14	Point Buchon OBS Project (PG&E), Dr. Felix Waldhauser	Map of Sensitivity Analyses: Location and Error Results Using Synthetic Event Locations
	Figure 2-3	map	5	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Sep-14	Point Buchon OBS Project (PG&E). Padre Associates, Inc.	A map of Seafloor Habitats with Installed OBS and Cable Locations, Marine Protected Area, and Original Planned OBS and Cable Locations
	Figure 3-2	map	8	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Map: (a) Vertical Seafloor Profile and (b) Water Depth and Habitat Type for As-Laid Cable Route from OBS-4 to DCPP Shoreline Intake
	Figure 4-1		9	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Map of Noise Survey: OBS Location Relative to the Waverider Buoy
	Figure 4-3		11	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	May-14	Point Buchon OBS Project (PG&E)	Noise Survey: Short-Period Noise Recorded on Temp-2
	Figure 4-4		12	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	May-14	Point Buchon OBS Project (PG&E)	Noise Survey: Long-Period Noise Recorded on Temp-1 and Temp-2
	Figure 4-5		13	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	May-14	Point Buchon OBS Project (PG&E)	Noise Survey: DPG Recording and Spectrogram
	Figure 4-6		14	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	May-14	Point Buchon OBS Project (PG&E)	Noise Survey: Example of Artificial Noise from Temp-1 vs. Temp-2 Recordings
	Figure 4-7	map	15	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Map of Earthquake Location Study Using OBS Recorded Data
	Figure 4-8		16	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E). USGS velocity model for the California Central Coast region from Dr. David Oppenheimer (oppen@usgs.gov).	Comparison of the USGS and PG&E CCSN Velocity Models (Depth over velocity)
	Figure 4-9		17	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	OBS Recordings for the M 2.35 Earthquake on 28 Nov 2013
	Figure 4-10	Focal Mechanism	18	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanisms for the M 2.35 Earthquake on 28 Nov 2013—Original NCSN Catalog Data with OBS-4 Data (USGS Velocity Model)
	Figure 4-11	Focal Mechanism	19	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanisms for the M 2.35 Earthquake on 28 Nov 2013—Original NCSN Catalog Data with OBS-4 Data (PG&E Velocity Model)
	Figure 4-12	Focal Mechanism	20	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanism for the M 2.35 Earthquake on 28 Nov 2013—Original NCSN Catalog Data with No OBS Data (PG&E Velocity Model)
	Figure 4-13	Focal Mechanism	21	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanisms for the M 2.35 Earthquake on 28 Nov 2013—Original NCSN Catalog Data with All OBS Data (USGS Velocity Model)
	Figure 4-14		22	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	OBS Recordings for the M 0.81 Earthquake on 08 Feb 2014
	Figure 4-15	Focal Mechanism	23	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanisms for the M 0.81 Earthquake on 08 Feb 2014—Original NCSN Catalog Data with OBS-1 and -4 Data (USGS Velocity Model)
	Figure 4-16	Focal Mechanism	24	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanisms for the M 0.81 Earthquake on 08 Feb 2014—Original NCSN Catalog Data with OBS-1 and -4 Data, (PG&E Velocity Model)

	Figure 4-17	Focal Mechanism	25	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanisms for the M 0.81 Earthquake on 08 Feb 2014—Original NCSN Catalog Data with No OBS Data (PG&E Velocity Model)
	Figure 4-18		26	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	OBS Recordings for the M 1.24 Earthquake on 11 Feb 2014
	Figure 4-19	Focal Mechanism	27	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanisms for the M 1.24 Earthquake on 11 Feb 2014—Original NCSN Catalog Data with All OBS Data (USGS Velocity Model)
	Figure 4-20	Focal Mechanism	28	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanism for the M 1.24 Earthquake on 11 Feb 2014—Original NCSN Catalog Data with All OBS Data (PG&E Velocity Model)
	Figure 4-21	Focal Mechanism	29	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanisms for the M 1.24 Earthquake on 11 Feb 2014—Original NCSN Catalog Data with No OBS Data (PG&E Velocity Model)
	Figure 4-22	Focal Mechanism	30	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanisms for the M 1.24 Earthquake on 11 Feb 2014—Original NCSN Catalog Data with All OBS Data and added PG&E S-Wave Picks, (USGS Velocity Model)
	Figure 4-23		31	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	OBS-4 Recording for the M 0.88 Earthquake on 01 Apr 2014
	Figure 4-24	Focal Mechanism	32	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanisms for the M 0.88 Earthquake on 01 Apr 2014—Original NCSN Catalog Data with OBS-4 Data (USGS Velocity Model)
	Figure 4-25	Focal Mechanism	33	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanisms for the M 0.88 Earthquake on 01 Apr 2014—Original NCSN Catalog Data with OBS-4 Data, (PG&E Velocity Model)
	Figure 4-26	Focal Mechanism	34	Central Coastal California Seismic Imaging Project\Ch5.GEO.DCPP.TR.14.04_R0_Figures.pdf	Jun-15	Point Buchon OBS Project (PG&E)	Focal Mechanisms for the M 0.88 Earthquake on 01 Apr 2014—Original NCSN Catalog Data with No OBS Data (PG&E Velocity Model)
Ch6.HESS_HOSGRI_Report_Figure		PDF		Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf			
	Figure 1-1	map	1	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	Hosgri Fault Geophysical Survey (PG&E). - HESS seismic-reflection profiles A-A' to H-H' from Willingham et al. (2013) - LESS seismic-reflection profiles (PBS) from Johnson and Watt (2012) - Potential field profiles I-I' and J-J' based on joint inversion of gravity and magnetic data from Langenheim et al. (2013)	Map Showing the Structural Trend of the HFZand the Location of LESS and HESS Seismic-Reflection and Potential Field Profiles
	Figure 1-2	Seismic	2	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	Hosgri Fault Geophysical Survey (PG&E). Western W74A, Willingham et al. (2013).	Seismic line:HESS Profile A-A'
	Figure 1-3	Seismic	3	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	Hosgri Fault Geophysical Survey (PG&E). (a) USGS 2D LESS profile (PBS-049, Johnson and Watt, 2012). (b) HESS Profile B - B' (Western W76A, Willingham et al., 2013)	Seismic line: USGS 2D LESS Profile PBS-049and HESS Profile B - B'
	Figure 1-4	Seismic	4	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	Hosgri Fault Geophysical Survey (PG&E). (a) USGS 2D LESS profile (PBS-043, Johnson and Watt, 2012). (b) HESS Profile C'' - C''' (CM86-33, Willingham et al., 2013)	Seismic Line: USGS 2D LESS Profile PBS-043and HESS Profile C'' - C'''
	Figure 1-5	Seismic	5	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	Hosgri Fault Geophysical Survey (PG&E). (a) USGS 2D LESS profile (PBS-021, Johnson and Watt, 2012). (b) HESS Profile D - D' (Line GSI-85, Willingham et al., 2013)	Seismic Line: USGS 2D LESS Profile PBS-021and HESS Profile D - D'
	Figure 1-6	Seismic	6	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	Hosgri Fault Geophysical Survey (PG&E). (a) USGS 2D LESS profile (PBS-026, Johnson and Watt, 2012). (b) HESS Profile E - E' (GSI-87, Willingham et al., 2013)	Seismic Line: USGS 2D LESS Profile PBS-026and HESS Profile E - E'
	Figure 1-7	Seismic	7	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	CM86-117, Willingham et al. (2013). Hosgri Fault Geophysical Survey (PG&E).	Seismic Line: HESS Profile F - F'
	Figure 1-8	Seismic	8	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	Hosgri Fault Geophysical Survey (PG&E). (a) USGS 2D LESS profile (PBS-047a, Johnson and Watt, 2012). (b) HESS Profile G - G' (J-126, Willingham et al., 2013)	Seismic line: USGS 2D LESS Profile PBS-047aand HESS Profile G - G'

	Figure 1-9	Seismic	9	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	Hosgri Fault Geophysical Survey (PG&E). Willingham et al. (2013), PG&E FLEC (1987).	Seismic Line: HESS Profile C - C'(Part of PG&E Profile PGE-1)
	Figure 1-10	Seismic	10	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	Hosgri Fault Geophysical Survey (PG&E). Willingham et al. (2013), PG&E FLEC (1987).	Seismic Line: HESS Profile H - H'(Part of PG&E Profile PGE-3)
	Figure 1-11	map	11	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14		Map of Proposed Track Lines for PG&E CCCSIP HESS.
	Figure 2-1	map	12	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	Hosgri Fault Geophysical Survey (PG&E). Langenheim et al. (2013).	Potential Field Maps for California Coastal Region. Gravity and Magnetics.
	Figure 2-2	graph	13	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	Hosgri Fault Geophysical Survey (PG&E). Langenheim et al. (2013).	Graphs of Gravity and Magnetic Model and a Cross Section I - I' (Estero Bay)
	Figure 2-3	graph	14	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Jul-14	Hosgri Fault Geophysical Survey (PG&E). Langenheim et al. (2013).	Graphs pf Gravity and Magnetic Model and Cross Section J - J' (Point Sal)
	Figure 3-1	map	15	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Aug-14	Hosgri Fault Geophysical Survey (PG&E). HASH; Hardebeck and Shearer, 2002. FPFIT; Reasenberg and Oppenheimer, 1985	Map of earthquake locations and single-event earthquake focal mechanisms along the central coast ranges.
	Figure 3-2	graph	16	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Aug-14	Hosgri Fault Geophysical Survey (PG&E). HASH; Hardebeck and Shearer, 2002. FPFIT; Reasenberg and Oppenheimer, 1985	Graph of Hosgri seismicity depth sections a-a' and b-b'
	Figure 3-3	graph	17	Central Coastal California Seismic Imaging Project\Ch6.HESS_HOSGRI_Report_Figure.pdf	Aug-14	DCPP 3D/2D Seismic reflection investigation. (PG&E). HASH; Hardebeck and Shearer, 2002. FPFIT; Reasenberg and Oppenheimer, 1985	Seismicity in relation to depth of 3D/2D seismic reflection and potential field imaging.
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	Figure 2-4	Stratigraphy	5	Central Coastal California Seismic Imaging Project\Ch7.GEO.DCPP.TR.14.03_R0_Figures.pdf	Feb-14	2011 ONSIP. Epoch, benthic foraminiferal zones, and coastal onlap data are from McDougall (2008). Irish Hills stratigraphy modified, from Hall (1973b)	Tertiary Stratigraphy of the Pismo Syncline in the Irish Hills
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	Figure 2-6	Map	7	Central Coastal California Seismic Imaging Project\Ch7.GEO.DCPP.TR.14.03_R0_Figures.pdf	Jun-14	2011 ONSIP. (Langenheim et al., 2009).	Merged Aeromagnetic and Marine Magnetic Data
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	Figure 5-5	Seismic	13	Central Coastal California Seismic Imaging Project\Ch7.GEO.DCPP.TR.14.03_R0_Figures.pdf	Jun-14	2011 ONSIP.	Vibroseis Line 204 West: (a) Uninterpreted and (b) Interpreted
	Figure 5-6	Seismic	14	Central Coastal California Seismic Imaging Project\Ch7.GEO.DCPP.TR.14.03_R0_Figures.pdf	Jun-14	2011 ONSIP.	Alternative Interpretation of AWD Line 204: (a) Uninterpreted and (b) Interpreted
	Figure 5-7	Seismic	15	Central Coastal California Seismic Imaging Project\Ch7.GEO.DCPP.TR.14.03_R0_Figures.pdf	Jun-14	2011 ONSIP.	AWD Line 112-140: (a) Uninterpreted and (b) Interpreted
	Figure 5-8	Seismic	16	Central Coastal California Seismic Imaging Project\Ch7.GEO.DCPP.TR.14.03_R0_Figures.pdf	Jun-14	2011 ONSIP.	Alternative Interpretation of AWD Line 112-140: (a) Uninterpreted and (b) Interpreted
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	Figure 5-29	Seismic	37	Central Coastal California Seismic Imaging Project\Ch7.GEO.DCPP.TR.14.03_R0_Figures.pdf	Jun-14	2011 ONSIP.	AWD Line 114: (a) Uninterpreted and (b) Interpreted
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Ch7.GEO.DCPP.TR.14.03_R0_Plates		PDF		Central Coastal California Seismic Imaging Project\Ch7.GEO.DCPP.TR.14.03_R0_Plates.pdf			
	Plates 1-6	map	1 through 6	Central Coastal California Seismic Imaging Project\Ch7.GEO.DCPP.TR.14.03_R0_Plates.pdf			Gravity profile and geologic map. Plates look like they are in multiple pieces and need to be stacked together in Illustrator

Ch8.Fugro.PGEQ-PR-21_R0_Figures_incl_App_A				Central Coastal California Seismic Imaging Project\Ch8.Fugro.PGEQ-PR-21_R0_Figures_incl_App_A.pdf			
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	Figure 1-2	Map	2	Central Coastal California Seismic Imaging Project\Ch8.Fugro.PGEQ-PR-21_R0_Figures_incl_App_A.pdf	2011	CCCSIP (PG&E and Fugro). Geologic data from PG&E (2014) Geologic Mapping Compilation, shaded relief from LiDAR and multibeam data (PG&E, 2010 and 2011).	Irish Hills 2011 2D/3D Seismic Acquisition Geometry
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	Figure 2-6	Map	10	Central Coastal California Seismic Imaging Project\Ch8.Fugro.PGEQ-PR-21_R0_Figures_incl_App_A.pdf	2011	CCCSIP (PG&E and Fugro).	2012 Zland Seismic Acquisition Geometry
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	Figure 3-2	Stereonets	14	Central Coastal California Seismic Imaging Project\Ch8.Fugro.PGEQ-PR-21_R0_Figures_incl_App_A.pdf	2011	Strike and dip data displayed for the south limb of the Pismo Syncline, taken from GMP Plate 1 GIS attribute table (PG&E, 2014).	Strike and Dip Stereonet Plots for Obispo and Monterey Formations, South Limb Pismo Syncline
	Figure 3-3	Map	15	Central Coastal California Seismic Imaging Project\Ch8.Fugro.PGEQ-PR-21_R0_Figures_incl_App_A.pdf	2011	CCCSIP, (PG&E and Fugro). Gravity data from Langenheim (2014).	Complete Bouguer Gravity Anomaly Map
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	Figure 3-8	Map	20	Central Coastal California Seismic Imaging Project\Ch8.Fugro.PGEQ-PR-21_R0_Figures_incl_App_A.pdf	2011	CCCSIP (PG&E and Fugro). Geologic data from PG&E (2014a, Plate 1), shaded relief from LiDAR and multibeam data (PG&E, 2010 and 2011).	Phase 2 Geologic Map
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	Figure A-32	map	104	Central Coastal California Seismic Imaging Project\Ch8.Fugro.PGEQ-PR-21_R0_Figures_incl_App_A.pdf	2011	CCCSIP (PG&E and Fugro). 2012 Onshore Seismic Survey Report	Isodensity Map, 2.70 g/cm3
Ch9.GEO.DCPP.TR.14.01 R0_App_A-E_Figure		PDF		Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01 R0_App_A-E_Figure.pdf			
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	Figure E2-3	map	81	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01 R0_App_A-E_Figure.pdf	May-14	DCPP Geologic Mapping Project. LiDAR-derived hillshade overlain by USGS topographic quadrangle map	Location of the Maino-Gonzales 1 and Spooner 1 Wells
	Figure E2-4	map	82	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01 R0_App_A-E_Figure.pdf	May-14	DCPP Geologic Mapping Project. LiDAR-derived hillshade overlain by USGS topographic quadrangle map	Location of the Pecho 1 Well
	Figure E2-5	map	83	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01 R0_App_A-E_Figure.pdf	May-14	DCPP Geologic Mapping Project. LiDAR-derived hillshade overlain by USGS topographic quadrangle map	Location of the Honolulu-Tidewater 1 Well
	Figure E2-6	map	84	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01 R0_App_A-E_Figure.pdf	May-14	DCPP Geologic Mapping Project. LiDAR-derived hillshade overlain by USGS topographic quadrangle map	Location of the Montadoro 1 Well
	Figure E2-7	map	85	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01 R0_App_A-E_Figure.pdf	May-14	DCPP Geologic Mapping Project. LiDAR-derived hillshade overlain by USGS topographic quadrangle map	Location of the Sousa 1 Well
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	Figure E2-11	log	89	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01 R0_App_A-E_Figure.pdf	May-14	DCPP Geologic Mapping Project	Sonic Logs for Guidetti A3 and Guidetti A4 Wells
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Ch9.GEO.DCPP.TR.14.01_R0_App_E_Plates		PDF		Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01_R0_App_E_Plates.pdf			
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	Plate E2	log	2	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01_R0_App_E_Plates.pdf	Apr-14	DCPP Geologic Mapping Project	Log of the Pecho 1 Well
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	Plate E4a	log	4	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01_R0_App_E_Plates.pdf	Apr-14	DCPP Geologic Mapping Project	Log of the Honolulu-Tidewater 1 Well
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	Figure 3-6	map	7	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01_R0_Figures.pdf	May-14	DCPP Geologic Mapping Project	Geologic Maps by T.W. Dibblee Reviewed for This Study
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	Figure 7-1	map	11	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01_R0_Figures.pdf	May-14	DCPP Geologic Mapping Project	Locations of Significant Revisions to Existing Geologic Maps
	Figure 7-2	map	12	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01_R0_Figures.pdf	Jun-14	DCPP Geologic Mapping Project	Comparison of (a) Revised and (b) Previous (AMEC, 2012a) Mapping, NE Margin of Pismo Syncline
	Figure 7-3	map	13	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01_R0_Figures.pdf	Jun-14	DCPP Geologic Mapping Project	Comparison of (a) Revised an (b) Previous (AMEC, 2012a) Mapping, Pismo Formation/Monterey Formation Contact
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	Figure 7-7	map	17	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01_R0_Figures.pdf	Jun-14	DCPP Geologic Mapping Project. (a)Image Source: Composite DEM, version 7 (DCPP Geodatabase, 2013) (b)Image Source: Composite DEM, version 6 (DCPP Geodatabase, 2011)	Comparison of (a) Revised and (b) Previous (PG&E, 2011) Artificial Hillshade Images of the Discharge Cove Area
	Figure 7-8	map	18	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01_R0_Figures.pdf	Jun-14	DCPP Geologic Mapping Project. Magnetic data are from Langenheim et al. (2012).	Helicopter Magnetic Survey Data in the DCPP Area and Inferred Geologic Contact between Tmod and Tmor
Ch9.GEO.DCPP.TR.14.01_R0_Plates		PDF		Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01_R0_Plates.pdf			
	Plate 1	map	1	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01_R0_Plates.pdf	Jun-14	DCPP Geologic Mapping Project (PG&E). Long list of sources listed on the plate for the geologic map	Geologic Map of the Irish Hills and Adjacent Area
	Plate 2	map	2	Central Coastal California Seismic Imaging Project\Ch9.GEO.DCPP.TR.14.01_R0_Plates.pdf	Jun-14	DCPP Geologic Mapping Project (PG&E). Long list of sources listed on the plate for the geologic map	Diablo Canyon Power Plant Site Geologic Map
Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B		PDF		Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf			
	Figure 2-1	map	2	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	Imagery from NAIP (2009). DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	3D Tomography Source and Receiver Locations
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	Figure 3-1	map	4	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	2012 Phase 1 DCPP 3D Survey Source and Receiver Locations Detail
	Figure 3-2	graph	5	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	2011 and 2012 Phase 1 Joint Travel-Time-Gravity Inversion Residual Distribution
	Figure 3-3	graph	6	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	2012 Phase 1 Offset <15,000-Foot Travel-Time-Inversion Residual Distribution
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	Figure 5-1	Photo	9	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	Imagery from TetraTech (2010). DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	DCPP Source-Receiver Pairs
	Figure 5-2	graphs	10	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	2D Rayfract Vp Models and Ray Coverage
	Figure 5-3		11	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	DCPP Receiver-Group Offset Stacks
	Figure 5-4	graph	12	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	1D Lateral Depth Averages of 2D Vp and 3D Vp Compared with 1D Vp-Depth
	Figure 5-5	seismic	13	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	DCPP Surface-Wave Dispersion
	Figure 5-6	depth model	14	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	1D Vs-Depth Models From Inversion of Surface Wave Dispersion
	Figure 5-7	graph	15	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	Comparison of IMASW Vs Depth with GeoTomo 3D Vs Depth
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	Figure 6-1	Depth Profile	17	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	DCPP Vs Depth Profiles Along Transects A–D
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	Figure 6-3	Depth Profile	19	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	Vs Elevation Profiles from Five Obispo Formation Sites Using Vp/Vs=2.45
	Figure A1	map	23	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2011	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo). Imagery from NAIP (2009).	Velocity Model Location Map
	Figure A2	model	24	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf	2014	DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	DCPP FLAC3D Model (Jigsaw Model)
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	Figure B-1	Depth Profile	27	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf		DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	DCPP Vs Depth Profiles Along Transect A-A'
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	Figure B-3	Depth Profile	29	Central Coastal California Seismic Imaging Project\Ch10.Fugro.PGEQ-PR-16_R1_Figures_incl_App_A-B.pdf		DCPP FOUNDATION VELOCITY REPORT (PG&E and Furgo)	DCPP Vs Depth Profiles Along Transect C-C'
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Ch11.GEO.DCPP.TR.14.06_R0_Figures		PDF		Central Coastal California Seismic Imaging Project\Ch11.GEO.DCPP.TR.14.06_R0_Figures.pdf			
	Figure 3-1	map	1	Central Coastal California Seismic Imaging Project\Ch11.GEO.DCPP.TR.14.06_R0_Figures.pdf	Aug-14	Site conditions evaluation (PG&E)	Locations of the Free-Field Ground-Motion Stations at the DCPP
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	Figure 3-3	graph	3	Central Coastal California Seismic Imaging Project\Ch11.GEO.DCPP.TR.14.06_R0_Figures.pdf	Aug-14	Site conditions evaluation (PG&E)	Factor to Correct for the Differences in the VS30 Values at ESTA27 and ESTA28 Based on the VS30 Scaling in the NGA-West2 GMPEs
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	Figure 3-5	graph	5	Central Coastal California Seismic Imaging Project\Ch11.GEO.DCPP.TR.14.06_R0_Figures.pdf	Aug-14	Site conditions evaluation (PG&E)	Site Amplification (760–1200 m/s) Given in RIL 12-01 (from Table 5-7 in NRC, 2012)
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Ch12.GEO.DCPP.TR.14.07_R0_Figures		PDF		Central Coastal California Seismic Imaging Project\Ch12.GEO.DCPP.TR.14.07_R0_Figures.pdf			
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	Figure 6-2	map	2	Central Coastal California Seismic Imaging Project\Ch12.GEO.DCPP.TR.14.07_R0_Figures.pdf	Jul-14	Fugro (2014a). Response to Dr. Hamilton's Testimony (PG&E)	Locations of Sources and Receivers in the DCPP Area for the 2012 3D Seismic Survey
	Figure 6-3	map	3	Central Coastal California Seismic Imaging Project\Ch12.GEO.DCPP.TR.14.07_R0_Figures.pdf	Jul-14	Modified from slide 22 of Dr. Hamilton's presentation at DCPP SSHAC Workshop No. 2 (November 2012). Fault names were added by PG&E. Response to Dr. Hamilton's Testimony (PG&E)	Interpretation of the Diablo Cove Fault Across the DCPP Site and Diablo Cove from Hamilton (2012c)
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	Figure 6-6	map	6	Central Coastal California Seismic Imaging Project\Ch12.GEO.DCPP.TR.14.07_R0_Figures.pdf	Jul-14	Jahns (1966, 1967a, 1967b, 1968); Jahns et al. (1973); PG&E (2014b). Response to Dr. Hamilton's Testimony (PG&E)	Geologic Map of the DCPP Site Showing Faults Identified During Pre-Construction Studies: (a) PG&E (1974) and (b) PG&E (2014b).
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	Figure 6-13	map	13	Central Coastal California Seismic Imaging Project\Ch12.GEO.DCPP.TR.14.07_R0_Figures.pdf	Jul-14	PG&E (2014b). FCL (2014b). Response to Dr. Hamilton's Testimony (PG&E)	Geologic Map of the DCPP Site Area Showing Locations of Seismic Lines and Shallow Geologic Cross Sections

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	Figure 1-2	graph	14	Central Coastal California Seismic Imaging Project\Technical_Summary.pdf	Aug-14	CCCSIP Report (PG&E)	The 84th percentile deterministic ground motions for four fault scenarios compared to the 1977 Hosgri Earthquake and the 1991 LTSP/SSER 34 spectra for the DCPP Turbine Building
	Figure 1-3	graph	15	Central Coastal California Seismic Imaging Project\Technical_Summary.pdf	Aug-14	CCCSIP Report (PG&E)	The 84th percentile deterministic ground motions for Joint shoreline and Hosgri-San Simeon Fault Rupture compared to the 1977 Hosgri Earthquake and the 1991 LTSP/SSER 34 spectra for the DCPP Power block and Turbine Buildings
Concern Document 3		PDF		DCPP Shoreline and Thrust Fault Allegation\Concern document 3.pdf	08/16/2011		Document contains a letter from a consulting geologist to Lois M. James, Senior Allegations Coordinator Office of Nuclear Reactor Regulation, comments for CEC IEPR Seismic Safety Workshop, Revised Seismic Hazard to DCNPP, and a list of three instances where PG&E appears to have either underestimated or failed to recognize (or acknowledge) potential seismic hazards to DCNPP
	2-1-(2)	Map	19	DCPP Shoreline and Thrust Fault Allegation\Concern document 3.pdf		Location and focal mechanism of pre Mclaren and Savage 2001	October 1987 through January 1997, Bull. Seism. Map with beach balls along major fault zones in the area
	2-3-(1)	Map	20	DCPP Shoreline and Thrust Fault Allegation\Concern document 3.pdf			Map Showing the Onshore and Offshore Terrain and Fault Traces, Estero Bay.. Irish Hills/Los OSOS Valley" and San Luis Obispo Bay Region
	2-3-(2)	Cross Section	21	DCPP Shoreline and Thrust Fault Allegation\Concern document 3.pdf			Geologic Cross Section A-B Showing Geologic Setting in the Vicinity of DCNPP
	2-3-(3)	Cross Section	22	DCPP Shoreline and Thrust Fault Allegation\Concern document 3.pdf			Cross Section Showing Earthquake Hypocenters and Faults, Irish Hills/Los Osos Valley and Adjacent Offshore Area
	2-3-(4)	Cross Section	23	DCPP Shoreline and Thrust Fault Allegation\Concern document 3.pdf			Diagrammatic Cross Section Showing Tectonics of Uplift and Scarp Formation Irish Hills and Adjacent Offshore Area
	I-28	Map	24	DCPP Shoreline and Thrust Fault Allegation\Concern document 3.pdf		California Department of Conservation Division of Mines and Geology. Nitchman and Slemmons (1994)	Generalized structural map of the San Luis Range
	2-4-(1)	Map	25	DCPP Shoreline and Thrust Fault Allegation\Concern document 3.pdf	2010	Onshore Geology from Hall, 1973b and Jahnus, 1966, 1967, 1978. Offshore geology from Multibeam image from PG&E	Geologic Map, Onshore and Offshore, of Diablo Cove Fault Area
	2-6-(4)	Map	32	DCPP Shoreline and Thrust Fault Allegation\Concern document 3.pdf			Untitled topographic and geologic map around plant
	2-6-(5)	Map	33	DCPP Shoreline and Thrust Fault Allegation\Concern document 3.pdf			GEOLOGIC MAP OF UNITS 1 AND 2 CONSTRUCTION EXCAVATIONS
	Figure 5-8	map	39	DCPP Shoreline and Thrust Fault Allegation\Concern document 3.pdf		PG&E SHORELINE FAULT ZONE STUDY	Seismic source model map traces of Hosgri, Los Osos, San Luis Bay, and Shoreline fault sources
	No Title		42	DCPP Shoreline and Thrust Fault Allegation\Concern document 3.pdf		PG&E SHORELINE FAULT ZONE STUDY	DHH Seismic source model map traces of Hosgri, Los Osos, San Luis Bay, and Shoreline fault sources
Concern Document 4		PDF (text)		DCPP Shoreline and Thrust Fault Allegation\Concern document 4.pdf	04/29/2011	Dr. Annie Kammerer (seismic hazard and risk specialist)	Document contains report titled "Evaluation of Technical Information Provided in Allegation NRR-201 O-A-022". This report evaluates the technical information provided in allegation NRR-2010-A-0022.
DCnrcTSBfnl		Word Doc		Diablo Canyon ISFSI SER\DCnrcTSBfnl.doc			TECHNICAL SPECIFICATIONS BASES FOR THE DIABLO CANYON INDEPENDENT SPENT FUEL STORAGE INSTALLATION. Docket No. 72-26 Materials License No. SNM-2511
DCnrcTSfnl		Word Doc		Diablo Canyon ISFSI SER\DCnrcTSfnl.doc			Appendix: TECHNICAL SPECIFICATIONS BASES FOR THE DIABLO CANYON INDEPENDENT SPENT FUEL STORAGE INSTALLATION. Docket No. 72-26 Materials License No. SNM-2511
DCPP SSC Report Rev A		PDF		NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	03/01/2015		
	Figure ES-1	Map	44	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E). Quaternary fault traces from Lettis and Hall 1994, Lettis et al 2004, AMEC 20011, PG&E 2013a, 2014, Chapter3, 2014, Chapter 9. Relocated earthquake data from Hardebeck 2014a	Regional distribution of seismicity from 1987 to 2013 and faults in the site area
	Figure 5-1	map	118	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E). Modified from Langenheim, Jachens, et al 2012. Jennings et al 1977, Jennings and Bryant 2010	Simplified geologic map and shaded relief topographic map of Central California Coast Region
	Figure 5-3	Diagram	120	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E). Modified from Dickinson 1981 and Irwin 1990	Post-30 Ma Development of the San Andreas Transform Boundary
	Figure 5-4	Cross Section	121	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E). PG&E-3 Seismic line. Crustal Velocity from Howie et al 1993. Earthquakes from Hardebeck 2010.	Deep Crustal Cross Section along Seismic line PG&E-3
	Figure 5-5	Stratigraphy	122	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E). Stratigraphic columns from Santa Maria Basin from Willingham et al 2013. Stratigraphic column for Pismo Basin from PG&R 2011 and Hall 1973.	Generalized Stratigraphic Columns for the Project Study Area
	Figure 5-13	graph and map	130	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E). Modified from DeMets et al 2014	Synthesis of Fault-Parallel rates for stations wthin a coastal transect equidistant from the San Andreas Fault.
	Figure 5-14	map	131	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E). Modified from Murray 2012	Resolved GPS Strain Rates on Tectonic Block Boundaries

Figure 5-15	map	132	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Feb-15	DCPP SSC Report (PG&E). Modified from Bird (2012)	GPS strain rates from the NeoKinema Model in South-Central Coastal California
figure 5-19	map	136	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E). From PG&E 2011	Example interpretation of submerged wavecut platforms from bathymetric data
Figure 7-4	map	201	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E). From PG&E 2011	Uplift rate contour map of San Luis Range Area
figure 7-6	seismic	203	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Jan-15	DCPP SSC Report (PG&E). USGS seismic reflection data (Sliter et al 2010). Modified from PG&E (2013) and Gray et al (2013)	Evidence of Central and Weastern Hosgri Fault Trace Activity
Figure 7-8	Focal Mechanisms	205	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	Modified from Hardebeck 2012c	Hosgri Fault Dip from first motion Polarity
Figure 7-9	Seismic cross section	206	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	Hardebeck 2014a	Seismicity cross section oriented perpendicular to the Hosgri Fault
Figure 7-10	Seismic cross section	207	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Feb-15	Hardebeck 2014a	Cross sections of the hosgri fault geometry models compared to seismic profiles.
Figure 7-14	seismic	211	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Feb-15	modified from PG&E 2014 chapter 7.	Vibroseis Line 204 North
Figure 8-4	graph	291	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Feb-15	Handon et al 1994, Muhs et al 2012	Comparison of Marine Terrace Uplift Rates on the Irish Hills Coastline from Alternative Paleosea-Level Models
Figure 8-10	map	297	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	PG&E 2013b	Edna Valley and Los Osos Valley Quaternary Terraces and Surfaces
figure 8-15	graph	302	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Feb-15	Handon et al 1994, Muhs et al 2012	Alternative correlations and Paleosea-level models used to evaluate ages of san simeon marine terraces
figure 8-19	seismic	306	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E). USGS seismic reflection data (Sliter et al 2010). Modified from PG&E (2014 chapters 2 and 3)	Excerpt of profile PBS-34 showing Regional Transgressive unconformities and sequence stratigrapihc interptetation
Figure 8-22	seismic	309	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E). USGS seismic reflection data (Sliter et al 2010).	Excerpt of profile PBS-T2 showing channels deep in stratigraphy west of the HFZ in Estero Bay
figure 8-23	seismic	310	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Feb-15	DCPP SSC Report (PG&E).	excerpt of line 1020 showing channel f west of the HFZ in the point sal study area
Figure 8-24	map	311	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E).	map of channels, faults, and bedrock surface on shelf, estero bay study area.
figure 8-25	map	312	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Report (PG&E).	estero bay; piercing point DBw-Ee1-De separation and uncertainty
figure 8-26	seismic	313	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	3D and 2D seismic USGS	Fence diagram showing correlation of channels De and Ee
Figure 8-27	seismic	314	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	3D and 2D seismic USGS	Interpreted fence diagram showing cahnnel DBw west of the HFZ
Figure 8-30	seismic	317	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Feb-15	2012 point sal 3d	Exerpt of line 1368 showing channel complex f East of the HFZ in the point Sal Study area
Figure 8-31	map	318	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Feb-15	2012 point sal 3d	Point sal channel f separation and uncertainty
Figure 8-35	map	322	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Feb-15	PG&E 2014 chapter 4	Shaded relief image of the bedrock surface interpreted from 3D seismic-reflection data in San Luis Obispo Bay study area showing faults, channels, and figure extents.
figure 8-36	seismic	323	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	San Luis Obispo Bay 3D survery	Time Slice 119.3 ms showign terace riser and assessment of offset across shoreline fault
figure 8-37	seismic	324	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Feb-15	San Luis Obispo Bay 3D survery	exerpt of line PBS 279A showing Stratigraphic context of terrace sequence
Figure 8-40	seismic	327	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	San Luis Obispo Bay 3D survery. USGS 2D lines 2010	Smoothed similarity of bedrock surface and crossline 1276 showing channel I intersection with shoreline fault
Figure 8-41	seismic	328	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	San Luis Obispo Bay 3D survery. USGS 2D lines 2010	Smothed similarity of bedrock surface and crossline 672 showing stratigraphic constraints on age of channel I
Figure 8-43	seismic	330	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	San Luis Obispo Bay 3D survery	time slice at 72 ms and crossline 1775 showing channel a intersection with shoreline fault
Figure 8-44	seismic	331	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	San Luis Obispo Bay 3D survery	time slice 66.3 ms showing crosscting relationships between channels A B and C
Figure 8-45	seismic	332	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	San Luis Obispo Bay 3D survery	profile showing difference in depth of incision in upper reaches of chanels a b and c
figure 8-50	seismic	337	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Feb-15	USGS 2D seismic reflection data (Sliter et al 2010)	Exceprt of seismic reflection profile PBS-32 and contours of bedrock surface showing absence of vertical separation across and the Point Buchon Fault
Table 9-17	table	398	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	DCPP SSC Study Rev A	Hosgri slip rate allocation north of the DCPP (evaluation for fault sections Hn and Sl)
figure 9-5	map	404	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Mar-15	modified from Wesnousky (2008, electronic supplement). Lateral offsets from Treiman et al (2002)	Surface Rupture Map for the 1999 hector Mine earthquake
Figure 10-46	graph	502	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf	Feb-15	UCERF3, Fault Model 3.1	Seubsection (Point) participation rate for te Hosgri Fault nearest the DCPP from the UCERF3
Table 11-1	table	521	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf		DCPP SSC Report (PG&E).	Hosgri fault equivalent Poisson ratios for three slip rates, three recurrence models and two minimum open intervals.
Table 11-2	table	522	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf		DCPP SSC Report (PG&E).	SLPB fault equivalent Poisson individual estimates
table 12-5	table	549	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf		DCPP SSC Report (PG&E).	Parameters for the Non-UCERF3 regionalfault sources
Table 13-4	table	568	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf		DCPP SSC Report (PG&E).	Independent earthquakes M>3 in the PG&E catalog, 1988 through 2013
Table 13-5	table	569	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf		DCPP SSC Report (PG&E).	Independent earthquakes M>2.5 in the UCERF3 catalog, 1988 through 2013
table 13-6	table	571	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf		DCPP SSC Report (PG&E).	Independent earthquakes M>4 used and considered to estimatre earthquakes rates in the local source zone based on the updated UCERF3 catalog and McLaren and Savage (2001)
Figure 13-8	graph	590	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf		Hardebeck 2014a	evaluation for Hardebeck 2014a earthquake catalog for estimating the magnitude of completeness for the Local source Zone.
Figure 13-16	map	598	NTTF DCCP PSHA Review\DCPP SSC Report Rev A.pdf		PG&E 2014 chapter 7	geologic mpa of the irish hills showing faults interpreted form geologic, well hole, and seismic reflection data.
			Shoreline and RIL\DCPP FSAR Update.pdf			

	Figure 2.5-2	map	82	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Earthquake epicenters within 200 miles of the plant site.
	Figure 2.5-3	map	83	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	FAULTS AND EARTHQUAKE EPICENTERS WITHIN 75 MILES OF PLANT SITE (FOR EARTHQUAKES WITH ASSIGNED MAGNITUDES)
	Figure 2.5-4	map	84	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	FAULTS AND EARTHQUAKE EPICENTERS WITHIN 75 MILES OF PLANT SITE (FOR EARTHQUAKES WITH ASSIGNED INTENSITIES ONLY)
	Figure 2.5-5	map	85	Shoreline and RIL\DCPP FSAR Update.pdf			**GEOLOGIC AND TECTONIC MAP OF SOUTHERN COAST RANGES IN THE REGION OF PLANT SITE**
	Figure 2.5-6	map	87	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Geologic map of the morro bay south and port Luis quadrangles, san Luis Obispo county, California.
	Figure 2.5-7	Cross Section	88	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Geologic Cross Section through explanatory oil wells in the San Luis Range
	Figure 2.5-8	map	89	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Geologic map of diablo canyon coastal area
	Figure 2.5-9	map	90	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	geologic map of switchyard area
	Figure 2.5-10	Cross Section	91	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Geologic Cross Section through the plant site
	Figure 2.5-11	map	92	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Site exploration features and bedrock contours
	Figure 2.5-12	Cross Section	93	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Geologic Cross Section and sketches along exploratory trenches
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	Figure 2.5-14	map	95	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	relationships of faults and shear at plant site
	Figure 2.5-15	map	96	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	geologic map of excavations for plant facilities
	Figure 2.5-16	Cross Section	97	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	geologic Cross Section through excavations for plant facilities
	Figure 2.5-17	map	98	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	plan of excavation and backfill
	Figure 2.5-19	graph	100	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Soil module of elasticity and Poisson's ratio
	Figure 2.5-20	graph	101	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Smooth response acceleration spectra, earthquake "b"
	Figure 2.5-21	graph	102	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Smooth response acceleration spectra, earthquake "d" modified
	Figure 2.5-23	Stratigraphy	104	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Power plant slope. Log of boring 1
	Figure 2.5-24	Stratigraphy	105	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Power plant slope. Log of boring 2
	Figure 2.5-25	Stratigraphy	106	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Power plant slope. Log of boring 3
	Figure 2.5-26	Stratigraphy	107	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Power plant slope. Log of test pits 1 & 2
	Figure 2.5-27	Stratigraphy	108	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	Power plant slope. Log of test pits 3
	Figure 2.5-28	Stratigraphy	109	Shoreline and RIL\DCPP FSAR Update.pdf		Image quality is too poor to read sources	power plant slope. Soil classification chart and key to test area
DCPP Seismic Hazard Update Slides 1-5-2010				Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf	05-Jan-10		
	Small faults in Southwest Boundary Zone	map	2	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E). PG&E 1988	fault map around the Los Osos fault
	Seismicity –October 1997 to March 2007	map	3	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E). J Hardebeck (USGS)	map of earthquakes
	Alignment of small earthquakes (M < 1 to 3.5)	map	4	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E). J Hardebeck (USGS)	map of earthquakes
	Epicentral uncertainty	map	7	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf	11/25/2009	Lloyd Cluff & Norm Abrahamson (PG&E). J Hardebeck (USGS) and Thurber, 2009 fault interpretation, 2008 MBES data	map of earthquake epicenters
	Seismicity alignment Cross Section	Seismic Cross Section	8	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E). J Hardebeck (USGS) and Thurber	Seismicity Cross Section projecting Hardebeck and Thurber locations
	Point Buchon area with respect to Hardebecks (2009) micro seismicity lineament	map	9	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E). J Hardebeck (USGS)	map of earthquake epicenters differentiated by depth and magnitude
	2009 USGS Marine Survey Area	map	11	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf	2009	Lloyd Cluff & Norm Abrahamson (PG&E).	map of 2009 USGS Marine Survey Area
	Track line map of marine geophysical data collected in 2008 and 2009.	map	12	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E).	Track line map of marine geophysical data collected in 2008 and 2009. Blue = tracks of high resolution marine seismic reflection and magnetic data were collected at 800 m spacing. Red = additional marine magnetics tracks for a net 400 m spacing (Watt et al., 2009).
	Onshore and Offshore Magnetic Integration Survey	map	13	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E).	map of the Boundaries of 2009 helicopter magnetic survey flown with 150 m line spacing at a nominal altitude of 100 m.
	MultibeamEcho-Sounding (MBES) Coverage Offshore Area	map	14	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E).	map of topography/bathymetry. Shaded area offshore of Pt. Buchon collected in 2007 Red track lines = areas collected in 2009
	Pt. Buchon Multibeam Bathymetry	map	15	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		collected as part of CA State Waters Mapping Program byCSU Monterey Bay Seafloor Mapping Lab 2006-2007	geologic map of Point Buchon area
	Schematic diagram of shoreline features used in tectonics studies	diagram	17	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E).	diagram of marine deposits, terrace surface, and wavecut platforms.
	Paleoshorelinesin Point Buchonarea	map	18	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E).	color coded map of paleoshorelines around DCPP
	Profile Delta across N40W Fault Zone	Cross Section	23	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E).	profile from southeast to northwest
	Seismic line PBS-32 across the N40W Faults	seismic	24	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E).	PaleoWave-Cut Platform Tectonic Strain-Gauge Evidence of No Faulting in Past 50 to 60,000 Years
	Hosgri Fault	seismic	25	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E).	screen shot of seismic along the Hosgri Fault
	Raw Multibeam data without interpretation	map	27	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E).	Multibeam (MBES) Image and DEM for the DCPP area
	Preliminary Interpretation	map	28	Shoreline and RIL\DCPP Seismic Hazard Update Slides 1-5-2010.pdf		Lloyd Cluff & Norm Abrahamson (PG&E). Hall 1973 onshore geology	Geologic map of the DCPP area
DCPP_VicinityGrid_InputFile_2014-11-04		Excel Doc		NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-11_VicinitySourceZone_InputFile\DCPP_VicinityGrid_InputFile_2014-11-04.xlsx	11/04/2014		These are the Vicinity gridded areal source zone coordinates and rates

DC_tsunami_memo_13Dec02	Word Doc	Diablo Canyon ISFSI SER\DC_tsunami_memo_13Dec02.doc	12/17/2002		TSUNAMI HAZARD AND DESIGN BASES; SPECIFIC ISSUES FOR THE DIABLO CANYON SITE AND IMPLICIT GENERIC ISSUES FOR EXISTING COASTAL NUCLEAR FACILITIES
Diablbo 7	Graph/JPEG	Figures\Diablbo 7.jpg			Spectral Acceleration (g) over Frequency
Diablo 1	Map/JPEG	Figures\Diablo1.jpg			Map of the study area with the major faults mapped.
Diablo 2	Graph/JPEG	Figures\Diablo 2.jpg			Spectral Acceleration (g) over Frequency. Comparison of DE, DDE, Hosgri, and LTSP Ground Motion Spectra
Diablo 3	Map/JPEG	Figures\Diablo 3.jpg		HASH: Hardebeck and Shearer, 2002. FPFIT: Reasenberg and Oppenheimer, 1985	Map of focal mechanisms along the Hosgri Fault
Daiblo 7	Graph/JPEG	Figures\Daiblo 7.jpg			PGA. Annual Hazard over Spectral Acceleration (g)
Diablo_Calcs	Excel Doc	Diablo Canyon ISFSI SER\Diablo_Calcs.xls			Contains calculation number, volume and title
Diablo Canyon-final	PDF	Figures\Diablo Canyon-final.pdf			(Information Extracted from Reports in ADAMS. Summary of the site, geology, hydrology, seismic hazards, ecology, etc.
Diablo Canyon Resources-1	Excel Doc	Figures\Diablo Canyon Resources-1.xls			List or resources and appendices
Diablo Shoreline	PowerPoint	Figures\Diablo Shoreline.pptx			4 slide PowerPoint about a "capable fault". Includes images from CCCSIP report cites elsewhere in the document catalogue
Diablo USGS EQ data	Text Document or Excel Doc	Shoreline and RIL\Diablo USGS EQ data.txt		USGS	USGS earthquake data
Evaluation of Technical Information Provided in DCPP Seisic Allegation	Word Doc	DCPP Shoreline and Thrust Fault Allegation\Evaluation of Technical Information Provided in DCPP Seisic Allegation.docx	02/10/2012		This report summarizes technical evaluation of information provided in allegation NRR-2010-A-0022, including the recent information provided by the Concerned Individual (CI) in their January 14, 2012 response to NRC Request for Information
Fig 4-17 ANNOT Part A LoRes	Map	Shoreline and RIL\Fig 4-17 ANNOT Part A LoRes.jpg		Shoreline Fault zone study	Earthquake Epicenters with residual marine and coastal helicopter magnetic field data
Fig 4-17 ANNOT Part B	Map	Shoreline and RIL\Fig 4-17 ANNOT Part B.jpg		Shoreline Fault zone study	Earthquake Epicenters with residual marine and coastal helicopter magnetic field data
Figure 2_CI_Report	Map	Shoreline and RIL\Figure 2_CI_Report.jpg			Map of earthquake epicenters and a Cross Section of earthquakes across the shoreline fault and san andreas fault
Figure 3	Map	Shoreline and RIL\Figure 3.jpg			Map showing the proposed 10 km-long extension of the south segment of the Shoreline fault
Figure1_CI_Report	Map	Shoreline and RIL\Figure1_CI_Report.jpg			Map of earthquake epicenters and a Cross Section of earthquakes across the shoreline fault and san andreas fault
Figure3-1b	Map	Shoreline and RIL\Figure3-1b.jpg			Earthquake Epicenters with residual marine and coastal helicopter magnetic field data
Figure3.2	Word Doc	Shoreline and RIL\Figure3.2.docx			Map showing the proposed 10 km-long extension of the south segment of the Shoreline fault
Hardebeck's data for John 9 Feb 2012	Map	Shoreline and RIL\Hardebeck's data for John 9 Feb 2012.jpg			Map of earthquake epicenters and a Cross Section of earthquakes across the shoreline fault and san andreas fault
Hardebecks Hypocenters Cross Section	Map	Shoreline and RIL\Hardebecks Hypocenters Cross Section.jpg			Map of earthquake epicenters and a Cross Section of earthquakes
Hosgri	map/JPEG	Figures\Hosgri.jpg			Map of the Hosgri fault
Hosgri	map/Illustrator	Figures\Hosgri.ai			Map of the Hosgri fault
Hosgri_bath_DEM	Map/JPEG	Figures\Hosgri_bath_DEM.jpg			Map of the Hosgri fault and bathymetry
IPRP Report no 6	PDF	Figures\IPRP Report no 6.pdf	08/12/2013	CALIFORNIA GEOLOGICAL SURVEY, CALIFORNIA COASTAL COMMISSION CALIFORNIA GOVERNOR'S OFFICE OF EMERGENCY SERVICES CALIFORNIA PUBLIC UTILITIES COMMISSION, CALIFORNIA ENERGY COMMISSION CALIFORNIA SEISMIC SAFETY COMMISSION, COUNTY OF SAN LUIS OBISPO	Site shear wave velocity at Diablo Canyon: summary of available data and comments on analysis by PG&E for Diablo Canyon Power Plant seismic hazard studies
Lompoc	Excel Doc	NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-08_Non-UCERF3_Faults_InputFiles\Lompoc.xlsx			Fault input file
Near horizontal view from SE	BMP	Shoreline and RIL\Near horizontal view from SE.bmp			3D image of earthquakes below regional map
NCEDC data for John 9 Feb 2012	Map	Shoreline and RIL\NCEDC data for John 9 Feb 2012.jpg			Map of earthquake epicenters and a Cross Section of earthquakes across the shoreline fault and san andreas fault
New Diablo EQs	Map	Shoreline and RIL\New Diablo EQs.jpg			Google earth screen shot of Eqs
Options for SE end of fault 2	Map	Shoreline and RIL\Options for SE end of fault 2.jpg			Map showing the proposed 10 km-long extension of the south segment of the Shoreline fault
Oblique aerial from E	BMP	Shoreline and RIL\Oblique aerial from E.bmp			3D image of earthquakes below regional map
Oblique aerial from S	BMP	Shoreline and RIL\Oblique aerial from S.bmp			3D image of earthquakes below regional map
Oblique aerial from SE	BMP	Shoreline and RIL\Oblique aerial from SE.bmp			3D image of earthquakes below regional map
Oblique aerial from SW	BMP	Shoreline and RIL\Oblique aerial from SW.bmp			3D image of earthquakes below regional map
Oblique aerial from W	BMP	Shoreline and RIL\Oblique aerial from W.bmp			3D image of earthquakes below regional map
Orthogonal View from Below	BMP	Shoreline and RIL\OrthogonalView from Below.bmp			3D image of earthquakes below regional map
plate-1	Map	Shoreline and RIL\USGS PP649C\plate-1.pdf	1968	Geology compiled by TW Dibblee Jr. (US geological Survey) 1968-1969	Geologic map With bougur gravity contours
plate-2	Map	Shoreline and RIL\USGS PP649C\plate-2.pdf	1968	Geology compiled by TW Dibblee Jr. (US geological Survey) 1968-1969	Aeromagnetic and Generalized Geologic map along the San Andreas Fault near Cholame California
plate-3	Map	Shoreline and RIL\USGS PP649C\plate-3.pdf	1968	Geology compiled by TW Dibblee Jr. (US geological Survey) 1968-1969	Vertical-intensity grounded magnetic and generalized geologic map along the san andreas fault near Cholame, California
plate-4	Cross Section	Shoreline and RIL\USGS PP649C\plate-4.pdf	1968	Geology compiled by TW Dibblee Jr. (US geological Survey) 1968-1969	Idealized Cross Section, Gravity Profiles, and Magnetic Profiles across the san andreas fault near Cholame, California

Plate 1 Geologic map of Shoreline Fault zone study area		map		Shoreline and RIL\Plate 1 Geologic map of Shoreline Fault zone study area.pdf		Bathymetry data and LIDAR (PG&E, 2010)	Geologic map of the Shoreline Fault Zone study area
Plate B-1A North Section Geologic Map Morrow Bay to Point Buchon		map		Shoreline and RIL\Plate B-1A North Section Geologic Map Morrow Bay to Point Buchon.pdf		Bathymetry data and LIDAR (PG&E, 2010)	North Section geologic map Morro Bay to Point Buchon
Plate B-1B		map		Shoreline and RIL\Plate B-1B.pdf		Bathymetry data and LIDAR (PG&E, 2010)	Central section geologic map Point Buchon to Double Rock
Plate B-1C		map		Shoreline and RIL\Plate B-1C.pdf		Bathymetry data and LIDAR (PG&E, 2010)	South Section geologic map, Double rock to San Luis Hill
Plate B-1D		map		Shoreline and RIL\Plate B-1D.pdf		Bathymetry data and LIDAR (PG&E, 2010)	Southwest section geologic map, Point san Luis to Pismo Beach
Plate I-1a		map		Shoreline and RIL\Plate I-1a.pdf		Bathymetry data and LIDAR (PG&E, 2010)	Map of Submerged wave-cut platforms and strandlines with top of bedrock contours
Plate I-1b		map		Shoreline and RIL\Plate I-1b.pdf		Bathymetry data and LIDAR (PG&E, 2010)	Map of Submerged wave-cut platforms and strandlines
Plate I-1c		map		Shoreline and RIL\Plate I-1c.pdf		Bathymetry data and LIDAR (PG&E, 2010)	Map of submerged wave-cut platforms and strandlines
Plate I-2a		map		Shoreline and RIL\Plate I-2a.pdf		Bathymetry data and LIDAR (PG&E, 2010)	Map showing submerged strandlines, wave-cut platforms, and geology
Plate I-2b		map		Shoreline and RIL\Plate I-2d.pdf		Bathymetry data and LIDAR (PG&E, 2010)	Map showing submerged strandlines, wave-cut platforms, and geology
Plate I-2c		map		Shoreline and RIL\Plate I-2c.pdf		Bathymetry data and LIDAR (PG&E, 2010)	Map showing submerged strandlines, wave-cut platforms, and geology
Plate I-2d		map		Shoreline and RIL\Plate I-2d.pdf		Bathymetry data and LIDAR (PG&E, 2010)	Map showing submerged strandlines, wave-cut platforms, and geology
Plate I-3a		Cross Section		Shoreline and RIL\Plate I-3a.pdf		Shoreline Fault Zone Study (PG&E)	Longitudinal profile along coastline showing correlation of submerged strandlines
Plate I-3b		Cross Section		Shoreline and RIL\Plate I-3b.pdf		Shoreline Fault Zone Study (PG&E)	Longitudinal profile along coastline showing correlation of submerged strandlines (alternative 1)
Plate I-3c		Cross Section		Shoreline and RIL\Plate I-3c.pdf		Shoreline Fault Zone Study (PG&E)	Longitudinal profile along coastline showing correlation of submerged strandlines (alternative 2)
Plate I-3d		Cross Section		Shoreline and RIL\Plate I-3d.pdf		Shoreline Fault Zone Study (PG&E)	Longitudinal profile along coastline showing correlation of submerged strandlines (alternative 3)
PP649C		PDF		Shoreline and RIL\USGS PP649C\PP649C.pdf		WF Hanna, SH Burch, TW Dibblee Jr. Geophysical Field Investigations	Gravity, Magnetics, and Geology of the San Andreas Fault Area near Cholame, California
Peer Review Comment Resolution_Diablo Canyon RIL_VERSION 2_7-26-2012		Word Doc		Diablo Canyon ISFSI SER\Peer Review Comment Resolution_Diablo Canyon RIL_VERSION 2_7-26-2012.docx	July, 2012		Peer Review Comment Resolution Report Research Information Letter on: Confirmatory Analysis of Seismic Hazard at the Diablo Canyon Power Plant from the Shoreline Fault Zone
profile		Graph/TIFF		Figures\profile.tif			m over km along Profile A-A' (along the Hosgri fault)
profile2		Diagram/TIFF		Figures\profile2.tif			Map of the Hosgri fault and bathymetry
Purisima		Excel Doc		NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-08_Non-UCERF3_Faults_InputFiles\Purisima.xlsx			Fault input file
Queenie		Excel Doc		NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-08_Non-UCERF3_Faults_InputFiles\Queenie.xlsx			Fault input file
RAI 1 combined		pdf		Shoreline and RIL\RAI 1 combined.pdf			
	Figure 1	Map	5	Shoreline and RIL\RAI 1 combined.pdf		RAI RESPONSES, SHORELINE FAULT ZONE STUDY. Base map is from Final Shoreline Fault Report (PG&E, 2011). Plate 1.	Seismic Sources and Geologic Cross-Section Lines Shown on Final Shoreline Fault Report Plate 1 (Geologic Map)
	Figure 2	Map	6	Shoreline and RIL\RAI 1 combined.pdf		RAI RESPONSES, SHORELINE FAULT ZONE STUDY. Base map is from Hall et al. (1979), original scale 1:62,500.	Seismic Sources and Geologic Cross-Section Lines Shown on Hall et al. (1979) Geologic Map
	Figure 3	Cross Section	7	Shoreline and RIL\RAI 1 combined.pdf		Shoreline Fault Report geologic map (PG&E, 2011), and Figure 2 for their locations on the geologic map of Hall et al. (1979). RAI RESPONSES, SHORELINE FAULT ZONE STUDY.	Geologic Cross-Section A-A' Showing Preferred Dips of Fault Sources for "Unlinked" Model
	Figure 4	Cross Section	8	Shoreline and RIL\RAI 1 combined.pdf		Shoreline Fault Report geologic map (PG&E, 2011), and Figure 2 for their locations on the geologic map of Hall et al. (1979). RAI RESPONSES, SHORELINE FAULT ZONE STUDY.	Geologic Cross-Section A-A' Showing "Alternative 1" Dips of Fault Sources for "Unlinked" Model
	Figure 5	Cross Section	9	Shoreline and RIL\RAI 1 combined.pdf		Shoreline Fault Report geologic map (PG&E, 2011), and Figure 2 for their locations on the geologic map of Hall et al. (1979). RAI RESPONSES, SHORELINE FAULT ZONE STUDY.	Geologic Cross-Section A-A' Showing "Alternative 2" Dips of Fault Sources for "Unlinked" Model
	Figure 6	Cross Section	10	Shoreline and RIL\RAI 1 combined.pdf		Shoreline Fault Report geologic map (PG&E, 2011), and Figure 2 for their locations on the geologic map of Hall et al. (1979). RAI RESPONSES, SHORELINE FAULT ZONE STUDY.	Geologic Cross-Section B-B' Showing Preferred Dips of Fault Sources for "Unlinked" Model
	Figure 7	Cross Section	11	Shoreline and RIL\RAI 1 combined.pdf		Shoreline Fault Report geologic map (PG&E, 2011), and Figure 2 for their locations on the geologic map of Hall et al. (1979). RAI RESPONSES, SHORELINE FAULT ZONE STUDY.	Geologic Cross-Section B-B' Showing "Alternative 1" Dips of Fault Sources for "Unlinked" Model
	Figure 8	Cross Section	12	Shoreline and RIL\RAI 1 combined.pdf		Shoreline Fault Report geologic map (PG&E, 2011), and Figure 2 for their locations on the geologic map of Hall et al. (1979). RAI RESPONSES, SHORELINE FAULT ZONE STUDY.	Geologic Cross-Section B-B' Showing "Alternative 2" Dips of Fault Sources for "Unlinked" Model
Recent Diablo Eqs		Text Document		Shoreline and RIL\Recent Diablo EQs.txt		USGS	USGS earthquake data
Recent Diablo Eqs 2		Text Document		Shoreline and RIL\Recent Diablo EQs 2.txt		USGS	USGS earthquake data
Report on Analysis of Shoreline Fault Zone Appendices C&D				Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf			
	Figure 1	Map and Cross Section	5	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf		Report on Analysis of Shoreline Fault Zone. Hardebeck	Figure Ia compares the epicenters from Hardebeck's tomographic inversion to epicenters derived from a tomographic inversion using a decimated version of Hardebeck's model as a starting model with all of the available data. Figure Ib shows a depth section for the target events.

Figure 2	Map and Cross Section	7	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Lin et al. (2009) and Hardebeck	Figure 2a compares the epicenters from Hardebeck's tomographic inversion (red stars) to epicenters derived from a tomographic inversion using an initial model extracted from the statewide 3D Vp model of Lin et al. (2009). Figure 2b shows a depth section for the target events from their Figure 2a locations.
Figure 3	Map and Cross Section	8	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Figure 3a compares the epicenters from Hardebeck's tomographic inversion (red stars) to epicenters derived from a tomographic inversion using an initial 3D Vp model from Thurber et al. (2006) for the greater Parkfield region. Figure 3b shows a depth section for the target events from their Figure 3a locations.
Figure 4	Map and Cross Section	10	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Figure 4a compares the epicenters from Hardebeck's tomographic inversion (red stars) to epicenters derived from a tomographic inversion using the same input model but excluding the waveform cross-correlation data. Figure 4b shows a depth section for the target events from their Figure 4a locations.
Figure 5	Map and Cross Section	11	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Figure 5a compares the epicenters from Hardebeck's tomographic inversion (red stars) to epicenters derived from a tomographic inversion using the same input model but excluding the S-wave data. Figure 4b shows a depth section for the target events from their Figure 4a locations.
Figure 1	Map and Cross Section	24	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Figure 1. (a) Map view and (b) cross-section of replicated locations from Hardebeck's tomographic inversion. The box in (a) indicates the earthquakes plotted in (b).
Figure 2a	map	25	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Lin et al. (2009)	Map showing the distribution of all the earthquakes (colored circles), explosions (red stars), seismic stations (black triangles) and model grid nodes (colored diamonds) included for the DD tomography inversions for Sub region 3 of Lin et al. (2009), from which the initial velocity model used here was extracted.
Figure 2b	map	26	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Lin et al. (2009)	Map showing the distribution of seismic stations (red triangles) and model grid nodes (black dots) for my tomoDD inversions, modified from the work of Lin et al. (2009).
Figure 3	Map and Cross Section	27	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Lin et al. (2009)	(a) Map view and (b) cross-section (center point at 35.2 10, _120.86', azimuth 1290 CW from North, half-width 1 km) of locations from a tomoDD inversion using P and S waves, the modified initial model from Lin et al. (2009), and cross-correlation data from my reanalysis of PG&E data.
Figure 4	Map and Cross Section	28	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Lin et al. (2009)	(a) Map view and (b) cross-section (center point at 35.2 10, _ 120.86o, azimuth 129° CW from North, half-width 1 km) of locations from a tomoDD inversion using the modified initial model from Lin et al. (2009), cross-correlation data from my reanalysis of PG&E data, and P waves only.
Figure 5	Map and Cross Section	29	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Lin et al. (2009) and Hardebeck	(a) Map view and (b) cross-section (center point at 35.2 10, _120.86o, azimuth 1290 CW from North, half-width 1 km) of locations from a tomoDD inversion using P and S waves, the modified initial model from Lin et al. (2009), and cross correlation data from my reanalysis of PG&E data plus Hardebeck's cross-correlation data for NCSN and SCSN stations.
Figure 6	Map and Cross Section	30	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Map view and (b) cross-section (center point at 35.210, _120.860, azimuth 129' CW from North, half-width I km) of locations from a tomoDD inversion using P and S waves, F the 4-km grid decimated Hardebeck model, and cross-correlation data from my reanalysis of PG&E data.
Figure 7	Map and Cross Section	31	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	(a) Map view and (b) cross-section (center point at 35.21', -120.86', azimuth 1290 CW from North, half-width 1 km) of locations from a tomoDD inversion using P and S waves, the 10-km grid decimated Hardebeck model, and cross-correlation data from my reanalysis of PG&E data.
Figure 8a	Map	32	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Comparison of the epicenters from Hardebeck's tomographic inversion (red stars) to the epicenters shown in Figure 3
Figure 8b	Map	33	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Comparison of the epicenters from Hardebeck's tomographic inversion (red stars) to the epicenters shown in Figure 7
Figure 1	map	39	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck and USGS	Study area in Central California. Epicenters color-coded by depth. Coastline and mapped surface traces of faults are shown. Polygon includes events analyzed in this study.
Figure 2	graph	41	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Histograms of differences between P-wave cross-correlation delay-times obtained by Jeanne Hardebeck and corresponding delay-times formed from the phase picks.
Figure 3	graph	42	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. M&S2001: McLaren and Savage (2001); M&S DD: re-sampled McLaren and Savage (2001) model; USGS CST: model used by the NCSN for routine location purposes for the Central Coast (CST) region (Oppenheimer, et al., 1993).	Velocity-depth functions for the study region
Figure 4	Map and Cross Section	43	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Map view (top panels) and cross-sections (bottom panels) of double-difference solutions (DD1Da) for 1380 earthquakes
Figure 5	Map and Cross Section	44	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Map view (top panels) and cross-sections (bottom panels) of double-difference solutions (DD1Da) for 349 earthquakes
Figure 6	Map and Cross Section	45	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Map view (top panels) and cross-sections (bottom panels) of double-difference solutions (DD1Da) for 65 earthquakes
Figure 7	Map and Cross Section	47	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Map view (top panels) and cross-sections (bottom panels) of double-difference solutions (DD1Da) for 1375 earthquakes, using 3d Model
Figure 8	Map and Cross Section	48	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Map view (top panels) and cross-sections (bottom panels) of double-difference solutions (DD1Da) for 351 earthquakes, using 3d Model
Figure 9	Map and Cross Section	49	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Map view (top panels) and cross-sections (bottom panels) of double-difference solutions (DD1Da) for 65 earthquakes using 3d Model
Figure 10	graph	50	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	Report on Analysis of Shoreline Fault Zone. Hardebeck	Histograms of lateral and vertical relative location errors of 3D double difference solutions for 1375 events using the combined pick and correlation data

	Figure 11	Map and Cross Section	51	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf		Report on Analysis of Shoreline Fault Zone. Hardebeck	Relative location errors for the 65 earthquakes along the Shoreline Fault Zone using the 3D model
	Figure 12	Map and Cross Section	52	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf		Report on Analysis of Shoreline Fault Zone. Hardebeck	but showing the double-difference locations with their relative horizontal and vertical bootstrap error ellipses at the 90% confidence level for the 3D DD solutions shown in Figure 8. 15 Shoreline Fault
	Figure 13	Map and Cross Section	54	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf		Report on Analysis of Shoreline Fault Zone.	Test with synthetic data
	Figure 14	Map and Cross Section	55	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf		Report on Analysis of Shoreline Fault Zone.	Test with synthetic data
	Figure 15	Map	57	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf		Report on Analysis of Shoreline Fault Zone.	Superposition of epicenters from the six different inversions carried out in this study and shown in Figure 4 - Figure 9.
	Figure 16	Cross Section	58	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf		Report on Analysis of Shoreline Fault Zone.	Relative hypocenter locations (in km) in horizontal (left panel) and vertical (right panel) direction after subtracting the mean of all six solutions for each event along the SFZ.
	Figure D1	map	69	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	12/01/2010	Shoreline Fault Study. PG&E 1989	Comparison of 1989 LTSP residual Magnetic Intensity with 2009 Helicopter. Total magnetic intensity anomaly map
	Figure D2	map	70	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study, Langenheim et al 2009.	2008 aeromagnetic survey tracklines along the central California coast ranges
	Figure D3	map	71	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study, Langenheim et al 2009.	aeromagnetic survey map of the central California coast ranges
	Figure D4	map	72	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/30/2010	Shoreline Fault Study	Total Magnetic intensity map for the 2009 Helicopter Survey Area
	Figure D5	map	73	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study. (Watt et al., 2009).	Track line map of marine geophysical data collected in 2008 and 2009.
	Figure D6	map	74	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study. (Sliter et al., 2009)	Magnetic anomaly map of the 2008-2009 marine survey area
	Figure D7	map	75	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study. (Sliter et al., 2009)	Residual magnetic anomaly map of the shallow subsurface (<500m) in the 2008/2009 marine survey area
	Figure D8	map	76	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study	Merged aeromagnetic and marine magnetics data
	Figure D9	map	77	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study	Helicopter total magnetic intensity re-gridded to 30m spacing
	Figure D10	map	78	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/30/2010	Shoreline Fault Study	Reduction to Pole Transformation of the Total Magnetic Intensity Map
	Figure D11	map	79	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study	Bathymetry in m (negative to denote depth below sea level) as white contours con the RTP field map
	Figure D12	map	80	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/30/2010	Shoreline Fault Study	Tilt Angle Magnetic Anomaly Map based on 2009 Helicopter RTP Anomaly Map
	Figure D13	map	81	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/30/2010	Shoreline Fault Study	Horizontal Gradient of Helicopter Reduction to Pole Anomaly Map
	Figure D14	map	82	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study	Tilt angle of the helicopter RTP with the approximate 40m bathymetry contour
	Figure D15	map	83	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study	Tilt-angle of RTP superimposed on terrain with offshore faults
	Figure D16	Cross Section	84	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study	Test magnetic model with line 6 azimuth of 008
	Figure D17	Cross Section	85	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study	Test magnetic model with line azimuth of 058
	Figure D18	Cross Section	86	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/30/2010	Shoreline Fault Study	Forward modeling of magnetic and gravity data
	Figure D19	Cross Section	87	Shoreline and RIL\Report on Analysis of Shoreline Fault Zone Appendices C&D.pdf	11/22/2010	Shoreline Fault Study	Magnetic sensitivity test with a thin vertical shoreline fault magnetic body (model 33)
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Research Information Letter 09-001, Diablo research info letter 09-001				Shoreline and RIL\Research Information Letter 09-001.pdf			
	Table 1	table	6	Shoreline and RIL\Research Information Letter 09-001.pdf			Parameters for the NGA Models and Parameter Values Used in this Study (after Table 5 in Abrahamson, et al., 2008)
	Figure 1	map and Cross Section of seismicity	13	Shoreline and RIL\Research Information Letter 09-001.pdf		Figure and underlying data from the PG&E-USGS CRADA	Seismicity in Vicinity of Diablo Canyon NPP
	Figure 2	map	14	Shoreline and RIL\Research Information Letter 09-001.pdf		Figure and underlying data from the PG&E-USGS CRADA	Regional Seismicity Based on Local Velocity Model
	Figure 3	map	15	Shoreline and RIL\Research Information Letter 09-001.pdf		The data was provided by the USGS.	Seismicity Comparison with Marine Magnetic Data
	Figure 4	map and Cross Section of seismicity	16	Shoreline and RIL\Research Information Letter 09-001.pdf			Seismicity in Vicinity of Diablo Canyon NPP Annotated with Interpretation by NRC Staff
	Figure 5	map	17	Shoreline and RIL\Research Information Letter 09-001.pdf		AGU 2008 Annual Meeting Poster Presentation by Watt, Fisher, Scheirer, Johnson, Sliter, and Hart of the USGS	Portion of "The Hosgri Fault Zone, Central California: Collection and Preliminary Analysis Of Marine Magnetic And Seismic Reflection Data"
	Figure 7	map	19	Shoreline and RIL\Research Information Letter 09-001.pdf		Figure and underlying data from the PG&E-USGS CRADA	Focal Mechanisms Recorded in Vicinity of Diablo Canyon NPP
	Figure 9	velocity profile	21	Shoreline and RIL\Research Information Letter 09-001.pdf			Site Shear Wave Velocity Profiles from 1978 Downhole Measurements (Figure 5-5 in DCPP LTSP Report) with Annotation by NRC Staff
	Figure 10	graph	22	Shoreline and RIL\Research Information Letter 09-001.pdf		Abrahamson & Silva (08). Campbell & Bozorgnia (08). Chiou & Youngs (08). Boore & Atkinson (08)	Comparison of Individual 84th Percentile Ground Motion Prediction Equations with Best Estimate Parameters and Diablo Canyon Review Spectrum
	Figure 11	graph	23	Shoreline and RIL\Research Information Letter 09-001.pdf			Comparison of Average Results of 84th Percentile Ground Motions with Varying Maximum Magnitudes
	Figure 12	graph	24	Shoreline and RIL\Research Information Letter 09-001.pdf			Comparison of Average Results of 84th Percentile Ground Motions with Varying Distance to Fault
	Figure 13	graph	25	Shoreline and RIL\Research Information Letter 09-001.pdf			Comparison of Average Results of 84th Percentile Ground Motions with Varying Site Shear Wave Velocity Profiles
	Figure 14	graph	26	Shoreline and RIL\Research Information Letter 09-001.pdf			Comparison of Spectra Developed and Provided by the Pacific Gas & Electric Company
Rev 11 of DCCP SAR, DCPP FSAR 2010				Shoreline and RIL\Rev 11 of DCCP SAR.pdf	2010		This section describes the DE, the DDE, and the postulated 7.5M HE and the seismic response of the different buildings at the powerplant. Images include graphs of "Free Field Ground Motion Analysis", "Comparison of Spectra damping ratio", "Design response to Spectra", Horizontal/Vertical time history"
RegionalGrid_InputFile_2014-10-04		Excel Doc		NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-10_RegionalSourceZone_InputFile\RegionalGrid_InputFile_2014-10-04.xlsx	10/04/2014		These are the Regional Gridded Areal Source Zone coordinates and rates; these rates are from the 2008 NSHMP

response to diablo canyon senior resident inspector concerns regarding shoreline fault research information letter rev2 - includes additional comment from John Stamatakos		Word Doc		DCPP Shoreline and Thrust Fault Allegation\response to diablo canyon senior resident inspector concerns regarding shoreline fault research information letter rev2 - includes additional comment from John Stamatakos.docx	07/25/2012	Michael T. Markley, Chief Plant Licensing Branch IV Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation	A memo to Neil F. O'Keefe which document the resolution of concerns from the Diablo Canyon Senior Resident Inspector (SRI) regarding the Diablo Canyon Research Information Letter (RIL) associated with the Shoreline fault.
	Figure ES-1			DCPP Shoreline and Thrust Fault Allegation\response to diablo canyon senior resident inspector concerns regarding shoreline fault research information letter rev2 - includes additional comment from John Stamatakos.docx	01/07/2011	Executive Summary	Problematic hazard curves for Hosgri, Los Osos, San Luis Bay and shoreline fault Zones
	Figure 6-19	Graph		DCPP Shoreline and Thrust Fault Allegation\response to diablo canyon senior resident inspector concerns regarding shoreline fault research information letter rev2 - includes additional comment from John Stamatakos.docx	January, 2011	Report on the Analysis of the Shoreline Fault Zone, Central Coast California to the USNRC, PG&E	spectral acceleration v frequency
RIL 12-01 as published		Word Doc		Shoreline and RIL\RIL 12-01 as published.docx	Sep-12		
	Figure 1-1	map	4	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	The location of DCPP and the Shoreline fault (Figure 1.1 from the PG&E Shoreline Fault Report).
	Figure 2-1	graph	8	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Ground motion response spectra for the DCPP.
	Figure 3-1	diagram	19	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Illustration of faulting mechanisms and focal mechanisms by the USGS.
	Figure 3-2	map	20	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Shoreline fault location and segments (from Figure 4-1 of the PG&E Shoreline Fault Report).
	Figure 3-3	map	21	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Regional tectonics and seismic setting of the DCPP (Figure 3-1 of the PG&E Shoreline Fault Report, annotated by the NRC).
	Figure 3-4	map	22	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Seismicity patterns and focal mechanisms of the DCPP region from 1987 through 2008 (extracted from Figure 3-2 of the PG&E Shoreline Fault Report).
	Figure 3-5	map	23	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Geology underlying DCPP (extracted from Plate B-1B of the PG&E Shoreline Fault Report).
	Figure 3-6	map	24	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Paleostrandlines in the DCPP region (extracted from Plate I-1b of the PG&E Shoreline Fault Report).
	Figure 3-7	map	25	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Northern California Earthquake Data Center earthquakes, 1987 through 2011, plotted in plan view and in Cross Section.
	Figure 3-8	map	26	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Earthquake data from Hardebeck (2010) plotted in plan view and in Cross Section.
	Figure 3-9	map	27	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Comparison of reanalysis of hypocenters by Hardebeck, Thurber, and Waldhauser in plan view (Figure 4-2 of Shoreline Fault Report).
	Figure 3-10	Cross Section	28	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Comparison of result from reanalysis of hypocenters by Hardebeck, Thurber, and Waldhauser in Cross Section (Figure 4-2 of Shoreline Fault Report).
	Figure 3-11	map	29	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Focal mechanisms recorded in the vicinity of DCPP (Figure 4-7 from Shoreline Fault Report).
	Figure 3-12	map	30	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Earthquake epicenters recorded in vicinity of DCPP plotted with magnetic field data and the local faults (Figure 4-17 from Shoreline Fault Report).
	Figure 3-13	map	31	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Franciscan mélange plotted with magnetic field data and local faults. (Figure 4-18 from Shoreline Fault Report)
	Figure 4-1	map	42	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Segments of the Shoreline fault.
	Figure 4-2	map	43	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Lateral extent of characteristic earthquake rupture scenarios considered as viable possibilities in this report.
	Figure 4-3	graph	44	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Seismicity and recurrence curves for the Shoreline fault (Figure 4-3 of the PG&E Shoreline Fault Report, annotated with the curves appropriate for a creeping fault).
	Figure 4-4	graph	45	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Commonly used forms of magnitude recurrence curves.
	Figure 4-5	rupture planes	46	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Schematic representation of typical rupture planes (above) and idealized models of rupture planes (below) for magnitude 4, 6, and 6.9 earthquakes.
	Figure 4-6	rupture planes	47	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Schematic representation of typical surface rupture dimensions for magnitude 4, 6, and 6.9 earthquakes.
	Figure 4-7	map	48	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Map showing the proposed 10-km-long extension of the south segment of the Shoreline fault (red line).
	Figure 5-1	graph	67	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	PGA values recorded on soil sites from the 2004 M6.0 Parkfield, CA earthquake compared with the median prediction of the western U.S. GMPE of Boore et al. (1997) (Figure B-11, of NUREG-2117).
	Figure 5-2	graph	68	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Predicted PGA values for soft soil sites at different distances (rJB) for a M7.0 earthquake based on the Western U.S. GMPE of Boore et al. (1997). The solid line represents median values, and the shaded area indicates the range from 16th to 84th-percentile values; the plots are identical except the left is on linear axes and the right on logarithmic (from Bommer and Boore, 2004).
	Figure 5-3	map	69	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Seismicity in vicinity of DCPP, figures and underlying data from the PG&E CRADA (Hardebeck, 2010).
	Figure 5-4	diagram	70	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Definitions of distance between a site and the source of an Earthquake (Abrahamson and Shedlock, 1997).
	Figure 5-5	Cross Section diagram	71	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Cross Section of DCPP (Figure 5-3 in DCPP LTSP Report).

Figure 5-6	velocity profiles	72	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Shear wave velocity profiles from 1978 downhole measurements (Figure 5-5 in DCPP LTSP Report, with annotation by the NRC Staff (from RIL 09-001)).
Figure 5-7	velocity profiles	73	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Comparison of 2010 DCPP ISFSI velocity profiles to that of the 1978 velocity profile.
Figure 5-8	photo	74	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Location of the ISFSI in relation to the power block.
Figure 5-9	graph	75	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Comparison of the 2003 San Simeon earthquake records at DCPP and Point Buchon with median motions predicted by Graizer and Kalkan (2009) using VS30 of 1,200 m/s directly in the GMPE.
Figure 5-10	graph	76	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Comparison of the 2004 Parkfield earthquake records at DCPP and Point Buchon with median motions predicted by Graizer and Kalkan (2009) using VS30 of 1,200 m/s directly in the GMPE.
Figure 5-11	graph	77	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Comparison of recording from 2003 San Simeon Earthquake at DCPP with predicted median ground motions from Graizer and Kalkan (2009) with and without site response correction factors of Silva (2008).
Figure 5-12	graph	78	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Comparison of recording from 2004 Parkfield Earthquake at DCPP with predicted median ground motions from Graizer and Kalkan (2009) with and without site response correction factors of Silva (2008).
Figure 5-13	graph	79	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Comparison of correction factors developed by NRC using DCPP specific velocity profile with time series (TS) and random vibration theory (RVT) approaches to the factors used by PG&E from Silva (2008). The heavy black line is the average of the three NRC results and was used in the present assessment.
Figure 5-14	graph	80	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Comparison of results of 84th-percentile ground motions for magnitude 5.9 and 6.7 earthquakes on the Shoreline fault to Hosgri and LTSP spectra. Results developed using NRC correction factors.
Figure 5-15	graph	81	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	84th-percentile ground motions for the five GMPEs used in NRC analyses for a M6.7 scenario earthquake on the Shoreline fault.
Figure 5-16	graph	82	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	84th-percentile ground motions for the five GMPEs used in NRC analyses for a M5.9 scenario earthquake on the Shoreline fault.
Figure 5-17	graph	83	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Comparison of median and 84th-percentile ground motions for the M5.9 and M6.7 scenario earthquakes on the Shoreline fault for Boore-Atkinson 2008 GMPE.
Figure 5-18	graph	84	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Contribution to seismic hazard by seismic source for PGA (Figure 6-20 (a) of the PG&E Shoreline Fault Report).
Figure 5-19	graph	85	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Contribution to seismic hazard by seismic source for 5 Hz (Figure 6-20 (b) of the PG&E Shoreline Fault Report).
Figure 5-20	graph	86	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Contribution to seismic hazard by seismic source for 1 Hz (Figure 6-20 (c) of the PG&E Shoreline Fault Report).
Figure B-1	Velocity profile	B-6	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	The DCPP shear-wave velocity profile is shown as an inset on the generic central California shear-wave velocity model (upper panel). Illustration of upper crustal amplification function (A(f) = (Zsource/Zavg(R))0.5) for the Diablo Canyon site (lower panel) computed from profile in upper panel.
Figure B-2	graph	B-7	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Fit to the acceleration Fourier amplitude spectrum of the 2003 Deer Canyon event recorded at the DCPP. Linear best fit kappa value of 0.03 s.
Figure B-3	graph	B-8	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Fits to the acceleration Fourier amplitude spectra of the 2003 San Simeon (top) and 2004 Parkfield (bottom) earthquakes recorded at the DCPP. Linear best fit kappa value of 0.056 and 0.042 s, respectively
Figure B-4	graph	B-9	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Illustration of tradeoff between stress drop and kappa for M 6.5 2003 San Simeon earthquake recorded at DCPP.. Kappa value of 0.04 s and stress drop of 170 bars produce best fitting (root mean square error) spectral estimates.
Figure B-5	graph	B-10	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Best fitting response spectral results for the Deer Canyon (top) and San Simeon (bottom) earthquakes in red, compared to observed recordings from DCPP in black.
Figure B-6	graph	B-11	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Shear-wave velocity profiles used in the time history based approach to developing DCPP-specific amplification functions. The red line indicates the DCPP shear-wave velocity profile used and the blue line the generic 760 m/s profile of Silva (2008). The profiles are identical below 80 m (262 ft).
Figure B-7	graph	B-12	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Subset of 27 of the 55 time histories used in the time series-based response analysis. .Events are from the Northridge, Imperial Valley, San Fernando, Gazli, and Friuli earthquakes. The geometric mean of the records is indicated by the heavy black line.
Figure B-8	graph	B-13	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Comparison of correction factors developed by NRC staff to those applied by PG&E (black dashed line). The heavy black line is the arithmetic mean of the correction factors developed by the NRC using the time-series (TS) method (shown in blue) and the RVT method (shown in red and green). The average of those three curves (solid black curve) was used by the NRC staff in the deterministic evaluation
Figure C-3	graph	C-17	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	A graphical display of the magnitude-frequency distribution for the Shoreline fault based on the characteristic earthquake model of Youngs and Coppersmith (1985) for the magnitude range 0 ≤ m ≤ 6.5.
Figure C-4	graph	C-17	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	The 97.7% probability (area of the shaded region) that surface rupture occurs during a magnitude 6.8 event on the central and southern segments of the Shoreline fault.
Figure C-5	graph	C-18	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Probability of surface rupture obtained from the empirical data (Wells and Coppersmith, 1993) (blue curve) and for the Shoreline fault developed by PG&E (red curve).
Figure C-6	graph	C-18	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Figure 4 of Petersen et al. (2004) showing the frequency of secondary surface rupture within a 50250 m2 footprint as a function of distance from the principal trace, shown with an overlay of the PG&E and NRC assumptions.
Figure C-7	graph	C-19	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	A plot of secondary rupture probability as a function of distance from the principal fault trace within a 50250 m2 cell.
Figure C-8	Diagram	C-20	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	General schematic diagram illustrating the final calculation in the determination of conditional probability for secondary rupture.
Figure C-9	map	C-21	Shoreline and RIL\RIL 12-01 as published.docx	Research Information Letter 12-01	Distance of Shoreline fault from intake structure and power block.

	Figure C-10	graph	C-22	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Histogram provided in Figure 6 in Petersen et al, (2004) showing the distribution of the ratio of the secondary rupture to the maximum displacement on the principal trace overlain with curve used by PG&E (in blue) and NRC (in red), from Petersen et al. (2011).
	Figure C-11	graph	C-22	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	An example of the lognormal distribution for secondary rupture associated with a magnitude 6.25 strike-slip earthquake (shown here in red).
	Figure C-12	graph	C-23	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Graphical representation of Equation C-20.
	Figure C-13	graph	C-23	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Plots of the distribution of the ratio of secondary rupture to the average displacement on the principal trace at 300 meters and 600 meters from the principal fault trace (Petersen et al., 2011).
	Figure D-1	map	D-4	Shoreline and RIL\RIL 12-01 as published.docx		Research Information Letter 12-01	Diagram illustrating the relative plate motions and the relative motions of major fault systems (base figure from Unruh presentation at the DCPP SSHAC WS#1, annotated for this report)
Santa_Lucia_Bank		Excel Doc		NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-08_Non-UCERF3_Faults_InputFiles\Santa_Lucia_Bank.xlsx			Fault input file
Shelf_topo_map		map/TIFF		Figures\Shelf_topo_map.tif			Map of the Hosgri fault and bathymetry
slip budget		Map/JPEG		Figures\slip budget.jpg			Map of local faults with slip rate of the Pacific plate
Slope_section		Diagram/ Illustrator		Figures\Slope_section.ai			Slope Cross Section
Slope_section		Diagram/JPEG		Figures\Slope_section.jpg			Slope Cross Section
Stamatakos Diablo Canyon Seismic 2012		PowerPoint		Figures\Stamatakos Diablo Canyon Seismic 2012.pptx	November 27, 2012	Presented by: John Stamatakos NRC Technical Project Manager: Joe Sebroski NRC Project Officer: Linda Yee/April Bucher CNWRA Manager: Todd Mintz	DIABLO CANYON POWER PLANT SEISMIC HAZARD REVIEW
Summary of Information to Close out Allegation NRR-10-22 V2		Word Doc		DCPP Shoreline and Thrust Fault Allegation\Summary of Information to Close out Allegation NRR-10-22 V2.docx	03/07/2012	Annie Kammerer and John Stamatakos	This document provides a description and summary of information, assessments and findings related to the investigation and closing of NRR-2010-A-0022. This report follows an earlier RES report entitled, "Investigation and Recommended Findings of Allegation NRR-2010-A-0022" that was provided to NRR in June 2011.
	Figure 1	Map		DCPP Shoreline and Thrust Fault Allegation\Summary of Information to Close out Allegation NRR-10-22 V2.docx	2011	PG&E's Shoreline Fault Report	NCEDC earthquakes 1987 through 2011 plotted on a UTM grid. Inset map is the geologic map. The Cross Section plot above shows the hypocenters located from the Line of Cross Section up to the northwest (also shown in red).
	Figure 2	Map		DCPP Shoreline and Thrust Fault Allegation\Summary of Information to Close out Allegation NRR-10-22 V2.docx	2011	PG&E's Shoreline Fault Report	Earthquake data from Hardebeck (2010) plotted on a UTM grid. Inset map on the plant view plot is the geologic map developed by PG&E as part of PG&E's Shoreline Fault Report (PG&E, 2011).
Table 1 SFZ_Hard_Th_1D_3D comparison		Excel Doc		Shoreline and RIL\Table 1 SFZ_Hard_Th_1D_3D comparison.xls		Hardebeck and Thurber	Earthquake data that includes Epicentral and depth differences between 1D and 3D
West_Basin_SW_Channel		Excel Doc		NTTF DCCP PSHA Review\Appendix C HID Attachments\Attachment_C-08_Non-UCERF3_Faults_InputFiles\West_Basin_SW_Channel.xlsx			Fault input file

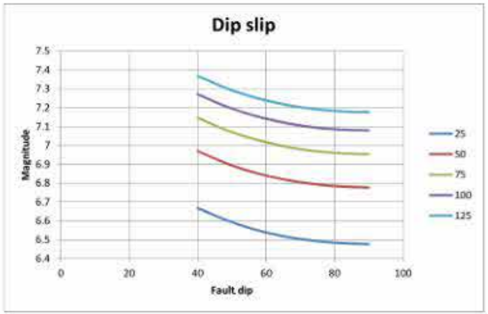
Equations from Leonard, M., 2010. Earthquake fault scaling: self-consistent relating of rupture length, width, average displacement, and moment release, Bulletin of the Seismological Society of America 100: 1971-1988

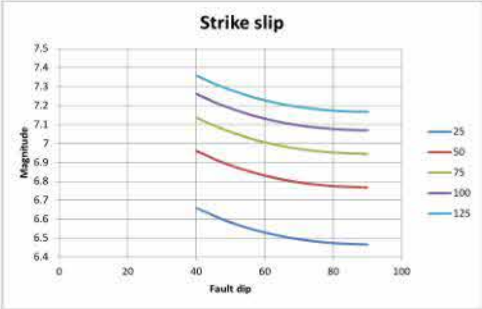
Strike slip

Max Fault Length (km)	Min Fault Dip	Thickness of seismogenic crust	Magnitude
25	90	12	6.4671213
25	80	12	6.4737698
25	70	12	6.4941354
25	60	12	6.5295906
25	50	12	6.5828673
25	40	12	6.6590538
50	90	12	6.7681513
50	80	12	6.7747998
50	70	12	6.7951654
50	60	12	6.8306206
50	50	12	6.8838973
50	40	12	6.9600838
75	90	12	6.9442425
75	80	12	6.9508911
75	70	12	6.9712567
75	60	12	7.0067119
75	50	12	7.0599885
75	40	12	7.136175
100	90	12	7.0691812
100	80	12	7.0758298
100	70	12	7.0961954
100	60	12	7.1316506
100	50	12	7.1849273
100	40	12	7.2611137
125	90	12	7.1660913
125	80	12	7.1727398
125	70	12	7.1931054
125	60	12	7.2285606
125	50	12	7.2818373
125	40	12	7.3580238

Dip slip

Max Fault Length (km)	Min Fault Dip	Thickness of seismogenic crust	Magnitude
25	90	12	6.477121255
25	80	12	6.483769796
25	70	12	6.504135438
25	60	12	6.539590623
25	50	12	6.592867288
25	40	12	6.669053758
50	90	12	6.77815125
50	80	12	6.784799791
50	70	12	6.805165434
50	60	12	6.840620619
50	50	12	6.893897284
50	40	12	6.970083754
75	90	12	6.954242509
75	80	12	6.96089105
75	70	12	6.981256693
75	60	12	7.016711878
75	50	12	7.069988543
75	40	12	7.146175013
100	90	12	7.079181246
100	80	12	7.085829787
100	70	12	7.10619543
100	60	12	7.141650614
100	50	12	7.194927279
100	40	12	7.271113749
125	90	12	7.176091259
125	80	12	7.1827398
125	70	12	7.203105443
125	60	12	7.238560627
125	50	12	7.291837293
125	40	12	7.368023762





John Stamatakos

From:John Stamatakos
Sent:27 Mar 2015 16:18:39 +0000
To:'Stieve, Alice'
Cc:Marla Morales
Subject:RE: Palo Verde

That would be great.

Marla .... can you run by and pick up this CD for me? Its 7th floor of Two White Flint.

Thanks,

John

From: Stieve, Alice [mailto:Alice.Stieve@nrc.gov]
Sent: Friday, March 27, 2015 12:12 PM
To: John Stamatakos
Subject: RE: Palo Verde

It is a huge. Several files. Perhaps Jane can make a copy and mail to you.

From: John Stamatakos [mailto:jstam@swri.org]
Sent: Friday, March 27, 2015 12:01 PM
To: Stieve, Alice
Subject: RE: Palo Verde

If I could get a copy that would be great.

I am unfortunately off to San Antonio next week to work with my guys on Diablo so I am not sure how I would get it?

John

From: Stieve, Alice [mailto:Alice.Stieve@nrc.gov]
Sent: Friday, March 27, 2015 11:58 AM
To: John Stamatakos
Subject: FW: Palo Verde

John
Sorry I forgot you.

From: Stieve, Alice
Sent: Thursday, March 26, 2015 3:58 PM
To: Munson, Clifford; Devlin-Gill, Stephanie; Heeszel, David; Ake, Jon; Graizer, Vladimir; Li, Yong; Hill, Brittain
Cc: Spence, Jane
Subject: Palo Verde

We have 2 CDs (duplicates) for the Palo Verde SSHAC material. I made a copy and will pass CD1 to Jane Spence. Stephanie has made a copy and will pass onto to David and then to Cliff.

John Stamatakos

From:John Stamatakos
Sent:20 Apr 2015 15:56:42 +0000
To:'Stieve, Alice';Devlin-Gill, Stephanie;Heeszel, David
Cc:Graizer, Vladimir;Munson, Clifford;Ake, Jon
Subject:RE: Palo Verde public meeting in mid-June?
I can

John

-----Original Message-----
From: Stieve, Alice [mailto:Alice.Stieve@nrc.gov]
Sent: Monday, April 20, 2015 11:17 AM
To: Devlin-Gill, Stephanie; Heeszel, David
Cc: Graizer, Vladimir; Munson, Clifford; Ake, Jon; John Stamatakos
Subject: Palo Verde public meeting in mid-June?

Can the Palo Verde team support a APS public meeting in mid-June?

I have no vacation plans yet so I guess I am open in June. What about the rest of you? Of course Vlad is in CA for the week. Maybe he will check his email.

-----Original Message-----
From: Devlin-Gill, Stephanie
Sent: Monday, April 20, 2015 11:10 AM
To: Stieve, Alice; Heeszel, David
Subject: FW: Inquiry: Palo Verde Public Meetings Dates

From: DiFrancesco, Nicholas
Sent: Monday, April 20, 2015 10:24 AM
To: Munson, Clifford
Cc: Jackson, Diane; Ake, Jon; Devlin-Gill, Stephanie; Vega, Frankie
Subject: Inquiry: Palo Verde Public Meetings Dates

Cliff, et. al.

Any preferences or limitations for planning the Palo Verde public meeting in mid-June.

Thanks,
Nick

From: DiFrancesco, Nicholas
Sent: Thursday, April 16, 2015 10:07 AM
To: Munson, Clifford
Cc: Ake, Jon; Jackson, Diane; Vega, Frankie; Hill, Brittain; Shams, Mohamed
Subject: Planning Items - DC Focus Areas and PV Meetings Dates

Cliff,

I am out PM today and Friday.

PG&E Licensing Coordination and NRC Public Meeting Prep Frankie is PM backup and has a licensing call with PG&E Friday at 1pm to discuss NRC technical focus areas as part of the April 28 public meeting. For Friday I would like to communicate a few topics for them to begin work on. Perhaps the 1. ergodic method vs. single-station correction weighting. Early next week I plan to email a formal request for incorporation into the meeting notice. Please let us know a couple of focus areas by noon Friday.

PV Meeting Date Coordination
The licensee (APS) cannot support meeting until the 2nd week of June. As I recall, I thought we had conflicts starting then with NGA-East Working Group. Let me know if I can propose any dates in the 2nd and 3rd week of June.

Thanks,

Nick

Senior Project Manager - Seismic Reevaluation Activities U.S. Nuclear Regulatory Commission Office of Nuclear Reactor Regulation Japan Lesson Learned Project Division
nicholas.difrancesco@nrc.gov<mailto:nicholas.difrancesco@nrc.gov> | Tel: (301) 415-1115

John Stamatakos

From:John Stamatakos
Sent:18 May 2015 18:50:43 +0000
To:Miriam R. Juckett;'Spence, Jane'
Cc:Stieve, Alice
Subject:RE: PV material
Yes

Thanks

John

From: Miriam R. Juckett
Sent: Monday, May 18, 2015 2:39 PM
To: 'Spence, Jane'; John Stamatakos
Cc: Stieve, Alice
Subject: RE: PV material

Thanks Jane- I think John was planning to come by to pick it up but he was out sick this week. John, will you be able to pick it up maybe tomorrow?

Cheers-
Miriam

From: Spence, Jane [mailto:Jane.Spence@nrc.gov]
Sent: Monday, May 18, 2015 1:38 PM
To: John Stamatakos; Miriam R. Juckett
Cc: Stieve, Alice
Subject: RE: PV material

CD is still here… do you want me to mail it?

Jane Spence
Administrative Assistant
Office of New Reactors
NRO/DSEA/RGS1 & RGS2
(301) 415-4717
T-7F01B

From: Spence, Jane
Sent: Wednesday, May 13, 2015 12:37 PM
To: John Stamatakos; Miriam Juckett (mjuckett@swri.org)
Cc: Stieve, Alice
Subject: PV material

Hi all,

CD is ready.

Please let me know when you'd like me to meet you to pick up the CD.
Thanks!

Jane Spence
Administrative Assistant
Office of New Reactors
NRO/DSEA/RGS1 & RGS2
(301) 415-4717
T-7F01B

From: Spence, Jane
Sent: Wednesday, May 13, 2015 9:36 AM
To: Stieve, Alice
Cc: John Stamatakos
Subject: RE: PV material

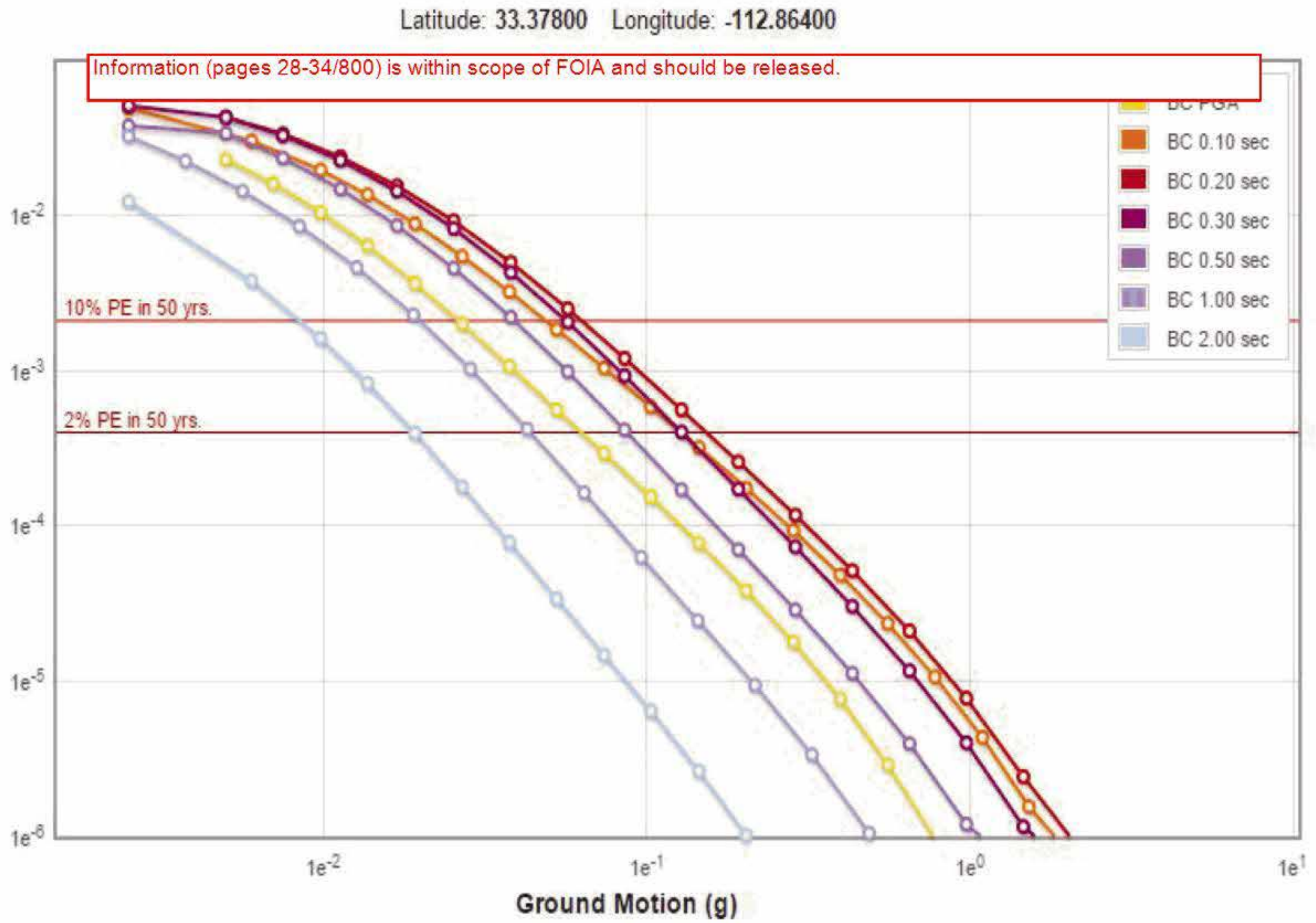
Will do when I return -
John, I'll let you know when ready for p/u.

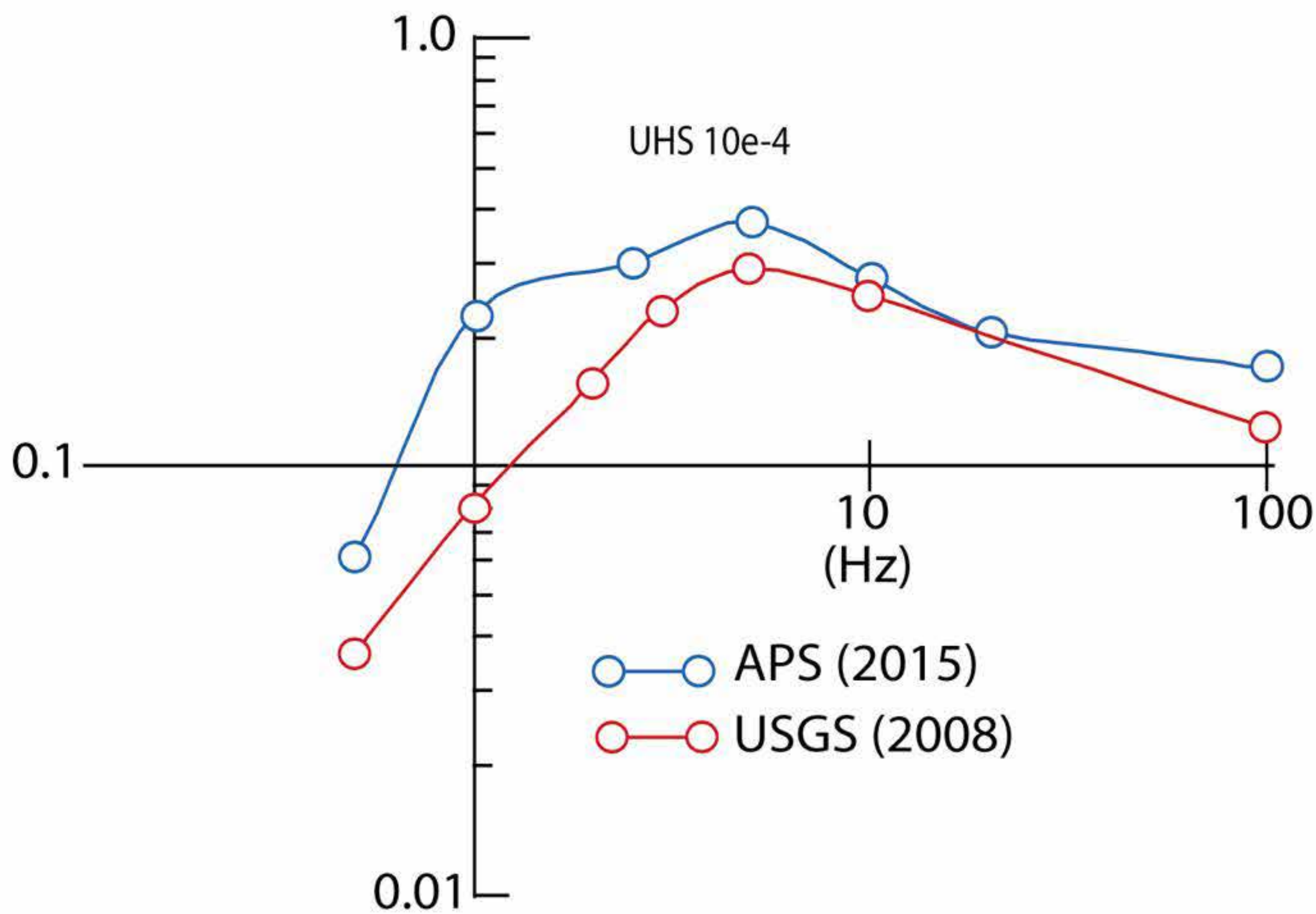
Jane Spence
Administrative Assistant
Office of New Reactors
NRO/DSEA/RGS1 & RGS2
(301) 415-4717
T-7F01B

From: Stieve, Alice
Sent: Wednesday, May 13, 2015 9:27 AM
To: Spence, Jane
Subject: PV material

Jane
Could you make a CD of all the files in the Palo Verde folder for John Stamatkos? He said he would drop by today or tomorrow. I told him you were out this morning and to wait until this afternoon. Let me and John know if you can accommodate that request.

http://epm.nrc.gov/environmental/jlltg/wus-sshac/Shared%20Documents/Forms/AllItems.aspx


Latitude: 33.37800 Longitude: -112.86400
Information (pages 28-34/800) is within scope of FOIA and should be released.
BC 0.10 sec
BC 0.20 sec
BC 0.30 sec
BC 0.50 sec
BC 1.00 sec
BC 2.00 sec
10% PE in 50 yrs.
2% PE in 50 yrs.
1e-2
1e-3
1e-4
1e-5
1e-6
1e-1
1e0
1e1
Ground Motion (g)


1.0
UHS 10e-4
0.1
10
100
(Hz)
0.01
APS (2015)
USGS (2008)

Freq (Hz)	A (10e-2 G)
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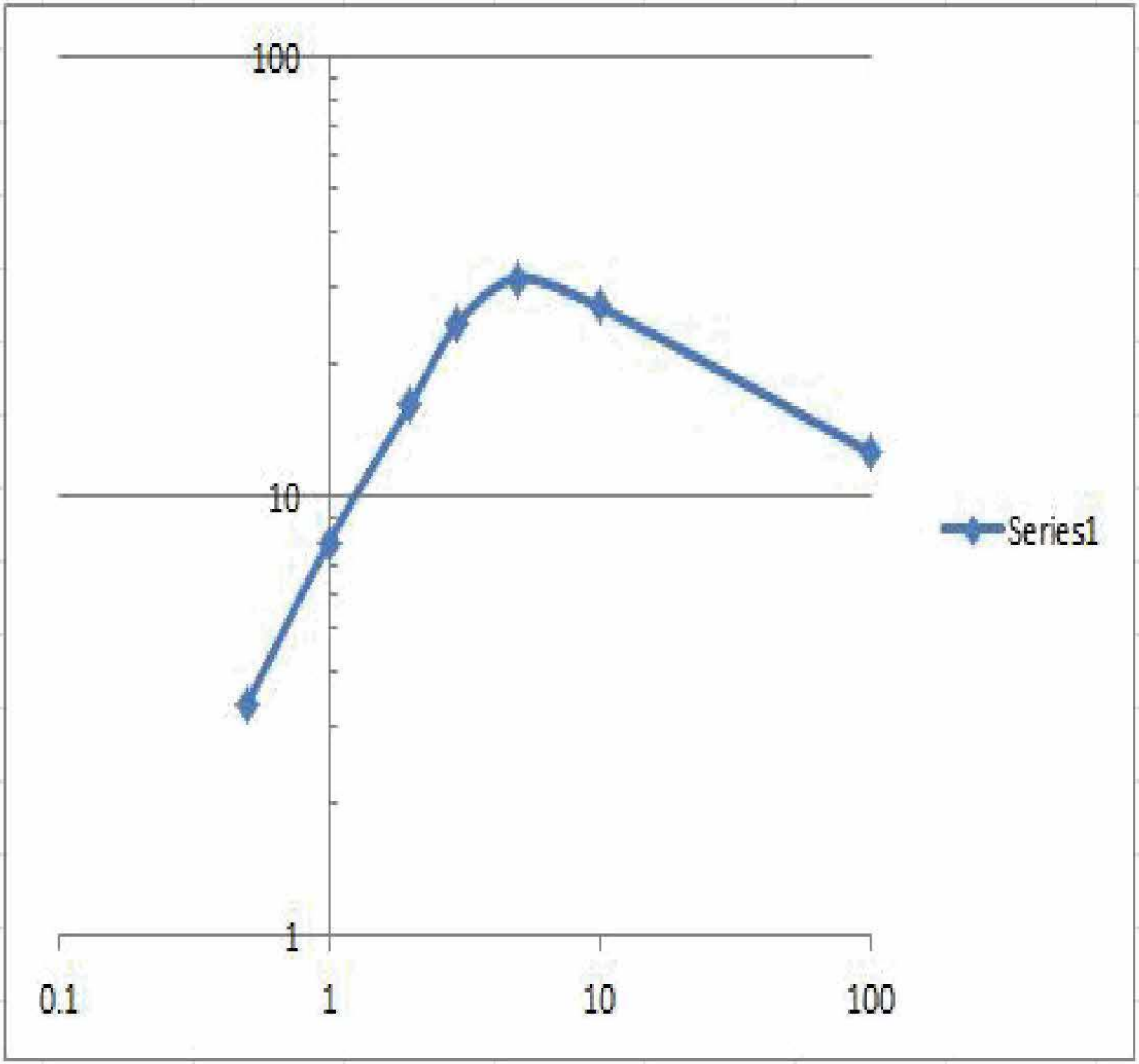
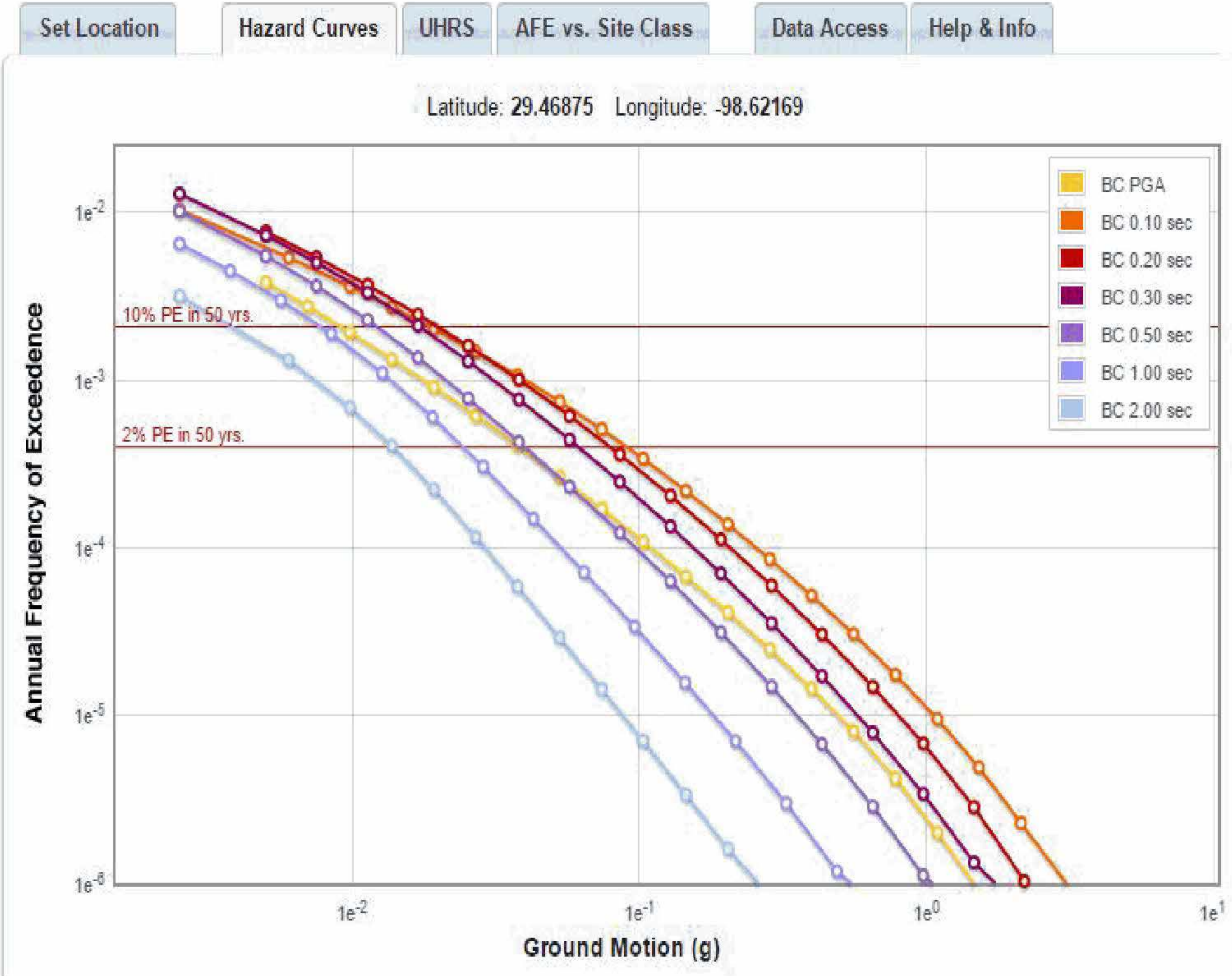
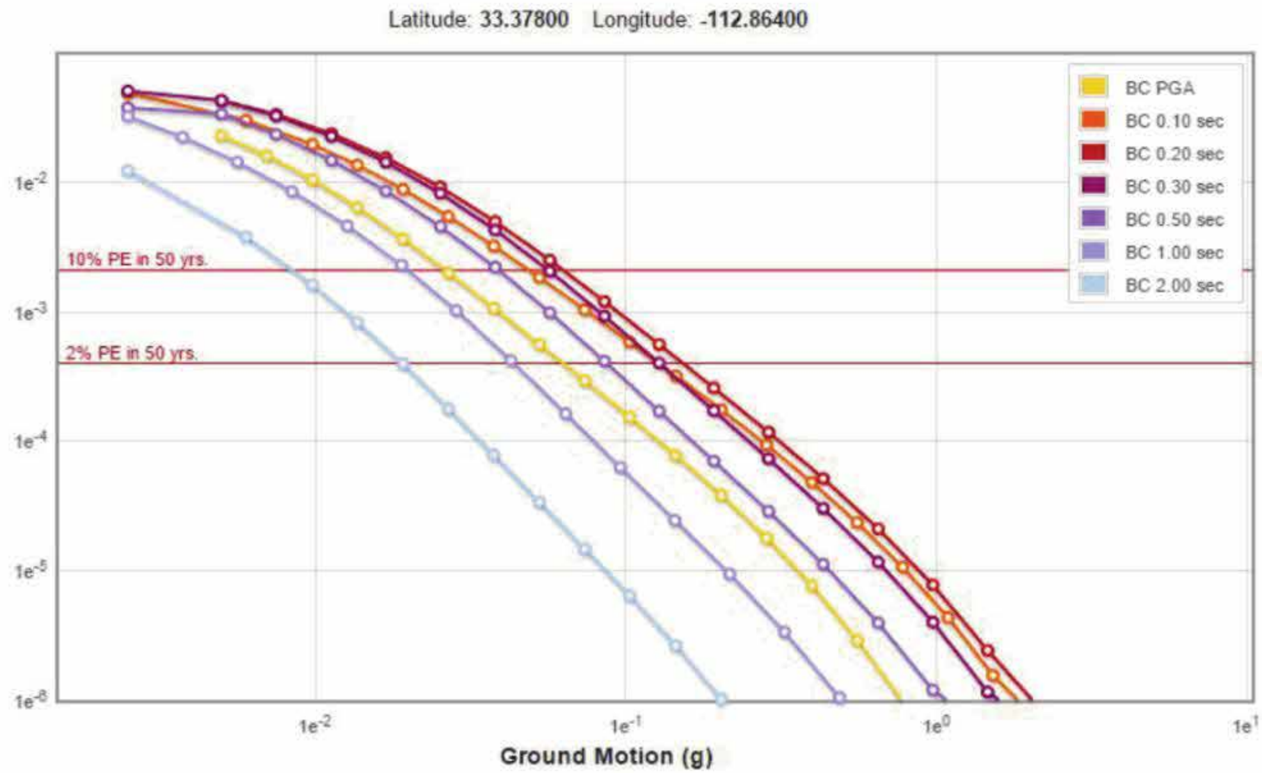
10	27.1
5	31.47
3	24.83
2	16.26
1	7.89
0.5	3.38

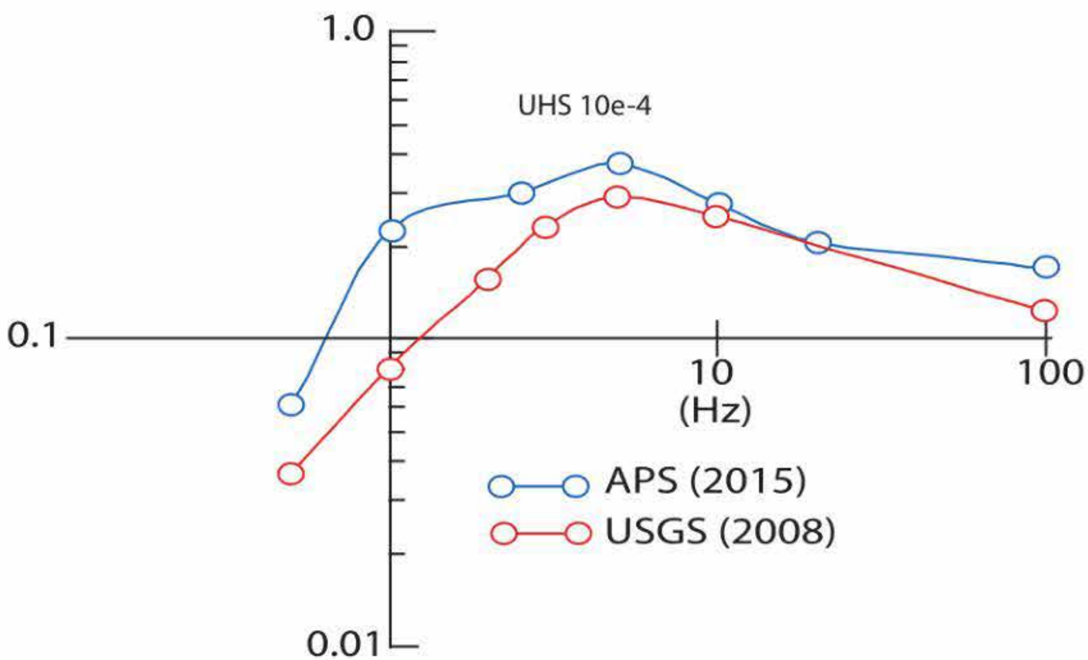




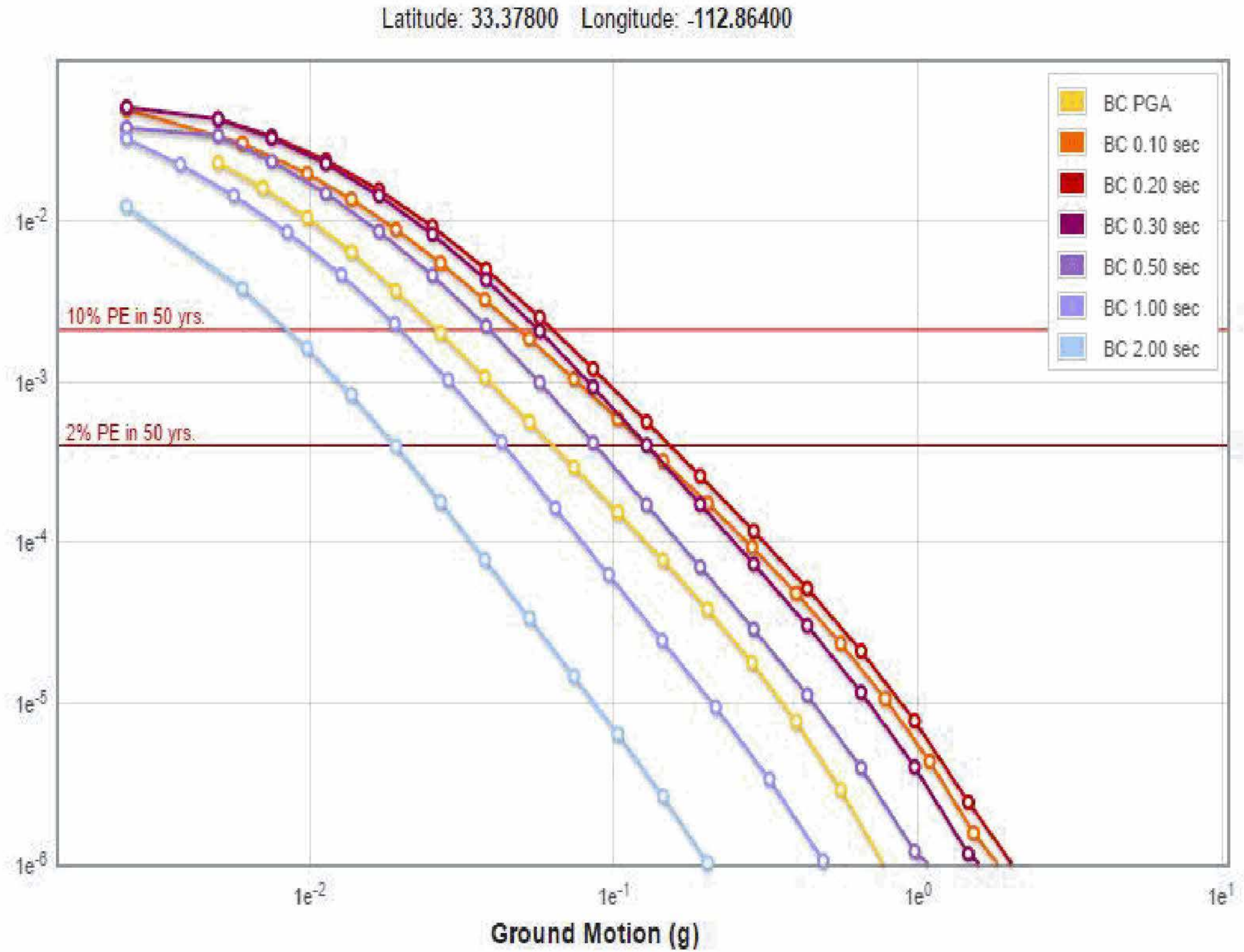
Set Location
Hazard Curves
UHRS
AFE vs. Site Class
Data Access
Help & Info
Latitude: 29.46875 Longitude: -98.62169
BC PGA
BC 0.10 sec
BC 0.20 sec
BC 0.30 sec
BC 0.50 sec
BC 1.00 sec
BC 2.00 sec
10% PE in 50 yrs.
2% PE in 50 yrs.
Annual Frequency of Exceedence
Ground Motion (g)
1e-2
1e-3
1e-4
1e-5
1e-6
1e-2
1e-1
1e0
1e1

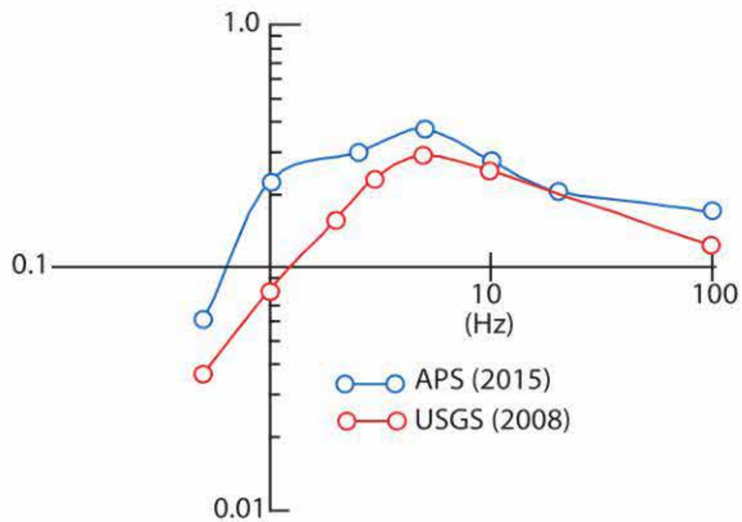


Latitude: 33.37800 Longitude: -112.86400
BC PGA
BC 0.10 sec
BC 0.20 sec
BC 0.30 sec
BC 0.50 sec
BC 1.00 sec
BC 2.00 sec
10% PE in 50 yrs.
2% PE in 50 yrs.
1e-2
1e-3
1e-4
1e-5
1e-6
1e-1
1e0
1e1
Ground Motion (g)



1.0
UHS 10e-4
0.1
10
100
(Hz)
0.01
APS (2015)
USGS (2008)


Latitude: 33.37800 Longitude: -112.86400
BC PGA
BC 0.10 sec
BC 0.20 sec
BC 0.30 sec
BC 0.50 sec
BC 1.00 sec
BC 2.00 sec
10% PE in 50 yrs.
2% PE in 50 yrs.
1e-2
1e-3
1e-4
1e-5
1e-6
1e-2
1e-1
1e0
1e1
Ground Motion (g)



1.0
0.1
0.01
10
100
(Hz)
APS (2015)
USGS (2008)

	USGS	Palo Verde	PV
Freq (Hz)	A (g)	Freq (Hz)	A (g)
100	0.1267	100	0.17
10	0.271	20	0.207
5	0.3147	10	0.275
3	0.2483	5	0.371
2	0.1626	2.5	0.297
1	0.0789	1	0.226
0.5	0.0338	0.5	0.061