ENCLOSURE 4

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Bob Rothman, MS 8D30, TO BE OPENED BY ADDRESSEE ONLY
U. S. Nuclear Regulatory Commission
Washington, DC 20550

Dear Bob:

This letter provides my comments on the NRC/PG&E's Meeting on Seismic Source Characterization, Diablo Canyon Long Term Seismic Program in Rockville, Maryland on August 8-10, 1989. At this meeting, new data was presented in response to previous suggestions and questions. The following paragraphs discuss some of the main issues, and provide my preliminary impressions.

<u>The Type of Fault for the Hosgri Fault:</u>

The meeting did not resolve the issue of fault type for the Hosgri fault system. However, PG&E did show a newly prepared panel based on selected seismic reflection profiles across the Hosgri fault in the San Luis Bay - Pt. Sal area. This panel provides an important new data base for analysis of the Hosgri fault system and is the first of several panels that PG&E is preparing along the Hosgri fault zone. Although the data are not conclusive, I believe that this that strongly suggests that there is a prominent, or predominant, strike-slip character for this section of the fault, although it does not preclude the possibility of a reverse-slip component. The seismic reflection data indicates that there is a broad belt of faults and folds of the Casmalia trend that are abruptly terminated (almost at a 90 degree angle) by the Hosgri fault zone. The geometry of this zone of intersection appears to me to be much more compatible with a strike-slip than a reverse-slip origin.

My current impression of the PG&E seismic reflection data is that there is a reverse-slip component that is suggested by the common development of anticlines parallel to and along the fault zone. I believe that these data indicates that parts of the fault zone show partitioning of the strain, with reverse-slip faults and folds in offshore Santa Maria Basin block on the west side of the Hosgri fault. A major strike-slip component of offset is indicated by the PG&E data that shows the straightness of the fault zone, and variations in side that has been uplifted.

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This leads to fault type weightings that are similar to of the PG&E report.

Earthquake Magnitude and Fault Type:

A possibly important relationships for the Hosgri fault zone was discussed at the meeting, and is indicated in the paper by Slemmons, Bodin and Zhang (1989) on determination of earthquake size from surface faulting events in contractional and extensional regions. The statistical relations of this paper emphasize that the surface fault rupture length and maximum displacement parameters, as well as the associated Ms earthquake magnitudes, do not show significant differences between strike-slip and reverse-slip faults for faulting with rupture lengths of 10 to 90 km. These data indicate that for a specific site, the earthquake magnitude on nearby faults is affected more by the rupture length, than by fault type. A preliminary evaluation of data in earlier compilations by Bonilla et al (1984), and Slemmons (1882) indicate that if their data was separated into contractional and extensional tectonic regimes, their data would also show similar results.

The Slemmons, Bodin and Zhang (1989) study did not evaluate strong ground motion effects at a given site; the character of strong ground motion at a site could be affected by the fault type.

Average and Maximum Displacement:

The abstract by Zhang, Slemmons, Wells, and Coppersmith (1989), titled "New Earthquake Magnitude and Fault Rupture Parameters: Part II. Maximum and Average Displacement Relationships" indicates that better statistical relations to magnitude are obtained if Mw (instead of Ms) magnitude, and average (instead of maximum) displacement are used. A related compilation (using the same data base) by Wells, Coppersmith, Zhang and Slemmons (1989), titled " New Earthquake Magnitude and Fault Rupture Parameters: Part I. Surface Rupture Length and Rupture Area Relationships" indicates that in the Mw magnitude range of 6.5 to 7.5, suggests that Mw magnitude values are about 0.1 to 0.2 magnitude higher than the Ms values for given fault rupture parameters.

Hosgri Fault Deterministic Magnitudes:

The discussions indicated that PG&E considered the maximum earthquake magnitude to be Ms = 7.2. This value is dependent on the fault rupture length that is assumed for the Hosgri fault zone.

My current determinations are not finalized, but at this meeting, I indicated that my present determinations have similar magnitude values that are used by PG&E, but I am using somewhat different analyses and approaches. The values that I am now

determining are close to Ms = 7.2 to 7.3, or to 7-1/4, if the values are rounded to the nearest quarter magnitude.

For a fault segmentation model, the potential fault rupture segments for the Hosgri faults are greatly affected by the character at seismogenic depth of the San Luis/Pismo block. Is this block bounded by two inward dipping faults and rooted at seismogenic depths? If the block is very narrow at seismogenic depth, one scenario is that the Hosgri fault could rupture in the following segments:

(1) Northern Hosgri Fault segment with rupture from near Pt.Buchon, opposite the middle of the San Luis/Pismo block, to near Cambria at the Cambria stepover, a length of about 35 km.

(2) Central Hosgri Fault segment, with a rupture from near Pt. Buchon, opposite the middle of the San Luis/Pismo block, to near Pt. Sal at the intersection of the Casmalia fault zone, also a length of about 35 km.

(3) Combined Northern and Central Fault segments rupture for a length of about 70 km.

The likelihood of longer or shorter ruptures may be low, based on the following:

(1) One of the most likely segmentation points is at or near the Cambria stepover. The geologic and geophysical data evidence for this 5 km stepover is good, with the intersection and change in style of deformation of the Piedras Blancas zone of deformation in the block west of the Hosgri fault. My final judgement is not made for the geometry and size of the stepover, but I believe that a somewhat longer length at the stepover is possible. Should the segmentation point at this stepover be taken at the northern end at the intersection with the Piedras Blancas structure, at a midpoint for the stepover zone, or at the southern end of the more easterly bounding fault?

(2) This model uses a mid-point of the San Luis/Pismo block as a single segmentation point, instead of using a length along the Hosgri of about 22 km for the San Luis/Pismo block (with bounding structures at the Los Osos fault, and the Pecho fault, or the Southwest fault zone). The single point model is based on both bounding faults (or fault zones) dipping toward each other and steepening with depth, to give a block of narrow width at seismogenic depth. Or does one of the two faults truncate the other above the seismogenic depth, in which case only one of the two zones could be used as a segmentation point?

(3) The segmentation point is taken at the intersection (at seismogenic depth) of the Casmalia fault, a geologically and seismologically capable fault, that marks a change in style of the offshore Santa Maria Basin, as well as an intersection of an active structure on the east side of the fault.

(4) The next segmentation point, to the south of the Pt. Sal point, is difficult for me to assign at this time. The amount of offset along the late Cenozoic Hosgri fault may diminish with intersecting structures to the east. The fault may extend to near the Santa Ynez fault, or to opposite Pt. Conception, but in some tectonic models, and based on some geophysical interpretations, may even die out.

This type of model, leads me to somewhat different weightings than is used by PG&E. Possible values are for the 20 km length, perhaps 0.1-, for the 35 km length, about 0.4, for the 70 km length, 0.4+, and for 110 km (or greater) lengths, about 0.1.

Earthquake Sources of the Southwest Border Zone of the San Luis/Pismo Block:

Current earthquake source modelling by PG&E for this zone uses small sources for the inferred (but probably present) Olson fault and the San Luis Bay fault, known at one locality (but probably continuous at least to the Rattlesnake locality). The longer, but more distant, Wilmar Avenue fault is not used as a source.

The present data bring up the possibility that the entire southwest border zone is a diffuse zone that may integrated at depth and may have the potential for a larger earthquake than either the Olson or San Luis Bay sources for this diffuse zone. The location of the boundary could also have more detailed discussion. For example, the Pecho fault appears to affect the surface pattern of the Hosgri fault, and may be an important element of the diffuse zone, but if it dips toward the San Luis/Pismo block, it may be located much closer to the block than the surface expression indicates. The greatest topographic relief of this border zone is near the coastline, this is near the inner part of the zone. Does the activity of this zone connect to Foxen structure?

Earthquake Magnitude for the Los Osos Fault System:

The magnitude of 7.0-, estimated by PG&E for the Los Osos fault zone appears to me to be logically determined from the present data base, but my feeling is that this may be too high. I am reexamining the data base in that other analogous reverse-slip faults may be compatible with about one-half magnitude lower. For example, the 1971 San Fernando fault rupture may show larger

displacements for a similar length to that of the Irish Hills segment. The magnitude was about Ms = 6.6.

Sincerely,

David B. Slemmons