

February 3, 1975

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of  
PACIFIC GAS AND ELECTRIC CO. }  
Units 1 and 2 }  
Diablo Canyon Site }

NRC Dockets 50-275/323-OL

MOTION OF SAN LUIS OBISPO MOTHERS FOR PEACE  
RELATIVE TO FORTHCOMING PG&E/NRC  
SEISMICITY MEETING OF FEBRUARY 7, 1975

By letter dated January 30, 1975 and received February 3, 1975, Thomas J. Hirons has informed us that the Light Water Reactors Project Branch 1-3, RL, will conduct, with P.G. and E., the applicant, a "discussion of the geology and seismology of the Diablo Canyon Site" at Bethesda on Friday, February 7, 1975.

Because:

1. The subject of the meeting involves one of the most important contentions of our intervention.
2. We have the right to attend or be present at a meeting in which such a vital issue will be discussed.
3. We have no way of participating in a meeting in Bethesda.
4. Even if we had the financial means of getting to Bethesda, we did not receive notification of the February 7th meeting until February 3rd, when it is obvious that such a meeting had to be scheduled weeks in advance. We feel that by having these meetings some 3,000 miles from the Diablo Site, the NRC is deliberately continuing its policy of excluding the public most concerned with the issues being discussed at these meetings.

We therefore request that the February 7th meeting be postponed until such time that it can be held in San Luis Obispo.

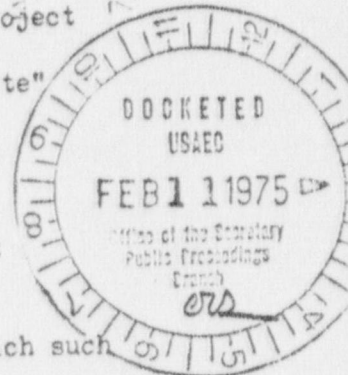
*Elizabeth E. Apfelberg*  
Elizabeth E. Apfelberg

Dated: Feb. 3, 1975

Xc: Glenn O. Bright  
Richard L. Black  
William P. Cornwell  
Frederick Kissler  
John Forster

William E. Martin  
Secretary, AEC  
Andrew Skaff  
Philip A. Crane Jr.  
Lonnie Valentine

12-Docketing & Services Section for appropriate action

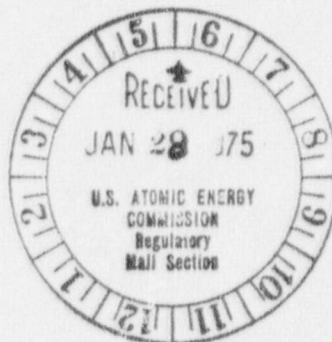


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RECEIVED TILT COPY  
United States Department of the Interior

GEOLOGICAL SURVEY  
RESTON, VIRGINIA 22092



JAN 28 1975

General L. V. Gossick  
Nuclear Regulatory Commission  
Washington, D.C. 20545

Dear General Gossick:

Transmitted herewith, in response to a request by your staff, is a review of the geologic and seismologic data relevant to the Diablo Canyon Site, Units 1 and 2 (AEC Docket Nos. 50-275 and 50-323).

This review was prepared by F. A. McKeown and James F. Devine of the U.S. Geological Survey.

We have no objection to your making this review part of the public record.

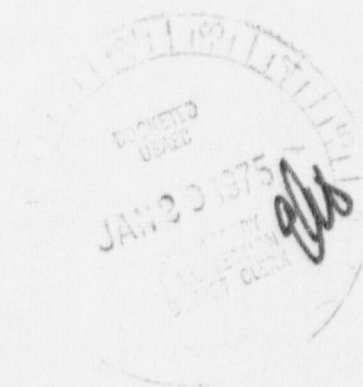
Sincerely yours,

Acting

Director

*Henry H. Condit*

Enclosure



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Pacific Gas and Electric Company  
Diablo Canyon Site, Units 1 and 2  
San Luis Obispo County, California  
AEC Docket Nos. 50-275 and 50-323

This is a final review of the geological and pertinent seismological data in the Final Safety Analysis Report (FSAR) and Amendments 11, 19, and 20 for the Diablo Canyon nuclear power plant site, Units 1 and 2. A preliminary review dated January 23, 1974, of the FSAR was transmitted to the Atomic Energy Commission by E. H. Baltz on March 28, 1974.

The principal consideration in the preliminary review was that it did not provide information to evaluate adequately an offshore fault or structural zone that had been reported in the literature (Hoskins and Griffiths, 1971) since review of the Preliminary Safety Analysis Report (PSAR). Since the preliminary review of the FSAR the applicant and its consultants have conducted extensive geophysical surveys and made geological analyses of them to determine the offshore geology, most of which is presented in Appendix D of Amendment 19. Prior to the applicant's surveys the U.S. Geological Survey on behalf of the U.S. Atomic Energy Commission had made a geophysical survey of a large part of the offshore structural zone. This information (Wagner, 1974) was open filed to the public in September 1974 and the applicant has used it extensively in Amendment 19. This final review therefore is directed mostly to evaluation of the data in Amendment 19, although all parts of the FSAR were reviewed. No field examination of the site was made in conjunction with review of the FSAR.

The FSAR and its amendments contain a reasonably accurate description and evaluation of a large amount of geophysical and geological data. The geologic maps (Plates III and IV, Amendment 19) offshore of the southcentral



California coast agree in general with the offshore geologic map of Wagner (1974). In detail however the maps differ at many places. For example, the trends, location, and number of faults in Estero Bay shown on Plate IV differ from those shown in Plate I of Wagner. A synopsis of the geology on Plates I, II, III, and IV is that the offshore Santa Maria basin is bounded on the east and west by major fault zones. Further, both fault zones are recognized as capable within criteria of the Atomic Energy Commission. The easternmost fault zone, called the East Boundary zone (EBZ) by the applicant and called the Hosgri fault zone (HFZ) by Wagner (1974), is of primary importance because it passes within four miles of the site and is about 90 miles long. As will be outlined in another part of the review, we do not concur with the applicant's conclusion that the current structural environment of both the offshore and onshore areas is dominated by vertical movements. We do concur with the applicant that the faults exposed in excavation for the site and in the cliffs near the site apparently are not capable within AEC criteria. However, the age (80,000-120,000 years before present) of the youngest terrace materials was inferred by long-distance correlation of terraces (p. 2.5-33). We accept the correlation as probable but an absolute age determination would be highly desirable. As these faults and foundation conditions have been amply documented and have not appeared to present problems that could not be managed by engineering practices, they are not discussed in this review.

#### Regional Geology

The applicant's description of the regional tectonic features given in Amendment 20, (p. 2.5-7 through 2.5-13f) is quite adequate. In brief the

plant site is located in the South Coast Ranges structural province which is characterized by northwest trending structural and geomorphic features. The applicant lists five major structural features (fault zones) in the region around the site (p. 2.5-9, Amend. 20). These are the San Andreas, Rinconada-San Marcos-Jolon, Sur-Nacimiento, Santa Lucia Bank and San Simeon faults at distances of 45, 25, 18, 28, and 18 miles from the site respectively (Table A, Amend. 19). All of these faults are considered capable by the applicant (p. 2.5D-64, 65, Amend 19). The East Boundary fault zone at 2.5 to 4 miles from the site is not listed as a major structural feature although it bounds the offshore Santa Maria basin as the Santa Lucia Bank fault does and is commensurate in size with the Santa Lucia Bank fault. We consider the East Boundary fault zone a major structural feature.

In the vicinity of the site, that is the Estero Bay-San Luis Range area, three principal fault zones are discussed in addition to the East Boundary fault zone (p. 2.5-13c through 13f, Amend. 20). These are the West Huasna, Edna, and San Miguelito faults at distances of 11, 4.5, and 2.5 miles from the site, respectively. Nearly all faults trend northwesterly. Highly deformed Mesozoic and Cenozoic rocks occur between the faults.

The available data do not indicate that any of these faults are capable according to AEC criteria. The trend of the Edna fault when projected to the northwest suggests that it could possibly intersect the EBZ in Estero Bay. The location and discontinuous style of faults mapped in Estero Bay however by both the applicant (Plate IV Amend 19) and Wagner (1974, Plate I) do not confirm intersection of the Edna fault with the EBZ. As the EBZ is larger and closer to the site, consideration of the Edna fault as a source of earthquakes is of less importance

### East Boundary Fault Zone

As indicated previously in this review and by the applicant (2.5D-9, Amend. 19) the East Boundary fault zone has been the structural feature of most interest and importance. Nearly all of the extensive geophysical explorations conducted and analyzed during the past year or so since the FSAR was first issued have been directed especially to defining this zone and its geologic relationship to contiguous features such as the Santa Maria basin, structures in the San Luis Range, and the Transverse Range structures projected from the southeast. The importance of the EBZ and need to investigate it thoroughly was evident from the facts that it is less than four miles from the site, is more than 90 miles in length, and appears to have minor seismic activity associated with it. The applicant has made a commendable effort to define and explain the zone.

We concur with the applicant's description of the EBZ and his conclusion that it is a faulted zone of inflection between the offshore Santa Maria Basin and the uplifted Coast Ranges (p. 2.5D-37 through 2.5D-42, and 2.5D-98, Amend. 19). It appears therefore that the zone once was more closely related to the vertical tectonics associated with basin development than to transcurrent tectonics associated with plate boundaries. As recognized by the applicant, the EBZ may also be a "---part of the San Andreas continental margin transform fault system---" (p. 2.5D-41, Amend 19). Such northwest trending fault zones as the EBZ, both offshore and onshore, have been considered by others (for example, Hamilton and Myers, 1966, p. 522 and figure 2, Atwater, 1970, p. 3525) to be part of a system of faults with right lateral movement. The applicant presents considerable data and arguments to support the concept"---that the current tectonic



environment in the southern Coast Ranges and adjacent offshore region is dominated by vertical movements associated with general uplift of the ranges." (p. 2.5D-63, Amend. 19). It is clear from the offshore seismic reflection profiles in Appendix A as well as mapping onshore that vertical separations of as much as several thousand feet occur in Pliocene and older strata. Evidence of lateral separation is less clear, probably because lateral separation can rarely be demonstrated unequivocally. The applicant concluded however that as much as several thousand feet of lateral displacement may have occurred on the EBZ throughout its history (p. 2.5D-41, Amend. 19). Evidence of lateral slip on the EBZ has been given by Wagner (1974, figure 13, p. 7). Similar evidence is apparent in figure 5A (Appendix A) and sections B-B', and D-D' Plate VII, where marked changes in thickness of acoustical units occur across faults and reverse sense of movement on the same fault is shown. Also, the San Simeon fault, which is considered the eastern boundary of the northern part of the Santa Maria basin is reported to have about 1500 feet of lateral displacement. Incomplete fault plane solutions (Smith, 1974) are used by the applicant in an attempt to demonstrate the dominance of vertical movements. All three solutions given by Smith however have significant lateral components to the inferred fault mechanism. Additional seismological evidence that Coast Range faults currently have lateral movement on them is given by Greene and others (1973, Sheet 2). These authors show on Sheet 2 predominant right-lateral movement in fault plane solutions of earthquakes in Monterey Bay near projections of northwest trending Coast Range faults.

As (1) nearly all of the evidence of lateral movement is in the youngest rocks, some of which may be Post-Wisconsinan (Wagner, 1974, p. 13) .

and (2) the mechanism of current earthquakes has a significant component of lateral movement, vertical movements may now be a subordinate component on faults in the EBZ as well as other major faults in southcentral coastal California.

### Conclusions

We conclude from the evidence in the FSAR and literature that large vertical displacements occurred in the EBZ, mostly during the late Miocene and Pliocene when the offshore Santa Maria basin was most actively developing. Most current tectonic activity however is causing as much or more lateral as vertical displacement on northwest trending faults in the Coast Ranges and offshore region. Both the East Boundary zone and Santa Lucia Bank fault zone may have a first order genetic relation to the Santa Maria basin and consequently are not regional in the sense that they do not transect structural provinces such as the Transverse Ranges as the San Andreas fault does. They should be considered inextricably involved, however, with the strike-slip fault mechanics of plate boundary motions that are currently concentrated along the San Andreas fault. Earthquakes along the EBZ presumably would not be as large as expected on the San Andreas fault; however, from the information presently at hand we can find no evidence that would preclude the occurrence of an earthquake as large as events characteristic of subparallel strike slip faults, which bound basins, such as the Santa Maria, in the San Andreas system and which do not transect structural provinces.



### Seismology

The portions of the Final Safety Analysis Report and Amendments 11, 19, 20 of the report entitled "Analysis of Offshore Seismicity in the Vicinity of the Diablo Canyon Nuclear Power Plant" and the Pacific Gas and Electric Company letter dated December 27, 1974, concerning seismic response and its enclosures have been reviewed. The seismological aspects of this site were previously investigated by the applicant and a review was prepared by the Seismological Division of the Coast and Geodetic Survey (since changed in organization in the National Oceanic and Atmospheric Administration) dated September 21, 1967.

As evidenced by the previous discussion of the Geology, a large amount of new data has been developed offshore from the plant site. The interpretation of these data, as previously discussed, necessitate the placing of a moderate to large earthquake on either the East Boundary Zone or the Santa Lucia Bank faults. The applicant, in Amendment 20, has addressed the significance of this interpretation and has indicated a "potential for large earthquakes involving faulting over distances in the order of tens of miles: Seismic activity at this level can occur along offshore faults in the Santa Lucia Bank region (the likely source of the Magnitude 7.3 earthquake of 1927)...." Elsewhere in the FSAR is stated "The East Boundary zone is considered to be seismically active...." Our opinion, is based on these statements and the current necessity of considering these two structures as having similar seismic potential.

Due to the lack of instrumental data from sites within 10 km of the surface expression of a fault, it is difficult to describe the

maximum acceleration, or velocity that would be recorded in this nearby zone. In addition, the correlation of any of these parameters with damage is suspect in the near zones. On the other hand, there are numerous incidents of structures, extremely close to the fault undergoing movement and experiencing earthquakes, that experienced little or no damage. Also, it is apparent that the maximum peak acceleration does not continue to climb as one approaches closer to and reaches the fault break or as one postulates larger and larger earthquakes at a given point on the fault.

The efforts by the applicant to consider the effects of earthquakes on existing records of strong motion from sites near to the earthquake fault in terms of the frequency content of the response spectra are worthwhile. However, a question of transferability still remains (the size of the event in one case and the distance in another). Nevertheless, this analysis when used to match peaks of the spectra (nearby and more distant sources) to the response of critical components is in our opinion an important technique for assessing potential damage.

However, in conclusion, we believe that with the limit of the present information as to the interpretation of the relationship of the East Boundary fault to the Santa Lucia Bank fault, an earthquake similar to the November 4, 1927, event but occurring along the East Boundary Zone or the Santa Lucia Bank fault zone represents the maximum earthquake that is likely to occur near to the site. This event is in addition to the maximum earthquakes considered in the Construction Permit evaluation and subsequent hearings and reviews. As long

as this interpretation remains valid, it is our opinion that the design value of 0.5 g used as a zero period acceleration in the development of the appropriate response spectra is inadequate.

#### References

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- Hamilton, W. and Myers, W. B., 1966, Cenozoic tectonics of the Western United States: Reviews of Geophysics, V. 4, no. 4, p. 509-549.
- Hoskins, E. G., and Griffiths, J. R., 1971, Hydrocarbon potential of Northern and Central California offshore: Am. Assoc. Petroleum Geologists Memoir 15, p. 212-228.
- Smith, S. W., 1974, Analysis of Offshore Seismicity in the vicinity of the Diablo Canyon Nuclear Power Plant. Report to Pacific Gas and Electric Company.
- Wagner, H. C., 1974, Marine geology between Cape San Martin and Pt. Sal South-Central California Offshore: U.S. Geol. Survey open file report 74-252.