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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	
PACIFIC GAS AND ELECTRIC COMPANY	)	Docket Nos. 50-275 O.L.
	)	50-323 O.L.
Diablo Canyon Nuclear Power Plant Units 1 and 2)	)	

AFFIDAVIT OF RICHARD B. MCMULLEN

I, Richard B. McMullen, being duly sworn, do depose and state:

1. I am a geologist employed by the Geosciences Branch, Division of Engineering, Office of Nuclear Reactor Regulation, USNRC. My professional qualifications are in the record of these proceedings following Tr. 8480.

The purpose of this affidavit is to address geological matters raised with respect to seismic reflection data reported in the "Affidavit of Robin Bruce Leslie" (February 28, 1980); viz. the connection of the Hosgri Fault Zone with the San Simeon Fault zone as it affects the seismic potential for the Hosgri Fault zone and the Diablo Canyon Nuclear Power Plant (DCNPP) reanalysis.

Background

1. In its direct testimony, Tr. following 8484 (January 11, 1979), the staff concluded, regarding the seismic potential of the Hosgri fault zone, that:

   A. The applicant has conducted an adequate investigation, which, when synthesized with data by other investigators, provides a basis for making a reasonable and conservative interpretation as to the length of the Hosgri fault zone, its relationship to other regional tectonic structure, and the nature, amounts, and geologic history of displacements on the fault.

   B. The Hosgri fault, although possibly belonging to the same fault system, does not appear to be directly linked to the San Simeon fault.

   C. The Hosgri fault may have experienced strike slip movement up to a few kilometers. It has not, in our view, experienced strike slip movement on the order of 80 to 115 kms, as suggested by Hall (1975).

   D. The 1927 earthquake could have occurred on either the Hosgri fault zone or faults of the Transverse Ranges structure based on error in location. The totality of the data supports an association of this event with the Transverse Ranges structures.

   E. It is conservative to assume a 7.5 magnitude on the Hosgri fault.

   F. An acceleration value of 0.75g is a conservative value for scaling the response spectra which describes the horizontal ground motion for seismic design at the site.

2. New seismic reflection information has been provided by R. B. Leslie (Affidavit of Robin Bruce Leslie dated February 28, 1980 ("Affidavit")), a graduate student at the University of California at Santa Cruz, who, conducted nearshore high resolution seismic reflection profiles in three general areas between Cape San Martin and Point Estero.

3. Mr. Leslie conducted his work under contract with the U. S. Geological Survey (USGS) (Affidavit, at 2). The seismic profiling lines used by Mr. Leslie were run normal to the structural grain within the three described areas at a spacing of about one kilometer.

4. Interpretation of the data by Mr. Leslie was done in conjunction with pre-existing data collected by the USGS, (Wagner, 1974, McCulloch, 1975), Hoskins and Griffiths (1971), and consultants to Pacific Gas and Electric Company (Aquatronics, data collected, 1974 and Bolt, Beranek & Newman, data collected 1973 and 1974), (Affidavit at 2, 4). The latter reflection profile data was presented in the FSAR Appendices 2.5D and 2.5E. The southernmost area of this study, which contains the reported connection between the Hosgri and San Simeon, is located between San Simeon Bay and Point Estero.

5. Mr. Leslie interprets the data to indicate that (1) the southern extension of the San Simeon fault zone can be followed for approximately 10 kilometers to the south-east from San Simeon Bay where it joins a strand of the Hosgri fault zone; (2) although major movement occurred along

the faults in this area during the Miocene and Pliocene, late Pleistocene and Holocene movement is indicated by possible offset of post Wisconsinan sediments, and linear trends of landward facing seafloor scarps; and (3) the Hosgri and San Simeon fault zones represent a continuous and throughgoing fault system. (Affidavit at 5-6).

6. I have considered the new information regarding the offshore connection between the Hosgri fault zone and the San Simeon fault zone. This information provided by Mr. Leslie is not significant with respect to previous staff conclusions described above with respect to the seismic potential of the Hosgri fault zone.

7. My conclusions are based on the following:

   A. The staff considered the possibility of a direct connection between the Hosgri and San Simeon fault zones during its review of the FSAR and requested PG&E to conduct additional investigations to determine the relationship between the two fault zones (NRC Question 2.19). After reviewing the results of these investigations, the staff concluded that the data available at that time indicated that the Hosgri and San Simeon faults did not appear to be directly linked but that the Hosgri and San Simeon faults belonged to the same fault system.

B. The staff conclusion was also based on the conclusion of the USGS, which acts as the staff advisor with respect to geology and seismology matters, that "The Hosgri fault zone is more than 90 miles long and may even be tectonically coupled to the San Simeon fault as they are within 2.5 miles of each other and both form parts of the eastern boundary of the Santa Maria Basin." (SER, Supplement 2, Appendix C, at C-14).

C. In the USGS analysis, which resulted in the assignment of a magnitude 7.5 to the Hosgri fault zone, the USGS considered that the Hosgri and San Simeon fault zones "could very well be tectonically coupled to each other by an en echelon or anastomosing series of faults which is characteristic of faults in the Coast Ranges." (SER, Supplement 4, Appendix C, at C-7).

D. The NRC staff adopted the USGS position, and the USGS reaffirmed that position following the publication of Leslie's interpretation in a letter (attached) dated March 31, 1980, from James F. Devine, USGS to Robert E. Jackson, NRC.

E. During the FSAR review the staff, based on the available data, concluded that the 1927 Magnitude 7.3 Lompoc Earthquake was most likely related to offshore Transverse Range structure rather than the Coast Range structure of which the Hosgri fault zone is a part. Therefore, the assumptions of a magnitude 7.5 anywhere on the Hosgri fault zone was conservative (Stepp, Direct Testimony, Tr-following,

8484). Recent studies related to an LNG (Liquified Natural Gas) site located near Point Conception, approximately 60 miles south of the Diablo Canyon site, tend to support that interpretation. In its geologic and seismologic review of the Point Conception LNG site, the USGS reported that "Existing evidence favors association of the 4 Nov., 1927 (M 7.3) Lompoc earthquake with an east-dipping reverse fault such as the Offshore Lompoc or a similar reverse fault 10 km to the south that offsets the seafloor" (USGS, 1979). However, this evidence does not eliminate the Hosgri or other faults in the area as a possible source of that earthquake.

F. Post-Pleistocene offsets along segments of the Hosgri fault zone have previously been mapped (Wagner 1974; PG&E FSAR Appendices 2.5D and 2.5E; and Fugro 1978). Pleistocene (post 2mybp* and pre 10,000 to 100,000 years bp) movement has been documented on the onshore section of the San Simeon fault zone (Envicom Inc., 1977, Hall, 1976, PG&E Appendix 2.5E 1975, and Hamilton, Willingham, and Jahns Direct Testimony, Tr. 4389; Tr. following 4457, (December 6, 1978). Therefore, the Leslie reflection profiles reveal no new information concerning recency of movement on the Hosgri and San Simeon fault zones.

G. The NRC staff considers the Hosgri and San Simeon fault zones to be parts of the same fault system, but not a master, plate-boundary break such as the San Andreas. This conclusion is supported by several regional constraints on the maximum amount of lateral displacement since early Miocene (20 mybp):

*mybp = million years before present

(1) Evidence shows that the Hosgri probably terminates at about the latitude of Purisima Point (Fugro, 1978). There is no evidence that large lateral movements up to 100 kms have been accommodated in the Transverse Range region to the south (Hamilton and Jahns Direct Testimony 1978).

(2) Correlation between the stratigraphy in the Oceano No. 1 Well west of the Hosgri fault and the stratigraphic section of the adjacent Santa Maria-Casmalia Region east of the fault (Howell et al, 1978) appears to limit the amount of lateral displacement to a maximum of 20 kms (Hamilton and Jahns, Direct Testimony, 1978). Comparison of this well log with the stratigraphy at Purisima Point would limit it to about 35 km (Seiders 1979).

(3) Constraints to the north are also indicated (Hamilton 1979 and Willingham, 1979). Such constraints on the maximum lateral displacement of the Hosgri fault zone do not require a continuous throughgoing fault, but permit the possibility of en echelon faults with displacement between faults accommodated by folding (Seiders, 1979).

8. For the above reasons, I conclude that the near shore high resolution seismic reflection profiling conducted by Mr. Leslie and presented in his affidavit of February 28, 1980 does not affect the Staff's conclusion with respect to the assignment of a 7.5M design basis Safe Shutdown Earthquake to the Hosgri fault.

References

1. Atomic Safety and Licensing Board, USNRC, Partial Initial Decision, Diablo Canyon OL Proceedings 29 September, 1979

2. Envicom, Inc., 1977, Report on the San Simeon area to the Hearst Ranch Corporation.

3. Fugro, 1978, Investigation of the Hosgri Fault Offshore Southern California, Point Sal to Point Conception, report prepared for: U. S. Dept of the Interior, Geological Survey, Menlo Park, Calif.

4. Hall, C. A., Jr., 1977, San Simeon-Hosgri Fault System, Coastal California: Economic and Environmental Implications, Science, Vol. 190 pp. 1291-1294.

5. Hall, C. A., Jr., 1976, Geologic map of the San Simeon-Piedras Blancas Region, California, USGS Map MF-784.

6. Hamilton, D. H. and C. R. Willingham 1979, The Coastal Boundary Zone of Central California, Abstract, Cordilleran Section, GSA.

7. Hoskins, E. G. and J. R. Griffiths, 1971, Hydrocarbon Potential of Northern and Central California Offshore, in Cram, I. H. (editor), Fugure Petroleum Provinces of the U. S. - Their Geology and Potential; Amer. Assoc. Petrol. Geol. Mem. 15, V. 1, p. 212-218.

8. Howell, D. G., D. S. McCulloch, and J. G. Vedder, 1978, U. S. Geological Survey Circular 786.

9. Joint Intervenors' Motion to Reopen, 28 March, 1980.

10. Leslie, R. B., 1979, Continuity and Recency of Movement of Offshore Extensions of the San Simeon Fault Zone, Central California, Abstract, EOS, Vol. 6, No. 46 November 13, 1979.

11. Pacific Gas and Electric Co., FSAR Appendix 2.5D and Appendix 2.5E.

12. Seiders, V. M., 1979, San Gregorio-Hosgri Fault Zone South of Monterrey Bay, Calif.: A Reduced Estimate of Maximum Displacement, USGS Open File Report 79-385, January 1979.

13. Stepp, J. C., USNRC, Direct Testimony Geology and Seismology Diablo Canyon, November, 1978.

14. U. S. Geological Survey, 1976, Review of the geologic and seismologic data relevant to the Diablo Canyon Nuclear Power Station, Units 1 and 2, Appendix C to Supplement No. 4 to the Safety Evaluation Report, May, 1976.

15. U. S. Geological Survey March 31, 1980 letter from J. F. Devine USGS, to R. E. Jackson, USNRC.

16. U. S. Geological Survey October 31, 1979 letter from J. I. Ziony to Dr. J. F. Davis, State Geologist, transmitting report entitled "Review of geologic and seismologic technical reports for proposed liquified natural gas storage facility near Point Conception, California."

17. Wagner, H. C., 1974, Marine Geology between Cape San Martin and Point Sal, South-Central California Offshore; a Preliminary Report, August, 1974, USGS Open-File Report 74-252.

The above statements and opinions are true and correct to the best of my knowledge and belief.

Richard B. McMullen

Subscribed and wron to before
me this 7th day of May, 1980

Notary Public

My Commission Expires: [illegible]