



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

OCT 16 1980

MEMO

Docket Nos. 50-361/362

APPLICANTS: SOUTHERN CALIFORNIA EDISON COMPANY (SCE)
SAN DIEGO GAS AND ELECTRIC COMPANY (SDG&E)

FACILITY: SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3

SUBJECT: SUMMARY OF MEETING ON SAN ONOFRE SEISMOLOGY AND GEOLOGY

On September 23, 1980, members of the NRC staff and their consultants, the U.S. Geological Survey (USGS), the California Division of Mines and Geology (CDMG), and the applicants met in Menlo Park, California, to discuss the above subject. Attendees at the meeting are given in Enclosure 1. The meeting agenda is given in Enclosure 2. A summary of the technical presentations and discussions at the meeting is given below.

P. Ehlig (consultant to SCE) discussed the geologic and tectonic development of the southern California coastal area since about 15 million years before the present (MYBP). Specifically, he discussed the tectonic development of the Capistrano Embayment and the origin and history of movement of the Cristianitos fault. His general conclusion was that the Cristianitos is a listric fault (i.e., a fault that bends at depth) and was most likely developed due to gravity sliding with associated buckling. He concluded that the tectonic development of the Cristianitos fault began approximately 10 to 15 MYBP and ended in the Pliocene (approximately 4 MYBP).

R. Schlemmon (consultant to SCE) reviewed wave-cut bench formation and the subsequent terrace deposits, including an evaluation of the age dates of high stands of sea level during the past 780,000 years. In addition, he reviewed the uplift rates of the terrace deposits along the southern California coast. He concluded that there has been no differential uplift across the onshore trace of the Cristianitos fault during the last 125,000 years, and, most likely, for a much longer period of time.

D. Moore (consultant to SCE) presented a comprehensive interpretation of all the available offshore seismic reflection data. He stated that most of the faulting along the offshore projection of the Cristianitos fault are contained within the Miocene (11 to 25 MYBP) Monterey formation. He also noted that a major syncline flanks the Offshore Zone of Deformation (OZD), to the east, for several miles in the vicinity of San Onofre.

G. Greene of the USGS (advisors to the NRC staff) also reviewed the offshore data and presented arguments for a Cristianitos "Zone of Deformation" offshore. His presentation included his recent review of the Nekton data (which had not been included in his report transmitted by cover letter dated August 13, 1980,

Robert H. Morris to Robert Jackson). His conclusions generally supported the conclusions of Moore regarding the origin and age of the faults and folds between the shoreline and the OZD in the vicinity of San Onofre. He also noted the continuous syncline which is immediately inshore of and parallel to the OZD. He concluded that the new data (Nekton) is of excellent quality and provides a good confirmation of the previous work in the adjacent area (Woodward-Clyde profiles obtained in 1978). He further concluded that the nature of the possible intersection of the CZD and the OZD is not known.

J. Andrews of the USGS (advisors to the NRC staff) commented on the applicant's proposed slip-rate versus magnitude relationship, indicating several possible difficulties associated with the data set used. These included exclusion of data from Japanese strike-slip faults and from other, non-strike-slip faults. He also discussed an hypothesis for a model study comparing the San Onofre 2 and 3 SSE with the October 15, 1979 Imperial Valley earthquake, including elements such as amplification, attenuation, stress drop, and stress-drop scaling. This point was responded to, later during the discussion period, by the applicant's consultant, G. Frazier. He indicated that these elements had been considered in the development of the model used to analyze San Onofre Unit 1. B. Slemmons (NRC staff consultant) also discussed the validity of not including Japanese and other data in a slip-rate versus magnitude relationship, and concluded that the applicant's treatment was reasonable.

E. Heath and W. Savage (consultants to SCE) discussed faulting and seismicity in Baja California. They concluded that there is no compelling evidence for a connection between the Baja faults (the San Miguel, Vallecitos, Calabasas, Tres Hermanos, and Agua Blanca faults) and the OZD or its southerly extension, the Rose Canyon fault. M. Kennedy of CDMG noted that the scarcity of fault data immediately to the south of San Diego Bay may be due to concealment by younger strata.

The applicant's studies were summarized by J. Smith. His conclusions are given in Enclosure 3.

After the above presentations were made, a discussion period followed, during which the following issues were discussed:

1. Magnitude saturation, i.e., the saturation of peak acceleration as a function of earthquake magnitude and the distance from the fault rupture.
2. Vertical acceleration components of the 1979 Imperial Valley earthquake.
3. The appropriateness of the distance range of the records used by the applicants to compare the Imperial Valley earthquake to the San Onofre 2 and 3 SSE.

4. The effect of differences in site conditions on the comparison of the Imperial Valley earthquake and the San Onofre 2 and 3 SSE.
5. The various methods of estimating the magnitude of the San Onofre 2 and 3 SSE.
6. Focusing effects of the SSE, specifically, whether the specific orientation of the OZD south of San Onofre would focus energy towards the plant in the event of a fault rupture beginning to the south of the plant and propagating northward.
7. The relationship of the A, B, C, D features (found during plant excavation) to the tectonic framework of the Capistrano Embayment.

At the end of the meeting, the NRC staff requested that the applicants provide the following information on the San Onofre 2 and 3 docket:

1. An earthquake spectra based on a magnitude 7.5 event occurring on the OZD, as previously requested in Q361.54.
2. The material presented at the September 23, 1980 meeting by P. Ehlig.
3. The material presented at the September 23, 1980 meeting by D. Moore.
4. A discussion of the relationship of the A, B, C, D features to the tectonic framework of the Capistrano Embayment.

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ENCLOSURE 1

ATTENDEES

SEPTEMBER 23, 1980 MEETING
SAN ONOFRE SEISMOLOGY/GEOLOGY

<u>NAME</u>	<u>ORGANIZATION</u>
H. Rood	NRC-LB3
L. Reiter	NRC-GSB
R. L. Rothman	NRC-GSB
A. T. Cardone	NRC-GSB
L. J. Chandler	NRC-OELD
D. B. Slemmons	NRC Consultant (Univ. Nev.)
G. Quittschreiber	NRC/ACRS
R. Jackson	NRC-GSB
C. Smith	S. D. Union
D. Perlman	San Francisco Chronicle
P. Grew	Dept. Conservation, St. of Calif.
J. Davis	CDMG
A. Morris	USGS
J. Devine	USGS
R. Vollmer	NRC-DE
J. Knight	NRC-DE
P. Amimoto	CDMG
D. Hadley	Sierra Geophysics
H. Peters	SDG&E
R. Rouch	San Diego Tribune
L. Wight	TERA
F. Brady	Pacific Gas & Elec. Co.
D. Moore	SCE
J. McNey	SCE
J. Smith	SCE (consultant)
M. Balderman	SCE (consultant)
R. Sholes	SCE
R. McNeill	SCE (consultant)
R. Willingham	Earth Sciences Assoc.
G. Frazier	SCE (consultant)
V. Ghio	Pacific Gas & Elec. Co.
C. Roberts	Orange County Register
Lloyd Cluff	Woodward-Clyde Consultants
K. McNally	Consultant to Woodward-Clyde
W. Savage	Woodward-Clyde Consultants
R. Nason	US Geological Survey
I. Idriss	Woodward-Clyde Consultants
D. Tillson	Wash. Public Power Supply System
G. Greene	USGS
M. Kennedy	CDMG
R. Wallace	USGS
D. McCollough	USGS

(ATTENDEES)

<u>NAME</u>	<u>ORGANIZATION</u>
D. Hamilton	ESA
J. Barneich	Woodward-Clyde
S. Smith	Consultant to SCE
P. Somerville	Woodward-Clyde
P. Guptiel	Woodward-Clyde
E. Heath	Woodward-Clyde
D. Streiff	Woodward-Clyde
J. Egan	Woodward-Clyde
R. Shlemon	Consultant to SCE
K. Baskin	SCE
D. Pigott	Chickering and Gregory
J. Beoletto	SCE
R. Sadigh	Woodward-Clyde
D. Barron	So. Calif. Edison
M. Medford	SCE
W. Moody	SCE
P. West	SCE
G. Barlow	Friends of the Earth
D. Andrews	USGS
H. Hawkins	SCE
S. Biehler	SCE (consultant)

ENCLOSURE 2

MEETING TO DISCUSS THE GEOLOGY AND SEISMOLOGY
OF SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 AND 3

MENLO PARK, CALIFORNIA

SEPTEMBER 23, 1980

- | | |
|--|-------------------------|
| I. Introduction/Meeting Objectives | W. C. Moody |
| II. Significance of Cristianitos Fault and
OZD to Geologic Setting of San Onofre
Area | P. Ehlig
R. Shlemon |
| III. Recent Offshore Geophysical Studies | D. Moore |
| IV. Offshore Cristianitos Fault Extension-
Interpretation of High Resolution
Seismic Reflection Profiles | G. Greene
M. Kennedy |
| V. Degree of Fault Activity and Analysis
of Imperial Valley Ground Motion Data | J. Andrews |
| VI. Relationship Between OZD and Baja Faulting
Faulting Tectonics
Seismicity, Historic Earthquakes | E. Heath
W. Savage |
| VII. Summary of Geotechnical Findings | J. Smith |
| VIII. Open Discussion | All |

ENCLOSURE 3

SCE CONCLUSIONS

1. There is no compelling geologic evidence for a connection of the San Miguel fault zone to the OZD; in fact, the preponderance of evidence is heavily against any connection.
2. Neither the San Miguel fault zone nor the AGUA Blanca fault zone extend east of the Sierra Juarez and thus do not connect with the transform fault system of the Gulf of California.
3. The tectonic models considered for Baja and Southern California do not require connection of the OZD to faults in Baja and suggest different origins for faulting in northern Baja and in Southern California.
4. Historical seismicity is consistent with tectonic models considered with large earthquakes occurring on the plate boundary and other identified active faults.
5. The spatial patterns of seismicity do not suggest or support the existence of connected and throughgoing fault zones between the OZD, continental borderland offshore faults, and faults in Baja California.

MEETING SUMMARY DISTRIBUTION

Docket File

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D. Tondi
J. Krammer
D. Vassallo
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D. Ziemann