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bcc: E. G. Case
P. Norian
J. Newell
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OCT 7 1966

50-275

Mr. Dwight M. Lemmon
Assistant Chief Geologist
U. S. Geological Survey
Room 4214, GSA Building
Washington, D. C.

Dear Mr. Lemmon:

In accordance with the understandings which were reflected in Secretary Udall's letter of March 20, 1964, I am forwarding herewith a request for a preliminary site review submitted by the Pacific Gas and Electric Company. This review involves the siting of the Company's proposed nuclear power plant at its site near Diablo Canyon, California. As you will note, this site is quite near the Cayucos Site previously reviewed by the Geological Survey.

We would appreciate receiving, by early November 1966, a draft report of the results of a preliminary review by the Geological Survey of those geological and hydrological features of the proposed reactor location which may have a bearing upon our evaluation of the suitability of the proposed site. Please note that the information contained in the enclosure should not be released or discussed publicly at this time.

Sincerely yours,

Original signed by
E. G. Case

Edson G. Case, Assistant Director
Division of Reactor Licensing

Enclosure:
Preliminary Site Rpt.

RD-419

OFFICE ▶	R&PRSB:DRL	DRL				
SURNAME ▶	RSBoyd:th	EGCase				
DATE ▶	10/6/66	10/7/66				

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☐ See me about this.	☐ Note and return.
☐ For concurrence.	☐ For signature.
☐ For action.	☐ For information.

TO (Name and unit)	INITIALS / DATE	REMARKS
~~Dr. Beck~~	6/29	Attached are draft reports from the Geological Survey and Coast & Geodetic Survey concerning four sites proposed by the California Department of Water
Dr. Mann		Resources. Copies of these drafts have been previously transmitted to the ACRS and should be made final for review of the Committee at its July meeting.
Dr. Doan		Subject to any comments you may have, I plan to request the Surveys to officially transmit these reports in their present form Tuesday, July 5.
FROM (Name and unit): Edson G. Case		REMARKS: 50-275
PHONE NO.	DATE: 6/28	

USE OTHER SIDE FOR ADDITIONAL REMARKS

GPO 16-77684-1

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UNITED STATES

DEPARTMENT OF THE INTERIOR

Geological Survey

DRAFT
May 26, 1966
Coulter

San Luis Obispo County, California

Cayucos Site

50-275

General

The Cayucos site is underlain by rocks of the Franciscan formation which contains many intrusive serpentine bodies. The difference in physical properties between the Franciscan rocks and the serpentines and within the serpentine bodies themselves between massive serpentine and altered and sheared serpentine is great. This dissimilarity in physical properties, primarily shearing strength, exercises a strong geologic control on slope stability and foundation conditions in terrain underlain by Franciscan rocks. There are no topographic indications of major landslide problems within the site area. Minor slope stability probelms related to cut-slope development during construction can be anticipated.

Faults

Detailed mapping which would give diagnostic evidence concerning the presence or absence of large faults at or near the site is not available and their existence there certainly cannot be precluded. High-angle shear zones with gouge development up to several feet in width are common. Such shear zones are characteristic in Franciscan rocks and are generally considered to relate to a geologically remote, not recent, period of tectonism. The seismically active Nacimiento fault is located approximately 10 miles northeast of the site. The nearest point to the site on the San Andreas fault is approximately 40 miles, and the Santa Ynez and Big Pine faults pass within 90 miles of the site. An undetermined number of offshore faults whose exact positions and trends are unknown have been postulated in the area approximately 75 miles southwest of the site.

Seismicity

The Cayucos site is located within a zone of active seismicity. In the period 1934 to 1962, 14 earthquakes with epicentral locations within 20 miles of the site have been recorded. Of these 14 earthquakes, seven had a Richter magnitude between 4.0 and 4.3 and the remainder were less than 4.0. Within the zone between 30 and 40 miles from the site three epicentral locations with Richter magnitudes of 6.0 and 6.5 have been recorded. The highest intensity assigned to the Cayucos area was VII M.M. associated with the earthquake of November 1927 with a Richter magnitude of 7.3 and an epicentral location 55 miles west of Point Arguello.

Problems

Because of the complex stratigraphy, the general lack of continuous mappable lithologic units, and the intricacies of localized shearing and attendant structures, the recognition of major throughgoing structural features in Franciscan terrain is difficult. Detailed regional mapping and structural analysis will be required to provide diagnostic evidence that may prove or disprove the existence of major faults south-west of the Nacimiento fault in the vicinity of the Cayucos site.

Massive serpentine is relatively stable in steep or vertical cuts whereas cut slopes in sheared serpentine are potentially unstable on slopes greater than 1:1. Insofar as bearing capacity under foundations is concerned, the shearing strength of massive serpentine is relatively high but decreases with increasing proportions of shearing and alteration. Veins of soft altered material in hard serpentine may present special problems. Hence, for adequate geologic evaluation of the Cayucos site accurate delineation of the distribution of serpentine bodies and of the degree of shearing and alteration within the bodies is required. Such delineation can best be provided by detailed geologic mapping combined with an adequate sampling and testing program designed to provide sufficient information on the physical properties of the various lithologic units underlying the site to formulate adequate slope and foundation design criteria.

UNITED STATES

DEPARTMENT OF THE INTERIOR

Geological Survey

DRAFT: May 1966

Coulter

Ventura County, California

Sycamore Canyon Site

General

The Sycamore Canyon site lies adjacent to the beach on the south flank of the Santa Monica Mountains. The site is underlain by a complexly folded, faulted and sheared sequence of Miocene sedimentary and intrusive igneous rocks. There is topographic evidence in Sycamore Canyon, beyond the limits of the site, of landslides in geologic environments similar to those existing within the site.

Faults

Three faults with large-scale stratigraphic displacement, the Sycamore Canyon fault, the Baudette fault and the Serrano fault, and several subsidiary faults of lesser displacement have been recognized within the site area. Diagnostic evidence as to whether or not any of these faults displace Pleistocene and/or Recent deposits is not available. The active San Gabriel fault lies 26 miles northeast of the site. The nearest point to the site on the Santa Ynez fault is 32 miles north; the Newport-Inglewood fault 36 miles east; the San Andreas fault 46 miles northeast; the Big Pine fault 45 miles north; the Garlock fault 52 miles north; and the White Wolf fault 56 miles north. An undetermined number of offshore faults whose exact positions and trends are unknown have been postulated in the Santa Barbara channel south of the site.

Seismicity

The Sycamore Canyon site is located within a zone of active seismicity. In the period 1934 to 1962, 39 earthquakes with magnitudes of 3.0 to 3.9

and epicentral locations within a radius of 20 miles of the site, have been recorded. Six of these earthquakes have epicentral locations less than 5 miles offshore from the site. There are three additional earthquakes with magnitudes of 4.1, 4.7, and 4.7 with epicentral locations within 5.5 and 6 miles respectively of the site. No maximum intensity records are available for the Sycamore Canyon area.

Problems

The following geologic problems are involved in the consideration of the Sycamore Canyon site.

1. The site is within the zone of intersection of several faults, the date of the latest movement on which has not been, and perhaps here for dearth of diagnostic stratigraphic criteria cannot be, established.
2. There is evidence of serious slope stability problems in the Sycamore Canyon area which may be found to affect either the site itself or the natural drainage system through the site.
3. The site is located in a zone of active seismicity the relationship of which to the faults through the site has not been established.

UNITED STATES

DEPARTMENT OF THE INTERIOR

DRAFT: May 1966
Coulter

Geological Survey

Ventura County, California

Oxnard Site

General

The Oxnard site is underlain by at least 1,800 feet of unconsolidated, saturated, predominantly fine-grained alluvium. The maximum elevation within the site is 10 feet above sea level and the relief is low. The general seaward slope offshore from the site is gentle, approximately 40 feet per mile; however, 1 mile west of the site this gentle slope is dissected by the steep declivity at the head of the Hueneme submarine canyon. Insofar as slope stability is concerned, this relationship imposes steep gradient rather than gentle gradient controls on the submarine topography.

Faults

Recognition of faults in an actively aggrading alluvial sequence of this type is virtually impossible without extremely detailed subsurface exploration. The nearest recognized seismically active faults, the Santa Ynez and Big Pine, are located approximately 30 miles north of the site. The nearest point to the site on the San Andreas fault is approximately 50 miles northeast. An undetermined number of offshore faults whose exact positions and trends are unknown have been postulated in the Santa Barbara channel south of the site.

Seismicity

The Oxnard site is located within a zone of active seismicity. In the period 1934 to 1962, 54 earthquakes with epicentral locations within a 20-mile radius of the site have been recorded. Of these 54 earthquakes, four had a Richter magnitude of 4.0 to 4.7 and the remainder were less than

4.0. Since 1769, six large earthquakes with estimated or recorded magnitudes of 6.0 or greater have occurred within a 60-mile radius of the site. The highest intensity assigned to the Oxnard area was VII M.M. associated with Kern County earthquake of 1952 with a Richter magnitude of 7.7 and an epicentral location along the White Wolf fault approximately 75 miles north of the site.

Problems

During the Alaskan earthquake of 1964, extensive surface rupture, massive liquefaction flow slides on relatively gentle slopes and differential compaction were observed to have taken place in thick saturated alluvial sections similar to that underlying the Oxnard site. These effects were observed at epicentral distances ranging from 30 to more than 100 miles.

The potentially unfavorable dynamic response characteristic of the alluvium at the Oxnard site combined with the steep gradient controls resulting from the location immediately offshore of the Hueneme submarine canyon suggests the likelihood that comparable effects resulting from a major earthquake centered on any one of the active faults located within 100 miles of the Oxnard site may be anticipated.

UNITED STATES

DEPARTMENT OF THE INTERIOR

DRAFT: May 1966

Coulter

Geological Survey

Tehachapi Site

General

The proposed plant site is located on the southeast edge of the San Joaquin Valley approximately 17 miles south of Arvin and 11 miles north of Gorman.

The site is underlain by silty sandstones of the Tejon formation of Eocene age which dip northwesterly at moderate to steep angles. The rocks of the Tejon formation are described as being weak when wet and slightly stronger when dry. Boring data indicate artesian groundwater conditions in the vicinity of the site and "suggest that serious hydrostatic uplift pressures may be encountered at foundation grade."

Faults

Five major seismically active faults showing evidence of recent primary surface rupture occur within a 20 mile radius of the site. Many additional faults with less prominent surface expression but with possibly equal or even greater potential effect on the site lie within this area. Evidence of a flowing spring and juxtaposed divergent bedding attitudes along the gully entering the plant site at the southeast corner suggest the presence of a fault traversing the site from southeast to northwest.

Water supply for the plant is to be taken from the aqueduct. To the extent that a continuous supply of water represents an operating requirement for the plant, consideration must be given to possible disruption of flow through the aqueduct in those many localities where the line crosses major fault zones between the Tehachapi Site and the ultimate source of water to the east.

Problems

In addition to the high regional seismicity of the area the following problems at the Tehachapi Site must be considered:

1. Poor foundation conditions on weak, saturated, silty sandstone with potential hydrostatic uplift pressures at foundation grade.
2. Complexly faulted bedrock adjacent to and perhaps beneath the site.
3. Possible interruption of plant water supply by disruption of the aqueduct throughout a broad zone of seismically active terrain east of the site.

REPORT ON THE SEISMICITY OF THE CAYUCOS, OXNARD, SYCAMORE CANYON, AND TEHACHAPI, CALIFORNIA AREA

In response to the request of the Division of Reactor Licensing of the Atomic Energy Commission, the Seismology Division of the Coast and Geodetic Survey has prepared this report on the seismicity of Cayucos, Oxnard, Sycamore Canyon, and Tehachapi,California, and their environs.

The fault nearest Cayucos is the Nacimiento fault which is inland and trends northwest-southeast parallel to the coast at a distance of about 8 miles from the site. The San Andreas has roughly the same orientation and is approximately 42 miles from the site at its nearest point. Historically, Cayucos has experienced macroseismic disturbance from at least sixteen earthquakes registering intensities above Modified Mercalli III. The strongest recorded intensity was MM VII caused by the earthquake of November 4, 1927, which occurred off Point Arguello about 75 miles from the site and had a magnitude of 7.5. This produced a maximum acceleration of 0.13g. On February 23, 1931, a small earthquake occurred in the immediate vicinity of Cayucos, a result of which a maximum intensity of V was produced.

Oxnard is in an area that is underlain by deep alluvial deposits and evidence of surface faulting is not readily detectable. However, to the north and east are a number of poorly defined faults of the transcurrent system prevalent in this region. The site is approximately 25 miles from the Santa Ynez fault and 50 miles from San Andreas fault. It has been subjected to seismic disturbances of MM intensity III at least 35 times during historic times.

Intensity VII is the highest experienced and occurred on three occasions. The first on January 9, 1857, as the result of an earthquake near Fort Tejon, distance, 50 miles; the second caused by a small nearby earthquake on December 14, 1912; and the third on July 21, 1952, as a result of the Kern County earthquake which was 55 miles distant and had a magnitude of 7.7.

The Sycamore Canyon site is located at a distance of about 26 miles from the San Gabriel fault, 32 miles from the Santa Ynez fault and 36 miles west of the Newport-Inglewood fault. The nearest point on the San Andreas fault is 46 miles to the northeast. It has been subjected to seismic disturbances of intensity III or more at least 42 times since 1769. A maximum intensity of VI was recorded as a result of 13 earthquakes ranging in distance from 10 to 210 miles.

The Tehachapi site is very near the juncture of the San Andreas fault and the faults of the transcurrent system of southern California. It lies between two seismically active faults, the White Wolf, 11 miles to the northeast and the Garlock, 5 miles to the southeast and at a distance of 9 miles from San Andreas which lies to the southwest.

It is an area of very high seismic activity. The most notable earthquake to occur here was the Kern County earthquake of July 21, 1952. It had a Richter magnitude of 7.7 and a maximum intensity of XI at a point near Bealville, 26 miles from the site which would have subjected the latter to an intensity of VIII and an acceleration of .27g.

Using the criterion of the effect of a magnitude 8.0 earthquake on the nearest point of the San Andreas fault to each site the following effects are postulated: Cayucos, intensity VIII, acceleration 0.27g; Oxnard, intensity VII, acceleration 0.13g; Sycamore Canyon, intensity VII+, acceleration 0.23g. The intensity given above for Oxnard refers to bedrock; however, the site is situated on 1800 ft of alluvial material so that the acceleration could be as much as 3.5 times higher. To evaluate further this estimated acceleration at Oxnard, a seismic measurement of the ground amplification factor is recommended.

With regard to Tehachapi a magnitude 8 shock occurring at the nearest point on the San Andreas fault would cause an intensity at the site of X+ and a maximum acceleration of .70g. If the complex nature of the fault structure near the intersection of the Garlock and the San Andreas faults is taken into consideration, there is a high degree of probability that a shock of magnitude 8 could occur within 5 miles of the site in which case it would be subjected to intensity XI and a maximum acceleration of .9g.

An excellent example of the earthquake forces encountered in this region is given in descriptions of the Kern County earthquake damage near Bealville in U. S. Earthquakes, 1952, page 17 and the publication "Earthquakes in Kern County, California during 1952," (see reference).

Another factor for consideration in evaluating the coastal areas as a reactor site is the possibility of tsunami damage. For the most part, a tsunami is generated by a submarine earthquake or an earthquake located close to coastal areas although only a small percentage of earthquakes of this type have been known to generate measurable water waves. The vertical displacement of submarine blocks of the earth's crust is the most commonly accepted explanation of the cause of these waves. Since it has been observed on land that great earthquakes have caused uplifts of 30-50 feet and affected crustal blocks hundreds of miles long and up to a hundred miles wide, it is easy to conceive of such a crustal movement under the ocean generating huge water waves. Slides along the coasts are also thought to be possible sources of tsunamis and great earthquakes originating on the sides of deep oceanic troughs may cause huge masses of unconsolidated material to slide into the depths, displacing a great amount of water. It has been suggested also that there is a possible coupling mechanism between tsunamis and large surface waves with periods over a minute. Historically, these waves have had amplitudes considerably less than those transmitted directly from the sources.

Along the coast of California there is no well established source areas for the generation of tsunamis. On December 21, 1812, there was a strong submarine earthquake (possibly 7 1/4-7 1/2 magnitude) off the southern California coast which reportedly generated a tsunami that reached land elevations of 50 feet at Gaviota, 30-35 feet at Santa Barbara, etc. However, it has not been possible to definitely substantiate these heights. So employing the results of Iida's work for estimating tsunami wave heights along the Japanese coast and realizing the fault movements along the California coasts are mostly strike-slip, it is estimated that tsunami run up (flooding) caused by locally generated tsunamis would not be more than approximately 30 feet. For tsunamis generated by distant sources such as Japan, Aleutians and the extension of the San Andreas fault off the west coast the tsunami run up at these sites would be approximately 30 feet above mean lower low water.

In summary, the Survey believes that within the lifetime of facilities located at the above sites and on rock, accelerations in the period range of 0.3 to 0.6 seconds should be taken into account in the designs as follows: Cayucos, 0.27g; Oxnard, 0.13g and as much as 3.5 times greater if on approximately 1800' of alluvium; Sycamore Canyon, 0.23g and Tehachapi 0.9g. For tsunami run up from distant severe marine earthquakes, the coastal sites should be protected to a vertical height of 30 feet above mean lower low water. This 30 feet level is also adequate protection for any tsunami generated by local earthquakes along the coast of southern California.

U. S. Coast and Geodetic Survey
Washington, D. C.

May 24, 1966

REFERENCES

"United States Earthquakes, 1952," Leonard M. Murphy and William K. Cloud, U. S. Department of Commerce, Coast and Geodetic Survey, Serial No. 773, 1954.

"Earthquakes in Kern County, California during 1952," California Department of Natural Resources, Division of Mines Bulletin 171, 1955.

Date	Epicentral Area	Maximum Intensity	Distance--Intensity (Miles) (MM) Cayucos	Oxnard	Sycamore	Tehachapi
1769 July 28	Los Angeles region	VIII-IX	165	45 V	40 V	
1812 Dec 21	Off Coast of So. Calif	X	110 IV	45 VI*	75 VI	
1852 Oct 26	San Simeon	X				135 III*
1852 Nov 27-30	Ventura County	VIII	120	30 V	35 V	
1855 July 10	Los Angeles County	VIII	165	50 V	15 VI	
1857 Jan 9	Fort Tejon	X-XI	115 V	50 VII	70 VI	6 (X)
1870 Jan 3	Bakersfield	V				30 III*
1872 Mar 26	Owens Valley	X-XI	175 IV	170 IV	170 IV	115 IV*
1883 Sept 5	Ventura	V-VI	120	10 V	35 III	
1885 Apr 7	Bakersfield	IV				30 III*
1890 July 24	Bakersfield	V-VI				30 (IV)
1892 Feb 23	Baja California	IX-X VII-IX U.S.		250 III	210 V-VI	
1893 Apr 4	Los Angeles region	VIII-IX	160 III	35 VI	35 VI	
1896 Aug 17	Hanford	VI				105 (IV)
1899 July 22	San Bernardino County	VIII		100 III	80 VI	
1899 Dec 25	San Jacinto	IX			130 V	

Date	Epicentral Area	Maximum Intensity	Distance--Intensity (Miles) (MM) Cayucos	Oxnard	Sycamore	Tehachapi
1902 July 27	Santa Barbara County (2 similar aftershocks July 31)	VIII	60 IV			
1902 Dec 12	Los Alamos	VII	60 III			
1903 Jan 7	Bakersfield	V-VI				30 IV+
1905 Mar 18	Bakersfield	VI				30 IV+
1905 Dec 23	Bakersfield	VII				30 IV+
1906 Apr 18	San Francisco	XI				280 (V)
1908 Sep 4	Bakersfield (2 shocks)	VI				30 IV+
1910 May 6	Near Bishop	VI				180 (III)
1912 Dec 14	Oxnard	VI-VII		Max.	25 V-VI	
1915 Jan 11	Los Alamos	VIII	60 IV			
1915 May 28	Southern Sierra Nevada	V+				85 (IV)
1916 Oct 22	Tejon Pass	VII				5 (VII)
1918 Mar 6	Santa Monica	(V-VI)			15 V	
1918 Apr 21	Riverside County, Mag 6.8	IX		125 IV	100 V-VI	
1918 Nov 19	Santa Monica Bay	VI			15 V	
1919 Jan 25	Tejon Pass	V				5 (V)
1919 Feb 16	South of Maricopa	VII				30 IV+

Date	Epicentral Area	Maximum Intensity	Distance--Intensity (Miles) (MM) Cayucos	Oxnard	Sycamore	Tehachapi
1902 July 27	Santa Barbara County (2 similar aftershocks July 31)	VIII	60 IV			
1902 Dec 12	Los Alamos	VII	60 III			
1903 Jan 7	Bakersfield	V-VI				30 IV*
1905 Mar 18	Bakersfield	VI				30 IV*
1905 Dec 23	Bakersfield	VII				30 IV*
1906 Apr 18	San Francisco	XI				230 (V)
1908 Sep 4	Bakersfield (2 shocks)	VI				30 IV*
1910 May 6	Near Bishop	VI				180 (III)
1912 Dec 14	Oxnard	VI-VII		Max.	25 V-VI	
1915 Jan 11	Los Alamos	VIII	60 IV			
1915 May 28	Southern Sierra Nevada	V+				85 (IV)
1916 Oct 22	Tejon Pass	VII				5 (VII)
1918 Mar 6	Santa Monica	(V-VI)			15 V	
1918 Apr 21	Riverside County, Mag 6.8	IX		125 IV	100 V-VI	
1918 Nov 19	Santa Monica Bay	VI			15 V	
1919 Jan 25	Tejon Pass	V				5 (V)
1919 Feb 16	South of Maricopa	VII				30 IV*

Date	Epicentral Area	Maximum Intensity	Distance--Intensity (Miles) (MM) Cayucos	Oxnard	Sycamore	Tehachapi
1920 June 21	Inglewood	VIII				
1922 Mar 10	Cholame Valley, Mag $6\frac{1}{2}$	IX	45 VI	125 III		100 IV*
1925 June 29	Santa Barbara, Mag 6.3	VIII-IX				
1926 Jun 30	Kern River Canyon	VI				30+([illegible])
1927 Jul 8	Bakersfield	IV				30 III*
1927 Nov 4	Off Pt. Arguello, Mag 7.5	IX-X	75 VII	135 V-VI	155 III	
1930 Jan 15	34.2N., 116.9W., Mag. 5.2	VII(?)			100 V	
1930 Aug 30	33.9N., 118.6W., " 5.2	VII		40 III	10 VII	
1931 Feb 23	Templeton, Parkfield, Cayucos	V	Max.			
1933 Mar 10	33.6N., 118.0W., Mag 6.3	IX		80 VI	50 VI	1[illegible] (IV)
1933 Oct 2	33.8N., 118.1W., " 5.4	VI			40 (V)	
1934 June 7	35.9N., 120.5W., " 6.0	VIII(?)	40 V	135 (IV)		110 (III)
1935 Jan 23	35.5N., 119.2W., " 4	V				40 (III)
1940 Oct 10	33.8N., 118.4W., " 5	VI			15 V	
1941 June 30	34.4N., 119.6W., " 5.9	VIII	100 V	30 VI	55 V	
1941 Sep 14	37.6N., 118.7W., " 6	VI-VII				185 (III)

Date	Epicentral Area		Maximum Intensity	Distance--Intensity (Miles) (MM) Cayucos	Oxnard	Sycamore	Tehachapi
1941 Sep 21	34.9N., 118.9W.,	Mag 5	VI				5 VI
1941 Oct 21	33.8N., 118.2W.,	" 5	VII		55 IV	40 V	
1941 Nov 14	33.8N., 118.2W.,	" 5.5	VII-VIII		55 IV	40 V	
1942 Oct 21	33.0N., 116.0W.,	" 6.5 4.5	VII			190 IV	
1944 June 18	33.9N., 118.2W.,	" 4.4	VI(2)			50 III	
1946 Mar 15	35.7N., 118.1W.,	" 6.3	VIII		125 V	120 V	70 V
1947 Apr 10	35.0N., 116.6W.,	" 6.4	VII		165 V	160 V	
1948 Feb 10	36.1N., 118.8W.,	" 4.6	VI				80(III)
1948 Apr 16	34.0N., 119.0W.,	" 4.7	VI		15 VI	10 VI	
1948 Dec 4	33.9N., 116.4W.,	" 6.5	VII		155 VI	140 VI	
1949 Aug 27	34.5N., 120.5W.,	" 4.9	VI	70 I-III	75'	90	
1950 Feb 25	34.6N., 119.1W.,	" 4.7	VI		40 VI	50 V	
1951 Dec 25	32.8N., 118.4W.,	" 5.9	VI		100 V	85 V	
1952 July 21	35.0N., 119.0W.,	" 7.7	XI	110 VI	55 VII	65 VI	10 VIII

(180 aftershocks, mag. 410 and over, recorded at Pasadena from July 21 to September 26; 6 aftershocks of 5.0 and over on the 21st).

Date	Epicentral Area	Maximum Intensity	Distance--Intensity (Miles) (MM)			
			Cayucos	Oxnard	Sycamore	Tehachapi
1952 July 25	East of Caliente (2 shocks)	VII				30 [illegible]*
1952 Jul 28	Near Bear Mountain	VII				20 [illegible]
1952 Jul 31	North of Caliente	VI				20 III*
1952 Aug 22	35.3N., 118.9W, Mag 5.8	VIII		70 IV	80 IV	15 V
1952 Aug 23	34.5N., 118.2W, " 5.0	VI		60 VI	60 V	
1952 Nov 21	35.8N., 121.2W, " 6.0	VII	35 VI			140 IV
1954 Jan 12	35.0N., 119.0W, " 5.9	VII-VIII		55 V	65 V	11 VI
1954 Jan 27	35.1N., 118.6W, "	VI				20 V
1954 Mar 19	33.3N., 116.2W, " 6.2	VI		180 IV	170 IV	
1954 May 23	35.0N., 119.0W, " 5.1	IV				10 IV
1954 Dec 16	39.3N., 118.2W, " 7.0	X	285(IV)	350(IV)	350(IV)	310(III)
1955 Aug 7	35.4N., 118.6W, " 4.7	V				30 (II[illegible]
1955 Nov 21	35.4N., 118.7W, " 4.3	V				25 (IV)
1956 Feb 9	31.8N., 115.9W, " 6.8	VIII-IX (VI-U.S.)		245 IV	260 IV	
1957 Jan 29	35.9N., 122.1W, " 4.9	V	75 IV			
1957 Mar 18	34.1N., 119.2W, " 5	VI		10 VI	20 V	

Date	Epicentral Area	Maximum Intensity	Distance--Intensity (Miles) (MM)			
			Cayucos	Oxnard	Sycamore	[illegible]
1958 July 13	34.4N., 119.5W., Mag 4.7	VI		25 V	40 IV	
1959 Sept 30	34.4N., 120.6W., " 4.5	VI				
1961 Jan 28	35.8N., 118.0W., " 5.3	VI				70 (IV)
1961 Nov 14	34.9N., 119.0W., " 5.0	VI				10 ([illegible])
1963 Feb 28	34.9N., 119.0W., " 5.0	VI				7 V

Intensity at Site:
*Estimated using Gutenberg-Richter Int. vs Distance

( ) Estimated from nearby reports