RELATED CORRESPONDENCE

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	Docket No. 50-70
GENERAL ELECTRIC COMPANY	)	
	)	Operating License No. TR-1
(Vallecitos Nuclear Center - General Electric Test Reactor	))	(Show Cause)

TESTIMONY OF ROBERT L. KOVACH, CHARLES F. RICHTER, GARRISON KOST, AND DWIGHT L. GILLILAND
CONCERNING ISSUE 1
(SEISMIC DESIGN)
SUBMITTED ON BEHALF OF THE GENERAL ELECTRIC COMPANY

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U.S. NUCLEAR REGULATORY COMMISSION

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Introduction

Issue (1) of the show cause order provides that the issues considered shall include:

(1) What the proper seismic and geologic design bases for the facility should be.

At the conclusion of its review of the GETR geologic and seismic investigations, the NRC Staff recommended the following design bases as being appropriate for the GETR site:

1. The Regulatory Guide (R.G.) 1.60 spectra anchored to 0.75g as the maximum effective vibratory ground motion at the site. This is set by motion on the Calaveras fault.

2. A surface displacement of one meter of reverse oblique net slip along a fault plane which could vary in dip from 10 to 45 degrees and which could occur on a Verona fault zone strand (splay) beneath the GETR during a single earthquake event.

3. An effective vibratory ground motion of 0.6g anchoring the R.G. spectra, together with a fault displacement of one meter as described in 2. above.

The testimony presented by Dr. Jahns, Mr. Harding, Dr. Reed and Mr. Meehan addressed the conservatism of the second subelement of the foregoing design bases (1.0 meter surface offset) from the standpoint of the relevant geologic, probabilistic, and soil/structure considerations. This testimony, which will be sponsored by Mr. Gilliland and Dr. Kovach, and supported by contributions from Dr. Richter and Mr. Kost, will assess the conservatism of all three elements of the above mentioned design bases from the standpoint of seismic considerations. In short, this testimony takes certain geological input parameters and presents the seismologist's point of view concerning the design bases. In what follows the criteria will be examined in the light of:

1) An overview of the governing state-of-the-art seismic principles and regional seismicity in order to establish a firm perspective for assessment of seismic activity along the postulated Verona fault.

2) Analysis of postulated Verona fault characteristics based upon correlations of worldwide data regarding fault length, width and magnitude to establish the magnitude of a design basis event on the Verona fault.

3) Analysis of Verona fault characteristics based upon correlation of earthquake magnitude and seismic moment*/ in order to independently measure the conservatism of the 1.0 meter offset criterion specified for the postulated Verona fault.

4) Analyses of peak acceleration data from such earthquakes as the 1979 Coyote Lake, 1979 Imperial Valley, 1978 Gazli, USSR, 1978 Tabas-e-Golshan, Iran and 1972 Kern County earthquakes to establish the expected peak instrument accelerations for design basis events on the Calaveras and Verona faults.

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*/ Seismic moment has come into common use in seismology as a means of characterizing the size of an earthquake. The dislocation caused by an earthquake in a medium can be mathematically represented by pairs of forces that would have to be applied to produce the same elastic displacements throughout the medium. The moment of these forces can be shown to be the product of the average slip, the fault area and the rigidity of the medium. Seismic moment can be empirically related to earthquake magnitude, thus making it possible to relate geologically observable quantities to seismological data.

On the basis of these seismic considerations it will be shown that the NRC Staff's design bases are conservative.

1. Overview of the Seismicity in the Vicinity of the GETR Site and the Surrounding Region

Studies of the seismicity of the Livermore Valley and the Vallecitos region have been done by Bolt and Hansen (1980; reference 49)*/ and Ellsworth and Marks (USGS Open File Report 80-515). The region under consideration is shown in Figure 1.

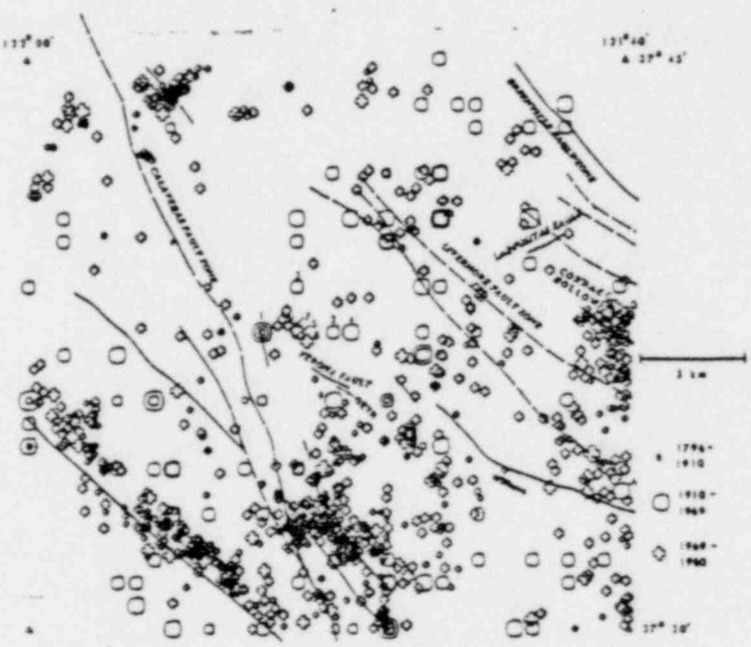

Figure 1. Epicenter Plot

*/ References identified throughout this testimony are as listed in Attachment A to the Feb. 25, 1981 Licensee's Supplemental Response to Intervenor's Discovery.

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It is roughly bounded by the Hayward (the most westerly fault shown in Figure 1) fault zone on the west and the Greenville fault zone on the northeast. Before discussing the seismicity of this region, a few introductory comments are in order. Dr. Charles Richter correctly points out that

1) Care should be taken not to give undue weight to the records of highly sensitive equipment, set up to record small earthquakes along a known or suspected fault line. Such observations are not acceptable evidence unless it can be shown that similar seismicity is not going on elsewhere in the area.

2) Occurrence of small earthquakes along an identified fault line is not evidence of its capability for large events. The entire region is under distorting strain, producing many minor displacements along pre-existing lines of weakness, which only lightly affect the stress pattern and indeed may partially relieve stress and thereby delay larger events.

The earthquake epicenters in Figure 1 show that the pattern of seismic activity is generally diffuse and many epicenters are unrelated to mapped faults. The events shown are mostly small earthquakes with magnitudes of approximately 1. On the other hand, there are some clusters of earthquakes which can be related to mapped tectonic features. There is a dense concentration of earthquakes along the Hayward fault and a clustering of events to the east of the Calaveras fault at the southwest portion of the map. Another concentration of events occurs at the east boundary of the map in the vicinity of the Corral Hollow fault. A further clustering of events (not shown in Fig. 1) is associated with the Greenville fault zone from an earthquake sequence which took place in January 1980. No apparent alignment or clustering can be associated with the Verona fault.

It is particularly informative to remove from Figure 1 all events having magnitudes less than 4.

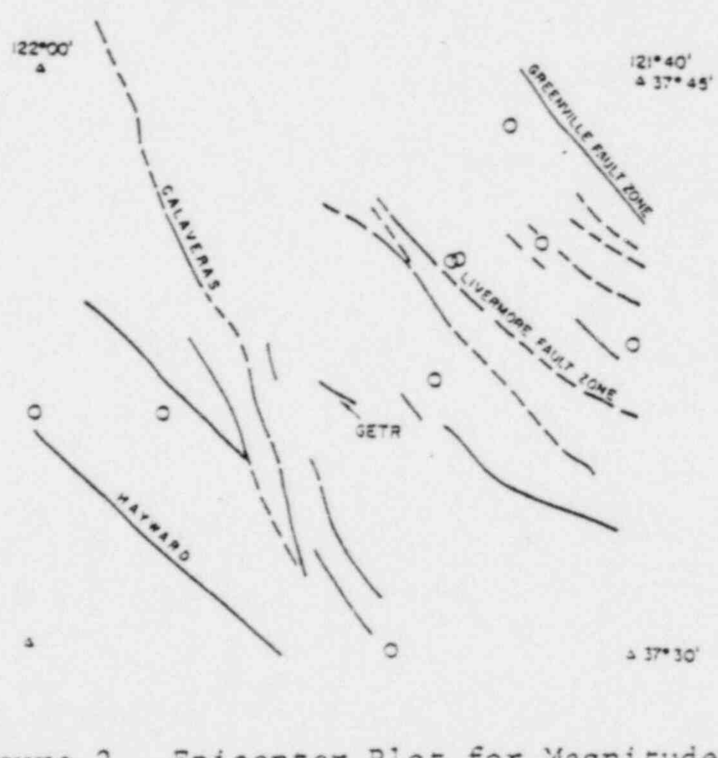

Figure 2. Epicenter Plot for Magnitude 4

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This would suggest activity along the Calaveras, Hayward, Livermore, and Greenville fault zones, but no corresponding association of activity along the Verona fault zone.

In the absence of seismic activity associated with the postulated Verona fault, it remains to consider whether the Verona fault can be characterized as active on other grounds. Existing seismographic coverage does not permit the unambiguous classification of the Verona fault as an active fault. Indeed, Ellsworth and Marks have stated (p. 19, Open File Report 80-515) that "inadequate seismographic coverage prevents the unambiguous classification of this fault as active." It is also particularly significant to note that within about 6 km of the GETR site no earthquakes above magnitude 3 have occurred in the last decade and no earthquakes above magnitude 4 have occurred during the past 37 years (reference 49).

Where seismographic evidence does exist, one can attempt to draw inferences about the nature of faults from seismographic readings. From the polarity of first motions as recorded on seismographs, it is possible to infer the mechanism of faulting which occurred, such as strike slip faulting or thrust faulting.

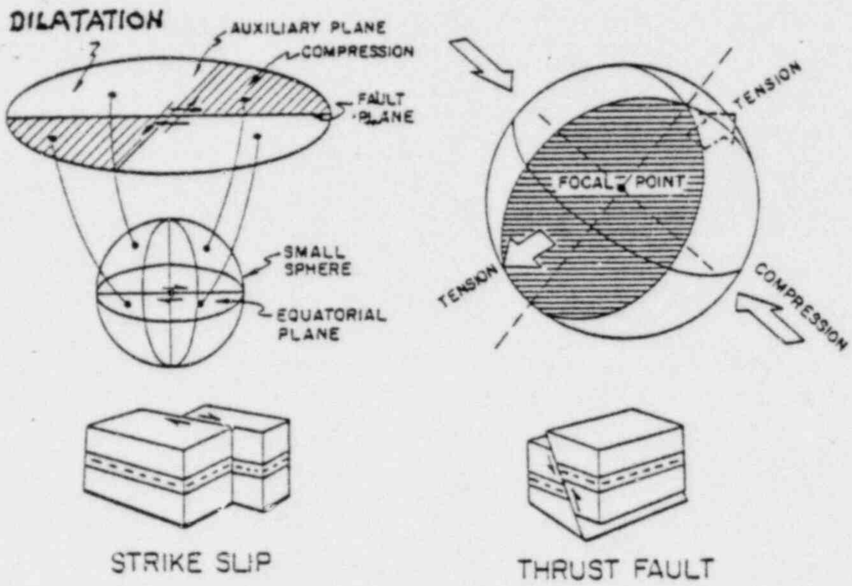

Figure 3. Mechanism of Faulting

Strike slip faulting such as that observed for the Calaveras fault gives a characteristic quadrantal pattern of compressions and dilatations, whereas thrust faulting, such as that hypothesized for the Verona fault, produces a different pattern. One can analytically relate seismograph readings to fault mechanisms by means of focal plane solutions. It is necessary to emphasize, however, that these focal plane solutions, by themselves, do not give a unique determination of the fault plane because motions on an orthogonal plane (the auxiliary plane) will produce an identical pattern of first motions. In other words, focal plane solutions are inherently equivocal. One can only test a given solution for compatibility against a geologically mapped fault or a particular hypothesized fault. One cannot use a focal plane solution to demonstrate the existence of a given fault.

Ellsworth and Marks (1980) have argued on the basis of very limited data and analyses that earthquakes in possible association with the Verona fault have focal mechanism solutions in agreement with north-over-south thrust movement on the fault and demonstrate that thrust faulting with a dip angle of 45° extends into the center of Livermore Valley.

Several comments are in order to place the Ellsworth and Marks argument in perspective. The strike and dip of any determined nodal plane may be uncertain by 10° or more, because of inadequate sampling of the radiation pattern and/or incomplete knowledge of crustal structure. Therefore, precise statements concerning the dip of the postulated Verona fault are not possible based on seismological evidence.

Ellsworth and Marks derived six focal plane solutions for the Vallecitos region. These solutions are shown in map view in Figure 4 and cross section in Figure 5.

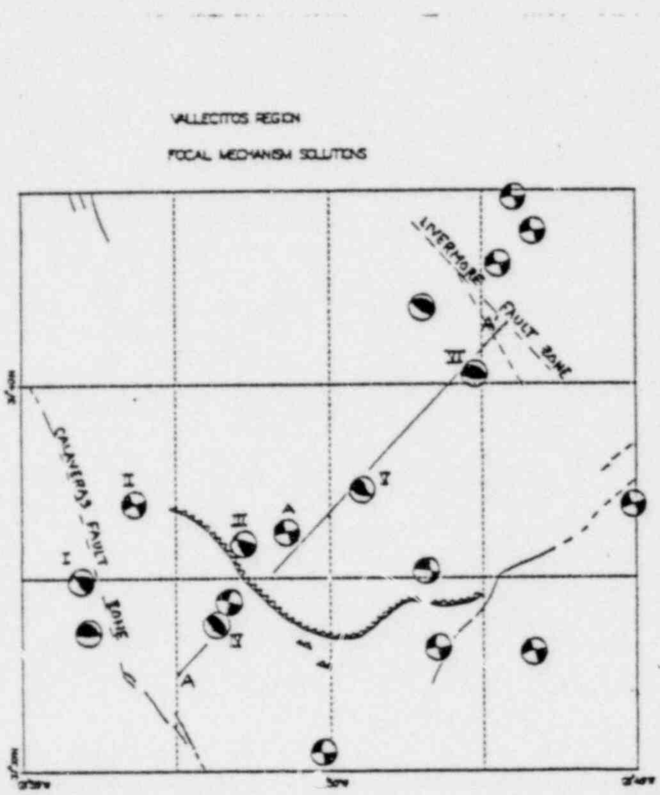

Figure 4

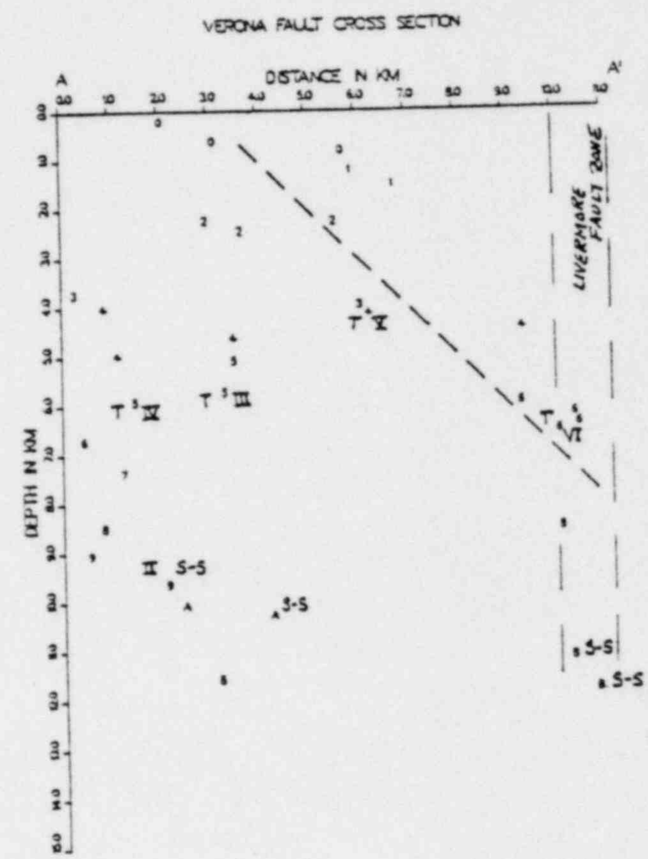

Figure 5

Ellsworth and Mark's solutions are labelled I-VI. The four points labelled "T" represent a thrust fault solution (III, IV, V, and VI), and those solutions are said to align with the 45° dip plane of the Verona fault. The two points labelled S-S represent strike slip solutions. If one examines the four points representing thrust fault solutions, it is clear that these focal plane solutions are equivocal for demonstrating solely thrust faulting for the Ver a Fault. Two thrust fault solutions (T IV and T III) are shown which can be associated in location and depth with the Calaveras - Sunol fault zone, a well known observed strike-slip fault. In any event, solutions III and IV are located at too great a depth to be associated with the postulated Verona fault (see Figure 5). The remaining two cases, points V and VI, have thrust fault mechanisms, but Event VI could equally well be associated with the Livermore fault zone rather than the postulated Verona fault. This would leave one solution as the basis for associating thrust faulting with the Verona fault.

It appears that Ellsworth and Marks have now modified their analysis. A letter dated October 22, 1980*/ from William L. Ellsworth to Professor John C. Maxwell states:

> One difference that should be noted, and which has some impact on my earlier evaluation of the Verona fault comes from our re-interpretation of the original seismograms for events 6 and 17 in the attached sheets. We now find that either strike slip or thrust fault

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*/ This letter was first brought to GE's attention by means of an April 1, 1981 letter from Nelson (NRC) to Darmitzel (GE), which was received by GE on April 17, 1981.

> plane solutions fit the observations. This weakens the case for the identification of the Verona as a "probably" active fault on the basis of seismological evidence. However, the evidence is still permissive and other focal mechanisms indicate compressive tectonics. I would now classify the Verona fault as "possibly" active, based on the microearthquakes and criteria defined in Open-File report 80-515. In view of the fact that the same criteria and data set classified the Greenville fault as possibly active prior to the January 1980 earthquakes, I find little comfort in the revised classification for the Verona fault (emphasis added).

Events 6 and 17 referred to by Ellsworth correspond to the solution labelled V in figures 4 and 5 (Events 6 and 17 have nearly identical hypocenters so only one focal mechanism is shown.) Thus, the only solution which can be associated with the postulated Verona thrust fault is also compatible with a strike-slip fault mechanism.

Professor Maxwell responded to this modified analysis, by letter dated December 3, 1980, as follows:

> In reviewing the geological and seismic evidence available at the time of our Sunol meeting it seemed to me that the major seismic danger definitely lay with the Calaveras Fault to the west of the GETR reactor. The major threat posed by a Verona Fault is that a large displacement (2-3 feet) might occur beneath and intersecting the base of the GETR reactor. Considering the thickness of sediments overlying basement rocks down dip to the northeast from the reactor site, this would seem to require a well-organized thrust fault surfacing

> directly beneath the reactor. The data now available on this point -- mainly the general lack of agreement among workers as to the precise location of the Verona Fault, the trenching in the reactor area, and the mix of strike slip and thrust faulting at various, perhaps random, depths throughout the area shown on your figure 8 -- suggest a response to the regional north-south compression by shearing on widely dispersed planes, rather than well-organized thrusting. The possibility that a major thrust would develop beneath the reactor, breaking through unsheared ground, seems to me to be exceedingly remote, and I therefore continue to believe that the overriding seismic danger which must be considered is that relating to the Calaveras Fault (emphasis added).

In my opinion, and upon review of the additional analysis by Ellsworth and Marks, the available seismic evidence would support the view expressed by Professor Maxwell.

In summary, a review of the available seismic evidence supports the following conclusions:

1. The pattern of observed seismic activity, in spite of the limitations on seismographic coverage, does not correlate with activity along the postulated Verona fault and therefore this fault cannot be uniquely classified as an active fault.
2. The focal plane solutions for the Vallecitos region show a mixture of strike-slip faulting and thrust faulting and do not unambiguously

demonstrate that thrust faulting is pervasive in this region.

3. The theoretical assignment of earthquake foci to a postulated fault is not independent evidence for the postulated Verona fault. The Verona fault can only be assumed to be active, if at all, for reasons apart from the available seismological evidence. The Calaveras fault would appear to be the dominant seismic feature for the GETR site area.

2. Expected Earthquake Magnitudes for the Verona Fault

On the assumption that the Verona fault is an active fault one can characterize size through the use of a magnitude scale. The magnitude scale is based on the simple premise that if two earthquakes occurred at the same place and were recorded on seismographs at a station, the larger earthquake will produce larger amplitude seismograms at that station. There is roughly 31.5 times as much energy released for each full step increase in earthquake magnitude.

Empirical correlations exist between fault area (the product of fault rupture length and width along dip) and earthquake magnitude. The data are sparse for inferring the precise length and geometry of the postulated Verona fault, but a length in the range of 7 to 15 km would seem appropriate, based upon the testimony of Dr. Jahns and Mr. Harding.*/

The depth of the postulated Verona fault is also not well known, but an examination of earthquake focal depths (see Figure 5) shows that the majority of focal depths are confined to depths of less than 6 km or so. (Focal depths are defined as the depth at which rupture commences.) Assuming a dip of 45° for the Verona fault, one arrives at a maximum width along dip for the Verona fault of about 8 km. However, an earthquake fault zone does not rupture over its entire length, and it is conservative to assume that one-half the total length of a fault will rupture during a single earthquake.**/ Therefore, fault rupture areas ranging from 14 to 60 km^2 would be a reasonable scenario for the postulated Verona fault.

A regressional analysis of world-wide data, which considers the probable errors in the data, shows that $M=4.402+0.929 \log A$ where M is earthquake magnitude and A is the fault area in km^2 (Singh, Bazan and Esteva, 1980):

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*/ In contrast, it should be noted that the San Fernando range front fault has a total length of about 100 miles.

**/ As one example, in 1971 the 100 mile long San Fernando fault, ruptured along a 12 mile segment.

FAULT LENGTH	WIDTH	AREA	MAGNITUDE
3.5 km	4 km	14 km^2	5.5
3.5 km	8 km	28 km^2	5.8
7 km	4 km	28 km^2	5.8
7 km	8 km	56 km^2	6.0
15 km	4 km	60 km^2	6.1
15 km	8 km	120 km^2	6.3

It can be seen that the expected earthquake magnitudes for events on the Verona fault would range from 5.5 to 6.1 with the most likely value in the range of 5.8. As the last entry in the table shows, even if the highly unlikely event of a rupture along the entire length and width occurred, the magnitude would be 6.3. Therefore the assignment by the NRC Staff of the possibility of magnitude 6 to 6.5 event on the Verona fault is conservative.

3. Seismic Moment

Empirical studies have been made of the correlation between earthquake magnitude and seismic moment (the product of the shear modulus (the resistance to shearing), the fault rupture area, and the average displacement or offset which occurs as the result of the seismic event). Recent correlations reveal a relation of the form M=0.67 log Mo-10.57 where M is magnitude and Mo is the seismic moment in dyne-cm:

MAGNITUDE	MOMENT
5.5	1.3×10^{24}
5.8	3.6×10^{24}
6.1	1.0×10^{25}
6.3	2.0×10^{25}

Using values for the seismic moment, the fault rupture area, and a shear modulus of 3×10^{11} dynes/cm^2 (an appropriate value for the rigidity of rocks), one can estimate the amount of expected average net offset for an event on the Verona fault:

MAGNITUDE	FAULT AREA	DISPLACEMENT
5.5	14 km^2	0.31 meters
5.8	28 km^2	0.43 meters
6.1	60 km^2	0.56 meters
6.3	120 km^2	0.56 meters

On the basis of these empirical correlations it can be seen that 1 meter of net offset on the postulated Verona fault is a conservative assumption.

4. Instrumental Peak Ground Accelerations

The NRC has specified that the maximum vibratory ground motion at the GETR site would result from a magnitude

7 to 7.5 earthquake on the sector of the Calaveras fault nearest the site and that peak accelerations in excess of 1g could be anticipated. Near field acceleration data from the magnitude 5.7 Coyote Lake 1979 earthquake and the magnitude 6.6 Imperial Valley 1979 earthquake significantly expand the data base for the prediction of near field strong ground motion. These peak acceleration data, when plotted against the nearest distance to the causative fault, exhibit a distinct curvature for distances less than 10 km, emphasizing that, in the near field, peak horizontal accelerations 'flatten' for distances close to a causative fault (Figure 6). The data from the above earthquakes implicitly contain any effects of focusing on peak accelerations and are therefore distributed with equal likelihood throughout the data base.

The 1979 Coyote Lake and 1979 Imperial Valley data were examined to determine whether these recent data had an impact on the stated seismic design criteria. The data were subjected to a non-linear regressional analysis by me to establish an appropriate functional form which describes the mean behavior of the data both in the near and far-field (Figure 6).

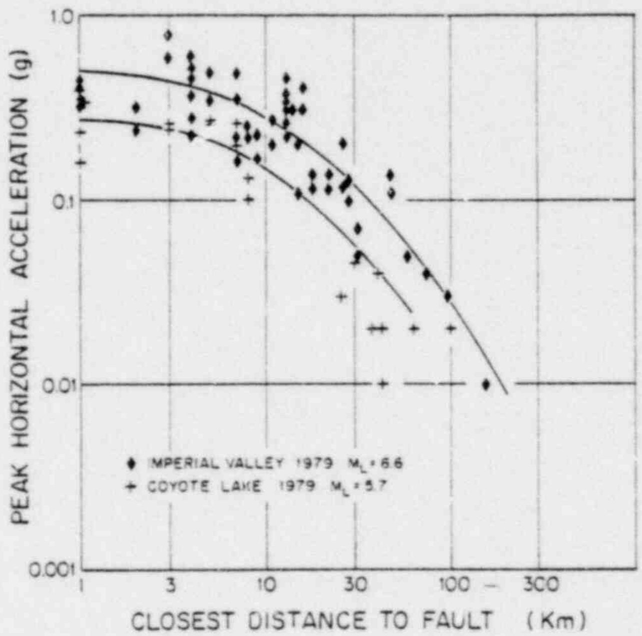

Figure 6.

The uppermost curve represents the fit to the Imperial Valley data, whereas the lowermost curve represents the fit to the Coyote Lake data.

This functional relationship was, in turn, tested against data from earthquakes such as the magnitude 7.7 1952 Kern County earthquake, the magnitude 7.0 1976 Gazli shock and the magnitude 7.7 1978 Tabas, Iran shock, earthquakes for which we have strong motion data in the magnitude range of 7 to 7.7 (see Figure 7).

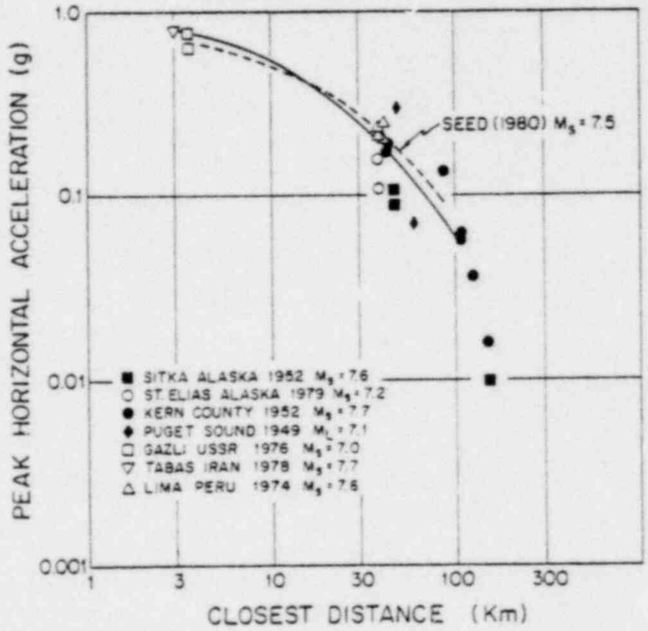

Figure 7.

The <u>predicted values</u> shown in Figure 7, and represented by the solid line, are in agreement with the data in the magnitude range of 7 to 7.7. The GETR is located approximately 3.5 km from the closest reach of the Calaveras fault. Thus, mean horizontal peak accelerations ranging from 0.57g to 0.74g are appropriate for a magnitude 7 to 7.5 earthquake on the nearby Calaveras fault. These

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acceleration values are instrumental free field values and do not incorporate factors dependent upon behavior of a structure, which would reduce the free field value for structural design purposes.

It is customary -- and the NRC Staff has taken this approach in regard to GETR -- to translate peak instrumental values of acceleration into an effective acceleration for the purpose of anchoring the response spectrum (here the spectrum of Regulatory Guide 1.60) used in structural design and analysis. The NRC Staff has recommended .75g effective and .6g effective for events correlated with the Calaveras and Verona faults, respectively.

In this particular case for the Calaveras fault, the peak instrument near field acceleration has a mean value ranging from .57g to .74g, and the effective value would be less. Thus, the 0.75g value of effective acceleration recommended by the NRC Staff is a conservative anchorpoint for the design response spectrum (irrespective of the distinction between peak instrumental and effective acceleration).

A magnitude 6 to 6.5 event has also been postulated to occur on the Verona fault. It is believed, based on the seismic moment considerations stated earlier, that a maximum magnitude 6.5 event is rather high, given the postulated dimensions of the Verona fault. (5.5 - 6.1 is more appropriate.) Utilizing the same functional form as was applied to the Calaveras fault in the foregoing analysis, a value of about 0.4g is an appropriate value for an earthquake on the postulated Verona fault in the vicinity of the GETR site. As before, this is an instrumental free field value, and the effective value for design should be less. Thus, one can conclude that the NRC Staff's recommended values of .75g effective (Calaveras), and .6g effective (Verona) are conservative.

Two additional points deserve mention. The intervenors have recommended that the proper design basis for vibratory ground motion at the site be greater than 1.15g horizontal acceleration and greater than 1.74g vertical acceleration. It is important to put these values in their proper perspective.

First, the 1.15g horizontal acceleration was recorded during the San Fernando earthquake of February 1971. However, it is now known that this value is strongly biased by topographic amplification and USGS Circular 795 - Estimation of Ground Motion Parameters, 1978 by Boore et al. states (p. 25) that "the acceleration (at Pacoima Dam) may have been amplified by as much as 50 per cent."

Second, the 1.74g vertical acceleration recorded at strong motion array station #6 during the October 15, 1979, Imperial Valley earthquake was due to a very local site effect in a wedge between the Imperial and Brawley faults (Mueller, C. S. and Boore, D. M., Site Amplification at El Centro Array Station #6, Earthquake Notes, vol. 52, #1, January-March 1981, p. 84). Therefore, it would be incorrect to use either of these values as a design basis acceleration.

CONCLUSIONS:

1. The available seismic evidence does not support the classification of the Verona fault as an active fault. This must be assumed for reasons apart from seismic evidence. The available seismic evidence indicates that the Calaveras fault is the dominant seismic feature for the GETR site area.

2. Assuming that the Verona fault is active, correlations of earthquake magnitude with fault area, based upon the available world-wide data, would support a magnitude for the Verona fault ranging from 5.5 to 6.1, with a most likely value of about 5.8. On this basis, the NRC Staff's recommended values of magnitude 6 - 6.5 for events associated with the Verona fault is conservative.

3. Given the above range of magnitudes calculated for the Verona fault, correlations of earthquake magnitude and seismic moment, based upon available world-wide data, yield average net offsets for the Verona fault

ranging from .31 to .56 meters, with a most likely value of .43 meters. On this basis the NRC Staff's recommended value of 1.0 meter is conservative.

4. Correlations of near field peak instrument acceleration data for the 1979 Imperial Valley and Coyote Lake earthquakes (magnitudes 6.6 and 5.7, respectively) yielded a functional form in agreement with available world-wide data for magnitude 7 - 7.7 events. This functional form would yield peak instrument accelerations at the GETR site of .57 - .74g for a magnitude 7 - 7.5 event on the Calaveras fault, and .4g for a magnitude 5.5 - 6.1 event on the Verona fault. On this basis the NRC Staff's recommended values of .75g (Calaveras) and .6g (Verona) for anchoring Regulatory Guide 1.60 Response Spectra are conservative.

5. The NRC Staff's recommended seismic design bases are conservative.

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SUMMARY OF RÉSUMÉ

FOR

ROBERT L. KOVACH

EDUCATION:

Geophysical Engineer 1955, Colorado School of Mines; MA 1959 in Geology, Geophysics, Columbia University; PhD 1962 in Geophysics, California Institute of Technology

REGISTRATION:

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PROFESSIONAL EXPERIENCE:

Professor of Geophysics: Stanford University, Stanford, California
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Visiting Scientist: California Institute of Technology, Weizmann Institute of Science, University of Hawaii, Japan Society for the Promotion of Science
Senior Scientist: Jet Propulsion Laboratory, Pasadena, California
Research Assistant in Seismology: California Institute of Technology

Dr. Kovach's experience includes serving as a Principal Investigator for seismic experiments on the Apollo moon missions; President, Seismology section, American Geophysical Union; California Earthquake Prediction Evaluation Council; John Simon Guggenheim Fellow; NASA Medal for Exceptional Scientific Achievement; Consultant to -- Engineering Decision Analysis Company and California Public Utilities Commission

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Geological Society of America
New York Academy of Sciences
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A. B. Stanford University, 1920
Ph.D. California Institute of Technology, 1928

Fellowships:
American Geophysical Union,
Geological Society of America,
Seismological Society of America,
Royal Astronomical Society (London).

Fields of research:
Seismology, especially of California,
Geography of earthquakes,
Instrumental earthquake magnitude scale.

Professional societies:
Seismological Society of America (Past President),
Geological Society of America,
American Geophysical Union,
Association of Engineering Geologists,
Royal Astronomical Society (London),
Royal Society of New Zealand.

Employment:
Research assistant, Carnegie Institution of Washington, Seismological Laboratory, Pasadena, 1928-1936.
Assistant professor of seismology, California Institute of Technology, 1937-1947; associate professor, 1947-1952; professor, 1952-1970; professor emeritus, 1970-present.
Member, Board of Directors, Lindvall, Richter & Associates.

Fulbright research scholar, Tokyo University, 1959-60.

Registered geologist and registered geophysicist, State of California.

Former Member:
California State Board of Registration for Geologists and Geophysicists.
Attorney-General's Environmental Task Force (State of California)

Founder of THE RICHTER MAGNITUDE SCALE used worldwide to measure the size of earthquakes.

DWIGHT L. GILLILAND

General Electric Company

EDUCATION:

BS Electrical Engineering, Kansas State University, 1952

PROFESSIONAL:

Professional Engineer Certificate of Registration
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EXPERIENCE:

Mr. Gilliland has been employed by General Electric Company since 1953, serving in several engineering and operations management positions. His first assignment was in the Aircraft Nuclear Propulsion Department where he worked in shielding experimentation and instrumentation at the Oak Ridge National Laboratory and later supervised the installation and checkout of nuclear power plant instrumentation at the Idaho Test Station. He also managed the Shield Test Facility there. It utilized a pool reactor and advanced instrumentation for the testing of experimental reactor shield configurations.

From 1961 to 1965, he managed in succession, two re-entry vehicle projects at Vandenburg Air Force Base for the Re-entry Systems Department. In 1963, Mr. Gilliland joined the Nuclear Thermionic Power Operations where he was responsible for testing thermionic devices and for the design of the thermionic reactor experiment.

From 1970 to 1973, he managed the development, design and requisition engineering and process development of nuclear sensors, penetration seals, radiation monitoring and source products in the Nuclear Instrumentation Department. Since 1973, Mr. Gilliland has managed the operations and plant engineering for the General Electric Test Reactor and the Nuclear Test Reactor. He also manages the activities related to GETR License Renewal.

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of GENERAL ELECTRIC COMPANY (Vallecitos Nuclear Center - General Electric Test Reactor)	))))))	Docket No. 50-70 Operating License No. TR-1 (Show Cause)

CERTIFICATE OF SERVICE

I hereby certify that the foregoing has been served as of this date by personal delivery or first class mail, postage prepaid, to the following:

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Dated: May 1, 1981