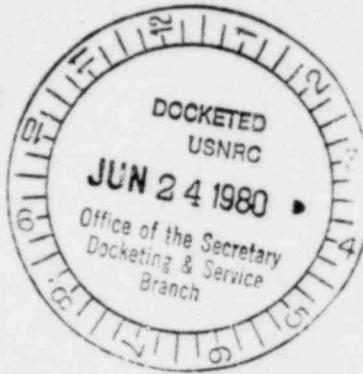


UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING APPEAL BOARD

Richard S. Salzman, Chairman  
Dr. John H. Buck  
Dr. W. Reed Johnson



In the Matter of )  
PACIFIC GAS AND ELECTRIC COMPANY )  
(Diablo Canyon Nuclear Power )  
Plant, Units 1 & 2 )  
)

SERVED JUN 24 1980

Docket Nos. 50-275 OL  
50-323 OL

Mr. David S. Fleischaker, Washington, D.C. (Mr. John R. Phillips, Los Angeles, California, with him on the brief) for Joint Intervenors, San Luis Obispo Mothers for Peace et al., appellants.

Mr. Herbert H. Brown, Washington, D.C. (Mr. J. Anthony Kline, Sacramento, California, with him on the brief) for the Governor of California, amicus curiae.

Mr. Bruce Norton, Phoenix, Arizona (Messrs. Malcom H. Furbush and Philip A. Crane, Jr., San Francisco, California, and Arthur C. Gehr, Phoenix, Arizona, with him on the brief) for the applicant, Pacific Gas and Electric Company, appellee.

Mr. James R. Tourtellotte (Messrs. L. Dow Davis, IV, and Edward G. Ketchen with him on the briefs) for the Nuclear Regulatory Commission staff.

DECISION

June 24, 1980

(ALAB-598)

I.

1. The Licensing Board concluded in its September 27, 1979 partial initial decision that the Diablo Canyon plant will be able to withstand safely any earthquake that can reasonably be anticipated

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DSO 11

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in its vicinity. LBP-79-26, 10 NRC 453. <sup>1/</sup> Joint Intervenors, <sup>2/</sup> supported by amicus curiae, <sup>3/</sup> appealed that determination. After the appeal was briefed but before it was argued, they moved to reopen the record on three grounds: <sup>4/</sup> First, that new data obtained from a major earthquake in California's Imperial Valley which occurred on October 15, 1979 -- about three weeks after the decision below was rendered -- cast a shadow on the adequacy of the Licensing Board's seismic analysis, making it problematical whether the Tablo Canyon design criteria meet Commission requirements; second, that "new seismic reflection data," gathered by a University of California graduate student, invalidate both the Licensing Board's

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- 1/ The decision also approved the physical security plan for the facility. We dealt with the separate appeal from that determination in ALAB-580, 11 NRC 227 (1980).
  - 2/ Comprised of San Luis Obispo Mothers for Peace; Scenic Shoreline Preservation Conference, Inc.; Ecology Action Club; Sandra A. Silver; Gordon Silver; John J. Forster; and Elizabeth Apfelberg.
  - 3/ Although not a party in the proceeding below, we allowed the Governor of California to participate on appeal as amicus in support of Joint Intervenors' exception number 45, challenging the Board's treatment of "seismic focusing." ALAB-583, 11 NRC \_\_\_\_ (March 12, 1980).
  - 4/ The motion was filed on March 28, 1980. At the oral argument on the main appeal in San Luis Obispo, California, on April 3, 1980, we set a date for responses to the motion and indicated that we would decide it on the papers. The applicant's response was accordingly filed on April 24, 1980, and the staff's on May 5th.

findings about the nature of the linkage between the Hosgri  
and San Simeon faults and its conclusion that a 7.5 magnitude  
is a "very conservative" value for the Safe Shutdown Earthquake;<sup>5/</sup>  
and, third, that the staff has changed position about the  
effect of aging on the ability of the facility's safety-related  
equipment to function properly and now believes that approval  
of the applicant's current "environmental qualification program"  
(pertaining to this subject) is not warranted.

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5/ The term is defined in 10 C.F.R. Part 100, App. A,  
§ III(c) as "that earthquake which is based upon an  
evaluation of the maximum earthquake potential con-  
sidering the regional and local geology and seismology  
and specific characteristics of local subsurface  
material. It is that earthquake which produces the  
maximum vibratory ground motion for which certain  
structures, systems, and components are designed to  
remain functional. These structures, systems, and  
components are those necessary to assure:

- (1) The integrity of the reactor coolant pressure boundary.
- (2) The capability to shut down the reactor and maintain it in a safe shutdown condition, or
- (3) The capability to prevent or mitigate the conse-  
quences of accidents which could result in potential  
offsite exposures comparable to the guideline expo-  
sures of this part."

2. We have discretion to reopen a record in order to consider new evidence. Whether to do so turns on the appraisal of several factors: (1) Is the motion timely? (2) Does it address significant safety (or environmental) issues? (3) Might a different result have been reached had the newly proffered material been considered initially? <sup>6/</sup>

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6/ Kansas Gas and Electric Co. (Wolf Creek Station, Unit 1), ALAB-462, 7 NRC 320, 338 (1978). Relying on decisions under Rule 60 of the Federal Rules of Civil Procedure and ICC v. Jersey City, 322 U.S. 503 (1944), applicant argues that an additional requirement for reopening a record is that "the newly discovered evidence which the proponent of the motion seeks to have considered must have been in existence at the time of trial." Applicant's Brief in Response to Motion to Reopen, dated April 24, 1980, at p. 2, fn. 2. The Federal Rules, however, apply only in district court litigation and do not govern agency practice. Rule 1, F.R. Civ. P. Unlike district courts, administrative agencies frequently have continuing responsibilities over matters under their supervision. The settled law on reopening administrative records is contrary to the applicant's position. Thus, in ICC v. Jersey City, the Supreme Court upheld an ICC refusal to reopen a record not because the consideration of post-trial evidence was proscribed, but because whether to reopen for that purpose was a matter entrusted to the agency's discretion. 322 U.S. at 514, 519, 524; accord, United States v. ICC, 396 U.S. 491, 521 (1970); Bowman Transportation v. Arkansas-Best Freight System, 419 U.S. 281, 294-96 (1974).

Given the NRC's oversight responsibilities (see Power Reactor Corp. v. Electricians, 367 U.S. 396 (1961)), it would be strange indeed if this Commission could not consider the most recent information bearing on safety in deciding whether to license operation of a nuclear power plant. Not surprisingly, agency decisions recognize that a motion to reopen a record may rest on evidence that "came into existence after the hearing closed." Vermont Yankee Nuclear Power Corp. (Vermont Yankee Station), ALAB-124, 6 AEC 358, 364-65, on remand, LBP-73-18, 6 AEC 448, affirmed in part and reversed in part, ALAB-138, 6 AEC 520, 523 (1973).

We have considered the motion to reopen in the light of those standards as well as in the context of the decision below and the record upon which it rests. In our judgment, the Imperial Valley earthquake data may well shed significant additional light upon the correctness of key seismic findings made by the Licensing Board. If so, we should take that new information into account in reviewing the decision approving the plant's seismic design. The matter has obvious safety implications and intervenors' motion was made with reasonable dispatch after the information became available. We accordingly grant the motion to reopen on this issue to the extent specified in part II of this opinion. However, as explained in parts III and IV, we find no cause to reopen the record on either the Hosgri-San Simeon linkage or the environmental qualification program questions.

3. The new seismic data may affect our evaluation of the entire seismic reanalysis. We are, therefore, holding our decision on the remainder of the appeal in abeyance until we have examined those data more closely and have fully evaluated their significance.

II.

1. A brief recapitulation of the circumstances surrounding the design of the Diablo Canyon nuclear power plant will place our decision to reopen in perspective. We observed when this case came before us for another purpose last year (ALAB-519, 9 NRC 42, 45) that:

[a]ll nuclear power plants must be designed and built to protect the public from the hazards of radioactive releases should the plant be subjected to movements in the earth's crust. And such considerations were taken into account when the Diablo Canyon facility was initially proposed for its Pacific coast site. At that time the Nacimiento fault was taken to be the nearest major active fault, some 18 to 20 miles northeast of the plant. The facility was designed, engineered, and constructed to withstand earthquake damage on this basis. But, years after construction was approved and well underway, that assumption was discovered to be ill-founded.

Subsequent offshore explorations for petroleum have revealed that, at its closest point, the "Hosgri fault" lies only a few miles off the site of the Diablo Canyon facility. That proximity raised the likelihood that an earthquake in the vicinity of San Luis Obispo might be "considerably more severe" than initially anticipated. In light of this intervening development, the plant's design was extensively reanalyzed by the applicant, the staff, and the [Advisory Committee on Reactor Safeguards]. Their consensus was [that] the Diablo Canyon facility as constructed, with some design modifications, would withstand safely the more severe earthquake shocks now reasonably anticipatable. [Footnotes omitted.]

Although it joined in that conclusion, the ACRS expressed reservations about the seismic reevaluation of the facility. The Committee noted, for example, "that, for want of better

data, certain calculations were necessarily accepted 'largely on [expert] judgment and experience rather than on extensive observations or analyses,' judgments not previously applied in approving power plant design," and "'that the design bases and criteria utilized in the seismic reevaluation of the Diablo Canyon station for the postulated Hosgri event are in certain cases less conservative than those that would be used for an original design.'" Ibid.

These matters were explored in the hearings below. The Licensing Board concluded that the plant was adequately designed to protect the public from harm in the event of an earthquake. Its conclusion rests, among other things, on (1) the "design response spectrum" utilized in the design reanalysis by staff witness Dr. Nathan M. Newmark; <sup>7/</sup> (2) the assumption that the magnitude of vertical acceleration experienced in a major earthquake would be two-thirds of <sup>8/</sup> the horizontal acceleration; <sup>9/</sup> and (3) use of the "tau effect" to justify a reduction in magnitude of higher frequency motion

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7/ 10 NRC at 492-506.

8/ See 10 NRC at 506-507; see also fn. 17, supra and accompanying text.

9/ "Tau" was explained by the Licensing Board "as a simplification of a very complex wave motion-structure action problem. The tau effect is ascribed to the fact that all points on the foundation of a building do not respond in phase. As a result, the motion of the foundation is reduced which, in turn, leads to a reduction in the motion of the building. \* \* \* The larger the foundation and the shorter the traveling wave length, the more effective is the so-called tau reduction." 10 NRC at 494 (citation omitted).

in large structures.<sup>10/</sup>

On October 15, 1979 -- after the decision below was rendered -- California's Imperial Valley experienced an earthquake ("IV-79") with a magnitude of 6.4 to 6.9 on the Richter Scale.<sup>11/</sup> This approached in size the 7.5 magnitude "Design Basis" (or Safe Shutdown) earthquake on the Hosgri Fault that, in accordance with Commission requirements, all parties agree the Diablo Canyon facility's safety systems must be designed to survive in functioning condition.<sup>12/</sup> Because of the Imperial Valley's known high seismicity (a result of the Imperial Fault, which bisects the region), numerous strong motion instruments (seismographs) had been put in place there before the earthquake occurred. The response of that instrumentation to IV-79 provided seismologists with what has been described as "the best near-field data set available to date."<sup>13/</sup> Intervenors argue that data obtained from this major seismic event have rendered the Licensing Board findings questionable and that the record should be reopened to take the new seismic information into consideration.

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10/ 10 NRC at 494-96.

11/ The magnitude of this earthquake is variously described in the record: 6.9 (Staff Brief); 6.4 (USGS Circular 795); 6.7 (Rojan and Ragsdale paper); and 6.6 or greater (Intervenors' Motion).

12/ See fn. 5, supra. The terms "Design Basis Earthquake" and "Safe Shutdown Earthquake" are interchangeable. 10 C.F.R. Part 100, Appendix A, § III(c) fn. 1 (on p. 546 of the 1980 ed.).

13/ Board Notification BN-79-43, December 17, 1979 (from R.E. Jackson memorandum of December 12, 1979, p. 1).

2. We have studied the intervenors' motion and the applicant's and staff's responses to it. Doing so has left us of the opinion that the IV-79 data do raise factual issues bearing on the safety of the plant and their resolution might lead us to a different result than the one the Licensing Board reached.

For example, the design response spectrum for Diablo Canyon was determined primarily from the record of the February 9, 1971 earthquake at Pacoima Dam. That record includes a peak horizontal acceleration of 1.2g which, upon reduction to a response spectrum, yields an "effective" or high frequency anchor point acceleration of 0.75g.<sup>14/</sup> Comparable figures for the smaller IV-79 event are a peak of 0.81g and a 0.36 mean acceleration.<sup>15/</sup> Yet some of the horizontal response spectra generated from the Imperial Valley motion records exceed the Diablo Canyon spectrum values.

In the case of vertical motion, the near-field IV-79 vertical peak accelerations and the vertical response spectra

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<sup>14/</sup> See Diablo Canyon Safety Evaluation Report (SER), Supplement 5, Appendix C, pp. C-4 and C-6.

<sup>15/</sup> Measured at a distance of 5.8 km from the Imperial Fault, which is equal to the Diablo Canyon facility's distance from the Hosgri Fault. Blume Affidavit, ¶6, Table-1, and Figure 1 (Attached to Applicant's Response to Motion to Reopen).

for frequencies greater than 5 cycles per second (cps) are generally equivalent to comparable values for horizontal motion.<sup>16/</sup> In the Diablo Canyon seismic reanalysis, however, vertical motion values are apparently taken to be two-thirds of comparable horizontal values.<sup>17/</sup> We further note that some of the vertical response spectra also exceed the Diablo Canyon design spectrum values.

Finally, we are told by the applicant and the staff not to be concerned that apparently no tau effect was exhibited at the Imperial County Services Building (which was heavily damaged as a result of the earthquake). They say this fact may be discounted because that building is built on piles, in soil, whereas the Diablo Canyon site is rock.<sup>18/</sup> In the proceeding below, Dr. Newmark (the staff's seismic expert witness) used the motion records of the Hollywood Storage Building -- approximately the same size as the Imperial County Services Building -- to demonstrate the existence and nature of the tau effect. But the Hollywood building is also built on piles, in soil.

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<sup>16/</sup> See Blume Affidavit, Table 1(Attached to Applicant's Response to Motion to Reopen); Rothman-Kuo Affidavit, Figures (Attached to Staff Response to Motion to Reopen).

<sup>17/</sup> Blume Testimony, fol. Tr. 6099 at 41, Figures 10 and 11; SER Supplement No. 7, at 3-18.

<sup>18/</sup> Applicant's Brief at 17-18; Staff Brief at 13~~ff~~.

Thus a number of apparently significant inconsistencies exist between the Imperial Valley data and the information presented during the Diablo Canyon seismic hearing. This, together with the fact that the Imperial Valley records provide the best existing set of near-field strong motion data, make it appropriate -- indeed prudent -- to reopen the record to receive the new data in order to test the conclusions that flow from them against those made by the Board below as justifying approval of the Diablo facility's seismic design.

3. As we mentioned, the Imperial Valley Earthquake occurred on October 15, 1979. Intervenors' expert witness, Dr. Brune, thereafter completed his review "in late February when he received the necessary data." (Motion, p. 9.) The motion to reopen was not filed, however, until March 28, 1980, before the appeal was argued but after it was briefed. The staff and applicant contend that the motion to reopen was untimely. We do not think so. But even were we to agree, "a matter may be of such gravity that the motion to reopen should be granted notwithstanding that it might have been presented earlier." <sup>19/</sup> In our judgment, that is the case here. <sup>20/</sup>

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19/ Public Service Co. of Oklahoma (Black Fox Station, Units 1 and 2), ALAB-573, 10 NRC 775, 804 (1979), quoting Vermont Yankee, supra, ALAB-138, 6 AEC 520, 523 (1973).

20/ For the reasons explained in fn. 6, above, applicant's contention that a motion to reopen must rest on evidence in existence at the time of trial -- which would rule out any use of the IV-79 data -- is not well taken.

4. The Licensing Board had no opportunity to peruse the Imperial Valley seismic data, which we have now given close (if preliminary) examination. This leaves us the more familiar with those aspects of the record challenged by the motion to reopen. In these circumstances, and in the interest of expedition -- for the plant is rapidly approaching completion and fairness entitles the applicant to learn as promptly as possible whether any reanalysis or redesign may be required -- we will conduct the reopened evidentiary hearing ourselves. In an effort to frame the issues for that hearing, we have prepared and set out in an Appendix to this decision specific questions generally related to the 1979 Imperial Valley earthquake data. We believe these encompass the intervenors' concerns and include the matters this Board wishes to consider. The parties should address them with written direct testimony by appropriately qualified witnesses. (Unless it is already in the record, a statement of each witness' qualifications should accompany his or her testimony.) All testimony is to be filed with this Board and served no later than 45 days from the date of this decision.<sup>21/</sup>

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21/ Submission of testimony on matters other than answers to our questions is permissible, provided that it is confined to topics directly relevant to the reopened issues.

III.

Joint Intervenors' second ground for reopening concerns the maximum credible earthquake that the Hosgri Fault is capable of causing. The Licensing Board determined it to be one of 7.5 magnitude, which the Board characterized as a "very conservative value for the safe shutdown earthquake." 10 NRC at 468 and 485. Intervenors' motion rests on investigations conducted in 1979 by Mr. R. B. Leslie, a graduate student and a candidate for a master's degree in Earth Sciences (geology) at the University of California at Santa Cruz. Mr. Leslie collected high-resolution seismic reflection data in shallow, near-shore areas proximate to the San Simeon and Hosgri fault zones. These led him to conclude that the offshore extension of the San Simeon fault zone "is 2 to 8 km wide and composed of numerous anastomosing [i.e., intercommunicating] fault strands," and that it "can be followed approximately 10 km southeastward from San Simeon Bay where it joins a strand of the Hosgri fault zone." Leslie Affidavit, p. 5 (attached to Motion to Reopen).

Joint Intervenors argue in essence that the Board's conclusion on earthquake magnitude rests on its assumption that the Hosgri Fault is not connected to any other, and that Mr. Leslie's affidavit invalidates that assumption. They add that

the U.S. Geological Survey's evaluation of the Hosgri Fault agrees with the idea that earthquakes greater than magnitude 7.5 could occur there. To support this proposition, intervenors cite passages from a 1976 USGS report.

Intervenors misstate the Geological Survey's position. The report on which they rely is in the record.<sup>22/</sup> When the relevant excerpts (reproduced in the margin below<sup>23/</sup>) are read in context, there is no question that the Survey's testimony mirrors the Licensing Board's finding -- viz., that the Hosgri Fault has not been shown capable of causing earthquakes greater than 7.5M. And, contrary to intervenors' assertions, the Geological Survey's expert testimony before the Board was that, even were the Hosgri Fault interconnected in the manner

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22/ Supplement No. 4 to the staff's Safety Evaluation Report (SER) on the Diablo Canyon Facility, page C-1; intervenors rely on pages C-10 through C-14.

23/ "The suggestion that the Hosgri-San Simeon-San Gregorio faults comprise a system capable of a magnitude 8 earthquake is a legitimate and serious question, which has been considered since discovery of the Hosgri fault zone by Hoskins and Griffiths (1971). It is our current judgment, however, based upon the data in the FSAR, data in the literature, some work in progress within the USGS, present concepts of earthquake source areas along the west coast of the U.S., and the arguments given above that such faults have not been demonstrated to be capable of generating magnitude 8+ earthquakes.  
(FOOTNOTE CONTINUED ON NEXT PAGE)

the Leslie affidavit now avers to be the case, the entire system is of a kind unlikely to experience earthquakes above a 7.5 magnitude.<sup>24/</sup> Mr. Leslie's affidavit does not suggest (much less state) that the USGS erred in reaching that conclusion. For that matter, Joint Intervenors themselves endorsed this USGS position in the proposed findings they submitted to the Licensing Board.<sup>25/</sup> Intervenors offer no support for their new view aside from the Leslie affidavit. In our judgment, the prffered evidence is not of such a character that, had it been introduced below initially, a different result might have obtained. There is no occasion to reopen the record to consider it now.

IV.

Joint Intervenors' third argument for reopening makes the assertion that approval of the applicant's "environ-

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(FOOTNOTE CONTINUED FROM PREVIOUS PAGE)

23/ In essence the Hosgri, San Simeon, and San Gregorio faults, even if parts of a common zone of deformation, have the dominant characteristics of subsidiary faults within the San Andreas system. Such subsidiary faults have no record of or estimate of earthquakes larger than magnitude 7.5 on them." SER Supp. No. 4 at p. C-14.

24/ See fn. 23, supra.

25/ Joint Intervenors' Proposed Findings of Fact and Conclusions of Law, ¶¶45, 46 and 63 (filed March 25, 1979).

mental qualification program"<sup>2</sup> was unwarranted. They allege that new information reveals that the program did not identify all the safety-related equipment involved at the Diablo Canyon facility and failed to take into account the effect of "aging" on that equipment's ability to function properly.

The "new information" consists of two staff communications to the applicant. The first, a letter dated November 2, 1979, sought additional material for an ongoing staff review of standards applicable to certain instrumentation and electrical equipment. The passage relied upon appeared in an enclosure with that letter and is reproduced in the margin below.<sup>27/</sup> Intervenors construe the

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26/ This "program" is a short-hand reference to the ability of safety-related equipment to withstand steam, heat, irradiation, humidity, and other adverse environmental conditions both in normal operation and in the event of an accident or other malfunction. General guidelines in this area appear in Appendices A and B to 10 C.F.R. Part 50; specific requirements are set forth in various Regulatory Guides and industrial standards described in section 3.11 of the staff's Standard Review Plan, NUREG-75/087.

27/ "The FSAR Tables that identify the operational requirements of equipment which must function during and subsequent to the design basis accidents are general and are not sufficiently complete for purposes of documenting equipment qualification parameters. Therefore, provide a table listing of all Class IE safety-related equipment and appropriate qualification related data for each as noted in the attachment. This table should include all equipment located both inside and outside of containment, including balance-of-plant and nuclear steam system supplied equipment."

passage as specific staff recognition "that the listing of equipment in the [applicant's] Diablo Canyon [Final Safety Analysis Report] was insufficient \* \* \*."<sup>28/</sup> They argue that because of this, the record must be reopened to consider the equipment not listed.

The staff responds that intervenors have drawn a mistaken inference from the paragraph they cite. The letter accompanying the enclosure was apparently intended to convey that all the staff wanted from this applicant was operating data for safety-related equipment which it had previously reported would be used at Diablo Canyon. While the covering letter may have been ambiguous, the staff represents unequivocally that the applicant did identify everything it should have and indicates where that information can be located in the record.<sup>29/</sup> Intervenors mention no additional items of equipment that the applicant should have but did not identify; they rely simply upon the passage from the enclosure that accompanied the staff's letter. Accordingly, their point is not well taken.

The other post-hearing staff communication that intervenors call our attention to is a February 25, 1980 notice to

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28/ Affidavit of R.B. Hubbard, p. 7 (attached to Joint Intervenors' Motion to Reopen).

29/ Affidavit of Thomas G. Dunning, p. 2 (attached to the Staff Response to Intervenors' Motion to Reopen); Diablo Canyon FSAR Tables 3.11-1, 3.11-1A and 2.11-2 and Tr. 8766-69.

"All Construction Permit and Operating License Applicants."<sup>30/</sup>

The notice apprised the addressees of a staff proposal for new generic standards (including ones pertaining to aging) on environmental qualifications of certain safety-related electrical equipment; transmitted the proposal to the addressees for review and comment; and informed them of the staff's "interim position" pending final adoption of the proposal. If the staff proposal is adopted in its present form, it may require items of electrical equipment at Diablo Canyon to be "backfitted" to meet the new standards.

Joint Intervenors assert that these new standards represent a significant departure from the position the staff espoused before the Licensing Board, and that the record must therefore be reopened to consider the change. We do not agree. The staff itself informed the Board of the pending proposals, which are based on work going back many years, and the Board took the prospect of their future adoption into consideration in its decision.<sup>31/</sup>

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30/ NUREG-0588; 45 Fed. Reg. 3124 (January 16, 1980).

31/ The Board stated that (10 NRC at 506-07):

Testimony as to the seismic qualification of the Class I electric equipment was presented by NRC staff witness Faust Rosa. (Testimony following Tr. 8748). He also testified concerning aging, noting there previously had been no such requirement but that did not make nuclear plants unsafe  
(FOOTNOTE CONTINUED ON NEXT PAGE)

A continuing staff effort to improve reactor safety standards is neither novel nor unexpected. The fact that a new proposal is in the wind does not perforce warrant reopening a record. For that result, there must be indication in the "new evidence" that the decision on the existing record would permit the use of unsafe equipment

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31/ (FOOTNOTE CONTINUED FROM PREVIOUS PAGE)

because there are other things going on continuously that would reveal the effects of age, such as seismic testing and normal maintenance. (Tr. 8785, 8786). The Staff, nevertheless, is conducting research programs and a systematic evaluation of older operating reactors to better determine the significance of aging in qualification testing. This subject will be reassessed by the Staff before natural aging could have any significant effect on the seismic qualification of equipment installed at Diablo Canyon. (Rosa Testimony at 6-7). It was also pointed out that there is nothing unique about most of the equipment in a nuclear power plant and that a wealth of experience exists with this equipment in facilities around the world which have been in existence the past ten, twenty or more years (Tr. 8790).

The Staff review of the seismic design of the Diablo Canyon plant was the most extensive ever undertaken by the Staff of the NRC. (Knight Testimony at 54). The Applicant's review was also extraordinarily thorough.

The Board finds that the Applicant has demonstrated through appropriate analysis and tests that Category I structure[s], systems, and components will perform as required during the seismic load of the safe shutdown earthquake.

The Board finds that the Category I structures, systems, and components will be adequate to assure (a) the integrity of the reactor coolant pressure boundary, and (b) the capability to shut down the reactor and maintain it in a safe condition.

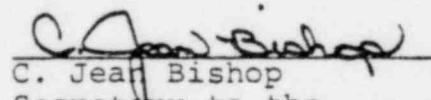
or create some other situation similarly fraught with danger to the public that merits immediate attention. Intervenors do not suggest this to be the case here and the Board specifically stated that it was not. 10 NRC at 506. Moreover, in the event the new standards are adopted, they provide for their application to existing reactors.<sup>32/</sup> In the circumstances, we find no cause in Joint Intervenors' submissions that warrants reopening the record on this subject.

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The motion to reopen the record is granted to the extent provided in Part II, above; the parties are directed to file written testimony with this Board within 45 days on the questions appended to this decision.

It is so ORDERED.

FOR THE APPEAL BOARD

  
C. Jean Bishop  
Secretary to the  
Appeal Board

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32/ See 45 Fed. Reg. at 3121.

APPENDIX

1. The October 15, 1979, Imperial Valley Earthquake (IV-79,  $M_L=6.4-6.9$ ) provided an extensive set of strong motion records in the near field of a rather severe earthquake.<sup>33/</sup> The parties should compare the horizontal peak acceleration values recorded for various instrument positions with earlier predictions and compilations of such motion, e.g., those contained in the Final Safety Analysis Report (FSAR) on the Diablo Canyon Nuclear Power Plant, Amendment 50, Appendix D LL 11B, Figures 2, 3 and 4; and United States Geological Survey (USGS) Circular 795, Figures 4, 24, 47, and 48. Those comparisons should (if possible) address whether there is magnitude independence or a saturation effect for ground motion intensity in the near field of earthquakes.<sup>34/</sup>

2. Response spectra have been developed from the near-field (1 to 11 km) ground motion records produced by IV-79. The records contain horizontal peak acceleration values in the range of 0.81g to about 0.2g. The applicant calculated a mean peak acceleration of 0.36g for IV-79 at the 5.8 km site-to-fault

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<sup>33/</sup> Preliminary Summary of the U.S. Geological Survey Strong-Motion Records from the October 15, 1979 Imperial Valley Earthquake by R.L. Porcella and R.B. Mathiesen (October 1979), Included in Board Notification, December 17, 1979.

<sup>34/</sup> See, for instance, Tr. 8597; 10,105; 5889-90.

distance that characterizes the Diablo Canyon site (Applicant's Brief). Despite the fact that the IV-79 peak acceleration values are generally lower than the 1.15g peak acceleration or 0.75g zero-period acceleration used as the design basis for the Diablo Canyon plant (resulting from a postulated 7.5M event on the Hosgri fault), there are instances (although only those from the El Centro Arrays are significant) for which the IV-79 horizontal responses exceed the Newmark Design Response Spectrum for Diablo Canyon. (See staff brief at p. 9; Brune affidavit, Attachments A and B.) In view of this, the parties should discuss whether the Newmark Spectrum is an appropriate and sufficiently conservative representation of  
35/  
the 7.5M event at Hosgri.

3. We are told that IV-79 data are not relevant to the Diablo Canyon seismic analysis because that plant is a "rock" site, whereas the Imperial Valley data were obtained on soil sites. (Rothman - Kuo Affidavit at p. 3; Blume Affidavit, Para. 8.) What is the significance of this difference in view of the conclusion of the authors of USGS Circular 795

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35/ In other words, if the various IV-79 near-field response spectra were used to generate a smoothed, average response spectrum for a zero-period acceleration appropriate to that event (in accordance with techniques explained in Blume's testimony fol. Tr. 6099 at page 6 and pages 39 and 40), and if this spectrum were scaled to a 0.75g zero-period acceleration, would the resulting response spectrum be bounded by the Newmark Spectrum for Diablo Canyon?

(based on an analysis of data provided in that document) that, for comparable earthquake magnitude and distance, there are no significant differences between peak horizontal accelerations measured on soil or rock? (USGS Circular 795 at pages 1, 17, and 26.) This question should be considered in light of statements by applicant's witness Blume to the effect that acceleration, rather than velocity or displacement, is the critical parameter in the design of Diablo Canyon (Blume Affidavit, Para. 9; Testimony fol. Tr. 6099, p. 33).

4. The magnitudes of vertical and horizontal acceleration values measured at IV-79 are generally comparable. (Mean values calculated at a distance of 5.8 km from the fault are virtually identical.)<sup>36/</sup> The response spectra developed for vertical motion within 11 km of the Imperial Fault during IV-79 appear to show generally equivalent values of vertical and horizontal response for periods less than about 0.2 seconds (i.e., frequencies in excess of 5 cps).<sup>37/</sup> Finally, in some instances the higher frequency portions of the IV-79 response spectra for vertical motion exceed comparable portions of the Diablo Canyon Design Response Spectrum.<sup>38/</sup>

Observations made of the IV-79 data and response spectra appear to be consistent with the criteria set forth in NRC

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36/ Blume Affidavit, Table 1, Figures 1 and 2.

37/ Rothman - Kuo Affidavit, Figures.

38/ Ibid.

Regulatory Guide 1.60. These require that vertical accelerations in the higher frequency range be equal to horizontal accelerations. As the guide states:

It should be noted that the vertical Design Response Spectra are 2/3 those of the horizontal Design Response Spectra for Frequencies less than 0.25; for frequencies higher than 3.5 they are the same, while the ratio varies between 2/3 and 1 for frequencies between 0.25 and 3.5.<sup>39/</sup>

The references to vertical motion made in the Diablo Canyon record, however, indicate that a 2/3 ratio between vertical and horizontal motion was apparently utilized at all frequencies.<sup>40/</sup> The parties should address this apparent inconsistency and explain it, if possible. Should there be substantive and relevant analyses suggesting that vertical motion records do not reflect the true vertical motion, these should be provided.<sup>41/</sup>

5. Peak horizontal acceleration values measured at the base of the Imperial Valley Services Building during IV-79 exceed those measured in the free field 103 meters

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<sup>39/</sup> We note that elsewhere in the Regulatory Guide frequencies are presented with accompanying units of cycles per second (cps), and assume that these units are inadvertently omitted in the portion we have quoted.

<sup>40/</sup> SER Supplement 7, p. 3-18; Knight Testimony, p. 13, fol. Tr. 8697, Ghio Test., p. 1, fol. Tr. 6993. Blume Testimony, p. 41, fol. Tr. 6099.

<sup>41/</sup> See, for example, Newmark Testimony, fol. Tr. 8552, Reference B at pp. 4, 5; Tr. 9349.

away from the building. The motion records are described as showing similar amplitudes but greater low frequency motion in the building than in the free field.<sup>42/</sup> No response spectra for the two recording locations have been provided. The acceleration data, however, may be taken to indicate that no reduction in building motion due to the tau effect was realized in this instance.

Based on these observations, intervenors question the validity of the tau concept as well as its use to reduce the higher frequency portions of the Diablo Canyon Design Spectrum. The staff and the applicant answer that, because the Imperial County Services Building was supported on piles in a deep soil structure, these observations are irrelevant to the use of a tau effect in the seismic reanalysis of Diablo Canyon,<sup>43/</sup> which is built on a rock site.<sup>44/</sup> Staff witness Newmark, however, used recorded earthquake motions at the Hollywood Storage Building to demonstrate the use of a tau effect analysis. The Hollywood Storage Building itself is built on

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42/ See "A Preliminary Report on Strong-Motion Records from the Imperial County Services Building by Christopher Rojahn, U.S. Geological Survey and J.D. Ragsdale, California Division of Mines and Geology (undated but issued early January 1980), pp. 7 and 8.

43/ Blume Affidavit, Para. 10; Rothman - Kuo Affidavit, p. 7.

44/ SER Supplement 5, Appendix C.

piles in soil. Thus, the "built-on-piles" rationale appears insufficient to explain why no tau effect was evident at the Imperial Valley Services Building.

One feature distinguishing the two buildings that no party commented upon is that the Hollywood Storage Building has a basement and the Services Building does not. Intervenors' witness, Dr. Luco, used this fact to explain in part why he believes the Hollywood building should have a large tau value.<sup>45/</sup> Rojahn and Ragsdale's discussion implies that to some extent ground level instrumental responses within the Imperial Valley Services Building may have been influenced by the response (and failure) of the building itself.<sup>46/</sup>

In any event, given the apparent similarities between the structural foundations of the two buildings, the explanations provided thus far for a seeming lack of a tau effect at the Imperial Valley Services Building are inadequate. The parties should provide additional information on this point and relate their analyses to both geologic and structural conditions prevailing at the Diablo Canyon site.

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45/ Tr. 8949.

46/ Rojahn and Ragsdale, pp. 7 and 8. That report also reflects information regarding the Services Building assymetric structure (at pp. 2 and 3) which may explain why it was susceptible to damage (see Newmark Testimony fol. Tr. 8552, Attachment B, pp. 14 and 15).

6. Throughout the Licensing Board hearings, parties stressed the role of soil-structure interactions as a mechanism that would reduce the magnitude of structure motion relative to ground motion (e.g., Tr. 8878; 8947-46). Staff and applicant's arguments (in response to intervenors' suggestion of the apparent lack of tau effect during IV-79) point to soil structure interactions as the reason for building motion exceeding that of the ground (Blume Affidavit, Para. 10; Rothman - Kuo Affidavit, p. 7). (a) Describe and explain the circumstances in which soil-structure interactions produce enhanced or reduced structural response. (b) Discuss the relevance and applicability for such interactions to the seismic response assumed for Diablo Canyon.

7. Intervenors (Brune Affidavit, p. 5) and the applicant (Frazier Affidavit, Para. 3) have suggested that the strong motion data obtained from stations along the direction of the Imperial Fault evidence the "focusing" of earthquake motion. Yet, when the acceleration data of two such stations, El Centro Array Numbers 6 and 7, are plotted as a function of distance from the fault (e.g., Blume Affidavit, Figures 1 and 2), the horizontal acceleration values fall well below the regression line mean for the 1 km distance. The vertical acceleration values are also lower than the mean on such a plot.

To the extent possible, the parties should analyze the seismic records for the IV-79 earthquake as they pertain to the focusing phenomenon and relate the results of such analyses to the likelihood that, in the event of an earthquake anywhere along the Hosgri Fault, focusing might result in amplified seismic motion at Diablo Canyon.

8. We have received preliminary reports of the effect of IV-79 on the El Centro Steam Power Station. (Board Notification December 17, 1979, Levin and Martore Observations; Rothman - Kuo Affidavit, p. 12). In many respects, the structures and systems of that facility resemble those of the Diablo Canyon plant. Their response to a severe, well instrumented seismic event can be analysed to help confirm or refute analytical techniques and assumptions used in the Diablo Canyon seismic analysis. The parties should prepare and submit such an analysis.

9. In addition to answering our questions about information from the Imperial Valley earthquake, we would like the parties to address Paragraph E on page 6 of the McMullen affidavit (included with the Staff Response to Joint Intervenors' Motion to Reopen). That paragraph states that, "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 similar reverse fault 10 km to the south that offsets the seafloor.'" Does this USGS statement reflect either evidence not presented in the Diablo Canyon hearing or a change in the USGS position based on evidence already in the record? In any event, discuss that statement's implications for this case.