



OFFICE OF THE  
COMMISSIONER

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

March 11, 1983

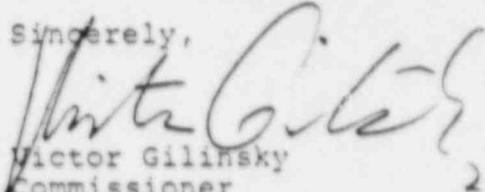
The Honorable Morris K. Udall, Chairman  
Subcommittee on Energy and the Environment  
Committee on Interior and Insular Affairs  
United States House of Representatives  
Washington, D.C. 20515

Dear Mr. Chairman:

In the testimony which they submitted for your Committee's hearing on Diablo Canyon, the San Luis Obispo Mothers for Peace quoted a portion of Commissioner Bradford's and my separate views regarding the Commission's March, 1982, decision not to take review of the Appeal Board's decision on the seismic standard to be used in the Diablo Canyon proceeding. Since this issue was alluded to during the hearing, I would like to submit for the record a copy of those views and of those expressed by the other Commissioners.

I continue to believe that the Commission failed to carry out its responsibilities when it ducked the issue of whether the seismic standard for Diablo Canyon was chosen correctly. The fact that it took an unprecedented nine months for the Commission to come to the conclusion that the Appeal Board's decision did not warrant review is, in itself, indicative of the substantial uncertainty which surrounds this issue. It is worth remembering that only two Commissioners actually voted against taking review of this matter; the Chairman voted to further postpone making a decision on whether to take review, stating that he would prefer "not to make a final decision until the Commission knows more about the results of the Diablo Canyon reverification...".

Sincerely,

  
Victor Gilinsky  
Commissioner

Attachment: ~~XXXX~~  
As stated

cc: The Honorable Manuel Lujan

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SEPARATE VIEWS OF CHAIRMAN PALLADINO

I would extend the time for the Commission to review this Appeal Board decision on Diablo Canyon seismicity. I would not make a final decision until the Commission knows more about the results of the Diablo Canyon reverification and has concluded the process with respect to its inquiry about Dr. Newmark, the staff's key expert on the seismic design of the Diablo Canyon plant.

I should say that my inclination, at this time, is not to review ALAB-644. However, I would prefer to have in hand the results of the matters I have mentioned above before I make a decision on this matter.

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

COMMISSIONERS:

Nunzio J. Palladino, Chairman  
Victor Gilinsky  
Peter A. Bradford  
John F. Ahearne  
Thomas M. Roberts

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

Docket Nos. 50-275 OL  
50-323 OL

OPINION OF COMMISSIONERS GILINSKY AND BRADFORD ON COMMISSION  
REVIEW OF ALAB-644 (DIABLO CANYON SEISMIC PROCEEDING)

The Commission has had in hand since June 16, 1981, the Appeal Board's decision approving the seismic design of the Diablo Canyon nuclear power plant. The Board's decision deals with the most important issue in this Operating License proceeding in view of the discovery of a nearby earthquake fault after plant construction was well underway, and the subsequent need to redo the seismic design.

Normally, the Commission allows itself 30 days to decide whether to review an Appeal Board decision. If the Commission does not act in that time the decision is not taken up for review. In this case, the General Counsel provided the Commission with a twenty-two page memorandum on the legal merits of the Board's

decision and, at the Commission's request, the Office of Policy Evaluation, after a six-week study involving four consultants,<sup>1</sup> produced an 89-page analysis of the technical aspects of the decision. After receiving these memoranda, the Commission found itself unable to decide whether to take review. Altogether over a period of nine months, the Commission extended the time for deciding whether to take review thirteen times. This week the last extension was allowed to lapse.

The issues in the Appeal Board decision need to be distinguished from those of the ongoing reverification of the Diablo Canyon seismic design which has received so much attention recently. The Appeal Board decision deals with whether the bases of the seismic design, as formulated by the applicant and approved by the NRC staff and Licensing Board, are adequate. The reverification program assumes the correctness of those bases and looks into whether they were properly applied in the detailed design of the plant structures and equipment.

The Appeal Board decision deals with the fundamental "response spectrum" at the site--in effect, the frequency and maximum amplitude of the various oscillations of structures attached to the plant's foundation. These maximum oscillations are calculated on the basis of the agreed-upon maximum earthquake, and all safety-related structures and equipment must be designed to withstand them. The Appeal Board deals, in particular, with the adequacy of the new seismic design standard chosen after the

discovery of the nearby Hosgri fault, which had not been taken into account in the original design of the plant. The case presents a number of novel problems, particularly as the assumed earthquake location is very near the plant, and the choices inescapably involve a good deal of judgment.

The difficulty the Commission found itself in, as the nine months of indecision betrays, is that the Appeal Board's decision is not a satisfactory one. On some points it can probably be rescued by different reasoning, though even that would not eliminate the need for review because of the decision's precedential significance. On at least one point, however, the use of the so-called "tau effect" to permit a substantial across-the-board relaxation of the seismic standard applied to the plant, the Board's reasoning is utterly inadequate and is very likely wrong.

Without Commission review, not only will questions remain about the correctness of the Diablo Canyon seismic design, but the Board's decision will stand as an unfortunate precedent which will undermine application of the Commission's regulations on seismic design.

#### Procedural Background

The NRC issued the Construction Permits for Diablo Canyon Units 1 and 2 in 1968 and 1970, respectively. These permits were issued on the assumption that the plants could be expected to face, at most, a 6.75 magnitude earthquake at a distance of about 20

miles. In 1971, Hoskins and Griffiths published a paper which established the existence of a fault approximately 3 miles off-shore of the Diablo Canyon site. The existence of the fault--called the Hosgri fault--was confirmed in a 1974 study. As the plant was largely constructed, this forced a reevaluation of the seismic design at an awkward time.

After reanalysis, the applicant, the NRC staff and the ACRS concluded that, with certain specified modifications, the plants could withstand the more severe earth movements which must be assumed as a result of the Hosgri fault discovery. This followed a determination by the U.S. Geological Survey that the maximum Hosgri fault earthquake against which the plant had to be designed was one of magnitude 7.5. The applicant and NRC staff did not believe this was the right choice, but apparently convenience dictated its acceptance for the purposes of the proceeding. Much of the difficulty in this case stems, in our view, from the formal acceptance of this standard, but the less-than-wholehearted application of it.<sup>2</sup>

In the course of the Diablo Canyon Operating License proceeding, the Licensing Board conducted evidentiary hearings on the seismic issues between December 1978 and February 1979. At the close of this part of the proceeding, the parties stipulated, and the Board agreed, that it would be conservative, in view of the existence of the Hosgri fault, to attribute a magnitude of 7.5 to the Safe Shutdown Earthquake ("SSE")<sup>3</sup>. The Licensing Board

also fixed the maximum vibratory ground motion that an SSE might induce at the plant site and concluded that the seismic reanalysis and redesign were adequate to withstand this SSE.<sup>4</sup>

The Joint Intervenors appealed several aspects of this decision to the Atomic Safety and Licensing Appeal Board, and were joined in their appeal by Governor Brown, participating as an amicus curiae. On June 16, 1981, the Appeal Board issued its decision affirming the Licensing Board's finding that the Diablo Canyon plants were adequately designed to withstand a 7.5 magnitude earthquake on the Hosgri fault. Since that date, the case has been before the Commission awaiting its decision on whether or not to take review.

#### Technical Background

As stated above, after the discovery of the Hosgri fault and the subsequent analysis by the U.S. Geological Survey, the parties to the Diablo Canyon proceeding agreed to an earthquake of magnitude 7.5 on a nearby portion of the fault as the fundamental seismic event against which the plant would be designed. Since the plant was in large part already constructed at this point, the reanalysis and redesign understandably did not proceed as they would have in a plant yet to be built. Every advantage was taken of slack in safety margins left in the pre-Hosgri analysis, both in developing the response spectrum and in its application. To cite a couple of examples: a larger damping value was used in analyzing structures (7 percent instead of the earlier 5

percent), which reduced the effect of ground vibrations on the structures. At the same time, credit was taken for the actual -- "as-built" -- strengths of materials (rather than for the minimum required strengths, as is the usual practice) so that larger vibrations became tolerable. These choices were not improper, but they do add significance to further substantial relaxations in the seismic standards for the plant on the basis of the "tau effect". The point is that these further relaxations come on top of a redesign that has already shaved safety margins to the extent permitted in the regulations.

Probably most important along these lines was the choice of the earthquake record used in developing the response spectrum, and the manner in which that record was used. Because no record was available from a station close to a 7.5 earthquake, the applicant used the seismic record, known as the Pacoima Dam record, from a recording station near the center of a 6.5 earthquake (the 1971 San Fernando Valley earthquake). This record could plausibly be taken to represent a larger magnitude earthquake, in particular because it included the largest horizontal acceleration recorded up to that time, about 1.2 g. Nevertheless, the Board's handling of this issue is unsatisfactory. As the Commission's Office of Policy Evaluation put it:

"It is not clear, however, from the Boards' records if the Pacoima Dam record in the frequency range of interest (1-10 Hz) represents a deviation from that expected for a 6.5 M

earthquake. Most of the testimony on Pacoima Dam centered on a frequency range of little practical interest (i.e., near 33 Hz) regarding excitation of structures important to safety. We found no supporting statement on the record which indicated that the Pacoima Dam record substantially exceeded that expected for a 6.5 M earthquake in the frequency range of 1-10 Hz. USGS Circular 672 (p.7) indicated that in the frequency range of 1-10 Hz, the Pacoima Dam record closely resembled what one would expect for a 6.5 M earthquake."<sup>5</sup>

Which brings us to the final point, that on top of all this trimming, the Board permitted a further substantial reduction, more-or-less across the board, in the response spectrum.

#### "Tau Effect"

The "tau effect", defined by Dr. Nathan Newmark, the NRC staff consultant, is used to describe the filtering effect that large rigid foundations have on the motion imparted to the building's structure during an earthquake. Newmark's estimate of the effect was used to justify a reduction in the response spectrum for each of the important structures in the reanalysis of Diablo Canyon. Newmark's analysis for the reactor containment reduced the acceleration response spectrum by about 20 percent over the frequencies of interest.<sup>6</sup>

A reading of both the Appeal and Licensing Boards' decisions shows an almost total reliance on the opinions of Newmark to justify the tau effect. Newmark in turn apparently relied heavily on the work of Yamahara. Yamahara's work dealt largely with an odd-shaped building quite unlike any of the structures at the Diablo Canyon plant and with earthquakes well below the magnitudes considered at the Diablo Canyon site. Neither of these discrepancies are explained in either Board decision. The Licensing Board's justification sounds almost mystical: "There is ample evidence of the excellent performance of large building foundations in earthquakes. Tau is a manifestation of this."<sup>7</sup> The Appeal Board responded to criticism of Dr. Newmark by stating: "Simply in light of his repeated references to Dr. Yamahara's work, only a very crabbed reading of Dr. Newmark's testimony could assume that he did not appreciate tau in all its ramifications."<sup>8</sup> What seems less clear is whether either Board had any idea what it was talking about.

That there is some effect of this kind is plausible, even likely; that the effect is as large as claimed by the applicant and staff is merely conjecture. Here is the way the Commission's Office of Policy Evaluation describes the situation:

"Based on the record, it appears that a phenomenon exists which at times limits the damage to structures in the near field during an earthquake. However, we have not been able to find an empirical or analytical approach which provides

justification as to why the tau effect should be calculated in one specific manner over another. Analyzed or existing data are so sparse that the actual reason for the observed effect may still not have been recognized within the engineering community. Except for the judgment of Drs. Blume and Newmark, there is no evidence to demonstrate an ability to predict tau effects over a range of earthquake magnitudes, structural configurations, and site conditions."<sup>9</sup>

The fact is that the tau effect has not been used in any other nuclear plant analysis. To our knowledge, it has not been used in the design of any other large building.

#### Comparison of Response Spectra

With the changes and adjustments permitted by the Board it turns out that the post-Hosgri seismic response spectrum does not in all respects represent a more severe seismic standard than the one used before the discovery of the Hosgri fault. As the accompanying diagram illustrates, in the frequency range between 5 and 10 hertz (cycles per second), a range of particular interest in the analysis of the containment building surrounding the reactor, the two response spectra are quite close.<sup>10</sup> For part of this range, in fact, the old spectrum shows a higher response. In other words, for that part of the range the original design conditions were more demanding than the new ones imposed after the discovery of the Hosgri fault. This new

spectrum is the basis of the engineering reanalysis and ultimately determined the extent to which the containment was to be modified. Not surprisingly, in view of the above, only minor changes were required in this area.

#### Precedential Significance

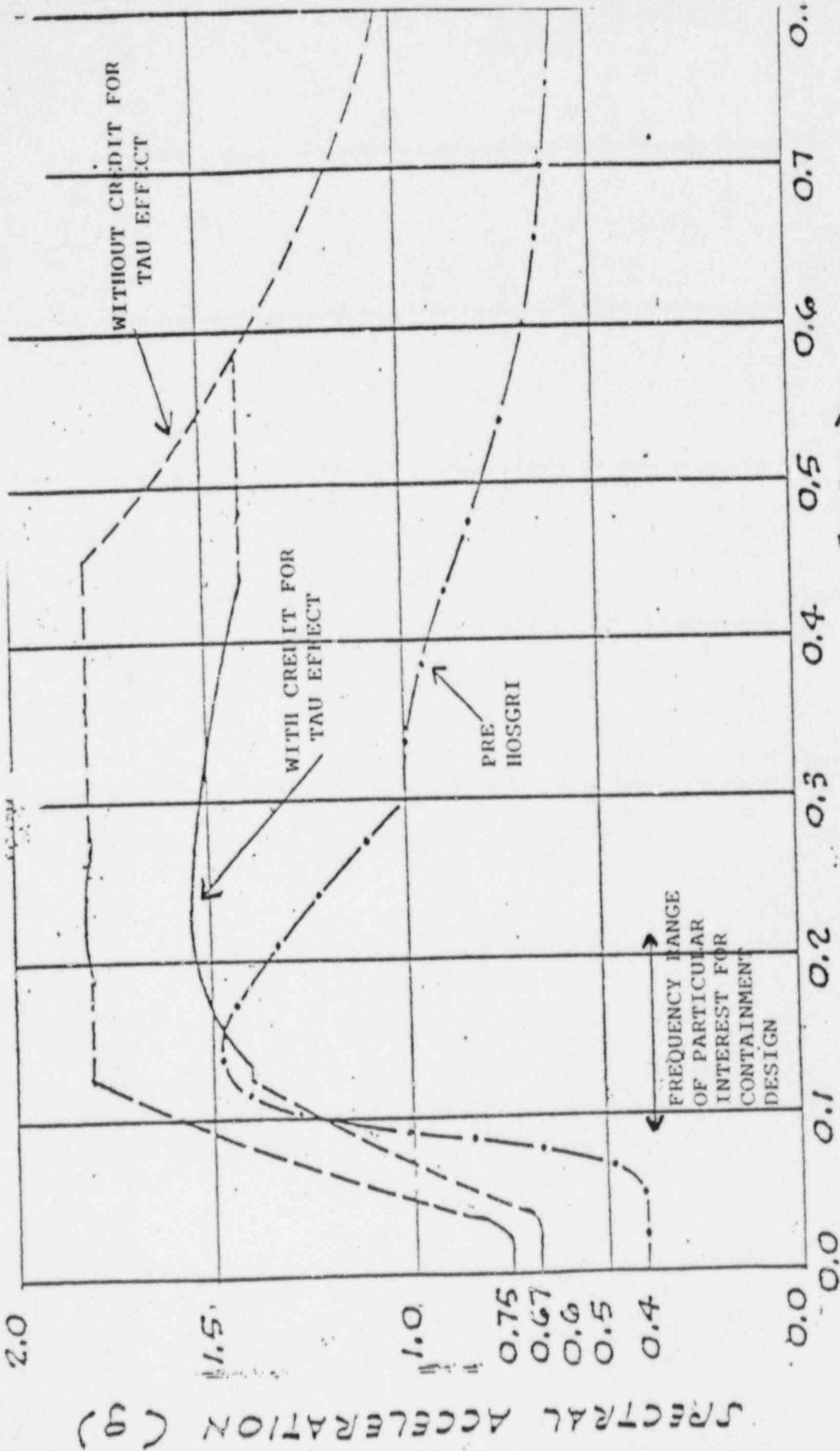
The Commission decision not to take review, in effect, places the Commission's stamp of approval on the Appeal Board's decision. The Board's reasoning on the "tau effect", for example, may be cited in future cases when an applicant or licensee would otherwise have difficulty in complying with our regulations. Or the tau effect could be used to compensate for deficiencies discovered in the design of completed plants. This would be a significant weakening of past agency practice.

Altogether, we cannot escape the impression that the Commission is declining review not because the opinion is essentially sound, but because it is unsound and the prospect of reviewing it is so unsettling.

## NOTES

1. We would note that one of the outside consultants retained by the Commission was also acting as a consultant on seismic issues to the applicant in the Summer case. We would have preferred to disqualify this expert in order to avoid any actual or apparent conflict of interest.
2. No hearings were held when the Hosgri fault was discovered. The persistence of litigation over these issues to this day suggests that it would have been wise policy, as well as good law, to reopen the construction permit hearing at that time.
3. The Commission's regulations, 10 CFR Part 100, Appendix A, define the "Safe Shutdown Earthquake" as being "that earthquake which is based upon an evaluation of the maximum earthquake potential considering 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."  
  
The specific structures, systems, and components which must remain functional are those which are 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 consequences of accidents which could result in potential off-site exposures comparable to the guideline exposures" of Part 100.
4. In the Matter of Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant (Units 1 and 2)), 10 NRC 453 (1979).
5. Memorandum to the Commissioners from Forrest Remick, Subject: Diablo Canyon Design, dated November 12, 1981 with enclosure.
6. ALAB-644, p. 114, footnote 266.
7. In the Matter of Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant (Units 1 and 2)), 10 NRC 453, 495 (1979).
8. ALAB-644, page 124.
9. Memorandum to the Commissioners from Forrest Remick, Subject: Diablo Canyon Design, dated November 12, 1981 with enclosure.

10. Seismic Evaluation for Postulated 7.5 M Hosgri Earthquake, Units 1 and 2 Diablo Canyon Site, figure 4-23.



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NEWMARK 7.5 M HOSGRI - 7% DAMPING  
 BLUME 7.5 M HOSGRI - 7% DAMPING  
 DCE - 5% DAMPING (PRE-HOSGRI RESPONSE SPECTRUM)

Taken From: "Seismic Evaluation for Postulated 7.5 M Hosgri Earthquake, Units 1 & 2, Diablo Canyon Site"

DIABLO CANYON CONTAINMENT STRUCTURE  
 COMPARISON OF VARIOUS ELASTIC RESPONSE SPECTRA

OPINION OF COMMISSIONER AHEARNE ON COMMISSION REVIEW  
OF ALAB-644 (DIABLO CANYON SEISMIC PROCEEDING)

Commissioners Gilinsky and Bradford are releasing their recently written opinion on Commission review of this case, and describe the Commission as being unable to act on it. In the interest of a more complete picture I am also releasing my opinion, distributed to my fellow Commissioners three months ago.

The issue before the Commission was whether to take review of the Appeal Board decision (ALAB-644). After reviewing the decision, and the staff memoranda referred to by Commissioners Gilinsky and Bradford (the last being the Office of Policy Evaluation memorandum of November 5th), I sent out the following on December 9, 1981:

I would not take review and I do not believe the record needs to be reopened again. However, the reader should understand three points about not taking review:

- (1) Not taking review of ALAB-644 does not in any way make a judgment concerning my position or the Commission's position with respect to the latest problems that have arisen at the Diablo Canyon plant, which led to the recent suspension of the low power license.
- (2) Not taking review does not indicate that either I or the Commission believe issues regarding earthquake estimates and seismic design are unimportant. Because of their significance for Diablo Canyon, the current problems were considered sufficiently important to lead to license suspension.
- (3) Not taking review is not synonymous with not examining.

To reach the conclusion on whether or not to take review, I did examine ALAB-644, the filings of all parties to the Commission on ALAB-644, and extensive staff reviews prepared by the Office of General Counsel and the Office of Policy Evaluation. I also reviewed USGS Circular 672 and USGS Open File Report 81-365. And, finally, I reviewed the Diablo Canyon SER Supplement No. 5.

I reached the following conclusions:

- (1) There is no real question that magnitude 7.5 is large enough for the SSE for Diablo Canyon. There is some question that it may be too large. This question is not irrelevant, although M7.5 is accepted by the NRC staff, because many of the other arguments would diminish or disappear if one were to conclude, as did at least one Board-called witness, that a lower value earthquake would be more appropriate.
- (2) There are several engineering issues addressed at length here for the first time in an NRC licensing case, making the decision quite important because it may establish precedents.
- (3) There are several important issues relating to earthquake analysis.

In my opinion the only remaining significant engineering issue is what modification is appropriate in predicting a building's response to earthquakes because the building is a large rigid object. Some effect is plausible. The Board used an analogy to waves affecting a large boat differently than a string of small boats. Probably there are two effects involved:

- (1) When the wavelength of a signal is small with respect to the size of an object which the signal perturbs, the resulting effect is modified from that when the wavelength is comparable to the

object size. The resulting effect is an integration because the body does not respond to each individual wave. This is the basic phenomenon which the Board's analogy addresses. This effect has little significance here since the important wavelengths (for the 1-10 Hz range) are several hundred to several thousand feet, i.e., comparable to or larger than the plant.

- (2) When a large object is perturbed by many signals, arriving so that the accelerations vary both in magnitude and frequency, and perhaps in direction, the perturbing signals are incoherent. The resulting effect upon the building is a smoothing or an averaging of the various accelerations. Thus the early references in the literature by Yamahara, Ambraseys, and Scanlan refer to an average acceleration over the width of the foundation (SER No. 5, p. C-10). In SER No. 5 Newmark used the "travel" time across an "effective width" for the building by taking the appropriate distance to be the square root of the area. He then averaged the spectrum over this time to develop his tau reduction factor.

The effect is plausible and the records cited from the Hollywood Storage Building show the effect exists for the frequencies of interest. The two important questions are

What magnitude is the effect and should the NRC allow for it in determining if our regulations are met.

If the technique is explainable, defensible, and reproducible, then I believe the NRC should allow for it. This technique appears to be sufficiently new and of limited applicability (only to large buildings with rigid foundations, such as nuclear plants) that it is not widely known. In addition, the data base is very limited. However, all earthquake analysis suffers from a limited data base, particularly analyses for very large earthquakes and in the near field (both representative of Diablo Canyon).

Those unfamiliar with seismic analysis may be surprised to see that the model used for the containment building, which contains the reactor and is a cylinder about 150 feet in diameter and 210 feet high, is a stick. The improved model uses weights distributed along the stick and examines the response of the weighted stick as the base shakes.

Dr. Newmark modified the input to this model by using a reduction to incorporate effects of building size at the higher frequencies. The approach is reasonable, all seismic data in this area is weak, and in the end the decision will be based upon engineering judgment. On balance, I support Dr. Newmark.

The third area, that of earthquake analysis, had many issues, but the possibly troubling one was whether the Pacoima Dam spectrum can be used to model the near field of an earthquake of magnitude 7.5. The earthquake registered at Pacoima Dam is estimated to be of magnitude 6.5-6.6. Dr. Newmark and others argued that the recording spot was on a rocky ridge which led to a much stronger signal than would be true of a less unique location. Dr. Newmark found the Pacoima Dam spectrum was well fit by a design spectrum appropriate to 0.75g, even though the measurement had a peak of 1.25g, the highest horizontal acceleration ever recorded. In SER No. 5 Dr. Newmark argued that in the near field of an earthquake the peak acceleration is not a reasonable basis to draw a design spectrum and it is more appropriate to match the overall spectrum.

Dr. Boore, et al., in USGS Circular 672 adopted the 1.25g as appropriate to the maximum considered amplitude (they were making estimates for the Trans-Alaska Pipe Line, which traverses regions of seismicity up to magnitude 8.5). Taking 1.25g as the maximum is consistent with the concept of magnitude saturation. In this particular case, they would be using 1.25g as the maximum appropriate to the largest earthquake being considered. The USGS reduced the measured spectrum to get an estimate of the spectrum for the

magnitude 6.5g earthquake that triggered the Pacoima Dam record. They argued that Newmark and Hall (the basic reference for establishing response spectra) overestimates the response above 8 Hz. By removing the components above 9 Hz, the authors modified the Pacoima Dam record to get 0.9g as the appropriate maximum horizontal acceleration for a 6.5 magnitude earthquake. They then interpolate between 0.9g for M6.5 and 1.25g for M8.5 to get 1.1g for M7.5. Boore, et al., rejected the use of the Pacoima Dam spectrum as anomalous because "[t]he authors are not aware of any investigations of possible side effects that conclusively demonstrate an anomalous amplification (greater than 25-50 percent) of recorded motion in the frequency range 1-10 Herz." (Emphasis added)(P. 7, Circular 672)

Finally, Open File Report 81-365 by Joyner, et al., proposes a new equation relating maximum horizontal acceleration and maximum horizontal velocity to earthquake magnitude and distance to the surface projection of the fault rupture,  $d$ . Unfortunately, like all available analyses, this report is based on data outside the near field of large earthquakes. The authors state: "The data set contains no recordings at rock sites with  $d$  less than 8 kilometers for earthquakes with  $M$  greater than 6.0, and caution is indicated in applying equations to rock sites at shorter distances for earthquakes of larger magnitude." (P. 15) Diablo Canyon is a rock site with  $d$  approximately 5.8 kilometers and, for design purposes,

considers an M of 7.5, i.e., exactly the type of site outside the data set, for which the authors indicated caution should be used.

Once again, this area is one in which data is poor and experts disagree. Dr. Newmark's arguments are based on matching the significant portions of the spectrum, and rest on his professional judgment. The criticisms of accepting the Newmark position are also judgments, as shown by the qualifications in the Boore and Joyner reports. I come down on the side of Dr. Newmark.

I agree that seismic design is a major issue relating to safe operation of the Diablo Canyon Nuclear Power Plant. However, I do not believe another full-scale adjudicatory review will add any additional light to the extensive reviews already done. Controversy in Diablo Canyon centers on the validity of judgments made by experts. An extensive record documents a wide range of expert opinion. So long as the Commission empowers Boards to sit for us to examine such disputed issues as the seismic design for Diablo Canyon, our decision to take review of a Board's decision should be based on whether there are any basic policy issues which must be addressed or any serious errors.

The basic question we have before us is whether an existing plant redesigned to some extent to withstand the predicted

effects of a large earthquake from a nearby fault is adequately designed. We are not addressing what should be the design criteria for new plants nor are we addressing what should be the design criteria for this plant were it seeking a construction permit. The degree of conservatism that the Commission imposes must take into consideration a greater level of realistic estimates with regard to modifications or acceptance of an existing plant than for projects not yet begun.

With the help of the Commission staff, the Commission has examined the seismic issues. This examination was necessary if we were to make an informed assessment. I agree in general with the Appeal Board decision and I have not identified any serious errors. Therefore, I do not believe the Commission should take review.

SEPARATE VIEW OF COMMISSIONER ROBERTS

*TRP*

I vote against review of ALAB-644 by the Commission based on my evaluation of the opinion and of the various analyses prepared to assist the Commission in its decision by the Office of General Counsel, the Office of Policy Evaluation, and by seismic consultants specially hired by the Commission for this task. All of the groups listed above recommended that the Commission not review ALAB-644. Under 10 CFR § 2.786(b), the Commission may not review ALAB-644 simply because it is intrigued by the technical issues raised or because it thinks its understanding of the technical issues is more sophisticated than the Appeal Board's understanding. Similarly, Commission review is not to be undertaken simply to correct the factual record in the proceeding. Rather, Commission review should be undertaken when the Appeal Board has clearly erroneously decided factual issues or incorrectly decided important legal or policy issues. I do not believe this to be the case here.

I agree with Commissioner Ahearne's technical analyses of the issues raised in the opinion. Beyond that, I wish to respond to some of the misleading statements made in the dissent. First, with regard to the allegation that the length of time between issuance of ALAB-644 and issuance of this Order reveals that the Appeal Board's decision is unsatisfactory. I note that I voted not to review ALAR-644 on November 23, 1981, several weeks after receipt of OPE's last analysis of the opinion. Second, with regard to the acceptability of assuming a magnitude 7.5 earthquake on the Hosgri Fault, I note that the figure was

described as "grossly conservative"<sup>1/</sup> during the hearing and that, on appeal, even the Joint Intervenors agreed that this figure was "acceptably conservative."<sup>2/</sup>

Third, with regard to the Appeal and Licensing Board's reliance on the expert testimony of Dr. Nathan Newmark, I note that, at the time of his death, Dr. Newmark was considered the preeminent authority on seismic engineering and seismology in this country. The technical issues resolved by the Boards in this case were not simply fact questions whose answers were within the grasp of educated laymen. Rather, resolution of these issues required the engineering judgment of experts who had vast experience not only in the history of earthquakes and how earthquakes move but also in how an earthquake transmits energy to a building and how that building, in turn, responds. Dr. Newmark's great depth of experience in every facet of the required analysis is precisely why the Boards properly relied on his testimony.

Finally, with regard to the allegation that the Commission declined to review ALAB-644 because it believes the decision is unsound and because to reveal that would be "unsettling," I wish to state that not only is that not the basis for the Commission's decision but that the process undertaken to determine whether to review ALAB-644 revealed quite the contrary. The history of the Diablo Canyon proceeding reveals a

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<sup>1/</sup> Pacific Gas and Electric Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), LBP-79-26, 10 NRC 453, 480 (1979).

<sup>2/</sup> Pacific Gas and Electric Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), ALAB-644, 13 NRC 903, 913 (1981).

willingness to examine and reexamine the design basis of this plant. Evidentiary hearings on the seismic issues in the Diablo Canyon operating license proceeding began in December of 1978.<sup>3/</sup> In its decision of September, 1979, the Licensing Board found that the plant was adequately designed to withstand any earthquake that could reasonably be expected.<sup>4/</sup> The Licensing Board found that the Staff's seismic review was the most extensive ever undertaken and that the Applicant's review was extraordinarily thorough.<sup>5/</sup> On October 15, 1979, a large earthquake struck California's Imperial Valley, approximately 250 miles southeast of the Diablo Canyon site. The Appeal Board reopened the record and took evidence itself. At that trial, 17 expert witnesses appeared, including two ACRS consultants called by the Appeal Board.<sup>6/</sup> Subsequent to the Appeal Board's decision, the Commission hired its own seismic consultants. This lengthy indepth checking and rechecking of the bases of the seismic design hardly reveals fear on the part of the Commission to scrutinize the numbers.

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<sup>3/</sup> Pacific Gas and Electric Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), LBP-79-26, 10 NRC 453, 458 (1979).

<sup>4/</sup> Id. at 507

<sup>5/</sup> Id.

<sup>6/</sup> Pacific Gas and Electric Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), ALAB-644, 13 NRC 903, 912 (1981).