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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

_____)	
In the Matter of:)	Docket Nos. 50-275 and 50-323- <i>CLA</i>
PACIFIC GAS & ELECTRIC COMPANY)	(Spent Fuel Reracking)
(Diablo Canyon Nuclear Power)	FINAL [PROPOSED] FINDINGS OF
Plant, Units 1 and 2))	FACT AND CONCLUSIONS OF LAW
_____)	

1. Sierra Club Contention II, as amended by the Board, is as follows:

It is the contention of the Sierra Club that the proposed reracking is inconsistent with the protection of the public health and safety, and the environment, for reasons which include the following:

A) during the PHE [postulated Hosgri earthquake], collisions between the racks and the pool walls are expected to occur resulting in:

- 1) impact forces on the racks significantly larger than those estimated in the reports;
- 2) impact forces on the racks significantly larger than those expected to damage the racks;
- 3) significant permanent deformation and other damage to the racks and pool walls;
- 4) reduction of the spacings between fuel assemblies;
- 5) increase in the nuclear criticality coefficient k_{eff} above 0.95;

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- 6) release of large quantities of heat and radiation;
- 7) radioactive contamination of the nuclear power plant and its employees above the levels permitted by federal regulations;
- 8) radioactive contamination of the environment in the vicinity of the nuclear power plant above the levels permitted by federal regulations; and
- 9) radioactive contamination of humans and other living things in the vicinity of the nuclear power plant above the levels permitted by federal regulations.

B) during the PHE, collisions between groups of racks with each other and/or with the pool walls are expected to occur with results similar to those described in II(A) above.

2. As a result of additional theoretical work performed by the applicant, it is now accepted by all parties that the expected impact forces on the racks as a result of postulated seismic motions are well in excess of the value cited in the Reracking Report as the maximum impact force on a rack. (NRC Staff Testimony, p.22, A.29; Ferguson Testimony, p.3, 1.23 (RT p.481 et seq.¹))

3. The applicant and NRC staff contend that even though the current estimates of impact-induced stresses are in some cases significantly higher than those estimated in the reports, these values are still thought to be less than allowable limits (NRC Staff testimony, p.22, A.29) It is argued that although Sierra Club contention II(A)(1) is true, it has no bearing on safety issues.

4. NRC staff assumes Sierra Club contentions II(A)(2) and

¹References to the Reporter's Transcript of the hearing are by page number, and where appropriate, line number, as follows: RT p. ____, 1. ____.)

II(B)(2) are false based on "adherence to the provisions of GDC's 61 and 62 as evidenced by licensee's commitments regarding the design and construction of the racks reflected in the Reracking Report the integrity of the spent fuel racks is assured during the PHE." (NRC staff testimony p.30, A.43.) NRC staff concludes that since rack stresses are within allowables, as predicted by the licensee and reviewed by NRC staff, Sierra Club contentions II(A)(3) through II(A)(9) and the similar contentions in II(B) must also be false, since they are predicated on the possibility of rack damage in II(A)(2).

5. Staff admits that no evaluation has been performed to ascertain the extent of damage to be expected should rack stresses exceed allowables. (NRC staff testimony, p.32, A.48.) Staff also admits that criticality cannot be precluded if sufficient damage to the racks should occur. (NRC staff testimony, p.34, A.48, comment 4.) Localized damage could also result in releases of radiation. (RT p.498.)

6. The crucial contentions are therefore contention II(A)(2) and II(B)(2) regarding the potential for spent fuel racks to be damaged as a result of impacts during the PHE. If the analysis of the impact-induced rack stresses is incorrect or inadequate, serious consequences affecting the public health and safety could result.

7. The Generic Environmental Impact Statement (GEIS) on which the Environmental Assessment was based assumes a rack configuration significantly different from that proposed for

Diablo Canyon. (Ferguson Testimony, p.40.) The GEIS assumes that the racks are secured to the floor of the pool and that no impacts between racks can occur. The possibility of impact-induced damage posing a threat to the public health and safety exists at Diablo Canyon because the proposed fuel storage system differs significantly from that used in the GEIS.

OT POSITION

8. At the time the GEIS was written, the guidelines in the Standard Review Plan prohibited all gross sliding, tilting and floatation (Sierra Club Exhibit 6, Section 3.8.5 II-5). The OT Position later modified the SRP guidelines to permit free-standing racks which might undergo minimal seismic motions (PG&E Exhibit 12, Section IV-6, p. IV-5) (RT pp.506 - 510.) However, there is no evidence that the GEIS was ever modified to include potential environmental hazards resulting from seismic motions.

9. The OT Position refers to the SRP guidelines in 3.8.5 II-5 as a "position on factors of safety against sliding and tilting." Neither the OT Position nor the SRP make reference to "factors of safety against impacts resulting from sliding and tilting motions." The licensee appears to have some confusion about what the SRP guidelines say (RT p.352, et seq.) Clearly, the exceptions contained in the OT Position are redundant and irrelevant if the SRP could be interpreted as permitting collisions between racks.

10. The first exception to the SRP guidelines against sliding and tilting specifically prohibits impacts. The second

exception does so implicitly by requiring the motions to be contained within "geometric constraints". Although the NRC staff evidently would like this exception to refer to physical constraints, it does not. (RT p.559 et seq.)

11. Tilting motions undoubtedly produce impacts between the rack support feet and the floor of the pool as a result of seismically induced rocking motions. (RT p.593, 1.21.) The OT Position permits such impacts so long as impacts due to rattling fuel are also incorporated and interrack impacts are precluded. Impacts between the support feet and the pool floor are not included in the Sierra Club contentions.

12. There is evidence that the OT Position guidelines against interrack impact have been followed until recently. (Ferguson Testimony, p.17 et seq.) Only one other nuclear power plant has attempted to use a spent fuel storage facility in which collisions between the racks are expected to result from seismic motions. (RT p.602.) There is no evidence as to whether or not the racks at this facility are also expected to collide with the walls of the pools during the safe-shutdown earthquake as are those at Diablo Canyon (Ferguson Testimony p.4.)

13. Colliding spent fuel racks are therefore a new phenomenon in the nuclear power industry. The licensee's consultant testified that some of the theoretical techniques used to estimate the magnitude and severity of the impact stresses were standard in the industry. (RT p. 262, 1.2.) However, an NRC consultant testifies that he had never seen an attempt to compute

the forces generated by many colliding fuel racks. (RT p.576, 1.1.) Attempts to estimate the consequences of multi-rack collisions are quite new. Rack collisions are not anticipated by the Generic Environmental Impact Statement, the Standard Review Plan, nor the OT Position. No evidence has been produced to indicate the existence of any NRC guidelines on the analysis of rack impacts.

THEORETICAL PROBLEMS

14. In order to attempt to compute the rack stresses resulting from rack motions and impacts, the licensee has conducted a series of complex calculations. (PG&E Exhibit 9.) It is not possible to guarantee that the rack stresses estimated by these calculations are "conservative", i.e., are larger than would be expected in a realistic situation. (Ferguson Testimony p.31 et seq.) The analytical problem of 16 flexible, interacting racks surrounded by water is too complex to be treated without making simplifying models and assumptions.

15. The licensee initially used a single rack model to compute rack impact stresses (PG&E Exhibit 2, Chapter 6.) Only recently has it been recognized by NRC staff that the single rack model is not conservative, and that multi-rack effects may well produce larger impact stresses. (NRC Staff Testimony, A.29, p. 22.) The single-rack model was questioned in connection with another reracking analysis for the Byron NPP by Mr. J. DeGrassi of Brookhaven. (RT p.575.) Consequently, the evidentiary hearings which had been scheduled for the Diablo Canyon reracking for

March were postponed by NRC staff and additional computations regarding multi-rack impacts were requested. (Ferguson Testimony, p.30, et seq.) The delay of the hearings and requests for additional computations are tantamount to an admission by NRC staff that there were serious unresolved technical questions regarding the impact stresses on the fuel racks as late as March, 1987.

16. The recently performed multi-rack impact analysis was done using only a two-dimensional model which estimated that in some cases rack impact forces might be 20% higher than for a two dimensional single rack model. (NRC Staff Testimony, A.29, p.22.) NRC witness DeGrassi testified that in a realistic three-dimensional model the impact forces might exceed the single rack estimates by even more than has been computed. (RT p.565 et seq.) In other words, NRC staff admits that the single rack model used as the licensing basis was not conservative and that the two-dimensional model recently used for multi-rack effects is not conservative. They rely on their judgement to predict that the real impact forces during the PHE would not exceed the computed forces by enough to threaten the integrity on the system (RT p.566, 1.23.)

17. The theoretical model of the fuel elements also lacks conservatism. According to the model, as a fuel element rattles in a rack, all the water surrounding the fuel is assumed to circulate around the fuel element, rather than going through it. (RT p. 574, 1.12.) A fuel element contains approximately two

inches of open space between the seventeen fuel rods on each side of the element, whereas the gap around the fuel element is of the order of 1/8 inches. (RT p.571 1.12 et seq.) It is therefore certain that the rattling of the fuel will cause water to move through the fuel, contrary to the theoretical assumption of a fuel element as a solid object. (RT p.573 1.19 et seq.) The assumption of solid fuel elements is not conservative, but there is no evidence as to how much larger rack impacts would be if a more realistic fuel model were used. NRC staff again relies on its judgement in predicting that the resulting increase in impact forces would be small.

18. The theoretical computation of rack impact stresses depends critically upon certain assumptions regarding the effect of fluid forces upon the racks. (Ferguson Testimony, p.35 et seq.) The magnitude of these forces has not been computed explicitly, but the fluid pressures from which these forces arise were estimated to be in the vicinity of 10 pounds per square inch and the forces of the order of 100,000 pounds. (RT p 243 et seq.) (For a rack face 110 x 150 inches on a side, a pressure of 10 psi would result in a force of 165,000 pounds).

19. It was admitted that fluid forces of this magnitude could deform the racks an amount comparable to the spacing between the racks, and that such flexibility would alter the estimated fluid coupling forces and thus the impact forces on a rack. (RT p.567.) Again, Staff relied on its judgment that these effects would be small and impact forces would be less than

allowable. (RT p.569 1.6.)

20. The fluid coupling effects have been computed using the work of R.J. Fritz, who assumed that the relative motions of the objects are small compared to the spaces between the objects, i.e., that impacts between the objects would not occur. (Sierra Club Exhibit 9) In 1986, NRC consultants pointed out that "this is opposite to the conditions which prevail for spent fuel rack modules, . . ." (Original version quoted in Ferguson Testimony p.26.) This statement was revised as of May 28, 1987 to read "this does not exactly correspond to the conditions that prevail for spent fuel rack modules, . . ." (NRC Staff Exhibit 1-A, p 23). The revision is misleading in that it implies that the assumptions used in the current theoretical work are similar to those used by Fritz. In fact, the original statement is closer to the truth. The impacting fuel elements and racks represent a much different physical situation than that envisioned by Fritz. The validity of the fluid coupling assumptions used to model the impacting fuel racks has been accepted by the NRC Staff with little or no evidence.

21. During the recent multi-rack analysis, certain assumptions were made regarding the way fluid surrounding the racks affected the motion of the racks. NRC Staff testified on cross-examination that in a realistic situation other more complicated fluid motions would exist which would be expected to increase the impact forces on the racks. (RT p.563 et seq.) It is unknown how much the inclusion of such effects might have on the

expected rack impacts. (RT p.565 1.12.)

22. Testimony adduced at the hearing stated that during the postulated seismic motion, the bridge plates on which the racks slide would become dented as a result of impacts between the plates and the rack pedestals, thereby creating regions of varying roughness. (RT p.582 1.10.) No analysis has been made using spacially varying coefficients of friction. (RT p.586 1.17.) It is unknown how much such effects could affect the predicted impact forces.

ALTERNATIVES

23. The consideration of alternatives to the proposed reracking was described as a very brief discussion. (RT p.607, 1.17.) The reason for including a discussion in the Environmental Assessment is to put the proposed action in context. (RT p.607 1.1.) However, the analysis of alternatives did not incorporate any of the testimony or contentions relating to safety or potential safety issues with the proposed racks. (RT p.612 1.21.) Reracking existing pools with racks which did not collide was not considered. (RT p.614 1.22.) The analysis of alternatives assumed that the proposed reracking posed no radiological dangers. (RT p. 622 1.10.)

24. A thorough analysis of alternatives was not performed because there had been a finding of no significant environmental impact for the proposed action. (RT p. 608 1.4.) The discussion of alternatives ignored the collisions of the racks in the presently proposed configuration, it ignored all theoretical

uncertainties in the safety analysis of the colliding racks, it ignored the fact that colliding fuel racks represent a new and untested technology, and it ignored public opinion. (RT p.625 1.21.)

PUBLIC OPINION

25. The limited appearance statements made by members of the public indicate strong opposition to the proposed reracking. Rack impacts during seismic events was a frequently cited as an objection. (RT pp.1-113.) The Board has noted that the limited appearance statements are part of the mechanisms established to obtain "the views of the population". (Order of June 27, 1986, ASLBP No. 86-523-03-LA) It is unknown what other measures of public opinion have been obtained, if any. Judging from material now in the record, the proposed reracking is highly unpopular and controversial.

ENVIRONMENTAL IMPACTS

26. An Environmental Assessment is a NEPA document that serves, in part, to briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact. (40 C.F.R. 1508.9.) The "significance" of a spent fuel pool reracking "varies with the setting of the proposed action". (40 C.F.R. 1508.27(a).)

27. The Environmental Assessment prepared for Diablo Canyon relies on an outdated Generic Environmental Impact Statement in which it is assumed that spent fuel storage racks are secured and

cannot impact with each other or with the walls of the pool. (Ferguson Testimony p.40 1.9.) A document which ignores the setting of the proposed action and which assumes a significantly different storage technology cannot possibly provide "sufficient evidence and analysis" for a finding of no significant impact.

28. The U.S. Court of Appeals for the Ninth Circuit expressed the following opinion regarding the adequacy of the Environmental Assessment:

"With respect to petitioners' NEPA claims, however, we note that the site specific environmental assessment was based on a seven year old generic environmental assessment and that no worst case analysis, 40 C.F.R. 1502.22, appears to have been conducted. We strongly suggest that any doubt concerning the need to supplement the NEPA documents be resolved in favor of additional documentation." (San Luis Obispo Mothers for Peace and The Sierra Club vs. U.S.N.R.C, September 11, 1986.)

29. The "significance" of the proposed action also requires considerations of the "intensity" or severity of the impacts. (40 C.F.R. 1508.27(b).) In evaluating the intensity, "the degree to which the proposed action affects public health or safety" should be considered. (40 C.F.R. 1508.27 (b)(2).) The Sierra Club contentions and the record show that the major safety issue arises from the risk associated with earthquakes at the site. The record also shows that the potential hazards are large should the racks become damaged, although NRC staff and others have testified that the likelihood of damage is minimal. Accordingly, the degree to which the proposed action affects the public safety is difficult to ascertain.

30. However, the significance of impacts of the proposed

action also depends on "the degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks". (40 C.F.R. 1508.27 (b)(5).) That the Diablo Canyon site poses unique seismic risks is not disputed. The use of colliding fuel racks is also unique, having been used at only one other plant. The degree to which the rack collision analyses are "uncertain" and involve "unknown risks" is a matter of some contention. All parties agree that some degree of uncertainty is unavoidable in calculations as complex as those required in the current analysis.

31. The significance of the impacts associated with the proposed action also depends on "the degree to which the effects on the quality of the human environment are likely to be highly controversial." (40 C.F.R. 1508.27 (b)(4).) There can be no doubt that the proposed action is highly controversial among those residing in the area surrounding the reactor.

32. The existing NRC guidelines against rack impacts implicitly recognize the inherent difficulties and risks involved if spent fuel racks are permitted to collide. If these guidelines had been followed, a finding of no significant impact might reasonably have been reached. If these guidelines are ignored, as in the current case, a finding of no significant impact is inappropriate, according to the NEPA definitions.

33. A finding of no significant impacts in the present case was cited as a reason not consider other reasonable alternatives or mitigations which might have eliminated or minimized the risks

and uncertainties associated with the current proposal. In addition, the finding of no significant impact and the concomitant lack of an environmental impact statement severely limited public review and comment on the proposal and its alternatives.

34. In summary, the environmental assessment and finding of no significant impact for the proposed reracking failed to recognize the significance of the site-specific difficulties associated with the proposal. It ignored the risks and uncertainties associated with the use of new technology involving colliding fuel racks. It also ignored the controversial nature of the project. The finding of no significant impact therefore fails to satisfy the NEPA requirements.

35. As a result of the reliance on this erroneous finding, consideration of reasonable alternatives was abbreviated to the point of uselessness and the desired public involvement in the NEPA review process was severely curtailed. The finding of no significant impact for the currently proposed license amendment fails both the letter and the spirit of the NEPA regulations and must be voided by this panel.

CONCLUSION

36. The proposed license amendment is based on a model which has not been demonstrated to be conservative. It violates existing NRC guidelines. An inadequate environmental analysis was performed. It was not sufficiently site specific, and, it ignored the potential for significant environmental impacts.

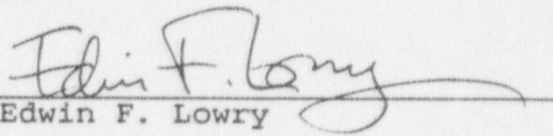
37. Therefore, the license amendment is denied.

Dated: June 29, 1987

Respectfully submitted,

GRUENEICH & LOWRY

By:


Edwin F. Lowry

PROOF OF SERVICE

I, Deborah M. Hunt, declare that on June 29, 1987, I deposited copies of the attached Final [Proposed] Findings of Fact and Conclusions of Law in the United States mail with postage thereon fully prepaid and addressed to the parties listed below:

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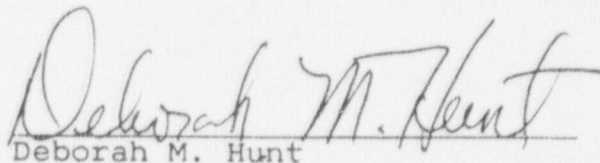
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I am, and was at the time of the service of the attached paper, over the age of 18 and not a party to the proceeding.

I declare under penalty of perjury that the foregoing is true and correct.


Deborah M. Hunt