October 20, 1987

Docket Nos.: 50-275
and 50-323

Mr. J. D. Shiffer, Vice President
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Dear Mr. Shiffer:

SUBJECT: ISSUANCE OF AMENDMENTS (TAC NOS. 64470 AND 64471)

Pursuant to the enclosed Initial Decision dated September 11, 1987 of the Commission's Atomic Safety and Licensing Board, we have issued the enclosed Amendment No. 22 to Facility Operating License No. DPR-80 and Amendment No. 21 to Facility Operating License No. DPR-82 for the Diablo Canyon Nuclear Power Plant, Unit Nos. 1 and 2, respectively. The amendments consist of a new license condition in further response to your application dated October 30, 1985 (LAR 85-13), as supplemented.

These amendments authorize PG&E to rerack the spent fuel pools and reinstate the effectiveness of Amendment No. 8 (Unit 1) and Amendment No. 6 (Unit 2) which were issued on May 30, 1986. The effectiveness of these amendments was stayed by the U.S. Court of Appeals for the Ninth Circuit until the completion of a prior NRC hearing, which has now been completed and an Initial Decision issued.

The amendments allow the expansion of the spent fuel storage capacity for each spent fuel pool from 270 spaces to 1324 spaces. The amendments also provide for storage in the present racks or the new racks (or both) until the installation of the new racks is complete.

NRC's evaluation of the safety and environmental aspects of these amendments is contained in the following documents: (1) Environmental Assessment by the Office of Nuclear Reactor Regulation Relating to the Expansion of the Spent Fuel Pools dated May 21, 1986, and related Notice of Issuance of Environmental Assessment and Finding of No Significant Impact published in the Federal Register on May 29, 1986 (51 FR 19430); (2) Safety Evaluation by the Office of Nuclear Reactor Regulation Relating to the Reracking of the Spent Fuel Pools at the Diablo Canyon Nuclear Power Plant, published on May 30, 1986 with the issuance of Amendments No. 8 and 6 to licenses No. DPR-80 and DPR-82, respectively; (3) the enclosed Initial Decision; and (4) NRC's Supplement to the Safety Evaluation and the Environmental Assessment dated October 15, 1987 and related Notice of Supplement to Environmental Assessment and Finding of No Significant Impact published in the Federal Register on October 20, 1987 (52 FR 38977).

A copy of the Notice of Issuance related to this action which is being filed with the Office of the Federal Register for publication is also enclosed.

Sincerely,

Original signed by

Charles M. Trammell, Project Manager
Project Directorate V
Division of Reactor Projects - III,
IV, V and Special Projects

Enclosures:
1. Initial Decision
2. Amendment No. 22 to DPR-80
3. Amendment No. 21 to DPR-82
4. Notice of Issuance

cc w/enclosures:
See next page

DRSP/PD5	DRSP/PD5	OGC	DRSP/PD5
JLee	CTrammell		GKnighton
10/15/87	10/19/87	10/15/87	10/30/87

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

B. Paul Cotter, Jr., Chairman
Glenn O. Bright
Dr. Jerry Harbour

875538

In the Matter of: PACIFIC GAS AND ELECTRIC COMPANY (Diablo Canyon Nuclear Power Plant, Units 1 and 2)	Docket Nos. 50-275-OLA and 50-323-OLA (ASLBP No. 86-523-03-LA) September 11, 1987

INITIAL DECISION

I. INTRODUCTION

The Sierra Club has challenged an application by Pacific Gas and Electric Company ("Applicant" or "PGandE") to substantially increase the storage capacity in each of the two spent fuel pools at the Diablo Canyon Nuclear Power Plant. The Sierra Club contends that the application fails to meet regulatory requirements and threatens the public health and safety and the environment in four major respects: (1) relevant data is missing concerning the velocity and displacement of the spent fuel pools and the spent fuel racks in the pools during an earthquake; (2) the impact forces an earthquake would create on the spent fuel pools and the racks they contain are significantly underestimated; (3) collisions between the racks, groups of racks, and

the spent fuel pool walls during an earthquake would cause the release of large quantities of radiation which would contaminate the plant, the environment, and all living things in the vicinity; and (4) the Applicant failed to consider other, safer alternatives to the high density reracking applied for. For the reasons set out below, we find that the Sierra Club's contentions are unfounded, and we authorize the Director of Nuclear Reactor Regulation, pursuant to the requirements of governing regulations, to issue the license as applied for.

II. HISTORY OF THE CASE

A. The Diablo Canyon Plant

On October 30, 1985, Applicant filed requests to amend its license to operate Units 1 and 2 of its Diablo Canyon Nuclear Power Plant, located 12 miles southwest of San Luis Obispo, California. The amendments would authorize Applicant to increase the number of spent fuel rod assemblies to be stored in each of two spent fuel pools from 270 to 1324. Applicant Exhibits 1 and 2; 51 Fed. Reg. 1451 (1986).

The Diablo Canyon plant consists of two large pressurized water reactors, capable of generating up to 1084 (Unit 1) and 1106 (Unit 2) megawatts of electrical energy. Unit 1 began commercial operation in May 1985, and Unit 2 began commercial operation in March 1986. Both units use steam generators and turbines to produce electricity. The

steam is created by heating water through energy originating in the nuclear reaction of uranium oxide pellets contained in 20-foot long, narrow, rods. The fuel pellets are encased in an exterior cover, or cladding, of Zircaloy. The rods are assembled in "bundles", or fuel assemblies, in the reactor core of each unit.

B. The Spent Fuel Pools

Each unit has a spent fuel pool for storing up to 270 fuel assemblies after their useful reactivity has burned up and they have been removed from the reactor core. The spent fuel pools are separate, but identical, large concrete structures located at opposite ends of the Diablo Canyon auxiliary building. Each pool is approximately 35 feet wide, 37 feet long, and 40 feet deep. The pool walls are of concrete, six feet thick, except around the fuel transfer canal where the walls are five feet thick. The pools rest on a reinforced concrete foundation at least five feet thick; the foundation, in turn, sits on five additional feet of lean concrete set directly on bedrock. The pool walls are lined with stainless steel, 1/4 inch thick on the floor and 1/8 inch thick on the walls.

C. The Racks

Under the license amendment sought, 16 modules, or "racks", of differing sizes would be placed in each pool. Each rack is a large,

rectangular, stainless steel "canister" approximately 17 feet high and weighing from 15,000 to 28,000 pounds. Each rack contains from 24 to 110 storage cells. Each cell is approximately 8.85 inches square, and each will store one Westinghouse spent fuel assembly. Stainless steel gap channels are welded between the cells to create a rigid, "honeycomb" structure to resist impact and seismic loads.

The racks are free standing at the bottom of the water-filled pool, so that the top of the spent fuel is approximately 23 feet below the water's surface. They are surrounded by, and filled with, water. The racks have no rigid structural member attaching them to the pool floor or walls or any adjacent rack. The racks stand on feet, large round steel dowels approximately 2 feet in diameter and 5 inches high, located near the four corners of each rack. Those feet, in turn, rest on bearing plates on the pool floor. Each rack has an exterior steel girdle bar welded near the top of all four sides of the "canister". The girdle bars serve as a designated impact location designed to accommodate impact loads which may occur during a seismic event. The girdle bars also maintain a specified minimum gap between the cell walls of adjacent racks for all loading conditions.

D. The 9th Circuit Stay

On May 30, 1986 after petitions to intervene had been filed herein, Staff made a finding of "no significant hazards consideration." 10

C.F.R. § 50.92 (1986). Based on that finding, NRC approved the license amendments requested and made them immediately effective. One of the then parties to this proceeding appealed the finding. San Luis Obispo Mothers for Peace v. U.S. NRC, 799 F.2d 1268 (9th Cir. 1986).

Pursuant to the "Sholly" amendment to the hearing requirement of the Atomic Energy Act, the Court found that the NRC finding of "no significant hazards consideration" violated the statute and implementing regulations. 42 U.S.C. § 2239(a)(2)(A) (1986 Supp.); Id., at 1271. The Court reversed, staying any further work on the spent fuel pools and barring Applicant from depositing any spent fuel rods therein, except in accordance with the pools' original configuration, until the conclusion of this proceeding. Id.

E. Status of the Contentions

The Sierra Club's contentions, as restated by this Board, were admitted to this proceeding in 1986.[1] Pacific Gas and Electric Co., 23 NRC 849 (LBP-86-21, 1986). The first contention, I(A), alleged that relevant data on six designated subjects was not contained in the

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[1]Two other parties initially admitted to the proceeding, Consumers Organized for Defense of Environmental Safety and the San Luis Obispo Mothers for Peace, subsequently withdrew from the case, and their contentions were dismissed. Memorandum and Order issued January 30, 1987, at 4 (Unreported).

license amendment application and subsequent communications. The Board held that the contention "goes to the availability of the data cited, not its accuracy or adequacy", and urged the parties to settle the matter and report on their efforts within 30 days. Id., at 861. As a result of the information subsequently made available, the Sierra Club reported that four of the six subjects had been resolved by the information supplied by Applicant, leaving only two still in dispute. The two subjects still at issue, items 3 and 4, generally concerned data on the expected velocity and displacement of the spent fuel pools and the racks during the postulated Hosgri earthquake. Memorandum and Order dated August 28, 1986, at 2 (Unreported).

Two other contentions remain.[2] In the first, Contention I(B), Sierra Club alleges that the license amendment application failed to consider certain relevant conditions, phenomena and alternatives necessary to verify health and safety and environmental claims made as they relate to four items: (1) the consequences of the resonant behavior of the spent fuel assemblies in the racks during an earthquake; (2) alternatives to on-site storage; (3) anchoring or bracing the free

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[2]At the outset of the hearing, Sierra Club moved the admission of two additional contentions which were taken under advisement pending subsequent filings by the parties. Tr. 142-174. The first, concerning the possibility of cladding fires, was denied by the Board in a Memorandum and Order issued September 2, 1987, 26 NRC ___ (1987). The second, concerning a Boraflex neutron absorber, was not pursued by the Sierra Club and is deemed withdrawn. See Board Finding 10, infra.

standing racks; and (4) the use of Boraflex neutron absorbing material for all spent fuel racks. That part of the contention concerning Boraflex was withdrawn during the hearing. Tr. 173-174.

The second, Contention II, has two parts. In Part A, Sierra Club contends that collisions between the racks and the pool walls during an earthquake will cause damage to the racks and spent fuel assemblies resulting in radioactive contamination of the Diablo Canyon plant, the environment, and all living things in the vicinity. Part B alleges similar results from collisions between groups of racks with each other and the pool walls.

III. ANALYSIS

A. Contention I(A)

Contention I(A) reads as follows:

> It is the contention of the Sierra Club, Santa Lucia Chapter (Sierra Club), that the report submitted to the Nuclear Regulatory Commission (NRC) entitled Reracking of Spent Fuel Pools, Diablo Canyon Units 1 and 2 and other communications between Pacific Gas and Electric Company (PG&E) and the NRC, which are available to the public on the same subject (the Reports), fail to contain certain relevant data necessary for independent verification of the claims made in the Reports regarding consistency of the proposed reracking with the protection of the public health and safety, and the environment.
>
> In particular, the Reports fail to contain data regarding:

* * *

3) The expected velocity and displacement of the spent fuel pools (pools) as a function of time in three dimensions during the postulated Hosgri earthquake (PHE);

4) The expected maximum velocity and displacement of the racks obtained from the computer modeling of rack behavior during the PHE.

Both Applicant and Staff concede the truth of Sierra Club's Contention I(A) allegation that the reracking report (PGandE Ex. 2) did not contain separately stated values of velocity and displacement for the fuel pools and fuel racks, respectively, during the Postulated Hosgri Earthquake (PHE). The PHE is the maximum earthquake that can be expected at the Diablo Canyon plant and sets the outer limit for seismic forces that certain plant structures must be able to withstand. However, both Applicant and Staff argue that it is not necessary to show the values separately because of the method of analysis used in designing the pools.

Their expert witnesses testified that the calculation methods employed for analysis and design do not use these particular values, but rather depend upon the acceleration time-histories of the PHE itself. The values of velocity and displacement can be derived from these acceleration time-histories, but were omitted in the reracking report as being unnecessary. See Board Findings 16-19.

The Board finds the explanation of Staff and Applicant experts persuasive. We find that a separate statement of the values in question was not required. Accordingly, Contention I(A) is denied.

B. Contention I(B)

Sierra Club's Contention I(B) has three parts which we address seriatim. The first, I(B)2, provides as follows:

> It is the contention of the Sierra Club that the Reports fail to include consideration of certain relevant conditions, phenomena and alternatives necessary for independent verification of claims made in the Reports regarding consistency of the proposed reracking with public health and safety, and the environment, and with federal law.
>
> In particular, the Reports fail to consider:
>
> * * *
>
> 2) The resonant behavior of the spent fuel assemblies in the racks in response to the PHE and the consequences of such behavior; ... .

Sierra Club's Contention I(B)(2) alleges that the Licensee's reracking report did not consider resonant behavior of the fuel assemblies in the racks during a PHE. Although resonance phenomena were not explicitly addressed, the design basis analysis performed by the Applicant would have revealed such behavior were it to exist. The absence of any resonance is not surprising, as it typically appears only

in linear response systems free to vibrate without damping, whereas the rack-fuel assembly system at issue here is highly nonlinear.

In any event, the amplitude of any resonant behavior of the fuel assemblies would be constrained by the 0.302 inch water-filled gap between the assembly and the cell inside the rack. Staff's experts testified that Licensee's analysis is appropriate, and that no resonance effects are expected. Board Findings, 22 and 23. The Sierra Club proposed no findings on this contention.

The Board agrees with Applicant and Staff that the analysis performed by Applicant would have detected any resonance effects if such effects existed. We therefore find the contention to be without merit, and it is denied.

Contention I(B)7 provides as follows:

> It is the contention of the Sierra Club that the Reports fail to include consideration of certain relevant conditions, phenomena and alternatives necessary for independent verification of claims made in the Reports regarding consistency of the proposed reracking with public health and safety, and the environment, and with federal law.
>
> In particular, the Reports fail to consider:
>
> * * *
>
> 7) Alternative on-site storage facilities including:
>
> (i) construction of new or additional storage facilities and/or;

(ii) acquisition of modular or mobile spent nuclear fuel storage casks; ... .

In Contention I(B)7 the Sierra Club maintains that the Reracking Report should have considered alternative methods of on-site fuel storage, namely, provision of new fuel pools or spent fuel storage casks. Both Applicant and Staff argue that consideration of these fuel storage modes is not an NRC requirement.

Applicant's experts testified that PGandE had analyzed and compared its options for greater storage capacity before making its decision to use high density reracking, as was only prudent. Applicant concluded that neither of the two alternatives mentioned by the Sierra Club had any safety advantage over reracking, and that there were probably some safety concerns that weighed against the alternatives, such as the necessity for greater fuel handling. The time frame in which new fuel pools would be needed, the lack of suitable sites for their location and the projected expense also weighed against construction of new or additional storage facilities. The Staff review essentially agreed with the PGandE position. Board Findings 25-30. Sierra Club's testimony presented no concrete evidence that PGandE had failed to adequately consider alternative on-site storage. Board Findings 31-33.

The only specific NRC requirements are consideration of off-site storage or reprocessing of the fuel and of shutting the reactor down.

PGandE Ex. 12, V-1. These comparisons are included in the Reracking Report. Board Finding 34. The Board finds that the alternative comparisons presented in the Reracking Report comply fully with NRC rules. Consequently, Contention I(B)7 is denied.

Contention I(B)8 provides as follows:

> It is the contention of the Sierra Club that the Reports fail to include consideration of certain relevant conditions, phenomena and alternatives necessary for independent verification of claims made in the Reports regarding consistency of the proposed reracking with public health and safety, and the environment, and with federal law.
>
> In particular, the Reports fail to consider:
>
> * * *
>
> 8) the use of anchors, braces, or other structural members to prevent rack motion and subsequent damage during the PHE; ... .

Sierra Club Contention I(B)8 claims that Applicant did not consider the use of structural members to prevent rack motion and possible damage during the PHE. Both Applicant and Staff argue that the design of the proposed racks satisfies NRC criteria and guidance applicable to spent fuel storage racks, and that anchors, braces or other structural members are not needed. They also point out that the use of free-standing racks has several advantages over anchored or braced racks. Board Findings 36, 37.

The Sierra Club presented no specific findings on this contention. The Board can only conjecture that either Sierra Club no longer has an interest in this contention or that whatever interest it had was subsumed in Contention II, which follows. A great deal of testimony, cross-examination and findings were presented on Contention II, the thrust of which was the alleged inadequacy of the Licensee's analysis of the free-standing racks. On this basis, we rule herein that on the narrow point that since, as Staff and Applicant agree, the free-standing racks satisfy NRC guidance and criteria (see infra Contention II), there is no need to consider structural members for the stabilization of the racks. Contention I(A)8 is denied.

C. Contention II

Contention II has two parts: Part A addresses possible collisions between the racks and the pool walls, and Part B addresses such collisions between groups of racks with each other and the pool walls. Each part has nine subparts. We address them here, seriatim.

Contention II(A), subparts 1 to 3 states 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, 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; ... .

The first three parts of Contention II(A) challenge the seismic design of the free-standing, high-density fuel storage racks proposed for reracking of the Diablo Canyon fuel storage pools. The two main prongs of the Sierra Club's challenge are: (1) an assertion that NRC regulations and guidance prohibit sliding and tilting of the fuel storage racks during earthquakes thus prohibiting rack-to-rack and rack-to-wall impacts; and (2) assertions that the complex analytical and modeling procedures used in deriving the earthquake-induced impact forces, loads, and stresses were based on inadequately demonstrated theory or practice; were inadequately performed; and were non-conservative in certain respects.

Because the remaining parts of Sierra Club Contention II (i.e., reduction of the spacing between fuel elements and an increase in the nuclear criticality coefficient k_{eff} above 0.95, with concomitant generation of heat and release of radioactivity) would be a consequence only of serious damage and deformation of the racks during the

postulated Hosgri Earthquake (PHE), the first three parts of Contention II are crucial to the Sierra Club's position.[3]

The Applicant maintains that its design procedures fully meet NRC seismic design requirements and guidance contained in the Standard Review Plan (primarily found in §§ 9.1.2 and 3.8.4 of Appendix D) and in the NRC Office Technical (OT) Position Paper, "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications", dated April 14, 1978. PGandE contends that the NRC criteria permit rack sliding and rack-to-rack and rack-to-wall impacts and provide specific guidance on how such impacts are to be incorporated in the rack design.

The Staff view on its OT Position Paper is that there is no dispute that sliding, tilting and impacts are permitted, so long as impact loading is quantified and that sliding and tilting motions are contained within suitable geometric constraints. Inter-rack and rack-to-wall boundaries constrain rack movement and prevent overturning of racks.

The Sierra Club's position that NRC regulations or guidance do not permit sliding, tilting and impact of the racks with each other or with

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[3]Sierra Club's Contention II(B), see infra, asserts the same deficiencies and potential consequences as II(A), but as a result of collisions of groups of racks with each other and with the pool walls. See, also, Sierra Club's Final Proposed Findings of Fact 6, at 3.

the pool walls was supported only by the interpretation of its witness, who was not persuasive in this regard. See Finding 45. Accordingly, we find that NRC regulations and guidance permit sliding, tilting and impacts of the racks, if impact loading is properly quantified and rack motions are suitably constrained.

The Sierra Club's challenge to the analytical and modeling procedures used in the design of the racks largely reduces to several assertions apparently related to the complexity of the models themselves and simplifying assumptions used by Applicant to predict rack motions.

In regard to the effect of fluid forces upon the racks, the Sierra Club asserts that, during closure of the gap between opposite-moving racks, fluid forces would be great enough to cause bowing of the rack. That bowing would allegedly alter the fluid coupling forces (by increasing the gap width) and thus increase the impact velocity and impact forces upon collision. The Sierra Club also asserts that Licensee's assumption of the fuel elements as solid objects is not conservative and that a more realistic model with water flowing through the fuel elements would result in larger but unknown impact forces. The Sierra Club also argues that the validity of the fluid coupling assumptions used in modeling the seismic response of the racks is in doubt and has been accepted by the Staff with little or no argument.

The use of two widely spaced coefficients of friction, 0.8 and 0.2, in the seismic response modeling is questioned by the Sierra Club on the grounds that denting of the bearing or bridge plates might occur during rack-to-floor impacts, and could result in spatially varying coefficients of friction. However, it is not argued that the resulting friction coefficients would be outside the range utilized by Applicant, or that such effects would affect rack sliding or acceleration response so as to result in design loads or stresses different from those obtained in Applicant's design analyses. Staff maintains that use of the bounding coefficient values (0.8 and 0.2) would cover possible effects of spatially varying coefficients of friction. Finding 52.

Testimony of the Applicant and Staff expert witnesses flatly contradicts the Sierra Club assertions in regard to fluid coupling effects. Applicant argues in each of the examples cited above, that its assumptions and modeling procedures treat fluid coupling forces so as to maximize impact loads and stresses in the racks; i.e., they increase, rather than decrease, conservatism. Additional conservatism is provided by neglecting fluid damping and form drag effects on rack motions in the models. Staff concurs. In regard to the applicability of the fundamental hydrodynamic concepts, Applicant demonstrated that the procedures are well-established and based on long-standing principles. Further, Applicant points to many areas of conservatism incorporated into its overall design of the free-standing high-density racks. Findings 49 a-g, 52-54, 57, 60-61.

According to the Applicant's calculations, the largest calculated impact force between a storage cell and a fuel assembly is 249,000 pounds, or 28 percent of the allowable 883,000 pounds, and the maximum calculated impact force between racks is 105,000 pounds, which is 60 percent of the allowable 175,000 pounds. Finding 63.

The Sierra Club does not maintain that its calculations that yielded impact forces larger than the allowables listed in the reports are accurate and reliable or show rack failure. Finding 62.

The Board finds that the design of the proposed high-density racks meets applicable NRC requirements and that the racks will withstand the effects of the Postulated Hosgri Earthquake without incurring significant permanent deformation and other damage to the racks or pool walls. Thus Sierra Club contention II(A) subparts 1, 2 and 3 are without merit and must fail.

Sierra Club's subparts 4 through 9 of Contention II(A) reads as follows:

> It is the contention of the Sierra Club that 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, collisions between the racks and the pool walls are expected to occur resulting in:
>
> 4) reduction of the spacings between fuel assemblies;

5) increase in the nuclear criticality (sic) [reactivity] coefficient k(eff) above 0.95;

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.

Because the effects alleged in Contention II(A), subparts 4-9, are postulated to result only from significant permanent deformation and damage of the racks and pool walls during the PHE, an assertion we have found, supra, to be without merit, subparts 4-9 must also fail.

The Sierra Club offered no testimony on subparts 5-9 of its Contention II(A), and its testimony on subpart 4 was incidental to that on subparts 1-3.

In its Safety Evaluation (Staff Ex. 1, at 3-6), the Staff found that the Applicant had demonstrated compliance with General Design Criteria (GDC) 61 and 62, 10 C.F.R. Part 50, Appendix A, Section VI.

GDC 61 requires that fuel storage facilities be designed so that adequate safety margins under normal and postulated accident conditions are assured. GDC 62 requires that criticality in fuel storage and handling systems be prevented. Because of demonstrated compliance with these criteria, no analysis of a criticality event in the spent fuel pools is required. However, we make findings, based on analyses performed by Applicant and Staff, to illuminate the considerations bearing on reactivity with and without borated water in the pools under normal and abnormal conditions. See Findings 67-70.

We also make certain findings on Contention II(A)6 concerning evidence evaluating the structural integrity of the fuel assemblies. We find that failure mechanisms other than significant permanent deformation of the storage racks will not cause rupture of the cladding. Thus, without rupture of the cladding, there will be no release of radioactivity. Findings 72-74.

Contention II(B)

Contention II(B) provides as follows:

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

As in Contention II(A), the issues here stem largely from the complexity of the design models and simplifying assumptions used in them to predict rack motions. Different models predicted different motions, forces, loads and stresses, because different assumptions and parameters were utilized.

At Staff's request, Applicant performed several parametric studies utilizing two-dimensional multi-rack models to demonstrate the conservatism of its three-dimensional single rack model. While some cases analyzed predicted higher impact forces than predicted in the single rack model, the predicted impact loads were comparable and well within the allowable impact loads used in the rack design. All potential collision conditions under the postulated Hosgri event are thus bounded by the loads for which the racks have been seismically qualified.

Because of the dissimilarity of the racks in terms of mass, geometry, tolerances and gap spacings, it is highly unlikely that the different racks would respond identically to earthquake motions or that groups of racks would move as a unit during the random motions of an earthquake.

We have found, therefore, that the evidence provides reasonable assurance that the potential effects of multiple rack impacts with each other and with the pool walls are bounded by those predicted in the single rack design basis models. Findings 78-82. Therefore, the assertions in Sierra Club Contention II(B) are rejected as unsupported.

IV. FINDINGS OF FACT AND CONCLUSIONS OF LAW

For all the foregoing reasons and based upon consideration of the entire record in this matter, we make the following findings of fact:

General

1. Pacific Gas and Electric Company ("Applicant") is a California utility duly licensed to own and operate the Diablo Canyon Nuclear Power Plant under applicable state and Federal laws.

2. The Sierra Club is a non-profit, environmental organization admitted to this proceeding through the petition of its Santa Lucia Chapter pursuant to 10 C.F.R. Part 2.

3. The Diablo Canyon Nuclear Power Plant consists of two pressurized water reactors ("PWR") located 12 miles west southwest of San Luis Obispo, California. The Units have a design electrical rating

(Net MWe) of 1086 for Unit 1 and 1119 for Unit 2. Unit 1 achieved initial criticality on April 29, 1987 and began commercial operation on May 7, 1985. Unit 2 achieved initial criticality on August 19, 1985 and began commercial operation on March 13, 1986.

4. The spent fuel pools at Diablo Canyon are located at each end of the east side of the auxiliary building. Each pool is approximately 35 feet wide, 37 feet long, and 40 feet deep. The normal water level in the pool provides a minimum of 23 feet of water above the top of the stored fuel. The concrete pool walls are 6 feet thick except around the fuel transfer canal where the walls are 5 feet thick. The reinforced concrete foundations of the pools have a minimum thickness of 5 feet and are founded on approximately 5 additional feet of lean concrete placed directly on rock. The pool walls and floors are lined with stainless steel plate with a thickness of 0.25-inches on the floor and approximately 0.125-inches on the walls. Shiffer, et al., ff. Tr. 179, at 14. As originally constructed, each pool could store 270 spent fuel assemblies.

The License Amendment Application

5. On October 30, 1985, Applicant filed requests to amend its licenses for Units 1 and 2 at Diablo Canyon to authorize high density

reracking of the spent fuel pools to increase the number of rack storage locations for spent fuel rod assemblies in each pool. PGandE Exhibit 1; 51 Fed. Reg. 1451 (1986).

6. The high density spent fuel racks proposed for each of the Diablo Canyon fuel pools consist of a total of 16 racks of various sizes, with a total of 1324 fuel assembly storage cells plus 10 miscellaneous storage locations. The number of storage cells ranges from 24 in the smallest racks to 110 in the largest racks. Individual storage cells have an 8.85-inch (nominal) square cross section, and each is sized to contain and protect a single Westinghouse-type PWR 17x17 fuel assembly. The cells are arranged with a 10.93-inch center-to-center spacing in the rack modules. Stainless steel gap channels are welded between the cells to provide a "honeycomb" type structure which provides considerable rigidity and resistance to impact as well as to seismic shaking loads. PGandE Exhibit 2; Shiffer, et al., ff. Tr. 179, at 12-13.

7. Each fuel assembly consists of a 17 x 17 array of cylindrical rods of which 264 rods contain fuel pellets. The assembly is approximately 8.4 inches square and 13.3 feet in length. Each fuel rod is a Zircaloy tube containing uranium dioxide fuel pellets. Grids are positioned at vertical intervals along the length of the fuel assembly to maintain the rod spacing. Shiffer, et al., ff. Tr. 179, at 39; PGandE Exhibit 2.

8. The active fuel region is the region within the fuel assembly which contains fuel pellets. This region extends 144 inches, from approximately 3 inches above the bottom of the fuel assembly nozzle, which rests on the rack baseplate, to approximately 10 inches below the rack girdle bars. Shiffer, et al., ff. Tr. 179, at 39.

9. The racks are freestanding, with no connection to the pool floor, walls, or adjacent rack modules. The rack support feet rest on bearing (or bridge) plates on the pool floor. Each module is equipped with a girdle bar on the outside of each of the modules' four sides, near the top. Each girdle bar serves as a designated impact location, and each is designed to accommodate impact loads which may occur during a seismic event. They also maintain a specified minimum gap between the cell walls of adjacent rack modules for all loading conditions. Shiffer, et al., ff. Tr. 179, at 11.

10. The rack modules are specifically designed for storage of spent fuel with different amounts of burnup. Three modules (290 cells) are designated as Region 1 in each pool; these utilize a neutron-absorbing material, Boraflex, on all four sides of the individual storage cells in the rack module. These cells in the Region 1 modules are designed for two kinds of storage, i.e., new fuel assemblies with enrichments up to 4.5 weight percent U-235, and spent fuel that has not achieved a specified minimum burnup. There are 13 modules (1034 cells) designated as Region 2 in each pool; spent fuel

stored in this region would be required by Technical Specifications to have a specified minimum burnup and, thus, no Boraflex is used in the Region 2 modules. Shiffer, et al., ff. Tr. 179, at 13-14.

The Contentions

11. Three of Sierra Club's contentions challenging various health and safety aspects of the application were admitted to the proceeding. Pacific Gas and Electric Co., 23 NRC 849 (LBP-86-21, 1986). Four of six issues in the first contention, Contention I(A), were resolved prior to hearing. Memorandum and Order dated August 28, 1986, at 2 (Unreported). A portion of Contention I(B) was deemed resolved during the hearing and withdrawn. Tr. 173-174.

12. Both Staff and Applicant presented expert witnesses concerning each of the Sierra Club's contentions. The witnesses were either employees of, or consultants to, their proponents, and the witnesses' expertise included structural, nuclear, civil, and reactor operations engineering. Their expert qualifications were not challenged by the Sierra Club. See, e.g., Tr. 179.

13. The Sierra Club offered one witness on all contentions, Dr. Richard B. Ferguson. On voir dire, Dr. Ferguson conceded that he was not an expert in the following technical subjects as they relate to the design and analysis of spent fuel racks: nuclear engineering;

nuclear systems; nuclear criticality; seismic design; and Federal laws, codes, and regulations. Tr. 424-426. He further stated that he has never taken courses in the following areas: nuclear engineering; nuclear systems; finite element analysis; and spent fuel storage technologies. Tr. 426-431. Dr. Ferguson's testimony and his professional qualifications clearly indicate that, other than his involvement with the proposed reracking at Diablo Canyon, he has limited or no experience with any of the technical subjects at issue in this proceeding. Accordingly, his testimony is given the weight which the Board feels is appropriate considering his doctorate in physics and over thirteen years of teaching physics at the University of California at Los Angeles and California Polytechnic State University.

Contention I(A)

14. Contention I(A) originally consisted of six subparts. Subparts I(A)1, I(A)2, I(A)5 and I(A)6 were withdrawn by the Sierra Club in their Report to the Board dated August 15, 1986. Memorandum and Order dated August 28, 1986 (Unreported).

15. Contention I(A)3 reads as follows:

> It is the contention of the Sierra Club, Santa Lucia Chapter (Sierra Club), that the report submitted to the NRC entitled Reracking of Spent Fuel Pools, Diablo Canyon Units 1 and 2 and other communications between Pacific Gas and Electric Company (PG&E) and the NRC, which are available to the public on the same subject (the Reports), fail to contain certain relevant data necessary for independent verification of the claims made

in the Reports regarding consistency of the proposed reracking with the protection of the public health and safety, and the environment.

In particular, the Reports fail to contain data regarding:

* * *

3) The expected velocity and displacement of the spent fuel pools (pools) as a function of time in three dimensions during the postulated Hosgri earthquake (PHE);

16. The design process for the racks utilized the postulated Hosgri earthquake acceleration time-histories for the base of the spent fuel pool. Velocity and displacement information can be derived from the acceleration time-histories used in the design, which are contained in the Reracking Report, Figures 6.1.1, 6.1.2, and 6.1.3. Shiffer, et al, ff. Tr. 179 at 24; Fishman, et al, ff. Tr. 519 at 6-7; PGandE Exhibit 2.

17. Data regarding the velocity and displacement of the fuel pools as a function of time in three dimensions for the postulated Hosgri earthquake is not necessary for rack analysis or review by the NRC Staff in evaluating the technical adequacy of the rack design because the postulated Hosgri earthquake acceleration time-histories are used for that purpose. Consequently, the velocity and displacement time-history data for the fuel pools were not included in the Reracking Report because a record of such data was not required during the design process. Shiffer, et al, ff. Tr. 179 at 24; Fishman, et al, ff. Tr. 519 at 6-7; PGandE Exhibit 2.

Contention I(A)4

18. Contention I(A)4 provides as follows:

> It is the contention of the Sierra Club, Santa Lucia Chapter (Sierra Club), that the report submitted to the NRC entitled Reracking of Spent Fuel Pools, Diablo Canyon Units 1 and 2 and other communications between Pacific Gas and Electric Company (PG&E) and the NRC, which are available to the public on the same subject (the Reports), fail to contain certain relevant data necessary for independent verification of the claims made in the Reports regarding consistency of the proposed reracking with the protection of the public health and safety, and the environment.
>
> In particular, the Reports fail to contain data regarding:
>
> * * *
>
> 4) The expected maximum velocity and displacement of the racks obtained from the computer modeling of rack behavior during the PHE;

19. The maximum velocity of the racks is not documented in the Reports because it is not a value needed for design of the racks. However, the maximum displacement for a loaded rack module is included in the Reracking Report in Table 6.8.2. Shiffer, et al, ff. Tr. 179 at 24-25; PGandE Exhibit 2. See also Finding 40, infra.

Contention I(B)

20. Contention I(B) originally consisted of ten subparts. Of these, the Board found that subparts I(B)1, I(B)5 and I(B)10 were subsumed in Contention II. Subparts I(B)3, I(B)4, and I(B)6 were rejected by the Board as not meeting the basis and specificity requirements of 10 C.F.R. § 2.714(b) (1986). Pacific Gas and Electric

Co., 23 NRC 849, 861-864 (LBP-86-21, 1986). I(B)9 was withdrawn by the Sierra Club during the hearing. Tr. 173-174.

21. Of those subparts remaining, Contention I(B)2 provides as follows:

> It is the contention of the Sierra Club that the Reports fail to include consideration of certain relevant conditions, phenomena and alternatives necessary for independent verification of claims made in the Reports regarding consistency of the proposed reracking with public health and safety, and the environment, and with federal law.
>
> In particular, the Reports fail to consider:
>
> 2) The resonant behavior of the spent fuel assemblies in the racks in response to the PHE and the consequences of such behavior;

22. The rack analysis performed by PGandE considered potential resonant behavior of fuel assemblies in that the design basis analysis performed to evaluate the fuel racks utilized a mathematical representation of the various components and their response behavior. Since resonant behavior is a fundamental condition described by the equations of motion, and since the equations of motion were appropriately represented, the analysis considered the possibility of resonant behavior. Shiffer, et al, ff. Tr. 179 at 26.

23. The design basis analysis demonstrated that, due to the specific conditions present, the fuel assemblies do not experience resonant behavior. These conditions include the nonlinearities of the

system (including the presence of water, the movement of the fuel assemblies within the fuel racks, and the presence of friction at the fuel rack base). The analysis appropriately represented these physical conditions and demonstrated that the integrity of the racks is maintained. As a practical matter, resonance will not occur since the displacement amplitude cannot increase beyond the 0.302 inch clearance between the fuel assembly and cell wall. Shiffer, et al, ff. Tr. 179 at 27; Fishman, et al, ff. Tr. 519 at 10-11.

Contention I(B)7

24. Contention I(B)7 provides as follows:

> It is the contention of the Sierra Club that the Reports fail to include consideration of certain relevant conditions, phenomena and alternatives necessary for independent verification of claims made in the Reports regarding consistency of the proposed reracking with public health and safety, and the environment, and with federal law.
>
> In particular, the Reports fail to consider:
>
> 7) alternative on-site storage facilities including:
>
> (i) construction of new or additional storage facilities and/or;
>
> (ii) acquisition of modular or mobile spent nuclear fuel storage equipment, including spent nuclear fuel storage casks;

25. PGandE had compared the two methods of on-site storage facilities mentioned in the contention with the proposed reracking. The evaluation was brief because these two specific methods, i.e., additional storage facilities and acquisition of modular storage equipment, do not offer any increase in safety over high density racks and they involve technical, regulatory, and other disadvantages when compared with high density racks. Shiffer, et al, ff. Tr. 179 at 28; Cleary, ff. Tr. 604 at 2-3; PGandE Exhibit 2, Chapter. 9.

26. An additional storage pool was considered less attractive because it would not provide any added safety for spent fuel storage than with properly designed high density racks in the existing pools. Moreover, the costs of constructing a new seismically qualified structure and auxiliary support systems would obviously be very high compared with reracking. Finally, this would involve increased handling of the spent fuel. Shiffer, et al, ff. Tr. 179 at 29; Cleary, ff. Tr. 604 at 3-5.

27. Acquiring modular storage equipment was considered less attractive because such equipment would not provide any added safety over and above properly designed high density racks. Further, modular equipment such as dry cask storage was not a licensed concept at the time the reracking decision was made by PGandE, and casks were still being tested. In any event, dry cask storage is not a viable option for Diablo Canyon based upon the design of the dry casks currently

available. The dry casks are designed to store only fuel that has been discharged from the reactor at least five years prior to cask storage. Thus, this storage method could not be used for at least five years following the first refueling outage. Cleary, Tr. 617. See 10 CFR 72 (1986).

28. The existing low density racks at Diablo Canyon were originally designed, in accordance with early NRC guidelines, to accommodate spent fuel discharged from one refueling (roughly 70 assemblies), plus a reserve capacity of a full core offload (193 assemblies) in the event a full core discharge were necessary. Shiffer, et al, ff. Tr. 179 at 29.

29. The storage space associated with one refueling discharge is currently occupied at Diablo Canyon Units 1 and 2 after the first refueling outages. Based upon operating schedules and the desirability of maintaining full core discharge capability, it is necessary that the spent fuel storage capacity for both units be increased. Further, the cost of the casks, assuming their availability, which would be required for the needed capacity at Diablo Canyon would be high compared with the reracking alternative. At the time that PGandE made the reracking decision, there were no plants in the United States using modular storage facilities for spent fuel storage. Subsequently, two plants were licensed to use modular storage facilities such as dry casks, but these plants did so only when all of the storage space in existing pools

had been filled after they had been previously reracked with high density racks. Shiffer, et al, ff. Tr. 179 at 29-30; Cleary, ff. Tr. 604 at 5-9.

30. The Staff reviewed the Licensee's fuel pool amendment with regard to alternatives and presented its findings in the Environmental Assessment. Staff Exhibit 2. They agreed that the Licensee's proposed reracking would have no significant environmental impacts, whereas the Sierra Club's asserted alternatives of new or additional storage facilities or use of modular or mobile fuel storage racks would have specific, although not significant, environmental impacts. They also found that reracking the existing fuel pools has clear financial advantages over the asserted alternatives. Cleary, ff. Tr. 604, pp. 2-9.

31. The Sierra Club did not present any affirmative evidence to show that PGandE failed to consider other alternatives to reracking. Rather, this contention is based only on opinion. Dr. Ferguson conceded as much when he stated that the particular contention "is just an opinion" he had reached. Ferguson, Tr. 443.

32. The Sierra Club's testimony on Contention I(B)7 was amended by its only witness, Dr. R. Ferguson, who conceded that PGandE did, in fact, consider other alternatives to reracking, though not in his opinion "seriously." He stated that he wished to amend his testimony to

say that PGandE "failed to consider them [other alternatives] seriously." Moreover, Dr. Ferguson acknowledged that during the discovery process, the Sierra Club received documents from PGandE which considered other alternatives. Specifically, he admitted that "[t]here were some documents provided related to cask storage." Ferguson, Tr. 444.

33. Appliant produced evidence which showed that it did review "four or five alternatives" before selecting reracking. PGandE Exhibit 13. Dr. Ferguson admitted that Exhibit 13 contains "a brief summary of descriptions of some factors involved with the alternatives" considered. Ferguson, Tr. 446-447.

34. The Diablo Canyon plant was designed to store spent fuel for a nominal period of one year and then ship the fuel offsite for reprocessing or disposal. Due to the unavailability of fuel reprocessing facilities and of permanent disposal sites, the spent fuel must now be stored for an extended period of time at Diablo Canyon. Therefore, the alternatives that must be considered, in addition to on-site storage, consist of various methods of storing the spent fuel offsite or shutting down the reactor. The consideration of alternatives, including offsite shipment of spent fuel and shutdown of the reactor, was documented in the Reracking Report, Chapter 9. While the on-site storage alternative was chosen, there are no regulations which specify the nature of on-site storage methods that must be

considered or documented. The discussion included in the Reracking Report was sufficient to comply with NRC requirements. PGandE Exhibit 2, Chapter 9 and 12, v-1.

35. Contention I(B)8 provides as follows:

> It is the contention of the Sierra Club that the Reports fail to include consideration of certain relevant conditions, phenomena and alternatives necessary for independent verification of claims made in the Reports regarding consistency of the proposed reracking with public health and safety, and the environment, and with federal law.
>
> In particular, the Reports fail to consider:
>
> * * *
>
> 8) the use of anchors, braces, or other structural members to prevent rack motion and subsequent damage during the PHE;

36. The use of anchors, braces, or other structural members to prevent rack motion is not discussed in the Reports because freestanding racks meet safety requirements, without such structural members. Shiffer, et al, ff. Tr. 179 at 31; Fishman, et al, ff. Tr. 519 at 11-12.

37. Structural anchors, braces, or other structural members are not required to prevent rack motion and potential subsequent rack damage. The freestanding racks satisfy NRC criteria and guidance applicable to spent fuel storage racks; Fishman, et al, ff. Tr. 519 at 11-12. The design accommodates the calculated rack motion during the postulated Hosgri earthquake and shows that the racks have sufficient

safety margins. In addition, freestanding racks have several advantages over anchored or braced racks. Particularly, freestanding racks reduce the stress on the liner caused by thermal loads from the heat generated by the spent fuel. Further, sliding provides a very effective means to dissipate energy. A freestanding rack is, therefore, considered a better design to absorb seismic energy and, thus, has a distinct advantage over anchored or braced racks. Further, no welding is required to install the freestanding racks. Finally, inspection, and replacement of racks if necessary, is simplified by the use of freestanding racks. Shiffer, et al, ff. Tr. 179 at 31.

Contention II(A)

38. Subparts 1 to 3 of Contention II(A) provide 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, 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.

39. The design process for the racks utilized the postulated Hosgri earthquake acceleration time-histories for the base of the spent fuel pool. The artificial time history utilized is the one that was previously developed in the 1977 time frame and used in the 1983 Independent Design Verification hearings. Shiffer, et al., ff. Tr. 179, at 24; Fishman, et al., ff. Tr. 519, at 6-8, Fig. 1; White, Tr. 410-11.

40. An artificial time history is developed as the superposition of sine waves with different amplitudes, frequencies and random phase-shifts. It is mathematically derived to correspond to a specified response spectrum. The vibratory characteristics of an actual earthquake tend to oscillate about zero, whereas artificial time histories may show the development of large cumulative values of acceleration, velocity or displacement. The artificial acceleration time histories for the PHE were computed by the Applicant using a modified version of the computer program SIMQKE. Using the acceleration time histories provided by the Applicant, the Staff consultant performed baseline corrections in accordance with a branch of SIMQKE and developed corrected acceleration, velocity, and displacement time histories. Fishman, et al., ff. and Figs. 1, 2, 3. The corrected final displacement from the PHE would be 4.83 inches in the east-west direction, and the maximum displacement amplitude would be 16.21 inches at 16.1 seconds. Id., Fig. 3. Based upon these baseline corrections, the Board concludes that the low magnitude of the spent fuel pool

displacement (when compared with the uncorrected values) would not significantly alter the results of the structural analyses of the racks performed by the Applicant.

41. The high density spent fuel racks, when fully loaded with spent fuel, would increase the overall mass of the auxiliary building by less than one percent. The liner plate and pool structures were evaluated for the new loading conditions and found to be adequate to support and transfer the high density rack reaction loads. Shiffer, et al., ff. Tr. 179, at 14-15.

42. The NRC has established acceptance criteria and design guidance for safe storage of spent fuel. The seismic design criteria and guidance are primarily contained in Section 9.1.2 and Section 3.8.4, Appendix D of the Standard Review Plan ("SRP"), and in the NRC Position Paper, "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications," ("Position Paper") dated April 14, 1978. PGandE Exhibit 12; Shiffer, et al., ff. Tr. 179, at 15.

43. SRP Section 9.1.2, Paragraph III.3.a, requires that spent fuel storage racks be classified and designed to Seismic Category I requirements. The criteria for seismic design and fuel assembly impact loads are provided in Section IV (3) of the OT Position Paper. Section IV (5) of the OT Position Paper states that SRP Section 3.8.4 provides acceptable procedures for modeling and analyzing the seismic responses

of the spent fuel racks. Further, Section IV (2) of the OT Position Paper identifies either of two industry codes, Section III of the American Society of Mechanical Engineers (ASME) Code or the American Institute of Steel Construction (AISC) Specification, as being acceptable for deriving the allowable stress criteria for the racks. Other codes are acceptable based on a case-by-case review. Structural acceptance criteria are provided in Section IV (6) of the Position Paper. The criteria permit rack sliding and rack-to-rack impacts and provide specific guidance on how such impacts are to be incorporated in the rack design. Shiffer, et al., ff. Tr. 179, at 15-16; Fishman, et al., ff. Tr. 519, at 12-13; Ashar, Tr. 591, 595, and 596.

44. Staff interprets the OT Position Paper to allow "the possibility of collision of the racks with each other and with the spent fuel pool walls." Staff's position, as stated in the Position Paper, is that "impact loading should be quantified and that sliding and tilting motions will be contained within suitable geometric constraints." Staff witnesses testified that there is no dispute that the Position Paper permits sliding, tilting, and impacts of racks, including rack-to-rack, rack-to-wall, and rack-to-floor impacts. Fishman, et al., ff. Tr. 519, at 12-13; Ashar, Tr. 591-592 and 595-596.

45. Sierra Club's contention that the SRP prohibits sliding and tilting of the spent fuel storage racks, as well as rack-to-rack and rack-to-wall impacts is not supported except by Dr. Ferguson's

interpretations of the SRP and OT Position Paper. On cross-examination, Dr. Ferguson testified that it is possible that his interpretations are incorrect. Ferguson, ff. Tr. 442, at 8-11; Ferguson, Tr. 465-70.

46. The Diablo Canyon high density racks comply with the applicable seismic design criteria in that:

a. The racks were designed as Seismic Category I components in accordance with SRP Section 9.1.2, Paragraph III.3.a.

b. The allowable stress criteria for the racks were derived from the Section III, Subsection NF requirements of the ASME Code for Class 3 component supports. Construction materials conform to Subsection NF of the ASME Code and were selected to be compatible with the fuel pool environment.

c. The seismic excitation was simultaneously applied in three orthogonal directions. Increased damping of fuel racks due to submergence in the spent fuel pool was not considered. Local impact of the fuel assemblies within the spent fuel rack cells was considered in a manner which maximized forces acting on a rack module.

d. The procedures used for modeling and analyzing the seismic responses of the Diablo Canyon spent fuel racks were consistent with the requirements of the Position Paper. The models were developed based on current engineering practices.

e. The possibility of gross sliding, tilting, and rack impacts under the postulated Hosgri event were evaluated in accordance with the acceptance criteria specified in Section IV (6) of the Position Paper.

f. No exceptions to acceptance criteria were taken for the design of the high density spent fuel racks.

Shiffer, et al., ff. Tr. 179, at 16-17.

47. The analytical process used in the design of the racks consisted of:

a. Development of a nonlinear dynamic model of a rack module consisting of inertial mass elements, hydrodynamic coupling, and gap and friction elements.

b. Generation of the equations of motion and inertial coupling and solution of the equations using a computer program, DYNAHIS, to determine rack forces, moments, and displacements.

c. Computation of the detailed stress field in the rack (at the critical locations) and in the support legs using the forces, moments, and displacements calculated in the previous step.

Shiffer, et al., ff. Tr. 179, at 19-20.

48. Using the methodology described above, Applicant calculated the potential loads on the racks. These calculations were performed in

conformity with the loading combinations and acceptance criteria specified in the NRC Staff's Position Paper and Section 3.8.4, Appendix D, of the Standard Review Plan. The loading combinations included the combined effects of dead load, live load, thermal interaction within the pool, and inertia loads due to seismic events. A series of rack loading cases (fully loaded, partially full) was considered in order to establish the design loads. The resulting stresses in the racks were determined to be lower than the allowable stress values permitted by acceptance criteria. These allowable values provide a sufficient factor of safety when compared with the ultimate capacity of the racks. Shiffer, et al., ff. Tr. 179, at 20.

49. Conservatisms were incorporated into the modeling and analysis performed for the high density racks in terms of modeling assumptions, postulated loadings, and safety margins on stress allowables. Several of the conservatisms inherent in the design basis analysis are:

a. Adjacent racks were assumed to move in a manner equal and opposite (out of phase) to the rack module being analyzed, thereby maximizing the potential for rack-to-rack impact.

b. A value of 4 percent structural damping was used between the fuel assemblies and racks, between adjacent racks and between racks and walls. A value of 10 percent for impact damping (in addition to structural damping) has been used at other plants licensed by the NRC. The analyses neglected fluid damping.

c. The impacts between cell walls and the fuel assemblies were assumed to occur in phase. In reality, the fuel assemblies exhibit complex and random behavior. However, they were all assumed to move in unison so that the maximum response could be obtained.

d. The form drag due to the geometric shape of the racks opposing their motion within the pool water was conservatively neglected.

e. The fluid coupling coefficients were calculated based on the conservative assumption that the adjacent rows of racks are an infinite distance away (the distance measured perpendicular to the direction of rack movement). This reduces the "cross-coupling effect" of the adjacent rows of racks and yields conservative displacements and impact forces.

f. The calculation of fluid inertial effects included an underestimate of the fluid kinetic energy and resulted in a conservative overestimate of rack displacement.

g. Hydrodynamic coupling coefficients used in the analysis neglected certain nonlinearities of the motion. Studies in the literature show that incorporation of these nonlinear effects would significantly lower rack response.

Shiffer, et al., ff. Tr. 179, at 20-22; Fishman, et al., ff. Tr. 519, at 21; Singh, Tr. 197.

50. The racks were designed and constructed using the approved acceptance criteria to maintain the spent fuel assemblies in a safe

configuration for normal and abnormal loads, including potential impacts between racks and between the racks and the fuel pool walls, which may occur during a Hosgri event. Shiffer, et al., ff. Tr. 179, at 17.

51. The analytical model developed by Applicant for high density rack analysis was a nonlinear dynamic model, and appropriately considered the potential effects of the following possibilities: movement of the fuel assemblies, frictional resistance at the base of the rack, rack sliding and rocking behavior, rack uplift and subsequent impact on the bearing plate, and rack impacts with adjacent racks and pool walls. In addition to the potential rack movements addressed in the analysis, fluid effects, known as hydrodynamic coupling, were also considered. Shiffer, et al., ff. Tr. 179, at 17.

52. In addressing rack sliding behavior in the model, friction coefficients of 0.8 and 0.2, which bound known experimental data, were used in the analysis to maximize the inertial force and horizontal displacement, respectively, of the racks. This wide range of friction values is typically used in the industry for rack design. Shiffer, et al., ff. Tr. 179, at 18. While spatially varying coefficients of friction were not explicitly utilized in the model, use of the bounding values (0.8 and 0.2) would cover possible effects of varying coefficients of friction as a function of position. Fishman, Tr. 586.

53. Fluid inertial effects, produced by rack motion, were also addressed in the model. In particular, the accelerating fluid mass results in two types of inertial effects. As a rack starts to slide, the water inside and surrounding the rack is set in motion. This produces an additional inertial force on the rack, which was addressed in the analysis by adding an appropriate amount of water mass, known as "virtual mass," to the mass of the rack and fuel assemblies. The second effect of the accelerating fluid mass is hydrodynamic coupling. As the space between moving racks or between the racks and adjacent walls is reduced, the fluid between the bodies is expelled from that space. This causes fluid pressures to develop on the surfaces bounding the fluid mass, which retards the seismic motion of the racks. The effects of the fluid motion on rack displacements are determined by the kinetic energy of the fluid. By underestimating the kinetic energy of the fluid, rack displacements are necessarily overestimated. If the kinetic energy of the fluid were ignored completely (e.g., assuming the absence of fluid), the rack displacements would be grossly overestimated. The calculation method used for rack analysis includes fluid motion but underestimates the fluid kinetic energy and, accordingly, overestimates rack displacements; i.e., the calculation method is conservative. PGandE's use of virtual mass and hydrodynamic coupling in the analysis is based on the fundamental principles of fluid dynamics. Shiffer, et al., ff. Tr. 179, at 18-19.

54. Fluid coupling effects in the model were derived based on the fundamental theories of hydrodynamics, known for well over 100 years, in terms of Lagrange's equations of motion and continuity for frictionless fluids. In the derivations for various rack-to-rack, rack-to-wall and fuel-to-cell wall configurations, the kinetic energy of the fluid flowing between the components was computed, using calculation methods that linearize the fluid coupling coefficients and underestimate the fluid kinetic energy. Since the seismic energy must be balanced by the kinetic energy of the fluid in the pool and rack components, the dynamic motion of the components is overestimated, which, contrary to the position of the Sierra Club, overestimates rack impact forces and resultant stresses calculated in the model. Further, the calculation methods employed other conservative assumptions including the assumption that adjacent rows of racks are an infinite distance away, reducing "cross-coupling" effects. Fishman, et al., ff. Tr. 519, at 21; Fishman, Tr. 596-97; DeGrassi, Tr. 597-98; Shiffer, et al., ff. Tr. 179, at 21-23; Singh, Tr. 222-23, 248-51, 261; Ashar, Tr. 598-99.

55. Several parametric studies were performed by Applicant that included both simplified and complex two-dimensional, single- and multi-rack analytical models, as well as enhancements to the original design basis, three-dimensional, single-rack model. The results of these studies confirm in all cases that rack impact loads and stresses due to the postulated Hosgri earthquake are below allowable values. Fishman, et al., ff. Tr. 519, at 22. Therefore, the design basis

evaluation was conservative and the high density spent fuel racks satisfy acceptance criteria and will maintain their integrity for the postulated Hosgri event. Shiffer, et al., ff. Tr. 179, at 34-36.

56. While impact forces are important to the design process, the stress ratios are more significant in that they better reflect the effect of impacts on the racks. The controlling stress ratios for the racks have an allowable value of 2.0. The highest stress ratio for the impacts determined from the design basis anaysis was 1.436. For the impacts determined from the parametric studies, the highest stress ratio was 0.743. Thus, the design basis evaluations were shown to be conservative and bounding, and the racks were shown to accommodate the impact with acceptable margins. Shiffer, et al., ff. Tr. 179, at 36; DeGrassi, Tr. 526-27.

57. In evaluating the walls and the rack components, impact loads were conservatively assumed to be static. No credit was taken for the short duration of the loading. Stresses derived from these calculated forces were significantly smaller than the stresses the racks and walls are capable of withstanding without any adverse effect. Shiffer, et al., ff. Tr. 179, at 36-37.

58. Because of the conservative assumptions and methods used to analyze rack-to-rack and rack-to-wall impact forces, the resulting impact forces on the racks bound those that might occur during the

postulated Hosgri event. Shiffer, et al., ff. Tr. 179, at 37; Fishman, et al., ff. Tr. 519, at 15-16.

59. If a rack should impact an adjacent rack or the wall, the impact force would occur at the girdle bar or at the baseplate. The fuel rack strength at the girdle bar level is significantly greater than that required to resist the design loads. As the rack impacts the wall, the rack girdle bars perpendicular to the wall would be loaded in compression by direct bearing. These bars can sustain a direct impact load greater than 175,000 pounds each before the onset of yielding, and incipient failure occurs at a load of at least twice the yield force. The impact resistance along the girdle bar which impacts flat against the wall is greater than 20,000 pounds per storage cell. With regard to the baseplate, its resistance is substantially greater than that for the girdle bars. Shiffer, et al., ff. Tr. 179, at 37; see Ferguson, Tr. 488-89.

60. Rack failure would not necessarily occur even with impact loads larger than the allowable loads. The NRC Staff agrees with PGandE in that such failure is highly unlikely due to the reserve margin between the onset of yielding and incipient failure. This yield-to-failure relationship is typical of ductile structural materials. Fishman, et al., ff. Tr. 519, at 16.

61. Between the allowable impact force and the force required to cause large permanent deformation of the racks, there is a large reservoir of energy absorbing capacity in the rack modules. Fishman, et al., ff. Tr. 519, at 13-15; DrGrassi, Tr. 526-28; Shiffer, et al., ff. Tr. 179, at 34-39; PGandE Exs. 2; Singh, Tr. 204-05, 210-11, 213; Section 6.9 in PGandE Exs. 3-7.

62. The Sierra Club no longer maintains that its calculations that yielded impact forces larger than the allowables listed in the reports are accurate and reliable, and show rack failure. Ferguson, Tr. 478-79.

63. From Table 6.8.2 of the Reracking Report (PGandE Ex. 2), it can be determined that the largest calculated impact force between a storage cell and a fuel assembly is 249,900 lbs. or 28 percent of the allowable 883,000 lbs. Similarly, the maximum calculated impact force between racks is 105,000 lbs., which is 60 percent of the allowable 175,000 lbs. Therefore, significant, permanent deformation and other damage to the racks and pool walls will not occur as a result of the PHE. Fishman, et al., ff. Tr. 519, at 14-15; Shiffer, et al., ff. Tr. 179, at 35-39; PGandE Ex. 2, Sections 6.9.1 and 6.9.2, Tables 6.8.1 and 6.8.2; PGandE Exs. 3-7; Singh, Tr. 211, 213.

Contention II(A)4

64. Contention II(A)4 provides 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 collisions between the racks and the pool walls are expected to occur resulting in:
>
> * * *
>
> 4) reduction of the spacings between fuel assemblies.

65. While there may be minor local deformation to the racks or pool walls during the postulated Hosgri event, there would be no permanent deformation or other damage that would lead to criticality, damage to the fuel, increases in heat generation, or radiological releases. Shiffer, et al., ff. Tr. 179, at 38-41; Fishman, et al, ff. Tr. 519, at 14-18, 32-33; See Findings 39-63, supra.

Contention II(A)5

66. Contention II(A)(5) provides 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, collisions between the racks and the pool walls are expected to occur resulting in:
>
> * * *
>
> 5) increase in the nuclear criticality (sic) [reactivity] coefficient k(eff) above 0.95;

67. Criticality analyses were performed for the Diablo Canyon high density spent fuel storage racks to assure that a k_{eff} equal to or less than 0.95 is maintained when the racks are fully loaded with fuel of the highest anticipated reactivity in each of two regions and when the pool is flooded with unborated water at a temperature corresponding to the highest reactivity. Fishman, et al, ff. Tr. 519, at 32. The maximum calculated reactivity includes a margin for uncertainty in reactivity calculations and in mechanical tolerances, statistically combined, such that the k_{eff} will be equal to or less than 0.95 with a 95 percent probability at a 95 percent confidence level. Shiffer, et al., ff. Tr. 179, at 40.

68. The Diablo Canyon spent fuel pools will be continually maintained at a boron concentration of at least 2000 ppm as required by the plant Technical Specifications. This soluble boron not only provides an additional and very large subcriticality margin under normal storage conditions, but precludes the possibility of exceeding a k_{eff} of 0.95 under credible abnormal conditions, including the postulated Hosgri event. Shiffer, et al., ff. Tr. 179, at 40-41; Fishman, et al., ff. Tr. 519, at 31.

69. The spacing requirement to maintain k_{eff} less than 0.95 without borated water is essentially the fuel assembly spacing in the rack design (10.93 inches), based upon the criticality analysis described in Section 4.0 of Applicant's Reracking Report. PGandE Ex. 2.

With borated water normally present in the spent fuel pool, the k_{eff} would not reach 0.95 until the water gap between storage cells in Region 1 (nominally 1.786 inches) has been reduced to less than 0.1 inch uniformly everywhere, an implausible condition. While analyses have demonstrated that significant rack deformation would not occur, even if it were assumed that there was zero gap between storage cells, the resulting configuration would still not be critical. In Region 2, reducing the gap between storage cells to zero from the nominal 1.9 inches would not result in k_{eff} exceeding 0.95. Shiffer, et al., ff. Tr. 179, at 41.

70. With unborated water in the spent fuel pool, the highest k_{eff}, including an allowance for uncertainties and manufacturing tolerances, was calculated to be 0.920 in Region 1 and 0.938 in Region 2. Both calculations are based upon conservative specifications of fuel enrichment and burnups and provide subcriticality margins greater than that required by NRC regulations. With the normal concentration of soluble boron present (2000 ppm), the safety margin below criticality is much larger, with the maximum k_{eff} being less than 0.75 in both regions. There are no postulated collisions or plausible reductions in spacing that could result in k_{eff} exceeding the limit of 0.95. Shiffer, et al., ff. Tr. 179, at 41-42; Fishman, et al., ff. Tr. 519, at 34-35.

Contention II(A)6

71. Contention II(A)6 provides 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, collisions between the racks and the pool walls are expected to occur resulting in:
>
> * * *
>
> 6) release of large quantities of heat and radiation;

72. Any postulated condition that would cause the release of radiation would require the fuel cladding to rupture; however, fuel cladding rupture cannot occur unless the fuel assembly grids are crushed. For Diablo Canyon, the calculated impact forces are not large enough to cause crushing of the grid and rupture of the cladding. Shiffer, et al., ff. Tr. 179, at 42.

73. During the postulated Hosgri event at Diablo Canyon Units 1 and 2, due to the motion of the rack module relative to the motion of the fuel assemblies, the fuel assemblies in the spent fuel pool storage racks could contact the stainless steel walls of the storage cells. However, the maximum impact force on a fuel assembly grid has been calculated to be only approximately 1700 pounds and the maximum fuel rod

bending stress has been calculated to be only approximately 800 psi. Shiffer, et at., ff. Tr. 179, at 42-43.

74. The structural integrity of the fuel assembly was evaluated by comparing the calculated forces against capacity determined from analytical and experimental data. Specifically, the maximum impact force on the grid, the fuel rod bending stresses due to flexure, and the fuel rod local contact forces at the grid supports were evaluated. The calculated local stress levels caused by the reaction force were well below the allowable stress levels in the fuel rods, ensuring that the integrity of the fuel cladding will be maintained during the Hosgri event. Thus, the integrity of fuel assemblies stored in the high density spent fuel racks at Diablo Canyon will be maintained, and there can be no resulting release of large quantities of heat and radioactive material. Shiffer, et al., ff. Tr. 179, at 43-44; Fishman, et al., ff. Tr. 519, at 31.

Contention II(A) 7, 8, 9

75. Contention II(A)7, 8, and 9 provide 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, collisions between the racks and the pool walls are expected to occur resulting in:

* * *

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.

76. The racks have been qualified to withstand the impact loads which may result from collisions between racks and pool walls during the postulated Hosgri earthquake. Therefore, no damage to the fuel would occur, and there can be no resulting releases of large quantities of heat and radioactive material. Additionally, the racks will maintain the fuel assemblies in a subcritical configuration even during any such collisions, and releases due to criticality in the pools cannot occur. Consequently, no radioactive contamination of humans and other living things in the vicinity of the plant above the levels permitted by federal regulations would result from collisions between the racks and the pool walls during the postulated Hosgri earthquake. Shiffer, et al., ff. Tr. 179, at 45.

Contention II(B)

77. Contention II(B) provides 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:
>
> * * *
>
> 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.

78. Because of the dissimilarity of the racks (in terms of geometry, tolerances, and gap spacings) it is highly unlikely that groups of racks would move as a unit under a random seismic motion. Shiffer, et al., ff. Tr. 179, at 46; Fishman, et al., ff. Tr. 519, at 19.

79. As a result of questions raised by the Brookhaven National Laboratory in the context of its review of the Commonwealth Edison Company application to rerack the Byron spent fuel pool, the Applicant was requested by the Staff to perform a number of analyses to demonstrate the conservatism of its single rack model. In particular, the Staff was concerned that the impact forces due to multi-rack impacts could exceed the forces computed by use of the single rack model. Fishman, et at., ff. Tr. 519, at 21, 23-24; DeGrassi, Tr. 526-28; Singh, Tr. 329-33, 335-36.

80. The Applicant conducted several multi-rack parametric studies and submitted these to the Staff for review. PGandE Exs. 3-8. These

analyses were reviewed by the Staff and its consultants FRC and BNL, as reflected in their respective Technical Evaluation Reports (TERs). Staff Exhibits 1-A and 1-B; Fishman, et al., ff. Tr. 519, at 22-23.

81. The parametric studies on multi-rack interactions utilized realistic modeling assumptions and evaluated variations of all key parameters that might affect the qualification of the racks. Some of these parameters include loading of the racks, hydrodynamic coupling coefficients as they apply to the specific location of the rack, manufacturing tolerances, and friction coefficients. These studies show that the loads on the racks are comparable to those predicted by the design basis analysis, and, in all cases, these loads are significantly lower than the allowables. Thus, the parametric studies confirm that Applicant's modeling assumptions in the design basis analysis adequately represent potential group behavior of the racks. All potential collision conditions under the postulated Hosgri event are bounded by the loads for which the racks have been qualified. Shiffer, et al., ff. Tr. 179, at 46-47.

82. The Staff concluded, on the basis of its review, that the rack-to-rack, fuel assembly-to-rack and rack-to-wall impact loads were within the respective allowable impact loads. Fishman et al., ff. Tr. 519, at 18-24; Ashar, Tr. 598-99. The Board finds that the Staff's review confirms the acceptability of the proposed rack design.

CONCLUSIONS OF LAW

This Board concludes as a matter of law that:

1. With respect to Contention I(A), Pacific Gas and Electric Company has submitted sufficient information and data in support of its license amendment application to verify that the reracking is consistent with the protection of the public health and safety, particularly with regard to the expected velocity and displacement of the spent fuel pools and the racks during the postulated Hosgri earthquake;

2. With respect to Contention I(B), Pacific Gas and Electric Company has submitted sufficient information and data concerning relevant conditions, phenomena, and alternatives to conclude that the reracking proposed will adequately protect the public health and safety, particularly with regard to: alleged resonant behavior of the spent fuel assemblies in the racks during the postulated Hosgri earthquake; the absence of alternative on-site storage facilities; and, the absence of structural members allegedly necessary to prevent rack motion during the postulated Hosgri earthquake;

3. With respect to Contention II, the proposed reracking is consistent with the protection of the public health and safety and the environment, and neither the postulated collisions between the racks and the pool walls nor between groups of racks with each other or the pool

walls have been shown to result in the harmful consequences alleged in the contention; and

4. The evidence adduced in this proceeding demonstrates that, with respect to the contentions considered, Pacific Gas and Electric Company's application to rerack the spent fuel pools at Diablo Canyon in a high density configuration will adequately protect the public health and safety and the environment and that the application otherwise meets or exceeds the requirements of 10 C.F.R. Parts 50 and 51 and related Nuclear Regulatory Commission regulations and requirements.

ORDER

For all the foregoing reasons and upon consideration of the entire record in this matter, it is this 11th day of September, 1987

ORDERED

1. That pursuant to the Atomic Energy Act of 1954, as amended, and the Commission's rules and regulations, the Director of Nuclear Reactor Regulation is authorized to issue to Pacific Gas and Electric Company amendments to its Diablo Canyon Power Plant Facility Operating Licenses Nos. DPR-80 and DPR-82 which revise the technical specifications to reflect the installation of the new spent fuel storage racks applied for;

2. That pursuant to 10 C.F.R. 2.760 of the Commission's Rules of Practice, this Initial Decision shall become effective immediately. It will constitute the final decision of the Commission forty-five (45) days from the date of issuance, unless an appeal is taken in accordance with 10 C.F.R. 2.762 or the Commission directs otherwise. See also, 10 C.F.R. 2.764, 2.785, and 2.786 (1987); and

3. That any party may take an appeal from this decision by filing a Notice of Appeal within ten (10) days after service of this Initial Decision. Each appellant must file a brief supporting its position on appeal within thirty (30) days after filing its Notice of Appeal (40 days if the Staff is the appellant). Within 30 days after the period has expired for the filing and service of briefs of all appellants (forty (40) days in the case of the Staff), a party who is not an appellant may file a brief in support of, or in opposition to, the appeal of any other party. A responding party shall file a single,

responsive brief only, regardless of the number of appellants' briefs filed. See 10 C.F.R. 2.762.

ATOMIC SAFETY AND LICENSING BOARD

B. Paul Cotter, Jr., Chairman
ADMINISTRATIVE JUDGE

for Glenn O. Bright*
ADMINISTRATIVE JUDGE

Jerry Harbour
ADMINISTRATIVE JUDGE

Dated at Bethesda, Maryland

this 11th day of September, 1987.

*Judge Bright participated in the writing of this decision and concurs in the result but was not available to sign the Initial Decision at the time of issuance.

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

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-275

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 22
License No. DPR-80

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Pacific Gas & Electric Company (the licensee) dated October 30, 1985, as supplemented, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by the addition of new paragraph 2.C.(11) to Facility Operating License No. DPR-80 to read as follows:

(11) Spent Fuel Pool Modification

The licensee is authorized to modify the spent fuel pool as described in the application dated October 30, 1985 (LAR 85-13) as supplemented. Amendment No. 8 issued on May 30, 1986 and stayed by the U.S. Court of Appeals for the Ninth Circuit pending completion of NRC hearings is hereby reinstated.

Prior to final conversion to the modified rack design, fuel may be stored, as needed, in either the modified storage racks described in Technical Specification 5.6.1.1 or in the unmodified storage racks (or both) which are designed and shall be maintained with a nominal 21-inch center-to-center distance between fuel assemblies placed in the storage racks.

3. This license amendment becomes effective at the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

George W. Knighton, Director
Project Directorate V
Division of Reactor Projects - III,
IV, V and Special Projects

Date of Issuance: October 20, 1987

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

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON NUCLEAR POWER PLANT, UNIT 2

DOCKET NO. 50-323

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 21
License No. DPR-82

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Pacific Gas & Electric Company (the licensee) dated October 30, 1985, as supplemented, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by the addition of new paragraph 2.C.(11) to Facility Operating License No. DPR-82 is hereby amended to read as follows:

(11) Spent Fuel Pool Modification

The licensee is authorized to modify the spent fuel pool as described in the application dated October 30, 1985 (LAR 85-13) as supplemented. Amendment No. 6 issued on May 30, 1986 and stayed by the U.S. Court of Appeals for the Ninth Circuit pending completion of NRC hearings is hereby reinstated.

Prior to final conversion to the modified rack design, fuel may be stored, as needed, in either the modified storage racks described in Technical Specification 5.6.1.1 or in the unmodified storage racks (or both) which are designed and shall be maintained with a nominal 21-inch center-to-center distance between fuel assemblies placed in the storage racks.

3. This license amendment becomes effective at the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

George W. Knighton, Director
Project Directorate V
Division of Reactor Projects - III,
IV, V and Special Projects

Date of Issuance: October 20, 1987

7590-01

NUCLEAR REGULATORY COMMISSION

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON NUCLEAR POWER PLANT

DOCKET NOS. 50-275 AND 50-323

NOTICE OF ISSUANCE OF AMENDMENTS TO FACILITY OPERATING LICENSES

The U.S. Nuclear Regulatory Commission (the Commission) has, pursuant to the Initial Decision of its Atomic Safety and Licensing Board dated September 11, 1987, issued Amendment No. 22 to Facility Operating License No. DPR-80 and Amendment No. 21 to Facility Operating License No. DPR-82 issued to Pacific Gas and Electric Company, which revised the licenses and appended Technical Specifications for operation of the Diablo Canyon Nuclear Power Plant, Unit Nos. 1 and 2, respectively, located in San Luis Opisbo County, California. The amendments are effective as of the date of issuance.

The amendments authorize the licensee to modify the spent fuel pools to increase the storage capacity of each from 270 fuel assemblies to 1324 fuel assemblies.

The Initial Decision is subject to review by the Atomic Safety and Licensing Appeal Board prior to its becoming final. Any decision or action taken by the Atomic Safety and Licensing Appeal Board in connection with the Initial Decision may be reviewed by the Commission.

The application for the amendments complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendments.

Notice of Consideration of Issuance of Amendments to Facility Operating Licenses and Proposed No Significant Hazards Consideration and Opportunity for a Hearing was published in the Federal Register on January 13, 1986 (51 FR 1451). Comments and petitions for leave to intervene were filed by San Luis Obispo Mothers for Peace, the Santa Lucia Chapter of the Sierra Club, and Consumers Organized for Defense of Environmental Safety.

On May 30, 1986, after the petitions to intervene had been filed, the NRC staff made a finding of "no significant hazards consideration". Based on that finding, NRC approved the license amendments and made them immediately effective. San Luis Obispo Mothers for Peace and the Sierra Club appealed the finding. The U.S. Court of Appeals for the Ninth Circuit found that the NRC finding of "no significant hazards consideration" violated the "Sholly" amendment to the Atomic Energy Act and implementing regulations. The Court stayed any further work on the spent fuel pools and barred the licensee from depositing any spent fuel therein except in accordance with the pools' original configuration, until the conclusion of the hearing.

The hearing was held at Avila Beach, California on June 15-18, 1987 with respect to the admitted contentions of the Sierra Club, other petitioners having withdrawn from the proceeding. Subsequently, the above-referenced Initial Decision was issued on September 11, 1987.

The hearing having been held and decided, and all other safety and environmental reviews having been completed, these amendments reauthorize the original amendments issued on May 30, 1986.

For further details with respect to this action, see (1) the application for amendments dated October 30, 1985, (2) Amendments No. 8 and 6 to License Nos. DPR-80 and DPR-82, respectively (issued on May 30, 1986), (3) Amendments

No. 22 and 21 to License Nos. DPR-80 and DPR-82 respectively (issued on October 20, 1987), (4) the Commission's related Safety Evaluation dated May 30, 1986, (5) the Commission's Environmental Assessment and Finding of No Significant Impact dated May 21, 1986, (6) NRC's Supplement to the Safety Evaluation and the Environmental Assessment, dated October 15, 1987, and (7) the Initial Decision of the Atomic Safety and Licensing Board dated September 11, 1987.

All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, N.W., Washington, D.C. 20555, and at the California Polytechnic State University Library, Government Document and Maps Department, San Luis Obispo, California 93407. A single copy of items (2) through (7) may be obtained upon request addressed to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

Dated at Bethesda, Maryland, this 20th day of October, 1987.

FOR THE NUCLEAR REGULATORY COMMISSION

Charles M. Trammell

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Division of Reactor Projects - III,
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