



DOCKET NUMBER

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UNITED STATES OF AMERICA
ATOMIC ENERGY COMMISSION

In the matter of)

PACIFIC GAS & ELECTRIC COMPANY)
(Diablo Canyon Nuclear Power)
Plant, Units 1 and 2))

DOCKET NOS. 50-275
50-323

INITIAL DECISION

I. Preliminary Statement

A. Procedural Background

1. By Memorandum and Order, issued April 21, 1972, with Notice of Hearing on Suspension of Construction Activities attached, the Atomic Energy Commission (Commission) ordered that a hearing be held before an Atomic Safety and Licensing Board (Board) on the question of whether the activities under construction permit Nos. CPPR-39 and CPPR-69 for the Diablo Canyon Nuclear Power Plant, Units 1 and 2, should be suspended pending completion of the final National Environmental Policy Act (NEPA) review.

2. On December 7, 1971, the Commission's Director of Regulation (Director) published in the Federal Register ^{1/} his determination under 10 C.F.R. Part 50, Appendix D, Section E, that, with certain exceptions, construction of the Diablo Canyon Nuclear Power Plant, Units 1 and 2 should not be suspended pending completion of the environmental review under NEPA. The Federal Register notice also provided that persons whose

1/ 36 Federal Register 23265.

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interests may be affected could request a hearing. A request was filed on December 30, 1971, by the Scenic Shoreline Preservation Conference, Inc. (Scenic Shoreline). The request alleged, inter alia, that geothermal power is available as an alternative source of power to meet the needs to be served by the units involved; that continued construction of the units and associated transmission lines would result in severe environmental impact; and that further evaluation of the seismic design of the units is essential. The request was opposed by the licensee, Pacific Gas & Electric Company (PG&E). The Regulatory Staff (Staff) of the Commission stated that a hearing would be appropriate but it requested that the contention regarding seismic design be excluded from hearing consideration.

3. The Commission concluded that a hearing was warranted, but determined that Scenic Shoreline's seismic design contention was the very same allegation Scenic Shoreline had advanced during construction permit hearings for Diablo Canyon Unit 2. The Commission noted that the seismic design for Unit 2 was found to be adequate by the Atomic Safety and Licensing Board, and that this decision had been upheld by the Atomic Safety and Licensing Appeal Board--once upon exceptions taken by Scenic Shoreline and again upon a petition for reconsideration largely involving the same material presented by Scenic Shoreline's December 30, 1971, request for a hearing. Thus, the Commission saw no warrant for considering the question of the adequacy of the seismic design again. Finally, the Commission noted that while the seismic design contention was initially

raised in connection with Unit 2, the Atomic Safety and Licensing Board had independently reviewed the seismic design for Unit 1, which is located at the same site and utilizes the same criteria, and found the design to be adequate. Thus, the Commission specifically limited the issues for hearing to those set forth in 10 C.F.R. Part 50, Appendix D, Section E.2, together with the considerations specified in the remand order of the United States Court of Appeals for the District of Columbia Circuits. Coalition for Safe Nuclear Power, et al., v. United States Atomic Energy Commission, No. 71-1396, Slip Opinion, dated April 7, 1972.

4. The Commission directed that the instant Board preside over the hearing and render a de novo decision, on or before June 5, 1972, based upon the criteria set forth in 10 C.F.R. Part 50, Appendix D, Section E.2, together with the considerations outlined in the Court's remand in Coalition for Safe Nuclear Power, et al., v. United States Atomic Energy Commission, supra. The Commission's Memorandum and Order of April 21, 1972, was published in 37 Federal Register 8126.

5. The Commission also determined in its Memorandum and Order with Notice of Hearing attached that the parties to this proceeding would be PG&E, the Staff, and Scenic Shoreline.

6. On April 27, 1972, an informal meeting of counsel for the parties was held by this Board in Santa Barbara, California, under the direction of its Chairman for the purpose of discussing the most appropriate procedure for expediting the hearing and issuance of an initial decision within the time specified by the Commission.

7. By Notice and Order for Evidentiary Hearing, dated May 1, 1972, this Board directed that the hearing for the taking of evidence in the above-captioned proceeding commence on May 17, 1972, at 10:00 a.m., local time, in San Luis Obispo, California. Actual notice of hearing was published in 37 Federal Register 9146.

8. The hearing commenced on May 17, 1972, in San Luis Obispo, California, and was concluded when the record was closed on May 20, 1972.

B. Hearing Issues

9. In its Memorandum and Order, dated April 21, 1972, the Commission directed that this Board, in deciding whether the activities under the construction permits for Diablo Canyon Nuclear Power Plant, Units 1 and 2, should be suspended pending completion of the NEPA environmental review, consider and balance the following criteria:

- a. Whether it is likely that continued construction during the review period will give rise to a significant adverse impact on the environment; the nature and extent of such impact, if any; and whether redress of any such adverse environmental impact can reasonably be effected should modification, suspension or termination of the permit or license result from the on-going NEPA review.
- b. Whether continued construction during the prospective review period would foreclose subsequent adoption of alternatives in facility design or operation of the type that could result from the on-going NEPA environmental review.

- c. The effect of delay in facility construction or operation upon the public interest. Of primary importance under this criterion are the power needs to be served by the facility; the availability of alternative sources, if any, to meet those needs on a timely basis; and delay costs to the licensee and to consumers.
- d. In the context of balancing environmental harm and economic cost of abandonment, a paramount consideration shall be whether the commitment of substantial financial resources, in proceeding with construction pending completion of the NEPA review, might affect the eventual decision reached on that review; and, if so, the degree to which such an effect might occur.

The Commission placed the burden of proof upon PG&E.

C. Scope of the Issues

10. This proceeding revolves about the effects of continued construction of the Diablo Canyon Nuclear Power Plant, Units 1 and 2, during the on-going NEPA review, which encompasses the period from June 1, 1972, through December 31, 1972, when the final NEPA review will have been completed (Tr. 200). As this Board views the issues specified by the Commission for our consideration and resolution, this proceeding is not concerned with the effects on the environment as a result of operation of the Diablo Canyon Nuclear Power Plant, Units 1 and 2, but whether continued construction, and the irretrievable commitment of additional resources during the on-going NEPA review would cause significant impact on the environment, foreclose adoption of alternatives in facility design or operation should the final NEPA decision require the same, affect power needs to be served by the nuclear power plant, and affect costs to

consumers. Thus, as regards environmental impact, this Board believes that the scope of the issues herein is logically restricted to a determination of what are the alternatives in facility design or operation to such plant, and the effects of continued construction and the commitment of additional resources on such alternatives. In our view, evidence of environmental effects of operation of the Diablo Canyon Nuclear Power Plant, Units 1 and 2, once construction is completed, may have the tendency to unfairly influence the final environmental determinations to be made by the Commission as a result of the on-going NEPA review. Thus, such evidence would neither be appropriate nor of decisional significance in this proceeding. Accordingly, we have only permitted evidence to be adduced in the record relating to the environmental effects of continued construction, the alternatives to the Diablo Canyon Nuclear Power Plant, Units 1 and 2, including design alternatives, the costs of abandonment of the Diablo Canyon Nuclear Power Plant, Units 1 and 2, the additional investment to be made during construction and how this investment may affect final disposition of the nuclear plant, and the effects of suspension or abandonment of the Diablo Canyon Nuclear Power Plant, Units 1 and 2, on the public interest. However, we have allowed a certain amount of evidence to be adduced with regard to the effects of plant operation on the environment in order to fully determine the nature and assess the reasonableness of the alternatives in facility design or operation that could result from the on-going NEPA review.

11. During the course of the hearing, Scenic Shoreline attempted to introduce the subject of the adequacy of the seismic design at Diablo Canyon Nuclear Power Plant, Units 1 and 2. We disallowed adduction of evidence on this subject as not being within the scope of the issues in this proceeding. Our ruling was based on the findings of the Atomic Safety and Licensing Appeal Board and by the Commission in its Memorandum and Order dated April 21, 1972, which required and established this hearing.

II. Diablo Canyon Nuclear Power Plant, Units 1 and 2

12. The Diablo Canyon site consists of approximately 750 acres on a gently sloping marine terrace about 1,000 feet wide with elevations of 50 to 150 feet, in San Luis Obispo County, California. The site is in a remote, undeveloped, and relatively uninhabited section of the coastline. The nearest permanent settlement is Avila Beach, California, located about seven miles southwest of the plant site. Land in the vicinity has lain idle or has been used for grazing.

13. Diablo Canyon Nuclear Power Plant, Units 1 and 2 are substantially identical units. Each unit will have a warranted net electrical output of 1,060 megawatts, and ultimately, each of the units is expected to have a net electrical output of 1,144 megawatts. Each unit will use a 3,250 megawatt (thermal) pressurized water nuclear reactor furnished by the Westinghouse Electric Corporation. The planned commercial operating dates are March 1, 1975 for Unit 1, and March 1, 1976, for Unit 2. The Diablo Canyon Nuclear Power Plant, Units 1 and 2 will operate with thermal efficiency of about 32 percent, so that about one-third of the heat released by the fission process in the reactor core will be converted to electricity.

14. The other major structures at the site are the two reactor containment structures, the auxiliary building, the fuel handling building, and the turbine generator building at the site. Other facilities associated with the two units

include the machine shop, laboratories, access control area, warehouse area and administrative office, fire protection systems, diesel fuel oil storage tanks, lubricating oil storage system, makeup water system, auxiliary boiler and two raw water storage reservoirs.

15. The plant is architecturally designed to be relatively unobtrusive in its natural setting and will employ exterior colors and profiles which are intended to blend with the natural contours and colors of the terrain. The construction permits for the units were issued by the Commission April 23, 1968 and December 9, 1970, respectively.

III. Impact of Continued Construction

A. On Site Plant Construction

16. As of June 1, 1972 PG&E estimates Unit 1 will be about 45.6% complete and Unit 2 about 12.8% complete.^{2/} As of that date PG&E will have spent a total of \$314 million on Units 1 and 2, exclusive of transmission lines, and will have committed a total of \$464 million on the units, exclusive of transmission lines. The estimated total costs of the units is \$665 million.

17. The record establishes that the status of work on the various components of the plant is as follows:

^{2/} As of May 1, 1972, PG&E had 177 of its employees, and an additional 1,214 contract personnel working at the Diablo Canyon site.

<u>Components</u>	<u>% Complete</u>
Access Road and Temporary Facilities	100
Grading, Excavation and Fill Operations	97
Breakwaters	100
Cooling System	
Discharge Structure Cofferdam	100
Discharge Structure	89
Intake Structure Cofferdam	100
Intake Structure	13
Intake Conduits	80
Discharge Conduits	100
Main Plant Structures	
Containment - Unit 1	58
Containment - Unit 2	19
Turbine Generator Building - Unit 1	78
Turbine Generator Building - Unit 2	
Excavation	90
Foundations	65
Auxiliary Building	88
Switchyards	70

18. As noted, grading, excavation, and fill operations for both units are almost complete, and construction during the on-going NEPA review period will involve only minor amounts of additional excavation. As also shown, almost all of the on-site work during the review period will involve completion of buildings which have already been begun, and installation of equipment, primarily within the structures themselves.

Specifically, the record establishes that the following on-site work will be undertaken during the review period:

Roofing and siding for the turbine-generator building will be completed.

For the containment structure of Unit 1, the exterior of the dome, interior walls, and the reactor cavity liner will be completed. Work on the liner and exterior walls of the Unit 2 containment structure will continue.

The Cooling System discharge structure, the scroll cases for the circulating water pumps will be installed and the intake conduits will be completed.

The control room structure within the auxiliary building will be completed.

The fuel storage pool liner will be installed. The fuel handling building superstructure will be completed.

19. During the review period, PG&E will expend approximately \$92 million on continued construction of Units 1 and 2, exclusive of transmission lines.

20. The record shows that on-site plant construction activities that necessarily have disturbed topography, vegetation, and wildlife are substantially complete, and that the main impact of plant construction has already occurred.

21. The Board finds that continued construction of the Diablo Canyon Units during the review period will not cause any significant adverse effect on the environment. On the contrary, the record shows that continued construction will improve the Units' effect on the environment because it will lead to completion of partially completed structures resulting in a continually improving visual effect as the architectural goal is achieved. As we have noted, construction activities that necessarily have disturbed topography, vegetation, and wildlife are substantially complete. And, the main impact of plant construction has already occurred. However, construction activities to be undertaken during the review period will involve truck traffic and construction equipment noise. These disturbances, however, will not have any significant off-site environmental effect, because the remote location of the Diablo Canyon site will render the off-site noise level negligible.

B. Transmission Lines

22. The Diablo Canyon Nuclear Power Plant, Units 1 and 2 will utilize four transmission lines:

- (1) An 11 mile 230 kv feeder line between the existing Morro Bay-Mesa 230 kv line just south of California Highway 1 and the plant site. This line is complete, has been energized, and is ready for service.
- (2) An 84-mile long 500 kv line from the plant

site running east to the Midway Substation, located about 25 miles west of Bakersfield, California. About 98% of the rights-of-way for this line have been acquired and cleared and construction of the line is complete except in the remaining 2%. Work during the review period will include acquiring about three additional rights-of-way, completing a section of the road between See Canyon and Cherry Canyon, constructing access roads to approximately forty towers, clearing 50 foot radius areas around the forty towers, and completing the stringing of conductor. The access roads to be constructed represent about 15% of the access roads for the whole line. Vegetation to be cleared consists of oak trees and native brush. Plans call for this line to be placed in service by August 1973.

- (3) A 79-mile long 500 kv line from the plant site running northeast to the existing Gates Substation beyond the Kettleman Hills. The first 11 miles of this line parallel the 230 kv line from the plant site to a crossing of the Morro Bay-Mesa 230 kv line just south of California Highway 1, and the line continues 68 miles

northeast to the Gates Substation. All necessary rights-of-way have been acquired, essentially all access roads have been constructed, and towers are erected between the site and California Highway 1. During the review period 10 to 12 miles of roads, will be completed, some scattered oak trees in the Cholome Valley area will be cleared, remaining tower foundations will be installed, approximately 200 towers will be erected, and about 28 to 30 miles of wire will be strung. Plans call for this line to be completed by December 30, 1972.

- (4) A second 500 kv line which will parallel the one described in subparagraph (2) above from the site to the existing Midway Substation in order to provide transmission capacity for Diablo Canyon Nuclear Power Plant, Unit 2. PG&E has voluntarily stipulated that it will postpone construction of this second Diablo-Midway transmission line until the anticipated date of completion of the on-going NEPA review on December 31, 1972.^{3/}

^{3/} Construction of the second Diablo-Midway transmission line was suspended by the Commission's Director of Regulation in an Order dated February 4, 1972. PG&E did not contest this Order, and its stipulation at hearing was made to avoid prolonging this proceeding. PG&E takes the position that suspension is not proper (Tr. 297).

23. Approximately \$922,000 has been expended on the eleven-mile 230 kv feeder line between the existing Morro Bay-Mesa 230 kv line. Since this line is complete, no additional expenditures will be made during the review period. About \$7,350,000 has been spent on the 79-mile Diablo-Gates line through April, 1972. During the review period approximately \$6,288,000 will be spent on this line out of an expected total cost of about \$15,000,000. Of the \$6,288,000 expected to be spent during the review period, approximately \$2,212,000 are fixed costs which would have to be spent by PG&E whether or not construction of this line is suspended.

24. Through April, 1972, PG&E had spent \$13,725,000 on the first Diablo-Midway line. Approximately \$1,976,000 will be spent on this line during the review period, out of an expected total cost of \$15,700,000. Of the \$1,976,000 to be spent during the review period, \$1,203,000 are fixed costs which would be incurred whether or not construction is suspended.

25. Most of the environmental impact from construction of the transmission lines has already occurred. PG&E has taken some steps to minimize the consequences to the environment caused by past transmission-line construction. For example, PG&E has constructed outsloped rather than insloped roads, end-hauled materials, utilized helicopters to effect tower erection, installed specially-designed towers which are more aesthetically pleasing to the eye, and galvaprimered towers with a phosphoric acid solution in order that they will blend

in with natural surroundings. In addition, PG&E has instituted a plan of reforestation, seeding, and planting to restore disturbed areas to their natural condition, and has painted erosion areas with a green paint to camouflage scars. However, these measures to redress the impact to the environment have only been minimally successful.

26. The record shows that, while substantial damage has already occurred to the environment as a result of past transmission-line construction, redress of some of the environmental impacts of construction could reasonably be effected should modification, suspension, or termination of construction result from the on-going NEPA review, by removing constructed towers, replanting the cleared areas, and returning the disturbed areas to their original condition. Considerable redress is even possible without removing structures, by such measures as reseeding and mulching. However, returning the areas to their original condition probably would take a number of years.

27. On balance, this Board finds that continued construction of the transmission lines and access roads during the NEPA review period will not give rise to additional severe adverse impact on the environment; that if some adverse impact does occur during this period, it can be reasonably redressed; and that continued construction of the transmission lines will not foreclose the subsequent adoption of alternatives of the type that could result from the on-going NEPA review.

28. The Board's reason for the above finding is that, as already noted, the evidence shows a major portion of the environmental impact due to construction of roads and transmission lines has already occurred. The Board believes that much of the impact of road construction has been adverse and even seriously damaging within certain restricted areas adjacent to the service roads, that this damage is probably permanent and cannot be redressed completely. However, the Board also believes that present errors can be alleviated and further damage minimized by further efforts on the part of PG&E to correct the more outstanding examples of erosion and to continue and extend the reseeding and reforestation programs. The Board hopes that such conclusions will also be included in the NEPA review.

C. Cooling System

29. As earlier noted, the Diablo Units 1 and 2 will operate with a thermal efficiency of about 32 percent, meaning that about one-third of the heat released by the fission process in the reactor core is converted to electricity. The rest of the energy is at too low a temperature to be efficiently converted to power and must be rejected. PG&E has selected a once-through cooling system as a means of dissipating this heat. Ocean water for cooling will be pumped through the Diablo Canyon plant from a cove located south of the Diablo Cove. Each unit has two circulating water pumps capable of pumping 867,000 gallons per minute of seawater from the intake structure through the two intake conduits to the condensers. Traveling screens are installed in the intake for the protection of fish. As the water passes through the condenser, steam from the turbine is condensed, and the waste heat transferred to the circulating water.

30. After leaving the condensers, the cooling water flows by gravity through two discharge conduits to the discharge structure located on the shoreline of Diablo Cove. Total travel time for the circulating water from the intake to the discharge is approximately 4-1/2 minutes, with a temperature increase of 18 degrees Fahrenheit across the condensers. The heated water returning to the ocean is mixed with the waters of the Cove. The volume of Diablo Cove is calculated to be 27,500,000 cubic feet. It is computed that the equivalent volume would be pumped through the condensers and discharged into the Cove

every four hours with one unit working. Flushing time for the Cove is estimated to be less than one tidal cycle.

31. The condenser tubes consist of an alloy of copper and nickel which are considered to be heavy metals. Trace amounts of these metals will be discharged into the marine environment during the 20-30 year life of the condenser tubes due to very slow erosion. The release of these two metallic ions in a few parts per billion are not considered to have any general toxic effects to organisms in the area of Diablo Cove.

32. PG&E has constructed east and west breakwaters, designed to protect the cooling water intake structure and its cofferdam. Marine life in the vicinity of these structures has started to re-establish itself. Although there will be some upset to the area behind the breakwaters during removal of the intake cofferdam, this disturbance will be minor and will be redressed by natural means.

33. The temporary cofferdam and access road for the discharge structure are complete, and the structure itself is 89 percent complete. Further construction, therefore, will cause little additional effect on the environment. When the structure is complete, the cofferdam and access road will be removed permitting sea life to re-establish itself.

34. Work on the intake structure, which also is common to both units, has begun. The cofferdam and dewatering were completed by January 25, 1972. The structure is now 13 percent complete.

35. Excavation for the intake conduits is complete, and the conduits are 80 percent installed and back-filled. When work on the conduits presently in progress is completed later this year, the excavation will be back-filled. The discharge conduits between the turbine buildings and the discharge structure are complete and back-filled.

D. Impact on Marine Environment

36. Although there will be disturbance to the marine biota during removal of the intake cofferdam, the major impact has already occurred and the marine biota can restore itself by natural means. Accordingly, we find that construction here need not be suspended.

37. Most of the environmental impact has already occurred so far as the present design for the discharge structure is concerned. We find that construction should not be suspended. However, in light of the generally insufficient monitoring of the marine ecosystem in Diablo Cove and the adjacent coastal area, which is desirable to anticipate the effects of plant operation on this ecosystem, we believe that the cofferdam should not be removed pending the on-going NEPA review. The record herein clearly establishes the potential need for further design studies for an alternate discharge structure.

38. The major environmental impact of the intake structure has already occurred. There will be some disturbance when the cofferdam is removed but the marine biota can be restored by natural means. Construction here should not be stopped.

39. The major environmental impact associated with the circulating water intake and discharge conduits has already occurred and the work is almost complete. Construction should not be suspended.

40. With respect to the impact on the marine environment as a result of the presently-designed cooling system, the PG&E evidence of record reveals a modest effort on PG&E's part to accumulate data concerning biological changes associated with the discharge into Diablo Cove. PG&E claims the biota of Diablo Cove is typical of conditions along this section of the coast, with the presence of both warm and cold water species. Moreover, according to PG&E, any changes in the biota will be exerted only through temperature alterations of the environment and so would not go beyond 15 feet in depth. PG&E studies show that there will be direct effects on the metabolism, growth, and reproduction, and indirect effects through alterations of food relationships among members of the community. In assessing the impact on marine environment, PG&E relied heavily upon a species list obtained as a result of on-site studies; no quantitative data were gathered respecting species. Moreover, no confidence was expressed in acquiring information about the numbers or age composition giving any conclusive evidence on the health of the population. PG&E claims there will be no barren area created in the Diablo Cove but there will be enhancement of the warm water species at the expense of the cold water biota. This would be particularly true in the immediate area of the discharge with no effect outside

the Cove. PG&E indicated that the acquisition of information about the quantitative estimate of population size and composition and problems of physiological stress associated with selected species would be useful, but that such information was beyond the scope of its modest effort to obtain data in determining the effect on marine life as a result of the presently envisioned cooling system. PG&E has not conducted any physiological studies in connection with its assessment of the effects of the cooling system on marine life. PG&E expressed no knowledge of what would happen to abalone larvae entrained in the condenser cooling water system.

41. The tentative conclusion of the AEC Staff is that the discharge of heated condenser cooling water from Units 1 and 2 will reduce the existing number, diversity, and biomass of the cold water flora and fauna in Diablo Cove. Warm water species probably will become more abundant in the Cove. However, these changes will not have an overall detrimental effect on the overall ecological balance of Diablo Cove. It is even less likely that any major ecological changes will occur beyond the Cove region. Chemical effluents released from the Diablo Canyon plant are not expected to have any adverse effect if kept below 0.5 ppm at the condenser outlet. Radiological effects will be exceedingly small. Fish of yearling size and larger should have no problem avoiding the approach velocities in the intake structures. Unknown quantities of plankton, fish eggs, and larval fish will be entrained in the circulating water systems and up to 100 percent may be destroyed. However,

the Staff's tentative conclusion is that the loss of these organisms will not have any major adverse effect on the ecosystem as a whole. If adverse effects are detected, modifications to the plant operation will be required.

42. Scenic Shoreline claims the continued construction and eventual operation of the Diablo Canyon Units with the once-through cooling would have substantial deleterious effects on the marine environment and associated fish and wildlife resources. Scenic Shoreline further claims the behavior of thermal plumes near the California coast are considered to be erratic and difficult to predict with any degree of reliability. It is probable, according to Scenic Shoreline, that the discharge will impact shore areas and inshore waters a considerable distance from the plant with ensuing environmental degradation. The indicated long-term temperature regimes will be higher than recorded by PG&E, reaching 68° Fahrenheit or greater rather than the 63° Fahrenheit maximum PG&E has recorded. Moreover, Scenic Shoreline states that temperature extremes need to be evaluated rather than averages. Scenic Shoreline believes that the standing crop of organisms, consisting of small or juvenile specimens, is expected to be reduced, which could indicate a constant recruitment of young animals into an area where adults cannot survive. Based on work done elsewhere, it is expected that species can be adversely effected directly and indirectly through the food supply. Furthermore, recurrent fish kills that could occur from thermal shock may cause substantial damage to the resource as a whole. With the advent

of warmer waters in the discharge area, species will be operating at temperature levels approaching their upper physiological limits. Scenic Shoreline concludes that a high mortality is expected from organisms entrained in the cooling water system. This rain of dead organisms could change the composition of the ecological community and its feeding relations.

43. This Board finds that PG&E has given only superficial consideration to the long-term effects of the operation of the Diablo Canyon units on the marine environment. (1) No substantial evidence was presented for a quantitative evaluation of the composition of the ecological community prior to operation of the plant. (2) No valid evidence was presented relating to the nature and distribution of this marine community in the Diablo Cove to the hydrography of the Cove and adjoining coastal areas. (3) No substantial evidence was presented related to feeding relationships within the community. (4) Nor was there evidence presented with regard to the age composition and population structure of various species. (5) No effort was made to identify plant and animal species that might require particular attention. (6) No evidence was presented of work done on stress physiology concerning selected local marine organisms as related to short-term, high intensity, or long-term, low-intensity, thermal additions. (7) No attention was paid to entrainment of planktonic organisms into the cooling water system in terms of direct effects and the subsequent effect on the structure of the ecological community associated with Diablo Cove. (8) Finally, there was no recognition of

the cumulative effects of heavy metals on marine organisms and the feeding relations of the community.

44. This Board finds that continued construction of the cooling system should not be suspended pending the on-going NEPA review, with the exception of the cofferdam associated with the discharge structure. We find that continued construction involving the removal of the cofferdam associated with the discharge structure should be halted during the review period.

45. This Board recommends that the on-going NEPA review thoroughly consider the need for action on the part of PG&E to initiate, design, and adequately fund a study in the Diablo Cove area encompassing at least the eight points enumerated above. These various elements of the study should have results with estimates of variability commensurate with the best possible design and sampling procedures that are available. These studies should begin well in advance of commencement of the Diablo Canyon plant's operation and continue for at least five years after the Diablo Canyon Units go into full operation.

46. This Board further recommends that the NEPA review give serious consideration to an alternative to the shoreline discharge for the thermal effluent, pending the outcome of the preoperative phase of the above study. The NEPA review should consider an offshore discharge using a perforated pipe with an upturned orifice designed to dissipate heat over a greater area. The construction of such a pipe would be more expensive and the environmental impact during construction would be great but of relatively short term. This is in contrast to the

potential continuous impact on the environment by shoreline discharge as a result of operation of the presently designed discharge system.

IV. Alternatives

A. Other Sources of Power

47. Scenic Shoreline contends that geothermal power could become an alternative source to meet the power needs to be served by Diablo Canyon Nuclear Power Plant, Units 1 and 2. The record establishes that the Union Oil Company provides geothermal steam from wells they own and operate at The Geysers, Sonoma County, California, to PG&E to generate 192 megawatts of electric power. The estimate of proven steam reserves is a total of 750 megawatts.

48. Additional reserves on U. S. Government and other privately owned lands are estimated by Union Oil Company to be 400 to 500 megawatts, providing a total of about 1,200 megawatts. The record also contains evidence to suggest a much larger geothermal capacity at The Geysers if it were to be heavily subsidized and exploited by industry. One estimate of the potential at The Geysers was 4,800 megawatts; another was 25,000 megawatts. However, after weighing all of the evidence of record on this point, this Board concludes that these higher estimates of geothermal steam capacity do not appear to be justified. Other potential sources such as geothermal hot water in Imperial Valley are not developed as yet.

49. Accordingly, this Board finds that the proven geothermal steam reserves are not large enough to be a valid alternative source to the Diablo Canyon Nuclear Power Plant, Units 1 and 2. This argument fails to justify suspension of construction of the plant pending completion of the on-going NEPA review.

B. Cooling System

50. Alternative methods for cooling were considered, such as several kinds of cooling towers, spray canals, and cooling ponds. These alternatives were discarded because of expense, gross effect on the environment, visual impact, insufficient fresh water supply for cooling, or the need for additional land which is unavailable due to the local topography.

51. Consideration of the impact of the heated discharge water on the marine environment suggests that an alternative to discharge at the shoreline of Diablo Cove would be an off-shore discharge using a perforated pipe with upturned orifice designed to dissipate heat over a greater area. This would require the installation of sub-sea-floor conduits extending out beyond the Cove. The construction of such pipes would be expensive and the environmental impact during construction would be great but of relatively short term. The record shows that this alternative is not foreclosed if it were to be recommended by the on-going NEPA review.

C. Transmission Lines

52. PG&E intends to use the Diablo-Midway No. 1 transmission line and the Diablo-Gates line as a circuit for alternate switching and improved reliability to the Pacific Northwest-Southwest Intertie; removal is not contemplated should there be a modification, suspension, or termination of the construction permits as a result of the on-going NEPA review. Moreover, PG&E has studied numerous alternatives for locating

its transmission lines and has selected the optimum routes in the public interest.

53. The Board finds that alternatives to the transmission lines appear unlikely as a result of the on-going NEPA review, but that appropriate requirements to redress the impact caused to the environment from past and continued construction would not be foreclosed.

D. Power Needs

54. PG&E makes new electric load forecasts every six months. The latest forecast was made in March, 1972. PG&E's forecasts have been fairly accurate, the difference between the forecasted and actual load being 3.35% of 1961 load and 1.74% of 1971 load. PG&E estimates that electric energy requirements and peak demands will grow at about a 6.5% compound rate during this decade. PG&E's historic long-term annual peak demand growth rate has been about 7.7% compounded.

55. PG&E has two criteria for determining minimum reserve requirements. The first one is a reliability criterion which requires that the planned generating system, when analyzed by the probability of loss of load method, show a reliability equal to or in excess of a reliability criterion of 10. This is a rather uniform criterion utilized in the electric utility industry. The other criterion requires reserve capacity, after allowance for scheduled maintenance, to be greater than the combined capacity of the two largest units in service. Of the two criteria, the one requiring the larger amount of reserve determines the minimum reserve required.

56. The Diablo Canyon Units are scheduled for commercial operation in 1975 and 1976, respectively. If Unit 1 is not available in 1975, PG&E would not meet its reliability index of 10. Moreover, reserves will probably be less than those expected. In addition, the reserves would fall below 15% of peak load, which the Federal Power Commission, in its latest National Power Survey, considers as a minimum to provide an adequate bulk power supply. The situation becomes worse if Unit 2 is not available in 1976. It would be extremely difficult for PG&E to render reliable electric service in 1975, 1976, or 1977 without the Diablo Canyon Units in operation on schedule.^{4/}

57. In the event of eventual abandonment of the Diablo Canyon project, the only feasible alternative for meeting power needs would be through the installation of combustion turbines. About thirty-six 50 megawatt units would be required to provide the capacity approximately equivalent to that of the Diablo Canyon Units.

^{4/} If all activities under the construction permits were suspended during the prospective NEPA review, and the final NEPA review were to recommend continuation of the project, the suspension would delay completion of the Diablo Canyon plant by eight months.

V. Cost of Suspension or Abandonment

58. In connection with construction activities at the Diablo Canyon plant, this Board is charged with the responsibility of balancing the environmental harm and economic costs of abandonment. In doing so, we must fully consider whether the commitment of substantial financial resources, in proceeding with construction pending completion of the NEPA review, might affect the eventual decision on that review, and if so, the degree to which such an effect might occur.

59. The record establishes that PG&E will expend approximately \$92 million, exclusive of transmission lines, during the prospective NEPA review period. In excess of \$7.5 million will be expended on transmission lines. The total amount of funds to be committed during the review period is indeed substantial, although the principal amount will be directed toward continuation of on-site construction of Units 1 and 2, and associated structures related to the Units' cooling system.

60. Against this background, the record reveals the following environmental effects:

The condenser cooling water in the Diablo Canyon Units will be heated to approximately 18°Fahrenheit before being discharged to Diablo Cove. This will result in about a 10°Fahrenheit surface water temperature rise in the Cove area immediately surrounding the discharge point, and about a 4°Fahrenheit surface water

temperature rise in the remaining area of the Cove and the immediate area surrounding the Cove. We find that such a temperature rise will result in a reduction in the number, species diversity, and biomass of some cold water species of flora and fauna. New warm-water species may appear in the area, although knowledge concerning this phenomenon is less certain.

61. The expected chemical emissions as a result of the cooling system operation will not result in any adverse environmental effects. An unknown quantity of plankton, fish eggs, and larval fish will be entrained in the circulating water system, and up to 100 percent of these organisms may be killed and then discharged back into the Cove. No significant fish mortality is expected at the intake structure. The full effects of the impact on the marine environment as a result of operation of the presently-designed cooling system discharge cannot be fully ascertained without additional substantial information.

62. The total environmental effects of the transmission lines are still uncertain. Although optimum choice of routes has been made and PG&E has applied certain techniques to minimize potential environmental consequences, the construction and operation of the lines may result in increased erosion as well as the killing of uncertain numbers of birds and other wildlife. The transmission lines unquestionably will interfere with the aesthetic enjoyment of the landscape they traverse, and raise difficult questions concerning the real value of

technological development. Nevertheless, since the lines would be necessary even if an alternative power source were adopted, and since various measures can and should be taken to minimize the environmental effects of the lines still further, the lines' existence does not appear at this time to significantly affect the overall cost-benefit evaluation of the Diablo Canyon facility. Thus, the environmental effects of continued construction of the plant, with one exception, appear at this time to be minimal. Where changes in the present design of the plant may be required following completion of the NEPA review to minimize these effects still further -- e.g., in the cooling system discharge, the radwaste system, and the chemical effluent control system -- changes would be technically and economically feasible.

63. Against these environmental costs, the power needs of the public and other identifiable benefits must be weighed. These include the provision of 15.4 million kilowatt-hours per year of electrical energy to serve consumers within PG&E's service area, and the financial contribution, in terms of taxes and employment, that continued construction and eventual operation will make to the San Luis Obispo Area.

64. In this Board's view, it appears highly unlikely that abandonment of the proposed facility will be required following the NEPA review. The cost of abandonment would be substantial. If construction of Diablo Canyon units 1 and 2 were suspended on June 1, 1972, and the units were then abandoned on January 1, 1973, following the NEPA review, the

capital costs of abandonment would be about \$293 million, after allowance of a credit of \$100 million for salvage. Should construction continue during the review period, and the units were then abandoned on January 1, 1973, the capital costs of abandonment would be about \$328 million, again after allowance of a credit of \$100 million for salvage. Abandonment in either instance would result in substantial incremental revenue requirements for PG&E. Under both cases of abandonment, the estimates of additional revenue requirements assumes that 1,800 megawatts of gas turbine capacity would be installed between 1975 and 1982 to replace Diablo Canyon capacity during the period through 1985 or 1986, by which time PG&E estimates that the Diablo Canyon plant could be replaced by new nuclear capacity. Similarly, the cost of abandonment of the transmission lines on January 1, 1973, assuming suspension of construction during the review period, would be about \$19,000,000. If construction continued during the NEPA review, and abandonment was then ordered, cost of abandonment is estimated at about \$29,000,000.

65. In view of the foregoing analysis, the Board does not find that the commitment of substantial financial resources, in proceeding with construction pending completion of the NEPA review, will substantially affect the eventual decision regarding the Diablo Canyon Nuclear Power Plant, Units 1 and 2, reached on that review. Thus, we are unwilling to suspend construction of the facility, with the exception of the removal of the cofferdam related to the discharge structure of the cooling system.

VI. Conclusions

- (1) Continued construction activities on the Diablo Canyon Nuclear Power plant site during the prospective NEPA review period will not have a significant adverse impact on the environment.
- (2) Continued construction activities on the transmission lines during this period will not further damage the environment irretrievably if proper efforts are made by PG&E to correct present faults and minimize future damage.
- (3) Continued construction activities on the cooling system for the reactors will not have a deleterious effect. However, the cofferdam for the discharge structure should not be removed pending the on-going NEPA review.
- (4) Continuation of construction pending completion of the on-going NEPA review will not foreclose the adoption of alternatives that could result from the NEPA review, relative to facility design, transmission lines, or the cooling system.
- (5) In the context of balancing environmental harm and economic costs of abandonment,

the commitment of substantial financial resources in proceeding with construction pending completion of the on-going NEPA review will not significantly affect the eventual decision as a result of the final NEPA review.

In accordance with the foregoing, IT IS HEREBY ORDERED THAT Pacific Gas and Electric Company may continue the construction activities at the Diablo Canyon Nuclear Power Plant, Units 1 and 2, authorized pursuant to Construction Permit Nos. CPPR-39 and CPPR-69 pending completion of the on-going NEPA review, except that construction activities related to the removal of the cooling system discharge cofferdam shall be suspended. Exceptions to this decision and a supporting brief may be filed by any party within five (5) days after the date of issuance hereof unless, within the same time period, the Appeal Board or Commission directs that the record be certified to it for final decision.

It is so ordered.

ATOMIC SAFETY AND LICENSING BOARD

M. Stanley Livingston
Dr. M. Stanley Livingston, Member

Franklin C. Daiber
Dr. Franklin C. Daiber, Member

Michael L. Glaser
Mr. Michael L. Glaser, Chairman

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Washington, D.C.