The terms "minimal," "acceptable," and "not significant" relate to a judgment made regarding the predicted impacts of the facility on the environment. A possible effect is termed insignificant if, for example, the impact is predicted to only occur locally in a nonunique, or widespread, population community of organisms, etc. When it is not possible to reach a firm conclusion regarding the significance of a projected impact (even under worst-case conditions), mitigation is either recommended immediately or an extensive monitoring program is stipulated.

The study report concerning use of the heat treatment process addresses a matter beyond the NRC's purview in accordance with the Federal Water Pollution Control Act Amendments of 1972. Thus, while the NRC must evaluate and consider the environmental impacts attributable to use of such heat treatment process, such consideration is limited to a determination of the impacts and their significance in terms of the cost-benefit analysis for this facility; any changes in the system or its use must be directed by the California Regional Water Quality Board and/or the Environmental Protection Agency. The applicant will provide the study report directly to those agencies, as well as to the NRC, when available.

For the foregoing reasons, we do not believe that the report itself is an integral part of the Draft Environmental Statement. Of course, as noted above, the NRC will consider the impacts attributable to the heat treatment process in the Final Environmental Statement as stated in Section 5.4.2.1. In this connection, the staff considers it to be no different than any other report of a study or analysis performed by a license applicant in support of its application. The staff is aware of no legal requirement which would give the report independent status such as EPA suggests, in the context of the NRC's licensing review. The status of this report in terms of the determination to be made under Section 316(a) of the FWPCA is a matter left to that agency charged with making that determination.

Sect. 5.4.2.2 concludes that significant impacts are unlikely, even under worst-case conditions. The effluent characteristics of SONGS must conform to the State standards prevailing at the time of the operation of the facility.

It is not the purpose of the staff analysis, as provided in the DES, to make rulings regarding statutory requirements, but rather to assess the impacts of proposed operation. In making this analysis it is not assumed that standards will be satisfied and, therefore, the environmental consequences of any violations resulting from the proposed plant operation is inherent in the staff's conclusions.

11.10 NEED FOR PLANT (MIL, A-45)

Table 2.2 of the FES relates to projected population growth within 16 km of the San Onofre site for the period 1976 to 2020.

Tables 8.3 and 8.4 are related to the electrical growth projected within the service areas of Southern California Edison Company and San Diego Gas and Electric Company for the periods 1976-1985. The combined annual growth rates for peak demand and energy for this period is 4.3 and 4.6%, respectively.

Population within 16 km of the site does not necessarily reflect electrical growth in the applicant's service areas.

11.11 SEISMOLOGY (EPA, A-40; MIL, A-45; RJW, A-49)

The staff's review and evaluation of the geological and seismological aspects of the San Onofre Nuclear Generating Station Units 2 and 3 is presented in the staff's Safety Evaluation Report, published December 1980. Included in the SER is a discussion of the potential for and nature of seismic activity at the site and its vicinity as well as of the design and construction measures taken by the applicants to prevent damage to the facility and its component parts. The staff considers that its assessment of the environmental impact of postulated accidents presented in Chapter 7 adequately accounts for the consequences of any accident caused by seismic activity. This chapter discusses the consequences of accidents regardless of cause.

Regarding the potential for affecting water quality and for offsite radiological contamination, to the extent such impacts are the result of airborne transportation of radionuclides, the consequences are included in the discussion in Chapter 7. The liquid pathway, because of the hydrological environment at the site, does not present a viable transport mechanism which could impact water quality or would otherwise result in offsite radiological consequences.

11.12 URANIUM PRICES (RJW, A-49)

The cost-benefit analysis in the DES is based on 1976 data, at which time the price of uranium was $18.10/kg ($40/lb) U_3O_8. Presuming SCE used the then existing U_3O_8 price in their cost-benefit analysis for SONGS 2 and 3, they would be using a price that reflected the rapid increase in prices in the 1973-1976 period. To extrapolate future prices on the basis of the 1973-1976 price increase would be erroneous in that uranium prices decreased 9% in real terms during 1977. Thus, it is inappropriate to consider a price escalation which is not even valid for a 5-year period of the uranium market for a cost-benefit analysis which covers the 30-year lifetime of a reactor. It would be just as appropriate (or inappropriate) to extrapolate the recent 9% decrease in uranium prices for use in the analysis. Many factors must be carefully investigated to estimate future uranium prices, and simplistic methods cannot be justified.

Long-term contracts are not generally tied to market prices at time of delivery or a 7% per year escalation, whichever is greater, based on current data. In fact, most long-term uranium requirements are not under contract, so it is inappropriate to make any generalization about the nature and terms of those contracts. Even if future contracts were based on the greater of market price or 7%/year escalation, it does not follow that fuel costs will increase to prohibitively high levels. If future prices were related to market prices and market prices do not increase substantially (it has not been established that they will), then the uranium cost component of fuel costs would not increase very much. And, if prices increase at 7%/year, they would probably just be keeping pace with inflation and thus not be relevant to a constant dollar analysis.

The cost of purchasing uranium is only one component of nuclear fuel costs, the other being, for example, separative work, UF_6 conversion, and fabrication. Thus, overall nuclear fuel costs would not escalate in proportion to the increase in uranium prices.

11.13 ACCIDENTS (HEW, A-10; MIL, A-45; RJW, A-49)

These comments were addressed to the Accident Section (Section 7) published in the Draft Environment Statement (DES), dated November 1978. In January 1981, the staff revised Section 7 and issued it for comment as a supplement to the DES. The January 1981 Supplement is included as Section 7 of this Final Environmental Statement (FES). The staff believes FES Section 7 is responsive to those accident comments previously addressed to the DES.

(FHA, A-53)

Part 50.13 of 10 CFR does not require a licensee "to provide for design features or other measures for the specific purpose of protection against the effects of (a) attacks...by an enemy of the United States...or (b) use or deployment of weapons incident to U.S. defense activities." The staff recognizes that acts of war would likely produce severe environmental impacts wherever they might take place.

(RJW, A-56, A-59)

The supplement is based on site-specific data, as described in Section 7.1.4.2. While not specifically stated in the supplement, U.S. average, year 2000 estimated, population data were used beyond 560 km (350 miles). The site-specific meteorological data used included lid heights to account for vertical mixing characteristics.

(RJW, A-58)

Both the staff and SAI used very similar methodologies in their analysis, and they both represent improvements over the Reactor Safety Study. There are some differences, however, in assumptions and data used in each study that lead to the variabilities or uncertainties that are inherent in such calculations. These differences appear in:

- accident release characteristics - probabilities and magnitudes;
- emergency response assumptions;
- meteorological data; and
- demographic data.

Specific consequence values that commentors quote from the SAI-OES report cannot be directly compared with those reported in the staff's draft supplement since the former are not associated with specified probability levels while the latter are. The staff has not made a

detailed comparison of the results of the two reports but judges that they are in agreement within the estimated bounds of uncertainties and assumptions associated with the current state of probabilistic risk assessments.

(RJW, A-58, A-59, A-60)

The studies of the San Onofre site relative to earthquake potential is extensively discussed in Section 2.5 of the Safety Evaluation Report (NUREG-0712, December 1980). The staff's position is that the safe shutdown earthquake is correctly determined for this site. A discussion of natural phenomena as initiators of accidents has been added to Section 7.1.4.2.

(RJW, A-58, A-59)

If Unit 1 had a meltdown, the staff agrees that it would impact the operation of Units 2 and 3. However, the ability to shut down both units following an accident at Unit 1 would not be impaired.

(RJW, A-59)

The reactor vessel was installed with its reference mark 180 degrees from the desired location. As discussed in the Safety Evaluation Report (Section 5.3.4), the flow skirt, which is not symmetrical, was installed in the direction to agree with the vessel's orientation and procedures for fuel handling, which reference the vessel orientation, were modified. No rewiring was necessary as a result of the error.

(RJW, A-59)

The dewatering well cavities were discussed in the Safety Evaluation Report in Section 2.5. It was determined that there would be no impact on seismic Category I structures.

(RJW, A-59)

The beach visitors were specifically addressed (e.g., Sections 7.1.3.2 and 7.1.4.6 and Table 7.1.4-5).

(RJW, A-60)

The staff has concluded that acts of sabotage, as initiating events, do not contribute significantly to the probability of accidents due to the Commission's safeguards requirements. Section 7.1.4.2 has been modified to discuss this point.

(RJW, A-60)

While it is true that one-half of the population of the State of California lies within 160 km (100 miles) of the San Onofre site, the staff does not consider this to be a relevant observation. The staff's focus on demographic data for site suitability and site comparison purposes has been traditionally within 80 km (50 miles) of plant sites.

The discussion in Section 7.1.4.3 indicates that most of the accident impacts occur within 50 miles of the site. The staff has compared the total population within 50 miles of the site with the total population within 80 km (50 miles) of other nuclear plant sites and has found that San Onofre does not have a uniquely large population. Moreover, it is important to note that, as stated in Section 7.1.4.2, the site-specific population projected to the year 2000 both in magnitude and distribution has been used in the calculations through all regions to 160 km (100 miles) and beyond. Those fractions of the consequences which take place up to 16, 48, 80, 160 km (10, 30, 50, 100 miles) or beyond, are accounted for in the results presented. The site does not have a uniquely large population contained within any of the above mentioned distances.

(RJW, A-60)

The San Onofre Units 2 and 3 at 3390 MWt are typical of the upcoming generation of reactors. The power level of each plant was specifically used in determining the inventory of the core for the risk calculations. Salem 1 is presently operating at a comparable power level of 3338 MWt.

(RJW, A-60)

The production of farm and dairy products is specifically considered in the calculation. Differences among the states (and countries) potentially impacted are taken into account.

(RJW, A-60)

The impacts within the Mexican borders were included in the evaluation. The method of determination of data for Mexican agricultural products is discussed in Section 7.1.4.2. Although not explicitly stated, the population within the Mexican border was included on a site-specific basis out to 560 km (350 miles) from San Onofre.

(RJW, A-61)

The staff recognizes the potential efficacy of drugs in mitigating consequences of offsite exposures. However, in the case of potassium salts of stable iodine, the staff does not require provision for distribution to the public.

(RJW, A-61)

Section 7.1.4.4 discusses that the condemning of foodstuffs was specifically considered and the interdiction of contaminated property "...until it is either free of contamination or can be economically decontaminated" was assumed.

(RJW, A-61)

The subject of filtered venting systems for the containment is being addressed in rulemaking, as discussed in NUREG-0660, 2.B.8. The whole subject of TMI-2-related improvements and the fact that no credit would be taken for them is discussed in the last paragraph of the section cited.

(RJW, A-61)

It is the staff's position that such a "worst case accident" is much too remote and speculative to require analysis under NEPA.

(UCS, A-63)

The staff believes that its treatment of a multiplicity of possible accident scenarios represents a reasonable and appropriate implementation of the guidance provided in the Commission's Statement of Interim Policy.

(UCS, A-63)

The probabilities of occurrence of releases in the nine categories are explicitly given in Table 7.3 and the probabilities of occurrence of specific levels of environmental consequences are given in Table 7.4. The staff judges that this is within the intent of the quoted part of the sentence and the additional directive in the Interim Policy which states: "The environmental consequences of releases whose probability of occurrence has been estimated shall also be discussed in probabilistic terms." See also the staff's answer to Joint Intervenors RJW, A-58.

(UCS, A-64)

The staff has presented a measure of individual risk in Figures 7.7 and 7.8. Table 7.4 and its associated figures and Table 7.5 provide group information. The discussion of relative susceptibility of various sub-groups of the population is given in Section 7.1.1.3. The staff judges that this conforms to the further directive that the discussion be "...in a manner that fairly reflects the current state of knowledge regarding such risks."

(EPA, A-66)

The Supplement is a replacement for Chapter 7 in the existing Draft Environmental Statement for the Operating License stage (November 1978). It is not a replacement for the accident sections of the Construction Permit stage Environmental Statements of 1973.

(EPA, A-66)

Nine tables could have been provided to show the impact contributions of the nine categories. It is the staff's judgment, however, that the summary table, reflecting sums of the contributions from all of the categories, is sufficient. Information regarding the relative contributions of the release categories is available in the Reactor Safety Study, WASH-1400.

(EPA, A-66)

The Design Basis Accidents are included because they are used in the Safety Evaluation Report to assess the adequacy of the performance of certain engineered safety features. In the SER, the DBAs are compared to the suitably small fractions of 10 CFR 100 for those accidents that are considered likely (infrequent accidents).

(EPA, A-66)

The DBAs are judged not to be significant contributors to environmental risks and have not been subjected to the same kind of probabilistic analysis as the more severe accidents that are treated.

(EPA, A-66)

The staff believes that it is more informative to discuss the environmental risks associated with accidents separated from those attributable to normal operations. Both may be found in the Final Environmental Statement. Risks associated with the operation of both Units 2 and 3 are, to a first approximation, the sum of the risks associated with each unit individually.

(EPA, A-67)

We agree certain biological changes in children and adults may be detected occasionally at doses as low as 10 rem (e.g., slight, temporary reductions in circulating lymphocytes). However, at doses of 25 rem or greater, such effects become measurable in nearly all exposed persons. In addition, although such changes have no physiologically significant impact, they can be clinically measured. We selected 25 rem as a point above which potentially serious effects due to radiation exposure (e.g., prodromal vomiting) become apparent to physicians and a point below which no difference between exposed and unexposed populations is apparent in terms of latent cancer incidence.

(EPA, A-67)

The NRC State Liaison Officer has informed us that the Region IX RAC has completed its review of the local plans for the environs of San Onofre. The licensee has transmitted to the NRC copies of emergency plans for the following:

San Onofre, San Clemente and Daheny State Park and Beach Areas

San Juan Capistrano City

Camp Pendleton

Orange County

Unified San Diego County

Interagency Agreement between San Diego County, Orange County, City of San Clemente, City of San Juan Capistrano; Marine Corps, Camp Pendleton; State Department of Parks, Pendleton Coast Area.

The staff preliminary review of these documents affirms its judgment that the plans are, in fact, in an advanced stage of development even though they have not been submitted for formal review. A full-scale exercise for the San Onofre site and its environs is scheduled for May 13, 1981.

(EPA, A-67)

The NRC staff Safety Evaluation Report, dated February 1981, states that the San Onofre onsite emergency plan, when revised in accordance with the applicant's commitments, will provide an adequate planning basis for an acceptable state of emergency preparedness, and will meet the requirements of 10 CFR Part 50 and Appendix E, thereto. This is still the staff's conclusion.

The SER states that the plan must be revised to address the final criteria and implementation schedule for the emergency centers and their functions, emergency manpower levels, and upgraded meteorological program, and to address the impact of earthquakes on emergency plans for the site and its environs. The NRC staff position is that the emergency plans are sufficiently complete to justify the estimates of parameters used in the consequence model.

It is true that the State of California does not use the U.S. EPA Protective Action Guides (PAGs). The State of California has elected to base its Protective Action Guides on the concept that no member of the general public should receive more than 500 millirem per year. The emergency plans of the local authorities in the environs of the San Onofre plant have followed the State's guidance. This guidance is more conservative than the EPA guidance, i.e., protective actions would be recommended at a lower projected dose. Consequently, it is reasonable to expect that if protective actions were to be taken at a lower value of projected dose, then exposures would be reduced.

(EPA, A-67)

The figure has been revised to present a more meaningful directional risk. The meaning of the new figures is discussed in Section 7.1.4.6. The scale of the figures has been expanded (a smaller distance from the plant shown) and it has been redrawn in an attempt to improve legibility.

(EPA, A-67)

Standard methods for estimating costs of reactor building cleanup and decontamination and replacement power for the economic risk calculations are under development. Reasonable estimates of plant decontamination and replacement power have been made, however, and are discussed in Section 7.1.4.6. Staff conclusions on the benefit cost balance are reported in Section 10 of the FES.

(SCE, A-68)

It is clearly stated in the third paragraph of Section 7.1.4.1 that the evaluations of the limiting faults and infrequent accidents are used to implement the provisions of 10 CFR 100. The conclusions regarding siting are in the Safety Evaluation Report and its supplements.

(SCE, A-69)

Section 7.1.4.2 states that the estimates of the consequences may have as large error bounds as for the probabilities. Any uncertainty in the fractions of nuclides released contributes to the error bounds on the consequences, as well as uncertainties in the meteorological and health effects models. The subject of releases of certain nuclides, mainly the radioiodines, is presently under review by the staff.

APPENDIX A
COMMENTS ON DRAFT ENVIRONMENTAL STATEMENT

APPENDIX A

COMMENTS ON

DRAFT ENVIRONMENTAL STATEMENT

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UNITED STATES DEPARTMENT OF AGRICULTURE
SCIENCE AND EDUCATION ADMINISTRATION

OFFICE OF THE DEPUTY DIRECTOR FOR
AGRICULTURAL RESEARCH
WASHINGTON, D.C. 20250

Subject: NRC Draft Environmental Statement

To: William H. Regan, Jr.
U.S. Nuclear Regulatory Commission
Environmental Projects Branch 2
Division of Site Safety and Env. Analysis
Washington, D.C. 20555

We have reviewed the draft environmental impact statement entitled San Onofre Nuclear Generating Station, Units 2 and 3, Southern California Edison Company, San Diego Gas & Electric Company, dated November 1978.

We have no comments to add to the evaluation provided by your staff. We do appreciate the opportunity of reviewing this statement.

H. L. BARROWS
Acting Deputy Assistant Administrator

A-2

790103 0193

U.S. DEPARTMENT OF AGRICULTURE
ECONOMICS, STATISTICS, and COOPERATIVES SERVICE
WASHINGTON, D.C. 20250

December 8, 1978

SUBJECT: Draft Environmental Statement

TO: William H. Regan, Jr., Chief
Environmental Projects Branch 2
Division of Site Safety and
Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

We have no comments on the Draft Environmental Statement related to operation of San Onofre Nuclear Generating Station, Units 2 and 3 by Southern California Edison and San Diego Gas and Electric Companies.

MELVIN L. COTNER
Director
Natural Resource Economics Division

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50-362 A

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
AREA OFFICE
2500 WILSHIRE BOULEVARD, LOS ANGELES, CALIFORNIA 90057

REGION IX
450 Golden Gate Avenue
P.O. Box 36003
San Francisco, California 94102

December 19, 1978

IN REPLY REFER TO:

U.S. Nuclear Regulatory Commission
Attention: Director, Division of Site Safety
and Environmental Analysis
Washington, D.C. 20555

Gentlemen:

Subject: San Onofre Nuclear Generating Station
Units 2 and 3
Draft Environmental Statement
Docket Nos. 50-361 and 50-362

We have reviewed the captioned document and have no comments to offer on it. There is no need to send this office a copy of the Final Environmental Statement.

Sincerely,

Roland E. Canfield, Jr.
Area Manager

A-3

7901080142

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2711
LOS ANGELES, CALIFORNIA 90053

50-361P
3620

SPLED-E

2 January 1979

Mr. Wm. H. Regan, Jr., Chief
Environmental Projects Branch 2
Division of Site Safety and Environmental Analysis
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Regan:

This is in response to a letter from your office dated 30 November 1978 which requested review and comments on the Draft Environmental Impact Statement for the San Onofre Generating Station, Units 2 and 3, proposed by Southern California Edison Company and San Diego Gas and Electric Company.

The proposed plan does not conflict with existing or authorized plans of the Corps of Engineers. We have no comments on the environmental statement for the proposed action.

Thank you for the opportunity to review and comment on this statement.

Sincerely yours,

NORMAN ARNO
Chief, Engineering Division

7901170209

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
2828 Chiles Road, Davis, CA 95616

January 9, 1979

William H. Regan, Jr., Chief
Environmental Projects Branch 2
Division of Site Safety and
Environmental Analysis
United States Nuclear Regulatory
Commission
Washington, D. C. 20555

Docket No.: 50-361
and 50-362

Dear Mr. Regan:

We acknowledge receipt of the draft environmental statement for San Onofre Nuclear Generating Station, Units 2 and 3, Southern California Edison Company, San Diego Gas & Electric Company in San Diego County, California, that was addressed to USDA Soil Conservation Service on November 30, 1978, for review and comment.

We have reviewed the above draft and have the following comments.

1) Provisions for erosion control and water management during construction as well as conservation treatment of disturbed areas following construction were inadequately addressed. We suggest that an erosion control plan be developed to adequately address the erosion hazard both during and following construction.

2) Approximately 10 acres of prime land will be lost to access roads and transmission towers. Mitigation or projected impacts from this loss were not adequately discussed. We suggest further discussion in the statement to address the prime land issue.

We appreciate the opportunity to review and comment on this proposed project.

Sincerely,

FRANCIS C. H. LUM
State Conservationist

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FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

January 17, 1979 IN REPLY REFER TO:

Mr. William H. Regan
Division of Site Safety and
Environmental Analysis
Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Regan:

I am replying to your request of November 30, 1978 to the Federal Energy Regulatory Commission for comments on the Draft Environmental Impact Statement for the San Onofre Nuclear Station Units 2 and 3, California. This Draft EIS has been reviewed by appropriate FERC Staff components upon whose independent evaluation this response is based.

The staff concentrates its review of other agencies' environmental impact statements basically on those areas of the electric power, natural gas, and oil pipeline industries for which the Commission has jurisdiction by law, or where staff has special expertise in evaluating environmental impacts involved with the proposed action. It does not appear that there would be any significant impacts in these areas of concern nor serious conflicts with this agency's responsibilities should this action be undertaken.

Thank you for the opportunity to review this statement.

Sincerely,

Jack M. Heinemann
Advisor on Environmental Quality

C002 ES 1/0

7901220093

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

JAN 16 1979

In Reply Refer To:
ER 78/1161

Mr. William H. Regan, Jr.
Chief, Environmental Projects Branch 2
Division of Site Safety and
Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Regan:

The Department of the Interior has completed its review of the draft environmental statement for San Onofre Nuclear Generating Station Units 2 and 3. We have comments in only two areas of our jurisdictional concern as set forth below.

Recreation Resources

The discussion of recreation impacts states that restrictive use of the beach area was unanticipated at the time issuance of the construction permit was being considered. Since no explanation is given, it is unclear to us how such a significant impact, the loss of recreational and scenic open space, could have been overlooked during the earlier planning stages. The final statement should disclose the reasons which now require restrictions upon beach use.

Although there is now recognition of the impact, we see no attempt being made by the applicant to mitigate the loss of recreation space and opportunity. With respect to the scenic quality of the area, we find the intended plan to construct an eight foot chain-link fence extending over three-fourths of a mile along the beach quite objectionable. Design of the walkway deserves much more attention. Given the fact that this stretch of beach is rather removed from the developed portions of the state park units and therefore receives minimal use and given the scenic nature of the beach area and bluffs it would certainly seem more preferable and perhaps sufficient to consider posting the area as to its restrictive use. If a barrier is still needed, a more aesthetically sensitive, light railing may best fulfill the need to restrict access.

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Cultural Resources

We are pleased that the NRC staff has directed the applicant to consider historic, archeological, and Native American cultural resources in its planning process. We understand that existing and possible new transmission corridors will be surveyed for such resources. However, we strongly urge that the applicant allow enough flexibility in its planning to actually take the results of these surveys into account in its final placement of tower bases, access roads, and proposed substations. This would include allowing the State Historic Preservation Officer enough time to properly evaluate the surveys results and make appropriate recommendations. In addition, any new land used for material storage or other project activities outside the transmission corridors should also be checked for cultural resources.

We hope these comments will assist your efforts in preparing the final environmental statement.

Sincerely,

Larry E. Meierotto
Deputy Assistant SECRETARY

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362

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ALAN R. BURNS
ROBERT L. LAVOIE
DANIEL K. SPRAGLIN

January 19, 1979

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Director, Division of Site, Safety and Environmental Analysis

Gentlemen:

Pursuant to the notice published in the Federal Register with respect to comments on the Draft Environmental Statement (DES), the Cities of Anaheim and Riverside, California wish to submit the following comments.

Anaheim and Riverside believe the Final Environmental Statement (FES) should be amended in Section 8, entitled "Need for the Station", to reflect probable ownership by the Cities of a portion of Southern California Edison Company (SCE), 80% interest in Units 2 and 3.

The Applicants and Anaheim and Riverside, entered into a Letter Agreement dated November 1, 1977 which incorporated other proposed Agreements, including a Participation Agreement which provides for Anaheim to acquire 1.66% of SCE's 80% interest in Units 2 and 3, and for Riverside to acquire 1.79% of Edison's 80% interest in Units 2 and 3. The Letter Agreement was entered into by the Parties because a question was raised as to whether SCE or SDG&E would lose the investment tax credit with respect to its ownership share of Units 2 and 3 due to Anaheim and Riverside, public agencies, owning an undivided interest in Units 2 and 3. The Letter Agreement further provides, however, that when this question is satisfactorily resolved in the opinion of each party to said Agreement, the Participation Agreement attached thereto will be executed by the Parties.

The Internal Revenue Service has issued Revenue Ruling 78-268, which holds that undivided ownership in property by exempt and non-exempt entities does not of itself disqualify the portion of the property owned by the non-exempt entity from taking investment tax credit with respect to its share of such property. Moreover, SCE and SDG&E received a private letter ruling, dated August 16, 1978 which holds with respect to San Onofre Nuclear Generating Station, Units 2 and 3, that SCE and SDG&E will not lose investment tax credit with respect to their undivided interest in Units 2 and 3 after the sale of the interest to Anaheim and Riverside. However, that Private Letter Ruling contained language which SCE and SDG&E believe to be ambiguous and therefore on October 27, 1978 they filed a Request for Clarification of the Private Letter Ruling of August 16, 1978. The Request for Clarification is still pending before the Internal Revenue Service, but we believe it will be favorably acted upon in the next several weeks.

Anaheim and Riverside are currently, and have for some years, been wholesale

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customers of SCE. Anaheim and Riverside purchase all of their capacity, and most of their energy requirements from SCE. Anaheim and Riverside have agreements with Nevada Power Company wherein each City purchases economy non-firm energy from Nevada Power Company. These agreements will expire by their own terms in 1980. Anaheim and Riverside do not currently own any generating resources.

In 1978 Anaheim's peak demand was 388 megawatts. The estimated peak demand for 1978 was 394 megawatts. During 1978 Anaheim purchased two billion kilowatt hours of energy. For the period 1979 through 1990 it is estimated the peak demand for Anaheim will increase in differing amounts. The smallest amount of increase for electrical demand in any year during that period is estimated to be 3.1 percent and the highest amount of increase for any year 4.8 percent. It is also estimated for the same period of time that energy requirements for Anaheim will increase with the lowest estimated annual increase being 3.6 percent and the highest estimated annual increase being 5.0 percent.

In 1978 Riverside's peak demand was 278 megawatts. The estimated peak demand for 1978 was 260 megawatts. During 1978 Riverside purchased over one billion kilowatt hours of energy. For the period 1979 through 1990 it is estimated the peak demand for Riverside will increase with the smallest annual increase to be 4.0 percent and the highest annual increase to be 5.4 percent. It is also estimated for the same period of time that the energy requirements for Riverside will increase with the lowest annual increase to be 4.0 percent and the highest annual increase to be 5.4 percent.

The acquisition of an ownership interest in Units 2 and 3 by Anaheim and Riverside does not change the conclusion that the Units are needed to meet the electrical load served by SCE, Anaheim and Riverside. The load forecasts of SCE include the loads served by Anaheim and Riverside. Therefore, whether you include the loads of Anaheim and Riverside in the SCE forecast of loads or break them out and identify them separately, the need for the station is the same.

Very truly yours,

Alan R. Watts

ALAN R. WATTS
Special Counsel

Cities of Anaheim and Riverside

ARW:jm:D:11

cc: Attached Listing

Mr. John Bury
Southern California Edison Company
2244 Walnut Grove Avenue
P. O. Box 800
Rosemead, California 91770

Mr. Mark Medford
Southern California Edison Company
2244 Walnut Grove Avenue
P. O. Box 800
Rosemead, California 92672

Mr. Robert J. Pate
U. S. Nuclear Regulatory Commission
P. O. Box 4167
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Janice E. Kerr, Esq.
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UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230
(202) 377-~~3111~~ 4335

50-361
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January 22, 1979

Director, Division of Site Safety
and Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

This is in reference to your draft environmental impact statement entitled "San Onofre Nuclear Generating Station, Units 2 and 3, Southern California Edison Company, San Diego Gas & Electric Company." The enclosed comments from the National Oceanic and Atmospheric Administration are forwarded for your consideration.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you.

We would appreciate receiving 10 copies of the final statement.

Sincerely,

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosures from: Gordon G. Lill--National Ocean Survey
Gerald V. Howard--National Marine Fisheries Serv

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SURVEY
ROCKVILLE, MD 20852

OA/C52x6

JAN 10 1979

TO: PP - Richard L. Lehman

FROM: OA/Cx1 - Gordon G. Lill

SUBJECT: DEIS #7812.06 - San Onofre Nuclear Generating Station, Units 2 and 3

The subject statement has been reviewed within the areas of NOS responsibility and expertise, and in terms of the impact of the proposed action on NOS activities and projects.

The following comments are offered for your consideration.

Section 2.3.1, Surface-water hydrology, has been found to be very adequate for the purposes intended. The authors are to be commended for the thorough bibliography on the subject.

NOS concurs with and encourages the oceanographic monitoring program described in Section 6.2.2. We feel this program will ensure environmental protection and help allay public concern.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Region
300 South Ferry Street
Terminal Island, California 90731

Date : January 8, 1979 FSW33/JJS

To : EC, Office of Ecology and Conservation

Thru : F/, Kenneth R. Roberts, Acting Director, Office of Habitat Protection

From : FSW, Gerald V. Howard, Regional Director, Southwest Region

Subject: Review of DEIS No. 7812.06 - San Onofre Nuclear Generating Station, Units 2 and 3 (NRC)

The subject DEIS which accompanied your memorandum of December 8, 1978, has been reviewed by the National Marine Fisheries Service. The following comments are offered for your consideration:

Specific Comments

5. Environmental Effects of Station Operation

5.4 Environmental Impacts

5.4.2 Impacts on the aquatic environment

Page 5-26, paragraph 7, Kelp

In paragraph 7 little information is included documenting the importance of kelp to coastal commercial fish species. Information available in the California Department of Fish and Game Fish Bulletin 139 (Quast, 1968) provides some insight in that regard.

Data developed by Jay Quast of the then U.S. Bureau of Commercial Fisheries, and included in that publication, indicate that in his studies he found more than twenty commercially important fish species occurring in the kelp beds off southern California. According to those studies the relationship of many of those species to the kelp habitat was more extensive than indicated by the final sentence of the subject paragraph. This should be reflected in the text of the final EIS.

6. Environmental Monitoring

6.3 Operational Monitoring Programs

6.3.3 Aquatic biological monitoring

Page 6-7, paragraph 1

The concept of continuing a kelp study program into the operational stage of SONGS is a good one. However, should those studies determine that significant harm is occurring to that resource, then some method of compensation satisfactory to the National Marine Fisheries Service would need to be developed. This should also apply to the studies being conducted on fish impingement at SONGS 2 and 3.

If such measures are not adopted and adverse impacts do appear the monitoring program may be merely documenting the demise of a valuable coastal resource.

10. Benefit-Cost Summary

10.7 Summary of Benefit-Cost

Page 10-3, paragraph 3

The potential additional cost of compensating for loss of biological resources due to the operation of SONGS 2 and 3 should be addressed.

LITERATURE CITED

Quast, Jay C. 1968. 8. Observations on the food of the kelp-bed fishes. In: California Department of Fish and Game, Fish Bulletin 139. Pp 109-142.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
FOOD AND DRUG ADMINISTRATION
ROCKVILLE, MARYLAND 20857

January 25, 1979

Mr. William H. Regan, Jr., Chief
Environmental Projects Branch 2
Division of Site Safety
and Environmental Analysis
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Regan:

The Department of Health, Education, and Welfare has reviewed the health aspects of Draft Environmental Statement related to operation of the San Onofre Generating Station, Units 2 and 3, Southern California Edison Company and San Diego Gas and Electric Company and has the following comments to offer.

Section 5.5 Radiological Impacts

The individual doses as identified in Table 5.3 are all within Appendix I, 10CFR50 design objectives and should assure adequate radiation protection of the public for routine releases. However, it should be recognized in this section that 10CFR190 promulgated by EPA became effective in January 1979. A statement should be included indicating that SONG 2 and 3 will also meet this standard.

It is recognized that there are many variables that influence occupational exposure for a specific plant. However, a recent Atomic Industrial Forum study of occupational exposures showed for a PWR a total of 694 man-rem per year as a representative PWR exposure pattern. As a conservative estimate the projected occupational exposure impact of the two-unit San Onofre Station would be 1400 man-rem per year.

The summary of environmental consideration for uranium fuel cycle shown in Table 5.8 appear to be within acceptable radiation protection limits. However, some additional explanation within the text or by a footnote is needed for the disposal of solids. In particular, the statement that TRU and HLW would be buried at a Federal Repository should be modified to indicate alternatives for disposal of these waste in the event the Federal repository is not operational when required by plant operations.

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Section 6.2.5 Radiological Monitoring Program

The preoperational monitoring program presented in Section 6.1.5 of the Environmental Report is adequate for meeting the objective stated in this section. The establishment of the radiological monitoring program prior to start of operations should provide the necessary data to verify the effectiveness of in-plant controls and to provide assurance that undetected radioactivity will not build-up in the environment.

Section 7 Environmental Impact of Postulated Accidents

The estimated exposure of the population within a 50 mile radius of the plant shown in Table 7.2 cannot be adequately evaluated without some specific data in the text on the source term. Without such data it is possible to assume that the environmental consequence as a result of a class 8 accident could be more severe than indicated in the unlikely event of such an accident.

There is no indication in this section or previous chapters on emergency response planning to mitigate the consequences of an accident that could impact on the offsite population. A discussion of the arrangement that has been made with State and local authorities should be included in this section.

The discussions in paragraph 4, page 7-2 on the Reactor Safety Study (WASH-1400) relative to discussion with EPA is outdated (1973), and since it discusses scope of the study, and not results, should be removed. More importantly, a statement should be included on the technical review or conclusions that have been provided by EPA, other Federal agencies or independent reviewers. Such a statement would be helpful in accepting the low environmental risks associated with the postulated radiological accidents.

On the basis of this review it is concluded that the San Onofre Nuclear Generating Station, Units 2 and 3 can be operated to meet current radiation protection guidance and provide adequate protection of the public health and safety.

Sincerely yours,

Charles L. Weaver
Consultant
Bureau of Radiological Health

Southern California Edison Company
P. O. BOX 800
2244 WALNUT GROVE AVENUE
ROSEMEAD, CALIFORNIA 91770

J. H. DRAKE
VICE PRESIDENT

TELEPHONE
213-572-2288

February 2, 1979

Director, Office of Nuclear Reactor Regulation
Attention: William H. Regan, Jr., Chief
Environmental Projects Branch 2
Division of Site Safety and Environmental Analysis
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Gentlemen:

Subject: San Onofre Nuclear Generating Station
Units 2 and 3
Docket Nos. 50-361 and 50-362

In accordance with your request of November 30, 1978, the Southern California Edison Company and the San Diego Gas & Electric Company have reviewed the Draft Environmental Statement (DES) related to the operation of San Onofre Nuclear Generating Station, Units 2 and 3. Enclosed are comments generated from this review.

Should have any questions or require clarification regarding these comments, please contact me.

Very truly yours,

Enclosure

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ATTACHMENTS

A	Figure 6.14, page 61 of Reference (5)
B	Figure 6.29, page 76 of Reference (5)
C	Figure 6.34, page 81 of Reference (5)
D	Figure A-7, page A-15 of Reference (5)
E	Figure 6.8, page 47 of Reference (5)
F	NOAA Climatological Data, July 1975
G	" " , July 1976
H	" " , April and July 1977
I	" " , July 1978
J	Air Temperatures at SONGS
K	Del Mar Current Meter and Temperature Data, May-December 1978
L	San Onofre Area Current and Temperature Data, May-August 1978
M	Pages 103-106 of DES reference 8
N	Figure 1 Surface Isotherms for 0.0 knots
O	Figure 2 " " " 0.1 "
P	Figure 3 " " " 0.25 "
Q	Reference (19)
R	Reference (20)
S	Reference (21)
T	Temperature Data from References (8), (22), (23) and (24)
U	Reference (2)
V	Bottom (30') Water Temperatures at San Onofre, July and Aug. 1976-78
W	Pages 41 and 71 of Reference (16) and page 42 of Reference (17)
X	Revised DES Table 8.1
Y	Revised DES Table 8.3
Z	Revised DES Figure 3.5

AA Reference (1)

BB " (12)

CC " (13)

DD " (14)

EE " (18)

COMMENTS

BY

SOUTHERN CALIFORNIA EDISON COMPANY

SAN DIEGO GAS & ELECTRIC COMPANY

ON THE

DRAFT ENVIRONMENTAL STATEMENT

RELATED TO THE OPERATION OF

SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3

DOCKET NOS. 50-361 AND 50-362

PREPARED BY THE

U. S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

TABLE OF CONTENTS

INTRODUCTION

The Draft Environmental Statement (DES) has been reviewed by the Southern California Edison Company and the San Diego Gas & Electric Company (hereinafter referred to as Applicants).

Comments resulting from this review are to identify inaccuracies in the data or discussion and provide clarification or correction. The comments follow the organization and numbering in the DES and should be read in conjunction with the referenced section.

SUMMARY AND CONCLUSIONS

Comment A-1

(page iii, item 2)

The DES states, "Each unit will produce up to 3410 MWe and a net electrical output of 1057 MWe".

It should be noted that 1057 MWe as stated in the applicants' ER-OLS* and in the DES was calculated using the Turbine-Generator (T-G) manufacturer's guaranteed output of 1127 MWe, which corresponds to an NSSS output of 3266 MWe, and an estimated in-plant consumption of 70 MWe.

However, when the NSSS is operating at 3410 MWe, and the T-G is at the wide-open valve condition (normal operating condition) the T-G output will be 1181 MWe. Current estimates of in-plant consumption have been revised to 75 MWe. Therefore, it is suggested that the net electrical output value be expressed as being in the range of 1052 MWe to 1106 MWe per unit when the NSSS is operating in the 3266 MWe to 3410 MWe range respectively.

*ER-OLS will be revised to reflect the range of 1052 MWe to 1106 MWe output per unit, in a future amendment.

Comment A-2

(page iii, item 3a)

The applicants do not agree with the conclusion reached by the staff on the possible destruction of at least a portion of the San Onofre kelp bed as a result of the thermal discharge from San Onofre Nuclear Generating Station. The assessment of impacts to the aquatic environment is invalid because of the use of inappropriate data from the staff's numerical model. A reassessment of the impacts is needed using ambient temperatures from actual field data. Actual field data are appended to these comments. Using appropriate ambient temperatures in the assessment, the excess temperature from thermal plume predictions made by either the applicants or staff will not create adverse effects on the San Onofre kelp bed. (Attachment T)

Comment A-3

(page iv, item 6(B)(2))

The preoperational monitoring program outlined in Section 6 goes beyond the applicants' program approved by the NRC by letter dated July 6, 1978, and is apparently based on inappropriate predictions of impact to the San Onofre kelp bed. The operational monitoring program outlined in Section 6 is an extension of the preoperational monitoring program. The operational environmental monitoring programs are under development for Units 2 and 3 Environmental Technical Specifications (ETS) and will be submitted in the near future.

1. INTRODUCTION

1.1 HISTORY

Comment 1-1

(page 1-1, paragraph 2)

The net electrical output for each unit is in the range of 1052 to 1106 MWe. Refer to Comment A-1 for discussion.

2. THE SITE

2.4 METEOROLOGY

2.4.4 Atmospheric dispersion

Comment 2-1

(page 2-8)

The DES indicates that the onshore tracer test conducted by SCE substantiates the acceptability of data measured on the San Onofre onsite (bluff) tower for use in calculating atmospheric dispersion. However, the DES does not consider the enhanced dispersion estimates derived from the onshore tracer test results. Consideration should be given to the enhanced dispersion estimates derived from the onshore tracer test results.

2.5 SITE ECOLOGY

2.5.2 Aquatic ecology

Comment 2-2

(page 2-9)

Oceanographic data reports from the past have incorrect consultant sources referenced. The first source in the list of three sources should be:

"(1) a thermal effects study performed jointly by Environmental Quality Analysts, Inc. and Marine Biological Consultants, Inc. in 1973 using data and results obtained from 1964-1972 by Bendix Marine Advisors, Inc., and Intersea Research Corporation."

3. THE PLANT

3.2 DESIGN AND OTHER SIGNIFICANT CHANGES

3.2.1 Plant water use

Comment 3-1

(page 3-1, paragraph 2)

Delete the words, "makeup to," in the second sentence.

Comment 3-2

(page 3-1, paragraph 3)

The word, "makeup" should be corrected to "cooling," in the second sentence.

Comment 3-3

(page 3-1, paragraphs 2 and 3)

In the discussion of plant water use, the flushing of traveling bars and screens is incorrectly described. Seawater will be used for the flushing of the traveling bars and screens, not fresh water.

3.2.2 Heat dissipation system

Comment 3-4

(page 3-1)

The discussion should also include a description of the Seismic Category I Auxiliary Intake Structure of the circulating water system. The description of this design change can be found in Section 3.4.1 of the ER-OLS and Section 9.2.5 of the FSAR.

Comment 3-5

(page 3-1, paragraphs 4 and 5)

The seawater used for "cooling" has been incorrectly labeled "makeup." This error appears in the second sentence of paragraph 4 and the first sentence of paragraph 5.

Comment 3-6

(page 3-1, paragraphs 5 and 6)

The word "screenwell" should refer to the intake screenwell structure shown in Figure 3.3 and not the traveling screens. Lines 6 and 7 of paragraph 5 use "screenwells" where "traveling bars and screens" are being described. Also, in the second sentence of paragraph 6 "screenwells" is used instead of "traveling screens" and should be corrected.

Comment 3-7

(page 3-3, Fig. 3.2)

Figure 3.2 has been revised by the applicants to include the design details of the Auxiliary Intake Structure (Comment 3-4) and show the elimination of the manhole on the velocity cap. The revised figure can be found in Section 3.4 of the ER-OLS, Figure 3.4-2.

Comment 3-8

(page 3-5, paragraph 1)

The seawater used for "cooling" has been incorrectly labeled "makeup." This error occurs on lines 2 and 5, and should be corrected.

Comment 3-9

(page 3-5, paragraph 1)

The third sentence should read:
"To achieve the temperature required to control biofouling each unit has a recirculation and crossover gate."

2.3.1 Liquid Radioactive Waste Treatment System

Comment 3-10

(page 3-7, paragraph 7)

The flashed steam is routed to the "third point heater", not the "main condenser hotwell".

Comment 3-11

(page 3-8, Fig. 3.5)

The figure should be changed to reflect the correction identified in Comment 3-10. See revised Fig. 3.5 (Attachment Z).

Comment 3-12

(page 3-11, line 1)

The discussion on steam generator blowdown is incorrect. There are two steam generators for each unit, not four.

Comment 3-13

(page 3-13)

The discussion on the containment ventilation system should include a description of the 2,000 cfm mini-purge system. The description of this design change can be found in Section 9.4.1 of the FSAR.

2.4.1 Chemical Effluents

Comment 3-14

(page 3-16, paragraph 1, line 4)

The statement, "maintain a clean circulating water system," should be changed to read, "maintain a clean condenser system."

Comment 3-15

(page 3-16, paragraph 3, line 11)

The applicants will use a nitrite base compound or potassium chromate (K_2CrO_4) as the corrosion inhibitor for the turbine and component cooling water system. The statement in line 11, "will be treated with Nalco 39 to inhibit corrosion," should be changed to read, "will be treated with a nitrite based compound or potassium chromate to inhibit corrosion."

3.2.5 Transmission Lines

3.2.5.1 SCE Transmission Lines

Comment 3-16

(page 3-19, line 3)

The reference number for the description of retrofitting should be "4" not "1."

Comment 3-17

(page 3-20, Fig. 3.9)

An additional note should be added to the figure as follows:

> "The drawing depicts the four-circuit structure that will be used by SCE. SDG&E will use a similar structure with five circuits."

3.2.5.2 SDG&E Transmission Lines

Comment 3-18

(page 3-20, paragraph 1)

In the discussion of SDG&E's transmission lines, Talega Substation has been misspelled consistently throughout.

3.2.6 Probable Maximum Flood Berm

Comment 3-19

(page 3-23, line 1)

The reference number for the letter to the NRC should be "5" not "4."

5. ENVIRONMENTAL EFFECTS OF STATION OPERATION

5.3 IMPACTS ON WATER USE

5.3.1 Thermal discharges

General Comment Concerning Section 5.3

Applicants and the NRC both have evaluated the thermal effects of the diffuser system proposed for SONGS 2&3. The applicants applied a physical hydraulic model study. The NRC staff applied a depth-averaged numerical model. Applicants' model predicts compliance with all state and federal water quality requirements. The NRC Staff model predicts similar compliance for all realistic conditions but predicts potential violations of state thermal regulations for certain admittedly unrealistic conditions.

For reasons inherent in the input and methodology of the NRC staff model, applicants do not consider the staff's predictions to be valid. Further, applicants' model does not predict violations of the State Thermal Plan even under the unrealistic conditions postulated by NRC staff. Specific comments on DES Section 5.3 are discussed below:

5.3.1.1 Applicant's thermal analysis

Comment 5-1

(page 5-1, paragraph 6)

In the discussion of the physical model, the temperature difference of the discharged water is reported to be 30°F higher than the surrounding water. The 30°F delta T was necessary to achieve dynamically correct scaling of the actual delta T of 20°F and this fact should be mentioned in the discussion to avoid confusion.

Comment 5-2

(page 5-2, paragraph 3)

The statements are made, "The staff has reviewed the applicant's thermal analysis and believes that the physical model does not adequately represent certain hydrodynamic mechanisms and certain physical features of the prototype. The most significant of these is the limitation of the duration of the simulation by the size of the model basin." and "In fact, for the conditions represented in Figure 5.3,

an increase in simulation time would likely have resulted in predicted excess temperatures that violate state thermal standards." The applicants do not agree with these statements. The assumption that the size of the model basin limits the ability of the model in terms of representing valid results for longer time duration conditions are not considered to be valid. The conditions represented in DES Figure 5.3 represent a worst case condition and it is illustrated in the following paragraph that equilibrium had already been reached. An increase in simulation time would not have changed the predicted results.

In Figure 6.14, page 61 of Reference (5) (Attachment A) it is shown that for the circumstances represented in the DES Fig. 5.3, the hydraulic model had clearly reached an equilibrium peak temperature. The prototype period of time represented in this hydraulic model test of a zero drift situation is in excess of 30 hours of continuous operation at full load. Referring to Attachment A it can be seen that the peak temperature measured in the hydraulic model basin (the upper curve) quickly reaches an equilibrium level in a time of approximately 12 prototype hours. For the subsequent 18 hours of operation at zero drift velocity, the only variation in temperature is that associated with the experimental fluctuations. The behavior is similar for the lower curve, which is the peak temperature measured at a distance equivalent to anywhere beyond 1000 ft. from the point of discharge.

The results given in Attachment A, and the detailed error analysis performed in Reference (5), show quite clearly that there is no basis for the assertion that the hydraulic simulation represented in Fig. 5.3 of the DES, if continued, would lead to a violation of the state thermal standards. To the contrary, it is clear that in a no-drift situation an equilibrium peak temperature of 2.3°F (beyond 1000 ft.) would be reached within about 12 hours and this peak temperature would not be exceeded for longer durations.

The DES further states, "Once the thermal plume reaches a lateral boundary of the tank, the simulation must be terminated. The length of the simulation is thus dictated by the size of the model basin rather than by the natural time scales of the problem."

The tests do not have to stop when the thermal plume reaches a boundary because a large prototype area is represented by the model basin and the maximum temperatures are close to the diffusers. Furthermore, the natural time scale of the problem is that associated with the initial jet mixing and establishment of the steady induced offshore drift of the

thermal field. The time scale associated with the establishment of steady state conditions in the model was found to be 12 hours at the most. The size of the basin does not limit the results until more than 40 hours, as shown in Attachment A. It is also confirmed by the results given in Figures 6.29 and 6.34, pages 76 and 81 of Reference (5) (Attachments B and C). The results shown are for a situation where the hydraulic model was operated for the accelerating current pattern given on Attachment B. The outcome of the model is shown in Attachment C. It can be seen that the peak temperature rapidly reduces as the current velocity increases, showing that the natural time scale or response time is only a few hours. Indeed, it is because of the short time scales of the problem that the hydraulic model is appropriate.

The reason for the short time scale can be seen in Figure A-7, page A-15, of Reference (5) (Attachment D) and in Figure 6.8, page 47, of Reference (5) (Attachment E) which both clearly show a surface layer of warm water overlying a cooler bottom layer. The diluting water for the discharge jets is always drawn from this cooler bottom layer so the dilution is fixed by the rate of supply of bottom water. When there is no drift the bottom flow is generated by the jet entrainment. When an ambient current is present the flow of diluting water is even greater so the peak temperatures are reduced.

Comment 5-3

(page 5-2, paragraph 4)

The DES states, "Although the problem of underprediction is inherent in all the applicant's results, it is less significant for the realistic cases." It cannot be concluded that the hydraulic model consistently underpredicts delta T's with respect to what will really occur; rather, the only conclusion that can be drawn is that the math model gives consistently higher values than the physical model.

The basic hydraulic model report (Reference (5)) discusses possible errors in hydraulic modeling and deduces a laboratory target value of 2.5°F so that all possible errors will be included within the 4°F limit; but the report does not imply that there is an expected bias in the results as the errors could as well be negative as positive.

5.3.1.2 Staff's thermal analysis

Comment 5-4

(pages 5-3, 5-4, and Fig. 5.6)

Atmospheric data purported to be typical of July are used in the NRC mathematical model to predict ocean temperatures. Specifically, air temperatures with a maximum of approximately 82°F and a minimum of 65°F were used in the model (see DES Fig. 5.6, page 5-7).

Actual field data measured at coastal sites in Southern California for July show mean daily maxima and mean daily minima substantially lower than these temperatures. In addition, temperature summaries for the San Onofre site presented in Table 2.3-6 of the FSAR and Table 2.3.2-4 of the Applicants' Environmental Report OL Stage show mean daily maxima and mean daily minima temperatures on the order of 67°F and 61°F respectively.

Published U.S. Climatological Data for July 1975, 1976, 1977, 1978 (Attachments F, G, H and I) give temperatures for two coastal stations (Newport Beach Harbor and Santa Monica Pier). Data at San Onofre are from the meteorological tower maintained at the site: (Attachment J).

Actual Air Temperatures For The Month Of July

	Newport Beach Harbor mean daily		Santa Monica Pier mean daily		San Onofre mean daily	
	max	min	max	min	max	min
1975	69.8°F	62.1°F	68.0°F	61.5°F	66.6°F	59.5°F
1976	72.4°F	64.4°F	71.1°F	63.5°F	67.6°F	63.3°F
1977	70.7°F	61.4°F	67.9°F	61.2°F	67.5 F	61.5°F
1978	70.7°F	62.0°F	68.1°F	59.8°F	67.5 F	61.2°F

The indication is clear that a typical July daily atmospheric maximum temperature at San Onofre should be in the order of 68°F with a typical minimum of about 61°F.

These atmospheric data are an important feature of the numerical model since high air temperatures will lead to high ambient water temperatures being produced by the numerical model in the inshore region. An indication that this has in fact occurred, are the water temperatures used in Section 5.4 (in the benthic section ambient depth-averaged temperatures of 27.8°C (82°F) and in the kelp section ambient bottom temperatures of 21.5-24°C (71-75°F)). These temperatures are considerably higher than have actually been measured in the field (References (8),(22) and (23)). High ambient water temperatures in the inshore region will, in turn, be reflected as high temperature increments offshore due to the inshore water being transported offshore by the net offshore drift produced by the diffusers. It is quite likely that these features of the numerical model could be responsible for the possible temperature excess violations predicted by the staff's numerical modeling.

Comment 5-5

(page 5-4, paragraph 2)

The DES omits computed ambient temperature maps (without heated water discharge) and computed temperature maps with thermal discharge from which the delta T maps were derived as presented in DES Figures 5.8, 5.10, 5.12, 5.14, 5.16, 5.18, 5.20, 5.22. DES Section 5.4, environmental impacts, refers to this section (5.3.1) and discusses absolute values of ambient temperatures.

Since the basis for the prediction of temperature excess associated with the operation of SONGS Units 2 and 3 is the difference between the numerically predicted temperature distributions for operating and ambient conditions, these temperature maps should be made available to the applicants for evaluation and interpretation, or included in the FES. In addition, these temperature maps are essential to the assessment of impacts on marine life and necessary to provide the basis for much of DES Section 5.4.

Comment 5-6

(page 5-7, paragraph 2)

The DES states, "The net downcoast drift used for these simulations is based on limited data for mid-July. During other times of the year, the data indicate that an absense of drift can persist for up to several days. Although there are no data to confirm a no-drift assumption during mid-July, the staff believes that this situation is at least possible, and therefore, should be considered." Applicants disagree with the assumpation that a no-drift situation is possible.

Current data analyses have been previously supplied to NRC (References (3) and (4)). In Reference (3), pages 59 and 60, it was concluded that current speeds are higher in summer than in winter and that, during winter, periods of very low currents could exist lasting a few days, but that tracks indicated no evidence of currents with no net transport during this period. The available current record for summer, published in Reference (3), shows no evidence of any period of no net drift.

In Reference (4) more recent data obtained by Winant and Severance for the Marine Review Committee were analyzed. These data were collected using a newer type of current meter less susceptible to clogging than the meters used for the data previously analyzed (obtained from Intersea Research Corporation). Reference (4) makes it clear that at no time in the current meter records are there data to indicate that there is a period of zero drift. In fact, the records indicate a substantial drift either upcoast or downcoast with a speed of the order of 0.1 to 0.2 knots (5-10 cms/sec). The data therefore confirm the drogue and current meter data initially obtained by Intersea Research Corporation (IRC). The data appear to indicate that in fact IRC's meters may have been underrecording the magnitude of the currents.

In the past year (1978) more data have been collected at Del Mar (15 miles downcoast from San Onofre) by Winant of Scripps Institution of Oceanography and also at San Onofre by Brown and Caldwell Engineers under contract to the Marine Review Committee of the California Coastal Commission. Winant's data (Attachment K) show substantial longshore currents always occur at Del Mar. The Brown and Caldwell data obtained at the San Onofre site appear to be well correlated with the Del Mar data and also indicate strong drift currents either upcoast or downcoast for periods of several days. The change in direction is always a rapid process. These most recent data further corroborate the previous conclusion that there exist no periods of zero drift (Attachment L). A zero drift period is not considered to be credible, and should not be postulated for evaluating compliance with the state thermal requirements.

Comment 5-7

(page 5-7, paragraph 3)

The DES states, "Although the thermal numerical model is depth-averaged, it is still possible to address the state standards with model results because the buoyancy and shear generated by the diffuser discharge produce a hydrodynamic instability, resulting in the water column's being well mixed within several diffuser lengths of the discharge[8]. Therefore, within the specified mixing zone, the depth-averaged predictions are reasonable representations of surface temperatures."

Reference 8. C. W. Almquist and K. D. Stolzenbach, Staged Diffusers in Shallow Water, Report No. 213, Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics, Massachusetts Institute of Technology, Cambridge, Massachusetts, 1976.

Referring to pages 103-106 of DES Reference 8 (Attachment M) it is clear that the hydrodynamic instability claimed as the basis for application of depth-averaged numerical modeling definitely will not occur with the San Onofre diffusers. It is therefore evident that depth-averaged modeling is inappropriate to the San Onofre configuration so that drawing conclusions about violation of the California thermal standards on the basis of the results of such a model is not valid. It cannot be concluded that depth-averaged predictions are reasonable representations of surface temperatures. For the same reasons, the bottom temperatures cannot be predicted correctly from the NRC depth-averaged numerical model.

Comment 5-8

(page 5-7, paragraph 4)

The DES states that, "The model numerical is inadequate for addressing the issue of bottom temperature. However, at worst, the 4°F excess temperature should only touch the bottom over a very limited area in the vicinity of the Unit 2 and 3 diffusers."

The applicants agree that the numerical model is inadequate for addressing the bottom temperature issue as noted above. In view of the staff's admission of this inadequacy, there is no basis for the staff's statement concerning the 4°F excess bottom temperatures. In the assessment of San Onofre 2&3 diffuser plume extent, Figures 1, 2 and 3 have been formulated from Reference (5) (Attachments N, O and P). These show hydraulic modeling results in the horizontal and vertical and with respect to the San Onofre kelp bed area under conditions of no ambient currents, and two typically encountered downcoast ambient currents.

It should be noted that the vertical profiles in Figures 1, 2 and 3 (Attachments N, O and P) stop at a depth of 35 feet but the actual bottom depth is deeper. These figures show no indication of impingment of a 4°F isotherm on the bottom or even present in the water column.

Figure A-7 (Attachment D) shows an actual vertical cross-section of the modeling results from surface to bottom along the centerline of the San Onofre 2 & 3 diffusers. This figure shows that the thermal plume does not impinge substantially anywhere on the bottom and that a temperature increase of 0.4°C (0.8°F) is not exceeded on the bottom.

Comment 5-9

(pages 5-2 through 5-24)

The DES omits any reference to error analysis for either applicants' hydraulic modeling or the staff's numerical modeling. Such an analysis is essential in determining the bounds within which the results are accurate or applicable.

The applicants' modeling has been subjected to a comprehensive error analysis, Reference (7), which discussed possible sources of error and determined appropriate error margins. This error analysis should be referenced in the DES.

There is no discussion of errors for the staff's math model. As with all math models, various assumptions and coefficients are necessary and the results must be viewed with consideration of the potential error inherent in the model. It is a particular concern with this math model which appears to be deficient in representing the real phenomenon occurring, specifically two-layer stratified shear flow and individual jet mixing. Because of this, the range of possible error for the math model is considered to be greater than for the hydraulic model. An error analysis for the staff's math model should be presented, or at least referenced and made available to the applicants.

Comment 5-10

(page 5-7, paragraph 5)
(page 5-24, paragraph 1)

The DES states, "In the absence of drift, the 4°F excess temperature will not reach the shore. However, state thermal standards would be violated since the 4°F surface isotherm will extend beyond the 1000 ft. radius during most of the tidal cycle. The staff concludes that although there exists a remote possibility that state thermal standards could be violated by the operation of Units 2 and 3, violations would, at worst, be infrequent and for short periods. There is no evidence in available drift data to indicate that such an occurrence would take place during the summer when thermal impacts would be the most severe."

The applicants do not agree that the state thermal standards limitation for the 4°F surface isotherm beyond 1000 ft. for more than one half of a tidal cycle will be violated in the absence of drift or under any other circumstance. The applicants' thermal modeling studies addressed a no-drift condition, showing no violation of state thermal standards (DES Figure 5.3). It is the position of the applicants that the mathematical model predictions are excessively high, mainly as a result of inappropriate inputs and assumptions. The staff selected inputs include air temperatures that are about 10°F too high (see Comment 5-4), unsubstantiated two day no-drift conditions along the open coast at San Onofre in July (see Comment 5-6), and modeled ambient depth average water temperatures that are higher than ever recorded in the area's field data (see Comment 5-8). Also, such violations predicted (as remote) by the staff are derived from output of their mathematical model when the model itself could be approaching its limits of validity. Yet, this can not be proven, mainly because an error analysis that would substantiate the claimed applicability of the numerical model is not included in the DES (see Comment 5-9).

For these reasons, the staff's conclusion, that even a remote possibility of a violation of the state thermal standard exists, cannot be justified on a technical basis.

5.4 ENVIRONMENTAL IMPACTS

5.4.1 Terrestrial environment

Comment 5-11

(page 5-24)

The discussion on environmental impacts to the terrestrial environment should also include an assessment of the Probable Maximum Flood (PMF) berm. The applicants submitted an environmental assessment of the PMF berm, by letter dated February 14, 1978. The assessment indicated that the PMF berm should have no adverse environmental impact on the terrestrial ecological characteristics.

5.4.2 Impacts on the aquatic environment

5.4.2.1 Effects of the heat dissipation system

Thermal effects

Comment 5-12

(page 5-24, paragraph 8)

The discussion of the proposed heat treatment states, "the applicant proposes to heat treat portions of the intake system to remove biological growth (Sect. 3.2.2)." This statement is incomplete since the applicants also propose to heat treat the discharge system. The text should be changed to reflect this point.

Comment 5-13

(page 5-25, paragraph 2)

While the applicants do not agree that the area to be affected by thermal discharges will be greater than previously thought, the applicants do concur that even assuming a larger plume, the impact to the aquatic environment is expected to be minimal and of an acceptable nature.

Fish

Comment 5-14

(page 5-25, paragraph 5)

The applicants agree that cold kills of fish are not likely to occur, but for the reason that the extent of the thermal plume is relatively small, and the difference between the ambient and the induced temperatures is less than the rapid temperature changes that occur naturally.

Comment 5-15

(page 5-25, paragraph 4)

It is stated that, "However, with more area to be influenced by the effluent, more fish potentially will be affected."

This appears to be an oversimplification since the thermal plume will not be uniformly distributed with depth but rather the more buoyant heated water will be on the surface with the bottom water remaining unaffected. This means that an increase in the surface area of the plume would only effect fish species which inhabit the upper water column and no additional effect would be expected for fish associated with the bottom. Fish are not uniformly distributed within the water column and actually exhibit a distribution opposite to that of the thermal plume, that is with a greater concentration of fish associated with the bottom and fewer fish associated with the surface. During the 1976 ETS studies a comparison of surface versus bottom gill net data showed that 88% of the fish were found on the bottom and only 12% in the surface waters. Therefore, the area potentially effected by a larger plume would be only the surface waters, which have a relatively small percentage of the total fish abundance.

Benthic fauna

Comment 5-16

(page 5-25, paragraph 8)
(page 5-26, paragraph 1)

In the discussion of DES reference 11 (Ford, et al., 1976), it is not made clear that effects upon growth and mortality of S. franciscanus, P. ochraceus and R. poulsoni occurred only in the experiment simulating a location 84 meters from the discharge and not at 335 m away.

The applicants recommend that clarification be added to these paragraphs in order that the reader be clearly informed that the effects discussed in the DES were limited to the simulation of the 84 location meter distant from the point of discharge.

Benthic fauna

Comment 5-17

(page 5-26, paragraph 2)

Ambient water temperatures in DES Section 5.3.1 are referenced here but no ambient temperatures are included in that section. As previously noted, in Comment 5-5, maps of these ambient temperatures should be presented.

The ambient temperatures used in the discussion of the assessment of benthic fauna are apparently taken from the staff's mathematical model. The ambient temperatures used are clearly too high, as example, "temperatures potentially as high as 27.8°C (82°F) may occur naturally,..." This is far in excess of actual measurement of natural ambient water for the area.

The maximum surface water temperature reported in the vicinity of San Onofre is approximately 23°C (References (8),(22), (23), (16) and (17)). Mean San Onofre natural surface temperatures for July and August of the past three years are on the order of 19°C and the corresponding bottom temperatures are about 17°C.

University of California Scripps Institution of Oceanography (SIO) data reports entitled "Surface Water Temperatures at Shore Stations - United States West Coast" give mean surface water temperatures at San Clemente pier, five miles North of San Onofre, References (16) and (17)):

Mean Surface water Temperatures at San Clemente

	July	August	September
1977	18.27	20.48	18.53°C
1976	19.59	17.95	19.77
1975	18.58	17.01	17.91
3 year mean	18.8	18.5	18.7°C

With surface temperatures in the 18-19°C range it should further be noted (for benthic assessment) that corresponding bottom temperatures will be even lower: all San Onofre field data support the existence of vertical temperature stratification in depths greater than about 30 feet when surface temperatures are in this range. (see Attachment T).

Comment 5-18

(page 5-26, paragraph 3)

The DES states, "On the basis of the 1977 study[11] the staff concludes that several components of the benthic fauna in the vicinity of SONGS would probably be adversely affected in areas where weekly mean temperatures of 22°C prevail for

one month or more or where daily temperatures reach or exceed 24°C. It is not, however, anticipated that temperatures averaging 22°C will occur for more than 2 to 3 weeks or that the areas experiencing temperatures of 24°C or greater as a result of SONGS operation will be considerably larger than the area experiencing these temperatures under natural conditions."

Based upon historical temperature records between 1975 and 1978 (References (8),(22) and (23)) the use of weekly mean bottom temperatures of 22°C appears to be inappropriate and should be lowered to 17°C.

The applicants recommend, therefore, that the sentence indicating 22°C weekly mean temperature could exist on the bottom for 2 to 3 weeks be changed and that a summary sentence be added to indicate that the components of the benthic fauna previously discussed will not be adversely affected.

Also, the date of DES reference 11 (Ford, et. al.) is 1976, not 1977, as stated in the first sentence of the paragraph.

Kelp

Comment 5-19

(page 5-26, paragraph 5)

The DES states, "Although this deterioration may have been partially a result of overharvesting, much of it is probably caused by the increased alteration of the near-shore environment by human activities. In particular increased temperatures and increased turbidity have been shown to be inimical to kelp survival."

The thermal effects on kelp cited in Phillips (1974) were for naturally occurring events and not as induced by human activities. Man induced thermal effects on kelp have not been demonstrated.

The turbidity comment by Phillips (1974)(Reference (15)) was in reference to work conducted by North (1960)(Reference (12)) on effects of sewage outfalls on kelp health. The type of turbidity generated by a sewage outfall is not equivalent to the surface turbidity which may be associated with a cooling water discharge.

It is recommended that the discussion be changed to reflect that the deterioration may have been partially a result of overharvesting, much of it is probably caused by increased alteration of the near-shore environment by human activities,

in particular, sewage treatment facilities and industrial/ chemical discharges. The toxic element of each discharge has not been isolated to date, i.e., heavy metals, sedimentation, oils, turbidity, etc.

Comment 5-20

(page 5-26, paragraph 6)

The DES states, "Typically, canopy tissue deteriorates during the warmest time of the year leaving the basal portion of the plant (which is in cooler water) for regeneration when temperature and light conditions permit."

It has been documented that kelp deterioration occasionally occurs when (apparently) surface temperatures exceed critical thermal limits. However, it appears that seasonal kelp deterioration may be due to synergistic effects and not just to a thermal component. In the open coast setting, an inverse relation often occurs between temperature and dissolved nutrients. As the temperature increases, the nutrient content often decreases, to or perhaps below levels critical to kelp. Additionally, the highest nutrient concentration is found on the bottom near the basal tissues and the lowest concentration near the surface where most kelp deterioration occurs (Reference (2)).

Other evidence (Reference (13)) implies that when Macrocystis pyrifera is placed in a bay, which are typically much higher in nutrients than found in the open coast, the kelp remains in the healthy state even when the entire plant is subjected to 25-26°C (77-79°F) for extended periods.

At this time, it is not known clearly if temperature, nutrients, and/or other unknown components of the water contribute the most to kelp deterioration. However,there is a possibility of a beneficial effect from Units 2 & 3 operation if outfall upwelling creates a surface nutrient plume that will occasionally come in contact with kelp plants during the warm water months.

It is recommended that the DES be changed to reflect the fact that typically, canopy tissue deteriorates during the warmest time of the year leaving the basal portion of the plant (which is in the cooler water) for regeneration when temperature and light conditions permit; and that reduced surface nutrients and higher bottom nutrient concentrations may contribute to canopy deterioration and basal tissue regeneration, respectively (Reference (2)).

Comment 5-21

(page 5-26, paragraph 7)

The DES states, "It is estimated that the larval, juvenile, and adult stages of 25 main sport fish use kelp beds for refuge and food gathering (eating the associated invertebrates, the kelp itself, or other algae) and the average standing crop of fish is estimated to be 300 kg/ha (300 pounds per acre)."

For many years it was believed that the kelp beds, especially the canopy region, represented spawning and nursery grounds of many sport and forage fish (Reference (1)). No evidence is available to support the therory that the canopy is widely used as a spawning area (Reference (6)). Larvae of a few fishes are found in greater abundance in kelp beds than elsewhere. These include the topsmelt, kelp goby, kelp clingfish and striped kelpfish (Reference (1)); species not considered important sport fish.

Many juvenile fishes inhabit the kelp canopy. However, those of recreational or commercial value are found to be more numerous in rocky areas away from kelp, i.e., kelp bass. The only common juvenile fish that are reported to be at higher concentrations within kelp beds are kelp surfperch, kelp pipefish and kelp clingfish (Reference (1)).

Only one adult species, the kelp clingfish, is considered to be obligate to kelp plants. All other fish species will persist in the environment with or without kelp plants present. Diversity of fish species is not altered significantly by the presence or absence of kelp. A highly varied bottom topography appears to be the most important factor for extensive fish-life and to be of greater significance in this respect than kelp (Reference (14)).

The DES should be changed to reflect the fact the kelp beds do not appear to be spawning grounds, rearing grounds, or refuge areas for recreationally or commercially important fish species (Reference (1) and (14)). Only the kelp clingfish appears to be obligate to kelp beds for survival.

Comments 5-22

(page 5-26, paragraph 8)

The DES states, "Kelp is an important commercial commodity ...harvested yearly at a landed value of $2 million."

The commercial value of kelp is well documented, although, a kelp bed is only considered commercially important when it has: high stand density, extensive areal coverage and close proximity to a commercial harbor. The San Onofre kelp bed does not now nor has it ever met these criteria because of the limited extent of substrate suitable for attachment. The DES should be revised to reflect the fact that the kelp beds in the vicinity of San Onofre are not commercially harvested.

Comment 5-23

(page 5-27, paragraph 2)

The DES states, "It has been rather well established that temperatures above 18-20°C (64-68°F) cause deterioration of kelp, and the degree of degradation is directly related to the duration of exposure to these temperatures. Increased surface temperatures caused by SONGS operation (all three units) would have the effect of extending the period of canopy absence. During the hottest time of the year, data in Section 5.3.1 suggests that the closest kelp bed (San Onofre bed) will experience an average surface temperature increase (over a 24-hour period) of 1.4°C (2.6°F); the range of temperature increase will be 0.6-2.2°C (1-4°F)."

The statement in Reference (15), of 18-20°C (64-68°F) thermal exposure causing kelp deterioration was based on comments made in Reference (12), which refers to the colder water variety of kelp found near Monterey, California. For kelp plants located in southern California waters, the critical thermal maximum is more in the range of 20-22°C (68-72°F) (Reference (21)).

During the warm water months of the year, data in Section 5.3.1 suggests that the closest kelp bed (San Onofre bed) will experience average surface water temperatures increases due to the operation of SONGS of less than 0.6°C (1°F); the range of temperature is 0-0.9°C (0-1.5°F).

Temperatures taken in the vicinity of San Onofre between July and September over a three year period show a range of averages of 18.5 to 18.8°C (65.3-65.8°F) for the surface waters (References (16) and (17)). Clearly, the predicted maximum temperature increase of 0.9°C from plant operation when added to the ambient temperature in the vicinity of San Onofre of 18.8 C will not exceed the critical thermal limits established by North. The DES should be revised to reflect this fact.

Comment 5-24

(page 5-27, paragraph 3)

The DES states, "Although daily natural temperature variations of 1°C (2°F) are not uncommon in the area (ER page 2.2-28) they would not be continuous in nature and would thus not affect the bed as severely as the continuous SONGS discharges would. Prediction of the degree to which canopy disappearance would be prolonged is impossible. Regeneration would be quicker in years with naturally cooler ocean temperatures, assuming the regenerative tissues remain unaffected (see below)."

The operation of SONGS 1, 2, and 3 will not have a continuous effect on the San Onofre kelp bed. Power plant thermal discharges will contribute no more than 0.9°C surface temperature increases to the kelp bed and thus will only occur with downcoast currents. The more recent current meter data, as discussed in Comment 5-6 must be considered in regard to this kelp section. It is seen from these data that summer upcoast currents, which would result in no kelp bed plume impingement, occur during approximately half of the summer season. Further, the increase in temperature will be dependent on the strength and duration of the current. Increased surface temperatures due to the operation of SONGS 1, 2 and 3 will always be less than the measured natural surface temperature variations of the area, and will be sporadic.

The staff is requested to revise the DES to reflect the fact that increased nutrients brought to the kelp bed surface waters by outfall induced upwelling may help resist the natural seasonal canopy deterioration and provide beneficial effects from station operation when an outfall induced nutrient plume drifts over the kelp bed during warm water months.

Comments 5-25

(page 5-27, paragraph 4)

The DES shows ambient bottom temperatures in July reaching as high as 23-24°C (74-76°F) with temperature of 22-23°C (72°F and 73°F) for a week at a time. These temperatures are the outcome of the staff mathematical model (DES Section 5.3.1) and are an inaccurate representation of existing natural conditions occurring at San Onofre. Applicants' Comment 5-17 suggests that a bottom temperature of 17°C (63°F) is a more realistic representation.

Also, this section references DES Section 5.3.1 as a basis for a typical bottom temperature range of up to 19°C (66°F) in August and September, however, these referenced temperatures are not found in DES Section 5.3.1. Such a temperature appears to represent more adequately the extreme or high end of the range of summer bottom temperatures at San Onofre. As indicated above, an appropriate representation of a monthly or weekly mean bottom temperature would be 17°C (63°F).

Comment 5-26

(page 5-27, paragraph 4)

The DES states, "...a several week period could exist in which temperatures exceed 19°C."

Results of the applicants' thermal analysis demonstrates that the temperature increase at the bottom in the San Onofre kelp bed will be much less than 0.6°C (1°F) under any current condition. Under most conditions it is predicted that there will be no increase in bottom temperature in any portion of the kelp bed. Bottom temperatures measured at San Onofre during July and August over a three year period show a range of averages of 12-18°C (55-64°F). The addition of less than 0.6°C (1.0°F) to measured ambient temperatures should have no adverse effects to kelp basal tissues from which the canopy is regenerated annually.

Comment 5-27

(page 5-27, paragraph 5)

This paragraph summarizes the staff's conclusions that, based on assumed natural bottom temperatures of 21.5 - 24°C (71 - 75°F) and bottom temperature increases in the San Onofre kelp bed of 1 - 1.5°C (2 - 3°F) due to operation of Units 1, 2 & 3, damage to the kelp basal tissue might result if slack currents occur for several days. Further, if this scenerio occurs frequently, the bed might not recover fully, resulting in long term damage. While the staff admits this is unlikely, it recommends additional extensive monitoring of the San Onofre kelp bed.

It is the applicants' conclusion that an assessment based on appropriate ambient bottom temperatures (17°C or 63°F) derived from actual field data, and temperature increases recognizing that the thermal plume will be stratified (0.6°C/1.0°F maximum) will yield a conclusion that damage to basal tissues will not occur, even under worse case conditions. Also, there is no evidence to support the use of an assumption that a condition of several days of slack current will ever occur, or that it would occur frequently. The applicants believe that the proper conclusion to be drawn from the relevant data is that the operation of San Onofre Units 1, 2 & 3 will have no significant adverse effects on the San Onofre kelp bed.

The greatest adverse effect which could be expected is a slight prolongation of the natural summer surface canopy deterioration period which does not effect the basal tissues or the regeneration of the kelp in the fall.

Based on the above evaluation, the extensive monitoring recommended by the staff is not justified, and monitoring presently being accomplished is sufficient to assess potential effects of San Onofre Units 1, 2 & 3. Specific comments on the monitoring are contained in Comment 6-3.

5.4.2.1 Turbidity and Sediment Transport Effects

Comment 5-28

(page 5-27, paragraph 6)

The DES is deficient in that it fails to substantiate the assertion that larger thermal plumes directly imply larger turbid plumes.

Comment 5-29

(page 5-28, paragraph 1)

The DES states, "The effect on the kelp would potentially be decreased photosynthesis, possibly causing many of the plants to die if the exposure is continuous (a 1% increase in the absorption coefficient has been found to result in a 20% loss in net photosynthesis at 15m)[13] and burial of the holdfasts in particles which settle out, inhibiting regeneration and recolonization. Regardless of the magnitude of these effects, their presence would add to the probability that the kelp bed would be adversely affected (see preceding section)".

As discussed in Comment 5-24, the plume from SONGS 1, 2 and 3 will not have continuous contact with the San Onofre kelp bed.

Reductions in photosynthesis from power plant induced turbidity has not been demonstrated. The net reduction in photosynthesis referred to by Phillips (1974)(Reference (15)) , was based on work by North (1958)(Reference (18)) . The model (computation) was based on a uniform dispersal of light absorbtive material throughout the water column. This model was designed for the turbidity generated by a sewage outfall. For thermal diffusers, there would be an uneven distribution of natural turbidity and the equation does not apply.

Sewage outfalls generate a substantial amount of turbidity that is dispersed throughout the water column. A thermal outfall does not create turbidity, but rather, can occasionally redistribute portions of a naturally occurring dense bottom turbid layer to the surface. Therefore, there is no net gain in the amount of suspended matter in the water. The major effect is that the turbidity on such occasions can be seen on the surface. Further, the turbid plume characteristics sometimes experienced at Unit 1 should not be applied to Units 2 and 3.

A surface plume can be seen at Unit 1 when the surface waters are relatively clear and the bottom water is turbid. The intake and outfall withdraws and upwells, respectively, portions of the bottom turbid layer and pumps it to the surface. The bottom turbid layer qualitatively appears to be essentially a nearshore phenonemon that is generated from wave agitated bottom sediments. Units 2 and 3 outfalls are located in deeper and clearer ocean waters, although the intakes are at a depth comparable with Unit 1. It is predicted that on occasions when naturally occurring turbidity is present the Units 2 and 3 intakes will withdraw turbid bottom water like Unit 1, however, the Units 2 and 3 outfalls will be upwelling clearer bottom waters. Additionally, Units 2 and 3 effluent will be initially diffused through 63 ports each and then mixed with the receiving water at an estimated ratio of 10:1 (Unit 1 dilution ratio is approximately 3:1). Given the situation of clearer water at the outfalls and increased mixing of effluent, it is predicted that a turbid plume will not normally be detected.

In terms of effects, Unit 1 can be viewed as potentially creating more severe effects than Units 2 and 3, i.e., single port outfall and reduced mixing (3:1). The environmental evidence indicates that there is no adverse impact on benthic faunal or floral groups near the outfall. In fact, results from the Environmental Technical Specifications benthic program demonstrate that the fauna and flora near the Unit 1 outfall are more abundant than those from the control station (References (8), (9) and (10)).

No relationship has been established between a turbid plume and thermal plume. The factors that influence the intensity and extent of each constituent are different and may not be interrelated.

The applicants' conclusions are that a turbid plume emanating from Units 2 and 3 operation may occur under certain oceanographic conditions, however, it should be less intense than observed at Unit 1 because (1) of increased mixing of the discharge and (2) the diffusers are located in deeper, clearer waters. Environmental Technical Specifications benthos study results show that redistributing a natural turbid layer has no adverse effects on faunal and floral groups for Unit 1 (References (8), (9) and (10)). Therefore, no adverse effects on faunal or floral biota are predicted.

Entrainment

Comment 5-30

(page 5-29, paragraph 2)

The DES states, "The staff's analysis of entrainment effects in the FES-CP remains valid (FES-CP, p. 5-7 to 5-12). A program on the mortality experienced by entrained ichthyoplankton is being planned currently at SONGS 1 and is expected to be submitted to the NRC staff in December, 1978, for approval."

Refer to (applicants' Comment 6-5).

Impingement

Comment 5-31

(page 5-29, paragraph 4)

The DES states, "The majority of the fish impinged at SONGS 1 are anchovy,..."

A review of last three years (1975-1977) of ETS in-plant impingement monitoring reveals that the Queenfish, Seriphus politus has been the most predominant species impinged at Unit 1 in terms of both numbers and weight.

Entrainment of anchovy has been sporadic and shows occasional high numbers entrapped probably reflecting the schooling behavior of the species. Early impingement information (pre-ETS-1975) indicating high impingement of anchovy may have been biased by a combination of sampling frequency and these chance occurrences.

It is recommended that the word anchovy be replaced with "Queenfish" to reflect the most recent data available. This change does not effect the overall assessment result indicating no significant effect on recreational or commercial fishing resources.

Offshore Current Induction

Comment 5-32

(page 5-29 paragraph 5)

The applicants agree that there are no detrimental effects of induced circulation on the aquatic environment. However, the discussion of the analysis in the DES concerning the effects of the induced circulation on the aquatic environment should mention that the analysis is based on the diffuser design described in Section 3.4 of the ER-OLS and Section 9.2 of FSAR.

5.5 RADIOLOGICAL IMPACTS

Comment 5-33

(page 5-33, Table 5.4)

Table 5.4 of the DES shows calculated annual doses nearly a factor of 3 greater than the values provided by the applicants in Table 5.2-12 of the Environmental Report - Operating License Stage (ER-OLS). The doses shown in Table 5.2-12 of the ER-OLS were calculated using annual average meteorology.

It appears that the staff has used short term 15th percentile meteorology (valid only for purge releases instead of continuous long-term releases) in calculating the doses shown in Table 5.4 of the DES. The staff is requested to revise the doses consistent with Table 5.2-12 of the ER-OLS.

Comment 5-34

(page 5-34, Table 5.6)

Table 5.6 of the DES shows that the dilution factor used for the dispersion of liquid release is 1. However, Section 5.2.4.3 of the applicants' Environmental Report-Operating License Stage (ER-OLS) shows that the dilution factor is 10 between 0-10 miles and 12.5 between 10-50 miles. The values reported by the applicants were derived consistent with Regulatory Guide 1.112.

The staff is requested to revise the values in Table 5.6 of the DES to be consistent with the dilution factors shown in Section 5.2.4.3 of the ER-OLS.

5.6 SOCIOECONOMIC IMPACTS

5.6.1 Introduction

Comment 5-35

(page 5-40, paragraph 8)

The second sentence should read:

"The central portion of Orange County ...".

5.6.5 Impact on recreational resources

Comment 5-36

(page 5-44 and 5-45)

The NRC staff concludes in this section and other sections (5.6.5, 9.1, 10.5, and 10.7) of the Draft Environmental Statement (DES), that the applicants' current plan to restrict the public use of the beach in front of the San Onofre Nuclear Generating Station, within the exclusion area, is a significant cost of the project unanticipated at the issuance of the construction permit. Applicants disagree with the conclusion that there will be any significant loss of recreation area.

Subsequent to the issuance of the Final Environmental Statement (FES) required for the construction permits of SONGS 2 and 3, the ASLAB in its initial decision dated December 24, 1974 (ALAB-248) questioned whether recreational activities within portions of the exclusion area should be permitted, and the adequacy of the applicants' authority to control activities in the exclusion area. By Decision dated April 25, 1975 (ALAB-268) the ASLAB ruled that the applicants' authority to control activities within the exclusion area was insufficient and remanded the issue for further hearing.

On October 10, 1975, the applicants submitted Amendment No. 22 to the PSAR consisting of information concerning a proposal for a reduced exclusion area. Amendment No. 22 also provided estimates of the number of persons anticipated within the proposed reduced exclusion area. Applicants' experts estimated the maximum number of persons within the proposed reduced exclusion area would be 31.

The NRC Staff evaluated applicants' assessment of potential beach use as provided in Amendment No. 22 to the PSAR and concluded that applicants' estimates of the maximum number of people on the beach or in the water within the proposed reduced exclusion area were conservative.

The ASLAB Memorandum of Order dated January 22, 1976 (ALAB-308) resolved the issue concerning authority to control activities within portions of the new reduced exclusion area landward of the mean high tide line in the applicants' favor. However, the Board declined to deal with the question concerning the tidal beach and remanded this issue to the ASLB.

The ASLB held hearings on May 19-21, 1976, at which time evidence was heard on several issues concerning the tidal beach, including the anticipated public use of the beach.

Applicants' expert witnesses provided testimony regarding activities within the beach areas in the vicinity of the San Onofre Nuclear Generating Station and the projected number of persons that would be anticipated within the reduced exclusion area. With respect to activities within the beach areas, applicants' expert witness indicated that distances from parking and beach access points to the area in front of the station are such that there will be a low level of activity on beaches within the reduced exclusion area as compared to other beach areas in the San Onofre State Beach because beach users tend to remain relatively close to their point of beach access. With respect to the projected number of persons within the reduced exclusion area, the applicants' expert witness conservatively assumed the total number of persons which could ultimately be accommodated by all park facilities developed to their planned ultimate capacity would occupy the beach at the same time. Based upon a probabilistic distribution of that population , an estimated 35 persons would be located within the reduced exclusion area. Further, based upon actual observations of persons using the San Onofre State Beach, in addition to similar observations on other beaches, it was predicted that the average and maximum number of people using the beach in front of the station, within the exclusion area, would be 7 and 31, respectively.

NRC Staff supported the applicants' contentions and indicated in both written and oral testimony that the area directly in front of the plant was the least desirable both from an aesthetic point of view and for swimming, surfing or sunbathing, and also indicated that when one is laden with beach blankets and other recreational gear, migration up or down the beach would be discouraged, therefore, beach users would congregate relatively close to the paths up the bluffs of the San Onofre State Beach.

ASLB Order dated January 6, 1977, ordered applicant to provide all data collected since March 14, 1976, reflecting the actual daily count of persons using the beach within the applicants' exclusion area, including the tidal beach. Oral Arguments were held on February 1, 1977, during which the applicants' provided an analysis of the daily counts previously submitted to the ASLB. That analysis showed less than 10 persons were observed on the beach in the exclusion area for approximately 57.6 percent of the time, and that, on the average, only 12 to 15 percent of the total number of people observed in the study area (area in front of the station and adjacent areas 1/4 mile north and 1/4 mile south) were in the exclusion area. There was a peak number of 108 persons observed in the exclusion area, however, the 108 persons (40 percent stationary, 19 percent in transit, 20 percent swimming, and 21 percent surfing) represent about 36 percent of the total number observed in the study area. It should be noted that the administrative features proposed in Amendment 22 will only effect stationary persons within the exclusion area. Transit through the exclusion area as well as activities below the mean high tide line such as, swimming, fishing and surfing will remain unrestricted.

The ASLB Initial Decision dated May 20, 1977, ruled in the applicants' favor ordering that the Construction Permits shall be continued in effect.

Given the following facts that:

1. The conclusions drawn by the NRC staff in the DES appear to be based upon the Final Environmental Statement Construction Permit Stage.

2. The ASLAB and ASLB have given detailed consideration, in hearings, regarding usage of the beach in front of the San Onofre Nuclear Generating Station within the exclusion area.

3. The applicants provided expert testimony supporting the fact that the beach in front of the station was the least desirable from the standpoint of aesthetics for swimming, surfing or sunbathing and does not receive significant usage and that people tended to congregate near the paths of the state beach away from the exclusion area.

4. The staff supported the applicants' contention regarding minimal beach usage and undesirability of the beach in front of the station.

In view of the above, the appropriate sections of the DES should be revised to conclude that limiting the use of the beach within the exclusion area boundary and above the mean high tide line to a passage way does not represent a significant loss of recreational space.

6. ENVIRONMENTAL MONITORING

6.2 PREOPERATIONAL MONTIORING PROGRAM

Comment 6-1

(page 6-2, Fig. 6.1)

The legend is in error, the triangle symbol should represent DO, pH and Heavy Metals. The square symbol should represent continuous temperature.

6.2.1.5 Intertidal Organisms

Comment 6-2

(page 6-3, paragraph 5 and 6)

The monitoring described in the first paragraph was a requirement for Unit 1 which was deleted in September, 1977, because no effects had been detected. Although this study has been deleted as a requirement, SCE has continued an intertidal study program somewhat reduced in scope. The applicants contend continued conduct of this present cobble intertidal sampling program as described below will meet the objectives outlined in the second paragraph of Section 6.2.1.5 of the DES.

The applicants recommend replacing the existing paragrpah with the following paragraph:

"Although not a required component of the monitoring programs, quarterly observations are made along cobble intertidal transects at four monitoring stations and one control station. Predominant macroscopic species and substrate composition are identified and enumerated within three permanent 0.25m^2 (2.69-$ft.^2$) quadrats along a line perpendicular to the beach. Photographs are also taken of each quadrat for a permanent record of ecological changes."

6.2.1.6 Requirements

Comment 6-3

(page 6-3, requirement 2)

The staff requires extensive monitoring of the San Onofre kelp bed based on predictions made in Section 5.4.2.1.

Kelp investigations are currently in progress with the Construction Monitoring Program, which is a special study of the Preoperational Monitoring Program. Detailed methods are outlined in Reference (11). A brief outline of the scope of effort, at all three San Onofre region beds, is as follows:

1. Three benthic stations are located in and about the San Onofre kelp bed and one each at Barn kelp and San Mateo kelp. Stations are quantatively assessed quarterly.

2. Kelp canopies and rock substrate are mapped for areal extent on a quarterly basis.

3. Water nutrient analysis for ammonia, nitrates, nitrites and phosphate taken monthly at all three beds. Water samples are taken for the surface and bottom from within each bed and offshore of each bed. An additional offshore station serves as a monitoring area for upwelling.

4. Kelp tissue analysis for nutrient content is conducted on a monthly basis at all three kelp beds. Each leaf is analyzed for nitrogen content.

5. Assessments of the health of kelp plants in the San Onofre region beds are made on a quarterly basis. Parameters assessed include: success of juvenile recruitment, density of kelp plants, amount of encrusting organisms and grazing by herbivores and abundance of senile and diseased plants.

Based upon the applicants' extensive comments dealing with the predicted impact of the San Onofre thermal plume on the San Onofre kelp bed, the applicants contend that requirement number 2 in Section 6.2.1.6 is unwarranted and should be deleted.

6.3.1 Water quality monitoring program

Comment 6-4

(page 6-6)

The entire section is in error and should be deleted. The program that the staff discusses in the DES is actually a 1976 draft of the applicants' proposed preoperational oceanographic program. An operational program for San Onofre 2 and 3 has not yet been established.

6.3.3 Aquatic biological monitoring

Comment 6-5

(page 6-7, paragraph 2)

This paragraph states, "The applicant intends to forward a description of the study with a schedule for completion to NRC by December, 1978, (see ER, Suppl. 1, p. S1-31)."

In keeping with efforts to avoid duplication and utilize the 316(b) study results, the study plan submittal to the NRC will be made after the completion of the methods development phase of 316(b). We presently anticipate that the 316(b) method development phase will be completed in early 1979, and, therefore, the study plan should be submitted to the NRC by mid-1979.

6.3.3 Aquatic biological monitoring, and

6.3.5 Requirements for Environmental Technical Specifications

Comment 6-6

(page 6-6 and 6-7)

The DES states in Section 6.3.3, paragraph 2 and in requirement number 3, Section 6.3.5, that "...the ichthyoplankton study now being conducted and the required

kelp preoperational program should be continued during operation of the facility until such time as it is possible to state credibly that no significant impacts result from the facility."

The ichthyoplankton study being conducted is a one year program to provide a baseline for comparison with the operational ichthyoplankton study which is also envisioned to be a one year program. Further, as stated in applicants' Comment 6-4, the required kelp preoperational program is considered to be unwarranted and the requirement should be deleted.

8. NEED FOR THE STATION

8.2 APPLICANT'S SERVICE AREAS AND REGIONAL RELATIONSHIPS

8.2.1 Applicant's service areas

Comment 8-1

(page 8-1, paragraph 2)

The reference number used in the discussion appears to be incorrect.

8.3 BENEFITS OF STATION OPERATION

8.3.1 Minimization of production costs

Comment 8-2

(page 8-3, Table 8.1)

Table 8.1 was derived from the applicants' ER-OLS, Table 1.1-3 and page S.2-188. However, the data found on ER-OLS Table 1.1-3 is not the most current for 1976 and will be updated in a future amendment to the ER-OLS. The applicants have revised Table 8.1 of the DES to reflect changes in data as reported to the Federal Power Commision on Form 1, Annual Operating Report for Southern California Edison Company for the year ending December 31, 1976.
(Revised Table 8.1 (Attachment X))

8.3.2 Energy demand

Comment 8-3

(page 8-4, paragraph 2)

The discussion on the overestimation of peak demands in the 1973 forecast should also mention load management programs. The applicants suggest the last sentence be rewritten as follows:

> "These peak demands were overestimated because the 1973 forecast did not foresee the Arab oil embargo, the following period of economic recession, the nationwide effort to promote energy conservation, and load management."

Comment 8-4

(page 8-4, paragraph 3 and Table 8.3)

The staff's evaluation is based on the 1976 forecast data provided by the applicants in their ER-OLS. The data found on ER-OLS Table 1.4-1[a] is based on an early 1976 forecast and does not reflect the revised forecast (July 23, 1976) data found on ER-OLS Table 1.1-1. SCE has revised Table 8.3[b] of the DES based on ER-OLS Table 1.1-1 and their revised 1976 forecast. The last line in the second paragraph has been changed by the applicants to be consistent with the revised data and reads as follows:

> "SCE's revised 1976 forecast shows a peak demand growth rate of 3.9% from 1976 to 1985, and energy requirements are expected to experience a growth rate of 4.3% in the same period."

a. ER-OLS Table 1.4-1 will be revised in a future amendment to the ER-OLS.

b. Revised Table 8.3 (Attachment Y).

Comment 8-5

(page 8-5)

The discussion of the three forecasts that states, "their projections do not reflect non-price-induced conservation...," this does not consider current SCE forecast methodology. Non-price-induced standards were incorporated into SCE's peak demand forecasts, e.g., the peak demand for 1985 includes a 2.4% reduction due to load management and the "weather sensitive demand" for 1985 was reduced 29% because of building insulation and air conditioning efficiency standards (Reference 19 and 20). Therefore, the discussion on page 8-5, specifically paragraphs 1, 3 and 4 should be modified.
(see Attachments Q and R)

10. BENEFIT-COST SUMMARY

10.2 BENEFITS

Comment 10-1

(page 10-1, paragraph 2, and page 10-2, Table 10.1)

The net power output for each unit is estimated to be in the range of 1052 to 1106 MWs (see Comment A-1 for discussion). The regional generating capacity will be increased 2104 to 2212 MWe with the addition of Units 2 and 3. The discussion on the primary benefit and Table 10.1 should be revised to reflect the estimated net power output.

10.7 SUMMARY OF BENEFIT-COST

Comment 10-2

(page 10-3, item (2))

The "possible destruction of at least a portion of the San Onofre Kelp Bed during summer months by the heated water discharge" is listed as an additional environmental cost. Because this cost is based on an assessment performed by the staff using disputed data, the applicants request that this cost be deleted if the reassessment of Section 5.4.2.1 Effects of the heat dissipation system warrants such a change.

REFERENCES

1. Feder, H. M., C. H. Turner and C. Limbaugh. 1974. Observations on Fishes Associated with Kelp Beds in Southern California. California Department of Fish and Game, Fish Bull. (160): 1-144.

2. Jackson, G. A., 1977, Nutrients and production of giant kelp, Macrocystis pyrifera, off Southern California. Limnol. Oceanogr. 22(6) 979-995.

3. Koh, R.C.Y. and List, E. J. Further Analysis Related to Thermal Discharges at San Onofre Nuclear Generating Station. Report to Southern California Edison Company, Sept. 30, 1974, 116 p.

4. Koh, R.C.Y. Estimation of Drift Flow at San Onofre. Memorandum to SCE, June 12, 1978, 23 p.

5. Koh, R.C.Y., Brooks, N. H., List, E. J. and Wolanski, E. J. Hydraulic Modeling of the Outfall Diffusers for the San Onofre Nuclear Power Plant. Tech. Rept. KH-R-30, W. M. Keck Laboratory of Hydraulics and Water Resources, California Institute of Technology, Pasadena, California, January 1974, 168 p.

6. Limbaugh, C., 1955, Fish Life in the kelp beds and the effects of harvesting. Univ. California Inst. Mar. Res., IMR Ref. 55-9:1-158.

7. List, E. J. and Koh, R.C.Y. Interpretations of Results from Hydraulic Modeling of Thermal Outfall Diffusers for the San Onofre Nuclear Generating Plant. Tech. Rept. KH-R-31, November 1974, 90 p.

8. Lockheed Center for Marine Research (LCMR). 1976. San Onofre Nuclear Generating Station Unit 1, Annual Analysis Report, Environmental Technical Specifications. Prepared for Southern California Edison Company, 257 p.

9. Lockheed Center for Marine Research (LCMR). 1977. San Onofre Nuclear Generating Station Unit 1, Environmental Technical Specifications, Annual Operating Report, Volume IV - Biological Data Analysis - 1976. Prepared for Southern California Edison Company, 257 p.