MASTER

COMMISSION DECISION

ON THE

NORTHERN CALIFORNIA POWER AGENCY'S

APPLICATION FOR CERTICATION FOR GEOTHERMAL PROJECT NO. 2

79-AFC-2

MARCH 1980

CALIFORNIA ENERGY COMMISSION

P800-80-006

DISCLAIMER

STATE OF CALIFORNIA
ENERGY RESOURCES CONSERVATION
AND DEVELOPMENT COMMISSION

In the Matter of:	
Application for Certification of the NORTHERN CALIFORNIA POWER AGENCY'S GEOTHERMAL PROJECT NO. 2	Docket No. 79-AFC-2 DECISION (revised)

The Commission's Decision in the above-captioned matter consists of the narrative in the proposed "Final Decision" as amended, including the Findings and Conclusions contained therein, Appendices A, B, and C thereto, as amended, and the environmental mitigation measures specified in the Final Joint Environmental Study, as amended.

The Commission directs that the Executive Director transmit a copy of this Decision and appropriate accompanying documents to all persons and agencies as specified under Section 25537 of the Public Resources Code and Section 1768 of the Commission's regulations.

The Commission further directs the Executive Director to ensure that the provisions of Public Resources Code Section 25703 are complied with within four (4) months of the date on which this Decision is final. This Decision shall be final following signature by voting members of the Commission upon filing with the Commission Secretariat.

Finally, the Commission directs the Staff to take the measures necessary to achieve final execution of the "Letter of Understanding" with the United States Geological Survey regarding post-licensing duties and responsibilities contained in Appendix B of the proposed

Final Decision, as amended. Following execution, this agreement will be incorporated into the final post-certification compliance monitoring program.

The Application for Certification in this matter is APPROVED, provided that the measures and criteria as contained in Appendices A, B, and C, as amended, and the environmental mitigations required in the Final Joint Environmental Study, as amended, are implemented.

ENERGY RESOURCES CONSERVATION
AND DEVELOPMENT COMMISSION

RUSSELL L. SCHWEICKART,
Chairman and Committee Member

RONALD D. DOCTOR,
Commissioner

C. SUZANNE REED,
Commissioner and Presiding Member

EMILIO E. VARANINI, III,
Commissioner

JAMES A. WALKER,
Commissioner

DATED: March 12, 1980

* * * * * FINAL JOINT ENVIRONMENTAL * * * * *
STUDY AMENDMENTS

Following are the Amendments to the Final Joint Environmental Study as considered and certified by the Commission:

Page III-23	delete Table III-8 and insert instead attached Table III-8.
Page IV-2	second mitigation measure, second sentence, delete "Following additional..." through "...and evaluation..." and insert instead "NCPA has conducted on-site geotechnical investigations and evaluation; as a result...".
Page IV-13	third mitigation measure, second line, delete "within 24 hours of ..." and insert instead "immediately after ...". third mitigation measure, third line, delete "30" and insert instead "14".
Page IV-16	second mitigation measure, first line, begin sentence with: "The first one-half inch of rainfall ..." and continue with sentence from "...entering the Stretford process...".
Page IV-26	first mitigation measure, delete second sentence beginning with "This management plan ..." and ending with "...of wildlife habitat."
Page IV-52	replace fourth mitigation measure beginning with "Shell's control valves..." and ending with "...by the NSCAPCD" and insert instead: "Shell's automated control valve system will be capable of reducing steam flow to the 22kg/hr maximum limit imposed by the Northern Sonoma County APCD, during any stacking condition (refer to Appendix E for Determination Compliance). CEC staff believes that this level of H_2S emissions is adequate to keep ambient air quality impacts from occuring during stacking conditions, in compliance with the NSCAPCD's New Source Review regulations and the H_2S ambient standard."

TABLE III-8: WATER QUALITY OF BIG SULPHUR AND LITTLE SULPHUR CREEKS, BEFORE FLOWING THROUGH THE GEYSERS FIELD

Parameter	Units	Big Sulphur Creek						Little Sulphur Creek		
		BS 17.8			BS 18.7			LS 13.3		
		May	June	July	May	June	July	May	June	July
Date	---	5/12	6/8	7/12	5/13	6/8	7/12	5/12	6/10	7/12
Time	---	--	1805	1150	--	1705	1025	--	1620	1545
Air Temperature	°C	11.7	26.5	18.8	28.3	31.2	19.5	24.4	25.8	26.0
Water Temperature	°C	14.6	22.5	20.5	20.3	25.5	18.2	15.2	22.8	20.5
Stream Flow	cfs	--	6.9	6.8	--	--	--	7.5	2.0	1.7
Total Coliform	MPN/100 ml[2]	93	460	64	--	--	—	3.6	43	460
Turbidity	JTU	<1	<1	<1	<1	<1	<1	<1	<1	<1
Color	APHA	<5	--	--	<5	--	--	<5	--	--
pH	---	8.0	8.0	8.0	8.2	8.7	8.2	8.1	8.0	8.2
Alkalinity	mg/liter	124.2	151.0	156.4	128.2	162.2	160.6	127.0	131.0	126.5
Settleable Solids	ml/liter	<0.1	--	--	<0.1	--	—	<0.1	--	--
Residue, Filtrable	mg/liter	20	--	--	10	--	—	10	--	--
Residue, Non-filtrable	mg/liter	0	--	--	0	--	—	20	--	--
Residue, Total	mg/liter	20	--	--	10	--	—	30	--	--
Boron	mg/liter	6.0	--	16.0	12.0	--	17.0	4.0	--	14.0
Carbon, Total organic	mg/liter	21.0	--	--	5i	--	—	31	--	--
Nitrogen, Total	mg/liter	0.1	--	--	0.1	--	—	0.1	--	--
Nitrite Nitrogen	mg/liter	<0.01	--	0.13	<0.01	--	<0.01	<0.01	--	<0.01
Nitrate Nitrogen	mg/liter	0.3	--	0.45	0.3	--	0.35	0.25	--	0.20
Ammonia Nitrogen	mg/liter	0.10	0.10	0.14	<0.1	0.1	<0.1	<0.1	0.18	<0.1
Ammonia, Un-ionized	mg/liter	0.01	0.01	0.01	—	0.02	—	--	0.01	--
Oxygen, Dissolved	mg/liter	9.3	7.3	9.6	9.5	7.4	9.6	9.2	--	8.6
Sulfates	mg/liter	31.0	20.5	27.0	17.0	21.0	27.0	8.0	10.5	8.0
Hydrogen Sulfide	mg/liter	<0.02	--	--	<0.02	--	—	<0.02	--	--
Chlorine, Free	mg/liter	--	--	<0.1	—	--	<0.1	--	--	<0.1
Chlorine, Total	mg/liter	--	--	0.15	—	--	0.1	--	--	<0.1
Chlorinated Hydrocarbons:										
Heptachlorepoxide	µg/liter	--	--	--	0.002	--	—	0.004	--	--
Unknown metabolite similar to above	µg/liter	--	--	--	0.002	--	—	0.004	--	--
Chromium	µg/liter	<0.2	--	--	<0.2	--	—	0.65	--	--
Copper	µg/liter	0.50	<0.05	--	0.10	2.0	—	0.20	<0.05	--
Zinc	µg/liter	<3	--	--	<3	--	—	<3	--	--
Arsenic	µg/liter	2.5	5.3	0.5	3.5	3.0	0.9	2.5	2.0	0.9
Selenium	µg/liter	<1	--	--	<1	--	—	<1	--	--
Bromine	mg/liter	1.0	--	--	0.5	--	—	1.0	--	--
Silver	µg/liter	<0.02	--	--	<0.02	--	—	<0.02	--	--
Cadmium	µg/liter	0.35	--	--	0.25	--	--	0.10	--	--
Mercury	µg/liter	1.02	0.55	1.90	1.13	5.45	116.0	5.64	0.30	<0.02
Lead	µg/liter	4.5	--	--	3.0	--	--	1.5	--	--
Cyanide	mg/liter	<0.05	--	--	<0.5	--	—	<0.5	--	--
Oil	mg/liter	<10	--	--	<10	--	--	<10	--	--

* values not reliable below 0.01 mg/liter.
** values not reliable below 0.02 ug/liter.
1 computed as per Spotte, 1973
u undetectable

Source: THE EFFECTS OF GEOTHERMAL ENERGY UTILIZATION ON STREAM BIOTA AND WATER QUALITY AT THE GEYSERS, CALIFORNIA - FINAL REPORT 1975 PARAMETRIX, INC.

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PROLOGUE

This Final Decision represents the culmination of a regulatory process that began on August 11, 1978. On that date the Applicant, the Northern California Power Agency (NCPA), filed a Notice of Intention (NOI) which commenced Commission review of the proposed Geothermal Project No. 2. The Commission approved the NOI on March 14, 1979 and on April 4, 1979 NCPA filed an Application for Certification (AFC) of its proposed project.

In the intervening months the Commission has reviewed NCPA's Geothermal Project No. 2 for its public health and safety, environmental, and economic impacts. The 1979 Biennial Report states that the Commission "...will continue to certify the maximum number of geothermal sites and facilities that demonstrate reasonably mitigable environmental impacts and that meet existing air and water quality standards" (p. 100). In the Commission's view, this project has met this test. By certifying the NCPA Geothermal Project No. 2, the Commission has also met with the basic mandate of the Warren-Alquist Act by protecting environmental quality while providing additional thermal electric generating capacity for California's needs.

The NCPA Geothermal Project No. 2 has created several "firsts" in Commission regulatory proceedings. It is the first power plant which will be constructed on Federal lands in the Geysers Known Geothermal Resource Area (KGRA); it is the first Geysers KGRA power plant which has been subjected to joint Federal-State environmental review; it is NCPA's first independently owned and operated generating facility; and it is the first Geysers KGRA power plant to make co-use of the geothermal resource with Pacific Gas and Electric Company.

The text of the Decision follows in narrative form, with the Commission reaching only the ultimate Findings and Conclusions required by the Public Resources Code. This is somewhat of a departure from former Commission NOI and AFC decisions which relied heavily on extensive and detailed Findings and Conclusions. However, in using the present format, the Commission seeks to avoid undue repetition of matters covered during the NOI, AFC, and joint Federal-State environmental review processes which are part of the public evidentary record, and focus instead on a clear, brief, and understandable explanation of the reasons salient to this Decision. In order to further the concept of an integrated decision-making process, the Commission has incorporated by reference the specific mitigation measures contained in the Final Joint Environmental Study. Additionally, two of the concerns crucial to certification and construction of this project - implementation of the mitigation measures and the monitoring necessary to assure compliance with applicable standards, ordinances and laws - are delineated in attached Appendices. Thus, these elements of the Commission's decision are readily retrievable for future reference and review.

THE FINAL DECISION

The Public Resources Code phrases the duties placed upon the Commission in the exercise of its exclusive power plant siting authority in both the affirmative and the negative. On the one hand, the Commission is required to affirmatively examine various aspects of a proposed project such as its impacts upon public health and safety; on the other hand, the Commission is proscribed from certifying a proposed project unless it finds compliance with applicable statutory provisions such as Federal and State air quality laws. The Commission's regulations amplify the statutory directives, and policy considerations such as those contained in the recently adopted 1979 Biennial Report give futher guidance in arriving at a certification decision.

Part One of this Final Decision contains Findings on compliance with statutory site certification requirements, a discussion of the Joint Environmental Study and its significance in terms of the California Environmental Quality and National Environmental Policy Acts (Public Resources Code sections 21000 ff and 42 USC 4321-4347, respectively), a brief recapitulation of the procedural steps which occured, and a summary of the evidentiary bases for this Decision.

Part Two contains topical discussions on the various human and natural environmental areas impacted by the project, as well as the technical, engineering, and other areas of conern affected by the project. These topical discussions summarize the basis for the Commission's ultimate Findings and Conclusions pertaining to each broad category.

PART ONE

A. Findings on Compliance with Statutory Site-Certification Requirements

I.

The springboard for the Commission's exclusive power plant siting authority is the statutory mandate to certify such environmentally acceptable power plant sites and related facilities as are required to provide a supply of electric power sufficient to accomodate the demand projected in the Commission's most recently adopted forecast of statewide and service area electric power demands (Public Resources Code (hereinafter PRC) sections 25500 ff.). More specifically, PRC section 25524 states in essence that the Commission shall not certify any facility unless it makes an affirmative Finding that such facility is in conformity with the adopted 12-year forecast (see also PRC sections 25523(f) and 25309(b)).

The Commission finds that these mandates have been complied with, as reflected in the discussion and Findings and Conclusions contained in the "Need" portion of this Decision.

II.

PRC section 25523(a) requires the Commission's Final Decision to contain specific provisions regarding the manner in which the proposed project is to be "designed, sited, and operated" in order to protect environmental quality and assure public health and safety. Section 25523(d) expands upon this mandate by further requiring the Decision to contain Findings regarding conformity with public safety standards, air and water quality standards, and with "other relevant" local, regional, state, and federal standards, ordinances, or laws.

The importance of designing, siting and operating a power plant in conformity with applicable standards, ordinaces, and laws is emphasized by PRC section 25525 which, absent in part a showing of "public convenience and necessity", basically prohibits the Commission from certifying a project which would not conform with any such standard.

The Commission finds that the applicable local, regional, state, and federal standards, ordinances, and laws have been identified in the record of this proceeding and that, for the reasons stated in Part Two of this Decision and with implementation of the measures as contained in Appendices A, B, and C of this Decision and in the Final Joint Environmental Study, the project can be designed, sited and operated to comply with all applicable standards, ordinances, and laws.

III.

PRC section 25532 requires the Commission to establish a monitoring system to assure that any project certified is constructed and operated in compliance with air and water quality, public health and safety, and other applicable regulations, guidelines, and conditions. Appendix B contains the required compliance monitoring program.

The Commission finds the program contained in Appendix B sufficient to satisfy the requirements of PRC section 25532.

IV.

The Public Resources Code prohibits certification of a power plant without consideration of, and conformity to if apprpriate, the applicable efficiency and load management standards (PRC sections 25402(d); 25403.5;

25523(d)). NCPA is not subject to any standards of this genre which have been adopted by the Commission.

The Commission therefore finds that these provisions of the Public Resources Code pose no bar to certification of the NCPA Geothermal Project No. 2.

B. The Joint Environmental Study; Findings

The California Environmental Quality Act (PRC sections 21000 ff.) and the Commission's regulations (20 CAC 23000 ff.) require the preparation of an Environmental Impact Report for proposed power plants and related facilities. This requirement was made somewhat more complex in the NCPA Geothermal Project No. 2 proceedings because the project is located on Federal lands. Three Federal agencies - the United States Geological Survey (USGS), the United States Bureau of Land Management (BLM), and the United States Department of Energy (DOE) - shared environmental, jurisdictional, or financing considerations similar to and concurrent with the Commission.

In order to avoid duplication of environmental review, these four agencies entered into a Memorandum of Understanding on November 16, 1978 to prepare a Joint Environmental Study (JES) sufficient to satisfy Federal requirements under the National Environmental Policy Act and State requirements under the California Environmental Quality Act. The fruits of this cooperative venture ripened in the publication of the Draft JES on November 26, 1979. The Staff held a workshop on December 17, 1979 to receive public comments on the JES and the Committee conducting the NCPA proceedings twice, on December 11, 1979 and January 4, 1980, solicited public comments on the environmental document during

Committee hearings. The public comment period, originally shceduled to end on January 10, 1980, was extended for review by Federal agencies to January 25, 1980.

The Commission Committee also invited the Federal Geothermal Environmental Advisory Panel (GEAP) to convene and provide further comments on environmental matters of mutual Federal-State concern.* Federal officials, however, perceived no necessity to convene the GEAP due to the extensive and thorough nature of the Commission's public siting process.**

Following review of comments received on the Draft JES, the Commission staff prepared the Final JES which was distributed on February 15, 1980. The JES is a crucial document since it encompasses the degree of environmental review required by Federal and State law, comprises a large part of the evidentiary base for Staff's position, and contains the mitigation measures which Applicant is required to implement as a part of this Decision.

I.

The Commission certifies that the Final Joint Environmental Study has been prepared in compliance with the California Environmental Quality Act and all applicable State and Commission guidelines. The Commission further certifies that the Final Joint Environmental Study has been considered in adopting this Decision. Finally, the Commission finds that the NCPA Geothermal Project No. 2 site and related facilities, if the measures as identified in Appendices A, B, and C of this Decision and the mitigation measures required in the Final Joint Environmental Study are implemented, shall cause no significant adverse environmental effects.

*Docketed letters from C. Suzanne Reed to Dr. G.D. Robinson, GEAP Chairman, dated October 25, 1979 and January 29, 1980.
**Docketed letter from Dr. Robinson to Commissioner Reed, dated February 8, 1980.

C. Procedural Steps

The Commission approved the NCPA Geothermal Project No. 2 NOI on March 14, 1979. The NOI Decision contained numerous conditions which reflected tasks to be performed and information to be submitted before the Commission could ensure that the project would be designed, sited, and operated in compliance with applicable standards, ordinances, and laws. The Commission considered the project in light of this additional information during the AFC proceeding.

NCPA submitted the AFC on April 4, 1979 and the Executive Director transmitted copies and summaries of the AFC document in conformity with the applicable provisions of the Public Resources Code and the regulations. The Commission accepted the filing on May 9, 1979. The Commission Committee conducting the NCPA AFC proceedings explicitly sought public agency comments on the proposed project and suggestions for monitoring compliance of the project with applicable standards, ordinaces and laws.

The Committee held an Information Hearing in the vicinity of the proposed project in order to gather the views and comments of members of the public and, additionally, the Commission staff sponsored several informal public workshops in order to discuss technical issues with the Applicant, interested agencies, and members of the public. These events were generally attended by representatives of one or more of the Federal agencies which shared review responsibilities with the Commission. No governmental agency or member of the public chose to formally intervene, although the Northern Sonoma County Air Pollution Control District played an active and valuable role throughout the NCPA AFC proceedings. The public agency and other comments received during the AFC proceedings were carefully considered by the Commission in reaching this Final Decision.

At the time of the first Prehearing Conference on October 11, 1979, neither Applicant nor Staff had identified any issues which would require adjudication by the Committee. At the second Prehearing Conference on November 8, 1979, however, it became apparent that three issues - modification of procurement specifications, modification of peak horizontal bedrock acceleration value, and transmission tap-line routing - were in fact disputed. The Committee accordingly scheduled evidentiary hearings for December 11, 12, and 13, 1979.

Presentations at these evidentiary hearings indicated that adjudication would not be required for the procurement specification or peak horizontal bedrock acceleration value issues. However, these presentations also convinced the Committee that full and fair adjudication of the transmission tap-line routing issue would require additional preparation by the parties and additional evidentiary hearings. By mid December 1979 it had also become evident that Federal and State review of the Draft Joint Environmental Study, negotiations among the Applicant, Federal agencies, and Staff concerning final versions of the appropriate mitigation measures and compliance monitoring programs, and preparation and submission of additional items previously required by the Committee would prevent the proceedings from being concluded within the anticipated timeframe. The Committee notified the parties of its concerns in these areas at the December hearings.

On December 18, 1979, the Applicant submitted an "Agreement to Extend Proceedings" for a period of up to 75 days past January 4, 1980. This document was executed by the Committee on behalf of the Commission on December 20, 1979. The matter was fully discussed at a public hearing on January 4, 1980, and the Applicant agreed that an extension of time up to March 12, 1980 was necessary and proper for the Commission to reach a final decision on the AFC. The Committee concluded evidentiary hearings on January 8, 1980.

D. Evidentiary Bases

The Commission has based this Final Decision on the written and oral testimony presented during the five days of evidentiary hearings, the Joint Environmental Study, the Determination of Compliance submitted by the Northern Sonoma County Air Pollution Control Officer, the documents and exhibits submitted with the testimony including the exhibit late-filed by the Applicant, comments from the public and governmental agencies including those offered at the hearings on this project, and the matters officially noticed by the Committee in relation to the issue of transmission tap-line routing. All of these items are a matter of the public record of this proceeding. In evaluating the evidence, the Commission has been guided further by its own expertise and policy considerations such as those enunciated in the 1979 Biennial Report.

The parties have arrived at joint positions which are supported by the weight of the evidence of record on all pertinent areas except for the issue of transmission tap-line routing. Part Two of this Final Decision contains a summary of these positions and their supporting bases, appropriate Commission Findings and Conclusions, and the Commission's resolution of the tap-line routing issue.

PART TWO

Introduction

The Draft and Final Joint Environmental Studies have described the proposed project in detail and have addressed environmental concerns in depth. In addition to these documents, the Commission Committee has received extensive oral and written testimony, as well as documentary evidence, from the parties. Due to the uncontroverted nature of the bulk of the evidence of record, the Commission perceives no reason to repeat it at length. Part Two of this Final Decision therefore contains only brief summaries of the evidentiary bases supporting the Commission's ultimate Findings and Conclusions relating to the broad categories of Need, Environmental Resources, Public Health and Safety, Plant and Site Safety and Reliability, and Socioeconomic, Land Use, and Cultural concerns. Part Two also contains a detailed discussion of the Transmission Tap-line routing issue, the only matter in the AFC proceeding which required extensive adjudication.

A. NEED

In arriving at its determination on the "need" for the NCPA Geothermal Project No. 2, the Commission is guided by the statutory mandate of PRC section 25500.5 to certify "sites and related facilities which are required to provide a supply of electric power sufficient to accomodate the demand projected in the most recent forecast of statewide and service area electric power demands" adopted pursuant to PRC section 25309(b). In conjunction with this statutory mandate, the Commission is further guided by the 1979 Biennial Report which states,

in essence, that any geothermal power plants and related facilities which demonstrate reasonably mitigable environmental impacts and meet existing air and water quality standards will be "deemed needed" (1979 Biennial Report, p. 100).

Both Applicant and Staff submitted testimony supporting NCPA's need for the 105.6 net megawatts which will be produced by the Geothermal Project No. 2. The evidence of record clearly indicates that the greatest need for the project exists in 1982 (anticipated to be the first year of commercial operation) and that it continues to be needed thereafter. Moreover, the testimony demonstrates that, based on an 83 percent capacity factor, operation of this geothermal power plant will displace approximately 1 to 1.2 million barrels of oil per year. Witnesses for both parties further testified that the project complies with both the 1977 and 1979 demand forecasts as adopted by the Commission* (RT 963-81; 1032-38).

During the NOI proceedings, the Commission was guided by a somewhat general directive contained in its Geothermal Policy Report recognizing geothermal development as a preferred technology. In the 1979 Biennial Report this general directive was made more explicit when the Commission concluded that "there are severe limits on the extent to which the state can look to conventional energy sources...for new electricity supplies" and that for environmental, health and resource considerations, energy sources such as geothermal "should be significantly expanded in the state's mix of electricity supplies". Moreover, the Commission determined that a reasonable balance of state interests as required by section 25309(b) of the Public Resources Code

* At the time this testimony was given, December 12, 1979, compliance with the 1979 forecast was somewhat speculative since the Commission did not adopt the 1979 Biennial Report and demand forecast until December 21, 1979. The witnesses testified, however, that a new forecast could not negate the need for the project.

would be promoted by giving "first priority to geothermal energy, cogeneration, and other renewable energy sources" and by authorizing the state's utilities to construct and to give preference to such energy sources, including geothermal power plants, not only to meet expected increases in electricity demand but also to meet Commission policy to reduce oil and natural gas use by 50 percent by 1991.

In analyzing these factors, the Commission determined that to meet anticipated growth in demand for electricity, to allow retirement of older facilities, to make up for potential losses resulting from the expiration of contracts for power from the Pacific Northwest, and to meet a 50 percent oil and gas reduction policy, approximately 7,000 megawatts of new generating capacity would be required by 1991. Thus, in the 1979 Biennial Report, the Commission determined that since the probable maximum amount of new generating capacity achievable from geothermal and other preferred energy sources by 1991 would be less than the total amount of new capacity needed to achieve a reasonable balance of State interests as required by section 25309(b), each and every geothermal proposal would be deemed needed provided the proposal generally possessed the favorable characteristics which make geothermal a preferred source for electricity supply. For that reason, the Commission determined that any geothermal facility which demonstrates reasonably mitigable environmental impacts and complies with air and water quality standards shall be deemed needed and in conformance with the forecast and assessment adopted pursuant to section 25309(b).

Finally, in the Biennial Report, the Commission found that geothermal energy is "one of the cheapest sources of electricity generation" and "should be expanded because of (its) favorable

environmental characteristics, efficiency, more stable costs, and the fact (it is) indigenous to California." This fiscally related determination was supported by testimony given at the hearings in these AFC proceedings*.

COMMISSION FINDINGS AND CONCLUSIONS

The NCPA Geothermal Project No. 2 comports with State and Federal energy policies and complies with the Commission's most recently adopted 12-year demand forecast. As is found in subsequent portions of this Decision, with implementation of the measures as contained in Appendices A, B, and C and the Final Joint Environmental Study, associated environmental impacts are reasonably mitigable and the project will comply with applicable air and water quality standards.

B. ENVIRONMENTAL RESOURCES

Both the Public Resources Code and the policies enunciated in the Biennial Report require the Commission to carefully consider and determine whether the impacts a proposed project will have upon the natural environment can be reasonably mitigated and to ensure that, absent unusual circumstances, the project is designed and constructed to operate in compliance with applicable standards, ordinances, and laws. The Commission, in complying with these directives for the purposes of this Final Decision, has categorized the presentations during the hearings on the topics of air and water quality, water

* The Federal Department of Energy is responsible for financing and loan guarantees regarding the NCPA Geothermal Project No. 2.

resources, hydrology, soils, solid waste management and biological resources as integrally related to the broad "environmental resources" concept.

i) Air Quality

Geothermal power plants emit hydrogen sulfide and particulate matter from the cooling tower, along with small quantities of mercury vapor, ammonia, arsenic, and certain other compounds. Additionally, when the power plant is shut down, steam may be released at the steam release valve. The most troublesome pollutant emitted is hydrogen sulfide, an odorous substance that has been characterized by residents of the Geysers area as a nuisance. The State standard for H_2S (based on a nuisance odor threshold) has been exceeded in the project area.

The Applicant has proposed to abate H_2S emissions with the use of a surface condenser and Stretford system. Results from PG&E test programs* indicate that this abatement system will likely require supplemental condensate treatment if the facility is to comply with local H_2S emissions limitations. In order to ensure compliance, the Applicant will construct an H_2S condensate system using a secondary hydrogen peroxide abatement process (described in the AFC) which will be available when the power plant begins operation (RT 501, 489). In this manner, the secondary treatment system can be utilized immediately if the surface condenser/Stretford system combination alone proves incapable of providing the required degree of emissions limitation. The relatively low concentration of H_2S expected

* PG&E's Unit 15 is the first Geysers power plant to utilize a surface condenser and Stretford system.

in the steam supply (70±20 ppm maximum; RT 488) is another factor indicating that the project will comply with applicable emissions limitations (RT 507).

Applicant's witness testified that the power plant will comply with all applicable emissions limitations and new source review requirements during normal power plant operation (RT 485-90). Pursuant to the Joint Policy agreement between the Commission and the Air Resources Board*, the Northern Sonoma County Air Pollution Control Officer (NSCAPCO) submitted a Determination of Compliance during the evidentiary hearings, a finalized version of which appears as Appendix A of this Decision. The NSCAPCO specified therein conditions which, if implemented, would ensure operation of the proposed facility in compliance with all applicable local air district rules and regulations (RT 507). Thus, with the implementation of such conditions, the NSCAPCO testified that the facility will not prevent the attainment, interfere with the maintenance or cause a violation of any state or national ambient air quality standard. A Staff witness supported the NSCAPCO's analysis and further stated that, in his opinion, the conditions specified in the Determination of Compliance were indeed necessary to ensure compliance with the district rules (RT 513).

Staff also sponsored the Air Resources discussions in the Draft JES (RT 514), including an independent analysis which led to the conclusion that the facility will comply with Federal

* This Joint Agreement does not specifically apply to geothermal power plants. The Commission, however, follows the spirit of this Agreement in all power plant siting cases.

rules for Prevention of Significant Deterioration (Draft JES, IV-50). The Draft JES, which has been reviewed by USGS, BLM, and DOE, concluded that the facility is not expected to produce significant adverse air quality impacts (Draft JES, IV-35; IV-48), and this conclusion has not been altered by the Final JES.

In the event of scheduled and unscheduled shutdowns of the power plant, the steam supply must be vented ("stacked") at the steam release valve. Therefore, since the steam release valve is by legal definition (PRC 25120) not part of the power plant, the steam supplier must obtain all air quality permits required by district rules. If these permits are not granted, the power plant would have no fuel supply. In this regard, the Applicant sponsored a witness from Shell Oil Company, the steam supplier, who testified that steam field permit requirements would in all likelihood be satisfied. The NSCAPCO also stated that it is likely that the steam supplier will obtain necessary permits, and Staff's independent analysis indicates that environmental impacts caused by steam stacking should not be significant if conditions on the steam field permit are observed (RT 491-8; Draft JES IV-50).

ii) Water Quality - Water Resources - Hydrology - Soils - Solid Waste Management

Potential degradation of water quality and water resources may be caused by erosion from excavation and fill activities during construction, erosion from sloped surfaces after completion of construction, spills

from the H_2S abatement process area, spills from the cooling water and condensate systems, storm run-off which may carry materials collected on the plant site prior to the first rain, plume drift deposition, and improper management of liquid and solid wastes.

Applicant's witnesses testified that the steam condensate will be used as cooling water for the plant with the excess, approximately 20 percent, reinjected via the reinjection well. The bulk of the approximately three pounds per hour of solid materials contained in the cooling water will be reinjected with the blowdown from the cooling tower, and the solid waste produced by the Stretford system will be transported to a licensed disposal site. These witnesses concluded that the project will have no significant adverse impacts upon the water quality of the area (RT 693-9). Another witness for the Applicant testified that the erosion control measures identified in the NOI and AFC would minimize related adverse environmental impacts (RT 765-7). Finally, a witness on behalf of Applicant testified that proposed measures for transporting and disposing of toxic waste material will avoid adverse environmental effects and comply with all applicable standards, ordinances, and laws (RT 773-5).

Staff witnesses sponsored portions of the Draft JES and concluded that, with the implementation of the specified mitigation measures, all of the potential adverse effects to water resources and water quality would be mitigated (RT 702; 771; 778). Staff witnesses also testified that, with the implementation of the specified mitigation measures, the project will comply with all laws and standards governing water quality and waste

management (RT 708; 777), and that soil erosion measures (as contained in Appendix B of this Decision and the JES) were adequate to avoid significant adverse environmental impacts (RT 769).

The only area of disagreement between the Staff and the Applicant concerned the amount of storm run-off which must be reinjected. This issue was basically resolved in Applicant's Spill Containment Plan as submitted to the North Coast Regional Water Quality Control Board on January 23, 1980. The Applicant shall thus handle this matter as indicated in the Spill Containment Plan, subject to provisions imposed by the North Coast Regional Water Quality Control Board.

iii) Biological Resources

Impacts to plant and animal species will occur during the construction of the facility due to vegetation and wildlife cover removal for site preparation, and may be magnified if construction results in increased siltation and sedimentation in nearby streams. Vegetation damage will also occur during the operation of the facility due to plume drift deposition, and more damage may occur if toxic spills reach waterways. Accordingly, the Commission has examined the sufficiency of measures proposed to mitigate such impacts, and has also examined the project's conformance with laws and standards for the preservation of biological resources with particular emphasis on laws protecting rare and endangered species.

The Applicant's witnesses testified that extensive surveys had been conducted at the proposed project site and that

mitigation measures including development of a wildlife watering facility and revegetation with native species would satisfactorily ameliorate the unavoidable impacts to the flora and fauna of the area (RT 578-91).

The testimony presented to the Commission Committee at the evidentiary hearings further revealed that the Peregrine Falcon is the only rare and endangered species known to frequent the vicinity of the NCPA No. 2 project (RT 579). The rare plant, Streptanthus morissonii, is included on the list of Uncommon, Threatened and Endangered (UTE) plants and has been found in the project area. However, sufficient measures have been identified which, when implemented, will adequately protect this plant species in particular and will additionally reduce the impacts from the facility on all biological resources to the point that they are deemed insignificant (RT 594-626).

Finally, a witness from the Bureau of Land Management testified that controlled plant site burnings would mitigate wildlife habitat losses and has agreed that BLM would ensure that this measure is performed properly by NCPA (RT 626-30).* On February 12, 1980 Applicant submitted a tentative agreement reached with BLM concerning the nature of periodic controlled burns.

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*The Federal site license will provide that NCPA will pay for the controlled burns which in fact will be conducted by BLM.

COMMISSION FINDINGS AND CONCLUSIONS

The NCPA Geothermal Project No. 2 can be designed and constructed to operate in compliance with all applicable standards, ordinances, and laws, including air and water quality standards, insofar as the potentially impacted environmental resources are concerned. The measures to ensure adequate mitigation of impacts to environmental resources and the program for implementing such measures have been identified and are contained in Appendices A and B of this Decision, as well as in Chapter IV of the Final Joint Environmental Study. The Applicant shall implement the mitigation measures in Appendices A and B of this Decision and those phrased as "must" and "will" in Chapter IV of the Final Joint Environmental Study. Mitigation measures phrased as "should" and "could" in Chapter IV of the JES are to be interpreted as identifying further impacts which must be mitigated, although the actual method of implementation may reasonably vary from those suggested in the JES.

C. PUBLIC HEALTH AND SAFETY

Evidence presented on this broad category consisted of testimony and exhibits on the topics of public health and safety, worker health and safety, noise impacts, and additional safety-related matters.

With respect to public health and safety, the principal concern is the potential effect of various regulated and unregulated pollutant emissions on nearby residents. Applicant's offer of proof indicated that reported background concentrations of arsenic, ammonium compounds, and sulfates will not be increased by emissions from the NCPA plant and that there should be no adverse public health impacts because of boron, H_2S, or ^{222}radon emissions. Staff's testimony comprised a lengthy analysis describing the potential increases in pollutant concentrations in the ambient air as a result of operation of the proposed facility (RT 997-1028). The sponsoring witness concluded that public health should not be adversely affected by the proposed facility (RT 1001-9) and that the facility will comply with all laws and standards for the protection of public health (RT 982-5).

Insofar as worker health is concerned, Staff's presentation recommended measures contained in the Draft JES intended to ensure compliance with applicable laws and standards (RT 1024). Included in these is the Applicant's accident prevention program which it will submit to USGS submittal to the CAL/OSHA consultation service for review (RT 992). The compendium of the necessary mitigation measures and implementation methods is contained in Appendix B of this Decision and in Chapter IV of the Final JES.

Testimony on behalf of Applicant on the topic of "noise" demonstrated that analysis indicated that power plant noises during normal operations would be inaudible at the closest receptors. Greater noise emissions would however occur during periods of construction and steam stacking. Measures to mitigate these noises, as required by local standards, will be implemented (RT 725-7). Commission staff sponsored prepared testimony on noise impacts

and those portions of the Draft JES which address noise. The analysis concluded that implementation of identified mitigation measures, including utilization of a rock muffler by the steam supplier, will ensure compliance with noise standards and that noise impacts will be environmentally acceptable (RT 727-62).

Finally, a Staff witness testified to other safety-related matters. His examination of proposed measures to ensure safe handling and storage of hazardous, toxic and flammable materials led the witness to conclude that adherence to existing codes governing such matters would provide an adequate measure of safety (RT 911-37).

COMMISSION FINDINGS AND CONCLUSIONS

The NCPA Geothermal Project No. 2 can be designed and constructed to operate without causing significant adverse impacts to public health and safety. The measures to ensure adequate mitigation of impacts to public health and safety and the program for implementing such measures have been identified and are contained in Appendix B of this Decision and Chapter IV of the Final Joint Environmental Study. The Applicant shall implement the mitigation measures in Appendix B and those phrased as "must" and "will" in Chapter IV of the Final Joint Environmental Study. Mitigation measures phrased as "should" and "could" in Chapter IV of the Final JES are to be interpreted as identifying further impacts which must be mitigated, although the actual method of implementation may reasonably vary from those suggested in the JES. Assuming such implementation, the project will cause no significant adverse impacts to public health and safety.

D. PLANT AND SITE SAFETY RELIABILITY

The area of safety and reliability necessitated inquiry by the Commission Committee into the geologic character of the project vicinity and the engineering aspects of the project. Accordingly, the Committee received evidence on the topics of geology, civil and structural engineering, systems engineering and reliability.

Questions addressed pertaining to geology included those factors which could potentially impact the project (e.g., shear zones, landslides, seismically active faults) and those resources which could potentially be impacted by the project (e.g., gem or mineral resources). Jurisdiction for pertinent concerns in this area rests with the United States Geologic Survey and a witness from USGS sponsored the geology portions of the Draft JES into evidence. This witness concluded that no undue geologic hazards to the facility are present at the site, and that with the implementation of the mitigation measures specified in the Draft JES, the impacts to geologic resources would be minimized (RT 905-11; Draft JES IV-2 through IV-7). These conclusions have not been altered in the Final JES. An additional Staff witness also proposed measures to ensure that adverse geologic conditions which are discovered during site preparation are adequately mitigated and considered in the final design work (RT 896-910). These measures and the plan for their implementation are contained in Appendix B of this Decision and in Chapter IV of the Final Joint Environmental Study.

In addition to these environmental disciplines, the Commission Committee received evidence on the engineering aspects of the project. Applicant's brief presentation on civil engineering principally described its method to provide slope stability at the project site by a cut and fill balance (RT 802-4). The Staff's presentation specified measures adequate to ensure

grading and site preparation consistent with the requirements of Chapter 70 of the Uniform Building Code; included in these measures was submission of the grading plans to Sononma County officials for review and inspection. Staff's witness concluded that the Applicant should be able to comply with applicable standards with respect to civil engineering and site preparation (RT 804-20).

Applicant and Staff initially voiced somewhat divergent opinions on the area of structural engineering. Applicant's witness testified that a peak horizontal bedrock acceleration value of 0.35g had been used in developing appropriate structural design criteria (RT 821-5). Staff's witness stated that the 0.35g value is acceptable but that Applicant's subsequent revision to 0.20g would require additional justification (RT 828-31). Eventually, after meeting at publicly noticed workshops*, Staff and Applicant agreed on appropriate analysis methods to be used in final design of the facility, and further agreed that the Applicant would specify consistent design criteria in purchase specifications for critical components (see Appendix C). Seismic design criteria keyed to a site specific peak ground acceleration of 0.25g will ensure a facility design capable of withstanding reasonably anticipated seismic occurrences (RT 1273-74). The testimony of record also specifies the various laws, standards, and professional codes with which the facility must comply (RT 834-35) and specifies measures to ensure that the facility will in fact comply with these laws, standards, and codes.

Applicant estimates that the plant will operate at an 83 percent capacity factor. Staff took no position on this indicia of high reliability, but a Staff witness did testify that equipment redundancy and plant supervisory

*The end results of the workshops were recorded in two December 10, 1979 letters from Jon Pietruszkiewicz to James Wazlaw, and supplemented by a December 26, 1979 letter from Robert Chittenden to Mr. Pietruszkiewicz. NCPA transmitted the Probabilistic Seismic Analysis which was conducted using mutually agreed upon methodology in a December 27, 1979 letter from J. Pietruszkiewicz to J. Wazlaw. These letters are included in Appendix C of this Decision.

control provisions which will be implemented by the Applicant should result in a facility in which unscheduled outages and damage to plant equipment will be minimized (RT 541, 549).

Finally, a witness sponsored by NCPA testified that extensive measures to ensure the fire safety of the project, such as special storage of flammable materials and certification by a registered fire protection engineer that the plant is in conformance with applicable fire and safety codes, would be instituted (RT 946-50). Prepared testimony submitted by Staff elaborates further upon the area of fire and safety (RT 938-40).

COMMISSION FINDINGS AND CONCLUSIONS

The NCPA power plant and site can be designed and constructed to provide a reasonably safe and reliable source of electrical power if the measures and criteria contained in Appendices B and C of this Decision and Chapter IV of the Final Joint Environmental Study, to the degree appropriate, are complied with and implemented. The Applicant shall therefore implement the measures and design characteristics contained in Appendices B and C of this Decision and those phrased as "must" and "will" in Chapter IV of the Final Joint Environmental Study. Mitigation measures phrased as "should" and "could" in Chapter IV of the Final JES are to be interpreted as identifying further impacts which must be mitigated, although the actual method of implementation may reasonably vary from those suggested in the JES.

E. SOCIOECONOMIC, LAND USE, AND CULTURAL CONCERNS

The Public Resources Code requires the Commission to assess impacts of a proposed project upon resources closely affecting the human environment. Thus, the statute mandates special consideration of impacts upon land areas devoted to park, wilderness, scenic, recreation, and historic uses (PRC section 25527). The Code also provides that the Commission may, under appropriate circumstances, require that an Applicant as a condition of certification establish an area for public use (PRC section 25529). While the appropriate use of a given area is typically established by local zoning and land use ordinances, the Commission nonetheless has the additional authority to require an Applicant to take measures (such as the acquistion of development rights to ensure control of population densities and land use restrictions) necessary to protect societal concerns (PRC section 25528).

The fact that the NCPA project is located on lands under Federal jurisdiction does not obviate the necessity for Commission inquiry into potential societal impacts. The extent to which construction and operation of the proposed facility will tax the resources of nearby communities and of Lake and Sonoma Counties, the extent to which the proposed development is consistent with land uses in the vicinity, and the potential aesthetic impacts of the proposed facility are germane concerns. Additionally, areas with high geothermal resource potential are typically areas with high cultural resource potential, largely because of the spiritual and community value of hot springs and fumaroles to Native American peoples.

Evidence presented to the Commission Committee on behalf of the Applicant indicated that the project is situated in an area of extensive geothermal development, that the project would not disrupt the workforce balance of Lake or Sonoma County, and that the payroll and tax revenues will at least offset any financial burdens imposed upon the counties (RT 644-7). The

testimony of the Staff witness, including relevant portions of the Draft JES, indicated that the proposed project should not result in significant population increases in the area (RT 654) and that the demand for public services caused by the project will be minimal (RT 655). Further, revenues accruing to the counties from the project should exceed incremental costs to the counties, thus providing a net increase in local revenues (RT 658, also Draft JES, IV-78, 79).

The Staff witness further testified that she examined existing land uses in the vicinity of the proposed facility and the General Plan and Zoning Ordinances of Sonoma County. This analysis revealed that the proposed power plant is located in an area designated by the county as a "primary geothermal resource area"--an area in which geothermal development is contemplated by the County (RT 662). Sonoma County has also affirmed the dedication of the area to geothermal resource development through the approval of permits for the development of the steam supply field (RT 662). This witness also testified to her belief that the project is consistent with land uses and the General Plan of Lake County (RT 650), and recommended measures to reduce the adverse aesthetic impacts of the proposed facility (RT 664; Draft JES IV-83,84).

Cultural resources in the proposed project area have been examined by an independent consultant for paleontological, archaeological, historical, and ethnographic value. No such resources were discovered within the power plant construction area (RT 679). The Staff witness affirmed this (RT 689), but also noted the presence of an archaeological site and a paleontological site within the leasehold (RT 689). Staff therefore recommended mitigation measures in the Draft JES which are necessary to protect such sites, as well as to adequately protect any resources at the plant site which may be discovered during construction (RT 684; Draft JES IV-72, 73). These measures,

suitable insofar as the Federal authorities are concerned,remain substantially unchanged in the Final JES.

COMMISSION FINDINGS AND CONCLUSIONS

The NCPA Geothermal Project No. 2 can be designed and constructed to operate without causing significant adverse impacts to socioeconomic and cultural resource concerns. The power plant and site are in conformity with the prevailing land use designations in the project vicinity and the project will not adversely impact areas of public use and interest. Conformity with applicable local land use ordinances will ensure sufficient control of population densities, and the Applicant is thus not required to acquire land development rights for the plant and site areas. The Applicant shall implement the measures in Appendix B of this Decision and those phrased as "must" and "will" in Chapter IV of the Final Joint Environmental Study. The measures phrased as "should" and "could" in Chapter IV of the Final JES are to be interpreted as identifying further impacts which must be mitigated, although the actual method of implementation may reasonably vary from those suggested in the JES.

F. TRANSMISSION TAP-LINE

i) Wheeling

As has been evident throughout the NOI and AFC proceedings, NCPA must ultimately interconnect with the Pacific Gas and Electric Company's (PG&E) transmission system in order to transport ("wheel") the electrical power from the Geothermal Project No. 2 into the main system.* NCPA and PG&E have been negotiating this general matter for a number of years. Since the AFC filing in April 1979, these utilities have met several times to negotiate an Interconnection Agreement including a provision for firm transmission service on the PG&E transmission grid from NCPA's geothermal developments to the NCPA members. The Interconnection Agreement would, however, also address concerns such as wholesale service, spinning reserves, capacity reserves, non-firm transmission service, designated points of delivery, emergency power purchases, maintenance power purchases, operating schedules, planning requirements, and the level of rates or charges for these items. NCPA and PG&E view all these factors as basically interrelated and dependent, and have therefore been negotiating an integrated Interconnection Agreement, rather than one providing solely for firm transmission service from the Geothermal Project No. 2.

NCPA has stated that it has reached basic agreement with PG&E on the majority of the interconnection provisions, save for questions involving calculations concerning the level of reserve requirements and the level and costing philosophy

* The actual route of the intertie (the Tap-line from the NCPA project to the PG&E transmission lines) is dealt with in the following subsections.

of rates and charges for each of the services, including firm transmission service (response to Data Requests, August 9, 1979, p. I-1). NCPA does not view any disagreement concerning the level of rates and charges as preventing, per se, the execution of an Interconnection Agreement because these matters are subject to review and approval by the Federal Energy Regulatory Commission (FERC). NCPA could, if necessary thus use FERC as a forum for contesting and finalizing such rates and charges.*

PG&E has confirmed its willingness to provide firm transmission service from NCPA's Geysers goethermal projects** (June 6, 1979 letter from E. E. Hall to Philip B. Michaels). Pursuant to Committee Order, the Applicant responded by letter of January 3, 1980 that preliminary evaluation of rates proposed in the Interconnection Agreement "do not appear to be unfair" and that it anticipates executing the Agreement by March 31, 1980 (see RT 1270).

The Commission is satisfied that the wheeling concerns are, at this point, best left to the negotiations between NCPA and PG&E. Should an agreement for firm transmission service not be forthcoming in a timely manner, the Commission will then assess available alternatives, including participation before FERC.

ii) Tap-line - Areas of Dispute

NCPA must build a 230 kV tap-line to connect its Geothermal Project No. 2 with the main PG&E transmission lines leading

* Commission staff informed the Committee that NCPA presently has two related cases before FERC but, due to the "enormous complexity" thereof, the Commission should presently undertake no action, such as intervention, in these areas.

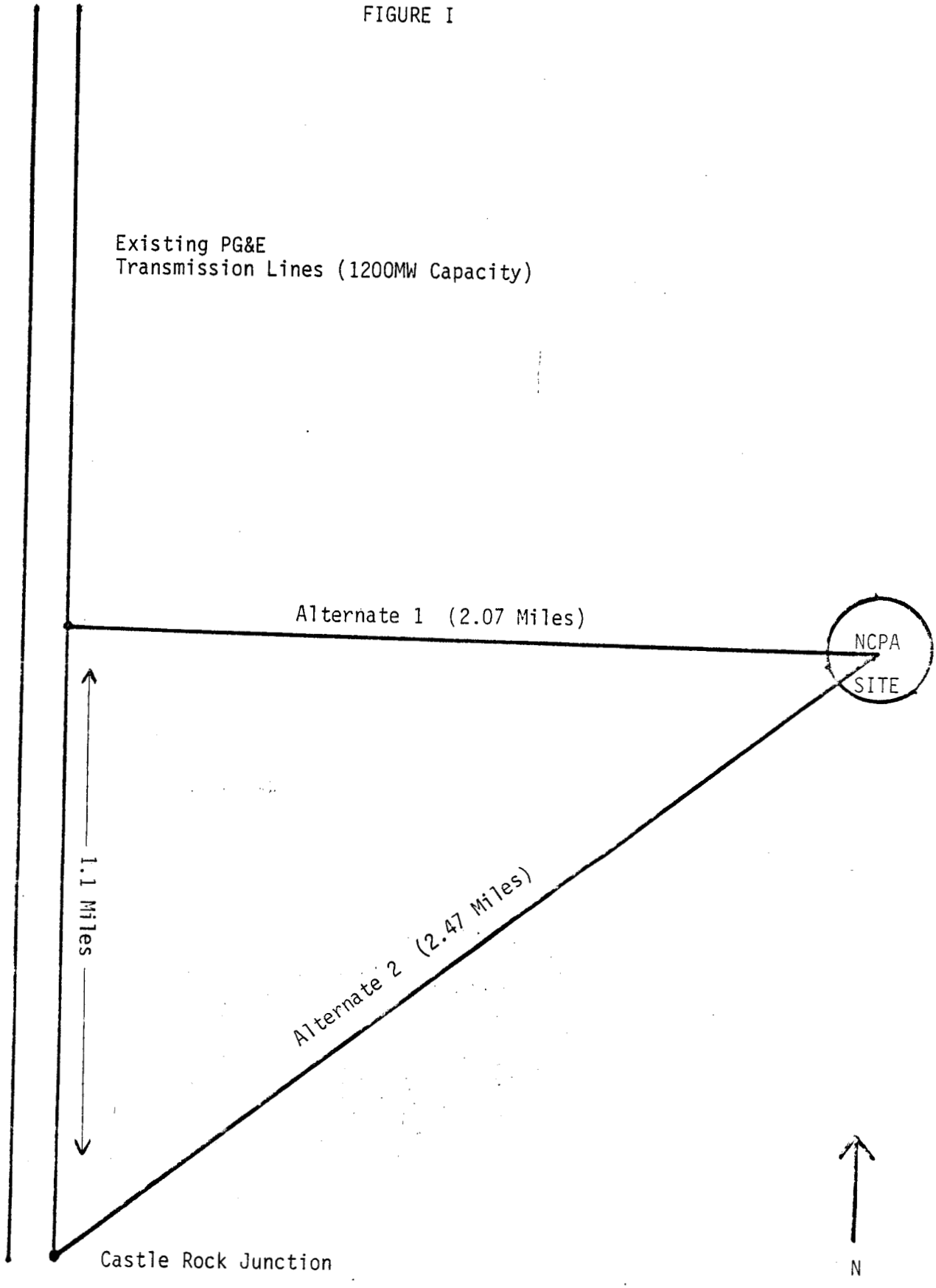
**In addition to the Geothermal Project No. 2, another NCPA Geysers area geothermal project is currently under NOI review.

from the Geysers. The routing of this tap-line was the subject of substantial dispute between Applicant and Staff, consuming nearly four days of hearings before the Commission Committee.

The main PG&E transmission line runs in a general north-south direction approximately two miles to the west of the NCPA plant site. It has a line capacity of 1200 MW. Alternate 1, the tap-line route proposed by Applicant, would run 2.07 miles westerly from the plant site and interconnect with the main PG&E line 1.1 miles north of Castle Rock junction; this tap-line route traverses only Federal lands within the Shell leasehold. Alternate 2, the tap-line route preferred by Staff, would run 2.47 miles southwesterly from the plant site and intercept the main PG&E line at Castle Rock junction. This route would, in part, cross privately owned lands outside the Federal leasehold. Figure I depicts a simplified rendition of these routes.

Applicant contended that: Alternate 1 is environmentally sound; is shorter and therefore less expensive to build; compares favorably with Alternate 2 concerning reliability; makes efficient use of the existing PG&E transmission line; the lower line losses on Alternate 2 are insufficient to warrant that route; and adoption of Alternate 2 would cause delays in the project and thus impose an undue burden. Staff, in espousing Alternate 2, took the position that this route offered additional benefits over Route 1 which would more than offset any increase in costs. In Staff's view, Alternate 2 provides greater reliability to the NCPA facility, gives greater flexibility to the Geysers transmission network overall, provides more efficient use of

FIGURE I



TAP-LINE ROUTING
(Simplified)

the geothermal resource resulting in a net energy conservation benefit, and does not impose an undue burden upon the Applicant.

Ultimate resolution of this controversy may be seen as depending upon the answers to such questions as: Can the Commission in fact require the Applicant to use Alternate 2 as the tap-line route? What are the environmental impacts of Alternate 1 versus Alternate 2? What effects do the alternate routes have upon system and plant reliability and flexibility? Which alternate makes best use of available resources? And finally, are any benefits derived from, or costs and burdens associated with, one route which on balance are sufficient to prevail over similar considerations associated with the other route? The Commission's weighing of these often competing factors follows.

a. Commission Authority

Applicant did not seriously contest the Commission's authority to require the use of Alternate 2 as the approved tap-line route during the Committee hearings. However, and presumably at least in part because Staff admittedly based its presentation regarding Alternate 2 on engineering rather than environmental concerns, Applicant suggested in its post-hearing Brief that PRC section 21061 would prevent the Commission from conditioning certification upon use of that route (Applicant's January 22, 1980 Brief, pp. 17-18). This statute provides, in part, that an environmental impact report (here JES) "...shall be considered by every public agency

prior to its approval or disapproval of a project". The issue is apparently raised by Applicant because it does not view the analysis of alternate transmission routes contained in the Draft JES (pp. V-9-11) sufficient for the purposes of CEQA.

The Commission cannot accept Applicant's stance for two basic reasons. First, the Final JES has replaced the Draft JES and has been reviewed and considered by this Commission in reaching this Final Decision. The Final JES contains a degree of environmental review sufficient to provide information as required under PRC 21061 in particular and under CEQA in general. While the Final JES lacks a certain degree of specificity concerning such matters as the environmental impacts occasioned by e.g., the placement of the actual transmission tower footings along Alternate 2, the Commission cannot view this as a fatal defect to full evaluation of this route*. Overall, the JES comports with the basic intent of CEQA by providing an assessment of reasonable alternatives. Furthermore, the analysis in an environmental document need not exhaust all potential environmental impacts; by its very nature, an environmental document such as the JES is informational and not binding upon the decision-maker. It is a piece of evidence which must be considered in conjunction with the other evidence of record.

Second, and as Staff states in its post-hearing Brief, the Commission wields broad statutory authority necessary for

* The Commission does not wish to have its holding misinterpreted. Adequate environmental review should be prepared at the earliest possible time and preferably included in the draft environmental document. The fact that this may not have been done in the present case should not be used for future guidance. It is possible for subsequent review to correct what may be viewed as earlier deficiencies but, absent unusual circumstances, the Commission does not intend to deviate from requiring early, comprehensive environmental review.

it to conduct a comprehensive, coordinated review of projects within its jurisdiction (Staff Brief re: Transmission Tap-line Routing, January 22, 1980, pp. 2-5). Accepted administrative practices give definition to this liberally construed grant of authority by permitting an administrative body such as the Commission to impose conditions which are reasonably related to a proposed project as long as such conditions are founded upon a reasonable factual basis and supported by substantial evidence. The routing of a transmission tap-line is reasonably related to the siting of a power plant, and the Commission believes that sufficient factual and evidentiary bases exist which would permit it to require tap-line routing along Alternate 2.

This rationale does not dispose of the issue, for the Commission has also weighed the matters dealt with in the following subsections. At this point the Commission concludes only that it has authority which would properly permit it to require routing along Alternate 2.

b. Environmental Impacts of the Alternate Tap-Line Routes - JES

The environmental impacts of three possible tap-line routes, including Alternates 1 and 2, were discussed in the Draft JES (pp. V-9-11). The Final JES expanded upon this discussion (pp. V-9-13).

The Final JES indicates that environmental impacts associated with either Alternate 1 or 2 would be essentially similar insofar as the tap-line corridors within the Shell leasehold are concerned, and that neither route would cause impacts severe

enough to render one environmentally unsuitable. The tentative plans for Alternate 1 would require placement of nine transmission towers and construction of approximately one-half mile of new access roads. Depending upon final routing, Alternate 2 would require 10 to 13 new transmission towers and 1.75 to 2.5 miles of new access roads. The Final JES further states that the length of access roads along either alternative could be shorter than estimated were the Applicant to utilize helicopter construction techniques.

The other evidence of record does not provide a basis sufficient to materially contradict the foregoing summary. The Commission therefore finds that both Alternates 1 and 2, insofar as these routes are contained within the Shell leasehold, are environmentally acceptable. Alternate 1 would appear to posses a lesser potential for environmental disruption because of fewer instances of vegetation losses and soil disturbances, but the Commission does not find this factor in and of itself sufficient to preclude routing along Alternate 2.

c. System Reliability and Flexibility Considerations

It is undisputed that the existing PG&E transmission line which Alternate 1 would intercept consists of two 600 MW circuits with a total line capacity of 1200 MW*. The Geysers

* This line is the easterly Geysers area line, there being an additional, more westerly 230 kV line with a capacity of 600 MW.

"gathering" lines travel southerly to Castle Rock junction, at which point other lines carry Geysers power to the main distribution system*. At present there are no substations or switching facilities at Castle Rock junction. The existing PG&E transmission line presently carries 457 MW;** at the time the NCPA Geothermal Project No. 2 becomes operational, it is anticipated that this line will be carrying 667 MW (or 56 percent of its total capacity; RT 1138-39).

In resolving this aspect of the tap-line routing issue, the Commission examined transmission system reliability and flexibility considerations as they pertain to system planning in general, as well as how they relate to NCPA in particular. The assumptions upon which both Staff and Applicant relied and the admittedly speculative nature of crucial future actions in the Geysers area added another level of complexity for the Commission's consideration. Basically, however, resolution of the reliability/flexibility subissue must be achieved by analyzing present day prospects concerning future events and relating these to the allocation of responsibilities among utilities planning or operating Geysers power plants insofar as the transmission network is concerned.

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*There are two existing lines which travel south from Castle Rock junction. The total carrying capacity south of Castle Rock will be greater than that north of Castle Rock, assuming construction of additional lines as presently proposed by PG&E in The Geysers 16 AFC proceeding (79-AFC-5) presently before the Commission.

**PG&E Units 9, 10, 12, 13 and 14 (RT 1445).

Staff's poisition in suggesting Alternate 2 is ultimately based on the "broader implications" of transmission line planning, an attempt at prudent planning which would serve to "optimize" the main system and rectify to an extent the "patchwork" planning evident thus far in the Geysers network (RT 1130; 1349-50; 1402). The Commission applauds this view and supports the motivation behind Staff's position; the Commission is not, however, convinced that this attempt at broad planning is appropriate in this particular case, at least insofar as reliability and flexibility factors are concerned.

First, much of Staff's case is premised on the assumption that a switching station will in fact be built at Castle Rock junction. It is uncontroverted that, with switching facilities at Castle Rock, NCPA would be able to transmit its Geysers power along any of the PG&E outlet lines should a fault render another PG&E line inoperable*. Even absent a switching station, NCPA could nevertheless utilize miltiple PG&E lines running south from Castle Rock by providing its own switching capabilities (RT 1142-44; 1353; 1469-70). While NCPA at one point contended that Alternate 2 would be more reliable only if a Castle Rock switching station were built (RT 1309), the Commission must conclude that connection at Castle Rock, and provision of switching facilities by PG&E or NCPA, would increase reliability of the transmission system pertinent to the NCPA project.

There are, however, other factors which the Commission considered regarding reliability. First, and as Staff's witness admitted, the transmission line north of Castle Rock to which Alternate 1

* The same benefit would not accrue were NCPA to interconnect via Alternate 1 since NCPA would be tied into only a single PG&E line north of Castle Rock.

would interconnect has a past history notable for the lack of unscheduled outages (RT 1460; Exhibit 32 late-filed by Applicant). Applicant's consultant believed that any future switching station at Castle Rock would be built if justified for main line system reliability, which would in turn depend upon the extent of future development and the frequency with which transmission service is lost (RT 1095-1100). Therefore, under the present scenario, given the admittedly speculative nature of a switching station at Castle Rock (e.g., RT 1163; 1313-16; 1456) and the favorable reliability of the transmission line to which Alternate 1 would connect, the Commission cannot conclude that construction of a Castle Rock switching station is more than a possibility or long-range planning alternative.

Secondly, connection at Castle Rock and improvement of overall system reliability raises certain philosophical questions. Factually, and except for three presently identified potential co-users - NCPA, the State Department of Water Resources (DWR), and the Sacramento Municipal Utility District (SMUD) - PG&E is the sole operator in the Geysers area and, quite naturally, own and operates the transmission system. As mentioned previously in this Final Decision, NCPA is currently negotiating a wheeling agreement which would provide for, among other things, use of the PG&E transmission lines*. It is likely that DWR and SMUD will do the same. NCPA has indicated that its reliability

* Staff has indicated that certain PG&E transmission system planners would prefer that NCPA route its tap-line to Castle Rock, even given the speculative nature of any future switching mechanisms (RT 1421-22).

considerations will be satisfactorily met in the forthcoming Interconnection Agreement (RT 1090-92); Staff admitted that a contractural arrangement could protect NCPA even though such arrangement would not necessarily benefit system reliability as a whole (RT 1143).

Thus, the question would seem to be whether NCPA should be required to provide reliability apparently more than sufficient to meet its needs, or whether integration of transmission system reliability needs should remain the responsibility of PG&E, subject of course to appropriate regulatory review and guidance from the Public Utilities Commission and Energy Commission. In the present case, and in view of all the competing considerations, this Commission cannot conclude that it should require NCPA, a comparatively small utility and new entrant into the Geysers area, to do other than meet reasonable transmission service reliability criteria, without being individually responsible for upgrading the overall Geysers transmission service. This does not mean that NCPA, or any other Applicant, can freely ignore transmission system planning considerations attendant to a particular project. Rather, it is a recognition that utilities new to the Geysers are, to large extent, presented with an existing system and cannot therefore be expected to unilaterally cure deficiencies in such system. No showing has been made that NCPA's Alternate 1 is not reasonably reliable, and the Commission will not thus require the use of Alternate 2 on reliability grounds.

Staff further bases its preference for Alternate 2 upon the position that interconnection at Alternate 1 would reduce

the carrying capacity of the existing PG&E line above and below the point of interconnection by the amount of capacity to be generated by NCPA (assumed to be 330 MW). Interconnection at Alternate 2 would not consume this capacity on the existing PG&E line and would thus leave the line free to accomodate additional development north of Castle Rock. NCPA did not contest the Staff's line capacity analysis, but rather suggested other means by which additional capacity could be attained when and if needed. Basically, NCPA indicated that PG&E may consider constructing a third circuit parallel to the existing circuits, that NCPA could consider constructing a third parallel circuit from Alternate 1 to Castle Rock, or that PG&E would be able to reconductor the existing circuits in order to accomodate additional capacity (RT 1291-93; 1312; 1455).

In examining these various contentions, the Commission was struck by two salient points. First, future development north of the NCPA project is quite speculative and, second, PG&E will in all probability need to build a third circuit parallel to the two existing circuits on the easterly line regardless of whether or not NCPA intercepts these lines via Alternate 1.

Regarding the first point, Staff has assumed that NCPA will place 330 MW of capacity on line by 1992 and that PG&E will also have placed an additional 330 MW on line by virtue of Units 19, 20 and 21 (RT 1141; 1165). Other evidence of record indicates, however, that NCPA has recently determined that available resources on the Shell leasehold would support only 220 MW of geothermal power, rather than the 330 MW originally

anticipated (RT 1546). Moreover, Staff acknowledged that future development, especially regarding Units 19, 20, 21, has recently become much more speculative due in part to difficulties in locating acceptable supplies of steam (RT 1466-69; 1475-78). Given this scenario, i.e. that NCPA would displace only 220 MW of capacity rather than 330 MW and that at least the three additional PG&E units are questionable in the near future, the case for saving additional capacity on the existing 1200 MW line becomes less compelling. A Staff witness intimated as much by explaining that his preference for Alternate 2 would diminish were NCPA to develop only 110 MW at the Shell leasehold (RT 1387-97; see also RT 1475-79). In his estimation, and given only this lesser level of development, there would be no good reason for NCPA to interconnect at Castle Rock (RT 1400).

While NCPA's projected 220 MW potential is double the level suggested by Staff's witness, it is nevertheless significantly lower than the previously assumed 330 MW. These factors further emphasize the speculative nature of future development as well as strongly suggest that contingency planning based on the need for additional capacity may be somewhat premature. The Commission can conclude only that sufficient capacity exists on the 1200 MW transmission line and that NCPA is not likely, at this point in time or in the near future, to displace a proportion of this capacity large enough to prevent future reasonably efficient utilization of the remaining capacity.

Moreover, as regards Staff's second point, the evidence of record clearly indicates that a third circuit will in all probability be required along the easterly line (RT 1407; 1420-21; 1444-45). This future third circuit could conceivably be built by PG&E or by NCPA*. Staff in fact has not contended otherwise and believes that, at best, tap-line routing along Alternate 2 would merely delay the need for this third circuit (RT 1364-65). Thus, the Commission is not faced with the relatively simple choice of deciding whether Alternate 1 or Alternate 2 is preferable because one route would obviate the possible need for an additional circuit; rather it is faced with this choice given the strong probability that an additional circuit will in any event be required. The evidence of record does not persuasively indicate that substantial benefit would result from delay in this third circuit.

Given these factors, the Commission concludes that delaying probable construction of a third circuit parallel to the easterly PG&E Geysers transmission line does not conclusively support tap-line routing along Alternate 2. Intermediate measures, such as changing loading patterns on the existing PG&E line (see RT 1287-88) or even reconductoring, appear feasible short-term alternatives to ensure system flexibility. Assuming that PG&E operates the transmission system in the most reasonably optimum manner, the aforementioned uncertainties in geothermal development and capacity additions as well as the probable eventual need for a third circuit,

* If built by NCPA, this circuit would most likely parallel the existing line from the interconnection of Alternate 1 to Castle Rock.

persuade the Commission that Alternate 2 cannot be required on system flexibility grounds.

d. Associated Costs

The Commission has considered costs to both society and to the utility associated with Alternates 1 and 2. Societal costs have been evaluated primarily in terms of transmission losses and the accompanying benefits which would accrue were these losses avoided. Utility costs have been evaluated basically in terms of additional expenditures which would be incurred were the Applicant required to route its tap-line along Alternate 2.

Staff persuasively established that Alternate 2 would result in energy conservation benefits, in the form of fewer transmission losses on the order of 1.5 million Kwh per year. Put differently, this would be the amount of energy required to supply the needs of approximately 250 homes per year (RT 1136-37; 1358). NCPA did not discredit this energy savings benefit, and one witness in effect admitted that this additional savings was undeniable (RT 1554). NCPA did, however, establish that it had taken heretofore unprecedented steps in achieving highly efficient geothermal generation of electricity by providing for a high degree of reliability* and by deriving an additional 8 percent of energy from a given quantity of steam. The increased efficiency of the NCPA project will thus provide an additional 29,000 Kwh per year because of increased capacity and 65,700 megawatt hours

* Projected 80-83 percent capacity factor as compared to 65-75 percent.

from each generating unit (RT 1555-57). This additional energy, as NCPA's witness pointed out, is equivalent to the energy consumption of approximately 10,000 homes (RT 1563). Moreover, the losses identified by Staff amount to only a small fraction of this additional energy which will be generated due to NCPA's efforts in increasing plant efficiency (RT 1555-56; 1563).

The Commission, as stated in the 1979 Biennial Report, is strongly in favor of reasonable and feasible energy conservation measures. Were this policy applied to the present case irrespective of other considerations, there would be no choice but to require NCPA to utilize the Alternate 2 tap-line route. However, the instant case presents the situation wherein a utility has provided for an admirable degree of energy conservation through design features hitherto unutilized in the State of California. It is true that NCPA's project is not refined to the Nth degree; it is also true that this utility has apparently designed its project to provide, in the altruistic sense and with comparatively minor exceptions, a great degree of societal benefits in terms of increased electrical generation and efficient resource use. While Staff's point that the project is perhaps not as energy efficient as possible is well taken, the Commission believes that the increased amount of energy generated at least offsets the comparatively minor societal loss which would accrue with Route 1.

Utility costs associated with Alternate 2 were somewhat more difficult to ascertain. Both Staff's and Applicant's witnesses definitively established the role which assumptions play in various cost-benefit calculations. The Commission is

truly cognizant of the fact that any desired result may be achieved if certain assumptions are used. Staff, through calculations done independently by two qualified witnesses, concluded that the value of transmission losses which would be incurred by Applicant along its preferred Route 1 amounted to approximately 1.4 million dollars over the life of the project (RT 1131-33; 1136; 1356-57). Applicant's witness, on the other hand, concluded that the dollar value of transmission losses was approximately only one-third of Staff's suggested value (RT 1299-1300; 1327). These figures were obviously based on different assumptions, chief of which was the proper value for the cost of replacement power*.

NCPA initially contended that 17.45 mils per Kwh was the proper value for the cost of replacement power based on the average annual cost of wholesale power on the PG&E system (RT 1104). Later in the Committee hearings, however, this same value was increased to 21.2 mils (RT 1297; 1301; 1313-21). Staff initially contended that 78 mils per Kwh was in fact the proper value, although a figure closer to 60 mils per Kwh was later introduced (RT 1360; 1369). Admittedly a large part of the difference in utility costs** allocated to the choice of alternate tap-line routes is due to the value used in this cost-calculation (see RT 1374-75).

* The calculations also differed regarding inclusion of a loss factor, system capacity factor, and present worth value (RT 1295-1306; 1415-19; 1440), but the effects of these variables were minor compared to the differences in the conclusions caused by using highly divergent replacement power costs.

**It must be noted, however, that under its contractual arrangements with PG&E, NCPA will pay a fixed percentage to the latter for line losses, irrespective of whether the tap-line interconnects along Alternate 1 or at Castle Rock. Thus, even if the transmission losses decrease, the associated cost savings would accrue to PG&E (RT 1094; 1113-14).

Based upon its expertise in this area, the Commission finds that the value suggested by Staff is more truly representative of the cost which NCPA would have to pay for replacement power from the PG&E system. The 17.45 or even the 21.2 mil figures advocated by NCPA simply do not reflect the average cost of power generated on the PG&E system when other than geothermally produced power is considered. The Commission therefore concludes that the project-life costs which accrue by routing along Alternate 1 would be closer to the 1.4 million dollar figure espoused by Staff.

This figure does not, however, dispose of the question regarding the extent of costs which NCPA would suffer. As was pointed out at length during the Committee hearings, the Applicant originally estimated that Alternate 2 required an additional capital of approximately $60,000 over that required for Alternate 1, exclusive of the value of transmission losses and acquisition of land and land rights (RT 1087-89; 1094; 1144-45; 1511-12). During the evidentiary hearings, however, Applicant revised this initial figure to indicate that Alternate 2 would require a capital expenditure of approximately $500,000 for additional construction costs plus approximately $245,000 for acquisition of land and land rights (RT 1525-27). This construction cost figure differed substantially from the $122,000 posed by Staff (RT 1434; 1462-64).

The computations of these costs are covered in great detail in the hearing record (e.g. RT 1462-64; 1499-1500; 1510-15; 1526; 1533) and need not be extensively explored at this point. Suffice to say that the Applicant's estimate of land acquisition costs was not discredited and that Staff's computation of road

construction costs appears based on techniques unacceptable for permissible development in the Geysers area. While certain elements of Applicant's construction cost itemization appear overly liberal, the Commission must conclude that routing along Alternate 2 would cause Applicant to expend in the vicinity of an additional $500,000 based on re-engineering, transmission line, road construction, and land and land rights acquisition costs. Even this magnitude of additional costs, taken alone, would not be sufficient to persuade the Commission to permit routing along Alternate 1.

Applicant, however, introduced uncontroverted evidence detailing other costs which it would incur as a result of tap-line routing along Alternate 2. These delays and resultant costs would emanate from the additional engineering, survey, environmental, and land acquisition which would perforce occur (RT 1537-38). Applicant's witness testified that NCPA could suffer an additional $80,000 per month interim financing cost, $300-400,000 per month equipment escalation cost, and $150,000 per month purchase of replacement power cost (RT 1539-41; 1561). In addition, NCPA's contractural arrangements with the steam supplier could be renegotiated to NCPA's detriment were final certification of the project substantially delayed* (RT 1541-42). Staff did not discredit the magnitude of these costs.

The Commission therefore concludes that NCPA would incur significant additional costs were routing along Alternate 2

* The Commission notes that Applicant's construction schedule appears to be quite optimistic.

required as a condition of certification. However, as stated above, society will incur a detriment in the form of potentially avoidable transmission losses if Alternate 1 is certified. The question thus ultimately becomes whether, in light of all pertinent considerations, society or NCPA must bear the brunt of these burdens.

e. Who Bears the Burden?

One of Staff's principal contentions is that NCPA is unjustifiably committed to Alternate 1 because of presumptuous planning on its part (see, e.g., Staff post-Hearing Brief, p. 1). The additional costs of Alternate 2 are caused by this premature committment and, as a result, the burden may fairly be placed upon the Applicant. NCPA, however, contends that it did not know of Staff's opposition to Alternate 1 until early November 1979 and that, had it known of Staff's preference as late as August 1979 it would have adjusted its plans accordingly (RT 1571-74).

The Commission accepts NCPA's contentions. First, Alternate 1 was in fact considered at least briefly during the NOI (RT 1583), although no firm decision was made at that point concerning final tap-line routing along any alternate route. Second, although NCPA had participated in workshops and responded to information requests early in 1979 concerning the tap-line routing question (e.g., RT 1544), such information exchanges covering the total scope of project review are customary in Commission proceedings. These exchanges and workshops serve a fundamental purpose of allowing the participants to clarify the areas over which disputes may arise. Some months

following these exchanges, in its October Prehearing Conference Statement, Staff had not yet identified the tap-line routing issue as being the subject of significant dispute. It was not until the November 1979 Prehearing Conference Statement that the breadth of the issue formally came to NCPA's (and the Committee's) attention*. Even though under other circumstances Staff may have made a credible case, the Commission does not desire to implicitly sanction eleventh-hour pleas except in unusual and compelling circumstances.

No such circumstances are evident in this case and the Commission is at a loss to fathom why the issue was not formally identified sooner. Compounding this sequence of events is the Commission's observation that the Applicant has generally conducted its portion of these proceedings in a cooperative manner. While this observation is of course insufficient to justify finding in NCPA's favor, it does lend credence to the contention that Applicant would have at least carefully considered Alternate 2 had it been specifically and formally apprised of Staff's concerns at an earlier date.

These considerations do not negate the almost precipitous lack of thoughtful tap-line planning or the effects of the cursory review given alternative routes by NCPA. The Commission will not condone such actions in the future, including the omission of tap-line transmission losses and overall system reliability

* The Commission notes that at this time the Commission Committee was proceeding on a schedule to enable a Final Decision by the close of 1979.

and flexibility consideration by an Applicant in selecting a proposed tap-line route. "Cheaper" does not always equate with "acceptable". By and large, the Commission also acknowledges the approach to tap-line routing adopted by Staff in this case. The approach appears valid and the depth of review laudatory; in future siting cases, however, similar concerns must be identified earlier.

In conclusion, and after weighing all of the considerations summarized in the preceeding sections and the overall evidence of record, the Commission must find that Alternate 1 is permissible as the tap-line route for the NCPA Geothermal Project No. 2.

iii) Tap-line Health, Safety and Nuisance Effects

Applicant's witness testified that the 230kV transmission tap-line will be constructed in such a way as to minimize fire hazards and that NCPA would be guided by Public Utilities Commission General Order 95 (RT 1123-4). Applicant will, however, be subject to USGS review insofar as construction of the tap-line is concerned. This witness further testified that NCPA will submit its worker safety plans to Cal/OSHA for review and that the tap-line will neither cause significant communications interference nor pose hazards to aircraft (RT 1123-27). Staff's witness testified that the tap-line would cause no undue threat to public health and that the nuisance effects, given the mitigation measures proposed, would be insignificant. This witness concluded that the tap-line

should meet all applicable standards, ordinances and laws, including the Sonoma County Noise Element (RT 1040-80). Finally, Staff's witness testified that his analysis of the health, safety, and nuisance effects of the 230 kV tap-line applied to all alternate routes under consideration during the AFC proceeding.

SUPPLEMENTARY COMMISSION FINDINGS AND CONCLUSIONS

Based on and including the foregoing discussion and the Findings and Conclusions therein, the Commission concludes that it has the authority within the scope of its broad jurisdiction to require an Applicant to adopt an alternate tap-line route as a condition of certification, based upon a sufficient showing as to the reasons supporting such alternate route. In the present case, the Commission finds that both Alternates 1 and 2 are environmentally acceptable, even considering the additional transmission losses incurred as a result of Alternate 1, due in part to the fact that Applicant's measures toward increased plant efficiency adequately mitigate these impacts. The Commission further finds that connection of the tap-line at Castle Rock along Alternate 2 would provide certain system reliability and flexibility benefits but cannot conclude that, when evaluated in light of all competing considerations, such advantages compel routing along Alternate 2. The Commission concludes that Applicant would suffer substantial economic burdens were Alternate 2 required as a condition of certification and the combination of this factor and all the considerations of record tends to make it unreasonable to require a tap-line route other than Alternate 1. Finally, the

Commission finds that there are no non-mitigable environmental or health and safety effects associated with either Alternates 1 or 2.

Tap-line routing along Alternate 1 is therefore approved, conditioned upon implementation of the measures identified in Appendix B of this Final Decision and Chapter IV of the Final Joint Environmental Study. The Applicant shall implement the mitigation measures phrased as "must" and "will" in Chapter IV of the Final Joint Environmental Study. The measures phrased as "should" and "could" in Chapter IV of the Final JES are to be interpreted as identifying further impacts which must be mitigated, although the actual method of implementation may reasonably vary from those suggested in the JES. The Commission specifically notes that the considerations contained in the Final JES on pages IV-89 and V-8-13 have been considered in reaching this Final Decision and should not be construed as inconsistent herewith.

APPENDIX A

Following is the Determination of Compliance submitted by the Northern Sonoma County Air Pollution Control Officer, as clarified at the December 11, 1979 evidentiary hearing.

November 15, 1979

California Energy Commission
1111 Howe Avenue
Sacramento, California 95825

Attention: Jeff Anderson
Subject: Necessary Conditions for NCPA's 79-AFC-2

Dear Mr. Anderson:

Since this District doesn't have all the data it would like on this proposed project the following conditions (or findings as you call it) would insure the project's compliance with District rules and regulations:

1) Applicant shall return all untreated steam and/or condensate to injection points such that hydrogen sulfide will be treated or eliminated up to the standards of rule 455 (a) and (b), during normal power plant operation, plant start-up and shut-down. Such untreated steam and/or condensates are Stretford system process steam, Stretford and cooling tower blowdown, inter and after condenser, etc.

2) For the primary hydrogen sulfide control system (Stretford system) the Applicant shall design the system for no more than 1 percent unavailability or a) install an auxillary for the following equipment items: agitator for the reaction tank, oxidizer air blower for the oxidizer tanks, agitator for oxidizer tank, balance tank agitator, cooler circulation pump, sulfur froth tank agitator, sulfur slurry pump, and sulfur storage tank transer pump where each auxillary item shall automatically take over the failed originals function and initiate an alarm and, b) fully winterize chemical feed lines and pumps.

3) Applicant shall install and operate a continuous (every fifteen minutes) H_2S monitoring device in the off-gas vent to the atmosphere and the off-gas vent to the cooling tower. The gas analyzer shall have an accuracy of $\pm$ 10 percent of full scale for the 1000-5000 ppmv range. The flowmeter shall have an accuracy of $\pm$ 10 percent of full scale for the range of 500-2,000 acfm range. Data shall be logged on a strip chart or other similar device which will be available for inspection on site upon request. Data capture shall be a minimum 85 percent on an annual basis.

4) For a secondary abatement system employing the hydrogen peroxide/iron catalyst control technique the Applicant shall:

   a) size the H_2O_2 and iron catalyst storage tanks for 8 days supply assuming 60 percent partitioning, 90 ppmv H_2S in

steam, 1.5 mole ratio of H_2O_2 to H_2S and 50 gm/GMW/hr standard;

b) Design the system for no more than one percent unavailability or install an auxiliary chemical feed pump and filter for the H_2O_2 and iron catalyst feed system which will automatically take over the failed originals function and initiate an alarm; and fully winterize chemical feed lines and pumps.

5) Although the Applicant may be licensed on the basis of a hydrogen peroxide/catalyst system, the Applicant may use other means to comply with Rule 455(b). The Applicant will submit, no later than two years prior to the scheduled commercial operation date of NCPA/Shell project, the conceptual design of the secondary abatement system, including data demonstrating that compliance with Rule 455(b) of the NSCAPCD can be met and the system design is expected to have no more than one percent unavailability. Such data shall be submitted to the CEC, ARB and NSCAPCD 30 days prior to proceeding with design of the proposed system unless otherwise notified by the Executive Director. In this event, the Commission shall hold a hearing within ten days and issue a decision within 20 days of the hearing.

6) Applicant approved-for-construction drawings of the secondary abatement system shall be submitted to the CEC, ARB, and NSCAPCD 30 days prior to the construction of this system unless notified by the Executive Director. In this event, the Commission shall hold a hearing within 10 days and issue a decision within 20 days of the hearing.

7) Applicant shall enter into a program to fund an outside contractor to perform a survey for continuous H_2S emission rate monitoring devices or systems. The preliminary report is due October 1, 1980, and shall include each instrument or system considered; each's advantages, disadvantages, accuracies, precision and applicability; recommendation for best candidate, if any; and a preliminary design. Unless the Applicant, CEC, ARB, and NSCAPCD agree continuous monitoring is not suitable the Applicant shall submit approved-for-construction drawings to the CEC, ARB, and NSCAPCD by January 1, 1981. Construction of the system shall start 30 days thereafter unless notified by the Executive Director. In this event, the Commission shall hold a hearing within 10 days and issue a decision within 20 days of the hearing.

In the event a continuous H_2S emission rate monitor is not employed the Applicant must install a recording system to indicate the rate of peroxide and iron catalyst injection. This recording system shall be useable in the field and provide a six month backlogue for review.

8) Applicant shall operate or participate in operating an ambient H_2S monitoring station at Middletown or old SRI#6 for the first three years of plant operation unless an alternative method of ambient monitoring mutually agreed upon by the Applicant, CEC and NSCAPCD is implemented, or monitoring at Middletown or old SRI#6 is performed by another party.

9) Applicant, within 60 days of commercial operation, shall demonstrate that the applicable emissions limitations of NSCAPCD rules are being maintainted during normal power plant operations. Applicant shall submit a detailed performance test plan to the NSCAPCD at least 30 days prior to such tests. Applicant's proposed test plan must receive NSCAPCD approval before such tests may be conducted to achieve compliance. In the event of disapproval the applicant may request the Commission to hold a hearing within 10 days and thus obtain resolution within 20 days of the hearing. During performance of the compliance testing the NSCAPCD must be present.

   Failure to completely and accurately make such compliance demonstrations may be cause for Commission action to shut-down or curtail the operation of Applicant's project until remedial action can be taken after proper notice and public hearing.

   For purposes of thes conditions, "normal" operation is defined as operation of the facility with all abatement equipment installed and operating to specifications enumerated herein.

In regards to the steam transmission line compliance, the air quality impact analysis provided by NCPA indicates that under adverse meteorology and only complying with minimum stacking rules an exceed of the State H_2S ambient air quality standard would occur. However, the District believes there are a number of abatement technologies available or potentially available to prevent this. Such technologies would have to reduce H_2S emissions to approximately 22 kg/hr level anytime during stacking.

/S/ MICHAEL W. TOLMASOFF
Air Pollution Control Officer

APPENDIX B (Revised)

Following is the program for monitoring compliance of the NCPA Geothermal Project No. 2 with applicable standards, ordinances, and laws. This program represents the final agreement reached among NCPA, the Federal agencies, and the Commission.

* * * * * * * *

The "Letter of Agreement" delineating the respective post-licensing duties of the United States Geological Survey and the California Energy Commission appears at pages B25-29 (Revised). This Agreement will be executed as directed in the Commission's Decision (Revised) and incorporated into the compliance and monitoring program.

COMPLIANCE AND MONITORING PROGRAM

NORTHERN CALIFORNIA POWER AGENCY
UNIT NO. 2

February 29, 1980

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COMPLIANCE AND MONITORING

I INTRODUCTION

A. The USGS shall be the lead agency for Compliance and Monitoring. All submittals shall be directed to the USGS who may then delegate responsibility for the review and approval. The final recommendation approval shall be from the USGS.

B. This document defines the standards and codes to which the power plant will be designed and constructed. Through those submittals listed throughout the document, the USGS will be able to monitor the design and construction in order to determine compliance with those standards and codes.

C. This document also lists actions to be taken by the NCPA during design and construction that must be approved by the USGS prior to construction or start up, as applicable.

D. The USGS has the responsibility for enforcement of this document.

E. This document applies to the "Project Area" which is defined to be the plant site area and the transmission line right of way.

F. Wherever NCPA disagrees with USGS action, the appeal procedures of the USGS shall be followed.

G. Post-licensing duties and responsibilities of CEC and USGS are prescribed in a letter of understanding appended hereto.

II GEOTECHNICAL

A. Standards and Codes

The following Standards and Codes shall be followed:

1) Uniform Building Code, Chapter 70 (1976) Section 7015 "Completion of Work".

2) California Business and Profession Code, Section 7835- "Preparation, Signing and Sealing Plans etc."

3) Public Resources Code 25532 "Monitoring Program Establishment".

B. Actions

1) A Geologic Grading Report and a Soil Grading Report shall be submitted to the USGS. This report shall be updated as required to incorporate new data found during the grading.

2) A registered engineering geologist shall sign and seal the submittals.

3) A registered engineering geologist shall be present as needed during all phases of site excavation and grading to evaluate geologic conditions and geologic safety.

4) Conditions found that shall warrant only minor changes shall be reflected in the as graded/as-built plans submitted to the USGS. If an adverse condition warranting major change is found, this information and the revised mitigation plan

shall be submitted. A Parallel submittal to the CEC shall be made.

C. Enforcement

1) The NCPA will extend permission to the USGS, its staff or delegate, to conduct site inspections during site excavation and grading and a final inspection upon final completion of site earthwork.

2) Upon notification that a hazardous or an adverse geologic condition has been confirmed at the site, the USGS or delegate may inspect the site to evaluate such conditions and to offer advice to the applicant in development of a mitigation plan.

3) Within 3 working days of submittal of the plans, the USGS or its delegate will notify the applicant whether or not the staff finds the applicant's proposed new or revised mitigation plans acceptable.

4) Upon notification by the USGS or its delegate that the applicant's new or revised mitigation plans are unacceptable:

   a. the applicant will cease (in the affected area only) earthwork and construction (other than that required for safety) or any other implementation of the unapproved plan by the USGS, and

   b. The USGS will resolve the dispute and determine an acceptable mitigation plan.

   c. USGS will not approve the Final Grading Plan until after submittal by the applicant of the Soils Grading Report and Geologic Grading Report.

III CIVIL ENGINEERING

A. Standards and Codes

The following Standards and Codes shall be followed:

1) Uniform Building Code (1976 edition)
2) Federal Regulations 30 CFR 270 and GRO 4 and 5.

B. Procedures

1) The grading requirements found in the UBC and required by the USGS shall be satisfied by the grading plans. The plans shall be submitted to the USGS for approval.

2) The grading plans shall be stamped by a registered Civil Engineer as required by the UBC.

3) The applicant shall make in-lieu payments to Sonoma County equivalent to the fees listed in Chapter 70 of the UBC for review of the grading plans and in-lieu permit.

4) A staff of field engineers and inspectors shall be provided on site at all times by the applicant to monitor contract and construction activities.

5) Filings and Notifications - Uponcompletion, NCPA will prepare and submit to the USGS the following:

   a. Summary of soils compaction tests;
   b. "As-built" grading drawings; and

6) After completion of the work, the NCPA shall submit to

the USGS final reports and site approvals by the responsible civil engineer, soil engineer, and engineering geologist. The final reports and site approvals shall be reviewed within 20 working days.

C. Enforcement

1) If the grading plans do not comply with the UBC and/or USGS requirements, no grading will be allowed until the appropriate corrections are made.

2) Inspection of the grading operation will be done by the USGS or his delegated agent. Special and continuous inspections may be delegated to NCPA by the Chief Building Official as provided in Section 305, Chapter 3 of the UBC. The inspector will be an engineer experienced in soil engineering and engineering geology per 1976 UBC Section 7014.

   a. Verification - The NCPA will notify the USGS of substantial design changes to the plans as required by UBC Sections 7014, 7015, and 302. Within 5 days, USGS will or its delegates will notify NCPA whether or not design changes are approved.

   b. Final reports and site approvals specified in UBC Section 7015 will be filed with the USGS. These reports will be filed upon completion of rough grading and completion of the work. The permittee or his agent will notify the USGS or his agent when grading is completed so that final approval may be given.

3) Enforcement - Inspections shall be performed in accordance with Chapters 3 and 70 of the UBC (1976 edition). The USGS may delegate responsibility for special and continuous inspections to NCPA as provided in Section 305, Chapter 3, of the UBC. If the inspector finds that the work is not being done in conformance with the 1976 UBC, or the approved grading plans, the discrepancies shall be reported by the inspector in writing to the USGS and to Sonoma County.

IV STRUCTURAL

A. Standards and Codes - The following Standards and Codes shall be followed:

1) Laws, Ordinances, Regulations, and Standards

a. Uniform Building Code, 1976 Edition (UBC 76), excepting Sections 2312 (Note: The UBC 76 is adopted as the minimum legal state building standard).

b. Sonoma County Ordinance No. 2395 excepting Section 2312 of the reference adopted in Section 4-14.a. (UBC 76)

c. American Society of Mechanical Engineers' Boiler and Pressure Vessel Code (ASME BPV Code) (Note: The ASME BPV Code is adopted by Title 8, CAC).

2) Standards and Codes

a. American National Standards Institute "B 31.1 Power Piping Code" (ANSI B 31.1).

b. American Concrete Institute (ACI) "Building Code Requirements for Reinforced Concrete" (ACI 318-77).

c. ACI "Building Code Requirements for Structural Plain Concrete" (ACI 322-72).

d. ACI "Commentary on Building Code Requirements for Reinforced Concrete" (ACI 318C-77).

e. American Institute of Steel Construction (AISC) "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings", Nov. 1978 (AISC 78).

f. AISC "Commentary on the Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings" (AISC C 78).

g. AISC "Specification for Structural Joints Using ASTM-A325 or A490 Bolts", April 1978 (AISC SST 78).

h. American Iron and Steel Institute (AISI) "Specification for the Design of Light Gage Cold Formed Steel Structural Members" (AISI).

i. Steel Joist Institute "Standard Specifications and Load Tables" (SJI).

j. American Welding Society "Structural Welding Code AWS D.1.1-79" (AWS D.1.1-79).

k. American Welding Society AWS D12.1-75 "Reinforcing Steel Welding Code".

l. "National Design Specification for Stress-Grade Lumber and Fastenings 1977" (NDS 77).

m. American Association of State Highway and Transportation Officials "Standards Specifications for Highway Bridges", 1977 Edition (AASHTO BRIDGE 77).

n. AFC Section III.C. and AFC Supplement Section S:II.

B. Procedure

1) The proposed structural analysis methods, and the proposed structural and seismic criteria used shall provide safety and reliability. shall meet performance criteria and be consistent with governmental laws, regulations and ordinances.

2) NCPA shall submit to the USGS all structural and seismic criteria (including basis therefore if not covered in applicable LORS, e.g. equipment operating loads) for approval at least 60 days prior to the intended start of construction of any structure or structure foundations.

3) The final structural and seismic design criteria shall be subjected to an analysis by the USGS for determination of adequacy. The structural design plans, specifications, and calculations should be reviewed to ensure that the approved design criteria are included therein as part of the review.

4) NCPA shall be required to submit to the USGS for approval the structural analysis methods at least 60 days prior to the intended start of construction of any structure or structure foundations. The data shall include:

   a. Technique
   b. Assumptions
   c. Description of the analytical model (e.g., space frame, 120 DOF, etc.)
   d. Methods used to account for interaction effects and bases (e.g. soil-structure interaction; mass or stiffness coupling between equipment and structure; etc.).

   This condition may be fulfilled by submission of complete design calculations.

5) The NCPA shall furnish to the USGS for approval complete set of final structural design plans, specifications, and design calculations for each structure or structure foundation. The plans, specifications, and calculations shall be filed not later than 60 days prior to the intended start of each structure or foundation, and shall be developed using the approved structural design criteria, seismic performance criteria, seismic design criteria, and seismic analysis methods. The design calculations shall clearly reflect the inclusion of approved criteria, assumptions, and methods used to develop the design.

6) The final structural design plans, specifications, and design calculations shall be subjected to review by the USGS.

7) a. USGS may delegate construction compliance monitoring to Sonoma County Office of Building Inspection except for major changes. Sonoma County Office of Building Inspection may in turn delegate responsibility to the NCPA providing the following conditions are met:

   1. The NCPA must file a Quality Control Plan with the USGS for approval. The Quality Control plan should address all aspects of construction monitoring including material testing, manufacture or fabricator certification, as-built drawings, deviations from plans, changed conditions, etc. The plan should also provide for the filing of periodic compliance reports with the USGS.

   2. The NCPA's responsible engineer will have the authority to act independently.

3. The NCPA's responsible engineer will have the authority to require changes or remedial repair work.

4. The NCPA shall furnish, for each completed structure, an affidavit that the "as-built" structure does not violate the applicable laws, ordinances, regulations, and standards.

5. The NCPA shall furnish the USGS as-built structural drawings which accurately reflect the as-built conditions.

b. Any changes to the structural plans or specifications which could be in violation of the applicable LORS or result in a change in design concept will be considered a major change. The NCPA will be required to file within 5 working days after discovery with the USGS a report documenting any major changes including the necessity for the change and the design details of the proposed change. The change must then be approved by the USGS prior to plant start-up and operation.

8) Any future modification or change in the constructed facility structures which could be in violation of LORS is considered to be a major change to the project and requires USGS approval prior to initiating the change.

9) For review purposes a parallel submittal to CEC shall be made of all seismic design criteria and structural design criteria for critical structures and components listed in Table 1, page 14 hereafter.

C. Enforcement

1) The final structural design plans, specifications and design calculations shall be subjected to review and approval by the USGS or its delegate prior to issuance of the construction permit.

2) The USGS or its delegate may monitor construction of the facility.

3) The USGS or its delegate shall review and approve structural changes necessary during construction.

4) The data on analysis methods of structural models and degree of refinement shall be available after completion of final design.

5) Table I lists the structures and components which are designated as critical.

6) Seismic Design Criteria
Seismic performance criteria are inferred from the seismic design criteria. Seismic design criteria for the turbine building, turbine generator pedestal, and H_2S absorber column response spectrum modal analysis with peak horizontal bedrock acceleration = 0.25g and working stress design.

7) The seismic design for the cooling tower shall require:

   a. Working stress design and an elastic response spectrum modal analysis with PGA - 0.17g.

b. Design check using the same spectrum and PGA = 0.25. If the stresses are not less than or equal to two times the allowable stresses, the tower may be redesigned to reduce maximum stresses to less than 2x allowable. The NCPA shall submit the design calculations and design check for approval as set forth below: NCPA shall specify to the cooling tower manufacturer that the cooling tower structure design be based upon: 1) a working stress criterion; 2) a peak ground acceleration of 0.17g; 3) a design specturm as specified in the procurement document; 4) a damping ratio of 7%; and 5) a dynamic analysis using conventionally acceptable methods.

c. 120 days prior to start of construction of the cooling tower NCPA shall submit for USGS review the dynamic analysis methods and models which will be used in the analysis. NCPA may proceed with the analysis unless notified otherwise by the USGS within 30 days.

d. 120 days prior to construction of the cooling tower a check of the design based on the following will be submitted:

1. A peak horizontal bed rock acceleration of approximately 0.25g;

2. The response spectrum specified in "a" above.

TABLE 1

CRITICAL STRUCTURES AND COMPONENTS

STRUCTURES:

1. Turbine-Generator Building

2. Cooling Tower

3. Turbine-Generator Pedestal

4. Switchyard Structures

EQUIPMENT:

1. Turbine-Generator

2. Surface Condensor

3. Gas Removal Equipment

4. Main Transformers

5. H_2S Abatement Facility

6. Circulation Water Pumps

7. Switchyard Equipment

V TRANSMISSION LINE

A. Standards

The following Standards and Codes shall be followed:

1) Noise: (Construction) CAL OSHA, 8 California Administrative Code Section 5095-5099.

2) Noise: (Operation) Sonoma County - Sonoma County General Plan Noise Element (adopted January 1978).

3) Safety/Reliability: CPUC GO-95.

4) Safety: CAL OSHA, 8 California Administrative Code, Article 85, Section 2940 et. seq., Article 87, Section 2950 et. seq., and general Construction Safety Orders Title 8, Subchapter 4.

5) Safety: (Interference with Navigable Airspace) FAA, 49 USCA 1348, 14 CFR, Part 77.

6) Safety: (Interference with Navigable Airspace) Department of Transportation, Division of Aeronautics, Public Utilities Code 21656 et. seq., 21 California Administrative Code 3500 et. seq.

7) Nuisance: (Radio Interference) Federal Communications

8) Electrical Clearances: Public Resources Code 4292-4296, State and Private Land Fire Protection.

9) Electrical Clearances: 36 CFR Section 261.52 (k)

10) CEC Staff grounding criteria.

11) CEC Staff RI/TVI criteria.

B. Actions

1) During Construction, operation and maintenance of the transmission line, the California Public Utilities Commission (CPUC) regulations governing public and occupational safety shall be followed.

2) A California Registered Electrical Engineer shall sign and seal that the transmission line has been designed, constructed and will be operated in accordance with CPUC GO-95. This certification shall be provided to the USGS within 30 days after completion of the transmission line construction.

3) If any transmission tower or conductor will be greater than 200 feet above ground at the site a "Determination of No Hazard to Air Navigation" shall be obtained from the FAA. Application must be made at least 30 days prior to the date proposed to start of construction.

4) If complaints are received concerning radio or television interference caused by the transmission line, the defects shall be repaired.

5) Minimum fire protection standards issued by the California Department of Forestry shall be followed.

6) The transmission lines shall be inspected annually.

7) Within 30 days of completion of the transmission line a certification to that effect shall be filed with the USGS. This certification shall be signed and sealed by a California Registered Engineer certifying that the design and construction meets the codes and standards listed in paragraph A.

8) All fences longer than 150 feet within the right of way shall be grounded. Fences installed subsequent to line construction shall be grounded.

9) Complaints regarding induced current from vehicles, portable objects or other metallic objects shall be investigated and corrected at the expense of the NCPA.

C. Enforcement

The USGS or its delegate shall have enforcement responsibility.

VI WORKER SAFETY

A. Standards and Codes

The plant Accident Prevention Program shall be in comformance with Title 8 CAC General Safety Order 3203 and Construction Safety Order 1509 issued by CAL-OSHA.

B. Actions

1) An Accident Prevention Program shall be developed and submitted to the USGS for approval 30 days prior to the start of construction.

2) The USGS shall be informed each time a violation occurs. Citations and/or penalties may be assessed.

C. Enforcement

The USGS shall be responsible for enforcement. The USGS or its delegated representative may make periodic site visits to monitor compliance.

VII HANDLING OF TOXIC, HAZARDOUS AND FLAMMABLE MATERIALS

A. Standards and Codes

The following standards and codes shall be followed as indicated:

1) H_2O_2 storage tank(s) shall be fabricated and constructed in accordance with MCA Chemical Safety Data Sheet SD-53 and TID 70.24, Chapter 6.

2) Stretford system pressure vessels shall be fabricated and constructed in accordance with ASME Code Section VIII, Division 1 and TID 70 24, Chapter 6.

3) Lube oil and Stretford system tanks shall be fabricated and constructed in accordance with API 650 and TID 70 24, Chapter 6.

4) Racks for storage of materials used for daily maintenance shall be constructed and installed in accordance with ATC-3 06 Chapter 8 for a performance level of 1.0 and Av = 0.4.

5) American Water Works Association, AWWA D100.

6) American Petroleum Institute, API 620 and API 650.

7) American Society of Mechanical Engineers, ASME Section II, VIII, IX and Section III, Division 1 Subsection ND No. ND3800.

8) American Welding Society, AWS D1.1, Rev. 1, 1976 Structural Steel Welding.

9) Technical Information Document, TID 70 24 Chapter 6.

B. Actions

1) An affidavit signed by a registered mechanical engineer shall be submitted to the USGS certifying compliance to the above standards.

2) Standard safety precautions will be required of operators handling chemicals. Eye protection and protective garments will be required. Eye wash and emergency shower stations will be provided at work areas where hazardous chemicals are handled. All piping and storage drums containing toxic, flammable or hazardous substances will be anchored to prevent overturning. Accidental spills of toxic, hazardous, and flammable materials are to be handled as described in the spill contingency plan.

3) A spill contingency plan shall be submitted for approval 30 days prior to receiving any chemicals on the site.

C. Enforcement

The USGS may cause construction to cease or take other appropriate action if the above standards and codes have not been applied, or if the spill contingency plan has not been submitted.

VIII FIRE SAFETY

The following standards and codes shall be followed:

A. Standards and Codes

1) Title 8, California Administrative Code, Chapter 4.7, Groups 20, 27.

2) NFPA Codes:

Volume 1 §§ 10, 13
Volume 2 §§ 14 - Class II service, 19B, 20, 194, 196
Volume 3 §§ 30
Volume 6 §§ 70
Volume 9 §§ 214
Volume 12 §§ 26, 27, 198
Volume 15 §§ 231A

3) UBC Chapters 5, 20, 32, 33

4) PRC §§ 4291

B. Actions

The NCPA shall submit the following to the USGS for approval 30 days before the start of construction:

1) Prior to construction, copies of agreements with California Department of Forestry and local entities for mutual assistance.

2) Prior to construction, a copy of the fire protection plan

shall be reviewed and approved by the USGS or its delegate.

3) Prior to commercial operation, an affidavit signed by a Registered Fire Safety Engineer or the NCPA's fire insurance company stating that the design construction and operation of the on-site fire protection system is in accordance with the above referenced codes.

C. Enforcement

If, for any reason, NCPA does not submit to the USGS the affidavit prior to commercial operation of the facility, the USGS may order NCPA to delay operation of the facility or take other appropriate action consistent with its certification decision and applicable laws.

IX ENVIRONMENTAL MITIGATION

The environmental impacts caused by construction and operation of the NCPA No. 2 Geothermal Project and measures to mitigate or lessen the adverse impacts as presented in Section IV of the Final Joint Environmental Study (JES) by the California Energy Commission in cooperation with the U. S. Department of Interior: Bureau of Land Management, Geological Survey and U. S. Department of Energy are incorporated herein by reference.

The mitigation measures described in Section IV of the JES will become stipulations in:

a. The NCPA No. 2 AFC decision prepared in conjunction with the California Energy Commission's certification process;

b. The license issued by BLM for the proposed use of public lands;

c. The series of permits issued by USGS for project development and operation; and

d. The loan guaranty granted by DOE for project development.

e. Standards and Codes - The following Standards and Codes shall be followed:

- o Federal Law - Geothermal Steam Act of 1970 and Regulations on the Leasing of Geothermal Resources (84 Stat. 1566).
- o Federal Law - United States Geological Survey Regulation (30 CFR 270.34 (k)).
- o Federal Law - Guidelines for Acquiring Environmental Baseline Data on Federal Geothermal Leases (Geothermal Environmental Advisory Panel, 1977.)

- Federal Law - Geothermal Resources Operational Orders (GRO Order 4. General Environmental Protection Requirements).
- Federal Law - Public Law 93 - 205 (U.S. Endangered Species Act of 1973) and implementing regulations.
- State Law - Fish and Game Code Sections 250-2055 (California Endangered Species Act of 1970) and implementing regulations.
- State Law - Fish and Game Code Sections 1580-1584 (California Ecological Reserve Act of 1968) and implementing regulations.
- State Law - Fish and Game Code Sections 3511, 4700, 5000, 5050, and 5515 (Fully Protected Species).

LETTER OF UNDERSTANDING BETWEEN CEC AND USGS WITH RESPECT TO POST-LICENSING DUTIES AND RESPONSIBILITIES FOR THE NCPA GEOTHERMAL PROJECT NO. 2

I. INTRODUCTION

Pursuant to the Memorandum of Understanding dated November 16, 1978, the California Energy Commission (CEC), United States Geologic Survey (USGS), Bureau of Land Management (BLM), and Department of Energy (DOE) undertook a cooperative effort to compile the environmental documentation necessary to comply with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) and to issue necessary permits, licenses, and loan guarantees for Northern California Power Agency's (NCPA) proposed Geothermal Project No. 2.

The purpose of this agreement is to set forth the duties and responsibilities of the CEC and the USGS following the issuance of licenses and approvals for the NCPA Geothermal Project No. 2. This agreement also includes provisions for post-certification supervision of the project to insure that the project is constructed and operated pursuant to the terms and conditions of certification and licenses, and in compliance with applicable laws, standards, and ordinances. These provisions are attached to this agreement as Appendix B.

II. GENERAL PROVISIONS

A. The CEC recognizes that the proposed project is located on federally-owned lands and will utilize geothermal resources owned by the United States and managed by the USGS

pursuant to the Geothermal Steam Act of 1970 (P.L. 91-581). Accordingly, the CEC acknowledges that the ultimate decision-making authority for all issues pertaining to the design, construction, and operation of the proposed facility which may arise pursuant to the implementation and execution of this agreement resides with the BLM and the USGS.

B. The USGS recognizes that the proposed project is located within the territorial confines of the State of California. Accordingly, USGS agrees to consider the interests of the State in making post-certification decisions pursuant to this agreement, and shall give great weight to the comments and recommendations of the CEC with respect to such decisions.

C. The USGS and the CEC agree that the Northern Sonoma County Air Pollution Control District shall have all of the rights, duties, and responsibilities specified in the "Approved ARB-CEC Joint Policy Statement of Compliance with Air Quality Laws by New Power Plants" executed by the CEC and the California Air Resources Board on January 23, 1979, to the extent the Statement is consistent with applicable federal laws. A copy of the agreement is attached hereto as Appendix C.

D. The USGS shall insure compliance with applicable local standards in conducting its post-certification duties and responsibilities in all technical areas in which the CEC is secondarily involved.

E. The CEC may recommend the use of state or local agencies in performing one or more monitoring functions as outlined in Appendix B. If the USGS does not utilize such an agency as recommended, it shall provide for such mitigation functions.

F. The USGS and the CEC agree that the terms of this agreement supersede any differing or inconsistent terms which may appear in Appendix B and that the provisions of Appendix B shall be implemented consistently with the terms of this agreement.

G. Decisions of the Area Geothermal Supervisor may be appealed under the provisions of 30 CFR Part 290.

H. The USGS agrees to maintain possession of all proprietary information which may be submitted by the Applicant pursuant to the provisions of Appendix B. The CEC may review such proprietary information at the offices of the USGS.

III. PRIMARY CEC INVOLVEMENT

Subsequent to CEC certification of the NCPA Geothermal Project No. 2, the Commission shall be primarily involved in the review of final seismic design criteria, structural design criteria for critical structures and components, conceptual and final design of air pollution control equipment, and in the evaluation and selection of mitigation measures for significant adverse geologic conditions encountered during site preparation.

Primary CEC involvement shall be carried out as follows:

(1) All required design drawings, reports, analyses, and similar documents shall be submitted by the Applicant concurrently to the USGS and the CEC.

(2) The USGS shall not approve the design criteria, designs, mitigation measures for the power plant and related

critical structures and components until it has expressly solicited the advice and recommendations of the CEC. If the decision of the USGS does not adopt the recommendations of the CEC, the USGS shall provide written explanation of its reasons for not adopting such recommendations.

As used in this agreement, critical structures include the turbine generator building, the cooling tower structure, the turbine generator structure, and the switchyard structure. Critical components include: the turbine generator, the surface condensor, the gas removal equipment, the overhead bridge crane, the main transformers, the H_2S abatement facility, the circulating water pumps, and the switchyard equipment.

(3) The USGS shall not approve mitigation measures for significant adverse geologic conditions until it has solicited the advice and recommendations of the CEC.

As used in this agreement, a significant adverse geologic condition is a condition which requires an alteration of the project's design concept and the preparation of new design calculations.

IV. SECONDARY CEC INVOLVEMENT

A. The CEC shall be secondarily involved in the execution and evaluation of all mitigation measures specified in the Final Joint Environmental Study. The Commission's secondary involvement shall be carried out as follows:

(1) All required Plans of Operation, Applications for Permits, reports, designs, and similar documents shall be submitted by the Applicant to the USGS. The USGS shall immedi-

ately forward copies of such documents to the CEC for its review and recommendations within the time frame established by the Supervisor, USGS.

(2) The CEC may submit advice and recommendations for consideration by USGS.

B. With respect to the mitigation measures specified in the Final JES; and unless the subject matter is covered in Appendix B:

(1) The USGS in accordance with 30 CFR 270.34-1 shall require the Applicant to prepare for USGS approval a detailed Plan of Utilization describing the manner in which each mitigation measure will be implemented;

(2) The USGS shall require the Applicant to submit Annual Reports of Compliance under 30 CFR 270.76;

(3) The USGS Construction Permit shall include provisions for CEC inspection of the site and related facilities.

Dated:

DAVID K. BICKMORE
Acting Area Geothermal Supervisor
United States Geologic Survey

Dated:

RUSSELL L. SCHWEICKART
Chairman
California Energy Commission

APPENDIX C (Revised)

Following are the communications, in chronological order, reflecting the determination of 0.20g as an acceptable design horizontal peak bedrock acceleration value.

* * * * * * * * * * * *

PROJECT FILE

(3)

Northern California Power Agency

770 Kiely Boulevard • Santa Clara, California 95051 • (408) 248-3422

PHILIP G. MICHAELS
General Manager

Final Copy as modified

November 8, 1979

Mr. Jim Wazlaw
California Energy Commission
1111 Howe Avenue
Sacramento, CA 95825

RE: Project NCPA No. 2 - Seismic Design Criteria

Dear Jim;

As you know, the California Energy Commission held a workshop on October 25, 26, 1979, for interested participants to develop a consistant, reasonable method for evaluating seismic conditions in the Geysers KGRA. Attendees included representatives from the CEC, USGS, PG&E, Dames and Moore, Earth Science Associates, SAI Engineers, Cooper-Clark, Ruth and Going, Stone and Webster and NCPA.

At that meeting it was decided that the data base was adequate to evaluate the seismicity of the region. Three faults and their associated maximum credible events were selected to model the seismicity of the region. The faults selected were the San Andreas with maximum earthquake Richter Magnitude of 8.25, the Rogers Creek Fault with a Magnitude of 6.5, and the Maacama with Magnitude of 6.75. To this model, a local event of Magnitude 5.0 was added, occuring within a five kilometer diameter circle centered on the production area. This event was determined not to be associated with any mapped fault and is thus a "floating" earthquake.

It was also suggested that a probabilistic approach be used to assess the site ground motion. Events not associated with the three above named faults would be treated as background earthquake having a Magnitude 6.0 in a statistical analysis.

As a result of the agreements reached at the workshop, our geotechnical consultant has recalculated the ground acceleration at our project site and has tentatively defined (pending consultation with the CEC Staff) the following Peak Horizontal Bedrock Acceleration using the above seismic model.

Causative Fault	San Andreas		Roger Creek		Maacama	
Earthquake Description	Max. Cred.	100 Yr. Recurr.	Max. Cred.	100 Yr. Recurr.	Max. Cred.	100 Yr. Recurr.
Peak Horizontal Bedrock Acceleration at Site (g)	0.27	0.20	.09	.07	0.27	0.17

The 100 year recurrence Peak Horizontal Bedrock acceleration values were established using a regression curve.

As stated in our AFC documents our design earthquake has been defined as the Maacama Fault 100 years recurrence earthquake with a Peak Horizontal Bedrock Acceleration at the site of 0.35g. In the new model this value has been reduced to 0.17g which is smaller than the San Andreas Fault 100 year recurrence earthquake with a PGA of 0.20g.

If we continue using a 100 year recurrence earthquake as our design earthquake, the San Andreas Fault would be the controlling fault and we would have a design PGA of 0.20g with the model agreed upon at the workshop.

Our engineer has proposed changing our seismic design criteria to a design earthquake corresponding to the San Andreas Fault 100 year recurrence earthquake with a Peak Horizontal Bedrock Acceleration of .20g. We would design a turbine generator pedestal for .20g using the dynamic analysis as indicated in the AFC and to expedite the design process we would like to use an Equivalent Lateral Force of 0.6w for the building which is based on a PGA of .20g, the fundamental period of vibration of the building, and its damping characteristic.

We will submit a complete review of our proposed seismic design criteria when our geotechnical consultant finishes the updating of the project seismic parameters in light of the new seismic model.

We will also submit information pertaining to a cost/risk analysis for the critical items in the project consistant with statements contained in the AFC.

We believe this information will provide adequate justification for the proposed changes. If your staff has any comments regarding this change, we would appreciate receiving them at the November 15, 1979, workshop.

Sincerely,

JON PIETRUSZKIEWICZ
Project Engineer

cc: Larry L. Marquis

Consulting Engineers • 940 East Meadow Drive • Palo Alto, California 94303 • Phone (415) 494-7555

December 3, 1979
Our Job No. 2005-A5

DEC 0 3 1979

RECEIVED

SAI Engineers, Inc.
3200 Scott Boulevard
Santa Clara, California 95050

Attention: Mr. Edgar Martinez

Gentlemen:

Re: Design Earthquake
NCPA 2 Geothermal Power Plant

This letter presents revised estimates of bedrock accelerations at the captioned site due to the seismic model suggested by the California Energy Commission (see our attached letter of October 30, 1979). We have revised the accelerations as requested by you on November 30, 1979, and on the basis of more up to date acceleration curves (Donovan, 1978, EERI Conference) which present data for earthquakes in the magnitude 5.0 to 6.5 range not presented in earlier curves. The newer curves also indicate slightly revised accelerations for some earthquakes greater than magnitude 6.5.

The 40-year, 60-year and 100-year return period earthquakes were determined from Figures 1-A and 1-B, Earthquake Recurrence and Magnitude Curves. These are based on the curves presented in our final report, dated February 13, 1979, (Our Job No. 2005-A6) but have been adjusted to reflect the CEC seismic model. Additionally, because of the extremely limited historic earthquake data on the Maacama fault and the local event, we have assumed "b" values (slope of recurrence curve) for both. Because the Rodgers Creek and Maacama faults are closely associated and considered to be part of the same system, we have used the previously calculated (Our Job No. 2005-A6) "b" value for the Rodgers Creek for the Maacama also. Chuck Wentworth of the U.S. Geological Survey has said (CEC workshop, October 1979) that, based on the Survey's seismic monitoring at the Geysers, the "b" value for the local event is nearly identical with that of the overall region. As such, we have used the "b" value calculated for our 80 km radius recurrence curve for the local event.

PROJECT FILE

OF CALIFORNIA—THE RESOURCES AGENCY
EDMUND G. BROWN JR., Governor

FORNIA ENERGY COMMISSION
OWE AVENUE
AENTO, CALIFORNIA 95825
(916) 920-6893

3H1

November 28, 1979

DOCKET
79-AFC-2
DATE: NOV 28 1979
RECD: NOV 28 1979

Mr. Jon Pietruszkiewicz
Project Engineer
Northern California Power Agency
770 Kiely Blvd.
Santa Clara, California 95051

Dear Jon,

In order to facilitate your submittal of the Revised Seismic Hazard Analysis for the NCPA No. 2 Project, I am sending you a copy of the items that should be included in the analysis. You will note that the items listed are for consideration in the geotechnical analysis. Appropriate structural engineering guidance for the Revised Seismic Hazard Analysis will be forwarded to you shortly.

Sincerely,

James H. Wazlaw

JAMES H. WAZLAW
Project Manager

Enclosures

GUIDANCE TO APPLICANT FOR SUBMITTAL OF REVISED SEISMIC HAZARD ANALYSIS FOR NCPA 2 SITE

1. The assumptions and methods used in the previous seismic analysis were clearly described in the "Final Report, Geotechnical Investigation, Proposed 110 MW Geothermal Power Plant and Transmission Line, Northern California Power Agency (NCPA), Sonoma County, California, for SAI Engineers, Inc." (Cooper-Clark and Associates, February 13, 1979).

2. To the degree that the assumptions and methods used in the revised analysis differ from those reported by Cooper-Clark (1979), they should be described in similar detail and clarity.

3. Specifically, the applicant should describe the assumptions and methods which were used to:

   a. define the geographical limits considered for each of the identified sources (San Andreas fault, Maacama fault, Rodgers Creek fault, local sources (5 km radius around steam production area) and background,

   b. determine the magnitude/frequency relations for each identified source,

   c. determine appropriate attenuation relationships, and

   d. determine site ground response (given the variable depth of fill across the site.

4. In addition, the applicant should submit a probabilistic analysis indicating the return period at the site of peak horizontal bedrock acceleration values of 0.15, 0.20, 0.25, 0.30, and 0.35 g. The report of such an analysis should clearly describe the assumptions and methods used to:

   a. determine locational probability for various levels of seismic events, and

   b. incorporate the statistical uncertainty in the magnitude/recurrence and attenuation relationships used.

Jem

Northern California Power Agency

770 Kiely Boulevard • Santa Clara, California 95051 • (408) 248-3422

PHILIP G. MICHAELS
General Manager

December 10, 1979

Jim Wazlaw
Project Manager
California Energy Commission
1111 Howe Avenue
Sacramento, CA

Re: NCPA Geothermal Project No. 2 - Seismic Criteria

Dear Jim:

The purpose of this letter is to formally transmit to the California Energy Commission (CEC) staff information which NCPA provided at the workshop on December 6, 1979. A follow-up letter will be transmitted shortly which will provide a statement of the agreement reached between NCPA and the CEC staff at that workshop.

Design Earthquake Peak Grand Acceleration Values

My letter of November 8, 1979, provided tentative peak horizontal bedrock acceleration values which had been calculated using the seismic model developed in the CEC staff's generic seismic workshop. The new project design earthquake was stated as a one hundred year recurrence earthquake on the San Andreas fault which is a design PGA of 0.20g. The attached letter dated December 3, 1979, prepared by Copper and Clark, provides the supporting information necessary to substantiate a reduction of the design PGA value from 0.35g. However, the design PGA value of 0.20g has been increased to 0.27g as a result of further discussions with the CEC staff. The attached letter by SAI Engineers, dated December 5, 1979 provides the explaination for this change.

Procurement Specifications Seismic Criteria

NCPA explained, at the workshop, that the seismic criteria for its procurement specifications was removed pending final determination of the design PGA value for the site. Appropriate criteria will be rein-

serted into the procurement contracts at that time. NCPA does not propose to alter the criteria stated in the AFC documentation other than the change in the design PGA value. It is our understanding that the CEC staff has no objection to this procedure.

Sincerely,

JON PIETRUSZKIEWICZ
Project Engineer

Attachment

cc: Larry L. Marquis
Bill Delude
Arnold Weibold
Bob Webster

Cooper & Clark

Consulting Engineers • 940 East Meadow Drive • Palo Alto, California 94303 • Phone (415) 494-7555

December 3, 1979
Our Job No. 2005-A5

SAI Engineers, Inc.
3200 Scott Boulevard
Santa Clara, California 95050

Attention: Mr. Edgar Martinez

Gentlemen:

adl

DEC 0 3 1979

RECEIVED

Re: Design Earthquake
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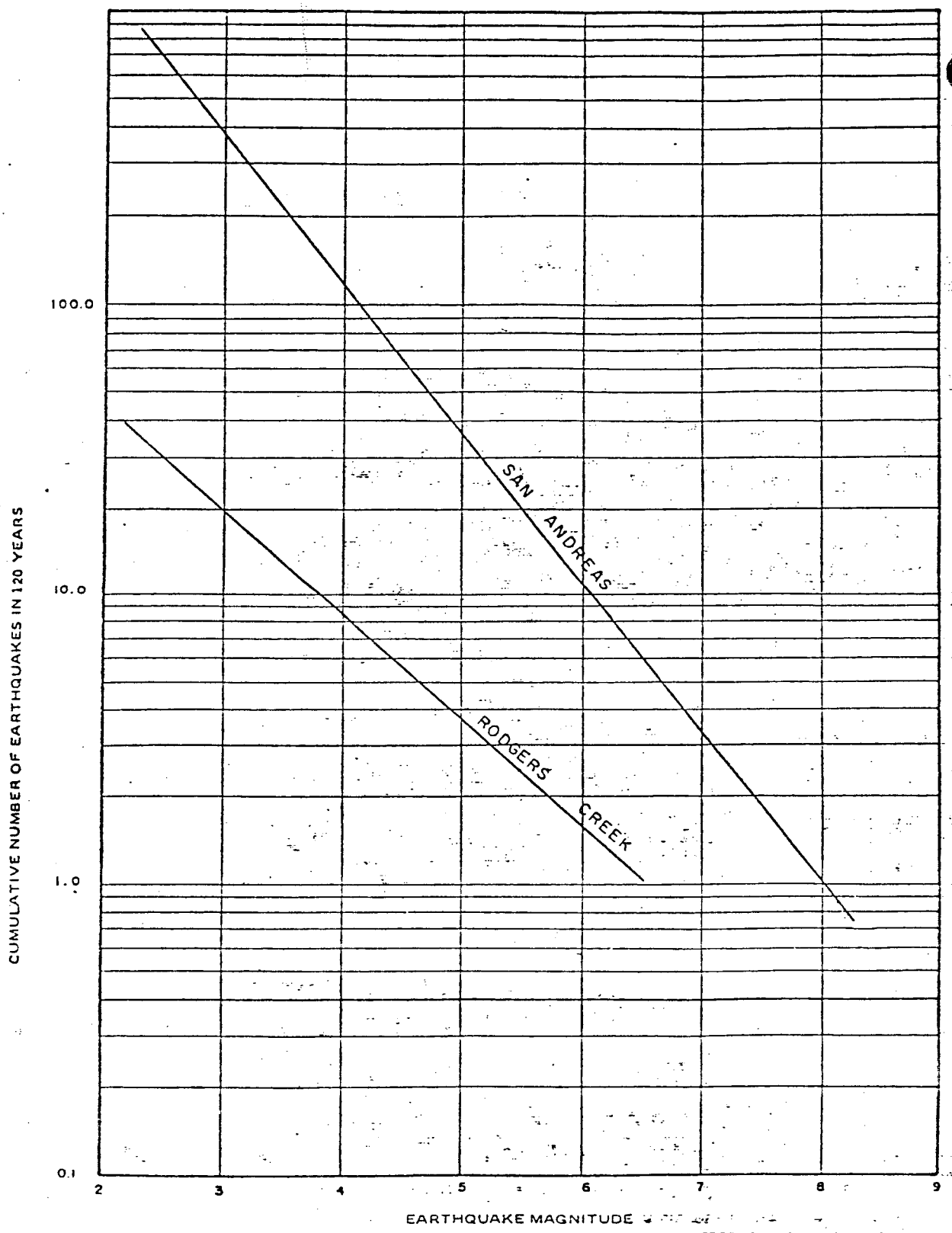
Revisions:
By_____ Date_____
By_____ Date_____

Location_____

By GBT Date 12/3/79
Checked By [illegible]
Job Number 2005-A5 Name SAI Engineers



EARTHQUAKE RECURRENCE AND MAGNITUDE CURVE

SAN ANDREAS AND RODGERS CREEK FAULTS

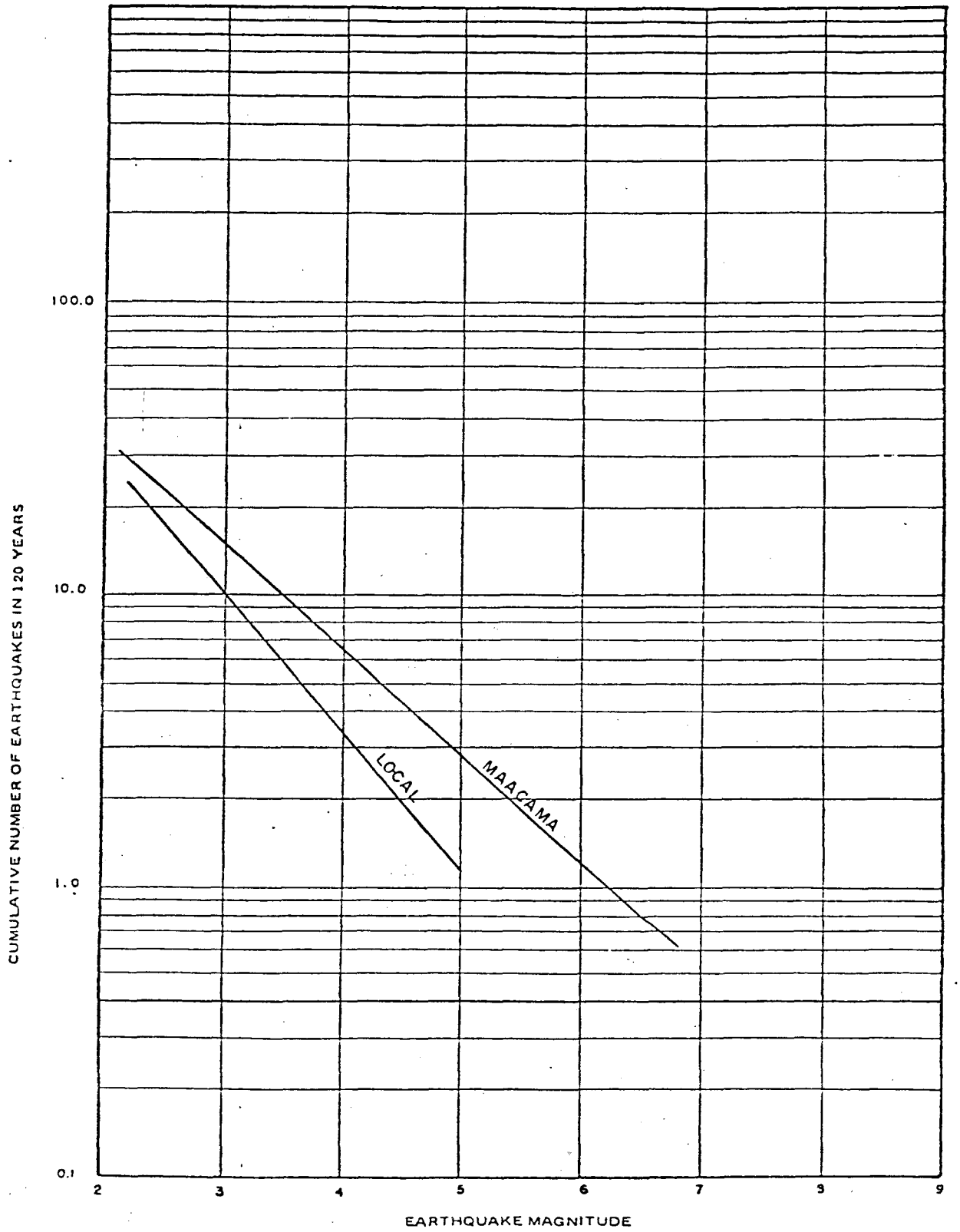
NOTES:

1. Based on procedures described in "Earthquake Resistant Design", by D.J. Dowrick, 1977.
2. Earthquakes given in Modified Mercalli Intensity Scales were convered to Richter Magnitude using the following formula: M=1+(2/3)(Ie), where M is the magnitude and Ie the intensity at the epicenter.

Revisions:
By_____ Date_____
By_____ Date_____

Location_____

By GBT Date 12/3/79
Checked By_____
Job Number 2005-A5 Name SAL Engineers



EARTHQUAKE RECURRENCE AND MAGNITUDE CURVE

MAACAMA AND LOCAL FAULTS

NOTES:

1. Based on procedures described in "Earthquake Resistant Design", by D.J. Dowrick, 1977.
2. Earthquakes given in Modified Mercalli Intensity Scales were co[illegible]ared to Richter Magnitude using the following formula: $M=1+(2/3)(Ie)$, where M is the magnitude and Ie the intensity at the epicenter.

The following table summarizes our revised bedrock acceleration estimates:

Causative Fault	San Andreas	Rodgers Creek	Maacama	Local
Earthquake Magnitude (MCE)	8.25	6.5	6.75	5.0
Distance to Site (km)	52	35	13	9*
Approximate Peak Horizontal Bedrock Acceleration at Site (g)	0.27	0.11	0.30	0.17
Approximate Peak Vertical Bedrock Acceleration at Site (g)	0.18	0.07	0.20	0.11
100-Year Return Period				
Earthquake Magnitude	8.25	6.2	6.0	5.0
Approximate Peak Horizontal Bedrock Acceleration at Site (g)	0.27	0.08	0.20	0.17
Approximate Peak Vertical Bedrock Acceleration at Site (g)	0.18	0.05	0.13	0.11
60-year Return Period				
Earthquake Magnitude	7.4	5.7	5.4	4.5
Approximate Peak Horizontal Bedrock Acceleration at Site (g)	0.15	0.06	0.14	0.13
Approximate Peak Vertical Bedrock Acceleration at Site (g)	0.10	0.04	0.09	0.09
40-Year Return Period				
Earthquake Magnitude	7.1	5.2	4.9	4.2
Approximate Peak Horizontal Bedrock Acceleration at Site (g)	0.12	0.05	0.11	0.10
Approximate Peak Vertical Bedrock Acceleration at Site (g)	0.08	0.03	0.07	0.07

*Distance from site to earthquake focus

We trust that this provides you with the information required at this time. If you have any questions or comments, please call.

Yours very truly,

COOPER & CLARK

GARY B. TAGGART
Geologist 3,536

TOM TEJIMA
Civil Engineer 21,113

GBT/TT/SKA/dme
(3 copies sent)

Attachment

SAI ENGINEERS, INC. Telex: 352138 SLINGER SNTA

ENGINEERS 3200 Scott Blvd. • Santa Clara, California 95050 • Telephone (408) 249-1328

December 5, 1979

Jon Pietruszkiewicz
Northern California Power Agency
770 Kiely Boulevard
Santa Clara, CA 95051

SUBJECT: DESIGN EARTHQUAKE
PROJECT NCPA NO.2

Dear Jon:

We are sending you a letter from Cooper and Clark dated December 3, 1979, in which they provide a new set of Peak Rock Accelerations for the project site in accordance with the new seismic model suggested by the California Energy Commission.

The Peak ground acceleration for 100 years return period of the San Andreas Fault had been tentatively estimated as 0.20g, based on the Maximum Credible Earthquake for that fault using a recurrence curve, but after consultation with the CEC Staff, it was realized that due to the fact that the San Andreas Fault Maximum Credible Earthquake had already occurred and according to the California Division of Mines and Geology, a maximum probable earthquake cannot be less than one that has already occurred; then for this fault, the maximum credible earthquake is considered equal to the maximum probable earthquake.

The Cooper Clark's letter clearly explains how they arrived to the new peak rock acceleration values. Cooper Clark will also update the site ground response peak ground acceleration values given on Plates 5A and 5B of the Geotechnical Report, these values will be given in a letter today.

Sincerely yours,

SAI ENGINEERS, INC.

A.A. Wiebold
Project Supervisor

AAW:kfs

SH-0019

Northern California Power Agency
770 Kiely Boulevard • Santa Clara, California 95051 • (408) 248-3422

PHILIP G. MICHAELS
General Manager

December 10, 1979

Jim Wazlaw
Project Manager
California Energy Commission
1111 Howe Avenue
Sacramento, CA

Dear Jim:

The following is a summary of the workshop held in Sacramento, on December 6, 1979 for the NCPA Geothermal Project No. 2 and a statement of the agreement reached by the CEC staff and NCPA. We believe this correctly summarizes the events which occured and the agreement reached. If we have incorrectly interpreted anything of substance, please notify me immediately.

Summary

1) NCPA provided the following comments to Mr. Gaylon Lee regarding his letter entitled, "Guidance To Applicant for Submittal of Revised Seismic Hazard Analysis For NCPA No. 2 Site":

   a) Cooper and Clark provided a response to the first three items in their letter of December 3, 1979 which was provided at the workshop. (This letter was subsequently provided to the staff under cover of my December 10, 1979 letter to yourself)
   b) NCPA and its consultants stated that item 4, a probablistic analysis, was not necessary to support the change in site design PGA value since the 100 year recurrence seismic event (maximum probable earthquake) is still the design event. Only the input model has changed not the methodology for selecting the design event and the CEC had previously accepted the methodology. Thus, NCPA believed that the new design value should require no additional analytical justification beyond that originally supplied.

      Mr. Lee stated, that it was not the original methodology which was accepted previously, but only the resulting PGA value. The basis for this acceptance was the obvious conservativeness of the result. The lower design PGA would require justification greater than that originally supplied.

2) NCPA provided additional comments to Mr. Chittenden regarding his letter also entitled "Guidance to Applicant For Submittal of Revised Seismic Criteria for NCPA No. 2".

   a) NCPA stated that items 1 thru 4 or Mr. Chittendens letter assumed that there had been a change in the criteria originally submitted in the AFC and subsequent responses to interrogatories. Since the criteria had not been changed, no further response is necessary.
   b) Item 5 is basically a cost/risk/benefit analysis similiar to that requested by Mr. Woo and Mr. Shurley in their letter of guidance to applicant. NCPA stated that an analysis of this type is not necessary since the structural criteria has not changed and the criteria for selection of the design quake has not changed.

      Mssrs. Shurley and Chittenden disagreed with this statement. They stated that the original design PGA values were accepted due to their conservativeness and any decrease must be justified with appropriate analysis.

CEC/NCPA Agreements

Each of the statements below represent the agreement reached between the CEC staff and NCPA.

1) It was determined that the NCPA and the CEC staff could reach an agreement which would insure adequate justification for NCPA's proposed change in design PGA with minimum delay of the plant design process. The justification would include a probablistic analysis to evaluate the various levels of bedrock motions which can be anticipated at the site during the life of the project. The methodology for the agreed upon analysis is listed in attachment A.

2) NCPA will provide the analysis to the CEC staff in 14 days.

3) Since the analysis is more sophisticated than that previously used by NCPA it is possible that a design PGA lower than that proposed by NCPA could be justified with the results of the analysis. The CEC will accept a lower value if justified by the agreed upon analysis.

4) The result of the agreed upon analysis is an acceleration/exceedance probability curve for the project site. If NCPA selects a new design PGA from the "flat" portion of the curve no further analysis will be required by the CEC staff. If NCPA selects a new design value above the "flat" part of the curve a cost/risk/benefit study will be required. The degrees of sophistication of this cost study will be dependent upon the relative increase in probability of occurence beyond that associated with a design value on the "flat" part of the curve (Note: The "flat" part of the curve is that portion were large changes in acceleration result in small changes in exceedance probability.)

5) NCPA will include the seismic criteria in purchase specifications, as stated in the AFC, upon determination of the final design PGA value. NCPA does not propose to change the structural criteria as stated in the AFC other than the design PGA value.

Sincerely,

JON PIETRUSZKIEWICZ
Project Engineer

Attachment

cc: Larry L. Marquis
Bill Dulude
Arnold Weibold
Bob Webster

ATTACHMENT A

The purpose of this methodology is to generate acceleration/exceedance probability curves for the NCPA 2 plant site based on the CEC seismic model developed in the October 1979 workshop. To do this, the locational probability for a given Ricther Magnitude earthquake producing a given site acceleration will be determined. Additionally, the probability of that earthquake occurring on a given fault will also be determined. The methodology for development of these probabilities is outlined below:

1) The seismic source model developed in the generic workshop on October 25 and 26, 1979 will be used (see attachement for model description)

2) Magnitude/frequency relationships for each source identified in the model will be developed using the same basic methodology utilized earlier for this project (Cooper & Clark report dated February 13, 1979).

3) The attenuation relationships of Schnabel and Seed (1973) or other appropriate attenuation relationships will be used to evaluate the severity and probability of peak bedrock accelerations at the site.

4) The mean fault reputre length/magnitude values derived by Mark (1977) will be used in evaluating the locational probability of earthquakes on identified faults. The locational probability will be established by evaluating the proportion which the total number of positions at which fault ruptures might occur along the fault bears to the number of positions at which the fault ruptures must occur to produce accelerations at the site equalling or exceeding a specified value.

5) The locational probability of seismic events attributed to the seismic background will be evaluated by establishing a proportion between the size of the area which may experience accelerations exceeding a specified value due to an event of a specified magnitude, and the size of the total area considered for background seismicity.

6) The response spectra and dynamic analysis methods previously used for analysis of site response will be used (Cooper & Clark, 1979).

7) The total probability of exceedance of a specified acceleration value at the site from each source will be obtained by multiplying the probability of occurrence of earthquakes of a specified magnitude by the probability that such earthquakes may be located at a position on the source so as to produce shaking at the site equal to or exceeding the specified acceleration value.

NCPA - 2

STATE OF CALIFORNIA—THE RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

ENERGY RESOURCES CONSERVATION
AND DEVELOPMENT COMMISSION
1111 HOWE AVENUE
SACRAMENTO, CALIFORNIA 95825
(916) 920-6133

DOCKET
79-AFC-2
DATE: DEC 26 1979
RECD: DEC 31 1979

December 26, 1979

Mr. Jon Pietruszkiewicz
Project Engineer
Northern California Power Agency
770 Kiely Boulevard
Santa Clara, California 95051

Dear Jon:

In response to your letter to Jim Wazlaw dated December 10, 1979, which provided a summary of your understanding of our December 6, 1979 workshop, I provide the following comments and clarifiactions for the technical area of Structural Engineering:

1. Referring to Item 2) a) Summary, there indeed was a proposed change in seismic design criteria. The horizontal peak ground acceleration (PGA) used as the zero period ordinate (ZPA) of the normalized design response spectrum is prepared to change from 0.35 g to 0.27 g. Since the PGA is part of the seismic design criteria for the turbine generator (TG), turbine-generator building, turbine pedestal, and Stretford abso-ber column, the seismic design criteria for these items is currently in flux pending agreement of a suitable PGA. It is my understanding that no other seismic design criteria will be changed other than the cited PGA.

2. Referring to Item 2) b) summary, the details of a cost/risk/benefits analysis were extensively discussed. As stated in your letter, this analysis may not be necessary depending on the selected PGA. In the case that NCPA is required to perform the cost/risk/benefit analysis, this analysis should include the following costs: a) initial plant cost; b) cost of upgrading (downgrading) plant to higher (lower) PGA; c) cost of plant replacement or repair; and d) cost of replacement power or forgone revenue.

Sincerely,

Robert Chittenden

ROBERT CHITTENDEN
Structural Engineer

cc: Bob Julian
Steve Burger
Jim Wazlaw
Paul Juncker

Northern California Power Agency
770 Kiely Boulevard • Santa Clara, California 95051 • (408) 248-3422

PHILIP G. MICHAELS
General Manager

December 27, 1979

Mr. Jim Wazlaw
Project Manager
California Energy Commission
1111 Howe Avenue
Sacramento, CA 95825

Subject: NCPA Geothermal Project No. 2 - Seismic Design Criteria

Dear Jim:

Please find enclosed one (1) copy of the Probabilistic Seismic Analysis prepared by NCPA's geotechnical consultant, Cooper and Clark, in accordance with the methodology agreed to on December 6, 1979 and a cover letter prepared by SAI Engineers, Inc. which proposes a project design PGA based upon a review of the subject analysis.

Although the combined exceedance curve did not have a "flat" portion as anticipated in the December 6 workshop, the individual exceedance curves more truly reflect the expected curve shape and lend themselves to selection of a point at the "flat" portion. Based upon the shape of the individual curves SAI has selected a design PGA of 0.2g. This value gives a combined exceedance probability of 30 percent and an individual exceedance probability of 19, 3, 4, and 6 percent for the San Andreas, Maacama background and local events respectively. As stated in the letter by SAI, it is believed that the 0.2g value used in conjunction with the site Seismic Response Spectra will result in a safe and adequate structural design. No further analysis should be required. NCPA offers the following observations to assist you in your review:

1) The combined exceedance curve indicates a zero percent (0%) exceedance probability at 0.34g and above. Thus, it is readily apparent that the 0.35g value originally proposed in the AFC documents was excessively conservative and is not a reasonable design requirement. Thus, this analysis supports the previous statements that a more sophisticated analysis would only serve to lower our criteria.

2) The 0.27g value proposed by NCPA at the December 6, 1979 workshop is also excessively conservative for an operating event with only a 12 percent exceedance probability.

3) The maximum credible event on the San Andreas fault produces only a 0.26g PGA at the site.

4) If it is assumed that the "flat" portion or design point on the individual curve can be redefined as; that point having a 5 percent greater exceedance probability than that point on the curve which indicates zero decrease in exceedance probability for increases in peak acceleration, the following values can be obtained from the individual exceedance curves:

Fault	PGA
Rodgers Creek	0.10g
San Andreas	0.20g
Maacama	0.18g
Local	0.20g
Background	0.19g

We look forward to your prompt review of this submittal. We hope to receive your concurrence prior to the January 4, 1980 hearing. I would appreciate receiving directly any comments or discussion you may have regarding this matter.

Sincerely,

JON PIETRUSZKIEWICZ
Project Engineer

cc: Larry Marquis

Enclosure

Consulting Engineers • 940 East Meadow Drive • Palo Alto, California 94303 • Phone (415) 494-7555

December 21, 1979
Our Job No. 2005-A5

SAI Engineers, Inc.
3200 Scott Boulevard
Santa Clara, California 95050

Attention: Mr. Edgar Martinez

Re: Probabilistic Seismic Analysis
NCPA 2 Geothermal Power Plant Site

INTRODUCTION

This letter presents the results of our probabilistic analysis of potential bedrock accelerations at the captioned site. The methodology used in this analysis was developed in the California Energy Commission (CEC) workshop of December 6, 1978 (see attachment).

METHODOLOGY

GENERAL

A probabilistic analysis of potential seismically induced bedrock accelerations at a given site consists of the following general elements:

1. Definition of the seismic source model.
2. Determination of the probability of occurrence of earthquakes of different magnitudes on each source identified.
3. Determination of the locational probability of earthquakes of different magnitudes on each source identified.
4. Obtain the product of the probability of occurrence and the locational probability for each individual source and for the combination of all sources.

SOURCE MODEL

The seismic source model was defined in the CEC generic workshop of October 25 and 26, 1979. It consists of three named faults (San Andreas, Rodgers Creek and Maacama

faults), a local event, and a background event. For the model, the San Andreas is considered to extend from Cape Mendocino southward some 485 km to Hollister. The Rodgers Creek fault extends 46 km from San Pablo Bay to just north of Santa Rosa. The Maacama fault extends roughly 150 km northward from a point east of Santa Rosa to the vicinity of Laytonville. Maximum credible earthquakes assigned to each of the faults are 8.25, 6.5 and 6.75, respectively. The local event could occur anywhere wthin a five kilometer radius from the center of the main Geysers production area and have a maximum probable (100-year recurrence) earthquake of magnitude 5.0. Likewise, the background event could occur anywhere within an 80 km radius from the site and have a maximum credible earthquake of 6.0.

PROBABILITY OF OCCURRENCE

To develop magnitude/frequency relationships for each source in the model, the procedure described in our report submitted to SAI Engineers, Inc., dated February 13, 1979, was used. Envelopes were described around each of the three faults. Each envelope extended 8 kilometers on either side of the fault and 16 kilometers beyond the mapped or assumed ends of the fault. Where envelopes overlapped, they were adjusted to halve the separating distance. New updated computer listings (December 18, 1979) of historic earthquakes which had epicenters within each envelope were then obtained from the University of California's Berkeley Seismographic Station. Epicenters within each fault envelope were assumed to have originated on that fault. A listing was also obtained for events within 80 km of the site excluding those events within the fault envelopes. Both of the listings covered the period from 1789 to 1977. For the envelopes described, however, the earliest recorded event was in 1800. Thus, the period of record is 178 years. This longer period of record results from the redefined envelopes and updated computer listings.

The U.S. Geological Survey has studied the seismicity of the Geysers production area in some detail and has indicated (Chuck Bufe, oral communication, CEC workshop, October, 1979) that the slope (b-value) of the magnitude/frequency curve is nearly identical to that of the regional b-value. Thus, the magnitude/frequency curve for the local event was drawn from the given 100-year recurrence earthquake (magnitude 5.0) and the regional b-value computed in our previous report (80 km radius curve).

Earthquakes listed for each envelope were evaluated and the Rossi-Forel and Modified Mercalli intensities were converted to Richter Magnitudes using the relationship M=1+2/3 (Ie), where M is the magnitude and Ie is the intensity at the epicenter. Where the listed intensity was noted at a location more than 8 kilometers from the epicenter, it was adjusted to give an epicentral intensity. In analyses for our previous report, it was found that consideration of magnitudes of less than 3.0 resulted in "skewed" curves. As such, events of less than magnitude 3.0 were dropped from this analysis. Earthquake magnitude vs. cumulative number of earthquakes was plotted on semi-log graph paper. Regression analyses were performed using the least squares method to determine the "best fit" curve for the data. The resulting curves are shown on Figures I-A through I-E, Magnitude/Frequency Curves.

The probability of occurrence for any magnitude event on each source can be determined from the magnitude/frequency curve for that source by dividing the cumulative number of events at that magnitude by the period of record.

LOCATIONAL PROBABILITY

The bedrock acceleration level at a given site is roughly dependent on the magnitude of the causative earthquake and its epicentral distance from the site. Isoseismal maps of larger historical earthquakes show an approximate correlation to the zone of surface rupture, particularly for strike-slip movements on vertical or near vertical faults. Thus, the distance from the site to the nearest point of surface rupture may reasonably be substituted for the site to earthquake distance. On this basis, the probability that an event of a given magnitude may be located at a position on a line (fault) source, so that a given site acceleration will be equalled or exceeded, can be computed. For our analysis, we used the following method:

1. The mean fault rupture length/magnitude values derived by Mark (1977) were first used to estimate rupture lengths for earthquake magnitude increments varying from 5.0 to 8.0.

2. Using the bedrock attenuation relationships of Donovan (1978), the attenuation distance for a given site acceleration, such as 0.05g, was then determined for earthquakes of each magnitude increment.

3. Circles representing the magnitude increments with radii equal to the attentuation distances determined above were drawn on

FIGURE I-A

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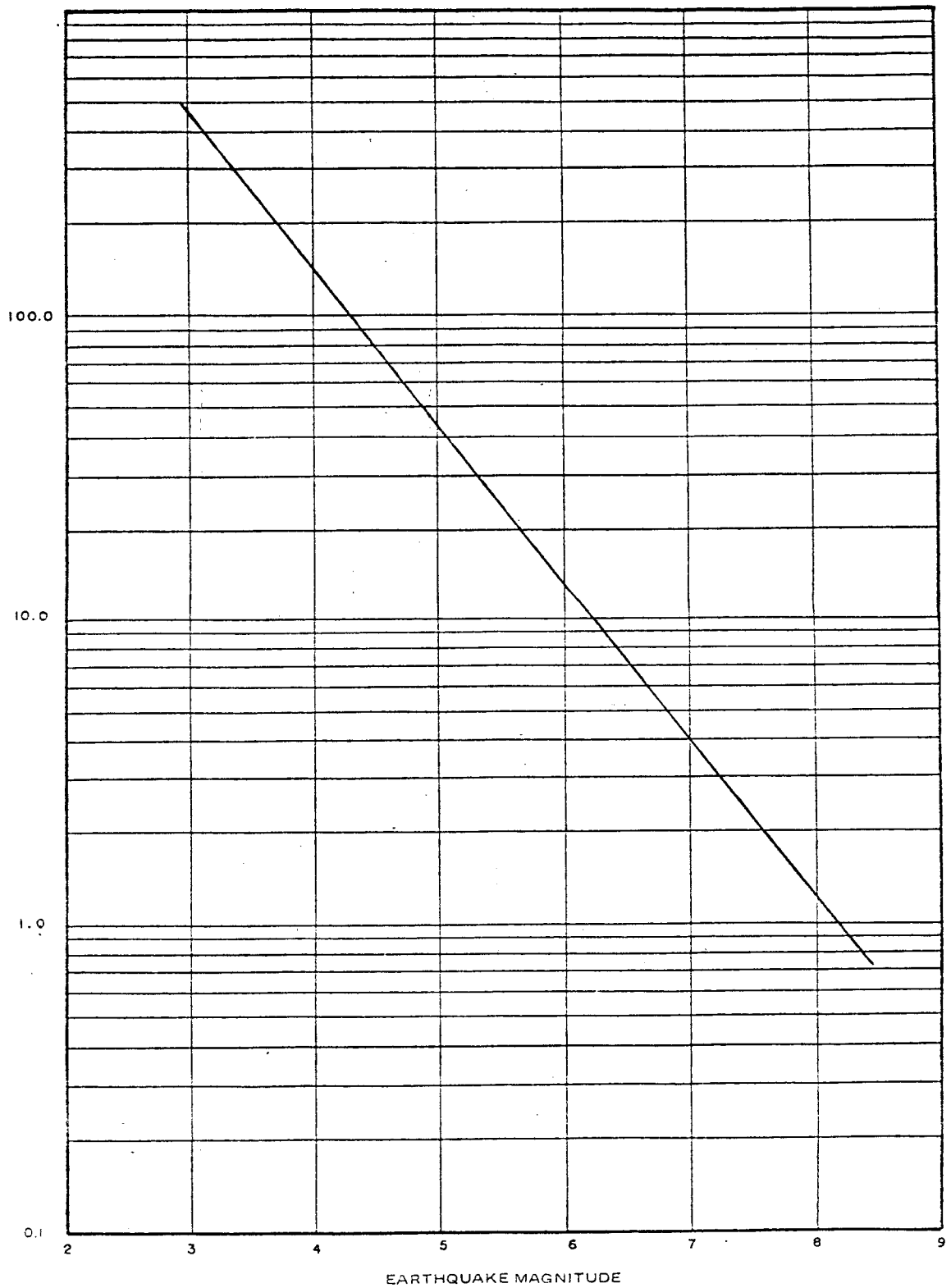

EARTHQUAKE RECURRENCE AND MAGNITUDE CURVE
SAN ANDREAS FAULT

NOTES:

1. Based on procedures described in "Earthquake Resistant Design", by D.J. Dowrick, 1977.
2. Earthquakes given in Modified Mercalli Intensity Scales were convered to Richter Magnitude using the following formula: M=1+(2/3)(Ie), where M is the magnitude and Ie the intensity at the epicenter.

Cooper & Clark

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By GBT Date 12-19-79
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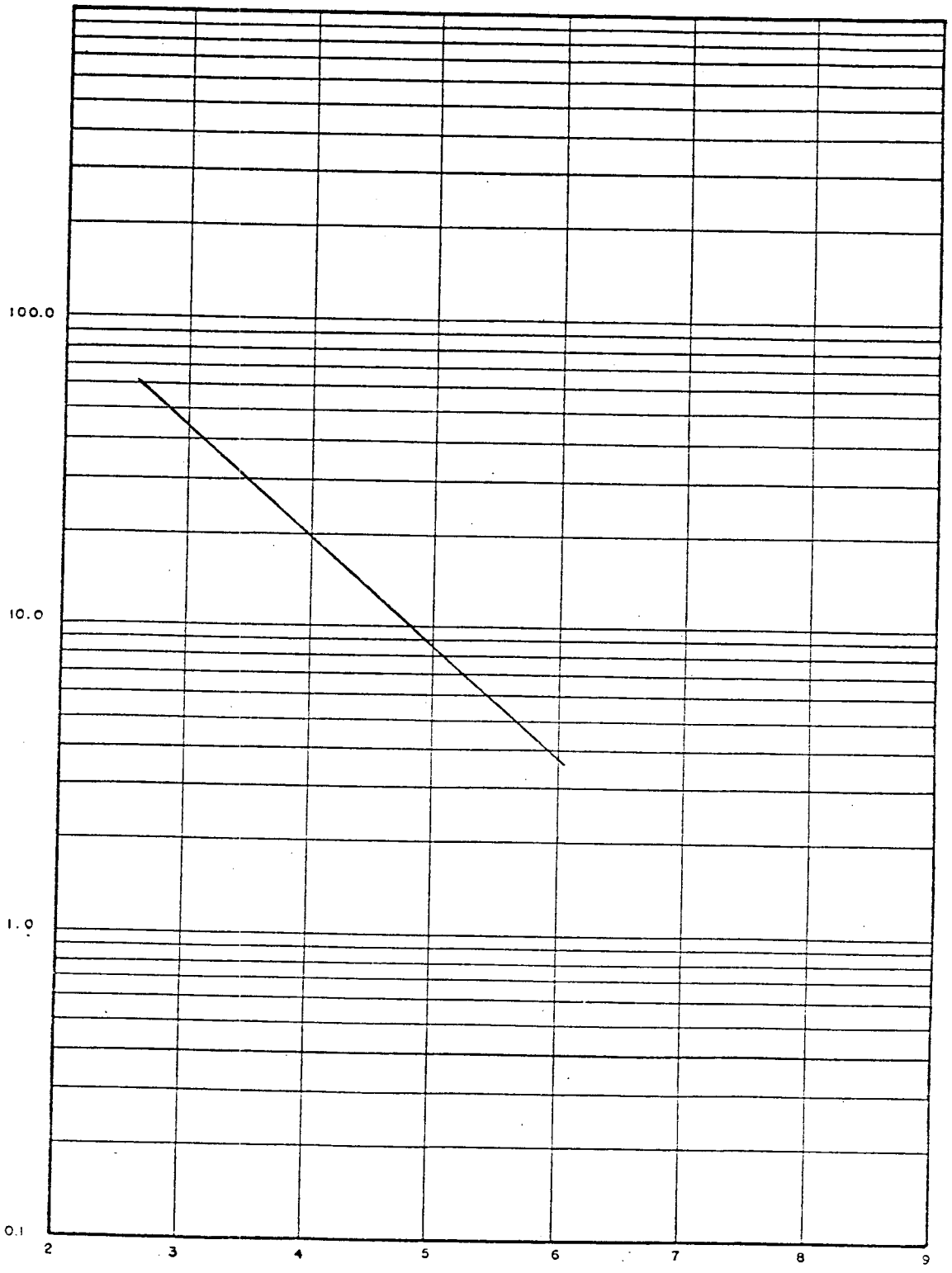

EARTHQUAKE RECURRENCE AND MAGNITUDE CURVE

RODGERS CREEK FAULT

NOTES:

1. Based on procedures described in "Earthquake Resistant Design", by D.J. Dowrick, 1977.
2. Earthquakes given in Modified Mercalli Intensity Scales were convered to Richter Magnitude using the following formula: M=1+(2/3)(Ie), where M is the magnitude and Ie the intensity at the epicenter.

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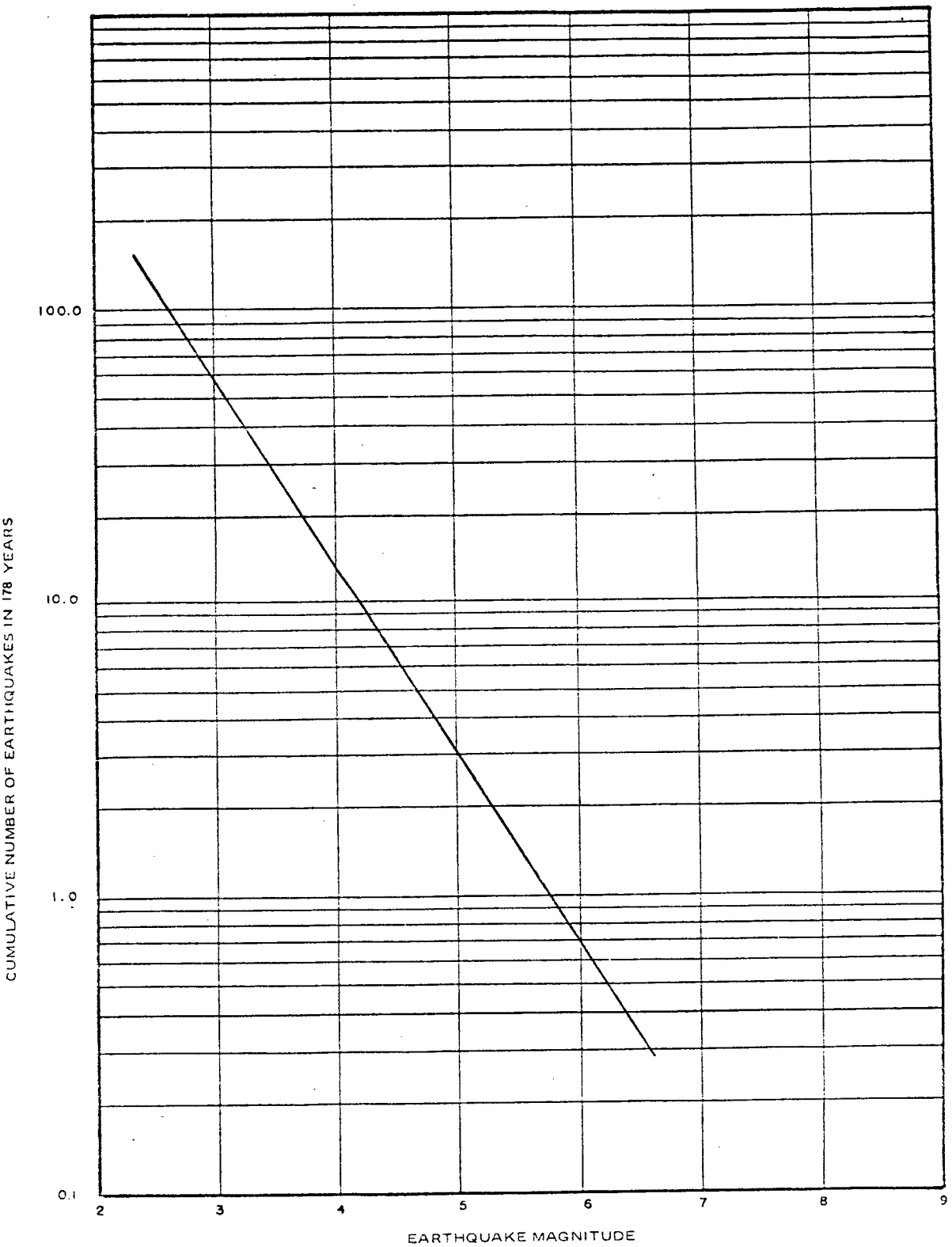

EARTHQUAKE RECURRENCE AND MAGNITUDE CURVE

MAACAMA FAULT

NOTES:

1. Based on procedures described in "Earthquake Resistant Design", by D.J. Dowrick, 1977.
2. Earthquakes given in Modified Mercalli Intensity Scales were convered to Richter Magnitude using the following formula: M=1+(2/3)(Ie), where M is the magnitude and Ie.the intensity at the epicenter.

FIGURE I-D

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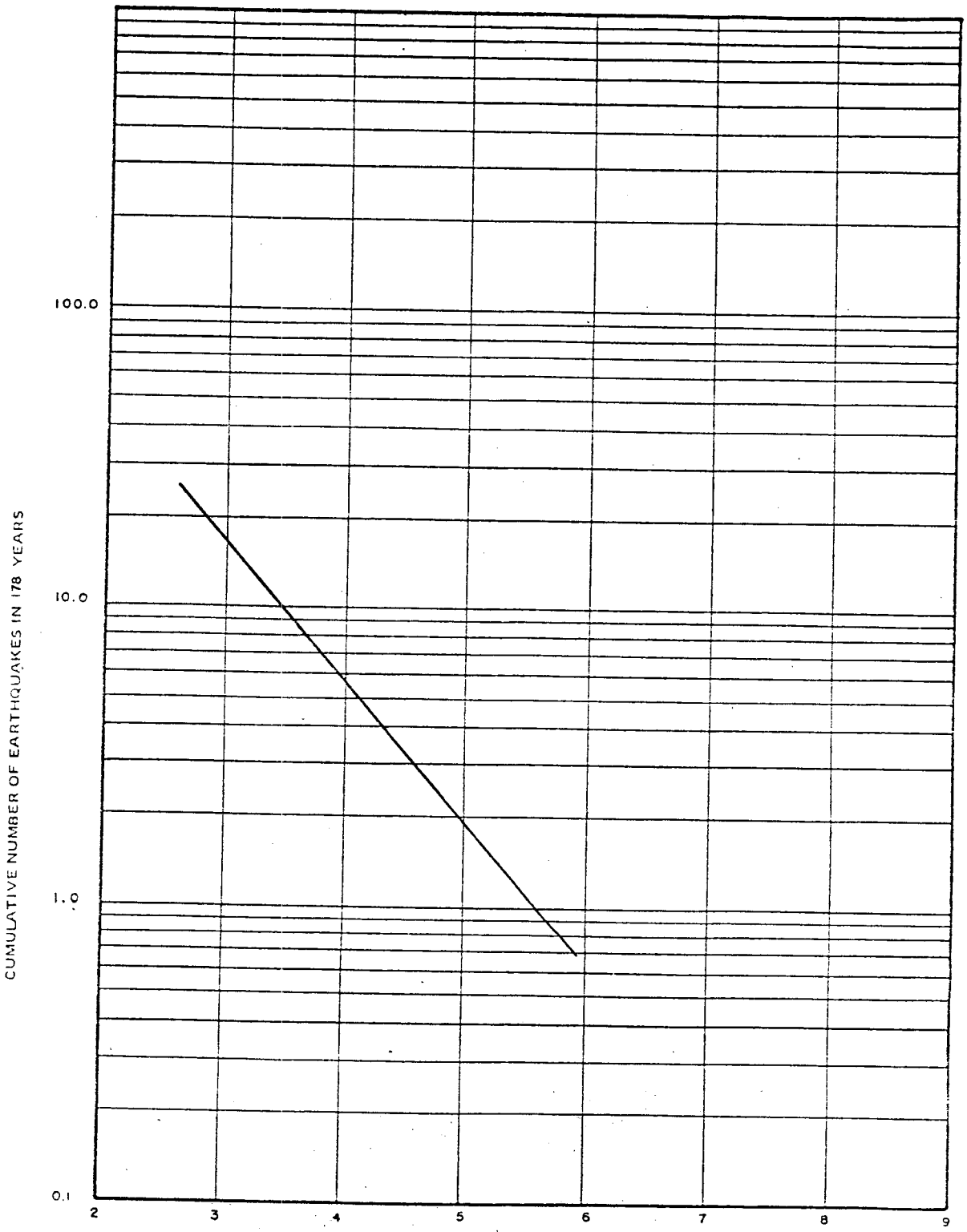

EARTHQUAKE RECURRENCE AND MAGNITUDE CURVE

LOCAL EVENT

NOTES:

1. Based on procedures described in "Earthquake Resistant Design", by D.J. Dowrick, 1977.
2. Earthquakes given in Modified Mercalll Intensity Scales were convered to Richter Magnitude using the following formula: M=1+(2/3)(Ie), where M is the magnitude and Ie the intensity at the epicenter.

FIGURE I-E

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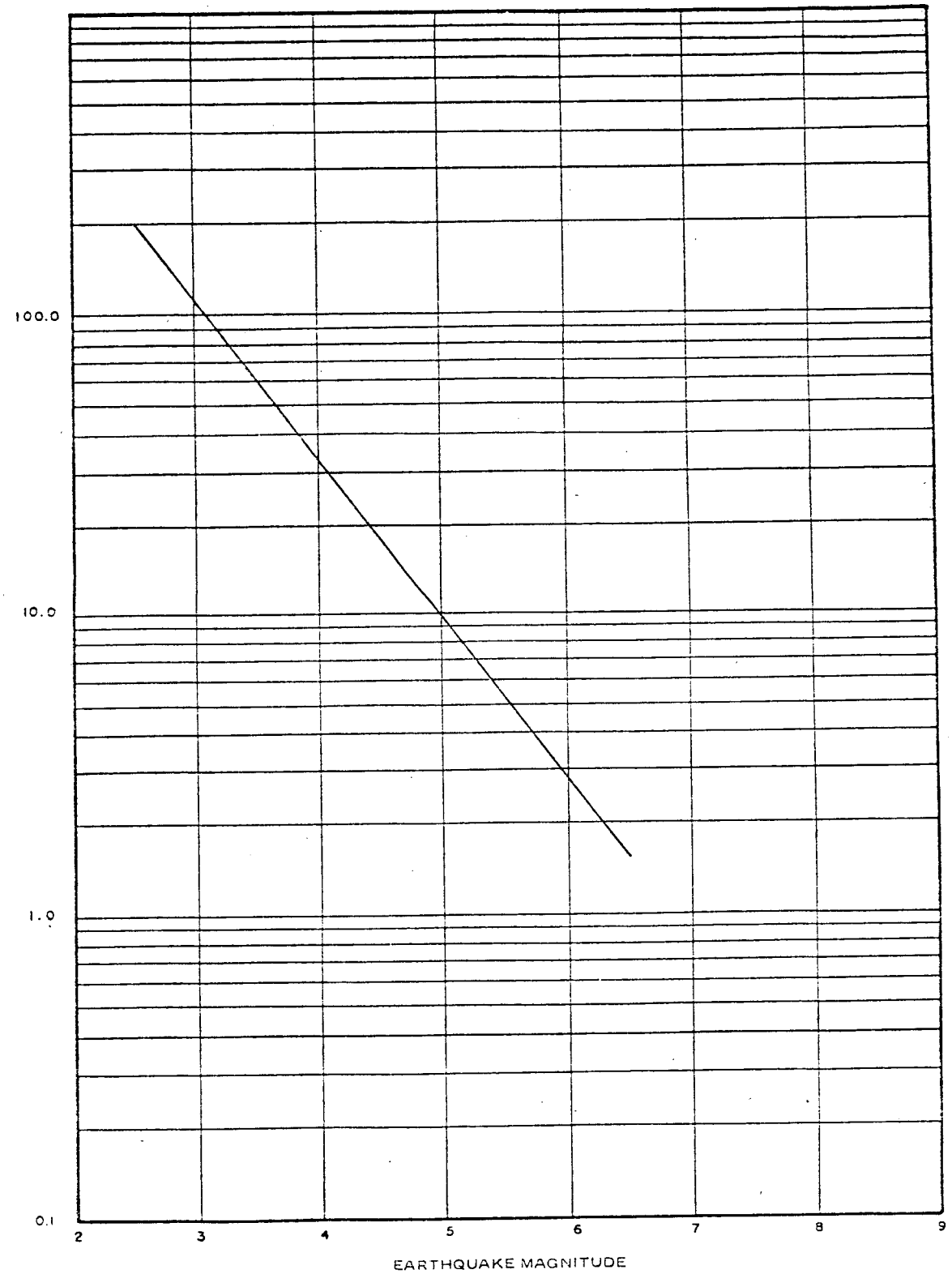

EARTHQUAKE RECURRENCE AND MAGNITUDE CURVE

80 km RADIUS

NOTES:

1. Based on procedures described in "Earthquake Resistant Design", by D.J. Dowrick, 1977.
2. Earthquakes given in Modified Mercalli Intensity Scales were convered to Richter Magnitude using the following formula: M=1+(2/3)(Ie), where M is the magnitude and Ie the intensity at the epicenter.

an appropriate scale geologic map showing the line (fault) sources.

4. Where a circle intersected a line source, it defined a fault segment on which a rupture must occur to produce accelerations at the site equalling or exceeding the specified value.

5. The probability that a rupture will occur at some place on that segment is:

$$P_L = \frac{R_{Lm} + X}{F_L - R_{LM}}$$

Where P_L is the locational probability.

R_{LM} is the rupture length for that magnitude increment.

F_L is the total fault length.

X is the length of the fault within the circle.

Since several circles representing different magnitudes for a specific acceleration can intersect each fault, the calculation was repeated for each circle and for each of the three faults.

6. The locational probabilities were then muliplied by the probability of occurrence per unit time of each magnitude increment and then summed to produce a probability factor (Pf). The total probability for each fault at the specified acceleration is then given by the expression $Pt_a = 1\text{-}e^{-Pf}$.

7. Steps 2 through 6 were repeated for each of the following acceleration levels: 0.10g, 0.15g, 0.20g, 0.25g, 0.30g and 0.35g.

Determination of the locational probability for the background and local source required a slightly different analytic method. For both, earthquakes were assumed to be point sources. Steps 2 and 3 above were performed for each acceleration level. The circles so described represented the area in which an earthquake of a given magnitude must occur to produce the specified acceleration at the site. The locational probability for the background source was then determined by dividing the area of each circle by the total background area minus the area of the fault and local envelopes within the background. The probability for each magnitude increment was multiplied by the probability of occurrence and then summed as before to produce a total probability at the specified acceleration level. The local source was treated in a similar manner, except that the size of the area in which the given earthquake must occur was determined by planimeter.

ACCELERATION EXCEEDANCE PROBABILITY

A plot of acceleration vs. probability of exceedance for each source was obtained by plotting the total probabilities obtained above for each acceleration level. The results are shown on Figures 2-A and 2-B, Acceleration Exceedance Probability Curves. The curves were "normalized" for the proposed 30-year plant design life by multiplying the probability factor Pf by the plant life in years. Figure 3, Combined Acceleration Exceedance Probability Curve, shows the combined probability from all sources. It was developed from the expression $Pc = 1-e^{-Pt}$

Where PC is the combined probability.

Pt is the sum of the total probabilities from each source at each acceleration level multiplied by the plant life in years (30 years).

RECOMMENDATIONS

Since the combined acceleration exceedance curve does not have a "flat portion" defining a design acceleration as discussed in the December 6, 1979, CEC workshop. We recommend that the design acceleration be selected in consultation with CEC representatives.

Yours very truly,

COOPER & CLARK

Gary B. Taggart by TT

GARY B. TAGGART
Geologist #3536

Tom Tejima

TOM TEJIMA
Civil Engineer #21,113

GBT/TT/dme
(3 copies sent)

FIGURE 2-A

By JJP Date 11/29/19
Checked By RWR
Job Number 2005-A5 Name SAI Engineers, Inc. Location Sonoma County, California

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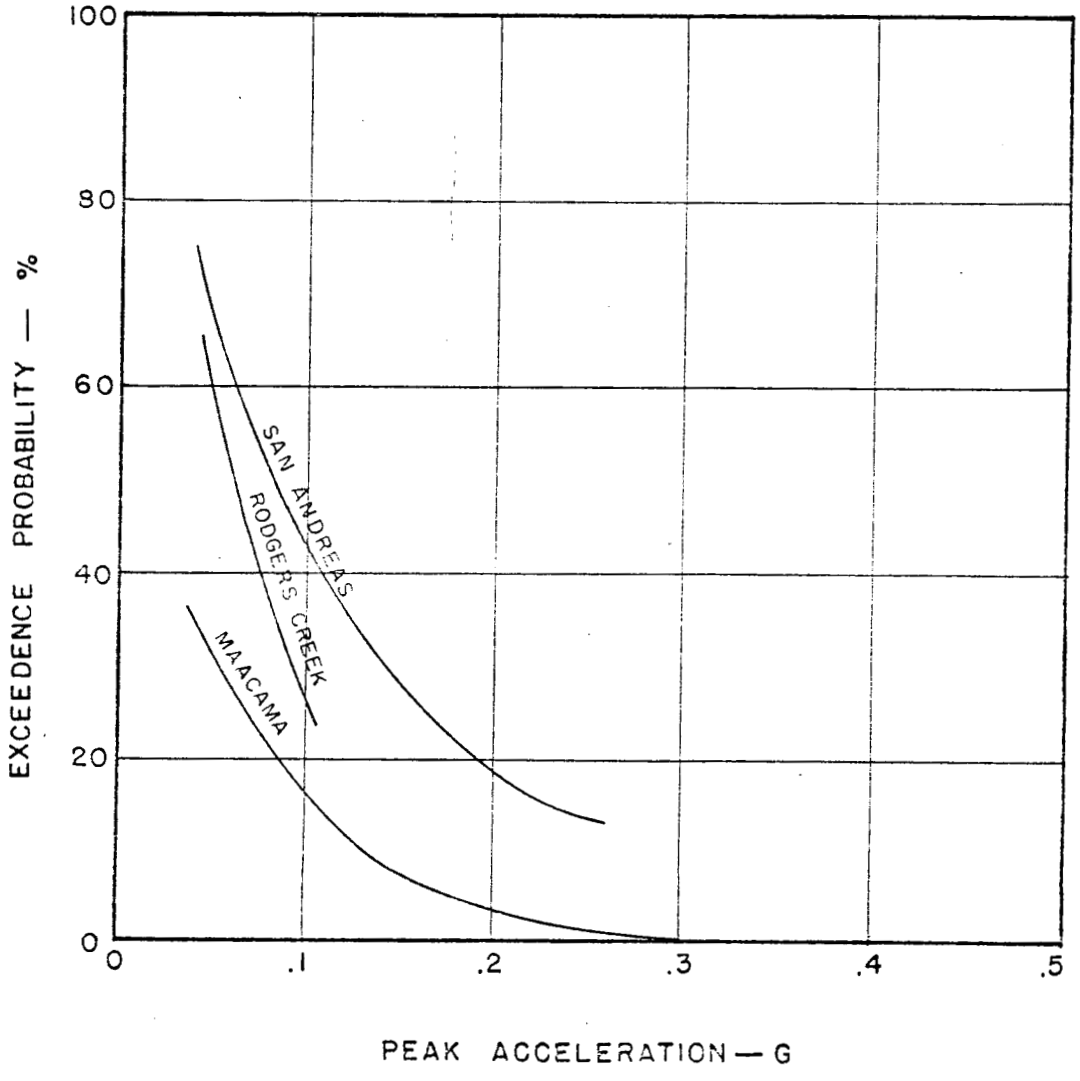

ACCELERATION EXCEEDENCE PROBABILITY
NCPA GEOTHERMAL POWER #2
30-YEAR PLANT LIFE

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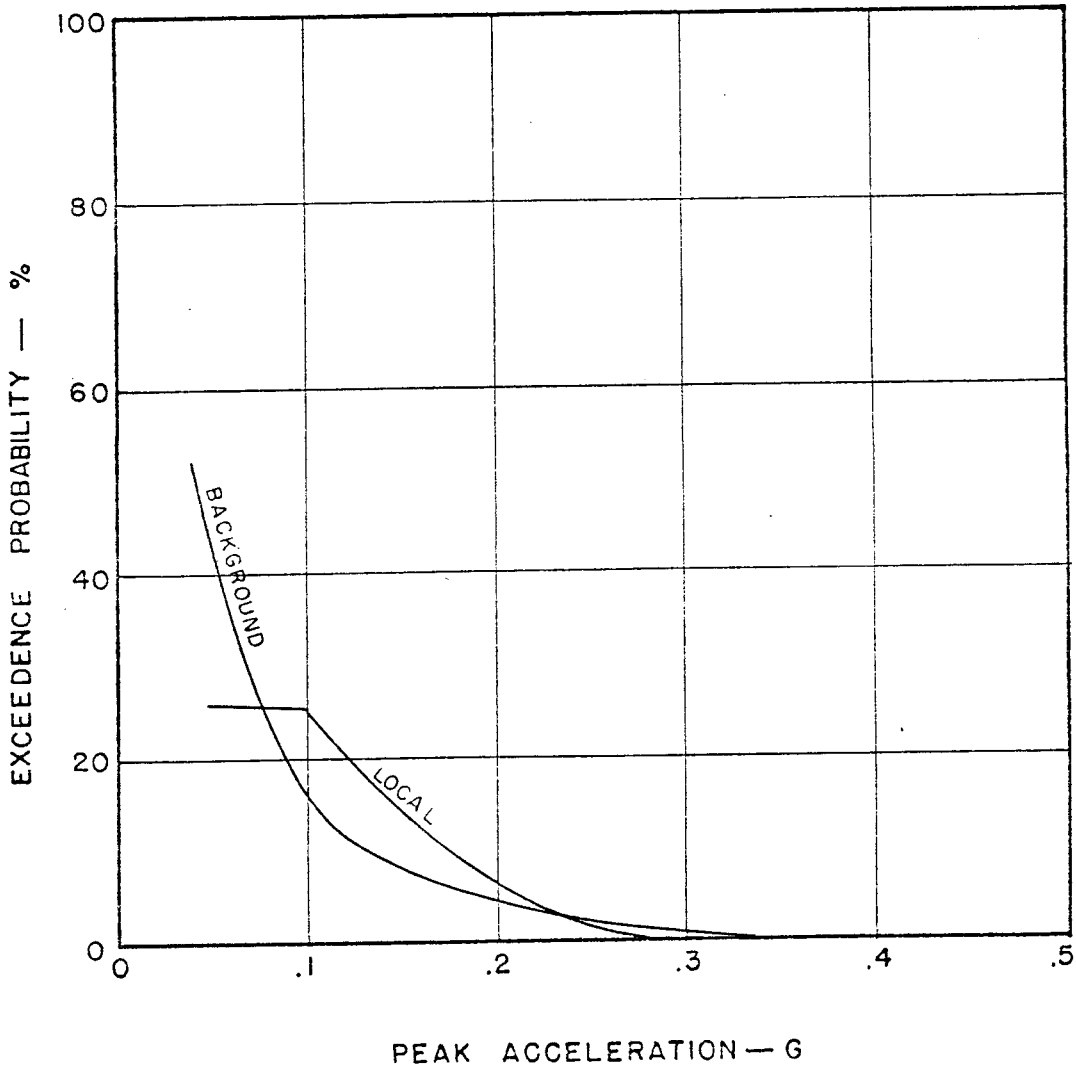

ACCELERATION EXCEEDENCE PROBABILITY
NCPA GEOTHERMAL POWER #2
30-YEAR PLANT LIFE

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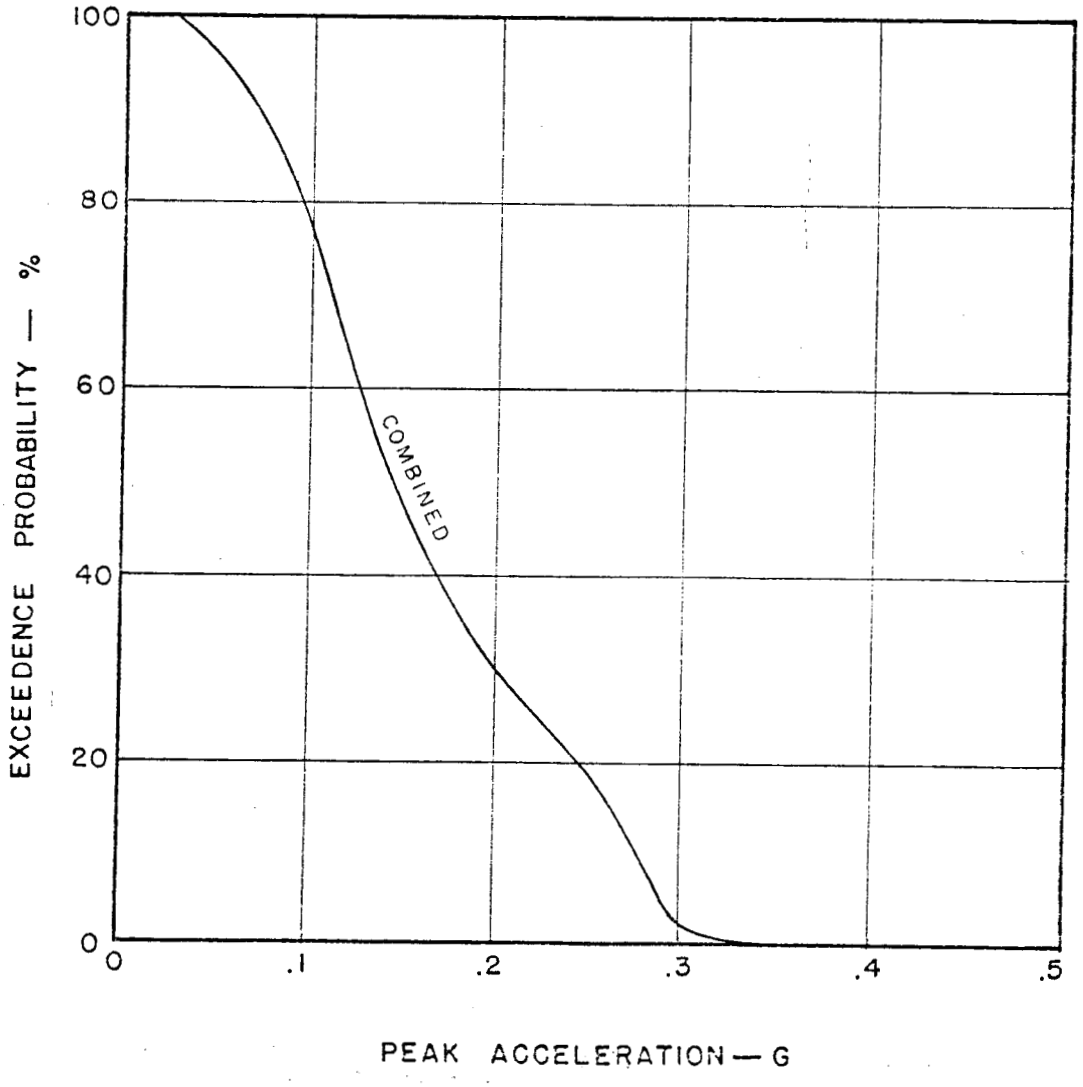

COMBINED
ACCELERATION EXCEEDENCE PROBABILITY
NCPA GEOTHERMAL POWER #2
30-YEAR PLANT LIFE

State of California — The Resources Agency of California

Memorandum

To : Commissioner C. Suzanne Reed

cc: Stan Valkosky

Date: February 19, 1980

Telephone: ATSS (916) 920-6893
( )

From : **California Energy Commission** - James H. Wazlaw

1111 Howe Avenue
Sacramento, 95825

Subject: NCPA #2 79-AFC-2: ACCEPTABILITY OF APPLICANTS' SEISMIC DESIGN CRITERIA

In November 1979,* the Applicant informed the Committee that it desired to change a major component of the proposed project's seismic design criteria. The Applicant sought to change the peak bedrock acceleration for critical plant components from the previously stipulated to 0.35g. to 0.20g. The Staff indicated that, if the peak bedrock acceleration were lowered to 0.20g , the Applicant would be required to perform an analysis that could demonstrate the validity of the lower value. The Staff offered guidance to the Applicant in developing the methodology for this analysis.

On December 6, 1979, the Staff and Applicant met in a workshop and developed a mutually acceptable methodology for the seismic analysis. On December 27, 1979, the Applicant informed the Staff (Re: Letter, dated December 27, 1979, Pietruszkiewicz to J. H. Wazlaw) that the analysis was completed and the results showed that a peak bedrock acceleration of 0.20g. was justifiable.

The Staff reviewed the Applicant's analysis and results and believes that a peak bedrock acceleration 0.20g. is not supportable by the analysis. In general, the previously agreed upon methodology was employed in the seismic hazard analysis, but the analysis was not conservative in several respects, most notably in recurrence relationships of the Maacama fault, and in attenuation relationships.

The Staff believes that, for this project, a value of 0.25g. is an acceptable design horizontal peak bedrock acceleration value. (0.25g. to be used as the zero period ordinate (ZPA) for the hard rock spectrum (Vs - 10,000 fps).) The peak ground acceleration for other conditions (e.g., fractured rock, fill etc.) shall be in the same proportion to 0.25g. as existed for the previous value of 0.35g.

Furthermore, the Applicant will incorporate this revised seismic design criteria component in its procurement specifications for critical components.

JHW:llc

*By letter of November 28, 1979