L. Lewis
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DOE REVIEW DRAFT

Implementation Plan for the Hawaii Geothermal Project Environmental Impact Statement

Prepared by
The United States Department of Energy
Conservation and Renewable Energy

September 18, 1992

U.S. Department of Energy
Washington, D.C.

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Implementation Plan for the Hawaii Geothermal Project Environmental Impact Statement

**Prepared by
The United States Department of Energy
Conservation and Renewable Energy
Washington, D.C.**

**In Cooperation with
County of Hawaii
County of Maui
National Marine Fisheries Service
National Park Service
State of Hawaii
United States Army Corps of Engineers
United States Fish and Wildlife Service
United States Geological Survey**

September 18, 1992

General

1. Weak consideration of verbal components

2. no apparent written in Assoc 40 guarantees p68 of C.9.500. Kipoko. Equum
C.9.500. Kipoko. Equum Assoc 40 guarantees p68 of C.9.500. Kipoko. Equum

3. no good scoping comment & analyses

4. missed many cooperative group comments

5. No work plan

6. not up to BH-25/RIE quality standard

NRDC P 60

NRDC p 65
Gordard/Gordard p 36

RANI P 19

moser p 75

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Implementation Plan for the Hawaii Geothermal Project Environmental Impact Statement

1. INTRODUCTION

The U.S. Department of Energy (DOE) is preparing an Environmental Impact Statement (EIS) that identifies and evaluates the environmental impacts associated with the proposed Hawaii Geothermal Project (HGP), as defined by the State of Hawaii in its 1990 proposal to Congress (DBED 1990). The location of the proposed project is shown in Figure 1.1. The EIS is being prepared pursuant to the requirements of the National Environmental Policy Act of 1969 (NEPA), as implemented by the President's Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508) and the DOE NEPA Implementing Procedures (10 CFR 1021), effective May 26, 1992.

The State's proposal for the four-phase HGP consists of (1) exploration and testing of the geothermal resource beneath the slopes of the active Kilauea volcano on the Island of Hawaii (Big Island), (2) demonstration of deep-water power cable technology in the Alenuihaha Channel between the Big Island and Maui, (3) verification and characterization of the geothermal resource on the Big Island, and (4) construction and operation of commercial geothermal power production facilities on the Big Island, with overland and submarine transmission of electricity from the Big Island to Oahu and possibly other islands. DOE prepared appropriate NEPA documentation for separate federal actions related to Phase 1 and 2 research projects, which have been completed. This

EIS will consider Phases 3 and 4, as well as reasonable alternatives to the HGP. Such alternatives include biomass coal, solar photovoltaic, wind energy, and construction and operation of commercial geothermal power production facilities on the Island of Hawaii (for exclusive use on the Big Island). In addition, the EIS will consider the reasonable alternatives among submarine cable technologies; geothermal extraction, production, and power generating technologies; pollution control technologies; overland and submarine power transmission routes; sites reasonably suited to support project facilities in a safe and environmentally acceptable manner; and non-power generating alternatives, such as conservation and demand-side management.

1.1 PURPOSE OF THE IMPLEMENTATION PLAN

This draft Implementation Plan (IP) has two purposes: (1) to provide guidance for the preparation of the HGP EIS and (2) to record the issues identified as a result of the scoping process. To serve these purposes, this IP has been prepared in accordance with DOE NEPA Regulations (57 Fed. Regist. 15122, April 1992) (10 CFR 1021). Section 2 of the IP describes the proposed action and alternatives. Section 3 discusses the scoping process, includes a discussion of the major issues identified through public scoping, and states how these issues will be addressed in the EIS. Consultations with other agencies are described in Section 4, and Section 5 lists significant EIS milestones.

Figure 1.1. Proposed location of the Hawaii Geothermal Project and cable. Source: Hawaiian Electric Company, Inc., Request for Proposal for the Geothermal/Inter-Island Transmission Project, Hawaiian Electric Company, Inc., Honolulu, Hawaii, May 1989.

Section 6 identifies the preparers of the EIS, and Section 7 contains a listing of environmental documentation related to the HGP EIS. Section 8 is references cited. The three appendices to this IP contain a proposed outline for the EIS, contractor disclosure statements, and acronyms and abbreviations used in the IP.

purpose of project - notes
purpose of EIS - notes

1.2 BACKGROUND

The HGP is the culmination of research and development efforts begun in the mid-1970s to explore the feasibility of using Hawaii's indigenous geothermal resource for the production of electricity. Geothermal exploration began in Hawaii in 1972 with funding from the National Science Foundation (NSF). A high-potential geothermal resource site was identified on the east rift of the Kilauea volcano on the Big Island. Subsequent exploratory drilling (also funded by NSF) between December 1975 and April 1976 resulted in a productive geothermal well at a depth of approximately 6000 feet. In 1976, the Energy Research and Development Administration (ERDA), a predecessor to DOE, funded the testing of the geothermal well, which was designated as the HGP-A well. In 1979, DOE, which succeeded ERDA, funded the development of a 3-MW demonstration power plant at the HGP-A site. In 1986, the HGP-A facilities were transferred by DOE to the State of Hawaii to be used for further research. The State has referred to this early exploration and testing of the Big Island geothermal resource as Phase 1 of the HGP.

DOE also provided funds for the Hawaii Deep Water Cable Program, referred to by the State of Hawaii as Phase 2 of the HGP, which was initiated in 1981. The goal of the program was to determine the technical and economic feasibility of constructing and operating a deep water submarine power transmission cable that would serve the island of Oahu and would operate for a

minimum of 30 years. This project, completed in 1991, demonstrated the feasibility of the deep water power transmission cable. Over an 11-year period, DOE has provided approximately \$33 million for geothermal and deep water cable research in Hawaii, which is about 80% of the HGP cost-shared effort.

The State of Hawaii considers the unknown extent of the geothermal resource as one of the primary obstacles to private investment and commercial development. State and private industry experts estimate that at least 25 commercial-scale exploratory wells will need to be drilled to verify the generating potential of the resource. (These wells would in turn be used in Phase 4.) To that end, Phase 3 activities would include well drilling, logging of cores from holes, measuring temperatures, collecting and analyzing geothermal fluid samples, and making downhole geophysical and geochemical measurements.

In the 1990 proposal, the State projected that permitting and financing for Phase 3 and 4 would occur in 1991 and that 500 MW of power could be on-line by 2005. Compliance with State and federal legal and environmental requirements is likely to extend this schedule.

In the 1990 proposal, the State of Hawaii requested additional federal funding for what is defined by the State as Phase 3 of the HGP: Resource Verification and Characterization. In 1990, Congress appropriated \$5 million (Pub. L. 101-514, *Energy and Water Development Appropriations Act*) for the State's use in Phase 3. Because Congress considered Phase 3 work to be "research" and not development or project construction, Congress indicated that this funding would not be considered a major federal action under NEPA that would typically require an EIS. However, because the project is highly visible, somewhat controversial, and involves a particularly sensitive environment in Hawaii, Congress directed in 1991 that

"...the Secretary of Energy shall use such sums as are necessary from amounts previously provided to the State of Hawaii for geothermal resource verification and characterization to conduct the necessary environmental assessments and/or environmental impact statement (EIS) for the geothermal initiative to proceed"

* (Managers Language 1991). In addition, the U.S. District Court of Hawaii, in litigation filed by several environmental groups (Civil No. 90-00407, June 25, 1991), ruled that the federal government must prepare an EIS for Phases 3 and 4 of the HGP before any further disbursement of federal funds to the State for the HGP.

DESCRIPTION OF PROJECT - NOTES ✓
CUMULATIVE IMPACTS - NOTES

2. PROPOSED ACTION AND ALTERNATIVES

2.1 NO ACTION

The *no action* alternative is defined as continued reliance on the existing and planned generating mix of resources, which is predominately oil-fired capacity plus some coal-based generation and renewables, to meet the equivalent amount of power associated with the proposed geothermal development. Under the no action alternative, the energy needs for the islands of Hawaii, Maui, Molokai, and Oahu would be achieved using supply- or demand-side supply options on each island. Further, the impacts of the cable would be alleviated.

2.2 PROPOSED ACTION

The proposed action is for DOE to partially fund Phase 3 of the HGP, as defined by the State in its 1990 proposal to Congress, using the funds, remaining from the \$5 million Congressional appropriation for Phase 3 of the HGP after EIS expenditures. The funding for Phase 4 is

currently uncertain. However, the EIS will address both Phases 3 and 4 as required by Congressional directive and U.S. District Court of Hawaii ruling (Section 1.2). Activities to be carried out in Phases 3 and 4 are described in Section 1.2.

Forecasts based on resource characterization indicate that from 10 to 20 separate geothermal power plants of from 25-30 MW each could be developed. The actual number of plants would depend on the extent of the resource defined in Phase 3. Because the exact location of plants will not be known until Phase 3 is completed, the EIS will rely on best available data and information to encompass impacts at development sites. Further NEPA documentation may be required for specific projects and permits. Based on the physical characteristics of the resource and contemporary geothermal energy development practice, the State estimated that about 125 production wells and 30 injection wells may be needed to produce 500 MW. The plants most likely would be connected by a network of roads, piping, and overland power transmission lines. Overland and underwater transmission lines (300 kV AC or DC) would be constructed to distribute power to Oahu and other islands.

According to the State of Hawaii (DBED 1988), the project was envisioned as 500 MW of power delivered to the Island of Oahu. This assumed a gross plant capacity of 520-550 MW at the geothermal site on the Island of Hawaii with a 50 MW loss during power transmission to Oahu. The Hawaiian Electric Company (HECO) indicated (HECO 1989) that it was interested in purchasing up to 500 MW of geothermally generated power. The Maui Electric Company (MECO) also has indicated (HECO 1989) some interest in whether a tap for 50 MW from the project's transmission system is technically feasible. Other configurations of the geothermal project including more or less power production are possible depending on,

among other things, the extent of the geothermal resource. For purposes of the EIS, the proposed project will be defined as development of ~~550~~ 500 MW gross capacity with a net of 500 MW of power delivered to Oahu. Throughout most of the rest of this IP, the "project" will refer to the 500 MW of geothermal power that would be delivered. Alternatives will consider variations that develop up to ~~550~~ 500 MW of gross capacity but not more. Some alternatives, however, that would develop less than ~~550~~ 500 MW of gross capacity will be considered in the EIS as well as transmission and delivery of some of the geothermal power to Maui and the Big Island.

2.3 ALTERNATIVES

The basic decision being considered by DOE is whether or not to partially fund Phase 3, as defined by the State, with the funds remaining from the \$5 million Congressional appropriation after EIS expenditures. Under the no action alternative, the federal government would not contribute funds to planned geothermal development in Hawaii; but this alternative would not preclude the continuation of the HGP using other sources of funding by the State or others.

2.3.1 Geothermal Technologies, Sites, and Capacities

Alternative sites for geothermal development and construction of power plants and associated facilities will be considered within the established geothermal resource subzones (GSRs) on the island of Hawaii. Other alternatives that will be considered are (1) development of up to 500 MW of geothermal power for exclusive use on the Big Island, with no inter-island transmission cable (It would include other sources on other islands to make up the equivalent power and generation of the

proposed projects) and (2) alternative geothermal power generating technologies. In addition, the EIS will also consider alternative non-geothermal power generating technologies and capacities.

2.3.2 Alternative Supply-Demand Options

The supply-demand alternatives to the "proposed action" cannot be evaluated on the basis of specific projects at specific sites. Rather, alternatives to the HGP need to be evaluated in the context of various energy scenarios for Hawaii's economy for the next 10 to 30 years. For example, a "no action" alternative implies an energy scenario in which the conventional resource options currently used on the island, that is oil- and coal-based power generation plants, would continue to play a dominant role. Conversely, an alternative action involving investments in renewable energy and in energy conservation would shift the resource mix to lesser dependence on conventional supplies. To assess the possible environmental and economic impacts of the proposed supply-demand alternative actions, it will thus be necessary to consider alternative energy scenarios for Hawaii.

Three supply and demand alternatives will be evaluated in the EIS. They include:

- (1) no action (see Section 2.1);
- (2) development of up to 500 MW geothermal for exclusive use on the Big Island, with no inter-island transmission cable (the State of Hawaii's preferred alternative is 100 MW on the Big Island);
- and (3) conservation and demand-side management (DSM) alternatives plus a mix of renewable options (e.g., biomass, solar thermal, wind, geothermal, and photovoltaics) available to Hawaiian utilities and the State. For example, DSM refers to the reduction of demand for energy through electrical load management, energy conservation, and improvements in energy utilization that focus on reduction in energy demand. All alternative supply-demand strategies will be

compared and assessed within the framework of integrated resource planning (IRP) using the data and methods developed for the State utilities' IRP where available. Where possible, the supply-demand options will be characterized in terms of their relative cost, fiscal impacts, and contribution to the State's overall energy demand.

Although many alternatives were mentioned during the scoping process only those alternatives deemed to be viable and reasonably foreseeable within the time frame of the proposed project (i.e., 30 year period) will be considered. In general, the alternatives that will not be considered in this EIS were either anticipated to be not technically feasible within the project time frame (e.g. ocean thermal energy conversion) or technically feasible but extremely unlikely because of legislative or other impediments. As an example, the construction of a nuclear fission power plant in Hawaii is unlikely because of a State Constitutional requirement for a two-thirds vote in each house of the Legislature for such an action (Act XI, Section 8).

During scoping, decreasing Hawaiian dependence on oil for transportation was mentioned as a possible alternative action. As one of the stated purposes of the development of geothermal energy was to reduce the State's reliance on imported oil, the EIS will address the reduction of oil consumption resulting from the use of geothermal power and other alternatives (i.e., the amount of oil replaced by the proposed geothermal power generation and other alternatives as part of the energy demand scenarios). Since transportation actions do not achieve one of the overall HGP objectives of supplying electric power, this alternative is not considered comparable to the proposed action and will not be evaluated as a supply-demand alternative in the EIS. (In fact, reducing imports of crude oil to be refined for transportation use could increase the need to import residual oil for use in power plants.)

2.3.3 Overland Transmission Routes

The EIS will address alternative overland transmission routes as they are identified. Potential routes, based on route configurations depicted in HECO (1989) and identified during on-going consideration, will be discussed in terms of impacts to ecological resources, land use, health and safety, socioeconomic, cultural resources, and aesthetics. *Issue of AC/DC to the underground and all AC impacts*

2.3.4 Submarine Cable Technologies and Routes

The EIS will address various alternatives related to different submarine cable routes and different submarine cable technologies. Various cable routes, based on prior HDWC studies and on-going consideration, will be evaluated in the EIS according to competing uses along the route and their possible impacts to marine species, economics, maritime safety, extreme events, and Native Hawaiian concerns. The EIS will also consider alternative cable materials and different transmission systems. The potential impacts of alternative land-sea transitions will be evaluated. *Need for smaller scale elec test*

2.3.4.1 Cable Routes

A number of optional cable routes have been proposed and are described elsewhere (HDWCP, 1985b,c). The simplest alternative involves no landings on the intermediate islands and goes directly from Upolu Point [Hawaii] crossing the Alenuihaha Channel and coming close to shore at roughly Kipahulu [Maui] following the Maui coast then through the channels between Maui and Kahoolawe, Maui and Lanai (the Auau Channel), and crossing to Oahu. Other variations include (1) landing only on Maui (see Figure 1.1) or (2) landing on both Maui and Molokai. Differing points of landing and returning to the ocean on the various islands will be considered. An

alternative to the previously considered routes was presented in the Maui scoping meeting and reiterated in a written submittal. This alternative route proceeds from Hawaii to Lanai and Lanai to Oahu with possible spur lines to Lahaina, Maui and Molokai. *For this route, treat impacts on Lanai*

2.3.4.2 Alternative Cable Materials and Configurations

A large number of cable configurations for the submarine cable have been examined from primarily technical and cost bases in previous studies (HDWCP, 1985a,c), including paper insulated, high-viscosity oil-impregnated, non-pressurized cables (SOLID) and low-viscosity, oil-impregnated, self-contained oil-filled pressurized cables (SCOF). Solid-dielectric cables present another option. Both Al and Cu were examined as conductors, but only Al was found to be acceptable. Since those studies were performed, technologies have advanced and the basis for costing scenarios have changed. The EIS will review technology advances and review costing for the prior solutions.

2.3.4.3 High Voltage DC vs High Voltage AC Transmission

Current plans for the submarine cable call for high voltage DC transmission. During scoping several commenters suggested that if development is staged then AC transmission over relatively short distances might be cost effective. This supposition will be examined and the relative environmental impacts of DC vs AC transmission discussed based on available literature and experience in other locations.

2.3.4.4 Land-Sea Transitions

Different land-sea transition configurations will be considered based on the need for oil pumping stations and

transformers. If a tap to the local system is required, a conversion station may also be necessary.

3. THE SCOPING PROCESS AND RESULTS

CEQ regulations (40 CFR 1501.7) require "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action." This process is termed "scoping" and usually has two phases. During the first phase, the lead agency conducts internal studies to define the proposed action, identify preliminary alternatives, and develop preliminary issue areas to be addressed in the EIS. The second phase involves participation by the public and other agencies. The objectives of public scoping are to notify interested persons, agencies, and other groups of the proposed action and alternatives; solicit their comments regarding environmental issues, alternatives to the proposed action, and other items of interest; and consider those comments in the preparation of the EIS.

CEQ regulations [40 CFR 1501.7(a)] require the lead agency to

- invite the participation of affected federal, State, and local agencies; any affected Indian tribe; and other interested persons
- determine the scope and significant issues to be analyzed in depth in the EIS
- identify and eliminate from detailed study the issues which are not significant or have been covered by previous environmental reviews, narrowing the discussion of these issues in the statement to a brief presentation of why they will not have a significant effect on the human environment, or providing a reference for their coverage elsewhere
- allocate assignments for preparation of the EIS among the lead and cooperating

- agencies, with the lead agency retaining responsibility for the statement
- indicate any public environmental assessments and other EISs that are being or will be prepared which are related to but not part of the scope of the EIS under consideration
 - identify other environmental review and consultation requirements so that other studies may be conducted concurrently and integrated with the EIS
 - indicate the relationship between the timing of environmental analyses and the planning and decision-making schedule.

The full range of potential impacts of the proposed project and alternatives that were identified during scoping will be addressed in the HGP EIS. A companion report to this IP contains a summary of all oral and written scoping comments regarding the HGP EIS. Environmental resource areas and concerns identified during scoping that have the potential for impact include land use, air quality, water resources, ecological resources, geologic resources, noise, health and safety, socioeconomic issues, cultural resources, marine resources, and aesthetic visual resources. Further information on these topics and on other topics expected to be addressed in the EIS is given in Section 3.3. A proposed outline for the HGP EIS is presented in Appendix A.

3.1 NOTICE OF INTENT

In accordance with DOE NEPA Guidelines (52 Fed. Regist. 47664, Dec. 1987), which have since been replaced by the DOE NEPA procedures (10 CFR 1021), an Advance Notice of Intent (ANOI) regarding preparation of the HGP EIS was issued in the *Federal Register* (Vol. 56, No. 170, pp. 43585-87) by DOE on September 3, 1991. It announced the initiation of planning and scoping of the HGP EIS and solicited public input regarding scope and

content of the EIS. DOE received 55 comment letters on EIS-related topics, which are considered in this draft IP. These comments helped frame the content of the NOI and were the stimulus for a series of information exchange meetings. DOE solicited further input at these meetings held during September, October, and November 1991, and March 1992. These meetings were conducted with federal, State, and local agencies, as well as with environmental, civic, Native Hawaiian, and public interest groups, in addition to utilities and geothermal developers (see Table 3.1).

In accordance with DOE NEPA Guidelines, on February 14, 1992, a Notice of Intent (NOI) was issued in the *Federal Register* (Vol. 57, No. 31, pp. 5433-37) by DOE to announce DOE's intent to prepare an EIS for Phases 3 and 4 of the HGP as defined by the State in its 1989 proposal to Congress. The NOI also announced that ten scoping meetings would be held in Hawaii from March 7 through March 16, 1992, to afford the public an opportunity to identify environmental issues and concerns related to the proposed project. The NOI also noted that written scoping comments, which were to be given equal weight with oral comments, would be received until April 15, 1992, for consideration in the IP.

SCOPING MEETINGS

Beginning on March 7, 1992, DOE held two scoping meetings at each of five locations in Hawaii, as shown below.

Scoping Meeting Locations and Dates

Pahoa (Big Island)	March 7, 1992
Wailuku (Maui)	March 9, 1992
Kaunakakai (Molokai)	March 12, 1992
Honolulu (Oahu)	March 14, 1992
Kamuela/Waimea (Big Island)	March 16, 1992

add Oct 3 ~~mtg~~ w/ SCLOF
 Nov " " HB10
 July

add all CA mtgs!

TABLE 3.1.—Information Exchange Meetings

November 12, 1991 - Wailuku, Maui, HI

- Blue Ocean Preservation Society
- Campbell Estate
- Coral Reef Foundation
- Kaupo Ranch
- Maui Tomorrow
- Pele Defense Fund
- Sierra Club

November 13, 1991 - Hilo, HI

- Mayor's Energy Advisory Committee *Commission*

November 13, 1991 - Pahoa, HI

- Big Island Papaya Growers
- Big Island Rainforest Action Group with Malu Aina
- Citizens for Responsible Energy Development with Aloha Aina
- Greenpeace Hawaii
- Hawaii Island Geothermal Alliance
- Kapoho Community Association
- Lani Puna Gardens Association
- Pele Defense Fund
- Puna Community Council
- West Hawaii Sierra Club

November 14, 1991 - Honolulu, HI

- Native Hawaiian Legal Corporation
- Pele Defense Fund

November 15, 1991 - Honolulu, HI

- National Audubon Society
- Natural Resources Defense Fund
- Oahu Rainforest Action Network
- Rainforest Action Network
- Sierra Club Legal Defense Fund

March 6, 1992 - Pahoa, HI

- Puna Geothermal Ventures (incl. site visit)

March 7, 1992 - Pahoa, HI

- Native Hawaiian Organizations
- Pele Defense Fund

March 8, 1992 - Pahoa, HI

- True-Mid-Pacific (incl. site visit)

The public scoping meetings were held in compliance with CEQ regulations (40 CFR 1501.7) and DOE NEPA Guidelines and in concert with DOE's policy to facilitate opportunities for public involvement in the NEPA process. The purpose of these meetings was to assure adequate opportunity for public and government agency participation in developing the EIS scope by identifying the issues to be addressed, commenting on the proposed action, and suggesting alternatives to be analyzed. The public scoping meetings ended March 16, 1992. Copies of the meeting transcripts are available at DOE Reading Rooms and other locations identified in the *Federal Register* Notices. DOE has also prepared an extensive mailing list identifying parties which are participating in the EIS preparation. DOE has notified all interested parties by mail of the availability of the meeting transcripts. About 170 people provided more than 700 comments during scoping meetings (see Figure 3.1). In addition, approximately 70 people submitted materials and letters to DOE during the scoping period (before the April 15, 1992, deadline). The majority of the comments in these written submissions came from individuals; however, about 50 organizations, including environmental, public interest, and community groups, also participated by offering comments through representatives.

3.3 RESULTS OF SCOPING

The following discussion summarizes the comments raised during the scoping process and is organized according to the issues raised. Figure 3.2 indicates the number of comments (written and oral) that were received relating to each concern or issue. Examples of comments from which each issue was derived are provided, followed by how the EIS will address that issue. The

discussion also identifies which issues DOE considers to be within the EIS scope.

3.3.1 Meteorology/Air Quality/HGP Emissions

Many commenters expressed concerns about atmospheric emissions from the geothermal wells and facilities-emissions that may occur during construction and operation of the proposed facilities, and during an accident. Based on recent experience with geothermal development and accidents in Puna, commenters suggested a variety of adverse environmental effects that may arise from these operations. Of particular concern was the emission of hydrogen sulfide (H_2S) and other airborne pollutants and their effects on the health of nearby residents; several examples of ongoing effects were noted. The commenters believed that such effects are poorly understood and frequently underestimated.

Issues that were identified in the scoping process include:

- Effects on human health of acute exposure to H_2S
- Nuisance effects of H_2S
- Effects of emissions other than H_2S (e.g., radon, heavy metals, and silicate)
- Potential synergistic effects among atmospheric pollutants
- Degradation of ambient air quality with regard to the concentrations of those pollutants for which ambient air quality standards exist (sulfur dioxide, nitrogen oxides, carbon monoxide, ozone, lead, and suspended inhalable particulate matter)
- Validity of data regarding H_2S exposure and the validity of using standards for healthy workers as opposed to standards for the general population
- Sufficiency of air quality monitoring
- Effects on human health of cumulative and chronic exposure to H_2S and other

*show basis
LBC count \$80*

Figure 3.1. Number of comments at the ten public scoping meetings for the HGP EIS.

pollutants (e.g., radon, heavy metals, and silicate)

- Global issues (acid rain and global warming)
- Effects of adverse meteorological conditions (air stagnation) on concentrations of pollutants that might affect human health.

The EIS will discuss the existing meteorological and climatological conditions characteristic of the Big Island and other islands and the influence of these conditions on air quality. Meteorological conditions necessary for volcanic smog (vog) formation will be addressed.

Figure 3.2. Number of scoping comments by subject area.

Both written & oral? Includes CA inputs? All in cooperation volume?

The air quality section of the EIS will identify pollutant sources during drilling, construction, and operation of the geothermal power plant as well as potential sources of pollutants that may occur during a facility accident. Additionally, pollutant sources during transmission line construction

(primarily in the form of particulates) will be identified. Background levels of air pollutant concentrations must be added to estimates of pollutant concentrations resulting from the proposed action, and the results must be compared with the National Ambient Air Quality Standards (NAAQS), State of

HGP

✓ plant cooling towers contribute a thermal pollution - address
contributions to thermal venting via other well casing losses
contributions of particulate to elements

Hawaii standards [including the recently passed State of Hawaii standard for H₂S (DOH 1992)], and other applicable standards. Pollutant concentrations will be estimated using EPA-approved modeling codes. Prevention of significant deterioration of air quality will also be addressed in this EIS. It is possible to conform to the NAAQS and still be in violation of the standards for prevention of significant deterioration. The description of ambient air quality presented in the affected environment section of the EIS will consider cumulative emissions from existing geothermal sources, from regional sources such as the volcano, and other sources (e.g., agricultural). The U.S. Geological Survey (USGS) will characterize volcanic contributions to ambient air quality. Ambient air quality specifically associated with vog will be addressed. Ongoing air quality monitoring (of existing conditions) will be discussed in the EIS. Any additional monitoring of air pollutants resulting from the proposed action will be discussed. Where applicable, the EIS will discuss mitigation measures that can be used to achieve the lowest possible emissions rate. The Hawaii Department of Health (DOH), Clean Air Branch, will be the primary cooperating agency for acquiring existing data on background levels of air pollutant concentrations and existing emissions sources other than the volcano; there are no air quality agencies at the local level in Hawaii.

DOE, through its cooperating agency relationships with the State of Hawaii, will obtain the necessary background data.

The EIS will address the impact of H₂S and other toxic pollutant emissions during routine operations and during facility accidents; H₂S is 1 of 189 hazardous air pollutants and 1 of the 16 extremely hazardous pollutants listed in Title III, Section 301 (r)(3), of the Clean Air Act Amendments of 1990 (Pub. L. 101-549). The Occupational Safety and Health Administration (OSHA) and National

Institute for Occupational Safety and Health (NIOSH) H₂S exposure limits (in addition to the new State H₂S ambient air quality rule) will be presented and discussed in the EIS. Because H₂S is a major issue relevant to the proposed action, measures for abatement and mitigation will be considered in the preparation of the EIS.

Additionally, the EIS will discuss emissions during routine operations that may affect global air quality concerns. These include atmospheric emissions of CO₂ and other greenhouse gases. & acid rain concerns ✓

Where not explicitly addressed above, scoping comments specifically brought forth by Region IX of the U.S. Environmental Protection Agency will be addressed in the EIS. Specific issues to be addressed include: background ambient air quality, nonattainment (if applicable), hazardous air pollutants, adverse meteorological conditions affecting air quality (e.g., stagnation), fugitive emissions from construction and operation, air quality monitoring, emergency response plans (see Section 3.3.7) and noise (see Section 3.3.5). and summarized in the companion volume ✓

The Hawaii Volcanoes National Park is designated a Class I area for the prevention of significant deterioration of air quality. Class I areas are designated to severely restrict the degradation of air quality, and specific standards for certain pollutants (nitrogen oxides, sulfur dioxide, and airborne particulate matter) apply. The effects on the Class I area will be addressed in the EIS. adel 1991 2 full 1st thru consultation ✓

Air quality related values such as visibility degradation and odors will be addressed in the EIS. These values are of particular importance in national parks and other Class I areas.

3.3.2 Surface and Groundwater Resources

Commenters thought that well drilling, resource utilization, and well reinjection activities may adversely affect water resources. Geothermal fluids would be

maximize water
of well is shown
in 3.3.4 R 2

work address water resource in area as sufficient to support HGP
discuss mitigation issues re water quality monitoring wells -
disposed of by reinjection during normal operation. A common concern was the
impact of airborne emissions deposited on the catchment water systems used by nearby
residents for drinking water supplies. Airborne emissions consist of geothermal
fluids containing sulfides, arsenic, boron, mercury, lead, and benzene as well as other
hazardous and toxic substances whose presence could render catchment water
systems unfit for human consumption.

Map of nearby drinking water wells that could be affected by construction and operation of the plant

Spill prevention, containment, and mitigation methodology

- Source of water for well drilling during construction and well quenching during plant operation
- Well casing and hydrologic monitoring plan for both production and reinjection wells

Commenters also noted the complex hydrogeology of the region and the importance of area aquifers. Hawaii's groundwater supplies consist of (1) a freshwater lense (referred to locally as basal water) floating on the underlying saltwater in a highly permeable, porous aquifer, and (2) groundwater reservoirs impounded by underground, volcanic dikes.

Issues and information requests identified in the scoping process include:

- Leakage from production and injection wells into aquifers caused by well casing failures
- Impacts of accidents, such as well blowouts on water resources
- Other effects of reinjection, such as thermal and chemical contamination
- Impacts on drinking water quality of nearby, affected catchment systems and deep wells
- Dewatering of groundwater resources
- Transport of contaminants from HGP-related wastes and effects of brine impoundments, both into underground sources of drinking water
- Erosion control during construction and operation of the plant
- Management of point and nonpoint contamination sources
- Groundwater monitoring system
- Mitigation plan to halt emanating groundwater contamination detected by groundwater monitoring system
- Complete geothermal fluid characterization

There is an inherent relationship between water resources and geologic resources. Issues related to geologic resources are discussed in Section 3.3.3. Springs and thermal springs are included in the definition of water resources as used in this section; wetlands and anchialine ponds are discussed in Section 3.3.4. Water resources are also important for subsistence and religious practices vital to Native Hawaiian culture. These cultural uses of water resources are addressed in Section 3.3.9.

Analyses will be performed to evaluate the environmental impacts associated with the above issues. Studies will be carried out to obtain information requested above that is not available in the open literature.

The State of Hawaii is considering the status of its water quality designation in the geothermal subzone beneath the District of Puna. All analyses of environmental impacts will be based on the water quality designation in effect at the time of writing of the EIS.

Cooperating agency involvement will include the State of Hawaii, USGS, and the County of Hawaii. The results from a surface water and groundwater survey that will be performed by the USGS will be included in the EIS.

The status of existing surface and groundwater resources and the effects of the HGP on these resources will be assessed in the EIS. Existing hydrogeological data for the HGP site and its surrounding environs as

well as other available background information will be used to assess the potential for contaminant transport and contamination. Impacts of routine operations and potential accidents also will be evaluated. Use of this information will provide the basis for the health and ecological assessments discussed in Sections 3.3.4 and 3.3.7, respectively. State of Hawaii and EPA-approved underground injection regulations will be used in the assessment of groundwater impacts.

Effects on water resources will be evaluated by comparing impacts that occur during normal plant operation against (1) impacts from accidents that would be mitigated by safety systems such as shutoff valves installed in the plants, and (2) impacts from severe accidents that would overwhelm safety features designed into the plants. These analyses will focus on temporary uncontrolled well venting during loss of cable, accidental well blowouts, and underground reinjection of geothermal fluids. This approach will place upper and lower bounds on potential impacts to water resources and will demonstrate that impacts attributable to reasonable design accidents are minimized by installed safety features.

3.3.3 Geologic Issues

The location of geothermal facilities on the site of an active volcano concerned many commenters. They indicated that the potential for seismic disturbances and lava flows at the geothermal facilities increased the risk of accidents and created conditions that cannot be addressed by the current state of technology. A geologically active and complex region, they said, is not suitable for industrial facilities. Geologic complexities and the potential for resource depletion were also of concern to Native Hawaiians, some of whom equate the geothermal resource with the volcano goddess, Pele. Native Hawaiian religious beliefs are addressed in Section 3.3.9. The rugged and

unstable terrain of the marine environment in which the undersea cable would be placed also was noted as a geologic issue.

The principal issues identified in the scoping process were:

- Hazards of development in a seismically and volcanically active area
- Potential for induced seismicity from withdrawal and reinjection of geothermal fluids
- Potential for geothermal-associated subsidence from withdrawal and reinjection of geothermal fluids
- Effects on soils *expand to impacts AC*
- Comparison of HGP site with other geothermal development sites (e.g., Iceland) *also see 3.3.6*
- Potential for lava flow hazards
- Potential for tephra hazards (airborne lava)
- Potential for uplift and subsidence hazards from volcanic activity
- Groundwater issues (detailed discussion in Section 3.3.2)
- Resource depletion; reliability of geothermal power production
- Geothermal fluid withdrawal and reinjection effects *geologic LC*
- Marine issues (detailed discussion in Section 3.3.4) *J. J. 4. J*
- Potential tsunami hazards *potential 3.3.12.2*
- Potential undersea slide hazards and turbidity current hazards
- Reliability of the cable in harsh and unstable marine environment

For both the HGP and the transmission/cable system, geologic issues will be treated in detail in the EIS. The volcanically and seismically active nature of the proposed development area raises a number of geologic issues that require an objective evaluation. Site studies and available literature will provide data; these data should provide a basis for assessing several geologic issues such as subsidence and withdrawal/reinjection effects. The

The USGS will assist DOE in acquiring and evaluating geologic suitability of the site for HGP facilities also will be assessed.

Geological literature of the Hawaiian Islands is extensive. ~~The USGS and DOE are in consultation about appropriate levels of analysis for natural hazards (earthquakes and volcanism) and for identifying the most appropriate information to be used in analyses of geologic issues.~~ The potential for damage to geothermal facilities by fresh lava flows will be assessed as well as effects of earthquake-induced phenomena such as excessive ground motion, surface rupture, liquefaction, and landslides. Environmental impacts of accidental release of geothermal fluids will be assessed (see Section 3.3.2). The effects of prolonged withdrawal and reinjection of geothermal fluids during plant operations also will be analyzed (see Section 3.3.2). If possible, reservoir engineering characteristics will be used to predict the nature of induced seismicity, subsidence, and geothermal reservoir depletion (the latter is addressed in Section 3.3.2). These analyses will depend on the availability and appropriateness of existing models. Analysis of routine operational impacts will be based on the assumption that automatic shut-off valves and blowout preventers function as intended and that other reasonable safety features (such as flexible joints between steam gathering lines on the surface and well heads) are included. Accident-driven impacts are discussed in greater detail in Section 3.3.7.

Soils in the Puna District and on transmission line rights-of-way will be described from existing U.S. Soil Conservation Service (USSCS), or equivalent, surveys. Construction, operational, and accident-related impacts (erosion and contamination) to these soils will be assessed. The USSCS will be consulted.

Well completion designs and erosion and sedimentation control plans (ESCPs) will be assessed for compliance with existing State regulations. In addition to the USGS, this

assessment will require consultation with the Hawaii Department of Land and Natural Resources, the Division of Water Resources Management, and Department of Health. County governments will be consulted with respect to ESCPs. Effective monitoring of construction- and operation-related erosion and sedimentation is a regulatory requirement of an ESCP. The National Park Service will be consulted regarding volcanic eruption mitigation measures.

3.3.4 Ecological Resources

A recurring concern expressed by commenters was the effect of geothermal development, transmission corridors, and cable construction on ecological resources. These ecological resources include terrestrial, aquatic, and marine resources. Concerns relative to each of these resource areas will be discussed in greater detail in the following subsections. A number of commenters cited the uniqueness and value of the Wao Kele O Puna rain forest as an overriding concern. Other commenters identified specific concerns related to effects of the submarine cable in the coastal zone and marine environment.

Ecological resources will be described in the EIS, and the impacts of HGP development, construction, and operation on the resources, including wetlands, floodplains, coastal zones, the marine environment, and species and areas of special concern, will be assessed. Assessment will draw upon existing literature and studies conducted by FWS and COE including comprehensive surveys of biota (e.g., forest bird and vegetation studies), a Hoary bat survey, a native rain forest ecosystem analysis, and wetland delineations. The need for additional data collection is currently being evaluated in consultation with DOE, FWS, COE, and others. The NMFS, NOAA, and other appropriate experts will be consulted for information on marine resources. Any deficiencies in the

information base required to prepare the EIS will be noted and supplemented if judged appropriate. Depending on the results of the assessment and the relationship to proposed alternatives, appropriate mitigation action plans will be developed in the preparation of the EIS.

Principal ecological issues for terrestrial, aquatic, and marine resources are listed below; there were several issues common to all ecological areas while others were specific to one or more resource areas. The issues are listed in such a way as to encompass major concerns, although the EIS will address all applicable concerns raised during the scoping process and additional issues identified during preparation of the EIS. Issues identified during scoping include:

General

- Effects of atmospheric emissions, liquid effluents, waste disposal and impoundments, and noise on ecological resources.
- Impacts to ecological resources from construction and operation of production sites, cable, and transmission corridors.
- Impacts on endemic, threatened and endangered, and sensitive species.

Terrestrial

- Deforestation and loss of biodiversity.
- Impacts of geothermal development and transmission right-of-way on habitat.
- Perceived impacts of electromagnetic field (EMF) on fauna along transmission corridors.
- Impact of corridor construction on fauna and flora, including sensitive plants, threatened and endangered species, and special habitats.
- Effects of operation on geothermal facilities on agricultural crops.
- Loss or disturbance of wetlands.
- Impacts of development on cave ecosystems and invertebrates.

Aquatic

- Impacts of development on anchialine pools (see Section 3.3.9).
- Impacts on populations of endemic, sensitive, and threatened and endangered species and critical habitat.
- Impacts of transmission right-of-way on aquatic habitat.
- Impacts to water quality from runoff, effluents, altered flows and quality of streams, springs, and hot springs pools on aquatic systems as the results of construction and operation of production sites, and transmission routes.

• use of herbicides & alien species control

- Impacts of cable on marine species, including Hawaiian monk seals, humpback whales, rays, skates, sharks, endemic, threatened and endangered, and other sensitive species.

- Competing uses of the undersea transmission cable with coastal zone use for marine emanations and cultural resources (see Section 3.3.9), and recreational uses (see Section 3.3.8) commercial, recreational, and subsistence fishing, shipping, etc.

- Competing uses of the transmission cable with marine coastal zones and channels for communications and military cables and national defense.

- Impacts on the marine environment as the result of water quality degradation runoff, effluents, oil spills, altered flows and quality of streams and springs from construction and operation of production sites, cable, and transmission routes.

- Potential for ciguatera as a result of cable construction.

- Regs & fish ponds + add text + AK

3.3.4.1 Terrestrial Resources

Commenters suggested that comprehensive surveys of rain forest species need to be completed and the results evaluated. Moreover, they thought that the EIS should fully investigate the potential

✓ *mention unique volcano/ rainforest naturally fragmented ecosystems and restricted evolutionary niches discuss roads, pipes, transmission lines and fragmentation impacts*

short- and long-term impacts of the HGP to pristine environments, such as the rain forest in Hawaii, the southeast coast and Hana districts of Maui, much of Molokai, the marine environment and other locations potentially affected by geothermal development.

The impacts of the proposed development on terrestrial ecosystems will be addressed in the EIS with particular emphasis on: the rain forest, wetlands, cave ecosystems (e.g., lava tubes), vegetation, birds, threatened and endangered species, invertebrates, and ethnobotanical and medicinal species. These topics particularly concern Native Hawaiians, whose culture and religion are closely tied to natural resources, and are addressed in that context in Section 3.3.9. Potential impacts of invasion of alien species into the rainforest

as a result of geothermal development and power transmission corridors will be evaluated; and the impacts to terrestrial ecosystems as the result of controlling alien species within the project area will be considered. A Geographic Information System (GIS) data base for the project will be built from existing data bases and results from studies to be conducted by the FWS (e.g., vegetation community, native bird, threatened and endangered species, and invertebrate surveys) and the COE (e.g., wetlands) will be used to integrate ecological resource data and assess potential impacts on terrestrial ecosystems and ecosystem components. Analyses in the EIS will include: (1) fragmentation of the rainforest; (2) alien species invasion into disturbed and natural areas; (3) potential for the project to contribute to loss of native fauna and flora, including impacts from erosion as a result of construction and maintenance operations; (4) land area impact of well pad size, number, and road length; (5) alternative locations of well pads and roads to minimize ecological disturbances; (6) interrelationships among biota, lava flows, and vegetation regeneration; and (7) transmission line EMF

exposure on terrestrial fauna; and (8) other issues identified as appropriate during data collection.

The extent and type of wetlands within all land areas potentially involved in the geothermal resource area and along transmission corridors will be delineated and significance ascribed by COE. The COE will use the 1987 COE Wetland Delineation Manual to delineate wetlands. Wetlands maps and supporting data will be provided to DOE for the purpose of performing wetlands assessments based on the practicable alternatives analysis in accordance with Clean Water Act [Section 404(b)(1)] guidelines for dredging and filling. When wetlands are identified, a detailed assessment of the potential impacts on the wetland ecosystem will be made and approaches for minimizing or avoiding wetland involvement will be discussed. The assessment will include potential impacts on wetland functions, including water quality, hydrology, vegetation composition and structure, habitat for threatened and endangered species, and biological diversity.

The potential for impacts to threatened and endangered species and wetlands (see above) are required analyses in the EIS. During the EIS process the FWS, as well as the State Department of Natural Resources, will be contacted for information and consultation under Section 7 of the Endangered Species Act.

3.3.4.2 Aquatic Resources

Commenters identified several issues related to aquatic resources that will be addressed in the EIS. Results of existing studies and those conducted in support of the EIS will be incorporated into the EIS.

Land-based freshwater and brackish-water ecosystems, including streams, springs, and anchialine pools, and their associated fauna and flora which occur in the proposed development area and along the transmission corridors of the affected islands will be

identified and potential impacts of the proposed development and alternatives will be addressed in the EIS. Existing information, including that from the FWS and NMFS and from studies conducted in support of the EIS, will be used to determine the impacts of the proposed development on land-based aquatic resources. Wetlands will be addressed primarily as part of the Terrestrial Resources Section (see Section 3.3.4.1); however, pertinent aspects of wetlands also may be addressed in this section.

The potential for impacts to threatened and endangered species in land-based aquatic ecosystems will be addressed using existing information and FWS survey information. During the EIS process, the FWS, the NMFS, the State Department of Natural Resources, and other knowledgeable experts as appropriate will be contacted for information; and consultation as required under Section 7 of the Endangered Species Act will be conducted. The results of these consultations will be included in the EIS.

3.3.4.3 Marine Resources

Commenters identified a number of concerns relative to the marine environment that will be addressed in the EIS. Marine ecosystems, including benthic communities, reefs, coastal zones, and deep waters along the underwater transmission corridors will be identified and described. Potential impacts of the proposed development, including trenching and laying transmission cables in the coastal zone, nearshore, and deep-water habitats and for competing uses of geothermal with fishing, shipping, and other uses of these areas will be addressed in the EIS (see also Sections 3.3.8 and 3.3.9). In addition, degradation of water quality that could occur as the result of geothermal development [e.g., runoff, effluents, oil spills, altered flows and quality of streams and springs (Section 3.3.2)] will be addressed as to potential effects on the marine

environment. The aesthetic impacts associated with construction in the marine environment will be addressed primarily in Section 3.3.10; however, they may also be addressed in this section as they relate to water quality of the marine environment. The impacts to the marine environment from construction and operation and from potential damage to the undersea transmission cable and alternatives to the proposed action will be addressed in the EIS. Scenarios in which an undersea cable may rupture or be severed and produce impacts as the result of strong ocean currents, submarine erosion by ocean currents, and submarine landslides generated by earthquakes will be addressed.

The potential for ciguatera as the result of disturbance of the marine environment during construction and measures to avoid, limit, and/or mitigate these impacts will be addressed. Those impacts that could occur as the result of oil spills and cable accidents will be addressed (see Section 3.3.12.2).

Impacts to commercial, recreational, and native subsistence fisheries in the coastal zone and along the transmission cable route as the result of construction and operation of the cable will be addressed in the EIS (see also Section 3.3.9). Economic impacts associated with the undersea cable as related to potential impacts on the livelihoods of those depending upon the sea (e.g., commercial, recreational, and subsistence fisheries and mariculture, use of recreational areas, and use of precious corals associated with the marine environment) will be addressed in Section 3.3.8. Those economic impacts associated with the cable construction, maintenance, operation, and other related aspects of deployment, retrieval, and rehabilitation will be addressed in Section 3.3.11.

As noted above, the marine ecosystems, including benthic communities, reefs, coastal zones, and deep waters along the underwater transmission corridors will be identified and described. The potential for

impacts to endemic, threatened and endangered, and other sensitive species in the marine environment will be determined. During the EIS process, the NMFS, the FWS, the NOAA Office of Marine Mammals, the State Department of Natural Resources, and other knowledgeable experts and agencies, as appropriate, will be contacted for information and consultation as required under Sect. 7 of the Endangered Species Act and the Marine Mammals Protection Act (see Tables 4.1 and 4.2).

The EIS will include an evaluation of the potential biological effects on marine life as the result of electric and magnetic fields (EMF) produced by the submarine cable. (There is concern that EMF may affect humpback whales and other sensitive species that use naturally occurring electromagnetic fields for navigation.) At least four possible cases will be evaluated for potential effects on marine species: (1) fields produced during normal operation of the cable system, including typical static magnetic and electric fields as well as induced fields that may occur during transients and line loading changes; (2) temporary events after damage to one or more of the cables with higher than normal current densities around the damaged cable; and (3) only one cable functioning with current return through the ocean. Impacts associated with staged development in which there could be AC transmission between the islands of Hawaii and Maui will be discussed as part of the discussion of Alternatives to the proposed action (Section 4.2.4 of the EIS).

Certain marine animals (e.g., sharks, rays, and skates) have specific sensory organs that detect extremely weak electric or magnetic fields which aid in navigation and foraging. Effects on behavior patterns, including potential attraction, may occur as the result of transmission line fields such as would be associated with the proposed undersea cable. The available knowledge regarding the effects of these fields on sensitive marine life will be reviewed and

pertinent information will be obtained from other cable transmission studies to address the potential impacts associated with this issue. This information, along with the calculations of the fields produced by the proposed undersea cables, will be used in the EIS to predict potential impacts on sensitive marine life.

3.3.5 Noise

Some commenters pointed out that well drilling and venting from geothermal development and operations will create noise. Well drilling and venting from current local geothermal developments were often cited as activities that produce intense noise. Noise is also associated with transmission lines, especially in moist conditions. Quiet conditions (with respect to human-produced sources) currently prevail in the area where noise impacts resulting from the proposed activity are expected.

Noise issues that were identified in the scoping process include:

- Occupational and public health impacts (including psychological impacts) of noise from drilling, construction, and venting operations, and possible associated exceedances of OSHA/NIOSH standards
- Effects on terrestrial fauna.

This section of the EIS will use existing data provided by qualified professionals specializing in noise characterization to describe and assess noise impacts. Noise measurements will include ambient levels as well as noise resulting from existing geothermal activities (drilling and operating). Noise contours will be developed. The noise measurements will include peak levels and energy-averaged levels. Noise from both normal operation (including transients) and upset conditions will be described.

The EIS will assess and evaluate potential impacts of noise to the nearest

HGP

NUISANCE NOISE
FROM TRANSMISSION AC

residential population, and to terrestrial species; and adaptation by terrestrial species to noise at other geothermal resources will be discussed. A section will be prepared which describes noise-induced hearing loss. The levels associated with this effect will be compared with expected contours. Compliance with applicable public and occupational standards and guidelines for noise, including psychological effects, will be addressed in the EIS. Noise-related annoyance and possible cardiovascular effects to residents living near well-drilling or other geothermal activities will be addressed. Noise abatement and mitigation measures (e.g., rock mufflers) will also be addressed and assessed.

3.3.6 Land Use

add consideration of land ownership and land use re geothermal development
Commenters raised land use concerns, especially those pertaining to conflicts between residential use and geothermal development.

Issues that were identified in the scoping process include:

- Incompatibility of HGP with existing nearby residential, agricultural, and military land uses, lands in conservation areas, and the Hawaii Volcanoes National Park and other preserve land areas
- Loss of unique land resources, such as the Wao Kele O Puna rain forest, to HGP and its associated features (transmission lines, roads, support facilities)
- Incompatibility of transmission line corridors with existing and planned land uses
- Coastal zone uses - fish ponds, recreation uses

Land-use issues will be addressed in multiple sections of the EIS. Agriculturally and ecologically related land-use issues will be discussed under the "land use" heading. Land use issues that affect Native Hawaiian interests and culture will be discussed

separately (see Section 3.3.9), and land use issues related to economics will be discussed in the socioeconomics sections of the EIS (see Section 3.3.8). To assess potential land use impacts, the EIS will estimate the total land area that would be required for the HGP, identify existing and planned land uses in the proposed vicinity of HGP facilities and transmission corridors, and determine if and to what extent the construction and operation of the HGP would be incompatible with or destructive to those land uses. Agencies that will provide information about existing and planned land uses include the Counties of Hawaii and Maui, the National Park Service, the U.S. Army Corps of Engineers, and the State of Hawaii (e.g., the Department of Land and Natural Resources and Office of State Planning). In particular, County Community Development Plans for affected counties and the State's statutes regarding the designation and regulation of geothermal resource subzones (Sections 205-5.1 and 205-5.2 HRS) will be consulted.

3.3.7 Health and Safety

Participants in scoping expressed concern about health risks to workers and the public from routine operations and accidents.

Issues that were identified in the scoping process include:

- Health and safety impacts of routine emissions (via air and water pathways)
- HGP accidents—effects on human health
- Cable accidents ref 3.3.12.2 R
- Effects of well venting and possible blowouts
- Occupational safety
- EMF effects
- Psychological effects of HGP development, construction, and operation, esp as result of non routine events
- Hazardous wastes and other materials

- ✓ civil disaster question re HGP development against comm. impacts
- ✓ civil defense issue if dependent on HGP and lose cable
- ✓ increased fire danger re transmission lines in dry areas

DRAFT (September 18, 1992)

Hawaii Geothermal Project EIS

HGP

Current plans depend on developer notification of emergency - not working.

acute and chronic exposures

geothermal re reef construction - cross ref to marine res.

loss of medicinal plants - cross ref to 3.3.9 and 3.3.10

impacts of herbicide use on human health exposure to coral res.

impacts of emissions/effluents on young, elderly, respiratory ailments, etc

Discuss uncontrolled unattended venting due to accident

Describe emergency plans with only one route possible, start work

The EIS will address health and safety issues as they relate to both operations and accident conditions. The basic methods for addressing the situations are similar. For public exposures first step is to identify the materials that will be emitted to air or water. These would include radon and daughters, H₂S, heavy metals, silicate and the entire inventory of gaseous and particulate emissions to the air (Section 3.3.1) or water. The next steps are to consider the various transport pathways, such as inhalation, food, and drinking water, and then calculate intake either on a continuous basis or under accident (episodic) conditions. These intakes then are converted to health effects via dose-response relationships, or compared with allowable intakes or other indices (e.g. State ambient air quality standards for the H₂S). In addition, potential occupational exposures will be evaluated, to the extent possible, with respect to OSHA and NIOSH regulations.

Of special concern are the hazardous materials, including waste, which are present at geothermal sites. To the extent possible, these will be listed along with applicable regulations. Drilling muds and waste ponds represent a source of possibly toxic materials and they may pose a special waste disposal challenge. To the extent possible, the contents of such muds and ponds will be characterized so that any potential health effects issues can be quantified and future waste disposal requirements can be identified.

Public concern over the possible health effects of EMFs associated with power generation and transmission has increased sharply in recent years. The EIS will include an evaluation of EMFs near the power generation facilities, along the transmission line right-of-ways, at the rectification stations, and at ocean entry and exit points. Safety issues associated with ocean return currents during single cable operation will also be evaluated. In addition, a section will be prepared which summarizes the most

recent scientific understanding of the systems possible long-term effects on humans.

Accidents could result from natural phenomena or from a variety of human factors including operator error, material and design choices.

The EIS will include a qualitative discussion of potential psychological effects and their manifestations (e.g., people moving out of their residences due to geothermal activities) resulting from factors related to the construction and operation of geothermal facilities (e.g., noise, odor, night lights).

The EIS will describe existing emergency plans of the County of Hawaii as they relate to emergencies in the Puna District. The EIS will address emergency preparedness needs both on the HGP site and in the Puna District that may arise from the proposed project, and discuss alternative mitigation measures that could be incorporated, such as monitoring of emissions. Emergency preparedness will be discussed in light of the existing State of Hawaii Department of Health's H₂S standards, the Federal Emergency Management Agency's (FEMA's) *Guide for Development of State and Local Emergency Operations Plans* (1985) and FEMA supplement to that document, *Guide for the Review of State and Local Emergency Plans* (1988), the requirements of Title III of the Superfund Amendments and Reauthorization Act (SARA) (1986) mandating public disclosure of chemical release information and the development of emergency response plans.

3.3.8 Socioeconomics

Socioeconomic concerns were expressed by many commenters. Scoping participants noted that the potential social and economic costs and benefits of geothermal development are complex and need to be evaluated in detail. Socioeconomic concerns ranged from the local effects of HGP (e.g., property values) to more general concerns

also include mitigation, rehabilitation, monitoring and enforcement costs
economic feasibility of HGP

Implementation Plan

DRAFT (September 18, 1992)

HGP

cost of backup ("spinning reserve")
+ reliability costs

(e.g., economics of Hawaiian tourism and industry).

Issues that were identified in the scoping process include:

• The need for an accurate estimate of the total cost of the HGP from inception to decommissioning and rehabilitation, including the cost of additional wells because of resource depletion, ^{to consumers, rate payers, utilities and taxpayers} ^{share to local cable}
• The impacts of further industrialization (heavy industry) as a result of power availability.

- Effects on property values near HGP facilities and along the transmission line corridor
- Effects on electric rates (because of HGP's cost and reliability) and comparison of those rates to the no-HGP alternative and to conservation and demand-side management for the same amount of power.

- Increasing tourist developments and economic dependence on tourism
- Impacts of the HGP on life styles of the general population, specifically on Native Hawaiians (not in 3.3.9)

The cost of cable of facility failure if geothermal energy provides a significant proportion of Hawaii's energy needs

• The total cost of property condemnation, relocation, and/or financial reimbursement to nearby residents due to HGP liability-related issues

• Economic impacts on agriculture, commercial fisheries, aquaculture, recreation, and tourism

• Economic effects of the HGP's visual impacts (e.g., the impact of night lighting on the Mona Kea observatories)

The EIS will assess several of these and other potential socioeconomic issues, including (1) HGP employment-related population changes and subsequent impacts to employment, housing, public services, land use, and recreation and tourism and (2) the possibility of the HGP providing power for

increased urbanization, industrialization, and tourism and subsequent impacts on population distribution and employment.

The EIS will assess socioeconomic impacts by examining the impacts of constructing and operating existing ^{transmission lines} geothermal projects and other large energy-related facilities and projecting the HGP's impacts based on past experiences. The socioeconomic impact assessment will rely heavily on data from local planning agencies and the State of Hawaii. ^{in other locations} ^{County} ^{+ other sources}

Some concerns raised by commenters are beyond the scope of the EIS. Issues that will not be addressed in the socioeconomic impact assessment include ~~the economic impacts of HGP construction and operation on marijuana growers~~, the financial impacts of the State's promotion and litigation of the HGP, and the political and social conflict generated by the HGP.. ^{or prob raised in scoping} ^{HGP}

3.3.9 Cultural Resources/Native Hawaiian Concerns

Many speakers at the public meetings requested that the EIS consider the Native Hawaiians and their rights, religion, and culture. Many people expressed the belief that geothermal development would desecrate the volcano goddess Pele, and recommended that the EIS examine potential impacts of the HGP on Native Hawaiian lifestyles and cultural and religious practices.

Issues that were identified in the scoping process include:

- Potential desecration of Pele, the volcano-nature goddess, and impaired ability to observe Native Hawaiian religious practices associated with Pele; interrupted generational continuity in the training of young persons in traditional religious and cultural practices
- Loss or desecration of religiously, spiritually, culturally, and socially unique habitats, land forms, resources (e.g.,

property loss/repair or corrosion damage
Office of Conservation and Renewable Energy

costs of HGP v/c investing in renewable/conservation (i.e. expensive HGP + backup)

archaeological sites and artifacts;
atmospheric signs such as rainbows); and
species *Impediments to AC*

- Cross ref
Spec. water
ground*
- Impaired religious and other cultural uses of surface and subsurface waters located near the geothermal resource
 - Compliance with the American Indian Religious Freedom Act, the National Historic Preservation Act of 1966, and other pertinent state and federal legislation (see Tables 4.1 and 4.2) *and*
 - Confidentiality of Native Hawaiian practices and religiously significant sites, including heiau (places of worship) and burial sites in caves, cliffs, lava tubes; concern for potential desecration of sites
 - Reduced access to traditional coastal trails, healing places, and areas important for subsistence gathering and medicinal use of plants; loss of ability to exercise gathering, fishing, and water rights
 - Reduced contact with and access to marine resources: sanctuaries (coastal caves and heiau), spiritual emanations or hoailona (natural signs) such as waves, subsistence fishing from reefs and nearshore fishing grounds, gathering of limu (seaweed). *malikuhua hit*
 - Reduced contact with fish, birds, and other wildlife identified as 'aumakua (deified ancestors); loss of traditions rooted in aloha 'aina (respect and love for the land)
 - *AC/C²
Precluded*
*AC
draw to
land use*
Inappropriate use of Native Hawaiian Homelands and ceded lands; ~~on several of the islands~~; loss of access to or delayed homesteading of such lands
 - Alteration of the traditional rural physical setting and landscape
 - Effects of geothermal development on the integrity of archaeological resources; potential for increased unauthorized access to archaeological sites and areas important to traditional culture, which could lead to their alteration or destruction
 - Potential for damage from submarine cables to submerged archaeological

remains such as nearshore underwater fishing sites.

- Loss of racial identity
- Effects on subsistence lifestyles, including degradation of fishponds
- Impact on State constitutional Native Hawaiian legal rights and Common Law rights of 1892
- Impact on Native Hawaiian family and community life
- Impact on intergenerational linkages to ancestral lands and cultural/historic sites
- Impact on quality of life, changes in mental/cultural health, and impact on Native Hawaiian identity and pride

Additional comments made by Native Hawaiians ~~subsequent to the scoping process~~ suggest that not all Native Hawaiians agree on how these issues should be characterized. For instance, some Native Hawaiians distinguish between worshipping and respecting Pele. They advocate wise use of and protection of natural resources but do not view geothermal development as an agent of potential religious desecration.

To assess specific cultural resources and Native Hawaiian concerns, the EIS will employ professional archaeologists to generate predictive models and conduct archaeological surveys in two of the main project areas, the GRS in the Puna District, Hawaii, and the south shore of Maui. The State Historic Preservation Division has identified these areas as being likely to contain previously unidentified cultural resources. Additional reconnaissance and inventory surveys will still be required on affected islands, of geothermal resource subzones, transmission line corridors and access roads, and land-sea transition points along submarine cable routes. Marine archaeological surveys may be required off the coast of Maui in areas where nearshore underwater fishing sites are suspected. These surveys will be undertaken when and if the proposed project or subsequent projects reach more precise levels of definition than

are currently available. In addition, the EIS will utilize a Native Hawaiian cultural resource survey which will involve archival research and ethnographic and ethnohistorical description and analysis of those aspects of Native Hawaiian culture covered by this project. Information from these sources is essential in evaluating and describing various claims that sites within the project area are important for the perpetuation of particular traditional practices and will be necessary for predicting the probable distribution of historic sites in the various areas of potential impact. Where appropriate, the EIS will also address impacts to cultural resources not specifically identified as Native Hawaiian. The Hawaii State Historic Preservation Officer, the Office of Hawaiian Affairs, the Office of Hawaiian Home Lands, the National Park Service, and the President's Advisory Council on Historic Preservation will be consulted as important sources of information and guidance in undertaking the required studies. These archaeological and cultural resource surveys will provide the basis for compliance with pertinent federal legislation, including the National Historic Preservation Act of 1966 (as amended), Sections 106 and 110; the American Indian Religious Freedom Act of 1978 (amendments proposed); and the Native American Graves Protection and Repatriation Act of 1990. Pertinent state legislation includes Hawaii State Constitution, Article 12, Section 7; Hawaii Revised Statutes, Chapter 6E; and State Act 306 concerning religious and cultural rights, historic preservation, and protection of burial sites, respectively.

Some aspects of Native Hawaiian issues are beyond the scope of the EIS; these include, for example, the potential loss of racial identity. Other issues will be addressed only to the extent that they relate clearly to impacts generated by HGP. For example, a compilation of litigation involving Native Hawaiian claims aside from those directly

related to HGP is beyond the scope of the EIS. However, DOE intends to consult and cooperate with Native Hawaiians through mutually recognized expert consultants and through recognized organizations (including the Office of Hawaiian Affairs and Hui Malama I Na Kupuna O'Hawai'i Nei) to ensure that the EIS accurately reflects to the extent practicable the concerns and issues that Native Hawaiians regard as significant. In addition, DOE will promote wherever possible community access to the results of cultural studies. To the extent possible, consultations on these surveys will extend directly to affected Native Hawaiian communities.

3.3.10 Aesthetic Resources

Impacts to aesthetic resources were a concern to several commenters. They thought the EIS should address the aesthetic impacts of HGP on all islands, including impacts to natural and agricultural landscapes, beaches, and recreation areas.

Issues that were identified in the scoping process include:

- Aesthetic (nuisance) impacts of noise
- Visual impacts of clearing land in the Wao Kele O Puna rain forest w/ added erosion effects
- Visual impacts of transmission lines, particularly in established scenic areas, near park lands and preserves, and near recreation areas
- Visual impacts of an industrial facility in a residential and/or rural environment
- Aesthetic impacts to the Puna District and along transmission line corridors because of HGP-related noise, odor, and night lighting
- Proximity of HGP facilities to Hawaii Volcanoes National Park in consideration of visual impacts (e.g., night lighting) and Air Quality Related Values under the Clean Air Act
- Visual impacts to the marine environment (e.g., oil slicks, cable presence, and water clarity)

The EIS will identify and describe important aesthetic resources in the vicinity of HGP facilities, and will assess the impacts of the proposed project on those resources. The assessment will involve an aesthetic resources survey and analysis conducted by local professional consultants specializing in landscape architecture and aesthetic impact analysis. These consultants will contact local planning agencies and citizen groups for information and assistance in preparing the aesthetic resources survey and analysis.

3.3.11 Alternatives

Commenters suggested that there are several issues related to the alternatives to the proposed HGP that should be addressed in the EIS. Issues raised include:

- Request for the examination of conservation and demand-side management and renewables (biomass, solar thermal, wind, etc.) as alternatives to the proposed action.
- Concern raised that if the purpose of the HGP is to reduce the need for imported oil, then the transportation sector should be examined.
- Economics of geothermal power need to be compared with other reasonably foreseeable alternatives.
- All alternative strategies should be analyzed in an integrated resource planning context and externalities should be identified and quantified where possible.
- Commenters noted that if a geothermal resource of 500 MW exists on the Big Island, then its full development is a reasonably foreseeable consequence.
- Effects of increased industrialization of the Big Island as the results of any alternative should be considered.
- Alternative power generation strategies need to be characterized for each island where geothermal-derived energy is being planned to be delivered.

including issue of coal source impacts (strip mining rare forest)

- Use of coal-fired power generation as an alternative should include an assessment of the potential environmental impacts (air quality and solid wastes).
- Use of petroleum byproducts (residual oil from petroleum processing for transportation fuels) should be considered for power production on the outer islands as well as on the Island of Oahu.
- Impact assessment of alternatives need to address fiscal impacts, population distribution, contribution to energy demand, and reliability of resource.
- Alternative cable (overland and submarine) routes and technologies should be evaluated in the EIS.
- Various HGP designs and configurations, including alternative facility locations should be considered and should be sited away from residential areas.
- Off-grid electric power systems (e.g., solar hot water, synthetic natural gas/propane for cooking, wind, etc.) should be considered where possible in assessment of alternatives.

Alternatives to the proposed DOE action (partially funding Phase 3) and reasonably foreseeable actions by others (such as Phase 4, the State's proposed construction and operation of HGP) will be addressed in the EIS. These alternatives will include the no action alternative of not partially funding Phase 3. In addition, reasonable alternatives within the proposed HGP, both supply and non-supply, as well as design and location alternatives will be considered. The criteria for evaluating alternatives will include and consider the energy objectives and policies cited in 226-18, HRS, of the Hawaii State Plan.

The HGP will be evaluated to determine which alternatives have the potential to achieve similar objectives. The main emphasis will be in determining the proposed HGP's contribution to meeting power generation needs and Hawaii's energy

policy goal of reducing reliance on imported oil. This determination will be based in part on projections of electric generation requirements and plans to meet these requirements. Transportation actions that would potentially reduce dependence on oil will not be considered as alternatives to the proposed action. Although these actions have been mentioned during scoping meetings as possible alternatives because they could potentially accomplish one of the proposed action's primary objectives, that is reduce Hawaii's dependence on imported oil, they do not achieve the crucial HGP objective of supplying electric power.

Therefore, this alternative is not considered comparable to the proposed action. The EIS will consider, however, the amount of oil displaced by the use of up to 500 MW of geothermal energy and other supply-demand alternatives.

Alternatives that will be considered include: alternative geothermal technologies, sites, and capacities; alternative supply-demand options, such as no action, geothermal on the Big Island only, and conservation and DSM plus renewable energy supply sources; alternatives associated with the overland transmission routes; and alternative submarine cable routes and technologies. Alternatives to the proposed submarine cable system will include: various cable routes and cable materials, such as solid dielectric or oil-filled submarine cables, operation at either high voltage AC or DC, and alternative methods of land-sea transition. Each of these alternatives will be evaluated based on their economic and technical viability. The potential environmental and economic impacts for each energy supply-demand option will be identified and examined.

3.3.11.1 Geothermal Technologies, Sites, and Capacities

Alternatives to the proposed 500 MW geothermal development will include various

power generation strategies including alternative geothermal sites, power generating technologies, and capacities. Other alternatives that will be considered are (1) development of up to 500 MW of geothermal power for exclusive use on the Big Island, with no inter-island transmission cable (It would include other sources on other islands to make up the equivalent power and generation of the proposed projects) and (2) alternative geothermal power generating technologies. In addition, the EIS will also consider alternative non-geothermal power generating technologies and capacities.

3.3.11.2 Alternative Supply-Demand Options

In addition to the no action alternative (Section 2.1), a second supply-demand option, reasonable increments up to 500 MW of geothermal energy will be considered for use on the Big Island only and thus with no submarine cable. This alternative addresses the scoping concern that if a resource of 500 MW exists on the Island of Hawaii, then its development is a reasonably foreseeable consequence. The definition of this alternative will consider the State of Hawaii and utility plans, and/or the projected needs for generating power on the Big Island. The third alternative includes conservation and DSM plus a mix of renewable supply alternatives, such as biomass, solar, photovoltaic, small-scale hydroelectric, and wind. These supply-demand options will be examined on an island-by-island basis in the framework of IRP. All supply-demand alternatives will be analyzed in the EIS using IRP methods available from Hawaiian utilities as well as from other sources. The extent of the EIS analysis will depend on the availability of credible data from the Hawaiian utilities and from the individual alternative assessments.

The energy supply-demand alternatives will be evaluated by first screening them for

including in situ heat exchange
and total reinjection ✓

shift

or later
installation
of cable ✓

technical feasibility, i.e., does the resource exist and is it technically feasible to develop it in the same time-frame as the HGP? If the alternative is technically feasible, its potential environmental impacts and economic costs will be evaluated.

The basis of the economic evaluation will be a comparison of the discounted valued of the life-cycle costs of geothermal to a configuration of alternatives that would provide equivalent power and generation (or an equivalent increase in energy efficiency and DSM) over the assumed lifetime of the geothermal resource. Cost estimates of alternatives will be based on the best available information with special consideration of cost factors affecting Hawaii.

Reasonable energy alternatives and strategies including conservation/DSM, renewable resources, alternative geothermal resources, and power generating plants will be compared using an integrated resource planning framework. This assessment will be conducted using available data and studies from the State of Hawaii (primarily the Department of Business, Economic Development and Tourism), local utilities, and others and will be coordinated, where possible, with Hawaii's integrated resource planning process that is currently under way.

Uncertainty about capital costs, energy costs, economic risks, and environmental factors will be incorporated through sensitivity analyses. Alternatives to the HGP will be evaluated through the simulation of alternative resource plans using utility planning models. The effect of alternatives on Hawaii's dependence on imported oil will also be explicitly examined where possible. This examination will focus on the displacement of imported petroleum for electric power generation, the use of petroleum processing residuals for power production, and how these reductions in the use of oil for electricity production would affect Hawaii's dependence on petroleum imports. The need for power production

facilities will also be evaluated. The effect on environmental resources that are being considered for the proposed action will be considered for viable alternatives.

3.3.11.3 Submarine Cable Routes and Technologies

The environmental concerns identified in Section 3.3.4.3 regarding the marine environment will be addressed for each of the alternative cable scenarios.

Cable routes. The preferred route is at present only roughly defined. Therefore questions regarding competing uses, impacts to water quality and marine ecologies (particularly to threatened and endangered species), economic considerations, impacts to cultural heritage, and risks of credible accident will be important in defining the preferred route and viable alternatives.

Alternative cable materials and configurations. When the HDWC program analyzed the many possible configurations an oil-filled cable was considered technically and economically the preferred alternative. Those cables that were found to be in the top 8% of the solutions technically (HDWCP, 1985b) will be reexamined from an environmental perspective, as will solid-dielectric cables, if they are demonstrated to be reasonable from a technical and cost basis.

High voltage DC vs high voltage AC transmission. The preferred technological alternative for the submarine cable is HV DC. If HV AC is found to have sufficient technological merit that it can be considered a reasonably foreseeable alternative, then its environmental impacts will be considered. Of particular concern is the EMF associated with AC, which is considerably greater than that observed for the same power rating with DC current.

Land-sea transitions. In this EIS, only the potential impacts of alternatives of pumping station/no pumping station and conversion station/no conversion station (if

there will be taps for the local power system) will be considered. An examination of alternative refinements is not reasonable in this EIS because of insufficient details of proposed pumping or conversion stations.

3.3.12 Credible Accidents

3.3.12.1 Proposed Geothermal, Geothermal Alternatives, and Overland Transmission Routes

As discussed in Section 3.3.7, accidents could result from natural phenomena or from a variety of human factors including operator error, material and design choices; to the extent possible, these will be bounded. A deterministic approach will be used. Because the area is geologically active, major potential accident initiators are natural in origin and include earthquakes and volcano eruptions. The quantities and effects of the primary materials released—such as radon, H₂S, and toxic heavy metal—will be contrasted with the quantities and effects that the natural events initiate at wells. Analysis of accident-driven impacts will assume that pipeline-well head connections fail and that automatic shut-off valves also fail or that a blowout preventer on a drilling well fails, leading to uncontrolled venting of geothermal fluid.

3.3.12.2 Submarine Cable and Alternatives

Commenters raised concerns about

- numerous hazards on land, in the coastal zone, and at sea with respect to fabrication, transportation, construction, deployment, maintenance, or retrieval operations for the submarine cable;
- cable reliability under normal sea conditions;
- cable reliability of extreme events, such as tsunamis, hurricanes, and debris flows or turbidity currents;

- potential of cable break due to mechanical impact (anchors, shark bite etc.)
- possible hazards to human health if the EMF from cable attracts sharks (see also Section 3.3.7). J.J.4.5.

Marine operations. Construction and operation in and near the marine environment involves numerous hazards on land, in the coastal zone, and at sea with respect to fabrication, transportation, construction, deployment, maintenance, or retrieval operations. Operations at sea must comply with U.S. Coast Guard Regulations including requirements for Navigational Safety, Inspection, Construction and Arrangement, Hazardous Materials, Pollution Prevention, Operations Manning and Documentation. In addition, Occupational Health and Safety and EPA rules and regulations must be considered, as well as numerous State and County rules and regulations.

The EIS will address operations in normal sea state and under extreme conditions. The impacts of a cable failure that impact primarily terrestrial systems, such as the community at the geothermal plant site or those relying on the power in Oahu, J.J.4.1 will be discussed (see also Section 3.3.12). J.J.4.1

Mechanical integrity. Commenters asked about the ability of the submarine cable system to withstand attacks such as anchors, shark bites, or purposeful sabotage. The EIS will examine those concerns using information in the available literature and experiences elsewhere.

Shark attraction. Commenters were also concerned that the EMF from the cable would attract sharks. Various experts on sharks will be consulted and the literature will be carefully reviewed to determine whether attraction of sharks is a significant possibility. Shark attraction will be addressed to the extent available information permits.

3.3.13 Federal, State, and Local Government and Geothermal Developers

During the public scoping process, participants questioned the credibility of some organizations involved in the development of the HGP. They suggested involvement of non-geothermal affiliated firms during preparation of the EIS to improve credibility.

Issues that were identified in the scoping process include:

- Lack of governmental concern for citizens' rights, health, and welfare
- Lack of due process in HGP-related litigation
- Dismissal of public concerns by government officials
- Collaboration between government and geothermal developers
- Powerlessness of citizens to influence government decisions on HGP
- Competence of government employees and geothermal developers

These concerns are not within the scope of the EIS; however, DOE recognizes the importance of independent oversight and public involvement in activities to build confidence and trust, and will continue to make information available to the public and respond to public comments.

As noted in Section 3.2, DOE held ten public scoping meetings (two a day at five locations) and provided a public comment period to accept written comments. Transcripts from these meetings were placed in the HGP EIS reading rooms for public review. In addition, information exchange meetings and meetings with Native Hawaiians were held (see Table 3.1 and Figure 3.1). This draft IP is being made available for public review and comment. Also, an interactive workshop will be held to receive comments and suggestions on the draft IP from all cooperating agencies. To

encourage public involvement, *Federal Register* notices, press releases, and local advertisements have been used to publicize activities. DOE will continue to publicize public participation opportunities.

3.3.14 Environmental Compliance Regulatory Issues

Commenters thought that the EIS should review all applicable federal, State, and County rules, regulations, and statutes, including NEPA, OSHA requirements, the National Historic Preservation Act, the American Indian Religious Freedom Act, the Endangered Species Act (including Section 7 consultation), and the Public Utilities Regulatory Policy Act, and other (see Tables 4.1 and 4.2). Commenters also thought that the EIS should include a review of regulatory issues in light of the major changes that have occurred during the course of the HGP.

Issues that were identified in the scoping process include:

- Federal, State, and local permit compliance
- Effect of past and current litigation on geothermal development
- Apparent violations of environmental laws by geothermal developers
- Inadequate monitoring for compliance with emissions standards
- Role of State and local enforcement agencies

The HGP will be required to comply with all relevant federal, State, and local regulations and legislation. The EIS will list and describe the federal, State, and local laws and acts that pertain to HGP, and will assess HGP impacts against the standards associated with those laws. For example, National Ambient Air Quality Standards and State of Hawaii air quality standards for H₂S will be used in the EIS assessment of HGP air quality impacts. In addition, Mitigation

Implementation Plan
DOH
SOH
NE
EPA

Action Plans, completed in conjunction with the EIS and its Record of Decision, will explain how measures designed to mitigate adverse impacts will be planned and implemented. These Mitigation Action Plans are required by DOE NEPA Implementing Procedures (10 CFR 1021).

Hawaii have agreed to be cooperating agencies on the HGP EIS. Memoranda of Understanding ^{have been signed} are being negotiated by DOE and each cooperator. Details of cooperating agency studies and/or assessments are currently under review. Discussions are under way to determine the type and degree of cooperating agency involvement.

4. AGENCY CONSULTATIONS

being discussed with agency treatment x APP.2

A partial list of agencies to be consulted during the EIS process is given by subject area and agency in Tables 4.1 and 4.2. This list will be revised and expanded if necessary in consultations with cooperating agencies.

OTHER FEDERAL AND LOCAL AGENCIES AND ORGANIZATIONS

While preparing the HGP EIS, DOE will consult and conduct reviews with other federal agencies and Native Hawaiian organizations that do not have "cooperating" status as defined by CEQ. Other federal agencies have regulatory and environmental responsibilities. In particular, EPA, U.S. Navy, U.S. Coast Guard, Soil Conservation Service, Department of Interior, and Department of Transportation have been identified for such consultation. These regulations and responsibilities will be addressed in the EIS. *? need*

4.1 COOPERATING AGENCIES

check to talk to list meetings

As part of the scoping process, DOE invited other federal agencies to participate in the EIS preparation as cooperating agencies. Cooperating agency roles and responsibilities in the EIS process, defined in the NEPA regulations, include participation in the scoping process, developing information, preparing environmental analyses, providing technical reviews, and lending staff support. COE, FWS, USGS, National Park Service, NMFS, State of Hawaii, County of Maui, and County of

5. SIGNIFICANT EIS MILESTONES

compare to Recovery, PREIS IP Work Plan
Significant EIS milestones are shown in the chart below.

TABLE 4.1.—Agency Consultations

<u>Subject Area</u>	<u>Legislation</u>	<u>Agency</u>
Endangered species	Endangered Species Act of 1973, as amended; state laws	U.S. Fish and Wildlife Service, National Marine Fisheries Service, State agencies
Migratory birds	Migratory Bird Treaty Act	U.S. Fish and Wildlife Service
Archaeological, historical, and cultural resource preservation	<i>Federal:</i> National Historic Preservation Act of 1966; Archaeological Resources Protection Act; American Indian Religious Freedom Act; and Native American Graves Protection and Repatriation Act; <i>State:</i> Hawai'i State Constitution, Article 12, Section 7; Hawai'ian Historic Preservation Law [Haw. Rev. Stat. 6E-1 (1985)]; Hawai'ian Burial Law [Act 306 (Session Laws 1990)]; <i>County:</i> Ordinance No. 1941: "A Bill For An Ordinance Establishing A New Chapter In Title 2 Of The Maui County Code Creating A Cultural Resources Commission; Maui County Code, Title 2: "Administration and Personnel," Chapter 2.88, "Cultural Resources Commission"	State Historic Preservation Office, President's Advisory Council on Historic Preservation, Native Hawai'ian Groups, Office of Hawai'ian Affairs, Maui County Cultural Resources Commission, State Department of Hawai'ian Home Lands
Discharge of pollutants to water	Clean Water Act; Safe Drinking Water Act	U.S. Environmental Protection Agency, National Marine Fisheries Service, State agencies
Work in navigable waters of the United States	Section 404 of Clean Water Act; Rivers and Harbors Act	Corps of Engineers, National Marine Fisheries Service

**TABLE 4.1.—Agency Consultations
(continued)**

<u>Subject Area</u>	<u>Legislation</u>	<u>Agency</u>
Prime and unique farmlands	Farmland Protection Policy Act of 1981	Soil Conservation Service
Floodplains	Executive Order 11988; Fish and Wildlife Coordination Act	Corps of Engineers, U.S. Fish and Wildlife Service, State agencies
Wetlands	Executive Order 11990; Fish and Wildlife Coordination Act; Section 404 of Clean Water Act	Corps of Engineers, U.S. Fish and Wildlife Service, National Marine Fisheries Service, State agencies, U.S. Environmental Protection Agency
Water body alteration	Fish and Wildlife Coordination Act	U.S. Fish and Wildlife Service, National Marine Fisheries Service, State agencies
River status	Wild and Scenic Rivers Act; Anadromous Fish Conservation Act; Hanford Reach Study Act	U.S. Department of the Interior
Air pollution	Clean Air Act	U.S. Environmental Protection Agency, State and local agencies
Water use and availability	Water Resources Planning Act of 1965; Safe Drinking Water Act; Primary and Secondary Drinking Water Standards; others	U.S. Environmental Protection Agency, Office of Water Policy, State agencies

TABLE 4.1.—Agency Consultations
(continued)

<u>Subject Area</u>	<u>Legislation</u>	<u>Agency</u>
Noise	Noise Pollution and Abatement Act of 1970; Noise Control Act of 1972	U.S. Environmental Protection Agency, State agencies
Siting and planning	State and County legislation	State and County agencies
Waste management and transportation	Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act and the Hazardous and Solid Waste Amendments of 1984; Comprehensive Environmental Response, Compensation and Liability Act; Emergency Planning and Community Right to Know Act	U.S. Environmental Protection Agency, U.S. Department of Transportation, State agencies
Coastal zones	Coastal Zone Management Act; State and County legislation	Office of State Planning, County Planning Department

TABLE 4.2.—Government Agency Permit Consultation List

<u>Permit Abbreviation</u>	<u>Permit Title or Type</u>	<u>Cross-Reference to Related Permits/Permits Delegated to Other Agencies</u>
Department of Land and Natural Resources		
DLNR 1	Ocean Waters Construction Permit	NOAA 1, CG 1, CG 2
DLNR 4	Forest Reserve Special Use Permit	
DLNR 5	Forest Reserve Access Permit	
DLNR 6	Entrance to Wildlife Sanctuary	
DLNR 7	Transporting Permit	
DLNR 8	Permit to Enter Closed Watershed	
DLNR 9	Natural Area Reserve Special Use Permit	
DLNR 10	Historic Preservation Review	COE 1, COE 5
DLNR 11	Use of State Land Including Submerged State Lands	NOAA 1, CG 1, CG 2
DLNR 12	Conservation District Use Application	
DLNR 13	Water Use Permit Within Water Management Areas	
DLNR 14	Stream Channel Alteration Permit	
DLNR 15	Stream Diversion Works Construction or Alteration Permit	
DLNR 16	Well Construction or Pump Installation Permit	
DLNR 17	Geothermal Resource Mining Lease	

**TABLE 4.2.—Government Agency Permit Consultation List
(continued)**

<u>Permit Abbreviation</u>	<u>Permit Title or Type</u>	<u>Cross-Reference to Related Permits/Permits Delegated to Other Agencies</u>
DLNR 18	Dams and Reservoirs Construction Approval	COE 2
DLNR 19	Geothermal Exploration Permit	
DLNR 20	Geothermal Resource Subzone Designation	
DLNR 21	Geothermal Plan of Operations	
DLNR 22	Geothermal Well Drilling or Modification Permit	
Department of Health		
DOH 1	Notification of Hazardous Waste Activity	EPA 1
DOH 2	Hazardous Waste Treatment, Storage and Disposal (TSD) Permit	EPA 1
DOH 3	Underground Storage Tank (UST)	
DOH 4	Underground Injection Control (UIC) Permit	EPA 3
DOH 5	Water Quality Certification (WQC) Army Corps of Engineers Section 401 Permit	
DOH 6	Authority to Construct (ATC) a Potential Air Pollution Source	
DOH 7	Permit to Operate (PTO) a Potential Air Pollution Source	
DOH 8	Prevention of Significant Deterioration (PSD)	

**TABLE 4.2.—Government Agency Permit Consultation List
(continued)**

<u>Permit Abbreviation</u>	<u>Permit Title or Type</u>	<u>Cross-Reference to Related Permits/Permits Delegated to Other Agencies</u>
DOH 9	Community Noise Permit for Construction Activities Department of Business, Economic Development and Tourism	
DBEDT 1	District Boundary Amendment	
DBEDT 2	Land Use Commission Special Use Permit Office of State Planning	
OSP 1	Federal Consistency With the Hawaii Coastal Zone Management Program Department of Transportation	COE 5
DOT 1	Permit to Perform Work on State Highways Hawaii County	FHA 1
HC 1	Geothermal Resource Permit (GRC)	
HC 2	Special Management Area (SMA)	
HC 3	Shoreline Setback Variance (SSV)	
HC 4	Special Permits	
HC 5	Use Permits	
HC 6	Subdivision of Land	
HC 7	Plan Approval	

**TABLE 4.2.—Government Agency Permit Consultation List
(continued)**

<u>Permit Abbreviation</u>	<u>Permit Title or Type</u>	<u>Cross-Reference to Related Permits/Permits Delegated to Other Agencies</u>
HC 8	Grubbing, Grading, Excavation and Stockpiling Permits	
HC 9	Excavation of Public Highways	
HC 10	Installation of Utilities Within Federal and Secondary County Highways	
HC 11	National Flood Insurance	
HC 12	Building Permits	
HC 13	Outdoor Lighting Permit	
HC 14	Electrical and Plumbing Permits	
HC 15	Sign Permit	
HC 16	Building Plan Approval	
Maui County		
MC 1	Department of Public Works Construction Permits	
MC 3	Land Use Commission Special Use Permit	DBEDT 2
MC 5	Shoreline Setback Variance	
MC 6	Special Management Area Use Permits	
City and County of Honolulu		
CCH 1	Conditional Use Permit-Type 1	

**TABLE 4.2.—Government Agency Permit Consultation List
(continued)**

<u>Permit Abbreviation</u>	<u>Permit Title or Type</u>	<u>Cross-Reference to Related Permits/Permits Delegated to Other Agencies</u>
CCH 2	Special Management Area Use Permit (SMP)	
CCH 3	Shoreline Setback Variance	
	Department of the Navy	
NAV 1	Notification Regarding Surface and Subsurface Plans	
	Department of the Army Corps of Engineers	
COE 1	Permits Under Sections 9 and 10 of the Rivers and Harbors Act of 1899 for Structures or Works in or Affecting Navigable Waters of the United States	NMFS 2
COE 2	Permits Under Section 103 of the Marine Protection Research and Sanctuaries Act of 1972 for Ocean Dumping of Dredged Material	USF&W 1, NMFS 7
COE 3, 4, and 5	COE 3: Permits Under Sections 404 of the Federal Water Pollution Control Act of 1972 and Amendments for Discharges or Dredged or Fill Material into Waters of the United States; COE 4: Water Quality Certification from the State of Hawaii Department of Health; COE 5: Coastal Zone Management Consistency Certification from the State of Hawaii	EPA 1, USF&W 2, NMFS 1
COE 6	National Environmental Policy Act (NEPA) Environmental Impact Statement	EPA 4

**TABLE 4.2.—Government Agency Permit Consultation List
(continued)**

<u>Permit Abbreviation</u>	<u>Permit Title or Type</u>	<u>Cross-Reference to Related Permits/Permits Delegated to Other Agencies</u>
National Oceanic & Atmospheric Administration		
NOAA 1	Notification to Charting and Geodetic Services	CG 1
Department of Transportation U.S. Coast Guard		
CG 1	Notification of Submerged Cable	NOAA 1
CG 2	Notification of Cable Laying Operations or Related Projects	
U.S. Fish and Wildlife		
USF&WS 1	Endangered Species Act Activities Review	COE 2, NMFS 6
USF&WS 2	Clean Water Act Review	EPA 1, DOH 5, COE 3, NMFS 1
USF&WS 3	Rivers and Harbors Act Review	COE 1, NMFS 2
USF&WS 4	Fish and Wildlife Coordination Act Review	NMFS 9
National Marine Fisheries Service		
NMFS 1	Clean Water Act Section 404 Permit Application Review	USF&W 2, COE 3
NMFS 2	Rivers and Harbors Act of 1899 Section 10 Permit Application Review	COE 1

**TABLE 4.2.—Government Agency Permit Consultation List
(continued)**

<u>Permit Abbreviation</u>	<u>Permit Title or Type</u>	<u>Cross-Reference to Related Permits/Permits Delegated to Other Agencies</u>
NMFS 3	Clean Water Act Section 401, Water Quality Certification Application Review	COE 4, USF&W 2, EPA 1
NMFS 4	Federal Coastal Zone Management Consistency Determination Review	OSP 1, COE 5
NMFS 5	Marine Mammal Protection Act (MMPA) Exemption	
NMFS 6	The Endangered Species Act (ESA) Section 7, Consultation Process	USF&W 1
NMFS 7	Marine Protection Research and Sanctuaries Act of 1972, Section 103 Permit Review	COE 2
NMFS 8	National Environmental Policy Act, EIS preparation and review	
NMFS 9	Fish and Wildlife Coordination Act	USF&WS 4
Environmental Protection Agency		
EPA 1	Permits and Licenses Under Section 402 of the Federal Water Pollution Control Act of 1972 and Amendments	DOH 1, DOH 2, USF&W 2, COE 3
EPA 2	Permits and Licenses Under the Clean Air Act	DOH 6, DOH 7
EPA 3	Underground Injection Control (UIC) Permit	DOH 6
EPA 4	National Environmental Policy Act (NEPA) Environmental Impact Statement	COE 6

TABLE 4.2.—Government Agency Permit Consultation List
(continued)

<u>Permit Abbreviation</u>	<u>Permit Title or Type</u>	<u>Cross-Reference to Related Permits/Permits Delegated to Other Agencies</u>
	Federal Highway Administration	
FHA 1	Approval for Work to be Performed on Interstate Highway	DOT 1

6. PREPARERS OF THE EIS

The Oak Ridge National Laboratory (ORNL) has been selected by DOE to assist in the preparation of the EIS on the proposed Hawaii Geothermal Project and to support all EIS procedural requirements. ORNL is assisted by the Lawrence Berkeley Laboratory in the area of alternatives and marine cable impacts and will be supported by other subcontractors having local expertise in specific areas, as appropriate. Supporting documentation and data will be provided by other federal, State and County agencies (especially those identified as cooperating agencies) and others. ORNL has the responsibility to ensure that the information meets quality assurance requirements for use in the EIS process. DOE is responsible for the scope and content of the EIS and supporting documents. NEPA disclosure statements are on file at DOE's Office of Conservation and Renewable Energy, Washington, D.C. Copies of these statements are included in Appendix B.

*FWJ, USGS, M&O
discuss work*

7. RELATED ENVIRONMENTAL DOCUMENTATION

Several federal and State environmental documents related to the HGP will be consulted during EIS preparation. In terms of federal NEPA documents, EIS preparers will consult the U.S. Energy Research and Development Administration's *Environmental Assessment of the Hawaii Geothermal Project Well Flow Test Program* (1976) and DOE's NEPA documentation for HGP-A, *Environmental Assessment, Hydrothermal Geothermal Subprogram, Hawaii Geothermal Research Station, Hawaii County, Hawaii* (1979).

EIS preparers will also consult a number of State environmental documents. Two early documents, prepared for the Hawaii Department of Planning and Economic

Development in 1978, are *Environmental Impact Statement for the Hawaii Geothermal Research Station Utilizing the HGP-A Well at Puna, Island of Hawaii* and *Revised Environmental Impact Statement for Hawaii Geothermal Research Station, Island of Hawaii*. DBED's more recent environmental documentation, *Environmental Assessment for the Hawaii Deep Water Cable Program* (1987) and *Environmental Review: 500 MWe Geothermal Development Within the Three Geothermal Resources Zones of the Kilauea East Rift Zone, Puna District, Island of Hawaii* (1989), will also be consulted during EIS preparation.

Several environmental documents related to private geothermal developments have been prepared to date, and some of them have served as State EISs. Those that will be consulted during HGP EIS preparation include two prepared for True/Mid-Pacific Geothermal Venture: *Revised Environmental Impact Statement for the Kahauale'a Geothermal Project, District of Puna, Island of Hawaii, State of Hawaii* (1982) and *Final Supplemental Environmental Impact Statement to the Revised Environmental Impact Statement for the Kahauale'a Geothermal Project* (1986). Another State environmental document prepared for a private geothermal development is Thermal Power Company's *1987 Environmental Impact Statement: Puna Geothermal Venture Project*.

*mn weekly
spaceport*

8. REFERENCES

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- DOH (Department of Health) 1992, Department of Health, State of Hawaii, *Amendment and Compilation of Chapter 11-59 Hawaii Administrative Rules*, Effective June 29, 1992.
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- Silver, D., Bonacorsa, L., Bazzi, G., and Valenza, D. 1985, *Hawaii Deep Water Cable Program, Phase II, Cable Design Parametric Study*, for Ralph M. Parsons, Hawaiian Electric Co., Inc. and U.S. Department of Energy.

APPENDIX A
PROPOSED OUTLINE FOR THE
ENVIRONMENTAL IMPACT
STATEMENT

**PROPOSED OUTLINE FOR THE HAWAII GEOTHERMAL
PROJECT (HGP) ENVIRONMENTAL IMPACT STATEMENT (EIS)**

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NEPA DISCLOSURE STATEMENT FOR
PREPARATION OF ENVIRONMENTAL IMPACT STATEMENT
FOR THE HAWAII GEOTHERMAL PROJECT

CEQ Regulations at 40 CFR 1506.5 (c), which have been adopted by the DOE (10 CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project" for purposes of this disclosure is defined in the March 23, 1981, guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations", 46 FR 18026-18038 at Question 17a and b.

"Financial or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)". 46 FR 18026-18038 at 18031.

In accordance with these requirements, Martin Marietta Energy Systems, Inc. hereby certifies as follows: check either (a) or (b), COMPANY NAME

(a) ☒ Martin Marietta Corp. has no financial or other interest in the outcome of the
COMPANY NAME Hawaii Geothermal Project.

(b) ☐ _____ has the following financial or other interest in the outcome
COMPANY NAME of the Hawaii Geothermal Project and hereby agrees to
divest itself of such interest prior to initiating any technical
analyses in support of this Project.

Financial or Other Interests

1.

2.

3.

Certified by:

Gary J. Draper
SIGNATURE

Gary J. Draper
NAME

Manager, Contracts
TITLE

May 27, 1992
DATE

NEPA DISCLOSURE STATEMENT FOR
PREPARATION OF ENVIRONMENTAL IMPACT STATEMENT
FOR THE HAWAII GEOTHERMAL PROJECT

CEQ Regulations at 40 CFR 1506.5 (c), which have been adopted by the DOE (10 CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project" for purposes of this disclosure is defined in the March 23, 1981, guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations", 46 FR 18026-18038 at Question 17a and b.

"Financial or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)". 46 FR 18026-18038 at 18031.

In accordance with these requirements, University of California, Lawrence Berkeley Lab. hereby certifies as follows: check either (a) or (b), COMPANY NAME

(a) ☒ University of California
Lawrence Berkeley Lab. has no financial or other interest in the outcome of the
COMPANY NAME Hawaii Geothermal Project.

(b) ☐ _____ has the following financial or other interest in the outcome
COMPANY NAME of the Hawaii Geothermal Project and hereby agrees to
divest itself of such interest prior to initiating any technical
analyses in support of this Project.

Financial or Other Interests

- 1.
- 2.
- 3.

Certified by:

SIGNATURE

Rick Inada

NAME

Acting Head, Office of Sponsored Research
TITLE

May 27, 1992

DATE

why w/o mention as preparer

NEPA DISCLOSURE STATEMENT FOR
PREPARATION OF ENVIRONMENTAL IMPACT STATEMENT
FOR THE HAWAII GEOTHERMAL PROJECT

CEQ Regulations at 40 CFR 1506.5 (c), which have been adopted by the DOE (10 CFR 1021), require contractors who will prepare an EIS to execute a disclosure specifying that they have no financial or other interest in the outcome of the project. The term "financial interest or other interest in the outcome of the project" for purposes of this disclosure is defined in the March 23, 1981, guidance "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations", 46 FR 18026-18038 at Question 17a and b.

"Financial or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)". 46 FR 18026-18038 at 18031.

In accordance with these requirements, Energy, Environment + Resource Center, Univ of Tennessee hereby certifies as follows: check either (a) or (b), COMPANY NAME

(a) ☒ Energy, Environment + Resource Center has no financial or other interest in the outcome of the COMPANY NAME Hawaii Geothermal Project.

(b) ☐ _____ has the following financial or other interest in the outcome of the Hawaii Geothermal Project and hereby agrees to divest itself of such interest prior to initiating any technical analyses in support of this Project.
COMPANY NAME

Financial or Other Interests

1.

2.

3.

Certified by:

Jack Barkenbus
SIGNATURE

JACK BARKENBUS

NAME

Acting Director

Energy, Environment + Resource Center

TITLE

May 28, 1992

DATE

APPENDIX C
ACRONYMS AND ABBREVIATIONS

ACRONYMS AND ABBREVIATIONS

AC	alternating current
ALARA	as low as reasonably achievable
ANOI	Advance Notice of Intent
BACT	best available control technology
CEQ	President's Council on Environmental Quality
COE	Department of the Army Corps of Engineers
CO ₂	carbon dioxide
CFR	<i>Code of Federal Regulations</i>
DBED	State of Hawaii Department of Business and Economic Development and Tourism
DC	direct current
DLNR	State of Hawaii Department of Land and Natural Resources
DOE	U.S. Department of Energy
DOH	Department of Health
DSM	demand-side management
EIS	Environmental Impact Statement
EMF	electromagnetic field
EPA	U.S. Environmental Protection Agency
ERDA	Energy Research and Development Administration
FEMA	Federal Emergency Management Agency
FR	Federal Register
FWS	U.S. Fish and Wildlife Service
GIS	Geographic Information System
GRSs	geothermal resource subzones
H ₂ S	hydrogen sulfide
HDWCP	Hawaii Deep Water Cable Program
HECO	Hawaiian Electric Company, Inc.
HELCO	Hawaii Electric Light Company (the electric company on the Island of Hawaii)
HGP	Hawaii Geothermal Project
IP	Implementation Plan
IRP	integrated resource planning
kV	kilovolt
LBL	Lawrence Berkeley Laboratory
MECO	Maui Electric Company, Ltd.
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NSF	National Science Foundation
OR	U.S. Department of Energy - Oak Ridge Operations Office
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OTEC	ocean thermal energy conversion

ACRONYMS AND ABBREVIATIONS (continued)

ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCS	U.S. Soil Conservation Service
SHPO	State Historic Preservation Office
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
USSCS	U.S. Soil Conservation Service