

**CERTIFIED MAIL
RETURN RECEIPT REQUESTED**

July 17, 1992

92-A481

Mr. Steven E. Morris
Vice President and General Manager
Puna Geothermal Venture
101 Aupuni Street, Suite 1014-B
Hilo, Hawaii 96720

Dear Mr. Morris:

Subject: Authority to Construct (ATC) No. A-833-795
Permit Modification and Compilation
Fourteen (14) Geothermal Exploratory/Developmental Wells
Located at TMK: 1-4-01:2, 1-4-01:3, 1-4-01:58 and 1-4-01:19,
Kilauea Lower East Rift Zone, Puna, Hawaii

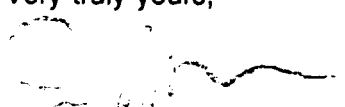
The Department of Health, in accordance with the requirements of Chapter 91, Hawaii Revised Statutes (HRS), amended and compiled Chapters 11-59 and 11-60, Hawaii Administrative Rules (HAR). These rules, among other things, amended the State's air quality rules, and became effective on June 29, 1992.

Special condition number 1 of Authority to Construct (ATC) No. A-833-795 specifically notes that the ATC may be revised to conform to the State's air quality rules. Pursuant to special condition number 1 (as well as Chapter 342B, HRS, and Chapters 11-59 and 11-60, HAR), the Department of Health has consolidated the prior permit changes and made additional minor revisions to ATC No. A-833-795 to conform to our most recent amendments to the State's air quality rules.

Enclosed with this letter are Attachments I and II. The conditions set forth in Attachments I and II supersede in their entirety the conditions issued with ATC No. A-833-795 dated February 6, 1990, and as modified on March 16, 1990, May 28, 1991, and January 13, 1992.

These modifications shall become final twenty (20) days after receipt, unless before the twenty (20) days expire, Puna Geothermal Venture submits a written statement to the Director of Health either waiving its right to a hearing or requesting a hearing pursuant to Chapter 91 and Chapter 342B, HRS. If a hearing is requested, it will be held at a date, time, and place to be specified later and conducted in accordance with Chapter 91, HRS, and the Rules of Practice and Procedure of the Department of Health.

Very truly yours,


JOHN C. LEWIN, M.D.
Director of Health

Enclosures
c: DHSA, Hawaii

**CERTIFIED MAIL
RETURN RECEIPT REQUESTED**

July 17, 1992

92-A480

Mr. Steven E. Morris
Vice President and General Manager
Puna Geothermal Venture
101 Aupuni Street, Suite 1014-B
Hilo, Hawaii 96720

Dear Mr. Morris:

Subject: Authority to Construct (ATC) No. A-834-796
Permit Modification and Compilation
25 MW Geothermal Power Plant
Located at TMK: 1-4-01:2 and 1-4-01:19, Kilauea Lower
East Rift Zone, Puna, Hawaii


The Department of Health, in accordance with the requirements of Chapter 91, Hawaii Revised Statutes (HRS), amended and compiled Chapters 11-59 and 11-60, Hawaii Administrative Rules (HAR). These rules, among other things, amended the State's air quality rules, and became effective on June 29, 1992.

Special condition number 1 of Authority to Construct (ATC) No. A-834-796 specifically notes that the ATC may be revised to conform to the State's air quality rules. Pursuant to special condition number 1 (as well as Chapter 342B, HRS, and Chapters 11-59 and 11-60, HAR), the Department of Health has consolidated the prior permit changes and made additional minor revisions to ATC No. A-834-796 to conform to our most recent amendments to the State's air quality rules.

Enclosed with this letter are Attachments I and II. The conditions set forth in Attachments I and II supersede in their entirety the conditions issued with ATC No. A-834-796 dated February 6, 1990, and as modified on March 16, 1990 and January 13, 1992.

These modifications shall become final twenty (20) days after receipt, unless before the twenty (20) days expire, Puna Geothermal Venture submits a written statement to the Director of Health either waiving its right to a hearing or requesting a hearing pursuant to Chapter 91 and Chapter 342B, HRS. If a hearing is requested, it will be held at a date, time, and place to be specified later and conducted in accordance with Chapter 91, HRS, and the Rules of Practice and Procedure of the Department of Health.

Very truly yours,


JOHN C. LEWIN, M.D.
Director of Health

Enclosures
c: DHSA, Hawaii

RECEIVED
92 JUL 22 A 6: 52
DIV. OF WATER &
LAND DEVELOPMENT

**ATTACHMENT I. STANDARD CONDITIONS OF AUTHORITY TO CONSTRUCT, NO. A-834-796
APPLICATION NO. A-834
POWER PLANT**

Modified and Compiled: July 17, 1992

This permit is granted in accordance with the State of Hawaii Administrative Rules, Title 11, Chapter 60, Air Pollution Control, and is subject to the following standard conditions:

1. This permit is non-transferable from person to person, from place to place, or from one piece of equipment to another.
2. This permit is automatically void if construction has not begun within one year of the date of issuance or if the work involved is suspended for one year or more.
3. This permit is automatically void when a Permit to Operate is issued or denied.
4. The facility covered by this permit shall be constructed as specified in the application for Authority to Construct. There shall be no deviation unless additional or revised plans are submitted to and approved by the Department.
5. This permit is not a guarantee that the facility will receive a Permit to Operate at the end of the construction period, nor does it absolve the holder from the responsibility for the consequences of non-compliance with all Rules, Regulations, and Orders of the Department.
6. This authority, (a) shall not in any manner affect the title of the premises upon which the equipment is to be located, (b) does not release the permittee from any liability for any loss due to personal injury or property damage caused by, resulting from or arising out of the design, installation, maintenance, or operation of the proposed equipment, (c) does not release the permittee from compliance with other applicable statutes of the State of Hawaii, or with applicable local laws, regulations, or ordinances, and (d) in no manner implies or suggests that the Department, or its officers, agents, or employees, assumes any liability, directly or indirectly, for any loss due to personal injury or property damage caused by, resulting from or arising out of the design, installation, maintenance, or operation of the proposed equipment.
7. The Department is to be notified promptly in writing upon completion of the construction or installation of any equipment for which an Authority to Construct has been issued.
8. The operation of this equipment is sanctioned by this Authority to Construct provided that the permittee has completed the following:
 - (a) Submittal of written notification of completion of construction or installation to the Department;
 - (b) Submittal of Permit to Operate Application, Form AS-P-3, to the Department; and
 - (c) Adherence to all applicable "special conditions" as included in the Authority to Construct.

**ATTACHMENT II. SPECIAL CONDITIONS OF AUTHORITY TO CONSTRUCT, NO. A-834-796
APPLICATION NO. A-834
POWER PLANT**

Modified and Compiled: July 17, 1992

In addition to the standard conditions of the Authority to Construct, this permit is subject to the following special conditions:

1. The permit conditions prescribed herein may at any time be revised by the Department of Health to conform to any Federal or State promulgated air quality rules on geothermal facilities.
2. The total fugitive isopentane emissions from all ten (10) Ormat Energy Converter (OEC) modules shall not exceed 0.4 lbs/hr or exceed 1000 ppm from any seal, flange, valve or any other fugitive emission point when measured from a distance of two (2) inches from the point. The permittee shall perform measurements on all fugitive isopentane emission points, as a minimum, on a weekly basis. The permittee shall take immediate corrective actions upon identifying any isopentane emissions in excess of 1000 ppm when measured from a distance of two (2) inches.
3. Records shall be maintained on all isopentane emission measurements, the amount of gallons of isopentane purchased, the amount of isopentane transferred to and from the OEC modules, and the amount of isopentane released to the atmosphere. The records shall be in a permanent form suitable for inspection, shall be made available upon request by the Department of Health, and shall be retained for at least three (3) years following the date of such records. A report on the amount of isopentane released to the atmosphere shall be submitted to the Department of Health on an annual basis.
4. The geothermal fluids injection system shall include at least two (2) geothermal injection wells, a spare fluid pump, and a spare noncondensable gas compressor. The backup injection system equipment shall be maintained in good operating condition at all times and shall be utilized immediately upon identification of any malfunctioning equipment.

In the event of an equipment malfunction or upset condition which results in a situation where the two geothermal injection wells are not capable of handling the total geothermal resource being utilized by the power plant, the power plant production and the associated geothermal resource being used shall be immediately reduced accordingly to the handling capacity of the two injection wells.

5. The diesel engine generator and the diesel firewater pump shall be fired only on diesel fuel oil no. 2 with a maximum sulfur content not to exceed 0.5% by weight.
6. The unabated cleanout of a pipeline utilizing the geothermal steam is prohibited. If the geothermal steam is used in the pipeline cleanout, the geothermal steam shall be directed through the hydrogen sulfide abatement equipment. The permittee shall utilize a cyclonic muffler or other equivalent device designed to minimize particulate and brine aerosol emissions, and direct venting into the vertical direction. In no case shall any abated pipeline cleanout coincide with any abated well cleanout, well drilling which opens new hole, or well flow testing operations, or commence if the emergency steam release facility is being utilized by the power plant. If emergency steam releases from the power plant occur during any

pipeline cleanout, the pipeline cleanout operations shall be terminated as quickly as practical. Prior to any pipeline cleanout, the Department of Health must be informed in writing, a minimum of two (2) days prior to commencement and so concur. The public shall be notified a minimum of 24-hours in advance by notices in the newspapers of general circulation in Hawaii County. In addition, the permittee shall make a reasonable effort to notify all residents living within 3,500 feet of the permittee's property boundary a minimum of 24-hours in advance of any pipeline cleanout. Each pipeline cleanout shall not exceed 20 minutes in duration and shall occur only in the daytime.

7. The permittee shall install, operate, and maintain a minimum of three (3) meteorological monitoring stations, three (3) air quality monitoring stations for hydrogen sulfide and one (1) PM₁₀ monitor. The monitoring stations required in any permit for the wellfield may be used towards fulfilling this requirement.

Prior to the commencement of plant operations, the permittee shall submit the siting of the air quality and meteorological monitoring stations for the Department of Health's approval. The permittee shall include with the siting locations a list of the monitoring equipment installed at each station and any anticipated modifications. As a minimum, two ambient air quality monitoring stations for hydrogen sulfide and one meteorological monitoring station shall be fully operational prior to commencement of plant operations. All three meteorological monitoring stations, three ambient air quality monitoring stations for hydrogen sulfide and the one PM₁₀ monitor shall be installed and fully operational on or before August 15, 1992. The permittee shall maintain a file of all measurements, including the monitoring system performance evaluations; calibration checks; and adjustments and maintenance performed on the system or devices. The measured data shall meet U.S. EPA capture requirements and quality assurance guidelines. As a minimum, a quality assurance check shall be conducted on each monitoring station every-other-day.

The air quality monitors shall be equipped with an alarm or acceptable equivalent system that is designed to page and notify the permittee or a governmental agency on a twenty-four hour basis of ambient hydrogen sulfide concentrations in excess of 10 ppb on a twenty-four hour average and 25 ppb on a one-hour average. The permittee shall immediately notify the Department of Health and the Hilo District Health Office of any exceedance above 10 ppb on a twenty-four hour rolling average and 25 ppb on a one-hour average.

Two (2) copies of the data file in a format acceptable to the Department of Health shall be submitted on an annual basis. The data file shall be in a format that can be utilized by a personal computer for ready extraction of data. The air quality and meteorological data shall be summarized and submitted monthly in writing to the Department of Health. Additional information on the monitoring stations and on the data collected shall be submitted upon request by the Department of Health.

8. At the discretion of the Director of Health the permittee may at any time be required to install, operate, and maintain additional air quality and meteorological monitoring stations, but only

after due notice to the permittee on the reasons for the proposed change and providing the permittee an opportunity to respond within seven (7) days.

9. All access roads into the permittee's property shall be limited to authorized personnel only. Twenty-four hour staffing shall be in place during plant operations.
10. The emergency steam release facility, consisting of two (2) rock mufflers, chemical storage tank(s) and associated equipment, shall be installed, maintained, and be fully operational prior to commencement of plant operations. Each rock muffler shall be capable of handling a steam flow rate of 570,000 lbs/hr or 100 percent of the total power plant steam flow, whichever is greater.
11. The emergency steam release facility shall only be utilized under one or more of the following conditions:
 - a) Failure of the electrical transmission lines out of the power plant or some incident that tripped all the steam turbines and OEC units;
 - b) Complete upset of the geothermal fluid injection system;
 - c) Pressure in the steam lines exceeds safety design set points; or
 - d) Any upset situation which would otherwise result in a release of unabated steam to the atmosphere.
12. The emergency steam release facility shall be equipped and maintained at all times with a minimum three-day operating storage capacity of sodium hydroxide. The chemical abatement system shall operate automatically when steam is released through the rock muffler(s). The hydrogen sulfide concentrations shall be continuously monitored both downstream and upstream of the chemical injection point. A sodium hydroxide treatment mole ratio of 4 to 1 (NaOH/H₂S) will be used initially and the abatement efficiency monitored. The optimum mole ratios will be determined during the hydrogen sulfide abatement operations.

Upon utilizing the emergency steam release facility, the permittee shall take immediate action to the extent practical to reduce the steam flow and perform the necessary corrective actions. The steam flow rate shall be reduced, as a minimum, to 50 percent of full flow within four (4) hours after initiating the use of the emergency steam release facility.
13. The permittee shall immediately notify the Department of Health of any operational upsets, equipment failure or malfunction which would allow an increase in the emissions of hydrogen sulfide, particulate matter or isopentane. The permittee shall apply best available control technology for the air emissions and take immediate steps to correct the condition. The permittee shall take appropriate action in accordance with Special Condition Nos. 15 and 17 if the hydrogen sulfide ambient concentration exceeds the specified limits in Special

Condition Nos. 15 and 17. In addition, a written report shall be submitted to the Department of Health within five (5) days of the occurrence. The report shall include a description of the malfunctioning equipment or abnormal operation, the date of the initial failure, the estimated resultant emissions, time and duration of the event, and the methods utilized to restore normal operations. Compliance with this notification provision shall not excuse or otherwise constitute a defense for any violation(s) of this permit, law, rule or order which results from the operational upset, equipment failure or malfunction.

14. The permittee shall maintain a 24-hour telephone service to accept calls concerning this Authority to Construct. This telephone number must be fully operational prior to commencement of construction.
15. The operation of the 25 MW geothermal power plant during periods of operational upsets, equipment failure or malfunctions shall not cause or contribute to an exceedance of the hydrogen sulfide ambient level of 10 ppb on a twenty-four-hour rolling average or 25 ppb on a one-hour average at or beyond the project boundary. Should any of the approved air quality monitoring stations indicate a hydrogen sulfide ambient concentration greater than 10 ppb on a twenty-four-hour rolling average or 25 ppb on a one-hour average, the permittee shall take immediate action terminating, within two (2) hours of the exceedance, all power plant activities not associated with normal power plant operations and contributing to hydrogen sulfide emissions. Following the reduction in project emissions, if the monitoring stations still indicate hydrogen sulfide ambient concentrations in excess of 10 ppb on a twenty-four-hour rolling average or 25 ppb on a one-hour average, the permittee shall curtail the power plant operations, unless the permittee can conclusively show to the Department of Health that the project operations and emissions are not contributing any impact to the monitoring site. If the hydrogen sulfide ambient concentration is below 10 ppb on a twenty-four-hour rolling average and 25 ppb on a one-hour average after the project emissions have been reduced, the permittee shall maintain the emissions at this reduced level until such time the Department of Health is assured that the resumption of full activity shall not result in another exceedance of the hydrogen sulfide ambient level of 10 ppb on a twenty-four-hour rolling average or 25 ppb on a one-hour average.

The permittee shall submit a written report to the Department of Health within five (5) days of the occurrence. The report shall include the date, time and duration of the exceedance, the estimated project emissions and any other emission sources that may have contributed to the exceedance, and all corrective measures and actions taken to reduce project emissions to a minimum. Compliance with this notification provision shall not excuse or otherwise constitute a defense for any violation(s) of this permit, law, rule or order.

16. (Previously Deleted)
17. During those periods of normal power plant and normal wellfield operations, the combined emissions of hydrogen sulfide from the 25 MW geothermal power plant (A-834) and associated wellfield (A-833) shall not cause an increase in the hydrogen sulfide ambient

concentration in excess of 5 ppb (above background) on a one-hour average at or beyond the project boundary as monitored at any of the approved air quality monitoring stations and so identified in the monthly monitoring report. As used in this context, a normal power plant operation is a power plant which is operating without any pipeline cleanouts, upsets, equipment failure, malfunction or which is otherwise operating normally. A normal wellfield operation is a wellfield in which no well drilling, flow testing, or abated well cleanouts are occurring and where the completed wells are not experiencing any equipment failure or malfunction and are either shut-in, being used as an injection well, or connected to a sound geothermal resource distribution system.

18. (Previously Deleted)
19. During normal power plant operations, the hydrogen sulfide emissions from the 25 MW geothermal power plant shall not exceed one pound per hour (one-hour average). During periods of malfunction or regularly scheduled maintenance, best available control technology shall be applied for the hydrogen sulfide emissions.
20. The Department of Health may at any time with reasonable cause, request the permittee to install, operate, and maintain emission monitors to continuously measure and record the hydrogen sulfide and isopentane emissions at any specified location in the power plant.
21. Prior to the commencement of any abated pipeline cleanout utilizing the geothermal steam, the permittee shall submit to, and receive the approval of, the Department of Health a sampling and testing protocol, identifying the analytical procedures and methodologies to be used and the constituents to be measured, which shall seek to physically and chemically characterize the particulate and aerosol emissions and corresponding ambient concentration from these operations. Each collected sample shall be submitted to a qualified laboratory for analyses within five (5) days after the sample is collected. The permittee shall submit a copy of the results of the analyses to the Department of Health within five (5) days after receiving the results from the qualified laboratory. The Department of Health may at any time require the permittee to analyze for additional constituents or perform more frequent testing.

JOHN WAIHEE
GOVERNOR OF HAWAII



WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

MANABU TAGOMORI
DAN T. KOCHI

AQUACULTURE DEVELOPMENT
PROGRAM
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ENVIRONMENTAL AFFAIRS
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
PROGRAM
LAND MANAGEMENT
STATE PARKS
WATER RESOURCE MANAGEMENT


STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

P. O. BOX 621
HONOLULU, HAWAII 96809

REF:WRM-KO

JAN 10 1992

Mr. Allan G. Kawada
True Geothermal Energy Company
Central Pacific Plaza
220 South King Street, Suite 868
Honolulu, Hawaii 96813

Dear Mr.  Kawada:

The Department of Land and Natural Resources, together with the Department of Health and the County of Hawaii, has been working towards the implementation of an interagency Geothermal Management Plan (GMP). The GMP is the result of three independent investigative reports which recommended specific government and developer actions. The overall goal of the GMP has been to minimize potential future adverse impacts and determine whether geothermal development by Puna Geothermal Venture (PGV) can proceed safely and without impacts to project personnel and the public health of the community.

All of the recommendations identified within the GMP have been implemented or are near completion. Those items related specifically to drilling procedures, equipment, supervision, etc., have been adequately addressed by PGV and approved by our Department.

Consistent with the recommendations of the investigative reports and the GMP, the Department has determined that a third-party review of True Geothermal's drilling and well completion program will be required. Although the Geothermal Well Drilling Permits for True/Mid-Pacific's Wells KA2-1 and KA3-1 have been approved, such approval is conditional and shall be subject to the required independent review. No commencement of any activity authorized under these permits shall be permitted until this review has been completed.

Mr. Allan G. Kawada

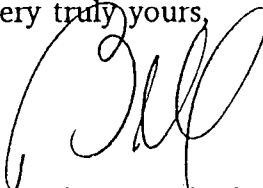
Page 2

Additionally, the Department shall require that your Emergency Plan be resubmitted to both the Department of Health and the Hawaii County Civil Defense Agency for review and approval. It is recommended that the Emergency Plan be revised, where appropriate, incorporating any new and pertinent information that is available prior to submission of the plan to the respective agencies.

Upon approval of the Emergency Plan and concurrence by the Department of the findings of the independent drilling/casing program review, True Geothermal Energy Company will be duly notified and allowed to proceed with the drilling of the permitted wells.

Thank you for your continued cooperation and should you have any questions concerning the above, please contact Manabu Tagomori, Deputy Director, at 587-0214.

Very truly yours,



WILLIAM W. PATY

cc: DBEDT
DOH
Hawaii County Civil Defense Agency
Hawaii County Planning Department

DIVISION OF WATER AND LAND DEVELOPMENT

FROM: [Signature] DATE: 4-18-0 FILE IN: _____

TO: INIT:

PLEASE:

REMARKS:

_____ M. TAGOMORI
_____ L. Nanbu
_____ G. Akita
_____ L. Chang
_____ E. Lau
_____ A. Monden
_____ H. Young
_____ T. Kam
_____ G. Miyashiro
_____ D. Lee

☐ See Me
☐ Call
☒ Review & Comment
☐ Take Action
☐ Investigate & Report
☐ Draft Reply
☐ Acknowledge Receipt
☐ Type Draft
☐ Type Final
☐ Xerox copies
☐ File

Let's discuss our response

FOR YOUR:

R. LOUI
S. Kokubun

____ Approval
____ Signature
____ Information

RECEIVED MATSUBARA, LEE & KOTAKE

BENJAMIN M. MATSUBARA
GARY B. K.T. LEE
MERVYN M. KOTAKE
STEPHANIE A. REZENTS
HOWARD M. NOBUNAGA
CURTIS T. TABATA

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COUNSEL
JASON M. YOSHIDA
TELEPHONE (808) 526-9566
FACSIMILE (808) 538-3840

DEPT. OF WATER &
LAND DEVELOPMENT

April 13, 1992

Mr. William W. Paty
Chairperson, Board of Land
and Natural Resources
1151 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Paty:

Reference is made to your letter of January 10, 1992 to Mr. Allan G. Kawada of True Geothermal Energy Company regarding the Company's drilling permits for Wells KA 2-1 and KA 3-1 and their Emergency Plan. While there have been continuing discussions prior to and subsequent to your January 10, 1992 letter, we believe it is necessary at this point to make our position a matter of record. As you are aware, the referenced drilling permits and Emergency Plan were previously approved by your Department. We are unaware of any action on True's part which should effect the authority granted under the drilling permits to proceed immediately with our scheduled drilling activities.

While we concur with the State and County's stated goal in your January 10, 1992 letter "to minimize potential future adverse impacts and determine whether geothermal development by Puna Geothermal Venture can proceed safely and without impacts to project personnel and the public health of the community" we are unaware of any action on our part or our submittals which would raise a question as to why our drilling and well completion program cannot proceed safely and without impacts to project personnel and the public health of the community. As you know, our drilling and well completion programs are completely different from what PGV had on file before your requested changes were instituted. We further believe that what we have on file with your Department conforms to the recommendations issued by the independent investigative report which is being incorporated in part by the Geothermal Management Plan. If there are specific shortcomings with what we have on file, please notify us and we will promptly discuss your concerns with you. We have always worked with your Department and will continue to do so, but please be aware that we will not

Mr. William W. Paty
Chairperson, Board of Land
and Natural Resources
April 13, 1992
Page Two

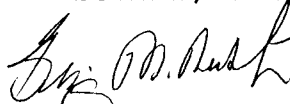
give up what we have waited so patiently for. We trust that specific concerns you have on our drilling and well completion program will be discussed shortly so as to allow us to proceed as expeditiously as possible.

We also consider our Emergency Plan as previously approved to be in effect, but will submit updated information to supplement the Plan to keep it current in conformance with the investigative committee's recommendations. We see no reason to halt our field operations while our approved Emergency Plan is being updated.

If our position on the drilling permits and Emergency Plan needs to be further discussed with you and your staff, please contact me.

Very truly yours,

MATSUBARA, LEE & KOTAKE

A handwritten signature in dark ink, appearing to read "Ben M. Matsubara", written over the typed name.

Benjamin M. Matsubara

BMM/gt

**DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT & TOURISM**

ENERGY DIVISION, 335 MERCHANT ST., RM. 110, HONOLULU, HAWAII 96813

PHONE: (808) 548-4080

FAX: (808) 531-5243

JOHN WAIH
Governor
MURRAY E. TOW
Deputy
SARAH KIM STANTO
Deputy Director
BICK EGGS
Deputy Director
TAKESHI YOSHIMIZU
Deputy Director

FACSIMILE TRANSMITTAL PAGE

PLEASE DELIVER THE FOLLOWING PAGES TO:

NAME: Hiram Young
COMPANY: DLWR - DONALD
FROM: Dean Nakano
DATE: 4/24/92 TIME: 11:30

MESSAGE:

Hi - Sharon / Faith / Lisa / Lorraine /
Kay / Elsie / Jane
How are you all doing?
Pls pass this to Hiram.
See you soon!
Dean

Total number of pages (including Transmittal Page): 2

IF YOU DO NOT RECEIVE ALL OF THE PAGES LEGIBLY,
PLEASE CALL: PHONE (808) 586-2353

Sending Facsimile Number: (808) 586-2536
Receiving Facsimile Number: (808) 587-0219


**STATE'S POSITION ON TRUE/MID-PACIFIC'S
REQUEST TO RESUME DRILLING ACTIVITIES
(WELL PAD #2)**

The State of Hawaii will not authorize True/Mid-Pacific to resume drilling activities unless all of the following items are satisfied:

1. Receive approvals from the County of Hawaii for all necessary County plans and/or permits, including grubbing and grading permits. Also, reaffirmation of the previously approved Emergency Response Plan.
2. Agree to adhere to State approved guidelines and recommendations made by a technical team to be engaged by the State of Hawaii regarding drilling equipment, techniques, and procedures. This is to minimize any potential adverse safety and health impacts related to drilling activities. The technical team will review and make appropriate recommendations concerning previously approved plans and permits such as the Plan of Operation, the Conservation District Use Permit's decision and order, and the Authority to Construct Permit, relative to drilling operations and procedures. The technical team will also scrutinize the yet to be submitted Geothermal Well Drilling Permit application prior to DLNR making its decision on the drilling permit request.
3. Agree to cooperate with regulatory agencies recognizing that True/Mid-Pacific will be subjected to monitoring that is to be at least as intensive and extensive as that required for PGV.
4. Agree that drilling activities, including grubbing and grading, shall not commence before November 1, 1991, or until PGV is granted permission to resume drilling activities, whichever occurs first. Such a timetable will allow regulatory agencies to put in place necessary enforcement and monitoring mechanisms, and also allow the PGV and True/Mid-Pacific projects to be subjected to similar degrees of control.

The above four items have been agreed to by the Department of Health, Department of Land and Natural Resources, and the Department of Business, Economic Development, and Tourism, serving in a coordinative role.

TO: T/MPG

Hric 

Ref. (a) directed T/MPG to submit and obtain approval ~~at~~ from Hawaii County Civil Defense Agency + DLRN a plan of action to deal with emergency situations such as _____ etc. etc. including procedures to facilitate coordination ~~of~~ with appropriate State + County officials and the evacuation of affected individuals.

Ref. (b) directed ~~that~~ T/MPG to resubmit their previously approved plan incorporating any revisions that may be appropriate to both the Department of Health and the County of Hawaii Civil Defense Agency for review and approval. (Because of Health related aspects of the operations for which the emergency action plan was required, it is deemed essential that DOH also review the plan.)

~~Dear~~
Due to the different responsibilities of the two agencies under current laws and the fact that DLNR retains responsibility for the execution of the provisions of the CDEA which include the emergency plan, it has been determined that it is more appropriate for that DLNR coordinate the review of the resubmitted plan among two or more government agencies. Accordingly, you are requested to resubmit the subject plan with such revisions as may be appropriate to DLNR () which

IN turn will coordinate with
all other appropriate agencies ~~and~~
~~also~~ and provide final approval
of the plan.

In the interim, your currently
approved plan will remain in
effect until superseded by
the resubmitted plan.

<u>NAME</u>	<u>ORGANIZATION</u>	<u>PHONE #</u>
Hiram Young	DLNR	581-0259
Don Thomas	HIG	956-6982
Fred Duenebier	Geology & Geophysics, UH	956-4779
Manabu Tagomori	DLNR	581-0230
Frank Peterson	UH	956-7897
GERRY NIIMI	THERMASOURCE	707-523-2960
Allen G. Kawada	True Geothermal Energy Co	528-3496
Harry J. Olson	HNEI	522-5620
GERALD O. LESPERANCE	DBED	586-2353
Tom Hulsebosh	Univ Hawaii - G & G	956-6193

TRUE GEOTHERMAL ENERGY COMPANY

CENTRAL PACIFIC PLAZA

Telephone No.: 808-528-3496
FAX No.: 808-526-1772
220 South King Street
Suite 868
Honolulu, HI 96813

April 2, 1992

Mr. Manabu Tagomori
Chief Engineer
Department of Land and Natural Resources
Kalanimoku Building, Room 227
Honolulu, Hawaii 96813

**SUBJECT: REPORT TO THE STATE OF HAWAII
TECHNICAL ADVISORY COMMITTEE
ON GEOTHERMAL.**

Dear Mr. Tagomori and Members of the Committee:

On behalf of True Geothermal Energy Company, we thank you for the opportunity to make a presentation on the progress and status of our geothermal drilling operations in the Kilauea Middle East Rift Zone (KMERZ).

As you know, True Geothermal Energy Company has been involved in drilling activity in the KMERZ since the middle of 1989. Since 1982 and throughout our active drilling operations, ThermaSource, Inc., of Santa Rosa, California has acted as our drilling and geothermal consultant and operations advisor on a continual and daily basis. Both Mr. Gerald Niimi and Mr. Louis Capuano, of ThermaSource, Inc., have rendered valuable and experienced assistance to our project activities.

ThermaSource, Inc. was selected and has remained as the consultant to True Geothermal Energy Company based upon the extensive and reputable geothermal experience of Mr. Niimi and Mr. Capuano throughout the world. In that light, the managers of True Geothermal Energy Company have chosen to use Mr. Niimi to make a presentation to your committee in order to allow our findings to be of use to the State Department of Land and Natural Resources.

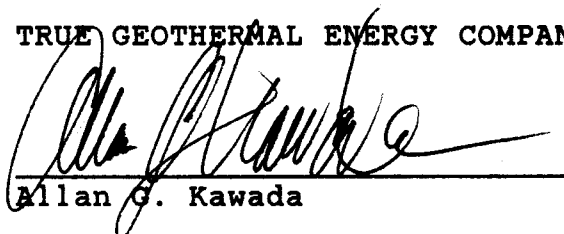
However, we do elect to make the presentation upon the understanding and agreement by the chairman and members of the committee that the information and materials revealed in the presentation are confidential and proprietary to True Geothermal Energy Company. The revelation of any information to unauthorized third parties is prohibited.

Mr. Manabu Tagomori
April 2, 1992
Page 2

Thank you for your cooperation and understanding.

Very truly yours,

TRUE GEOTHERMAL ENERGY COMPANY

A handwritten signature in dark ink, appearing to read 'Allan G. Kawada', is written over a horizontal line. The signature is fluid and cursive.

Allan G. Kawada

AGK/reg

TRUE GEOTHERMAL ENERGY COMPANY

CENTRAL PACIFIC PLAZA

Telephone No.: 808-528-3496
FAX No.: 808-526-1772
220 South King Street
Suite 868
Honolulu, HI 96813

April 2, 1992

Mr. Manabu Tagomori
Chief Engineer
Department of Land and Natural Resources
Kalanimoku Building, Room 227
Honolulu, Hawaii 96813

**SUBJECT: REPORT TO THE STATE OF HAWAII
TECHNICAL ADVISORY COMMITTEE
ON GEOTHERMAL.**

Dear Mr. Tagomori and Members of the Committee:

On behalf of True Geothermal Energy Company, we thank you for the opportunity to make a presentation on the progress and status of our geothermal drilling operations in the Kilauea Middle East Rift Zone (KMERZ).

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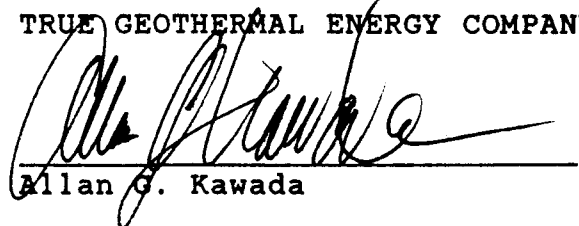
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Mr. Manabu Tagomori
April 2, 1992
Page 2

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Very truly yours,

TRUE GEOTHERMAL ENERGY COMPANY

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Allan G. Kawada

AGK/reg

JOHN WAIHEE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

P.O. BOX 621
HONOLULU, HAWAII 96809

MAY 7 1992

REF-WC-CD

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

JOHN P. KEPPELER, II
DONA L. HANAIIKE

AQUACULTURE DEVELOPMENT
PROGRAM
AQUATIC RESOURCES
CONSERVATION AND
ENVIRONMENTAL AFFAIRS
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
PROGRAM
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

Mr. Benjamin M. Matsubara
Matsubara, Lee & Kotake
888 Mililani Street, Eighth Floor
Honolulu, Hawaii 96813

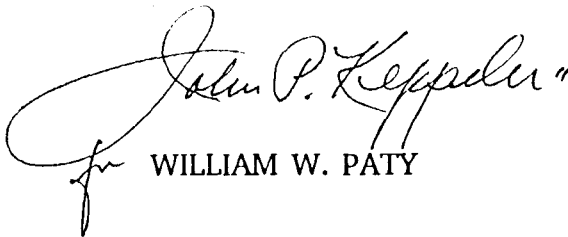
Subject: True Geothermal Wells KA2-1 and KA3-1

In response to your letter of April 13, 1992 an updated Emergency Response Plan reflecting the current operation conditions should be submitted to the Department.

Procedurally, we will be submitting the Emergency Response Plan to both Hawaii County Department of Civil Defense and the Department of Health for their review and approval within a four week time period with a stipulation that if we do not get a response within this time frame we will consider the document approved.

In the interim, The current Emergency Response Plan will remain in effect until superceded by the resubmitted plans. Should you have any questions regarding the above, please contact Mr. Manabu Tagomori at 587-0227.

Very truly yours,


WILLIAM W. PATY

MATSUBARA, LEE & KOTAKE

ATTORNEYS AT LAW

A LAW CORPORATION

CHARLES R. KENDALL BUILDING

888 MILILANI STREET, EIGHTH FLOOR

HONOLULU, HAWAII 96813-2918

COUNSEL

JASON M. YOSHIDA

TELEPHONE (808) 526-9566

FACSIMILE (808) 536-3840

BENJAMIN M. MATSUBARA

GARY B. K. T. LEE

MERVYN M. KOTAKE

STEPHANIE A. REZENTS

HOWARD M. NOBUNAGA

CURTIS T. TABATA

April 13, 1992

Mr. William W. Paty
Chairperson, Board of Land
and Natural Resources
1151 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Paty:

Reference is made to your letter of January 10, 1992 to Mr. Allan G. Kawada of True Geothermal Energy Company regarding the Company's drilling permits for Wells KA 2-1 and KA 3-1 and their Emergency Plan. While there have been continuing discussions prior to and subsequent to your January 10, 1992 letter, we believe it is necessary at this point to make our position a matter of record. As you are aware, the referenced drilling permits and Emergency Plan were previously approved by your Department. We are unaware of any action on True's part which should effect the authority granted under the drilling permits to proceed immediately with our scheduled drilling activities.

While we concur with the State and County's stated goal in your January 10, 1992 letter "to minimize potential future adverse impacts and determine whether geothermal development by Puna Geothermal Venture can proceed safely and without impacts to project personnel and the public health of the community" we are unaware of any action on our part or our submittals which would raise a question as to why our drilling and well completion program cannot proceed safely and without impacts to project personnel and the public health of the community. As you know, our drilling and well completion programs are completely different from what PGV had on file before your requested changes were instituted. We further believe that what we have on file with your Department conforms to the recommendations issued by the independent investigative report which is being incorporated in part by the Geothermal Management Plan. If there are specific shortcomings with what we have on file, please notify us and we will promptly discuss your concerns with you. We have always worked with your Department and will continue to do so, but please be aware that we will not

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JASON M. YOSHIDA
COUNSEL
MAY 13 1992

Mr. William W. Paty
Chairperson, Board of Land
and Natural Resources
April 13, 1992
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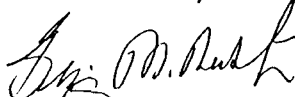
give up what we have waited so patiently for. We trust that specific concerns you have on our drilling and well completion program will be discussed shortly so as to allow us to proceed as expeditiously as possible.

We also consider our Emergency Plan as previously approved to be in effect, but will submit updated information to supplement the Plan to keep it current in conformance with the investigative committee's recommendations. We see no reason to halt our field operations while our approved Emergency Plan is being updated.

If our position on the drilling permits and Emergency Plan needs to be further discussed with you and your staff, please contact me.

Very truly yours,

MATSUBARA, LEE, & KOTAKE



Benjamin M. Matsubara

BMM/gt

cc: Mr. Manabu Tagamori



DEPUTIES

MANABU TAGOMORI
DAN T. KOCIII

AQUACULTURE DEVELOPMENT
PROGRAM
AQUATIC RESOURCES
CONSERVATION AND
ENVIRONMENTAL AFFAIRS
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
PROGRAM
LAND MANAGEMENT
STATE PARKS
WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

P. O. BOX 621
HONOLULU, HAWAII 96809

REF:WRM-KO

JAN 10 1992

Mr. Allan G. Kawada
True Geothermal Energy Company
Central Pacific Plaza
220 South King Street, Suite 868
Honolulu, Hawaii 96813

Dear Mr. Kawada:

The Department of Land and Natural Resources, together with the Department of Health and the County of Hawaii, has been working towards the implementation of an interagency Geothermal Management Plan (GMP). The GMP is the result of three independent investigative reports which recommended specific government and developer actions. The overall goal of the GMP has been to minimize potential future adverse impacts and determine whether geothermal development by Puna Geothermal Venture (PGV) can proceed safely and without impacts to project personnel and the public health of the community.

All of the recommendations identified within the GMP have been implemented or are near completion. Those items related specifically to drilling procedures, equipment, supervision, etc., have been adequately addressed by PGV and approved by our Department.

Consistent with the recommendations of the investigative reports and the GMP, the Department has determined that a third-party review of True Geothermal's drilling and well completion program will be required. Although the Geothermal Well Drilling Permits for True/Mid-Pacific's Wells KA2-1 and KA3-1 have been approved, such approval is conditional and shall be subject to the required independent review. No commencement of any activity authorized under these permits shall be permitted until this review has been completed.

Mr. Allan G. Kawada

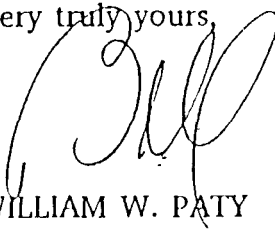
Page 2

Additionally, the Department shall require that your Emergency Plan be resubmitted to both the Department of Health and the Hawaii County Civil Defense Agency for review and approval. It is recommended that the Emergency Plan be revised, where appropriate, incorporating any new and pertinent information that is available prior to submission of the plan to the respective agencies.

Upon approval of the Emergency Plan and concurrence by the Department of the findings of the independent drilling/casing program review, True Geothermal Energy Company will be duly notified and allowed to proceed with the drilling of the permitted wells.

Thank you for your continued cooperation and should you have any questions concerning the above, please contact Manabu Tagomori, Deputy Director, at 587-0214.

Very truly yours,



WILLIAM W. PATY

cc: DBEDT
DOH
Hawaii County Civil Defense Agency
Hawaii County Planning Department

*Kennedy/Holmes
Rod Mills/Bill Dement
Ben Matsubara*

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DEPT. OF WATER &
LAND DEVELOPMENT

REF: HP-JLE

JAN 29 1991

Mr. Allan Kawada
True Geothermal Energy Company
220 South King Street, Suite 868
Honolulu, Hawaii 96813

Dear Mr. Kawada:

SUBJECT: Historic Preservation Compliance for True Geothermal
Energy Company Proposed Well Site Number 2 (KMERZ)
Former Puna Forest Reserve, Puna, Hawaii
TMK: 1-2-10: 3

Pursuant to the terms and conditions of the Decision and Order of the Board of Land and Natural Resources dated April 11, 1986, a full archaeological survey is to be conducted and approved prior to any clearing activities for each drill site and roads in the project area. This survey, which is called an archaeological inventory survey by our department, is to cover all areas to be cleared for construction and an area two to five times that to be developed. The procedures for the survey work are spelled out in the Research Design called for in the Decision and Order, with this design having been amended by joint agreement in the Fall of 1990 to accommodate the potential presence of lava tubes with significant historic remains at or in the vicinity of proposed well sites.

To comply with this survey requirement, True Geothermal Energy Company has conducted an archaeological inventory survey of proposed Well Site Number 2 and a buffer quadrat around it. This survey has been done in three fieldwork increments. Results of the first two increments were submitted to the Department in separate reports (Reports of Archaeological Consultants of Hawaii dated September 6, 1990 and October 26, 1990). After reviewing these two reports, it was concluded by our department that the survey methods for the two increments already completed had to be clarified in the report and that the survey fieldwork had not yet adequately covered the project area specified in the revised Research Design, necessitating a third increment of fieldwork.

Your consulting archaeologist, Mr. Joseph Kennedy, carried out this third increment of fieldwork, and as requested, he arranged for a staff archaeologist from our department to conduct a field inspection with his field crew on the last day of their work. The staff member inspected portions of proposed Well Site Number 2, accompanied the field crew on two survey sweeps north of the main access road and noted the intervals between the flagged survey sweeps leading off the access road. A lava tube segment found during this increment of fieldwork also was inspected. It lies along the eastern boundary of the Well Site and runs in a Southwest to Northeast direction. There was no evidence of past human use in the tube segment and, based on the condition of the lava tube, the probability that it was used appears low. The tube could not be followed for more than several hundred feet

Mr. Allan Kawada
Page 2

~~JAN 29 1991~~ JAN 29 1991

up-slope and down-slope where ceiling collapse and lava seals block passage. Based on these observations and discussions with the field crew, the State Historic Preservation Division is satisfied that the combined coverage of the three increments constitutes adequate fieldwork for an archaeological inventory survey and that no archaeological sites are present.

The department therefore feels that historic preservation fieldwork concerns have been adequately met for proposed Well Site Number 2. Full compliance with the historic preservation survey conditions will only be complete when an adequate inventory survey report of the third increment of the fieldwork has been submitted and accepted by the department (to include a map depicting areas covered by the survey transects). However, in this case, with no sites having been found, we believe that proceeding with the grubbing and grading will have "no effect" on historic sites, with the understanding that an adequate survey report must still be submitted and accepted at a later date.

Several agreed upon mitigation measures (Ltr. Paty to Kawada, Jan. 7, 1991) need to be followed during preparation of the drill site and drilling. These include (1) having your consulting archaeologist instruct your field staff and contractors on the identification and treatment of archaeological remains and (2) notifying your consulting archaeologist and our State Historic Preservation Division if any archaeological sites or lava tubes are found during construction, using a 7 1/2" drill bit for the first 100' of drilling and stopping all drilling activity if a void of 8' or more is encountered during the first 100' of drilling.

In sum, this letter serves as written approval that you have complied with the historic preservation survey fieldwork concerns. Since no historic sites were found, this letter further authorizes the commencement of clearing activities for Well Site Number 2. This authorization is contingent on your obtaining all necessary state and county permits (including the medicinal plants, grading and grubbing permits) prior to any clearing or excavation.

Should you have any questions, please call Manabu Tagomori, Deputy Director, at 548-7533.

Very truly yours,

/S/ WILLIAM W. PATY

 WILLIAM W. PATY
Chairperson and State
Historic Preservation Officer

Dean Nakano/HM:jle 1/24/91
02130/2252

~~JAN 29 1991~~ JAN 29 1991



DEPUTIES

KEITH W. AHUE
MANABU TAGOMORI
RUSSELL N. FUKUMOTO

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION

33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

REF: HP-JE

JAN 10 1991

Mr. Allan Kawada
True Geothermal Energy Company
200 South King Street, Suite 868
Honolulu, Hawaii 96813

Dear Mr. Kawada:

SUBJECT: Historic Preservation Review of True Geothermal
Energy Company Proposed Well Site #2 (KMERZ)
Former Puna Forest Reserve, Puna, Hawaii
TMK: 1-2-10: 3

On December 27, 1990, members of the State Historic Preservation Division and the Division of Water Resource Management met with you and your consulting archaeologist, Joseph Kennedy, to reach an agreement on what archaeological work and mitigation measures are needed before and during proposed drilling at Well Site #2. Discussions centered on two draft reports of the archaeological inventory survey conducted for Well Site #2, our written comments on this pending survey and your responses to some of our concerns. Also discussed were the guidelines for archaeological work set out in the Research Design mandated by the Decision and Order of the CDUA (April 11, 1986) and recommended revisions to these guidelines which were agreed to in our meeting of October 1990. These revisions have been prompted by the results of previous compliance work in the area and our study of the lava tubes in the former Puna Forest Reserve.

The following summarizes the major points agreed upon at the meeting:

1. Confusion Over Changes in Project Plans. The meeting clarified to our satisfaction confusion over use of the terms Well Site #2 and Pad A in the documents submitted for our review. We understand that these two sites are identical in location, size and configuration. Confusion arose when an alternative well site called Pad B was introduced to the project plans because of concerns over a nearby hawk nest. Pad B was subsequently eliminated from the project plans but only partially removed from portions of the documents submitted.

2. Steps Needed to Complete Archaeological Inventory Survey for Well Site #2. First, it was agreed that ambiguities in the description of survey coverage would be clarified in the final survey report. The description we received stated that "visual assessment of surface conditions was maintained for a width of no more than twenty feet to each side of the each corridor, whose width is estimated to be approximately ten feet, or the average distance between the two team members as they traveled the corridor." To us, this indicated that a total of 50 ft. was surveyed along each corridor. The current survey report must be revised to clarify this description of how the survey sweeps were conducted and demonstrate that total coverage along each corridor was greater than a total of 50 ft. and was, thus, equivalent to the map which Mr. Kennedy had at the meeting.

Second, from our discussions it was clear that portions of Well Site #2 had not been covered by the survey sweeps. It was agreed that this would be covered before submittal of the final report.

Third, we addressed the problem of complete survey of the entire survey quadrat (1,000 feet upslope of the pad, 1,000 feet downslope, and 500 feet to each side), as required by the revised research design agreed to in October. It was agreed that survey sweeps would be made in areas which were marked at the meeting on the schematic map of the survey area (Fig. 4, Ltr. Report, Kennedy to Kawada Oct. 26, 1990). This included corridors between those already covered on the southern side of the existing access road and coverage within an area located directly north of Well Site #2. This area was shaded on the map during the meeting and should extend no more than 500 ft. north of the road. As we have stated repeatedly in our written comments, we realize that the terrain is rough and hazardous and we do not ask that anyone place their life in danger.

3. Field Check by State Historic Preservation Division and Review of Final Report. We agreed that a field inspection will be undertaken by our staff while the survey team is completing the survey specified above. Our concurrence to proceed with grubbing and grading can then be given if no sites are found, with the understanding that an acceptable final archaeological report shall be submitted later. If sites are found, then acceptable mitigation measures will need to be developed.

4. Monitoring of Grading and Grubbing. The Research Design requires that an archaeologist inspect all areas subject to disturbance after initial grading and grubbing. The research design, as revised, agreed that this step is no longer necessary because it has not proven useful at the previous sites inspected.

Grading and grubbing could expose historic remains or an undetected lava tube. Thus, your proposal that your consulting archaeologist brief all True Geothermal Energy Company field staff and contractors involved in clearing, construction activities and drilling at Well Site #2 is an excellent suggestion. While the identification of lava tubes is of particular concern in this area, other archaeological site types and deposits should also be described. If historic remains or a lava tube are exposed, we will make every effort to assess the situation and proposed appropriate action as soon as possible.

5. Measures to Minimize Potential Damage to Remains in Undiscovered Lava Tubes during Drilling. To avert potential damage to historic remains in undiscovered lava tubes, we accept the measures which you suggested. For the first 100' of drilling, a smaller bit (7 1/2") will be used and drilling will stop if a void of 8 ft. or more is encountered. You stated that your choice of 8 feet instead of 6 was based on the advice of your drilling advisors who felt that voids less than 8 feet in height may not be detected reliably. A camera device would be lowered into the void as a means of assessing whether or not the void is a lava tube which could have historic remains or burials. To assure rapid appraisal of a void, we agree to have a staff member either at the drill site or on the island while the first 100 ft. is being drilled.

There are two additional points we want to clarify before closing. We left the meeting with the impression that there may be a misunderstanding about the State Historic Preservation Division's review process and how it applies within the context of this particular project.

First, there appeared to be a tendency to see our review comments as asking for a series of additional conditions and surveys. In regard to Well Site #2, our requirements for more work have been part of a single review process for a single inventory survey which has not yet been completed. This inventory survey can be

Mr. Allan Kawada
January 7, 1991
Page 4

considered complete only when it meets the requirements of the CDUA conditions, the revised Research Design mandated by the CDUA and the standards set forth in our historic preservation program's Draft Rules and Regulations which are used to evaluate all archaeological reports. Thus, instead of asking for additional archaeological work, we have had to ask several times that this inventory survey meet specified requirements.

Second, both the Research Design for geothermal exploration in the former Puna Forest Reserve and the historic preservation Draft Rules and Regulations have standard provisions to deal with what we call "inadvertent discoveries." These are instances in which new information or unexpected historic properties are discovered after a project has been through the historic preservation review process and they are deemed of sufficient value to require reopening the review process or modification to mitigation measures stated in the permit conditions. We consider the results of our study of lava tubes in the former Puna Forest Reserve to be an example of this because it demonstrates that the likelihood of burials and other historic remains is higher than previously realized. Thus, in our October meeting, we agreed upon revisions to the Research Design requirements for inventory surveys and mitigation measures during site clearance and drilling. The size and configuration of the buffer zone that we now require to be surveyed is less than the maximum potentially required by the CDUA (two to five times the area to be disturbed). We see our requirements for the inventory survey and the mitigation measures to be used during drilling as an honest attempt to accommodate our heightened concern for significant remains in the area, the existing conditions of the CDUA permit and the various constraints your project may be facing.

If you have any questions please contact Ross Cordy at 587-0012 or Holly McEldowney at 587-0008.

Very truly yours,

/S/ WILLIAM W. PATY

WILLIAM W. PATY
Chairperson and State
Historic Preservation Officer

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[Signature]

DIV OF WATER &
LAND DEVELOPMENT



Phones 935-0031
935-0032

HAWAII COUNTY CIVIL DEFENSE AGENCY

34-A Rainbow Drive
HILO, HAWAII 96720

0099P

March 23, 1989

Dean Nakano
Department of Land and Natural Resources
Division of Water and Land Development
Box 373
Honolulu, Hawaii 96809

RE: Geothermal Exploration Drilling Activities Within the
Kilauea Middle East Rift Zone, TMK 1-2-10:3

The Emergency Plan as submitted by True/Mid-Pacific Geothermal
Venture, required by the State Board of Land and Natural Resources,
has been reviewed and is approved as meeting all requirements.

Thank you for the submittal and attention to public safety.

Harry Kim

Harry Kim, Administrator
Hawaii County Civil Defense Agency

jg

cc: Duane Kanuha, Director
Hawaii County Planning Department

H. A. True, III, Partner
True Geothermal Energy Company

COMMISSION ON RESOURCE MANAGEMENT

FROM: _____ DATE: _____ FILE IN: _____

TO: _____ INIT: _____ PLEASE: _____ REMARKS: _____

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| _____ | _____ | E. Sakoda | _____ | Call |
| _____ | _____ | Y. Shiroma | _____ | Review & Comment |
| _____ | _____ | E. Hirano | _____ | Take Action |
| _____ | _____ | S. Samuels | _____ | Investigate & Report |
| _____ | _____ | G. Bauer | _____ | Draft Reply |
| _____ | _____ | R. Rozeboom | _____ | Acknowledge Receipt |
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FOR YOUR:

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| _____ | _____ | R. LOUI | _____ | Approval |
| _____ | _____ | S. Kokubun | _____ | Signature |
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RICHARD S. H. WONG
PRESIDENT

JAMES AKI
VICE-PRESIDENT

GERALD T. HAGINO
MAJORITY LEADER
CHAIR, LEADERSHIP COMMITTEE
ON LEGISLATIVE MANAGEMENT

MALAMA SOLOMON
MAJORITY FLOOR LEADER

BERTRAND KOBAYASHI
MAJORITY POLICY LEADER

ANDREW LEVIN
MAJORITY CAUCUS LEADER

RANDY IWASE
MAJORITY WHIP

ANN KOBAYASHI
CHAIR, LEADERSHIP COMMITTEE
ON EXECUTIVE APPOINTMENTS

MARY GEORGE
MINORITY LEADER

RICK REED
MINORITY FLOOR LEADER

FIRST DISTRICT
ANDREW LEVIN

SECOND DISTRICT
RICHARD M. MATSUURA

THIRD DISTRICT
MALAMA SOLOMON

FOURTH DISTRICT
MAMORU YAMASAKI

FIFTH DISTRICT
RICK REED

SIXTH DISTRICT
RANDY IWASE

SEVENTH DISTRICT
GERALD T. HAGINO

EIGHTH DISTRICT
MIKE MCCARTNEY

NINTH DISTRICT
STANLEY T. KOKI

TENTH DISTRICT
MARY GEORGE

ELEVENTH DISTRICT
DONNA R. IKEDA

TWELFTH DISTRICT
STEVE COBB

THIRTEENTH DISTRICT
BERTRAND KOBAYASHI

FOURTEENTH DISTRICT
ANN KOBAYASHI

FIFTEENTH DISTRICT
MARY-JANE MCMURDO

SIXTEENTH DISTRICT
RUSSELL BLAIR

SEVENTEENTH DISTRICT
ANTHONY K. U. CHANG

EIGHTEENTH DISTRICT
MILTON HOLT

NINETEENTH DISTRICT
DENNIS M. NAKASATO

TWENTIETH DISTRICT
RICHARD S. H. WONG

TWENTY-FIRST DISTRICT
NORMAN MIZUGUCHI

TWENTY-SECOND DISTRICT
ELOISE YAMASHITA TUNGALAN

TWENTY-THIRD DISTRICT
MIKE CROZIER

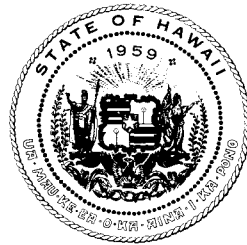
TWENTY-FOURTH DISTRICT
JAMES AKI

TWENTY-FIFTH DISTRICT
LEHUA FERNANDES SALLING

CHIEF CLERK
T. DAVID WOO, JR.

The Senate
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The Sixteenth Legislature
of the
State of Hawaii P 1: 24

STATE CAPITOL
HONOLULU, HAWAII 96813
DIV. OF WATER &
LAND DEVELOPMENT



March 27, 1992

Mr. William W. Paty, Jr.
Chairman
Dept. of Land & Natural Resources
1151 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Paty:

The incident on March 21st at Puna Geothermal Venture leads me to request your immediate attention to the possibility of amending the PGV drilling permit to prohibit drilling, or at least the activity called "spudding", during evening and nighttime hours.

According to the attached article which appeared in the Hawaii Tribune-Herald, PGV is allowed to have drilling activities which average 55 decibels on an hourly basis. I am told that the reference to "hourly" is incorrect, and that actually it is based on a 20-minute sampling. Nevertheless, the issue is that anything that exceeds the decibel limits specified, even for a short time, should be prohibited. To do otherwise is to allow for unacceptable noises to occur at any hour of the day or night, so long as the duration of the noise is brief. Presumably it would be possible for PGV to set off some dynamite at 2 o'clock in the morning and argue that the hourly average or the 20-minute sample is within acceptable levels, even though the entire community has been awakened and terrified by the incident.

I am told that the Department of Land & Natural Resources can rescind the permit at any time with suitable notice to PGV. I therefore would urge you, in the strongest possible terms, to immediately begin the process of re-doing that permit, so this kind of incident cannot recur. My reference above to dynamite may be an exaggeration, but what actually occurred at the KS-8 well on March 21st is not acceptable.

I am informed that it is technically difficult to monitor and regulate noise on a continuous basis.

Mr. William W. Paty, Jr.

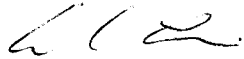
Page 2

March 27, 1992

I am also told that "spudding" is the activity which creates the most noise. Therefore, the solution would seem to be that all drilling, or at least spudding, be prohibited during hours that would be unacceptable in any residential community. I recognize that this would slow down drilling operations, but that is an inconvenience the developers should be forced to accept, considering the torment they are inflicting on their neighbors. (I am reminded that the developers previously claimed that open venting was absolutely necessary, yet now the information from our experts has enabled us to ban open venting in our latest permits.)

May I please hear from you.

Very truly yours,



ANDREW LEVIN
Senator, First District

AL:CSY
Enc.

PGV steam 'kick' awakens frightened Puna residents

□ Hydrogen sulfide gas not released in loud 2 a.m. incident

By Gordon Y.K. Pang
Tribune-Herald

A steam "kick" lasting between 15 seconds and a minute occurred at Puna Geothermal Venture's KS-8 well shortly after 2 a.m. yesterday.

The steam released was "clean" water and there was no emission of hydrogen sulfide, PGV vice president Maurice Richard said.

Civil Defense Administrator Harry Kim and Lanipuna Gardens resident Aurora Martinovich, who lives closest to KS-8, compared the 2:04 a.m. incident

to a well kick which occurred at nearby KS-7 in February 1991.

Martinovich said she and four others in her house were awakened by "this big blasting sound, the same sound we heard in February and June."

In June, a 33-hour long blow-out at KS-8 led to the evacuation of residents and shut the project down for nearly nine months. State and county officials allowed PGV to resume drilling only three weeks ago. PGV is expecting to begin production within the next two months.

Martinovich said the incident lasted about a minute and she saw a plume rising from the well.

Kim said that according to information from PGV monitors verified by Department of

Health officials, the highest recorded sounds from the incident were 92 decibels outside PGV. At Martinovich's house, south-east of the well, levels reached 80 decibels, he said.

PGV spokesman Maurice Richard said the average hourly level reached 38 decibels. During drilling, which PGV was not doing at the time, rules allow for a 55 decibel hourly average, he said.

Lanipuna Gardens resident Janice Wilson said she too was awakened by the noise, which she likened to the sound of a jet airplane taking off.

Martinovich said her family did not smell the rotten egg odor associated with hydrogen sulfide, among the main health concerns raised by residents about geothermal development.

Leilani Estates resident Robert Petricci said he was already awake because of loud equipment noises that had been coming from the well. Like Martinovich, he detected an unfamiliar smell in the air near the plant as he was driving to a friend's house in Lanipuna Gardens.

Petricci said he was examined by a medical team called to the scene by Kim "because I was quite upset." Petricci was told he had elevated blood pressure and should see his private physician.

Kim said he was told the steam release happened while a PGV crew was inserting drill pipes down the well at about 1,300 feet when "it hit a steam pocket and apparently steam rushed up the drill pipe and into

the atmosphere."

Richard said workers were pumping water into the hole at the time "to keep it cool" as part of the pre-drilling process.

An automatic valve in the drill string that should have immediately prevented the steam release into the atmosphere "took a little longer to set."

Richard said the incident lasted no more than 10 to 15 seconds.

"They were trying to monitor the condition of the well," he said of the events leading up to the kick. "They were taking log surveys ... part of the pre-drilling process," he said. "It was in compliance with what (the Department of Land and

See PGV,
Page 8

PGV: Geothermal steam 'kick' frightens residents

From Page 1

Natural Resources) wants us to do to ensure the well is reactivated in a sound manner. I don't expect this to be a routine occurrence."

"I'm sure they are looking at the reasons why this automatic setting plug didn't work," he said.

Kim said police logged five complaints about the incident from residents in Lanipuna, Leilani and Nanawale Estates.

Yesterday afternoon, Richard said PGV officials were trying to tabulate calls made to the company's hotline. A release

from Bill Cook of the Hawaii Island Geothermal Alliance said, however, that four calls were received by the plant.

Kim said he got the call from police within minutes of the incident and arrived on the scene in half an hour.

He noted that the calls received by police were from nearby residents and not PGV officials. Richard said he did not know if workers notified authorities.

Health Department officials responsible for air and noise monitoring were also at the scene, Kim said. The Health De-

partment will check to see if toxins may have been released in the air, he said.

Kim, the lone government official still critical of geothermal's direction, was not happy about the incident.

"PGV calls it a steam kick, residents called it an explosion. I call it an incident that caused stress, trauma and fear," he said.

Kim expressed frustration that those living outside of the area have not been more sympathetic to PGV residents.

"I don't know what it will take to make people outside the area realize that we've got peo-

ple who are scared," he said. "And it's not a figment of their imaginations."

Geothermal backers were unimpressed with the incident, however. "This was a non-event," said HIGA's Cook. "There was no H2S emitted. There were no permit violations. There was no emergency."

Cook said HIGA empathizes with PGV's neighbors, however. "We hope that over time, neighbors' faith can be restored in both the technical expertise of the plant operators and county and state regulation and monitoring."

HAWAII TRIBUNE-HERALD
SUNDAY, MAR. 22, 1992

DIVISION OF WATER AND LAND DEVELOPMENT

FROM: _____ DATE: 11/1 FILE IN: _____

TO: INIT: PLEASE: REMARKS:

_____	G. Akita	_____	See Me
_____	L. Chang	_____	Call
_____	E. Lau	_____	Review & Comment
_____	A. Monden	_____	Take Action
_____	H. Young	_____	Investigate & Report
_____	T. Kam	_____	Draft Reply
_____	G. Miyashiro	_____	Acknowledge Receipt
_____	D. Lee	_____	Type Draft
_____	_____	_____	Type Final
_____	_____	_____	Xerox _____ copies
_____	_____		
_____	_____		
_____	_____		

FOR YOUR:

_____ M. TAGOMORI
 _____ L. Nanbu

_____ Approval
 _____ Signature
 _____ Information

MEMORANDUM:

PLANNING DEPARTMENT

County of Hawaii,

Hilo, Hawaii 96720

To: Harry Kim
Civil Defense Administrator

Date: 3/24/92

From: Planning Director

Subject: Geothermal Resource Permit No. 2 - Puna Geothermal Venture
Piping Requirements and Wm. D. Foster letter (2/19/92)

I have received the enclosed letter from the Director of the State Department of Labor and Industrial Relations. I believe this adequately responds to the issue raised by Mr. Foster.

Should we be of further assistance, please contact us.

RKN:smo
4777D
Enclosure

cc/encl: Mayor
Managing Director
Chief Engineer
Chairperson, DLNR
BIRAG

RECEIVED

APR 1 11:23

PLANNING &
DEVELOPMENT

RECEIVED
PLANNING &
DEVELOPMENT

APR 27 10:54

RECEIVED

JOHN WAIHEE
GOVERNOR



KEITH W. AHUE
DIRECTOR

KANANI HOLT
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS

830 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

March 17, 1992

RECEIVED
MAR 1 1992
COUNTY OF HAWAII

Mr. Norman Hayashi
Planning Director
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Hayashi:

Re: Geothermal Power Piping Requirements
and William D. Foster Letter of
February 19, 1992 to Harry Kim

Please be advised that pressure containing components of geothermal energy systems fall under the jurisdiction of this office by virtue of Chapter 397, Hawaii Revised Statutes, and must comply with the Hawaii Boiler and Elevator Safety Standard Sect. 12-225-2 (see Attachment 1). This standard makes compliance with the American Society of Mechanical Engineers (ASME) B31.1 Power Piping Code mandatory.

Scott Company of California is the piping subcontractor responsible for installation of the piping in accordance with ASME B31.1. Scott Company holds ASME Certificate of Authorization No. 7177, expiring January 31, 1994, to install power piping in accordance with the ASME B31.1 Power Piping Code. One of the many requirements of the ASME certification is to maintain a contract with an independent third party inspection agency. The authorized inspection agency of record for Scott Company of California is the Hartford Steam Boiler Inspection and Insurance Company. Mr. T. Keith Schafer is the Hawaii resident Authorized Inspector for Hartford. Mr. Schafer holds National Board Commission No. 8302 and Hawaii Commission No. 130.

Scott Company of California is responsible for compliance with ASME's requirements for the fabrication and installation of the piping systems.

During installation of these systems, the fabrication and installation is inspected by an authorized inspector for compliance, so that the system may be certified as being in

Mr. Norman Hayashi
Planning Director
Page 2
March 17, 1992

compliance with ASME B31.1 upon completion. Any certified piping systems found not in compliance would invoke an investigation by the National Board of Boiler Inspectors and, subject to findings, a hearing before the ASME with possibility of revocation of the current ASME Certificate of Authorization to perform such work.

Attached is a letter (see Attachment 2) from Puna Geothermal Venture Construction (PGVC) delineating requirements they invoked to assure compliance with ASME B31.1. Please note that the system operating pressures and temperatures are below that which requires mandatory radiography. All radiography performed by PGVC and Scott Company are above and beyond the requirements of ASME B31.1. Except for several weeks in August when the project was slowed due to the well head blowout, frequency of their inspector visits to the site has been weekly.

Regarding the "William D. Foster" letter, Mr. Foster was contacted by this office by phone on March 6, 1992, and requested to be interviewed at this office on Monday, March 9, 1992 at 10:00 a.m. Mr. Foster agreed. Mr. Foster called at 7:20, March 9, and left a message that he would not attend. Attempts to contact Mr. Foster that day were fruitless. Mr. Foster was contacted by phone at 8:30 a.m., Tuesday, March 10, with regards to rescheduling the interview. Mr. Foster indicated that he was "too busy making a living" to assist an investigation by this office. He indicated that he would be willing to be interviewed at his place of business. He did fax copies of his radiograph technician certification while in the employ of Finlay Testing Labs. It was determined that further communications with Mr. Foster would provide no additional relevant information.

The specific welds questioned by Mr. Foster were in sections prefabricated in Israel by Ormat. During the telephone conversation, Mr. Foster was specifically asked if the poor quality welds he observed were in the main steam systems. He replied that it was not in the main steam system and "may even have been in an air conditioning system."

Mr. Foster's position as a technician for a sub-subcontractor did not allow him to be in the decision-making loop regarding which welds would be radiographed or which system they were in. Weld tracking was accomplished by Scott Company of California and not Finlay Testing Labs. This office was advised that Finlay Testing Labs is no longer retained to provide radiography due to inconsistent quality of radiographs provided.

Mr. Norman Hayashi
Planning Director
Page 3
March 17, 1992

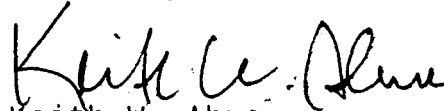
Contrary to the assertions of Mr. Foster, ASME B31.1 addresses the requirements for toxic gases in para. 122.8.2, Toxic Fluids (Gas or Liquid). However, after consultation with the Health Branch, Occupational Safety and Health Division, regarding hydrogen sulfide concentrations in the steam, it is our determination that the potential effects of escaping steam greatly exceed the effects of toxic fluid concentrations in the event of and in the immediate vicinity of a steam piping failure.

Conclusion

The concerns presented by William D. Foster in a letter to Harry Kim on February 17, 1992, were reviewed by this office. It is the determination of this office that:

1. The ASME B31.1 Power Piping Code is the construction code mandated by State Law Sect. 12-225-2.
2. The main steam piping system was installed by a company holding a valid ASME Certificate of Authorization to install power piping.
3. Inspections were made almost weekly since May 1991 by an ASME Authorized Inspector responsible to this office to assure compliance with ASME B31.1.
4. Piping not installed by Scott Company of California but within the jurisdictional scope of this office will be inspected for compliance with ASME B31.1 and any nonconformities will be corrected in accordance with the standards as set forth in ASME B31.1.

Sincerely,


Keith W. Ahue
Director

Attach. (2)

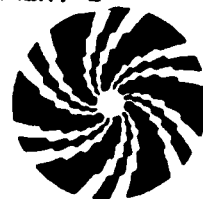
§12-225-2

§12-225-2 Geothermal energy systems. (a) Geothermal energy systems operating at a pressure of more than 15 PSI are subject to the provisions of this chapter. They shall be designed and erected in accordance with all applicable requirements for design, materials, fabrication, erection, test, and inspection of power piping systems included in the ANSI/ASME B31.1.

(b) Boiler external piping as defined in section 12-225-1 shall be provided with data reports, inspection, and stamping as required by Section I of the ASME Code. The quality control system requirements of Section I of the ASME Code shall apply. All other piping shall meet the requirements of ANSI/ASME B31.1 1989 and be provided with data reports by an authorized inspector.

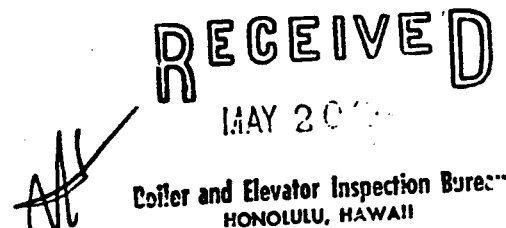
(c) Piping for which inspection and stamping is required as determined in accordance with subsection (b) shall be inspected during construction and after completion and, at the opinion of the authorized inspector, at such stages of the work as he may designate. Each assembler or erector is required to arrange for the services of authorized inspectors as defined in Section I PG-91 of the ASME Code.

- (1) Certification by stamping and data reports, where required, shall be as per Section I Part PG Rules 104, 105, and 109 through 112 of the ASME Code.
- (2) All data reports shall be filed with the department's chief boiler inspector.
- (3) All pressure vessels forming a part of a geothermal energy system shall be fabricated in accordance with the provisions of Section I or Section VIII Division 1 or Division 2, as applicable, of the ASME Code by a manufacturer who is in possession of the appropriate symbol stamp, a valid certificate of authorization, and National Board registered.
- (4) When pressure vessels having a manhole opening form part of a geothermal pressure system, the piping-up stream from the pressure vessel shall be fitted with two stop valves having an ample free-blow drain between them. In determining the existence of two stop valves, the well head stop valve shall not be counted.
- (5) When multiple geothermal wells supply the same pressure system, all pressure vessels having a manhole opening shall be fitted on both the up stream side and the down stream side with two stop valves having an ample free-blow drain between them.
- (6) Plans and material specifications for geothermal energy systems within the scope of this code shall be submitted to the department's chief boiler inspector, prior to commencement of work, for review. [Eff. 8/5/88; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

ORMAT®

May 15, 1991

Mr. Vernon A. Harding
Chief Boiler Inspector
Dept. of Labor & Industrial Relations
Division of Occupational Safety and Health
Boiler and Elevator Inspection Bureau
830 Punchbowl Street, Room 423
Honolulu, HI 96813



Subj: GEOTHERMAL PIPING REQUIREMENTS

Dear Vern,

Let met start by extending our thanks for your patience and consideration by discussing the issue and taking the time to visit our facility on May 14, 1991, therefore based on this visit and information we have previously sent to you, I would like to confirm the following understanding resultant of discussions by your Agency, Puna Geothermal Venture (PGV) and PGVs mechanical subcontractor, Scott Mechanical.

1. PGV had submitted their plans and specifications to the Department on April 30, 1991 and anticipates comments if any in a timely fashion.
2. The Geothermal fluid and Steam piping installed from the wellhead throttle valve to the power plant throttle valve of each steam turbine shall be designed, fabricated, constructed and installed in accordance with or exceeding ANSI/ASME B31.1 requirements; as part of this PGV agrees to insure that:
 - a. All welding will be visually inspected by a third party inspector specifically Hartford Steam Boilers authorized inspector.
 - b. A minimum of 2% of each welders work shall be radiographed and meet the acceptance criteria of ASME Section VIII Spot-X-Ray. The total minimum shall meet or exceed 6" of weld for every 50' of circumferential welding.
 - c. Hyrostatic testing of the Geothermal fluid and steam lines shall be recorded on a chart recorder which records on a permanent record, the pressure, temperature and time of each test. The Hydro test shall require a 24 hour "soak" or stabilization time then the system will be pressurized to 1.5 times the design pressure and held for a period of no less than two hours.

PUNA GEOTHERMAL VENTURE CONSTRUCTION

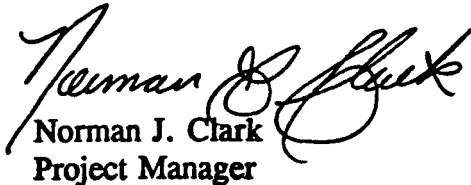
P.O. Box 1337 • Hilo, Hawaii 96721-1337 • Telephone (808) 961-2786 • Facsimile (808) 935-5562

Mr. V. Harding
(page 2)

- d. At the completion of the project PGV/Scott will submit a complete quality control package for the Geothermal fluid and Steam system which shall include the design calculations, stress analysis, material test reports, radiography results, hydro-test records, system inclusive pressure vessel data reports, and any other items pertinent to demonstration of system constructed in accordance with or exceedance of ANSI/ASME B31.1

I trust that what I have just outlined meets and conforms to what was discussed and agreed by both parties but if you have any comments or changes to this please do not hesitate to contact me.

Sincerely,


Norman J. Clark
Project Manager

NC/kk

cc: Z. Reiss, OESI
A. Nathan, PGV
C. Chin, PGV
P. Watt, Scott Co.
R. Benson, Scott Co.
File: 11.1.9

(20716F/kk)

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TELEX 709152 STEAM UD
FAX (510) 527-8164**TELEFAX**

To: Mr. Gerald O. Lesperance
Energy Division
DBED
Fax: (808) 586-2536

Date: December 11, 1991

Page: 1 of 1

From: Murray C. Gardner
Executive Vice President

In reply to your request, we think that the tasks additional to those discussed/costed by HIG that should be considered for State funding include:

1. Any useful new proposals from HIG; Don Thomas indicated in the November 5, 1991, memorandum; "Cost Estimates for Geothermal Program" that some geophysics proposals may be forthcoming.
2. Future SOH site selection by the program team. This was recommended in GeothermEx's October 11, 1991, memorandum to you. For this, personnel time for photo/map analysis, travel and field examination, and reporting should be included. Direct costs for ground/air travel should also be considered. I estimate the total cost for this to be about \$12,000. If the professional time is already in staff budgets, then it is just a matter of getting the work done; direct costs may be \$2,000.
3. Site specific environmental work for future SOHs once the locations are picked. Harry Olson apparently has some ideas about contractors for this. I estimate \$60,000.
4. Additional temperature and pressure runs and hole instrumentation in the original SOHs. I estimate \$15,000 for the initial installation work by contractors, \$8,000 for data interpretation and reporting, and \$60,000 for continued monitoring, periodic equipment inspection, maintenance, replacement of tubing and chambers as required, data interpretation and reporting.

We already added \$15,000 to the geophysical task for initial gravity work under the Cooper-Moore proposal. This may be increased depending upon results. It would be worthwhile to reserve an additional \$20,000 for expansion of gravity work in the KERZ or survey of another

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TELEFAX

To: Mr. Gerald O. Lesperance
Energy Division
DBED
Fax: (808) 586-2536
Date: December 9, 1991
Page: 1 of 15

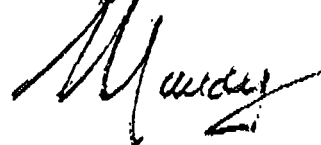
From: Murray C. Gardner
Executive Vice President

Subject: Transmission of review of HIG proposals

Herewith are our comments on the submission by HIG of proposals and budgets for scientific work to be funded by DBED. The detailed analyses of the proposed tasks have been prepared by me with assistance from senior specialists for each of the disciplines. Please review the comments in confidence as you indicated would be done. I look forward to discussing the issue with you. I anticipate being in Honolulu late Tuesday afternoon, December 17 and Wednesday morning, in the event you want to meet prior to the TAC meeting on Wednesday.

I feel competent to address the issues of the HIG proposal, but it would be preferable to have others (Sanyal, Greensfelder) take a more active roll, including on-island appearances in the future. Some discussions and explanations of interpretations are not easily put into memoranda and reports and would make memoranda to burdensome for readers. We can talk further about this issue at your convenience.

Best regards.



CONFIDENTIAL**MEMORANDUM****To:** Mr. Gerald O. Lesperance
Energy Division
DBED**Date:** December 10, 1991**From:** Murray C. Gardner**Page:** 2 of 15**1. Introduction**

At the request of DBED, under the terms of the contract to provide technical advisory services on geothermal resource assessment to DBED, GeothermEx has reviewed the Integrated Geothermal Resource Program submitted by The Hawaii Institute of Geophysics (HIG) on November 5, 1991. The HIG program includes proposals for reorganizing the management and administration of the program, identification of principal tasks in the program (Resource Identification, Reservoir Assessment, Resource Management and Environmental Documentation), descriptions of subtasks as discussed below, and estimates of budgets for the tasks and subtasks. All these items are reviewed here.

The proposed new organization of the program clearly represents an effort to shift management and budget from the drilling activities of the Scientific Observation Hole (SOH) program to the Geosciences disciplines. There are flaws with this proposed organization, as described below.

First, the proposed overall Program Manager would not actually have control of Geosciences, since the Geosciences Manager would have an independent budget. Second, the Drilling Manager would be faced with all responsibility for drilling, testing and completion, but may not be able to both drill economically and satisfy the demands of Geoscience objectives. The drilling operations under this scheme are likely to exceed the budget and fail to attain objectives, given the observed philosophies of the Geoscience Program team.

Few drilling efforts deliver all expectations. The likelihood of achieving target depth and obtaining truly critical data diminishes as the instructions from scientific programs are made more complicated. It already appears that the preliminary plan to contract a drilling rig of the size and type used for the existing SOH wells could be a fatal blow to the estimated cost of the future drilling program.

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Drilling design and direction is a matter for expert drilling engineers, not for GTAC or Geoscience program personnel. The drilling program should not be overburdened with projects that interfere with the principal objectives of determining downhole temperature, pressure, deliverability of wells and reservoir conditions. The selection of locations of SOHs may be usefully guided by knowledgeable members of GTAC, but extraneous input may be counterproductive. A future memorandum and report by GeothermEx will propose and explain drilling methods for new SOHs under Task 2 of our contract.

The integrated DBED program is understood to have the objectives of encouraging geothermal exploration and development, while protecting the fresh groundwater system and the environment, and assuring resource development with minimal impact on the continued productivity of wells drilled into the geothermal reservoir. DBED is less concerned with subsidizing the growth of staff functions and research at HIG and other agencies which conduct idealized scientific investigations. The rationale by HIG that some percentage of a total DBED budget should be expended to support scientific research is not defensible. Each scientific investigation should justify its own funding. If scientific programs cannot clearly be applied to identifying and confirming the extent of the geothermal reserves, or methods of conservation and economical development, they should be funded elsewhere.

The State has undertaken its geothermal program to ultimately obtain the acceptance by and funding from financial institutions for the continued development of geothermal resources in the State. We agree that resource identification, reservoir assessment, resource management and environmental documentation all contribute to the acceptance of geothermal resources by such institutions. However, some of the programs submitted by HIG are impractical and/or have been proven to have little value to operators and financial institutions at geothermal fields elsewhere. Some of the Geoscience proposals may be professionally endorsed and represent worthwhile investigations which should be supported, perhaps by the University of Hawaii or the National Science Foundation, but not by DBED. Programs which are not appropriate for support by DBED include those which: 1) conserve great amounts of core for possible use of future generations; 2) analyze 300 samples to store and compare data when 50 analyses would be sufficient for interpretation by a trained investigator; and 3) conduct surveys which have already been tried and shown to have no useful application to mapping geothermal reservoirs in Hawaii.

It is acknowledged that drilling as an alternative to laboratory investigations is comparatively expensive; for example, one

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month of rig standby may consume more than \$100,000. However, this should not be a reason to expend similar amounts of money for unnecessary scientific programs. The following sections of this memorandum objectively discuss the merits of the several subtask proposals of the Geosciences program.

2. Comments on the Geology Program

The principles of the geology program appear well-founded. The aspects of core "curation" presented by Dr. Thomas were discussed in detail in our recommendations in the memorandum of November 6, 1991 entitled Review of Core Data from State of Hawaii Scientific Observation Holes, SOH-1, SOH-2 and SOH-4. The core curator (Ms. R. Evans?) should be primarily responsible for this recommended work; "student help" should only be involved for fetch-and-carry assistance. This is work for professional staff. Ms. Evans should have access to senior geologic staff for confirmation of her interpretations and discussions of sample intervals selected for geochemical and XRD investigations.

The concept of total core splitting remains controversial. The cost-benefit to geothermal development of core splitting is questionable at best. Our opinion is that only the footage which is identified as meaningful to a study of reservoir conditions during the preparation of the core summary should be split and preserved for archive. It is simply not necessary to split every part of every flow of the repetitive sequence of eruptive rocks, especially the upper several thousand feet of each hole. As we have recommended before (October 11, 1991) in a memorandum entitled Recommendations for SOH and Geothermal Assessment Programs, one hole may be selected for splitting and archiving for future scientific investigation. The costs should then be assessed against those of alternative tasks if arguments are presented for any further splitting. In any case, the core curator should not be distracted from urgent technical tasks to split core at this time.

The budgeted cost for technical curation of \$57,824 is appropriate if it is for the scientific aspects of this work, not for core splitting and preparation. If the costs of the wages of graduate students (\$12,720, plus fringes) and materials and supplies (\$8,000) is partly for core splitting, it should be reduced to \$6,360 for wages plus fringes for general assistance and \$3,000 for supplies, inclusive of any core splitting and preserving. This would reduce the total budget from \$57,824 to about \$47,000.

Two specific geological proposals are presented: Whole Rock Chemical Analysis and Study of Secondary Mineralization. Both are

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important studies, although both are less applied to the development of geothermal resources than to academic interest. It is unlikely that the rocks from Mauna Loa volcano will have meaningful differences in reservoir characteristics than those from Kilauea. There may be small difference in initial structure, thickness of individual flows, silica content, gas inclusions and so forth that affect alteration and permeability.

It also remains to be proven that the work could lead to the ability to map the areal extent of fresh and saline water alteration episodes, and the impact of such alteration on reservoir permeability. The salinity of fluids circulating in the KERZ are best determined by sampling during flow tests of wells. Although salinity affects development practices, it has already been shown (in geothermal fields in the Imperial Valley and elsewhere) that highly saline geothermal fluids can be economically developed for power production.

The cost of the proposal for Chemical and Mineralogical Characterization of SOH Cores (Sinton and Hulsebosch) is determined by sub-sampling and preparation. The number of samples should be reduced to that number necessary to fulfill the goal of confirmation of description of cores. Every flow unit need not be examined. We have recommended an initial selection of 60 samples rather than 300. The proposer has stated that he wants this study to be precursor to later proposals to outside funding agencies. This should not be viewed as a valid reason for expending DBED budget to obtain detailed volcanic stratigraphy. We recommend that \$12,000 be initially budgeted for this task, including a complete report. The work should be closely coordinated with core curation.

The budget of the specific proposal for Mineralogic Assessment of Reservoir Fluid Conditions, SOH Geothermal Drill Holes (Sykes) is also determined by sample preparation and laboratory analyses. There may be some redundancy in preparation of sections for petrography with the Sinton proposal. With reduction to about 60 additional samples for XRD, microprobe and SEM analyses, plus the fluid inclusion work on 15 samples, and commensurate reduction of personnel time, the budget should be \$10,000, including a complete report to confirm the existing (binocular) descriptions, and discussion of relations of alteration to permeable zones, fluid rock ratios, fluid composition and paragenesis.

The total budget for the geological subtask as presented here is:

Curation	\$47,000
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Chemical/Mineralogical Characterization	12,000
Mineralogical Assessment of Reservoir Fluids	<u>10,000</u>
Total	\$69,000

This contrasts with the estimation in HIG's proposal of \$133,479.

3. Comments on the Geochemical Subtask

GeothermEx has generally supported the principles and program of the geochemical subtask in a previous memorandum (October 11, 1991). We recognize that the work may be redundant with U.S Geological Survey programs in the KERZ; however, the program appears necessary to contribute in a timely way to a State EIS, to evaluate and forecast contamination possibilities, and to guide any future exploration in Hawaii and other countries.

There are some details of the program presented which are of questionable technical value and therefore questionable cost-benefit value. The principal criticism of the geochemical subtask proposal is of the attempt to marry the publicly funded geochemical program to a geothermal reservoir modeling and engineering program that is the responsibility of private operators and their consultants under the regulation of DLNR. In other words, analytical data and interpretations resulting from geochemical surveys should be obtained by operators at their cost in the course of their reservoir management programs and sent to DLNR for State review and use for regulatory purposes. Furthermore, we think that the personnel classifications and costs in the proposal are not realistic for this work. It is clear that this work would extend for more than one year. The following specific comments relate to the geochemical subtask.

I. With respect to the relationship between the subtask and the four stated program objectives:

A. ASSESSMENT OF RESOURCE POTENTIAL OUTSIDE OF THE KERZ

To the extent that data are not already available for Maui and other counties, and Hawaii County outside the KERZ, this appears to be a reasonable program objective. It is also consistent with general geothermal exploration practice.

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B. CHARACTERIZATION OF THE IDENTIFIED RESOURCE IN THE KERZ

Continuous monitoring of "shallow" groundwater wells throughout the rift for temperature, water level and conductivity, combined with monthly sampling for chemical and isotopic analysis is likely to produce a tremendous volume of data. Based on our experience reviewing similar data collected at projects elsewhere, there is considerable likelihood that the volume of data will greatly exceed the reasonable needs of a modeling subtask or any questions about the groundwater system. It is possible, for example, that little or no variation in temperature, conductivity or chemical composition will be seen for months or even years at many or even all of the data collection sites.

As an alternative, we suggest that the "shallow" groundwater sources be sampled once every six weeks for one year, with temperature, water level and conductivity measured at the time of sample collection, and isotopes analyzed initially and after twelve weeks only if there are changes in chemical composition. If the chemistry at a given site shows significant variation during the year, more frequent data collection at that site can be considered. If there is no significant variation during the year, the data collection interval should be increased to 3 or 6 months during the second year. A shorter interval might continue at sites known to be close to geothermal injection locations and thought (from a conceptual hydrogeologic model) to be susceptible to injection effects.

The subtask description would be clearer if the approximate number and locations of "shallow" wells available for sample collection were included.

It is not clear why the State should fund or conduct the sampling and analysis of "deep" fluids and gases from new and existing private geothermal exploration holes and geothermal monitoring holes, unless as a paid service for the private operators. Private operators involved in exploration and field development are likely to be collecting geochemical data from well tests and downhole sampling. If they are not, they are missing opportunities for obtaining valuable information needed to meet their own program objectives.

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It is possible that some operators may be poorly funded or using geochemical programs and methods which are poorly designed. Perhaps the State should consider: 1) setting up guidelines for mandatory geochemical methods and data collection, based on standard industry practices; 2) requiring that all operators follow these methods; and 3) requiring that copies of essential laboratory results be filed immediately with the State.

Included in the data to be generated are radioactive isotopes C^{14} , T, and Rn. Although we agree that selected analyses of T may be warranted, the need for data on C^{14} and Rn is questionable. In our experience, these isotopes have been of little use in resource assessment, even though they may be of scientific interest.

C. RESERVOIR MANAGEMENT SUPPORT

As stated above, it is not clear why the State should fund or carry out routine analyses of production and reinjection fluids on a long term basis, unless as a service paid for by the private operators. All responsible operators collect these data.

However, individual operators may not be very concerned with the integration of their data with those from other parts of the KERZ, or with modeling the KERZ as a whole. Therefore, it appears appropriate that a private operator's chemical data, collected according to standard industry practices and formatted in standard fashion, should routinely be made available for modeling by an appropriate party as discussed below in our comments on reservoir engineering.

D. ENVIRONMENTAL DOCUMENTATION

This documentation should be considered an integral part and objective of the shallow groundwater data collection program discussed under program objective B, above. All chemical analyses, water levels, temperatures, flow rates and well locations should be carefully and systematically compiled into a computer database.

II. With respect to the budget:

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We are concerned about the proposed team of one lab analyst, one lab/field technician and a graduate student. This team structure is less than optimal in terms of seniority and continuity of personnel.

It is unlikely that the analyst will be able to perform an adequate and quality job of determining dissolved species, gases, stable isotopes and radioactive isotopes. It is stated that some analytical support costs for the use of equipment not available in Puna will be needed, but no detail is given. Realistically, the Puna analyst should be able to perform high-quality analyses of dissolved species. All of the remaining analyses should be performed by outside labs specializing in gases or isotopes. The projected costs of this outside work should be documented; the budget of \$8,000.00 for analytical services seems low.

If it has been established that the Puna lab analyst can produce high quality, reproducible data on dissolved species, then gas analyses may be considered for addition, but only with back-up from outside sources to confirm data quality. We are very cautious about this because we have seen too often that labs attempting to provide too many services experience problems with data quality.

Another major concern is continuity of lab personnel. The use of a graduate student to assist with data compilation and interpretation needs to be controlled carefully. The lab analyst should not be involved in compilation and interpretation because the analyst needs to concentrate his/her efforts on analytical methods and data quality. A few analysts are also capable of data reduction and interpretation, but not many and probably not someone funded at the proposed \$28,800/yr.

The graduate student will need to work closely with the analyst to monitor results, and both need to be monitored by someone with experience in geothermal geochemistry to assure that attention is focussed on appropriate tasks. Is this senior person Dr. Donald Thomas? If so, this should be discussed even if funded from other sources. In other words, a serious full-time activity is proposed under the geochemistry program. Timely and accurate results must be produced, and continuity from one graduate student to the next must be ensured. The budget may be adequate if sampling and analyses of deep geothermal fluids from operators' wells and equipment for continuous monitoring is excluded. If this is the case, a budget of about \$160,000 is not excessive.

4. Comments on Geophysical Subtasks

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The passive seismic and gravity surveys addressed in the introductory section are appropriate and potentially useful in furthering our understanding of the geologic structure and seismicity of the KERZ. However, the vertical seismic profiling (VSP) has doubtful utility, as discussed below, in the discussion of that proposal.

Concerning passive seismic studies, the letter (and the proposal by Drs. Cooper and Moore) does not describe priorities or phasing of the five tasks comprising this report. In our view, this omission represents a potential for inefficient use of resources. Most of the stated research objectives are reasonable, with one exception. We believe that the data which are proposed to be gathered to evaluate the possible movement of reinjection fluid and contamination of groundwater are unlikely to have the resolving power to answer such a question.

Gravity surveys should be confined to one or a few traverses of closely spaced stations, perpendicular to the trend of the KERZ, and located near and west of Puulena Crater, and should be tied to the previous regional survey. Although no budget request has been made, a minimum task as described above could be supported.

1. Comments on the Proposal to Conduct an Analysis of
Seismic Activity on the Kilauea East Rift Zone (KERZ)

A. GENERAL COMMENTS

The scope of work proposed is reasonable and potentially useful in defining the structure and seismicity of the KERZ in ways that may illuminate hydrothermal systems and potential geothermal drilling targets. As it stands, however, the proposal does not set forth priorities and relative levels of effort for the five elements or task included. While each of the tasks (excepting the use of VSP) is likely to be worthwhile, the proposers do not explain how the data, analyses, and resulting models are to be integrated.

It is important that the scientists and students undertaking this work have sufficient (that is to say, advanced) skills in geophysical forward and inverse modeling. Qualifications of the principal investigators have not been stated. The time allocated to the principal investigators (7 person months) may be insufficient for satisfactory completion of the HVO seismic data analysis. The duration of such a project would need to be at least one year, and two years is a more reasonable duration for the ambitious effort; adequate time to plan, conduct, modify, and repeat modeling procedures is vital. Rushed research is not a good investment. The proposed budget, appropriately

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reallocated according to the priorities described below, may be adequate and is certainly not excessive.

We feel that an incremental approach, in which successive phases of work build upon preceding ones, is required to achieve maximum benefit for the dollar resources expended. Too many elements are included in this proposal; VSP and microearthquake portable arrays should be omitted.

A large amount of high quality data has been collected by the HVO array of permanent seismographic stations over the past 22 years, and little work appears to have been done to analyze and interpret these data in relationship to hydrothermal activity and geothermal targets in the KERZ. Klein and Koyanagi (1989) have presented a comprehensive, brief summary of the seismicity of the Kilauea region, as observed by the HVO network. They point out that, since 1985, virtually all shocks with $M > 1$ have been detected and located. The maps and cross sections presented in this article suggest that swarms of shocks have occurred around Puulena Crater and some geothermal wells, especially HGP-A.

We believe that the first step in any research program on seismicity of the KERZ should be a truly thorough analysis of the HVO seismic data set, at least for the period since 1985. This work should precede collection of new seismic data with portable equipment, but might well be accompanied by conduct and interpretation of one or a few densely spaced gravity traverses transverse to the KERZ, in the general vicinity of Puulena Crater and perhaps to the west. The analysis and interpretation should include a variety of procedures for analysis of P- and S-wave travel times in order to interpret seismic velocity structure. Geophysical inverse modeling should include models which incorporate constraints based on other geophysical (e.g., gravity and aeromagnetic) and surface geologic data (e.g., dike occurrence). Source mechanism studies are addressed below, with spatial-temporal analyses of hypocentral locations.

Short-term microearthquake surveys with state-of-the-art equipment (PASSCAL portable seismographs) may be appropriate following thorough analysis and interpretation of available data. In this way, structural and earthquake source features developed out of the HVO data may be methodically selected and investigated.

Spatial-temporal windowing of hypocentral locations should be an important part of the program to analyze and interpret the HVO seismographic data. This would serve to isolate swarms and possible relationships among swarms, which may illuminate hydrothermal systems.

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In addition, these analyses should attempt to isolate and interpret source mechanisms (from first-motions) characteristic of various swarms and of structural features identified in the project, and of their interrelationships.

No consideration is given to the use of "calibration shots" to establish first-order receiver delays for observing epicentral areas of interest. This may be more useful than microearthquake surveys, and would certainly be more valuable than the VSP work described in the companion proposal. However, it is recognized that a variety of logistical and institutional problems may be encountered in conducting this kind of work.

B. COMMENTS ON THE FIVE LISTED RESEARCH TASKS

1. Analysis of P-Wave Travel Times to USGS Stations

Research procedures for this task are not defined. It might be assumed that forward (ray tracing) and inverse modeling (two- or three-dimensional?) of travel time residuals would be employed, and both ought to be, as well as hypocentral relocation procedures. Use of "master-event" methods is not mentioned but is likely to be beneficial. None of these techniques, nor their probable resolving power, are discussed, nor are specific objectives described.

2. Construction of Initial Velocity Model

Use of zero-offset VSP profile data is proposed. However, the accompanying proposal on that subject states that the maximum depth of exploration is to be 2,000 feet. How useful can such shallow data be? It is said that published velocity models for "deeper" (deeper than 2,000 feet?) structure will be used. The comments above, under task 1, indicate the types of analyses that are appropriate and which will serve to model seismic velocity structure to depths of at least 20 km. This work, together with task 1, may be expected to engage skilled seismologists for at least one year.

There is little advantage in investigating travel times if deep structure (to depths of at least 10 km) is not to be modeled. VSP profiling is not necessary, and would be of little help unless carried to depths of at least 10,000 feet in many wells, in the basic structural modeling that needs to be done. This is discussed in our comments on the VSP proposal.

3. Microearthquake Array Study

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This is potentially valuable as presented. However, it should not be part of the same proposal as task 1 and 2 above. Rather, it should follow satisfactory completion of that work.

4. Calculate P- and S-wave Slowness (etc.)

This properly belongs to tasks 1 and 2, and, as commented, needs to be discussed in detail. Vp/Vs ratio mapping is potentially useful, but should not be attempted before very thorough modeling or velocity structure, forward and inverse, is completed.

5. Earthquake Locations and Source Parameters

This task has not been defined, but important objectives and methods are noted above (under "General Comments").

6. Suggestions for Further Exploration

These should not be considered at this time, but may become important in the future, following completion of tasks 1, 2 and 5, if those tasks are thoroughly done as described in the comments above.

2. Comments on the Proposal for Acquiring a Zero-Offset Vertical Seismic Profile (VSP) in SOH

In the discussion of the first proposal, it was explained why this work would be of little use. The least attractive aspect of this proposal is its small maximum depth of exploration, just 2,000 feet. We fail to see how such shallow structural information can be an important part of the kind of work needed to illuminate the structure of the KERZ and its hydrothermal systems. VSP to depths of 10,000 feet in many wells might be useful, but that should not receive consideration until much other work has been completed, *i.e.*, for some years.

From these comments, it follows that the budget for geophysics is recommended to be about \$115,000.00, including gravity surveys, for the proposal to Conduct Analysis of Seismic Activity on the Kilauea East Rift Zone by Cooper and Moore, as redefined by our technical advice. This contrasts with the \$140,887.00 proposed for the work.

5. Comments on the Reservoir Engineering Subtask (including Hydrological Modeling)

We have maintained that numerical modeling of the geothermal reservoir is not an appropriate effort and expense for the State of

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Hawaii, and particularly for the DBED (see memoranda of October 11, 1991 and October 23, 1991, by Gardner and Sanyal respectively). Workovers, additional measurements and tests of SOH-1, -2, and -4 are, however, appropriate works to be continued under the SOH program supported by DBED. Specifically, temperature and pressure measurements and monitoring should be implemented as soon as possible in the SOHs and perhaps HGP-A. This work should be conducted as before, by experienced professional scientists and technicians. The work should not be used as a reason to augment or train inexperienced staff. This is work that must be accomplished routinely and continually if data are to be accurate and useful, and should be conducted in its entirety by contractors and consultants with proper equipment. The State would also be exposed to general liability if its personnel perform this work.

1. Comments on the Proposal for Reservoir Engineering

We agree with the proposal that high priority should be given to monitoring downhole pressures in wells HGP-A, SOH-1 and possibly Lanipuna 6, if it is available. (Lanipuna 6 is not likely to be made available as long as the operator is liable for damages.) Long-term monitoring of the reservoir response to future production/injection at the PGV plant will provide important data on reservoir properties. This monitoring should have priority over possible tidal monitoring in wells SOH-2 and SOH-4, particularly in view of the limited number of data loggers acquired for the SOH project.

Running of downhole temperature surveys should also be undertaken, as suggested by the proposal, but should not be conducted if significant pressure responses are occurring. Removal and reinstallation of capillary tubing to conduct temperature surveys generally causes a displacement of the pressure data, as it is very difficult to return the tubing to exactly the same depth in the observation wells.

However, it will be necessary during such a long-term pressure monitoring program to remove the tubing periodically for inspection and possibly replacement. The inspections and temperature surveys could be conducted at the same time. The cost of removing and reinstalling the tubing in the three wells on a periodic basis and possible replacement has not been considered in the budget. We would suggest that inspections should initially be done on a three monthly basis; the frequency can then be changed depending on the condition of the tubing.

2. Comments on the Proposal for Hydrologic Modeling

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We agree with the proposal that modeling is an important part of reservoir management for the KERZ. However, in order to accomplish the objectives described in the first paragraph of the proposal regarding the interaction of the shallow and deep systems, it will be necessary to construct a single model of both systems rather than the two separate models discussed. In addition to this overall model, it will also be necessary to construct a separate, more detailed model of the area that is presently being exploited to thoroughly evaluate geothermal reservoir productivity issues. Both of these models should be based on a detailed conceptual model, as mentioned in the proposal.

The proposed budget also suggests the modeling will be done as a research project by a graduate student and that the principal investigators will have only a minimal role in the work. This is not realistic. The State will be left with neither a useful product nor an expert staff. Consultants will not be able to simply continue the work from a graduate thesis product. Although the principal investigators have considerable reputation in theoretical (rather than practical) aspects of groundwater modeling, this experience will be unlikely to suffice for geothermal reservoir modeling. GeothermEx is currently working with an experienced groundwater analyst on a project involving dewatering of a shallow geothermal system; much of his work is not applicable to geothermal reservoir modeling by integrated finite difference methodology. We cannot recommend any funding for this proposal as it is presented. The task should be assigned to practical, experienced professionals. The difference in budget is the total amount of \$167,000.00.

6. Conclusions

On the basis of the proposals as written, GeothermEx advises that DBED accept certain scientific studies and budget funds as follows:

Geology	\$ 69,000
Geophysics	115,000
Geochemistry	158,026
Reservoir Engineering	0
Reservoir Modeling	0
Total	\$342,026

Additional budget may be committed elsewhere in the case of use-it-or-lose-it funding. This should be done based on the merit of alternative proposals, several of which have been suggested herein.

Response - Milwaukee (L)

- 1. P1, ^{D-102} Schindler, Amendment 5 to ERP Assoc
- 2. D-102 will fund ~~transfers~~ to a County L.O. ~~for~~ for volume and approval within 60 six weeks.
- 3. If we do not get a Response within time we will ~~cancel~~ cancel it by June
- 4. Meanwhile, ~~the~~ the your current ERP ~~is~~ is ~~being~~ is continued to be supplied or in form until answer.

POSTION DESCRIPTIONS

Geologist (Exempt)

Organizes, conducts, and reviews geologic studies and investigations, environmental assessments, and environmental impact statements relating to assesement and management of geothermal resources, and the administration of the Department's geothermal resource subzone regulations. Also conducts and/or supervises investigations relating to the administration of the Department's geothermal well drilling regulations including permit approval and compliance.

Reviews, interprets, and evaluates geothermal resource data and makes recommendations on various aspects of the geothermal resources program. Prepares and/or supervises the preparation of geologic reports, maps, charts, etc. of findings on geothermal resources. Prepares correspondence, memoranda, and administrative reports on geothermal resource matters.

Geothermal Technician (Exempt)

Under the supervision of the Geologist, this position is responsible for the monitoring of geothermal development activities permitted by the Department for compliance with statutory geothermal regulations including the leasing and drilling of geothermal resources and the administration of geothermal resource subzones.

Performs independent inspection of geothermal projects involving geothermal well drilling, pipeline, power plant and roadway construction. Also monitors mobilization and installation of drilling equipment and testing of geotheraml blow-out prevention equipment to ascertain whether construction methods and activity, practices, materials, and performance of duties conform with plans and specifications, contracts, and standard methods of work.

Clerk Typist II (Exempt)

Provides typing, clerical and receptionist services to the Mineral Resources Section. Receives and screens all vistiors. Using good judgement and knowledge of geothermal resources policies and procedures, answers routine questions or directs them to other personnel in the section who can help them, otherwise to the head of the section. Arranges appointments, conferences, and meeting with federal, state, county, and private parties or groups for the Mineral Resources Section.

Prepare in the approved format, correspondence, memoranda, technical and scientific reports, contract documents, memoranda of understanding, reports on field and inspection trips and other highly scientific and technical studies required by the Mineral Resources Section.

GEOHERMAL MANAGEMENT PLAN

Prepared by State of Hawaii
and
County of Hawaii
Geothermal Task Force
October 1991

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ATTACHMENT A

STATE - COUNTY GEOTHERMAL TASK FORCE

	STATE OF HAWAII	COUNTY OF HAWAII
Task Force	Murray E. Towill Director, DBED Co-Chairperson	Barry Mizuno Managing Director Co-Chairperson
	William W. Paty Director, DLNR	Norman Hayashi Planning Director
	John C. Lewin, M.D. Director, DOH	Harry Kim Civil Defense Administrator
Sub-Committee Members	Takeshi Yoshihara, DBED	Tadato Nagasako, Planning
	Bruce Anderson, DOH	Rodney Nakano, Planning
	Manabu Tagomori, DLNR	
	Maurice Kaya, DBED	
	Tom Arizumi, DOH	
	Jerry Haruno, DOH	
	Gerald Lesperance, DBED	
	Dean Nakano, DLNR	
	Janet Swift, DLNR	
	Michelle Wong-Wilson, DBED	
	Harold Matsuura, DOH	

INTRODUCTION

A 31-hour blowout at Puna Geothermal Venture's (PGV) KS-8 well near Pahoa occurred on June 12, 13 and 14. The blowout resulted in the evacuation of some nearby families and in numerous complaints of acute health symptoms from the released gases, the noise, and odor nuisance. The blowout also raised a question as to whether or not the geothermal resource in the Kilauea East Rift Zone can be developed safely and without impacting the health of the nearby residents.

On June 14, the Hawaii County Planning Director suspended all drilling activities at PGV's present site. On June 16, immediately after the well was temporarily secured, State of Hawaii and County of Hawaii officials met to outline a strategy which has since been followed.

INVESTIGATIONS

With joint State-County participation three concurrent investigations of the blowout were undertaken: A review of KS-8 well drilling equipment and procedures (Element I) conducted by four mainland government and private drilling, geologic and regulatory experts; a review of the emergency response procedures (Element II) conducted by the Department of Health and Hawaii County Civil Defense; and a review of air and noise mitigation, monitoring and enforcement (Element III) conducted by two mainland government and private engineering and regulatory experts. The final reports from the three groups were made available to the State and County on July 24, 1991. A community meeting was held the following day at which time the reports were presented to the public by the investigative teams. Based on the experts' recommendations, the County of Hawaii extended the suspension order to include all further activities at the PGV site exclusive of efforts to fully control KS-8.

On July 30, 1991 the Mayor proclaimed a State of Emergency at PGV's well site because there were subsurface symptoms, confirmed by the State and County investigators, that the KS-8 well was not fully under control. This proclamation allowed the cognizant agencies to expeditiously approve the drilling of a nearby water well by the developer for the purpose of quenching and finally killing the KS-8 well.

A conclusion of the investigations was that the blowout did not occur as a result of "unusual or unmanageable subsurface geologic or hydrologic conditions." All three of the investigative reports recommended specific developer and government actions to minimize the potential for future adverse impacts on health and safety of personnel involved in the project and residents of nearby communities.

GEOHERMAL TASK FORCE

At the direction of the Governor and Mayor, a Geothermal Task Force consisting of the Directors of DBED, DOH and DLNR; and the County's Managing Director, Planning Director and Civil Defense Administrator, assisted by their staffs, was established to develop a Geothermal Management Plan for implementing the recommendations of the investigative reports. Attachment A contains a complete listing of the Task Force and subcommittee members. The joint State-County Task Force has met at least weekly since mid-August.

The Task Force developed the following Overall Goal and Objectives, which have been diligently pursued in formulating the Management Plan described herein:

OVERALL GOAL

To determine whether geothermal development by Puna Geothermal Venture can proceed safely and without adverse effect upon the public health of the community.

OBJECTIVES

- 1) Determine what changes in Puna Geothermal Venture's drilling procedures, equipment, supervision, and regulatory oversight are necessary before drilling may proceed safely.
- 2) Determine what changes are necessary to improve Puna Geothermal Venture's emergency response plan as a result of the experience at well KS-8.
- 3) Determine what changes in air quality and noise monitoring and enforcement programs are necessary to assure public health is protected as a result of the experience at well KS-8.

On September 5, 1991 the Task Force received Puna Geothermal Venture's report on their own investigation of the blowout as well as PGV's response to the recommendations contained in the investigative reports.

SUMMARY DESCRIPTION OF MANAGEMENT PLAN

Attachment B is the Task Force's recommended Geothermal Management Plan. It is organized in a manner corresponding to investigative Elements I, II and III. The plan addresses each of the investigative report recommendations, referencing the page(s) in the Element report on which each recommendation was discussed. The matrix indicates for each item a due date based on practical estimates by the agencies affected, as well as the lead and, if

indicated, support agency(s) involved. The Task Force believes that the due dates may be improved significantly through cooperative efforts between the developer and the regulatory agencies involved. It should also be noted that while a particular item is logically to be completed by PGV, the Task Force believes the ultimate responsibility to carry out the plan should remain a regulatory function of the government, whose agencies are identified in the plan. The plan does not specify which tasks must be completed before PGV is allowed to resume drilling. The respective regulatory agencies will be responsible to determine what changes are necessary to be performed by PGV in order to satisfy the stringent requirements of their permits.

SUMMARY OF ISSUES

The Task Force believes that all Element I tasks relating to drilling equipment and procedures must be completed prior to resumption of drilling activity. PGV must also receive DLNR approval to change certain wells already drilled from injection to production wells, and vice versa, before further drilling can resume. PGV cannot resume any drilling activities without agency approvals of modifications to drilling permits and plans of operations previously approved. Finally, DOH and DLNR need to execute a Memorandum of Understanding relating to regulatory oversight of injection wells.

Element II addresses the adequacy of emergency response actions and plan review and revision that must be completed before activity can resume. Many of the concerns which have been raised resulted from the confusion which arose during and following the blowout. The Task Force recognizes that one of the major tasks that must be completed is the comprehensive review and modification, as appropriate, of PGV's Emergency Response Plan (ERP). The ERP, approved in 1990, is formulated around a worst-case scenario of anticipated emissions from the project. The plan further cites the levels of emissions that would trigger "warning", "alert" and "emergency" actions. The Task Force believes that the worst-case scenario and triggering levels of emissions need to be thoroughly reviewed (as confirmed by the analysis in Element III). The ERP must be appropriately revised by the developer, and approved by the County. The review and approval of the comprehensive ERP is considered to be the "critical path" item that must be completed before PGV is allowed to resume drilling or proceed with any other activity where there is any risk of emission.

Element III consists of a review of air quality and noise abatement and monitoring recommendations. The Task Force believes that a number of Element III actions will require considerable time and resources to implement, particularly those that require long lead times for equipment purchase, and obtaining funding and

personnel. Health and safety of residents can be adequately safeguarded if the intent of these recommendations are fulfilled through several remedial actions.

CONCLUSION

The information contained in the three investigative reports and recommendations, and the subsequent review and analysis by State and County agencies which is provided in this geothermal management plan enables the agencies to properly oversee PGV'S activities and enforce permit conditions. With the issuance of this report, Puna Geothermal Venture is expected to inform the State and County agencies of their plans for compliance.

The agencies, through their respective permits, will ensure that compliance is achieved prior to the resumption of any drilling activity. The following tasks are critical in that regard:

- All recommendations related to drilling activity covered by the Element I report must be fulfilled.
- The Emergency Response Plan must be updated, revised and accepted.
- Adequate air quality and noise monitoring and enforcement capability must be in place.

GEOHERMAL MANAGEMENT PLAN

Attachment B

<u>I. Changes in PGV's Drilling Procedures and Supervision (Element I)</u>		<u>DUE DATE</u>	AGENCIES: 1. LEAD 2. SUPPORT	<u>COMMENTS / SCHEDULE</u>
A. Operators Supervisory Personnel				
1.	DLNR require operators to: (pg. 13 & 15)	10/01/91	DLNR	Amend Plan of Operations for KS-8; by 12/31/91 amend Plan of Operations for KS-4, 5, 6, 9, 10, 11.
	a. Have supervisors on rig floor while drilling, especially during crew changes			
	b. Enter all blowout prevention drills and BOPE operations in A.I.D.C. tour reports			
	c. School all toolpushers, drillers and derrickmen in the use of recommended monitoring equipment			
	d. Ensure all drilling personnel understand the implications of changes in subsurface conditions as indicated by the monitoring equipment			
	e. Establish criteria for all drilling personnel to communicate significant changes in subsurface conditions to supervisors and regulators			
2.	Be conservative and flexible in their approach to casing wells above 2,000 ft. (pg. 13)	10/01/91	DLNR	Amend Plan of Operations for KS-8; by 12/31/91 amend Plan of Operations for KS-4, 5, 6, 9, 10, 11
3.	When drilling below 500 feet, without BOPE, to: (pg. 14)	10/01/91	DLNR	Amend Plan of Operations for KS-8; by 12/31/91 amend Plan of Operations for KS-4, 5, 6, 9, 10, 11.
	a. Run maximum bottom hole temperatures at every connection, looking for increase in thermal gradient			
	b. Take representative water samples and analyze as soon as possible for salinity and conductivity increases			
	c. Catch cutting samples every 10 feet and			

GEOTHERMAL MANAGEMENT PLAN

Attachment B

AGENCIES:

1. LEAD
2. SUPPORT

I. Changes in PGV's Drilling Procedures and Supervision (Element I)

DUE DATE

COMMENTS / SCHEDULE

analyze for hydrothermal minerals

- d. If it appears geothermal zone is to be encountered, with approval of DLNR, operator run casing, cement and rig BOPE

B. Equipment Modifications

1. DLNR require operators to: (pg. 14 & 15)

10/01/91

DLNR

Amend Plan of Operations for KS-8; by 12/31/91 amend Plan of Operations for KS-4, 5, 6, 9, 10, 11.

- a. Install larger flow relief from BOPE stack
- b. Install low pressure burst plate in flow line to divert flow
- c. Include an additional double gate preventer in the BOPE stack
- d. Install a silencer or muffler in the 13 3/8 inch diverter line
- e. Equip mud pumps with the maximum sized pump liners
- f. Provide adequate cool water supply, on site, to kill well
- g. Provide a larger mud cooler or add a mud cooler
- h. Install monitor to alert driller to downhole pressures and changes
- i. Install mud pit alarm system to alert driller

C. Regulatory Oversight (pg. 15 & 16)

1. Prepare MOU between DLNR and DOH assigning over-

10/01/91

DLNR

Draft MOU has been completed

GEOHERMAL MANAGEMENT PLAN

Attachment B

<u>I. Changes in PGV's Drilling Procedures and Supervision (Element I)</u>		<u>DUE DATE</u>	AGENCIES: 1. LEAD 2. SUPPORT	<u>COMMENTS / SCHEDULE</u>
	sight and control of both production and injection wells to one agency		DOH	
2.	Establish mechanism whereby operator permitted to propose and agency approve on-site modifications to casing program or drilling operations	10/01/91	DLNR	
3.	DLNR review casing program on a well-to-well basis, incorporating accumulated knowledge	10/01/91	DLNR	
4.	Require operators to inform DLNR of changes in the reservoir model	10/01/91	DLNR	Amend Plan of Operations for KS-8; by 12/31/91 amend Plan of Operations for KS-4, 5, 6, 9, 10, 11
5.	DLNR to update independent reservoir model	12/31/91	DLNR	Use GEO-TAC, GeothermEx or other consultants
6.	Delete specific BOPE and casing requirements in administrative rules.	12/31/91	DLNR	Amend Ch. 13-183 Administrative Rules
7.	Prepare standard specifications with specific construction details to include BOPE and procedures for the construction of geothermal production and injection wells	12/31/91	DLNR	Use California DOG manual as model
8.	Ask NGO and ASTM to review current procedures and establish standards for geothermal drilling	12/31/91	DLNR	

GEOHERMAL MANAGEMENT PLAN

Attachment B

<u>II. Emergency Response (Element II)</u>		<u>DUE DATE</u>	AGENCIES: <u>1. LEAD</u> <u>2. SUPPORT</u>	<u>COMMENTS / SCHEDULE</u>
A.	Agencies review and approve PGV's Emergency Response Plan (pg. 11):	12/31/91	HEER, HCD	Agency approval about 30 days after developer submits revised plan.
1.	Evaluate the analysis of the hazard of an uncontrolled well venting	11/30/91	1. DOH 2. HCD, DLNR	Requires review of PGV's submission
2.	Re-evaluate the warning, alert and emergency action levels for H2S	11/30/91	1. DOH 2. HCD	Requires toxicologist support
3.	Develop an emergency action level for noise	11/30/91	DOH	
4.	Complete a review of H2S monitoring capability and procedures	11/30/91	1. DOH 2. HCD, HPD, HFD	
5.	Ensure communications and awareness of the plan contents with all responding agencies	11/30/91	DOH	
B.	Resolve confusion over housing reimbursement (El. II, pg. 11)	08/30/91	HCPD	Completed
C.	Resolve function of PGV employee alarm system (El. II, pg. 11)	08/30/91	HCPD	Completed
D.	Review notification procedures and provide appropriate verbal and written notification to ensure compliance with the Emergency Planning and Community Right-to-Know Act of 1986 (El. II, pg. 11)	08/30/91	1. DOH 2. HCD	Completed

GEOTHERMAL MANAGEMENT PLAN

Attachment B

<u>III, Part I. Air and Noise Monitoring (Element III, Part I, Reynolds)</u>		<u>DUE DATE</u>	AGENCIES: 1. LEAD 2. SUPPORT	<u>COMMENTS / SCHEDULE</u>
A. Air Monitoring Network				
1.	Discontinue unneeded background monitoring sites and redirect savings to source control, evaluation and high quality portable field monitors (pg. 5)	07/01/92	CAB	DOH to ensure H2S and met stations are appropriately located
2.	Establish a unified air monitoring system, managed and audited by DOH, and follows input from Stakeholders, to include (pg. 5 & 6):			Need to better define scope of this program
a.	Verification of concentrations of other (non-H2S) toxic pollutants	11/30/91	CAB	
b.	A meteorological measurement system at each permanent H2S monitoring station	3 months after funding		
c.	The acquisition of a password protected remote access modem capability system at each permanent H2S monitoring system in order to provide timely information to regulatory agencies	3 months after funding		
d.	A uniform, functional, short, sampling intake, manifold and monitor intake line to be cleaned regularly	11/01/91		DOH require PGV to establish this in their maintenance program. Also addressed in task I.A.2
e.	Add a meteorological station to the Irvine site	3 mos. after funding	ASAB	
f.	Establish a QA program, using GAMP or existing SAIC program, at all stations with quarterly independent DOH staff audits.	11/01/91	ASAB	Development underway by DOH
g.	Obtain additional portable H2S monitors (Jerome equivalent). Configure 1 for automatic data recording	11/01/91	CAB	Possible access to PGV's Jerome monitor. Inclusion of portable H2S monitors will improve ability to alert rescue personnel
h.	At existing H2S monitoring stations:			
	(1) Modify or replace manifold intake probe and sample line at Alvarez and Wade stations to remove condensation	11/01/91	CAB	

<u>III, Part I. Air and Noise Monitoring (Element III, Part I, Reynolds)</u>		<u>DUE DATE</u>		AGENCIES: 1. LEAD 2. SUPPORT	<u>COMMENTS / SCHEDULE</u>
(2)	Conduct independent gas phase audit at Alvarez and Wade stations	11/01/91		ASAB	
(3)	Improve written station procedures, data handling and station equipment diagram at Alvarez, Wade, Leilani and Nanaweke stations	11/01/91		CAB	
(4)	Regularly clean manifold, intake probe and sample line at all H2S monitor stations	11/01/91		CAB	Being implemented
(5)	Establish a station log and perhaps a monitor log that remains with station and equipment at Alvarez, Wade, Leilani and Nanaweke stations	10/01/91		CAB	Being implemented
(6)	Offset chart zero by 10% and carefully document drift if accuracy in the 2-6 ppb range is to be claimed. Establish tolerances in the QA program that reflect the desired low concentration accuracy at all stations except Leilani and Nanaweke	11/01/91		ASAB	
(7)	Add password level remote access integration into QA and data reduction of station data. Provide password level controlled immediate access to appropriate agencies at all stations	07/01/92		1. CAB 2. ASAB	Refer to Task A.2.C.
(8)	Add meteorological capability to Nanaweke station	07/01/92		1. ASAB	
(9)	Direct PGV to add meteorological capabilities to PGV SE and Woods Stations	07/01/92		CAB	CAB to meet with PGV by 09/16/91
(10)	Calibrate and audit station at a lower range of H2S than presently utilized at all stations	11/01/91		ASAB	About 2 months needed to prepare calibration gas mixture
(11)	Add functional data loggers (CAB presently preferred) at Leilani and Nanaweke stations	07/01/92		ASAB	Refer to Task A.2.C
(12)	Prepare monthly tables showing hourly averages and peak daily H2S rates (and DOH clearly identify station location, name and operator) at all stations	07/01/92		CAB	
3.	Redistribute H2S monitoring stations (pg. 7)				

GEOHERMAL MANAGEMENT PLAN

Attachment B

<u>III, Part I. Air and Noise Monitoring (Element III, Part I, Reynolds)</u>		<u>DUE DATE</u>	AGENCIES: 1. LEAD 2. SUPPORT	<u>COMMENTS / SCHEDULE</u>
a.	Drop PGV Woods Station; retain only one background Station at Nanawele	07/01/92	CAB	Refer to Tasks A.2.h.(8) and A1.
b.	Relocate PGV Southeast Station more to Southwest	07/01/92	CAB	Refer to Tasks A.2.h.(9) and A1
c.	Drop Alvarez Station	11/30/91	CAB	After relocation of Wood Station to Lailani Estates
d.	Retain Irvine Station for met only and add multi-level wind and temperature capability		ASAB	Refer to Task A.I.C
B. Geothermal Resources Permit and Noise Monitoring (El. III, Pt. 1, pg. 7 & 8)				
1.	Clarify GRP requirements for noise	10/01/91	1. NR 2. HCPD	
2.	Designate one government office to receive and investigate noise complaints	10/01/91	DOH	Included in Task C.3.
3.	Acquire one mobile/portable unmanned noise monitor with shelter and modem	07/01/92	NR	
4.	More frequently perform agency spot checks of developer's noise control efforts and periodically compare calibrators	09/01/91	NR	On-going
5.	Evaluate present noise standards with, if necessary, an expert opinion on BACT assessments	07/01/92	NR	Task requires communication with local accoustical consultant and sound measuring equipment manufacturers.
6.	Direct noise monitoring effort toward resolution of complaints and identification of source problem solutions. Redirect part of monitoring effort to specific problem noise identification	07/01/92	NR	On-going
7.	Noise BACT determination should be sensitive to worker safety, and not allow equipment choices to dictate subsequent noise control steps	07/01/92	NR	Included in Task B.5.
C. Permit and Compliance Review (El. III, Pt. 1, pg. 8 & 9)				

GEOHERMAL MANAGEMENT PLAN

Attachment B

<u>III, Part I. Air and Noise Monitoring (Element III, Part I, Reynolds)</u>		<u>DUE DATE</u>	AGENCIES: 1. LEAD 2. SUPPORT	<u>COMMENTS / SCHEDULE</u>
1.	Evaluate 100 ppbv one hour average limitation (AAQS)	11/01/91	CAB	Included in Task II.A.
2.	Evaluate remaining KS-8 health complaints	On-going	DOH	Center for Disease Control may assist
3.	Designate one government office to receive and investigate air and noise complaints. Avoid referring complaints to developer	10/01/91	1. CAB 2. NR	DOH designated
4.	Characterize resource (test and analyze all components of all fluids)	11/30/91	CAB	DOH enforce ATC condition 20
5.	DOH actively participate in source tests and independently quantify H2S emissions during drilling, stacking and controlled or uncontrolled venting, specifically (Pg. 8 & 9):			Also relates to Task II.A, "Worst-Case Scenarios"
a.	Obtain expertise to measure drift and trace toxics contained in particulate and gas phases during emission release events until they are well documented and established	11/30/91	DOH	See IIA
b.	Develop accurate and comprehensive emissions inventory and geothermal resource chemical constituent database specific to the project and individual wells	11/30/91	CAB	Refer to Task III.C.4
c.	Develop emission limits and/or technology development and application to all known emission points based upon BACT, and test performance under good dispersal conditions (start with stacking control system)	on-going	CAB	BACT analysis is done for all emission points. Testing is done to determine compliance with ATC before PTO is issued. This recommendation more applicable to power plants.
d.	Remove restriction on air drilling from ATC, if possible	11/01/91	CAB	DOH consult with DLNR
e.	Determine if KS-8 explosions caused by a pressure surge (gas pressured from bottom of hole) or it was a water/mud hammer	11/01/91	DLNR	Refer to GEO-TAC, GeothermEx, or other experts
f.	Evaluate maximum accidental exposure to close residents and ensure those residents know of circumstances/risk and steps they can take to protect themselves	11/01/91	DLNR	To be addressed under Task II.A

GEOHERMAL MANAGEMENT PLAN

Attachment B

III, Part II. Micrometeorological, Aerometric and Health Effects Analysis (Element III, Part II, Goddard)		DUE DATE	AGENCIES:	COMMENTS / SCHEDULE
			1. LEAD	
			2. SUPPORT	
D.	Rigorously enforce H2S limits (pg. 2 & 42)	07/01/92	CAB	Initiated
	1. Conduct frequent unannounced field inspections			
	2. Implement emission rate measuring procedurs, equipment and database to quantify emission rates and log emission data			Refer to Tasks IIIA.2.c. and IIIA.2.h.(7)
	3. Frequently verify resource geo-chemical analysis by independent laboratory analysis			Included in Task IIIA.2.f.
	4. Immediately geo-chemically analyze new resources at a frequency at which minimal changes between samples are observed			Included in Task IIIA.2.f.
	5. Chemically analyze developed reosurces quarterly or more frequent if a 10% change is observed			Included in Task III.C.4.
E.	Establish a Puna Air Monitoring Panel to advise on air and noise monitoring	07/01/92	DOH	Unification scope needs to be defined Refer to Task III.A.2.
F.	Modify station positions and install additional met equipment and sites as shown in Figure 6-1 and described in pg. 43 and 45 of Element III, Part II. Each station change should be done sequentially starting with existing stations farthest from PGV site (Element III, Part II, Pg. 2, 43, 45)	07/01/92	1. CAB 2. ASAB	See Task III.A.1

GLOSSARY

AIDC - Association of International Drilling Contractors
ASAB - Air Surveillance and Analysis Branch (Air Lab)
ASTM - American Society for Testing of Materials
ATC - Authority to Construct Permit (Air Quality)
BACT - Best Available Control Technology
BOPE - Blowout Prevention Equipment
CAB - Clean Air Branch (DOH)
CHPD - County of Hawaii Planning Department
DOG - California's Division of Oil and Gas
GAMP - Geysers Air Monitoring Program
GEO-TAC - Geothermal Technical Advisory Committee
GRP - Geothermal Resources Permit
HCD - Hawaii County Civil Defense
HEER - Hazardous Evaluation and Emergency Response Office, DOH
HFD - Hawaii County Fire Department
HPD - Hawaii County Police Department
MOU - Memorandum of Understanding
NR - Noise and Radiation Branch
NGO - National Geothermal Organization (actually National Drilling Organization)
PGV - Puna Geothermal Venture
SAIC - Science Applications International Corporation
QA - Quality Assurance

TRUE GEOTHERMAL ENERGY COMPANY

CENTRAL PACIFIC PLAZA

Telephone No.: 808-528-3496
FAX No.: 808-526-1772
220 South King Street
Suite 868
Honolulu, HI 96813

April 2, 1992

Mr. Manabu Tagomori
Chief Engineer
Department of Land and Natural Resources
Kalanimoku Building, Room 227
Honolulu, Hawaii 96813

**SUBJECT: REPORT TO THE STATE OF HAWAII
TECHNICAL ADVISORY COMMITTEE
ON GEOTHERMAL.**

Dear Mr. Tagomori and Members of the Committee:

On behalf of True Geothermal Energy Company, we thank you for the opportunity to make a presentation on the progress and status of our geothermal drilling operations in the Kilauea Middle East Rift Zone (KMERZ).

As you know, True Geothermal Energy Company has been involved in drilling activity in the KMERZ since the middle of 1989. Since 1982 and throughout our active drilling operations, ThermaSource, Inc., of Santa Rosa, California has acted as our drilling and geothermal consultant and operations advisor on a continual and daily basis. Both Mr. Gerald Niimi and Mr. Louis Capuano, of ThermaSource, Inc., have rendered valuable and experienced assistance to our project activities.

ThermaSource, Inc. was selected and has remained as the consultant to True Geothermal Energy Company based upon the extensive and reputable geothermal experience of Mr. Niimi and Mr. Capuano throughout the world. In that light, the managers of True Geothermal Energy Company have chosen to use Mr. Niimi to make a presentation to your committee in order to allow our findings to be of use to the State Department of Land and Natural Resources.

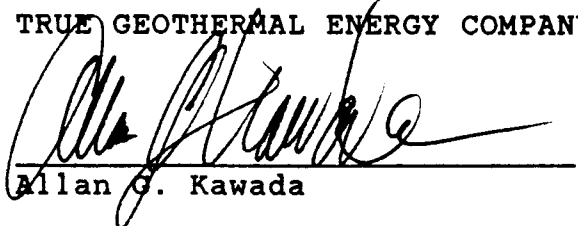
However, we do elect to make the presentation upon the understanding and agreement by the chairman and members of the committee that the information and materials revealed in the presentation are confidential and proprietary to True Geothermal Energy Company. The revelation of any information to unauthorized third parties is prohibited.

Mr. Manabu Tagomori
April 2, 1992
Page 2

Thank you for your cooperation and understanding.

Very truly yours,

TRUE GEOTHERMAL ENERGY COMPANY

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Allan G. Kawada

AGK/reg

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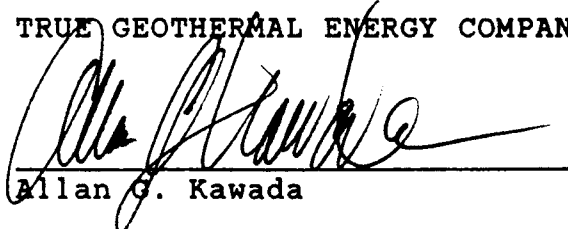
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Allan G. Kawada

AGK/reg

PLANNING BRANCH
Division of Water and Land Development

FROM: Janet DATE: 4/10/92 FILE IN: _____

TO: INITIAL:

PLEASE:

REMARKS:

____ G. AKITA
____ L. Choo
____ E. Lau
____ A. Monden
____ H. Young
____ T. Kam
____ A. Yim
____ S. Yong
____ C.P. Chang
____ T. Nakama
____ Z. Agraan
____ S. Lee
____ J. Swift
____ J. Florez
____ M. Tanouye
____ C. D'Araujo

____ M. TAGOMORI
____ L. Nanbu
____ L. CHANG

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the cost to rent

Can I make these arrangements?

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second hand desk, chair, supplies?

Janet

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Janet

MEMOARNDUM

TO: HONORABLE MURRAY TOWILL

FROM: WILLIAM W. PATY

SUBJECT: REQUEST FOR USE OF OFFICE SPACE AT FORMER HGP-A SITE

The Division of Water and Land Development has recently made arrangements to hire a geologist to carry out hydrological monitoring work in the area of the Puna Geothermal Venture site. We would like to request use of office space to house this staff member while she is operating in the area.

I understand that there is warehouse space available at the former HGP-A site. May we have the use of some of this space for one staff member at this facility? We will provide office furniture, supplies and some equipment. Our request is from April 15, 1992 through December 1993.

Please let me know at your earliest convenience if this arrangement will be possible. If you have any questions about this request, please contact Manabu Tagomori at 587-0230.

PLANNING BRANCH
Division of Water and Land Development

FROM: M. Tanouye DATE: 4/20/92 FILE IN: _____

TO: INIT: PLEASE: REMARKS:

_____	_____	G. AKITA	_____	See Me
_____	_____	L. Choo	_____	Call
_____	_____		_____	Review & Comment
_____	_____	E. Lau	_____	Take Action
✓	_____	A. Monden	_____	Investigate & Report
✓	_____	H. Young	_____	Draft Reply
_____	_____	T. Kam	_____	Acknowledge Receipt
_____	_____	A. Yim	_____	Type Draft
_____	_____	S. Yong	_____	Type Final
_____	_____	C.P. Chang	_____	Xerox _____ copies
_____	_____	T. Nakama		
_____	_____	Z. Agraan		
_____	_____	S. Lee		
_____	_____	J. Swift	_____	Approval
_____	_____	J. Florez	_____	Signature
_____	_____	M. Tanouye	✓	Information
_____	_____	C. D'Araujo		

FOR YOUR:

_____ M. TAGOMORI
_____ L. Nanbu
_____ L. CHANG

Geo. Reservoir Modeling
Summary & Review

M. Tanouye

MEMORANDUM

April 20, 1992

To: Manabu Tagomori
From: Mark Tanouye
Re: Geothermal Reservoir Background Summary

In anticipation of the GEOTAC Meeting on April 21, this is a quick summary and review of current concepts in the geothermal modeling field. Another memo to follow later will outline my ideas about our data needs.

I. Why is a model needed?

Geothermal systems are generally very complex, exhibiting features like fracture-dominated flow, phase changes, chemical reactions, and thermal effects. There are current problems in the modeling of such systems. Most outstanding is the fact that each geothermal field has its own set of special features that make it a unique challenge to a modeler. Most high temperature fields have a fracture-dominated nature, making porous-medium models inapplicable. Multiporosity techniques are available, but often the necessary data required by such models is not obtainable. The issue of "preferential flowpaths" is a more fundamental problem that can cause interference between closely spaced wells. Conditions where liquid-gas phase mixes and non-condensable gases are prevalent are difficult to model given current data collection schemes. However there is a consensus in academia and industry that the development, use, and management of such complex resources cannot be achieved without some type of reservoir model. Such a model can be developed either by or in conjunction with developers. It is clear that the task of modeling a reservoir is a difficult but necessary task if management is a long term goal.

II. What is the purpose of a reservoir model?

Concisely, a good geothermal reservoir model (GRM) should:

1. Provide a good understanding of physical processes that occur in a geothermal system.

2. Provide information on the nature, distribution, and availability of a specific geothermal resource.
3. Assess the power potential of such a resource.
4. Provide that basis on which a scheme for harnessing such a resource can be built.
5. Provide answers to important management questions such as those relating to well decline, well spacing, injection effects, future flow, and potential ~~problems~~

III. Model types

There are generally two types of reservoir models: conceptual models and numerical models. A conceptual model is the result of data gathering and analysis. Both quantitative and qualitative information are valuable. It is an intuitive form integrating ideas of diverse experts in field exploration and development. A conceptual model can take on different forms based on the detail of available data, the nature of the questions posed by the project and the personal or collective bias of the researchers. In its simplest form, a conceptual model can be little more than rough ideas about approximate depth and areal extent of the reservoir, temperature, and permeability. Basically, a reliable conceptual model is one that gives a good understanding of the physical processes that take place in the geothermal system, both static and dynamic. A numerical model is just a conceptual model that has had appropriate mathematical techniques applied to it. Such a quantitative model can be no better than its underlying conceptual model. In the case of the KERZ, the need for a good conceptual model is particularly great, since the area demonstrates complexity on a wide variety of scales. A numerical reservoir model for the KERZ area need not be tied to one set of equations. Many small areas can have their own models according to site-specific conditions. With appropriate scale factors, these can be merged into a general "Model."

IV. What makes a good model?

Grant (1983) in *Geothermics* provides a list of qualities for a good model and requirements for a thorough modeling job. It is exhaustive and certainly no current model satisfies all the criteria. (NOTE: I like this list because the criteria are similar for projects of all levels; the only difference being that more detailed projects will need more detailed validation.)

Step 1 Assessment of the reservoir and the development of a conceptual model. This is the most important and difficult step, and it predetermines the value of all subsequent modeling. Best done by or in conjunction with field operators. Use geochemical, geophysical, geological interpretations of self and others.

Step 2 Quantify conceptual model. Decide what equations should apply, what numerical method to use. Assign numerical parameters (volume, porosity, etc.). Some parameters must be fitted or assumed.

Step 3 Define initial reservoir state (before exploitation), including things such as pressure, temperature, gas content, etc. Matching the natural state can place strong constraints upon the model, making subsequent interpretations easier and more believable.

Step 4 Try to match the history of the field with the model. Usually a recursive, trial-and-error procedure. Revisions of parameters and perhaps the basic conceptual model. As wide a variety of data types should be matched. Possible types:

- Reservoir pressure (seldom omitted)
- Reservoir temperature
- Discharge enthalpy/temperature
- Salinity
- Gas content
- Changes in gravity, resistivity
- Subsidence and deformation (important for KERZ)

It is better to match poorly a wider range of data than to accurately match only one or two histories. In general, the initial assessment of data types needed is important at this stage.

V. What has been done, and what next?

Geothermex's scope of work for DBEDT lists two areas where they are involved in geothermal resource modeling work. In Task 3, "Design and Plan Additional Work to Improve Resource Evaluation," Geothermex proposes to evaluate past drilling activities along with the latest survey methods and well-test options to develop work programs for future operations. This involves modeling only peripherally, but is a stage in which criteria for data collection and quality could be discussed. Task 6, "Quantify the Extent and Characteristics of Hawaiian Geothermal Resources," is a reservoir assessment task. Their first step is to develop a conceptual model of the exploitable reservoir from all available data. Their second step is to estimate the volume of reserves.

Geothermex's opinion is that the modeling effort requires deep well data. Geothermex's hydrogeologic model, presented in their November 1991 Draft Interim Report, was arrived at by using temperature and pressure information from all available wells to plot a 3-D picture of temperature, then using that picture to define flow paths in the system and relate those paths to geologic structures. In order to define the system more effectively more quantitative data for water levels, chemistry, and other parameters need to be collected. Accurate and timely measures of downhole temperature and pressure are particularly important and flow tests should be conducted by professionals. At present, Geothermex considers the SOH holes as the most valuable sources of information, although they consider data from KS7, 8, and the True wells to be extremely valuable to assess the effect of large fractures on the system.

There should be attempts to identify sensitive parameters while at the conceptual stage, i.e., parameters upon which the model heavily depends, or parameters where a small change in value results in a large change in the model output. I think pressure will be an important factor, as will pH or salinity (indicator of fresh-salt mixing). Temperatures in the holes seems to be believable, although Geothermex freely admits it fabricated what it considered to be appropriate curves out of the data in some cases. I agree with Grant in that a good model (conceptual or numerical) should be both transparent and balanced. That is, the form of the model, features, and details should be readily apparent and due weight is given to all relevant data about the reservoir.

cc: Hiram Young
Janet Swift
Jon Florez

JOHN WAIHEE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

P. O. BOX 621
HONOLULU, HAWAII 96809

WILLIAM W. PATY
CHAIRPERSON

JOHN C. LEWIN, M.D.
MICHAEL J. CHUN, Ph.D.
ROBERT S. NAKATA
RICHARD H. COX
GUY K. FUJIMURA

MANABU TAGOMORI
DEPUTY

August 30, 1991

TO WHOM IT MAY CONCERN:

Mr. Duey Milner, has been retained as a Geothermal Well Drilling Consultant by the State Department of Land and Natural Resources effective August 30, 1991.

Mr. Milner is assigned to the Puna Geothermal Venture's (PGV) Control program of geothermal well KS-8 located in Kapoho, Puna, Hawaii. Specific duties and responsibilities are as follows:

- Inspect and monitor field operations of PGV for conformance with approved control plan
- Participate in PGV's meetings on implementing control plan
- If public health, safety, and welfare is eminent as determined by Mr. Milner, a stop order of all control activities shall be issued immediately. Mr. Milner shall immediately notify higher authorities to resolve the problems
- Prepare daily activity reports for the Department of Land and Natural Resources
- Prepare a final report at the conclusion of the control program

Mr. Milner is to report directly to Manabu Tagomori at 548-7533.

A large, stylized handwritten signature in black ink, appearing to read "William W. Paty".

WILLIAM W. PATY
Chairperson

JOHN WAIHEE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

P. O. BOX 621
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August 30, 1991

WILLIAM W. PATY
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MICHAEL J. CHUN, Ph.D.
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RICHARD H. COX
GUY K. FUJIMURA

MANABU TAGOMORI
DEPUTY

MEMORANDUM

TO: Mr. Eric Tanaka

FROM: Manabu Tagomori

SUBJECT: DLNR Consultant - Mr. Duey Milner

Mr. Duey Milner of Bakersville, California has been retained by the Department of Land and Natural Resources to serve as technical consultant on the KS-8 control program. Mr. Milner will represent the Department on the KS-8 project. His duties and responsibilities are:

- Inspect and monitor field operations of PGV for conformance with approved control plan
- Participate in PGV's meetings on implementing control plan
- If public health, safety, and welfare is eminent as determined by Mr. Milner, a stop order of all control activities shall be issued immediately. Mr. Milner shall immediately notify higher authorities to resolve the problems
- Prepare daily activity reports for the Department of Land and Natural Resources
- Prepare a final report at the conclusion of the control program

You are to assist Mr. Milner in keeping a 24-hour watch of activities at the well site, attend meetings with Mr. Milner, and to make your office available to him to operate from during his stay on the island.

Please give Mr. Milner all the courtesies and support he needs to complete the job successfully. If for any reason, you have any questions on your role in this project, please call me directly at 548-7533.

Thanks for your help and keep up the good work.