

FROM: J. Florez DATE: 2-22-94 FILE IN: _____

TO: INITIAL:
2 EF G. AKITA
 _____ E. Keb
 _____ T. Kam
3 _____ H. Young
 _____ S. Yong
 _____ C.P. Chang
 _____ Y.F. Xu
 _____ T. Nakama
4 sm J. Swift
5 _____ J. Florez *lost.*
 _____ M. Tanouye
 _____ C. D'Araujo
2 _____ M. TAGOMORI
 _____ L. Nanbu
 _____ L. CHANG
 _____ E. LAU
 _____ A. Monden
 _____ G. Miyashiro
 _____ D. Lee
 _____ A. Yim

PLEASE:
 _____ See Me
 _____ Call
2 Review & Comment
 _____ Take Action
 _____ Investigate & Report
 _____ Draft Reply
 _____ Acknowledge Receipt
 _____ Type Draft
 _____ Type Final
 _____ Xerox _____ copies

REMARKS:
 Mark and I met w/ Ralph Patterson today to receive his final version of the Hawaii Drilling Guide. He delivered two bound and one loose copy and a diskette.
 He might be able to make a presentation to the GEOTAC members on March 16. Ralph will let us know ASAP if he can make it.
 Meanwhile, Mark and I have begun preparation work for publication of the BOP Manual and Drilling Guide, i.e. change font, re-do the state seals and check for errors.

OK *find out & arrange*
 FOR YOUR:
 _____ Approval
 _____ Signature
X Information
 _____ File

REQUESTED BY: _____
 DATE _____

P.S. Ralph also made requested changes to the BOP Manual

R. A. PATTERSON & ASSOCIATES

1274 Kika Street
(808) 262-5651

Kailua, Hawaii 96734-4521
(808) 262-5350 (FAX)

RECEIVED

94 FEB 22 P 2: 18

February 22, 1994

DIV. OF WATER &
LAND DEVELOPMENT

Mr. Manabu Tagomori
Department of Land & Natural Resources
Division of Water and Land Development
P. O. Box 373
Honolulu, HI 96809

Dear Mr. Tagomori;

In accordance with, and in partial fulfillment of, our technical services contract, two bound, and one loose, copies of the HAWAII GEOTHERMAL DRILLING GUIDE are forwarded.

A diskette containing the files used to produce this document is also enclosed. The document files are in WordPerfect 5.0 format; there are three WP master documents - DRLTITLE.MST, DRLCONT5.MST and DRLREVIS.MST. The cover and appendix division sheets were produced in Harvard Graphics format; copies of these files are also included.

We are anxious to complete the remaining task under this contract, as we expect to be on assignment away from Hawaii from mid-March onwards. According to our records, the contract will be complete when the documents (Blowout Prevention Manual, submitted in September 1993, and this Guide) are presented at a meeting of the DOWALD staff and Technical Advisory Committee. We will work with your staff to schedule these meetings at the earliest practical date.

Sincerely,

enclosures
cc: RCUH (letter only)



R. A. PATTERSON & ASSOCIATES
1274 Kika Street Kailua, Hawaii 96734-4521
(808) 262-5651 (808) 262-5350 (FAX)

RECEIVED

94 FEB 22 P 2: 19

February 22, 1994

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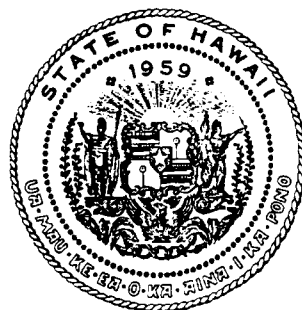
Sincerely,

enclosures
cc: RCUH (letter only)
bcc: G. Akita, J. Flores (letter only)

Ralph A. Patterson

HAWAII GEOTHERMAL BLOWOUT PREVENTION MANUAL

Circular C 125



State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Water and Land Development



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Governor

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DONA L. HANAIKE, Deputy

DIVISION OF WATER AND LAND DEVELOPMENT

MANABU TAGOMORI, P. E., Manager - Chief Engineer

ACKNOWLEDGEMENT

This document was prepared by R. A. Patterson & Associates, Kailua, Hawaii, for the Hawaii Department of Land and Natural Resources under Contract Agreement No. RCUH P. O. 4361021. The work was performed by Ralph A. Patterson, William L. D'Olier, and Herbert E. Wheeler. We wish to gratefully acknowledge the assistance of the staff of the Division of Water and Land Development, under the direction of Manabu Tagomori, and of the invaluable suggestions and assistance of all those who discussed the project with us.

Development of this Manual would not have been possible without the willing cooperation of many managers, technicians and professionals in the geothermal industry, various laboratories and academic institutions, and in other areas where their knowledge was helpful in presenting the review and recommendations of the Manual. The authors wish to acknowledge their help and candor, and their accumulated knowledge that has made our job easier.

Participants In The External Review Of This Manual

Paul Stroud & Bill Rickard
Drilling Engineers
Resource Group

Gerald Niimi & Louis E. Capuano, Jr.
Drilling Engineers
ThermaSource, Inc.

W. R. Craddick
Senior Vice President
Water Resources International, Inc.

William Teplow
Geologist
Teplow Geologic

Pete Wygle
Energy and Mineral Resources Engineer
State of California Department of Conservation
Division of Oil and Gas

Gene Anderson
Division Superintendent
Nabors Loffland Drilling Company

PREFACE

The prevention of an uncontrolled well flow, commonly known as a "blowout", is of vital importance for geothermal operators, drilling crews, state and county regulators, and the general public. Geothermal well blowouts have not been the cause of a significant number of fatalities, and the danger of fire, as in petroleum drilling, is quite low. However, blowout incidents may have a negative impact on surface and subsurface environments, cause resource waste, and develop unfavorable public perceptions of geothermal activity. These concerns are powerful incentives to operators and regulators to minimize the risks of a blowout.

This Manual has been developed to promote safety and good resource management by discussing and describing blowout prevention as it can best be practiced in Hawaii.

The intent of this Manual is to provide the necessary information to guide regulators and operators in the practices and procedures, appropriate to each drilling situation, that will minimize the risks of a blowout. The Manual is also intended to promote an informed flexibility in blowout prevention practices, and to supplement State and County regulations, especially those pertaining directly to drilling permits and operations.¹

This first edition of the Blowout Prevention Manual is a likely candidate for revision as more drilling experience and information is gathered in the exploration and development of Hawaii's geothermal resources.

¹ Department of Land and Natural resources (DLNR) Title 13, Subtitle 7. Water and Land Development; Chapter 183.

R. A. PATTERSON & ASSOCIATES

RECEIVED

93 JUL 28 P 4: 12

MEMORANDUM

Date: July 28, 1993

DIV. OF WATER &
LAND DEVELOPMENT

TO: Jon Flores - DOWALD

SUBJECT: REVISED DRAFT - GEOTHERMAL DRILLING GUIDE

The revised draft of the Drilling Guide, with the latest corrections incorporated, is enclosed for review.

It is our understanding that this will be marked up, and then returned to us for final submission per our contract. Please call if there are any questions.

Ralph Patterson

DIVISION OF WATER AND LAND DEVELOPMENT

FROM: *[Signature]*

DATE: *11/16*

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
- [Signature]*
- [Signature]*
- [Signature]*
- R. LOUI
- S. Kokubun

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

1
File #20
6-11-16

FOR YOUR:

- Approval
- Signature
- Information

Chris (retiree's son)

R. A. PATTERSON & ASSOCIATES

RECEIVED

92 DEC 22 A 8: 43

MEMORANDUM

Date: December 16, 1992

DIV. OF WATER &
LAND DEVELOPMENT

TO: Manabu Tagamori-DOWALD

SUBJECT: Activity report - Contract RCUH #4361021

SUMMARY - 16 NOVEMBER - 15 DECEMBER

During the period of this report, activities consisted of:

- Preparation of the review draft of the Drilling Guide. A copy of the draft table of contents for the draft is enclosed. The draft itself is awaiting small revisions to two sections, and the completion of illustrations; a completed copy is expected to be ready for delivery in early January.

PROBLEMS ENCOUNTERED

A slight delay in the completion of the Drilling Guide draft, as noted above, has been encountered due to schedules of the team members. No other problems are expected for completion of the draft.

DLNR PROGRESS 09/RAP/December 15, 1992



HAWAII GEOTHERMAL DRILLING GUIDE

DRAFT

CONTENTS (Revised: December 20, 1992/RAP)

Page

Acknowledgement

Preface

Summary

I. INTRODUCTION

II. PERMITTING HAWAII GEOTHERMAL WELLS

III. GENERAL REQUIREMENTS FOR DRILLING OPERATORS

IV. GEOTHERMAL DRILLING ENVIRONMENT

V. GEOTHERMAL WELL PLANNING

VI. THE DRILLING PROGRAM

VII. DRILLING MONITORING PROCEDURES

VIII. COMPLETED WELL CONCEPTS

IX. WELL FLOW TESTING

X. SLIMHOLE DRILLING OPTION

XI. DRILLING DOCUMENTATION AND REPORTING

APPENDICES

A - Procedures for Review and Revisions

B - Illustrations

C - References

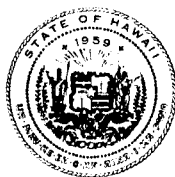
D - Glossary

DRAFT

Person Requested To Review	Consultant	Company Contracted To	Date Response Received
Gerald Niimi	ThermaSource	True Mid-Pacific	July 22, 1993
Louis E. Capuano	ThermaSource	True Mid-Pacific	July 22, 1993
Bill Rickard	Resource Group	PGV	May 28, 1993
Paul Stroud	Resource Group	PGV	May 28, 1993

via telephone

JOHN WAIHEE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT

P. O. BOX 373
HONOLULU, HAWAII 96809

AUG -5 1993

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RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

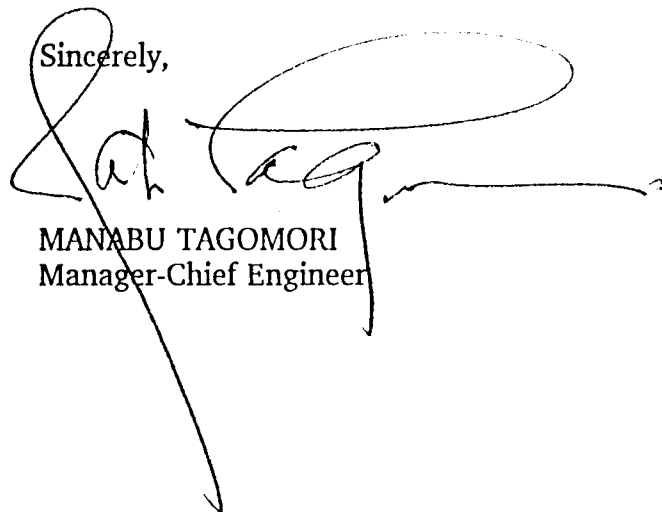
Mr. Paul Stroud
c/o Resource Group
P.O. Box 1483
Healdsburg, California 95448

Dear Mr. Stroud:

Thank you for your May 1993 letter conveying your comments on the draft of the Hawaii Geothermal Drilling Guide. Your participation in our external review process is appreciated and your comments will certainly be considered in finalizing the document.

Should you have any questions regarding this matter, please contact Mr. Gordon Akita of the Flood Control and Mineral Resource Branch at (808) 587-0227.

Sincerely,



MANABU TAGOMORI
Manager-Chief Engineer

JF:lc

JOHN WAIHEE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT

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Sincerely,

MANABU TAGOMORI
Manager-Chief Engineer

JF:lc

July 23, 1993

Memorandum to the files

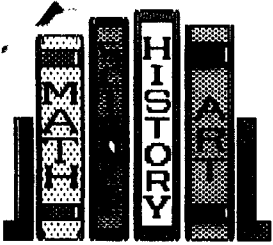
Hawaii Geothermal Drilling Guide

I phoned Mr. Louis Capuano of ThermaSource, Inc. on July 22, 1993, regarding his review and comments on the Hawaii Geothermal Drilling Guide. A copy had been sent to him and his colleague Mr. Gerald Niimi in March and a response was pending.

Mr. Capuano reported that he and Mr. Niimi had no problem with the Drilling Guide.

Jonathan Florez

A handwritten signature in black ink, appearing to read "Jonathan Florez". The signature is written in a cursive style with a large, looping initial "J".



RESOURCE GROUP

TAPPING THE EARTH'S RESOURCES
(707)433-2104
(619)341-0186



Mr. Manabu Tagomori
DLNR
P.O. Box 373
Honolulu, Hawaii 96809

Dear Mr. Tagomori

Thank you for the opportunity to comment on the "Hawaii Geothermal Drilling Guide". We found a few problems with the guide that could lead to problems for the DLNR and the geothermal industry.

You will find our comments marked in and through out the document.

Things seem to be running fine here at PGV. Bill and I will be heading home and on to other projects. We wish you luck in your future endeavors. We have enjoyed working with you and your staff and we feel you are putting a great team together. If Bill or I can be of any assistance to you in the future please feel to call.

In the words of Ronald Reagan "Stay the course".

Sincerely

RESOURCE GROUP

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MAY 28 1988
DLNR
HONOLULU, HAWAII

R. A. PATTERSON & ASSOCIATES
1274 Kika Street Kailua, Hawaii 96734-4521
(808) 262-5651 (808) 262-5350 (FAX)

Joh #1
78

RECEIVED
94 FEB 24 A 9: 46
DIV. OF WATER &
LAND DEVELOPMENT

February 22, 1994

Mr. Manabu Tagomori
Department of Land & Natural Resources
Division of Water and Land Development
P. O. Box 373
Honolulu, HI 96809

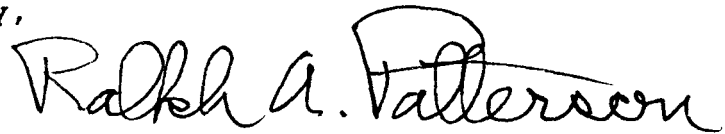
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Sincerely,



enclosures
cc: RCUH (letter only)
bcc: G. Akita, J. Flores (letter only)

JOHN WAIHEE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT

P.O. BOX 373
HONOLULU, HAWAII 96809

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CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

SEP 28 1993

Mr. Ralph A. Patterson
President
R.A. Patterson & Associates
1274 Kika Street
Kailua, Hawaii 96734

Dear Mr. Patterson:

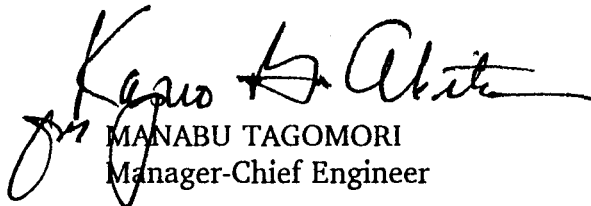
Geothermal Drilling Guide

Thank you for your August 4, 1993 letter and overall cooperation in preparing the Geothermal Drilling Guide.

Attached is a list of corrections to be made along with a marked-up copy. A few text changes were necessary in order to provide clarity and flexibility in the manual.

Should you have any questions on the list or marked-up copy, please contact Mr. Gordon Akita of the Flood Control and Mineral Resource Branch at 587-0227.

Sincerely,


MANABU TAGOMORI
Manager-Chief Engineer

JF:lc

Enc.

CORRECTIONS FOR FINAL HAWAII DRILLING GUIDE
9/24/93

Note: Please see marked-up copy of the Drilling Guide for a reference to the requested changes.

Text to be deleted is in [brackets]

Text to be added is underlined

Please make the following corrections:

1. Drilling Guide cover sheet: line up the State seal with the rest of the text.

2. Table of Contents: Format this page similar to the final Hawaii Geothermal Blowout Prevention Manual. See Mark-up for a guide to changes.

Move "Preface" to space below "Acknowledgement" and above "SUMMARY" and delete assigned page number. (place actual "Preface" page behind "Acknowledgement" page)

Delete [i] page number for SUMMARY and assign ii page number

Add PROCEDURES after "DRILLING MONITORING"

Delete [APPENDIX] and add APPENDICES (underline)

Delete [Review and Revisions]; add Procedures for Guide Review and Revisions

3. Page i, first paragraph,

Line 4: delete the space before "It"

Line 6: delete [the]

Line 8: add geothermal between "and" and "production"

4. Page i, third paragraph,

Line 6: delete [to]; add for

Line 7: delete [Permit to Drill]; add Geothermal Well Drilling Permit for

Line 6: delete [geothermal]

Example: The Guide then treats the important drilling and casing program, which is critical for DLNR approval of the Geothermal Well Drilling Permit for each proposed well.

Line 11: delete [Finally, comments on drilling documentation and reporting, and on the slimhole drilling option are included to focus on a successful outcome]

5. Page i, last paragraph, line 2: delete [Jointly]; add Working jointly.

6. Page 1, second paragraph, line 5: delete [greater]; add improved

7. Page 2, first paragraph, line 4: delete [1992]; add early 1993

8. Page 2, second paragraph: align all numbered text flush to the left.

Example: 1. Promote safety and proficiency in all geothermal drilling operations.

9. Page 2, second paragraph, item no. 3,

Line 2: delete [force]; add require

Line 3: delete [on]; add in

Example: Facilitate better discussions between Operators and regulators when subsurface conditions encountered require changes in the approved drilling program.

10. Page 3, second paragraph, line 1: delete comma (,) after "1961"

11. Page 3, third paragraph, bottom line: delete [following]; add page 13.

12. Page 3, last paragraph, line 2: delete [discovery]; add HGP-A

13. Page 4, third paragraph, line 1: delete [Division Manager]; add Manager-Chief Engineer

14. Page 6, first paragraph, line 6: delete [level upwards]; add phase of permitting

15. Page 6, second paragraph, line 4: delete [the] between "and" and "public"

16. Page 6, third paragraph, line 9: delete [(A)]; add A
17. Page 7, first paragraph, line 1: add Hawaii between "the" and "geothermal", delete [not unlike]; add similar to
18. Page 7, second paragraph, under "Each application will include:"
 delete [Operator (applicant) identification, mining lease, surface owner identification, and proposed location.]
 [Well designation and location by tax map key.]

Add the following:

Operator (applicant) name, address and signature.

Owner of mining rights.

Landowner (if applicant is not the land owner)

Well designation and plot plans showing tax map key, well location and elevation.

Statement of purpose and extent of proposed work.

Estimate of depths between which discovery, production, injection or plugging will be attempted.

19. Page 7, third paragraph, last line: delete [of]; add by
20. Page 8, first paragraph, last line: delete [supply]
21. Page 8, second paragraph,
 Line 1: delete [steep]
 Line 4: add a hyphen (-) between "on" and "site"
 Example: on-site
 Line 7: add act after "or"
22. Page 8, last paragraph, line 2: delete [manpower]; add personnel
23. Page 9, bottom paragraph, line 2: add a comma (,) between "services" and "commonly"
24. Page 10, second paragraph, line 8: delete [, with] after "horizontal"; add and have a
25. Page 11, second paragraph, line 3: add a hyphen (-) between "cross" and "rift". Example: cross-rift

26. Page 11, second paragraph,
 - Line 13: delete [fracturing]; add fractures
 - Line 14: delete [faulting]; add faults
 - Line 17: delete [620°+ F]; add 620+° F
27. Page 11, last paragraph, line 2: delete [12]; add 14
28. Page 12, first paragraph,
 - Line 2: delete [1992]; add 1993
 - Line 5: add a comma (,) after "feet"; add a period (.) followed by two spaces after "depth".
 - Line 9: add a comma (,) after fluids; delete the comma [,] after "and" and before "occasionally"
29. Page 12, second paragraph, last line: add fluids. after "temperature"
30. Page 13, TABLE IV-1, header: delete [1992]; add 1993
31. Figure 1: add KS-10 to the list of Puna Geothermal Venture wells.
32. Page 16, first paragraph,
 - Line 1: delete [fluids.]
 - Line 4: add a hyphen (-) between "on" and "site". Example: on-site
33. Page 16, third paragraph, item 1, line 11: delete [the]; add an
34. Page 17, first paragraph,
 - Line 6: delete [large]; add the after "and"
 - Line 7: delete [big bladed heavy]; add large capacity
 - Line 8: add worst between "the " and "possible"; delete [worst]
 - Line 9: add parenthesis to "s" in events. Example: event(s)

35. Page 17, second paragraph (No. 3),
Line 1: add To date, much at the beginning of the sentence;
delete [, to date,]
Line 4: delete [now]
Line 6: add s to indicate and a after indicates
Example: indicates a
36. Page 17, third paragraph (No. 4),
Line 2: delete [have been]; add are
Line 3: delete [having]; add and have
Line 6: delete [elements]; add components
37. Page 17, last paragraph,
Line 3: add magnitude between "common" and "range"; delete
[magnitudes]
38. Page 18, first paragraph, line 1: add magnitude before
"earthquakes"
39. Page 18, second paragraph,
Line 1: delete [of 600-700° F range]; add ranging from
600°-700° F
Line 2: delete [the] after "drilling"; add this range of
Line 3: delete [in these intervals]
Line 10: delete [linear]; add the
Line 11: add accurately between "to" and "characterize"
40. Page 18, third paragraph, line 2: delete [have]; add has, add
yet between "not" and "received"
Example: has not yet received
41. Page 19, second paragraph,
Line 1: delete [13]; add 15
Line 2: delete [15]; add 17
42. Page 20, first paragraph, line 10: delete [this]; add the need
for

43. Page 24. sixth paragraph,
Line 3: delete [production]; add conductor pipe, surface,
Line 4: delete [, surface casings and conductor pipe]; add
and production casings.
Example: This then determines the hole sizes and casing sizes
for conductor pipe, surface, intermediate (possibly
more than one) and production casings.
44. Page 26, second paragraph, line 8: add long between "for" and
"periods"
45. Page 26, third paragraph, line 1: delete [700°+F]; add 700+°
F
46. Page 26, fifth paragraph,
Line 5: add Thermal expansion of voids (delete capital
letter [V] in voids)
Line 6: delete [ln]; add in, delete [that expand with]; add
, due to
Line 7: add a comma (,) after "temperature"
47. Page 27, first paragraph, top of page: after "corrosion
failure can occur." add Proper cement slurry design is crucial
for maximum protection from external corrosion and should be
indicated by the physical characteristics recorded on the
drilling mud log (see Section VII, page 32).
48. Page 27, second paragraph, item no. 1, line 4: delete
[producing]; add production
49. Page 27, middle of page, items no. 1-5: move text to the right
to bring flush with the left side.
Example: 1. The cement additives, including lost
circulation materials, and the proper mix of
slurry for different temperatures and hole
conditions and for the prevention of cement
strength degradation during the future life of
the production or injection well.
2. The use of light weight cements.

50. Page 27, bottom paragraph, item no. 1,
- Line 1: delete [There is a preference to cement the surface casing (commonly 20 inch diameter)]; add Surface casing (commonly 20 inch diameter) is preferably cemented
- Line 5: delete [is]; add may be
- Line 6: delete [set at say 1,700 feet,]
51. Page 28, third paragraph, item no. 3, line 2: delete [4,000 feet+]; add 4,000+ feet
52. Page 29, top paragraph, item no. 4,
- Line 2: delete [No information]; add Two successful production wells
- Line 6: add recent between "in" and "initial".
- Line 7: delete [would collapse]; add remain intact.
- Example: The amount of rock debris discharged in recent initial flow tests suggests that open hole completion intervals remain intact without liners.
53. Page 31, first paragraph, align all numbered text flush to the left.
- Item no. 3: add for each wellbore segment, after "procedures"
- Item no. 6: add a comma (,) after procedures; delete [and]; delete the period (.) after "strategy"; add and testing for each wellbore segment.
54. Page 31, bottom paragraph, line 11: add the better before "it"; delete [better] after "be"
55. Page 32, first paragraph,
- Line 4: delete [data]; add of data after "stream"
- Line 5: add and gases after "fluids"
- line 8: delete [employed]
- Line 9: delete [in]; add for
56. Page 32, second paragraph,
- Line 4: begin a new paragraph with "First"

- Line 9: begin a new paragraph with "Secondly"
57. Page 33, item no. 1, line 1: delete [conditions] after "Physical"; add properties, and add the following text at the end of the paragraph.
1. Physical properties and resource potential of the newly penetrated rock formation. The array of information gathered in this sector is commonly presented in a continuous "mud log" graphic record over the entire interval drilled. The mud log includes, but is not limited to, the continuous and automatic analysis of formation gases such as methane, carbon dioxide and hydrogen sulfide, as well as the geologist's description of the lithology and associated alteration minerals at various depths.
58. Page 33, item no. 3, line 7: add , as well as the temperature in and out of the wellbore after "gains"
- Example:
- Drilling fluid losses and gains, as well as the temperature in and out of the wellbore are of special significance as forewarning of upset conditions.
59. Page 33, MONITORING SECTORS section, bottom paragraph:
- Line 2: add well construction after "potential"
- Line 4: delete [or casing and completion plans in the well itself.]; add , casing and cementing programs, and completion plans.
- Example: The information products from the sectors discussed above have important potential well construction applications. Possible immediate improvements might be indicated in drilling procedures, drilling fluid properties, casing and cementing programs, and completion plans.
60. Page 36, first paragraph, line 5: add a comma (,) after "spool"
61. Page 36, first paragraph, numbered text: align all text flush to the left.
62. Page 36, first paragraph, item no. 2, line 2: add parenthesis to "s" in parts. Example: part(s)
63. Page 36, bottom paragraph, line 5: add should between "and" and "be"

64. Page 38, bottom paragraph: add ON after **WELL**; add a hyphen (-) between **SHUT** and **IN**; add STATUS after **SHUT-IN**. Example: **WELL ON SHUT-IN STATUS**
65. Page 38, bottom paragraph, line 5: delete entire section beginning with "This casing corrosion appears to be... and ending with "might lead to casing damage." and replace with the following:
- Fluid convection can operate inside the wellbore in full shut-in conditions, building highly concentrated H₂S gas caps. Prior to placing a high temperature well on shut-in status for extended lengths of time, an Operator may pump caustic water down the wellbore to abate any H₂S and protect the well from acidic corrosion. Next, a column of caustic water can be sufficiently pressurized with nitrogen to keep any remaining H₂S gas in solution. This would prevent a highly concentrated H₂S gas cap from forming while the well is on shut-in status. As an option for long term well shut-in, the H₂S gas cap may need to be bled-off, properly abated, to the atmosphere.
66. Page 40, first paragraph,
Next to the last line: delete [in]
Last line: add production after "geothermal"
67. Page 40, second paragraph, line 9: delete [are not likely to]; add may not
68. Page 41, first paragraph, line 1: delete [ten]; add twelve
69. Page 42, first paragraph, line 3: add which is after "pressure"
70. Page 43, third paragraph, third line from the bottom: delete [productive]; add production
71. Page 44, title for item D: delete[Venting]; add Venting/Cleanout
Line 11: add begin to before "cut". Example: begin to cut any steel surface it strikes
72. Page 45, first line, top of page: add can before "rapidly"; delete [safety and]
73. Page 45, first paragraph, line 2: add , with hydrogen sulfide abated, between "well" and "to".
Example: The safest response to this transient hazard is to

vent the well, with hydrogen sulfide abated, to the atmosphere.

74. Page 45, first paragraph,

Line 9: delete [when]; add if after "failures".

Line 11: delete space between "clean" and "out" Example: cleanout

75. Page 45, second paragraph,

Line 1: delete [At a selected wellhead flowing pressure,]; add After the permanent piping from the power plant has been attached to the wellhead,

Line 1: delete [wellhead]; add resource

Line 2: add , at a constant wellhead flow rate, after "directed"

76. Page 46, first paragraph,

Line 15: delete [failure]; add corrosion

Line 17: delete [This]; add The

77. Page 46, second paragraph,

Line 2: delete space between "clean" and "out". Example: cleanout.

Line 6: delete [continuous, long]; add well cleanout

78. Page 47, first paragraph, line 3 & 5: change the first "o" in operator to a capital. Example: Operator

79. Page 49, item "2)", line 2: delete [para.]; add paragraph

80. Page 50, first paragraph,

Line 7: delete [in]; add from

Line 8: delete [the] and [interval]

81. Page 50, second paragraph,

Line 2: delete [in]; add from

Line 3: delete [91]; add 1991; add s to the SOH. Example: SOHs

82. Appendix A-1: delete bottom paragraph.

83. Appendix B-1 and B-2: fill in all the blanks where a dashed line exists or delete [_____;]
84. Appendix B-1, third reference: Delete H²S; add H₂S
85. Appendix B-2, ninth reference, line 2: delete[and]; add an in its place. Example: Institutional and Financial Aspects of Developing an Inter-Island Electrical Transmission System
86. Appendix C-1, definition for blowout preventer, line 6: add a period (.) after "surface".
87. Appendix C-2, definition for casing, line 3: add or injection between "production" and "of"; delete [from the well]; add a period (.) after "fluids".

R. A. PATTERSON & ASSOCIATES

1274 Kika Street

(808) 262-5651

Kailua, Hawaii 96734-452

(808) 262-5350 (FAX)

August 4, 1993

RECEIVED
93 AUG 6 10:41
DIV. OF WATER & LAND DEVELOPMENT

Mr. Gordon Akita
Department of Land & Natural Resources
Division of Water and Land Development
P. O. Box 373
Honolulu, HI 96809

Dear Mr. Akita;

Subsequent to Mr. Tagomori's letter of July 27th, we have had discussions with DOWALD staff that point toward a different schedule for completing our work on the "Hawaii Geothermal Blowout Prevention Manual," and the "Hawaii Geothermal Drilling Guide."

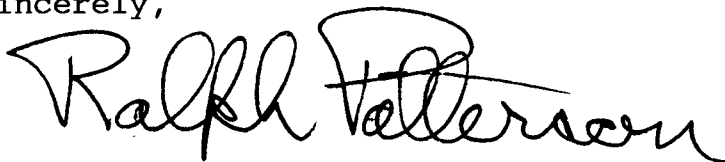
We understand that a review of the "Blowout Prevention Manual" has indicated that there are some pages that will need replacing due to typographical errors; when these have been identified, we will reprint the pages and provide them to you. The two bound copies will have replacement pages inserted in the copies.

The draft copy of the "Drilling Guide" has been submitted for review and comment; since these comments have not yet been received, we will be unable to deliver the final version on August 6, 1993, as outlined in your letter.

We will be glad to expedite the above corrections and deliveries, but will have to have a reasonable time to make the corrections and do the printing and binding when the staff reviews are completed.

The final versions of the documents and diskette files will be delivered, and the presentations to staff and the Geotechnical Advisory Committee scheduled as soon as possible.

Sincerely,



cc: Mr. Manabu Tagomori
Mr. Jon Flores



R. A. PATTERSON & ASSOCIATES

1274 Kika Street
(808) 262-5651

Kailua, Hawaii 96734-4521
(808) 262-5350 (FAX)

July 19, 1993

Mr. Manabu Tagamori
Manager and Chief Engineer
Division of Water and Land Development
Department of Land and Natural Resources
1151 Punchbowl Street
Honolulu HI 96813

RECEIVED
93 JUL 21 11:14
DIV. OF WATER &
LAND DEVELOPMENT

Dear Mr. Tagamori;

Enclosed please find two bound and one unbound copies of the final version of the Hawaii Geothermal Blowout Prevention Guide, in partial fulfillment of our contract. A copy of the file disk for this and the Hawaii Geothermal Drilling Guide will be forwarded under separate cover.

Sincerely,

Ralph A. Patterson

enclosures

R. A. PATTERSON & ASSOCIATES

RECEIVED

93 JUL 28 P 4: 12

MEMORANDUM

DIV. OF WATER &
LAND DEVELOPMENT

Date: July 28, 1993

TO: *Nanda Tagomori*
Jon Flores - DOWALD

SUBJECT: REVISED DRAFT - GEOTHERMAL DRILLING GUIDE

The revised draft of the Drilling Guide, with the latest corrections incorporated, is enclosed for review.

It is our understanding that this will be marked up, and then returned to us for final submission per our contract. Please call if there are any questions.

Ralph Patterson



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT

P. O. BOX 373
HONOLULU, HAWAII 96809

July 27, 1993

KEITH W. AHUE, Chairperson
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LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

Mr. Ralph A. Patterson
President
R. A. Patterson & Associates
1274 Kika Street
Kailua, HI 96734

Dear Mr. Patterson:

Geothermal Blowout Prevention Manual and Drilling Guide

Thank you for the two bound copies and the original unbound copy of your "Hawaii Geothermal Blowout Prevention Manual". We will review the manual and provide you with our comments prior to printing and release to the public.

Submittal of two complete copies of the draft "Hawaii Geothermal Drilling Guide" is due on July 30, 1993. The final version of the drilling guide which is due on August 6, 1993, should include two bound copies and one original unbound copy. Also, copies of the Blowout Prevention Manual and Drilling Guide on disk in Wordperfect format should be submitted along with the final drilling guide.

Please note that according to the March 15, 1992 Agreement, you will be expected to present the Blowout Prevention Manual and Drilling Guide to our staff and to the Geotechnical Advisory Committee as your final tasks. The dates of these presentations will be scheduled after the submittal of the final Hawaii Geothermal Drilling Guide.

Should you have any questions on these matters, please contact Mr. Gordon Akita at 587-0227.

Sincerely,

A handwritten signature in black ink, appearing to read "Manabu Tagomori".

MANABU TAGOMORI
Manager-Chief Engineer

JF:ln



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT

P. O. BOX 373
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STATE PARKS
WATER AND LAND DEVELOPMENT

Mr. Gerald Niimi
Vice-President
ThermaSource, Inc.
P.O. Box 1236
Santa Rosa, California 95402

Dear Mr. Niimi:

As a result of recommendations made in the "Independent Technical Investigation of the Puna Geothermal Venture Unplanned Steam Release", of June 12-13, 1991, the Department of Land and Natural Resources is preparing a Hawaii Geothermal Drilling Guide.

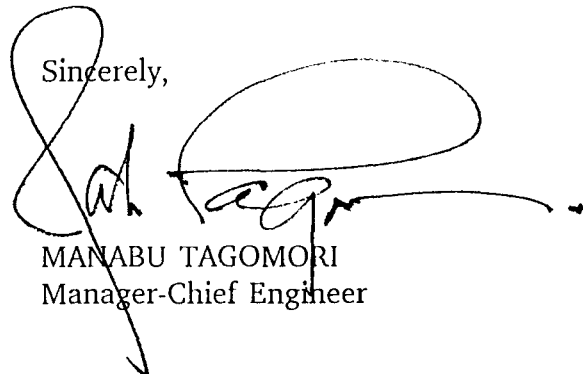
This document is intended to guide both regulatory agencies and geothermal developers in the planning and procedures regarding drilling activities in Hawaii. The guide is designed to provide operational and safety procedures for all geothermal drilling activities in the state.

A draft copy of this guide is enclosed for your consideration. We would appreciate your review of and comments on the draft so that the final guide will reflect the experiences and thoughts of the industry.

In order to maintain our schedule, we would appreciate your providing your comments to us by **March 12, 1993**. Your comments, and others that we may receive, will be considered in the preparation of the final document.

Your assistance in this review is appreciated; we hope to manage the Hawaii geothermal resources so that the best possible development practices are followed at all times.

Sincerely,



MANABU TAGOMORI
Manager-Chief Engineer

JF:lc
Enc.



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT

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WATER AND LAND DEVELOPMENT

FEB 26 1993

Mr. Louis E. Capuano, Jr.
c/o ThermaSource, Inc.
P.O. Box 1236
Santa Rosa, California 95402

Dear Mr. Capuano:

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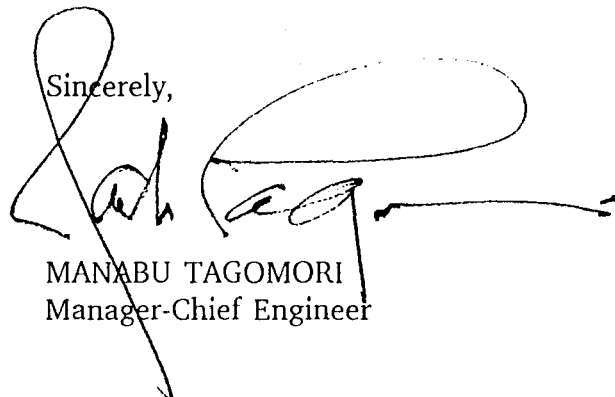
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Sincerely,



MANABU TAGOMORI
Manager-Chief Engineer

JF:lc
Enc.



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WATER AND LAND DEVELOPMENT

FEB 26 1993

Mr. Paul Stroud
c/o Puna Geothermal Venture
P.O. Box 30
Pahoa, Hawaii 96778

Dear Mr. Stroud:

As a result of recommendations made in the "Independent Technical Investigation of the Puna Geothermal Venture Unplanned Steam Release", of June 12-13, 1991, the Department of Land and Natural Resources is preparing a **Hawaii Geothermal Drilling Guide**.

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Sincerely,

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MANABU TAGOMORI
Manager-Chief Engineer

JF:lc
Enc.



STATE OF HAWAII
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STATE PARKS
WATER AND LAND DEVELOPMENT

Mr. Bill Rickard
c/o Puna Geothermal Venture
P.O. Box 30
Pahoa, Hawaii 96778

Dear Mr. Rickard:

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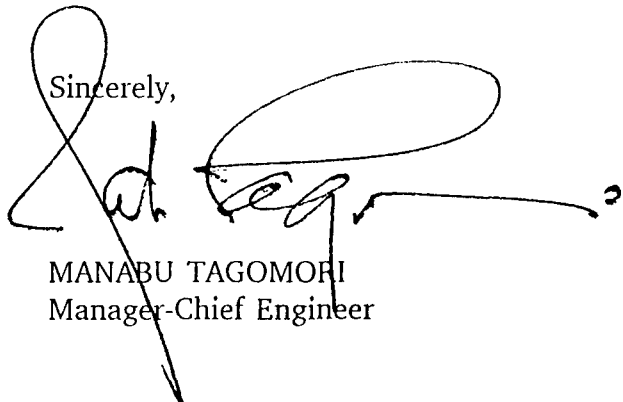
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Sincerely,



MANABU TAGOMORI
Manager-Chief Engineer

JF:lc
Enc.