G0146960

California Energy Company, Inc.

MAZAMA CORE HOLE MANUAL

Deep Temperature Gradient Core Holes

Winema National Forest
Klamath County, Oregon

August 1986

TABLE OF CONTENTS

MAZAMA I AND II UNITS
Deep Temperature Gradient Core Holes

PERMITS

PLEASE READ ALL PERMITS AND RULES SO THAT YOU WILL BE ABLE TO ANTICIPATE REQUIRED NOTIFICATIONS, TECHNICAL CONSTRAINTS AND REPORTS. READ THE DOE DATA COLLECTION PLAN FOR MZI-11A. SEE MAP AT END POCKET FOR APPROVED ACCESS ROUTES TO THE SITES AND TO WATER SOURCES. KEEP THE SUNRIVER OFFICE INFORMED OF YOUR FIELD HOUSING PHONE NUMBERS.

BLM and WINEMA NF:

BLM and Winema NF have approved a four-hole drilling program. BLM is permitting the holes one at a time and has issued a permit for the MZI-11A site. As soon as we determine whether we are going to drill MZII-1, we must notify BLM.

BLM will be conducting a noise monitoring program. They will give Crater Lake National Park an opportunity to witness any monitoring in the Park. California Energy will be subcontracting a supplemental noise monitoring program.

Winema NF will be conducting fire inspections to ensure compliance with their rules (communication equipment, proper muffling, spark arrestors, fire fighting tools, water, extinguishers, etc.). See USFS Fire Rules for details.

Winema NF has issued a road use permit designating the roads to be used for access to sites. Be especially careful that equipment is restricted to the authorized access route to the MZII-1 hole to the south. HEAVY EQUIPMENT MUST NOT USE THE ANNIE CREEK BRIDGE.

DOGAMI:

BLM and DOGAMI have coordinated their stipulations for the hole (see BLM letter of July 12, 1985). DOGAMI will also receive cuttings from the surface hole and will select core samples from the lithologic log (see DOGAMI letter of August 27, 1986). Dennis Simontacchi, BLM, will handle communications with DOGAMI regarding drilling operations.

OR WATER RESOURCES DEPARTMENT:

OR WRD has issued permits to appropriate water from specific locations for specific well sites. Water withdrawal from sites other than those specified can be done only with concurrence of the Winema NF. Check the authorized water diversion points noted on the maps in the end pocket.

DOE COST SHARING:

DOE is cost-sharing the MZI-11A hole with Cal Energy. In addition to the notices required under the BLM, WNF and DOGAMI permits, we must send a daily drilling report to DOE and the University of Utah Research Institute (UURI). Call in the report to Santa Rosa for typing and transmittal by telecopy. UURI will be providing technical advice to DOE and must be provided access to the drillsite. Please coordinate all media releases through DOE.

AUTHORITIES AND COMMUNICATIONS

The Bureau of Land Management (BLM) and Winema National Forest (WNF) have established the following responsibilities and authorities:

BLM	Drilling compliance/GROs/DOGAMI contact/noise monitoring.
WNF	Surface compliance/GRO 4/Fire/Access/Public information.

Bob Fujimoto, BLM Portland (503-231-6946) is responsible for administration of California Energy BLM permits. Communications are to be directed to the contact persons listed below, in the order listed. See the permits for additional names and numbers if you are unable to reach the partyies named below.

DRILLING/DOWNHOLE COMPLIANCE

BLM (Lead Agency):

1st	DENNIS SIMONTACCHI Inspector, Lakeview	Day: Night:	503-947-2177 503-947-2355
2nd	DENNIS DAVIS Inspector, Bend	Day: Night:	503-447-4115 503-382-3440

DOGAMI - Oregon Department of Geology and Mineral Industries:

DENNIS SIMONTACCHI (BLM, above) will handle communications with DOGAMI.

Dennis Olmstead (DOGAMI)	Day:	503-229-5580
	Night:	503-231-3835

CALIFORNIA ENERGY COMPANY, INC.:

1st	BOB PRYDE/GORDY GOLLAN	Field Phone: Santa Rosa:	Day/Night (to be supplied) 707-526-1000
2nd	DESIGNATED DRILLSITE GEOLOGIST	Field Phone: Santa Rosa: Sunriver Office:	Day/Night (to be supplied) 707-526-1000 503-593-2414
3rd	JIM MOORE	Santa Rosa:	707-526-1000

* For major drilling decisions, coordinate with DOE or their UURI designate.

SURFACE: ON- AND OFF-SITE COMPLIANCE
(Site Construction, Water, Roads, Fire):

WINEMA NATIONAL FOREST (Lead Agency):

1st	BILL JENSEN, Chemult Ranger District:	503-365-2229
2nd	MARV STUMP, Winema NF, K. Falls:	503-883-6799

BLM:

Dennis Simontacchi	503-947-2177

CALIFORNIA ENERGY COMPANY, INC.:

Field Operations: Bob Pryde/Designated Drillsite Geologist

Environmental Monitoring/Permits/Reports: Dave McClain/Anna Carter

PUBLIC INFORMATION
(Media/Public Inquiries, Tours, Press Releases, Drillsite Visitors):

Generally, coordinate any press releases through Winema NF, BLM and DOE.

WINEMA NATIONAL FOREST (Lead Agency):

1st	DEE WESTERBERG, Public Information Officer:	503-883-6715
2nd	ART DUFAULT, Forest Supervisor:	503-883-6714

BLM:

1st	STEVE SHERMAN, Klamath Falls Area Manager:	503-883-6916
2nd	ED CILIBERTI, Chief, Public Info, Portland:	503-231-6274

DOE:

Susan Prestwich, DOE Project Officer	503-526-1147
Pete Mygatt, Director, Office of External Affairs	503-526-1318

PUBLIC INFORMATION
Continued

CALIFORNIA ENERGY COMPANY, INC.:

1st*	DAVE McCLAIN	Santa Rosa:	707-526-1000
2nd*	ANNA CARTER	Santa Rosa:	707-526-1000

*Within Cal Energy, inquiries are to be referred for response as follows:

Exploration Planning/Policy	Jim Moore
Land/Lease/Unit Administration	Phil Essner
Geology/Geotechnical/Hydrology	Joe La Fleur/Paul Brophy
Drilling Operations	Bob Pryde/Jim Moore
Environmental Compliance/Monitoring/ Permits-Reports	Dave McClain/Anna Carter

DOE AND UURI CONTACTS

U.S. DEPARTMENT OF ENERGY (DOE)

Idaho Operations Office
785 DOE Place
Idaho Falls, Id. 94302

Telecopier 208-526-0524 Xerox
208-526-1184 3M
Confirmation 208-526-1503 (Bernice)

Susan Prestwich — 208-526-1147
DOE Project Officer — Home 208-522-3356
Role: Technical Oversight

Elizabeth Bowhan — 208-526-1229
Contracts Specialist
Role: Contract/Finance Oversight

Cliff Clark — 208-526-0457
Role: Environmental Review

Sue Steiger: E.G.& G.
Role: Support to Cliff Clark

Public Relations: Prestwich/Bowhan (for releases prepared by others)

DOE Public Information
Pete Mygatt, Director — 208-526-1318
Office of External Affairs
Role: DOE Generated Releases

UNIVERSITY OF UTAH RESEARCH INSTITUTE (UURI)

391 Chipeta Way
Salt Lake City, Ut. 841-8-1295

Contact Secretary: Beth Orvin 801-524-3422
Carolyn Davidson
Telecopier: 801-524-3453

Role: Technical Advisors to DOE

Mike Wright (Primary contact) — 801-524-3422
Director Earth Science Laboratory — Home 801-277-8330
(Geophysicist)

Dennis Nielson, Assoc. Director
Earth Science Laboratory
Geologist - Head Geologic Group

Joe Moore, Head Geochemist Group
Project Geochemist

NOTE: Send copy of all plans as submitted to DOE to Phillip Michael Wright, Director, Earth Science Laboratory, UURI.

CALIFORNIA ENERGY COMPANY, INC.

Santa Rosa Headquarters:	707-526-1000
California Energy Company, Inc. 3333 Mendocino Avenue, Suite 100 Santa Rosa, CA. 95401	
Sunriver Field Office:	503-593-2414 or 2415
California Energy Company, Inc. 201 N Sunriver Plaza Sunriver Business Park P. O. Box 3399 Sunriver, OR. 97702	
Mazama Drillsite Rig Phones - 24 Hours:	503-
Robert A. Pryde/Gordy Gollan - Coso Rig Phones:	619-375-1818
Radio Phone	619-375-1128
Heritage Inn, Ridgecrest	619-446-6543
Bar S Motel, Ridgecrest	619-446-2551
Reference Numbers:	
CTC House, Sunriver, OR.	503-593-2404 (2405)
Thunderbird Motel, Klamath Falls, OR.	503-882-8864
Spring Creek Ranch, Chiloquin, OR.	503-783-2775
Ft. Creek Resort, Ft. Klamath, OR.	503-381-2207

EMERGENCY PHONE NUMBERS

INJURIES:	Klamath County Emergency Services (Fire and Medical)	Day:	503-882-2501
	Merle West Medical Center Klamath Falls, OR.	Emergency:	503-882-6311
POLICE:	Klamath County Sheriff's Office		503-883-7111
FIRES:	Kingsley Fire Center (24 hours)	Day: (five lines)	503-883-6850, 6851, 52, 53, 54
	Answering service notifies proper authorities	Evenings:	503-882-8274
	Mazama I: Chemult Ranger District Bill Jensen Fire & Resources Forester		503-365-2229
	Mazama II: Klamath Ranger District Dave Pederson		503-883-6824

Anna:Z6242:D3

IN REPLY REFER TO:

MZI-11A
(930)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

OREGON STATE OFFICE
P.O. Box 2965 (825 NE Multnomah Street)
Portland, Oregon 97208

AUG 2 9 1986

RECEIVED
SEP 3 1986
C.E.C.I

Anna Carter
California Energy Company
3333 Mendocino Avenue
Santa Rosa, California 95401

Dear Ms. Carter:

We have received Sundry Notices to change the surface casing size and depth for wells MZI-11A and MZII-1. We are taking action on MZI-11A at this time, but will postpone taking action on MZII-1 until after a pre-operation, on-site inspection is held.

We are approving the Sundry Notice for MZI-11A, dated August 21, 1986, and the accompanying "Proposed Drilling and Coring Procedure" with one exception. Item 5 of the drilling procedures calls for pressure testing all equipment to 500 psi. After having several temperature gradient wells drilled this summer to depths below 4,000 feet, we have modified this requirement. You will be required to pressure test all equipment to 700 psi, with advance notification to BLM.

If you have any questions regarding the Sundry Notice, please call Bob Fujimoto at (503) 231-6946.

Sincerely,

Patrick H. Geehan

Patrick H. Geehan
Deputy State Director
for Mineral Resources

Enclosure
Approved Sundry Notice for
MZI-11A dtd 8/21/86

BLM: Geothermal Drilling Permit
No. OR-920-85-WN-001
DOGAMI: 116

Form: USGS 9-1958

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No. _____

GEOTHERMAL SUNDRY NOTICE

The U.S. Geological Survey requests this form or other Supervisor approved form to be prepared and filed in triplicate with requisite attachments with the Supervisor. The Supervisor must approve this permit prior to any lease operations.

4. LEASE SERIAL NO.: OR 34669

5. SURFACE MANAGER: BLM ( ) FS ( ) Other ( ): Winema NF

1a. WELL TYPE: PRODUCTION ( ) INJECTION ( ) HEAT EXCHANGE ( ) OBSERVATION ( ) OTHER (X): Temperature Gradient Core Hole

6. UNIT AGREEMENT NAME: Mazama I

1b. WELL STATUS: Not yet drilled.

7. WELL NO.: MZ-11A

8. PERMIT NO.:

9. FIELD OR AREA: Winema Nat'l Forest

2. NAME OF LESSEE/OPERATOR: California Energy Company, Inc.

10. SEC. T., R., B.& M.: Section 10 T31S R7½E

3. ADDRESS OF LESSEE/OPERATOR: 3333 Mendocino Ave., Ste. 100, Santa Rosa, CA 95401

11. COUNTY: Klamath

13. LOCATION OF WELL OR FACILITY: Approximately 2225'E and 725'N of SW Corner Sec. 10 T31S R7½E

12. STATE: Oregon

14. TYPE OF WORK

CHANGE PLANS	(X)	CONVERT TO INJECTION	( )	PULL OR ALTER CASING	( )
SITE AND ROAD CONSTRUCTION	( )	FRACTURE TEST	( )	MULTIPLE COMPLETE	( )
CONSTRUCT NEW PRODUCTION FACILITIES	( )	SHOOT OR ACIDIZE	( )	ABANDON	( )
ALTER EXISTING PRODUCTION FACILITIES	( )	REPAIR WELL	( )	OTHER	( )

15. DESCRIBE PROPOSED OPERATIONS (Use this space for well activities only. See instructions for current well conditions on reverse)

To change the proposed drilling program to incorporate technical and cost advantages based on drilling experience in the Cascades (4-1/2" conductor casing cemented by Halliburton to 550', begin coring with HQ size core, and run 1-1/2" or 1-3/4" tubing to T.D.) A revised drilling permit form is attached for convenience in documenting the changes--See Item 21 and attached Proposed Drilling and Coring Procedure.

16. DESCRIBE PROPOSED OPERATIONS (Use this space for all activities other than well work)

(Use reverse side if needed)

17. I hereby certify that the foregoing is true and correct

SIGNED James L. Moore TITLE Senior Vice President Exploration DATE 8/21/86

James L. Moore

(This space for Federal use)

APPROVED BY _____ TITLE DEPUTY STATE DIRECTOR FOR MINERAL RESOURCES DATE AUG 29 1986

CONDITIONS OF APPROVAL, IF ANY:

This permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.34, 30 CFR 270.35, 30 CFR 270.45, 30 CFR 270.71-1, 30 CFR 270.72; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

Form: USGS 9-1957

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No. _____

GEOTHERMAL DRILLING PERMIT

The U.S. Geological Survey requires this form or other Supervisor approved form to be prepared and filed in lieu with requisite attachments with the Supervisor. The Supervisor must approve this permit prior to lease operation.

4. LEASE SERIAL NO.: OR 34669

5. SURFACE MANAGER: BLM ( ) FS ( ) Other ( ): Winema Nat'l Forest

1a. TYPE OF WORK: DRILL NEW WELL ( ) REDRILL ( ) DEEPEN ( ) PLUG BACK ( ) DIRECTIONALLY DRILL ( ) OTHER (X): Drill/Core Temperature Gradient Core Hole

6. UNIT AGREEMENT NAME: Mazama I

1b. WELL TYPE: PRODUCTION ( ) INJECTION ( ) HEAT EXCHANGE ( ) OBSERVATION ( ) WATER SUPPLY ( ) OTHER ( )

7. WELL NO.: MZI-11A*

8. PERMIT NO.:

1c. WELL STATUS:

9. FIELD OR AREA:

2. NAME OF LESSEE/OPERATOR: California Energy Company, Inc. (707) 526-1000

3. ADDRESS OF LESSEE/OPERATOR: 3333 Mendocino Ave., Ste. 100, Santa Rosa, CA 95401

10. SEC. T., R., B.& M.: SE¼,SW¼,Sec. 10 T31S, R7½E Willamette B & M

15. LOCATION OF WELL
At surface: Approx. 2,225 feet east and 725 feet north of the SW corner, Sec. 10, T31S, R7½E
At proposed prod. zone:

11. COUNTY: Klamath

16. DISTANCE FROM PROPOSED LOCATION TO NEAREST PROPERTY OR LEASE LINE: Approx. .43 miles SE of MZ I Unit boundary

12. STATE: Oregon

17. DISTANCE FROM PROPOSED LOCATION TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR ON THIS LEASE: Approx. .6 miles north of MZ I-11

13. APPROX. STARTING DATE: Sept. 1, 1986

14. ACRES ASSIGNED (WELL SPACING): N/A

18. DRILLING MEDIA AND CHARACTERISTICS: AIR (X) WATER ( ) MUD (X) FOAM ( ) Other ( )

19. PROPOSED DEPTH: MEASURED: 4000' TRUE VERTICAL:

20. ELEVATIONS: ESTIMATED (X) FINAL ( ) 6050'
REFERENCE DATUM: GR (X) MAT ( ) DF ( ) KB ( ) RT ( ) CASINGHEAD FLANGE ( ) OTHER ( )

21. EXISTING AND/OR PROPOSED CASING AND CEMENTING PROGRAM (List existing program first, followed by proposed program, and separate by a sufficient space to clearly distinguish the two programs)

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	COUPLING (Collars & Threads)	GRADE	SETTING DEPTH Top	SETTING DEPTH Bottom	QUANTITY OF CEMENT
Set 6-7' of	8-5/8" conductor pipe (optional).				Surf.	6-7'	To Surface
7-7/8"	4-1/2	11.5#	8RD ST&C	K55	Surf.	550'	To Surface

Drill out cement plug and resume drilling with 3.782 OD (HQ) wireline coring system. Reduce core size to 2.980 OD (NQ), as mandated by drilling conditions.

22. PROPOSED WORK SUMMARY

*Approximate Kettleman designation: 47-10.

See attached Proposed Drilling and Coring Procedure.

(Use additional space on reverse side of form)

23. James L. Moore

SIGNED James L. Moore — TITLE Senior Vice President Exploration — DATE 8/21/86

(This space for Federal use)

APPROVED BY Patrick W. Shelton — TITLE DEPUTY STATE DIRECTOR FOR MINERAL RESOURCES — DATE AUG 29 1986

CONDITIONS OF APPROVAL, IF ANY:

A permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.71; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

PROPOSED DRILLING AND CORING PROCEDURE

All drilling operations will conform with or exceed the safety and environmental protection requirements of the federal Geothermal Resources Operational Orders (GROs), stipulations of the Forest Service, and the Department of Geology and Mineral Industries' Laws and Administrative Rules Relating to Geothermal Exploration and Development in Oregon.

The proposed program for drilling and completion is outlined below. The 4-1/2" surface casing will be set and cemented in a 7-7/8" hole rotary drilled with either mud or air as prescribed by subsurface conditions. The remainder of the hole, 550'-4000'± will be drilled by using conventional wireline coring equipment. With this technique, two progressive reductions in hole size are permitted if 1-1/2" or 1-3/4" tubing is to be run for final temperature measurement. Previous recent drilling experience from the flanks of Newberry suggests that such a designed program should not have any significant difficulty in reaching the planned total depth.

Drilling Procedures

1. Prepare site and set 7'± of 8-5/8" conductor pipe with back-hoe and cement with Ready-Mix in a 5' x 5' x 7' deep cellar.

2. Move in and rig up a combination core and rotary rig.

3. Spud 7-7/8" hole and drill to 550'+ using a fresh water and gel drilling mud. Standby air drilling equipment will be part of the rig package to aerate the drilling mud if any serious lost circulation is encountered.

4. 4-1/2" casing will be run at 550' and cemented to surface by Halliburton. Surface casing is designed to exceed 10% of total depth.

5. Weld on casing head flange. Nipple up to 4-1/2" casing with a master valve and hydraulic operated annular B.O.P. Pressure test all equipment to 500 psi, with advance notification to USFS/BLM/DOGAMI to witness test.

6. Drill out cement plug to 2' below 4-1/2" casing shoe with HQ core bit.

7. Start wireline core drilling with 3.782' OD bit (HQ) reducing to 2.980 (NQ) as deemed necessary by drilling conditions.

8. At completion, run 1-1/2" or 1-3/4" tubing to total depth; fill w/water and cap.

9. Run periodic temperature surveys up to one year after completion.

10. After completion of temperature surveys, plug and abandon the hole in conformance with stipulations of the Forest Service, Federal GROs and DOGAMI's Laws and Administrative Rules relating to Geothermal Exploration and Development in Oregon.

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

LAKEVIEW DISTRICT OFFICE
P.O. Box 151 (1000 Ninth Street S.)
Lakeview, Oregon 97630

IN REPLY REFER TO:
3262

July 12, 1985

James L. Moore, Vice President, Exploration
California Energy Company
3333 Mendocino Ave., Suite 100
Santa Rosa, CA 95401

Dear Mr. Moore:

In order to clarify California Energy's responsibilities with respect to drilling and notification requirements and to mitigate your concerns regarding dual Federal/State requirements, a meeting was held on June 12, 1985, in Portland. The two BLM State I&E inspectors (Dennis Davis, Dennis Simontacchi), State Dept. of Geology and Mineral Industries inspector (Dennis Olmstead), and Jack Feuer and Bob Fujimoto of the BLM State Office were present.

At that meeting, it was decided that Dennis Simontacchi would be the main contact for operational activities. All required notifications relating to start-up, casing, cementing, BOPE testing, plugging and abandonment, and emergencies shall be directed to Simontacchi, or if he is unavailable, his alternate, Dennis Davis. Simontacchi will keep DOGAMI informed. California Energy shall submit all required completion and survey reports directly to each agency (BLM and State).

Attached is a list of conditions and stipulations that BLM and DOGAMI mutually developed. This list effectively unifies and coordinates federal and state requirements. In this way, state requirements are complied with, cooperation is enhanced, and the potential for duplication of effort is reduced. It should be noted that in addition to these stipulations, all operations must be conducted in accordance with:

a. Conditions of Approval for Geothermal Drilling (Approval for MZI-11a dated May 9, 1985)
b. Terms and conditions noted in the approval letter dated February 21, 1985, for the Plan of Exploration.
c. Special Lease Stipulations
d. Special design features noted in the Amended Environmental Assessment (EA OR 010-84-28)
e. The requirements set forth in the "California Energy Monitoring Plan" included in the plan approval Decision Document.

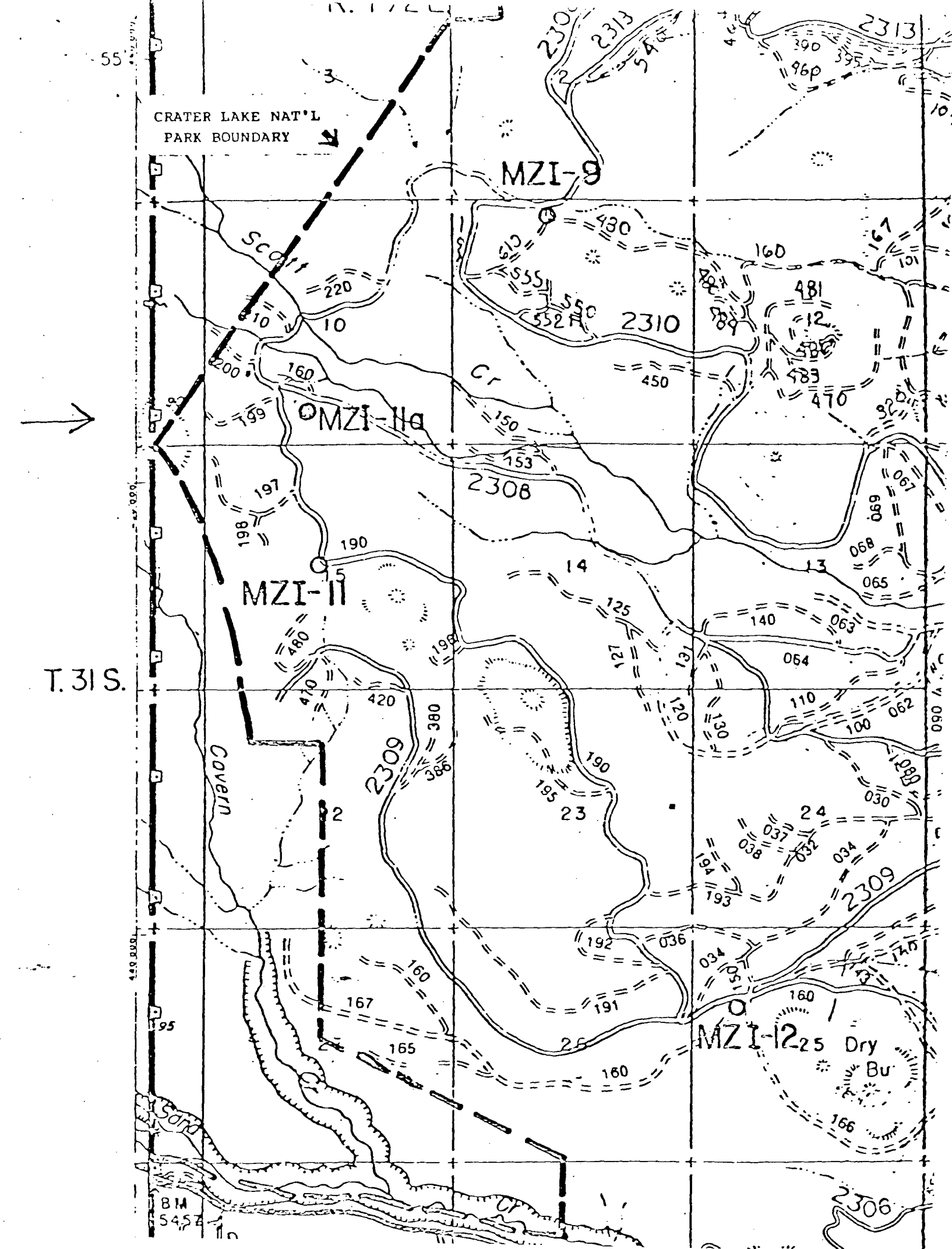
Hopefully, the attached list adequately addresses your concerns. If you have any questions, feel free to call Dennis Simontacchi at (503) 947-2177.

Sincerely yours,

Dick Harlow

Dick Harlow
Associate District Manager

cc w/attach:
Dennis Olmstead, DOGAMI
Dennis Davis, Prineville, BLM
Jack Feuer, OSO, BLM


CRATER LAKE NAT'L
PARK BOUNDARY
MZI-9
MZI-11
MZI-11a
MZI-12
Dry
Scott
Cr
Covern
2310
2309
2308
2306
T. 31 S.

IN REPLY REFER TO

3260 (920)
OR34669

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

OREGON STATE OFFICE
P.O. Box 2965 (825 NE Multnomah Street)
Portland, Oregon 97208

RECEIVED
MAY 15 1985
C.E.C.L

May 9, 1985

James L. Moore, Vice President, Exploration
California Energy Company
3333 Mendocino Ave., Suite 100
Santa Rosa, California 95401

Dear Mr. Moore:

In response to your letter of April 12, 1985, containing five (5) applications for Geothermal Drilling Permits, we have enclosed an approved permit for drill hole No. MZI-11A on Geothermal Lease No. OR 34669. Please note that the approval is subject to the attached conditions as well as those noted in our letter of approval (February 21, 1985), for the modified Plan of Exploration. As you know, we can permit up to four of the five wells under the approved Plan of Exploration; approval of additional wells would require an additional plan and subsequent approval.

Barring any unforeseen difficulties, we expect that approval of subsequent wells should proceed smoothly. The approval process will begin after we receive notification from you as to which hole you plan to drill next.

Thank you again for your past cooperation and we wish you well in your drilling and environmental protection efforts.

Sincerely,

Patrick H. Geehan

Patrick H. Geehan
Deputy State Director
for Mineral Resources

1. Enclosure
   Encl. 1 - Approved Geothermal Drilling Permit with Attached Conditions of Approval

Form 9-1957 UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No.

GEOTHERMAL DRILLING PERMIT

U.S. Geological Survey requires this form or other Supervisor approved form to be prepared and filed in triplicate with requisite attachments with the Supervisor. The Supervisor must approve this permit prior to any lease operation.

4. LEASE SERIAL NO.: OR 34669

5. SURFACE MANAGER: BLM ( ) FS (X) Other: Winema National Forest

6. UNIT AGREEMENT NAME: Mazama I

7. WELL NO.: MZI - 11A*

8. PERMIT NO.:

9. FIELD OR AREA:

10. SEC., T., R., B.& M.: SE¼,SW¼, Sec. 10 T31S, R7½E Willamette B & M

11. COUNTY: Klamath

12. STATE: Oregon

13. APPROX. STARTING DATE: July 1, 1985

14. ACRES ASSIGNED (WELL SPACING): NA

1. TYPE OF WORK: DRILL NEW WELL ( ) REDRILL ( ) DEEPEN ( ) PLUG BACK ( ) DIRECTIONALLY DRILL ( ) OTHER ( ): Drill/Core Temperature Gradient Core Hole

2. WELL TYPE: PRODUCTION ( ) INJECTION ( ) HEAT EXCHANGE ( ) OBSERVATION (X) WATER SUPPLY ( ) OTHER ( ): Temperature Gradient Core hole

3. WELL STATUS:

4. NAME OF LESSEE/OPERATOR: CALIFORNIA ENERGY COMPANY, INC. (707) 526-1000

5. ADDRESS OF LESSEE/OPERATOR: 3333 Mendocino Avenue, Suite100, Santa Rosa, CA 95401

6. LOCATION OF WELL At surface / At proposed prod. zone: Approx. 2,225 feet west and 725 feet north of the SW corner Section 10, T31S, R7½E

7. DISTANCE FROM PROPOSED LOCATION TO NEAREST PROPERTY OR LEASE LINE: Approx. .43 miles SE of MZ I Unit boundary

8. DISTANCE FROM PROPOSED LOCATION TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR ON THIS LEASE: Approx. .6 miles north of MZ I-II

15. DRILLING MEDIA AND CHARACTERISTICS: AIR (X) WATER ( ) MUD (X) FOAM ( ) Other ( )

16. PROPOSED DEPTH: MEASURED: 4000' TRUE VERTICAL:

17. ELEVATIONS: ESTIMATED (X) FINAL ( ): 6050'
REFERENCE DATUM: GR (X) MAT ( ) DF ( ) KB ( ) RT ( ) CASINGHEAD FLANGE ( ) OTHER ( )

18. EXISTING AND/OR PROPOSED CASING AND CEMENTING PROGRAM (List existing program first, followed by proposed program, and separate by a sufficient space to clearly distinguish the two programs)

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	COUPLING (Collars & Threads)	GRADE	SETTING DEPTH Top	SETTING DEPTH Bottom	QUANTITY OF CEMENT
Set 6-7'	of 8-5/8" conductor pipe (optional)				Surf.	6-7'	To Surface
7-7/8"	5-1/2"	14#	8RD ST&C	K55	Surf.	400±	To Surface

Drill out cement plug and resume drilling with 4.872" OD wireline coring system.

Reduce core size as mandated by drilling condition.

19. PROPOSED WORK SUMMARY

* Approx. Kettleman designation: 47-10

See attached drilling program.

(Use additional space on reverse side of form)

SIGNED: James J. Moore TITLE: Vice President Exploration DATE: April 12, 198

This space for Federal or State office use

APPROVED BY: Robert A. Bruce TITLE: Deputy State Director for Mineral Resources DATE: May 9, 1985

CONDITIONS OF APPROVAL, IF ANY:

See Attached Conditions and Requirements

This permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.71; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

BLM COPY

Drilling and Coring Procedure

1. Set 5'+ of 8-5/8" conductor pipe with back-hoe and cement with Ready-Mix in a 5' x 5' x ±7" deep cellar.

2. Move in and rig up a combination core and rotary rig. Approximate location size (100' x 60').

3. Spud 7-7/8" hole and drill to 400'+ using a fresh water and gel drilling mud. Standby air drilling equipment will be part of the rig package to aerate the drilling mud if any serious lost circulation is encountered.

4. 5-1/2" casing will be run at 400' and cemented to surface with Halliburton.

5. Weld on casing head flange. Nipple up to 5-1/2" casing with a master valve and hydraulic operated annular B.O.P. Pressure test all equipment to 500 psi, with advance notification to BLM to witness test.

6. Drill out cement plug to 2' below 5-1/2" casing shoe with 4-3/4" bit.

7. Start core drilling with 3.345" ID x 4.872" OD wireline coring system. Reduce core size as mandated by drilling conditions.

8. At completion, run 1-1/2" tubing to total depth; fill w/water and cap.

9. Run periodic temperature surveys up to six months after completion.

10. After completion of temperature surveys, plug and abandon the hole in conformance with federal Geothermal Resources Operational Orders.

All surface casing design will exceed 10% of total depth.

The proposed program calls for drilling 7-7/8" hole with mud, aerated mud, or air (depending on subsurface conditions encountered) to 400+ feet and cementing 400' of 5-1/2" casing to surface with "Halliburton". The remainder of the hole will be cored. Coring provides better geological information, requires less drilling fluid (lowering potential for "washing out" in highly fractured or unconsolidated rocks), and increased flexibility in protective casing strings. The "nesting" characteristics of mining-type coring equipment allows us to reduce hole size three times, providing for maximum safety and enhanced ability to reach the planned depth.

RAP:lat:42
4/1/85

1. Blowout Prevention Equipment (BOPE)

a. Blowout Prevention Equipment and auxilary support equipment shall be properly installed, frequently tested and shall at least include either annular BOPE and full opening gate valve or pipe ram/blind ram BOPE, acceptable to the Authorized Officer.

b. A kill line shall be installed below the BOPE, leading directly to the mud pumps, and be fitted with a valve through which cement could be pumped, if necessary.

c. A choke line with an adjustable choke shall be installed below the BOPE. The choke line shall be placed in such a manner as to permit containment of displaced fluids and to minimize any safety hazard to personnel. (Properly tied down at the ends and bends).

d. BOPE shall have manually operated gates and hydraulic actuating systems and accumulators of sufficient capacity to close all of the hydraulically-operated equipment and have a minimum pressure of 69 bars (1,000 p.s.i.) remaining on the accumulator. Dual control stations shall be installed with a high pressure (N_2) backup system. One control panel shall be located at the driller's station and one control panel shall be located, on the ground at least 15 meters (50 feet) away from the wellhead.

e. The BOPE shall be pressure tested when installed, and immediately following any repairs or operations that require disconnecting a pressure seal in the assembly. BOPE shall be tested to 500 p.s.i. with no more than a 10% decrease in pressure for 30 minutes. In the event that a pressure test cannot be conducted following the reconnection of a pressure seal, the BOPE shall be actuated to test for proper functioning.

During drilling operations, BOPE shall be actuated to test proper functioning as follows:

(1) Once each trip for blind and pipe rams but not less than once each day for pipe rams; and
(2) At least once each week on the drill pipe for expansion-type preventers, and at least once each week for full opening gate valve.

f. Related Well Control Equipment. A full opening drill string safety valve in the open position shall be maintained on the rig floor at all times while drilling operations are being conducted.

Prior to core drilling, a test shall be conducted to determine if the hydraulic chuck will be adequate for shutting in the well should problems arise during core retrieval. If not adequate, a drill pipe safety valve or wireline BOP will be required.

2. Surface Casing

The plan of operations and drilling permit call for 400 feet of surface casing to be cemented to the surface. If it becomes necessary to set more than 400 feet of surface casing, the bottom hole temperature shall be taken, and before deepening the hole, the Authorized Officer shall be contacted for concurrence. Remedial cementing will be required if the original cementing job is not adequate.

3. Hydrogen Sulphide Detectors

A strategically placed and properly functioning hydrogen sulphide (H2S) indicator and alarm system shall be emplaced at the drill site. This must include: a. At least two H2S detectors with audio and visual alarms set no higher than 20 ppm and preferably at 10 ppm. b. At least one windsock type streamer prominently ad strategically placed to display wind direction.

4. Temperature Monitoring and Mud Requirements

a. During drilling operations, inlet and outlet temperatures shall be recorded either hourly or at 30 ft (9M) intervals.

b. When drilling without returns, the bottom hole temperature (BHT) shall be recorded at a minimum of 100 ft (30m) intervals. Should the BHT reach 125 degrees F (52 degrees C) and later 175 degrees F (79 degrees C), the recording intervals shall be increased to 50 ft (15m) and 30 ft (9m) respectively. (Actual required intervals may be slightly shorter or longer, to coincide with core runs).

c. If a 175 degree F (79 degree C) circulating temperature is reached while drillig, further drilling shall stop immediately and the hole will be either:
   (1) Equipped with mud cooling equipment to maintain the return flowline temperature at or below 175 degrees F (79 degrees C). If approved by the Authorized Officer, drilling may then be resumed;
   (2) Completed as an observation hole by cementing steel tubing from total depth to surface; or
   (3) Abandoned by cementing from total depth to surface.

d. If a 212 degree F (100 degree C) BHT is reached while drilling without returns, the lessee shall immediately stop drilling and the hole will then be either completed as in C(2), abandoned as in C(3), or if approved by the Authorized Officer the hole may be deepened if an adequate supply of cold water to pump downhole to prevent flashing is maintained on-site. The amount of water will be determined during drilling, when the water losses are better known. At a minimum, 2000 gallons of cold water, and means to replenish this supply must be maintained on-site.

e. High/low mud pit level indicators will not be required if mud pits can be visually monitored by driller during drilling operations. Desilters and desanders are not required.

5. Witnessing BOPE Testing and Cementing Jobs

The Authorized Officer shall be given the opportunity to witness all BOPE pressure tests, and cementing jobs. At least a 24 hour notice will be given prior to actual cementing and BOPE pressure testing.

6. Reports

All drilling completion, temperature and other downhole survey reports and logs, lithology, depths of any waters encountered, and drill hole location, shall be submitted in duplicate to the Authorized Officer, and to the Oregon Dept. of Geology and Mineral Industries within 30 days of reaching total depth. Subsequent temperature logs are due 30 days after logs are run. The abandonment report is due 30 days after abandonment.

7. Plugging and Abandonment

The downhole abandonment program must be designed and implemented to prevent interzonal migration of fluids. If no problems are evident, final abandonment may be done by placing a 50 ft. (15m) cement plug across the shoe of the casing and plugging the hole with cement from 10 ft (3m) to the surface.

8. Modifications in Plan of Operations/Drilling Permit

Any proposed modifications in the proposed plan of operations and/or drilling permit with respect to approved operations, approved casing, cement, BOPE, and other equipment, shall be submitted to the Authorized Officer for approval. Adequate lead time should be given so that operations can resume as soon as possible.

Conditions of Approval for Geothermal Drilling

Permit NO. OR-920-85-WN-001
Well No. MZI-11A
California Energy Company, Inc.
Federal Lease OR 34669
Winema National Forest-Mazma I Unit
Klamath County, Oregon

General - This hole is for determining a temperature gradient and cannot be used to produce or physically test geothermal resources.

Unless otherwise directed by the Authorized Officers, Deputy State Director for Minerals/District Manager or their designated representative.

1. All operations must be conducted in accordance with:

   a. Terms and conditions noted in the approval letter dated February 21, 1985, for the Plan of Exploration.
   b. Special Lease Stipulations
   c. Special design features noted in the Amended Environmental Assessment (EA OR 010-84-28)
   d. The requirements set forth in the "California Energy Monitoring Plan" included in the plan approval Decision Document. (enclosed)

2. A copy of this permit No. OR-920-84-WN-001 with attached conditions, GRO orders and approved drilling program with all subsequently approved amendments (Sundry Notices) shall be retained at the well site for reference.

3. The authorized officer or her/his designated representative shall be afforded an opportunity to witness any well test. Contact can be made as noted in item 20 below.

4. Variances from the approved Plan of Exploration or well program must be approved in advance by the Authorized Officer or his/her representative.

5. The Authorized Officer shall be contacted prior to actual entry onto the land.

6. Drilling fluids or cuttings shall not be discharged onto the surface where such discharge will contaminate lakes and perennial or intermittent streams.

7. Blowout Prevention Equipment (BOPE) and auxilary support equipment shall be properly installed, frequently tested and shall at least include either annular BOPE, annular BOPE and full opening gate valve, or pipe ram/blind ram BOPE, acceptable to the Authorized Officer.

8. A kill line shall be installed below the BOPE, leading directly to the mud pumps, and be fitted with a valve through which cement could be pumped, if necessary.

9. A blow-down line shall be installed below the BOPE. The blow-down line shall be placed in such a manner as to permit containment of displaced fluids and to minimize any safety hazard to personnel. (Properly tied down at the end and at bends.)

10. An adequate supply of drilling fluid and materials shall be at the drill site to cure any significant lost circulation problems which may be encountered.

11. A strategically placed and properly functioning hydrogen sulphide (H2S) indicator and alarm system shall be emplaced at the drill site. This must include: a. At least two H2S detectors with audio and visual alarms set no higher than 20 ppm and preferably at 10 ppm. b. At least one windsock type streamer prominently and strategically placed to display wind direction.

12. During drilling operations, inlet and outlet temperatures shall be recorded either hourly or at 30 ft (9m) intervals.

13. When drilling without returns, the bottom hole temperature (BHT) shall be recorded at a minimum of 100 ft (30m) intervals. Should the BHT reach 125 degrees F (52 degrees C) and later 175 degrees F (79 degrees C), the recording intervals shall be increased to 50 ft (15m) and 30 ft (9m) respectively.

14. If a 175 degree F (79 degree C) circulating temperature is reached while drilling, further drilling shall stop immediately and the hole will be either:

a. Equipped with mud cooling equipment to maintain the return flowline temperature at or below 175 degrees F (79 degrees C). If approved by the authorized officer, drilling may then be resumed;
b. Completed as an observation hole by cementing steel tubing from total depth to surface; or
c. Abandoned by cementing from total depth to surface.

15. If a 212 degree F (100 degree C) BHT is reached while drilling without returns, the lessee shall immediatly stop drilling and the hole will then be either completed as in 14 b. or abandoned as in 14 c., or if approved by the Authorized Officer the hole may be deepened.

16. Throughout the duration of drilling operations, drilling reports to the Authorized Officer shall be made on Tuesday and Friday mornings before 8:30 AM. The reports should include bottom hole depth, and significant temperatures encountered, e.g. in and out-flow temperatures, last bottom hole temperature, if drilling without returns, the last few temperatures taken and any significant general information, problems or unusual encounters. It will be phoned in to Dennis Simontacchi in the BLM Lakeview District Office (see

item 20 for phone numbers) or, if unavailable, his alternate.

17. The downhole abandonment program must be designed and implemented to prevent interzonal migration of fluids. If no problems are evident, final abandonment may be done by placing a 50 ft. (15m) cement plug across the shoe of the casing and plugging the hole with cement from 10 ft (3m) to the surface.

18. Excavated pits or sumps used during drilling shall be backfilled as soon as practicable and restored to conform with the original topography.

19. Reporting requirements after completion of drilling operations are as follows:

All reports are to be submitted to the BLM Deputy State Director for Mineral Resources, P.O. Box 2965, Portland, Oregon 97208. Duplicate copies of any temperature data, logs, or other downhole surveys must be submitted within 30 days after the operation is completed. A completion report shall be submitted in duplicate within 30 days after all operation sites are abandoned. The report shall contain a copy of the approved Geothermal Drilling Permit; and the following information for the hole drilled:

a. A final hole designation and location;
b. A driller's log noting the depths to the water table and other water aquifers, and to any other mineral deposits (salt, coal, etc.) encountered;
c. The method of completion, including cementing, and casing or tubing used with wellhead components. The completion method may be presented by engineering drawings;
d. Complete details of the abandonment procedures;
e. Any information on drilling difficulties or unusual circumstances encountered which would be helpful in assuring future safety of operations or protection of the environment in the area concerned; and
f. Temperature data and logs for the hole surveyed, if not previously submitted in writing.

20. In case of emergency, call the following designated representative:

a. Dennis Simontacchi, Inspector, Lakeview — Day (503) 947-2177, Night (503) 947-2355
b. Dennis Davis, Inspector, Bend — Day (503) 447-4115, Night (503) 382-3440
c. Jerry Asher, District Manager, Lakeview — Day (503)947-2177, Night (503) 947-2482
d. Pat Geehan, Deputy State Director for Mineral Resources, Portland — Day (503) 231-6812, Night (503) 654-5166

GEOTHERMAL RESOURCES
OPERATIONAL ORDERS

Issued under the Geothermal Steam Act of 1970

(DRAFT) GRO Order 5. Plans of Operation, Permits, Reports, Records and Forms

United States Department of Interior
Geological Survey
Office of Deputy Conservation Manager,
Geothermal

August 1980

TABLE OF CONTENTS

Page

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOTHERMAL RESOURCES OPERATIONAL ORDER NO. 5

Effective _____

PLANS OF OPERATIONS, PERMITS, REPORTS, RECORDS, AND FORMS

AUTHORITY: This order is established pursuant to the authority prescribed in 30 CFR 270.11 and 270.12.

INTRODUCTION: This order contains information about plans, permits, reports, records, and forms required for geothermal operations conducted on Federal leases. Additional information not detailed in this order may be required by the Deputy Conservation Manager in support of required data. The former title "Area Geothermal Supervisor" (Supervisor) was changed in May, 1980, to Deputy Conservation Manager - Geothermal, and will be referred to herein as the "Deputy Conservation Manager" or "DCM". Written approval by the Deputy Conservation Manager must be received before commencing any activities other than casual use. However, emergency actions that involve an immediate need for protection of personnel, the public, or the environment may be taken without prior approval, provided that the DCM is promptly notified.

The requirements of this order apply to operations proposed by lessees

on Federal geothermal leases including lands with private surface ownership and Federal mineral ownership, and Federal lands committed to a Federal unit. Utilization facility construction on leased lands with private surface ownership is not subject to the provisions of this order. State and private lands committed to a Federal unit are subject to the provisions of this order only if the responsible State agency is agreeable to Federal regulatory control.

HOW TO SUBMIT INFORMATION: Six copies of plans and permit applications must be submitted; reports and records resulting from operations must be submitted in duplicate. Any proprietary information should be so designated and included in a manner which allows it to be easily separated from the non-proprietary portion. Information which may be considered proprietary by the DCM includes, but is not necessarily limited to, geological, geophysical, reservoir and financial data, interpretations of such data and trade secrets. All non-proprietary information submitted shall be available for inspection under the Freedom of Information Act. Information which has been previously submitted need not be resubmitted, but must be properly cross-referenced. All maps submitted with a plan or permit application should be on readily reproducible transparencies. Consolidation of information and cooperation with other lessees is encouraged to avoid duplication. Copies of USGS forms to be used to submit various information are appended to this order. Lessees or operators are encourged to consult with the DCM prior to preparation of plans of operations or applications for permits to conduct operations.

WHERE TO SUBMIT: Unless otherwise directed, all required plans, applications, and information should be submitted to the Deputy Conservation Manager - Geothermal, 345 Middlefield Road, Mail Stop 92, Menlo Park, CA 94025, telephone (415) 323-8111, Ext. 2841.

PLANS OF OPERATIONS (POO)

Orderly development of a geothermal resource involves six major phases. These phases shall be covered in the Plan of Exploration, Plan of Baseline Data Collection, Plan of Development, Plan of Injection or Disposal, Plan of Utilization, and Plan for Production. Plans may be submitted separately or combined. A plan will also be required for any subsequent operations involving major surface disturbance in addition to that approved under a previous plan. Plans must be approved by the DCM and surface manager(s) before permits which authorize commencement of activities can be issued. A plan may not be approved without receipt of a satisfactory cultural resource report and approval of an Environmental Assessment. A copy of the approved plan and any special conditions of approval must be available at the worksite.

Exhibit 1 specifies information applicable to all plans of operation except for the Plan of Baseline Data Collection. Exhibit 2 is a flow diagram presenting a representative exploration program from lease issuance through resource utilization, and shows necessary application and regulatory procedures. Exhibit 3 presents the necessary applications and permits required to perform various exploration and development activities. In Exhibit 2 and 3 processing times are representative and are based on the applicant's initial submittal of all required information and where no unusal problems develop.

PLAN OF EXPLORATION (POE)

Exploration drilling to determine the existence, extent, quality, and commercial potential of a geothermal resource must be covered in a Plan of Exploration. However, activities which involve the search for evidence of the geothermal resource without major surface disturbances may not require approval of a plan. Activities not requireing a plan may be permitted by a Geothermal Exploration Permit. (See "Geothermal Exploration Permit" section, below).

WHEN TO SUBMIT: A Plan of Exploration must be submitted and approved prior to commencing exploration drilling which involves major surface disturbances and the drilling of holes to test or produce the resource. A plan may also be required for temperature gradient hole drilling in areas where harazardous subsurface geologic conditions are known or suspected or where the resource may be encountered.

REQUIREMENTS: The Plan of Exploration must include all information shown as Exhibit 1. It may cover a multiwell drilling program or just specific operations on localized portions of the lease; however, submittal of a broad plan proposing serveral drill sites or several alternatives to an activity is recommended. For multiwell or multisite programs, it is important to submit area-wide geological, geophysical, hydrological, and other environmental data.

ASSOCIATED APPROVALS: Approval of the Plan of Exploration does not authorize the lessee to initiate activities. Authorization is issued by the DCM by approval of:

1. USGS Form 9-1957, Geothermal Drilling Permit, or

2. USGS Form 9-1958, Geothermal Sundry Notice

(See "Geothermal Drilling Permit" and "Geothermal Sundry Notice" sections, below.)

APPLICABLE REFERENCES: 30 CFR 270.34 and Section 18 of lease Form 3200-21.

PLAN OF BASELINE DATA COLLECTION (PBDC)

Before submitting a Plan of Production, the lessee must collect environmental data for a period of at least one year. The data will be used to establish environmental baselines for the assessment of the effects of later production and utilization. Data shall be collected in accordance with an approved plan of baseline data collection. In areas where more than one lessee intends to produce the geothermal resource, lessees are encouraged to submit a cooperative plan.

WHEN TO SUBMIT: The baseline data collection program should begin as soon as a potentially producible resource has been identified. To ensure acceptability of the data gathered, it is recommended that the Plan of Baseline Data Collection be submitted and approved prior to any new data collection.

REQUIREMENTS: The Geothermal Environmental Advisory Panel (GEAP) has published a report, "Guidelines for Acquiring Environmental Baseline Data on Federal Geothermal Leases" (U.S. Department of the Interior, January, 1977), which can be obtained from the DCM. (These guidelines will be in lieu of Exhibit 1 requirements). The plan of baseline data collection shall describe how baseline data will be collected and the

frequency of reporting. The format of the plan will follow that suggested in the GEAP guidelines.

A final report covering the results of the entire study is to be submitted at the completion of the data collection period. The final report should contain a discussion of which parameters should be subsequently monitored and which shall be deleted and why. This applies to all parameters covered in the report, whether measured by the operator or his contractor or previously measured and included by reference in the report of baseline data. The DCM may require additional reporting in cases where usual reporting and interpretation are not adequate.

ASSOCIATED APPROVALS: The joint approval letter of the Plan of Baseline Data Collection will constitute a permit to proceed with the plan.

APPLICABLE REFERENCES: 30 CFR 270.34(k) and "Guidelines for Acquiring Environmental Baseline Data on Federal Geothermal Leases" (Geothermal Environmental Advisory Panel, U.S. Department of the Interior, January, 1977).

PLAN OF DEVELOPMENT (POD)

After the exploration phase, all additional drilling and construction (excluding utilization facility construction) which is necessary for initiation of commerical production must be covered in a Plan of Development.

WHEN TO SUBMIT: The Plan of Development should be prepared after determining the extent, characteristics, and performance of the reservoir and before full-scale subsurface and surface development of the resource for

commercial utilization. It may be combined with the Plan of Injection or Disposal and/or the Plan of Utilization, to expedite processing.

REQUIREMENTS: The Plan of Development must contain all appropriate information shown as Exhibit 1. It should also include:

1. Topographic Map (preferred scale 1:24,000, but not less than 1:63,360) showing:

   Location and spacing of all existing and proposed production and injection wells (distinguished by type) and their connecting pipelines and surface production and injection facilities; and location of the utilization facility.

2. Justification (using geologic and geophysical maps, cross sections, and other pertinent data) for the proposed location and spacing of wells including information about:

   a. Reservoir characteristics: Areal extent, thickness, geologic structure, lithology, temperatures, pressures, water analyses, enthalpy, porosities, permeabilities, etc.

   b. Reservoir performance characteristics: Productive area, producibility, and anticipated future performance.

   c. Hydrologic and geologic conditions.

   d. Methods to be used to prevent drainage of other lessees' geothermal resource and minimize interference with other land uses.

3. Representative Drilling Program describing:

   Drilling procedures; type of drilling equipment; zone of completion; casing, cementing, and mud programs; and safety provisions.

4. Downhole Production and Injection Equipment (operational description or drawings, capacities, etc.).

5. Surface Production Equipment Installations (pipelines, separators, metering systems, transmission lines, etc.): Operational descriptions or drawings, capacities, safety provisions, etc.

ASSOCIATED APPROVALS: Approval of the Plan of Development does not authorize the lessee to commence development operations. Authorization is issued by the DCM by approval of:

1. USGS Form 9-1957, Geothermal Drilling Permit, or
2. USGS Form 9-1958, Geothermal Sundry Notice.

(See "Geothermal Drilling Permit" and "Geothermal Sundry Notice" sections, below.)

APPLICABLE REFERENCES: 30 CFR 270.34. GRO Orders 2, 6, and 7

PLAN OF INJECTION OR DISPOSAL (POI)

Liquid well effluent must be disposed of in conformance with regulatory requirements. Injection may be required for subsidence control or reservoir recharge. The injection or disposal of geothermal effluent and associated byproducts must be covered by a Plan of Injection or Disposal.

WHEN TO SUBMIT: The Plan of Injection or Disposal may be submitted at the same time and in combination with the Plan of Development and the Plan of Utilization, to expedite processing.

REQUIREMENTS: The Plan of Injection or Disposal must include appropriate

Items of information shown as Exhibit 1. In addition, a plan of waste disposal by injection must include documents 1, 2, 3, 10, and 11 below, and discussion of remaining items:

1. Topographic Map (preferred scale 1" = 1000'), showing all existing and proposed wells (distinguished by type), pipelines, and surface production, injection, and utilization facilities.

2. Subsurface Maps and Cross Sections showing structure and lithology of producing and injection zones.

3. Logs and Histories of wells penetrating the injection zone, if not previously submitted.

4. Injection Zone Characteristics: Volume capacity, geologic formation and structure, porosity, permeability, static formation pressures and temperatures, chemical analysis of zonal fluids and their anticipated reactivity with injected fluids, information about injectivity tests conducted and previous injection operations into the same or similar formations, etc.

5. Injection Fluid Characteristics: Quantity, source, chemical analysis and reactivity, toxicity, temperature, etc.

6. Hydrology, including:

   Quantity and analyses of ground water and predicted effects of injection on surface and ground water.

   Identify existence (or lack) of fresh drinking water aquifers. If present,

address how these aquifers will be protected in compliance with applicable regulations.

7. Local Tectonic Conditions and predicted seismic effects of injection.
8. Available Subsidence Data and the discussion of implications of the injection on subsidence control.
9. Proposed Drilling Programs describing:

   Type of drilling procedures and equipment; zone of completion; casing, cementing, and mud programs; and safety provisions.
10. Downhole Production and Injection Equipment (operational drawings, capacities, etc.).
11. Injection Facilities, Pipelines and Metering Equipment: Engineering design plans and descriptions detailing system capabilities, capacities and safety control devices which will demonstrate pollution prevention requirements of GRO Order No. 6.
12. Injectivity Surveys and other means to monitor injection activities.

A plan for waste disposal (including solid and liquid byproducts) by means other than injection must include:

1. Disposal Facilities (equipment with flowline drawings).
2. Processing, Treatment, and Disposal Methods.
3. Waste Volume.
4. Hydrology, including:

   Location and quality of surface and ground water and in particular, existing or potential fresh drinking water aquifers, which may be affected and their chemical compatibility with waste liquids; chemical analyses and reactivity of all fluids; and methods for maintaining

separation of waste from natural water systems. If fresh drinking water acquifers underlie the disposal area, it must be clearly shown that the disposal system will be in compliance with all applicable regulations and standards protecting such drinking water sources.

5. Monitoring and Recordkeeping Methods.

ASSOCIATED APPROVALS: Approvals of the Plan of Injection or Disposal does not authorize the lessee to perform disposal operations. Authorization is issued by the DCM by approval of:

1. USGS Form 9-1957, Geothermal Drilling Permit, or
2. USGS Form 9-1958, Geothermal Sundry Notice.

(See "Geothermal Drilling Permit" and "Geothermal Sundry Notice" sections, below.)

APPLICABLE REFERENCES: 30 CFR 270.41 and Section 9 of GRO Order No. 4.

PLAN OF UTILIZATION (POU)

Any utilization facility construction, and utilization and transmission of the resource products must be covered in a Plan of Utilization which the facility operator must prepare.

WHEN TO SUBMIT: A Plan of Utilization must be submitted prior to constructing either electric or direct use geothermal resource utilization facilities on a Federal lease. When surface rights and mineral rights are separated (e. g., Stock Raising Homestead Act lands), the lessee should consult with the DCM, on a case-by-case basis, as to whether a Plan of

Utilization will be required. To expedite preparation and processing, the plan may be submitted either separately or in combination with the Plan of Development and the Plan of Injection or Disposal.

REQUIREMENTS: The Plan of Utilization should present a general overview of the proposed facility and its operation. Detailed engineering design plans and specifications for actual construction should be submitted with the Geothermal Utilization Permit application. Certain requirements of this part may be waived or modified when the DCM determines such requirements are not necessary for the proper consideration of the Plan of Utilization (e. g., individual well site generators, small scale direct use facilities). Operators are urged to contact the DCM for guidance in such situations. The Plan of Utilization should include the appropriate information shown in Exhibit 1 and the following:

1. Information about proposed structures, equipment, and support facilities, including:
   a. Topographic map (preferred scale 1:6000 in lieu of item 2a, Exhibit 1, showing:
      . Facilities and production and injection wells (distinguished by type), power transmission lines, Federal and private lease boundaries and serial numbers, existing and planned access roads, source of road building materials and other pertinent features.
   b. Description, purpose and operation procedures for each facility or important components of the facility.
   c. Schematic flow diagram of the important components of each facility.
   d. Plan of proposed architectural landscaping.

e. Time Schedule for installation and start-up of the facility, including designing of the plant, acquiring materials, construction, and prestart-up testing.

f. Number of Personnel necessary to operate the facilities.

g. Schedule for testing and maintaining safety devices.

2. Facility-Site Suitability Studies conducted and planned, including reports, logs, laboratory reports, and raw data obtained from geological, geotechnical and soil bearing surveys.

3. Water Supplies: Source, quality, consumption rate, and planned use.

4. Disposal Methods for waste water, solid wastes, and noncondensible gases, other than these covered in a Plan of Injection.

5. Narrative Statement (in lieu of Item 3, Exhibit 1) containing: Measures to prevent or control fires, pollution of surface and ground water, air and noise, pollution, hazards to public health and safety, and damage to fish, wildlife, natural resources, and areas of cultural, historical, or archeological value.

6. Program for monitoring operations to assure compliance with noise, air, hazardous wastes, and water quality standards and regulations. The monitoring program shall complement the program presented in the Plan for Production. (See "Plan for Production" section, below.)

7. Abandoment and Reclamation Procedures.

8. Any additional data the DCM may require in support of the Plan of Utilization.

ASSOCIATED APPROVALS: Pursuant to 43 CFR 3250 permanent electrical power generation facilities of any capacity (other than a facility for an individual production well) will require issuance of a land use license by the Bureau of Land Management. Research and demonstration projects (non-electric or electric power generation facilities) of not more than 20 megawatt (MW) net capacity will not require a Bureau of Land Management land use license, unless retained for commerical operation beyond an initial five-year period. All of the above will require approval of a Geothermal Utilization Permit. Approval of the Plan of Utilization does not authorize the lessee to initiate construction and operation of utilization facilities. Authorization will be issued by the DCM by approval of:

1. USGS Form 9-1968, Geothermal Utilization Permit, and if necessary
2. USGS Form 9-1958, Geothermal Sundry Notice.

(See "Geothermal Utilization Permit" and " Geothermal Sundry Notice" sections, below.)

APPLICABLE REFERENCES: 30 CFR 270.2, 30 CFR 270.34-1, and 43 CFR 3250

PLAN FOR PRODUCTION (PFP)

Production procedures, monitoring, and any operations to be conducted after completion of drilling, construction, and installation of all wells and facilities needed to commence commercial production must be covered in a Plan for Production.

WHEN TO SUBMIT: The Plan for Production must be submitted and approved prior to initiating production for commercial utilization (except

for approved test period) of the geothermal resource.

REQUIREMENTS: The Plan for Production must contain appropriate items of information shown in Exhibit 1, unless previously submitted, in which case they may be referenced. It must also include:

1. Proposed Policy on rates of production, commingling, use of byproducts, remedial work, infill drilling, maintenance, shutdown and start-up, etc.
2. Data to be collected (pressures, temperatures, etc.) and methods to be used for determining and evaluating past and predicting future reservoir performance. The DCM may require scheduled reports and/or reviews of reservoir performance throughout the life of the project.
3. Details of the methods of calculating Federal royalty.
4. Sales contracts or any other agreements not previously submitted.
5. Monitoring Program for noise, air and water quality, seismic and land subsidence activity, and the ecological system other than (or in conjunction with) that covered under the Plan of Utilization.

ASSOCIATED APPROVALS: Before submission of a Plan for Production, the lessee must collect environmental data for a period of at least one year. A Plan of Baseline Data Collection should be submitted and approved prior to any data collection. The collected data must be submitted for approval in a baseline data report before or with the Plan for Production. (See "Plan of Baseline Data Collection" section, above and "Baseline Data Report" section, below.) In addition to an approved Plan for Production, an appropriate permit and plan of operation may be required before commencing various post-development

activities. (See "Geothermal Sundry Notice and Geothermal Drilling Permit sections, below.)

APPLICABLE REFERENCES: 30 CFR 270.34.

P E R M I T S

GEOTHERMAL EXPLORATION PERMIT

A permit is required for any exploration operations on Federal lands which involve the search for evidence of geothermal resources, such as geophysical surveys and drilling and coring of temperature gradient holes. A permit is not required for casual use exploration activities, however.

For exploration activities on unleased lands, or lands leased to other than the applicant, the exploration permit is issued by the appropriate surface management agency (either Bureau of Land Management or Forest Service).

For exploration activities on lands under lease to the applicant, a Geothermal Exploration Permit must be obtained from the DCM. A Geothermal Exploration Permit may only be used to permit activities not connected with an approved plan of operation. In addition to the above activities the permit may be required for the brushing of roads and off-road vehicle use associated with exploration activities, and may also be required for geotechnical site suitability studies.

WHEN TO SUBMIT: A permit application must be filed and approved prior to initiating any exploration operations.

REQUIREMENTS: To obtain a permit, the lessee must submit;

1. USGS Form 9-1956, Geothermal Exploration permit.
2. Brief Explanation of Proposed Operations.
3. Topographic Map (preferred scale 1:24,000, but not less than 1:63,360) showing the lease boundaries and serial numbers and proposed station points, drill sites, access roads, etc..
4. Description of Proposal, including the information required by GRO Order No.1.
5. Certified Statement of the presence or absence of any cultural, historical, or Native American religious site which may be disturbed by proposed surface disturbing activities, e.g. temperature gradient hole drilling. The statement must be made by a person acceptable to the surface manager, and copies must be submitted to the surface manager and DCM.

ASSOCIATED APPROVALS: A plan is not required to permit exploration operations; however, an approved Plan of Exploration may be required for certain activities, such as deep gradient holes where a potentially hazardous geologic environment is suspected, where the resource may be encountered, or where significant surface disturbance may be necessary for site access or preparation. (See "Plan of Exploration" section, above.) Site suitability surveys involving trenching or road construction in preparation for the submittal of a Plan of Operation require approval by the DCM and concurrence by the surface manager. Such site suitability surveys may be obtained via a Geothermal Exploration Permit. An exploration permit expires one year from the date of issue. All operations must be

completed and abandoned within that time, unless a written request for an extension is approved by the DCM.

APPLICABLE REFERENCES: 30 CFR 270.2, 30 CFR 270.78, GRO Order No.1, and Section 18 of Lease Form 3200-21.

GEOTHERMAL DRILLING PERMIT

A geothermal drilling permit is required for each well drilled to determine the presence of, test, develop, produce, or inject the geothermal resource. An approved copy of Form 9-1957 and the drilling program, with any special stipulations or conditions of approval, must be available at the worksite during operations.

WHEN TO SUBMIT: A permit application must be filed and approved prior to drilling, redrilling, deepening, or plugging back wells. Necessary access road construction and drill site preparation may be authorized by the Drilling Permit or by separate Sundry Notice. The application may be filed at the same time as any plan which proposes drilling, to expedite processing. However, the Drilling Permit will not be approved until such plan has been approved.

REQUIREMENTS: To obtain approval for drilling, the lessee must submit:

1. USGS Form 9-1957, Geothermal Drilling Permit
2. Detailed Drilling Program, including:
   a. Chronological description of drilling plans indicating depths, hole sizes, tests, logging runs etc.

18. b. Blowout prevention equipment. Include:

A drawing showing installation, types, rating, landing heads, and auxiliary equipment for each stage of drilling; proposed accumulator and backup systems; and testing procedures (including advance notification of USGS for witnessing).

c. Casing: Size, weight, grade, condition, design criteria (safety factors, including burst, collapse, tension, and thermal stress allowances), couplings, proposed landing depths and perforated intervals, number and size of perforations or slots, and pressure testing procedures (including advance notifications of USGS for witnessing).

d. Cement: Quantities, type, additives, desired fill, excess to be used, and testing or recementing procedures to insure desired fill and cement bond.

e. Directional measurements to be taken. If the well is to be directionally drilled, include plan and profile drawings and coordinates or bearing to projected hole bottom.

f. Circulating media: Type, additives, cooling measures, reserve supplies kept onsite, toxicity and protective measures for any toxic materials, and noise and dust control procedures for air drilling.

g. Completion wellhead: Manufacturer, type, design specifications (pressure and temperature ratings, etc.), and drawing showing wellhead, valve assembly with auxiliary outlets, etc. Use API recommended nomenclature.

h. Formation evaluation: Proposed methods and tools for coring,

and mud and borehole logging.

i. Drilling hazards: A brief summary of previous drilling experience in the immediate area. Description of suspected zones of severe lost circulation, high gas or water pressure, hydrogen sulfide gas, etc., and safety equipment to handle any hazards.

j. Drilling equipment: Type and capacity rating of rig, pumps, and accessory equipment.

k. Production testing: Details about surface piping and facilities, measurement of flow rates and temperatures, fluid sampling, and containment or disposal.

l. Abandonment: Proposed abandonment procedures compliant with GRO Order No. 3.

3. Plat: A plat (scale not less than 1:24,000) shall accompany each application to drill a new well. The plat shall show the surface and expected bottom hole locations and the distances from the nearest section or tract lines or corners, as shown on the official plat of survey or protracted survey, with bearings of those lines (if available). Located section survey markers should be indicated. The method of obtaining the final ground level should be indicated (topographic map, surveyed, etc). A plat of the preliminary location and elevation will be acceptable, but shall be followed by the final official surveyed location and elevation above sea level after the location is completed.

4. Geological, Geophysical, and Hydrological Conditions. Describe briefly: General geologic evironment; anticipated reservoir type, estimated depths and types of formations to be drilled, and temperature profile; and anticipated kind and quality of production.

(Previously submitted data on an area may be referenced rather than resubmitted.)

ASSOCIATED APPROVALS: A plan which proposes deep drilling must be submitted and approved before a drilling permit will be issued. (See "Plan of Exploration", "Plan of Development", and "Plan of Injection or Disposal" sections above.) Drill site and access road construction may be commenced before the permit is issued if the plan has been approved. In such cases, approval for construction can be obtained with a USGS Form 9-1958, Geothermal Sundry Notice. A Sundry Notice may also be required for other activities, such as subsequent production testing and for changes in a drilling program in progress.

(See "Geothermal Sundry Notice" section, below.)

APPLICABLE REFERENCES: 30 CFR 270.71 and GRO Orders No. 2 and 3.

GEOTHERMAL SUNDRY NOTICE

A Geothermal Sundry Notice may only be used for certain miscellaneous activities where the proposed activity is within the area of operations established by a previously approved Plan of Operation, and which can be conducted without additional surface disturbance.

The following may be authorized by an approved Sundry Notice:

1. Drill Site Preparation Activities (if conducted before the Geothermal Drilling Permit is issued): Surveying; constructing access roads, well pads and sumps; digging cellars; and setting conductor pipe.
2. Changes to Approved Plans or Permits: Proposed total depth, casing

sizes, and cementing depths; powerplant installations; etc.

3. Subsequent Well Operations: Repairing, testing, shooting, or plugging and abandoning wells; stimulating or changing the method used to produce the well; altering casing or liner; changing or reconditioning downhole production or injection equipment; converting a formation or well for fluid injection; production/injection tests (when not covered by the Drilling Permit).
4. Construction or Alteration of surface production facilities and of phases of construction of a utilization facility when complete construction plans were not submitted with the utilization permit application, or subsequent alternations of a utilization facility. (See "Geothermal Utilization Permit" section, below.)
5. Other activities not previously covered by, but connected with, an approved Plan of Operations.

WHEN TO SUBMIT: Prior to initiating certain miscellaneous activities, written request to do work must be approved by the DCM. Application is made by submitting USGS Form 9-1958, Geothermal Sundry Notice.

REQUIREMENTS: The Sundry Notice should include a detailed description of the proposed operations. When proposing subsequent well operations, include current mechanical and production status of the well (casing details and condition, effective depth, etc), reason for proposal, remedial program, proposed starting date and anticipated duration.

ASSOCIATED APPROVALS: Sundry Notices covering the above activities will be approved only if within an existing area of operations and there will be no further significant surface disturbance than that anticipated by

operations approved under a plan. In an emergency, oral approval may be obtained for an activity, but a Sundry Notice must subsequently be filed.

APPLICABLE REFERENCES: 30 CFR 270.17, 30 CFR 270.34, 30 CFR 270.35, 30 CFR 270.45, 30 CFR 270.71-1, 30 CFR 270.72, 43 CFR 3205.3-8, and GRO Order No. 3.

GEOTHERMAL UTILIZATION PERMIT

The Geothermal Utilization Permit (USGS Form 9-1968) requires a two step approval. First approval authorizes construction and prestart-up testing of the facility. Geothermal Sundry Notices (Form 9-1958) may be used to authorize various phases of facility construction when construction plans are not submitted with the initial application, however, approval of these permits must follow the first approval of the Geothermal Utilization Permit. The second approval of the Utilization Permit authorizes the operation of the facility. Such approval can be made after evaluation of the prestart-up testing results submitted by the lessee. Where surface and mineral rights are under separate ownership (e.g., Stock Raising Homestead Act of 1916 lands), the facility operator should consult with the DCM, on a case-by-case basis, as to whether a Utilization Permit under this Order is required.

WHEN TO SUBMIT: The permit application must be submitted for first step approval prior to facility construction and prestart-up testing. Concurrent submittal with the Plan of Utilization is recommended for timely approval. After construction and testing, the original or a copy of the signed Utilization Permit must be submitted with the prestart-up test results for

second step approval to operate the facility.

REQUIREMENTS: To obtain a permit, the lessee must submit:

1. USGS Form 9-1968, Geothermal Utilization Permit.
2. Plat: An official surveyor's plat (scale not less than 1:24,000) showing elevation at ground level and location of the facility and all related sites by distances from the nearest section or tract lines or corners.
3. Detailed Engineering Design Plans and Specifications for all construction of principal and related facilities, power transmission lines, and facility sites, including road construction and improvement. Each drawing submitted should contain an original signature of the supervising registered engineer.
4. A list of all state, county and other local agencies and private organizations, including professional consultants, who have conducted or will conduct independent reviews of criteria, analyses and designs for verification of sound design practice and compliance with applicable codes and standards. The permit will not be granted until the extent of independent review is deemed adequate by the DCM. In order to expedite processing of the Utilization Permit application, the DCM may require additional independent design review, funded by the applicant.
5. Operating Plan containing procedures and standards to operate and maintain the facility.
6. Planned Metering to determine facility input and output.
7. Proposed sampling and chemical analyses program to monitor fluid flow

stream through facility, including byproducts.

8. Schedule and Procedures for installation and prestart-up testing of all equipment and commencement of operations for commercial utilization of resources.

ASSOCIATED APPROVALS: A plan of utilization must be submitted and approved before a Geothermal Utilization Permit will be issued. Sundry Notices may be used to approve the construction activities in phases or stages. (See "Plan of Utilization" section, above.)

APPLICABLE REGULATIONS: 30 CFR 270.60, 30 CFR 270.61, 30 CFR 270.71-1, and 30 CFR 270.72.

REPORTS

COMPLETION OF EXPLORATION OPERATIONS

A completion report must be submitted for exploration operations permitted by a Geothermal Exploration Permit.

WHEN TO SUBMIT: The report should be filed within 30 days after completion of activities. The DCM may, however, require submittal of available data prior to full completion of all scheduled activities.

REQUIREMENTS: Submit data and information required by GRO Order No. 1, properly identified as to lease and Exploration Permit number.

ASSOCIATED APPROVALS: USGS Form 9-1956, Geothermal Exploration Permit. Completed operations must be left in a condition acceptable to the District Geothermal Supervisor.

APPLICABLE REFERENCES: GRO Order No. 1.

GEOTHERMAL WELL COMPLETION REPORT

A completion report must be submitted for wells drilled under a Geothermal Drilling Permit, including all newly drilled and completed wells and old wells which have been deepened, redrilled, or plugged back.

WHEN TO SUBMIT: The report should be filed within 30 days after release of the drilling rig. If results of production tests, water analyses, etc. are not available within this time period, such data shall be submitted in subsequent reports.

REQUIREMENTS: The lessee must submit in duplicate:

1. USGS Form 9-1960, Geothermal Well Completion Report.
2. Chronological History of all operations conducted on the well, giving complete details of drilling, cementing, formation and production tests, and geologic or reservoir phenomena (downhole problems, lost circulation zones, steam and/or water entries, etc).
3. Final Prints of all downhole logs run (electric, sonic, dipmeter, formation density, including 1" = 100' scale S.P. - resistivity logs, if available, etc.) and analyses of these logs (e.g., Saraband).
4. Results of Surveys Run: Temperature, fluid entry, etc.
5. Directional Survey Data: If directionally drilled, plan and profile drawings of the hole course, including projected hole bottom if not measured.
6. Analyses of produced liquids, gases and solid effluents.

7. Plat: An official surveyor's plat showing the final location and elevation of the well if different from the location submitted with the Geothermal Drilling Permit application.

8. Geologic Data:

   Complete geologist's lithologic log or mud log, geologic summary of drilling results, and geologist's reports to the operator.

9. Samples: A Split of all drill cuttings (if requested by the DCM) washed and bagged with intervals clearly labeled.

(Previously submitted data may be referenced by title and date submitted.)

ASSOCIATED APPROVALS: Well operations must be conducted in accordance with an approved USGS Form 9-1957, Geothermal Drilling Permit. (See "Geothermal Drilling Permit" section, above.)

APPLICABLE REFERENCES: 30 CFR 270.72 and 30 CFR 270.73.

GEOTHERMAL POLLUTION INCIDENT REPORT

All blowouts, spills, leaks, toxic or noncondensible gaseous emissions, or other incidents which may have a significant impact on the environment must be reported to the District as soon as possible but no later than 18 hours after the incident. If unable to contact the District Geothermal Supervisor, the DCM should be contacted directly.

WHEN TO SUBMIT: The initial report must be confirmed by a written report to the DCM and District Supervisors within 30 days after the incident.

REQUIREMENTS: The report should be submitted on USGS Form 9-1961, Geothermal Pollution Incident Report. With prior approval of the DCM,

standard pollution report forms (government, company, insurance carrier, computerized, etc.) may be used instead of Form 9-1961.

ASSOCIATED APPROVALS: Corrective measures taken in mitigation of the incident must be acceptable to the DCM.

APPLICABLE REFERENCES: 30 CFR 270.30 and Section 9.B. of GRO Order No. 4.

GEOTHERMAL ACCIDENT AND INJURY REPORT

All accidents and injuries must be reported to the DCM as soon as possible but within 24 hours of the occurrence.

WHEN TO SUBMIT: A written report must be filed not later than 15 days after the accident.

REQUIREMENTS: The report should be submitted on USGS Form 9-1962, Geothermal Accident and Injury Report. With prior approval of the DCM, standard forms (government, company, insurance carrier, computerized, etc.) may be used in place of Form 9-1962.

ASSOCIATED APPROVALS: Corrective and/or preventetive measures to prevent similar accidents must be acceptable to the DCM.

APPLICABLE REGULATIONS: 30 CFR 270.46.

MONTHLY REPORT OF GEOTHERMAL OPERATIONS

The lessee must file a complete report covering all lease activities (production, injection, drilling, exploration, etc) for each lease each

month, starting with the month in which operations conducted under an Exploration or Drilling Permit are started and continuing until the lease is terminated or the DCM authorizes omission of the report.

WHEN TO SUBMIT: The report must be submitted on or before the last day of the succeeding month, unless an extension is granted by the DCM.

REQUIREMENTS: The report should be filed on USGS Form 9-1963, Monthly Report of Geothermal Operations. With prior approval of the DCM, computerized or other special forms may be used in lieu of Form 9-1963. The DCM may from time to time require cumulative production and injection data by well, lease, reservoir, formation, or field.

ASSOCIATED APPROVALS: None

APPLICABLE REFERENCES: 30 CFR 270.74, and Section 9.C.(2) of GRO Order No. 4.

MONTHLY REPORT OF SALES AND ROYALTIES

Beginning with the month in which production is first sold or utilized, the lessee must file a monthly report of sales and royalties for each productive lease, unless otherwise authorized by the DCM.

WHEN TO SUBMIT: The report must be received by the DCM on or before the last day of the succeeding month together with the royalties due the United States. If the last day of the month occurs on a weekend or holiday the report and payment must be received by the last day of business for that month. In addition, the lessee must submit, within 30 days after its effective date, a copy of any sales contract (or utilization

agreement) for disposal of geothermal resources from the lease.

REQUIREMENTS: Prior to submittal of the first report, the DCM will determine what information is required and the form on which it must be submitted. The report should clearly show all of the critical data (volumes, factors, values, etc) and calculations used in arriving at the royalty value due the United States. Unless otherwise authorized by the DCM, this report is required for intermittent as well as continuing sales.

APPLICABLE REFERENCES: 30 CFR 270.49, 30 CFR 270.50 and 30 CFR 270.75.

ANNUAL REPORT OF EXPENDITURES FOR DILIGENT EXPLORATION OPERATIONS

If diligent exploration credit is desired, the lessee must file an annual report of expenditures for diligent exploration operations for that lease.

WHEN TO SUBMIT: The report must be submitted on or before the lease anniversary date.

REQUIREMENTS: The report must include an itemized list of expenditures for exploration activities performed during the lease year. Proprietary data, reports and results of all surveys for which expenditures are claimed should accompany the report if not previously submitted. The report should also indicate the desired mannner of allocation of expenditures toward all related leases.

APPLICABLE REFERENCES: 30 CFR 270.77 and 43 CFR 3203.5, NTL-79-01

ANNUAL REPORT OF COMPLIANCE WITH ENVIRONMENTAL

PROTECTION REQUIREMENTS

The lessee must submit an annual report on actions taken to comply with regulations and requirements for protection of the environment, if any action conducted on the lease during the preceding 12 months resulted in environmental impact. This report can be combined with the appropriate environmental quarterly report required by Section 12, Lease Form 3200-12.

WHEN TO SUBMIT: The report must be submitted on or before the lease anniversary date. No report will be required on inactive leases unless requested by the DCM. Related leases may be covered by one report.

REQUIREMENTS: The report must include:

1. Cover Page: Report title (including year), operator, lease serial number(s), location (section, township, range, base meridian, county, State, and field or KGRA name), lease date, report submittal date, and chronological activity list.
2. Chronological Description of all activities related to geothermal exploration, development, and production, giving dates and actions taken to protect the surface and subsurface environment. (A statement that no citations were received and operations were suspended is not sufficient.) Concerns that should be discussed for each activity include:

Noise, erosion, and pollution control; water and air quality; flora and fauna; aesthetics, antiquities, and historical sites; subsidence and seismic activity; sanitation and waste disposal; public access;

and rehabilitation activities. (Monitoring of various parameters and remote sensing using infra-red or other aerial color photography may be used to substantiate compliance with various requirements.)

3. If Pollution Incidents Occurred: Reference appropriate Pollution Incident Reports and discuss any changes or new development, and the effectiveness of corrective measures.

APPLICABLE REFERENCES: 30 CFR 270.76, Lease Form 3200-21.

BASELINE DATA REPORT

Before submitting a Plan for Production, the lessee must collect environmental data for at least one year so that baselines can be established before starting commercial production.

WHEN TO SUBMIT: Collected data must be submitted in a final report before the approval of the Plan for Production. During data collection, interim baseline data reports shall be submitted as required under the approved Plan for Baseline Data Collection. A final report covering the results of the entire study is to be submitted upon completion of data collection. The DCM may require additional reporting in cases where unusual reporting and interpretation are encountered.

REQUIREMENTS: Data submitted must include air and water quality, noise, seismic and land subsidence activity, species and abundance of vascular plants and vertebrate animals, and other topics as specified in the approved Plan for Baseline Data Collection. Data must be compiled, analyzed, and interpreted in an orderly manner, and the report shall

include: How the geothermal resources will be used; how the data was collected; clear, concise discussions of the data collected for each environmental parameter; and conclusions. The report must stand alone. If other reports are referenced, pertinent data must be summarized. A single report will suffice for all operators participating in a cooperative effort to collect baseline information.

The final report should contain a discussion of which parameters should be subsequently monitored and which should be deleted and why. This applies to all parameters covered in the report, whether measured by the operator or his contractor or previously measured and included by reference in the report of baseline data.

ASSOCIATED APPROVALS: Not applicable.

APPLICABLE REFERENCES: 30 CFR 270.34(k), "Guidelines for Acquiring Environmental Baseline Data on Federal Geothermal Leases" (U.S. Department of the Interior, January 1977).

ENVIRONMENTAL QUARTERLY REPORT

WHEN TO SUBMIT: If required by the DCM, the lessee must submit quarterly reports of environmental monitoring.

REQUIREMENTS: The reports must contain environmental data collected during lease development and subsequent operating activities. It must follow the format of the baseline data report or as otherwise specified by the DCM. (See "Baseline Data Report" section above.)

ASSOCIATED APPROVALS: Not applicable.

APPLICABLE REFERENCES: Section 12 of Lease Form 3200-21, Plan of Baseline Data Collection, Plan for Production.

MONTHLY REPORT OF FACILITY OPERATIONS

A monthly summation of facility operations for each individual production well, research and demonstration, or plant facility must be submitted by the facility operator, unless otherwise authorized by the DCM.

WHEN TO SUBMIT: The report for any month must be submitted on or before the last day of the following month. The first report must be made for the month in which initial operations and sales begin.

REQUIREMENTS: The report must be filed on a form and in a manner agreed to by the DCM.

APPLICABLE REGULATIONS: 30 CFR 270.74-1.

MISCELLANEOUS COMPLETION REPORTS

Completion reports are required for all miscellaneous well operations permitted by a Sundry Notice except for surface facility construction and where operations are reported in a Geothermal Well Completion Report, USGS Form 9-1960.

WHEN TO SUBMIT: The lessee must submit the report within 30 days after completion of the work.

REQUIREMENTS: The report must describe the activities performed and the results obtained. It must include records of any well logs or surveys,

if not previously submitted.

ASSOCIATED APPROVALS: The report may be submitted in a form convenient to the lessee. A copy of the approved USGS Form 9-1958, Geothermal Sundry Notice, must be attached to the report.

APPLICABLE REGULATIONS: 30 CFR 270.72.

RECORDS

During deep drilling activities, all pertinent well records must be made available at the worksite and field headquarters for use or inspection, unless otherwise directed by the DCM.

DAILY DRILLING REPORT AND RECORD

WHEN TO SUBMIT: Unless specifically otherwise arranged with the DCM, a daily telephone report must be made to the District Geothermal Supervisor during the drilling of any well approved by a Geothermal Drilling Permit.

REQUIREMENTS: The telephone report should be a chronological accounting of operations conducted and should include:

1. Depth: Total and plugged back.
2. Footage Drilled and hole size.
3. Drilling Fluid Characteristics:
   Weight or pressure (air drilling),
   Drilling fluid temperature in and out, and
   Drilling fluid losses.

4. Hole Deviation Surveys and, if directionally drilled, hole bottom coordinates.
5. Casing Run.
6. Cementing Details.
7. Logs and Surveys Run.
8. Drilling Problems: Tight hole, lost circulation, etc.
9. Tests:

   Formation or production test details, and

   Blowout preventer and casing tests.

APPLICABLE REGULATIONS: 30 CFR 270.37.

WELL LOGS AND SURVEYS

WHEN TO SUBMIT: During operations, field prints or working copies of the following must be submitted to the DCM and District Geothermal Supervisor:

1. All Downhole Logs (electrical, radioactive, formation density, etc): one copy each to the DCM and District Geothermal Supervisor immediately after running.
2. Temperature and Fluid Entry Surveys: One copy each to the DCM and District Geothermal Supervisor immediately after running.
3. Mud Logging Results: One copy each to the DCM and District Geothermal Supervisor on completion of a data page.

REQUIREMENTS: The following records must be kept at the worksite:

1. Data and Plots for directional surveys and mud logging.
2. Field Prints of downhole logs.

3. Temperature and Fluid Entry Surveys.

4. Fluid Sampling Results.

5. Core Recovery and Description.

APPLICABLE REGULATIONS: 30 CFR 270.37.

SERVICING RECORDS

REQUIREMENTS: Working copies of the following well service records must be kept at the worksite, and copies must be made available to the DCM when requested: Cementing, stimulation, perforation, acidizing, and formation fracturing reports; casing, drill pipe, and other downhole component measurements; fishing tool reports; etc.

APPLICABLE REGULATIONS: 30 CFR 270.37.

COMPANY RECORDS

REQUIREMENTS: Copies of all geologic, geophysical, stratigraphic, structural, engineering, and environmental studies, reports, and records must be made available to the DCM, when requested.

SAFETY RECORDS

REQUIREMENTS: Records of safety meetings, safety devices installed at the worksite, and work crew drills on contingency plan procedures must be available at the worksite.

BASIC INFORMATION FOR PLANS OF OPERATION

1. Title Page showing:

   Lease number(s) or unit agreement name;

   Known Geothermal Resources Area (KGRA) name, if any;

   Location (section, township, range, base and meridian; county, and State); Name, address, and phone number for lessee or operator, contractor, and field representatives;

   Brief description of proposed operations and objectives; and

   Estimated starting and completion dates for each activity.

2. Maps:

   a. Topographic map, orthophoto quad or equivalent (preferred scale 1:24,000), and, if necessary, written explanation presenting:

      Federal lease boundaries and serial numbers;

      Fee lease boundaries, ownership, and lessees, if known;

      Names, addresses and phone numbers of private surface owners of, and those adjancent to, lands to be disturbed by proposed operations;

      Proposed, existing, and abandoned wells;

      Existing and planned access roads;

      Water supplies and road building materials;

      Campsites, airstrips, and other support facilities;

      Homes and other pertinent surface facilities;

   b. Large-scale map showing layout of the operations site (equipment, facilities, sumps, etc.).

c. Detailed engineering plan and profile drawings for any site, road, or other construction or modification located on rugged terrain, potentially unstable ground, or environmentally sensitive areas.

3. Narrative Statement containing:

Measures to prevent or control: fires; soil erosion; pollution of surface and ground water, air and noise pollution, hazards to public health and safety, and damage to fish, wildlife, natural resources, and areas of cultural, historical, or archeological value;

Methods for disposing of waste materials (including sanitary facilities);

Provisions for monitoring air quality, noise, drilling mediums, and produced gases, liquids, and solids; and

Information about construction and drilling personnel (crew size, housing, and support facilities).

4. Certified Statement of the presence of or absence any cultural, historical, or Native American religious site which may be disturbed by operations. The statement must be made by a person acceptable to the surface manager, and a copy must be submitted to the surface manager and the DCM. A certified statement of the presence of any rare, threatened or endangered animal or plant species may also be required.

5. Emergency Contingency Plans including:

Accident and injury contingency plan for all plans; a blowout contingency plan where drilling is proposed; and when required by the DCM, contingency plans for the control of fires, pollution incidents or hazards resulting from adverse weather conditions. Each contingency plan shall contain:

A Description of adverse effects the emergency would have on operations, personnel, public health, and the environment;

Measures to control these effects, including shutdown procedures;

Responsibilities of each employee in an emergency situation;

Information about personnel with special training or experience with emergency procedures;

Where to obtain emergency control services and medical aid; and

Emergency notification list (names, addresses, and telephone numbers of pertinent Federal, State and local regulatory, law enforcement, and emergency service offices).

APPLICABLE REFERENCES: 30 CFR 270.34 and Section 18 of Lease Form 3200-21.

6. Environmental Information. Submittal of the following information will facilitate the approval process:

Regional and local geology, hydrology, and meteorology;

Potential geologic hazards (active faults, landslide areas, etc.);

Soil, air, noise, and visual studies;

Fauna and flora (associations, communities, habitats, life patterns, etc.);

Current and prospective land uses, including recreational areas; and

Local economy.

Sites of cultural, historical, or archeological value; and

Wildlife migration routes, watering holes, and habitats.

Exhibit 3. APPLICATIONS AND REPRESENTATIVE PROCESSING TIMES FOR VARIOUS GEOTHERMAL ACTIVITIES

ACTIVITY	MUST BE ADDRESSED IN						ACTIVITY AUTHORIZED BY				PROCESS TIME	REFERENCE PAGE(S)
	POE	PBDC	POD	POI	POU	PFP	GEP	GDP	GUP	SN		
Casual Use							Advance notice required for expenditures to qualify as diligent exploration expenditures				None	16
Aerial Surveys												
Geologic Mapping												
Surveying												
Water Sampling												
Exploration Operations												
Areal Geophysical Surveys							x				30 days maximum	16-17
Temperature Gradient Hole Drilling and Coring (max. 3000 feet)							x					
Exploration Drilling and Testing											30 days maximum	
Geotechnical Site Study												16-17
With trenching or road construction							x					
No trenching or road construction							x					16-17
Well Pad and Access Road Construction	x							x		x	3-6 months	3-4, 17-21, Exn. 1
Exploratory Well Drilling	x							x				
Well Testing												
Additional surface disturbance	x									x	3 months maximum	3-4, 21-22
No additional surface disturbance										x	15 days maximum	21-22
Development												
Geotechnical Site Study											30 days maximum	6-8, 16-17
With trenching or road construction			x				x					
No trenching or road construction							x					16-17
Well Pad and Access Road Construction			x	x				x		x	4-6 months	6-11, 17-22, Exn. 1
Injection Well Drilling				x				x				8-11, 17-21, Exn. 1
Production Well Drilling			x					x				6-8, 17-21, Exn. 1
Pipeline Construction			x							x		6-8, 21-22
Well Testing (production and injection)												
Additional surface disturbance			x	x						x	3 months maximum	3, 6-11, 21-22
No additional surface disturbance										x	15 days maximum	21-22
Injection facilities construction				x						x	2-6 months	8-11, 21-22
Production facilities construction			x							x		6-8, 21-22
Later construction on same site										x		21-22
Alteration										x	15 days maximum	
Production and Utilization												
Geotechnical Site Study											30 days maximum	11-14, 16-17
With trenching or road construction					x		x					
No trenching or road construction							x					16-17
Site Construction					x				x	x	3-18 months	11-14, 21-24
Facility Construction					x				x	x		11-14, 21-24
Power Transmission Line Construction					x				x	x		
Facility Operation					x				x			11-14, 23-24
Production						x					45 days	14-15
Injection or Disposal (incl. byproducts)				x							4-6 months	8-11
Environmental Data Collection												
Baseline Data Collection (pre-development operations - one year minimum)		x									45 days maximum	5-6
Environmental Monitoring (post development operations)					x	x						11-5
Miscellaneous Activities												
Abandonment											15-30 days	11-14, 21-22
Utilization facility					x					x		
Well								x		x	7 days	17-22
Changes to Approved Plans or Permits										x		
Subsequent Well Operations											7 days	21-22
Acidize										x		
Casing changes										x		
Convert to injection well										x		
Deepen								x			7-15 days	17-21
Directionally drill								x			1-15 days	
Fracture test										x	7 days	
Perforate										x		21-22
Plug back								x				17-21
Redrill								x			7-15 days	17-21
Repair										x		21-22

KEY - POE=Plan of Exploration, PBDC=Plan of Baseline Data Collection, POD=Plan of Development, POU=Plan of Utilization, PFP=Plan for Production, GEP=Geothermal Exploration Permit, GDP=Geothermal Drilling Permit, GUP=Geothermal Utilization Permit, SN=Geothermal Sundry Notice.

Note: Where more than one Plan or Permit is checked off, the acitivity may be addressed in either Plan and authorized by either Permit.

Many of the itemized activities are processed together under one Plan rather than individually. Processing times shown are those for the entire Plan, and are based on submittal of a complete application. Processing of the Plans of Development, Injection or Disposal, and Utilization may be done concurrently, and submittal of these Plans togther is encouraged.

APPENDIX
(Forms)

Form USGS 9-1955

Form approved
Budget Bureau No.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

DESIGNATION OF GEOTHERMAL OPERATOR

The U.S. Geological Survey requires this form or other Supervisor approved form or letter to be prepared and filed in triplicate, with the Supervisor.

The undersigned is, on the records of the Bureau of Land Management, holder of lease(s)

SERIAL NO.: State Office:

and hereby designates

NAME:
ADDRESS:

as his operator and local agent, with full authority to act in his behalf in complying with the terms of the lease and regulations applicable thereto and on whom the Supervisor or his representative may serve written or oral instructions in securing compliance with the Operating Regulations with respect to (describe acreage to which this designation is applicable):

This designation of operator does not relieve the lessee of responsibility for compliance with the terms of the lease and the Operating Regulations. This designation of operator does not constitute an assignment of any interest in the lease.

If the designated operator defaults, the lessee will promptly comply with all regulations, lease terms, or orders of the Secretary of the Interior or his representative.

The lessee agrees to promptly notify the Supervisor of any change in the designated operator.

I hereby certify the foregoing is true and correct.

SIGNED _____ TITLE _____

ADDRESS _____ DATE _____

This report is required by law (30 U.S.C. 1023); and regulations: 30 CFR 270.31. Failure to report in a prescribed manner can result in shutting down operations, suspension and or recommendation of cancellation of lease (30 U.S.C. 1011, 30 CFR 270.80, 43 CFR 3244.3). The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

Form: USGS 9-1956

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No. _____

GEOTHERMAL EXPLORATION PERMIT

J.S. Geological Survey requires this form or other Supervisor approved form to be prepared and filed in triplicate with requisite attachments with the Supervisor. The District Geothermal Supervisor must approve this permit prior to any lease operations.

1. NAME OF LESSEE/OPERATOR

2. ADDRESS OF LESSEE/OPERATOR

3. CONTRACTOR(S) ADDRESS

12. TYPE OF OPERATIONS TO BE CONDUCTED (give brief description)

13. Exploration operations will be conducted during the period (date)
from: to:

4. LEASE SERIAL NO.

5. SURFACE MANAGER: BLM ( ) FS ( ) Other ( )

6. UNIT AGREEMENT NAME

7. PERMIT NO.

8. FIELD OR AREA

9. SEC. T., R., B.& M.

10. COUNTY

11. STATE

14. BOND: Surety bond for $ ( ) Nationwide ( ) Statewide ( ) Lease ( ) Bond to be furnished ( )
Rider to Nationwide bond ( ) Rider to Statewide bond ( ) Bond No.:

15. The undersigned agrees that all exploration operations under this permit shall be conducted in accordance with regulations, GRO Orders and Special Permit Stipulations:

1) The lessee/operator shall have copies of this Permit available on location, at all times, while operations are being conducted.

2) Unless waived, the lessee/operator shall submit in writing to the appropriate District Geothermal Supervisor the status of activities completed or in progress at the end of each month during the term of this permit.

3) If requested by the Supervisor the lessee/operator shall submit two copies of all available records of any operations, surveys, tests, or projects immediately after completion of such activities.

4) Within 30 days after completion of each survey, test, analysis or activity of the permitted operations the undersigned agrees to furnish the Supervisor with two copies of the records of the operation(s).

5) Special Conditions of Approval:

The undersigned agrees: (1) to the special stipulations which may be added by the Supervisor as a condition of approval of this Geothermal Exploration Permit; and (2) that the proposed operations will not be commenced until this Permit has been approved by the Supervisor. Appeals from decisions under this Permit may be made in accordance with 30 CFR 270.90.

16.

SIGNED _____ TITLE _____ DATE _____

(This space for Federal use)
I hereby approve this permit to conduct geothermal resource exploration operations. This permit is effective for one year after the approval date.

SIGNED _____ TITLE _____ DATE _____

This permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.78; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

Form: USGS 9-1957

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No. _____

GEOTHERMAL DRILLING PERMIT

The U.S. Geological Survey requires this form or other Supervisor approved form to be prepared and filed in triplicate with requisite attachments with the Supervisor. The Supervisor must approve this permit prior to any lease operation.

4. LEASE SERIAL NO.

5. SURFACE MANAGER: BLM ( ) FS ( ) Other ( )

1a. TYPE OF WORK: DRILL NEW WELL ( ) REDRILL ( ) DEEPEN ( ) PLUG BACK ( ) DIRECTIONALLY DRILL ( ) OTHER ( )

6. UNIT AGREEMENT NAME

1b. WELL TYPE: PRODUCTION ( ) INJECTION ( ) HEAT EXCHANGE ( ) OBSERVATION ( ) WATER SUPPLY ( ) OTHER ( )

7. WELL NO.

8. PERMIT NO.

1c. WELL STATUS:

2. NAME OF LESSEE/OPERATOR

9. FIELD OR AREA

3. ADDRESS OF LESSEE/OPERATOR

10. SEC. T., R., B.& M.

15. LOCATION OF WELL
At surface

At proposed prod. zone

11. COUNTY

16. DISTANCE FROM PROPOSED LOCATION TO NEAREST PROPERTY OR LEASE LINE

12. STATE

17. DISTANCE FROM PROPOSED LOCATION TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR ON THIS LEASE

13. APPROX. STARTING DATE

14. ACRES ASSIGNED (WELL SPACING)

18. DRILLING MEDIA AND CHARACTERISTICS: AIR ( ) WATER ( ) MUD ( ) FOAM ( ) Other ( )

19. PROPOSED DEPTH
MEASURED:
TRUE VERTICAL:

20. ELEVATIONS: ESTIMATED ( ) FINAL ( )
REFERENCE DATUM: GR ( ) MAT ( ) DF ( ) KB ( ) RT ( ) CASINGHEAD FLANGE ( ) OTHER ( )

21. EXISTING AND/OR PROPOSED CASING AND CEMENTING PROGRAM (List existing program first, followed by proposed program, and separate by a sufficient space to clearly distinguish the two programs)

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	COUPLING (Collars & Threads)	GRADE	SETTING DEPTH Top	SETTING DEPTH Bottom	QUANTITY OF CEMENT

22. PROPOSED WORK SUMMARY

(Use additional space on reverse side of form)

23.

SIGNED _____ TITLE _____ DATE _____

(This space for Federal use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

A permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.71; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

INSTRUCTIONS

GENERAL: This form shall be submitted for any application to drill for, test, extract, produce, dispose and/or utilize the actual geothermal resource on Federally leased lands or lands covered by a unit or cooperative agreement.

ITEM 1C: Show the current status for existing wells; I=injecting, F=flowing, P=pumping, HE=heat exchange, SI=shut-in, WS=water supply, OB=observation, other (explain).

ITEM 7: Number wells using the Modified Kettleman Well Numbering System (see below).

ITEM 15: Show the surface location coordinates from the nearest section corner or tract lines and if the well is to be directionally drilled, the proposed production zone coordinates (top and bottom) from the surface location.

ITEM 19: Indicate reference datum from which measurement was made (see item 20).

ITEM 20: If the reference datum shown is not the graded mat, also show the measurement from the mat surface (e.g. mat-to-derrick floor (DF)measurement, mat-to-rotary table (RT) measurement, mat-to-kelly bushing (KB) measurement, etc.).

ITEM 21: For subsequent well work the latest well conditions along with all proposed additions and changes must be shown. To show current well conditions, either fill out this item or attach the latest completion report on the subject well.

ITEM 22: Summarize other pertinent existing data such as producing and injecting zones, type, size, and density of perforations and perforated intervals, etc., in addition to the proposed work. Indicate reasons for changes undertaken.

PROCEDURE FOR NUMBERING GEOTHERMAL WELLS USING THE MODIFIED KETTLEMAN WELL NUMBERING SYSTEM

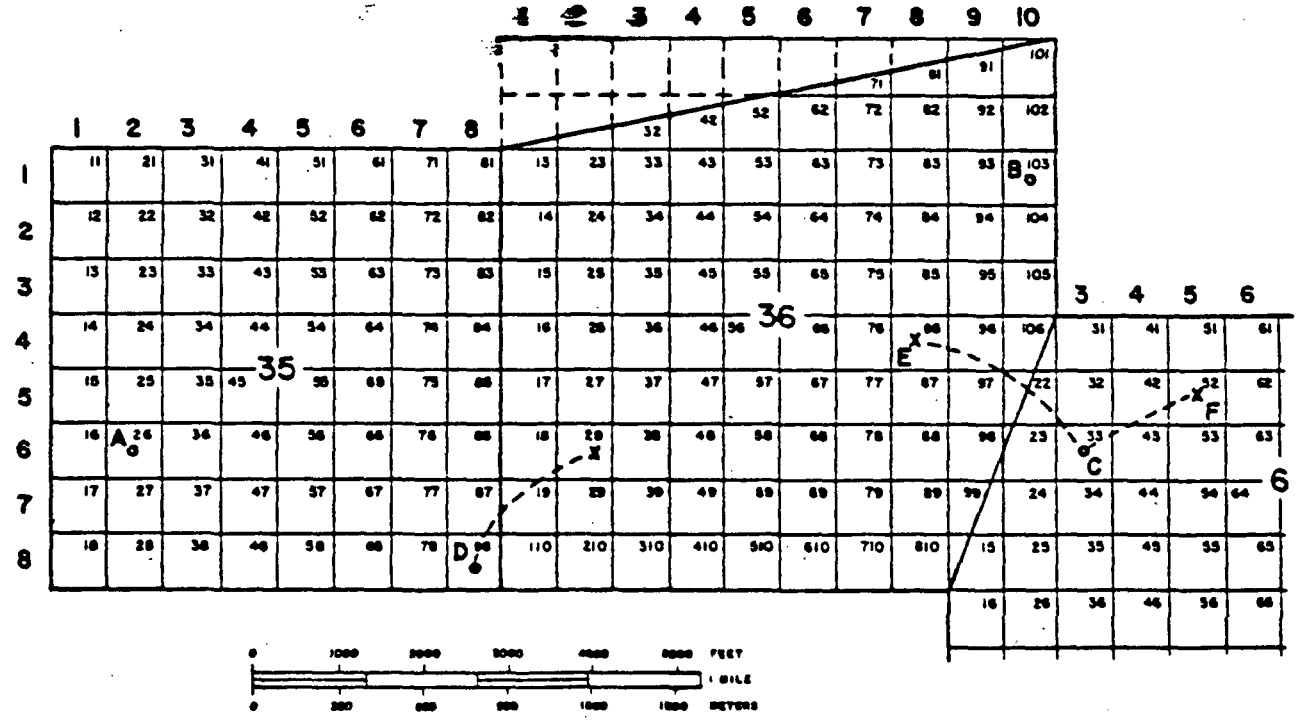
1. Subdivide the sections where the wells are to be located into 10-acre (660 feet X 660 feet) subdivisions. Number each horizontal and vertical subdivision starting in the northwest corner of each section with 1, 1 and increasing to the east and south. A regular 640-acre section contains 64 subdivisions numbered from 11 to 88 (vertical digit first, followed by horizontal digit).

2. Number the first vertical well with the number of the 10-acre subdivision in which it is located, followed by the section number. (See Examples "A", "B", and "C", below.) If the first well is directionally drilled, number it with the subdivision number of its surface location, followed by the subdivision number in which the bottom of the completion interval lies and that section number (if different from the surface section number), and followed by the surface section number. (See Example "D".)

3. Subsequent wells drilled from the same 10-acre surface location are numbered in the manner described above with an A, B, C, etc., added following the surface subdivision number. (See Examples "E" and "F".)

4. For sections with irregular boundaries, align a 10-acre grid pattern North-South, running through the westernmost section point or line, and East-West, running through the northernmost section point or line. Number wells according to the 10-acre grid, subdividing as far as possible to the east and south.

Example A	26-35	Example D	Directional 88(28-36)-35
Example B	103-36	Example E	Directional 33A(86-36)-6
Example C	33-6	Example F	Directional 33B(52)-6



Form: USGS 9-1958

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No. _____

GEOTHERMAL SUNDRY NOTICE

The U.S. Geological Survey requests this form or other Supervisor approved form to be prepared and filed in triplicate with requisite attachments with the Supervisor. The Supervisor must approve this permit prior to any lease operations.

4. LEASE SERIAL NO.

5. SURFACE MANAGER: BLM ( ) FS ( ) Other ( )

1a. WELL TYPE: PRODUCTION ( ) INJECTION ( ) HEAT EXCHANGE ( ) OBSERVATION ( ) OTHER ( )

6. UNIT AGREEMENT NAME

1b. WELL STATUS:

7. WELL NO.

8. PERMIT NO.

2. NAME OF LESSEE/OPERATOR

9. FIELD OR AREA

3. ADDRESS OF LESSEE/OPERATOR

10. SEC. T., R., B.& M.

13. LOCATION OF WELL OR FACILITY

11. COUNTY

12. STATE

14. TYPE OF WORK

CHANGE PLANS	( )	CONVERT TO INJECTION	( )	PULL OR ALTER CASING	( )
SITE AND ROAD CONSTRUCTION	( )	FRACTURE TEST	( )	MULTIPLE COMPLETE	( )
CONSTRUCT NEW PRODUCTION FACILITIES	( )	SHOOT OR ACIDIZE	( )	ABANDON	( )
ALTER EXISTING PRODUCTION FACILITIES	( )	REPAIR WELL	( )	OTHER	( )

15. DESCRIBE PROPOSED OPERATIONS (Use this space for well activities only. See instructions for current well conditions on reverse)

16. DESCRIBE PROPOSED OPERATIONS (Use this space for all activities other than well work)

(Use reverse side if needed)

17. I hereby certify that the foregoing is true and correct

SIGNED _____ TITLE _____ DATE _____

(This space for Federal use)

APPROVED BY _____ TITLE _____ DATE _____

CONDITIONS OF APPROVAL, IF ANY:

This permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.34, 30 CFR 270.35, 30 CFR 270.45, 30 CFR 270.71-1, 30 CFR 270.72; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

INSTRUCTIONS

GENERAL: This form shall be used for applications for well work, road, site and facilities construction and other miscellaneous activities performed on federally leased lands or lands under a unit or cooperative agreement, and are related to operations performed under an approved Plan of Operation.

ITEM 1b: Show the current status for existing wells; I=injecting, P=flowing, P=pumping, HE=heat exchange, SI=shut-in, WS=water supply, OB=observation, O=other (explain).

ITEM 15: The latest well conditions (hole size, casing, cement, perforations, producing and injecting zones, etc.) along with all proposed additions and changes must be shown. When completing this section list existing well program first, followed by the proposed program, and separate by a sufficient spac to clearly distinguish the two programs. Current well conditions may be either listed in this section or may be shown by attaching a copy of the latest completion report on the subject well.

ITEM 16: Attach all pertinent engineering plans and specifications.

COMPLETED OPERATIONS: Thirty days after completion of all operations other than construction activities, approved under this permit, a completion report must be submitted in duplicate, to the Supervisor. The completion report shall include a copy of the approved Geothermal Sundry Notice with an attached report detailing the important activities performed, and the completion and abandonment procedures undertaken. Copies of all records of the operations shall accompany the report if not previously submitted.

Form: USGS 9-1960

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No. _____

GEOTHERMAL WELL COMPLETION REPORT

The U.S. Geological Survey requires this form or other Supervisor approved form to be prepared and filed in duplicate with requisite attachments with the Supervisor within 30 days after completion of permitted operations.

4. LEASE SERIAL NO.

5. SURFACE MANAGER: BLM ( ) FS ( ) Other ( )

1a. WELL TYPE: PRODUCTION ( ) INJECTION ( ) DISPOSAL ( ) WATER SUPPLY ( ) OBSERVATION ( ) COLD ( ) HEAT EXCHANGE ( ) OTHER ( )

6. UNIT AGREEMENT NAME

1b. COMPLETION: NEW ( ) WORKOVER ( ) DEEPENED ( ) PLUGBACK ( ) REDRILL ( ) RECOMPLETED ( ) DRILLED & ABANDONED ( ) OTHER ( )

7. WELL NO. | 8. PERMIT NO.

9. FIELD OR AREA

2. NAME OF LESSEE/OPERATOR

10. SEC. T., R., B.& M.

3. ADDRESS OF LESSEE/OPERATOR

11. COUNTY

18. LOCATION OF WELL
At Surface:
At Top of Production Zone:
At Total Depth:

12. STATE

13. SPUD DATE DATE T.D. REACHED

14. COMPLETION DATE (Ready to produce)

19. TOTAL DEPTH
Measured: True Vertical:

15. DIRECTIONALLY DRILLED INTERVALS

20. PLUGBACK TOTAL DEPTH
Measured: True Vertical:

21. ELEVATION: ESTIMATED ( ) FINAL ( )
REFERENCE DATUM: GR ( ) MAT ( ) DF ( ) KB ( ) RT ( ) CASINGHEAD FLANGE ( ) OTHER ( )

16. SURVEYED INTERVALS

22. DRILLING MEDIA: AIR ( ) WATER ( ) MUD ( ) FOAM ( ) OTHER ( )
List Characteristics:

17. CORE SIZE AND INTERVALS

23. LOG TYPE & INTERVALS

CASING RECORD

Size	Weight	Grade	Collars & Threads	Depths Set Top	Depths Set Shoe	Hole Size	Cementing Record (slurry volume)

25. LINER RECORD

Size	Weight	Grade	Collars & Threads	Top	Bottom	Perforated Intervals	Cementing Record (slurry volume)

26. TUBING RECORD

Size	Weight	Grade	Depth Set	Packer Depth

27. CEMENT SQUEEZE, ACID, FRACTURE, ETC. (detail type, amount, intervals

28. PERFORATION RECORD

Type	Total No.	Density (No./ft)	Size	Intervals

29. ATTACHMENTS & PREVIOUS SUBMITTALS: List all reports, surveys, tests and logs, not listed in item 23, which have resulted from drilling and completion operations. List relevant previously furnished data with date of submittal referenced.

30. WELL STATUS: PRODUCING ( ) SHUT-IN ( ) SUSPENDED ( ) INJECTION ( ) DISPOSAL ( ) HEAT EXCHANGE ( ) ABANDONED ( ) WATER SUPPLY ( ) OTHER ( )

31. DO YOU CONSIDER THE WELL TO BE COMMERCIAL? EXPLAIN:

32. I hereby certify the information on this report and the attached information is complete and accurate according to the best of by knowledge.

SIGNED: _____ TITLE _____ DATE _____

This report is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.37, 30 CFR 270.73; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. Failure to report in a timely prescribed manner can result in shutting down operations, suspension and or recommendation of cancellation of lease (30 U.S.C. 1011, 30 CFR 270.80, 43 CFR 3244.3). The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

INSTRUCTIONS

GENERAL: This form is designed for submitting a complete and accurate geothermal well completion report, and should be accompanied by a detailed chronological history of well operations and final copies of the results of any logs, surveys or tests performed on the well, which have not previously been submitted. The report shall be submitted within 30 days after the date of completion of continuous well activities, as determined by the District Geothermal Supervisor. The completion date in many cases will be the day the drilling rig is released. The Supervisor may postpone the required report submittal date if adequate justification is presented by the lessee.

18: Show the surface location coordinates from the nearest section corner or tract line. Show production zone and total depth coordinates from the surface location if the well is directionally drilled.

ITEM 34: If the well is immediately placed into operation without testing, this section should reflect the first month's production data.

ITEMS 35 & 36: Indicate the depth(s) of subsurface pressure and temperature measurement, and include the reference datum.

33. WELL TEST

TEST DATE	PRODUCTION METHOD: FLOWING ( ) OTHER ( )	POMPING ( ) - include size, type, intake depth, etc.

34. PRODUCTION

HOURS TESTED	PRODUCTION DURING TEST			ENTHALPY (Btu/lb)
	TOTAL LIQUIDS (lb)	STEAM (lb)	WATER (lb)	

35. STATIC TEST DATA

DEPTH	SURFACE PRESSURE (psig)	SUBSURFACE PRESSURE (psig)	SUBSURFACE TEMPERATURE (°F)	WATER ANALYSIS	
				Total Dissolved Solids	pH

36. FLOWING TEST DATA

SURFACE PRESSURE	SUBSURFACE PRESSURE	SURFACE TEMPERATURE	SUBSURFACE TEMPERATURE	AVE. TOTAL MASS FLOW RATE PER HOUR		
	at _____ feet		at top of perfs.	TOTAL (lb/hr)	STEAM (lb/hr)	WATER (lb/hr)
WELLHEAD:						
SEPARATOR:						

37. SUMMARY OF POROUS ZONES: Show all important porous zones and contents of each; cored intervals with recoveries, drill stem or formation tests with depth of interval tested, time open, cushion used, and flowing and shut-in pressures, temperatures and recoveries.

38. GEOLOGIC MARKERS (TOP)

FORMATION	TOP	BOTTOM	DESCRIPTION OF DETAILS	NAME	MEASURED DEPTH	TRUE VERTICAL DEPTH

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No. _____

GEOTHERMAL POLLUTION INCIDENT REPORT

The U.S. Geological Survey requires this form or other Supervisor approved form to be prepared and filed with requisite attachments with the District and Area Geothermal Supervisors within 30 days after the pollution incident.

1. TYPE OF REPORT

2. NAME OF LESSEE/OPERATOR

3. ADDRESS OF LESSEE/OPERATOR

13. INCIDENT DATE AND TIME

14. DURATION (Days/Hours)

15. WEATHER AND WIND CONDITIONS

4. LEASE SERIAL NO.

5. SURFACE MANAGER: BLM ( ) FS ( ) Other ( )

6. UNIT AGREEMENT NAME

7. WELL NO.

8. PERMIT NO.

9. FIELD OR AREA

10. SEC. T., R., B. & M.

11. COUNTY

12. STATE

16. TYPE OF POLLUTION

17. EXTENT OF POLLUTION (attach map of involved area)

18. DESCRIPTION OF INCIDENT (Include the cause such as human error, mechanical or equipment failure, or natural event; the immediate and long range effects; and other pertinent information.)

19. WATER BODY AFFECTED (Lake, Stream, Groundwater) WITH FLOW RATES (if applicable) (Attach analyses of unpolluted and polluted water if possible.)

20. CORRECTIVE ACTION TAKEN (Describe fully; give date, the method used to correct the action, and the name and title of the person performing or supervising the action)

USGS APPROVAL: YES _____ NO _____

(Use additional pages if needed)

21. PREVENTIVE ACTION TAKEN AND PROPOSAL TO PREVENT RECURRENCE (Fully detail including implementation date. Use additional pages, if needed.)

22. REMARKS AND ADDITIONAL PERTINENT INFORMATION (Use additional pages if needed).

23.

SIGNED _____ TITLE _____ DATE _____

(This space for Federal use)

Oral report received by _____ Field Inspection by _____

Date _____ Time _____

Potential environmental damage and pertinent remarks:

Report is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.30, 43 CFR 3204.1; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. Failure to report in a prescribed manner can result in shutting down operations, suspension and/or recommendation of cancellation of lease (30 U.S.C. 1011, 30 CFR 270.80, 43 CFR 3244.3). The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

INSTRUCTIONS

GENERAL: This form or other acceptable form shall be submitted in all cases where significant accident and/or injury related to lease operations occurs.

ITEM 13: If the accident occurred at a drill site, locate the area of occurrance in relation to the nearest structure or equipment. Accidents occurring in other lease areas may be located by the appropriate 1/4, 1/4, 1/4 section, other appropriate description, or by maps of sufficient scale to clearly show the accident area. Use additional space under remarks if needed.

ITEM 15: Submit drawings or maps if appropriate.

THE INJURY

26. NAME OF INJURED EMPLOYEE(S)	27. ADDRESS OF INJURED EMPLOYEE(S)	28. COMPANY REPRESENTING
29. OCCUPATION WHEN INJURED (Job Title)	30. DATE INJURED STOPPED WORKING (mo/day/yr)	31. WAS HE/SHE DOING HIS/HER REGULAR WORK?
32. HOW LONG ON THIS TYPE OF WORK?	33. HAD HE/SHE BEEN INSTRUCTED REGARDING HAZARDS OF THE JOB AND THE PROPER WAY TO DO THIS WORK?	34. WERE YOU A WITNESS TO THE ACCIDENT?
35. TYPE OF INJURIES		
36. NAME OF DOCTOR AND/OR MEDICAL FACILITY	37. ADDRESS OF DOCTOR AND/OR MEDICAL FACILITY	
38. WAS PROPER SAFETY PROTECTIVE EQUIPMENT PROVIDED?	39. WAS IT BEING PROPERLY USED AT THE TIME OF THE ACCIDENT?	

40. WHAT TRAINING OR SPECIAL INSTRUCTIONS, REGARDING PREVENTION OF THIS OR SIMILAR ACCIDENTS, HAVE BEEN GIVEN TO THE EMPLOYEES? GIVE DATES OF ANY SAFETY MEETINGS HELD DURING PAST SIX MONTHS ON PREVENTION OF SIMILAR ACCIDENTS.

DATE (mo/day/yr) SIGNATURE OF LESSEE'S FIELD SUPERVISOR _____

SIGNATURE OF EMPLOYEE's SUPERVISOR _____

(This space for Federal use)

Oral report received by: _____

Field inspection by: _____ Date and Time: _____

Date _____

Remarks:

Form USGS 9-1962

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No. _____

GEOTHERMAL ACCIDENT AND INJURY REPORT

U.S. Geological Survey requires this form or other Supervisor approved form to be prepared and
ed with requisite attachments with the District Geothermal Supervisor and the Supervisor within
__ days after the accident or injury. If the accident is fatal or involves serious injury, report
immediately to the District Geothermal Supervisor and Area Geothermal Supervisor by telephone.

3. LEASE SERIAL NO.

4. SURFACE MANAGER: BLM ( ) FS ( ) Other ( )

5. UNIT AGREEMENT NAME

1. NAME OF LESSEE/OPERATOR

6. WELL NO.

7. PERMIT NO.

2. ADDRESS OF LESSEE/OPERATOR

8. FIELD OR AREA

9. SEC. T., R., B. & M.

10. COUNTY

THE ACCIDENT

12. TIME AND DATE OF ACCIDENT

13. LOCATION OF ACCIDENT

11. STATE

14. OPERATION OR WORK IN PROGRESS AT TIME OF ACCIDENT

15. DESCRIPTION OF ACCIDENT

16. NATURE AND APPARENT UNSAFE CONDITION OR ACTION WHICH CAUSED ACCIDENT

17. HAD THIS CONDITION OR ACTION BEEN REPORTED AS A HAZARD BEFORE THE ACCIDENT?

18. WHAT, IF ANY, REMEDIAL ACTION HAS BEEN RECOMMENDED?

19. HAD IT BEEN OR WAS IT BEING IMPLEMENTED AT TIME OF ACCIDENT?

20. IF NOT, EXPLAIN

21. HOW COULD THE ACCIDENT HAVE BEEN PREVENTED?

22. WHAT ACTION HAS BEEN RECOMMENDED AND/OR TAKEN TO PREVENT A SIMILAR ACCIDENT?

23. RECOMMENDATIONS FOR ADDITIONAL PREVENTIVE ACTION

EFFECTS OF THE ACCIDENT

24. WERE THERE ANY INJURIES? _____ IF SO, FILL OUT INJURY REPORT ON REVERSE. DID A POLLUTION INCIDENT RESULT? _____
IF SO, FILL OUT GEOTHERMAL POLLUTION REPORT, FORM USGS 9-1961. DID ACCIDENT CAUSE A SHUT-DOWN OF OPERATIONS? _____
IF SO, FOR HOW LONG? _____ HAS OPERATION BEEN RESUMED? _____ IF NOT, WHEN WILL IT BE? _____

25. NAME, ADDRESS AND STATEMENT OF WITNESSES TO ACCIDENT INCLUDING INVOLVEMENT (IF APPLICABLE) IN THE ACCIDENT. (THESE SHOULD BE ATTACHED AS ADDITIONAL PAGES TO THIS REPORT AND BE SIGNED BY THE PERSON MAKING THE STATEMENT.)

ALL ACCIDENTS INVOLVING FAILURE OF EQUIPMENT, UNSAFE CONDITIONS OR HAZARDS WHICH HAVE RESULTED IN PERSONNEL INJURY OR SHUTTING-DOWN OF OPERATIONS MUST BE REPORTED TO THE DISTRICT SUPERVISOR AND THE SUPERVISOR IMMEDIATELY, BUT NO LATER THAN 24 HOURS AFTER THE ACCIDENT OR INJURY.

This report is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.46; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. Failure to report in a timely prescribed manner can result in shutting down operations, suspension and/or recommendation of cancellation of lease (30 U.S.C. 1011, 30 CFR 270.80, 43 CFR 3244.3). The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

Form: L 9-1963

UNITED STATES D[ ]MENT OF THE INTERIOR
GEOLOGICAL SURVE[ ], CONSERVATION DIVISION

Form [ ]roved
Budg[ ] Bureau No

MONTHLY REPORT OF GEOTHERMAL OPERATIONS

The U.S. Geological Survey requires this form or other Supervisor approved form (computerized, company, State, etc.) to be prepared for each month beginning with the month in which drilling is initiated and filed in duplicate with the Supervisor, on or before the last day of the month following unless exception is granted by the Supervisor.

The following is a complete and accurate report of all operations and production for the Month of _____, 19_____.

Signed: _____ Title: _____ Date: _____

1. Name of Lessee/Operator

2. Address of Lessee/Operator

3. LEASE SERIAL NO.

4. SURFACE MANAGER: BLM ( ) FS ( ) Other ( )

5. Unit Agreement Name

6. Field or Area

7. County

8. State

9. INDIVIDUAL WELL PRODUCTION

TWSP, RGE, SEC., B&M	WELL NUMBER	TYPE (STATUS)	DAYS PROD. OR INJ.	MONTHLY PRODUCTION OR INJECTION			PRODUCTION OR INJECTION RATE			AVERAGE		
				TOTAL (lb)	STEAM (lb)	WATER (lb)	TOTAL (lb/hr)	STEAM (lb/hr)	WATER (lb/hr)	TEMPERATURE IN °F	TEMPERATURE OUT °F	PRESS. psi

This report is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.74; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. Failure to report in a prescribed manner can result in shutting down operations, suspension and/or recommendation of cancellation of lease (30 U.S.C. 1011, 30 CFR 270.80, 43 CFR 3244.3). The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

INSTRUCTIONS

General: This form is designed for submitting a complete and accurate account of monthly activity and performance of geothermal wells and production facilities on Federal leases. The report must include all wells on the lease which have not been abandoned.

Item 9: Group wells together which are producing or injecting into the same reservoir or zone, and distinguish reservoirs or zones by name such as upper, lower, formation name, etc. Within each zone, list injection wells separately from production wells. In column 3, show the type of well reported (P=production, I=injection, D=disposal*, WS=water supply, OB=observation, HE=heat exchange, O=other (specify under remarks)) and in parenthesis the current month end status for each well or completion (i=injecting, f=flowing, p=pumping, si=shut-in, susp=suspended, obs=observation, o=other (specify under remarks)). For heat exchange wells, report production in British thermal units, Btu and production rate in Btu/hr. Production or injection rate is the total amount of mass flow divided by the total number of active well hours.

Item 10: In reporting current operations, particular attention should be directed toward 30 CFR 270.74(e).

Remarks: Report in this section any environmental monitoring conducted, and the results obtained.

10. OPERATIONS CONDUCTED DURING MONTH: Describe Drilling, Remedial Drilling, Redrilling, Stimulation, Testing and other Well Work Performed.

TWSP, RGE, SEC, B&M	WELL NUMBER	OPERATIONS CONDUCTED	MONTH END STATUS

Remarks: (use additional pages if needed)

*A Disposal well is used to inject fluids into the same formation or reservoir from which they are produced. An injection well is used for injection of fluids which are not produced from the formation or reservoir.

Form USGS 9-1968

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No. _____

GEOTHERMAL UTILIZATION PERMIT

The U.S. Geological Survey requires this form or other Supervisor approved form to be prepared and d in triplicate with requisite attachments with the Supervisor. The Supervisor must approve this mit prior to any lease operations.

1. NAME AND ADDRESS OF LESSEE

2. NAME AND ADDRESS OF OPERATOR

3. NAME AND ADDRESS OF CONTRACTOR AND/OR FACILITY DESIGNER

13. TYPE OF FACILITY: INDIVIDUAL WELL ( ) RESEARCH & DEMONSTRATION ( ) PLANT ( )
OTHER ( )

ESTIMATED PROJECT LIFE:

14. LOCATION OF FACILITY (1/4, 1/4, 1/4 SECTION)

4. LEASE SERIAL NO. UPON WHICH FACILTY IS LOCATE

5. LEASE SERIAL NO(S). SERVING FACILITY

6. SURFACE MANAGER: BLM ( ) FS ( )
Other ( )

7. UNIT AGREEMENT NAME

8. WELL NO., FACILITY NO. OR DESIGNATION

9. FIELD OR AREA

10. SEC. T., R., B.& M.

11. COUNTY

12. STATE

15. NET GENERATING CAPACITY
ELECTRIC (MW) HEAT (Btu)

16. GROSS GENERATING CAPACITY
ELECTRIC (MW) HEAT (Btu)

17. NAME OF RESOURCE PURCHASER/USER (If other than lessee/operator)

18. NO. OF ACRES AFFECTED BY FACILITY CONSTRUCTION

19. APPROXIMATE START OF CONSTRUCTION

20. APPROXIMATE DATE OF START-UP

21. ELEVATIONS: ESTIMATED ( ) FINAL ( )
REFERENCE DATUM: GR ( ) MAT ( ) Other ( )

22. DESCRIPTION OF PROPOSED UTILIZATION PROGRAM (Include a brief description of the facility, method of operation, manner of proposed utilization of the resource and the anticipated by-products and their proposed uses)

(Use additional sheets if necessary)

23.

SIGNED: _____ TITLE: _____ DATE: _____

(This space for Federal use)
Approval is hereby granted for the construction of a geothermal utilization facility.

PERMIT NO. _____ APPROVAL DATE _____

APPROVED BY _____ TITLE _____

CONDITIONS OF APPROVAL, IF ANY:

Whereas all requirements set forth in the subject leases, laws, regulations and orders have been satisfied, approval to operate the geothermal utilization facility is hereby granted. This permit shall be effective for a period of _____ from the date the facility is certified as operational by the Geological Survey.

CERTIFIED BY _____ DATE _____ APPROVED BY _____ DATE _____
District Geothermal Supervisor Area Geothermal Supervisor

This permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.71-1; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

INSTRUCTIONS

GENERAL: This form shall be used for applications to construct and operate any utilization facility on Federally leased lands or lands under a unit or cooperative agreement. Approval to operate the utilization facility shall be obtained subsequent to the approval for construction, as provided for on this form, and shall not be granted until all necessary requirements have been satisfied.

IN REPLY REFER TO

United States Department of the Interior

3262.4
(920)

BUREAU OF LAND MANAGEMENT

OREGON STATE OFFICE
P.O. Box 2965 (825 NE Multnomah Street)
Portland, Oregon 97208

James L. Moore, Vice President, Exploration
California Energy Company
3333 Mendocino Ave., Suite 100
Santa Rosa, California 95401

Dear Mr. Moore:

I am pleased to inform you that a modified Plan of Exploration for drilling of temperature gradient/core holes on your geothermal leases in the Mazama I and Mazama II Units in the Winema National Forest is hereby approved. The modified plan provides for drilling up to four holes on previously disturbed sites. All operations must be conducted in accordance with the Geothermal Steam Act of 1970, applicable regulations, GRO orders, lease terms, special stipulations, special design features discussed in the Amended Environmental Assessment (EA OR 010-84-28, enclosed), and the "California Energy Monitoring Plan" as stated in the enclosed Decision Document. Approval of this plan of exploration does not constitute authorization to commence drilling or surface disturbing operations. Such authorization is granted by approval of a Geothermal Drilling Permit or Sundry Notice.

In order to approve Geothermal Drilling Permits for holes located within 1/4 mile of the new unmarked eastern boundary of Crater Lake National Park, careful ground-siting of these locations is necessary. Our Lakeview District Office will coordinate field efforts with you, the Forest Service, and the Park Service for hole location. The Authorized Officer will have to be satisfied that the well sites are located on National Forest lands, and this could include surveying a portion or portions of the Park boundary. Should this be necessary, planning and lead time are essential to avoid delays. Also, such surveys performed by recognized surveyors would need BLM approval, or alternatively the work could be performed on a cost reimbursable basis by BLM Cadastral Survey crews.

Acknowledging that while the approval process has been lengthy, it also has been quite thorough in review, analysis, and study of the many concerns raised. I want to thank California Energy Company and its staff for excellent

cooperation in providing information and material, attending meetings, and field trips and facilitating the process.

We are gratified that our decision rests on a firm and well reasoned environmental foundation. We believe that careful work at this stage should facilitate more efficient permit approvals in the future.

We look forward to continued cooperation and wish you well in your project.

Sincerely,

Leroy M. Mohorich
Deputy State Director
for Mineral Resources
Acting

Referred to the Winema National Forest Supervisor, Klamath Falls, Oregon.

I concur

Feb. 28, 1985
Date of Concurrence

Forest Supervisor, Winema National Forest

1. Enclosure
   Encl. 1 - Decision Record

IN REPLY REFER TO:

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
OREGON STATE OFFICE
825 NE Multnomah Street
P.O. Box 2965
Portland, Oregon 97208

Dear Friend,

We appreciate your continued interest in the geothermal exploration program proposed by California Energy Company in the Winema National Forest.

A decision has been made by the State Director, and concurred by the Regional Forester. A copy of the Decision Record is enclosed for your information. Included with the decision is a copy of all the other documents prepared: the monitoring plan, briefing paper, Amended Environmental Assessment, and Finding of No Significant Impact.

Edward T. Ciliberti
Chief, Public Affairs

DECISION RECORD

Regarding applications to drill (phase 2) temperature gradient wells in the Winema National Forest, by California Energy Company.

I have carefully reviewed the Amended Environmental Assessment, Finding of No Significant Impact, and briefing paper for California Energy Company's proposed geothermal exploration activities in the Winema National Forest.

I have analyzed the following options:

1. Approve the proposed action - drilling up to 24 temperature gradient wells on 24 specifically identified, previously disturbed sites within the unitized area.

2. Approve drilling temperature gradient wells anywhere within the unitized area on otherwise disturbed ground.

2a. Approve drilling 4 temperature gradient wells on previously disturbed ground, with approval of drilling additional temperature gradient wells contingent upon the results of drilling and monitoring as detailed in the attached monitoring plan, evaluation of the data obtained from those 4 wells, and submission and approval of another Plan of Operations.

3. Approve drilling temperature gradient wells anywhere within the unitized area.

4. Disallow drilling any temperature gradient wells.

My decision is to implement option 2a, for the following reasons:

1. This option provides for limited exploration with the greatest amount of precaution and protection from possible adverse impacts to the surrounding environment, including Crater Lake and the National Park, and as such, meets the requirements of Public Law 97-250 for maintaining the Lake's water quality.

2. BLM will obtain detailed information as a result of implementing the monitoring plan, to more accurately judge potential impacts of any future drilling operations and reduce surface impacts. Collection of this information will compliment the other ongoing studies and investigations of the water quality of

Crater Lake as authorized and directed by Public Law 97-250.

3. BLM will obtain all information regarding the temperature gradient wells to use in future geothermal-related analyses.

4. California Energy Company will be able to explore to an appropriate extent at this time for geothermal resources under the terms of their leases and unit agreements.

This decision will be implemented by a letter of approval to California Energy Company, subject first to the review and concurrence by the Winema National Forest Supervisor. After a 30-day period has elapsed from the date of this decision, to allow for any appeal under the procedures noted below, BLM Deputy State Director for Mineral Resources will proceed to approve the modified Plan of Exploration, and issue the first four drilling permits, as conditioned. Subsequent Plans of Operation and drilling permits will be issued as appropriate, all subject to the usual protest/appeal procedures offered all parties of standing in such cases. Copies of approvals will be sent to the Lakeview BLM District, the Winema National Forest, and Crater Lake National Park Headquarters. Full public notice is to be provided on this decision and subsequent approval documents.

This decision may be appealed to the Board of Land Appeals, Office of the Secretary, in accordance with the regulations contained in 43 CFR Part 4 and the enclosed Form 1842-1. If an appeal is taken, the notice of appeal must be filed in this office so that the case file can be transmitted to the Board. A copy of the notice of appeal and of any statement of reasons, written arguments, or briefs must also be served on the Regional Solicitor, Pacific Northwest Region, U.S. Department of the Interior, Lloyd 500 Building, Suite 607, 500 NE Multnomah Street, Portland, Oregon, 97232. In taking an appeal there must be strict compliance with the regulations.

William G. Leavell — Date 12/12/84

William G. Leavell
State Director, Oregon/Washington
Bureau of Land Management

I concur:

Jeff Sirmon — Date 12/12/84

Jeff Sirmon
Regional Forester, Region 6
U. S. Forest Service

Finding of No Significant Impact
EA No. OR 010-84-28

Geothermal Exploration on the Winema National Forest

Drilling Program

The Bureau of Land Management Lakeview District and the United States Forest Service Winema National Forest have analyzed a program for geothermal exploration drilling of temperature gradient core holes on the Winema National Forest.

The proposal, three alternatives, associated design features and potential mitigating measures are described in the attached Environmental Assessment No. OR-010-84-28 which was made available to the public on May 10, 1984.

The design features and if adopted, mitigation measures identified for the proposed action and each alternative in the attached EA would assure that no significant impacts would occur to the human environment.

This finding is based upon the following reason:

1. Surface impacts associated with temperature gradient holes are temporary in nature. The holes and drilling pads can be restored to prework characteristics with only the capped thermal probe remaining. If no re-entry is made within a reasonable time, total surface restoration can be accomplished.

2. Upon completion of this phase of geothermal exploration any roads constructed solely for access to drilling sites would be closed and reseeded with appropriate vegetation or recontoured and seeded.

3. Dust resulting from drilling pad construction, truck traffic, and road construction is temporary and can be mitigated by watering.

4. Noise from drilling operations would be virtually undetectable during daytime operations due to ever present background noise. Nighttime noise would be no greater than that experienced in an undeveloped rural area.

5. Cultural resources would not be affected since any resource found during site specific surveys would be protected in accordance with applicable laws.

6. Adoption and implementation of any drilling alternative would have no adverse impact of importance on Crater Lake National Park, its visitors or Crater Lake. Intrusions to the quality of the visitors experience from dust, noise, etc., are expected to be no more objectionable than normal logging activities outside the Park.

Since geothermal fluids would not be produced under any alternative, and with incorporation of blowout prevention and containment procedures, it is virtually impossible for geothermal discharges to enter Crater Lake. In addition, existing geothermal heating/discharges at the bottom of Crater Lake would not be affected. The only drill site of the proposed 24 which has a potential for an accidental discharge to flow into the park is MZI-13. However, adoption of a mitigation measure which moves this site over the ridge and prohibits drilling site in drainages which flow into the park, would satisfy this concern.

Special Design Feature No. 9 will adequately protect the Park from any unforseen impacts.

7. There would be no effect on threatened or endangered species. The Peregrine Falcon is the only known species on the T&E list that uses the lease area. Timber harvesting activities have had no known adverse effect on the Peregrine falcon's activities in the area. The proposed drilling activities under all alternatives would have less impact than logging activities. A letter from the U.S. Fish and Wildlife Service supports this finding.

8. No wilderness areas, proposed wilderness areas, wild or scenic rivers, would be affected by the proposed action or alternatives.

On the basis of the information contained in the EA, and all other information available to me as is summarized above, it is my determination that none of the alternatives analyzed, when standard and special design features are included, constitutes a major Federal action affecting the quality of the human environment. Suggested mitigation measures would reduce adverse impacts to an even greater degree. Therefore, an Environmental Impact Statement is unnecessary and will not be prepared.

12/11/84
Date

Jerry E Ashes
Jerry Ashes
District Manager
Lakeview District

I Concur Arthur DuFault
Arthur DuFault
Supervisor
Winema National Forest

California Energy Monitoring Plan

California Energy Company, Incorporated has submitted a geothermal exploration plan to drill up to 24, 4000-foot deep temperature gradient core holes on geothermal leases on the Winema National Forest, east of Crater Lake National Park.

The attached monitoring plan has been prepared to assess and mitigate both surface and subsurface impacts, if any, resulting from the drilling of the initially permitted drill holes.

Based upon the results of the monitoring of the initial holes, a decision will be made as to whether or not additional holes should be permitted, and if so, what, if any, additional protective measures will be necessary.

The monitoring plan is based upon the Geothermal Resource Operational Orders and the Standard and Special Design Features developed in the environmental assessment prepared for this proposal.

This monitoring plan was developed with input provided by personnel from the Winema National Forest and Crater Lake National Park during a meeting held November 9, 1984, at the Supervisor's Office, Winema National Forest, Klamath Falls.

Any unforseen impacts to Crater Lake National Park from any drilling operations identified through monitoring and consultation with representatives of the National Park, will result in immediate suspension of the drilling operations by the Authorized Officer, and the adoption of procedures to mitigate those impacts.

1. All drill holes located within 1/4 mile of the new unmarked eastern boundary of Crater Lake National Park shall be referenced to survey monuments, or some other identifiable geographic or cultural feature, to the satisfaction of the Authorized Officer. The on-the-ground location of these sites shall be field-checked by the Authorized Officer and a representative from the National Park prior to any surface disturbance.

2. The lessee shall be required to conduct noise level measurements during drilling operations to determine noise objectionability and potential health and safety dangers. The location of the monitoring stations, and frequency of monitoring, shall be determined by the Authorized Officer, after consultation with personnel from Winema National Forest and Crater Lake National Park. All noise level measurements and accompanying data shall be filed with the Authorized Officer.

3. The Authorized Officer periodically will take noise level measurements to ensure that the data submitted by the lessee is reliable.

4. Personnel from the National Park shall be given the opportunity to accompany the lessee and/or the Authorized Officer whenever noise level measurements are taken within the National Park boundaries.

5. Drilling facilities shall be inspected daily by the lessee to ensure that drilling fluids do not contaminate any surface waters. The Authorized Officer shall make periodic inspections.

6. In order to prevent subsurface interzonal migration of fluids that could affect aquifers and nearby lakes and streams, the lessee shall be required to monitor mud pit levels. If drilling problems, such as lost circulation or increased mud pit levels due to water infiltration are encountered, the lessee will be required to seal the zone of fluid inflow or fluid loss.

7. In the event groundwater enters the well, such water will be collected and analyzed to see if Crater Lake water is present. Such analyses will be performed by the USGS (Mike Thompson), and paid by Cal Energy.

8. In order to prevent impacts associated with uncontrolled blowouts, all drill holes shall be equipped with blowout prevention equipment (BOPE). All BOPE shall be inspected by the Authorized Officer and pressure tested to ensure proper functioning. Specific stipulations relating to casing program, BOPE specifications, and allowable downhole temperatures will be developed by the Authorized Officer, and required as part of the drilling permits.

9. Inspections will be made by the Authorized Officer to ensure compliance with these stipulations.

10. Joint field inspections will be scheduled by the Authorized Officer to give Crater Lake National Park personnel an opportunity to observe drilling operations.

California Energy Monitoring Plan

California Energy Company, Incorporated has submitted a geothermal exploration plan to drill up to 24, 4000-foot deep temperature gradient core holes on geothermal leases on the Winema National Forest, east of Crater Lake National Park.

The attached monitoring plan has been prepared to assess and mitigate both surface and subsurface impacts, if any, resulting from the drilling of the initially permitted drill holes.

Based upon the results of the monitoring of the initial holes, a decision will be made as to whether or not additional holes should be permitted, and if so, what, if any, additional protective measures will be necessary.

The monitoring plan is based upon the Geothermal Resource Operational Orders and the Standard and Special Design Features developed in the environmental assessment prepared for this proposal.

This monitoring plan was developed with input provided by personnel from the Winema National Forest and Crater Lake National Park during a meeting held November 9, 1984, at the Supervisor's Office, Winema National Forest, Klamath Falls.

Any unforseen impacts to Crater Lake National Park from any drilling operations identified through monitoring and consultation with representatives of the National Park, will result in immediate suspension of the drilling operations by the Authorized Officer, and the adoption of procedures to mitigate those impacts.

1. All drill holes located within 1/4 mile of the new unmarked eastern boundary of Crater Lake National Park shall be referenced to survey monuments, or some other identifiable geographic or cultural feature, to the satisfaction of the Authorized Officer. The on-the-ground location of these sites shall be field-checked by the Authorized Officer and a representative from the National Park prior to any surface disturbance.

2. The lessee shall be required to conduct noise level measurements during drilling operations to determine noise objectionability and potential health and safety dangers. The location of the monitoring stations, and frequency of monitoring, shall be determined by the Authorized Officer, after consultation with personnel from Winema National Forest and Crater Lake National Park. All noise level measurements and accompanying data shall be filed with the Authorized Officer.

3. The Authorized Officer periodically will take noise level measurements to ensure that the data submitted by the lessee is reliable.

4. Personnel from the National Park shall be given the opportunity to accompany the lessee and/or the Authorized Officer whenever noise level measurements are taken within the National Park boundaries.

5. Drilling facilities shall be inspected daily by the lessee to ensure that drilling fluids do not contaminate any surface waters. The Authorized Officer shall make periodic inspections.

6. In order to prevent subsurface interzonal migration of fluids that could affect aquifers and nearby lakes and streams, the lessee shall be required to monitor mud pit levels. If drilling problems, such as lost circulation or increased mud pit levels due to water infiltration are encountered, the lessee will be required to seal the zone of fluid inflow or fluid loss.

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8. In order to prevent impacts associated with uncontrolled blowouts, all drill holes shall be equipped with blowout prevention equipment (BOPE). All BOPE shall be inspected by the Authorized Officer and pressure tested to ensure proper functioning. Specific stipulations relating to casing program, BOPE specifications, and allowable downhole temperatures will be developed by the Authorized Officer, and required as part of the drilling permits.

9. Inspections will be made by the Authorized Officer to ensure compliance with these stipulations.

10. Joint field inspections will be scheduled by the Authorized Officer to give Crater Lake National Park personnel an opportunity to observe drilling operations.

IN REPLY REFER TO:

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
OREGON STATE OFFICE
825 NE Multnomah Street
P.O. Box 2965
Portland, Oregon 97208

Dear Friend,

We appreciate your continued interest in the geothermal exploration program proposed by California Energy Company in the Winema National Forest.

A decision has been made by the State Director, and concurred by the Regional Forester. A copy of the Decision Record is enclosed for your information. Included with the decision is a copy of all the other documents prepared: the monitoring plan, briefing paper, Amended Environmental Assessment, and Finding of No Significant Impact.

Edward T. Ciliberti
Chief, Public Affairs

DECISION RECORD

Regarding applications to drill (phase 2) temperature gradient wells in the Winema National Forest, by California Energy Company.

I have carefully reviewed the Amended Environmental Assessment, Finding of No Significant Impact, and briefing paper for California Energy Company's proposed geothermal exploration activities in the Winema National Forest.

I have analyzed the following options:

1. Approve the proposed action - drilling up to 24 temperature gradient wells on 24 specifically identified, previously disturbed sites within the unitized area.

2. Approve drilling temperature gradient wells anywhere within the unitized area on otherwise disturbed ground.

2a. Approve drilling 4 temperature gradient wells on previously disturbed ground, with approval of drilling additional temperature gradient wells contingent upon the results of drilling and monitoring as detailed in the attached monitoring plan, evaluation of the data obtained from those 4 wells, and submission and approval of another Plan of Operations.

3. Approve drilling temperature gradient wells anywhere within the unitized area.

4. Disallow drilling any temperature gradient wells.

My decision is to implement option 2a, for the following reasons:

1. This option provides for limited exploration with the greatest amount of precaution and protection from possible adverse impacts to the surrounding environment, including Crater Lake and the National Park, and as such, meets the requirements of Public Law 97-250 for maintaining the Lake's water quality.

2. BLM will obtain detailed information as a result of implementing the monitoring plan, to more accurately judge potential impacts of any future drilling operations and reduce surface impacts. Collection of this information will compliment the other ongoing studies and investigations of the water quality of

Crater Lake as authorized and directed by Public Law 97-250.

3. BLM will obtain all information regarding the temperature gradient wells to use in future geothermal-related analyses.

4. California Energy Company will be able to explore to an appropriate extent at this time for geothermal resources under the terms of their leases and unit agreements.

This decision will be implemented by a letter of approval to California Energy Company, subject first to the review and concurrence by the Winema National Forest Supervisor. After a 30-day period has elapsed from the date of this decision, to allow for any appeal under the procedures noted below, BLM Deputy State Director for Mineral Resources will proceed to approve the modified Plan of Exploration, and issue the first four drilling permits, as conditioned. Subsequent Plans of Operation and drilling permits will be issued as appropriate, all subject to the usual protest/appeal procedures offered all parties of standing in such cases. Copies of approvals will be sent to the Lakeview BLM District, the Winema National Forest, and Crater Lake National Park Headquarters. Full public notice is to be provided on this decision and subsequent approval documents.

This decision may be appealed to the Board of Land Appeals, Office of the Secretary, in accordance with the regulations contained in 43 CFR Part 4 and the enclosed Form 1842-1. If an appeal is taken, the notice of appeal must be filed in this office so that the case file can be transmitted to the Board. A copy of the notice of appeal and of any statement of reasons, written arguments, or briefs must also be served on the Regional Solicitor, Pacific Northwest Region, U.S. Department of the Interior, Lloyd 500 Building, Suite 607, 500 NE Multnomah Street, Portland, Oregon, 97232. In taking an appeal there must be strict compliance with the regulations.

William G. Leavell — Date 12/12/84

William G. Leavell
State Director, Oregon/Washington
Bureau of Land Management

I concur:

Jeff Sirmon — Date 12/12/84

Jeff Sirmon
Regional Forester, Region 6
U. S. Forest Service

Finding of No Significant Impact
EA No. OR 010-84-28

Geothermal Exploration on the Winema National Forest

Drilling Program

The Bureau of Land Management Lakeview District and the United States Forest Service Winema National Forest have analyzed a program for geothermal exploration drilling of temperature gradient core holes on the Winema National Forest.

The proposal, three alternatives, associated design features and potential mitigating measures are described in the attached Environmental Assessment No. OR-010-84-28 which was made available to the public on May 10, 1984.

The design features and if adopted, mitigation measures identified for the proposed action and each alternative in the attached EA would assure that no significant impacts would occur to the human environment.

This finding is based upon the following reason:

1. Surface impacts associated with temperature gradient holes are temporary in nature. The holes and drilling pads can be restored to prework characteristics with only the capped thermal probe remaining. If no re-entry is made within a reasonable time, total surface restoration can be accomplished.

2. Upon completion of this phase of geothermal exploration any roads constructed solely for access to drilling sites would be closed and reseeded with appropriate vegetation or recontoured and seeded.

3. Dust resulting from drilling pad construction, truck traffic, and road construction is temporary and can be mitigated by watering.

4. Noise from drilling operations would be virtually undetectable during daytime operations due to ever present background noise. Nighttime noise would be no greater than that experienced in an undeveloped rural area.

5. Cultural resources would not be affected since any resource found during site specific surveys would be protected in accordance with applicable laws.

6. Adoption and implementation of any drilling alternative would have no adverse impact of importance on Crater Lake National Park, its visitors or Crater Lake. Intrusions to the quality of the visitors experience from dust, noise, etc., are expected to be no more objectionable than normal logging activities outside the Park.

Since geothermal fluids would not be produced under any alternative, and with incorporation of blowout prevention and containment procedures, it is virtually impossible for geothermal discharges to enter Crater Lake. In addition, existing geothermal heating/discharges at the bottom of Crater Lake would not be affected. The only drill site of the proposed 24 which has a potential for an accidental discharge to flow into the park is MZI-13. However, adoption of a mitigation measure which moves this site over the ridge and prohibits drilling site in drainages which flow into the park, would satisfy this concern.

Special Design Feature No. 9 will adequately protect the Park from any unforseen impacts.

7. There would be no effect on threatened or endangered species. The Peregrine Falcon is the only known species on the T&E list that uses the lease area. Timber harvesting activities have had no known adverse effect on the Peregrine falcon's activities in the area. The proposed drilling activities under all alternatives would have less impact than logging activities. A letter from the U.S. Fish and Wildlife Service supports this finding.

8. No wilderness areas, proposed wilderness areas, wild or scenic rivers, would be affected by the proposed action or alternatives.

On the basis of the information contained in the EA, and all other information available to me as is summarized above, it is my determination that none of the alternatives analyzed, when standard and special design features are included, constitutes a major Federal action affecting the quality of the human environment. Suggested mitigation measures would reduce adverse impacts to an even greater degree. Therefore, an Environmental Impact Statement is unnecessary and will not be prepared.

12/11/84
Date

Jerry E. Asher
Jerry Asher
District Manager
Lakeview District

I Concur Arthur DuFault
Arthur DuFault
Supervisor
Winema National Forest

Form 1842-1
(December 1980)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

INFORMATION ON TAKING APPEALS TO THE BOARD OF LAND APPEALS

DO NOT APPEAL UNLESS

1. This decision is adverse to you,

AND

2. You believe it is incorrect

IF YOU APPEAL, THE FOLLOWING PROCEDURES MUST BE FOLLOWED

1. NOTICE OF APPEAL . . . . Within 30 days file a *Notice of Appeal* in the office which issued this decision (see 43 CFR Sec. 4.411). You may state your reasons for appealing, if you desire.

2. WHERE TO FILE NOTICE OF APPEAL . . .

3. STATEMENT OF REASONS . . Within 30 days after filing the *Notice of Appeal*, file a complete statement of the reasons why you are appealing. This must be filed with the United States Department of the Interior. Office of the Secretary, Board of Land Appeals, 4015 Wilson Blvd., Arlington, Virginia 22203 (see 43 CFR Sec. 4.412). If you fully stated your reasons for appealing when filing the *Notice of Appeal*, no additional statement is necessary.

4. ADVERSE PARTIES . . . . Within 15 days after each document is filed, each adverse party named in the decision and the Regional Solicitor or Field Solicitor having jurisdiction over the State in which the appeal arose must be served with a copy of: (a) the *Notice of Appeal*, (b) the Statement of Reasons, and (c) any other documents filed (see 43 CFR Sec. 4.413). Service will be made upon the Associate Solicitor, Division of Energy and Resources, Washington, D.C. 20240, instead of the Field or Regional Solicitor when appeals are taken from decisions of the Director (WO-100) or if the subject matter of the appeals involves mineral activities on the Outer Continental Shelf.

5. PROOF OF SERVICE . . . . Within 15 days after any document is served on an adverse party, file proof of that service with the United States Department of the Interior, Office of the Secretary, Board of Land Appeals, 4015 Wilson Blvd., Arlington, Virginia 22203. This may consist of a certified or registered mail "Return Receipt Card" signed by the adverse party (see 43 CFR Sec. 4.401(c)(2)).

Unless these procedures are followed your appeal will be subject to dismissal (see 43 CFR Sec. 4.402). Be certain that all communications are identified by serial number of the case being appealed.

NOTE: *A document is not filed until it is actually received in the proper office (see 43 CFR Sec. 4.401(a))*

SUBPART 1821.2--OFFICE HOURS; TIME AND PLACE FOR FILING

Sec. 1821.2-1 *Office hours of State Offices.* (a) State Offices and the Washington Office of the Bureau of Land Management are open to the public for the filing of documents and inspection of records during the hours specified in this paragraph on Monday through Friday of each week, with the exception of those days where the office may be closed because of a national holiday or Presidential or other administrative order. The hours during which the State Offices and the Washington Office are open to the public for the filing of documents and inspection of records are from 10 a.m. to 4 p.m., standard time or daylight saving time, whichever is in effect at the city in which each office is located.

Sec. 1821.2-2(d) Any document required or permitted to be filed under the regulations of this chapter, which is received in the State Office or the Washington Office, either in the mail or by personal delivery when the office is not open to the public shall be deemed to be filed as of the day and hour the office next opens to the public.

(e) Any document required by law, regulation, or decision to be filed within a stated period, the last day of which falls on a day the State Office or the Washington Office is officially closed, shall be deemed to be timely filed if it is received in the appropriate office on the next day the office is open to the public.

* * * * *

GPO 850-997

CALIFORNIA ENERGY COMPANY: GEOTHERMAL EXPLORATION BRIEFING PAPER

Required Decision

The decision requires the selection and implementation of either the proposed action, one of the three alternatives identified in the Environmental Assessment (EA), or other options. The proposed action is drilling up to 24 temperature gradient/core holes, with a maximum of 8 holes drilled in the first field season (originally 1984, now 1985).

Forcing Event

A decision should be made as soon as possible, but no later than the end of the calendar year so that the proponent can make necessary arrangements prior to the next field season.

Background

The initiating event was the submittal of a geothermal Plan of Exploration (POE) by the proponent, California Energy Company, Inc. (Cal Energy). The POE, received by the BLM on March 1, 1984, requested approval to drill up to 24 temperature gradient/core holes on two federal geothermal unit areas on the Winema National Forest, adjacent to Crater Lake National Park. This action follows leasing and unit agreement approvals.

Leasing

Cal Energy was awarded federal geothermal leases totaling approximately 97,000 acres in the Winema National Forest. Cal Energy received concurrent approval for two federal geothermal unit agreements, encompassing approximately 84,000 acres of the 97,000 acre total.

According to the regulations, geothermal leases on Forest Service lands can only be issued with the consent of, and subject to such terms and conditions as may be prescribed by the Forest Service. Usually, the Forest Service prepares an environmental analysis for the lease applications, in order to determine whether the leases should be issued, and with what, if any, stipulations to mitigate or eliminate impacts to surface resources.

All of the federal geothermal leases on the Winema National Forest contain a contingent right stipulation, which states in part: "All operations on this lease are subject to Government approval with such site-specific stipulations as may be necessary to assure reasonable protection of or mitigation of effects on other values. A plan of operations shall not be approved if it results in unacceptable impact on other resources, land uses, and/or the environment."

The contingent right stipulation is a mechanism which allows the Forest

Service to recommend geothermal leasing to the BLM, without first conducting an environmental analysis. With this strategy, the environmental analysis process is postponed until such time that a site-specific, post-lease operation is proposed, and the rights of the lessee are contingent on the results of any environmental analysis.

Unit Agreements

The unit agreements are contractual agreements between the lessees and the Federal government, and allow for the timely and orderly exploration of geothermal resources without regard to individual lease boundaries. There are two approved geothermal unit agreements involved in this POE, Mazama I and Mazama II. Under the combined terms of these unit agreements, Cal Energy is obligated to drill 4 wells within 18 months of the effective date of the agreements (January 1, 1984). The 18 month timeframe will be extended for that period of time required by the Federal government to complete the environmental analysis. The unit obligations escalate during subsequent 12 to 18 month periods.

Plan of Exploration

According to the regulations, a plan of operations and individual drilling permits must be submitted by the lessee or the lessee's representative, and approved by the authorized officer (BLM) prior to commencement of actual drilling operations. Specific types of plans of operations include Plans of Exploration, Injection, and Development.

The Plan of Exploration details the surface use requirements, on a site-specific basis, of the proposed drilling operations, and includes discussions on water use, road and drill pad construction, and measures to prevent or control impacts to other surface resources.

Any approved plan and accompanying drilling permit(s) would include standard design features, including Geothermal Resource Operational (GRO) Orders, and special stipulations. Several key standard design features appropriate to this proposal are:

GRO Order 1, section 5. Drilling fluids or cuttings shall not be discharged onto the surface where such discharge might contaminate lakes and perennial or intermittent streams. Excavated pits or sumps used in drilling shall be backfilled as soon as drilling is completed and restored to conform with the original topography.

GRO Order 3, section 1.A. In uncased portions of wells, cement plugs shall be placed to protect all subsurface mineral resources including fresh water aquifers. Such plugs shall extend a minimum of 100 feet below, if possible, and 100 feet above such zones. Cement plugs shall be placed in a manner necessary to isolate formations, and to protect the fluids in such formations from interzonal migration or contamination.

History of Events

Cal Energy submitted their Plan of Exploration to drill up to 24 temperature gradient/core holes, to a maximum depth of 4000 feet. The plan was received by the BLM on March 1, 1984. Upon receipt of the POE, the BLM Lakeview District, in cooperation with the Winema National Forest, initiated an EA based on the proposed action. An interdisciplinary team was formed from personnel of the Lakeview District and Klamath Falls Resource Area offices of the BLM, and Winema National Forest. Crater Lake National Park staff participated as observers. The following week a summary of the POE was sent out to interested parties, requesting public comments.

On May 11, 1984, the EA was completed and made available for public review and comment. Two letters of comment were received; one from the Sierra Club, and one from the National Park Service Regional Office in Seattle, Washington. Both letters expressed concerns about the potential impacts on the environment, and in particular on Crater Lake National Park, as a result of the proposed drilling operations. In addition, the Regional Director of the Park Service wrote a memorandum to the National Park Service Director, identifying concerns and asking that the issue be brought to their Assistant Secretary, as required by their headquarter's instructions. That memorandum also requested that the Department's Office of Environmental Project Review (OEPR) review the EA.

The State Director, in consideration of ongoing circumstances, wrote a memorandum to the Director (500), stating that the BLM had advised the Park Service Regional Office that while the BLM understands the Park Service concerns regarding potential impacts to Crater Lake National Park, the BLM must follow its own procedures in permit review and NEPA compliance, which call for quality control and issue resolution at the field level. The memorandum went on to state that the State Director's review of the situation continues to strongly confirm that the BLM should resolve concerns at the field level, in coordination with the Park Service and Forest Service.

In light of the concerns expressed, and in keeping with the concept of field level resolution of concerns, the State Director, along with other BLM and Forest Service managers and staff, and representatives of Cal Energy, conducted an on-site field inspection of the proposed drilling sites and neighboring Park lands on June 30, 1984. A National Park Service ranger guided the party around the east rim of Crater Lake. As a result of the inspection, the State Director acquired a better understanding of the proposed action, proximity of operations to the Park, and scope of environmental impacts. On July 3, 1984, the first of two Park Service/Forest Service/BLM meetings to review the EA was held. Also, the State Director requested the Lakeview District, in conjuction with the Winema National Forest, to conduct a public meeting and field trip open to all interested parties.

On July 20, 1984, the public meeting and field trip were held. About 50 people attended, representing the television and print media, U. S. Congressman Bob Smith's staff, State Senator Judy Carnahan, Klamath County Commissioners, the Klamath Indians, various environmental organizations, the Oregon Departments of Fish and Wildlife, Geology and

Minerals Industries, State Lands, and Water Resources, the National Park Service, Forest Service, and BLM. No new concerns were raised during the meeting or field trip.

The EA was subsequently amended, specifically to address the Park Service concerns. BLM, on July 19, 1984, requested the advice of the USGS regarding the hydrologic concerns of the NPS. The USGS replied (copy attached) that "the potential for affecting the flow of hydrothermal fluids into Crater Lake is clearly very small... A second Park Service/Forest Service/BLM meeting was held to review the draft amended EA, and Finding of No Significant Impact (FONSI). The Park Service concluded that, with minor modifications, the amended EA adequately addressed those concerns. The amended EA was revised to incorporate those modifications, and transmitted to the Lakeview District Manager and Winema National Forest Supervisor, along with the FONSI, for signature and concurrence.

Outstanding Issues

The decision is dependent on the following factors:

1. Environmental sensitivities;
2. Drilling concerns;
3. Bureau Mineral Resources Policy;
4. Park Service concerns;
5. Public concerns.

Environmental sensitivities

The amended EA concludes that the following potential environmental consequences are anticipated for the below listed environmental components, as a result of the proposed action or another drilling-related alternative approved with standard and special design features incorporated:

Crater Lake National Park
- short-term increases in dust levels;
- noise levels a nuisance to recreational users at Lost Creek campground and the Pinnacles overlook;
- virtually undetectable intrusions in the scenic quality.

surface water - minor depletion of local water sources.
soils - soil compaction and loss of ground cover (0.2 acres per drill site under all drilling alternatives; increased disturbance associated with road construction under alternative 1).
wildlife - minor and temporary impacts due to some interruption of localized habitat occupancy.
transportation system - minor unavoidable impacts from compaction, surface displacement, dust, and noise due to increased traffic and essential road maintenance.
wood products - no impacts.
threatened and endangered species - no impacts.
cultural resources - no impacts under the proposed action or alternative 2; possible impacts on unidentified cultural resources under alternative 1.
minerals - positive impact due to increased minerals information.
land uses - no impact on existing authorized uses.

The potential for intermingling of geochemically discrete groundwater aquifers would be eliminated by selection and implementation of the hydrologic-related mitigation measure as stated in the EA, "the zones of fluid inflow or fluid loss [in the well] will be required to be sealed."

Noise levels can be controlled with standard design features (Geothermal Resource Operational Order number 4). This GRO Order states, "the lessee shall not exceed a noise level of 65 dB(A) for all geothermal-related activity as measured at the lease boundary line or one-half mile from the source, whichever is greater." Noise levels could be further reduced by selection and implementation of the noise-related mitigation measure as stated in the EA, "no more than one site in the vicinity of MZI-13 and MZI-14 would be drilled simultaneously."

Possible impacts on unidentified cultural resources, resulting from the implementation of Alternative 1 would be eliminated by selection and implementation of the cultural resources-related mitigation measure as stated in the EA, "appropriate [cultural resources] site surveys and mitigation (as needed) would be conducted prior to ground disturbing activities."

Drilling concerns

Two drilling uncertainties are associated with any drilling alternative: the potential for water flowing within a hole between aquifers with different pressure heads; and the potential for a blowout (uncontrolled emissions of fluids and/or gases from a well).

There are no guarantees that either event would not occur; however, standard design features that would be incorporated into any drilling permit would minimize the potential for either of these two occurrences. In addition, it would be prudent to incorporate the mitigation measure regarding intermingling of ground water (see discussion in the environmental uncertainties section above) as contained in the letter from the Director, USGS, to the State Director, even though this measure is a standard design feature. Reiteration of the USGS mitigation measure would: acknowledge the consultation and cooperation of the USGS; notify those parties concerned about the hydrology of Crater Lake that the BLM has treated those concerns with high regard; and single out this standard design feature as being more important than some other standard design features.

With respect to the uncertainty of a blowout, the EA did not discuss in detail the risks associated with such an event. A blowout would be considered an accident, and the U. S. Supreme Court has determined that "a risk of an accident is not an effect on the physical environment," and is therefore beyond the reach of NEPA (Metropolitan Edison v. People Against Nuclear Energy et al., no. 81-2399, decision of April 19,1983).

Also, the EA did not address mitigation measures to further reduce the potential risks or impacts associated with a blowout, because the standard design features (casing, cementing, and blowout prevention equipment specifications and testing) are more than adequate to maintain effective control of a drilling well. These standard design features incorporate current industry specifications and practices with respect to

GRO Order 4, section 2. Operations under a geothermal lease shall not unreasonably interfere with or endanger operations under any other lease, license, claim, permit, or other authorized use of the same land. GRO Order 4, section 11. The lessee shall conduct noise level measurements during exploration, development, and production operations to determine the potential nuisance to nearby residents as well as the potential health and safety danger to noise emissions. Noise level measurements and accompanying data shall be filed with the authorized officer.

GRO Order 4, section 11.C. The lessee shall not exceed a noise level of 65 dB(A) for all geothermal-related activity including but not limited to exploration, development, or production operations as measured at the lease boundary line or one-half mile from the source, whichever is greater.

Special stipulation. All wells drilled below 500 feet shall be equipped with blowout prevention equipment.

Approval Process

With the consolidation of onshore minerals responsibilities, the BLM has the authority to approve industry operations on all federal leases, regardless of surface ownership or management. The existing nationwide BLM/Forest Service/Geological Survey Memorandum of Understanding for the geothermal program requires concurrence of post-lease operations by the surface management agency.

In order for Cal Energy to enter on the land and start dirt work/drilling operations, the following documents require approval by the authorized officer, and concurrence by the surface management agency, where appropriate:

Document	Authorized Officer	Concurrence
EA	Lakeview DM	Forest Supervisor
FONSI	Lakeview DM	Forest Supervisor
Decision Document	State Director	
Plan of Exploration	Deputy State Director	Forest Supervisor
Drilling Permit	Deputy State Director	Forest Supervisor

In addition, concurrence of the decision will be obtained from the Regional Forester, USFS. Although this concurrence is not required, such action exemplifies the cooperative working relationship between BLM and USFS. The National Park Service Regional Director has been continually advised on BLM's progress on this matter, and will briefed prior to any decision to insure his input and understanding.

A 30-day period should lapse between the date of this decision and its implementation (approval of the Plan of Exploration and the drilling permits) to allow for appropriate protest/appeals.

Bureau of Land Management Mineral Resources Policy

This policy, updated by the Director on May 29, 1984, states, in part:

> "BLM actively encourages and facilitates the development by private industry of public land mineral resources in a manner that satisfies national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation practices."
>
> "BLM will process mineral use authorizations for public lands in a timely and efficient manner."

National Park Service concerns

The National Park Service forwarded eight concerns in their letter of comment from their Regional Director. The amended EA has addressed those comments, as well as all other issues and concerns raised at two separate Park Service/Forest Service/BLM meetings held to review the EA. At the conclusion of the second meeting, the Park Service representatives agreed that BLM had addressed the Park Service concerns.

The Park Service has also raised the concern of maintaining the water quality of the Lake. This concern is shared by all agencies of the Department of the Interior via Public Law 97-250 (16 U.S.C. 122a, September 8, 1982) which authorizes and directs the Secretary of the Interior to promptly instigate studies and investigations as to the status and trends of change of the water quality of Crater Lake, and to immediately implement such actions as may be necessary to assure the retention of the lake's natural pristine water quality. As the Department's agent for mineral leasing activities, including issuance of leases and permits for activities on Federal mineral leases, the BLM is required to comply with this law. Any activity permitted by the BLM will be monitored and controlled by the BLM to assure retention of the Lake's natural pristine water quality.

In addition, a monitoring plan was developed by the Lakeview District office, and was reviewed by representatives of Crater Lake National Park and the Winema National Forest on November 9, 1984. The monitoring plan further addresses concerns of the National Park, by detailing how BLM will: prevent well sites from being located in the Park; monitor noise levels; prevent possible interzonal migration of fluids; prevent impacts associated with uncontrolled blowouts; and involve Crater Lake National Park personnel in observing drilling operations. A copy of the monitoring plan is appended to this document. The acquisition of data required by the monitoring plan will compliment other ongoing studies and investigations of the water quality of Crater Lake as authorized and directed by Public Law 97-250.

Public concerns

Potential geothermal activity near Crater Lake National Park has generated much public interest, expressed by:

- newspaper coverage

television coverage
Congressional interest
environmental organizational interest

Newspaper coverage

The proposed drilling has been covered by virtually every newspaper in the Pacific Northwest. Various out-of-region newspapers have also run news stories about the proposed drilling, mainly by publishing the stories written by the Associated Press correspondent stationed in GrantsPass and Portland, Oregon. In addition, the Oregonian has published an editorial, expressing its view that the recreational and scenic values of the Park far outweigh any other resource values in the area.

Television coverage

There has been local and Portland-based television news coverage of the proposed drilling activity. Three television news crews were at the July 20, 1984 public meeting and field trip. NBC, in New York, has been in contact with the Public Affairs staff in the Oregon State Office, requesting the status of the proposal.

Congressional interest

State Senator Judy Carnahan, whose district includes the proposed area of exploration, attended the public meeting and field trip. In a conversation between her and the BLM staff during the field trip, she indicated that she was not uncomfortable with the temperature gradient/core hole drilling proposal, but wished to be kept informed of developments.

A staff member of U. S. Congressman Bob Smith's office was also in attendance at the public meeting and field trip. He indicated that the Congressman's office should be kept informed of developments.

A briefing for Senator Mark Hatfield's staff (Tom Imeson and Susan Long) was held in June. Ms. Long has since requested and received additional information through the Public Affairs staff in the State Office.

Environmental organizational interest

Various environmental organizations have attended the public meeting and field trip, or have contacted the Oregon State Office, Division of Mineral Resources. These groups have been interested in information gathering only at this time. The following groups have been in contact with the BLM:

Sierra Club
Oregon Natural Resources Council
Oregon Environmental Coalition
1000 Friends of Oregon

The Sierra Club has been the only environmental group which has provided written comments on the EA.

Other public interest

Other groups which were present at the public meeting and field trip, but did not comment, are:

Klamath County Commissioners
Klamath Indians
Klamath School District
Oregon Department of Fish and Wildlife
Oregon Department of Geology and Mineral Industries
Oregon Division of State Lands
Oregon Department of Water Resources
Oregon Institute of Technology

The completed original EA was sent to the Oregon State Clearinghouse for distribution to State and local agencies. No further comments were received.

Options

The proposed action is to drill up to 24 temperature gradient/core holes to a maximum depth of 4000 feet. Each of the 24 drill sites has been located on the ground with staff of the Winema National Forest, and each site has been previously disturbed by timber harvesting activities. The EA identified and discussed three alternatives to the proposed action: no action; drilling on any previously disturbed site within the boundaries of the federal geothermal unit areas; and drilling anywhere within the boundaries of the federal geothermal unit areas. One other option should be considered at this time; approval of a portion of the 24 drill sites during the first field season, with stipulations requiring intensive monitoring. The data collected as a result of the monitoring would enable the BLM to identify new or modify any existing conditions of approval.

All options discussed meet the requirements of Public Law 97-250 (16 U.S.C. 122a, September 8, 1982) concerning the water quality of Crater Lake.

Option 1. Approve the proposed action

This option would approve temperature gradient/core drilling at 24 specific sites. All sites have been inspected and approved by the Forest Service. Should any deviation from the original plan be proposed, such as an alternate or additional drilling site, another EA would be required.

Pros

1. There would be only minor environmental impacts associated with the approved operations, as assessed by the BLM and Forest Service.

2. Cal Energy would be able to drill temperature gradient wells under the terms of their federal leases.

3. BLM would obtain all information regarding the wells, to use in future geothermal-related analyses.

Cons

1. Any deviation from the plan, such as an alternate or additional site, would require another EA.

2. There would be a low risk of a blowout, which could affect up to three acres of the surface surrounding the well.

Option 2. Allow drilling anywhere in the unit areas.

This option would allow Cal Energy to drill anywhere within the boundaries of the unit agreements.

Pros

1. Cal Energy would be able to drill temperature gradient wells under the terms of their federal leases.

2. BLM would obtain all information regarding the wells, to use in future geothermal-related analyses.

Cons

1. Environmental impacts associated with drilling activities on previously undisturbed sites would be unknown. Any future proposal by Cal Energy for geothermal exploration operations on previously undisturbed sites would require another EA.

2. There would be a low risk of a blowout, which could affect up to three acres of the surface surrounding the well.

Option 2a. Approve drilling at 4 sites during the first field season.

This option would approve, without further environmental analysis, the first 4 drill sites Cal Energy would want to drill on previously disturbed sites. In addition, the monitoring plan, as appended, would be incorporated into the approval of the Plan of Exploration. Approval of any other site would be contingent upon the results of drilling, monitoring, and evaluation of the first 4 wells.

Pros

1. Cal Energy would be able to drill some temperature gradient wells under the terms of their leases.

2. BLM would obtain all information regarding the wells, to use in future geothermal-related analyses.

3. BLM would have additional information from these wells, through intensive monitoring, to more accurately judge potential impacts from future drilling operations and reduce surface impacts.

4. This option would provide the greatest amount of environmental protection, while still allowing Cal Energy to drill the exploratory wells.

Cons

1. There would be a low risk of a blowout, which could affect up to three acres of the surface surrounding the well.

2. Cal Energy would have no guarantees of drilling more than 4 of the wells proposed in this Plan of Exploration.

Option 3. Allow drilling anywhere in the unit areas that have been previously disturbed.

Pros

1. There would be only minor environmental impacts associated with the approved operations, as assessed by the BLM and Forest Service.

2. Cal Energy would be able drill temperature gradient wells under the terms of their federal leases.

3. BLM would obtain all information regarding the wells, to use in future geothermal-related analyses.

4. A new EA would not be required should Cal Energy wish to relocate or propose an additional site. This would result in a potential savings of time and workload.

Cons

1. There would be a low risk of a blowout, which could affect up to three acres of the surface surrounding the well.

Option 4. No action.

This option would deny approval of all proposed drilling operations submitted under the Plan of Exploration.

Pros

1. There would be no environmental impacts resulting from geothermal operations.

Cons

1. Cal Energy would not be able to explore for geothermal resources under the terms of their leases.

2. BLM would not be able to obtain any subsurface information which could be used in assessing future drilling proposals.

36 CFR 219.19
CONFORMANCE DETERMINATION

The proposed geothermal exploration drilling of temperature gradient/core holes on the Winema National Forest is considered to be in conformance with applicable land and resource management plans. These plans are as follows:

Chemult R.D. Multiple Use Plan	Approved Oct. 2, 1968
Chiloquin R.D. Multiple Use Plan	Approved July 7, 1968
Klamath R.D. Multiple Use Plan	Approved Feb. 7, 1969
Chemult Unit Plan	Approved Aug. 9, 1977
McLoughlin-Klamath Unit Plan	Approved July 12, 1979
Winema Timber Resource Plan	Approved Sept. 14, 1978

The conformance determination is based on the following reasons:

1. The Multiple Use Plans were approved by the Forest Supervisor. The Winema Timber Resource Plan and the Unit Plans were approved by the Regional Forester.

   The Forest Supervisor and the Regional Forester have determined that the plans are in conformance with the principles of multiple use and sustained yeild and were developed with appropriate public participation and Governmental coordination.

2. The drilling of temperature gradient holes would benefit the public interest and is in conformance with the Multiple Use-Sustained Yield Act of 1960, the National Forest Management Act of 1976, the Forest and Range Renewable Resources Planning Act of 1974, the Federal Land Policy and Management Act of 1976, the Geothermal Steam Act of 1970 and the National Energy Act of 1978.

   Drilling of temperature gradient holes would aid in determining if a regionally important geothermal resource exists under the Winema National Forest, and if this resource is suitable for electric energy generation.

3. The drilling of temperature gradient holes does not conflict with officially approved and adopted resource related plans, policies and programs of other Federal agencies, State and local Governments.

Arthur DuFault
Forest Supervisor
Winema National Forest

AMENDED ENVIRONMENTAL ASSESSMENT

GEOTHERMAL TEMPERATURE GRADIENT CORE DRILLING PROGRAM ON THE WINEMA NATIONAL FOREST

Responsible Officials:

Surface

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AMENDED ENVIRONMENTAL ASSESSMENT

Geothermal Temperature Gradient
Core Drilling Program on the
Winema National Forest

I. PURPOSE AND NEED FOR THE ACTION

On January 1, 1984 California Energy Company, Inc. (CECI) was awarded geothermal leases on approximately 97,070 acres of Federal land in the Winema National Forest. The Winema National Forest administers the surface resources; the Bureau of Land Management administers the subsurface resources.

The geothermal resource exploration and possible development of those resources is being conducted in four phases. This environmental assessment (EA) is being prepared to document the analysis of the environmental consequences of the Phase 2 Plan of Exploration. The first phase was initial exploration and reconnaissance, and was completed in 1983 under a prospecting permit issued by the Winema National Forest.

The second phase, now proposed, is drilling of small diameter temperature gradient holes, 8-inch diameter at the surface tapering to 2-1/2 inches at 4,000 feet. The third phase would be to drill large diameter, (36 inches at the surface, tapering to 7 to 13 inches at 10,000 feet) production test wells, assuming sufficient geothermal resources were located in Phase 2 to warrant further exploration.

Phase 4 would be development of a geothermal power plant, again assuming sufficient geothermal resources were produced from Phase 3 and assuming a favorable economic situation is present.

The proposed temperature gradient/core drilling is designed to determine if a geothermal resource is or is not present. The proposed drilling is not designed to enter into a geothermal resource.

All exploration and development phases of the leases are subject to the contingent right stipulation (CRS). The text of the CRS reads as follows:

> The Lessee shall comply with the following special conditions and stipulations unless they are modified by mutual agreement of the Lessee, Authorized Officer and the responsible surface management official. (In addition to the definition found in Section 5 of this lease document and as defined in the regulations under 43 CFR 3000.0-5(f), the term "Authorized Officer" as used in this lease for the lands whose surface is managed by an agency other than the Bureau of Land Management is: (a) for sections 5 and 11, the Authorized Officer of the Bureau of Land Management; (b) for sections 12, 14, and 18 involving surface management responsibilities, the authorized representative of the United States Department of Agriculture Forest Service.)

All operations on this lease are subject to Government approval with such site-specific stipulations as may be necessary to assure reasonable protection of or mitigation of effects on other values. A plan of operations shall not be approved if it results in unacceptable impact on other resources, land uses, and/or the environment. If for these reasons a plan of operations cannot be approved, the lease term may be suspended for up to 5 years subject to timely submittal of an appropriate application by the lessee for a suspension of operating and producing requirements of the lease and approval by the United States. If the conditions do not change sufficiently, and/or significantly improved techniques are not developed such that a plan of operations has not been approved during the suspended term of the lease, the suspension shall automatically terminate. Unless relinquished sooner, the lease will continue for the term remaining at the effective date of the suspension or, if not suspended, for the term remaining when the plan of operations was disapproved, subject to Government approval of all operations as provided herein, without recourse for compensation.

On March 1, 1984, the Oregon State Office, Bureau of Land Management, received a Plan of Exploration (POE) from CECI. The plan covers only Phase 2, the gathering of temperature and stratigraphic data necessary to determine whether future extensive drilling is warranted. Any proposed plans for future exploration or development of geothermal resources beyond the scope of the March 1 POE will require additional environmental analysis in accordance with the National Environmental Policy Act and the CRS prior to the approval of any surface disturbing activities.

II. DESCRIPTION OF ALTERNATIVES INCLUDING THE PROPOSED ACTION

General Project Description Applicable to All Drilling Alternatives.

CECI proposes to conduct an exploratory temperature gradient/core drilling program (Phase 2) within the Mazama I and Mazama II Geothermal Units, to gather temperature and stratigraphic data necessary to determine whether future more extensive drilling is warranted.

The two units comprise approximately 84,958 acres of the total 97,070 acres leased.

A typical drill site pad would be approximately 60 feet by 100 feet. It would contain the drill rig, water tank, mud pit, fuel storage, a small trailer for the workers, and a supply trailer and workshop. No other surface disturbance would be necessary for each drill site except under Alternative 1.

All drilling fluids would be formulated from non-toxic components (as defined by EPA). Drilling mud and fluids would be contained in steel or earthen pits during the drilling phase.

Water for drilling/coring activity would be obtained either by truck or pipeline from existing stream access sites used by the Forest Service and its contractors for road watering. The proposed operations generally require 3,000 to 5,000 gallons of water per day.

Under extreme lost circulation conditions a maximum of 20,000 gallons might be used in one day. This condition would not be expected to last more than 24 hours. Water would also be used if necessary to keep down dust during any grading of roads or drill pad sites. CECI has applied for and must receive permits to appropriate water from the Oregon Department of Water Resources.

Drilling operations would be on a 24 hour a day basis, 7 days a week. Drilling of each site is expected to take 45 days although the time period may vary depending upon the conditions encountered at each site. CECI anticipates using one or two drilling rigs at any one time.

Proposed Action

CECI has identified 24 potential drill site locations from the data obtained in Phase 1. All the proposed sites are located on or adjacent to existing log landings, skid roads or otherwise previously disturbed ground. Construction of new roads and major cut and fill operations will not be necessary.

CECI anticipates that a maximum of four to nine, 8-inch diameter by 4,000 feet deep holes would be completed during the 1984 and 1985 field seasons. Some of the remaining locations would be completed during future years.

Some of the proposed sites may never be drilled and alternative sites may be proposed as new data is generated. Alternative drill site locations would be evaluated through additional site-specific environmental analyses and the documentation made available for public review prior to any surface disturbing activities.

A map and legal description of the proposed drill sites is in Appendix A.

Alternative 1, Drill Anywhere Within the Unit Areas.

This alternative provides maximum flexibility in the selection of drilling sites but the least protection for surface resources. Drill site location and drilling operations must be in accordance with existing laws and regulations. The construction of new roads under this alternative would require separate site specific environmental analysis and documentation.

Drill pad construction and location in wetlands and streamside management areas would be subject to Forest Service approval. Drilling waste would not be left on the surface of wetlands or streamside management areas. Berms around drilling pads would be required if drill sites were located in water courses, wetlands, streamside management areas, etc.

There would be no surface occupancy within Spotted Owl Management areas between February 1 through July 31.

Alternative 2, Drill Anywhere With Environmental Protection Emphasis

This alternative emphasizes protection of affected resources and sensitive surface environments while still allowing drilling over an extensive portion of the leased lands. Drill holes could be anywhere within the unit areas but would be outside of known sensitive areas. All drill pads would be on or adjacent to existing roads, log landings, skid roads or otherwise disturbed ground and drilling operations would be coordinated with other authorized uses. Drill site locations, other than the proposed original 24, must be approved by the surface manager, Winema National Forest, prior to surface disturbance.

There would be no surface occupany within the following areas:

1. Administrative sites.

2. Within a minimum distance of 300 feet of any moving surface water or wetlands.

3. Within 600 feet of Spring Creek.

4. Within a variable distance, as shown on the attached map (Appendix A, map 4), from Sevenmile Creek with a minimum distance of 300 feet.

5. Within elk calving areas between May 15 and July 15 (Appendix A, map 4).

6. Within Spotted Owl Management Areas between February 1 through July 31.

7. Within designated areas of old growth management stands (All maps, Appendix A).

8. Within 300 feet of the centerline of State Highways 62, 97, and 138.

Alternative 3, No action.

Under this alternative, exploratory drilling would not take place. All other ongoing surface resource management activities (i.e. timber harvest and road construction) will continue.

Standard and Special Design Features Applicable to All Drilling Alternatives

Required Standard Design Features

Drilling operations under all drilling alternatives are subject to and must be in accordance with the Federal Regulations (43 CFR part 3200); Geothermal Resource Operational (GRO) Orders; approved Geothermal Drilling Permit stipulations of the surface manager, Winema National Forest; and

the Department of Geology and Mineral Industries' Laws and Administrative Rules Relating to Geothermal Exploration and Development in Oregon (DOGAMI). These rules and regulations apply regardless of the drill site location within the Forest. GRO Order No. 4 relates to environmental concerns and, GRO Orders 1 through 3 and 5 through 7 deal with the specifics of drilling. All are available for review upon request at BLM's local office.

The drilling permits for temperature gradient/core holes do not allow for the production of geothermal fluids or steam. If flowing steam or hot water is encountered above 100°C, or if drilling muds cannot be maintained at or below 79°C, the well must be completed by filling with cement. A temperature probe may or may not be installed at the lessee's option. The GRO's require that blowout prevention equipment be installed to maintain control of the well.

GRO No. 4 provides for issuance of field orders in the event that monitoring efforts indicate adopted environmental protection measures are insufficient.

Special Design Features

The following special design features are the result of past environmental assessments, planning documents, and the experience of the BLM and the Forest Service in conducting resource management activities.

1. The existing bridge across Annie Creek on Road Number 6237, SE 1/4 SE 1/4, Section 25, T. 32 S., R. 6 E., W.M., Klamath Ranger District, has been load rated at less than the legal highway load limits for various axle spacings. Any crossings of this structure will need to be coordinated with Engineering prior to use. Special crossing permits may be required.

2. Any conflicts between timber sale operations and the proposed geothermal operations, as identified by the surface managing agency, will need to be resolved prior to the start of any geothermal drilling.

3. Alternate drill site locations would be inventoried for cultural resource occurrence prior to surface disturbance.

   A determination of eligibility of cultural resource sites under 36 CFR (800) would be made prior to ground disturbance.

4. The lease area adjoins Crater Lake National Park. The Park boundary is well established and posted except for recent Park additions along the north and east boundary that were transfered to the Park in December 1980.

   All drill sites within 1/4 mile of the new park boundary would be located with reference to an existing monument, to assure that they aren't within the Park.

5. There are two areas adjacent to the lease area that obtained wilderness status on June 26, 1984, when the President signed The Oregon Wilderness Bill, (PL 98-328).

   The Sky Lakes Wilderness lies south of the park and adjacent to the west boundary of the Mazama II Unit. The Mt. Thielsen Wilderness lies northerly of the Park and adjacent to the northwest corner of the Mazama I Unit. Both wilderness areas are located along the Cascade Crest.

   Any proposed drill site within ¼ mile of the new wilderness boundary will be referenced to an existing monument to preclude entry into the wilderness area.

6. Winema National Forest requires a No Surface Occupancy restriction within 300 feet of wildlife watering cisterns. If the drill site cannot be moved, for whatever reason, then CECI has the option to move the cistern or construct a new one in a suitable location as determined by the Forest Service at CECI's expense.

7. Upon completion of the geothermal temperature gradient testing project, timber access roads that were reopened would be closed according to Forest Service standards.

8. Any unforseen impacts to Crater Lake National Park from any drilling operations identified through monitoring and consultation with NPS, will result in immediate suspension of the drilling operations, by the authorized officer, and the adoption of procedures to mitigate those impacts. Consultation would occur between CLNP Superintendent and the Lakeview District Manager.

9. There would be no surface occupancy on a slope which drains directly into the Park. (CECI has already agreed to relocate the originally proposed MZI-13 site.)

III. COMPARISON OF ALTERNATIVES

The alternatives differ in the restrictions placed on CECI to select drill site locations. Alternative No. 1, the least restrictive of the three alternatives, provides less protection for natural surface waters, wildlife habitat and other surface environments. CECI could select any site it wished within the constraints of DOGAMI and the GRO Orders and outside of northern spotted owl management areas, which could result in more drilling close to the park.

Alternative 2 provides protection for known sensitive areas and affected resources while allowing drilling over an extensive area of the units. CECI would be free to select any site for drilling as long as the site meets the criteria identified in Alternative 2 and is approved by the surface resource manager.

The proposed action as submitted by CECI would restrict drilling to only the 24 sites identified. Any alternative sites proposed by CECI would require separate environmental documentation prior to approval.

The no-action alternative would not allow drilling on the Forest and eliminates any adverse environmental effects that would result from drilling.

IV. AFFECTED ENVIRONMENT

This section describes the environmental components adjacent to and within the geothermal unit areas that would be affected by the alternatives.

Crater Lake National Park

Crater Lake National Park encompasses an area of approximately 260 square miles and receives over 500,000 visitors annually. The majority of this visitation (75 percent) occurs between Memorial and Labor Day holidays.

Approximately 15 percent of the visitors stay longer than 8 hours and overnight camping is restricted to the developed campgrounds during the summer months.

Crater Lake is 4.5 to 6.0 miles across, has 20 miles of shoreline, a surface area of 21.5 square miles and a depth of 1,932 feet at its deepest point. It is known for the clarity of its water and the intense blue color.

Air Quality

Air quality within the area, including the Park, is generally excellent except during wildfire and controlled management burns within private, State, National Forest, and Park lands. Most burning in the Park and its immediate vicinity is normally accomplished in summer and fall.

Crater Lake National Park has been designated a Class I area under the Clean Air Act, as amended in 1977. Only the smallest allowable increases of sulfur dioxide and particulate material are allowed in Class I areas from major emitting facilities.

Hydrology

According to the USGS, it has been shown by David Williams of the USGS and Richard Von Herzen of the Woods Hole Oceanographic Institute that Crater Lake has a significant input of hydrothermal fluids, based on oceanic-type, heat-flow measurements and temperature anomalies found in the lake's water. This is confirmed by anomalous chloride concentrations in lake waters reported by Kenneth Phillips and A. Van Denburgh (1968) and Michael Thompson and Douglas White (1983) of the USGS. There is essentially no information available concerning the areal extent of the hydrothermal system found under Crater Lake to the surrounding land. A partial search by Michael Thompson of the chemistry of spring waters in the lands around Crater Lake has not found any lake water nor evidence of the hot water that feeds the hydrothermal system found in Crater Lake. It should be noted that the temperature of 25 degrees C for Annie Springs (3 miles southwest of the lake), reported by Edward Sammel in USGS Open-File Report 76-127, is in error. Thompson measured a temperature of 4 degrees

C in 1981, and Newcomb and Hart (1958) reported a temperature of 35 degrees F or about 2 degrees C at Annie Springs. Some of the sampled springs, however, could contain up to 10 percent water from Crater Lake that could not be detected. It is not surprising that Thompson did not find evidence of water from Crater Lake in the springs. These springs have a total flow that is much larger that the leakage from Crater Lake measured by Phillips and Van Denburgh, so that there is ample water available to dilute possible leakage from Crater Lake. Thompson's study is being continued with further field work this summer.

Geology

The proposed project area is located near the crest of the Cascade Range in south central Oregon. Crater Lake, which lies in the caldera of the extinct volcano Mount Mazama, is located about 3 miles west of lease unit Mazama I, and about 7 miles north of lease unit Mazama II. Volcanoes of the Cascade Range, both north and south of Crater Lake, have been active in geologically recent times.

The Crater Lake area lies at the intersection of the north-northwest trending downthrown Klamath fault block (basin and range structure) and the north-south trending faults of the Cascade Range. These structures are cross-cut by a subordinate east-northeast trending fault set.

A cross section showing the spatial relationships of Crater Lake, the National Park, and well site MZI-11 have been prepared by CECI. A copy of that cross section is in Appendix D. The vertical line below the ground surface at MZI-11 represents a well bore that is 4000 feet deep. The arrows on the cross section depict the direction of surface and ground water flow. The two sets of subparallel vertical faults depict the confines of the collapsed caldera, and are thought to act as vertical seals to groundwater movement within the collapsed caldera. The "secondary seal depth unknown" represents a horizontal seal which prevents downward movement of water below.

Outdoor Recreation

Recreational activities are generally limited to such dispersed activities as camping, fishing, hunting, hiking, sightseeing, cross country skiing and snowmobiling. Backcountry use is minimal with the Pacific Crest Trail receiving the heaviest use.

Two features of Crater Lake National Park which are closest to the Park's eastern boundary and the Mazama I Unit are the Pinnacles and Lost Creek campground. Lost Creek campground is a primitive camping area with 12 sites approximately 2-1/2 miles from the boundary. The Pinnacles are unusual topographic features which have an overlook for public viewing approximately 700 feet from the Park boundary.

Noise levels are classified as low for all practical purposes. However, the usual short duration noises associated with National Forest activities are found in the area. The noises include chain saws, logging equipment, moving transport vehicles, aircraft passing overhead, and snowmobiles in the winter.

Visual Resources

The visual resource includes the scenic quality of landscape features visible from the Park such as streamside vegetation, dry and wet meadows, forested slopes, aspen groves and lodgepole pine flats.

A visual management system has been developed by the U.S. Forest Service to facilitate protection and appeal of the visual resource. The system inventories existing condition of the scenic resources and provides direction for management activities.

Surface Water Resources

Major streams in the unit areas are Cottonwood, Bear, Pothole, Annie, Sevenmile and Dry Creeks. These streams have average annual flows of less than 15 cubic feet per second. Spring Creek and Reservation Spring each flow more than 40 cubic feet per second. Scott and Sand Creeks each have a base flow of approximately 10 cubic feet per second, or 6,500,000 gallons per day. There are also several smaller springs within the project area. Water quality is excellent in all of these streams and springs.

Water from Sevenmile, Annie, Spring, Sand, and Scott Creeks and Reservation Springs is used for irrigation off the Forest by private landowners. Flows from Bear, Cottonwood, and portions of Scott and Sand Creeks sink into the highly porous pumice and ash soils near the east edge of the unit areas.

Surface and ground water is available for filing water use applications. In dry years the water may not be available.

Soils

Soils in the leased area have developed mostly in pumice and ash. These soils have low bulk densities, high water infiltration rates, low natural fertility, and high-water holding capacities. When dry, these soils become water repellent. The soil erosion hazard for most of the area is low to moderate with small areas having a high hazard. Soil and landforms are very stable. No landslides or slumps have been identified in or near the lease area. Detailed soil information is found in the Soil Resource Inventory for the Winema National Forest.

Wildlife

The lease area contains a variety of plant associations. The various successional stages represented in these plant associations, combined with aquatic systems, geologic forms, and elevation create numerous habitat niches for many species of wildlife.

Most of the area is short of water for wildlife during the summer months. To alleviate this problem, habitat improvements in the form of spring developments, with trough or catchment aprons, and cisterns have been installed in key locations.

Streams in the area provide habitat for trout. Riparian areas associated with streams and some early season surface water provide habitats for animals seeking out such areas. As is usually the case, riparian habitats occupy a relatively small percentage of the area, but are used by a disproportionately higher number of animal species than other habitats.

Mule deer are the primary big-game animal occuring in the area. They utilize the area for summer range moving to winter ranges to the east. Elk numbers have increased considerably, utilizing primarily the southern end of the area. Most of these animals winter on the west side of the Cascades, coming to summer ranges on the east side in early spring. Some elk calving areas have been identified in the Cedar Springs - Dry Creek area on the Klamath Ranger District.

Three spotted owl management areas have been identified on the north end of the Klamath Ranger District. One of them lies completely within the unit areas. Current regional direction for managing spotted owl territories required maintaining a 300 acre old-growth reproductive core around the nest and an additional 700 acres of mature or old growth within 1.5 miles of the core for feeding.

Transportation

The existing transportation system provides access for the protection, management, and utilization of National Forest land and resources. The major components of this system are roads and trails.

Transportation system development has been concentrated in areas of timber harvest on National Forest, State, and private lands.

Roads that are used exclusively for timber harvesting are closed after the timber sale is completed. If CECI wishes to use these roads they would have to be reopened and reclosed at CECI's expense.

Wood Products

The major land use in the area is the harvesting of commercial timber and related activities. Current and proposed timber sales are located throughout the unit areas.

Threatened or Endangered Species

The peregrine falcon is the only endangered species known to use any of the unit areas. The only known active peregrine falcon nest in the State is located within the caldera in Crater Lake National Park. Prey remains gathered from the nest indicate these birds forage heavily on marsh and forest birds. The nearest marsh eco-systems to the nest site are Klamath Marsh to the east and Agency and Upper Klamath Lakes to the south. To reach either of these areas, the birds fly across a portion of the project area.

A threatened and endangered plant survey was performed on the Winema National Forest in 1982. Selected portions of the Forest were surveyed based on previous known sightings plus high probability areas. Surveys

were conducted in Sevenmile Marsh, Sevenmile Creek, Reservation Spring, Scott Creek, Pothole Creek and Cottonwood Creek areas. The results of the survey indicate a low probability for occurrence of a threatened, endangered, or sensitive plant in the general area of the proposed geothermal drilling.

Cultural Resources

Peaks, ridge lines, slope breaks, and other such features in the lease area may contain rock outcroppings favored by the human prehistoric cultures as vision questing locations. Historic activities in the area generally were limited to logging, especially railroad logging.

Probability for cultural site occurence overall is lower than for the rest of the Forest and known sites in the area are few and limited in variety. An exception to this might be in the immediate vicinity of Spring Creek and Reservation Springs where the probability would be much higher.

Of the 24 site-specific drill locations shown in the POE, 20 are in low probabilty areas, two occur in medium probability areas and two in low medium probability areas. Alternate unsurveyed sites would be inventoried prior to surface disturbance.

Land Uses

Authorized uses under special use permits or easements that were in effect prior to January 1, 1984, take precedence over the geothermal leases. Any geothermal uses in these areas will be coordinated with authorized users by the Forest Supervisor. These include Sand Creek Rock Quarry, Lookout Butte Cinder Pit, Sevenmile Creek Diversion Canal, Scott Creek Proposed Small Hydrolectric Project, National Forest Timber Sales and grazing permits, power and telephone lines.

V. ENVIRONMENTAL CONSEQUENCES

Introduction

This section discusses the scientific and analytic basis for the comparison of the alternatives. It describes the consequences of implementing all alternatives and standard design features described in Section II.

The initial geophysical analysis and reconnaissance was conducted in 1982 and 1983. Phase 2 test drilling is being analyzed in this environmental analysis. Surface impacts associated with temperature gradient/core drilling are temporary in nature since all well sites would be restored in accordance with standard permitting stipulations.

Since no drilling would be allowed under Alternative 3, there would be no impact on the environment.

Impacts to Crater Lake National Park

Air Quality

There is the potential for short-term increases in dust levels, but there is a highly unlikely potential for emissions of hydrogen sulfide, nitrogen oxide, ammonia, methane or sulfur dioxide. Dust generated as a result of test drilling activity near the Park boundary could contribute slightly to degradation of air quality in the vicinity. This would be created by vehicle movement on untreated or unsurfaced roads and by activity on the drill pad.

The Oregon Department of Environmental Quality, which has primary regulatory jurisdiction for the Clean Air Act, views the proposed drilling operation as non-emitting, and temporary (Lloyd Kostow, Air Quality Division, telephone conversation, July 31, 1984).

Hydrologic

According to the USGS, (letter to BLM's Oregon State Director, August 15, 1984), the potential for affecting the flow of hydrothermal fluids into Crater Lake is clearly very small under phase 2 operations. A properly completed temperature-gradient hole will not produce any fluids and, therefore, could not divert fluid from flowing to the lake, even assuming that a hydrothermal system exists under the lease area and assuming that it is connected to the hydrothermal system feeding the lake. If high temperatures are encountered in these drill holes, there is the potential for a blowout. Normal drilling procedures, however, should be able to control eruption potential derived from a hot column of fluids, especially since, according to regulations, drilling of temperature-gradient holes must be abandoned if mud temperatures exceed 79 degrees C. There is unlikely to be much overpressure in the system, otherwise there would be hot springs flowing at the surface.

Another aspect of the proposed drilling operations is the potential for water flowing within a hole between aquifers with different pressure heads, particularly between cold water aquifers and a potential geothermal aquifer. The proposed drilling program calls for 400 feet of cemented casing. Assuming that no drilling difficulties are encountered, the hole will then be drilled to a depth of up to 4,000 feet and completed by installing 1 ½-inch tubing. If drilling problems such as lost circulation, or mud pit levels rising due to water infiltration are encountered, the following mitigation measure will be required: the zones of fluid inflow or fluid loss will be required to be sealed. Sealing of the zones would be accomplished either by casing the hole as drilling progresses, cementing the zones and drilling through, completing the hole by cementing in the tubing, or by other methods approved by the authorized officer. Thus, no interaquifer contamination would be expected.

Recreational Activities

Visitors to the Pinnacles area adjacent to Sand Creek and the Mazama II area near the park's south entrance may find the noise to be objectionable. These intrusions to the quality of the visitors experience

in the park are expected to be comparable to those of normal logging activities on lands outside the Park.

Three relationships have been used or suggested for use to predict the attenuation of noise with distance from geothermal well drilling. The first relationship was first proposed by Gennis and Associates, consulting engineers in Sacramento, California, and has since been used by VTN, consulting engineers, and the University of California Lawrence Livermore Laboratories. This relationship is that sound intensity decreases at a rate of six decibels for each doubling of distance from the source to the receptor, plus an additional one decibel for each 1,000 feet.

The second relationship was proposed by Tom Norris, a professional engineer who has investigated and monitored noise sources associated with geothermal well drilling by Aminoil in the Geysers area. This relationship is that sound intensity decreases approximately eight decibels for each doubling of distance from the source to the receptor. The third relationship was developed by Pacific Gas and Electric Company, the major electrical-producing utility company in the Geysers. This relationship was developed through the use of empirical noise attenuation data and is represented graphically in Appendix B, along with the first two relationships.

There are two critical recreation sites in Crater Lake National Park that could be impacted by noise, Lost Creek Campground and the Pinnacles overlook. Lost Creek Campground is used on a 24-hour basis during the summer months when Rim Drive is open. The nearest drilling sites to the campground are Mazama I-11, I-13, and I-14. Site I-11 is located 14,000 feet away and is separated by topographic ridges. Sites I-13 and I-14 are both located over 16,000 feet away, with no major ridges separating the sites from the campground. Given the noise attenuation relationships (shown in Appendix B), noise from site I-11 should be attenuated by 61 to 64 decibels at the campground, and noise from sites I-13 and I-14 should be attenuated by 63 to 66 decibels at the campground. Sound level measurements taken around a drilling rig of the same type that will be used for the proposed operations, at a radius of 50 feet from the power source, range from 79 to 88 decibels. If the highest noise level is used at the source (88 decibels), and the least amount of noise attenuation from the three relationships is used at the receptor (61 decibels), the resultant noise levels expected at the campground from drilling would be 27 decibels from site I-11, and 25 decibels from sites I-13 and I-14. These sound levels are below the typical value of yearly day-night average sound levels for an undeveloped rural area with a population density of 20 people per square mile (35 decibels). 1/

The Pinnacles overlook is a day-use area located near the old east entrance to the park, and is used during the summer months when Rim Drive is open. Drill site I-13 is about 7,000 feet away from the overlook and site I-14 is about 6,000 feet away. Using the same assumptions for the overlook as were used for the campground, noise from site I-13 would be attenuated by 50 decibels at the overlook and noise from site I-14 would be attenuated by 48 decibels. The resultant noise levels expected at the overlook from drilling would be 38 decibels from site I-13, and 40

decibels from site I-14. These maximum noise levels are equivalent to typical values of yearly day-night average sound levels for a partially developed rural neightborhood with a population density of 60 people per square mile (40 decibels). 1/

In a recently prepared draft Environmental Impact Report for geothermal operations in Lake County, California, George S. Nolte and Associates state; "For any two simultaneous operations, the combined noise level will be up to 3 decibels higher than the individual level of the noisier of the two operations. However, the maximum increase could only occur if all of the noise sources were exactly equal as measured at the receptor; if (multiple) drill rigs were operating in the vicinity of the project, the total noise would more likely be half of the maximum increase or less."

A mitigating measure which could be employed to minimize noise at Lost Creek Campground and the Pinnacles overlook would be to limit drilling so that no more than one site in the vicinity of MZI-13 and MZI-14 would be drilled simultaneously. In addition, standard required GRO Orders provide for incorporation of noise reduction measures, when deemed necessary by the authorized officer.

Visual

Alternative 1 is the least restrictive of the three drilling alternatives. It allows for drilling within sensitive areas that are excluded in the other two Alternatives. Visual resources could possibly be adversely affected whenever drill sites are visible from viewing areas.

Drill sites in the viewshed between Grayback Ridge and Anderson Bluffs could be visible from southeast portions of Rim Drive. Four of the proposed 24 sites are within this viewshed, and are located between 5 1/2 and 8 miles from Rim Drive. The drill rig would stand about 60 feet above the ground so if a site were visible from Rim Drive, the only portion visible would be that part of the rig that stood above the trees, and would be a virtually undetectable intrusion in the scenic quality.

Impacts to Surface Water Resources

Some minor depletion of local water sources is expected to occur under all drilling alternatives. Each well drilled would require 3,000 to 5,000 gallons of water per day which is less than 0.1 percent of the flow rate for either Sand or Scott Creek. Water quality however, would not be affected by drilling activities under all alternatives.

Impacts to Soils

Leveling of a pad for drilling, equipment storage, and sump placement would result in less than 0.2 acre disturbance per site. This would result in soil compaction and loss of ground cover.

1/ National Research Council, Committee on Hearing, Bioacoustics, and Biomechanics, Assembly of Behavioral and Social Sciences, 1977, Guidelines for Preparing Environmental Impact STatements on Noise; Report of Working Group 69 on Evaluation of Environmental Impact of Noise: National Academy of Sciences, Washington, D.C., Table IV-1.

Installation of sumps would create local, temporary site disturbance. Rehabilitation would return the site to its original countour, although it could be possible to use sumps for other National Forest management purposes.

Under Alternative 1 soil erosion and compaction would result from new road construction to drill sites not adjacent to existing roads. The severity would depend on the amount of new construction.

Impacts to Wildlife

While the effects on wildlife are expected to be minor and temporary, some interruption of localized habitat occupancy and use would occur.

Summer migration of elk into and from the park would not be adversely affected under any of the alternatives since drill sites would be less than 0.2 acre in size.

No adverse effects are anticipated on either fish or wildlife.

Impacts to Transportation System

Increased traffic and essential maintenance of roads to provide access for drilling equipment and supplies to the drilling sites could involve unavoidable effects. Traffic related effects can include compaction, surface displacement, dust, and noise.

Overall, the environmental impacts associated with drilling temperature/core holes would be less than the impacts that normally occur as a result of logging operations. The proposed drilling would occur in previously disturbed areas, except under Alternative 1, and would be confined to areas of 0.2 acre or less in size.

Impacts to Wood Products

Under the proposed action and Alternative 2 there would be no effect other than the possible need to remove a tree or two.

Possible road construction under Alternative 1 may, depending upon road location, require timber removal. Under Alternative 1 and 2, CECI would be required to purchase any merchantable trees that would be cut.

Impacts to Threatened and Endangered Species

There should be no effect on plant or animal species. The peregrine falcon is the only known species on the Federal T&E list that is in or near the unit areas.

Past timber harvesting activities have had no known adverse effects on the peregrine falcons' activities in the area. The proposed drilling operations would have less impact than logging activities, even though drilling would occur on a 24-hour basis.

Coordination with USFWS (letter dated July 5, 1984) has indicated that under Phase II, there would be no adverse effect on the peregrine falcon.

Impacts to Cultural Resources

No impact to cultural sites would occur as a result of the proposed activity. Under the proposed action, drill site locations have been selected to coincide with previously logged timber harvest areas. Ground surfaces and immediate subsurface in these types of areas have already been disturbed to varying extents. Under Alternative 1 and 2 CECI could select alternate drill sites in addition to the 24 identified in the proposed action. Alternate locations could be in undisturbed areas under Alternative 1 and could require road construction. However, appropriate site surveys and mitigation (as needed) would be conducted prior to ground disturbing activities.

Impacts to Minerals

Under all drilling alternatives there would be no effect other than expanding the data base on geologic and other subsurface resources. The no-action alternative would preclude expanding the data base.

Impacts to Land Uses

There should be no affect on existing authorized uses of National Forest lands within the unit areas. Potentially conflicting exploration activities in these areas will be coordinated with the existing authorized users by the Forest Supervisor before such activities would be permitted.

Blowout Hazard

Blowouts in which steam, gases, or hot water escape uncontrolled, pose an environmental hazard in geothermal operations, but the risk is low. The potential adverse environmental effects of accidental releases of geothermal fluids include air contamination from gaseous emissions, pollution of surface and shallow ground water resources, and hazards to health and safety of workers. Blowouts in exploratory work are highly unlikely due to required well control programs which include installation of blowout prevention equipment (on exploratory wells when a temperature of 125 degrees F. is encountered and on all wells over 500 feet in depth), periodic equipment testing and required safety drills.

The blowout equipment and standard BLM testing procedures have resulted in only one well becoming a problem out of approximately 750 wells that were required to have blowout prevention equipment installed. The well that failed was not due to equipment failure but was the result of an unqualified individual allowing the well to be deepened without adequate safeguards being installed. The blowout occurred when the diameter of the well was 17 1/2 inches. This well was designed as a deep exploratory well. The affected area of the blowout (2 to 3 acres) included the ground that was covered with drilling mud and cement to a maximum depth of 3 inches, plus the area of the drill site that was enlarged to accomodate a larger rig.

In the unlikely event of a blowout, the small diameter of the hole would prevent large quantities of materials from escaping. Such small amounts of escaping material would not have a discernable effect on surrounding subsurface geothermal features and surface resources since the lessee would take immediate measures to control the well.

VI. CONSULTATION AND COORDINATION

PARTICIPATING STAFF

Bureau of Land Management
Lakeview District Staff
- Tom Cottingham, Realty Specialist, Team Leader/Editor
- Dennis Simontacchi, Geology
- Steve Sherman, Area Manager, Klamath Falls

Oregon State Office - Portland, Oregon
- Philip C. Hamilton, Chief, Planning and Environmental Coordination Staff
- R. Gregg Simmons, Environmental Coordinator
- Robert W. Fujimoto, Geologist

Winema National Forest
Supervisor's Office
- Jack Mathews, Forest Resources Staff
- Marvin Stump, Lands and Minerals
- Garwin Carlson, Soils and Hydrology
- Jack Inman, Wildlife
- Christina Lilienthal, Visuals and Recreation
- Frances Philipek, Archeology
- Craig Miller, Engineering
- Tom Neal, Engineering

Chemult Ranger District
- Malcolm Stump, Forester
- Bill Jensen, District Resources Staff

Klamath Ranger District
- Jim Galaba, District Resources Staff

Forest Service Region 6 Staff, Portland, Oregon
- Kent Chirchill, Environmental Coordinator

National Park Service
Crater Lake National Park
- Jon Jarvis, Resource Specialist
- Mark Forbes, Resource Specialist

Regional Office, Seattle, Washington
- Shirley Clark, Air and Water Quality Coordinator

OTHER AGENCIES CONSULTED

State Clearinghouse
Klamath County Planning Commision
Oregon State Department of Environmental Quality
Oregon State Department of Fish and Wildlife
U.S. Department of Interior, Fish and Wildlife Service
U.S. Department of Interior, Geological Survey

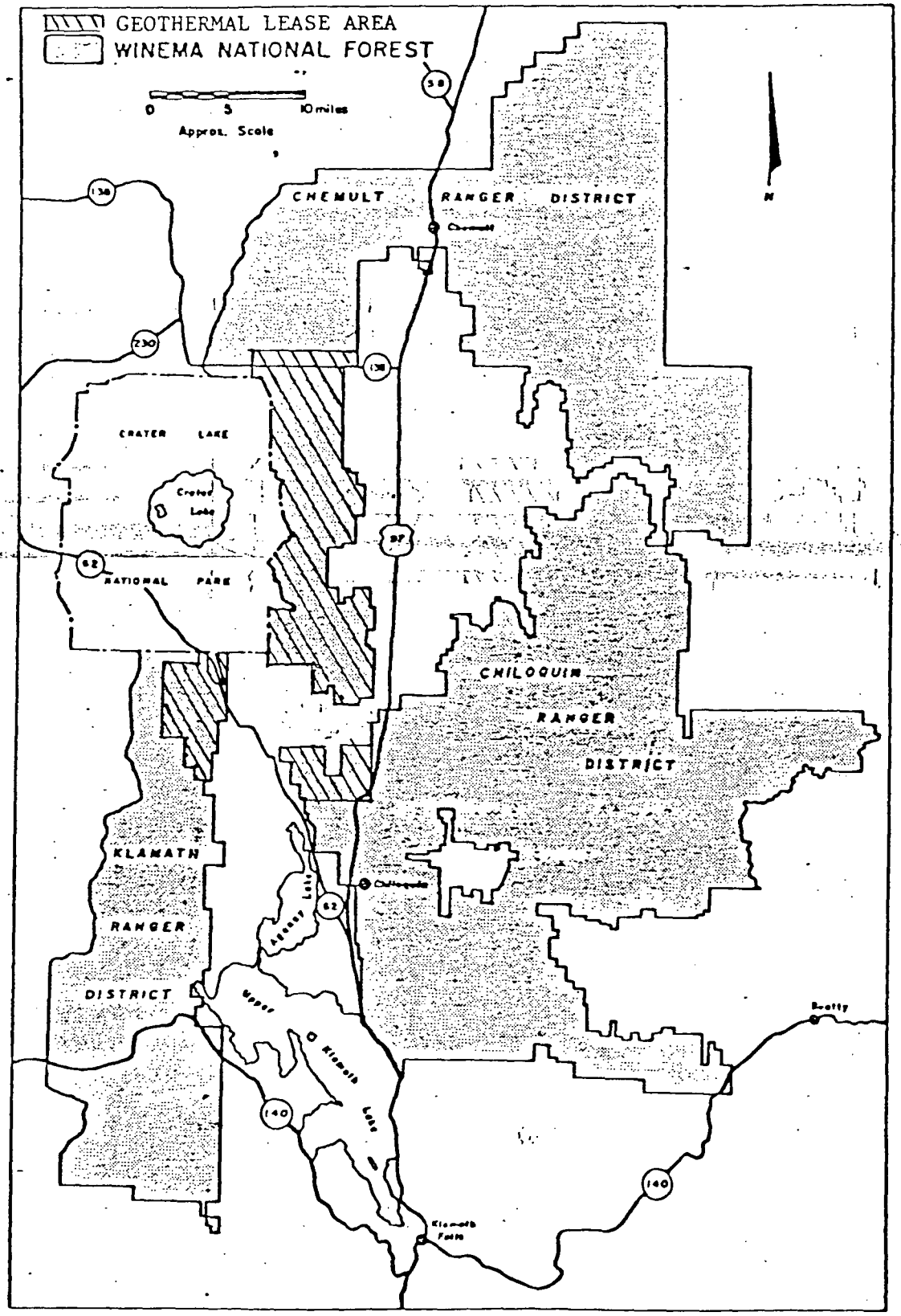
Comment Letters Received

The original Environmental Assessment and Preliminary Finding of No Significant Impact were made available to the public on May 10, 1984. Two letters were recieved which questioned the adequacy and accuracy of information presented in the EA. These letters along with BLM's responses have been incorporated into the Amended Environmental Assessment as Appendix C.

Letters were recieved from:

Sierra Club, Hamilton Hess, Geothermal Coordinator
U.S. National Park Service, Regional Director, Pacific Northwest Region

VICINITY MAP
GEOTHERMAL LEASES



3-5-84
MRS

California Energy Company

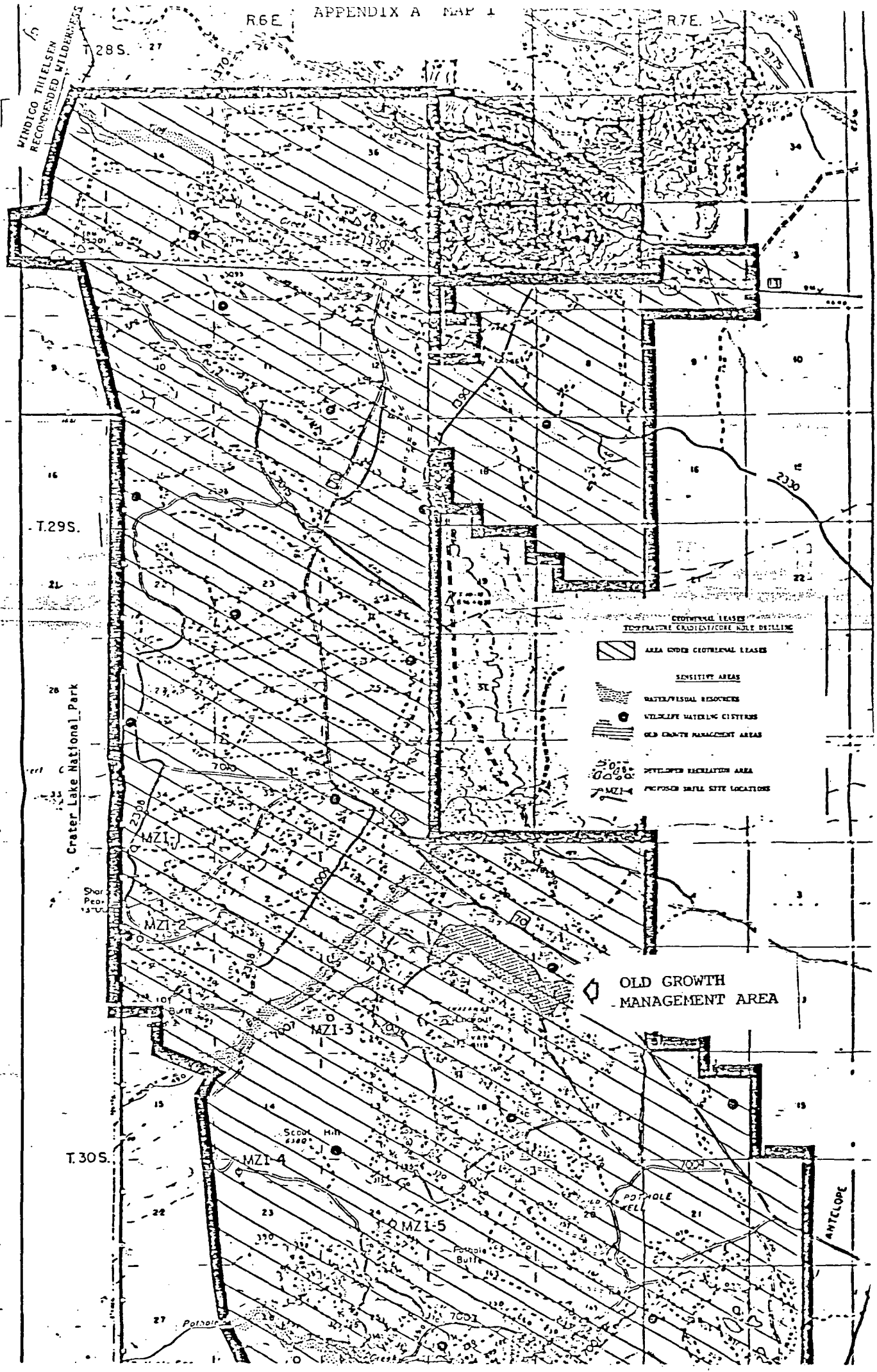
PROPOSED TEMPERATURE HOLE SITE LOCATIONS
MAZAMA I, MAZAMA II, STATE LANDS

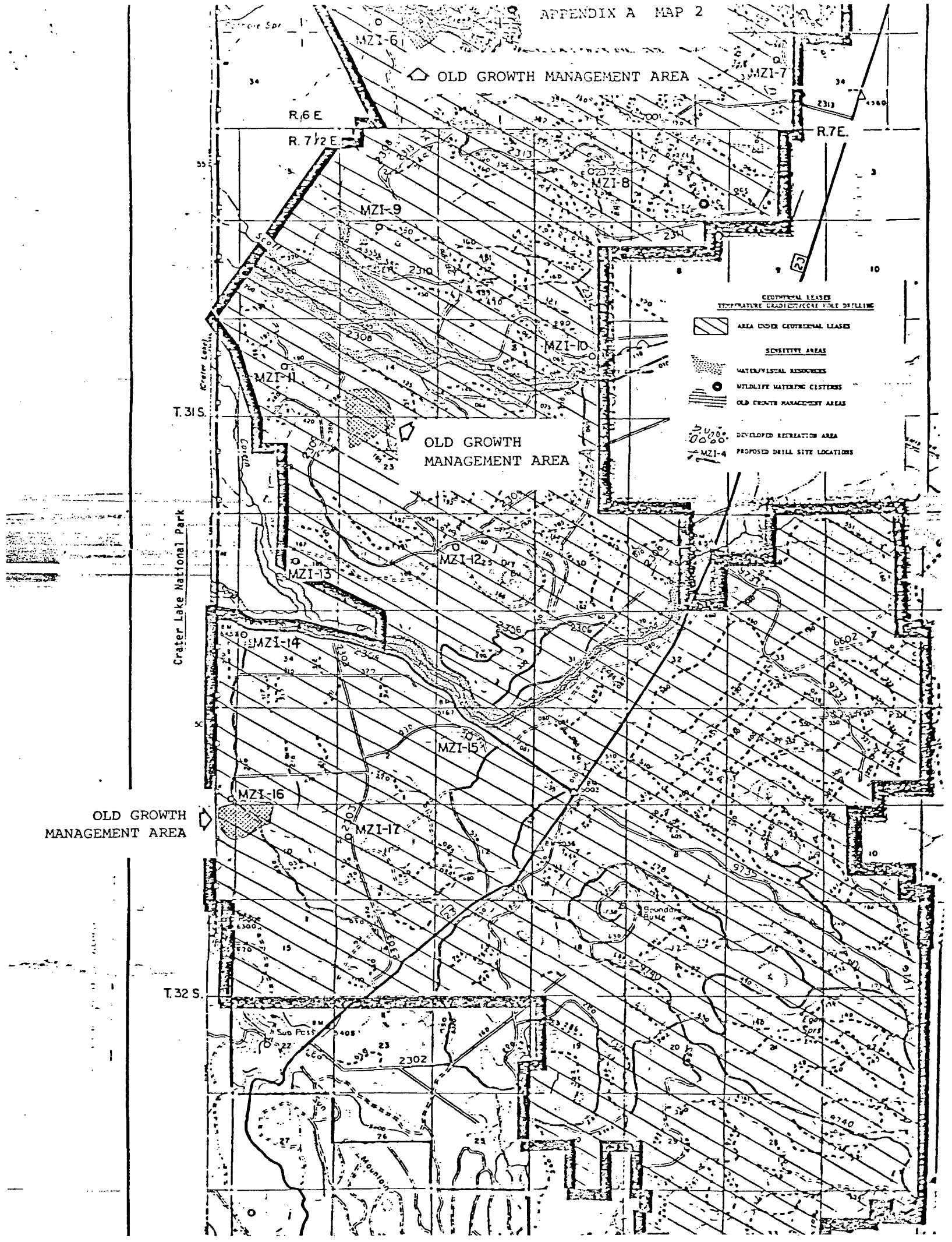
Hole No.	Kettleman Number*	Elev.**	Approximate Location*
MZ-I-1	21- 3	5370'	1250' E and 150' S of NW Corner, Sec. 3, T30S R6E
MZ-I-2	38- 3	5380'	1300' E and 250' N of SW Corner, Sec. 3, T30S R6E
MZ-I-3	16-12	5360'	2000' N and 450' E of SW Corner, Sec. 12, T30S R6E
MZ-I-4	21-23	6000'	1250' E and 750' S of NW Corner, Sec. 23, T30S R6E
MZ-I-5	65-24	5580'	1750' W and 2100' N of SE Corner, Sec. 24, T30S R6E
MZ-I-6	77-26	5805'	1250' W and 550' N of SE Corner, Sec. 26, T30S R6E
MZ-I-7	73-33	4635'	2400' S and 1850' W of NE Corner, Sec. 33, T30S R7E
MZ-I-8	54- 6	4740'	2150' W and 2200' S of NE Corner, Sec. 6, T31S R7E
MZ-I-9	41-11	6080'	2100' E and 350' S of NW Corner, Sec. 11, T31S R7½E
MZ-I-10	53-18	4700'	2000' W and 1950' S of NE Corner, Sec. 18, T31S R7E
MZ-I-11	44-15	6100'	2550' E and 2800' S of NW Corner, Sec. 15, T31S R7½E
MZ-I-12	23-25	5370'	1500' E and 1500' S of NW Corner, Sec. 25, T31S R7½E
MZ-I-13	54-27	5440'	2200' W and 2550' S of NE Corner, Sec. 27, T31S R7½E
MZ-I-14	12-34	5430'	200' E and 1300' S of NW Corner, Sec. 34, T31S R7½E
MZ-I-15	33- 1	5170'	1850' E and 1500' S of NW Corner, Sec. 1, T32S R7½E
MZ-I-16	88- 4	5390'	200' W and 400' N of SE Corner, Sec. 4, T32S R7½E
MZ-I-17	23-11	5345'	350' E and 1800' S of NW Corner, Sec. 11, T32S R7½E
MZ-II-1	66-13	4665'	2000' N and 2050' W of SE Corner, Sec. 13, T32S R6E
MZ-II-2	16-14	4955'	450' E and 1900' N of SW Corner, Sec. 14, T32S R6E
MZ-II-3	32-21	5750'	1900' E and 1000' S of NW Corner, Sec. 21, T32S R6E
MZ-II-4	66-23	4635'	3450' E and 2100' N of SW Corner, Sec. 23, T32S R6E
MZ-II-5	18-26	4480'	450' E and 300' N of SW Corner, Sec. 26, T32S R6E
MZ-II-6	88- 5	5035'	550' W and 450' N of SE Corner, Sec. 5, T33S R6E
MZ-II-7	13-11	4320'	1800' S and 170' E of NW Corner, Sec. 11, T33S R6E
CEC-ST-1	75-17	4770'	800' W and 2400' N of SE Corner, Sec. 17, T32S R7½E
CEC-ST-2	34-22	5585'	1800' E and 2700' N of SW Corner, Sec. 22, T32S R7½E
CEC-ST-3	22-34	4340'	1000' E and 1300' S of NW Corner, Sec. 34, T32S R7½E
CEC-ST-4	25-11	4285'	1200' E and 2250' N of SW Corner, Sec. 11, T33S R7½E

* Kettleman numbers and other location designations are subject to possible change because minor adjustments of the exact location may be made in cooperation with the surface manager to minimize surface disturbance and avoid adverse impacts.

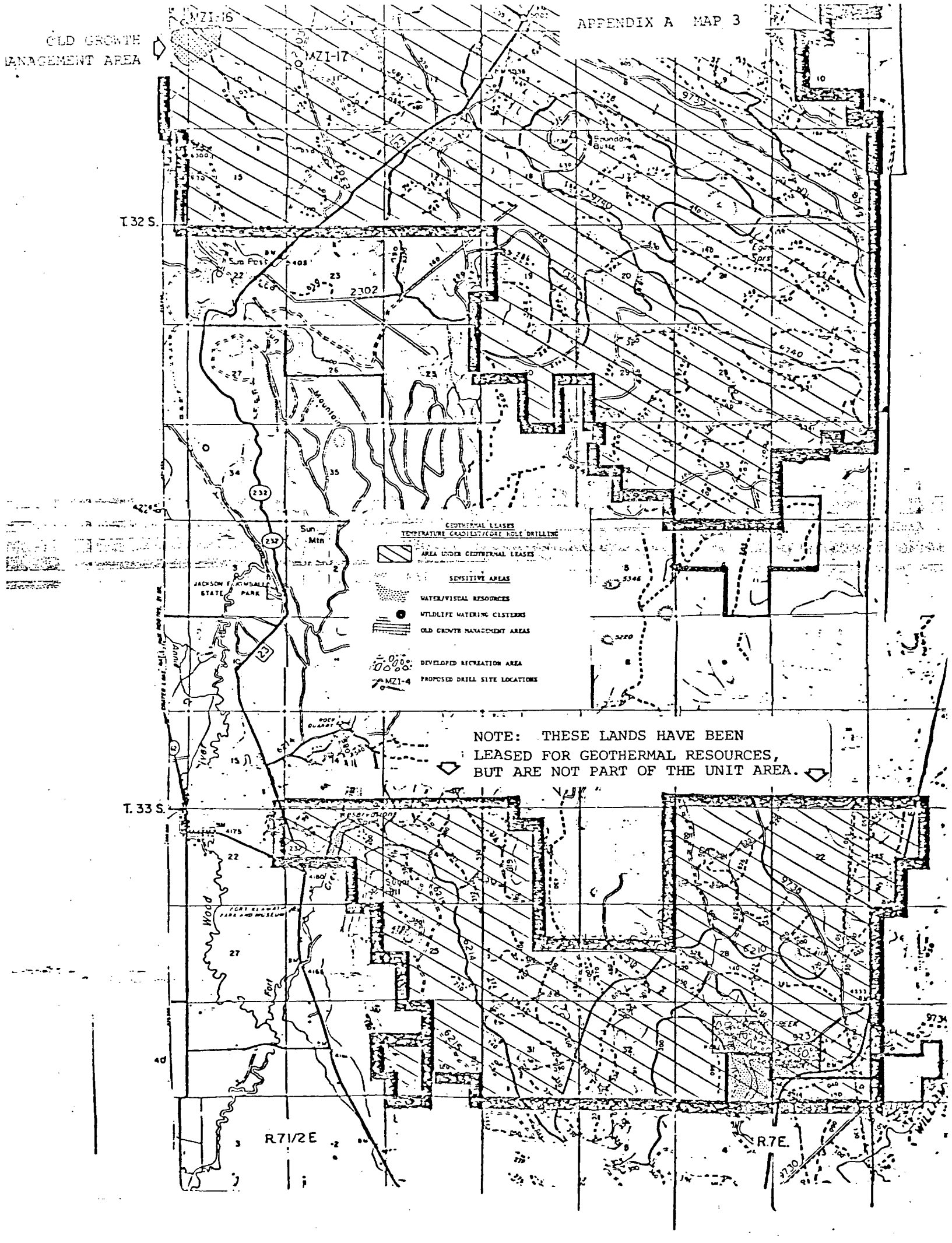
** Approximate elevations and locations were taken from existing topographic maps (mainly 1:62,500 scale).

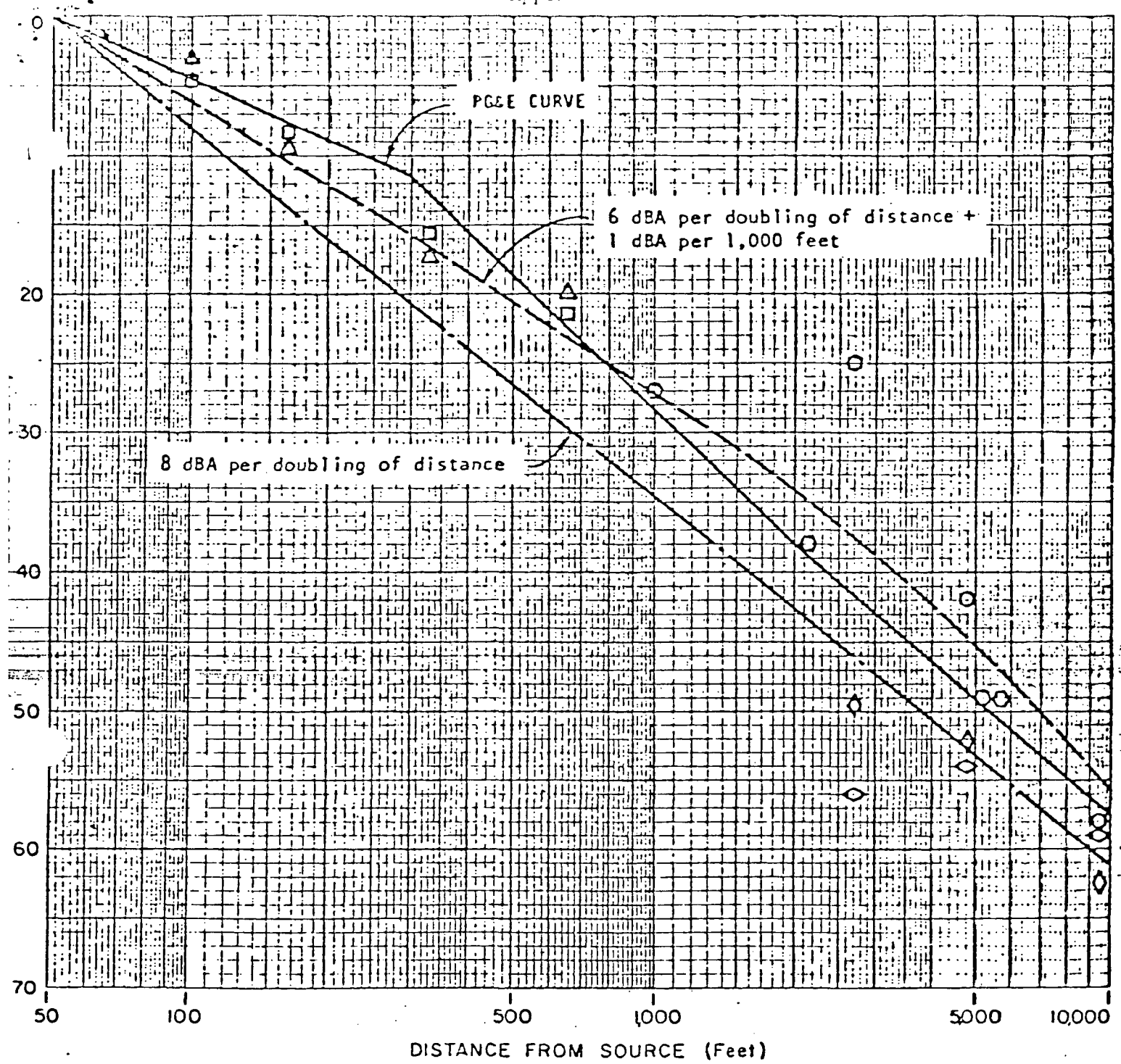
JLF:sm:42:Z29/B4
2-6-84


APPENDIX A MAP 1
R6E.
R7E.
T28S.
T.29S.
T.30S.
WINDIGO THIELSEN RECOMMENDED WILDERNESS
Crater Lake National Park
MZI-1
MZI-2
MZI-3
MZI-4
MZI-5
OLD GROWTH MANAGEMENT AREA
GEOTHERMAL LEASES
TEMPERATURE GRADIENT/CORE HOLE DRILLING
AREA UNDER GEOTHERMAL LEASES
SENSITIVE AREAS
WATER/VISUAL RESOURCES
WILDLIFE WATERING CISTERNS
OLD GROWTH MANAGEMENT AREAS
DEVELOPED RECREATION AREA
PROPOSED DRILL SITE LOCATIONS
Scout Hill
Potholes
Potholes Butte
Potholes Creek
POTHOLE LEVEL
ANTELOPE
Pumice Butte
Pumice Desert


APPENDIX A MAP 2
OLD GROWTH MANAGEMENT AREA
MZI-6
MZI-7
MZI-8
MZI-9
MZI-10
MZI-11
MZI-12
MZI-13
MZI-14
MZI-15
MZI-16
MZI-17
R.6 E
R. 7 1/2 E.
R.7E.
T.31S.
T.32 S.
OLD GROWTH MANAGEMENT AREA
OLD GROWTH MANAGEMENT AREA
Crater Lake National Park
GEOTHERMAL LEASES
AREA UNDER GEOTHERMAL LEASES
SENSITIVE AREAS
WATER/FISCAL RESOURCES
WILDLIFE WATERING CISTERNS
OLD GROWTH MANAGEMENT AREAS
DEVELOPED RECREATION AREA
MZI-4 PROPOSED DRILL SITE LOCATIONS

APPENDIX A MAP 3





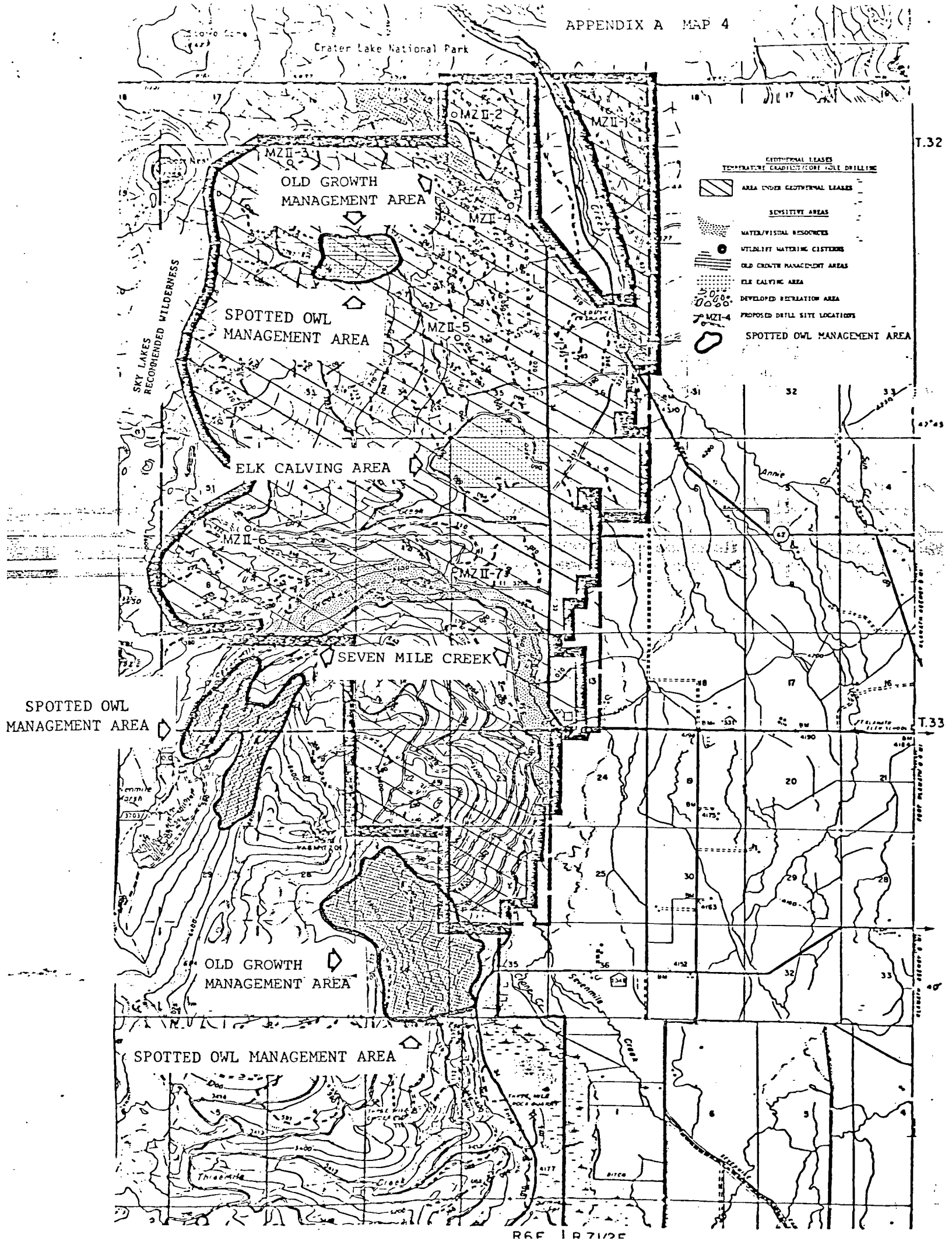
EXPLANATION

- ○ 3/10/78 Day Noise Measurements, Union DX-22
- △ 12/09/77 Day Noise Measurements, McCulloch Newfield #1
- □ 12/09/77 Night Noise Measurements, McCulloch Newfield #1
- ◇ 5/25/76 Day Noise Measurements, Aminoil McKinley #1
- ◇ 5/26/76 Day Noise Measurements, Aminoil McKinley #1
- ○ 7/20/76 Day Noise Measurements, Aminoil Abel #1

NOISE ATTENUATION WITH DISTANCE
FROM GEOTHERMAL WELL DRILLING AND TESTING

FIGURE 11.3-1

APPENDIX A MAP 4



APPENDIX C

RESPONSE TO COMMENTS

1-1. The presence of a conductive geothermal heat flow into the bottom of Crater Lake is documented by Williams and Von Herzen (1983). They describe their heat flow observations, and make interpretations of the observations, by stating:

> "We can make several observations concerning the Crater Lake Temperature data and distribution and magnitudes of the conductive heat flow.
>
> 1. Conductive heat flow varies regularly from relatively low values...to high values. There is a significant lateral modulation evident... with a wavelength of about 3 to 4 km.
>
> If we assume the aquifer that supplies fluids to the thermal area causes the 3 to 4 km variations in the heat flow fields, then we can roughly describe this aquifer. Its top lies at a depth of 1 to 2 km thick and has a temperature between 100° and 200° c."

The comment states "The temperature gradient holes drilled to 4000 feet will be 2000 feet to 4000 feet below the lake bottom". However, the fact that the well bottoms will be located at a lower elevation does not mean that the wells will have an impact on the heat flow into Crater Lake.

According to the report by Williams and Von Herzen (1983), "Thermal convection in a permeable medium tends to be cellular, with the cells being approximately equidimensional (Williams et al., 1974; Hartline and Liston, 1981). The width of the cells beneath Crater Lake appears to be 1-1/2 to 2 km, implying a height of like magnitude. This is the minimum depth to the bottom of the shallow hydrothermal system that is reflected in the heat flow data. The thickness of any impermeable cap rock would be added to it."

In other words, the minimum depth to the top of the geothermal aquifer is 5000 to 6500 feet below the bottom of the lake. This places the bottom of the wells at least 1000 feet above the top of the geothermal aquifer. In addition, the wells are located at least 20,000 feet from the edge of the lake. This spatial relationship can be seen in Appendix D.

The comment further states, "There is potential that the drilling of these holes could affect the geothermal imput to the lake and therefore the limnological processes."

According to the U.S. Geological Survey (letter from Director, USGS, to Oregon State Director, BLM, dated August 15, 1984), "The potential for affecting the flow of hydrothermal fluids into Crater Lake is clearly very small under phase 2 operations."

1-2. Blowout preventers are required components of any well control system. During the technical review of each geothermal drilling permit, the well control system is checked to assure that its design is adequate for the conditions likely to be encountered in the hole. The well control system includes blowout prevention drills, periodic pressure tests, and regular maintenance. As a result, the probability of a blowout occurring is very low. In addition, Crater Lake is separated from the drill sites by the rim of the crater which extends a minimum of 1,000 feet above the lake. In the unlikely event of a blowout, the fluids would have to flow uphill 1,000 feet and laterally over 3 miles to reach the lake. Therefore, there will be no impact to Crater Lake due to the proposed drilling operations.

1-3. Air quality impacts addressed in the Targhee National Forest EIS , and referenced by the commenter, are associated with the test drilling phase of geothermal operations, not with the exploration phase. In the test drilling phase, "test wells are drilled to provide subsurface geologic data, locate productive zones, help delineate limits and provide a means for determining the physical and chemical properties of reservior fluids" (Island Park Geothermal EIS).

Air quality impacts associated with the exploration phase are short term increases in particulates due to increased dust. The exploration phase includes "intensive activities [which] require minor land disturbances. This includes shallow well drilling for temperature gradient and heat flow measurement. Road construction and clearing are seldom required for access to these sites" (Island Park Geothermal EIS).

The proposed action by California Energy Company, core drilling and temperature measurements, are within the exploration phase as defined in the Island Park Geothermal EIS. As such, there is the potential for short-term increases in dust levels, but there is no potential for emissions of hydrogen sulfide, nitrogen oxides, ammonia, methane, or sulfur dioxide.

1-4. Drill sites in the viewshed between Grayback Ridge and Anderson Bluffs could be visible from southeast portions of Rim Drive. Four of the proposed 24 sites are within this viewshed, and are located between 5 1/2 and 8 miles from Rim Drive. The drill rig would stand about 60 feet above the ground so if a site were visible from Rim Drive, the only portion visible would be that part of the rig that stood above the trees, and would be a virtually undetectable intrusion in the scenic quality.

1-5. Refer to the revised text, Environmental Consequences, Recreation.

1-6. Site MZI-13 has been relocated. Refer to the Special design feature number 9.

1-7. Refer to revised text, Environmental Consequences, Wildlife and Threatened and Endangered Species Sections.

1-8. The 24 proposed sites have been located on the ground with the aid of aerial photography. In addition, refer to special design feature number 4.

1-9. Alternatives 1 and 2 assume drilling could occur anywhere in the units, given certain constraints. Potential and cumulative impacts have been identified and mitigation measures have been proposed where appropriate.

1-10. This environmental assessment identifies impacts of phase 2 temperature gradient drilling only. If and when Phase(s) 3 or 4 are proposed by the applicant, the appropriate level of environmental analysis and documentation will be determined and accomplished.

2-1 See response to comment 1-2.

O.S.U., Oregon
State Univ.
Comment letter
1

N40(PNR-RS)

June 12, 1984

Mr. Arthur Du Fault
Forest Supervisor
Winema National Forest
P.O. Box 1390
Klamath Falls, Oregon 97601

Dear Mr. Du Fault:

We have reviewed the environmental assessment for the Geothermal Temperature Gradient Core Drilling Program on the Winema National Forest. Our specific comments are attached.

Our primary concern about the proposed project is potential impacts on the main resource of Crater Lake National Park--Crater Lake itself. Though the preliminary FONSI concludes that no significant impacts are expected on the lake, the environmental assessment does not include a geological analysis to substantiate the conclusion. On the contrary, the assessment states that a blowout could affect thermal discharges into Crater Lake, and that in the event of a blowout, geothermal fluids could flow into the park.

Crater Lake National Park was established in 1902 as "an area ... set apart forever as a public park or pleasure ground for the benefit of the people of the United States." In 1974, 122,000 acres of the park were recommended for official wilderness designation. In 1979 Crater Lake was recommended as a scientific benchmark for limnological research. In 1982, Crater Lake National Park was identified as a potential International Biosphere Reserve. In September of 1982, PL 97-250 instructed the Secretary of Interior to "... immediately implement such actions as may be necessary to assure the retention of the Lake's pristine water quality." As Oregon's only national park and the destination of over 500,000 national and international visitors annually, the significance of Crater Lake National Park on a world scale cannot be overstated and potential impacts on the park, its resources and visitors must be considered.

We request, therefore, that exploration activities not be permitted until it has been demonstrated by a geological analysis that Crater Lake will not be affected by geothermal exploration and development activities adjacent to the park boundary.

Sincerely,

Daniel J. Tobin, Jr.

Daniel J. Tobin, Jr.
Regional Director

Enclosure

cc:
BLM, Oregon State Director
BLM, Klamath Falls, Oregon
USFS, Regional Forester, Portland

Pacific Northwest Region
National Park Service

Comments on Environmental Assessment for
Geothermal Temperature Gradient Core Drilling Program
on Winema National Forest

1. Crater Lake: The presence of geothermal heat flow into Crater Lake is well documented (Williams and Von Herzen) but poorly understood. The effects of these deep water thermal inputs are integral to the temperature stratification, circulation, chemistry and mixing of these waters (Williams), though their specific effects are as yet undetermined. According to the USGS, there are a number of documented cases throughout the world which clearly illustrates that geothermal development has had an adverse effect on nearby geothermal features. The temperature gradient holes drilled to 4000 feet will be 2000 feet to 4000 feet below the lake bottom (bottom elevation 4,244 ft). There is potential that the drilling of these holes could affect the geothermal input to the lake and therefore the limnological processes. The text of the BLM environmental assessment states that a drill site "... blowout could affect the thermal discharges into Crater Lake." However, the environmental assessment FONSI makes no mention of this potential and cites specifically that: "Geothermal fluids would not be produced ... consequently, geothermal discharges into Crater Lake would not be affected." The potential for significant impact to the primary resource of Crater Lake should not be ignored.

2. Air Quality: Crater Lake National Park is a class I area as defined in the Clean Air Act Amendments of 1977. Additionally, Crater Lake is located in southern Oregon and has some of the cleanest air in the country. The BLM environmental assessment only mentions that the air quality is "generally good" within the area, and does not mention any potential impacts on the class I air quality. The Environmental Impact Statement prepared by the Targhee National Forest for the geothermal exploration and development of the Island Park Geothermal Area next to Yellowstone National Park indicates there is a real potential for air quality degradation. The EIS cites H_2S, NO_x, NH_3, CH_4, and SO_2 as possible results of geothermal drilling and development.

3. Visitor Experience and Aesthetics: The BLM environmental assessment states that the proposed action is expected to "... have no significant impact on Crater Lake National Park, (or) it visitors..." A survey conducted in Bryce Canyon National Park in 1980 indicated 98 percent of the respondents thought clean air in the park was important to their visit and 60 percent thought it extremely important (Kelley). A similar study in Grand Canyon National Park in 1983 determined that the clean air attribute was very or extremely important to 82 percent of the respondents (Ross). This same study established that visitors were aware of small reductions in air quality, and that the perception that the air quality was reduced,

made their visit less satisfactory. Crater Lake is the epitome of a "vista" park, with the primary scene being the view of the lake from the Rim Drive. The central attraction is the lake and its deep blue color. This intense color is directly related to the cleanliness of the air (for a reflected blue sky) and the absence of suspended particles within the lake allowing deep light penetration and scattering of blue light (Pettit). Any reduction in air quality and/or lake clarity would be cause for a loss of deep blue color and therefore a reduction in visitor enjoyment. A visitor use study conducted at Crater Lake in 1981 indicated that 65% of all park visitors use the Rim Drive on the west side and 20-15% (@ 140,000) of all park visitors use the east side Rim Drive (Shelby, Wolf). The east side Rim Drive provides regular views into the Klamath Basin and therefore over the proposed geothermal development area. The views from these overlooks are quite spectacular and are integral to the park visitor experience, and they will be affected by the development.

1-4

4. Noise Pollution: The BLM environmental assessment states that "noise levels resulting from movement of vehicles, drilling of wells, and related activity can be expected as an adverse impact." Noise levels "... up to 95 dB at 50 feet can be expected..." and lowering by "... 6 dB for every doubling of distance from the source." Geothermal drilling is expected to occur 24 hours per day. Using the BLM environmental assessment noise level reduction figure, the sound of one drilling operation at MZI-14 would be 62 dB at the Pinnacles parking lot/overlook. There would be an additional 56 dB heard at Pinnacles from a drilling operation at MZI-13. If both operations were drilled simultaneously, the noise levels at Pinnacles would be cumulative. This area is visited by 10% of all park visitors annually, all occurring during the summer drilling season. Proposed drill sites MZII-1,2,4 are close to the south entrance to the park and lie on both sides of the park "panhandle". Noise levels as estimated from the middle of the entrance road are 62 dB, 53 dB, and 56 dB respectively. MZII-1 and MZII-2 are located on opposite sides of the entrance road so that if drilled simultaneously, their sound would be cumulative. For reference, these sound levels are equivalent to sitting next to a word-processer printer. It is obvious that these noise levels would be a detriment to the visitor experience. The BLM environmental assessment states that "these intrusions ... are expected to be no more objectionable than normal logging activities." Logging activity noises, however, tend to be intermittent while the drilling will be a constant 24 hours per day.

1-5

1-6

5. Water Pollution: The BLM environmental assessment states that a spill of drilling fluid from MZI-13 associated with a blowout would flow into the park. This would affect Cavern Creek and Sand Creek. The EIS on the Island Park Geothermal Development area states that entry of drill fluids from exploration into streams will cause an increase in pH, Na, TDS and alkalinity. Sand Creek has a known fish population and any entry of drill fluids will have a significant effect on the fishery resource and any upstream migration. To prevent contamination between aquifers, pressure grouted casing should be used on wells throughout the depth of drilling.

1-7 6. Wildlife and Threatened and Endangered Species: Noise and increased activity associated with the drilling have potential to affect wildlife summer migration of elk into and from the park. Additionally, the proposed development is along the feeding route for the endangered peregrine falcon from the park to the Klamath Forest Refuge. The Island Park Geothermal Area EIS cites a "modification of atmosphere and disturbance of wildlife dependent on air space for travel, feeding, etc. (birds...)". The BLM environmental assessment state there will be no impact on the peregrine falcon.

1-8 7. Boundary: The new boundary on the east side of Crater Lake National Park has been neither posted nor surveyed. Since drilling operations are close to the park boundary as marked on the map, it should be the responsibility of the BLM and the USFS to ensure that all operations occur outside of park lands. To ensure no drilling occurs within the park, a boundary survey should be completed prior to any operation.

1-9 8. Cumulative, potential and unforeseen long-term Impacts: Under the current USFS stipulations, the drill sites may be moved to almost anywhere within the lease area. Therefore, impacts noted above may not reflect a true picture should drilling occur closer to the park and to visitor use areas that proposed in the Plan of Exploration. Several holes drilled in close proximity to each other and to the park could cause cumulative impacts greater than expected. In case wells are abandoned, abandonment procedures should be described in the assessment. Procedures should include pressure grouting from bottom to top.

Additionally, it should be noted that the temperature gradient drilling is only the second phase of the proposed program. Phase 3 calls for drilling of production test wells, 36 inches in diameter, 10,000 feet deep. The impacts on the park, the visitors and the lake can be expected to be greater than the temperature gradient drilling. Finally, phase 4 calls for development of geothermal power plant(s) which will be associated with even greater impacts to the park, e.g. removal of geothermal resource thus affecting lake, stream plumes, air quality reduction, noise, etc.

1-10 We want to emphasize that the evaluation of the impacts of any development beyond the phase 2 temperature gradient drilling should be taken from a cumulative standpoint and analyzed in an Environmental Impact Statement prepared by BLM.

REFERENCES

Final Environmental Impact Statement, Island Park Geothermal Area. Targhee National Forest, St. Anthony, ID.

Kelley, K. 1980 "Results of National Park Service Visitor Survey Conducted at Bryce Canyon National Park". Summer 1980.

Pettit, E. "Why is Crater Lake So Blue" 1939. Carnegie Institute of Washington. Vol. IV, Number 4.

Ross, D.M., 1984 "Visibility Impairment and Visitor Enjoyment". Air and Water Quality Division. NPS Report $84-61 P. 1, Fort Collins, Colorado.

Shelby, B. and D.W. Wolf. 1981 "Social Impacts of Design Alternatives--Crater Lake National Park" Final Report 81-2, Cooperative Park Studies Unit, NPS. Oregon State University, Corvallis, Oregon.

Williams, D.L. and R.P. Von Herzen. 1983. "On Terrestrial Heat Flow and Physical Limnology of Crater Lake, Oregon." Journal of Geophysical Research, Vol. 88, No. B2, pages 1094-1104.

Comment Letter #2

SIERRA CLUB

530 Bush Street San Francisco, California 94108 (415) 981-8634

8 June 1984

Mr. Arthur W. DuFault
Forest Supervisor
Winema National Forest
P.O. Box 1390
Klamath Falls, OR 97601

Dear Mr. DuFault:

I am responding on behalf of the Sierra Club with brief comments regarding Environmental Assessment OR-010-84-28, Geothermal Exploration on the Winema National Forest, Temperature Gradient Core Drilling Program.

First of all, it is not entirely clear which alternative treated in the EA is the recommended alternative for the California Energy Company, Inc. (CECI) temperature gradient core drilling program. We presume that it is that which is described as the "proposed action". We would hope, and so request, that the conditions stipulated for Alternative 2 (unnumbered pages 3-4) will also appertain to the proposed action of restricting drilling to twenty-four predetermined sites. We also request that if alternative drill site locations are applied for later by CECI, additional site-specific EA's will be prepared (as stated on unnumbered pages 2 and 6) and that interested parties will be notified.

Our concerns with the core drilling program as described in the EA are as follows:

1. On unnumbered page 2 it is stated, "All the proposed sites are located on, or adjacent to, existing log landings, skid roads, or otherwise previously disturbed ground. Construction of new roads and major cut and fill operations will not be necessary." We ask that these conditions be strictly observed and that all operational sites be confined to log landings or other previously disturbed ground, and that all roads be confined to existing logging roads or skid roads.

2. On unnumbered pages 11 and 12 reference is made to the installation of earthen sumps. We request that CECI be required to use portable sumps for these shallow, slender hole drilling operations. This is feasible and has been practised elsewhere. It obviates the necessity of excavation and provides a safer means of containing drilling muds and preventing them from entering the local environment.

2-1 3. On unnumbered page 13 it is stated that a blow out could affect the thermal discharges into Crater Lake. This is a matter of great concern. We ask that additional, standby equipment be required for.

emergency use in the event of simultaneous blow out and equipment failure. From the map locations of the proposed core holes, it seems reasonable to request that hole bores be no closer than three miles to Crater Lake.

Sincerely yours,

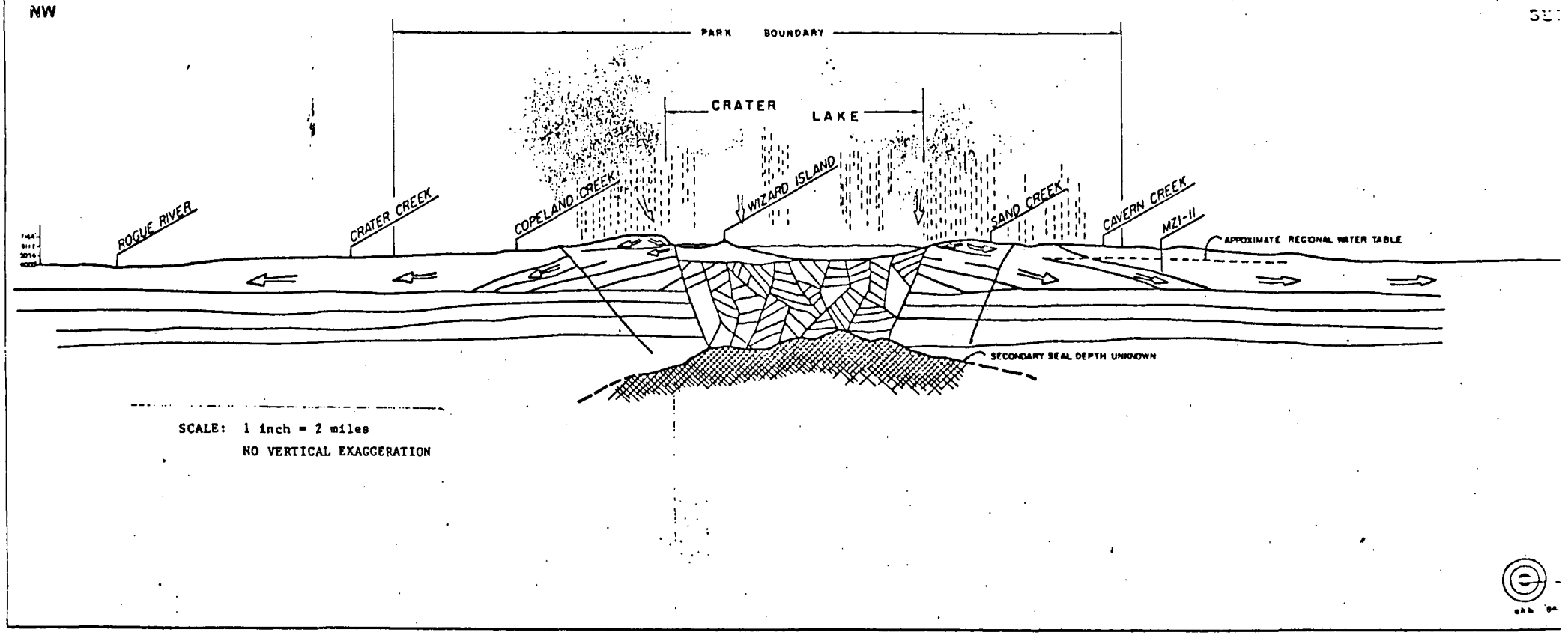
Hamilton Hess

Hamilton Hess
Geothermal Coordinator
Sierra Club

255 Ursuline Road
Santa Rosa, CA 95401

cc: Frederick Hirsch
Elizabeth Frenkel

APPENDIX D


NW
PARK BOUNDARY
CRATER LAKE
ROGUE RIVER
CRATER CREEK
COPELAND CREEK
WIZARD ISLAND
SAND CREEK
CAVERN CREEK
MZ1-11
APPROXIMATE REGIONAL WATER TABLE
SECONDARY SEAL DEPTH UNKNOWN
SCALE: 1 inch = 2 miles
NO VERTICAL EXAGGERATION

BLM Rec'd: 3-01-84

California Energy Company, Inc.

PLAN OF EXPLORATION FOR DRILLING OF TEMPERATURE GRADIENT/CORE HOLES

MAZAMA I AND MAZAMA II UNITS

February 1984

CALIFORNIA ENERGY COMPANY
3333 MENDOCINO AVENUE, SANTA ROSA, CA 95401 (707) 526-1000 TELEX II: 510-744-2088

PLAN OF EXPLORATION
MAZAMA I AND MAZAMA II FEDERAL GEOTHERMAL UNITS
KLAMATH COUNTY, OREGON

CALIFORNIA ENERGY COMPANY, INC.
3333 Mendocino Avenue, Suite 100
Santa Rosa, California 95401

Santa Rosa Office: (707) 526-1000
Oregon Field Office: (503) 593-2414

Drilling Contractor: Not Designated

Estimated Starting Date: May 1, 1984
Estimated Completion Date: November 1, 1984

Objectives:

To drill or core four to eight holes to maximum depths of 4,000 feet for the purpose of measuring temperature and defining lithology. No fluids will be produced. All operations will be conducted and holes will be plugged and abandoned in accordance with the federal Geothermal Resources Operational Orders, stipulations of the surface manager, Winema National Forest, and the Department of Geology and Mineral Industries' Laws and Administrative Rules Relating to Geothermal Exploration and Development in Oregon.

TABLE OF CONTENTS

INTRODUCTION

California Energy Company, Inc. proposes to conduct an exploratory temperature gradient/core drilling program within the Mazama I and Mazama II Federal Geothermal Units. The public lands leased within the Unit area are defined in documents on file with the U.S. Department of the Interior, Bureau of Land Management, Oregon State Office, Division of Mineral Resources. The drillsites proposed in this application lie on public lands administered by the Winema National Forest. Those sites on Oregon State Lands are for regional planning purposes only and will be permitted separately through DOGAMI at a later date. It is anticipated that a maximum of four (4) to eight (8) holes will be completed during the 1984 field season. Some of the remaining locations will be completed during 1985 and future years under separate applications. Some of the proposed sites may never be drilled, and alternative sites may be proposed as data is generated.

Based on surface geology and geophysical surveys, California Energy Company believes substantial geothermal resources may exist within the confines of the Mazama I and Mazama II Units. The exploration program proposed in this Plan of Exploration (POE) is designed to gather the temperature and stratigraphic data necessary to determine whether future, more intensive exploration drilling is warranted. Additional exploration activity will be defined under addendums to this POE or under additional POE's.

Location of Mazama I and Mazama II Units:

The Mazama I Unit is located within the Winema National Forest, east of Crater Lake National Park and approximately 40 miles northerly of Klamath Falls. The Mazama II Unit is immediately south of the southern perimeter of Crater Lake National Park. A map showing the unit boundaries is attached. A complete description of the Units, including lease serial numbers of public lands and ownership of private lands is on file with the Department of the Interior, Bureau of Land Management, Division of Mineral Resources, Oregon Office.

Current and Prospective Land Uses:

The major land use, both current and prospective, on the Mazama Units is commercial logging. Operations include both selective logging and clear cutting. Timber production varies widely with local soil/drainage conditions. Some areas, particularly on the lower, flatter slopes have poor growing conditions and are covered with stunted lodgepole pine. Where better soil and drainage conditions exist, commercial-grade timber of Shasta Red Fir, Douglas Fir and Ponderosa Pine are harvested.

Seasonal sheep grazing is locally permitted on the flat ground on the eastern side of the Mazama I Unit.

Each fall the area is subjected to a brief but intense deer hunting season. The deer hunting season usually runs for a week or two in early October. The area is also usually opened to elk hunting for a week or two in November. Since the streams in the Mazama Units are relatively small, there is no real sport fishing interest in the area.

All California Energy Company operations will be closely coordinated with the Winema National Forest so as to assure that the Forest Service concept of multiple use may be successfully implemented.

PLAN OF EXPLORATION

Proposed Drillsite Locations:

See list of Proposed Site Locations, page 4, and Regional Topographic Map (1:62,500), Map Pocket at end.

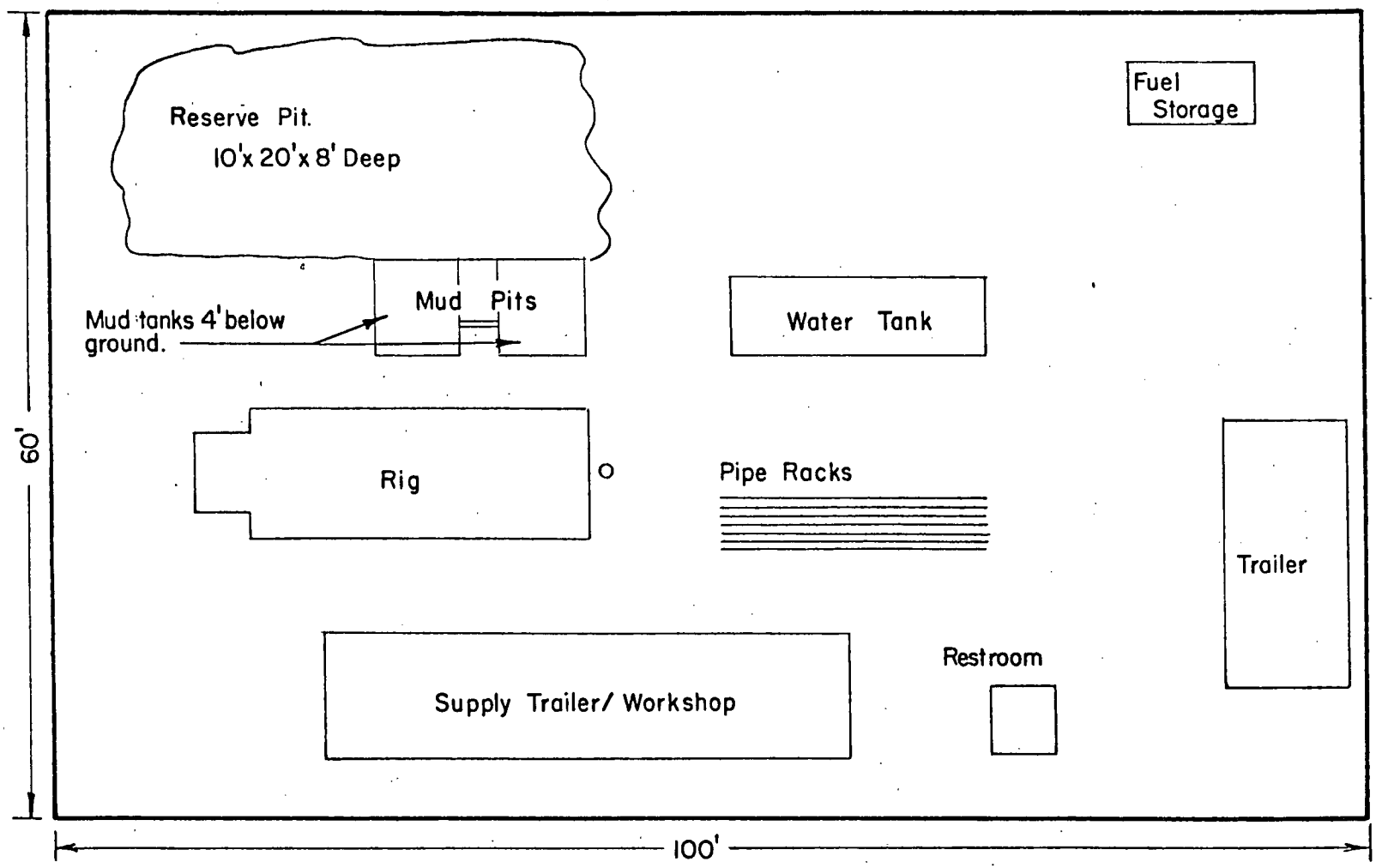
Existing Access Roads and Planned Drill/Core Sites:

All of the proposed sites are located on or adjacent to existing log landings, skid roads, or otherwise previously disturbed ground (see USFS Fire Road Map, Map Pocket). Construction of new roads will not be necessary. Major cut and fill operations will not be necessary. See page 3 for diagram of a typical rig and facility layout for drill sites.

Location and Source of Water Supply and Road Metal:

Water for drilling/coring activity will either be trucked or piped from existing stream access sites used by the Forest Service and its contractors for road watering. All such water withdrawal will be coordinated with and subject to the approval of the surface manager. A permit for appropriation of water will be obtained from the Oregon Department of Water Resources. If piping is practical, temporary above-ground pipelines will be laid along existing roads or other appropriate routes from the source to the drill site. The proposed operations generally require 3,000 to 5,000 gallons of water per day. Under extreme lost circulation conditions a maximum of 20,000 gallons might be used.

Any gravel or other road metals necessary for improvement or repair of existing roads or site construction will be obtained from existing road metal pits (cinder pits) with the concurrence of the surface manager. Water will also be used if necessary to keep down dust during any grading of roads or drill pad sites.



TYPICAL DRILLSITE LAYOUT

California Energy Company

PROPOSED TEMPERATURE HOLE SITE LOCATIONS
MAZAMA I, MAZAMA II, STATE LANDS

Hole No.	Kettleman Number*	Elev.**	Approximate Location*
MZ-I-1	21- 3	5370'	1250' E and 150' S of NW Corner, Sec. 3, T30S R6E
MZ-I-2	38- 3	5380'	1300' E and 250' N of SW Corner, Sec. 3, T30S R6E
MZ-I-3	16-12	5360'	2000' N and 450' E of SW Corner, Sec. 12, T30S R6E
MZ-I-4	21-23	6000'	1250' E and 750' S of NW Corner, Sec. 23, T30S R6E
MZ-I-5	65-24	5580'	1750' W and 2100' N of SE Corner, Sec. 24, T30S R6E
MZ-I-6	77-26	5805'	1250' W and 550' N of SE Corner, Sec. 26, T30S R6E
MZ-I-7	73-33	4635'	2400' S and 1850' W of NE Corner, Sec. 33, T30S R7E
MZ-I-8	54- 6	4740'	2150' W and 2200' S of NE Corner, Sec. 6, T31S R7E
MZ-I-9	41-11	6080'	2100' E and 350' S of NW Corner, Sec. 11, T31S R7½E
MZ-I-10	53-18	4700'	2000' W and 1950' S of NE Corner, Sec. 18, T31S R7E
MZ-I-11	44-15	6100'	2550' E and 2800' S of NW Corner, Sec. 15, T31S R7½E
MZ-I-12	23-25	5370'	1500' E and 1500' S of NW Corner, Sec. 25, T31S R7½E
MZ-I-13	54-27	5440'	2200' W and 2550' S of NE Corner, Sec. 27, T31S R7½E
MZ-I-14	12-34	5430'	200' E and 1300' S of NW Corner, Sec. 34, T31S R7½E
MZ-I-15	33- 1	5170'	1850' E and 1500' S of NW Corner, Sec. 1, T32S R7½E
MZ-I-16	88- 4	5390'	200' W and 400' N of SE Corner, Sec. 4, T32S R7½E
MZ-I-17	23-11	5345'	350' E and 1800' S of NW Corner, Sec. 11, T32S R7½E
MZ-II-1	66-13	4665'	2000' N and 2050' W of SE Corner, Sec. 13, T32S R6E
MZ-II-2	16-14	4955'	450' E and 1900' N of SW Corner, Sec. 14, T32S R6E
MZ-II-3	32-21	5750'	1900' E and 1000' S of NW Corner, Sec. 21, T32S R6E
MZ-II-4	66-23	4635'	3450' E and 2100' N of SW Corner, Sec. 23, T32S R6E
MZ-II-5	18-26	4480'	450' E and 300' N of SW Corner, Sec. 26, T32S R6E
MZ-II-6	88- 5	5035'	550' W and 450' N of SE Corner, Sec. 5, T33S R6E
MZ-II-7	13-11	4320'	1800' S and 170' E of NW Corner, Sec. 11, T33S R6E
CEC-ST-1	75-17	4770'	800' W and 2400' N of SE Corner, Sec. 17, T32S R7½E
CEC-ST-2	34-22	5585'	1800' E and 2700' N of SW Corner, Sec. 22, T32S R7½E
CEC-ST-3	22-34	4340'	1000' E and 1300' S of NW Corner, Sec. 34, T32S R7½E
CEC-ST-4	25-11	4285'	1200' E and 2250' N of SW Corner, Sec. 11, T33S R7½E

* Kettleman numbers and other location designations are subject to possible change because minor adjustments of the exact location may be made in cooperation with the surface manager to minimize surface disturbance and avoid adverse impacts.

** Approximate elevations and locations were taken from existing topographic maps (mainly 1:62,500 scale).

JLF:sm:42:Z29/B4
2-6-84

DRILLING PROGRAM
California Energy Company

Mazama Temperature Gradient/Core Holes

Drilling and Coring Procedure

1. Set 5'+ of 8-5/8" conductor pipe with back-hoe and cement with Ready-Mix in a 5' x 5' x 5' deep cellar.

2. Move in and rig up a combination core and rotary rig. Approximate location size (100' x 60').

3. Spud 7-7/8" hole and drill to 400'+ using a fresh water* and gel drilling mud. Standby air drilling equipment will be part of the rig package to aerate the drilling mud if any serious lost circulation is encountered.

4. 5-1/2" casing will be run at 400' and cemented to surface with Halliburton.

5. Weld on casing head flange. Nipple up to 5-1/2" casing with a master valve and hydraulic operated annular B.O.P. Pressure test all equipment to 500 psi, with advance notification to BLM to witness test.

6. Drill out cement plug to 2' below 5-1/2" casing shoe with 4-3/4" bit.

7. Start core drilling with 3.345" ID x 4.872" OD wireline coring system. Reduce core size as mandated by drilling conditions.

8. At completion, run 1-1/2" tubing to total depth; fill w/ water and cap.

9. Run periodic temperature surveys up to six months after completion.

10. After completion of temperature surveys, plug and abandon the hole in conformance with Geothermal Resources Operational Orders and DOGAMI's Laws and Administrative Rules Relating to Geothermal Exploration and Development in Oregon.

All surface casing design will exceed 10% of total depth.

*Water will be trucked or piped to location from locally available sources with approval of surface manager (USFS) and in accordance with state and federal regulations.

RAP:akc:42
Z15/A3:2-21-84

ENVIRONMENTAL CONSIDERATIONS

Fire Prevention

An adequate fire break will be cleared around all operating locations in accordance with Forest Service guidelines. Suitable fire extinguishers, water, and hand tools will be kept on location at all times and employees will be instructed in their use. Spark arrestors will be used on all potential spark-emitting equipment. Smoking will be allowed only in cleared areas (drill pad). The Forest Service fire prevention rules will be distributed to all drillsite employees and service personnel.

Soil Erosion

No major cut and fill will be required for the sites. Careful grading and appropriate use of berms, culverts or other methods will prevent accelerated erosion or gullying. Culverts and ditches, if appropriate, will be emplaced upon direction of the surface manager.

Surface and Ground Water Protection

All drilling fluids will be formulated from non-toxic components (as defined by EPA). Drilling mud and fluids will be contained in steel or earthen pits during the drilling phase. No geothermal fluid will be produced. The contents of the pits will either be allowed to desiccate and be covered over, or removed to an approved suitable disposal area, depending on the constituents and preference of the surface manager. Portable sanitary facilities will be provided and maintained according to state and federal health standards.

Solid waste such as paper, cans, packing materials, etc. will be collected on site in an approved receptacle and disposed of at a public disposal facility or other approved disposal location.

See Emergency Contingency Plans, page 12.

Clean Air and Noise Standards

Diesel or gasoline engines are used to power the drilling machinery. Exhaust stacks on all diesel or gas-driven equipment and vehicles will be equipped with mufflers. All equipment will be properly maintained and muffled to assure compliance with standards and intent of appropriate regulations. Motor vehicles will be restricted to established roads.

Public Health and Safety

None of the proposed sites are in areas of heavy public use. During operations, the sites will be occupied on a 24 hour per day basis by company and contractor personnel. Persons not directly involved in the operations will be restricted from the site. Following completion of each hole, the contents of the sump will be pumped out and removed, or allowed to desiccate and filled in, and the location graded back to its original contours.

Natural Resource Preservation

All operations will be confined to drill sites and access roads to minimize impacts on wildlife. Drilling fluids will be confined to steel or earthen pits. Preservation of fish, wildlife, natural resources and areas of cultural, historical or archeological value will be coordinated with the surface manager. All sites will be inspected by the surface manager and other interested agencies prior to occupancy and mitigation measures will be implemented.

Support Construction Facilities

Drilling crews will commute to the site from existing living quarters (motels, trailer parks, etc.) on a daily basis. Drill rig crews consist of three (3) men and generally work eight (8) hour shifts. Operators are on site on a 24 hour basis, 7 days per week. California Energy Company's supervisory and geological personnel will also stay in local motels. A small trailer may be placed on site to provide office and communications facilities. Equipment likely to be on site consists of the drilling rig, casing storage area, a water storage tank, and personnel vehicles. An area approximately 60 x 100' will be occupied. The cores will be stacked at the site and periodically removed to storage off-site.

The expected working season extends from about June 1 through October 15. However, because of this relatively short season, it may be necessary (with concurrence of the surface manager) to lengthen the work season by clearing roads of snow to selected sites.

Preservation of Cultural Resources

No known significant cultural, historical, or archeological sites will be effected by the actions proposed in this POE. Additionally, each proposed site has already been extensively disturbed by logging operations.

Potential Geologic Hazards:

California Energy Company's exploration planning procedures include early detection and avoidance of sites posing a potential geologic hazard (such as landslides). None of the proposed sites are known to present any significant hazard.

REGIONAL HYDROLOGY/REGIONAL GEOLOGY/LOCAL GEOLOGY

Regional Hydrology

By extrapolation of the data presented by R. C. Newcomb and D. H. Hart in USGS Open File Report 58-73 entitled "Preliminary Report on the Ground Water Resources of Klamath River Basin, Oregon," the regional water table is anticipated at elevations of 4400 ft. to 4600 ft. above sea level under Mazama I Unit and 4200 ft. to 4500 ft. above sea level under the Mazama II Unit. The regional direction of deep groundwater flow is southerly toward Klamath Lake. However, on both Mazama I and II units, higher topography to the west imparts west to east flow direction in the upper groundwater levels. At elevations above the regional water table, lateral groundwater flows may be anticipated to occur locally.

Regional Geology/Geothermal Summary

The Crater Lake area is located at the intersection of the north-south trending Cascade volcanic axis and the north-northwest trending Klamath Graben. Crater Lake occupies a caldera formed by collapse of the summit of Mt. Mazama during an especially large silicic pyroclastic eruption 6600 years ago. Volume estimates of material erupted during this event indicate the liklihood of a large underlying magma chamber.

Somewhat older (30,000 - 700,000 years) silicic domes and lava flows occur across a highland centered just east of Crater Lake. This highland is ringed by faults on the southeast, east and northeast sides and may be underlain by an intrusive complex large enough to contain residual magmatic heat. Several northeast and northwest trending fault zones and dome alignments are prominent features that show up on several kinds of imagery as well as on gravity anomaly maps by Couch and others, 1981. In the Western Cascades, thermal springs tend to occur where northeast and northwest trending cross faults intersect the dominantly north-south and north-northwest Cascade structural trends. If similar relationships hold for the Crater Lake area, thermal features may also be localized at depth along cross structures.

The Cascade volcanic arc north and south of the Crater Lake area has been especially active in geologically recent times and contains numerous volcanic vents less than one million years old. However, most of these vents are andesitic or basaltic and are probably not as geothermally significant as the silicic vents of the Crater Lake area.

The southern Cascades, from Three Sisters to Lassen, is concentric to the western margin of the Basin and Range province. Along this physiographic boundary, extensional faulting has locally cut into the east flank of the Cascade arc. This is especially evident in Klamath Graben which cuts obliquely across the east flank of the arc and intersects the arc axis beneath Crater Lake. Possible continuation of the graben structure north of Crater Lake through the Diamond Lake area east of Mt. Bailey is supported by gravity anomaly maps which suggest a northward continuation of the Klamath Graben gravity low, through and beyond Crater Lake. Regional studies of the Basin and Range

province indicate its high regional heat flow to be directly related to the high rate of crustal extension. The maximum amount of westward crustal extension in the Basin and Range is adjacent to the Crater Lake-Klamath Graben area; hence, a high heat flow should be expected there.

Older rocks that occur beneath the young volcanics of the Crater Lake area are the Pliocene Yonna Formation and Miocene Little Butte Formation. These units consist of permeable fractured lava flows, breccias, and coarse clastic sediments interlayered with impermeable altered tuffs and lake sediments. This sequence provides zones of extensive lateral permeability sealed between less permeable layers--an ideal situation for the formation of geothermal reservoirs.

As in most parts of the Cascade Range, high precipitation has saturated the uppermost 1000 to 3000 feet of porous volcanics with cold groundwater which effectively conceals any deep geothermal systems that may be present. Because of extreme lateral variability of volcanic deposits and abundant fault zones, the hydrology of the Cascade Range and the Basin and Range margin is undoubtedly complex. Drillhole information will be needed to adequately model the structure and hydrology.

In summary, the Crater Lake-Klamath graben area appears to be very prospective for geothermal development based on the combination of: (1) high regional heat flow augmented by volcanic heat of the Cascade arc, (2) favorable reservoir rocks, (3) horst and graben structure, (4) active deformation, and (5) adequate fluid recharge.

HP:JLM:Z29:A6
2-9-84

Local Geology

Mount Mazama consists of numerous volcanic vents and flows which reflect a focus of high level magma evolution which has been intermittently active for at least the last 400,000 and possibly 700,000 years. Mount Mazama is located at the juncture of the Klamath graben, a north-northwesterly trending basin-and-range structure and the main N-S axis of the High Cascade volcanic chain. Although the north end of the Klamath graben bends northward into coincidence with the High Cascade trend as it disappears beneath the flanks of Mazama, no regional faults have been recognized in the walls of Crater Lake caldera.

The Mazama Quaternary stratovolcano lies on a pile of interspersed shields, stratocones, small monogenetic volcanoes and valley filling flows that compose the volcanic rocks of the High Cascades. This base of older High Cascade volcanics may date back to 7 m.y.b.p. Rocks of the Western Cascades volcanic group presumably also underlie the Mazama massif. The Western Cascades rocks exposed to the west of Crater Lake constitute a volcanic pile about 18,000 ft. thick ranging in age from 15 to 35 m.y.b.p. The nature of older basement is unknown.

The Mt. Mazama massif was constructed north and east of an older field of profuse dacitic (rhyodacite) venting and peripheral basaltic cinder cones. These older dacites (or rhyodacites) constitute the dome vents on the east side of the park boundary and the two large ridges that flank Sun Creek canyon. The K-Ar dating on these vents gives ages of about 600 to 700 k.y.b.p. The dacite field flanking the east and southeast of Crater Lake may or may not have been vented from the magmatic system that later built the Mazama massif.

The building of the main Mazama massif began with the andesitic stratocones of Mount Scott and Phantom Cone approximately 400 k.y.b.p. A period of andesitic and dacitic venting came next. The estimated time for these flows is about 355-220 k.y.b.p. Subsequently, mafic andesite shields were built near Cloudcap about 290-220 k.y.b.p. and near Lloa Rock about 185-110 k.y.b.p. Andesitic to dacitic lavas were erupted near Lloa Rock about 130--110 k.y.b.p. This was followed by rapid construction of a complex andesitic stratocone near Hillman Peak and eruption of widespread dacitic airfall and flows from many widespread vents about 70 k.y.b.p. Andesite flows of about 50 k.y.b.p. cap the southwest and north caldera walls, and the dacite Watchman was also erupted about that time. Dacite lava erupted sporadically 50-25 k.y.b.p.; concurrently basalts were erupted from outlying vents (e.g. Red Cone, 36 k.y.b.p.). Forgotten Crater, 2.5 km west of the lake, erupted basalt commingled with dacite about 22 to 30 m.y.b.p. That composite venting may identify the western edge of the dacitic magma chamber. A period of quiescence about 15 k. years long preceded the eruption of the preclimactic rhyodacite lava flows. There are four main rhyodacitic vents remaining on the caldera rim that preceded the main blast by, at most, a couple of hundred years (i.e., 7000 ±200 k.y.b.p.). One of these vents, Redcloud, is actually on the due east side of the rim. Llao Rock, Grouse Hill, and Cleetwood are the main Holocene vents left on the north rim. Similar vents "probably" collapsed from view.

The climactic eruption is now dated at 6,845 ±50 y.b.p. It began with a single vent erupting from a position that would lie in the northeast quadrant of the present caldera floor. Caldera collapse soon followed and was accompanied by

voluminous venting of ash flows from the ring fractures produced. During this phase the erupting magma changed in composition from dacitic or rhyodacitic to andesitic.

Three post-collapse vents have been identified on the Caldera floor. Wizard Island and Merriam Cone formed where andesitic magma ereupted near the inferred structural margin of the caldera. A broad platform of rhyodacite erupted east of Wizard Island. Whether this silicic platform vented residual magma from the climactic eruption magmatism or whether it reflects a newly maturated batch is unknown.

"The Crater Lake Caldera provides the best evidence for a recent shallow magma chamber in the Cascade Range." (C. R. Bacon, 1982). The tentative conceptual model proposed by Bacon is the climactic eruption vented 51-59 km^3 off the top of a compositionally zoned magma chamber which may have taken 40,000 years to differentiate. The underlying andesitic magma and still deeper basaltic fraction is presumably still present as melt. Bacon would probably restrict the areal extent of the Upper Pleistocene-Holocene magmatic system to the immediate caldera area. The Forgotten Crater vent trend and Sharp Peak vent trend apparently were fed by radial dikes extending from the central magma body.

In a broader perspective, the Crater Lake area can be viewed as a relatively long-lived focus of silicic volcanism which reflects prolonged heat replenishment via upper mantle derived basalts ascending in a zone of major crustal weakness. The dacite dome field east of the park and the dacite ridges in the southeast corner of the park may have vented from an independent magmatic system which evolved 600-700 k.y.b.p. Presumably such a dense profusion of silicic venting would overly a large magmatic source with deeply descending roots. The continued heat flow from such a magmatic system may be much greater than one would anticipate from the age dating of the surface vented rocks. Whether or not the older east side dome field and the late Pleistocene Mount Mazama vents are magmatically related at some depth is perhaps an esoteric argument. Both are reflective of the same general zone of crustal weakness. Their close proximity is not just coincidental as evidenced by the fact that there are no other major late Quaternary silicic vent areas within 100 km in the Cascade Range.

Structural Interpretation: The most strongly evidenced structural control, which apparently focused volcanism in the Crater Lake area, is the intersection of NNW trending basin-and-range faults and N-S faults typical of the Cascade crest. Perhaps of equal significance, but less evident, is a strong ENE structural fabric which is best seen cutting across the southern end of the park and is on trend with the abrupt ENE bend in Sun Creek. This ENE trend is evident in much older western Cascades far to the southwest of Crater Lake and also is seen breaking Tertiary lava flows in the basin and range far to the northeast. This trend may be quite old but perhaps is continuing to be rejuvenated, as suggested by the ENE bend in Sun Creek which occurs in a 6800 year old welded ash flow.

On the eastern flanks of Mount Mazama one might anticipate that current stress field would be dominated by basin-and-range extensional tectonism. Normal faults, downthrown to the east, define the abrupt change in slope on the eastern side. In the southeast corner of the area of interest, the large normal fault defining the eastern margin of the Klamath Graben, splays and disappears beneath

the Mazama volcanics within the park. This fault dips about 85° to the west with probably several thousand feet of downward displacement on the western side. Exposure of fault plane in a quarry at Agency Hill shows striations with a rake of 87° to the north indicating a lesser component of right lateral strike-slip displacement.

Within the southwest area of interest, the Mazama II unit, the north-south trending western margin fault zone of the Klamath Graben is the dominant structure. This fault zone is generally defined by the abrupt change in slope on the west side of the graben and presumedly dips eastward with several thousand feet of downdrop on the east side. North-south vent trends (e.g. Goosenest vent trend) and N-S faults typical of the Cascade Crest are seen to the east and north of the Mazama II Unit. East-northeast faulting may structurally control the lower portion of Seven Mile Creek and Dry Creek.

In the area northwest of the park, the most evident structure is the north-northeast apparent fault zone containing the upper Rogue River. Due NE striking faults are apparent in the area of Soda Spring. Less distinct northwest trending faults are also seen in this area.

JLF:akc:42

March 29, 1984

TO: JLM, RAP

FM: Anna Anna

RE: Tools and Fire Equipment Required by USFS

USFS "Fire Protection and Suppression" rules are attached. Following is a summary of the equipment they require:

1. All pickups, panels, passenger carrying-type vehicles, trucks:

   Fire extinguisher having a UL rating of at least 5BC

   One long-handled, round-pointed shovel 0 size or larger.

   Double-bitted axe or pulaski having at least a 36" handle.

   Mounted in Vehicles

2. Tractors, welding machines, compressors, motor patrols, fuel and water pumps shall be equipped with fire extinguishers, as above.

3. Power Saws: Pressurized chemical fire extinguisher of not less than 8 oz. capacity by net weight and one size 0 or larger long-handled, round-pointed shovel.

4. Extinguishers: One refill for each type or one extra of each type, stored in readily accessible place on site.

5. Fire Tools: To be kept on site in weather-tight fire tool boxes, painted red, marked "Tools for Fire Only" with letters three inches or more high, with list of tools kept in the box so it is visible when opened. Sharpened edges are to be greased or painted.

Kind of Tool	Number of Workers in Area	
	1-4	5-8
Axe, Dbl bld, chopping 36" hdl or Pulaski	2	2
Hazel Hoe, Adz Eye Hoe or Pulaski	1	2
Shovels, lg. hdl, rd pt. 0 or larger	2	4
Canteen, 1 gal. (metal or plastic)	1	1

AKC:40 See Tank Truck specs!

cc: DW

Exhibit C

USDA FOREST SERVICE
REGION 6

FIRE PROTECTION AND SUPPRESSION (EASTSIDE) 1/

1. Fire Period and Normal Precautions

Specific fire prevention measures are listed below and shall be effective for the period April 1 to October 31 of each year. The Contracting Officer 2/ may change the dates of said period by advance written notice if justified by unusual weather or other conditions. Required tools and equipment shall be kept currently in serviceable condition and immediately available for initial attack on fires.

2. Fire Plan

Before starting any operations on the project, the Contractor, Permittee, Licensee, or Purchaser, hereinafter referred to as the "Contractor", shall prepare a fire plan in cooperation with the Contracting Officer providing for the prevention and control of fires in the project area.

3. Substitute Measures

The Contracting Officer may by written notice authorize substitute measures or equipment or may waive specific requirements during periods of low fire danger.

4. Emergency Measures

The Contracting Officer may require emergency measures, including the necessary shutting down of equipment or portions of operations in the project area during periods of fire emergency created by hazardous climatic conditions.

5. Fire Control

The Contractor shall, both independently and in cooperation with the Forest Service, take all reasonable action to prevent and suppress fires in the project area. Independent initial action shall be prompt and shall include the use of all personnel and equipment available in the project area.

For the purpose of fighting forest fires on or in the vicinity of the project, which are not caused by the Contractor's operations, the Contractor shall place employees and equipment temporarily at the disposal of the Forest Service. Any individual hired by the Forest Service will be employed in accordance with the Interagency Pay Plan for Emergency Firefighters. The Forest Service will compensate the Contractor for equipment rented, at fire fighting equipment rates common in the area or at prior agreed rates.

6. Compliance with State Forest Laws

Listing of specific fire precautionary measures herein is not intended to relieve the Contractor in any way from compliance with the State Fire Laws covering fire prevention and suppression equipment, applicable to operations under this contract, permit or license.

7. Fire Precautions

Specific fire precautionary measures are as follows:

a. Smoking and Open Fires

Smoking and fires shall be permitted only at the option of the Contractor. When smoking is allowed it will be permitted only in areas that are free of flammable material. While smoking, smokers shall sit down in such a position that any burning material will fall within a cleared area. Before leaving the cleared area, all burning material shall be extinguished and pressed out in mineral soil. The Contractor shall not allow open fires without first obtaining written authorization from the Contracting Officer.

b. Fire Extinguishers and Equipment, on Trucks, Tractors, etc.

All pickups, panels, and passenger-carrying type motor vehicles used in the operation; trucks, tractors, welding machines, compressors, fuel and water pumps, motor patrols, and similar equipment, except portable fire pumps, shall be equipped with a fire extinguisher having a UL rating of at least 5BC and one long-handled, round-pointed shovel size "0" or larger.

In addition, each truck, pickup, panel, passenger-carrying type vehicle and motor patrol shall be equipped with a double-bitted axe or Pulaski, 3½ pounds or larger. Equipment required shall be mounted so as to be ready for immediate use on all equipment, provided that equipment required in passenger cars may be placed so as to be readily available.

c. Power Saws

Each power saw operator shall be equipped with a pressurized chemical fire extinguisher of not less than 8-ounce capacity by net weight and one size "0," or larger, long-handled, round-pointed shovel. The extinguisher shall be kept in possession of the saw operator at all times. The shovel shall be located so that the operator may get the shovel and return to the saw operations in a maximum time of one minute. Power saws should be moved not less than 20 feet from point of fueling before starting.

d. Extinguishers

One refill for each type or one extra extinguisher sufficient to replace each size extinguisher shall be stored in a safe place on the project area so that it is readily available for replacement purposes.

e. Spark Arresters and Mufflers

Each internal combustion engine shall be equipped with a spark arrester qualified and rated under USDA Forest Service Standard 5100-1a unless it is:

(1) Equipped with a exhaust driven turbocharger. There shall be no exhaust bypass.

(2) A multi-position engine, such as on chain saws, which must meet the performance levels set forth in the Society of Automotive Engineers "multi-positioned small engine exhaust fire ignition standard, SAE recommended practice J335B" as now or hereafter amended.

(3) A passenger carrying vehicle or light truck, or medium truck up to 40,000 GVW, used on roads and equipped with a factory designed muffler and an exhaust system in good working condition.

(4) A heavy duty truck, such as a dump or log truck, or other vehicle used for commercial hauling, used only on roads and equipped with a factory designed muffler and with a vertical stack exhaust system extending above the cab.

Exhaust equipment described in this Subsection, including spark arresters and mufflers, shall be properly installed and constantly maintained in serviceable condition.

f. Emergency Fire Precautions

The Contractor shall restrict operations in accordance with the Fire Precautions Schedule listed below. The Forest Service may change the Fire Precautions Class values to other values upon revision of the National Fire Danger Rating System and may change the specific Fire Precautions when such changes are necessary for the protection of the National Forest. When sent to Contractor, the revised Fire Precautions Schedule will supersede the below listed schedule.

FIRE PRECAUTIONS SCHEDULE

Fire Precautions Class	Fire Precautions
A	Normal fire precautions. No fireguard required.
B	Normal fire precautions. Fireguard services required on areas of yarding, tractor operation, mechanized treatment of slash, loading sites, and powersaw operations.
C	For this and higher precautions classes, Contractor shall provide fireguard services to all areas of operation.
D	The following are prohibited from 1:00 p.m. until 8:00 p.m., local time: (1) Operating power saws, except at loading sites; (2) Operating cable yarding systems, except those gravity systems not employing self-powered carriages that present significantly lower risk of starting a fire than normal cable yarding operations and have been approved in writing in advance by the Forest Service and those cable systems not employing self-powered carriages, which when operating have all moving lines, other than that line from the carriage to the chokers and all blocks through which lines move, suspended not less than 10 feet vertically above the ground; (3) Blasting; (4) Welding; and (5) Operating acetylene or other torches with open flame.

FIRE PRECAUTIONS SCHEDULE (CONTINUED)

Fire Precautions Class	Fire Precautions
E	The measures stated in Precautions Class C and D above, remain in effect. In addition, the following operations are prohibited from 1:00 p.m. until 8:00 p.m., local time: (1) Operating power saws at loading sites; (2) Operating tractors; (3) Mechanized yarding; (4) Mechanized loading; (5) Mechanized hauling of any product or material; and (6) Mechanized treatment of slash. Provided that, the Forest Service may allow these activities to continue outside of high-hazard areas when approved in writing in advance.
F	All mechanized and spark-emitting operations are prohibited, except the following activities may continue outside of high-hazard areas with advance written permission of the Forest Service: (1) Mechanized loading; (2) Operating power saws; (3) Mechanized hauling; (4) Earthwork; (5) Watering and dust oiling; (6) Grading; (7) Gravel surfacing; (8) Rock crushing; (9) Paving; and (10) Maintenance (other than welding and metal cutting) of equipment, roads, and other improvements. One person and equipment will be permitted within high-hazard areas for fire prevention and security of property.

The following definitions shall apply to this Clause:

1. Loading Site: A place where any product or material (including but not limited to logs, firewood, slash, soil, rock, poles, posts, etc.) is placed in or upon a truck or other vehicle.

2. Cable Yarding Systems: A Yarding system employing winches in a fixed position.

The Contractor shall obtain the predicted Fire Precautions Class from the appropriate District Ranger headquarters. If predictions made after 6:00 p.m., local time, are significantly different than originally estimated, the Forest Service will inform Contractor when changes in restrictions or fire precautions are indicated.

8. Fire Tools

The Contractor shall furnish firefighting tools to equip all personnel employed on the project. Tools shall be in serviceable condition and kept in one or more weather-tight fire tool boxes. Fire tool boxes shall be painted red, marked "Tools for Fire Only" with letters three inches or more high, and kept sealed. A list of the contents shall be posted inside each fire tool box so it is visible when opened. Sharpened edges of tools shall be greased or painted.

Fire tool boxes shall contain numbers and kinds of tools as follows:

Kind of Tool	Number of Employees Working in Area			
	1-4	5-8	9-15	16-20
Axe, (d.b.) chopping min. 32" hdl. or Pulaski	2	2	4	6
Shovels, L.H., R.P. #0 or larger	1	2	5	6
Hazel Hoe, Adz Eye Hoe or Pulaski	2	4	6	8
Canteen 1 gal. (metal or plastic)	1	1	2	2

For operations employing more than 20 people, special tool lists will be specified by the Contracting Officer so as to equip 100 percent of the personnel.

Pumps, backpack cans (or neoprene bags), 5-gal. filled with water	1	1	2	2

Backpack cans shall be located inside or immediately adjacent to the tool box in a safe, readily available area.

Fire tool boxes shall be placed at the following applicable locations:

a. Each work site, except when two work sites are within 600 feet of each other, one tool box will meet this requirement.

b. Each operating road construction job unless finish grading or surfacing is the only road work in progress and sufficient fire tools are available on equipment for use by all construction personnel.

c. As close as possible and practical to the hazardous area.

9. Fireguard for Power-Driven Equipment

A Fireguard shall be provided at each operation area where power-driven equipment has been operated during the day, as specified in the Fire Precautions Schedule, and shall be constantly on duty for at least three hours from the time the equipment is shut down.

The Contracting Officer may modify or waive, in writing, any requirement of this Section whenever the operation is not of sufficient duration or fire hazard to justify the requirement.

Each Fireguard shall be physically able, vigilant, and suitably trained to detect and to promptly and efficiently take suppression action with available required firefighting equipment on any fire that starts in project area, and shall be competent to operate all fire and communications equipment.

Fireguard service in one area will satisfy the requirements in adjacent areas if the travel time with available transportation is not in excess of five minutes to any of the other areas requiring such service.

10. Blasting

Fuses shall not be used for blasting. Explosive cords shall not be used without written permission of the Contracting Officer, which may specify conditions under which such explosives may be used, precautions to be taken and similar measures.

Whenever the Fire Precautions Class exceeds B, a watchman equipped with a long-handled, round-pointed size "0" or larger shovel and a filled, five gallon backpack pump can, shall stay at the blast site for one hour after termination of blasting.

1/ "Eastside" refers to all National Forest System lands administered by the USDA Forest Service, Region 6, located east of the Cascade Mountains and including Jackson and Josephine Counties in Oregon, and; that portion of Douglas County within the Rogue River National Forest in Oregon, and; that portion of Curry County within the Galice and Illinois Valley Ranger Districts of the Siskiyou National Forest in Oregon, and; those portions of the Rogue River and Siskiyou National Forests in California.

2/ "Contracting Officer" is the person executing the contract, permit or license on behalf of the Government and includes that persons designated representative, acting within the limits of their delegated authority, or any duly appointed successor to these individuals.

ADDITIONAL FIRE PRECAUTIONARY MEASURES - TANK TRUCK

Tank Truck - Contractor shall provide a tank truck or trailer during yarding, loading, land clearing, right-of-way clearing (excluding falling and bucking) and mechanical treatment of slash at each operating area or more suitable place designated by the Forest Service. A tank truck or trailer at one area of operation will satisfy the requirement on an adjacent area(s) if the travel time of the fully loaded and equipped tank truck or trailer from its principal location to an adjacent area(s) of operation does not exceed ten minutes, including the time required for a driver to get to the tank truck or required tow vehicle and start it. Each tank truck or trailer shall be equipped with a water tank containing not less than 300 gallons of water for eastside 1/ areas and not less than 500 gallons of water for westside 2/ areas. Water tanks shall be equipped with a rapid shut-off type fitting which shall be located near the bottom of the tank and designated to permit direct gravity water-flow and rapid filling of backpack pump cans.

The pump may be a portable power pump or a suitable power take-off pump. If the pump is of the gear type, a by-pass or pressure relief valve shall be provided. The pump shall develop pressure sufficient to discharge 20.5 gallons per minute through a 50 foot length of 1-inch or 1½-inch rubberlined hose, using a ¼-inch nozzle tip at pump level. The pump, as mounted, shall be capable of drafting water from a water source located 10 feet vertical distance below the center of the rear axle through the required suction hose.

The tank trucks or trailers shall be equipped with a live reel containing from 250 feet to 300 feet of 1-inch fabric-jacketed rubberlined (FJRL) hose. The hose shall be charged with water and then wound on the reel so that it is "alive". While full 1-inch FJRL hose is preferred because of the lesser friction loss, 1-inch hard rubber hose will be acceptable on the live reel, provided the inside diameter of the hose is not less than 3/4-inch.

In addition to the hose on the live reel, 250 feet of 1-inch FJRL hose shall be carried on the tank truck or trailer. The necessary fittings to connect at least 500 feet of hose together shall be provided. The nozzle shall be of a shut-off type. It shall have a capability of projecting a ¼-inch straight stream or its equivalent in water output and distance. It shall also have the capability of producing a spray pattern.

A water supply sufficient for rapidly filling the tank shall be provided where practicable at one or more accessible points along or adjacent to the main truck roads.

List of necessary accessories which are required to be with each tank truck or trailer is as follows:

8 gallons of fuel to operate pump
1 reducer, 1½-inch and 1-inch suitable for hose and equipment supplied
1 wrench, spanner, suitable to fit each size hose supplied, including suction hose
1 suction screen suitable to fit suction hose
24 feet (approx.) suction hose suitable to fit pump intake
12 washers for each size hose supplied

The following accessories are also required if the pump is operated by a separate engine:

Sufficient extra spark plugs to replace all spark plugs in the engine
1 wrench, crescent, 10-inch
1 wrench, spark plug, unless the crescent wrench is suitable for use on the spark plugs
1 pliers, 6-inch slip joint
2 quarts oil, crankcase, if engine is the type that requires crankcase oil
1 screwdriver, 4-inch
2 rope starters, if engine can be started with a rope
1 gun, grease, if the pump is the type that requires periodic greasing. The grease gun shall be filled with grease.

These accessories shall be stored on or near the pump in a suitable compartment or box. A list of contents should be posted inside the compartment or box so as to be visible when the storage place is open.

The following safety items are required with the tank truck or trailers:

Rearview mirror
Parking brake
Foot brake
Muffler
**Spare tire with lug wrench and jack

*Safety chains (trailers only)
Reflective flares, 1 set of 3
Headlights
*Tail-lights
*Stop-lights
**Reflectors (rear - 2 red; side rear - 2 red)

*Required on trailers.

**The lug wrench and jack with the truck-type vehicle for pulling trailers will suffice if of adequate size.

All tires must have sound sidewalls, body and tread.

In the event a water trailer is used, the Contractor shall supply a truck-type vehicle (meeting the same safety items required above for a tank truck) for pulling the trailer. In addition, the vehicle must be attached to the trailer during all operations, including the fireguard services.

1/ "Eastside" refers to all National Forest System lands administered by the USDA Forest Service, Region 6, located east of the Cascade Mountains and including Jackson and Josephine Counties in Oregon, and; that portion of Douglas County within the Rogue River National Forest in Oregon, and; that portion of Curry County within the Galice and Illinois Valley Ranger Districts of the Siskiyou National Forest in Oregon, and; those portions of the Rogue River and Siskiyou National Forests in California.

2/ "Westside" refers to all National Forest System lands administered by the USDA Forest Service, Region 6, located west of the Cascade Mountains, except in, Jackson and Josephine Counties in Oregon, and; that portion of Douglas County within the Rogue River National Forest in Oregon, and; that portion of Curry County within the Galice and Illinois Valley Ranger Districts of the Siskiyou National Forest in Oregon, and; those portions of the Rogue River and Siskiyou National Forests in California.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOTHERMAL RESOURCES OPERATIONAL ORDER NO. 4

Effective August 1, 1975

GENERAL ENVIRONMENTAL PROTECTION REQUIREMENTS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.2, 270.34(k), 270.37, 270.41, 270.42, 270.43, 270.44, and 270.76. Lessees shall comply with the provisions of this Order. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. References in this Order to approvals, determinations, or requirements are to those given or made by the Area Geothermal Supervisor (Supervisor) or his delegated representative.

All data submitted under this Order shall be available for inspection in accordance with the Freedom of Information Act of 1966 (P.L. 89-487), as amended in 1974 (P.L. 93-502), except information such as geological, geophysical, reservoir, trade secrets, and financial data and interpretations of such data, maps, and related files for which a lessee requests proprietary status; provided that such status is determined by the Supervisor to be warranted and is approved by appropriate officials of the Department of the Interior.

Protection of the environment includes the lessee's responsibility to: conduct exploration and development operations in a manner that provides maximum protection of the environment; rehabilitate disturbed lands; take all necessary precautions to protect the public health and safety; and conduct operations in accordance with the spirit and objectives of all applicable Federal environmental legislation and supporting executive orders.

Adverse environmental impacts from geothermal-related activity shall be prevented or mitigated through enforcement of applicable Federal, State, and local standards, and the application of existing technology. Inability to meet these environmental standards or continued violation of environmental standards due to operations of the lessee, after notification, may be construed as grounds for the Supervisor to order a suspension of operations.

The lessee shall be responsible for the monitoring of readily identifiable localized environmental impacts associated with specific activities that are under the control of the lessee. Monitoring of environmental impacts may be conducted by the use of aerial surveys, inspections, periodic samplings, continuous recordings, or by such other means or methods as required by the Supervisor. Due to the differing natural environmental conditions among geothermal areas, the extent and frequency of such monitoring activities will be determined by the Supervisor on an individual basis. In the event the Supervisor determines that the degree and adequacy of existing environmental protection regulations in certain areas are insufficient, the Supervisor may establish additional and more stringent requirements by the issuance of field orders or by modifying existing orders.

Lessees shall provide for acquisition of environmental baseline data as required in accordance with 30 CFR 270.34(k) for a period of one year prior to submission of a plan for production. Techniques and standards to be used by the lessee for meeting these requirements shall receive prior approval by the Supervisor.

1. Aesthetics. The lessee shall reduce visual impact, where feasible, by the careful selection of sites for operations and facilities on leased lands. The design and construction of facilities shall be conducted in a manner such that the facilities will blend into the natural environmental setting of the area by the appropriate use of landscaping, vegetation, compatible color schemes, and minimum profiles. Native plants or other compatible vegetation shall be used, where possible, for landscaping and revegetation.

2. Land Use and Reclamation. Operating plans shall be designed so that operations will result in the least disturbance of land, water, and vegetation. Existing roads shall be used where suitable. Entry upon certain environmentally fragile land areas, as designated by the surface management agency, may be either seasonally restricted or restricted to special vehicles or transportation methods which will minimize disturbance to the surface or other resources as specified by the Supervisor and surface management agency.

Operating plans shall provide for the reclamation and revegetation of all disturbed lands in a manner approved by the Supervisor and the appropriate surface management agency. Land

reclamation may include preparation and seeding with prescribed wildlife food and plant cover or improved and acceptable substitutes thereof which will equal or enhance the food values for indigenous wildlife species and domesticated animals. Temporary fencing for such reclaimed areas may be required to facilitate restoration thereof.

The lessee shall at all times maintain the leased lands in a safe and orderly condition and shall perform the operations in a workmanlike manner. The lessee shall remove or store all supplies, equipment, and scrap in a timely and orderly fashion.

Operations under a geothermal lease shall not unreasonably interfere with or endanger operations under any other lease, license, claim, permit, or other authorized use on the same lands.

3. Public Access. The public shall have free and unrestricted access to geothermal leased lands, excepting however, where restrictions are necessary to protect public health and safety or where such public access would unduly interfere with the lessee's operations or the security thereof. The lessee shall provide warning signs, fencing, flagmen, barricades, or other safety measures deemed necessary by the Supervisor to protect the public, wildlife, and livestock from hazardous geothermal or related activities.

4. Recreation. Recreational values shall be adequately protected through planning and designing of site development to minimize the aesthetic degradation of the particular recreation area. The lessee shall generally be restricted from surface locations for drilling and other lease operations within 61 metres (200 feet) of established recreation sites and access routes thereto. However, the lessee may relocate a recreational site and/or access routes thereto when approved by the Supervisor with the concurrence of the land management agency.

5. Slope Stability and Erosion Control. Operations shall be conducted in such a manner so as to minimize erosion and disturbance to natural drainage. The lessee shall provide adequate erosion and drainage control to prevent sediments from disturbed sites from entering water courses for soil and natural resource conservation protection.

Mitigating measures to lessen environmental damage may include reseeding of disturbed soils, chemical stabilization, and dust and erosion control on well sites, roads, and construction areas.

All operating plans shall give proper consideration to the potential hazards of slope instability. Where potentially unstable ground conditions exist, design of proposed roads, drill sites, and surface facilities shall be approved by and constructed under the supervision of a qualified engineer or engineering geologist satisfactory to the Supervisor.

6. Biota. The lessee shall conduct all operations in such a manner as to afford reasonable protection of fish, wildlife, and natural habitat. The lessee shall take such measures as are necessary for the conservation of endangered and threatened species of flora and fauna as set forth in applicable executive orders, regulations, and State or Federal legislation such as the Endangered Species Act of 1973 and the Fish and Wildlife Coordination Act. When such species would be adversely affected by the lessee's operations on the leased lands, the lessee shall implement those measures necessary to minimize or eliminate such adverse effects and to protect the flora and fauna as specified by the Supervisor in accordance with recommendations by appropriate Federal and State agencies. Such measures may be in addition to provisions set forth in the lease or accompanying stipulations.

The Supervisor may receive information from recognized experts that a delicate balance of flora and/or fauna exists in the area of operations or proposed operations. Upon receiving such notice, the Supervisor will request timely advice and assistance from appropriate Federal and State agencies regarding: (1) an assessment of the status of flora and fauna in the area which may be adversely affected by operations, and (2) advice as to reasonable mitigating measures appropriate to minimizing or preventing adverse trends in populations, growth, vegetative recovery, or repopulations in potentially affected flora and/or fauna. Based on timely receipt of advice from appropriate agencies, the Supervisor will direct the lessee to take appropriate measures to minimize significant adverse trends in flora and fauna. Such measures may include, but not be limited to, revegetation with grasses, shrubs, or other vegetation of high forage values desirable for habitat, replacement of fauna where lost, replacement of water supply, or sources where destroyed.

Where the lessee's operations have destroyed significant flora and/or fauna or their natural habitat and replacement by natural processes will not take place in a normal growth cycle, the lessee shall take reasonable measures to replace those species or their habitat with the same or other acceptable species or habitat as directed by the Supervisor. The Supervisor's requirements shall be based on recommendations and advice received from appropriate Federal and State agencies.

7. Cultural Resources Preservation. The lessee shall exercise due diligence in the conduct of his operations to protect and preserve significant archaeological, historical, cultural, paleontological, and unique geologic sites. The lessee shall not disturb any known cemetery or burial ground of any group or culture.

Previously unknown sites uncovered by the lessee shall be immediately reported to the Supervisor, and operations on the particular site shall cease until said site can be assessed for its archaeological value and preservation. Necessary controls and remedial actions for the protection and preservation of cultural resources shall be issued on an individual site basis by the Supervisor as warranted.

The preservation, restoration, maintenance, and nomination of all resources for purposes of the National Register of Historic Places shall be in accordance with the provisions of Executive Order 11593 (36 FR 8921) entitled, "Protection and Enhancement of the Cultural Environment," or any amendments thereto.

8. Subsidence and Seismicity. Surveying of the land surface prior to and during geothermal resources production will be required for determining any changes in elevation of the leased lands. Lessees shall make such resurveys as required by the Supervisor to ascertain if subsidence is occurring. Production data, pressures, reinjection rates, and volumes shall be accurately recorded and filed monthly with the Supervisor as provided in 30 CFR 270.37. In the event subsidence activity results from the production of geothermal resources, as determined by surveys by the lessee or a governmental body, the lessee shall take such mitigating actions as are required by the lease terms and by the Supervisor.

If subsidence is determined by the Supervisor to present a significant hazard to operations or adjoining land use, then the Supervisor may require remedial action including, but not limited to, reduced production rates, increased injection of waste or other fluids, or a suspension of production.

A. Surveys. All required surveys shall be second order or better and shall be conducted under the direct supervision of a registered civil engineer or licensed land surveyor using equipment acceptable by the National Ocean Survey for second order surveys. All such work shall be coordinated with the county surveyor of the county in which the surveys and bench marks are to be established. Level lines and networks shall be tied to available regional networks.

Adjusted survey data shall be filed with the Supervisor within 60 days after leveling is completed. Any

lessee having a commercially productive geothermal well or wells shall participate in cooperative County/State subsidence detection programs. All survey data filed with the Supervisor shall be available to the public.

B. Bench Marks. One or more wellsite bench marks shall be required at each completed well prior to prolonged production and said bench marks shall be located in a manner such that there is a minimal probability of destruction or damage to said bench marks. Wellsite bench marks shall be tied to existing regional networks. Additional bench marks between the wellsites and the regional network shall be at 0.8-km (one-half mile) intervals or as otherwise specified by the Supervisor. These bench marks shall be resurveyed during well production operations on a periodic basis as determined by the Supervisor.

Acceptable bench marks include, but are not limited to, a brass rod driven to refusal or 9 metres (about 30 feet) and fitted with an acceptable brass plate or a permanent structure with an installed acceptable brass plate.

C. Reservoir Data. Initial reservoir pressure and temperature shall be reported to the Supervisor in duplicate on Well Completion or Recompletion Report (Form 9-330C) for all completed wells within 30 days after the completion of measurements or tests conducted for the purpose of obtaining such data. Initial production test data including steamwater ratio, surface pressure and temperature, quality, and quantity of well effluent shall also be filed with the Supervisor on Form 9-330C within 30 days after a well is completed.

D. Seismicity. The installation of seismographs or other like instruments in producing geothermal areas for the purpose of detecting potential seismic activity may be initiated from time to time by appropriate public agencies. Lessees shall cooperate with the appropriate public agencies in this regard. The lessee and the appropriate public agency should take care not to unreasonably interfere with or endanger each other's respective operations. The Supervisor shall coordinate such detection programs between the appropriate public agency conducting the program and the lessee.

Where induced seismicity caused by the production of geothermal fluids is determined to exist by the Supervisor, then the Supervisor may require the lessee to install such monitoring devices as necessary to adequately quantify the effects thereof. If induced seismicity is determined to represent a significant hazard, the Supervisor may require remedial

actions including, but not limited to, reduced production rates, increased injection of waste or other fluids, or suspension of production.

9. Pollution, Waste Disposal, and Fire Prevention. The lessee shall comply with all applicable Federal and State standards with respect to the control of all forms of air, land, water, and noise pollution, including the control of erosion and the disposal of liquid, solid, and gaseous wastes. The Supervisor may, at his discretion, establish additional and more stringent standards. Plans for disposal of well effluents must be approved by the Supervisor before any implementation action is undertaken. Immediate corrective action shall be taken in all cases where pollution has occurred.

The lessee shall timely remove or dispose of all waste including human waste, trash, refuse, and extraction and processing waste generated in connection with the lessee's operations in a manner acceptable to the Supervisor.

The lessee shall provide safeguards to minimize potential accidental fires and shall instruct field personnel in fire-prevention methods. The lessee shall maintain fire-fighting equipment in working order at strategic locations on the leased lands.

A. Pollution Prevention. In the conduct of all geothermal operations, the lessee shall not contaminate any natural waters and shall minimize adverse effects on the environment.

(1) Liquid Disposal. Liquid well effluent or the liquid residue thereof containing substances, including heat, which may be harmful or injurious and cannot otherwise be disposed of in conformance with Federal, State, and regional standards, shall be injected into the geothermal resources zone or such other formation as is approved by the Supervisor.

Toxic drilling fluids shall be disposed of in a manner approved by the Supervisor and in conformance with applicable Federal, State, and regional standards.

(2) Solid Waste Disposal. Drill cuttings, sand, precipitates, and other solids shall be disposed of as directed by the Supervisor either on location or at other approved disposal sites. Containers for mud additives for chemicals and other solid waste materials shall be disposed of in a manner and place approved by the Supervisor.

(3) Air Quality. Noncondensible gases such as carbon dioxide, ammonia, and hydrogen sulfide may be vented or ejected into the atmosphere, provided, however, that the volume and the measured concentration of such vented gas or gases shall not exceed applicable Federal, State, or regional air pollution standards. Copies of each permit issued by the appropriate air pollution control agency and the reports required thereunder shall be submitted to the Supervisor.

(4) Pits and Sumps. Pits and sumps shall be lined with impervious material and purged of environmentally harmful chemicals and precipitates before backfilling. In no event shall the contents of a pit or sump be allowed to contaminate streams, lakes, and ground waters. Pits and sumps shall be constructed in a manner and in such locations so as to minimize damage to the natural environment and aesthetic values of the lease or adjacent property. When no longer used or useful, pits and sumps shall be backfilled and the premises restored to as near a natural state as reasonably possible. Temporary fencing of unattended pits and sumps to protect wildlife, livestock, and the public may be required by the Supervisor and the surface management agency.

(5) Production Facilities Maintenance. Production facilities shall be operated and maintained at all times in a manner necessary to prevent pollution. The lessee's field personnel shall be instructed in the proper maintenance and operations of production facilities for the prevention of pollution.

B. Inspection and Reports. Lessees shall comply with the following pollution inspection and reporting requirements.

(1) Pollution Inspections. Drilling and production facilities shall be inspected daily by the lessee. Appropriate preventative maintenance shall be performed as necessary to prevent failures and malfunctions which could lead to pollution. Wells and areas not under production shall be inspected by the lessee at intervals prescribed by the Supervisor. Necessary repairs or maintenance shall be made as required.

(2) Pollution Reports. All pollution incidents shall be reported orally within 18 hours to the appropriate Geothermal District Supervisor and shall be followed within 30 days thereof by a written report stating the cause and corrective action taken.

C. Injection. The use of any subsurface formation, including the geothermal resources zone for the disposal of well effluent, the residue thereof, or the injection of fluids

for other purposes such as subsidence prevention shall not be permitted until the lessee has submitted a plan of injection covering the proposed injection project and has subsequently received the Supervisor's written approval thereof.

(1) Plan of Injection. The plan of injection shall include the quantity, quality, and source of the proposed injection fluid; the means and method by which the fluid is to be injected; a structure map contoured on the intended injection zone; and cross-sections showing producing well locations and the proposed injection well location(s).

(2) Injection Report. The lessee shall file in duplicate with the Supervisor a Monthly Water Injection Report in a form approved by the Supervisor. The subject report shall be filed on or before the last day of the month following the month in which the injection took place.

(3) Inspection. Injection wells and facilities shall be inspected by the lessee at intervals as prescribed by the Supervisor to ascertain that all injected fluids are confined to the approved injection zone. A spinner survey, a radioactive tracer survey, and a cement bond log may be required on each injection well within 30 days after injection begins. The lessee shall furnish to the Supervisor two legible exact copies of any and all such surveys and logs. In the event of a casing failure, inadequate annular cement, or other mechanical failure, the lessee shall without unreasonable delay repair, suspend, or abandon the well. Where failure occurs in a zone which may damage surface or fresh water aquifers, injection shall immediately cease.

(4) New Wells. The drilling of new injection wells in accordance with an approved plan of injection shall be in conformance with the provisions of GRO Order No. 2. An Application for Permit to Drill, Form 9-331C, shall be filed in triplicate and approved for each injection well.

(5) Conversions. The conversion of an existing well to an injection well in accordance with or modification of an approved plan of injection shall be in conformance with the requirements of GRO Order No. 2. The lessee shall demonstrate to the satisfaction of the Supervisor by appropriate testing and logging that the well is mechanically sound and suitable for injection purposes. A Sundry Notice, Form 9-331, shall be filed in triplicate and approved for each conversion.

10. Water Quality. The primary responsibility for water quality and pollution control has been delegated to the States where such States have standards approved by the Environmental

Protection Agency. Such State standards must meet basic Federal requirements prohibiting the deterioration of waters whose existing quality is higher than established water quality standards. The lessee shall comply with the State water quality control organization's standards in such States as have federally-approved standards. The Supervisor, at his discretion, may establish additional and more stringent standards.

The lessee shall file, in duplicate, a detailed water analysis report for all completed geothermal wells within 30 days after completion and annually thereafter or as otherwise specified by the Supervisor. Unless otherwise prescribed by the Supervisor, such analyses shall include a determination of arsenic, boron, radioactive content, and radioactivity of the produced fluids. In the event that a health hazard exists, the Supervisor shall require appropriate health and safety precautions, periodic monitoring, or the suspension of production.

11. Noise Abatement. The lessee shall minimize noise during exploration, development, and production activities. The method and degree of noise abatement shall be as approved by the Supervisor.

The lessee shall conduct noise level measurements during exploration, development, and production operations to determine the potential objectionability to nearby residents as well as the potential health and safety danger due to noise emissions.

Noise level measurements and accompanying data shall be filed with the Supervisor. Such data shall provide the basis for operational and noise control decisions by the Supervisor and shall be based on an assessment of the noise relative to Federal or State criteria including adjustments for the area involved, meteorological conditions, and the time of day of the noise occurence.

The lessee shall comply with Federal occupational noise exposure levels applicable to geothermal activity under the Occupational Safety and Health Act of 1970 as set forth in 29 CFR 1910.95, which are incorporated herein by reference, or with State standards for protection of personnel where such State standards are more restrictive than Federal standards.

A. Measurement Condition. Outdoor noise measurements shall be made at least 3 metres (10 feet) from structures, facilities, or other sound reflecting sources and approximately 1 metre (3 feet) above ground level. Extreme weather conditions, electrical interference, and unusual background noise levels shall be avoided or given due consideration when measuring sound levels.

B. Measurements. The lessee shall monitor and measure noise levels using an octave band noise analyzer with an A-weighted frequency response or a standard sound level meter that conforms to the requirements set forth in USA Standard Specifications for General Purpose Sound Level Meters USASI S1.4-1961 or the latest approved revision thereof. Bandpass filters shall conform to the requirements of USASI S1.11-1966. The lessee shall measure noise level frequency distribution as required by the Supervisor. Sound levels shall be measured in conformance with the USA Standard-Method for the Physical Measurement of Sound USASI S1.2-1962.

C. Criteria. In the absence of more restrictive criteria as may be established in this paragraph, the lessee shall not exceed a noise level of 65 dB(A) for all geothermal-related activity including but not limited to, exploration, development, or production operations as measured at the lease boundary line or 0.8 km (one-half mile) from the source, whichever is greater, using the A-weighted network of a standard Sound Level Meter. However, the permissible noise level of 65 dB(A) may be exceeded under emergency conditions or with the Supervisor's approval if written permission is first obtained by the lessee from all residents within 0.8 km (one-half mile).

D. Assessment. The lessee shall be responsible for taking such noise level measurements as are deemed necessary by the Supervisor. The background noise level shall serve as the criterion for the rating and assessment, by the Supervisor, of the objectionableness of noise emission from a particular source. The background or ambient noise is defined hereby as the minimum sound level at the relevant place and time in the absence of the source noise and shall include consideration for the type of land use, the season, atmospheric conditions, and the time of day.

E. Attenuation. To attenuate objectionable noise, the lessee shall utilize properly designed muffling devices as required by the Supervisor.

F. Relationships. Reference levels and relationships for noise measurements shall be as follows:

(1) Reference sound pressure for airborne sounds shall be 20 MN/m (20 micronewtons per square metre).

(2) Reference power shall be 10-12 watts.

(3) Sound levels shall be measured using a standard Sound Level Meter with an "A" frequency response characteristic (weighting network).

(4) Sound level meter controls shall be set for as uniform a frequency response as possible when measuring sound pressure levels.

(5) Octave band noise levels shall be reported in equivalent A-weighted levels.

G. Record of Sound Measurements. The Supervisor may require sound level measurements during drilling, testing, and producing operations. Such measurements shall be filed in duplicate with the Supervisor and shall include the following data:

(1) Date, time, and location.

(2) Name of observer.

(3) Description of primary noise source emitter under test.

(4) Kind of operation and operating conditions.

(5) Description of secondary noise sources including location, type, and kind of operation.

(6) Type and serial numbers on all microphones, sound level meters, and octave band analyzers used. Length and type of microphone cables.

(7) Position of observer.

(8) Direction of arrival of sound with respect to microphone orientation.

(9) Approximate temperature of microphone.

(10) Results of maintenance and calibration tests.

(11) Weighting network and meter speed used.

(12) Measured overall response and band levels at each microphone position and extent of meter fluctuation.

(13) Background overall response and band levels at each microphone position with primary noise source not operating.

(14) Cable and microphone corrections.

(15) Any other pertinent data such as personnel

exposed directly and indirectly, time pattern of the exposure, atmospheric conditions, attempts at noise control, and personnel protection.

Reid T. Stone
Area Geothermal Supervisor

APPROVED:

Russell G. Wayland
Chief, Conservation Division

☆GPO 695-811

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries C.E.C.I.
ADMINISTRATIVE OFFICE
910 STATE OFFICE BLDG., 1400 SW 5th AVE., PORTLAND, OR 97201-5528 PHONE (503) 229-5580

June 5, 1986

Anna K. Carter
California Energy Company
3333 Mendocino Ave.
Santa Rosa, CA 95401

Dear Ms. Carter:

This is in response to your written request of May 21, 1986 for an extension of geothermal permits 113-117 in Klamath County, Oregon.

We hereby extend until June 7, 1987 provision 3 of the Governing Board order of June 7, 1985 with respect to the term of these permits for geothermal wells on Mazama I and II Federal units. Please note that the order is contingent upon continuation of the Federal unit on which the well is located.

The permits included in this extension are listed below:

Permit	Well	Location
113	MZI-3	12-30S-6E
114	MZI-9	11-31S-7½ E
115	MZI-11	15-31S-7½ E
116	MZI-11A	10-31S-7½ E
117	MZII-1	13-32S-6E

Sincerely,

Donald A. Hull
State Geologist

DAH:ak

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

June 7, 1985

James L. Moore
California Energy Co., Inc.
3333 Mendocino Ave., Suite 100
Santa Rosa, CA 95401

Dear Mr. Moore:

Enclosed are California Energy's permits, effective June 7, 1985, for the drilling of geothermal wells, Permit Nos. 113-117, Well Nos. MZI-3, MZI-9, MZI-11, MZI-11a, and MZII-1, in Klamath County. The January 1984 stipulations approved by the State Geologist are conditions of these permits.

In addition, the June 7, 1985 order of the Governing Board of the Department of Geology and Mineral Industries (enclosed) is a condition of these permits.

Please let us know when operations begin. Remember that water zones must be sealed by cement behind casing or by plugs in the well upon abandonment.

If we can be of assistance, let us know.

Sincerely,

Dennis L. Olmstead

Dennis L. Olmstead
Petroleum Engineer

DLO:ak

Enclosures

STIPULATIONS WHICH A[illegible]Y TO GEOTHERMAL DRILLING PERMIT

1. The operator of a geothermal well must keep a daily record of work, collect drill samples, and maintain a log of rock formations penetrated.
2. If redrilling, deepening, altering of casing, testing or plugging is planned, notice must be given to the Department on Form 5, "Miscellaneous Notices and Reports on Geothermal Wells." Approval or disapproval can be given by phone but work approved in this way must still be proposed in writing by the operator.
3. Well summary (Form 8), well history, representative drill samples and copies of borehole surveys must be submitted to the Department within 60 days after completion, abandonment, or suspension. These records will be kept confidential for a four-year period from date of completion, abandonment, or suspension.
4. In the event of an emergency or blow-out, a Department representative should be contacted as soon as possible:

Dennis L. Olmstead - Petroleum Engineer	(503) 229-5580 office (503) 231-3835 home
William L. King - Petroleum Geologist	(503) 229-5580 office (503) 644-9331 home
Donald A. Hull - State Geologist	(503) 229-5580 office (503) 281-4895 home
John D. Beaulieu - Deputy State Geologist	(503) 229-5580 office (503) 234-6323 home

5. Permission must be obtained from the State Department of Environmental Quality (DEQ) for any extraordinary offsite disposal of drilling mud or wastes or any other emergency that could affect adjoining properties.
6. No fluid shall be discharged unless a permit has been issued by the State DEQ.
7. Notice is to be given to the State Geologist or his representative:
   a. Prior to construction of drill site and sump.
   b. Prior to BOP tests after running casing strings.
   c. Prior to performing work to complete or abandon a well.
   d. Prior to pulling casing strings.
   e. Prior to deviating a well from the vertical.
   f. In the event of fire, spill of fluids, or serious accident.
8. Unless the surface owner wants the drilling pad to be left, the site is to be restored to as near original condition as is practical, including revegetation using native species. Recommended seed mixture can be obtained by calling the Department of Fish and Wildlife at (503) 229-5679.
9. This permit does not include land-use approval. A separate approval should be obtained from the county or city in which the drilling takes place.
10. The State Geologist or his representative may enter the site at any time to make inspections and/or witness work done.
11. Release of the bond will be granted following proper plugging of the hole, restoration of the drill site, and filing of the required records.

DOGAMI: 166

Form: USGS 9-1957

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No.

GEOTHERMAL DRILLING PERMIT

The U.S. Geological Survey requires this form or other Supervisor approved form to be prepared and filed in triplicate with requisite attachments with the Supervisor. The Supervisor must approve this permit prior to any lease operation.

4. LEASE SERIAL NO.: OR 34669

5. SURFACE MANAGER: BLM ( ) FS (X) Other: Winema National Forest

6. UNIT AGREEMENT NAME: Mazama I

1a. TYPE OF WORK: DRILL NEW WELL ( ) REDRILL ( ) DEEPEN ( ) PLUG BACK ( ) DIRECTIONALLY DRILL ( ) OTHER ( ): Drill/Core Temperature Gradient Core Hole

1b. WELL TYPE: PRODUCTION ( ) INJECTION ( ) HEAT EXCHANGE ( ) OBSERVATION (X) WATER SUPPLY ( ) OTHER ( ): Temperature Gradient Core hole

7. WELL NO.: MZI - 11A*

8. PERMIT NO.

1c. WELL STATUS:

9. FIELD OR AREA

2. NAME OF LESSEE/OPERATOR: CALIFORNIA ENERGY COMPANY, INC. (707) 526-1000

3. ADDRESS OF LESSEE/OPERATOR: 3333 Mendocino Avenue, Suite100, Santa Rosa, CA 95401

10. SEC., T., R., B.& M.: SE¼,SW¼, Sec. 10 T31S, R7½E Willamette B & M

15. LOCATION OF WELL At surface / At proposed prod. zone: Approx. 2,225 feet ~~west~~ east and 725 feet north of the SW corner Section 10, T31S, R7½E

11. COUNTY: Klamath

16. DISTANCE FROM PROPOSED LOCATION TO NEAREST PROPERTY OR LEASE LINE: Approx. .43 miles SE of MZ I Unit boundary

12. STATE: Oregon

17. DISTANCE FROM PROPOSED LOCATION TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR ON THIS LEASE: Approx. .6 miles north of MZ I-II

13. APPROX. STARTING DATE: July 1, 1985

14. ACRES ASSIGNED (WELL SPACING): NA

18. DRILLING MEDIA AND CHARACTERISTICS: AIR (X) WATER ( ) MUD (X) FOAM ( ) Other ( )

19. PROPOSED DEPTH: MEASURED: 4000' TRUE VERTICAL:

20. ELEVATIONS: ESTIMATED (X) FINAL ( ): 6050' REFERENCE DATUM: GR (X) MAT ( ) DF ( ) KB ( ) RT ( ) CASINGHEAD FLANGE ( ) OTHER ( )

21. EXISTING AND/OR PROPOSED CASING AND CEMENTING PROGRAM (List existing program first, followed by proposed program, and separate by a sufficient space to clearly distinguish the two programs)

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	COUPLING (Collars & Threads)	GRADE	SETTING DEPTH Top	SETTING DEPTH Bottom	QUANTITY OF CEMENT
Set 6-7'	of 8-5/8" conductor pipe (optional)				Surf.	6-7'	To Surface
7-7/8"	5-1/2"	14#	8RD ST&C	K55	Surf.	400±	To Surface
Drill out cement plug and resume drilling with 4.872" OD wireline coring system.							
Reduce core size as mandated by drilling condition.							

22. PROPOSED WORK SUMMARY

* Approx. Kettleman designation: 47-10

See attached drilling program.

NOTE: The January 1984 stipulations approved by the State Geologist are conditions of this permit.
This permit is valid only if land use approval is obtained from the county or city in which the drilling takes place, and provided the authorities make a determination of compliance with statewide goals. Issuance of this permit is not a finding of compliance with the Statewide Planning Goals or the acknowledged comprehensive plan.

(Use additional space on reverse side of for

23. SIGNED: James F. Moore TITLE: Vice President Exploration DATE: April 12, 198

(This space for Federal use)

APPROVED BY: Dennis L. Olmstead TITLE: Petroleum Engineer - DOGAMI DATE: Permitted by BLM 5/9/85

CONDITIONS OF APPROVAL, IF ANY:

This permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.71; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

DOGAMI 117

Form 9-1931

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No.

GEOTHERMAL DRILLING PERMIT

U.S. Geological Survey requires this form or other Supervisor approved form to be prepared and filed in pli[illegible] with requisite attachments with the Supervisor. The Supervisor must approve this permit prior to it[illegible] peration.

4. LEASE SERIAL NO.: OR34681

5. SURFACE MANAGER: BLM ( ) FS ( ) Winema National Fore

6. UNIT AGREEMENT NAME: Mazama II

TYPE OF WORK: DRILL NEW WELL ( ) REDRILL ( ) DEEPEN ( ) PLUG BACK ( ) DIRECTIONALLY DRILL ( ) OTHER ( ) Drill/Core Temperature Gradient Core Hole

WELL TYPE: PRODUCTION ( ) INJECTION ( ) HEAT EXCHANGE ( ) OBSERVATION (X) WATER SUPPLY ( ) OTHER ( ) Temperature Gradient Core Hole

7. WELL NO.: MZII-1

8. PERMIT NO.

WELL STATUS:

NAME OF LESSEE/OPERATOR: CALIFORNIA ENERGY COMPANY, INC. (707-526-1000)

9. FIELD OR AREA

ADDRESS OF LESSEE/OPERATOR: 3333 Mendocino Avenue, Suite 100, Santa Rosa, CA 95401

10. SEC. T., R., B.& M.: Section 13 T32S, R6E, WM

LOCATION OF WELL
At surface: 2000' N and 2050' W of SE Corner, Section 13
At proposed prod. zone: NA

11. COUNTY: Klamath

12. STATE: Oregon

DISTANCE FROM PROPOSED LOCATION TO NEAREST PROPERTY OR LEASE LINE: Approx. 1600' from Unit Boundary

DISTANCE FROM PROPOSED LOCATION TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR ON THIS LEASE: No proposed nor existing geothermal wells.

13. APPROX. STARTING DATE: July 1, 1985

14. ACRES ASSIGNED (WELL SPACING): NA

DRILLING MEDIA AND CHARACTERISTICS: AIR ( ) WATER ( ) MUD (X) FOAM ( ) Other ( )

19. PROPOSED DEPTH: MEASURED: 4000' TRUE VERTICAL:

20. ELEVATIONS: ESTIMATED XX FINAL ( ) 4665'

REFERENCE DATUM: GR (X) MAT ( ) DF ( ) KB ( ) RT ( ) CASINGHEAD FLANGE ( ) OTHER ( )

EXISTING AND/OR PROPOSED CASING AND CEMENTING PROGRAM (List existing program first, followed by proposed program, and separate by a sufficient spac to clearly distinguish the two programs)

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	COUPLING (Collars & Threads)	GRADE	SETTING DEPTH Top	SETTING DEPTH Bottom	QUANTITY OF CEMENT
Set 6-7' of 8-5/8" conductor pipe (optional)					Surf.	6-7'	To Surface
-7/8"	5-1/2"	14#	8RD ST&C	K55	Surf.	400'+	To Surface
Drill out cement plug and resume drilling with 4.872" OD wireline coring system.							
Reduce core size as mandated by drilling conditions.							

PROPOSED WORK SUMMARY

See attached drilling program.

NOTE: The January 1984 stipulations approved by the State Geologist are conditions of this permit This permit is valid only if land use approval is obtained from the county or city in which the drilling takes place, and provided the authoritites make a determination of compliance with statewide goals. Issuance of this permit is n[illegible] a finding of compliance with the Statewide Planning Goals or the acknowledged comprehensive plan.

RECEIVED - PTLD
APR 24 198[illegible]
DEPT. OF GEOLOGY & MINERAL INDUSTRIES

James L. Moore

(Use additional space on reverse side of fo[illegible])

Vice President Exploration — April 12, 1985

[illegible]ED James L. Moore — TITLE — DATE

(This space for Federal use)

[illegible] Dennis L. Olmstead — TITLE Petroleum Engineer - DOGAMI — DATE 6-7-85

CONDITIONS OF APPROVAL, IF ANY:

[illegible] permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.71; Federal Geothermal Lease Terms and Stipulations and other regulatory requi[illegible]. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Depart[illegible]ency of the United States as to any matter within its jurisdiction.

(See Instructions on reverse side)

Form 9-331C (May 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No.

GEOTHERMAL DRILLING PERMIT

...eological Survey requires this form or other Supervisor approved form to be prepared and filed in ...ipl... with requisite attachments with the Supervisor. The Supervisor must approve this permit prior to ...y lease operation.

1. LEASE SERIAL NO.: OR34611
2. SURFACE MANAGER: BLM ( ) F...: Winema National For...
3. TYPE OF WORK: DRILL NEW WELL ( ) REDRILL ( ) DEEPEN ( ) PLUG BACK ( ) DIRECTIONALLY DRILL ( ) OTHER ( ): Drill/Core Temperature Gradient Core Hole
4. UNIT AGREEMENT NAME: Mazama I
5. WELL TYPE: PRODUCTION ( ) INJECTION ( ) HEAT EXCHANGE ( ) OBSERVATION (X) WATER SUPPLY ( ) OTHER ( ): Temperature Gradient Core Hole
6. WELL NO.: MZI-3
7. WELL STATUS:
8. FIELD OR AREA
9. NAME OF LESSEE/OPERATOR: CALIFORNIA ENERGY COMPANY, INC. (707-526-1000)
10. ADDRESS OF LESSEE/OPERATOR: 3333 Mendocino Avenue, Suite 100, Santa Rosa, CA 95401
11. LOCATION OF WELL
At surface: 2000' N and 450'E of SW corner, Section 12
At proposed prod. zone: NA
11. SEC. T., R., B.& M.: Section 12 T30S, R6E, WM
12. COUNTY: Klamath
13. DISTANCE FROM PROPOSED LOCATION TO NEAREST PROPERTY OR LEASE LINE: Approx. 6,000' from Unit Boundary
14. STATE: Oregon
15. DISTANCE FROM PROPOSED LOCATION TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR ON THIS LEASE: No proposed nor existing geothermal wells.
16. APPROX. STARTING DATE: July 1, 1985
17. ACRES ASSIGNED (WELL SPACING): NA
18. DRILLING MEDIA AND CHARACTERISTICS: AIR ( ) WATER ( ) MUD (X) FOAM ( ) Other ( )
19. PROPOSED DEPTH: MEASURED: 4000' TRUE VERTICAL:
20. ELEVATIONS: ESTIMATED XX FINAL ( ) 5,360' REFERENCE DATUM: GR (X) MAT ( ) DF ( ) RB ( ) RT CASINGHEAD FLANGE ( ) OTHER ( )

21. EXISTING AND/OR PROPOSED CASING AND CEMENTING PROGRAM (List existing program first, followed by proposed program, and separate by a sufficient ... to clearly distinguish the two programs)

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	COUPLING (Collars & Threads)	GRADE	SETTING DEPTH Top	SETTING DEPTH Bottom	QUANTITY OF CEMENT
S	6-7' of 8-5/8" conductor pipe (optional)				Surf.	6-7'	To Surface
7-7/8"	5-1/2"	14#	8RD ST&C	K55	Surf.	4000'	To Surface
Drill out cement plug and resume drilling with 4.872" OD wireline coring system.							
Reduce core size as mandated by drilling conditions.							

22. PROPOSED WORK SUMMARY

See attached drilling program.

NOTE: This permit is valid only if land use approval is obtained from the county or city in which the drilling takes place, and provided the authorities make a determination of compliance with statewide goals. Issuance of this permit is not a finding of compliance with the Statewide Planning Goals or the acknowledged comprehensive plan.

RECEIVED - PTLD
APR 2 1 1985
DEPT. OF GEOLOGY & MINERAL INDUSTRIES

The January 1984 stipulations approved by the State Geologist are conditions of this permit.

(Use additional space on reverse side of f...

James L. Moore — Vice President Exploration — April 12, 1985
SIGNED: James L. Moore — TITLE — DATE

(This space for Federal use)

APPROVED BY: [signature] TITLE: Petroleum Engineer - DOGAMI DATE: 6-7-85

CONDITIONS OF APPROVAL, IF ANY:

...permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.71; Federal Geothermal Lease Terms and Stipulations and other regulatory ...ts. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any ...agency of the United States as to any matter within its jurisdiction.

Form USGS 9-1957 | UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY, CONSERVATION DIVISION | Form Approved Budget Bureau No.

GEOTHERMAL DRILLING PERMIT

The U.S. Geological Survey requires this form or other Supervisor approved form to be prepared and filed in triplicate with requisite attachments with the Supervisor. The Supervisor must approve this permit prior to any operation.

4. LEASE SERIAL NO.	OR34668
5. SURFACE MANAGER: BLM ( ) FS	Winema National Fore
1a. TYPE OF WORK: DRILL NEW WELL ( ) REDRILL ( ) DEEPEN ( ) PLUG BACK ( ) DIRECTIONALLY DRILL ( ) OTHER ( )	Drill/Core Temperature Gradient Core Hole
6. UNIT AGREEMENT NAME	Mazama I
1b. WELL TYPE: PRODUCTION ( ) INJECTION ( ) HEAT EXCHANGE ( ) OBSERVATION (X) WATER SUPPLY ( ) OTHER ( )	Temperature Gradient Core Hole
7. WELL NO.	MZI-9
8. PERMIT	
1c. WELL STATUS:	
9. FIELD OR AREA	
2. NAME OF LESSEE/OPERATOR	CALIFORNIA ENERGY COMPANY, INC. (707-526-1000)
10. SEC. T., R., B.& M.	Section 11 T31S, R7½E, WM
3. ADDRESS OF LESSEE/OPERATOR	3333 Mendocino Avenue, Suite 100, Santa Rosa, CA 95401
4. LOCATION OF WELL At surface	2100' E and 350' S of NW Corner, Section 11
At proposed prod. zone	NA
11. COUNTY	Klamath
5. DISTANCE FROM PROPOSED LOCATION TO NEAREST PROPERTY OR LEASE LINE	Approx. 4000' from Unit Boundary
12. STATE	Oregon
6. DISTANCE FROM PROPOSED LOCATION TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR ON THIS LEASE	No proposed nor existing geothermal wells.
13. APPROX. STARTING DATE	July 1, 1985
14. ACRES ASSIGNED (WELL SPACING)	NA
18. DRILLING MEDIA AND CHARACTERISTICS: AIR ( ) WATER ( ) MUD (X) FOAM ( ) Other ( )	
19. PROPOSED DEPTH MEASURED:	4000'
TRUE VERTICAL:	
20. ELEVATIONS: ESTIMATED XX FINAL ( )	6080'
REFERENCE DATUM: GR (X) MAT ( ) DF ( ) KB ( ) RT ( ) CASINGHEAD FLANGE ( ) OTHER ( )	

17. EXISTING AND/OR PROPOSED CASING AND CEMENTING PROGRAM (List existing program first, followed by proposed program, and separate by a sufficient space to clearly distinguish the two programs)

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	COUPLING (Collars & Threads)	GRADE	SETTING DEPTH Top	SETTING DEPTH Bottom	QUANTITY OF CEMENT
Set 6-7' of 8-5/8" conductor pipe (optional)					Surf.	6-7'	To Surface
-7/8"	5-1/2"	14#	8RD ST&C	K55	Surf.	400'+	To Surface
Drill out cement plug and resume drilling with 4.872" OD wireline coring system.							
Reduce core size as mandated by drilling conditions.							

21. PROPOSED WORK SUMMARY

See attached drilling program.

NOTE: The January 1984 stipulations approved by the State Geologist are conditions of this permit.
This permit is valid only if land use approval is obtained from the county or city in which the drilling takes place, and provided these authorities make a determination of compliance with statewide goals. Issuance of this permit is not a finding of compliance with the Statewide Planning Goals or the acknowledged comprehensive plan.

RECEIVED - PTLD
APR 24 1985
DEPT. OF GEOLOGY & MINERAL INDUSTRIES

James L. Moore

(Use additional space on reverse side of fo

SIGNED James L. Moore | Vice President Exploration (TITLE) | April 12, 1985 (DATE)

(This space for Federal use)

APPROVED BY James L. Moore TITLE Petroleum Engineer - DOGAMI DATE 6-7-85

CONDITIONS OF APPROVAL, IF ANY:

This permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.71; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

orm: USGS 9-1957

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No.

GEOTHERMAL DRILLING PERMIT

he Geological Survey requires this form or other Supervisor approved form to be prepared and filed in rip e with requisite attachments with the Supervisor. The Supervisor must approve this permit prior to ny lease operation.

a. TYPE OF WORK: DRILL NEW WELL ( ) REDRILL ( ) DEEPEN ( ) PLUG BACK ( ) DIRECTIONALLY DRILL ( ) OTHER ( )
Drill/Core Temperature Gradient Core Hole

b. WELL TYPE: PRODUCTION ( ) INJECTION ( ) HEAT EXCHANGE ( ) OBSERVATION (X) WATER SUPPLY ( ) OTHER ( )
Temperature Gradient Core Hole

c. WELL STATUS:

4. NAME OF LESSEE/OPERATOR
CALIFORNIA ENERGY COMPANY, INC. (707-526-1000)

ADDRESS OF LESSEE/OPERATOR
3333 Mendocino Avenue, Suite 100, Santa Rosa, CA 95401

5. LOCATION OF WELL
At surface 2550' E and 2800' S of NW Corner, Section 15
At proposed prod. zone NA

6. DISTANCE FROM PROPOSED LOCATION TO NEAREST PROPERTY OR LEASE LINE
Approx. 2000' from Unit Boundary

7. DISTANCE FROM PROPOSED LOCATION TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR ON THIS LEASE
No proposed nor existing geothermal wells.

1. LEASE SERIAL NO.
OR34669

2. SURFACE MANAGER: BLM ( ) FS
Winema National For

3. UNIT AGREEMENT NAME
Mazama I

7. WELL NO.
MZI-11

8. PERMIT

9. FIELD OR AREA

10. SEC. T., R., B.& M.
Section 15
T31S, R7½E, WM

11. COUNTY
Klamath

12. STATE
Oregon

13. APPROX. STARTING DATE
July 1, 1985

14. ACRES ASSIGNED (WELL SPACING)
NA

8. DRILLING MEDIA AND CHARACTERISTICS: AIR ( ) WATER ( ) MUD (X) FOAM ( ) Other ( )

19. PROPOSED DEPTH
MEASURED: 4000'
TRUE VERTICAL:

20. ELEVATIONS: ESTIMATED XX FINAL ( ) 6100'
REFERENCE DATUM: GR (X) MAT ( ) DF ( ) RB ( ) RT ( )
CASINGHEAD FLANGE ( ) OTHER ( )

1. EXISTING AND/OR PROPOSED CASING AND CEMENTING PROGRAM (List existing program first, followed by proposed program, and separate by a sufficient spa to clearly distinguish the two programs)

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	COUPLING (Collars & Threads)	GRADE	SETTING DEPTH Top	SETTING DEPTH Bottom	QUANTITY OF CEMENT
Cut 6-7' of 8-5/8" conductor pipe (optional)					Surf.	6-7'	To Surface
7-7/8"	5-1/2"	14#	8RD ST&C	K55	Surf.	400'+	To Surface

Drill out cement plug and resume drilling with 4.872" OD wireline coring system.

Reduce core size as mandated by drilling conditions.

2. PROPOSED WORK SUMMARY

See attached drilling program.

NOTE: The January 1984 stipulations approved by the State Geologist are conditions of this permit.

This permit is valid only if land use approval is obtained from the county or city in which the drilling takes place, and provided these authorities make a determination of compliance with statewide goals. Issuance of this permit is not a finding of compliance with the Statewide Planning Goals or the acknowledged comprehensive plan.

RECEIVED - PTLD
APR 24 1985
DEPT OF GEOLOGY & MINERAL INDUSTRIES

James L. Moore

(Use additional space on reverse side of fo

James L. Moore — Vice President Exploration — April 12, 1985
SIGNED — TITLE — DATE

(This space for Federal use)

APPROVED BY Dennis L. Olmstead TITLE Petroleum Engineer - DOGAMI DATE 6-7-85

CONDITIONS OF APPROVAL, IF ANY:

This permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.71; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

BEFORE THE GOVERNING BOARD OF THE

DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

STATE OF OREGON

In the Matter of the Request of California Energy Company for the Suspension of State Geothermal Law as to Federal Units Mazama I and II in Klamath County	)))))))	ORDER

This matter came before the Board at the request of California Energy Company (hereinafter "Cal Energy") pursuant to ORS 522.525, seeking to suspend provisions of state geothermal law, ORS chapter 522, as to federal geothermal units Mazama I and II in Klamath County.

FINDINGS OF FACT

1. Effective January 1, 1984, Cal Energy entered into two geothermal unit agreements with the Bureau of Land Management for land in the Winema National Forest, Klamath County. The units are known as Mazama Unit I and Mazama Unit II and consist of 80,483.49 and 18,682.66 acres respectively as shown in Appendix A. The unit agreements are part of the record of this proceeding and contain the provisions discussed below.

2. Cal Energy has requested partial or complete suspension of the state geothermal laws contained in ORS 522 for the Mazama I and II units.

3. Cal Energy has indicated that it encountered problems during 1984 because of conflicting state and federal permit

requirements related to the drilling of temperature gradient wells.

4. Five permit applications have been submitted for wells in the units in 1985, and action must be taken on these permit applications by June 7, 1985.

ULTIMATE FINDINGS AND CONCLUSIONS OF LAW

1. Under ORS 522.525, the Board has the authority to suspend state geothermal laws for federal units Mazama I and II because those units are regulated by the United States and the unit agreements prevent waste and encourage maximum economic development of the resource.

2. Based upon the policies contained in ORS chapter 522 and discussed below, the Board finds that a partial suspension of state geothermal laws is appropriate in this case.

OPINION AND RATIONALE

ORS 522.525 provides:

> "Board authority applies to all private, municipal, state and federal land in the state which is subject to the state's regulatory authority. When land subject to federal jurisdiction is committed to a unit agreement or cooperative agreement the board may suspend the operation of this chapter or any provision of this chapter if:
>
> (1) The unit operation is regulated by the United States; and
>
> (2) The unit agreement prevents waste and encourages maximum economic development of the resource."

The conditions for suspension are met in this case.

The land in question is committed to federal unit agreements and is regulated by the U.S. Bureau of Land Management. Furthermore, the unit agreements serve to prevent waste and encourage maximum economic development. The agreements require submittal and approval of a plan of operation that would conserve the resource (Art. XI, § 11.3), and they also authorize the federal government to alter the rate of prospecting, development, and production. (Art. X, § 10.5). In addition, the unit agreements impose requirements on the operator for diligent exploration in accordance with agreed upon schedules. (Art. XI, § 11.4(c)).

Once the conditions of ORS 522.525 are met, the Board acquires broad discretion to determine what state requirements should be suspended. In the exercise of this discretion, the Board believes it is appropriate to look to the general legislative policies contained in ORS chapter 522. Such policies are expressed primarily in ORS 522.015 as follows:

> "(1) The Legislative Assembly hereby finds and declares that:
>
> "(a) The people of the State of Oregon have a direct and primary interest in the development of geothermal resources situated in this state.
>
> "(b) The State of Oregon, through the State Department of Geology and Mineral Industries, shall control the drilling, redrilling and deepening of wells for the discovery and production of geothermal resources so that such wells will be constructed, operated, maintained and abandoned in the manner necessary to safeguard the life,

health, property and welfare of the people of this state, to safeguard the air, water and other natural resources of this state, and to encourage the maximum economic recovery of geothermal resources therefrom.

"(2) It is the policy of the Legislative Assembly that this chapter be administered:

"(a) To prevent damage to and waste of geothermal resources;

"(b) To prevent interference with or damage to waters used or to be used for beneficial purposes that may result from improper drilling, operation, maintenance or abandonment of geothermal or prospect wells;

"(c) To supervise the drilling, operation, maintenance and abandonment of geothermal or prospect wells in a manner permitting the operator to utilize all methods known to the industry for the purpose of increasing the ultimate economic recovery of geothermal resources, that are suitable, and consistent with protection of the air, water and other natural resources of the state; and

"(d) To provide for the development, management and production of geothermal resources in a manner that minimizes state involvement, enhances resource recovery, prevents waste, maximizes economic development and protects correlative rights of the resource owners."

These policies call for a balance between minimizing state involvement in geothermal development and assuring the state's interests in development activities that are safe, economically efficient and fair, and environmentally sound.

The Board believes that a number of these policies would be best met by generally retaining the requirements of state law:

(1) The state permit process provides an important opportunity for state agencies, including the Department of Environmental Quality and the Water Resources Department,

to review and comment upon proposed geothermal activities. Review by these agencies will help assure that the activities are consistent with protection of the air, water and other natural resources of the state.

(2) The state should retain basic legal authority and jurisdiction to take legal action against any improper geothermal development activities. The Board has broad authority to enjoin and seek penalties. ORS 522.810, 522.990. In some cases, the state may be able to ensure more efficient and effective enforcement than could the federal government.

(3) With some possible limited exceptions, requirements of state geothermal law are consistent with federal requirements and will not subject the permit applicant to undue time delays or additional administrative costs.

Therefore, with two exceptions, the Board concludes that the provisions of ORS chapter 522 should not be suspended. The two exceptions are for the state provisions relating to expiration of permits and the disclosure of records. Cal Energy has objected to these provisions in particular, and application of these provisions does not appear necessary to assure compliance with the general policies of the state geothermal law.

ORDER

IT IS THEREFORE ORDERED that:

1. This order shall apply to all wells, except for reinjection wells, permitted in 1985 by the Department

of Geology and Mineral Industries in federal units Mazama I and II, Klamath County, as defined by the Bureau of Land Management at the time of this order. This order shall become a condition of all 1985 permits issued for such wells.

2. All provisions of ORS chapter 522 and OAR chapter 332, division 20, which are not specifically suspended below remain in full force and effect.

3. The following statute and rule provisions relating to expiration of permits are suspended subject to the terms and limitations set forth below:

> "A drilling, redrilling, or deepening operation must begin within 180 days after the date of permit issuance or the permit shall expire. However, the State Geologist may extend the permit for a reasonable period not to exceed 180 days beyond the initial 180-day period." ORS 522.135(5).

> "Drilling, redrilling, deepening, or altering casing operations must commence within 180 days from the date of issuance of the permit or such permit shall become invalid. The permit may be extended by the State Geologist for a maximum of an additional 180 days upon receipt of written request from the permittee before the expiration date giving reasons for an extension." OAR 632-20-030(4).

The suspension of these provisions will be valid for a period of one year from the date of issuance of permits in the affected units. The suspension may be extended for an additional year by the State Geologist upon receipt of a written request from the permittee giving satisfactory reasons for an extension.

4. The provision of ORS 522.365(2) exempting certain records from disclosure "[f]or a period of four years" is suspended. The parallel provision of OAR 632-20-060(7) is similarly suspended. The purpose of these suspensions is to make pertinent trade secret records exempt from disclosure for the duration of this order.

5. The Board, on its own motion or the motion of any person affected by this order, may reconsider and change the terms and conditions of this order.

6. This order will automatically terminate with respect to the Mazama I or Mazama II unit eight years from the date of the order or upon termination of the respective unit agreement, whichever is sooner.

DATED: June 7th, 1985.

BY ORDER OF THE GOVERNING BOARD

By Donald A. Haagensen
Donald A. Haagensen
Chairman

VICTOR ATIYEH
GOVERNOR

Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE
910 STATE OFFICE BLDG., 1400 SW 5th AVE., PORTLAND, OR 97201-5528 PHONE (503) 229-5580

RECEIVED
SEP 2 1986
C.E.C.I.

August 27, 1986

Mr. James Moore
California Energy Company
3333 Mendocino Avenue
Santa Rosa, CA 95401

Dear Mr. Moore:

Thank you for your letter of July 30, 1986 regarding procedures by which we will receive core and cutting samples from your Oregon geothermal wells.

In the rotary drilled portion of the holes to a depth of about 550 ft, samples at 30 ft intervals should be taken, washed, dried, labeled and packaged for DOGAMI.

The cored portion of the holes will be described and the descriptions sent to DOGAMI. From this lithologic log, DOGAMI will select intervals to be sampled for the permanent repository. Cal Energy will sample these intervals (6-inch samples) and forward to DOGAMI.

We appreciate your offer to submit a copy of the photographic record of the core and a copy of the DOE Agreement for our reference.

In addition to the items noted above, it will, of course, be necessary for California Energy to submit temperature logs and other data as required by the Oregon geothermal law and administration rules (enclosed).

On matters of a regulatory nature, please work with myself or Dan Wermiel as you have in the past. If DOGAMI is involved with any of your wells on a research basis, you will be working with George Priest and his staff. We try to keep the regulatory and research functions in DOGAMI separate to avoid any accidental breach of confidentiality of data.

We look forward to continuing cooperation with your and your colleagues.

Sincerely,

Dennis L. Olmstead
Petroleum Engineer

cc JLM
JLF
PB
AK

DLO:ak

Enclosure

m: USGS 9-1957

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No.

GEOTHERMAL DRILLING PERMIT

e U. Geological Survey requires this form or other Supervisor approved form to be prepared and filed in ip/ with requisite attachments with the Supervisor. The Supervisor must approve this permit prior to y l operation.

4. LEASE SERIAL NO.: OR 34669

5. SURFACE MANAGER: BLM ( ) FS ( ) Other ( ): Winema Nat'l Forest

. TYPE OF WORK: DRILL NEW WELL ( ) REDRILL ( ) DEEPEN ( ) PLUG BACK ( ) DIRECTIONALLY DRILL ( ) OTHER (X): Drill/Core Temperature Gradient Core Hole

6. UNIT AGREEMENT NAME: Mazama I

. WELL TYPE: PRODUCTION ( ) INJECTION ( ) HEAT EXCHANGE ( ) OBSERVATION ( ) WATER SUPPLY ( ) OTHER ( )

7. WELL NO.: MZI-11A*

8. PERMIT NO.:

. WELL STATUS:

9. FIELD OR AREA:

NAME OF LESSEE/OPERATOR: California Energy Company, Inc. (707) 526-1000

ADDRESS OF LESSEE/OPERATOR: 3333 Mendocino Ave., Ste. 100, Santa Rosa, CA 95401

10. SEC. T., R., B.& M.: SE¼,SW¼,Sec. 10 T31S, R7½E Willamette B & M

. LOCATION OF WELL
At surface: Approx. 2,225 feet east and 725 feet north of the SW corner, Sec. 10, T31S, R7½E
At proposed prod. zone:

11. COUNTY: Klamath

. DISTANCE FROM PROPOSED LOCATION TO NEAREST PROPERTY OR LEASE LINE: Approx. .43 miles SE of MZ I Unit boundary

12. STATE: Oregon

. DISTANCE FROM PROPOSED LOCATION TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR ON THIS LEASE: Approx. .6 miles north of MZ I-11

13. APPROX. STARTING DATE: Sept. 1, 1986

14. ACRES ASSIGNED (WELL SPACING): N/A

. DRILLING MEDIA AND CHARACTERISTICS: AIR (X) WATER ( ) MUD (X) FOAM ( ) Other ( )

19. PROPOSED DEPTH: MEASURED: 4000' TRUE VERTICAL:

20. ELEVATIONS: ESTIMATED (X) FINAL ( ) 6050'
REFERENCE DATUM: GR (X) MAT ( ) DF ( ) KB ( ) RT ( ) CASINGHEAD FLANGE ( ) OTHER ( )

. EXISTING AND/OR PROPOSED CASING AND CEMENTING PROGRAM (List existing program first, followed by proposed program, and separate by a sufficient space to clearly distinguish the two programs)

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	COUPLING (Collars & Threads)	GRADE	SETTING DEPTH Top	SETTING DEPTH Bottom	QUANTITY OF CEMENT
Set 6-7' of	8-5/8" conductor pipe (optional).				Surf.	6-7'	To Surface
7-7/8"	4-1/2	11.5#	8RD ST&C	K55	Surf.	550'	To Surface

D: out cement plug and resume drilling with 3.782 OD (HQ) wireline coring system. Reduce core size to 2.980 OD (NQ), as mandated by drilling conditions.

. PROPOSED WORK SUMMARY

*Approximate Kettleman designation: 47-10.

See attached Proposed Drilling and Coring Procedure.

(Use additional space on reverse side of form)

James L. Moore — Senior Vice President Exploration — 8/21/86

GNED: James L. Moore — TITLE — DATE

his space for Federal use)

PROVED BY: Donald L Mumstead — TITLE: Petroleum Engineer, DOGAMI — DATE: 9/2/86

NDITIONS OF APPROVAL, IF ANY:

.s (is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.71: Federal Geothermal Lease Terms and Stipulations and other regulatory require-ies. ; United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department Agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

BLM: _____

DOGAMI: 117

USGS 9-1957

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, CONSERVATION DIVISION

Form Approved
Budget Bureau No. _____

GEOTHERMAL DRILLING PERMIT

The U.S. Geological Survey requires this form or other Supervisor approved form to be prepared and filed in duplicate with requisite attachments with the Supervisor. The Supervisor must approve this permit prior to lease operation.

1a. TYPE OF WORK: DRILL NEW WELL ( ) REDRILL ( ) DEEPEN ( ) PLUG BACK ( ) DIRECTIONALLY DRILL ( ) OTHER (X) Drill/Core Temperature Gradient Core Hole

1b. WELL TYPE: PRODUCTION ( ) INJECTION ( ) HEAT EXCHANGE ( ) OBSERVATION ( ) WATER SUPPLY ( ) OTHER ( )

1c. WELL STATUS:

2. NAME OF LESSEE/OPERATOR: California Energy Company, Inc. (707) 526-1000

3. ADDRESS OF LESSEE/OPERATOR: 3333 Mendocino Ave., Ste. 100, Santa Rosa, CA 95401

4. LOCATION OF WELL At surface: 2000'N and 2050'W of SE Corner, Section 13

At proposed prod. zone:

5. LEASE SERIAL NO.: OR34681

6. SURFACE MANAGER: BLM ( ) FS ( ) Other ( ) Winema N.F.

7. UNIT AGREEMENT NAME: Mazama II

8. WELL NO.: MZII-1

9. PERMIT NO.:

10. FIELD OR AREA:

11. SEC. T., R., B.& M.: Section 13, T32S, R6E WM

12. COUNTY: Klamath

13. STATE: Oregon

16. DISTANCE FROM PROPOSED LOCATION TO NEAREST PROPERTY OR LEASE LINE: Approx. 1600' from Unit Boundary

17. DISTANCE FROM PROPOSED LOCATION TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR ON THIS LEASE: No proposed nor existing geothermal wells.

18. APPROX. STARTING DATE: September 15, 1986

14. ACRES ASSIGNED (WELL SPACING): N/A

18. DRILLING MEDIA AND CHARACTERISTICS: AIR (X) WATER ( ) MUD (X) FOAM ( ) Other ( )

19. PROPOSED DEPTH: MEASURED: 4000' TRUE VERTICAL:

20. ELEVATIONS: ESTIMATED ( ) FINAL (X) 4665'
REFERENCE DATUM: GR (X) MAT ( ) DF ( ) KB ( ) RT ( ) CASINGHEAD FLANGE ( ) OTHER ( )

21. EXISTING AND/OR PROPOSED CASING AND CEMENTING PROGRAM (List existing program first, followed by proposed program, and separate by a sufficient space to clearly distinguish the two programs)

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	COUPLING (Collars & Threads)	GRADE	SETTING DEPTH Top	SETTING DEPTH Bottom	QUANTITY OF CEMENT
Set 6-7' of	8-5/8" conductor pipe (optional).				Surf.	6-7'	To Surface
7-7/8"	4-1/2"	11.5#	8RD ST&C	K55	Surf.	550'	To Surface
Mill out cement plug and resume drilling with 3.782 OD (HQ) wireline coring system. Reduce core size to 2.980 OD (NQ), as mandated by drilling conditions.							

22. PROPOSED WORK SUMMARY

* Approximate Kettleman designation: 66-13

See attached Proposed Drilling and Coring Procedure.

(Use additional space on reverse side of form)

23. SIGNED James L. Moore TITLE Senior Vice President Exploration DATE 8/21/86

(This space for Federal use)

APPROVED BY James F. Munkwood TITLE Petroleum Engineer - DOGAMI DATE 9/2/86

CONDITIONS OF APPROVAL, IF ANY:

This permit is required by law (30 U.S.C. 1023); regulations: 30 CFR 270.71; Federal Geothermal Lease Terms and Stipulations and other regulatory requirements. The United States Criminal Code (18 U.S.C. 1001) makes it a criminal offense to make a willfully false statement or representation to any Department or Agency of the United States as to any matter within its jurisdiction.

(See instructions on reverse side)

OREGON ADMINISTRATIVE RULES

DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

CHAPTER 632

Table of Contents

DIVISION 1
PROCEDURAL RULES

DIVISION 20
GEOTHERMAL REGULATIONS

Geothermal Blow-Out Prevention

DIVISION 1

PROCEDURAL RULES

Notice of Rule Making

632-01-000 In addition to other hearing and notice of rule making requirements, the Department will furnish notice of its intended agency action, depending on the sphere of interest, to interested parties named on a list maintained, with periodic revision, by the State Geologist.

Stat. Auth.: ORS Ch. 183 & 520
Hist: GMI 9, f. & ef. 12-13-76; GMI 1-1982, f. & ef. 6-25-82

Model Rules of Procedure

632-01-005 Pursuant to the provisions of ORS 183.341, the Department of Geology and Mineral Industries adopts the Attorney General's Model Rules of Procedure under the Administrative Procedure Act effective September 26, 1983.

Stat. Auth.: ORS Ch. 183
Hist: GMI 6, f. 12-21-73, ef. 1-11-74; GMI 9, f. & ef. 12-13-76; GMI 2-1981, f. & ef. 12-30-81; GMI 2-1984, f. & ef. 2-22-84

[**ED. NOTE**: The full text of the Attorney General's Model Rules of Procedure is available from the office of the Attorney General or the Department of Geology and Mineral Industries.]

DIVISION 20

GEOTHERMAL REGULATIONS

Jurisdiction and Authority

632-20-005 (1) The 1971 Geothermal Resources Act authorized the Department of Geology and Mineral Industries to control the drilling, redrilling, and deepening of wells for the discovery and production of geothermal resources so that such wells will be constructed, operated, maintained, and abandoned in the manner necessary to safeguard the life, health, property, and welfare of the people of this state and to encourage the maximum economic recovery of geothermal resources therefrom. The Act also gives the Department responsibility for regulating re-injection of geothermal fluids into underground reservoirs within prescribed limits of ORS 522.019(2) in a manner which will not be detrimental to beneficial use of waters of the state.

(2) The Governing Board of the Department shall:

(a) Administer and enforce the provisions of the Geothermal Resources Act; and

(b) In accordance with the applicable provisions of ORS Chapter 183, adopt rules and regulations and issue orders that it may deem necessary in carrying out the provisions of the Geothermal Resources act.

(3) The permittee shall in addition to complying with the 1971 Geothermal Act and these regulations comply with applicable laws and regulations of the Water Resources Department, Department of Environmental Quality, and any other agency having jurisdiction and control in the field of natural resources within the State of Oregon.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80

Definitions

632-20-010 (1) "Abandonment" shall mean the condition of a well when it is permanently plugged to the satisfaction of the State Geologist.

(2) "Artesian" means the response of water or fluid under natural pressure whereby it rises above the level where it was originally encountered.

(3) "Blow-Out" means a sudden or violent uncontrolled escape of fluids, such as from a drilling well when high formation pressure is encountered.

(4) "Board" means governing board of the State Department of Geology and Mineral Industries.

(5) "By-Products" means any mineral or minerals, exclusive of helium or oil, hydrocarbon gas, or other hydrocarbon substances, which are found in solution or in association with geothermal resources and which have a value of less than 75 percent of the value of the geothermal resource or are not, because of quantity, quality, or technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves.

(6) "Completed geothermal well" means a well with a bottom hole temperature of at least 250° F. that is constructed according to ORS 522.005 to 522.990 and OAR 632-20-005 to 632-20-180, and which is capable of producing geothermal resources.

(7) "Contamination" means any alteration of the physical, chemical, or biological properties of surface or groundwaters of the state; such alteration may not prevent the beneficial use of such waters.

(8) "Department" means the State Department of Geology and Mineral Industries.

(9) "Fresh water" means water which is used or could be used for irrigation or domestic purposes.

(10) "Geothermal Area" means any parcel of land that is, or resonably appears to be underlaid by Geothermal Resources.

(11) "Geothermal Reinjection Well" means any well or converted well constructed to dispose of geothermal fluids derived from geothermal resources into an underground reservoir.

(12) "Geothermal Resources" means the natural heat of the earth, the energy, in whatever form, below the surface of the earth present in, resulting from, or created by, or which may be extracted from, the natural heat, and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases, and steam, in whatever form, found below the surface of the earth, exclusive of helium or of oil, hydrocarbon gas or other hydrocarbon substances, but including, specifically:

(a) All products of geothermal processes, embracing indigenous steam, hot water, and hot brines;

(b) Steam and other gases, hot water, and hot brines resulting from water, gas or other fluids artificially introduced into geothermal formations;

(c) Heat or other associated energy found in geothermal formations; and

(d) Any by-product derived from them.

(13) "Geothermal well" includes any well drilled to explore for and produce geothermal resources from any depth, any geothermal reinjection well as defined in section (10) of this rule, and any temperature gradient or geophysical test well deeper than 2,000 feet.

(14) "Operator" means the person:

(a) Who possesses the legal right to drill a geothermal well;

(b) Who has obtained a drilling permit pursuant to ORS 522.135; or

(c) Who possesses the legal right to operate a completed geothermal well as described by ORS 522.185.

(15) "Owner" means the person who has the right to drill geothermal wells and/or prospect wells, or to appropriate the production from a completed geothermal well, either for himself or for himself and others.

(16) "Permittee" means owner or operator.

(17) "Person" means any individual, corporation, company, association of individuals, joint venture, partnership, receiver, trustee, guardian, executor, administrator, or personal representative that is the subject of legal rights and duties under these regulations.

(18) "Pollution" means contamination or other alteration of the physical, chemical, or biological properties of any waters of the state, including change in temperature, taste, color, turbidity, silt, or odor of the waters, or such radioactive or other substance into any waters of the state which either by itself or in connection with any other substance present, will or can reasonably be expected to create a public nuisance or render such waters harmful, detrimental, or injurious to public health, safety, or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses or to livestock, wildlife, fish or other aquatic life, or the habitat thereof.

(19) "Prospect Well" includes any well drilled as a geophysical test well, core drilling, or temperature gradient test well, less than 2,000 feet in depth, and drilled in prospecting for geothermal resources. "Prospect Well" does not include a geothermal well as defined in section (12) of this rule.

(20) "Reservoir" means an aquifer or combination of aquifers or zones containing a common geothermal or groundwater resource.

(21) "Royalty Interest" means a right or interest in geothermal resources produced from land or in the proceeds of the first sale of those resources.

(22) "State Geologist" means the director of the Depart-

ment of Geology and Mineral Industries.

(23) "Unit agreement" means an agreement or plan of development and operation under the provisions of ORS 308.370, 522.015, 522.405 to 522.545, 522.815, 522.990 and this Division of OAR 632 for the production and/or use of geothermal resources in separately owned interests as a single consolidated unit and which provides for the allocation of costs and benefits.

(24) "Unit operator" means the person designated in the unit agreement to manage and conduct the unit agreement.

(25) "Waste" means any physical waste, deleterious effects on surface and groundwater, including but not limited to underground waste resulting from the inefficient, excessive or improper use or dissipation of reservoir energy or resulting from the location, spacing, drilling, equipping, operation, or production of a geothermal resource well or prospect well in such manner that reduces or tends to reduce the ultimate economic recovery of the geothermal resources within a reservoir; and surface waste resulting from the location, spacing, drilling, equipping, operation, or production of a geothermal resource well or prospect well in such a manner that causes or tends to cause the unnecessary or excessive surface loss or destruction of geothermal resources released from the reservoir.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Inspection and Supervision

632-20-015 The State Geologist or his representive shall inspect and supervise geothermal operations for the purpose of enforcing compliance with the rules, regulations, and orders promulgated by the Board.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80

General Rules

632-20-020 General rules shall be statewide in application unless otherwise specifically stated and applicable to all lands within the jurisdiction of the State of Oregon.

Stat. Auth.: ORS Ch.
Hist: GMI 4, f. 7-20-72, ef. 8-1-72

Supremacy of Special Rules

632-20-025 Special rules will be issued when required and shall prevail as against general rules if in conflict therewith.

Stat. Auth.: ORS Ch.
Hist: GMI 4, f. 7-20-72, ef. 8-1-72

Application and Permit to Drill, Redrill, Deepen, or Alter Casing

632-20-030 (1) The owner or operator of any geothermal well or prospect well before commencing the drilling, redrilling, deepening, or altering of casing of any geothermal well or prospect well shall file with the State Geologist or representative a written application for permit to drill, redrill, deepen, or alter casing accompanied by a fee of $100 for each geothermal well or program of prospect wells. The application shall contain the following:

(a) The location(s) and ground elevation(s) of the proposed well(s). The location shall include the township, range, and section, together with the footage measurement from a section or quarter section corner. For prospect wells, a map may replace the footage measurements;

(b) The number or other designation, approved by the State Geologist, by which the well(s) shall be known;

(c) The proposed geologic objectives and proposed well depth(s);

(d) Such other pertinent data as the State Geologist may require on forms supplied by the Department or in other form acceptable to the State Geologist. The information on the permit application shall be non-confidential, with the exception of Prospect Well locations.

(2) Circulation of the application to drill shall be in accordance with ORS 522.125(1).

(3) Upon receipt of the application, the fee, the bond required under rule 632-20-035, and after the comment period provided for by ORS 522.125, the State Geologist or representative will make a determination and issue such person a permit to drill, unless the drilling of the geothermal well or prospect well is contrary to law, rule, or order of the Board. The drilling, redrilling, deepening, or altering of casing of a geothermal well or prospect well is prohibited until a permit is obtained. If the permit is disallowed, the State Geologist or representative will immediately notify the person in writing giving the reasons therefor.

(4) Drilling, redrilling, deepening or altering casing operations must commence within 180 days from the date of issuance of the permit or such permit shall become invalid. The permit may be extended by the State Geologist for a maximum of an additional 180 days upon receipt of written request from the permittee before the expiration date giving reasons for an extension.

(5) The issuance of a permit is not a finding of compliance with the Statewide Planning Goals (ORS 197.225) or the acknowledged comprehensive plan. The applicant must receive a land use approval from the affected local government. That approval may or may not include a determination that the proposed action is in compliance with the Statewide Planning Goals.

(6) After completion, suspension, or abandonment of any well, the provisions of this section shall also apply to the deepening, redrilling, or altering casing of the well.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83; GMI 1-1984, f. & ef. 1-23-84

Drilling Bond

632-20-035 (1) Every person who engages in the drilling, redrilling, deepening, or altering casing of any geothermal well shall file with the State Geologist an indemnity bond in the sum of $10,000 for each well drilled, redrilled, deepened, or altered, or a $50,000 blanket bond for the drilling, redrilling, deepening, or altering of one or more geothermal wells. The bond shall be filed with the State Geologist at the time of the filing of an application to drill, redrill, deepen, or alter as under rule 632-20-030. The bond shall be executed by such person, as principal, and by a surety company authorized to do business in the State of Oregon, as surety, conditioned upon the faithful compliance by the principal with the rules and orders of this chapter.

(2) Every person who engages in the drilling of any prospect well shall file with the State Geologist an indemnity bond of not less than $5,000 for each prospect well or a blanket bond in the amount of $25,000 for all prospect wells to be drilled by the applicant.

(3) Any bond submitted as required by this section may, with the consent of the Board, be terminated and canceled and the surety relieved of all obligations thereunder. However, the Board shall not consent to termination and cancellation of any bond until the well or wells covered by such bond have been properly abandoned.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Assignment, Transfers of Ownership

632-20-040 The owner or operator of an existing and/or proposed geothermal or prospect well shall notify the State Geologist in writing in such form as the State Geologist may direct, of the sale, assignment, transfer, conveyance, or exchange of such well and/or a change in the lessor of the land upon which such well is situated within five days thereof. Each such notice shall contain the following:

(1) The name and address of the person to whom such well or mineral rights was sold, assigned, transferred, conveyed, or exchanged.

(2) The name and location of such well.

(3) The date of such sale, assignment, transfer, conveyance, or exchange.

Stat. Auth.: ORS Ch.
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 1-1983, f. & ef. 9-30-83

Notice of Change in Ownership

632-20-045 Every person who acquires the ownership or the right of operation of a well or proposed well as described by rule 632-20-040 shall within five days after acquiring such well or proposed well, notify the State Geologist or representative in writing of the newly acquired ownership or right of operation. Each notice shall contain the following:

(1) The name and address of the person from whom the well or proposed well was acquired.

(2) The name and location of such well.

(3) The date of such acquisition.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Cancellation of Bond

632-20-050 [GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; Repealed by GMI 1-1983, f. & ef. 9-30-83]

Proper Completion and Abandonment

632-20-055 (1) A geothermal well or prospect well is properly completed for the purposes of this chapter when it is demonstrated that the well is capable of production and the person engaged in drilling, redrilling, deepening, or altering casing of such well has shown to the satisfaction of the State Geologist that both the manner of drilling, redrilling, deepening or altering casing of the well and the manner of producing geothermal resources therefrom are satisfactory.

(2) A well shall be considered properly abandoned, for the purpose of this chapter, when the conditions of ORS 522.005 to 522.990 and these rules are fulfilled and the person drilling, redrilling, deepening or altering casing of such well has shown to the satisfaction of the State Geologist that all proper steps have been taken to protect groundwater and surface water from pollution resulting from the abandoned well and to prevent the escape of all fluids to the surface.

(3) Proper completion and abandonment shall be conditioned also upon adequate protection of the environment and of aesthethic qualities of the surface in the area of operation.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Well Records, Confidentiality

632-20-060 (1) The owner or operator of any geothermal well shall keep, or cause to be kept, a careful and accurate log, core record, representative samples of drill cuttings and cores, if cores are taken, and history of the drilling of the well. In the case of prospect wells, a log shall be kept describing the type of rock penetrated and depths of water-bearing formations. Copies of prospect well logs may be made available to the State Water Resources Department.

(2) The log referred to in section (1) of this rule for geothermal wells shall show the character and depth of each formation encountered in the drilling of the well; the amount, size, and weight of casing used; the size, type, and depths of perforations; and the location, depth, and temperature of water-bearing strata, including the temperature, chemical composition, and other chemical and physical characteristics of fluid encountered from time to time, so far as determined.

(3) The core referred to in section (1) of this rule for geothermal wells shall show the depth, character, and fluid content of cores obtained, so far as determined from the study and analysis thereof.

(4) The history referred to in section (1) of this rule for geothermal wells shall show the location and amount of sidetracked casings, tools, or other material; type and depth of bore hole, surveys made; the depth and quantity of cement in cement plugs; the shots of dynamite or other explosives used; the results of production and other tests during drilling operations and completion data.

(5) The log referred to in sections (1) and (2) of this rule for geothermal wells and prospect wells shall be kept at the drill-site or local office of the owner or operator and, together with the tour reports of the owner or operator, shall be subject, during business hours, to inspection by the State Geologist or representative.

(6) Upon the completion, abandonment, or suspension of operations of a geothermal well, a copy of the lithologic log, core record, borehole surveys, representative samples of drill cuttings and cores, if any cores were taken, and history shall be filed with the State Department of Geology and Mineral Industries within 60 days after such completion, abandonment, or suspension. For prospect wells, a copy of the history, lithologic log, and well location shall be filed as above.

(7) For a period of four years from the date of completion, abandonment, or suspension, the State Geologist shall keep such logs and records confidential and shall not permit public inspection of such records.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83; GMI 1-1984, f. & ef. 1-23-84

Sundry Applications and Reports

632-20-065 (1) A written application for a permit to do work or to change plans previously approved must be filed with the State Geologist unless otherwise directed, and must be approved by him before work is begun. Approval or denial must be given within 15 days by the State Geologist. If, in case of emergency, an application is submitted orally or by wire, and approval is obtained, the transaction shall be confirmed in writing. A subsequent report of the work performed must also be filed with the State Geologist.

(2) Before the repairing or performance of work to permanently alter the casing of a well, an application setting forth in detail the proposed work must be filed with, and approved by, the State Geologist. A detailed report of the work accomplished and the methods employed, including all dates and the results of such work must be filed within 60 days after completion of the work.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Well Designations

632-20-070 Every person drilling any well for geothermal resources or operating, owning, or controlling or in possession of any well drilled for geothermal resources, shall paint or

stencil and post and keep posted in a conspicuous place near the well, the name of the person drilling, operating, owning, or controlling the well, the name of the lease, the number of the well, and the number of the permit for the well, together with the Section, Township, and Range.

Stat. Auth.: ORS Ch.
Hist: GMI 4, f. 7-20-72, ef. 8-1-72

Filing of Records Confidential Period

632-20-075 [GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; Repealed by GMI 1-1983, f. & ef. 9-30-83]

Inspection of Records

632-20-080 Each owner, operator or designated agent of any geothermal well shall file with the State Geologist a copy of the lithologic log, bore hole surveys, history and core record, or any portion thereof, or the driller's log in the case of a prospect well, at any time after commencement of the work of drilling any geothermal well or prospect well upon the written request of the State Geologist or representative. The request shall be signed by the State Geologist and served such owner, operator or agent either personally or by mailing a copy of the request by registered mail to the last-known post-office address of such owner, operator, or agent.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Blow-Out Prevention

632-20-085 [GMI 4, f. 7-20-72, ef. 8-1-72; Repealed by GMI 4-1980, f. & ef. 10-2-80]

Noise Abatement

632-20-090 The lessee shall minimize noise when conducting air drilling operations or when the well is allowed to produce while drilling or drilling is conducted. Welfare of the operating personnel and the public must not be affected as a consequence of the noise created by the expanding gases. The method and degree of noise abatement shall be as approved by the State Geologist and shall comply with the regulations and standards pertaining thereto adopted by the Oregon Department of Environmental Quality.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80

Casing Requirements

632-20-095 (1) The owner or operator of any geothermal well or prospect well shall properly case such well with adequate grade casing and cement such casing where necessary to provide adequate anchor for blow-out preventers. Design of casings shall take into account stress imposed by the maximum expected temperature and the physical effects of produced fluids and gases on casing durability. Surface casing for any well with a proposed depth of more than 500 feet shall be set at a depth of at least 10% of the proposed total depth of the well, or at least 25 feet into consolidated, competent rock, whichever is deeper, unless otherwise approved by the State Geologist.

(2) The owner or operator of any such well shall shut out pollution from strata containing water used for irrigation or domestic purposes and from surface water used for such purposes. The operator of any well drilled for geothermal resources which penetrates a usable fresh water aquifer shall be required to set casing or tubing through this formation and cement such casing or tubing from bottom to top unless the State Geologist approves a different program.

(3) Casing and casing seals used for prospect wells, where the temperature of groundwater does not exceed 250°F., shall comply with the general standards for the construction and maintenance of water wells set by the State Water Resources Department.

(4) Each fluid bearing zone above the producing horizon in a geothermal resources well shall be cased and sealed off to prevent effectively the migration of formation fluids to other areas. Such casing and sealing off shall be effected and tested in such manner and by such methods and means as may be prescribed by the State Geologist.

(5) Cements used in cementing casing and sealing formations shall be of grade and type best suited for expected reservoir temperature, formation water chemistry and bonding properties. Cements acceptable for use in high temperature holes include Modified Type A or G, Alumina Silica Flour, Phosphate Bonded Glass or other equivalent high temperature design cement.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Removal of Casings

632-20-100 No person shall remove a casing, or any part thereof, from any geothermal well or prospect well without applying in advance and obtaining approval in writing from the State Geologist or representative.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Directional Drilling

632-20-105 (1) The maximum point at which a well penetrates the producing formation shall not unreasonably vary from the vertical drawn from the center of the hole at the surface. Deviation is permitted without special permission for short distances to straighten the hole, sidetrack junk or correct other mechanical difficulties.

(2) Except for the purposes of straightening the hole, sidetracking junk, or correcting mechanical difficulties as provided in this rule, no well shall be intentionally deviated from the vertical unless the operator thereof shall first file application and obtain a permit from the State Geologist. If drilling is in progress, the operator must notify the State Geologist immediately of the deviation of the hole or his intention to deviate the hole. When an operator follows this procedure, he must file an application as soon as practicable.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80

Serving Orders

632-20-110 Whenever the State Geologist or representative gives any written direction concerning the drilling, testing, or other operations conducted with respect to any geothermal well or prospect well drilled, in the process of being drilled, redrilled, deepened, altered, or in the process of being abandoned, and the operator, owner, or designated agent of either, serves written notice, either personally or by mail, addressed to the State Geologist or representative, requesting that a definite order be made upon such subject, the State Geologist or representative shall, within a reasonable time after receipt of the notice, deliver a final written order on the subject matter. Any such final written order of the State Geologist may be appealed to the Board and further redress may be sought in the manner provided in ORS Chapter 183 for appeals from final orders in contested cases.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Measurement of Geothermal Resources

632-20-115 The lessee shall measure or gauge all production from each well in accordance with methods approved by the State Geologist or may arrange with the State Geologist for other acceptable methods of measuring and recording production. The quantity and quality of all production shall be determined in accordance with the standard practices, procedures, and specifications generally used in industry.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80

Production Reports

632-20-120 The owner or operator of any well producing geothermal resources shall file with the State Geologist before the 20th day of each month a statement of the geothermal resources production from such well during the preceding calendar month. Such report shall be submitted on such forms and in such manner as may be prescribed by the State Geologist.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80

Abandonment

632-20-125 (1) Notice of Intention. Protection of water and geothermal resources:

(a) Before any operation is commenced to abandon any geothermal well, the owner or operator of such well shall apply to the State Geologist or representative for a permit to abandon the well, giving the condition of the well and the proposed method of abandonment;

(b) The owner or operator shall notify the State Geologist or representative at least 24 hours before the proposed date for the commencement of abandonment operations. Notification may be made by phone, but must be followed by written application. The State Geologist or representative shall either approve or deny the application within 10 days. A representative of the department may be present during any abandonment operation, and shall approve the procedure if found to be satisfactory;

(c) The owner or operator of such well shall furnish the State Geologist or representative any additional information that may be requested regarding the condition of the well and the proposed method of abandonment, at any time between the filing of the notice of intention to abandon the well and the completion of abandonment.

(2) Geothermal resource, environment, and water resources to be protected:

(a) Before any well or any producing horizon encountered therein shall be abandoned, the owner or operator shall use such means, methods, and procedure as may be necessary to prevent water from entering any geothermal resources bearing formation, and to protect any underground or surface water that is suitable for domestic or irrigation purposes from waste, downward drainage, harmful infiltration, and addition of deleterious substances.

(b) Prior to granting approval for final abandonment of any well drilled for geothermal resources, the State Geologist shall determine that the site be restored to as near its original state as possible.

(3) Suspension, Unlawful Abandonment, Removal of Equipment:

(a) The Board may authorize a permittee to suspend operations or remove equipment from a well for the period stated in the Board's written authorization, given upon written application of the permittee and his or its affidavit showing good cause. The period of suspension may be extended by the Board, upon written application made before expiration of the previously authorized suspension, accompanied by affidavit of the permittee showing good cause for granting of such extension.

(b) After operations on or at a well have been suspended with the approval of the Board pursuant to subsection (a) of this section, if operations are not resumed within six months from the date specified in such approval of suspension, an intention to abandon and unlawful abandonment shall be presumed unless the permittee has obtained from the Board an extension of time of such suspension, upon his or its written application and affidavit showing good cause for the granting of such extension.

(c) Whenever operations on or at any well shall have been suspended for a period of six months without compliance with these regulations, the well shall be presumed unlawfully abandoned.

(d) A well shall be deemed unlawfully abandoned if, without notice given to the Board as required by these rules, any drilling or producing equipment is removed.

(e) Any unlawful abandonment under these regulations shall be declared by the Board and such declaration of unlawful abandonment shall be entered in the Board minutes and written notice thereof delivered by registered mail both to such permittee at the last known post office address as disclosed by the records of the Board, to the registered agent of the permittee, if any, and to the permittee's surety; and the Board may thereafter proceed against the permittee and permittee's surety.

(f) All wells abandoned or declared abandoned as herein provided shall be plugged as required by law and by these regulations.

(4) Plugging Methods and Procedure, Geothermal Wells:

(a) The well shall be filled with mud-laden fluid from bottom to top consisting of mud weighing 9.0 pounds per gallon of not less than 36 viscosity (API Full Funnel Method), with the exception of intervals required to be plugged with cement. Other fluids may be used upon approval of the State Geologist;

(b) At the top of each producing formation, or fluid zone at greater than hydrostatic pressure, a cement plug shall be placed which extends either from the bottom of the well or from a point 50 feet below the top of each such producing formation or zone to a point at least 50 feet above each producing formation or zone;

(c) If a well is uncased through a freshwater zone, a cement plug shall extend from 50 feet below the bottom of the water-bearing zone to at least 50 feet above the water zone;

(d) If the surface string of casing is set below the deepest freshwater-bearing formation, and the well is uncased below this point, a cement plug shall be placed in the well extending from a point at least 50 feet below the base of the surface casing and 50 feet into the bottom of the casing;

(e) The top of all casing strings shall be cut off at least 4 feet below ground surface, and casing and all annuli shall be plugged with cement to a depth of at least 10 feet.

(f) The operator shall have the option as to method of placing cement in the well:

(A) Pumping through tubing,

(B) Pump and plug displacement, or

(C) Other method approved by the State Geologist.

(5) Plugging Methods and Procedure, Prospect Wells. Before abandoning any prospect well which penetrates a usable fresh-water horizon, it shall be the duty of the owner or operator of such prospect well to plug the well in such manner as to protect properly all freshwater-bearing formations; and within 60 days after the plugging, an affidavit shall be filed with the State Geologist by the owner or operator, setting forth

the location of the prospect well and the method used in plugging the well to protect water-bearing formations, if any were penetrated. Plugging shall consist of the following procedures unless a different method is approved by the State Geologist. These procedures may be done in open hole if the well is being abandoned, or in the annulus around tubing if the well is being completed as a temperature gradient well:

(a) In wells where water is not encountered, the hole shall be filled with heavy mud-laden fluid or with drill cuttings and a ten (10) foot cement plug placed at the top of the hole, buried at least two feet in such a manner as not to interfere with soil cultivation;

(b) In wells where groundwater is encountered but is not under artesian pressure, the hole shall be filled with cement to a point at least 50 feet above the water zone, or if the top of the zone is less than 50 feet from the ground surface, the cement shall extend to the ground surface. If a well penetrates below a freshwater zone, a cement plug shall extend from 50 feet below the bottom of the zone to at least 50 feet above the zone;

(c) In wells where artesian water is encountered, the well shall be plugged with cement from bottom to top.

(6) Report on Completion. Within 60 days after the plugging of a geothermal well or prospect wells, the owner or operator thereof shall file a report with the State Geologist setting forth in detail the method used in plugging the well(s). Such report shall be made on a form supplied by or approved by the State Geologist.

(7) Wells Used for Fresh Water:

(a) When the well to be plugged may safely be used as a freshwater well and such use is desired by the land owner, the well need not be filled above the required sealing plug set below fresh water; provided, however, authorization for use of any such well shall be obtained from the Water Resources Department;

(b) Application for leaving the well partially unplugged as a fresh water well shall be made to the State Geologist by the land owner, accompanied by his affidavit as to his need of water and the intended use of the well, together with a copy of the Water Resources Department's order or permit authorizing such use;

(c) The operator shall leave the fresh water well in a condition approved by the State Geologist.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Subsequent Abandonment Report

632-20-130 (1) Within 60 days after the abandonment of any well, the owner or operator of such well shall make, in such form as the State Geologist or his representative may direct, a written report, of all work done with respect to the abandonment.

(2) Failure to abandon in accordance with the approved method of abandonment, failure to submit to the State Geologist or representative any application or report required by these rules, or failure to furnish the State Geologist or representative, upon request, with any information regarding the condition of the well(s), shall constitute sufficient grounds for disapproval of the abandonment.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Naming of Fields

632-20-134 The Board, on its own or upon request of any interested person, may, after a public hearing, name a geothermal field and set the boundaries of the field. Using the same procedure, the Board may later change the boundaries of a field.

Stat. Auth.: ORS Ch. 522
Hist: GMI 1-1983, f. & ef. 9-30-83

Well Spacing

632-20-135 The Board shall approve proposed well-spacing programs for geothermal wells in a field or prescribe such modifications to the programs as it determines necessary for proper development. The Board may do this by rule or order. In determining well spacing the Board shall give consideration to such factors as:

(1) Topographic characteristics of the area;

(2) Hydrologic and geologic conditions in the reservoir;

(3) Minimum number of wells required for adequate development; and

(4) Protection of the environment.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Unit Agreements

632-20-138 (1) When voluntary unitization occurs under ORS 522.405 to 522.545, the operator of the unit shall pay to the Board a fee, to be determined by the Board on a case-by-case basis for administration of the unit. The unit operator shall collect equitable shares of this fee from all persons, or state or local governing bodies, special districts or agencies with a royalty interest in the unitized development.

(2) When the Board requires the development of a unit agreement under ORS 522.405 to 522.545, the operator of the unit shall pay to the Board a fee to be determined by the Board on a case-by-case basis, for creation and administration of the unit. The unit operator shall collect equitable shares of this fee from all persons, or state or local governing bodies, special districts or agencies with a royalty interest in the unitized development.

(3) The State Geologist shall review voluntary unit agreements governing production of geothermal resources to ensure compliance with the provisions of ORS 522.405 to 522.545.

(4) The operator or person proposing a Board-initiated unit agreement shall make application to the Board.

(5) The State Geologist shall enforce, when necessary, Board-approved or initiated unit agreements.

(6) The Board may change or approve proposed changes in the boundaries of a unit area, upon application by the unit operator or interested person. Such changes shall not jeopardize pre-existing contractual relationships between participating parties.

(7) The Board may levy fees upon any operator, person, state or local governing body, special district or agency that holds a royalty interest in a unit area to cover reasonable costs associated with the development and administration of a unit agreement. If such a fee is not paid when due, the Board may require the fee to be paid from proceeds of the sale of the unit production.

Stat. Auth.: ORS Ch. 522
Hist: GMI 1-1983, f. & ef. 9-30-83

Commingling Production

632-20-140 The State Geologist may authorize the lessee to commingle the production from different wells and/or leases with the production of other operators subject to such conditions as he may prescribe.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80

Pits or Sumps

632-20-145 (1) Materials and fluids or any fluid necessary to the drilling, production, or other operations by the permittee may be discharged or placed in pits and sumps if approval to do so is obtained from the State Geologist and the State Department of Environmental Quality. The operator shall provide pits and sumps of adequate capacity and design to retain all materials. In no event shall the contents of a pit or sump be allowed to:

(a) Contaminate streams, artificial canals or waterways, groundwaters, lakes, or rivers;

(b) Adversely affect the environment, persons, plants, fish, and wildlife and their populations; or

(c) Damage the aesthetic values of the property or adjacent properties.

(2) When no longer needed, pits and sumps are to be filled and covered and the premises restored to a near natural state.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80

Disposal of Solid and Liquid Wastes

632-20-150 (1) The Department of Geology and Mineral Industries has authority for regulating re-injection of geothermal fluids derived from geothermal resources as specified in ORS 522.025 and ORS 522.019(2) and the Department of Environmental Quality has authority for regulating other methods for disposing of fluids and wastes derived from geothermal operations.

(2) Re-injection of geothermal fluids shall not pollute waters of the state, create a public nuisance, impair beneficial uses of waters, or degrade the biologic habitat of aquatic life and domestic and wild animals.

(3) Methods of handling geothermal fluids derived from geothermal resources other than re-injection may be approved by the State Geologist or his representative if after consultation with the Director of the Department of Environmental Quality or his representative it is determined that no pollution will occur.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80

Handling of Test Fluids

632-20-151 Prior to conducting formation and production tests, the operator shall provide adequate storage for anticipated volumes of formation fluids and drilling mud. Arrangements for ultimate disposal of waste fluids shall be made with the local Department of Environmental Quality representative.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4-1980, f. & ef. 10-2-80

Reinjection and Conservation

632-20-154 Reinjection shall be the preferred method for handling geothermal fluids derived from geothermal resources to conserve natural heat energy and to maintain reservoir temperature and pressure. This rule applies to fluids derived from wells defined in ORS 522.005(12) and ORS 522.025 and to wells 2,000 feet in depth or deeper used for injection of geothermal fluids regardless of temperature of the fluids.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Application to Drill Re-Injection Well

632-20-155 (1) No person shall engage in the drilling or operating of any geothermal re-injection well without first obtaining a permit issued under the authority of the State Geologist, and without complying with the conditions of such permit.

(2) An application for a permit to re-inject a geothermal fluid into any underground reservoir shall contain all the information required by the State Geologist, including but not limited to the following:

(a) A plan of re-injection explaining the proposed system including facilities other than the re-injection well necessary to conduct the operations.

(b) A map of adequate scale (preferably 1:24,000, but not less than 1:62,500 or 1" = 1 mile) to show all existing and proposed wells, pipelines, and other surface facilities. All wells shall be distinquished by type.

(c) The injection fluid characteristics such as quality, quantity, source, chemical analysis, chemical reactivity, toxicity, temperature, etc.

(d) The characteristics of the proposed injection zone including volume capacity of the zone, geologic formation and structure, porosity, permeability, chemical analysis of zonal water, static formation pressures and temperatures, anticipated zonal fluid reactivity to the injected fluids, any previous history of injection operations into the same or similar formations, any injectivity tests which may have been conducted, and other pertinent data.

(e) Hydrology of the surrounding area, including groundwater quality, quantities, analyses, and the predicted effects of contamination by injected fluids on the existing surface and groundwaters.

(f) Subsurface maps and cross sections of the producing and injecting zone structure and lithology and any available logs or histories of well or other wells penetrating the injection zone, that have not previously been submitted. Discuss the effects of injection on such factors as potable water, seismicity, and local tectonic conditions.

(g) Representative injection well drilling program.

(h) Proposed downhole and surface injection equipment and metering facilities with capacity, design capabilities and design safety factors, in sufficient detail to enable adequate environmental analysis. Construction and engineering design plans should be included.

(i) Proposed injectivity surveys and other means to monitor injection performance.

(3) The State Geologist shall circulate copies of an application to construct a re-injection well to those agencies specified in ORS 522.125. Any of those agencies desiring to suggest conditions under which a permit should be granted shall provide such information to the Department within 30 days of receipt of the copy of the application. Such conditions may be stipulated by the State Geologist as conditions of the permit.

(4) An application for a re-injection well permit shall be accompanied by a $100 fee to cover cost of processing.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80

Permit for Reinjection

632-20-156 (1) Within 30 days after receipt of the application for a reinjection well permit, the State Geologist or representative shall issue, deny, suspend, modify, revoke, or not renew a permit subject to the right of appeal by the applicant described in rule 632-20-165.

(2) The State Geologist or representative may issue the permit after finding that issuance thereof is consistent with the purposes set forth in ORS 468.280, 468.710, 468.725, 537.525, and ORS 522.

(3) A water pollution control facilities permit shall be obtained from the Department of Environmental Quality under ORS 468.740 before re-injection is commenced. The Department of Environmental Quality may, by agreement with the State Department of Geology and Mineral Industries, waive this requirement for re-injection into the reservoir from which

the fluid came where adequate standards and tests have been adopted to insure the fluid and its residues will not cause pollution.

(4) Issuance of a re-injection permit does not relieve any person from any obligation to obtain a permit under ORS 468.725 or 468.730 (Department of Environmental Quality).

(5) The State Geologist or representative shall not issue a permit for reinjection of geothermal fluids until the operator has posted a bond in compliance with OAR 632-20-035.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Construction of Re-Injection Wells

632-20-157 (1) Re-injection wells shall be constructed in compliance with standards required in rules 632-20-095 and 632-20-125.

(2) Special standards may be required by the State Geologist to allow for corrosive effects of injected fluids, precipitation of dissolved minerals, more extensive cementing of casings, specifications for tubing packers and casing packers or other construction practices generally accepted by the industry.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4-1980, f. & ef. 10-2-80

Well-Head Equipment

632-20-158 Adequate well-head equipment shall be installed to control expected pressures. Where underground conditions are unknown, the same equipment shall be used as required for exploration holes.

Stat. Auth.: ORS Ch.
Hist: GMI 4-1980, f. & ef. 10-2-80

Monitoring Re-injection

632-20-159 (1) The State Geologist shall require monitoring of re-injection operations to insure that there will be no escape of geothermal fluids from the casings or through the annular space between casings and open hole except in the zone for which re-injection is permitted.

(2) Monitoring required by the State Geologist may include gauging pressure between casings, periodic testing for casing leaks, surveys to detect movement of fluid in adjacent rock formations, cement bond logs, temperature measurements, analyses of water chemistry, special well-head equipment or other methods employed by industry to monitor re-injection operations.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4-1980, f. & ef. 10-2-80

Appeals From Board Actions

632-20-160 Application for rehearing by person adversely affected by order of Board. Any person adversely affected by any rule, regulation, or order of the Board may within 30 days after its entry apply to the Board for a rehearing. Such application shall be acted upon by the Board within 30 days from its filing date, and if granted, such rehearing shall be held without undue delay.

Stat. Auth.: ORS Ch.
Hist: GMI 4, f. 7-20-72, ef. 8-1-72

Judicial Review of Board Actions

632-20-165 Any person adversely affected by any rule or order by the Board may obtain judicial review thereof pursuant o ORS Chapter 183.

Stat. Auth.: ORS Ch. 522
Hist: GMI 4, f. 7-20-72, ef. 8-1-72; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

Environmental Protection

632-20-170 In the absence of coverage by any other section of these regulations, the permittee shall conduct operations under this chapter so as not to pollute land, water or air, pollute streams, damage the surface or pollute the underground water. The operator must comply with Federal and State air and water quality standards. Plans for disposal of well effluents must take into account the effect on groundwaters, streams, plants, fish and wildlife and their populations, atmosphere, or any other effects which may cause or contribute to pollution, and such plans must be approved by the Supervisor before action is taken under them.

Stat. Auth.: ORS Ch.
Hist: GMI 4, f. 7-20-72, ef. 8-1-72

Geothermal Blow-Out Prevention

Blow-Out Prevention, Geothermal Wells

632-20-175 (1) Cementing of Casing. The conductor and surface casing strings shall be cemented with a quantity of cement sufficient to fill the annular space back to the surface. The intermediate casing string shall be cemented to prevent migration of fluids. Production casing shall be cemented with a high temperature resistant admix, unless waived by the State Geologist and shall be cemented in a manner necessary to exclude, isolate, or segregate overlying formation fluids from the geothermal resources zone and to prevent the movement of fluids into possible fresh water zones. Production casing shall be cemented back to the surface or, if lapped, to the top of the lap. A temperature or cement bond log may be required by the State Geologist after setting and cementing the production casing and after all primary cementing operations if an unsatisfactory cementing job is indicated. Proposed well cementing techniques differing from the requirements of this paragraph will be considered by the State Geologist on an individual well basis.

(2) Pressure Testing:

(a) Prior to drilling out the casing shoe after cementing, all casing strings set to a depth of 500 feet or greater, except for conductor casing, shall be pressure tested to a minimum pressure of 1,000 psi or 0.2 psi/ft whichever is greater. All casing strings set at a depth less than 500 feet, except for conductor casing, shall be pressure tested to a minimum pressure of 500 psi. Exceptions to these minimum pressures may be allowed with the specific prior permission of the State Geologist. Such test shall not exceed the rated working pressure of the casing or the blow-out preventer stack assembly, whichever is lesser.

(b) In the event of casing failure during the test, the casing must be repaired or recemented until a satisfactory test is obtained. A pressure decline of 10 percent or less in 30 minutes shall be considered satisfactory.

(c) Casing test results shall be recorded in the driller's log and reported to the State Geologist within 60 days after the completion of such test. Advance notice of all casing and lap tests shall be given in sufficient time to enable the State Geologist or his representative to be present to witness such tests. The casing and lap test reports shall give a detailed description of the test; including mud and cement volumes, lapse of time between running and cementing casing and testing, method of testing and test results.

(3) Blow-Out Prevention Equipment and Procedures. All necessary precautions shall be taken to keep all wells under control at all times, utilize trained and competent personnel, and utilize properly maintained equipment and materials. Blow-out preventers and related well control equipment shall be installed, tested immediately thereafter and maintained ready for use until drilling operations are completed. Certain

components, such as packing elements and ram rubbers, shall be of high temperature resistant material as necessary. All kill lines, blowdown lines, manifolds and fittings shall be steel and shall have a temperature derated minimum working pressure rating equivalent to the maximum anticipated wellhead surface pressure. Subject to subsections (a) and (b) of this section, blow-out prevention equipment shall have manually operated gates and hydraulic actuating systems and accumulators of sufficient capacity to close all of the hydraulically operated equipment and have a minimum pressure of 1,000 psi remaining on the accumulator. Dual control stations shall be installed with a high pressure backup system. One control panel shall be located on the ground at least 50 feet away from the wellhead or rotary table. Air or other gaseous fluid drilling systems shall have blow-out prevention assemblies. Such assemblies may include, but are not limited to, a rotating head, a double ram blow-out preventer or equivalent, a banjo-box or an approved substitute therefor and a blind ram blow-out preventer or gate valve, respectively. Exceptions to the requirements of this paragraph will be considered by the State Geologist only for certain geologic and well conditions such as stable surface areas with known low subsurface formation pressures and temperatures:

(a) Conductor Casing. In certain instances a remotely controlled hydraulically operated expansion type preventer or an acceptable alternative, approved by the State Geologist, including a drilling spool with side outlets or equivalent may be required by the State Geologist in areas where shallow thermal zones are indicated.

(b) Surface, Intermediate, and Production Casing. Unless otherwise approved by the State Geologist, before drilling below any of these strings, the blow-out prevention equipment shall include a minimum of:

(A) One expansion-type preventer and accumulator or rotating head;

(B) A manual and remotely controlled hydraulically operated double ram blow-out preventer or equivalent having a temperature derated minimum working pressure rating which exceeds the maximum anticipated surface pressure at the anticipated reservoir fluid temperature;

(C) A drilling spool with side outlets or equivalent;

(D) A fillup line;

(E) A kill line equipped with at least one valve; and

(F) A blowdown line equipped with at least two valves and securely anchored at all bends and at the end.

(c) Testing and Maintenance:

(A) Ram type blow-out preventers and auxiliary equipment shall be tested to a minimum of 1,000 psi or to the working pressure of the casing or assembly, whichever is the lesser. Expansion type blow-out preventers shall be tested to 70 percent of the above pressure testing requirements. The blow-out prevention equipment shall be pressure tested:

(i) when installed;

(ii) prior to drilling out plugs and/or casing shoes;

(iii) not less than once each week, alternating the control stations; and

(iv) following repairs that require disconnecting a pressure seal in the assembly.

(B) During drilling operations, blow-out prevention equipment shall be actuated to test proper functioning as follows: once each trip for blind and pipe rams but not less than once each day for pipe rams; and at least once each week on the drill pipe for expansion type preventers.

(C) All flange bolts shall be inspected at least weekly and retightened as necessary during drilling operations. The auxiliary control systems shall be inspected daily to check the mechanical condition and effectiveness and to insure personnel acquaintance with the method of operation. Blow-out prevention and auxiliary control equipment shall be cleaned, inspected, and repaired, if necessary, prior to installation to assure proper functioning. Blow-out prevention controls shall be plainly labeled, and all crew members shall be instructed on the function and operation of such equipment. A blow-out prevention drill shall be conducted weekly for each drilling crew. All blow-out prevention tests and crew drills shall be recorded on the driller's log.

(4) Related Well Control Equipment. A full opening drill string safety valve in the open position shall be maintained on the rig floor at all times while drilling operations are being conducted. A kelly cock shall be installed between the kelly and the swivel.

(5) Drilling Fluid. The properties, use, and testing of drilling fluids and the conduct of related drilling procedures shall be such as are necessary to prevent the blow-out of any well. Sufficient drilling fluid materials to ensure well control shall be maintained in the field area readily accessible for use at all times.

(6) Drilling Fluid Control. Before pulling drill pipe, the drilling fluid shall be properly conditioned or displaced. The hole shall be kept reasonably full at all times, however, in no event shall the annular mud level be deeper than 100 feet from the rotary table when coming out of the hole with drill pipe. Mud cooling techniques shall be utilized when necessary to maintain mud characteristics for proper well control and hole conditioning.

(7) Drilling Fluid Testing:

(a) Mud testing and treatment consistent with good operating practice shall be performed daily or more frequently as conditions warrant. Mud testing equipment shall be maintained on the drilling rig at all times.

(b) The following drilling fluid system monitoring or recording devices shall be installed and operated continuously during drilling operations, with mud, occurring below the shoe of the conductor casing. No exceptions to these requirements will be allowed without the specific prior permission of the State Geologist:

(A) High-low level mud pit indicator including a visual and audio-warning device;

(B) Degassers, desilters, and desanders;

(C) A mechanical, electrical, or manual surface drilling fluid temperature monitoring device. The temperature of the drilling fluid going into and coming out of the hole shall be monitored, read, and recorded on the driller's or mud log for a minimum of every 30 feet of hole drilled below the conductor casing; and

(D) A hydrogen sulfide indicator and alarm shall be installed in areas suspected or known to contain hydrogen sulfide gas which may reach levels considered to be dangerous to the health and safety of personnel in the area.

(8) Well-head Equipment and Testing:

(a) Completions. All wellhead connections shall be fluid pressure tested to the API or ASA working pressure rating. Cold water is recommended as the testing fluid. Welding of wellhead connections shall be performed by a certified welder using materials in conformance with ASTM specifications.

(b) Well-head Equipment. All completed wells shall be equipped with a minimum of one casinghead with side outlets, one master valve and one production valve, unless otherwise authorized by the State Geologist. All casingheads, christmas trees, fittings, and connections shall have a temperature derated working pressure equal to or greater than the surface shut-in pressure of the well at reservoir temperature. Packing, sealing mediums, and lubricants shall consist of materials or substances that function effectively at, and are resistant to, high temperatures. Wellhead equipment, valves, flanges, and fittings shall meet minimum ASA standards or minimum API Standard 6A specifications. Casinghead connections shall be made such that fluid can be pumped between casing strings.

(9) Supervision. From the time drilling operations are initiated and until the well is completed or abandoned, a member of the drilling crew or the toolpusher shall monitor the rig floor at all times for surveillance purposes, unless the well is secured with blow-out preventers or cement plugs.

Stat. Auth.: ORS Ch. 522
Hist: GMI 8, f. & ef. 11-17-76; GMI 4-1980, f. & ef. 10-2-80

Blow-Out Prevention Rules for Prospect Wells

632-20-180 All prospect wells drilled below a depth of 500 feet shall have adequate casing and well-head controls installed, unless otherwise approved by the State Geologist. The casing shall extend from the surface to at least 10% of the proposed total depth of the well, and be cemented back to the surface. Well-head controls shall consist of an annular preventer or double ram preventer or pipe rams and gate valve. Controls may be manual or hydraulic.

(1) If hot water or flowing steam at 65° C. (150° F.) or greater is encountered, further drilling shall stop immediately, the operator shall notify the State Geologist, and the hole will be either:

(a) Completed as an observation hole using steel tubing cemented from total depth to surface; or

(b) Abandoned by plugging with cement from total depth to surface; or

(c) Deepened only after a review of the adequacy of well-head control equipment and permission of the State Geologist. If the prospect well is deepened as described in this section, it shall be completed as described in (a) and (b) above.

(2) If cold flowing artesian water is encountered, the hole will be completed as in (1)(a) or (1)(b) hereinabove, except that plastic tubing may be used.

(3) Locations proposed in natural thermal areas within a 1,000 foot radius of hot springs, fumaroles, or other surface geothermal indicators, or in areas of known artesian water flow, will require a detailed drilling program for each hole, approved by the State Geologist. The State Geologist may require special drilling and completion techniques for such holes (such as cemented surface casing and simple expansion type blow-out preventers) to safely control formations containing geothermal or other resources which may be penetrated.

(4) A supply of mud and lost circulation material shall be kept on hand while drilling to control abnormal pressure if rotary equipment is used.

Stat. Auth.: ORS Ch. 522
Hist: GMI 8, f. & ef. 11-17-76; GMI 4-1980, f. & ef. 10-2-80; GMI 1-1983, f. & ef. 9-30-83

MEMORANDUM OF UNDERSTANDING

Between

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

And

BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF INTERIOR

This is an intergovernmental cooperative agreement for general management of mineral resources between the State of Oregon, acting by and through the Department of Geology and Mineral Industries, hereinafter termed "DOGAMI", and the United States of America, acting by and through the Bureau of Land Management (Oregon State Office) of the Department of Interior, hereinafter termed "BLM". This agreement supersedes and replaces any existing agreement.

RECITALS

1. DOGAMI administers:

   a. The Reclamation of Mining Lands Act (ORS Chapter 517.750 et. seq.), and OAR Chapter 30 and 35 which are intended to allow the mining of valuable minerals in a manner consistent with the protection, reclamation, and subsequent benefical use of the land so mined, and
   b. Statutes and rules relating to Geothermal Resources (ORS 522 and OAR 632 Chapter 20) and Conservation of Gas and Oil (ORS 520 and OAR 623 Chapter 10) which are intended to permit the exploration and development of these resources in a manner consistent with protection of public interests including health, safety, environmental protection, correlative rights, and subsequent reclamation and beneficial use of lands.

2. Pursuant to various Federal statutes, the Oregon/Washington BLM administers applicable Federal Regulations under 43 CFR Groups 3045, 3100, 3200, 3400, 3500, 3600, and 3800. These statutes include:

   a. Federal Land Policy and Management Act of 1976, Public Law 94-579.
   b. Intergovernmental Cooperation Act, Public Law 90-577.
   c. Federal Oil and Gas Royalty Management Act of 1982.
   d. National Materials and Minerals Policy, Research and Development Act of 1980, Public Law 96-479.
   e. National Environmental Policy Act, Public Law 91-90, and Executive Order 11752 of December 17, 1973.
   f. General Mining Law of 1872, 17 Stat 91, as amended.
   g. Mineral Leasing Act of 1920, 41 Stat 437, as amended.
   h. Materials Act of 1947, 61 Stat 681, as amended.
   i. Acquired Lands Act of 1947, 61 Stat 913, as amended.
   j. Geothermal Steam Act of 1970, 84 Stat 1566, as amended.

k. The Surface Mining Control and Reclamation Act of 1977, 30 USC 1201.
l. Resource Conservation and Recovery Act, Public Law 94-580.
m. Comprehensive Environmental Resource, Compensation, and Liability Act of 1980, Public Law 95-510.

3. DOGAMI has responsibility to permit and inspect surface mineral exploration, development and production operations on lands in the State. To minimize duplication on Federal lands, DOGAMI can, at its option, cooperate with BLM, in conjunction with other Federal surface management agencies, in the regulation of activities consistent with DOGAMI's authorities, policies and requirements.

4. The BLM has the responsibility to permit and inspect all exploration, development, and production operations including utilization of resources where a lessee or operator is conducting activities to recover Federal oil and gas geothermal steam and associated geothermal resources, or solid locatable, leasable and saleable minerals on Federal lands.

5. DOGAMI and BLM desire:

a) To avoid duplication of regulations, inspections, and approval of reclamation plans; to minimize repetitive costs to miner/operators, the public, and both Governments; to provide for an efficient, centralized regulatory program to serve the needs of both DOGAMI and BLM; to insure proper protection and reclamation of lands located in the State of Oregon; and to achieve uniformity and consistency in enforcement actions.

b) To provide a system whereby DOGAMI and BLM identify, communicate, and coordinate actions upon issues of common concern in the management of Federally owned geological and mineral resources and thereby achieve maximum effectiveness in the use of funds and personnel.

c) To provide a means for regular communications and a framework for effective cooperation between the DOGAMI and the BLM in planning for and management of the Federal mineral estate and significant geological and mineral resources.

d) To cooperate on specific areas or projects through agreements between the BLM and appropriate State agencies, commissions or entities either as supplements to this agreement or as separate agreements.

e) To provide for State-Federal cooperation in the administration of mineral resource management programs as may be specifically determined at any time.

f) To assure that statutes, regulations and major policies related to geological and mineral resource management

administered by BLM and DOGAMI are transmitted to each other.

g) To ensure communication and coordination on issues of mutual concern and to provide for regular exchanges of information on matters related to geological and mineral resources on a timely, continuing, and professional basis.

h) To exchange information related to permit applications in order to meet requirements under The Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for management of hazardous materials.

GENERAL AGREEMENTS

The BLM State Director or designated representative, and the State Geologist (DOGAMI) or designated representative, mutually agree to meet on a quarterly basis. The responsibilities for holding these meetings will alternate between the State Director and the State Geologist, who will co-chair each meeting. Purposes of the meetings shall be:

1. Provide each other with information regarding key personnel, location, telephone number, laws, or funding which affect the administration of this agreement.

2. Develop and maintain a coordination program in which each party will notify the other of proposed plans or actions that might impact the other party.

3. To provide for the exchange at no cost of non-proprietary and non-confidential geological and mineral data, except in circumstances where a separate agreement is negotiated to provide services or studies that involve more than nominal expense. The mechanism shall be mutual placing of the BLM State Office and DOGAMI Portland Office on complimentary mailing lists for all appropriate publications.

4. Advise each other of current and proposed geological or mineral research, studies or investigations.

5. Cooperate in providing each other with adequate notice and opportunity to comment upon and participate in the formulation of plans, programs, and regulations relating to the management of geological and mineral resources.

6. Explore ways to enhance the sharing of mineral data by investigating acceptable ways to share and protect proprietary and confidential information within the constraints of each agency's security requirements, and consistent with applicable laws and regulations.

7. Facilitate solutions to issues where there is disagreement between subordinate personnel on geological or mineral issues.

8. Advise each other on policies, statutes, standards, rules and regulations that affect the BLM administered mineral estate.

9. Solicit the other party's participation in the work of appropriate councils, commissions, and advisory groups concerned with geological and mineral resources.

10. Notify each other of mineral resource assessment needs and to design programs to take maximum advantage of the knowledge, skills, and abilities of both organizations through appropriate cooperative agreements such as through the use of the Intergovernmental Cooperative Act, PL 90-577.

11. Carry out these agreements in a manner consistent with the schedules and operating procedures of both agencies.

REGULATORY AGREEMENTS

The BLM and DOGAMI mutually agree to cooperate in the regulation of mineral exploration, development and production activities under applicable State and Federal laws. This will be done to achieve the objectives stated in Recital No. 5.

With regard to all mineral operations:

1) Appoint specific individuals to function as key contact to facilitate communication and coordination for implementing inspections on Federal land. During related emergencies, if officials of either agency are unavailable, officials of the other Agency shall take such action as is necessary to prevent pollution, or damage to persons, natural resources, or property. In these cases, the other agency shall be notified as soon as possible.

2) Exchange non-confidential information regarding site and drilling plans, well permits, exploration, and production plans.

3) Notify each other within 30 days of any approved permits.

With regard to oil, gas, and geothermal (fluid mineral) regulation, BLM and DOGAMI will coordinate bond requirements as follows:

a) For prospect and geothermal wells on Federal land, BLM agrees not to release bonds on those wells for which the DOGAMI has agreed to recognize the Federal bond until DOGAMI agrees in writing that obligations of the operator under the bond have been fulfilled.

b) BLM will notify the operator that prior to release of any bond, DOGAMI will be afforded an opportunity to review and/or comment on the suitability of site reclamation.

c) For oil and gas wells on Federal land, joint bonding will be implemented as soon as DOGAMI has authority for such agreements under ORS 520 or OAR 632-10-205.

With regard to surface mining and the surface impacts of underground mining on public lands for solid minerals, BLM and DOGAMI will regulate on a cooperative basis, except DOGAMI will not regulate sites excluded by ORS 517.750 et seq., (including mining in the beds or banks of any waters in the State; construction, reconstruction, or maintenance of access or onsite roads; subsurface impacts of underground mines; or surface mining operations which involve less than 5,000 cubic yards total material and less than one acre of ground disturbance during any consecutive twelve month period;) or BLM "Community Pits".

In addition:

1) Upon receipt, BLM shall immediately send DOGAMI copies of non-proprietary/confidential portions of notices, plans, intent to operate, reclamation plans, environmental assessments, operating (mine) plans, permits, bonds, other financial arrangements in lieu of bonds, and other relevant documents including inspection reports concerning mining or surface effects of such activities on the public lands. These documents shall be sent to the Supervisor, Mined Land Reclamation Program, Oregon Department of Geology and Mineral Industries, 1129 S. E. Santiam Road, Albany, Oregon 97321 (503) 967-2039.

2) BLM shall provide an indication if a proposed operation, other than a community pit, is forecasted to be large enough within 12 months to exceed 5,000 yards or over one acre of disturbance.

3) DOGAMI shall provide verbal or written comment within 14 days of receipt by BLM of a mining notice submitted under 43 CFR 3809, unless it is deemed no comments are warrented. For other actions listed in item 1, above except for notices under 43 CFR 3809, DOGAMI shall provide written comment within 20 days of receipt of these documents, unless field conditions preclude inspection or it is deemed that no comments are warrented.

4) Similarily, for any proposed site on or adjacent to BLM administered lands whose operator has applied for a permit under the provisions of ORS 715.750 et. seq., or expansion of a site requiring review, DOGAMI shall provide BLM with a complete set of documents as provided to other authorized reviewing agencies. BLM shall provide written response within 21 days of dispatch of these documents, unless no comments are warrented.

5) For Federal leased sites, BLM will provide DOGAMI with copies of site specific inspection plans as they are developed to ensure consistency of enforcement actions on adjacent lands.

6) Until recxlamation on site is completed, DOGAMI shall provide BLM with copies of inspection reports, permits, security documents,

correspondence relating to security adjustments, notices of non-compliance, closure orders, notices of abandonment, and other significant non-confidential documentation relative to each site on BLM administered lands.

7. Maximum effort shall be made by both agencies to avoid duplicate bonding or conflicting requirements:

a) Performance bonds or equivalent security will be obtained from an operator/applicant by the State prior to issuance of a state surface mining permit in accordance with the provisions of ORS 517.810 and BLM Instruction Memorandum No. 83-796, August 23, 1983. When the BLM requires a reclamation performance bond or equivalent security, such that it is adequate to meet State needs, the State will accept a rider or equivalent control upon the security in order to relieve the operator from posting two securities for the same operation. Final release of the mutual accepted bond will require written action by both agencies.

b) BLM will advise DOGAMI when it intends to release a mutually agreed to bond 20 days prior to the release. DOGAMI has the opportunity to make an inspection within that 20 day period, and if the reclamation has not been satisfactorily completed, DOGAMI will so indicate to BLM in writing and the bond will not be released. Deficiencies will be corrected or completed under BLM direction. If the reclamation is found satisfactory, DOGAMI will so indicate in writing and the bond can be released.

c) DOGAMI will seek similar recommendation from BLM prior to release of any state bond involving a site which BLM has a surface mine regulatory interest.

With regard to mineral development on Federal lands:

1) BLM and DOGAMI shall coordinate efforts at reclamation and permitting in a manner which seeks to avoid contradictory requirements.

2) Field personnel of BLM and the State will cooperate with each other, the operator, and personnel of other agencies in achieving effective management and the reclamation of disturbed areas.

3) BLM will notify each applicant that they must comply with applicable State requirements and permits. BLM, however, will not enforce permit requirements of other agencies.

4) Each agency will strive to inform the other of the general nature

and type of mineral activity occuring on lands under their respective jurisdiction statewide in order to maintain an accurate accounting of mineral development activity.

5) BLM shall notify DOGAMI of any regulatory activity on Federal lands with respect to mineral production which contemplates integration, unitization, or any other coordinated management that has a bearing on correlative rights. Likewise, DOGAMI shall notify BLM of any such developments within the scope of State regulatory activities if Federal lands or resources are involved.

LIMITATIONS

Nothing in this Memorandum of Understanding shall be construed as limiting or modifying in any way the authority, statutory, or regulatory responsibilities of the State or the BLM, or binding either the State of Oregon or the Department of the Interior to perform beyond their respective authorities, or requiring either party to assume or expend any sum in excess of available appropriations. Each and every provision of this agreement is subject to the laws of the State of Oregon, the laws of the United States, and the regulations promulgated pursuant to these statues by government.

EFFECTIVE DATE

This Memorandum of Understanding shall become effective upon signature by the State Geologist of Oregon and the BLM Oregon State Director, and will remain in force, unless formally terminated by either of the signatories after thirty (30) days written notice to the other of intention to do so.

This Agreement shall terminate on July 1, 1990, unless extended by mutual agreement.

AMENDMENTS

Amendments to this agreement may be proposed at any time by any of the signatories, and shall become effective upon approval by all.

STATE OF OREGON:

By _____
State Geologist

3/25/85
Date

BUREAU OF LAND MANAGEMENT:

BY _____
State Director

3/15/85
Date

MEMORANDUM OF UNDERSTANDING

Between

OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

And

BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF INTERIOR

This is an intergovernmental cooperative agreement for general management of mineral resources between the State of Oregon, acting by and through the Department of Geology and Mineral Industries, hereinafter termed "DOGAMI", and the United States of America, acting by and through the Bureau of Land Management (Oregon State Office) of the Department of Interior, hereinafter termed "BLM". This agreement supersedes and replaces any existing agreement.

RECITALS

1. DOGAMI administers:

   a. The Reclamation of Mining Lands Act (ORS Chapter 517.750 et. seq.), and OAR Chapter 30 and 35 which are intended to allow the mining of valuable minerals in a manner consistent with the protection, reclamation, and subsequent benefical use of the land so mined, and
   b. Statutes and rules relating to Geothermal Resources (ORS 522 and OAR 632 Chapter 20) and Conservation of Gas and Oil (ORS 520 and OAR 623 Chapter 10) which are intended to permit the exploration and development of these resources in a manner consistent with protection of public interests including health, safety, environmental protection, correlative rights, and subsequent reclamation and beneficial use of lands.

2. Pursuant to various Federal statutes, the Oregon/Washington BLM administers applicable Federal Regulations under 43 CFR Groups 3045, 3100, 3200, 3400, 3500, 3600, and 3800. These statutes include:

   a. Federal Land Policy and Management Act of 1976, Public Law 94-579.
   b. Intergovernmental Cooperation Act, Public Law 90-577.
   c. Federal Oil and Gas Royalty Management Act of 1982.
   d. National Materials and Minerals Policy, Research and Development Act of 1980, Public Law 96-479.
   e. National Environmental Policy Act, Public Law 91-90, and Executive Order 11752 of December 17, 1973.
   f. General Mining Law of 1872, 17 Stat 91, as amended.
   g. Mineral Leasing Act of 1920, 41 Stat 437, as amended.
   h. Materials Act of 1947, 61 Stat 681, as amended.
   i. Acquired Lands Act of 1947, 61 Stat 913, as amended.
   j. Geothermal Steam Act of 1970, 84 Stat 1566, as amended.

k. The Surface Mining Control and Reclamation Act of 1977, 30 USC 1201.
l. Resource Conservation and Recovery Act, Public Law 94-580.
m. Comprehensive Environmental Resource, Compensation, and Liability Act of 1980, Public Law 95-510.

3. DOGAMI has responsibility to permit and inspect surface mineral exploration, development and production operations on lands in the State. To minimize duplication on Federal lands, DOGAMI can, at its option, cooperate with BLM, in conjunction with other Federal surface management agencies, in the regulation of activities consistent with DOGAMI's authorities, policies and requirements.

4. The BLM has the responsibility to permit and inspect all exploration, development, and production operations including utilization of resources where a lessee or operator is conducting activities to recover Federal oil and gas geothermal steam and associated geothermal resources, or solid locatable, leasable and saleable minerals on Federal lands.

5. DOGAMI and BLM desire:

a) To avoid duplication of regulations, inspections, and approval of reclamation plans; to minimize repetitive costs to miner/operators, the public, and both Governments; to provide for an efficient, centralized regulatory program to serve the needs of both DOGAMI and BLM; to insure proper protection and reclamation of lands located in the State of Oregon; and to achieve uniformity and consistency in enforcement actions.

b) To provide a system whereby DOGAMI and BLM identify, communicate, and coordinate actions upon issues of common concern in the management of Federally owned geological and mineral resources and thereby achieve maximum effectiveness in the use of funds and personnel.

c) To provide a means for regular communications and a framework for effective cooperation between the DOGAMI and the BLM in planning for and management of the Federal mineral estate and significant geological and mineral resources.

d) To cooperate on specific areas or projects through agreements between the BLM and appropriate State agencies, commissions or entities either as supplements to this agreement or as separate agreements.

e) To provide for State-Federal cooperation in the administration of mineral resource management programs as may be specifically determined at any time.

f) To assure that statutes, regulations and major policies related to geological and mineral resource management

administered by BLM and DOGAMI are transmitted to each other.

g) To ensure communication and coordination on issues of mutual concern and to provide for regular exchanges of information on matters related to geological and mineral resources on a timely, continuing, and professional basis.

h) To exchange information related to permit applications in order to meet requirements under The Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for management of hazardous materials.

GENERAL AGREEMENTS

The BLM State Director or designated representative, and the State Geologist (DOGAMI) or designated representative, mutually agree to meet on a quarterly basis. The responsibilities for holding these meetings will alternate between the State Director and the State Geologist, who will co-chair each meeting. Purposes of the meetings shall be:

1. Provide each other with information regarding key personnel, location, telephone number, laws, or funding which affect the administration of this agreement.

2. Develop and maintain a coordination program in which each party will notify the other of proposed plans or actions that might impact the other party.

3. To provide for the exchange at no cost of non-proprietary and non-confidential geological and mineral data, except in circumstances where a separate agreement is negotiated to provide services or studies that involve more than nominal expense. The mechanism shall be mutual placing of the BLM State Office and DOGAMI Portland Office on complimentary mailing lists for all appropriate publications.

4. Advise each other of current and proposed geological or mineral research, studies or investigations.

5. Cooperate in providing each other with adequate notice and opportunity to comment upon and participate in the formulation of plans, programs, and regulations relating to the management of geological and mineral resources.

6. Explore ways to enhance the sharing of mineral data by investigating acceptable ways to share and protect proprietary and confidential information within the constraints of each agency's security requirements, and consistent with applicable laws and regulations.

7. Facilitate solutions to issues where there is disagreement between subordinate personnel on geological or mineral issues.

8. Advise each other on policies, statutes, standards, rules and regulations that affect the BLM administered mineral estate.

9. Solicit the other party's participation in the work of appropriate councils, commissions, and advisory groups concerned with geological and mineral resources.

10. Notify each other of mineral resource assessment needs and to design programs to take maximum advantage of the knowledge, skills, and abilities of both organizations through appropriate cooperative agreements such as through the use of the Intergovernmental Cooperative Act, PL 90-577.

11. Carry out these agreements in a manner consistent with the schedules and operating procedures of both agencies.

REGULATORY AGREEMENTS

The BLM and DOGAMI mutually agree to cooperate in the regulation of mineral exploration, development and production activities under applicable State and Federal laws. This will be done to achieve the objectives stated in Recital No. 5.

With regard to all mineral operations:

1) Appoint specific individuals to function as key contact to facilitate communication and coordination for implementing inspections on Federal land. During related emergencies, if officials of either agency are unavailable, officials of the other Agency shall take such action as is necessary to prevent pollution, or damage to persons, natural resources, or property. In these cases, the other agency shall be notified as soon as possible.

2) Exchange non-confidential information regarding site and drilling plans, well permits, exploration, and production plans.

3) Notify each other within 30 days of any approved permits.

With regard to oil, gas, and geothermal (fluid mineral) regulation, BLM and DOGAMI will coordinate bond requirements as follows:

a) For prospect and geothermal wells on Federal land, BLM agrees not to release bonds on those wells for which the DOGAMI has agreed to recognize the Federal bond until DOGAMI agrees in writing that obligations of the operator under the bond have been fulfilled.

b) BLM will notify the operator that prior to release of any bond, DOGAMI will be afforded an opportunity to review and/or comment on the suitability of site reclamation.

c) For oil and gas wells on Federal land, joint bonding will be implemented as soon as DOGAMI has authority for such agreements under ORS 520 or OAR 632-10-205.

With regard to surface mining and the surface impacts of underground mining on public lands for solid minerals, BLM and DOGAMI will regulate on a cooperative basis, except DOGAMI will not regulate sites excluded by ORS 517.750 et seq., (including mining in the beds or banks of any waters in the State; construction, reconstruction, or maintenance of access or onsite roads; subsurface impacts of underground mines; or surface mining operations which involve less than 5,000 cubic yards total material and less than one acre of ground disturbance during any consecutive twelve month period;) or BLM "Community Pits".

In addition:

1) Upon receipt, BLM shall immediately send DOGAMI copies of non-proprietary/confidential portions of notices, plans, intent to operate, reclamation plans, environmental assessments, operating (mine) plans, permits, bonds, other financial arrangements in lieu of bonds, and other relevant documents including inspection reports concerning mining or surface effects of such activities on the public lands. These documents shall be sent to the Supervisor, Mined Land Reclamation Program, Oregon Department of Geology and Mineral Industries, 1129 S. E. Santiam Road, Albany, Oregon 97321 (503) 967-2039.

2) BLM shall provide an indication if a proposed operation, other than a community pit, is forecasted to be large enough within 12 months to exceed 5,000 yards or over one acre of disturbance.

3) DOGAMI shall provide verbal or written comment within 14 days of receipt by BLM of a mining notice submitted under 43 CFR 3809, unless it is deemed no comments are warrented. For other actions listed in item 1, above except for notices under 43 CFR 3809, DOGAMI shall provide written comment within 20 days of receipt of these documents, unless field conditions preclude inspection or it is deemed that no comments are warrented.

4) Similarily, for any proposed site on or adjacent to BLM administered lands whose operator has applied for a permit under the provisions of ORS 715.750 et. seq., or expansion of a site requiring review, DOGAMI shall provide BLM with a complete set of documents as provided to other authorized reviewing agencies. BLM shall provide written response within 21 days of dispatch of these documents, unless no comments are warrented.

5) For Federal leased sites, BLM will provide DOGAMI with copies of site specific inspection plans as they are developed to ensure consistency of enforcement actions on adjacent lands.

6) Until recxlamation on site is completed, DOGAMI shall provide BLM with copies of inspection reports, permits, security documents,

correspondence relating to security adjustments, notices of non-compliance, closure orders, notices of abandonment, and other significant non-confidential documentation relative to each site on BLM administered lands.

7. Maximum effort shall be made by both agencies to avoid duplicate bonding or conflicting requirements:

a) Performance bonds or equivalent security will be obtained from an operator/applicant by the State prior to issuance of a state surface mining permit in accordance with the provisions of ORS 517.810 and BLM Instruction Memorandum No. 83-796, August 23, 1983. When the BLM requires a reclamation performance bond or equivalent security, such that it is adequate to meet State needs, the State will accept a rider or equivalent control upon the security in order to relieve the operator from posting two securities for the same operation. Final release of the mutual accepted bond will require written action by both agencies.

b) BLM will advise DOGAMI when it intends to release a mutually agreed to bond 20 days prior to the release. DOGAMI has the opportunity to make an inspection within that 20 day period, and if the reclamation has not been satisfactorily completed, DOGAMI will so indicate to BLM in writing and the bond will not be released. Deficiencies will be corrected or completed under BLM direction. If the reclamation is found satisfactory, DOGAMI will so indicate in writing and the bond can be released.

c) DOGAMI will seek similar recommendation from BLM prior to release of any state bond involving a site which BLM has a surface mine regulatory interest.

With regard to mineral development on Federal lands:

1) BLM and DOGAMI shall coordinate efforts at reclamation and permitting in a manner which seeks to avoid contradictory requirements.

2) Field personnel of BLM and the State will cooperate with each other, the operator, and personnel of other agencies in achieving effective management and the reclamation of disturbed areas.

3) BLM will notify each applicant that they must comply with applicable State requirements and permits. BLM, however, will not enforce permit requirements of other agencies.

4) Each agency will strive to inform the other of the general nature

and type of mineral activity occuring on lands under their respective jurisdiction statewide in order to maintain an accurate accounting of mineral development activity.

5) BLM shall notify DOGAMI of any regulatory activity on Federal lands with respect to mineral production which contemplates integration, unitization, or any other coordinated management that has a bearing on correlative rights. Likewise, DOGAMI shall notify BLM of any such developments within the scope of State regulatory activities if Federal lands or resources are involved.

LIMITATIONS

Nothing in this Memorandum of Understanding shall be construed as limiting or modifying in any way the authority, statutory, or regulatory responsibilities of the State or the BLM, or binding either the State of Oregon or the Department of the Interior to perform beyond their respective authorities, or requiring either party to assume or expend any sum in excess of available appropriations. Each and every provision of this agreement is subject to the laws of the State of Oregon, the laws of the United States, and the regulations promulgated pursuant to these statues by government.

EFFECTIVE DATE

This Memorandum of Understanding shall become effective upon signature by the State Geologist of Oregon and the BLM Oregon State Director, and will remain in force, unless formally terminated by either of the signatories after thirty (30) days written notice to the other of intention to do so.

This Agreement shall terminate on July 1, 1990, unless extended by mutual agreement.

AMENDMENTS

Amendments to this agreement may be proposed at any time by any of the signatories, and shall become effective upon approval by all.

STATE OF OREGON:

By _____
State Geologist

3/25/85
Date

BUREAU OF LAND MANAGEMENT:

BY _____
State Director

3/15/85
Date

VICTOR ATIYEH
GOVERNOR

Water Resources Department
MILL CREEK OFFICE PARK
555 13th STREET N.E., SALEM, OREGON 97310
PHONE 378-8508

May 28, 1985

California Energy Co., Inc.
for U.S. Winema National Forest
3333 Mendocino Avenue
Santa Rosa, CA 95401

REFERENCE: Files 68036, 68037, 68038 and 68039

We have received and accepted your Notices of Beginning of Construction of Permits 48464, 48465, 48466 and 48467.

At the time of proof we may allow the use of water at a different location other than described by the permit provided an enlargement of the right does not occur.

If you have any questions, please feel free to call me.

Sincerely,

Stephen C. Brown
Senior Water Rights Examiner

SCB:jvm

May 24, 1985

State of Oregon
Department of Water Resources
555 NE 13th Street
Salem, Oregon 97310

Att'n: Mr. Steve Brown
Senior Water Rights Examiner

RE: Permits to Appropriate Surface Water--Notice of Beginning of Construction

Gentlemen:

California Energy Company applied for Permits to Appropriate Surface Water in March of 1984 in connection with a planned geothermal exploration drilling project in the Winema National Forest. The Oregon DWR issued the following permits on June 15, 1985.

Application No.	Permit No.
68036	48464
68037	48465
68038	48466
68039	48467

Following preparation of a comprehensive environmental study of the proposed project, the U.S. Bureau of Land Management (BLM) and Winema National Forest approved a modified Plan of Exploration for this project on February 28, 1985. California Energy Company is now prepared to commence this exploration project, and the permitted use of water. A permit to drill has been issued by BLM and permit applications are being processed by the Oregon Department of Geology and Mineral Industries.

Submitted herewith are Notice of Beginning of Construction forms for these permits. As stated in our applications, water withdrawals will be made by pumping to a water truck (truck-mounted pump) and hauling to the drill sites. No damming or physical modification to the diversion points will be necessary in order to withdraw water. As noted in the attached letter from Longyear, water trucks/pumps are to be supplied under the terms of the solicitation for bid to drilling contractors. A showing of "beginning of construction" is established by these permitting and contractual actions evidencing the initiation of operations required under the permits.

Please add to permit 48467 a new alternative site for Place of Use, as follows:

Township 31 South, Range 7 1/2 East, WM Section 10 SE 1/4 SW 1/4 Geothermal Exploration drilling MZI-11A. Enclosed is copy of a portion of the map submitted with our original applications, with the MZI-11A site added.

Additional or clarifying information, if need, will be gladly provided.

Very truly yours,

Anna K. Carter
Administrative Manager
Permits and Reports

AKC:42

Enclosures

Form A (690—9-77)

Application No. 69036

NOTICE OF BEGINNING OF CONSTRUCTION

I, California Energy Company, Inc., the holder of Permit No. 48464

to appropriate the public waters of the state of Oregon, began the actual construction of the works described therein on the 15th day of May, 19 85

Remarks: Obtained U.S. Bureau of Land Management and Oregon Department of Geology and Mineral Industries permits. Obtained confirmation that water truck with tank and pumps included as part of drilling contract (May 15, 1985).

The appropriator must state the manner of beginning of construction, the amount of work completed and the type of equipment acquired for the water system up to the date of this statement, and any additional information which shows a substantial beginning of construction as authorized by your permit.

IN WITNESS WHEREOF, I have hereunto set my hand this 24th day of May, 19 85

James L. Moore
(Signature of Applicant)

3333 Mendocino Avenue, Suite 100
Santa Rosa, CA 95401
(Address)

Fill out, detach and mail to the Water Resources Department, Salem, OR 97310, when construction work is begun.

SP*35567-690

Form A (690—9-77)

Application No. 68037

NOTICE OF BEGINNING OF CONSTRUCTION

I, California Energy Company, Inc., the holder of Permit No. 48465

to appropriate the public waters of the state of Oregon, began the actual construction of the works described therein on the 15th day of May, 19 85

Remarks: Obtained U.S. Bureau of Land Management and Oregon Department of Geology and Mineral Industries permits. Obtained confirmation that water truck with tank and pumps included as part of drilling contract (May 15, 1985).

The appropriator must state the manner of beginning of construction, the amount of work completed and the type of equipment acquired for the water system up to the date of this statement, and any additional information which shows a substantial beginning of construction as authorized by your permit.

IN WITNESS WHEREOF, I have hereunto set my hand this 24th day of May, 19 85

James L. Moore
(Signature of Applicant)

3333 Mendocino Avenue, Suite 100
Santa Rosa, CA 95401
(Address)

Fill out, detach and mail to the Water Resources Department, Salem, OR 97310, when construction work is begun.

SP*35567-690

Form A (690—9-77) Application No. 68038

NOTICE OF BEGINNING OF CONSTRUCTION

I, California Energy Company, Inc., the holder of Permit No. 48466

to appropriate the public waters of the state of Oregon, began the actual construction of the works described therein on the 15th day of May, 19 85

Remarks: Obtained U.S. Bureau of Land Management and Oregon Department of Geology and Mineral Industries permits. Obtained confirmation that water truck with tank and pumps included as part of drilling contract (May 15, 1985).

The appropriator must state the manner of beginning of construction, the amount of work completed and the type of equipment acquired for the water system up to the date of this statement, and any additional information which shows a substantial beginning of construction as authorized by your permit.

IN WITNESS WHEREOF, I have hereunto set my hand this 24th day of May, 19 85

James L. Moore
(Signature of Applicant)

3333 Mendocino Avenue, Suite 100
Santa Rosa, CA 95401
(Address)

Fill out, detach and mail to the Water Resources Department, Salem, OR 97310, when construction work is begun.

SP*35567-690

Form A (690—9-77) Application No. 68039

NOTICE OF BEGINNING OF CONSTRUCTION

I, California Energy Company, Inc., the holder of Permit No. 48467

to appropriate the public waters of the state of Oregon, began the actual construction of the works described therein on the 15th day of May, 19 85

Remarks: Obtained U.S. Bureau of Land Management and Oregon Department of Geology and Mineral Industries permits. Obtained confirmation that water truck with tank and pumps included as part of drilling contract (May 15, 1985).

The appropriator must state the manner of beginning of construction, the amount of work completed and the type of equipment acquired for the water system up to the date of this statement, and any additional information which shows a substantial beginning of construction as authorized by your permit.

IN WITNESS WHEREOF, I have hereunto set my hand this 24th day of May, 19 85

James L. Moore
(Signature of Applicant)

3333 Mendocino Avenue, Suite 100
Santa Rosa, CA 95401
(Address)

Fill out, detach and mail to the Water Resources Department, Salem, OR 97310, when construction work is begun.

SP*35567-690

Longyear Company
13875 Mt. McClellan Street
Reno, NV 89506

Telephone: (702) 972-0296
Telex: 354-494

May 15, 1985

Mr. Robert Pryde, Vice President
California Energy Company
3333 Mendocino Avenue
Santa Rosa, California 95401

In reference to the footage bid of 4,000 ft. core holes at MAZMA #1 & #2, geothermal units Winema National Forest, Klamath Falls, Oregon.

Dear Bob,

The following proposal for water hauling for California Energy:

For the water truck. It holds 2800 gallons of water, tank is enclosed so no overspil of water.

Motor size, 318
Has spray bar
Muffler is McDonald type
Spark arrester
Exhaust is the side of the cab.
Pump size is a 2½" Honda with a fine mesh screen on the 30' suction hose.
Truck has a fire extingusher, shovel and fire ax.

Tariff rates are in the footage price plus mileage.

Thanks for the opportunity to bid on this project.

Sincerely,

LONGYEAR COMPANY

Manager, Nevada Western Zone
Contract Drilling Division

GDS:es

Longyear

Longyear Company
13875 Mt. McClellan Street
Reno, NV 89506

Telephone: (702) 972-0296
Telex: 354-494

May 15, 1985

Mr. Robert Pryde, Vice President
California Energy Company
3333 Mendocino Avenue
Santa Rosa, California 95401

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The following proposal for water hauling for California Energy:

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Tariff rates are in the footage price plus mileage.

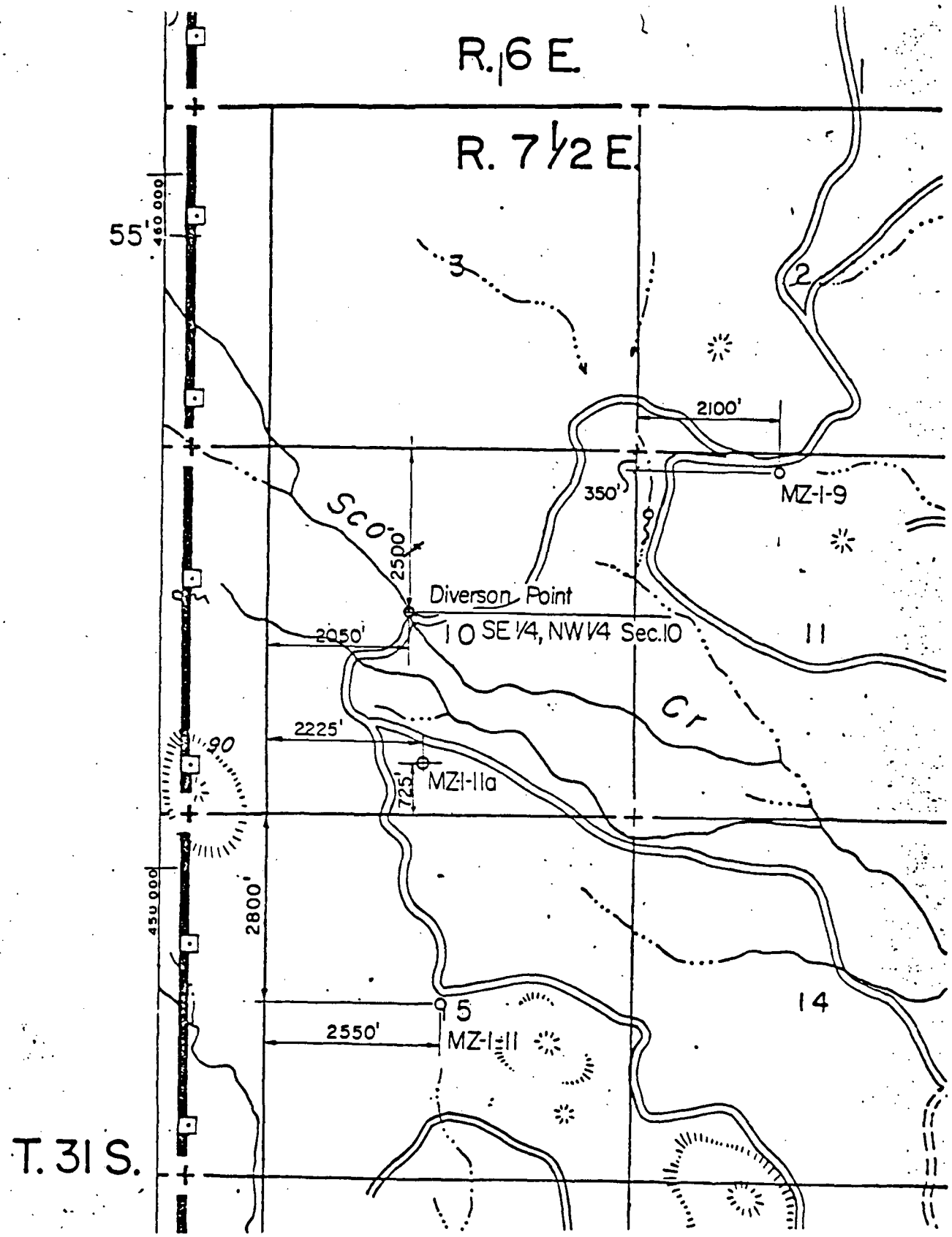
Thanks for the opportunity to bid on this project.

Sincerely,

LONGYEAR COMPANY

Manager, Nevada Western Zone
Contract Drilling Division

GDS:es



48467

CALIFORNIA ENERGY CO.
MAZAMA I UNIT WATER SITE
Date 5/85

MZI-11A

STATE OF OREGON

County of KLAMATH

PERMIT TO APPROPRIATE THE PUBLIC WATERS

This is to certify that I have examined APPLICATION 68039 and do hereby grant the same SUBJECT TO EXISTING RIGHTS INCLUDING THE APPROPRIATE MINIMUM FLOW POLICIES ESTABLISHED BY THE WATER POLICY REVIEW BOARD and the following limitations and conditions:

This permit is issued to California Energy Company, Inc., for the United States, Winema National Forest) of 3333 Mendocino, Avenue, Suite 100, Santa Rosa, California 95401, phone (707)526-1000, for the use of the waters of Scott Creek, a tributary of Klamath* for the PURPOSE of for geothermal exploration drilling

that the PRIORITY OF THE RIGHT dates from March 28, 1984

and is limited to the amount of water which can be applied to beneficial use and shall not exceed 20,000 gallons per day

The POINT OF DIVERSION is to be LOCATED: Diversion 1 - 2500 feet South and 2050 feet East from the Northwest Corner of Section 10, being within the SE 1/4 NW 1/4 of Section 10, Township 31 South, Range 7 1/2 East; Diversion 2 - 2575 feet North and 1700 feet West from the Southeast Corner of Section 18, being within the NW 1/4 SE 1/4 of Section 18, Township 31 South, Range 7 East, WM, both in the County of Klamath.

A description of the PLACE OF USE under the permit, and to which such right is appurtenant, is as follows:

* Marsh,

Township 30 South, Range 7 East, WM	Section 33 SE 1/4 NE 1/4	Geothermal Exploration drilling MZI-7
Township 31 South, Range 7 East, WM	Section 6 SW 1/4 NE 1/4	Geothermal Exploration drilling MZI-8
	Section 18 SW 1/4 NE 1/4	Geothermal Exploration drilling MZI-10
Township 31 South, Range 7 1/2 East, WM	Section 11 NE 1/4 NW 1/4	Geothermal Exploration drilling MZI-9
	Section 15 NE 1/4 SW 1/4	Geothermal Exploration drilling MZI-11
	Section 25 SW 1/4 NW 1/4	Geothermal Exploration drilling MZI-12
	Section 27 SW 1/4 NE 1/4	Geothermal Exploration drilling MZI-13

Actual construction work shall begin on or before June 15, 1985 . and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 19 86 .

Complete application of the water to the proposed use shall be made on or before October 1, 19 87 .

Witness my hand this 15th day of June , 19 84 .

William N. Young
WATER RESOURCES DIRECTOR

This permit, when issued, is for the beneficial use of water. By law, the land use associated with this water use must be in compliance with statewide land-use goals and any local acknowledged land-use plan. It is possible that the land use you propose may not be allowed if it is not in keeping with the goals and the acknowledged plan. Your city or county planning agency can advise you about the land-use plan in your area.

APPLICATION 68039 PERMIT 48467

MZII-1

STATE OF OREGON

County of KLAMATH

PERMIT TO APPROPRIATE THE PUBLIC WATERS

This is to certify that I have examined APPLICATION 68036 and do hereby grant the same SUBJECT TO EXISTING RIGHTS INCLUDING THE APPROPRIATE MINIMUM FLOW POLICIES ESTABLISHED BY THE WATER POLICY REVIEW BOARD and the following limitations and conditions:

This permit is issued to California Energy Company, Inc., for the United States, Winema National Forest) of 3333 Mendocino, Avenue, Suite 100, Santa Rosa, California 95401, phone (707)526-1000, for the use of the waters of Annie Creek,
for the PURPOSE of for geothermal exploration drilling

that the PRIORITY OF THE RIGHT dates from March 28, 1984

and is limited to the amount of water which can be applied to beneficial use and shall not exceed 20,000 gallons per day

The POINT OF DIVERSION is to be LOCATED: 450 feet North 925 feet West from the Southeast Corner of Section 25, being within the SE 1/4 SE 1/4 of Section 25, Township 32 South, Range 6 East, WM, in the County of Klamath.

A description of the PLACE OF USE under the permit, and to which such right is appurtenant, is as follows:

Township 32 South, Range 6 East, WM Section 13 NW 1/4 SE 1/4 Geothermal Exploration drilling MZII-1
Section 14 NW 1/4 SW 1/4 Geothermal Exploration drilling MZII-2
Section 23 NW 1/4 SE 1/4 Geothermal Exploration drilling MZII-4
Section 26 SW 1/4 SW 1/4 Geothermal Exploration drilling MZII-5

Actual construction work shall begin on or before June 15, 1985 . and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 1986 .

Complete application of the water to the proposed use shall be made on or before October 1, 1987 .

Witness my hand this 15th day of June , 19 84 .

William N. Young
WATER RESOURCES DIRECTOR

This permit, when issued, is for the beneficial use of water. By law, the land use associated with this water use must be in compliance with statewide land-use goals and any local acknowledged land-use plan. It is possible that the land use you propose may not be allowed if it is not in keeping with the goals and the acknowledged plan. Your city or county planning agency can advise you about the land-use plan in your area

APPLICATION 68036 PERMIT 48464

California Energy Company, Inc.
Operator

MAZAMA

SAFETY PRACTICES
AND
EMERGENCY PROCEDURES

This manual contains general safety practices and contingency plans for response to emergency situations. A copy of this manual will be issued to all California Energy Company drillsite personnel and subcontractors/suppliers operating in the field.

Receipt and understanding of these materials will be required to be acknowledged in writing (see Acknowledgement form, at end).

Contents

GENERAL SAFETY PRACTICES

The following general safety regulations are designed to meet mandated standards and are for the protection of all personnel and others at the jobsite.

Employees who violate these safety rules, or others issued, will be subject to disciplinary action.

Accidents/Injuries

All supervisors are responsible for prevention of accidents to workers under their supervision. It is the supervisor's responsibility to train employees in the safest and most efficient way to work. It is the further responsibility of each employee to correct or report to their supervisor any unsafe condition or practice they may observe.

All on-the-job personal injuries, even of a minor nature, must be reported in writing on appropriate forms no later than the end of the shift in which the injury occurred.

All personnel will attend and participate in periodic Safety Meetings.

There will be no gambling, liquor, or narcotics on project properties.

Horseplay or practical jokes will not be permitted.

Good housekeeping is an aid to safety. All employees will keep tools, equipment and general area clean and orderly.

Personnel Safety Equipment

All employees shall be clothed in a manner which will not impair their safety.

Adequate eye and face protection devices will be worn when grinding, welding, chipping, pouring hazardous chemicals or wherever flying particles may cause eye injury. Hearing protection devices will be worn where required.

Steel-toed safety shoes should be worn by all employees working on or near drilling equipment.

Safety hats must be worn by employees and visitors in accordance with the rules established for the particular jobsite.

Safety belts will be worn on all above-ground work as prescribed.

Equipment Operation

Only qualified and designated employees shall work on electrical lines and equipment. All personnel will follow State and Federal Safety regulations and maintain a minimum clearance of 10 feet from overhead or other high voltage electrical conductors.

Only tools in good working condition and designed for the particular job being performed shall be used.

Portable electric hand tools with exposed non-current carrying metal parts shall be grounded unless the portable tools are protected by an approved system of double insulation.

Repairs shall not be made on machinery until power is positively locked out at the electrical disconnect.

Prime movers, machinery or equipment capable of movement shall be effectively blocked or secured while repairs are being made. All engines should be equipped with explosion resistant or explosion proof ignition systems and water injection system for exhaust. All engine exhausts should be welded to ensure a closed system.

Guards must not be removed while equipment is operating and must be in place before start-up.

Safe Driving

Automotive equipment should be parked at a designated safe distance from rig.

While driving company automotive equipment, seat belts must be work at all times by driver and passengers, if so equipped.

All personnel will drive with caution in the project area. Where steam or dust conditions limit visibility, personnel will use vehicle headlights and proceed slowly through the area.

A speed limit of 25 mph must be observed in the project area.

Fire Prevention

Smoking will be permitted only in authorized smoking zones.

No welding will be done without fire watch with extinguisher. Welding is not to be permitted on the rig unless authorized. If welding is required, approval of the Drilling Supervisor is required.

All workers must familiarize themselves with the location and operation of fire extinguishers and fire tools on site.

Hazardous Materials

Safety equipment shall be worn when handling chemicals. Only authorized personnel are to handle chemicals or potentially hazardous materials. Handling and storage of such materials shall conform with packaging instructions.

EMERGENCY PROCEDURES

THESE PROCEDURES WERE DEVELOPED FOR DRILLING OF PRODUCTION-SIZE WELLS FOR "WORST-CASE" SITUATIONS. AS SUCH THEY MAY BE UNDULY ALARMING. IMPACTS OF EMERGENCIES IN DRILLING OF TEMPERATURE GRADIENT/CORE SIZE HOLES ARE SIMILAR IN NATURE, BUT LESSER IN DEGREE. CONTROL PROCEDURES, HOWEVER, ARE THE SAME.

FIRES

Use fire extinguishing equipment, water and tools at the site, and notify USFS if assistance is needed. Should a wildfire threaten the site, drillsite personnel, in communication with USFS, will take appropriate action, including evacuation by pre-established routes, if warranted.

INJURIES

Use first aid supplies available at site; call for medical assistance; provide immediate transportation (air or vehicle) to medical facility, as needed.

ACCIDENTAL SPILLS AND DISCHARGES CONTROL PROCEDURES

This section contains emergency control procedures for accidental spills or discharges of drilling muds and produced geothermal fluids. Potential sources of accidental spills are:

1. Drilling rigs.
2. Sumps.
3. Pipelines.

Drilling muds are a mixture of water, chemicals, and solid particles used in drilling operations to lubricate and cool the bit in the hole and to carry cuttings out of the hole. Drilling muds are stored in sumps at the drilling locations. These sumps are open and are adequately sized to hold the volume of muds and produced fluids necessary for drilling and testing operations. Potential circumstances of discharge are minimal, but could occur by:

1. Sump overflow.
2. Sump wall seepage or wall breakdown.
3. Mud discharge from elsewhere on location.
4. Shallow lost circulation channeling to surface.

In the event of accidental discharges of geothermal fluids or drilling muds, the overall contingency plan is as follows:

The onsite Drilling Supervisor will make an immediate investigation of the nature and extent of the spill.

If the spill is small (less than 250 gallons) and easily containable onsite (pad area) CECI's Drilling Supervisor will direct and supervise complete cleanup, return to normal operations, and notify CECI managing personnel, BLM and **USFS.**

Major Spill Contingency Plan

If the spill is larger than 250 gallons; is not easily contained on site or threatens to cause offsite gullying or erosion; or requires operation of equipment off of the cleared pad area, CECI will proceed to take necessary action to curtail, contain and clean up the spill, and notify personnel, as follows:

1. Stop operations contributing to spill, (if testing, for instance).
2. Call out heavy equipment, vacuum trucks or water pump trucks.
3. Call CECI Project Manager and advise of spill.

The Project Manager or the Manager of Drilling Operations will notify BLM and USFS as soon as practically possible and work closely with them in all phases of operations.

Specific Procedures

Divert spill to the sump. If sump will not hold volumes, contain with berms or dikes. Haul liquid to another sump or available tank or approved disposal site. Repair sump.

Dry and solidify spilled muds. Depending on extent of spill, constituents of drilling muds, and preference of BLM and USFS, either return solids to sump and compact on the bottom or intermix with soils.

Continue working crews, equipment and vacuum trucks on cleanup until BLM and USFS are satisfied.

Telephone notification shall be confirmed by the Manager of Drilling Operations or the Project Manager, in writing, within two (2) weeks of telephone notification, containing:

1. Reason for discharge or spillage.
2. Duration and volume of discharge.
3. Steps taken to correct problem.
4. Steps taken to prevent reoccurrence of problem.

Provide spill report to → regulatory agencies.

See "Emergency Personnel and Services - Telephone Numbers"

6241:A5

HYDROGEN SULFIDE CONTINGENCY PLAN

Introduction

THE FOLLOWING EMERGENCY PROCEDURES WERE DEVELOPED FOR DRILLING OF PRODUCTION-SIZE WELLS AND COVER THE 'WORST-CASE' SITUATIONS. AS SUCH THEY MAY BE UNDULY ALARMING. THE LIKELIHOOD OF AN H_2S EMERGENCY IN DRILLING OF TEMPERATURE GRADIENT CORE HOLES IS LESS--PROCEDURES FOR RESPONSE, HOWEVER, ARE THE SAME.

It is CECI's intent to provide a safe working place, not only for its own employees, but also for those of other firms whose services will aid in the drilling and testing of wells. CECI and the drilling subcontractor will make every effort to provide adequate safeguards against harm to persons on the rig and in the immediate vicinity from the effects of hydrogen sulfide which may, under emergency conditions, be released to the atmosphere.

CECI intends to keep all formations over-balanced so that no intrusions of gas will occur. However, we have provided plans in the event of an emergency so that it could be handled safely and with a minimum of trouble. It is anticipated that if hydrogen sulfide is encountered it will be of low pressure and its reaching the surface would most likely be a result of lost circulation.

This plan provides for personnel safety programs, precautionary measures, safety equipment, emergency procedures and general information necessary to safely operate in a "sour gas" area.

To be effective, the plan requires the cooperation and effort of each person participating in the drilling of the well(s). Each person must know his/her responsibilities and duties, not only under normal operations, but while operating under emergency situations. All personnel should therefore familiarize themselves with the location and operation of all safety equipment and see that their own equipment is properly stored, easily accessible at all times, and routinely maintained.

General Information

The drilling contractor's personnel, necessary service company personnel, and CECI personnel will be thoroughly trained in the use of breathing equipment, emergency procedures, individual and group responsibilities, and first aid. CECI and the drilling subcontractor will keep a list, at the drill site, of all personnel who have been through special training programs.

All personnel shall undergo an eardrum examination before assignment to this area. Persons with perforated eardrums are prohibited from working in a hydrogen sulfide environment.

Smoking will be allowed only in designated areas.

Two briefing areas shall be designated at each drill site. These areas will be situated to provide one briefing area that would be upwind of the well at any given time.

All personnel, without exception, when coming on the drill site must proceed directly to CECI's Drilling Supervisor or the drilling subcontractor's supervisor for assignment of breathing apparatus and instruction and orientation briefing. Each person will be required to read the H_2S Contingency Plan and verify that he/she has read and understands the procedures by signing the form provided. The signed form will be forwarded to CECI's Manager of Drilling Operations, or his designated representative.

A list of emergency stations and phone numbers of personnel and agencies to be contacted in case of an emergency will be posted at the following places:

1. CECI Field Drilling Supervisor's trailer.
2. Drilling subcontractor supervisor's trailer.
3. Briefing areas--if briefing area is not one of the above.

Evacuation Plan

Upon completion of construction of each drill site, an alternate escape route (one other than the main access road) and evacuation procedures applicable to the particular drill site will be outlined to all personnel.

All nonessential personnel will be evacuated when danger to life exists. The evacuation will be under the supervision of a person designated by CECI's Manager of Drilling Operations or CECI Field Drilling Supervisor.

1. Do not panic!
2. Be aware of wind direction.
3. Follow instructions.

Safety Equipment

Automatic Hydrogen Sulfide continuous monitoring detectors with audio alarms will be placed at the shale shakers and on the rig floor. Portable hand operated H_2S detectors (can also be utilized for detection of Sulfur Dioxide) and H_2S detector ampules will be readily available for spot checks.

Self contained breathing equipment and resuscitators will be readily available for emergency use. Approved First Aid kits will be located at both briefing areas.

Approved blowout prevention equipment will be installed, maintained, and frequently tested.

If required, an adequate degasser manifolded to permit gas exhaust will be installed. Gas will always be vented to the pit downwind of the rig.

Explosion proof electric fans (bug blowers) will be positioned to ensure adequate circulation in critical areas, should gas be encountered.

Wind socks or streamers will be positioned so as to be in easy view of rig floor and both briefing areas during both night and daylight hours.

Warning signs will be available for posting on the access road to the location. "No Smoking" signs will be posted.

Training

A training and information session will be conducted covering the following:

1. Location of H_2S safety equipment, portable fire extinguishers and H_2S detectors.
2. Proper use of H_2S detectors.
3. General information on breathing equipment including length of time it can be worn, testing for leaks around face and hose connections, warning signals when pressure is depleting, maintenance and storage procedures.
4. Proper use of oxygen resuscitators.
5. Procedure for rescuing a person overcome by H_2S.
6. Responsibilities and duties during an emergency.
7. Condition I, II, and III alerts (see following pages).

A drill, with breathing equipment, will be conducted with each crew, including the mud loggers and mud engineer. The purpose of the drill is to instruct the crew in the use of breathing equipment and H_2S procedures.

The drill will include the following personnel:

1. Rig crew.
2. Mud engineer.
3. Mud logger.
4. Service company personnel assigned to essential duty during an emergency.
5. Drilling subcontractor's supervisor.
6. CECI Manager of Drilling Operations.
7. CECI Field Drilling Supervisor.
8. CECI Project Geologists.

The following procedure will be used for drills:

1. All personnel will be informed that a drill is to be staged.

2. The mud logger will initiate the drill by manually activating the alarm system.

3. The rig crew, mud logger, mud engineer and drilling supervisors will put on their breathing equipment. All other personnel will report to the proper briefing station.

4. Once breathing equipment is on, the driller will pull off bottom, shut down pumps and check for flow.

5. The drilling shall proceed as if the well is flowing and simulate well shut-in procedures.

6. Mud logger will continue to monitor his equipment.

7. The mud engineer will perform a mud check for weight and funnel viscosity and run a "Hach Test" to determine the sulfide concentration.

8. Drilling supervisors will observe to make certain all personnel know their duties. Corrections will be made where needed.

Procedures for Operating Conditions

When Hydrogen Sulfide has been detected in the drilling fluid returns, operations will be performed under one of the three following conditions:

CONDITION I - POTENTIAL DANGER

Alarms: None (less than 10 ppm)

This condition will be in effect continuously from the commencement of drilling, unless it is necessary to go to Condition II.

1. Be alert for condition changes.

2. Run a "Hach Test" on drill fluid routinely.

3. Check that all safety equipment is available and working.

4. Conduct drills and familiarization programs.

CONDITION II - MODERATE DANGER

Alarm: Horn or Siren actuates at 10 ppm.

1. The following personnel will immediately put on their breathing equipment:

   a. All personnel on rig floor.

   b. All personnel in area of mud pits.

2. Notify Drilling Supervisors.

3. Follow instructions of Drilling Supervisors.

4. Immediately begin to ascertain the source of the H_2S and take the required steps to suppress the H_2S. Drilling will not proceed until the source is determined, the well is circulated, and the gas is controlled.

5. The supervisors will make sure all nonessential personnel are out of the potential danger area.

6. Check all gas monitoring devices and increase gas monitoring activities with the portable, hand-operated H_2S detector units.

7. The Field Drilling Supervisor will assess the situation, outline a control program and assign duties to each person or group as required to bring the situation under control.

8. Signs to be posted on access road to location indicating "Danger - Hydrogen Sulfide - H_2S."

9. Access to drill site to be limited to authorized personnel only.

10. Notify Manager of Drilling Operations.

CONDITION III - EXTREME DANGER TO LIFE

Alarm: Horn or Siren, Blinking Lights

Critical well operations, well control problems, poisonous gas above threshold levels (see Table 2, page 13), and, in the extreme, loss of well control.

1. All personnel will put on their protective breathing equipment.

2. All personnel not required for well control will proceed to upwind briefing area for evacuation instructions.

3. Follow instructions of Drilling Supervisor.

4. The Field Drilling Supervisor will assess the situation, outline a control program and assign duties to each person or group as required to bring the situation under control.

5. Drilling Supervisor will notify CECI Manager of Drilling Operations of the situation and steps taken.

6. CECI Manager of Drilling Operations will brief his immediate supervisor of the situation.

7. CECI's Project Manager or Manager of Drilling Operations, or, in case they are unavailable, the Drilling Supervisor, will notify regulatory agencies. (see Telephone Numbers - Emergency Personnel and Services, at end).

Extreme Emergency

If there is no hope of containing well under prevailing conditions and there is a definite threat to human life and property.

1. Initiate Emergency Evacuation Plan.

2. Refer to "Contingency Plan for Uncontrolled Blowout."

3. Time and circumstances permitting, the Field Office should be notified of the situation.

4. As a last resort, the well is to be ignited (Poison Gas).

Instructions for Igniting the Well:

Two people are required for the actual igniting operation. Both will wear self-contained breathing units and will have 200 foot retrieval ropes tied around their waists. One man is responsible for checking the atmosphere for explosive gases with the Explosimeter. The other is responsible for lighting the well. Keep personnel not assigned special duties within the "Safe Breathing Area." Those in the "Safe Breathing Area" will be alert to the needs of the two persons assigned to ignite the well. Should either of these persons be overcome by fumes, they will immediately be pulled to safety by the retrieval ropes.

The primary method for igniting the well is a 25 mm meteortype flare gun. It has a range of approximately 500 feet. If this method fails or well conditions are such that a safer or better method is apparent, then the alternate should be used.

If the well is ignited, the burning Hydrogen Sulfide will be converted to Sulfur Dioxide, which is also poisonous. Therefore, DO NOT ASSUME THAT THE AREA IS SAFE AFTER THE GAS IS IGNITED. CONTINUE TO OBSERVE EMERGENCY PROCEDURES AND FOLLOW THE INSTRUCTIONS OF THE SUPERVISORS.

Initiate program to kill, plug, and abandon the well.

Rescue of H_2S Victim

While drilling operations procedures include preparations for personnel safety, all personnel should be aware of first aid procedures in the event someone becomes careless. First aid for H2S victims is, primarily:

1. Move the victim to fresh air immediately.

   Warning: Do not jeopardize your own safety. Always wear a self-contained breathing apparatus while attempting rescue.

2. If victim is unconscious and not breathing, move the victim at once to the safe breathing area and apply mouth-to-mouth artificial respiration until a resuscitator is available. Use the resuscitator until normal breathing is restored. Symptons may pass rapidly. However, keep the victim warm and take them to a hospital and place under the care of a physician.

Emergency Evacuation Plans:

Personnel will assemble at the most upwind briefing area for instruction.

All evacuation plans will be coordinated through USFS. Ambulance, hospital, and doctor will be coordinated by CECI/Driller.

TABLE 1

PHYSICAL EFFECTS OF HYDROGEN SULFIDE

CONCENTRATION			
PERCENT (1%)	PPM	GRAINS/100 STD. FT.^{3}	PHYSICAL EFFECTS
0.001	10	.65	Obvious and unpleasant odor.
0.002	20	1.30	Safe for 8 hours exposure.
0.01	100	6.48	Kills smell in 3 to 15 minutes; may sting eyes and throat.
0.02	200	12.96	Kills smell shortly; stings eyes and throat.
0.05	500	32.96	Dizziness; breathing ceases in a few minutes; need prompt artificial respiration.
0.07	700	45.36	Unconscious quickly; death will result if not rescued promptly.
0.10	1000	64.80	Unconscious at once; followed by death within minutes.

TABLE 2

TOXICITY OF VARIOUS GASES

COMMON NAME	CHEMICAL FORMULA	GRAVITY (SG) SG AIR = 1	THRESHOLD[1] LIMIT	HAZARDOUS[2] LIMIT	LETHAL[3] CONCENTRATION
Hydrogen Cyanide	HCN	0.94	10 ppm	150 ppm/hr	300 ppm
Hydrogen Sulfide	H_2S	1.18	10 ppm[4] 20 ppm[5]	250 ppm/hr	600 ppm
Sulfur Dioxide	SO_2	2.21	5 ppm	-	1000 ppm
Chlorine	Cl_2	2.45	1 ppm	4 ppm/hr	1000 ppm
Carbon Monoxide	CO	0.97	50 ppm	400 ppm/hr	1000 ppm
Carbon Dioxide	CO_2	1.52	5000 ppm	5%	10%
Methane	CH_4	0.55	90000 ppm	9% combustible above 5% in air	-

[1] Threshold Limit - concentration at which it is believed that all workers may be repeatedly exposed day after day without adverse effects.

[2] Hazardous Limit - concentration that may cause death.

[3] Lethal Concentration - concentration that will cause death with short term exposure.

[4] Threshold Limit = 10 PPM - 1972 ACGIH (American Conference of Governmental Industrial Hygienists)

[5] Threshold Limit = 20 PPM - 1966 ANSI acceptable ceiling concentration for eight-hour exposure (based on 40-hour week) is 20 PPM. OSHA Rules and Regulations (Federal Register, Volume 37, No. 202, Part II, dated October 18, 1972).

CONTINGENCY PLAN FOR UNCONTROLLED BLOWOUT

Temperature gradient holes are neither designed, planned, nor allowed by federal regulations to be capable of encountering a producible resource. The likelihood of blowout is therefore minimal. This unlikely event, if it occurred would be further mitigated by the small diameter of these holes.

When the means to shut in or control the flow from a well is lost, California Energy Company's Field Drilling Supervisor or the V.P. of Drilling Operations is to:

Initiate appropriate control procedures (procedures will vary greatly depending on the magnitude of the problem).

If any injuries have occured, dispatch all injured personnel to nearest medical facility.

If there is a threat to any local residents or Forest Service facilities notify USFS as soon as possible.

Secure and maintain control of access roads to area to eliminate entry of unauthorized personnel.

Contact CECI's V.P. Drilling Operations and advise of the situation. V.P. Drilling Operations will follow same procedure as stated in Major Spill Contingency Plan.

Initiate any further or supplemental steps which may be necessary or advisable based on consultation with the V.P. Drilling Operations.

Make certain that all safety practices and procedures are being followed and that all members of the drilling crew are performing their assigned duties correctly.

Attempt to control the well at the rig site with rig personnel and supervisors until relieved by V.P. Drilling Operations.

If fluid flow is of an uncontained nature, attempt containment with required equipment to contruct sumps and/or dikes as rapidly as possible as needed.

Attempt to construct and/or fabricate and install any well head facilities required to contain fluid flow at the well or casing head.

Maintain a continuing inspection of the pad area immediately around the well site, subject to erosion, that may cause a failure to the drilling rig structure. Take necessary steps to avert areas of possible erosion by excavation and rebuilding of the area as indicated.

Following complete containment of the well, initiate steps to return the area to its normal state prior to the blowout or fluid flow, such as reseeding with similar and approved vegetation.

Injuries:

In the event injuries occur, utilize first aid supplies available at site. Immediate attention will be given to proper air and/or other transportation to a medical facility as required.

Refer to "Emergency Personnel and Services - Telephone Numbers".

Copies of accident reports from California Energy Company and/or the subcontractor employing the injured individual will be submitted to BLM and other agencies as required.

EMERGENCY PHONE NUMBERS

INJURIES:	Klamath County Emergency Services (Fire and Medical)	Day:	503-882-2501
	Merle West Medical Center Klamath Falls, OR.	Emergency:	503-882-6311
POLICE:	Klamath County Sheriff's Office		503-883-7111
FIRES:	Kingsley Fire Center (24 hours)	Day: (five lines)	503-883-6850, 6851, 52, 53, 54
	Answering service notifies proper authorities	Evenings:	503-882-8274
	Mazama I: Chemult Ranger District Bill Jensen Fire & Resources Forester		503-365-2229
	Mazama II: Klamath Ranger District Dave Pederson		503-883-6824

Anna:Z6242:D3

CALIFORNIA ENERGY COMPANY, INC.

Santa Rosa Headquarters:	707-526-1000
California Energy Company, Inc. 3333 Mendocino Avenue, Suite 100 Santa Rosa, CA. 95401	
Sunriver Field Office:	503-593-2414 or 2415
California Energy Company, Inc. 201 N Sunriver Plaza Sunriver Business Park P. O. Box 3399 Sunriver, OR. 97702	
Mazama Drillsite Rig Phones - 24 Hours:	503-
Robert A. Pryde/Gordy Gollan - Coso Rig Phones:	619-375-1818
Radio Phone	619-375-1128
Heritage Inn, Ridgecrest	619-446-6543
Bar S Motel, Ridgecrest	619-446-2551
Reference Numbers:	
CTC House, Sunriver, OR.	503-593-2404 (2405)
Thunderbird Motel, Klamath Falls, OR.	503-882-8864
Spring Creek Ranch, Chiloquin, OR.	503-783-2775
Ft. Creek Resort, Ft. Klamath, OR.	503-381-2207

AUTHORITIES AND COMMUNICATIONS

The Bureau of Land Management (BLM) and Winema National Forest (WNF) have established the following responsibilities and authorities:

BLM	Drilling compliance/GROs/DOGAMI contact/noise monitoring.
WNF	Surface compliance/GRO 4/Fire/Access/Public information.

Bob Fujimoto, BLM Portland (503-231-6946) is responsible for administration of California Energy BLM permits. Communications are to be directed to the contact persons listed below, in the order listed. See the permits for additional names and numbers if you are unable to reach the partyies named below.

DRILLING/DOWNHOLE COMPLIANCE

BLM (Lead Agency):

1st	DENNIS SIMONTACCHI Inspector, Lakeview	Day: Night:	503-947-2177 503-947-2355
2nd	DENNIS DAVIS Inspector, Bend	Day: Night:	503-447-4115 503-382-3440

DOGAMI - Oregon Department of Geology and Mineral Industries:

DENNIS SIMONTACCHI (BLM, above) will handle communications with DOGAMI.

Dennis Olmstead (DOGAMI)	Day:	503-229-5580
	Night:	503-231-3835

CALIFORNIA ENERGY COMPANY, INC.:

1st	BOB PRYDE/GORDY GOLLAN	Field Phone: Santa Rosa:	Day/Night (to be supplied) 707-526-1000
2nd	DESIGNATED DRILLSITE GEOLOGIST	Field Phone: Santa Rosa: Sunriver Office:	Day/Night (to be supplied) 707-526-1000 503-593-2414
3rd	JIM MOORE	Santa Rosa:	707-526-1000

* For major drilling decisions, coordinate with DOE or their UURI designate.

SURFACE: ON- AND OFF-SITE COMPLIANCE
(Site Construction, Water, Roads, Fire):

WINEMA NATIONAL FOREST (Lead Agency):

1st	BILL JENSEN, Chemult Ranger District:	503-365-2229
2nd	MARV STUMP, Winema NF, K. Falls:	503-883-6799

BLM:

Dennis Simontacchi	503-947-2177

CALIFORNIA ENERGY COMPANY, INC.:

Field Operations: Bob Pryde/Designated Drillsite Geologist

Environmental Monitoring/Permits/Reports: Dave McClain/Anna Carter

California Energy Company, Inc.

ACKNOWLEDGEMENT

I have received a copy of California Energy Company's Safety Practices and Emergency Procedures, including:

General Safety Practices

Emergency Procedures

Fire

Injuries

Accidental Spills and Discharges Control Procedures

Contingency Plan for Uncontrolled Blowout

Hydrogen Sulfide (H_2S) Contingency Plan

Emergency Personnel and Services - Telephone Numbers.

I have read, and thoroughly understand the procedures, safety practices and prohibitions contained therein.

Name: _____
(signature)

Affiliation: _____

Date: _____

.....

Please sign and return this Acknowledgement to Cal Energy's Drilling Supervisor in the field or mail to:

Robert A. Pryde
Vice President Drilling Operations
California Energy Company, Inc.
3333 Mendocino Avenue, Suite 100
Santa Rosa, CA 95401

MZI-11A

Form 3200–21
(May 1974)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Serial Number OR 34669
USGS – KGRA Determination:

GEOTHERMAL RESOURCES LEASE

☐ Competitive ☒ Noncompetitive

In consideration of the terms and conditions contained herein, and the grant made hereby, this lease is entered into by the UNITED STATES OF AMERICA (hereinafter called the "Lessor"), acting through the Bureau of Land Management (hereinafter called the "Bureau") of the Department of the Interior (hereinafter called the "Department"), and

California Energy Company, Inc.
3333 Mendocino Avenue
Santa Rosa, CA 95401 (hereinafter called the "Lessee").

This lease is made pursuant to the Geothermal Steam Act of 1970 (84 Stat. 1566; 30 U.S.C. 1001–1025) (hereinafter called "the Act") to be effective on JAN 1 1984 (hereinafter called the "effective date"). It is subject to all the provisions of the Act and to all the terms, conditions, and requirements of (a) all regulations promulgated by the Secretary of the Interior (hereinafter called "the Secretary") in existence upon the effective date, specifically including, but not limited to, 43 CFR Parts 3000 and 3200 and 30 CFR Parts 270 and 271, (b) all geothermal resources operational orders (hereinafter called "GRO orders") issued pursuant thereto, all of which are incorporated herein and by reference made a part hereof, and (c) any regulations hereafter issued by the Secretary (except those inconsistent with any specific provisions of this lease other than regulations incorporated herein by reference) all of which shall be, upon their effective date, incorporated herein and, by reference, made a part hereof.

Sec. 1. GRANT – The Lessor hereby grants and leases to the Lessee the exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources, (hereinafter called "geothermal resources"), in or under the following described lands situated within the County of Klamath, State of Oregon:

National Resource Lands	Acquired Lands
T. 31 S. ; R. 7½ E. ; Willamette Meridian	T. ; R. ; Meridian
Sec. 3, E½, excluding that part within Crater Lake NP; Sec. 9, lot 4, excluding that part within Crater Lake NP; Sec. 10, all, excluding that part within Crater Lake NP; Sec. 14, all; Sec. 15, all, excluding that part within Crater Lake NP; Sec. 16, lot 1, excluding that part within Crater Lake NP.	
Total Area 1,570.62 acres	Total Area

Containing 1,570.62 acres (hereinafter called the "leased area" or "leased lands"), together with:

(a) The nonexclusive right to conduct within the leased area geological and geophysical exploration in accordance with applicable regulations; and

(b) The right to construct or erect and to use, operate, and maintain within the leased area, together with ingress and egress thereupon all wells, pumps, pipes, pipelines, buildings, plants, sumps, brine pits, reservoirs, tanks, waterworks, pumping stations, roads, electric power generating plants, transmission lines, industrial facilities, electric, telegraph or telephone lines, and such other works and structures and to use so much of the surface of the land as may be necessary or reasonably convenient for the production, utilization, and processing of geothermal resources or to the full enjoyment of the rights granted by this lease, subject to compliance with applicable laws and regulations; *Provided that,* although the use of the leased area for an electric power generating plant or transmission facilities or a commercial or industrial facility is authorized hereunder, the location of such facilities and the terms of occupancy therefor shall be under separate instruments issued under any applicable laws and regulations; and

(c) The nonexclusive right to drill potable water wells in accordance with state water laws within the leased area and to use the water produced therefrom for operations on the leased lands free of cost, provided that such drilling and development are conducted in accordance with procedures approved by the Supervisor of the Geological Survey (hereinafter called "Supervisor"); and

(d) The right to convert this lease to a mineral lease under the Mineral Leasing Act of February 25, 1920, as amended, and supplemented (30 U.S.C. 181–287) or under the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351–359), whichever is appropriate, if the leasehold is primarily valuable for the production of one or more valuable by-products which are leasable under those statutes, and the lease is incapable of commercial production or utilization of geothermal steam: *Provided that,* an application is made therefor prior to the expiration of the lease extension by reason of by-product production as hereinafter provided, and subject to all the terms and conditions of said appropriate Acts. The Lessee is also granted the right to locate mineral deposits under the mining laws (30 U.S.C. 21–54), which would constitute by-products if commercial production or utilization of geothermal steam continued, but such a location to be valid must be completed within ninety (90) days after the termination of this lease. Any conversion of this lease to a mineral lease or a mining claim is contingent on the availability of such lands for this purpose at the time of the conversion. If the lands are withdrawn or acquired in aid of a function of any Federal Department or agency, the mineral lease or mining claim shall be subject to such additional terms and conditions as may be prescribed by such Department or agency for the purpose of making operations thereon consistent with the purposes for which these lands are administered; and

(e) The right, without the payment of royalties hereunder, to reinject into the leased lands geothermal resources and condensates to the extent that such resources and condensates are not utilized, but their reinjection is necessary for operations under this lease in the recovering or processing of geothermal resources. If the Lessee, pursuant to any approved plan, disposes of the unusable brine and produced waste products into underlying formations, he may do so without the payment of royalties.

Sec. 2. TERM

(a) This lease shall be for a primary term of ten (10) years from the effective date and so long thereafter as geothermal steam is produced or utilized in commercial quantities but shall in no event continue for more than forty (40) years after the end of the primary term. However, if at the end of that forty-year period geothermal steam is being produced or utilized in commercial quantities, and the leased lands are not needed for other purposes, the Lessee shall have a preferential right to a renewal of this lease for a second forty-year term in accordance with such terms and conditions as the Lessor deems appropriate.

(b) If actual drilling operations are commenced on the leased lands or under an approved plan or agreement on behalf of the leased lands prior to the end of the primary term, and are being diligently prosecuted at the end of the primary term, this lease shall be extended for five (5) years and so long thereafter, but not more than thirty-five (35) years, as geothermal steam is produced or utilized in commercial quantities. If at the end of such extended term geothermal steam is being produced or utilized in commercial quantities, the Lessee shall have a preferential right to a renewal for a second term as in (a) above.

(c) If the Lessor determines at any time after the primary term that this lease is incapable of commercial production and utilization of geothermal steam, but one or more valuable by-products are or can be produced in commercial quantities, this lease shall be extended for so long as such by-products are produced in commercial quantities but not for more than five (5) years from the date of such determination.

Sec. 3. RENTALS AND ROYALTIES

(a) *Annual Rental* – For each lease year prior to the commencement of production of geothermal resources in commercial quantities on the leased lands, the Lessee shall pay the Lessor on or before the anniversary date of the lease a rental of $ 1.00 (One Dollar) for each acre or fraction thereof.

(b) *Escalating Rental* – Beginning with the sixth lease year and for each year thereafter until the lease year beginning on or after the commencement of production of geothermal resources in commercial quantities, the Lessee shall pay on or before the anniversary date of the lease an escalated rental in an amount per acre or fraction thereof equal to the rental per acre for the preceding year and an additional sum of one (1) dollar per acre or fraction thereof. If the lease is extended beyond ten (10) years for reasons other than the commencement of production of geothermal resources in commercial quantities, the rental for the eleventh year and for each lease year thereafter until the lease year beginning on or after the commencement of such production will be the amount of rental for the tenth lease year. If any expenditures are made in any lease year for diligent exploration on the leased lands in excess of the minimum required expenditures for that year, the excess may be credited against any rentals in excess of $ 1.00 (One Dollar) per acre or fraction thereof due the Lessor for that or any future year.

(c) *Royalty* – On or before the last day of the calendar month after the month of commencement of production in commercial quantities of geothermal resources and thereafter on a monthly basis, the Lessee shall pay to the Lessor:

(1) A royalty of FIVE percent on the amount or value of steam, or any other form of heat or other associated energy produced, processed, removed, sold, or utilized from this lease or reasonably susceptible to sale or utilization by the Lessee.

(2) A royalty of FIVE percent of the value of any by-product derived from production under this lease, produced, processed, removed, sold, or utilized from this lease or reasonably susceptible of sale or utilization by the Lessee, except that as to any by-product which is a mineral named in Sec. 1 of the Mineral Leasing Act of February 25, 1920, as amended, (30 U.S.C. 181), the rate of royalty for such mineral shall be the same as that provided in that statute and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that statute.

(3) A royalty of FIVE percent of the value of commercially demineralized water which has been produced from the leased lands, and has been sold or utilized by the Lessee or is reasonably susceptible of sale or utilization by the Lessee. In no event shall the Lessee pay to the Lessor, for the lease year beginning on or after the commencement of production in commercial quantities on the leased lands or any subsequent lease year, a royalty of less than two (2) dollars per acre or fraction thereof. If royalty paid on production during the lease year has not satisfied this requirement, the Lessee shall pay the difference on or before the expiration date of the lease year for which it is paid.

(d) *Waiver and Suspension of Rental and Royalties* – Rentals or royalties may be waived, suspended, or reduced pursuant to the applicable regulations on the entire leasehold or any portion thereof in the interest of conservation or for the purpose of encouraging the greatest ultimate recovery of geothermal resources if the Lessor determines that it is necessary to do so to promote such development, or because the lease cannot be successfully operated under the terms fixed herein.

(e) *Undivided Fractional Interests* – Where the interest of the Lessor in the geothermal resources underlying any tract or tracts described in Sec. 1 is an undivided fractional interest, the rentals and royalties payable on account of each such tract shall be in the same proportion to the rentals and royalties provided in this lease as the individual fractional interest of the Lessor in the geothermal resources underlying such tract is to the full fee interest.

(f) *Readjustments* – Rentals and royalties hereunder may be readjusted in accordance with the Act and regulations to rates not in excess of the rates provided therein, and at not less than twenty (20) year intervals beginning thirty-five (35) years after the date geothermal steam is produced from the lease as determined by the Supervisor.

Sec. 4. PAYMENTS – It is expressly understood that the Secretary may establish the values and minimum values of geothermal resources to compute royalties in accordance with the applicable regulations. Unless otherwise directed by the Secretary, all payments to the Lessor will be made as required by the regulations. If there is no well on the leased lands capable of producing geothermal resources in commercial quantities, the failure to pay rental on or before the anniversary date shall cause the lease to terminate by operation of law except as provided by Sec. 3244.2 of the regulations. If the time for payment falls on a day on which the proper office to receive payment is closed, payment shall be deemed to be made on time if made on the next official working day.

Sec. 5. BONDS – The Lessee shall file with the Authorized Officer of the Bureau (hereinafter called the "Authorized Officer") shall maintain at all times the bonds required under the regulations to be furnished as a condition to the issuance of this lease or prior to entry on the leased lands in the amounts established by the Lessor and to furnish such additional bonds or security as may be required by the Lessor upon entry on the lands or after operations or production have begun.

Sec. 6. WELLS

(a) The Lessee shall drill and produce all wells necessary to protect the leased land from drainage by operations on lands not the property of the Lessor, or other lands of the Lessor leased at a lower royalty rate, or on lands as to which royalties and rentals are paid into differ funds from those into which royalties under this lease are paid. However, in lieu of any part of such drilling and production, with the consent of the Supervisor, the Lessee may compensate the Lessor in full each month for the estimated loss of royalty through drainage in the amount determined by said Supervisor.

(b) At the Lessee's election, and with the approval of the Supervisor, the Lessee shall drill and produce other wells in conformity with any system of well spacing or production allotments affecting the field or area in which the leased lands are situated, which is authorized by applicable law.

(c) After due notice in writing, the Lessee shall diligently drill and produce such wells as the Supervisor shall require so that the leased lands may be properly and timely developed and for the production of geothermal steam and its by-products, including commercially demineralized water for beneficial uses in accordance with applicable state laws. However, the Supervisor may waive or modify the requirements of this subparagraph (c) in the interest of conservation of natural resources or for economic feasibility or other reasons satisfactory to him. If the products or by-products of geothermal production from wells drilled on this lease are susceptible of producing commercially demineralized water for beneficial uses, and a program therefor is not initiated with due diligence, the Lessor may at its option elect to take such products or by-products and the Lessee shall deliver all or any portion thereof to the Lessor at any point in the Lessee's geothermal gathering or disposal system without cost to the Lessee, if the Lessee's activities, under the lease, would not be impaired and such delivery would otherwise be consistent with field and operational requirements. The retention of this option by the Lessor shall in no way relieve the Lessee from the duty of producing commercially demineralized water where required to do so by the Lessor, except when the option is being exercised and then only with respect to wells where it is being exercised, or limit the Lessor's right to take any action under Sec. 25 to enforce that requirement.

Sec. 7. INSPECTION – The Lessee shall keep open at all reasonable times for the inspection of any duly authorized representative of the Lessor the leased lands and all wells, improvements, machinery, and fixtures thereon and all production reports, maps, records, books, and accounts relative to operations under the lease, and well logs, surveys, or investigations of the leased lands.

Sec. 8. CONDUCT OF OPERATIONS – The Lessee shall conduct all operations under this lease in a workmanlike manner and in accordance with all applicable statutes, regulations, and GRO orders, and all other appropriate directives of the Lessor to prevent bodily injury, danger to life or health, or property damage, and to avoid the waste of resources, and shall comply with all requirements which are set forth in 43 CFR Group 3200, including, but not limited to, Subpart 3204, or which may be prescribed by the Lessor pursuant to the regulations, and with the special stipulations which are attached to the lease, all of which are specifically incorporated into this lease. A breach of any term of this lease, including the stipulations attached hereto, will be subject to all the provisions of this lease with respect to remedies in case of default. Where any stipulation is inconsistent with a regular provision of this lease, the stipulation shall govern.

Sec. 9. INDEMNIFICATION

(a) The Lessee shall be liable to the Lessor for any damage suffered by the Lessor in any way arising from or connected with the Lessee's activities and operations conducted pursuant to this lease, except where damage is caused by employees of the Lessor acting within the scope of their authority.

(b) The Lessee shall indemnify and hold harmless the Lessor from all claims arising from or connected with the Lessee's activities and operations under this lease.

(c) In any case where liability without fault is imposed on the Lessee pursuant to this section, and the damages involved were caused by the action of a third party, the rules of subrogation shall apply in accordance with the law of the jurisdiction where the damage occurred.

Sec. 10. CONTRACTS FOR SALE OR DISPOSAL OF PRODUCTS – The Lessee shall file with the Supervisor not later than thirty (30) days after the effective date thereof any contract, or evidence of other arrangement for the sale or disposal of geothermal resources.

Sec. 11. ASSIGNMENT OF LEASE OR INTEREST THEREIN – Within ninety (90) days from the date of execution thereof, the Lessee shall file for approval by the Authorized Officer any instruments of transfer made of this lease or of any interest therein, including assignments of record title and working or other interests.

Sec. 12. REPORTS AND OTHER INFORMATION – At such times and in such form as the Lessor may prescribe, the Lessee shall comply with all reporting requirements of the geothermal resources leasing, operating, and unit regulations and shall submit quarterly reports containing the data which it has collected through the monitoring of air, land, and water quality and all other data pertaining to the effect on the environment by operations under the lease. The Lessee shall also comply with such other reporting requirements as may be imposed by the Authorized Officer or the Supervisor. The Lessor may release to the general public any reports, maps, or other information submitted by the Lessee except geologic and geophysical interpretations, maps, or data subject to 30 CFR 270.79 or unless the Lessee shall designate that information as proprietary and the Supervisor or the Authorized Officer shall approve that designation.

Sec. 13. DILIGENT EXPLORATION – In the manner required by the regulations, the Lessee shall diligently explore the leased lands for geothermal resources until there is production in commercial quantities applicable to this lease. After the fifth year of the prime term the Lessee shall make at least

the minimum expenditures required to qualify the operations on the leased lands as diligent exploration under the regulations.

Sec. 14. PROTECTION OF THE ENVIRONMENT (LAND, AIR AND WATER) AND IMPROVEMENTS – The Lessee shall take all mitigating actions required by the Lessor to prevent: (a) soil erosion or damage to crops or other vegetative cover on Federal or non-Federal lands in the vicinity; (b) the pollution of land, air, or water; (c) land subsidence, seismic activity, or noise emissions; (d) damage to aesthetic and recreational values; (e) damage to fish or wildlife or their habitats; (f) damage to or removal of improvements owned by *the United States or other parties; or (g) damage to or destruction* or loss of fossils, historic or prehistoric ruins, or artifacts. Prior to the termination of bond liability or at any other time when required and to the extent deemed necessary by the Lessor, the Lessee shall reclaim all surface disturbances as required, remove or cover all debris or solid waste, and, so far as possible, repair the offsite and onsite damage caused by his activity or activities incidental thereto, and return access roads or trails and the leased lands to an acceptable condition including the removal of structures, if required. The Supervisor or the Authorized Officer shall prescribe the steps to be taken by Lessee to protect the surface and the environment and for the restoration of the leased lands and other lands affected by operations on the leased lands and improvements thereon, whether or not the improvements are owned by the United States. Timber or mineral materials may be obtained only on terms and conditions imposed by the Authorized Officer.

Sec. 15. WASTE – The Lessee shall use all reasonable precautions to prevent waste of natural resources and energy, including geothermal resources, or of any minerals, and to prevent the communication of water or brine zones with any oil, gas, fresh water, or other gas or water bearing formations or zones which would threaten destruction or damage to such deposits. The Lessee shall monitor noise, air, and water quality conditions in accordance with any orders of the Supervisor.

Sec. 16. MEASUREMENTS – The Lessee shall gauge or otherwise measure all production, sales, or utilization of geothermal resources and shall record the same accurately in records as required by the Supervisor. Reports on production, sales, or utilization of geothermal resources shall be submitted in accordance with the terms of this lease and the regulations.

Sec. 17. RESERVATIONS TO LESSOR – All rights in the leased area not granted to the Lessee by this lease are hereby reserved to the Lessor. Without limiting the generality of the foregoing such reserved rights include:

(a) *Disposal* – The right to sell or otherwise dispose of the surface of the leased lands or any resource in the leased lands under existing laws, or laws hereafter enacted, subject to the rights of the Lessee under this lease;

(b) *Rights-of-way* – The right to authorize geological and geophysical explorations on the leased lands which do not interfere with or endanger actual operations under this lease, and the right to grant such easements or rights-of-way for joint or several use upon, through or in the leased area for steam lines and other public or private purposes which do not interfere with or endanger actual operations or facilities constructed under this lease;

(c) *Mineral Rights* – The ownership of and the right to extract oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from the leased lands;

(d) *Casing* – The right to acquire the well and casing at the fair market value of the casing where the Lessee finds only potable water, and such water is not required in lease operations; and

(e) *Measurements* – The right to measure geothermal resources and to sample any production thereof.

Sec. 18. ANTIQUITIES AND OBJECTS OF HISTORIC VALUE – The Lessee shall immediately bring to the attention of the Authorized Officer any antiquities or other objects of historic or scientific interest, including but not limited to historic or prehistoric ruins, fossils, or artifacts discovered as a result of operations under this lease, and shall leave such discoveries intact. Failure to comply with any of the terms and conditions imposed by the Authorized Officer with regard to the preservation of antiquities may constitute a violation of the Antiquities Act (16 U.S.C. 431-433). Prior to operations, the Lessee shall furnish to the Authorized Officer a certified statement that either no archaeological values exist or that they may exist on the leased lands to the best of the of the Lessee's knowledge and belief and that they might be impaired by geothermal operations. If the Lessee furnishes a statement that archaeological values may exist where the land is to be disturbed or occupied, the Lessee will engage a qualified archaeologist, acceptable to the Authorized Officer, to survey and salvage, in advance of any operations, such archaeological values on the lands involved. The responsibility for the cost for the certificate, survey, and salvage will be borne by the Lessee, and such salvaged property shall remain the property of the Lessor or the surface owner.

Sec. 19. DIRECTIONAL DRILLING – A directional well drilled under the leased area from a surface location on nearby land not covered by the lease shall be deemed to have the same effect for all purposes of this lease as a well drilled from a surface location on the leased area. In such circumstances, drilling shall be considered to have been commenced on the nearby land for the purposes of this lease, and production of geothermal resources from the leased area through any directional well located on nearby land, or drilling or reworking of any such directional well shall be considered production or drilling or reworking operations (as the case may be) on the leased area for all purposes of this lease. Nothing contained in this section shall be construed as granting to the Lessee any right in any land outside the leased area.

Sec. 20. OVERRIDING ROYALTIES – The Lessee shall not create overriding royalties of less than one-quarter (1/4) of one percent of the value of output nor in excess of 50 percent of the rate of royalty due to the Lessor specified in Sec. 3 of this lease except as otherwise authorized by the regulations. The Lessee expressly agrees that the creation of any overriding royalty which does not provide for a prorated reduction of all overriding royalties so that the aggregate rate of royalties does not exceed the maximum rate permissible under this section, or the failure to suspend an overriding royalty *during any period when the royalties due to the Lessor have* been suspended pursuant to the terms of this lease, shall constitute a violation of the lease terms.

Sec. 21. READJUSTMENT OF TERMS AND CONDITIONS – The terms and conditions of this lease other than those related to rentals and royalties may be readjusted in accordance with the Act at not less than ten-year intervals beginning ten (10) years after the date geothermal steam is produced from the leased premises as determined by the Supervisor.

Sec. 22. COOPERATIVE OR UNIT PLAN – The Lessee agrees that it will on its own, or at the request of the Lessor where it is determined to be necessary for the conservation of the resource or to prevent the waste of the resource, subscribe to and operate under any reasonable cooperative or unit plan for the development and operation of the area, field, or pool, or part thereof embracing the lands subject to this lease as the Secretary may determine to be practicable and necessary or advisable in the interest of conservation. In the event the leased lands are included within a unit, the terms of this lease shall be deemed to be modified to conform to such unit agreement. Where any provision of a cooperative or unit plan of development which has been approved by the Secretary, and which by its terms affects the leased area or any part thereof, is inconsistent with a provision of this lease, the provisions of such cooperative or unit plan shall govern.

Sec. 23. RELINQUISHMENT OF LEASE – The Lessee may relinquish this entire lease or any officially designated subdivision of the leased area in accordance with the regulations by filing in the proper BLM office a written relinquishment, in triplicate, which shall be effective as of the date of filing. No relinquishment of this lease or any portion of the leased area shall relieve the Lessee or its surety from any liability for breach of any obligation of this lease, including the obligation to make payment of all accrued rentals and royalties and to place all wells in the leased lands to be relinquished in condition for suspension or abandonment, and to protect or restore substantially the surface or subsurface resources in a manner satisfactory to the Lessor.

Sec. 24. REMOVAL OF PROPERTY ON TERMINATION OR EXPIRATION OF LEASE

(a) Upon the termination or expiration of this lease in whole or in part, or the relinquishment of the lease in whole or in part, as herein provided, the Lessee shall within a period of ninety (90) days (or such longer period as the Supervisor may authorize because of adverse climatic conditions) thereafter remove from the leased lands, no longer subject to the lease all structures, machinery, equipment, tools, and materials in accordance with applicable regulations and orders of the Supervisor. However; the Lessee shall, for a period of not more than six (6) months, continue to maintain any such property needed in the relinquished area, as determined by the Supervisor, for producing wells or for drilling or producing geothermal resources on other leases.

(b) Any structures, machinery, equipment, tools, appliances, and materials, subject to removal by the Lessee, as provided above, which are allowed to remain on the leased lands shall become the property of the Lessor on expiration of the 90-day period or any extension of that period which may be granted by the Supervisor. If the Supervisor directs the Lessee to remove such property, the Lessee shall do so at its own expense, or if it fails to do so within a reasonable period, the Lessor may do so at the Lessee's expense.

Sec. 25. REMEDIES IN CASE OF DEFAULT

(a) Whenever the Lessee fails to comply with any of the provisions of the Act, or the terms and stipulations of this lease, or of the regulations issued under the Act, or of any order issued pursuant to those regulations, and that default shall continue for a period of thirty (30) days after service of notice by the Lessor, the Lessor may (1) suspend operations until the requested action is taken to correct the noncompliance, or (2) cancel the lease in accordance with Sec. 12 of the Act (30 U.S.C. 1011). However, the 30-day notice provision applicable to this lease under Sec. 12 of the Act shall also apply as a prerequisite to the institution of any legal proceedings by the Lessor to cancel this lease while it is in a producing status. Nothing in this subsection shall be construed to apply to, or require any notice with respect to any legal action instituted by the Lessor other than an action to cancel the lease pursuant to Sec. 12 of the Act.

(b) Whenever the Lessee fails to comply with any of the provisions of the Act, or of this lease, or the regulations, or of any GRO Orders, or other orders, and immediate action is required, the Lessor without waiting for action by the Lessee may enter on the leased lands and take such measures as it may deem necessary to correct the failure, including a suspension of operations or production, all at the expense of the Lessee.

(c) A waiver of any particular violation of the provisions of the Act, or of this lease, or of any regulations promulgated by the Secretary under the Act, shall not prevent the cancellation of this lease or the exercise of any other remedy or remedies under paragraphs (a) and (b) of this section by reason of any other such violation, or for the same violation occuring at any other time.

(d) Nothing herein shall limit or affect the Lessee's right to a hearing and appeal as provided in Sec. 12 of the

Act and in the regulations promulgated thereunder.

(e) Upon cancellation, the Lessee shall remove all property in accordance with Sec. 24 hereof, and shall restore the leased lands in a manner acceptable to the Lessor or as may be otherwise required by the Lessor.

Sec. 26. HEIRS AND SUCCESSORS IN INTEREST – Each obligation hereunder shall extend to and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns, of the respective parties hereto.

Sec. 27. UNLAWFUL INTEREST – No Member of, or Delegate to Congress, or Resident Commissioner, after his election or appointment, either before or after he has qualified, and during his continuance in office, and no officer, agent, or employee of the Department shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Sec. 3741 of the Revised Statutes (41 U.S.C. Sec. 22), as amended, and Sections 431, 432, and 433 of Title 18 of the United States Code, relating to contracts made or entered into, or accepted by or on behalf of the United States, form a part of this lease so far as the same may be applicable.

Sec. 28. MONOPOLY AND FAIR PRICES – The Lessor reserves full power and authority to protect the public interest by promulgating and enforcing all orders necessary to insure the sale of the production from the leased lands at reasonable prices, to prevent monopoly, and to safeguard the public interest.

Sec. 29. EQUAL OPPORTUNITY CLAUSE – The Lessee agrees that, during the performance of this contract:

(1) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Lessor setting forth the provisions of this Equal Opportunity clause.

(2) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the Lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The Lessee will send to each labor union or representative of workers with which Lessee has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Lessor, advising the labor union or workers' representative of the Lessee's commitments under this Equal Opportunity clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Secretary of the Interior and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Federal Government contracts or leases in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions as may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, as amended, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Lessee will include the provisions of Paragraphs (1) through (7) of this Section (29) in every contract, subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each contractor, subcontractor, or subcontract, or purchase order as the Secretary may direct as a means of enforcing such provisions including sanctions for noncompliance; *provided, however,* that in the event the Lessee becomes involved in, or is threatened with, litigation with a contractor, subcontractor, or vendor as a result of such direction by the Secretary, the Lessee may request the Lessor to enter into such litigation to protect the interests of the Lessor.

Sec. 30. CERTIFICATION OF NONSEGREGATED FACILITIES – By entering into this lease, the Lessee certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The Lessee agrees that a breach of this certification is a violation of the Equal Opportunity clause of this lease. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, or restaurants or other eating areas, time clocks, or locker rooms, and other storage or dressing rooms, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise. Lessee further agrees that (except where it has obtained identical certifications from proposed contractors and subcontractors for specific time periods) it will obtain identical certifications from proposed contractors and subcontractors prior to the award of contracts or subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause; that it will retain such certifications in its files; and that it will forward the following certification to such proposed contractors and subcontractors (except where the proposed contractor or subcontractor has submitted identical certifications for specific time periods); it will notify prospective contractors and subcontractors of requirement for certification of nonsegregated facilities. A Certification of Nonsegregated Facilities, as required by the May 9, 1967 Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a contract or subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each contract and subcontract or for all contracts and subcontracts during a period (i.e., quarterly, semiannually, or annually).

Sec. 31. SPECIAL STIPULATIONS – *(stipulations, if any, are attached hereto and made a part hereof)*

PLEASE NOTE: As a result of amendments to 43 CFR 3200, published in the Federal Register on April 20, 1983, this lease form is changed as follows:

1. Paragraph (b) of Section 3, Escalating Rental, was deleted;
2. That part of lines 3 and 4 of Section 13, "production in commercial quantities applicable to this lease" was changed to read "a well capable of commercial production on the leased lands".
3. In accordance with SO 3087, December 3, 1982, the defined duties of the Supervisor will be performed by the Deputy State Director for Mineral Resources, BLM.

This lease is subject to additional stipulations attached. See Exhibit "A".

"The undersigned hereby certifies compliance with 43 CFR Part 3200 and the Geothermal Steam Act of 1970."

In witness whereof the parties have executed this lease.

Lessee:

A R Tower
(Signature of Lessee)

K P Kem
(Signature of Lessee)

NOV 22 1983
(Date)

SEAL

THE UNITED STATES OF AMERICA, Lessor:

By David C Sinclair
(Authorized Officer)

Chief, Minerals Operations Section
(Title)

DEC 20 1983
(Date)

GPO 888 - 471

Special Stipulations
Winema National Forest

The Lessee shall comply with the following special conditions and stipulations unless they are modified by mutual agreement of the Lessee, Authorized Officer and the responsible surface management official. (In addition to the definition found in Section 5 of this lease document and as defined in the regulations under 43 CFR 3000.0-5(f), the term "Authorized Officer" as used in this lease for the lands whose surface is managed by an agency other than the Bureau of Land Management is: (a) for sections 5 and 11, the Authorized Officer of the Bureau of Land Management; (b) for sections 12, 14, and 18 involving surface management responsibilities, the authorized representative of the United States Department of Agriculture Forest Service.)

All operations on this lease are subject to Government approval with such site-specific stipulations as may be necessary to assure reasonable protection of or mitigation of effects on other values. A plan of operations shall not be approved if it results in unacceptable impact on other resources, land uses, and/or the environment. If for these reasons a plan of operations cannot be approved, the lease term may be suspended for up to 5 years subject to timely submittal of an appropriate application by the lessee for a suspension of operating and producing requirements of the lease and approval by the United States. If the conditions do not change sufficiently, and/or significantly improved techniques are not developed such that a plan of operations has not been approved during the suspended term of the lease, the suspension shall automatically terminate. Unless relinquished sooner, the lease will continue for the term remaining at the effective date of the suspension or,if not suspended, for the term remaining when the plan of operations was disapproved, subject to Government approval of all operations as provided herein, without recourse for compensation.

M2II-1

Form 3200-21
(May 1974)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

GEOTHERMAL RESOURCES LEASE
☐ Competitive ☒ Noncompetitive

Serial Number OR 34681
USGS – KGRA Determination:

Described lands were not within a KGRA as of _____

In consideration of the terms and conditions contained herein, and the grant made hereby, this lease is entered into by the UNITED STATES OF AMERICA (hereinafter called the "Lessor"), acting through the Bureau of Land Management (hereinafter called the "Bureau") of the Department of the Interior (hereinafter called the "Department"), and

California Energy Company, Inc.
3333 Mendocino Avenue
Santa Rosa, CA 95401 (hereinafter called the "Lessee").

This lease is made pursuant to the Geothermal Steam Act of 1970 (84 Stat. 1566; 30 U.S.C. 1001–1025) (hereinafter called "the Act") to be effective on JAN 1 1981 (hereinafter called the "effective date"). It is subject to all the provisions of the Act and to all the terms, conditions, and requirements of (a) all regulations promulgated by the Secretary of the Interior (hereinafter called "the Secretary") in existence upon the effective date, specifically including, but not limited to, 43 CFR Parts 3000 and 3200 and 30 CFR Parts 270 and 271, (b) all geothermal resources operational orders (hereinafter called "GRO orders") issued pursuant thereto, all of which are incorporated herein and by reference made a part hereof, and (c) any regulations hereafter issued by the Secretary (except those inconsistent with any specific provisions of this lease other than regulations incorporated herein by reference) all of which shall be, upon their effective date, incorporated herein and, by reference, made a part hereof.

Sec. 1. GRANT – The Lessor hereby grants and leases to the Lessee the exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources, (hereinafter called "geothermal resources"), in or under the following described lands situated within the County of Klamath, State of Oregon:

National Resource Lands	Acquired Lands
T. 32 S. ; R. 6 E. ; Willamette Meridian	T. ; R. ; Meridian
Protracted Sec. 13, all, excluding that part within Crater Lake NP; Protracted Sec. 24, all, excluding that part within Crater Lake NP; Protracted Sec. 25, all, excluding that part within Crater Lake NP; Protracted Sec. 36, all, excluding that part within HES 133.	
Total Area 1,479.41 acres	Total Area

Containing 1,479.41 acres (hereinafter called the "leased area" or "leased lands"), together with:

(a) The nonexclusive right to conduct within the leased area geological and geophysical exploration in accordance with applicable regulations; and

(b) The right to construct or erect and to use, operate, and maintain within the leased area, together with ingress and egress thereupon all wells, pumps, pipes, pipelines, buildings, plants, sumps, brine pits, reservoirs, tanks, waterworks, pumping stations, roads, electric power generating plants, transmission lines, industrial facilities, electric, telegraph or telephone lines, and such other works and structures and to use so much of the surface of the land as may be necessary or reasonably convenient for the production, utilization, and processing of geothermal resources or to the full enjoyment of the rights granted by this lease, subject to compliance with applicable laws and regulations; *Provided that*, although the use of the leased area for an electric power generating plant or transmission facilities or a commercial or industrial facility is authorized hereunder, the location of such facilities and the terms of occupancy therefor shall be under separate instruments issued under any applicable laws and regulations; and

(c) The nonexclusive right to drill potable water wells in accordance with state water laws within the leased area and to use the water produced therefrom for operations on the leased lands free of cost, provided that such drilling and development are conducted in accordance with procedures approved by the Supervisor of the Geological Survey (hereinafter called "Supervisor"); and

(d) The right to convert this lease to a mineral lease under the Mineral Leasing Act of February 25, 1920, as amended, and supplemented (30 U.S.C. 181–287) or under the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351–359), whichever is appropriate, if the leasehold is primarily valuable for the production of one or more valuable by-products which are leasable under those statutes, and the lease is incapable of commercial production or utilization of geothermal steam: *Provided that*, an application is made therefor prior to the expiration of the lease extension by reason of by-product production as hereinafter provided, and subject to all the terms and conditions of said appropriate Acts. The Lessee is also granted the right to locate mineral deposits under the mining laws (30 U.S.C. 21–54), which would constitute by-products if commercial production or utilization of geothermal steam continued, but such a location to be valid must be completed within ninety (90) days after the termination of this lease. Any conversion of this lease to a mineral lease or a mining claim is contingent on the availability of such lands for this purpose at the time of the conversion. If the lands are withdrawn or acquired in aid of a function of any Federal Department or agency, the mineral lease or mining claim shall be subject to such additional terms and conditions as may be prescribed by such Department or agency for the purpose of making operations thereon consistent with the purposes for which these lands are administered; and

(e) The right, without the payment of royalties hereunder, to reinject into the leased lands geothermal resources and condensates to the extent that such resources and condensates are not utilized, but their reinjection is necessary for operations under this lease in the recovering or processing of geothermal resources. If the Lessee, pursuant to any approved plan, disposes of the unusable brine and produced waste products into underlying formations, he may do so without the payment of royalties.

Sec. 2. TERM

(a) This lease shall be for a primary term of ten (10) years from the effective date and so long thereafter as geothermal steam is produced or utilized in commercial quantities but shall in no event continue for more than forty (40) years after the end of the primary term. However, if at the end of that forty-year period geothermal steam is being produced or utilized in commercial quantities, and the leased lands are not needed for other purposes, the Lessee shall have a preferential right to a renewal of this lease for a second forty-year term in accordance with such terms and conditions as the Lessor deems appropriate.

(b) If actual drilling operations are commenced on the leased lands or under an approved plan or agreement on behalf of the leased lands prior to the end of the primary term, and are being diligently prosecuted at the end of the primary term, this lease shall be extended for five (5) years and so long thereafter, but not more than thirty-five (35) years, as geothermal steam is produced or utilized in commercial quantities. If at the end of such extended term geothermal steam is being produced or utilized in commercial quantities, the Lessee shall have a preferential right to a renewal for a second term as in (a) above.

(c) If the Lessor determines at any time after the primary term that this lease is incapable of commercial production and utilization of geothermal steam, but one or more valuable by-products are or can be produced in commercial quantities, this lease shall be extended for so long as such by-products are produced in commercial quantities but not for more than five (5) years from the date of such determination.

Sec. 3. RENTALS AND ROYALTIES

(a) *Annual Rental* – For each lease year prior to the commencement of production of geothermal resources in commercial quantities on the leased lands, the Lessee shall pay the Lessor on or before the anniversary date of the lease a rental of $ 1.00 (One Dollar) for each acre or fraction thereof.

(b) *Escalating Rental* – Beginning with the sixth lease year and for each year thereafter until the lease year beginning on or after the commencement of production of geothermal resources in commercial quantities, the Lessee shall pay on or before the anniversary date of the lease an escalated rental in an amount per acre or fraction thereof equal to the rental per acre for the preceding year and an additional sum of one (1) dollar per acre or fraction thereof. If the lease is extended beyond ten (10) years for reasons other than the commencement of production of geothermal resources in commercial quantities, the rental for the eleventh year and for each lease year thereafter until the lease year beginning on or after the commencement of such production will be the amount of rental for the tenth lease year. If any expenditures are made in any lease year for diligent exploration on the leased lands in excess of the minimum required expenditures for that year, the excess may be credited against any rentals in excess of $ 1.00 (One Dollar) per acre or fraction thereof due the Lessor for that or any future year.

(c) *Royalty* – On or before the last day of the calendar month after the month of commencement of production in commercial quantities of geothermal resources and thereafter on a monthly basis, the Lessee shall pay to the Lessor:

(1) A royalty of TEN percent on the amount or value of steam, or any other form of heat or other associated energy produced, processed, removed, sold, or utilized from this lease or reasonably susceptible to sale or utilization by the Lessee.

(2) A royalty of FIVE percent of the value of any by-product derived from production under this lease, produced, processed, removed, sold, or utilized from this lease or reasonably susceptible of sale or utilization by the Lessee, *except that as to any by-product which is a mineral named* in Sec. 1 of the Mineral Leasing Act of February 25, 1920, as amended, (30 U.S.C. 181), the rate of royalty for such mineral shall be the same as that provided in that statute and the maximum rate of royalty for such mineral shall not exceed the maximum royalty applicable under that statute.

(3) A royalty of FIVE percent of the value of commercially demineralized water which has been produced from the leased lands, and has been sold or utilized by the Lessee or is reasonably susceptible of sale or utilization by the Lessee. In no event shall the Lessee pay to the Lessor, for the lease year beginning on or after the commencement of production in commercial quantities on the leased lands or any subsequent lease year, a royalty of less than two (2) dollars per acre or fraction thereof. If royalty paid on production during the lease year has not satisfied this requirement, the Lessee shall pay the difference on or before the expiration date of the lease year for which it is paid.

(d) *Waiver and Suspension of Rental and Royalties* – Rentals or royalties may be waived, suspended, or reduced pursuant to the applicable regulations on the entire leasehold or any portion thereof in the interest of conservation or for the purpose of encouraging the greatest ultimate recovery of geothermal resources if the Lessor determines that it is necessary to do so to promote such development, or because the lease cannot be successfully operated under the terms fixed herein.

(e) *Undivided Fractional Interests* – Where the interest of the Lessor in the geothermal resources underlying any tract or tracts described in Sec. 1 is an undivided fractional interest, the rentals and royalties payable on account of each such tract shall be in the same proportion to the rentals and royalties provided in this lease as the individual fractional interest of the Lessor in the geothermal resources underlying such tract is to the full fee interest.

(f) *Readjustments* – Rentals and royalties hereunder may be readjusted in accordance with the Act and regulations to rates not in excess of the rates provided therein, and at not less than twenty (20) year intervals beginning thirty-five (35) years after the date geothermal steam is produced from the lease as determined by the Supervisor.

Sec. 4. PAYMENTS – It is expressly understood that the Secretary may establish the values and minimum values of geothermal resources to compute royalties in accordance with the applicable regulations. Unless otherwise directed by the Secretary, all payments to the Lessor will be made as required by the regulations. If there is no well on the leased lands capable of producing geothermal resources in commercial quantities, the failure to pay rental on or before the anniversary date shall cause the lease to terminate by operation of law except as provided by Sec. 3244.2 of the regulations. If the time for payment falls on a day on which the proper office to receive payment is closed, payment shall be deemed to be made on time if made on the next official working day.

Sec. 5. BONDS – The Lessee shall file with the Authorized Officer of the Bureau (hereinafter called the "Authorized Officer") shall maintain at all times the bonds required under the regulations to be furnished as a condition to the issuance of this lease or prior to entry on the leased lands in the amounts established by the Lessor and to furnish such additional bonds or security as may be required by the Lessor upon entry on the lands or after operations or production have begun.

Sec. 6. WELLS

(a) The Lessee shall drill and produce all wells necessary to protect the leased land from drainage by operations on lands not the property of the Lessor, or other lands of the Lessor leased at a lower royalty rate, or on lands as to which royalties and rentals are paid into diffe funds from those into which royalties under this lease are paid. However, in lieu of any part of such drilling and production, with the consent of the Supervisor, the Lessee may compensate the Lessor in full each month for the estimated loss of royalty through drainage in the amount determined by said Supervisor.

(b) At the Lessee's election, and with the approval of the Supervisor, the Lessee shall drill and produce other wells in conformity with any system of well spacing or production allotments effecting the field or area in which the leased lands are situated, which is authorized by applicable law.

(c) After due notice in writing, the Lessee shall diligently drill and produce such wells as the Supervisor shall require so that the leased lands may be properly and timely developed and for the production of geothermal steam and its by-products, including commercially demineralized water for beneficial uses in accordance with applicable state laws. However, the Supervisor may waive or modify the requirements of this subparagraph (c) in the interest of conservation of natural resources or for economic feasibility or other reasons satisfactory to him. If the products or by-products of geothermal production from wells drilled on this lease are susceptible of producing commercially demineralized water for beneficial uses, and a program therefor is not initiated with due diligence, the Lessor may at its option elect to take such products or by-products and the Lessee shall deliver all or any portion thereof to the Lessor at any point in the Lessee's geothermal gathering or disposal system without cost to the Lessee, if the Lessee's activities, under the lease, would not be impaired and such delivery would otherwise be consistent with field and operational requirements. The retention of this option by the Lessor shall in no way relieve the Lessee from the duty of producing commercially demineralized water where required to do so by the Lessor, except when the option is being exercised and then only with respect to wells where it is being exercised, *or limit the Lessor's right to take any action under Sec. 25* to enforce that requirement.

Sec. 7. INSPECTION – The Lessee shall keep open at all reasonable times for the inspection of any duly authorized representative of the Lessor the leased lands and all wells, improvements, machinery, and fixtures thereon and all production reports, maps, records, books, and accounts relative to operations under the lease, and well logs, surveys, or investigations of the leased lands.

Sec. 8. CONDUCT OF OPERATIONS – The Lessee shall conduct all operations under this lease in a workmanlike manner and in accordance with all applicable statutes, regulations, and GRO orders, and all other appropriate directives of the Lessor to prevent bodily injury, danger to life or health, or property damage, and to avoid the waste of resources, and shall comply with all requirements which are set forth in 43 CFR Group 3200, including, but not limited to, Subpart 3204, or which may be prescribed by the Lessor pursuant to the regulations, and with the special stipulations which are attached to the lease, all of which are specifically incorporated into this lease. A breach of any term of this lease, *including the stipulations attached hereto, will be* subject to all the provisions of this lease with respect to remedies in case of default. Where any stipulation is inconsistent with a regular provision of this lease, the stipulation shall govern.

Sec. 9. INDEMNIFICATION

(a) The Lessee shall be liable to the Lessor for any damage suffered by the Lessor in any way arising from or connected with the Lessee's activities and operations conducted pursuant to this lease, except where damage is caused by employees of the Lessor acting within the scope of their authority.

(b) The Lessee shall indemnify and hold harmless the Lessor from all claims arising from or connected with the Lessee's activities and operations under this lease.

(c) In any case where liability without fault is imposed *on the Lessee pursuant to this section, and the damages* involved were caused by the action of a third party, the rules of subrogation shall apply in accordance with the law of the jurisdiction where the damage occurred.

Sec. 10. CONTRACTS FOR SALE OR DISPOSAL OF PRODUCTS – The Lessee shall file with the Supervisor not later than thirty (30) days after the effective date thereof any contract, or evidence of other arrangement for the sale or disposal of geothermal resources.

Sec. 11. ASSIGNMENT OF LEASE OR INTEREST THEREIN – Within ninety (90) days from the date of execution thereof, the Lessee shall file for approval by the Authorized Officer any instruments of transfer made of this lease or of any interest therein, including assignments of record title and working or other interests.

Sec. 12. REPORTS AND OTHER INFORMATION – At such times and in such form as the Lessor may prescribe, the Lessee shall comply with all reporting requirements of the geothermal resources leasing, operating, and unit regulations and shall submit quarterly reports containing the data which it has collected through the monitoring of air, land, and water quality and all other data pertaining to the effect on the environment by operations under the lease. The Lessee shall also comply with such other reporting requirements as may be imposed by the Authorized Officer or the Supervisor. The Lessor may release to the general public any reports, maps, *or other information submitted by the Lessee except geologic* and geophysical interpretations, maps, or data subject to 30 CFR 270.79 or unless the Lessee shall designate that information as proprietary and the Supervisor or the Authorized Officer shall approve that designation.

Sec. 13. DILIGENT EXPLORATION – *In the manner required* by the regulations, the Lessee shall diligently explore the leased lands for geothermal resources until there is production in commercial quantities applicable to this lease. After the fifth year of the prir term the Lessee shall make at least

the minimum expenditures required to qualify the operations on the leased lands as diligent exploration under the regulations.

Sec. 14. PROTECTION OF THE ENVIRONMENT (LAND, AIR AND WATER) AND IMPROVEMENTS – The Lessee shall take all mitigating actions required by the Lessor to prevent: (a) soil erosion or damage to crops or other vegetative cover on Federal or non-Federal lands in the vicinity; (b) the pollution of land, air, or water; (c) land subsidence, seismic activity, or noise emissions; (d) damage to aesthetic and recreational values; (e) damage to fish or wildlife or their habitats; (f) damage to or removal of improvements owned by the United States or other parties; or (g) damage to or destruction or loss of fossils, historic or prehistoric ruins, or artifacts. Prior to the termination of bond liability or at any other time when required and to the extent deemed necessary by the Lessor, the Lessee shall reclaim all surface disturbances as required, remove or cover all debris or solid waste, and, so far as possible, repair the offsite and onsite damage caused by his activity or activities incidental thereto, and return access roads or trails and the leased lands to an acceptable condition including the removal of structures, if required. The Supervisor or the Authorized Officer shall prescribe the steps to be taken by Lessee to protect the surface and the environment and for the restoration of the leased lands and other lands affected by operations on the leased lands and improvements thereon, whether or not the improvements are owned by the United States. Timber or mineral materials may be obtained only on terms and conditions imposed by the Authorized Officer.

Sec. 15. WASTE – The Lessee shall use all reasonable precautions to prevent waste of natural resources and energy, including geothermal resources, or of any minerals, and to prevent the communication of water or brine zones with any oil, gas, fresh water, or other gas or water bearing formations or zones which would threaten destruction or damage to such deposits. The Lessee shall monitor noise, air, and water quality conditions in accordance with any orders of the Supervisor.

Sec. 16. MEASUREMENTS – The Lessee shall gauge or otherwise measure all production, sales, or utilization of geothermal resources and shall record the same accurately in records as required by the Supervisor. Reports on production, sales, or utilization of geothermal resources shall be submitted in accordance with the terms of this lease and the regulations.

Sec. 17. RESERVATIONS TO LESSOR – All rights in the leased area not granted to the Lessee by this lease are hereby reserved to the Lessor. Without limiting the generality of the foregoing such reserved rights include:

(a) *Disposal* – The right to sell or otherwise dispose of the surface of the leased lands or any resource in the leased lands under existing laws, or laws hereafter enacted, subject to the rights of the Lessee under this lease;

(b) *Rights-of-way* – The right to authorize geological and geophysical explorations on the leased lands which do not interfere with or endanger actual operations under this lease, and the right to grant such easements or rights-of-way for joint or several use upon, through or in the leased area for steam lines and other public or private purposes which do not interfere with or endanger actual operations or facilities constructed under this lease;

(c) *Mineral Rights* – The ownership of and the right to extract oil, hydrocarbon gas, and helium from all geothermal steam and associated geothermal resources produced from the leased lands;

(d) *Casing* – The right to acquire the well and casing at the fair market value of the casing where the Lessee finds only potable water, and such water is not required in lease operations; and

(e) *Measurements* – The right to measure geothermal resources and to sample any production thereof.

Sec. 18. ANTIQUITIES AND OBJECTS OF HISTORIC VALUE – The Lessee shall immediately bring to the attention of the Authorized Officer any antiquities or other objects of historic or scientific interest, including but not limited to historic or prehistoric ruins, fossils, or artifacts discovered as a result of operations under this lease, and shall leave such discoveries intact. Failure to comply with any of the terms and conditions imposed by the Authorized Officer with regard to the preservation of antiquities may constitute a violation of the Antiquities Act (16 U.S.C. 431-433). Prior to operations, the Lessee shall furnish to the Authorized Officer a certified statement that either no archaeological values exist or that they may exist on the leased lands to the best of the of the Lessee's knowledge and belief and that they might be impaired by geothermal operations. If the Lessee furnishes a statement that archaeological values may exist where the land is to be disturbed or occupied, the Lessee will engage a qualified archaeologist, acceptable to the Authorized Officer, to survey and salvage, in advance of any operations, such archaeological values on the lands involved. The responsibility for the cost for the certificate, survey, and salvage will be borne by the Lessee, and such salvaged property shall remain the property of the Lessor or the surface owner.

Sec. 19. DIRECTIONAL DRILLING – A directional well drilled under the leased area from a surface location on nearby land not covered by the lease shall be deemed to have the same effect for all purposes of this lease as a well drilled from a surface location on the leased area. In such circumstances, drilling shall be considered to have been commenced on the nearby land for the purposes of this lease, and production of geothermal resources from the leased area through any directional well located on nearby land, or drilling or reworking of any such directional well shall be considered production or drilling or reworking operations (as the case may be) on the leased area for all purposes of this lease. Nothing contained in this section shall be construed as granting to the Lessee any right in any land outside the leased area.

Sec. 20. OVERRIDING ROYALTIES – The Lessee shall not create overriding royalties of less than one-quarter (1/4) of one percent of the value of output nor in excess of 50 percent of the rate of royalty due to the Lessor specified in Sec. 3 of this lease except as otherwise authorized by the regulations. The Lessee expressly agrees that the creation of any overriding royalty which does not provide for a prorated reduction of all overriding royalties so that the aggregate rate of royalties does not exceed the maximum rate permissible under this section, or the failure to suspend an overriding royalty during any period when the royalties due to the Lessor have been suspended pursuant to the terms of this lease, shall constitute a violation of the lease terms.

Sec. 21. READJUSTMENT OF TERMS AND CONDITIONS – The terms and conditions of this lease other than those related to rentals and royalties may be readjusted in accordance with the Act at not less than ten-year intervals beginning ten (10) years after the date geothermal steam is produced from the leased premises as determined by the Supervisor.

Sec. 22. COOPERATIVE OR UNIT PLAN – The Lessee agrees that it will on its own, or at the request of the Lessor where it is determined to be necessary for the conservation of the resource or to prevent the waste of the resource, subscribe to and operate under any reasonable cooperative or unit plan for the development and operation of the area, field, or pool, or part thereof embracing the lands subject to this lease as the Secretary may determine to be practicable and necessary or advisable in the interest of conservation. In the event the leased lands are included within a unit, the terms of this lease shall be deemed to be modified to conform to such unit agreement. Where any provision of a cooperative or unit plan of development which has been approved by the Secretary, and which by its terms affects the leased area or any part thereof, is inconsistent with a provision of this lease, the provisions of such cooperative or unit plan shall govern.

Sec. 23. RELINQUISHMENT OF LEASE – The Lessee may relinquish this entire lease or any officially designated subdivision of the leased area in accordance with the regulations by filing in the proper BLM office a written relinquishment, in triplicate, which shall be effective as of the date of filing. No relinquishment of this lease or any portion of the leased area shall relieve the Lessee or its surety from any liability for breach of any obligation of this lease, including the obligation to make payment of all accrued rentals and royalties and to place all wells in the leased lands to be relinquished in condition for suspension or abandonment, and to protect or restore substantially the surface or subsurface resources in a manner satisfactory to the Lessor.

Sec. 24. REMOVAL OF PROPERTY ON TERMINATION OR EXPIRATION OF LEASE

(a) Upon the termination or expiration of this lease in whole or in part, or the relinquishment of the lease in whole or in part, as herein provided, the Lessee shall within a period of ninety (90) days (or such longer period as the Supervisor may authorize because of adverse climatic conditions) thereafter remove from the leased lands, no longer subject to the lease all structures, machinery, equipment, tools, and materials in accordance with applicable regulations and orders of the Supervisor. However, the Lessee shall, for a period of not more than six (6) months, continue to maintain any such property needed in the relinquished area, as determined by the Supervisor, for producing wells or for drilling or producing geothermal resources on other leases.

(b) Any structures, machinery, equipment, tools, appliances, and materials, subject to removal by the Lessee, as provided above, which are allowed to remain on the leased lands shall become the property of the Lessor on expiration of the 90-day period or any extension of that period which may be granted by the Supervisor. If the Supervisor directs the Lessee to remove such property, the Lessee shall do so at its own expense, or if it fails to do so within a reasonable period, the Lessor may do so at the Lessee's expense.

Sec. 25. REMEDIES IN CASE OF DEFAULT

(a) Whenever the Lessee fails to comply with any of the provisions of the Act, or the terms and stipulations of this lease, or of the regulations issued under the Act, or of any order issued pursuant to those regulations, and that default shall continue for a period of thirty (30) days after service of notice by the Lessor, the Lessor may (1) suspend operations until the requested action is taken to correct the noncompliance, or (2) cancel the lease in accordance with Sec. 12 of the Act (30 U.S.C. 1011). However, the 30-day notice provision applicable to this lease under Sec. 12 of the Act shall also apply as a prerequisite to the institution of any legal proceedings by the Lessor to cancel this lease while it is in a producing status. Nothing in this subsection shall be construed to apply to, or require any notice with respect to any legal action instituted by the Lessor other than an action to cancel the lease pursuant to Sec. 12 of the Act.

(b) Whenever the Lessee fails to comply with any of the provisions of the Act, or of this lease, or the regulations, or of any GRO Orders, or other orders, and immediate action is required, the Lessor without waiting for action by the Lessee may enter on the leased lands and take such measures as it may deem necessary to correct the failure, including a suspension of operations or production, all at the expense of the Lessee.

(c) A waiver of any particular violation of the provisions of the Act, or of this lease, or of any regulations promulgated by the Secretary under the Act, shall not prevent the cancellation of this lease or the exercise of any other remedy or remedies under paragraphs (a) and (b) of this section by reason of any other such violation, or for the same violation occuring at any other time.

(d) Nothing herein shall limit or affect the Lessee's right to a hearing and appeal as provided in Sec. 12 of the

Act and in the regulations promulgated thereunder.

(e) Upon cancellation, the Lessee shall remove all property in accordance with Sec. 24 hereof, and shall restore the leased lands in a manner acceptable to the Lessor or as may be otherwise required by the Lessor.

Sec. 26. HEIRS AND SUCCESSORS IN INTEREST – Each obligation hereunder shall extend to and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns, of the respective parties hereto.

Sec. 27. UNLAWFUL INTEREST – No Member of, or Delegate to Congress, or Resident Commissioner, after his election or appointment, either before or after he has qualified, and during his continuance in office, and no officer, agent, or employee of the Department shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom; and the provisions of Sec. 3741 of the Revised Statutes (41 U.S.C. Sec. 22), as amended, and Sections 431, 432, and 433 of Title 18 of the United States Code, relating to contracts made or entered into, or accepted by or on behalf of the United States, form a part of this lease so far as the same may be applicable.

Sec. 28. MONOPOLY AND FAIR PRICES – The Lessor reserves full power and authority to protect the public interest by promulgating and enforcing all orders necessary to insure the sale of the production from the leased lands at reasonable prices, to prevent monopoly, and to safeguard the public interest.

Sec. 29. EQUAL OPPORTUNITY CLAUSE – The Lessee agrees that, during the performance of this contract:

(1) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Lessor setting forth the provisions of this Equal Opportunity clause.

(2) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the Lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The Lessee will send to each labor union or representative of workers with which Lessee has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Lessor, advising the labor union or workers' representative of the Lessee's commitments under this Equal Opportunity clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Secretary of the Interior and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Federal Government contracts or leases in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions as may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, as amended, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Lessee will include the provisions of Paragraphs (1) through (7) of this Section (29) in every contract, subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each contractor, subcontractor, or subcontract, or purchase order as the Secretary may direct as a means of enforcing such provisions including sanctions for noncompliance; *provided, however,* that in the event the Lessee becomes involved in, or is threatened with, litigation with a contractor, subcontractor, or vendor as a result of such direction by the Secretary, the Lessee may request the Lessor to enter into such litigation to protect the interests of the Lessor.

Sec. 30. CERTIFICATION OF NONSEGREGATED FACILITIES – By entering into this lease, the Lessee certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The Lessee agrees that a breach of this certification is a violation of the Equal Opportunity clause of this lease. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, or restaurants or other eating areas, time clocks, or locker rooms, and other storage or dressing rooms, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive, or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise. Lessee further agrees that (except where it has obtained identical certifications from proposed contractors and subcontractors for specific time periods) it will obtain identical certifications from proposed contractors and subcontractors prior to the award of contracts or subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause; that it will retain such certifications in its files; and that it will forward the following certification to such proposed contractors and subcontractors (except where the proposed contractor or subcontractor has submitted identical certifications for specific time periods); it will notify prospective contractors and subcontractors of requirement for certification of nonsegregated facilities. A Certification of Nonsegregated Facilities, as required by the May 9, 1967 Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a contract or subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each contract and subcontract or for all contracts and subcontracts during a period (i.e., quarterly, semiannually, or annually).

Sec. 31. SPECIAL STIPULATIONS – *(stipulations, if any, are attached hereto and made a part hereof)*

PLEASE NOTE: As a result of amendments to 43 CFR 3200, published in the Federal Register on April 20, 1983, this lease form is changed as follows:

1. Paragraph (b) of Section 3, Escalating Rental, was deleted;
2. That part of lines 3 and 4 of Section 13, "production in commercial quantities applicable to this lease" was changed to read "a well capable of commercial production on the leased lands".
3. In accordance with SO 3087, December 3, 1982, the defined duties of the Supervisor will be performed by the Deputy State Director for Mineral Resources, BIM.

This lease is subject to additional stipulations attached. See Exhibit "A".

"The undersigned hereby certifies compliance with 43 CFR Part 3200 and the Geothermal Steam Act of 1970."

In witness whereof the parties have executed this lease.

Lessee:

A R Tower
(Signature of Lessee)

(Signature of Lessee)

NOV 22 1983
(Date)

SEAL

THE UNITED STATES OF AMERICA, Lessor:

By David E Finlan
(Authorized Officer)

Chief, Minerals Operations Section
(Title)

DEC 20 1983
(Date)

GPO 888-471

Special Stipulations
Winema National Forest

The Lessee shall comply with the following special conditions and stipulations unless they are modified by mutual agreement of the Lessee, Authorized Officer and the responsible surface management official. (In addition to the definition found in Section 5 of this lease document and as defined in the regulations under 43 CFR 3000.0-5(f), the term "Authorized Officer" as used in this lease for the lands whose surface is managed by an agency other than the Bureau of Land Management is: (a) for sections 5 and 11, the Authorized Officer of the Bureau of Land Management; (b) for sections 12, 14, and 18 involving surface management responsibilities, the authorized representative of the United States Department of Agriculture Forest Service.)

All operations on this lease are subject to Government approval with such site-specific stipulations as may be necessary to assure reasonable protection of or mitigation of effects on other values. A plan of operations shall not be approved if it results in unacceptable impact on other resources, land uses, and/or the environment. If for these reasons a plan of operations cannot be approved, the lease term may be suspended for up to 5 years subject to timely submittal of an appropriate application by the lessee for a suspension of operating and producing requirements of the lease and approval by the United States. If the conditions do not change sufficiently, and/or significantly improved techniques are not developed such that a plan of operations has not been approved during the suspended term of the lease, the suspension shall automatically terminate. Unless relinquished sooner, the lease will continue for the term remaining at the effective date of the suspension or,if not suspended, for the term remaining when the plan of operations was disapproved, subject to Government approval of all operations as provided herein, without recourse for compensation.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Serial Number
Bond. No.
U 43 61 01

NATIONWIDE-STATEWIDE GEOTHERMAL RESOURCES LEASE BOND

Act of December 24, 1970 (84 Stat. 1566)

☐ Personal Bond ☒ Corporate Surety Bond

KNOW ALL MEN BY THESE PRESENTS, That ☒ We ☐ I,

CALIFORNIA ENERGY COMPANY, INC., as obligor,

and UNITED PACIFIC INSURANCE COMPANY, as surety, ☒ are ☐ am held and firmly bound unto the United States, in the sum of One Hundred Fifty Thousand & no/100 Dollars ($ 150,000.00) lawful money of the United States, to be paid to the United States, for the use and benefit of: (1) the United States; (2) any entryman, patentee, or surface owner of any portion of the lands covered by the lease bearing the above serial number who holds his lands subject to a reservation of the geothermal resources deposits to the United States; and (3) any lessee, permittee, or contractor under a lease, permit, or resource sale contract issued, or to be issued, by the United States covering the use of the surface, or the prospecting for, or development of, other mineral deposits in any portion of such lands. For such payment, well and truly to be made, we bind ourselves, and each of us, and each of our heirs, executors, administrators, successors, and assigns, jointly and severally, by these presents.

If the amount of this bond is $150,000, or if it is raised by an attached rider to that amount, the coverage shall extend to all the obligor's holdings involving geothermal resources deposits in the United States, including Alaska, under the Act.

If the amount of this bond is less than $150,000, its coverage extends only to the obligor's holdings involving geothermal resources deposits in the State or States named in Schedule A and to any other State or States that may be named in a rider attached hereto. Furthermore, such coverage is confined to the obligor's holdings under the Act.

SCHEDULE A

Names of State(s)

The conditions of the foregoing obligations are such that, whereas the said obligor, in one or more of the following ways, has an interest in geothermal resources leases issued under the Act:

1. as the lessee of such leases;
2. as the approved holder of operating rights in all or part of the lands covered by such leases under operating agreements with the lessees; and
3. as designated operator or agent under such leases pending approval of an assignment or operating agreement; and

WHEREAS the obligor is authorized to drill for, mine, extract, remove, and dispose of geothermal resources in or under the lands covered by the leases, operating agreements or designations, and is obligated to comply with certain covenants and agreements set forth in such instruments; and

WHEREAS the obligor agrees that the coverage of this bond, in addition to the present holdings of the obligor shall extend to and include:

1. Any geothermal resources lease hereafter issued to, or acquired by, the obligor affecting geothermal resources deposits in the State or States now named in Schedule A, or later named in a rider, the coverage to be confined in the obligor's holdings under the Act and to become effective immediately upon such issuance or upon departmental approval of a transfer in favor of the obligor.

2. Any operating agreement hereafter entered into or acquired by the obligor, affecting geothermal resources deposits in the States now named in Schedule A, or later named in a rider, relating to such leases issued under the Act. The coverage shall become effective immediately upon departmental approval of the agreement or of a transfer of an operating agreement to the obligor.

3. Any designation subsequent hereto of the obligor as operator or agent of a lessee under a lease issued pursuant to the Act and covering lands in a State named in Schedule A, either presently or by rider. This coverage shall become effective immediately upon the filing of such a designation under a lease.

4. Any extension of a lease covered by this bond, such coverage to continue without any interruption due to the expiration of the term set forth in the lease.

WHEREAS the obligor hereby agrees that notwithstanding the termination of any lease or leases, operating agreements or designations as operator or agent, covered by this bond, whether the termination is by operation of law or otherwise, the bond shall remain in full force and effect as to any remaining leases, operating agreements, or designations covered by the bond; and

WHEREAS the obligor as to any lease or part of a lease for lands as to which he has been designated as operator or agent, or approved as operator, in consideration of being permitted to furnish this bond in lieu of the lessees, agrees and by these presents does hereby bind himself to fulfill, on behalf of each lessee, all the obligations of each such lease for the entire leasehold in the same manner and to the same extent as though he were the lessee; and

WHEREAS the obligor agrees that notwithstanding any use of the security pledge herewith for the purpose for which it is pledged, the bond shall remain in full force and effect in the sum above set forth and that he will, whenever so required by the lessor, deposit additional security to bring the security up to the full amount; and

WHEREAS the obligor agrees that the neglect or forbearance of said lessor in enforcing, as against the lessees of such lessor, the payment of rentals or royalties or the performance of any other covenant, condition, or agreement of the leases, shall not, in any way, release the obligor from any liability under this bond; and

WHEREAS the obligor agrees that in the event of any default under the leases, the lessor may commence and prosecute any claim, suit, action, or other proceeding against the obligor without the necessity of joining the lessees.

NOW, THEREFORE, If said obligor shall in all respects faithfully comply with all of the provisions of the leases referred to hereinbefore, then the above obligations are to be void; otherwise to remain in full force and effect.

That said obligor, in order the more fully to secure the United States in the payment of the aforesaid sum, hereby pledges as security therefor negotiable bonds of the United States, of a par value equal to the amount specified, which said bonds are numbered serially and are in the denominations and amounts and are otherwise more particularly described in the attached schedule, which is made a part hereof, and which said bonds have been deposited with the Secretary of the Interior.

That the said obligor does hereby constitute and appoint the Secretary of the Interior as his attorney, for him and in his name to collect or sell, assign, and transfer the said United States bonds above described and deposited by the obligor, as aforesaid, pursuant to authority conferred by Section 1 of the Act of July 30, 1947 (61 Stat. 646; 6 U.S.C. 15) as security for the faithful performance of any and all of the conditions or stipulations as hereinbefore set out, and it is agreed that, in case of any default in the performance of the conditions and stipulations of such undertaking the said attorney shall have full power to collect said bonds or any part thereof, or to sell, assign, and transfer said bonds or any part thereof without notice, at public or private sale, free from any equity or redemption or without appraisement or valuation, notice and right to redeem being waived, and to apply proceeds of such sale or collection to the full amount of the bond to the satisfaction of any damages, or deficiencies arising by reason of such default, as said attorney may deem best. The interest accruing upon said United States bonds deposited as above stated, in the absence of any default in the performance of any of the conditions or stipulations of the bond, shall be paid to said obligor. The said obligor hereby for himself, his heirs, executors, administrators, and successors, ratifies and confirms whatever his said attorney shall do by virtue of these presents.

Special Stipulations

Signed on this 27thday of May , 1983 , in the presence of:

_____
(Name of Witness)

_____
(Address of Witness)

_____
(Name of Witness)

_____
(Address of Witness)

CALIFORNIA ENERGY COMPANY, INC.

BY: _____
(Signature of Obligor)

3333 MENDOCINO AVE., SANTA ROSA, CA
(Business Address of Obligor)

UNITED PACIFIC INSURANCE COMPANY

BY: _____
(Signature of Surety)

TERRY J. MCGHAN ATTORNEY-IN-FACT

100 BUSH ST., SAN FRANCISCO, CA
(Business Address of Surety)

If this bond is executed by a corporation, it must bear the seal of such corporation

State of California, County of Sonoma, ss.

On this 8th day of June, 1983, before me Gayle F. Detillion, Notary Public, personally appeared Charles T. Condy, known to me to be the President of the corporation that executed the within instrument on behalf of the corporation therein named, and acknowledged to me that such corporation executed the same.

OFFICIAL SEAL
GAYLE F. DETILLION
NOTARY PUBLIC - CALIFORNIA
PRINCIPAL OFFICE IN
SONOMA COUNTY
My Commission Expires APRIL 25, 1986

Gayle F. Detillion

Gayle F. Detillion, Notary Public

State of California,)
) SS.
County of SAN FRANCISCO)

On this 27th day of May, in the year 1983, before me, a Notary Public personally appeared TERRY J. MOUGHAN, known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to this instrument as the Attorney-In-Fact of UNITED PACIFIC INSURANCE COMPANY, and acknowledge to me that he (she) subscribed the name of UNITED PACIFIC INSURANCE COMPANY thereto as Surety, and his (her) own name as Attorney In Fact.

OFFICIAL SEAL
LORI SUZANNE LUTZ
NOTARY PUBLIC - CALIFORNIA
City and County of SAN FRANCISCO
My Commission Expires Sept. 6, 1985

My Commission expires 19

Notary Public

UNITED PACIFIC INSURANCE COMPANY

HOME OFFICE, FEDERAL WAY, WASHINGTON

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS, That the UNITED PACIFIC INSURANCE COMPANY, a corporation duly organized under the laws of the State of Washington, does hereby make, constitute and appoint

TERRY J. MOUGHAN of SAN FRANCISCO, CALIFORNIA---

its true and lawful Attorney-in-Fact, to make, execute, seal and deliver for and on its behalf, and as its act and deed

ANY AND ALL BONDS AND UNDERTAKINGS OF SURETYSHIP----

and to bind the UNITED PACIFIC INSURANCE COMPANY thereby as fully and to the same extent as if such bonds and undertakings and other writings obligatory in the nature thereof were signed by an Executive Officer of the UNITED PACIFIC INSURANCE COMPANY and sealed and attested by one other of such officers, and hereby ratifies and confirms all that its said Attorney(s)-in-Fact may do in pursuance hereof.

This Power of Attorney is granted under and by authority of Article VII of the By-Laws of UNITED PACIFIC INSURANCE COMPANY which became effective September 7, 1978, which provisions are now in full force and effect, reading as follows.

ARTICLE VII – EXECUTION OF BONDS AND UNDERTAKINGS

1. The Board of Directors, the President, the Chairman of the Board, any Senior Vice President, any Vice President or Assistant Vice President or other officer designated by the Board of Directors shall have power and authority to (a) appoint Attorneys-in-Fact and to authorize them to execute on behalf of the Company, bonds and undertakings, recognizances, contracts of indemnity and other writings obligatory in the nature thereof, and (b) to remove any such Attorney-in-Fact at any time and revoke the power and authority given to him.

2. Attorneys-in-Fact shall have power and authority, subject to the terms and limitations of the power of attorney issued to them, to execute and deliver on behalf of the Company, bonds and undertakings, recognizances, contracts of indemnity and other writings obligatory in the nature thereof. The corporate seal is not necessary for the validity of any bonds and undertakings, recognizances, contracts of indemnity and other writings obligatory in the nature thereof.

3. Attorneys-in-Fact shall have power and authority to execute affidavits required to be attached to bonds, recognizances, contracts of indemnity or other conditional or obligatory undertakings and they shall also have power and authority to certify the financial statement of the Company and to copies of the By-Laws of the Company or any article or section thereof.

...is power of attorney is signed and sealed by facsimile under and by authority of the following Resolution adopted by the Board of Directors of UNITED PACIFIC INSURANCE COMPANY at a meeting held on the 5th day of June, 1979, at which a quorum was present, and said Resolution has not been amended or repealed.

> "Resolved, that the signatures of such directors and officers and the seal of the Company may be affixed to any such power of attorney or any certificate relating thereto by facsimile, and any such power of attorney or certificate bearing such facsimile signatures or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by facsimile signatures and facsimile seal shall be valid and binding upon the Company in the future with respect to any bond or undertaking to which it is attached."

IN WITNESS WHEREOF, the UNITED PACIFIC INSURANCE COMPANY has caused these presents to be signed by its Vice President, and its corporate seal to be hereto affixed, this 17th day of December 19 81.

SEAL

UNITED PACIFIC INSURANCE COMPANY

Charles B. Schmalz

Vice President

STATE OF Washington
COUNTY OF King } ss.

On this 17th day of December, 19 81, personally appeared Charles B. Schmalz

to me known to be the Vice-President of the UNITED PACIFIC INSURANCE COMPANY, and acknowledged that he executed and attested the foregoing instrument and affixed the seal of said corporation thereto, and that Article VII, Section 1, 2, and 3 of the By-Laws of said Company, and the Resolution, set forth therein, are still in full force.

My Commission Expires:

June 12, 1982

NOTARY PUBLIC STATE OF WASHINGTON

Nancy Stannes

Notary Public in and for State of Washington

Residing at Tacoma

Charles J. Falskow, Assistant Secretary of the UNITED PACIFIC INSURANCE COMPANY, do hereby certify that the e and foregoing is a true and correct copy of a Power of Attorney executed by said UNITED PACIFIC INSURANCE COMPANY, which is still in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of said Company this 27th day of May 19 83

SEAL

Assistant Secretary Charles J. Falskow

BDU-1431 Ed. 4/80

If the amount of this bond is $50,000, or if it increased to that amount, the coverage shall extend to all of the ncipal's geothermal resources exploration operaons in the United States, including Alaska.

If the amount of this bond is $ 50,000,00 , its coverage shall extend only to the principal's single geothermal resources exploration operations in the township(s) and range(s) set forth in Schedule B.

If the amount of this bond is $25,000, its coverage extends only to the principal's geothermal resources exploration operations in the State named in Schedule A.

The conditions of the foregoing obligations are such that, whereas the said principal has filed a *Notice of Intent*, for approval with the Authorized Officer for the District wherein such operations are to be conducted, and

WHEREAS, the principal is obligated to comply with the covenants and conditions set forth in such *Notice of Intent.*

NOW, THEREFORE, If said principal shall in all respects faithfully comply with all of the terms and conditions of the *Notice of Intent* and such other corrective measures to rehabilitate the land as may be required by the Authorized Officer, the surety shall incur no liability but, if the principal should fail to do so, the surety shall be liable to the extent provided in this bond.

Signed on this 24TH day of JUNE , 19 85 , in the presence of:

NAMES AND ADDRESSES OF WITNESSES

CALIFORNIA ENERGY COMPANY

(Principal)

BY: Richard A Kuhlman V P Finance

3333 MENDOCINO AVENUE, SANTA ROSA, CA. 95401

(Business Address)

UNITED PACIFIC INSURANCE COMPANY

(Surety)

BY: Sheila O'Connor

SHEILA O'CONNOR-ATTORNEY IN FACT

100 BUSH ST., SAN FRANCISCO, CA. 94104

(Business Address)

The Paperwork Reduction Act of 1980 (44 U.S.C. 3501 et seq.) requires us to inform you that:
This information is being collected in accordance with 43 CFR 3209.
This information will be used to identify and communicate with the parties involved.
Response to this request is necessary for you to conduct geothermal exploration on Federal lands.

GPO 838-483

BOND NO. U 513083

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FORM APPROVED
OMB NO. 1004–0074
Expires: April 30, 1985

GEOTHERMAL RESOURCES EXPLORATION OPERATION BOND
(43 CFR Subpart 3209)

KNOW ALL MEN BY THESE PRESENTS, That we CALIFORNIA ENERGY COMPANY

of SANTA ROSA, CALIFORNIA , as principal,

and UNITED PACIFIC INSURANCE COMPANY

of SAN FRANCISCO, CALIFORNIA , as Surety, DEPARTMENT OF AGRICULTURE Forest Service are held and firmly bound unto the United States of America in the sum of FIFTY THOUSAND AND NO/100 - - - - dollars ($ 50,000.00), lawful money of the United States, to be paid to the United States, which sum may be increased or decreased by a rider hereto executed in the same manner as this bond, for the use and benefit of (1) the United States; (2) any entryman, patentee, or surface owner of, or the holder of any interests in, any lands in which the geothermal resources are reserved to the United States and upon which exploration operations will be conducted; and (3) any lessee under a lease issued or to be issued by the United States for lands on which the geothermal resources exploration operations will be conducted. For such payment, well and truly to be made, we bind ourselves, and each of our heirs, executors, administrators, successors and assigns, jointly and severally by these presents.

SCHEDULE A

STATE OR STATES

VARIOUS

SCHEDULE B

TOWNSHIP(S) AND RANGE(S)	APPROXIMATE DATE(S) OF COMMENCEMENT AND COMPLETION OF OPERATIONS
VARIOUS	

(Continued on reverse)

UNITED PACIFIC INSURANCE COMPANY

HOME OFFICE, TACOMA, WASHINGTON

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS, That the UNITED PACIFIC INSURANCE COMPANY, a corporation duly organized under the laws of the State of Washington, does hereby make, constitute and appoint

SHEILA O'CONNOR of SAN FRANCISCO, CALIFORNIA----

its true and lawful Attorney-in-Fact, to make, execute, seal and deliver for and on its behalf, and as its act and deed

ANY AND ALL BONDS AND UNDERTAKINGS OF SURETYSHIP----

and to bind the UNITED PACIFIC INSURANCE COMPANY thereby as fully and to the same extent as if such bonds and undertakings and other writings obligatory in the nature thereof were signed by an Executive Officer of the UNITED PACIFIC INSURANCE COMPANY and sealed and attested by one other of such officers, and hereby ratifies and confirms all that its said Attorney(s)-in-Fact may do in pursuance hereof.

This Power of Attorney is granted under and by authority of Article VII of the By-Laws of UNITED PACIFIC INSURANCE COMPANY which became effective September 7, 1978, which provisions are now in full force and effect, reading as follows:

ARTICLE VII – EXECUTION OF BONDS AND UNDERTAKINGS

1. The Board of Directors, the President, the Chairman of the Board, any Senior Vice President, any Vice President or Assistant Vice President or other officer designated by the Board of Directors shall have power and authority to (a) appoint Attorneys-in-Fact and to authorize them to execute on behalf of the Company, bonds and undertakings, recognizances, contracts of indemnity and other writings obligatory in the nature thereof, and (b) to remove any such Attorney-in-Fact at any time and revoke the power and authority given to him.

2. Attorneys-in-Fact shall have power and authority, subject to the terms and limitations of the power of attorney issued to them, to execute and deliver on behalf of the Company, bonds and undertakings, recognizances, contracts of indemnity and other writings obligatory in the nature thereof. The corporate seal is not necessary for the validity of any bonds and undertakings, recognizances, contracts of indemnity and other writings obligatory in the nature thereof.

3. Attorneys-in-Fact shall have power and authority to execute affidavits required to be attached to bonds, recognizances, contracts of indemnity or other conditional or obligatory undertakings and they shall also have power and authority to certify the financial statement of the Company and copies of the By-Laws of the Company or any article or section thereof.

This power of attorney is signed and sealed by facsimile under and by authority of the following Resolution adopted by the Board of Directors of UNITED PACIFIC INSURANCE COMPANY at a meeting held on the 5th day of June, 1979, at which a quorum was present, and said Resolution has not been amended or repealed:

> "Resolved, that the signatures of such directors and officers and the seal of the Company may be affixed to any such power of attorney or any certificate relating thereto by facsimile, and any such power of attorney or certificate bearing such facsimile signatures or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by facsimile signatures and facsimile seal shall be valid and binding upon the Company in the future with respect to any bond or undertaking to which it is attached."

IN WITNESS WHEREOF, the UNITED PACIFIC INSURANCE COMPANY has caused these presents to be signed by its Asst. Vice President, and its corporate seal to be hereto affixed, this 28th day of January 19 80

UNITED PACIFIC INSURANCE COMPANY

D. Keith Johnson

Asst. Vice President

STATE OF Washington
COUNTY OF Pierce } ss.

On this 28th day of January, 19 80 personally appeared D. Keith Johnson

to me known to be the Asst. Vice-President of the UNITED PACIFIC INSURANCE COMPANY, and acknowledged that he executed and attested the foregoing instrument and affixed the seal of said corporation thereto, and that Article VII, Section 1, 2, and 3 of the By-Laws of said Company, and the Resolution, set forth therein, are still in full force.

My Commission Expires:

June 12, ,1982

Nancy Stames

Notary Public in and for State of Washington

Residing at Tacoma

Charles J. Falskow, Assistant Secretary of the UNITED PACIFIC INSURANCE COMPANY, do hereby certify that the above and foregoing is a true and correct copy of a Power of Attorney executed by said UNITED PACIFIC INSURANCE COMPANY, which is still in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of said Company this 24TH day of JUNE 19 85

Assistant Secretary Charles J. Falskow

SEAL

BDU-1431 Ed. 6/79