GLO1902

THERMAL POWER COMPANY
Santa Rosa Office

Project Title: Cascade Geothermal Drilling

CLACKAMAS 5000-FOOT THERMAL GRADIENT HOLE

Cooperative Agreement No. DE-FC07-85ID12614

Project Period: 9/30/85 thru 9/30/87

PROJECT MANAGEMENT PLAN
30 October 1985

Submitted by:
Thermal Power Company
3333 Mendocino Avenue
Santa Rosa, Calif. 95401

W. L. D'Olier
Participant
Project Manager

Approved by:
U.S. DOE, Idaho Operations Office
785 DOE Place
Idaho Falls Idaho 83402

Susan Prestwich
DOE Project Officer

PROJECT SUMMARY

Thermal Power Company, under a Cooperative Agreement dated 30 September 1985 with the U. S. Department of Energy - Idaho Operations Office, will drill and core the Clackamas 5000-Foot Thermal Gradient Hole during June and July 1986. Thermal will select all subcontractors, upon the completion of evaluations now in progress, to accomplish this Hole and its related important Data Collection Program in accordance with a Statement of Work included in both the Cooperative Agreement and this Project Management Plan.

Approximately 12 Thermal professional employees will be involved in the planning, prosecution and management of the work tasks, subcontractors and data collection for timely delivery to DOE. Milestone achievements, mutually determined by Thermal and DOE, will control payment of a maximum 50% DOE share of authorized costs, not to exceed $240,000. Thermal will provide a 12-month borehole access period to DOE following the expected August 1986 completion of the Thermal Gradient Hole. Thermal will provide its Final Technical Report to DOE before termination of the Cooperative Agreement on 30 September 1987. Thermal may elect to retain the Thermal Gradient Hole at its sole cost, risk and legal responsibility rather than to abandon it and restore the drillsite as allowed in the Cooperative Agreement.

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Project Management Plan
Clackamas 5000-Foot Thermal Gradient Hole

The Cooperative Agreement, effective as of 30 September 1985, between Thermal Power Company and U. S. Department of Energy - Idaho Operations Office (see Appendix 1), requires an approved Project Management Plan by 30 October 1985. Thermal Power Company has formulated this Project Management Plan based on the important Statement of Work included in the Cooperative Agreement (see Appendix 2).

Six major, sequential work sectors for Thermal are evident in this Project as follows:

1. Plan, permit and environmental approvals required of DOE, BLM, USFS, Oregon State and Marion County authorities.

2. Evaluate and select subcontractors for drilling-coring, geophysical logging and wellsite data collection.

3. Drilling-coring the 5000-foot Thermal Gradient Hole within time and cost estimates.

4. Data collection, its quality control and early delivery to DOE - Idaho Falls.

5. Providing the 12-month Hole access period to DOE.

6. Submitting cost accounting, supported by subcontractor invoices for progress payments in accordance with the Payment Milestone Schedule.

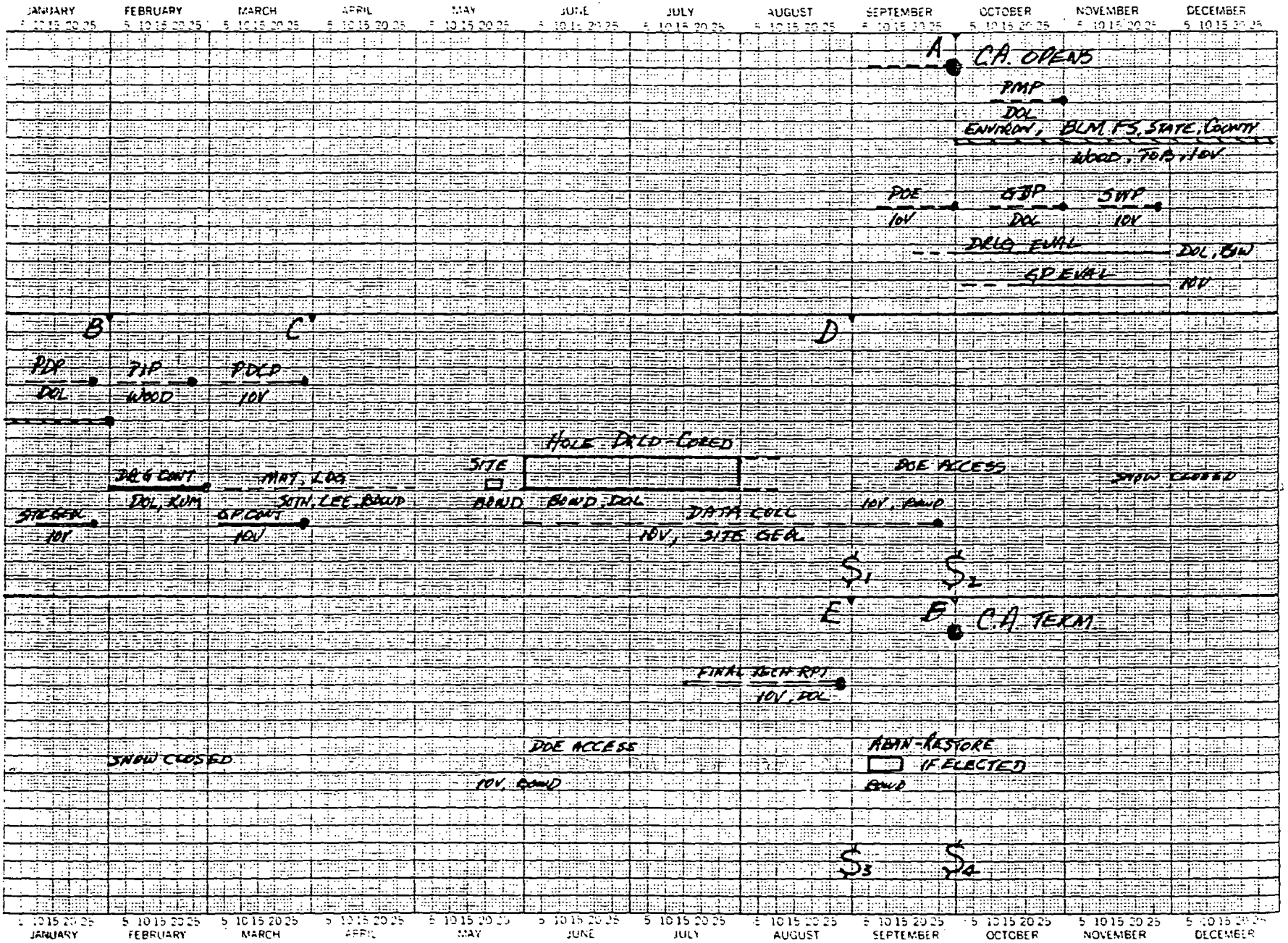
7. Submit Final Technical Report, abandon Hole and restore drillsite if elected, and terminate Cooperative Agreement at the end of its 24-month term.

The foregoing sequential work sectors are presented in the following table of Activity Milestones and Work Tasks. The Work Tasks are also illustrated on the succeeding Project Schedule Timeline which additionally shows the key Thermal personnel accountable for each Work Task.

Term Month Time	Activity Milestones and Work Tasks
0	**A. MILESTONE: Cooperative Agreement Executed on 9/30/85**
	1. Prepare and submit multiple Plans, Reports, Permits:
	Plan of Exploration (POE) to BLM and USFS
	Project Management and Drilling Plans to DOE
	Environmental Evaluation (EE) Support to BLM and DOE
	Geothermal Drilling Permit (GDP) to BLM
	2. Conduct Subcontractor Evaluations
End 4	**B. MILESTONE: POE, GDP and EE Approved by 1/30/86**
	3. Project Institutional Data Collection Plans to DOE
	4. Make Subcontractor Selections and initial contract negotiations
End 6	**C. MILESTONE: Drilling & Geophysical Subcontracts Signed by 3/31/86**
	5. Integrate Subcontractors and logistics with Project Drilling Plan
	6. Prepare drillsite and water supply; move-in drilling rig
	7. Execute Drilling and Data Collection Plans in June-July
End 11	**D. MILESTONE: Complete Thermal Gradient Hole at 5000-feet by 8/31/86**
	8. Open and maintain borehole and drillsite for DOE 12-month access period
	9. Review-confirm full compliance, costs and payments
End 23	**E. MILESTONE: Close DOE Access Period by 8/30/87**
	10. If TPC elects, abandon the Thermal Gradient Hole and fully restore the drillsite to its original condition. Alternatively, TPC may elect to preserve the hole and drillsite at its sole cost, risk and legal responsibility.
End 24	**F. MILESTONE: Terminate Cooperative Agreement on 9/30/87**

46 2890

PROJECT SCHEDULE TIMELINE
CLACKAMAS 5000 FOOT THERMAL GRADIENT HOLE



Thermal Power Company Personnel: Project Assignments

The Geothermal Exploration staff, located in Thermal's Santa Rosa, California office, (707/576-7022) will lead the twelve person group that will accomplish this Project. The key persons are:

W. L. D'Olier, Vice President - Geothermal Exploration

Joe Iovenitti, Senior Geologist

Royce Bowden, Geothermal Drilling Supervisor

D'Olier as Project Manager is the accountable person for the completion of all work under this Cooperative Agreement.

The following Work Task assignments are made for this Project.

Work Task	Persons Responsible	
Leases	Wood, Kumin	
Plans, Permits	D'Olier, Iovenitti, Wood	
Environmental	Tobias, Wood	
	Drilling/Coring	Data Objectives
Subcontractor Selection	D'Olier Bowden Sutherland Lee	D'Olier Iovenitti Lee
Contracts	D'Olier Kumin Walker	D'Olier Kumin Walker
Drillsite Preparation	Bowden Iovenitti	
Thermal Gradient Hole Drill-Core-Log	D'Olier Bowden	Iovenitti Hebein Goyal Wellsite Geologists
Cost Accounting	Scott, D'Olier	
DOE Access	Iovenitti, Bowden	
Final Report	Iovenitti, D'Olier	
Termination	D'Olier, Kumin	

Management Techniques

The Project Manager will establish a comprehensive understanding of the Project objectives and its integrated, sequential Work Tasks with the Thermal Power Company personnel group assigned. Each Work Task has an experienced lead person assigned to it and they are teamed with support persons to ensure its careful preparation and execution. A constant use and upgrading of the Project Schedule Guideline will guide the work inputs. At the achievement of each Activity Milestone (Events A thru E), the Thermal personnel group will meet to review work quality, problems, updated schedules and any Project modifications that may be required. The Project Manager and key employees will review and summarize Project progress both monthly and quarterly. A long practiced teamwork and a high level of internal, informal communications will allow the Thermal personnel to effectively prosecute all Work Tasks as required by the Project Schedule Guideline and the Statement of Work. A current Table of Organization for Thermal Power Company is included as Appendix 4 of this Plan.

Subcontractor Selection Process

The Thermal Power Company geothermal operations experience underscores the great importance of first class subcontractor participants in executing drilling programs and related field work for coherent results and success to be achieved.

For the Drilling and Geophysical Logging subcontractors, we will:

1. Interview managers and key persons to obtain measures of each firm's competence and geothermal specific experience. We will cross check these findings with other client geothermal operators, if possible. We are evaluating Boyles Bros., Tonto, Longyear and Jannsen as qualified Drilling Subcontractors. BPB Instruments, Inc., Colorado Well Logging, Inc., Georand, and Southwest Surveys are being evaluated as potential Geophysical Logging Subcontractors.

2. We are looking at the specific rigs and borehole logging equipment proposed to be used. We will attempt to additionally examine these critical items in on-site working modes.

3. The critical Project requirements will be examined with the most qualified candidates to select the best equipment and technical procedures at acceptable costs.

4. First Quarter 1986 cost estimates will be solicited for the basic work programs for further qualification of expected performance and cost values. This will not be worked as a competitive bidding for the lowest cost selection basis.

5. Selection of a final subcontractor will be based on TPC combined consideration of equipment, personnel, relevant experience and reasonable costs.

Project Cost Accounting and DOE Progress Payments

Thermal Power Company will submit invoices in accordance with Articles IV and V of the Schedules Articles attached to the Cooperative Agreement. The following table shows the Progress Payment Milestones and the DOE payable limits.

	Progress Payment Milestones	Maximum Cumulative Amount Payable by DOE	Probable Date
1.	Drilling and Hole Completed	$170,000	8/30/86
2.	Logs and Fluid Data Submitted to DOE	$202,500	9/30/86
3.	Remainder of Data and Final Report Submitted to DOE	$215,000	8/30/87
4.	Abandonment and Site Restoration Completed:		
	Total Maximum Payable by DOE	$240,000	9/30/87

These Progress Payment Milestones are also shown on the Project Schedule Timeline with the symbol "$". An additional, detailed Summary of Cost, Schedule and Deliverability is included as Appendix 3 of this Project Management Plan as a subordinate reference.

DOE F 4600.3
(7-81)

U.S. DEPARTMENT OF ENERGY

NOTICE OF FINANCIAL ASSISTANCE AWARD

(See Instructions on Reverse)

Under the authority of Public Law 93-410 and subject to legislation, regulations and policies applicable to *(cite legislative program title)*:
Geothermal Research, Development and Demonstration Act of 1977

1. PROJECT TITLE
Cascade Geothermal Drilling

2. INSTRUMENT TYPE
☐ GRANT ☒ COOPERATIVE AGREEMENT

4. INSTRUMENT NO.
DE-FC07-85ID12614

5. AMENDMENT NO.
--

3. RECIPIENT *(Name, address, zip code, area code and telephone no.)*
Thermal Power Co.
3333 Mendocino Ave, Suite 120
Santa Rosa, CA 95401

6. BUDGET PERIOD
FROM: 9/30/85 THRU: 9/30/87

7. PROJECT PERIOD
FROM: 9/30/85 THRU: 9/30/87

8. RECIPIENT PROJECT DIRECTOR *(Name and telephone No.)*
William L. D'Olier (707) 576-7040

10. TYPE OF AWARD
☒ NEW ☐ CONTINUATION ☐ RENEWAL
☐ REVISION ☐ SUPPLEMENT

9. RECIPIENT BUSINESS OFFICER *(Name and telephone No.)*
Philip Scott (415) 765-0329

12. ADMINISTERED FOR DOE BY *(Name, address, zip code, telephone No.)*
Ronald A. King (208) 526-0790
U. S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

11. DOE PROJECT OFFICER *(Name, address, zip code, telephone No.)*
Susan Prestwich (208) 526-1147
U.S. DOE, Idaho Operations Office
785 DOE Place, Idaho Falls, ID 83402

13. RECIPIENT TYPE
☐ STATE GOV'T ☐ INDIAN TRIBAL GOV'T ☐ HOSPITAL ☒ FOR PROFIT ORGANIZATION ☐ INDIVIDUAL
☐ LOCAL GOV'T ☐ INSTITUTION OF HIGHER EDUCATION ☐ OTHER NONPROFIT ORGANIZATION ☒ C ☐ P ☐ SP ☐ OTHER *(Specify)*

14. ACCOUNTING AND APPROPRIATIONS DATA

a. Appropriation Symbol	b. B & R Number	c. FT/AFP/OC	d. CFA Number
89X0224.19	AM101510	ID-54-91/250	

15. EMPLOYER I.D. NUMBER/SSN

16. BUDGET AND FUNDING INFORMATION

a. CURRENT BUDGET PERIOD INFORMATION

(1) DOE Funds Obligated This Action	$ 240,000
(2) DOE Funds Authorized for Carry Over	$ -0-
(3) DOE Funds Previously Obligated in this Budget Period	$ -0-
(4) DOE Share of Total Approved Budget	$ 240,000
(5) Recipient Share of Total Approved Budget	$ 240,000
(6) Total Approved Budget	$ 480,000

b. CUMULATIVE DOE OBLIGATIONS

(1) This Budget Period *[Total of lines a.(1) and a.(3)]*	$ 240,000
(2) Prior Budget Periods	$ -0-
(3) Project Period to Date *[Total of lines b. (1) and b. (2)]*	$ 240,000

17. TOTAL ESTIMATED COST OF PROJECT $ _____

(This is the current estimated cost of the project. It is not a promise to award nor an authorization to expend funds in this amount.)

18. AWARD/AGREEMENT TERMS AND CONDITIONS

This award/agreement consists of this form plus the following:

a. Special terms and conditions (if grant) or schedule, general provisions, special provisions (if cooperative agreement)

b. Applicable program regulations *(specify)* N/A *(Date)* _____

c. DOE Assistance Regulations, 10 CFR Part 600, as amended, Subparts A and ☐ B (Grants) or ☒ C (Cooperative Agreements).

d. Application/proposal dated 4/29/85, ☐ as submitted ☒ with changes as negotiated

19. REMARKS
This Agreement consists of this NFAA, Schedule Articles, General Provisions, Appendix A - Statement of Work, Appendis B - Labor Determination, DOE Order 1332.2, and Cost Principles FAR 31.2 and DEAR 931.2.

20. EVIDENCE OF RECIPIENT ACCEPTANCE
BY William L. D'Olier 9/30/85
(Signature of Authorized Recipient Official) *(Date)*
William L. D'Olier
Vice President *(Name)*
Geothermal Exploration
(Title)

21. AWARDED BY
William C. Drake 9/27/85
(Signature) *(Date)*
William C. Drake
(Name)
Contracting Officer
(Title)

TPC
Statement of Work

1.0 Introduction

The Cascade volcanic region has long been suspected to contain considerable geothermal potential, as evidenced by recent volcanism and other thermal expressions. There are few known surface manifestations of geothermal energy in spite of the obvious occurrence of heat sources. One possible explanation is that the downward percolation of the extensive regional cold ground water system suppresses surface evidence of underlying hydrothermal systems. However, there have been few wells drilled in the Cascades region to a sufficient depth to properly evaluate the temperature and hydrological conditions beneath the cold water zone. There is a great need for characterization identification of the deeper hydrothermal regime in order to more conclusively define the geothermal potential of the Cascades volcanic environment.

DOE's primary objectives for this cost-shared drilling project are to obtain and release to the public subsurface information to include but not limited to the following:

- o rock samples (core and/or drill chips),
- o equilibrium temperature profiles,
- o uncontaminated fluid samples,
- o evidence for the existence and depth of potentially producible aquifers,
- o geophysical well logs, and
- o information on drilling conditions and problems in the Cascades environment.

2.0 Scope

1. The Participant will drill a thermal gradient hole to an approximate target total depth of 5000 feet in Section 28, T8S, R8E Willamette Meridian, Marion County, Oregon. This primary task will be accomplished by 24 hours per day continuous work to achieve its completion in an estimated 60 days of rig operations.

2. The Participant will collect all required data both during and subsequent to drilling the thermal gradient hole.

3. The Participant will provide all data and information gathered under this Project to DOE.

4. The Participant will obtain all permits and approvals required by government regulatory agencies for the performance of this Project.

5. The Participant will perform all Project work in compliance with federal, state and local laws, rules and regulations and agency orders and guidelines.

3.0 Applicable Documents

Work performed by the Participant will be in compliance with all Federal, State, and local laws, rules and regulations, and agency orders and guidelines.

4.0 Technical Tasks

4.1 Project Management

A. The Participant will prepare and obtain DOE approval of a Project Management Plan within 30 days after award of this agreement. The plan will include a work breakdown structure and a list of deliverables by task, identify the individuals and subcontractors responsible for each task, discuss the management techniques to be used, and include a schedule that shows the period for performance of each subtask and identifies principal milestones and decision points for each. This plan will also designate an individual or individuals who will act as principal points of contact with DOE on behalf of the Participant.

B. The Participant will submit and obtain DOE approval of a Project Institutional Plan prior to initiation of site preparation. The plan will identify items required by governmental regulatory agencies for the performance of this work, the agency whose requirement the item fulfills, and the actual or projected submittal and agency approval dates. The plan will also discuss any legal, social, or institutional problems anticipated during performance of the project and planned solutions.

C. The Participant will prepare and obtain DOE approval of a Project Drilling Plan prior to drilling. The plan shall describe:

1. Surface and subsurface conditions anticipated to be encountered during drilling, including configuration of the resource.

2. Site access.

3. Site preparation.

4. Hole design including hole size, casing size, cementing, etc.

5. Rig and equipment specifications.

6. Well containment during and after drilling including applicable regulatory requirements).

7. Drilling fluids and disposal method.

8. Hole completion.

9. Plugging and abandonment.

10. Site restoration.

11. Anticipated hole problems, if any, and proposed solutions.

12. Health, safety and environmental considerations.

13. Site facilities, if any.

14. Drilling schedule including major activities and estimated duration.

15. On-site supervision to be used during drilling, including drilling supervisor(s) and geologist(s).

D. The Participant will prepare and obtain DOE approval of a Project Data Collection Plan prior to drilling. This plan will address data collection both during drilling and after drilling. The plan will identify the types of data to be collected, the depth(s) at which each type of data will be collected, the timing of collection, and the method by which the Participant plans to collect each type of data, including type of instrument and planned calibration, where appropriate. The plan will specifically identify all logs and samples of rock and fluid that are to be collected.

E. The Participant will conduct subcontractor evaluations, select subcontractors and complete contract negotiations with selected subcontractors.

F. The Participant will perform project management in accordance with the approved Project Management Plan. In addition to close general coordination with DOE, immediate and full disclosure of any project problem areas to DOE is required, so that timely corrective action may be taken with DOE technical support, if necessary.

Deliverables: Approved Project Management Plan, Project Institutional Plan, Project Drilling Plans and Project Data Collection Plan.

4.2 Permitting and Environmental Reporting

A. The Participant will prepare, submit and obtain approval of any documentation required by governmental regulatory agencies for the performance of this work, including a geothermal exploration permit and a plan of operations. A copy of all documentation provided to any governmental agency and pertinent to this project shall be provided to DOE.

B. An approved environmental document is required for this project prior to any ground disturbance. It is anticipated that an environmental assessment will be prepared by the Bureau of Land Management for this project. This environmental assessment may satisfy DOE's environmental reporting requirements. If DOE determines that a separate Environmental Evaluation Report is required prior to any ground disruptive activity, DOE will notify the Participant in writing. In that event, the Participant will prepare the Environmental Evaluation Report in accordance with DOE Environmental guidelines. If a DOE Environmental Assessment is required, the Participant will provide information to DOE as required for DOE's preparation of the Environmental Assessment.

If DOE determines that an Environmental Assessment is required, DOE will notify TPC in writing. Upon such notification, TPC will provide information to DOE as required for DOE's preparation of the Environmental Assessment.

Deliverables: Approved environmental document and regulatory documentation.

4.3 Drilling

A. The Participant will confirm logistics, services and vendors with requirements outlined in the approved Project Drilling Plan.

B. The Participant will prepare drill site, access and water supply and move in drilling rig in accordance with approved Project Drilling Plan.

C. The Participant will drill a thermal gradient hole to 5000 feet TD in accordance with the approved Project Drilling Plan. The Participant shall report on drilling status daily to the designated DOE representative, so that discussions concerning the drilling operation can be made in a timely manner.

4.4 Data Collection

A. The Participant will collect the following data as a minimum in accordance with the approved Project Data Collection Plan. These data shall be provided to DOE by the Participant as soon as acquired.

Rock Sampling - The drilling of the hole is designed such that a continuous core from bedrock to total depth will be obtained. It is anticipated that a 2.50" core will be recovered from the drilling of HQ (3.85" OD) size hole. If it is necessary to reduce to NQ (3.03") hole size, a 1.88" core will then be retrieved. Drill cuttings will also be

obtained from at least the upper 500 feet of the hole. The Participant's drill site geologist will provide data collection and on-site handling of samples. DOE will provide procedures for identification and splitting of core and cuttings and will coordinate disposition and storage of the samples with the Participant.

Fluid Sampling - Daily measurements of the hydraulic head (natural water level in the hole) will be obtained as allowed during the drilling operation. Lost circulation data will be collected. If artesian flow is encountered and the issued drilling permit allows the performance of a flow test, a short-term test will be conducted at total depth to obtain samples of the formation water and wellhead temperature and pressure. Drilling fluid samples will be collected as per SCAP. The drill site geologist will maintain a log of the daily water level and lost circulation data. If no artesian flow is encountered, the Participant will still endeavor to collect samples of uncontaminated aquifer fluids at locations in the hole at which fluid production would be anticipated on the basis of lost circulation, indications of fracturing in the core or chips, geophysical well logs or other standard indicators. Potential methods for collection of these samples include swabbing, bailing, air lift, drill stem tests and pumping. The Participant will examine these and/or other fluid sampling techniques and address collection of these samples in the Project Data Collection Plan.

Geophysical Borehole Logging - The complete suite of geophysical borehole logs identified in the SCAP (temperature, caliper, resistivity, self-potential, sonic velocity and density logs) along with natural gamma, will be run in the wellbore not more than three separate times. The three logging runs would correlate with the running of the surface casing at 3000' (if needed and a total depth (5000'). The open-hole logs (SP, caliper, resistivity and sonic) will only be run in the open-hole. Temperature logs will be run from surface to total depth. Gamma and/or density will only be run a couple hundred of feet into the cased-hole. The latter will allow cross-cablibration between the three intended logging runs. The Participant's geologist will direct and observe all logging operations. A comprehensive logging operation report will be prepared for each logging operation. One set of field prints will be sent to DOE as soon as available.

Maximum Temperature Reading - Three maximum recording thermometers will be run at every core recovery. These data will be collected by the drill site geologist.

Daily Drilling Report - A drilling report will be completed every day and submitted to DOE.

Directional Survey - A multi-shot direction survey will be made at total depth to allow for oriented core analysis. Specific hole conditions may require an additional survey.

"Mud" Log - A "Mud" log will be maintained during the drilling operation. This log will provide the following principal data, summarized at a vertical scale of 1' = 100':

1. geologic field description of core (including lithology, alteration minerology and fracture geometery assuming a vertical hole),

2. graph of penetration rate versus depth,

3. graph of measured water level versus depth,

4. lost circulation zones (including time/date, depth, total amount of fluid loss and rate of fluid loss), and

5. casing profile.

Temperature surveys

The Participant will conduct two temperature surveys. The first to be conducted at one week and the second at one month after the thermal gradient hole has been completed. These surveys will be from surface to total depth.

Deliverable: Data and samples.

4.5 Hole Completion and Maintenance

A. Upon satisfactory completion of drilling, open-hole geophysical logging and sampling, a steel tubing string will be hung or cemented in the borehole from surface to TD and the well completed by the Participant in accordance with the approved Project Drilling Plan.

B. Upon completion of the hole, DOE and the Participant shall review and discuss the data. The Participant will obtain Project Manager's agreement prior to releasing the rig.

C. The Participant shall provide to DOE within 15 days of completion of the hole a schematic of the actual completed hole configuration.

D. The Participant shall maintain the hole and site for a period of 12 months after hole completion in accordance with the approved Project Drilling Plan. The hole and site shall be

made available to DOE during this period for DOE's scientific use. The Participant will not attempt to preserve access to the site during the period of winter snow cover.

Deliverable: Completed hole configuration schematic.

4.6 Abandonment and Site Restoration

The Participant will plug and abandon the hole and fully restore the site in accordance with BLM regulations, Forest Service stipulations and the Project Drilling Plan. Alternatively, the Participant may elect to preserve the hole and drill site at its sole risk, cost and legal responsibility. In this instance, the Participant shall provide DOE with a copy of the plug and abandonment and site restoration plans from the approved Plan of Operations and shall provide confirmation of these activities. DOE will not cost-share costs incurred after the project period of this agreement.

Deliverables: Approved P&A and restoration plans.

5.0 Reports, Data and Other Deliverables

A. The Project Drilling Plan as required by Subtask 4.1.C.

B. The Project Data Collection Plan as required by Subtask 4.1.D.

C. The Project Management Plan as required by Subtask 4.1.A.

D. The Project Institutional Plan as required by Subtask 4.1.B.

E. All data collected by the Participant under Task 4.4.

F. Regulatory documentation and approved environmental document under Subtasks 4.2.A and 4.2.B.

G. Completed hole completion schematic as required by Subtask 4.5.C.

H. Approved plug and abandonment plan as required by Task 4.6.

I. Project status and management reports as identified on DOE Form CR-537, Reporting Requirements Checklist. The final technical report will include a description of drilling and completion and data will be presented and discussed.

U.S. DEPARTMENT OF ENERGY

FEDERAL ASSISTANCE REPORTING CHECKLIST

FORM EIA-459A
(10-80)

FORM APPROVED
OMB NO 1900-0127

1. Identification Number: DE-FC07-85ID12614	2. Program/Project Title: Cascade Geothermal Drilling

3. Recipient: Thermal Power Company

4. Reporting Requirements:	Frequency	No. of Copies	Addressees
PROGRAM/PROJECT MANAGEMENT REPORTING			
[X] Federal Assistance Milestone Plan	O	2,1,1	A,B,E
[ ] Federal Assistance Budget Information Form			
[X] Federal Assistance Management Summary Report	Q	1,1,1	A,B,C
[X] Federal Assistance Program/Project Status Report	Q	2,1.1	A,B,E
[X] Financial Status Report, OMB Form 269	Y,F	1,1	B,C
TECHNICAL INFORMATION REPORTING			
[XX] Notice of Energy RD&D	O,Y	1,1	B,D
[ ] Technical Progress Report			
[X] Topical Report	A	3,1,1,1	A,B,E,F
[X] Final Technical Report	F	*4,1,1,1	A,B,E,F

FREQUENCY CODES AND DUE DATES:

A - As Necessary; within 5 calendar days after events.
F - Final; ~~90 calendar days after the performance of the effort ends.~~ Upon completion of agreement
Q - Quarterly; within 30 days after end of calendar quarter or portion thereof.
O - One time after project starts; within 30 days after award.
X - Required with proposals or with the application or with significant planning changes.
Y - Yearly; 30 days after the end of program year. (Financial Status Reports 90 days).
S - Semiannually; within 30 days after end of program fiscal half year.

5. Special Instructions:

A draft to the Final Technical Report shall be submitted for review to the contracting officer at least 60 days prior to the final due date. Comments resulting from this review shall be resolved and the report revised accordingly prior to final submission to DOE. The Final Technical Report shall be submitted with a camera-ready copy.

NOTE: Contracting officer copy shall list all distribution.

*Includes camera-ready copy.

6. Prepared by: (Signature and Date)	7. Reviewed by: (Signature and Date)

REPORT DISTRIBUTION LIST

DE-FC07-85ID12614

U. S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

A. Susan Prestwich
Geologist
Advanced Technology Division

B. Ronald A. King
Contract Specialist
Contracts Management Division

C. Earl G. Jones
Director
Financial Management Division

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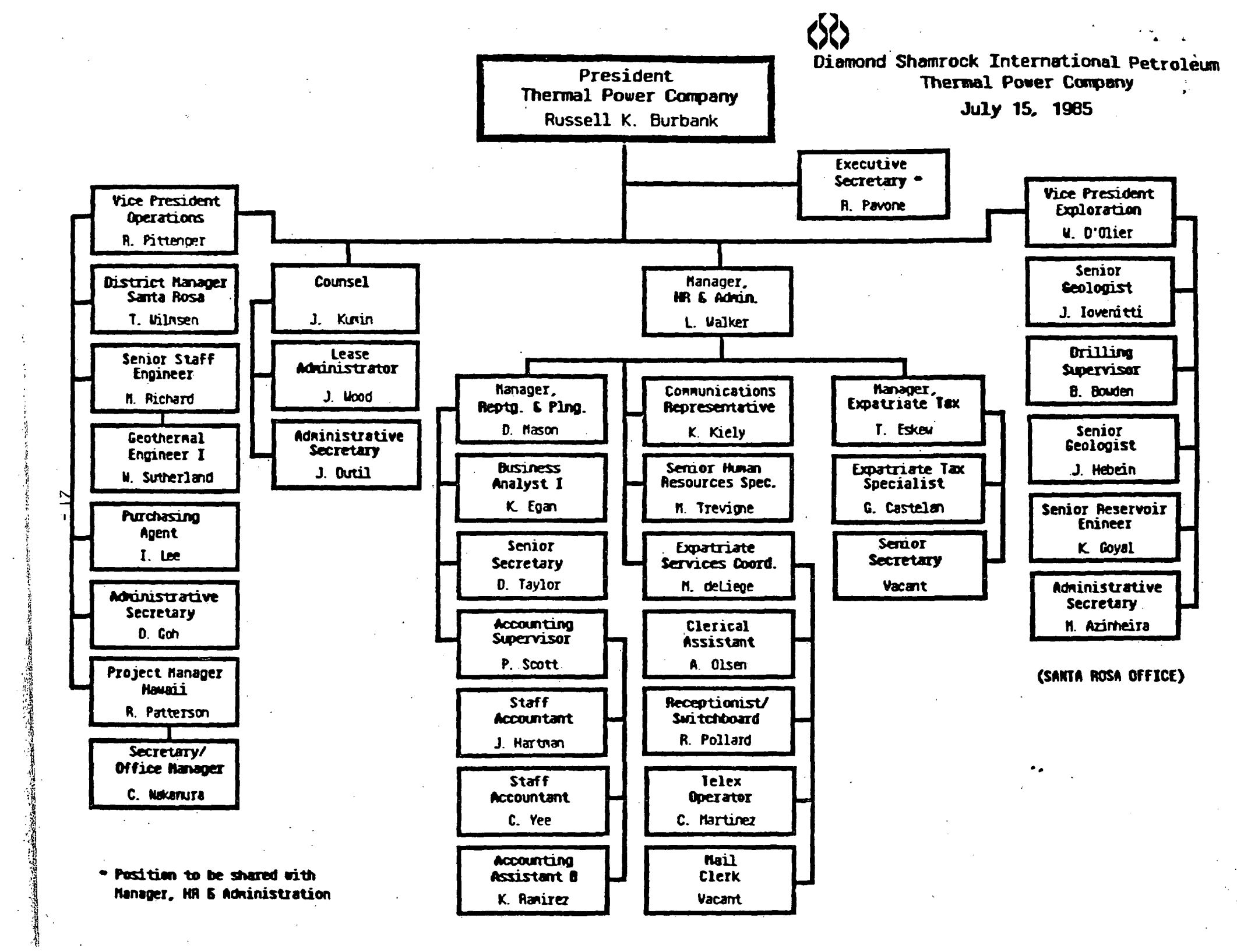
Oak Ridge, TN 37830

E. P. M. Wright
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, UT 84108-1295

F. Marshall Reed
U. S. Department of Energy
CE-323 Forestal Building
1000 Independence Avenue, S.W.
Washington DC 20585

COST, SCHEDULE AND DELIVERABLE SUMMARY

TASK	ESTIMATED 100% COST	SCHEDULE START	SCHEDULE COMPLETE	MILESTONES & DELIVERABLES
1. Project Management	NO CHARGE	10·1·85	10·31·85	1. Management Plan
2. Permitting and Environmental Reporting	NO CHARGE	8·8·85	2·28·86	1. Institutional Plan 2. Regulatory Documentation 3. EER
3. Drilling SITE PREPARATION	$15.000	5·20·86	5·25·86	1. Drilling Plan 2. Daily Drilling Status Reports
DRILLING - CORING	343.000	6·1·86	7·31·86	
4. Data Collection (a) During Drilling				1. Data Collection Plan
GEOPHYS. LOGS	22,200	6·3·86	7·29·86	2. Rock & Fluid Results of Analyses Samples, & Data Reports
FLUID SAMPLES	3000	"	"	
FLOW TEST 3000'?	7000	6·29·86	6·30·86	
SITE GEOLOGISTS	22.000	6·1·86	7·31·86	
(b) After Drilling				1. Well Legs
FLOW TEST 5000'	10.000	7·29·86	7·31·86	2. Fluid Samples
TWO TEMP. SURVEYS	7800	8·7·86	8·30·86	3. Other Data & Results
5. Completion & Maintanance TUBING ETC.	20.000	7·31·86	7·31·86	1. Completion Schematic
6. Abandonment IF ELECTED	25.000	95·87	9·10·87	1. Approved Abandonment Plan
7. Site Restoration IF ABANDONED	5000	9·10·87	9·15·87	1. Restoration Confirmation Report
8. Reporting	NO CHARGE	10·31·85	9·30·87	1. As summarized in this table
9. Dissemination of Information	NO CHARGE	10·1·85	9·30·87	1. Project sign, press release(s) 2. Final Technical Report
TOTAL ESTIMATED 100% COSTS	$480.000			


Diamond Shamrock International Petroleum
Thermal Power Company
July 15, 1985
President
Thermal Power Company
Russell K. Burbank
Executive Secretary *
R. Pavone
Vice President Operations
R. Pittenger
District Manager Santa Rosa
T. Wilmsen
Senior Staff Engineer
M. Richard
Geothermal Engineer I
W. Sutherland
Purchasing Agent
I. Lee
Administrative Secretary
D. Goh
Project Manager Hawaii
R. Patterson
Secretary/ Office Manager
C. Nakamura
Counsel
J. Kunin
Lease Administrator
J. Wood
Administrative Secretary
J. Dutil
Manager, HR & Admin.
L. Walker
Manager, Reptg. & Plng.
D. Mason
Business Analyst I
K. Egan
Senior Secretary
D. Taylor
Accounting Supervisor
P. Scott
Staff Accountant
J. Hartman
Staff Accountant
C. Yee
Accounting Assistant B
K. Ramirez
Communications Representative
K. Kiely
Senior Human Resources Spec.
M. Trevigne
Expatriate Services Coord.
M. deLiege
Clerical Assistant
A. Olsen
Receptionist/ Switchboard
R. Pollard
Telex Operator
C. Martinez
Mail Clerk
Vacant
Manager, Expatriate Tax
T. Eskew
Expatriate Tax Specialist
G. Castelan
Senior Secretary
Vacant
Vice President Exploration
W. D'Olier
Senior Geologist
J. Ioveniti
Drilling Supervisor
B. Bowden
Senior Geologist
J. Hebein
Senior Reservoir Enineer
K. Goyal
Administrative Secretary
M. Azinheira
(SANTA ROSA OFFICE)
* Position to be shared with Manager, HR & Administration
- 17 -

Diamond Shamrock
Thermal Power Company

13 August 1985

U. S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

Attention: Ronald A. King
R&D Contracts Branch
Contracts Mgmt. Div.

Ref: SCAP Number
DE-SC07-85ID12580
DOE Letter 8/5/85

Gentlemen:

Thermal Power Company has examined the DOE's draft revision of the Statement of Work and our comments are restricted to the Geophysical Borehole Logging element on page 5 of your draft. Our proposed wording for this element is Enclosure 1 to this letter. All other portions of the revised Statement of Work presented in your letter of August 5, 1985 are acceptable to us.

Enclosure 2 of this letter is your Cost Schedule and Deliverable Summary, as completed by Thermal, which should assist payment schedules.

Yours very truly,

W. L. D'Olier
Vice President
Geothermal Exploration

WLD/ma

Enclosures 1 and 2

Thermal Power Company
A subsidiary of Diamond Shamrock, 3333 Mendocino Avenue, Suite 120, Santa Rosa, California 95401
Phone 707 576-7022

ENCLOSURE I

THERMAL POWER COMPANY
Santa Rosa Office

PROPOSED CHANGE IN REVISED TPC STATEMENT OF WORK

Geophysical Borehole Logging: The complete suite of geophysical borehole logs identified in the SCAP (temperature, caliper, resistivity, self-potential, sonic velocity and density logs) along with natural gamma, will be run in the wellbore not more than three separate times. The three logging runs would correlate with the running of the surface casing planned at 500', of intermediate casing at 3000' (if needed) and at total depth (5000'). The open-hole logs (SP, caliper, resistivity and sonic) will only be run in the open-hole. Temperature logs will be run from surface to total depth. Gamma and/or density will only be run a couple hundred of feet into the cased-hole. The latter will allow cross-calibration between the three intended logging runs. The Thermal Power Company geologist will direct and observe all logging operations. A comprehensive logging operation report will be prepared for each logging operation. One set of field prints will be sent to DOE as soon as available.

JLI/ma
8/13/85

ENCLOSURE 2

COST, SCHEDULE AND DELIVERABLE SUMMARY

TASK	ESTIMATED 100% COST	SCHEDULE START	SCHEDULE COMPLETE	MILESTONES & DELIVERABLES
1. Project Management	NO CHARGE	10·1·85	10·31·85	1. Management Plan
2. Permitting and Environmental Reporting	NO CHARGE	8·8·85	2·28·86	1. Institutional Plan 2. Regulatory Documentation 3. EER
3. Drilling				1. Drilling Plan 2. Daily Drilling Status Reports
SITE PREPARATION	$15,000	5·20·86	5·25·86	
DRILLING - CORING	343,000	6·1·86	7·31·86	
4. Data Collection				1. Data Collection Plan
(a) During Drilling				2. Rock & Fluid Results of Analyses Samples, & Data Reports
GEOPHYS. LOGS	22,200	6·3·86	7·29·86	
FLUID SAMPLES	3000	"	"	
FLOW TEST 3000'?	7000	6·29·86	6·30·86	
SITE GEOLOGISTS	22,000	6·1·86	7·31·86	
(b) After Drilling				1. Well Legs 2. Fluid Samples 3. Other Data & Results
FLOW TEST 5000'	7000	7·29·86	7·31·86	
TWO TEMP. SURVEYS	7800	8·7·86	8·30·86	
5. Completion & Maintanance TUBING ETC.	20,000	7·31·86	7·31·86	1. Completion Schematic
6. Abandonment IF ELECTED	25,000	95·87	9·10·87	1. Approved Abandonment Plan
7. Site Restoration IF ABANDONED	5000	9·10·87	9·15·87	1. Restoration Confirmation Report
8. Reporting	NO CHARGE	10·31·85	9·30·87	1. As summarized in this table
9. Dissemination of Information	NO CHARGE	10·1·85	9·30·87	1. Project sign, press release(s) 2. Final Technical Report
TOTAL ESTIMATED 100% COSTS	$477,000			

TPC · 13 AUG 85

John W. Hook & Associates, Inc.
Geothermal and Mineral Exploration

P.O. Box 3133
Salem, Oregon 97302
(503) 371-3901

August 12, 1985

Mr. Ronald A. King
R&D Contracts Branch
Contracts Management Division
Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

Re: Solicitation No. DE-SC07-85ID12580

Dear Mr. King:

We received your letter of August 5, 1985, with the revisions of the Statement of Work in draft form.

We strongly object to the requirements for openhole geophysical logging in both the original and the draft of the revised Statement of Work. Such geophysical logging requires that a logging truck and crew be brought up from California prior to running any string of casing below the surface casing (revised draft--the original required openhole logging to the surface and was later amended to exclude the conductor pipe). At the Blue Lake explosion crater we will be drilling into unknown formations and have planned for as many as three reductions in the size of our rotary hole and four reductions in core if needed. This could require as many as seven trips to give openhole geophysics from the surface casing to TD. At the least, it would require a trip to log the rotary hole prior to setting the 4 1/2 inch casing and a second trip to log the core hole to the TD.

A similar logging run cost $30,000 for Well-Ex to log the Old Maid Flat No. 1 well to 4,000 feet in 1979 when I was working for Northwest Natural Gas on the Mt. Hood Project. I don't have the costs for the logging of OMF-7A but these should be in the DOE files. In either case, the results of this very expensive electric logging were virtually meaningless except for temperature gradients which were run later in cased hole at a fraction of the expense.

Our experience at Mt. Hood has been duplicated by others in industry who have found that openhole geophysics have been of little or no value in volcanic terranes. I have permission from Richard Dondanville of Union and Tsvi Meidav of Trans-Pacific Geothermal to use them as reference to this conclusion. (In fact, Dick Dondanville told me that Union had not applied for assistance under this SCAP because the added cost of this questionable geophysics practically offset the advantages of the 50% cost share. Union preferred to pay the slight difference and keep the information to themselves.)

In addition to the costs of the logging, the rig must be put on stand-by time until the logging is completed. This would add another $1,500 for each day used for this purpose. Furthermore, the longer the hole is left uncased, the greater the danger of losing it. We strongly object to taking this risk.

Blue Lake Geothermal Company's proposal to DOE is based on "turn key" fixed prices for each item in our proposal. Our budget simply does not allow for the unknown factors of the openhole geophysical logging which could increase the costs of the project by as much as 50% and negate any advantage of the DOE funding.

We again wish to point out that we plan to core at least the bottom 1,000 feet of the well, and probably more. This is the critical part of the well which hopefully will give a first look at Taylor's "Plio-Cascades" formations. Furthermore, the core will provide hard data on the fracturing, permeability, alteration and other factors which could only be guessed at by openhole geophysics. We are proposing to provide data which is far superior to electric logs, especially in unknown volcanic terranes. We respectfully request that the requirement for openhole geophysics be dropped from the revised Statement of Work.

Yours very truly,

John W. Hook

John W. Hook

cc: C. Girard Davidson
Wilford F. Covert

M I L E S T O N E S — GEO North

Phase 1 ---Drilling

8/19/85 Spud Corehole
10/ 7/85 Release Rig
11/ 1/85 Final Billing from Contractor
11/15/85 End Phase 1

Phase 11 --Evaluation, DOE Access Period

Phase 111--Technology Transfer

MILESTONE DELIVERABLE

DATE	MILESTONE	DELIVERABLES
8/15/85	Letter Agreement	* Project Drilling Plan * Project Data Collection Plan * Project Management Plan * Project Institutional Plan * Regulatory Documentation * Environmental Document * Proof of Site Access * GEO AFE Documents * GEO Procurement Procedures * Documentation for Additional (Hg) Studies * Breakdown of Cost According to Milestones and deliverables * Other Information as Required
9/1/85	Contract Award	N/A
11/15/85	Phase 1-Drilling	Geophysical Logs Temperature Logs Lithologic Log Drillers Log Hole Completion Schematic Temperatures Measured during Drilling Hydraulic Head Data taken during Drilling Other Data Collected during Phase 1

* No DOE Funds Requested

11/15/86 Phase 11 Evaluation

6/15/86

- Geochemical Data-fluids
- Geochemical Data-rocks
- Age Dates
- Petrographic Analysis
- Mercury Survey
- Splits of core, cuttings, fluids, etc.
- Final Temperature Log
- Plug and Abondonment Plan
- Project Status and Management Reports
- Other Reports as required
- Other Data collected during Phase 11
- All reports written during Phase 11
- DOE access to Site

11/15/87 Phase 111
Technology Transfer

1/15/87

- Final Project report
- Project Status and Management reports
- Other reports as required
- Other remaining Data and miscellaneous items

COST BREAKDOWN

COSTS ACCRUED	PHASE 1	PHASE 11	PHASE 111	TOTAL
1. Direct material				
a. Purchased parts, maps,etc.	8,000	-0-	-0-	8,000
b. Subcontracted items				
Environmental	-0-	-0-	-0-	-0-
Archeology	5,000	-0-	-0-	5,000
Drilling	260,000	-0-	-0-	260,000
Geophysical logging	25,000	5,000	-0-	30,000
Geochemical analysis	-0-	10,000	-0-	10,000
2. Material Overhead	-0-	-0-	-0-	-0-
3. Direct Labor				
Environmental coordinator	3,443(75%)	-0-	1,148(25%)	4,591
Geologist-supervison corehole	7,128	-0-	-0-	7,128
Geologist-analysis of core	2,851(40%)	2,851(40%)	1,426(20%)	7,128
Geologist-evaluation of logs	-0-	3,564	-0-	3,564
Geologist-evaluation	-0-	5,346(75%)	1,782(25%)	7,128
Project Management	2,596(40%)	1,299(20%)	2,596(40%)	6,491

COSTS ACCRUED	PHASE 1	11	111	TOTAL
4. Labor Overhead, payroll taxes Insurance(@ 25.48%)	4,081	3,328	1,771	9,180
5. Special tesing-mercury survey	-0-	6,150	-0-	6,150
6. Special equipment	-0-	-0-	-0-	-0-
7. Travel	9,000	1,000	-0-	10,000
8. Consultants	-0-	-0-	-0-	-0-
9. Other Direct costs				
Site preparation	5,000	-0-	-0-	5,000
Hole maintenance	-0-	7,000	-0-	7,000
Abandonment	-0-	-0-	5,000	5,000
Technology transfer	2,000	2,000	6,000	10,000
0. Total Direct cost & overhead	334,099	47,538	19,723	401,360
1. General and administrative expense @ 7% of 1,3,4,5,7,9	23,387	3,328	1,380	28,095
2. TOTAL ESTIMATED COST	357,486	50,866	21,103	429,455

Wright

Diamond Shamrock
Thermal Power Company

11 October 1985

Ms Susan Prestwich
DOE Project Officer
U.S. DOE, Idaho Operations Office
785 DOE Place
Idaho Falls, Idaho 83402

Re: Cooperative Agreement
No. DE FC07-85ID12614

Dear Ms Prestwich:

We appreciate your willingness to examine a draft of the Project Management Plan for the Clackamas 5000-foot Thermal Gradient Hole. Your comments will be much appreciated. We might best discuss them by telephone and I propose to call on October 18th or 22nd. Our final Plan should reach your office shortly thereafter.

Separately, Thermal filed the Plan of Exploration with BLM-Portland on September 30th. When we file the Geothermal Drilling Permit application, expectedly by October 30th, copies of both documents will be provided to you.

Yours very truly,

W. L. D'Olier
Vice President
Geothermal Exploration

WLD/ma

OCT 1 > 1985

ADVANCED TECHNICAL
BRANCH

Thermal Power Company
A subsidiary of Diamond Shamrock, 3333 Mendocino Avenue, Suite 120, Santa Rosa, California 95401
Phone 707 576-7022

DRAFT

THERMAL POWER COMPANY
Santa Rosa Office

Project Title: Cascade Geothermal Drilling

CLACKAMAS 5000-FOOT THERMAL GRADIENT HOLE

Cooperative Agreement No. DE-FC07-85ID12614

Project Period: 9/30/85 thru 9/30/87

PROJECT MANAGEMENT PLAN
30 October 1985

Submitted by:
Thermal Power Company
3333 Mendocino Avenue
Santa Rosa, Calif. 95401

W. L. D'Olier
Participant
Project Manager

Approved by:
U.S. DOE, Idaho Operations Office
785 DOE Place
Idaho Falls Idaho 83402

Susan Prestwich
DOE Project Officer

TABLE OF CONTENTS

PROJECT SUMMARY

Thermal Power Company, under a Cooperative Agreement dated 30 September 1985 with the U. S. Department of Energy - Idaho Operations Office, will drill and core the Clackamas 5000-Foot Thermal Gradient Hole during June and July 1986. Thermal will select all subcontractors, upon the completion of evaluations now in progress, to accomplish this Hole and its related important Data Collection Program in accordance with a Statement of Work included in both the Cooperative Agreement and this Project Management Plan.

Approximately 12 Thermal professional employees will be involved in the planning, prosecution and management of the work tasks, subcontractors and data collection for timely delivery to DOE. Milestone achievements, mutually determined by Thermal and DOE, will control payment of a maximum 50% DOE share of authorized costs, not to exceed $240,000. Thermal will provide a 12-month borehole access period to DOE following the expected August 1986 completion of the Thermal Gradient Hole. Thermal will provide its Final Technical Report to DOE before termination of the Cooperative Agreement on 30 September 1987. Thermal may elect to retain the Thermal Gradient Hole at its sole cost, risk and legal responsibility rather than to abandon it and restore the drillsite as allowed in the Cooperative Agreement.

Project Management Plan
Clackamas 5000-Foot Thermal Gradient Hole

The Cooperative Agreement, effective as of 30 September 1985, between Thermal Power Company and U. S. Department of Energy - Idaho Operations Office (see Appendix 1), requires an approved Project Management Plan by 30 October 1985. Thermal Power Company has formulated this Project Management Plan based on the important Statement of Work included in the Cooperative Agreement (see Appendix 2).

Six major, sequential work sectors for Thermal are evident in this Project as follows:

1. Plan, permit and environmental approvals required of DOE, BLM, USFS, Oregon State and Marion County authorities.

2. Evaluate and select subcontractors for drilling-coring, geophysical logging and wellsite data collection.

3. Drilling-coring the 5000-foot Thermal Gradient Hole within time and cost estimates.

4. Data collection, its quality control and early delivery to DOE - Idaho Falls.

5. Providing the 12-month Hole access period to DOE.

6. Submitting cost accounting, supported by subcontractor invoices for progress payments in accordance with the Payment Milestone Schedule.

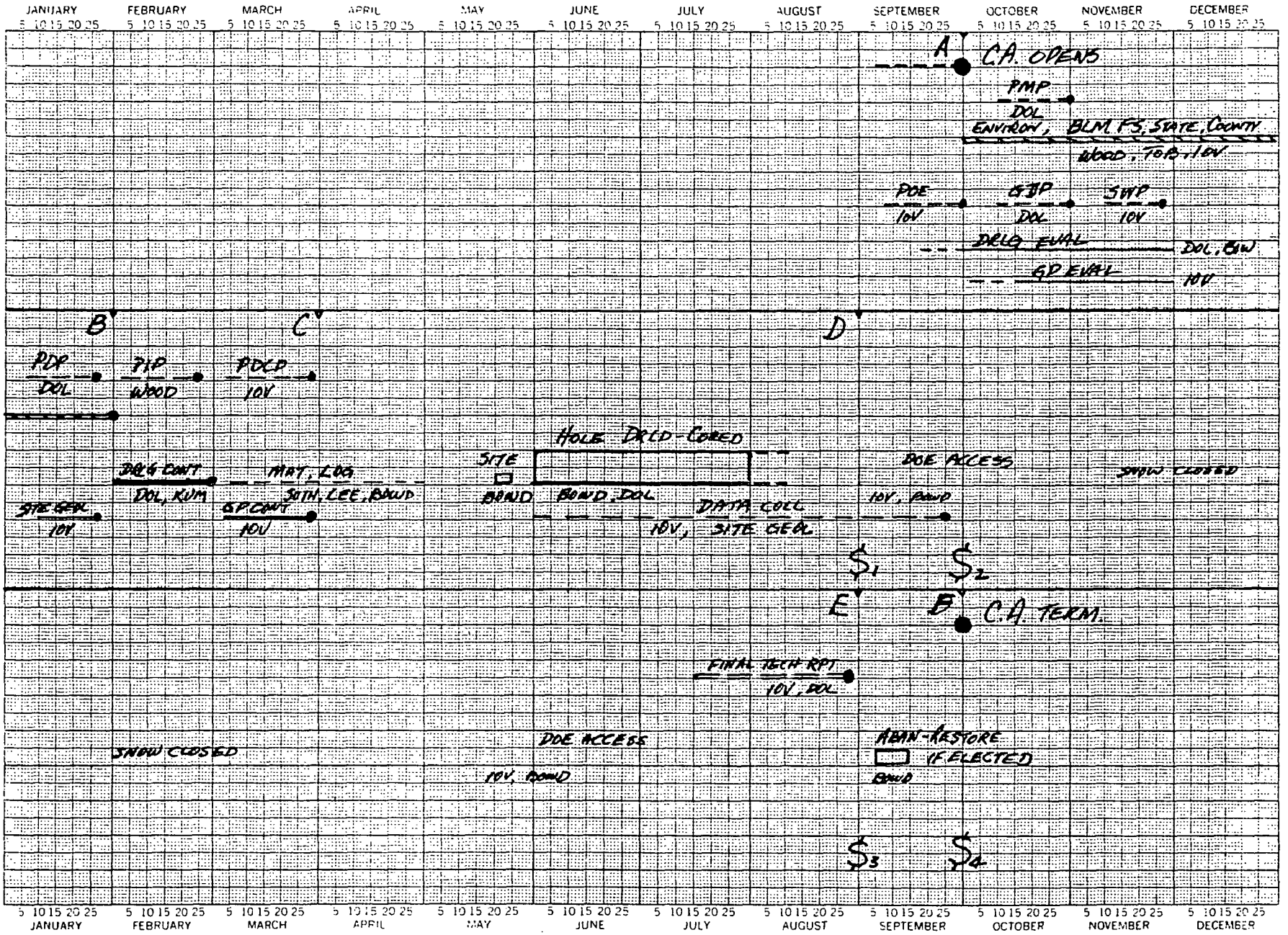
7. Submit Final Technical Report, abandon Hole and restore drillsite if elected, and terminate Cooperative Agreement at the end of its 24-month term.

The foregoing sequential work sectors are presented in the following table of Activity Milestones and Work Tasks. The Work Tasks are also illustrated on the succeeding Project Schedule Timeline which additionally shows the key Thermal personnel accountable for each Work Task.

Term Month Time	Activity Milestones and Work Tasks
0	**A. MILESTONE: Cooperative Agreement Executed on 9/30/85**
	1. Prepare and submit multiple Plans, Reports, Permits:
	Plan of Exploration (POE) to BLM and USFS
	Project Management and Drilling Plans to DOE
	Environmental Evaluation (EE) Support to BLM and DOE
	Geothermal Drilling Permit (GDP) to BLM
	2. Conduct Subcontractor Evaluations
End 4	**B. MILESTONE: POE, GDP and EE Approved by 1/30/86**
	3. Project Institutional Data Collection Plans to DOE
	4. Make Subcontractor Selections and initial contract negotiations
End 6	**C. MILESTONE: Drilling & Geophysical Subcontracts Signed by 3/31/86**
	5. Integrate Subcontractors and logistics wiht Project Drilling Plan
	6. Prepare drillsite and water supply; move-in drilling rig
	7. Execute Drilling and Data Collection Plans in June-July
End 11	**D. MILESTONE: Complete Thermal Gradient Hole at 5000-feet by 8/31/86**
	8. Open and maintain borehole and drillsite for DOE 12-month access period
	9. Review-confirm full compliance, costs and payments
End 23	**E. MILESTONE: Close DOE Access Period by 8/30/87**
	10. If TPC elects, abandon the Thermal Gradient Hole and fully restore the drillsite to its original condition. Alternatively, TPC may elect to preserve the hole and drillsite at its sole cost, risk and legal responsibility.
End 24	**F. MILESTONE: Terminate Cooperative Agreement on 9/30/87**

46 2890

PROJECT SCHEDULE TIMELINE
CLACKAMAS 5000 FOOT THERMAL GRADIENT HOLE



Thermal Power Company Personnel: Project Assignments

The Geothermal Exploration staff, located in Thermal's Santa Rosa, California office, (707/576-7022) will lead the twelve person group that will accomplish this Project. The key persons are:

W. L. D'Olier, Vice President - Geothermal Exploration

Joe Iovenitti, Senior Geologist

Royce Bowden, Geothermal Drilling Supervisor

D'Olier as Project Manager is the accountable person for the completion of all work under this Cooperative Agreement.

The following Work Task assignments are made for this Project.

Work Task	Persons Responsible	
Leases	Wood, Kumin	
Plans, Permits	D'Olier, Iovenitti, Wood	
Environmental	Tobias, Wood	
	Drilling/Coring	Data Objectives
Subcontractor Selection	D'Olier Bowden Sutherland Lee	D'Olier Iovenitti Lee
Contracts	D'Olier Kumin Walker	D'Olier Kumin Walker
Drillsite Preparation	Bowden Iovenitti	
Thermal Gradient Hole Drill-Core-Log	D'Olier Bowden	Iovenitti Hebein Goyal Wellsite Geologists
Cost Accounting	Scott, D'Olier	
DOE Access	Iovenitti, Bowden	
Final Report	Iovenitti, D'Olier	
Termination	D'Olier, Kumin	

The above assignments are also reflected on the Project Schedule Timeline. Each Work Task has both a lead person accountable and a work team assigned to ensure its careful preparation and execution. An initial Project personnel group meeting will be held in Thermal's San Francisco headquarters office on or about 21 October 1985 to introduce, explain and critique this Project Management Plan. Subsequent Project personnel group meetings will be held at the achievement of each Activity Milestone (Events A thru E) to review asccomplishments, problems, updated schedules and any Plan modification that may be required. Effective teamwork and high frequency of internal informal communications will effectively prosecute all activity required by the Statement of Work. A current Table of Organization for Thermal is included as Appendix 4 of this Plan.

Subcontractor Selection Process

The Thermal Power Company geothermal operations experience underscores the great importance of first class subcontractor participants in executing drilling programs and related field work for coherent results and success to be achieved.

For the Drilling and Geophysical Logging subcontractors, we will:

1. Interview managers and key persons to obtain measures of each firm's competence and geothermal specific experience. We will cross check these findings with other client geothermal operators, if possible. We are evaluating Boyles Bros., Tonto, Longyear and Jannsen as qualified Drilling Subcontractors. BPB Instruments, Inc., Colorado Well Logging, Inc., Georand, and Southwest Surveys are being evaluated as potential Geophysical Logging Subcontractors.

2. We are looking at the specific rigs and borehole logging equipment proposed to be used. We will attempt to additionally examine these critical items in on-site working modes.

3. The critical Project requirements will be examined with the most qualified candidates to select the best equipment and technical procedures at acceptable costs.

4. First Quarter 1986 cost estimates will be solicited for the basic work programs for further qualification of expected performance and cost values. This will not be worked as a competitive bidding for the lowest cost selection basis.

5. Selection of a final subcontractor will be based on TPC combined consideration of equipment, personnel, relevant experience and reasonable costs.

Project Cost Accounting and DOE Progress Payments

Thermal Power Company will submit invoices in accordance with Articles IV and V of the Schedules Articles attached to the Cooperative Agreement. The following table shows the Progress Payment Milestones and the DOE payable limits.

	Progress Payment Milestones	Maximum Cumulative Amount Payable by DOE	Probable Date
1.	Drilling and Hole Completed	$170,000	8/30/86
2.	Logs and Fluid Data Submitted to DOE	$202,500	9/30/86
3.	Remainder of Data and Final Report Submitted to DOE	$215,000	8/30/87
4.	Abandonment and Site Restoration Completed:		
	Total Maximum Payable by DOE	$240,000	9/30/87

These Progress Payment Milestones are also shown on the Project Schedule Timeline with the symbol "$". An additional, detailed Summary of Cost, Schedule and Deliverability is included as Appendix 3 of this Project Management Plan as a subordinate reference.

DOE F 4600.3
(7-81)

U.S. DEPARTMENT OF ENERGY

N CE OF FINANCIAL ASSISTANCE AWARD

(See Instructions on Reverse)

Under the authority of Public Law 93-410 and subject to legislation, regulations and policies applicable to *(cite legislative program title)*:

Geothermal Research, Development and Demonstration Act of 1977

1. PROJECT TITLE
Cascade Geothermal Drilling

2. INSTRUMENT TYPE
☐ GRANT ☒ COOPERATIVE AGREEMENT

4. INSTRUMENT NO.
DE-FC07-85ID12614

5. AMENDMENT NO.
--

3. RECIPIENT *(Name, address, zip code, area code and telephone no.)*
Thermal Power Co.
3333 Mendocino Ave, Suite 120
Santa Rosa, CA 95401

6. BUDGET PERIOD
FROM: 9/30/85 THRU: 9/30/87

7. PROJECT PERIOD
FROM: 9/30/85 THRU: 9/30/87

8. RECIPIENT PROJECT DIRECTOR *(Name and telephone No.)*
William L. D'Olier (707) 576-7040

10. TYPE OF AWARD
☒ NEW ☐ CONTINUATION ☐ RENEWAL
☐ REVISION ☐ SUPPLEMENT

9. RECIPIENT BUSINESS OFFICER *(Name and telephone No.)*
Philip Scott (415) 765-0329

12. ADMINISTERED FOR DOE BY *(Name, address, zip code, telephone No.)*
Ronald A. King (208) 526-0790
U. S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

11. DOE PROJECT OFFICER *(Name, address, zip code, telephone No.)*
Susan Prestwich (208) 526-1147
U.S. DOE, Idaho Operations Office
785 DOE Place, Idaho Falls, ID 83402

13. RECIPIENT TYPE
☐ STATE GOV'T ☐ INDIAN TRIBAL GOV'T ☐ HOSPITAL ☒ FOR PROFIT ORGANIZATION ☐ INDIVIDUAL
☐ LOCAL GOV'T ☐ INSTITUTION OF HIGHER EDUCATION ☐ OTHER NONPROFIT ORGANIZATION ☒ C ☐ P ☐ SP ☐ OTHER *(Specify)*

14. ACCOUNTING AND APPROPRIATIONS DATA

a. Appropriation Symbol	b. B & R Number	c. FT/AFP/OC	d. CFA Number
89X0224.19	AM101510	ID-54-91/250	

15. EMPLOYER I.D. NUMBER/SSN

16. BUDGET AND FUNDING INFORMATION

a. CURRENT BUDGET PERIOD INFORMATION

(1) DOE Funds Obligated This Action	$ 240,000
(2) DOE Funds Authorized for Carry Over	$ -0-
(3) DOE Funds Previously Obligated in this Budget Period	$ -0-
(4) DOE Share of Total Approved Budget	$ 240,000
(5) Recipient Share of Total Approved Budget	$ 240,000
(6) Total Approved Budget	$ 480,000

b. CUMULATIVE DOE OBLIGATIONS

(1) This Budget Period *[Total of lines a. (1) and a. (3)]*	$ 240,000
(2) Prior Budget Periods	$ -0-
(3) Project Period to Date *[Total of lines b. (1) and b. (2)]*	$ 240,000

17. TOTAL ESTIMATED COST OF PROJECT $ _____

(This is the current estimated cost of the project. It is not a promise to award nor an authorization to expend funds in this amount.)

18. AWARD/AGREEMENT TERMS AND CONDITIONS

This award/agreement consists of this form plus the following:

a. Special terms and conditions (if grant) or schedule, general provisions, special provisions (if cooperative agreement)

b. Applicable program regulations *(specify)* N/A *(Date)* _____

c. DOE Assistance Regulations, 10 CFR Part 600, as amended, Subparts A and ☐ B (Grants) or ☒ C (Cooperative Agreements).

d. Application/proposal dated 4/29/85, ☐ as submitted ☒ with changes as negotiated

19. REMARKS

This Agreement consists of this NFAA, Schedule Articles, General Provisions, Appendix A - Statement of Work, Appendis B - Labor Determination, DOE Order 1332.2, and Cost Principles FAR 31.2 and DEAR 931.2.

20. EVIDENCE OF RECIPIENT ACCEPTANCE

William L. D'Olier 9/30/85
(Signature of Authorized Recipient Official) *(Date)*

William L. D'Olier
(Name)

Vice President
Geothermal Exploration
(Title)

21. AWARDED BY

William C. Drake 9/27/85
(Signature) *(Date)*

William C. Drake
(Name)

Contracting Officer
(Title)

TPC
Statement of Work

1.0 Introduction

The Cascade volcanic region has long been suspected to contain considerable geothermal potential, as evidenced by recent volcanism and other thermal expressions. There are few known surface manifestations of geothermal energy in spite of the obvious occurrence of heat sources. One possible explanation is that the downward percolation of the extensive regional cold ground water system suppresses surface evidence of underlying hydrothermal systems. However, there have been few wells drilled in the Cascades region to a sufficient depth to properly evaluate the temperature and hydrological conditions beneath the cold water zone. There is a great need for characterization identification of the deeper hydrothermal regime in order to more conclusively define the geothermal potential of the Cascades volcanic environment.

DOE's primary objectives for this cost-shared drilling project are to obtain and release to the public subsurface information to include but not limited to the following:

- o rock samples (core and/or drill chips),
- o equilibrium temperature profiles,
- o uncontaminated fluid samples,
- o evidence for the existence and depth of potentially producible aquifers,
- o geophysical well logs, and
- o information on drilling conditions and problems in the Cascades environment.

2.0 Scope

1. The Participant will drill a thermal gradient hole to an approximate target total depth of 5000 feet in Section 28, T8S, R8E Willamette Meridian, Marion County, Oregon. This primary task will be accomplished by 24 hours per day continuous work to achieve its completion in an estimated 60 days of rig operations.

2. The Participant will collect all required data both during and subsequent to drilling the thermal gradient hole.

3. The Participant will provide all data and information gathered under this Project to DOE.

4. The Participant will obtain all permits and approvals required by government regulatory agencies for the performance of this Project.

5. The Participant will perform all Project work in compliance with federal, state and local laws, rules and regulations and agency orders and guidelines.

3.0 Applicable Documents

Work performed by the Participant will be in compliance with all Federal, State, and local laws, rules and regulations, and agency orders and guidelines.

4.0 Technical Tasks

4.1 Project Management

A. The Participant will prepare and obtain DOE approval of a Project Management Plan within 30 days after award of this agreement. The plan will include a work breakdown structure and a list of deliverables by task, identify the individuals and subcontractors responsible for each task, discuss the management techniques to be used, and include a schedule that shows the period for performance of each subtask and identifies principal milestones and decision points for each. This plan will also designate an individual or individuals who will act as principal points of contact with DOE on behalf of the Participant.

B. The Participant will submit and obtain DOE approval of a Project Institutional Plan prior to initiation of site preparation. The plan will identify items required by governmental regulatory agencies for the performance of this work, the agency whose requirement the item fulfills, and the actual or projected submittal and agency approval dates. The plan will also discuss any legal, social, or institutional problems anticipated during performance of the project and planned solutions.

C. The Participant will prepare and obtain DOE approval of a Project Drilling Plan prior to drilling. The plan shall describe:

1. Surface and subsurface conditions anticipated to be encountered during drilling, including configuration of the resource.

2. Site access.

3. Site preparation.

4. Hole design including hole size, casing size, cementing, etc.

5. Rig and equipment specifications.

6. Well containment during and after drilling including applicable regulatory requirements).

7. Drilling fluids and disposal method.

8. Hole completion.

9. Plugging and abandonment.

10. Site restoration.

11. Anticipated hole problems, if any, and proposed solutions.

12. Health, safety and environmental considerations.

13. Site facilities, if any.

14. Drilling schedule including major activities and estimated duration.

15. On-site supervision to be used during drilling, including drilling supervisor(s) and geologist(s).

D. The Participant will prepare and obtain DOE approval of a Project Data Collection Plan prior to drilling. This plan will address data collection both during drilling and after drilling. The plan will identify the types of data to be collected, the depth(s) at which each type of data will be collected, the timing of collection, and the method by which the Participant plans to collect each type of data, including type of instrument and planned calibration, where appropriate. The plan will specifically identify all logs and samples of rock and fluid that are to be collected.

E. The Participant will conduct subcontractor evaluations, select subcontractors and complete contract negotiations with selected subcontractors.

F. The Participant will perform project management in accordance with the approved Project Management Plan. In addition to close general coordination with DOE, immediate and full disclosure of any project problem areas to DOE is required, so that timely corrective action may be taken with DOE technical support, if necessary.

Deliverables: Approved Project Management Plan, Project Institutional Plan, Project Drilling Plans and Project Data Collection Plan.

4.2 Permitting and Environmental Reporting

A. The Participant will prepare, submit and obtain approval of any documentation required by governmental regulatory agencies for the performance of this work, including a geothermal exploration permit and a plan of operations. A copy of all documentation provided to any governmental agency and pertinent to this project shall be provided to DOE.

B. An approved environmental document is required for this project prior to any ground disturbance. It is anticipated that an environmental assessment will be prepared by the Bureau of Land Management for this project. This environmental assessment may satisfy DOE's environmental reporting requirements. If DOE determines that a separate Environmental Evaluation Report is required prior to any ground disruptive activity, DOE will notify the Participant in writing. In that event, the Participant will prepare the Environmental Evaluation Report in accordance with DOE Environmental guidelines. If a DOE Environmental Assessment is required, the Participant will provide information to DOE as required for DOE's preparation of the Environmental Assessment.

If DOE determines that an Environmental Assessment is required, DOE will notify TPC in writing. Upon such notification, TPC will provide information to DOE as required for DOE's preparation of the Environmental Assessment.

Deliverables: Approved environmental document and regulatory documentation.

4.3 Drilling

A. The Participant will confirm logistics, services and vendors with requirements outlined in the approved Project Drilling Plan.

B. The Participant will prepare drill site, access and water supply and move in drilling rig in accordance with approved Project Drilling Plan.

C. The Participant will drill a thermal gradient hole to 5000 feet TD in accordance with the approved Project Drilling Plan. The Participant shall report on drilling status daily to the designated DOE representative, so that discussions concerning the drilling operation can be made in a timely manner.

4.4 Data Collection

A. The Participant will collect the following data as a minimum in accordance with the approved Project Data Collection Plan. These data shall be provided to DOE by the Participant as soon as acquired.

Rock Sampling - The drilling of the hole is designed such that a continuous core from bedrock to total depth will be obtained. It is anticipated that a 2.50" core will be recovered from the drilling of HQ (3.85" OD) size hole. If it is necessary to reduce to NQ (3.03") hole size, a 1.88" core will then be retrieved. Drill cuttings will also be

obtained from at least the upper 500 feet of the hole. The Participant's drill site geologist will provide data collection and on-site handling of samples. DOE will provide procedures for identification and splitting of core and cuttings and will coordinate disposition and storage of the samples with the Participant.

Fluid Sampling - Daily measurements of the hydraulic head (natural water level in the hole) will be obtained as allowed during the drilling operation. Lost circulation data will be collected. If artesian flow is encountered and the issued drilling permit allows the performance of a flow test, a short-term test will be conducted at total depth to obtain samples of the formation water and wellhead temperature and pressure. Drilling fluid samples will be collected as per SCAP. The drill site geologist will maintain a log of the daily water level and lost circulation data. If no artesian flow is encountered, the Participant will still endeavor to collect samples of uncontaminated aquifer fluids at locations in the hole at which fluid production would be anticipated on the basis of lost circulation, indications of fracturing in the core or chips, geophysical well logs or other standard indicators. Potential methods for collection of these samples include swabbing, bailing, air lift, drill stem tests and pumping. The Participant will examine these and/or other fluid sampling techniques and address collection of these samples in the Project Data Collection Plan.

Geophysical Borehole Logging - The complete suite of geophysical borehole logs identified in the SCAP (temperature, caliper, resistivity, self-potential, sonic velocity and density logs) along with natural gamma, will be run in the wellbore not more than three separate times. The three logging runs would correlate with the running of the surface casing at 3000' (if needed and a total depth (5000'). The open-hole logs (SP, caliper, resistivity and sonic) will only be run in the open-hole. Temperature logs will be run from surface to total depth. Gamma and/or density will only be run a couple hundred of feet into the cased-hole. The latter will allow cross-cablibration between the three intended logging runs. The Participant's geologist will direct and observe all logging operations. A comprehensive logging operation report will be prepared for each logging operation. One set of field prints will be sent to DOE as soon as available.

Maximum Temperature Reading - Three maximum recording thermometers will be run at every core recovery. These data will be collected by the drill site geologist.

Daily Drilling Report - A drilling report will be completed every day and submitted to DOE.

Directional Survey - A multi-shot direction survey will be made at total depth to allow for oriented core analysis. Specific hole conditions may require an additional survey.

"Mud" Log - A "Mud" log will be maintained during the drilling operation. This log will provide the following principal data, summarized at a vertical scale of 1' = 100':

1. geologic field description of core (including lithology, alteration minerology and fracture geometery assuming a vertical hole),
2. graph of penetration rate versus depth,
3. graph of measured water level versus depth,
4. lost circulation zones (including time/date, depth, total amount of fluid loss and rate of fluid loss), and
5. casing profile.

Temperature surveys

The Participant will conduct two temperature surveys. The first to be conducted at one week and the second at one month after the thermal gradient hole has been completed. These surveys will be from surface to total depth.

Deliverable: Data and samples.

4.5 Hole Completion and Maintenance

A. Upon satisfactory completion of drilling, open-hole geophysical logging and sampling, a steel tubing string will be hung or cemented in the borehole from surface to TD and the well completed by the Participant in accordance with the approved Project Drilling Plan.

B. Upon completion of the hole, DOE and the Participant shall review and discuss the data. The Participant will obtain Project Manager's agreement prior to releasing the rig.

C. The Participant shall provide to DOE within 15 days of completion of the hole a schematic of the actual completed hole configuration.

D. The Participant shall maintain the hole and site for a period of 12 months after hole completion in accordance with the approved Project Drilling Plan. The hole and site shall be

U.S. DEPARTMENT OF ENERGY

FEDERAL ASSISTANCE REPORTING CHECKLIST

FORM EIA 459A
(10 80)

FORM APPROVED
OMB NO 1900 0127

1. Identification Number: DE-FC07-85ID12614	2. Program/Project Title: Cascade Geothermal Drilling
3. Recipient: Thermal Power Company	

4. Reporting Requirements:	Frequency	No. of Copies	Addressees
PROGRAM/PROJECT MANAGEMENT REPORTING			
[X] Federal Assistance Milestone Plan	O	2,1,1	A,B,E
[ ] Federal Assistance Budget Information Form			
[X] Federal Assistance Management Summary Report	Q	1,1,1	A,B,C
[X] Federal Assistance Program/Project Status Report	Q	2,1.1	A,B,E
[X] Financial Status Report, OMB Form 269	Y,F	1,1	B,C
TECHNICAL INFORMATION REPORTING			
[XX] Notice of Energy RD&D	O,Y	1,1	B,D
[ ] Technical Progress Report			
[X] Topical Report	A	3,1,1,1	A,B,E,F
[X] Final Technical Report	F	*4,1,1,1	A,B,E,F

FREQUENCY CODES AND DUE DATES:

A - As Necessary; within 5 calendar days after events.
F - Final; ~~90 calendar days after the performance of the effort ends~~ Upon completion of agreement
Q - Quarterly; within 30 days after end of calendar quarter or portion thereof.
O - One time after project starts; within 30 days after award.
X - Required with proposals or with the application or with significant planning changes.
Y - Yearly; 30 days after the end of program year. (Financial Status Reports 90 days).
S - Semiannually; within 30 days after end of program fiscal half year.

5. Special Instructions:

A draft to the Final Technical Report shall be submitted for review to the contracting officer at least 60 days prior to the final due date. Comments resulting from this review shall be resolved and the report revised accordingly prior to final submission to DOE. The Final Technical Report shall be submitted with a camera-ready copy.

NOTE: Contracting officer copy shall list all distribution.

*Includes camera-ready copy.

6. Prepared by: (Signature and Date)	7. Reviewed by: (Signature and Date)

made available to DOE during this period for DOE's scientific use. The Participant will not attempt to preserve access to the site during the period of winter snow cover.

Deliverable: Completed hole configuration schematic.

4.6 Abandonment and Site Restoration

The Participant will plug and abandon the hole and fully restore the site in accordance with BLM regulations, Forest Service stipulations and the Project Drilling Plan. Alternatively, the Participant may elect to preserve the hole and drill site at its sole risk, cost and legal responsibility. In this instance, the Participant shall provide DOE with a copy of the plug and abandonment and site restoration plans from the approved Plan of Operations and shall provide confirmation of these activities. DOE will not cost-share costs incurred after the project period of this agreement.

Deliverables: Approved P&A and restoration plans.

5.0 Reports, Data and Other Deliverables

A. The Project Drilling Plan as required by Subtask 4.1.C.

B. The Project Data Collection Plan as required by Subtask 4.1.D.

C. The Project Management Plan as required by Subtask 4.1.A.

D. The Project Institutional Plan as required by Subtask 4.1.B.

E. All data collected by the Participant under Task 4.4.

F. Regulatory documentation and approved environmental document under Subtasks 4.2.A and 4.2.B.

G. Completed hole completion schematic as required by Subtask 4.5.C.

H. Approved plug and abandonment plan as required by Task 4.6.

I. Project status and management reports as identified on DOE Form CR-537, Reporting Requirements Checklist. The final technical report will include a description of drilling and completion and data will be presented and discussed.

REPORT DISTRIBUTION LIST

DE-FC07-85ID12614

U. S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

A. Susan Prestwich
Geologist
Advanced Technology Division

B. Ronald A. King
Contract Specialist
Contracts Management Division

C. Earl G. Jones
Director
Financial Management Division

D. U. S. Department of Energy
Technical Information Center
Oak Ridge, TN 37830

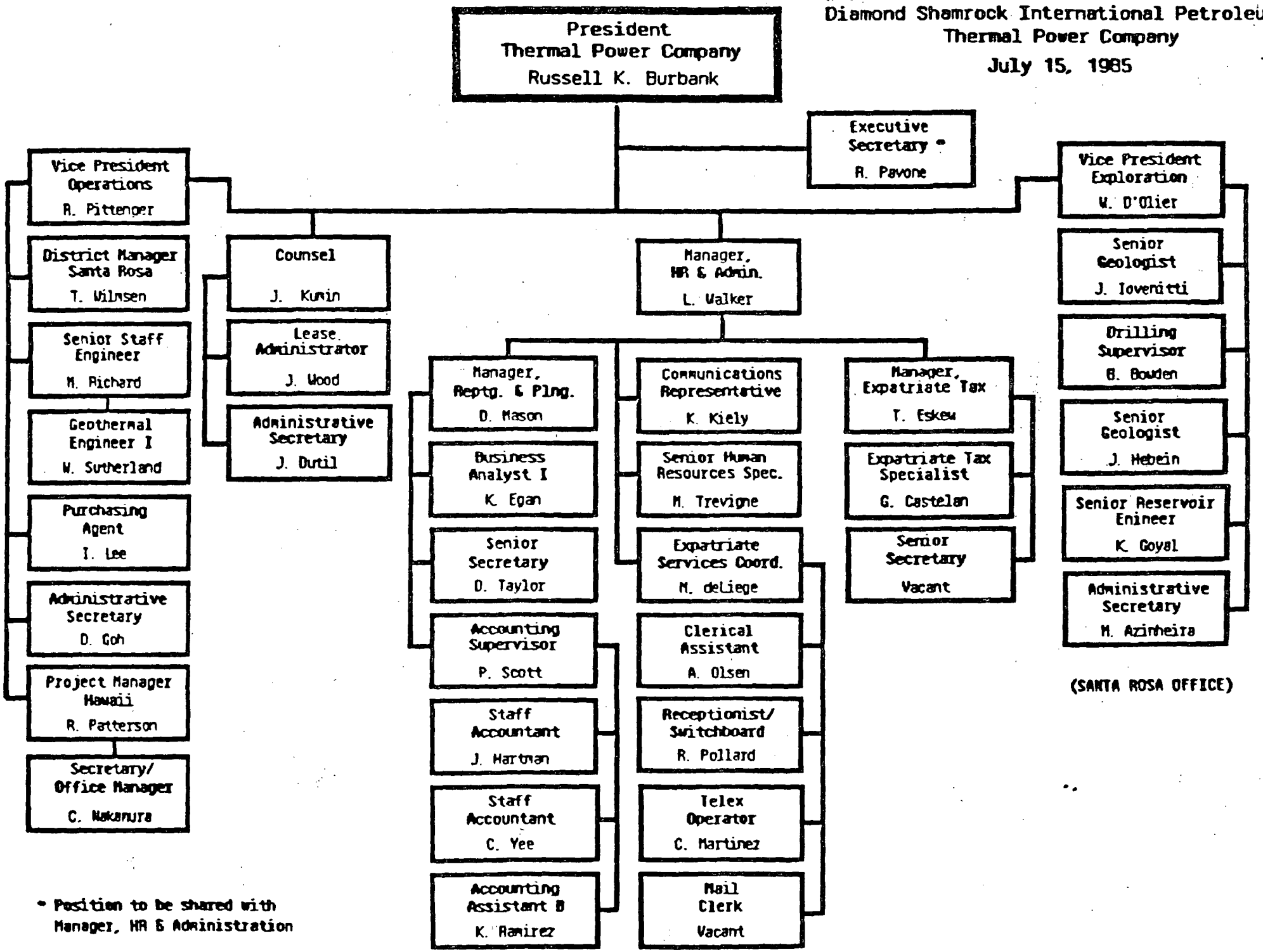
E. P. M. Wright
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, UT 84108-1295

F. Marshall Reed
U. S. Department of Energy
CE-323 Forestal Building
1000 Independence Avenue, S.W.
Washington DC 20585

COST, SCHEDULE AND DELIVERABLE SUMMARY

TASK	ESTIMATED 100% COST	SCHEDULE START	SCHEDULE COMPLETE	MILESTONES & DELIVERABLES
1. Project Management	NO CHARGE	10·1·85	10·31·85	1. Management Plan
2. Permitting and Environmental Reporting	NO CHARGE	8·8·85	2·28·86	1. Institutional Plan 2. Regulatory Documentation 3. EER
3. Drilling SITE PREPARATION	$15.000	5·20·86	5·25·86	1. Drilling Plan 2. Daily Drilling Status Reports
DRILLING - CORING	343.000	6·1·86	7·31·86	
4. Data Collection (a) During Drilling				1. Data Collection Plan
GEOPHYS. LOGS	22,200	6·5·86	7·29·86	2. Rock & Fluid Results of Analyses Samples, & Data Reports
FLUID SAMPLES	3000	"	"	
FLOW TEST 3000'?	7000	6·29·86	6·30·86	
SITE GEOLOGISTS	22.000	6·1·86	7·31·86	
(b) After Drilling				1. Well Legs
FLOW TEST 5000'	10.000	7·29·86	7·31·86	2. Fluid Samples
TWO TEMP. SURVEYS	7800	8·7·86	8·30·86	3. Other Data & Results
5. Completion & Maintanance TUBING ETC.	20.000	7·31·86	7·31·86	1. Completion Schematic
6. Abandonment IF ELECTED	25.000	95·87	9·10·87	1. Approved Abandonment Plan
7. Site Restoration IF ABANDONED	5000	9·10·87	9·15·87	1. Restoration Confirmation Report
8. Reporting	NO CHARGE	10·31·85	9·30·87	1. As summarized in this table
9. Dissemination of Information	NO CHARGE	10·1·85	9·30·87	1. Project sign, press release(s) 2. Final Technical Report
TOTAL ESTIMATED 100% COSTS	$480.000			

Diamond Shamrock International Petroleum
Thermal Power Company
July 15, 1985



(SANTA ROSA OFFICE)

* Position to be shared with Manager, HR & Administration

Department of Energy

Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

June 26, 1985

Thermal Power Company
3333 Mendocino Avenue, Suite 120
Santa Rosa, CA 95401

ATTENTION: W. L. D'Olier

SUBJECT: Solicitation No. DE-SC07-85ID12580

Dear Sir:

With regard to the proposal which you submitted in reponse to the subject solicitation, you are requested to provide additional information. Please respond to the following by July 5, 1985. You should contact me on (208)526-1229 if you have any questions.

Sincerely,

Elizabeth M. Hyster
Contract Specialist
R&D Contracts Branch
Contracts Management Division

cc: S. M. Prestwich

THERMAL POWER COMPANY

- Would Thermal Power consider drilling the hole in the 1985 field season?
- The proposed drilling program (page 15 of Volume I of the proposal) indicates drilling a 10 3/4" hole through 8 5/8" casing. Please clarify.
- What diameter and strength tubing is planned to be run in the hole after completion?
- What criteria does Thermal Power plan to use in selecting the well site geologist?
- Has the lease option been exercised? If so, please provide a copy.
- If the targeted interface between the colder waters of the "rain cap" and deeper thermal fluids is deeper than anticipated, is Thermal Power considering drilling deeper than 5,000 feet? Would the anticipated drilling rig be a limiting factor?
- How will Thermal Power provide 24-hours drilling supervision on-site during drilling? Only one on-site individual has been identified for this.
- The proposed cost estimate for drilling differs from the lowest subcontractor proposed price. Identify the differences specifically, explaining why the proposed amount is higher.
- Provide the details of the proposed amount estimated for site preparation.
- Provide the details of the proposed amount for drill site geologists, including the proposed rate per hour and the estimated hours.

Diamond Shamrock
Thermal Power Company

5 July 1985

Ms Elizabeth Hyster
U. S. Department of Energy
Idaho Operations Office
550 Second Street, Room 119
Idaho Falls, Idaho 83401

Re: SCAPNumber
DE-SC07-85ID12580
DOE Letter 6/26/85

Dear Ms Hyster:

We are responding to the ten point attachment in your referenced letter of June 26th.

1. Thermal Power Company will not consider drilling the hole in 1985 because of the uncertain time requirements of U. S. Forest Service consideration and approval of the required Plan of Operations for the drillsite within the issued lease Oregon 12344. We are advised that the understaffed condition of the Mt. Hood National Forest Unit will be a problem here. The acceptable weather window at this drillsite is prudently judged to close about November 1st each year with initial snows. We would need Cooperative Agreement and approved Plan of Operation by July 31st to trigger drilling contractor selection, negotiation and move-in by September 1st. This is not an acceptable schedule even if possible in view of the depth of technical preparation we believe is required.

2. We have corrected shallow casing diameter and bit size in our Hole Design and submit herewith a revised Page 15 of Volume I of our Proposal.

3. The completion tubing string, extending from surface to 5000-foot total depth, is planned to be 2.875", 6.5 pound per foot, J-55 grade of 2.441" inside (drift) diameter.

4. The following criteria would be applied to selection of two wellsite geologists.

   a) Personal reliability in work habits and interest level in this specific deep thermal gradient corehole.

   b) Experience with the geotechnical aspects of drillsite operations including, but not limited to, core-handling, core-labelling, fluid sample and data collection, well logging operations, etc.

Thermal Power Company
A subsidiary of Diamond Shamrock. 3333 Mendocino Avenue. Suite 120. Santa Rosa. California 95401
Phone 707 576-7022

c) Familiarity with the rock types expected to be encountered in the hole and hydrothermal alteration mineralogy.

5. The lease option has been exercised by Chevron. A copy of Chevron's letter of July 2, 1985 to John Hook is enclosed. When the OR 12344 Assignment document is approved and completed by BLM-Portland, a copy will be forwarded to you.

6. The depth capacities of the rigs under consideration for our Proposal generally exceed 6000 feet. Thermal Power Company can give consideration to drilling-coring below 5000 feet with continued 50% DOE funding, depending on Thermal's review of actual corehole conditions and cumulative expenditures at a 5000-foot depth achieved.

7. It has been Thermal's long practice, in drilling from one to two geothermal wells per year, to use Mr. Bowden's exceptional drillsite supervisorial abilities on a 24-hour per day by his living on the drillsite for the usual 50-60 day drilling episode. This too has been his personal preference and his repeated achievement. Of course, we have given him relief on a few occasions with two geothermal experienced drilling consultants available to Thermal.

8. The requested drilling cost estimate comparison between Thermal's proposal and the lowest subcontractor proposal is enclosed. We call your attention to the correction (reduction) in our total casing cost estimate. This puts Thermal's $363,000 estimate in reasonable proximity to Longyear's indicated $349,000 supplemented estimate.

9. The Section 28 drillsite was visited by Thermal personnel on 26 June 1985 and was found to be more favorable than anticipated. The details for a reduced site preparation cost estimate are as follows:

Clear and bench drillsite with D6Cat.	$ 7,000
Berm, downslope drainage control?	1,000
Sump, 20' 8' x 6' deep; lines	4,000
Parcel entry road addition	1,500
Cellar 4' x 4' x 3" deep	500
Rare plant and cultural surveys	1.000
	$ 15,000

10. Detailed cost estimate for drillsite geologists is as follows:

2 Drillsite Geologists (Graduate Students) $165 per person for 55 days each (includes per diem)	$ 18,150
Consulting Geologist to supervise (expect Al Waibel - Portland) $400 per day for 7 days	2,800
Trailer - $500 per month for 2 months	1.000
	$ 21,950

Separately, in your telephone discussions with D'Olier, Wood and Scott of Thermal , we believe we have clarified Thermal's position on CASB. Because Thermal has its own accounting system, independent of Diamond Shamrock, and Thermal is not performing any CSA-covered national defense contracts, Thermal is claiming an exemption from CASB requirements. Corrected pages 144 and 145 are enclosed for inclusion in the Representations and Certifications of Volume II of our Proposal.

We trust that all of this additional information will assist your considerations and allow an early meeting between Thermal and DOE towards completing the Cooperative Agreement.

Yours very truly,

W. L. D'Olier
Vice President
Geothermal Exploration

WLD/ma

enclosures

Site Access and Preparation

Fortunately, numerous clear cut parcels of 10 to 80 acre areal size and a logging road network exist in this portion of the Mt. Hood National Forest. The specific site chosen is the northwest quarter of the southeast quarter of Section 28, T8S, R8E, WM, in clear cut parcel 30 as shown on Forest Service maps. At the approximate 4000-foot elevation of this site, a winter snow cover of 6-10 foot thickness will preclude access during a five month interval, commonly November to March. The specific site is immediate to an access road. A rectangular one acre level bench will be cleared of any logged cuttings trash for the drillsite. Care will be taken to minimize any toll of young second growth trees and drainage changes in the existing land surface.

Hole Design

A proposed hole design for the 5000-foot Thermal Gradient Hole is shown in the following Figure 12. TPC proposes the following drilling-coring program.

1. Drill 12-1/4" hole with tricone bit and mud through overburden to 30-foot depth. Cement 9-5/8" casing back to surface.

2. Drill 8-3/4" hole with tricone bit and mud to 500 feet depth. Run geophysical borehole logs. Run 6-1/2" casing to 500 feet and cement it in from shoe to surface.

3. Install head flange on 6-1/2" casing; install CSO ram above flange and install MSP Hydril above CSO ram. Test and verify reliable BOP equipment operation and compliance with BLM regulations.

4. Continuously core with HQ diamond heads (3.85" outside diameter) to 5000 feet or greatest depth possible. Use 4-1/2" core guide casing as required. If hole conditions become difficult, open corehole with 6" bit and run geophysical borehole logs before cementing 4-1/2" casing as intermediate protection string.

5. If required, reduce to NQ diamond heads (3.032" outside diameter) and continuously core to 5000 feet. Run geophysical borehole logs.

Anticipated Hole Problems

Loss of drilling fluid circulation is the chief problem anticipated. Lost circulation material, additives or cement plugs may be utilized in resolving lost circulation events above the 500-foot depth. Below the 4-½" casing shoe, the continuous coring methods can proceed without fluid returns if an adequate water supply is used (continuously pumped into the coring string) to lubricate and cool the diamond core head.

Drilling Fluids and Disposal

The drilling fluids, which will range between clay-water muds and water only, will be confined and recirculated in the borehole to the maximum

Chevron U.S.A. Inc.
c/o Chevron Resources Company
P.O. Box 7147, San Francisco, CA 94120-7147

July 2, 1985

John Hook Federal
Geothermal Leases
OR 11742, [redacted] &
OR 12345
Clackamas Area, OR

Mr. John Hook
P.O. Box 3133
Salem, OR 97302

Dear John:

Under the terms of Chevron's Option Agreement with you dated June 24, 1981, as amended, we wish to acquire your interest in the subject leases as to those acreages indicated on the attached forms of assignments.

Also pursuant to said Option Agreement, Chevron is providing a 3% overriding royalty to you on this acreage as noted in the assignment forms.

Please execute all three copies of each assignment in the space provided and return them to me for Chevron's execution and filing with the Bureau of Land Management for approval.

We will advise you when such approval has been received.

Sincerely,

Allie Loose

O. C. LOOSE
District Land Supervisor

Form 3200-17
(March 1975)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Serial No. [redacted]

New Serial No.

ASSIGNMENT AFFECTING RECORD TITLE TO GEOTHERMAL RESOURCES LEASE
PART I

1. CHEVRON USA INC.
c/o Chevron Resources Company
P.O. Box 7147
San Francisco, CA 94120-7147

The undersigned, as owner of 100 percent of record title of the above-designated geothermal resources lease issued effective *(date)* December 1, 1983, hereby transfers and assigns to the assignee shown above, the record title interest in and to such lease as specified below.

2. Describe the lands affected by this assignment *(43 CFR 3241.2-5)* Clackamas Co., OR

T8S-R8E WM
Unsurveyed Sec. 16: All
" Sec. 21: All
" [redacted]
" Sec. 33: N½

Total Area 2,240 Acres

3. What part of assignor(s) record title interest is being conveyed to assignee? *(Give percentage or share)* 100%

4. What part of the record title interest is being retained by assignor(s)? None

5a. What overriding royalty or production payments is the assignor reserving herein? *(See Item 4 of General Instructions; specify percentage; no assignment will be approved which does not comply with 43 CFR 3241.7-2 on limitation of overriding royalties)* 3%

b. What overriding royalties or production payments, if any, were previously reserved or conveyed? *(Percentage only)* None

It is agreed that the obligation to pay any overriding royalties or payments out of production of geothermal resources created herein, which, when added to overriding royalties or payments out of production previously created, aggregate in excess of 50 percent, of the rate of royalty due the United States, shall be suspended.

I CERTIFY That the statements made herein are true, complete, and correct to the best of my knowledge and belief and are made in good faith.

Executed this day of July, 19 85

(Assignor's Signature)

John W. Hook

P.O. Box 3133
(Assignor's Address)

Salem (City) OR (State) 97302 (Zip Code)

Title 18 U.S.C., Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.

THE UNITED STATES OF AMERICA

Assignment approved as to the lands described below:

Assignment approved effective _____ By _____
(Authorized Officer)

(Title) (Date)

NOTE: *This form may be reproduced provided that copies are exact reproductions on one sheet of both sides of this official form in accordance with the provisions of 43 CFR 3241.2-4.*

PART II

ASSIGNEE'S REQUEST FOR APPROVAL OF ASSIGNMENT

A. ASSIGNEE CERTIFIES THAT

1. Assignee is qualified to hold a geothermal resources lease under 43 CFR 3202.1
2. Assignee is ☐ Individual ☐ Municipality ☐ Association ☒ Corporation
3. Assignee is the sole party in interest in this assignment *(information as to interests of other parties in this assignment must be furnished as prescribed in Specific Instructions)*
4. Filing fee of $50 is attached *(See Item 2 of General Instructions)*
5. Assignee's interests, direct and indirect, in geothermal resources leases, do not exceed 20,480 chargeable acres *(43 CFR 3201.2)*

B. ASSIGNEE AGREES to be bound by the terms and provisions of the lease described here, provided the assignment is approved by the Authorized Officer.

C. IT IS HEREBY CERTIFIED That the statements made herein are true, complete, and correct to the best of undersigned's knowledge and belief and are made in good faith.

Executed this day of July , 19 85

CHEVRON USA INC.

By _____
(Assignee's Signature)

Attorney-In-Fact

c/o Chevron Resources Co.
P.O. Box 7147
San Francisco, CA 94120-7147

(Address, include zip code)

Title 18 U.S.C., Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.

GENERAL INSTRUCTIONS

1. *Use of form* — Use only for assignment of record title interest in geothermal resources leases, *and for assignments of working or royalty interests, operating agreements, or subleases.* An assignment of record title may only cover lands in *one* lease. If more than one assignment is made out of a lease, file a separate instrument of transfer with *each* assignment.

2. *Filing and number of copies* — File three (3) completed and manually signed copies in proper BLM office. A $50 nonrefundable filing fee *must* accompany assignment. File assignment within ninety (90) days *after* date of final execution.

3. *Effective date of assignment* — Assignment, if approved, takes effect on the first day of the month following the date of filing of *all* required papers.

4. *Overriding royalties or payments out of production* — Describe in an accompanying statement any overriding royalties or payments out of production created by assignment but not set out therein. If payments out of production are reserved by assignor, outline in detail the amount, method of payment, and other pertinent terms.

5. *Effect of assignment* — Approval of assignment of a definitely described portion of the leased lands creates separate leases. Assignee, upon approval of assignment, becomes lessee of the Government as to the assigned interest and is responsible for complying with *all* lease terms and conditions, including timely payment of annual rental and maintenance of *any* required bond; *except* in the case of assignment of undivided interests, royalties, and operating agreements.

6. A copy of the executed lease, out of which this assignment is made, should be made available to assignee by assignor.

SPECIFIC INSTRUCTIONS

(Items not specified are self-explanatory)

PART I

Item 1 — Type or print plainly, in ink, between and below heavy dots, the assignee's full name and mailing address, including zip code.

PART II

A. Certification of assignee

3. If assignee is an association or partnership, assignee *must* furnish a certified copy of its articles of association or partnership, with a statement that (a) it is authorized to hold geothermal resources leases; (b) that the person executing the assignment is authorized to act on behalf of the organization in such matters; and (c) names and addresses of members controlling more than 10 percent interest.

If assignee is a corporation, it *must* submit a statement containing the following information: (a) State in which it was incorporated; (b) that it is authorized to hold geothermal resources leases; (c) that officer executing assignment is authorized to act on behalf of the corporation in such matters; and (d) percentage of voting stock and percentage of *all* stock owned by aliens or those having addresses outside the United States. If 10 percent or more of the stock of any class is owned or controlled by or on behalf of any one stockholder, a separate showing of his citizenship and holdings *must* be furnished.

If evidence of qualifications and ownership has previously been furnished as required by the above, reference by serial number of record in which it was filed together with a statement as to any amendments. Qualifications of assignee *must* be in full compliance with the regulations (43 CFR 3241.1–2).

4. *Statement of interests* — Assignee *must* indicate whether or not he is the sole party in interest in the assignment; if not, assignee *must* submit, at time assignment is filed, a signed statement giving the names of other interested parties. If there are other parties interested in the assignment, a separate statement *must* be signed by each assignee, giving the nature and extent of the interest of *each*, the nature of agreement between them, if oral; and a copy of agreement, if written. *All* interested parties *must* furnish evidence of their qualifications to hold such lease interests. Separate statements and written agreements, if any, *must* be filed with the filing of the assignment.

THERMAL POWER COMPANY
Santa Rosa Office

5 July 1985

Clackamas 5000-Foot Thermal Gradient Hole
Proposed Under DOE SCAP Number DE-SC07-851D12580
Drilling Cost Estimates: Review and Comparison

	TCC 4/29/85	TPC 7/5/85	Longyear 4/16/85
Rig Mobilization - Demob	$ 20,000	$ 20,000	$ 56,000[a]
Rig Rate $2650/day for 60 days	159,000	159,000	224,750[b]
Casing 9-5/8",6-½", and 4-½"	30,000	19,000	7,775[c]
BOP Rental for 60 days	13,000	13,000	Not known
Bits and Diamond Coring	35,000	35,000	--
Cement and Services	15,000	15,000	--
Drilling Fluids	25,000	25,000	15,000
Water Supply	20,000	20,000	Not known
Borehole Directional Survey	4,000	4,000	Not known
Casing Head-Tubing Hanger	4,000	4,000	--
Completion Tubing, 2-7/8" to T.D.	16,000	16,000	--
Subtotal	341,000	330,000	303,525
Contingency 10%	34,000	33,000	--
Total Estimate Cost	$ 375,000	$ 363,000	$ 303,525
		Add 4-½" csg.	12,200
		BOP Rental	13,000
		Water	20,000
			45,200
			$ 348,725

a) Mob-demob, plus cementing, BOP setup, casing and reaming time.

b) Must include all bits and diamond coring hardware; may include cushion for contingency.

c) Omits 4-½" casing, which Thermal expects will be required to reach 5000 feet.

II. COST ACCOUNTING STANDARDS-EXEMPTION FOR CONTRACTS OF $500,000 OR LESS

If this proposal is expected to result in the award of a contract of $500,000 or less, the offeror shall indicate whether the exemption below is claimed. Failure to check the box below shall mean that the resultant contract is subject to CAS requirements or that the offeror elects to comply with such requirements.

( ) The offeror hereby claims an exemption from the CAS requirements under the provisions of 4 CFR 331.30(b)(7) and certifies that notification of final acceptance of all deliverable items has been received on all prime contracts or subcontracts containing the Cost Accounting Standards clause or the Disclosure and Consistency of Cost Accounting Practices clause. The offeror further certifies that the Contracting Officer will be immediately notified in writing when an award of any other contract or subcontract containing Cost Accounting Standards clauses is received by the offeror subsequent to this certificate but before the date of any award resulting from this proposal.

III. COST ACCOUNTING STANDARDS-ELIGIBILITY FOR MODIFIED CONTRACT COVERAGE

If the offeror is eligible to use the modified provisions of 4 CFR 332 and elects to do so, the offeror shall indicate by checking the box below.

Checking the box below shall mean that the resultant contract is subject to the Disclosure and Consistency of Cost Accounting Practices clause in lieu of the Cost Accounting Standards clause.

( ) The offeror hereby claims an exemption from the Cost Accounting Standards clause under the provisions of 4 CFR 331.30(b)(2) and certifies that the offeror is eligible for use of the Disclosure and Consistency of Cost Accounting Practices clause because (i) during the cost accounting period immediately preceding the period in which this proposal was submitted, the offeror received less than $10 million in awards of CAS-covered national defense prime contracts and subcontracts, and (ii) the sum of such awards equaled less than 10 percent of total sales during that cost accounting period.

The offeror further certifies that if such status changes before an award resulting from this proposal, the offeror will advise the Contracting Officer immediately.

CAUTION: An offeror may not claim the above eligibility for modified contract coverage if this proposal is expected to result in the award of a national defense contract of $10 million or more or if, during its current cost accounting period, the offeror has been awarded a single CAS-covered national defense prime contract or subcontract of $10 million or more.

IV. ADDITIONAL COST ACCOUNTING STANDARDS APPLICABLE TO EXISTING CONTRACTS

The offeror shall indicate below whether award of the contemplated contract would, in accordance with paragraph (a)(3) of the Cost Accounting Standards clause, require a change in established cost accounting practices affecting existing contracts and subcontracts.

( ) YES ( ) NO

NOTE: If the offeror has checked "yes" above and is awarded the contemplated contract, the offeror will be required to comply with the requirements of paragraphs (a)(i), (b) and (c) of the Administration of Cost Accounting Standards Clause.

FAR 52.230-2 COST ACCOUNTING STANDARDS NOTICES AND CERTIFICATION (NONDEFENSE) (APR 1984)

Note: This notice does not apply to small businesses or foreign governments.

(a) Any contract over $100,000 resulting from this solicitation shall be subject to Cost Accounting Standards (CAS) if it is awarded to a business unit that is currently performing a national defense CAS-covered contract or subcontract, except when;

(1) The award is based on adequate price competition;

(2) The price is set by law or regulation;

(3) The price is based on established catalog or market prices of commercial items sold in substantial quantities to the general public; or

(4) One of the exemptions in 4 CFR 331.30(b) applies (also see Federal Acquisition Regulation (FAR) 30.301(b)).

(b) Contracts not exempted from CAS shall be subject to full or modified coverage as follows:

(1) If the business unit receiving the award is currently performing a national defense contract or subcontract subject to full CAS coverage (4 CFR 331), this contract will have full CAS coverage and will contain the clauses from the FAR entitled Cost Accounting Standards (52.230-3) Administration of Cost Accounting Standards (52.230-4).

If the business unit receiving the award is currently performing a national defense contract or subcontract subject to modified CAS coverage (4 CFR 332), this contract will have modified coverage and will contain the clauses entitled Disclosure and Consistency of Cost Accounting Practices (52.230-5) and Administration of Cost Accounting Standards (52.230-4).

A. Certificate of CAS Applicability

(XX) The offeror is not performing any CSA-covered national defense contract or subcontract.

Note: Statement applies to Thermal Power Company as offeror, and not to parent company. Thermal Power Company maintains a separate accounting system independent of the parent company's.

TPC

Statement of Work

1.0 Introduction

The Cascade volcanic region has long been suspected to contain considerable geothermal potential, as evidenced by recent volcanism and other thermal expressions. There are few known surface manifestations of geothermal energy in spite of the obvious occurrence of heat sources. One possible explanation is that the downward percolation of the extensive regional cold ground water system suppresses surface evidence of underlying hydrothermal systems. However, there have been few wells drilled in the Cascades region to a sufficient depth to properly evaluate the temperature and hydrological conditions beneath the cold water zone. There is a great need for characterization identification of the deeper hydrothermal regime in order to more conclusively define the geothermal potential of the Cascades volcanic environment.

DOE's primary objectives for this cost-shared drilling project are to obtain and release to the public subsurface information, specifically:

- rock samples (core and/or drill chips),
- equilibrium temperature profiles,
- uncontaminated fluid samples,
- evidence for the existence and depth of potentially producible aquifers,
- geophysical well logs, and
- information on drilling conditions and problems in the Cascades environment.

2.0 Scope

1. The Participant, TPC, will drill a thermal gradient hole to a total depth of 5000 feet in Section 28, T8S, R8E Willamette Meridian, Marion County, Oregon. This primary task will be accomplished by 24 hours per day continuous work to achieve its completion in an estimated 60 days of rig operations.

2. The Participant will collect all required data both during and subsequent to drilling the thermal gradient hole.

3. The Partcipant will provide all data and information gathered under this Project to DOE.

4. The Participant will obtain all permits and approvals required by government regulatory agencies for the performance of this Project.

5. The Participant will perform all Project work in compliance with federal, state and local laws, rules and regulations and agency orders and guidelines.

3.0 Applicable Documents

Work performed by the Participant will be in compliance with all Federal, State, and local laws, rules and regulations, and agency orders and guidelines.

4.0 Technical Tasks

4.1 Project Management

A. Prepare and obtain DOE approval of a Project Management Plan within 30 days after award of this agreement. The plan will include a work breakdown structure and a list of deliverables

by task, identify the individuals and subcontractors responsible for each task, discuss the management techniques to be used, and include a schedule that shows the period for performance of each subtask and identifies principal milestones and decision points for each. This plan will also designate an individual or individuals who well act as principal points of contact with DOE on behalf of the Participant.

B. Submit and obtain DOE approval of a Project Institutional Plan prior to initiation of site preparation. The plan will identify items required by governmental regulatory agencies for the performance of this work, the agency whose requirement the item fulfills, and the actual or projected submittal and agency approval dates. The plan will also discuss any legal, social, or institutional problems anticipated during performance of the project and planned solutions.

C. Prepare and obtain DOE approval of a Project Drilling Plan prior to drilling. The plan shall describe:

1. Surface and subsurface conditions anticipated to be encountered during drilling, including configuration of the resource.

2. Site access.

3. Site preparation.

4. Hole design including hole size, casing size, cementing, etc.

5. Rig and equipment specifications.

6. Well containment during and after drilling including applicable regulatory requirements).

7. Drilling fluids and disposal method.

8. Hole completion.

9. Plugging and abandonment.

10. Site restoration.

11. Anticipated hole problems, if any, and proposed solutions.

12. Health, safety and environmental considerations.

13. Site facilities, if any.

14. Drilling schedule including major activities and estimated duration.

15. On-site supervision to be used during drilling, including drilling supervisor(s) and geologist(s).

D. Prepare and obtain DOE approval of a Project Data Collection Plan prior to drilling. This plan will address data collection both during drilling and after drilling. The plan will identify the types of data to be collected, the depth(s) at which each type of data will be collected, the timing of collection, and the method by which the Participant plans to collect each type of data, including type of instrument and planned calibration, where appropriate. The plan will specifically identify all logs and samples of rock and fluid that are to be collected.

E. Conduct subcontractor evaluations, select subcontractors and complete contract negotiations with selected subcontractors.

F. Perform project management in accordance with the approved Project Management Plan. In addition to close general coordination with DOE, immediate and full disclosure of any project problem areas to DOE is required, so that timely corrective action may be taken with DOE support, if necessary.

Deliverables: Approved Project Management Plan, Project Institutional Plan, Project Drilling Plans and Project Data Collection Plan.

4.2 Permitting and Environmental Reporting

A. Prepare, submit and obtain approval of any documentation required by governmental regulatory agencies for the performance of this work, including a geothermal Exploration

Permit and a Plan of Operations. A copy of all documentation provided to any governmental agency and pertinent to this project shall be provided to DOE.

B. An approved environmental document is required for this project prior to any ground disturbance. It is anticipated that an environmental assessment will be prepared by the Bureau of Land Management for this project. This environmental assessment may satisfy DOE's environmental reporting requirements. If DOE determines that a separate Environmental Evaluation Report is required prior to any ground disruptive activity, DOE will notify the Participant in writing. In that event, the Participant will prepare the Environmental Evaluation Report in accordance with DOE Environmental guidelines. If a DOE Environmental Assessment is required, the Participant will provide information required by DOE for DOE's preparation of the Environmental Assessment.

If DOE determines that an Environmental Assessment is required, DOE will notify TPC in writing. Upon such notification, TPC will provide information as required by DOE for DOE's preparation of the Environmental Assessment.

Deliverables: Approved environmental document and regulatory documentation.

4.3 Drilling

A. Confirm logistics, services and vendors with requirements outlined in the approved Project Drilling Plan.

B. Prepare drill site, access and water supply and move in drilling rig in accordance with approved Project Drilling Plan.

C. Drill a thermal gradient hole to 5000 feet TD in accordance with the approved Project Drilling Plan. The Participant shall report on drilling status daily to the designated DOE representative, so that discussions concerning the drilling operation can be made in a timely manner.

4.4 Data Collection

A. Collect the following data as a minimum in accordance with the approved Project Data Collection Plan. These data shall be provided to DOE as soon as acquired.

Rock Sampling - The drilling of the hole is designed such that a continuous core from bedrock to total depth will be obtained. It is anticipated that a 2.50" core will be recovered from the drilling of HQ (3.85" OD) size hole. If it is necessary to reduce to NQ (3.03") hole size, a 1.88" core will then be retrieved. Drill cuttings will

1st 500' @ 10' interval.
Box the core according to protocol.

also be obtained from at least the up
hole. The Participant's drillsite g
data collection and on-site handl
will provide procedures for identif
of core and cuttings and will coordinate disposition and storage of the samples with the Participant.

Fluid Sampling - Daily measurements of the hydraulic head (natural water level in the hole) will be obtained as allowed during the drilling operation. Lost circulation data will be collected. If artesian flow is encountered and the issued drilling permit allows the performance of a flow test, a short-term test will be conducted at total depth to obtain samples of the formation water and well-head temperature and pressure. Drilling fluid samples will be collected as per SCAP. The drillsite geologist will maintain a log of the daily water level and lost circulation data. If no artesian flow is encountered, the Participant will still endeavor to collect samples of uncontaminated aquifer fluids at locations in the hole at which fluid production would be anticipated on the basis of lost circulation, indications of fracturing in the core or chips, geophysical well logs or other standard indicators. Potential methods for collection of these samples include swabbing, bailing, air lift, drill stem tests and pumping. The Participant will examine these and/or other fluid sampling techniques and address collection of these samples in the Project Data collection Plan.

Geophysical Borhole Logging - The complete suite of geophysical borehole logs identified in the SCAP (temperature, caliper, resistivity, self-potential, sonic velocity and density logs) along with natural gamma, will be run in the wellbore at two separate times. The first

logging operation will occur prior to setting the surface casing which is planned at 500'. The second will take place at 5000' total depth. The open-hole logs (SP, caliper, resistivity and sonic) will only be run from the shoe of the surface casing to total depth. The others (temperature, gamma and density) will be run from surface to total depth. Cased hole gamma and density logging will provide data for cross-calibration between the two intended logging runs. The drillsite geologist, along with the Thermal Power Company geologist, will observe the logging operations. A comprehensive logging operation report will be prepared for each logging operation. One set of field prints will be sent to DOE as soon as available.

This is ↑ unnecessary — and time consuming

Change of shift if really want this data or every day

Maximum Temperature Reading - Th thermometers will be run at every data will be collected by the drills

Daily Drilling Report - A dril completed every day and submitted to DOE.

Directional Survey - A multi-shot direction survey will be made at total depth to allow for oriented core analysis. Specific hole conditions may require an additional survey.

"Mud" Log - A "mud" log will be maintained during the drilling operation. This log will provide the following principal data, summarized at a vertical scale of 1" = 100'.

1. geologic field description of core (including lithology, alteration minerology and fracture geometery assuming a vertical hole),

2. graph of penetration rate versus depth,

3. graph of measured water level versus depth,

4. lost circulation zones (including time/date, depth, total amount of fluid loss and rate of fluid loss), and

5. casing profile.

Temperature surveys

Two temperature surveys are planned to be conducted one week and one month after the thermal gradient hole has been completed. These surveys will be from surface to total depth.

Deliverable: Data and samples.

4.5 Hole Completion and Maintenance

A. Upon satisfactory completion of drilling, open-hole geophysical logging and sampling, a steel tubing string will be hung or cemented in the borehole from surface to TD and the well completed in accordance with the approved Project Drilling Plan.

B. Upon completion of the hole, DOE and the Participant shall review and discuss the data. A mutual agreement between DOE and the Participant must be reached prior to releasing the rig.

C. The Participant shall provide to DOE within 15 days of completion of the hole a schematic of the actual completed hole configuration.

D. The hole and site shall be maintained for a period of 12 months after hole completion in accordance with the approved Project Drilling Plan. The hole and site shall be made available to DOE during this period for DOE's scientific use. The will not attempt to preserve access to the site during the period of winter snow cover.

Deliverable: Completed hole configuration schemati

4.6 Abandonment and Site Restoration

If the Participant so elects, the hole will the site fully restored in accordance with BLM regulations, Forest Service stipulations and the Project Drilling Plan. Alternatively, the Participant may elect to preserve the hole. and drillsite at its sole risk, cost and legal responsibility. In this instance, the Participant shall provide DOE with a copy of the plug and abandonment and site restoration plans from the approved Plan of Operations and shall provide confirmation of these activities.

Deliverables: Approved P&A and restoration plans.

5.0 Reports, Data and Other Deliverables

A. The Project Drilling Plan as required by Subtask 4.1.C.

B. The Project Data Collection Plan as required by Subtask 4.1.D.

C. The Project Management Plan as required by Subtask 4.1.A.

D. The Project Institutional Plan as required by Subtask 4.1.B.

E. All data collected by the Participant under Task 4.4.

F. Regulatory documentation and Approved Environmental document under Subtasks 4.2.A and 4.2.B.

G. Completed hole completion schematic as required by Subtask 4.5.C.

H. Approved plug and abandonment plan as required by Task 4.6.

I. Project status and management reports as identified on DOE Form CR-537, Reporting Requirements Checklist.

Diamond Shamrock
Thermal Power Company

9 July 1986

Ms Susan Prestwich
Messrs Earl G. Jones and
Ronald A. King
U. S. Department of Energy
785 DOE Place
Idaho Falls, Idaho 83402

Mr. P. M. Wright
University of Utah
391 Chipeta Way, Suite C
Salt Lake City, Utah

Re: Cooperative Agreement
DE-FC07-851D12614
Quarterly Reports

Gentlemen:

Enclosed are the Federal Assistance Management Summary Report and the Federal Assistance Program/Project Status Report for the reporting period 1 April 1986 through 30 June 1986.

Should you have any questions, please feel free to contact us.

Yours very truly,

W. L. D'Olier
Vice President
Geothermal Exploration

WLD/ma

enclosure

Thermal Power Company
A subsidiary of Diamond Shamrock, 3333 Mendocino Avenue, Suite 120, Santa Rosa, California 95401
Phone 707 576-7022

FORM EIA-459E
(10/80)

U.S. DEPARTMENT OF ENERGY

FEDERAL ASSISTANCE MANAGEMENT SUMMARY REPORT

FORM APPROVED
OMB No. 1900-0127

Page ___ of ___

1. Program/Project Identification No.	2. Program/Project Title	3. Reporting Period
DE-FC07-851D12614	Cascade Geothermal Drilling	4/1/86 through 6/30/86

4. Name and Address
Thermal Power Company
3333 Mendocino Avenue, Suite 120
Santa Rosa, California 95401

5. Program/Project Start Date: 9/30/85

6. Completion Date: 9/30/87

7. FY: 86

8. Months or Quarters: Months

9. Cost Status a. Dollars Expressed in $000

b. Dollar Scale

10. Cost Chart

Fund Source		Quarter FY '86 1st	2nd	3rd	4th	Cum. to Date	Tot. Plan
DOE	P	0	0	0	170	0	
	A						
TPC	P	0	0	37	133	37	
	A						
	P						
	A						
	P						
	A						
Total P					340	0	
Total A						0	
Variance							

P = Planned A = Actual

Total Planned Costs for Program/Project: $480

	1986 A	M	J	J	A	S	O	N	D	1987 J	F	M
400												
300												
200												
100												

C Cumulative Accrued Costs

Planned	0	0	50									
Actual			37									
Variance			13									

11. Major Milestone Status

	Units Planned / Units Complete	
1. Drilling - Hole Completed	P / C	
2. Logs - Fluid Data to DOE	P / C	
3. All Data - Final Rpt to DOE	P / C	→ 87
4. Abandon - Restore Site	P / C	→ 87
	P / C	

FORM EIA-459F
(V0201)

FEDERAL ASSISTANCE PROGRAM/PROJECT STATUS REPORT

FORM APPROVED
OMB No. 1900-0127

1. Program/Project Identification No.	2. Program/Project Title	3. Reporting Period
DE-FC07-851D12614	Cascade Geothermal Drilling	4/1/86 through 6/30/86

4. Name and Address	5. Program/Project Start Date	6. Completion Date
Thermal Power Company 3333 Mendocino Avenue, Suite 120 Santa Rosa, California 95401	9/30/85	9/30/87

7. Approach Changes

☒ None

8. Performance Variances, Accomplishments, or Problems

Commenced drillsite construction on 6/3/86 and spudded Clackamas Thermal Gradient Hole on 6/7/86. The 7" surface casing was cemented at 488 feet depth on 6/13/86; BLM approved same. Blowout prevention equipment tested and BLM approved on 6/18/86. Diamond coring 3.937" hole below 1316 feet at midnight 6/30/86.

☐ None

9. Open Items

Diamond Shamrock
Thermal Power Company

August 5, 1986

Dr. Keith Barger
United States Geological Survey
345 Middlefield Road
Menlo Park, California 94025

Dear Keith:

Enclosed please find five pieces of core from Thermal Power Company/DOE's Clackamas Thermal Gradient Hole (CTGH-1). These selected pieces of core are being provided to enhance your mineralogical identification and interpretation of alteration mineralogy samples from the hole being sent by Mr. A. Waibel. Your ready assistance on this work is greatly appreciated because it may affect upcoming drilling decisions.

If I can provide any additional information, please do not hesitate to contact me at 707/576-7232.

Best regards,

Joe Iovenitti

J. L. Iovenitti
Senior Geologist

JLI/ma
JLI068

cc W. L. D'Olier, Thermal Power
E. D. James, Chevron
Susan Prestwich, DOE
A. Waibel, Columbia Geoscience
P. M. Wright, UURI
OR-CL-BR-06

Thermal Power Company
A subsidiary of Diamond Shamrock, 3333 Mendocino Avenue, Suite 120, Santa Rosa, California 95401
Phone 707 576-7022

TPC

CRITERION 2: TECHNICAL OBJECTIVES OF THE PROJECT

Thermal Power Company (TPC), if selected for a Cooperative Agreement, will proceed under a Statement of Work, as approved by the DOE, which will include the following objectives:

SCOPE

1. TPC will drill a Thermal Gradient Hole to a total depth of 5000 feet in Section 28, T8S, R8E Willamette Meridian and in Marion County, Oregon. This primary task will be accomplished by 24 hours per day continuous work to achieve its completion in an estimated 60 days of rig operations.

2. TPC will collect all required data both during and subsequent to drilling the Thermal Gradient Hole.

3. TPC will provide all data and information gathered under this Project to DOE.

4. TPC will obtain all permits and approvals required by government regulatory agencies for the performance of this Project.

5. TPC will perform all Project work in compliance with Federal, state and local laws, rules and regulations and agency orders and guidelines.

PROPOSED DRILLING PLAN

Surface and Subsurface Conditions Anticipated

The drillsite, in Section 28 T8S R8E Willamette Meridian, approximately four miles northwet of Olallie Butte, is situated in a clear cut parcel surrounded by older forest stands within the Mt. Hood National Forest. An unknown thickness of soil and rock overburden is expected above bedrock. Initial ground water flows may be first evident when the borehole encounters the top of hard, volcanic bedrock. A subsurface sequence of varied volcanic rocks, ranging from hard, crystalline flows to bedded clastic deposits is expected to be penetrated by the 5000-foot borehole. In the deeper intervals, discrete dikes or masses of younger intrusive rocks may be recognized. The geothermal resource evidence sought is an expected sharp temperature increase somewhere between 3000 and 5000 feet. This phenomena would mark a transition zone between overlying cold waters of the postulated rain cap and the deeper hot fluids of a prospective geothermal regime. The temperature increase may not be first perceived while actually drilling and coring the borehole. A loss of drilling fluids, into expectable fractures, correlated with a temperature increase would be the most encouraging finding in terms of the primary objective of the Project. The TPC perception of the configuration of the postulated geothermal resource has been discussed in Criterion 1.

Site Access and Preparation

Fortunately, numerous clear cut parcels of 10 to 80 acre areal size and a logging road network exist in this portion of the Mt. Hood National Forest. The specific site chosen is the northwest quarter of the southeast quarter of Section 28, T8S, R8E, WM, in clear cut parcel 30 as shown on Forest Service maps. At the approximate 4000-foot elevation of this site, a winter snow cover of 6-10 foot thickness will preclude access during a five month interval, commonly November to March. The specific site is immediate to an access road. A rectangular one acre level bench will be cleared of any logged cuttings trash for the drillsite. Care will be taken to minimize any toll of young second growth trees and drainage changes in the existing land surface.

Hole Design

A proposed hole design for the 5000-foot Thermal Gradient Hole is shown in the following Figure 12. TPC proposes the following drilling-coring program.

1. Drill 12-1/4" hole with tricone bit and mud through overburden to 30-foot depth. Cement 8-5/8" casing back to surface.

2. Drill 10-3/4" hole with tricone bit and mud to 500 feet depth. Run geophysical borehole logs. Run 6-1/2" casing to 500 feet and cement it in from shoe to surface.

3. Install head flange on 6-1/2" casing; install CSO ram above flange and install MSP Hydril above CSO ram. Test and verify reliable BOP equipment operation and compliance with BLM regulations.

4. Continuously core with HQ diamond heads ~~(3.85"~~ outside diameter) to 5000 feet or greatest depth possible. Use 4-1/2" core guide casing as required. If hole conditions become difficult, open corehole with 6" bit and run geophysical borehole logs before cementing 4-1/2" casing as intermediate protection string.

5. If required, reduce to NQ diamond heads (3.032" outside diameter) and continuously core to 5000 feet. Run geophysical borehole logs.

Anticipated Hole Problems

Loss of drilling fluid circulation is the chief problem anticipated. Lost circulation material, additives or cement plugs may be utilized in resolving lost circulation events above the 500-foot depth. Below the 4-½" casing shoe, the continuous coring methods can proceed without fluid returns if an adequate water supply is used (continuously pumped into the coring string) to lubricate and cool the diamond core head.

Drilling Fluids and Disposal

The drilling fluids, which will range between clay-water muds and water only, will be confined and recirculated in the borehole to the maximum

extent possible. Storage of excess or waste drilling fluids will be contained in an excavated sump immediate to the rig while the drilling-coring operations proceed. At the conclusion of rig operations, the drilling fluid remainder will be disposed of as required by BLM and Forest Service and the sump will be closed by earth fill, compacted and levelled to the drillsite elevations.

Hole Completion and Access Interval Status

It is contemplated that a steel tubing string, from surface to total depth, will be hung or cemented in the borehole. A gate or valve, selected to contain the wellhead pressure that may occur, will be fixed to the casing head flange and will allow full closure or full opening of the borehole. The casing head gate will be chained closed and locked. A prominent sign will identify the borehole, its purpose, telephone number and party to contact if upset conditions occur. Periodic inspections of the hole site and access roads will allow TPC's Santa Rosa office to advise and assist DOE in its intended Access Interval activities. TPC will not attempt to preserve access to the Thermal Gradient Hole during the period of winter snow cover.

Hole Abandonment and Site Restoration

These actions and their costs are included in TPC's proposal to DOE on the condition that TPC shall have the right not to abandon the hole. If electing to abandon, TPC will complete these actions in the 24th month of the Cooperative Agreement, and in accordance with the BLM regulations and Forest Service stipulations in the Geothermal Exploration Permit and in the Plan of Operations. If TPC elects not to abandon, DOE will escape its cost share of these actions and TPC will assume full legal responsibility and all future abandonment and site restoration costs.

Rig and Equipment Specifications

The important subcontractors for drilling the proposed Thermal Gradient Hole and for borehole geophysical logging have not been identified at this time. We anticipate using a rig specifically designed to continuously core the proposed Hole and with a 10,000-foot depth capacity in this mode of operation. We anticipate no problems in obtaining the geophysical logging equipment to operate in the 3.85" and 3.032" diameter boreholes established by the coring program.

Hole Containment

A double element (rams and Hydril) BOP stack would be secured to 500-feet of 6-½" casing, fully cemented from shoe to surface. The details and operating verification checks of this critical equipment will be as approved by the BLM authority for operations on Federal geothermal leases. Containment after drilling was described in Hole Completion above.

Site Facilities

After completion of drilling operations and sump closure, no site facilities of any kind are contemplated. The locked wellhead, the identification signs and the clean, level two acre location bench will be the expected site condition during the Access Interval required under the Cooperative Agreement.

Health, Safety, and Environmental Considerations

TPC will fully comply with the special stipulations of the Federal geothermal lease containing the drillsite, its Geothermal Exploration Permit as issued by the BLM, and the Plan of Operations required and approved by both BLM and the Forest Service. TPC will give special attention to drinking and natural water safeguards, drilling fluid and human waste disposal and the fire risks posed by the drilling operation.

Drilling Schedule

The anticipated 60-day drilling schedule for the Clackamas 5000-foot Thermal Gradient Hole is shown in the following Figure 13.

PROPOSED DATA COLLECTION PROGRAM

Data Collection During Drilling

The planned data collection program during drilling is described below. Included is the specified DOE requirements (1-3) along with additional Thermal Power Company data requisites. The program is designed to maximize data retrieval at minimal costs for critical evaluation of the geotechnical characteristics and potential of this prospect.

Rock Sampling

The drilling of the hole is designed such that a continuous core from bedrock to total depth will be obtained. It is anticipated that a 2.50" core will be recovered from the drilling of a HQ (3.85" OD) size hole. If it is necessary to reduce to NQ (3.03") hole size (see Proposed Drilling Plan), a 1.88" core will then be retrieved. Drill cuttings will also be obtained from at least the upper 500 feet of the hole. The drillsite geologist will provide data collection and on-site handling of samples (Appendix 3).

Fluid Sampling

Daily measurements of the hydraulic head (natural water level in the hole) will be obtained as allowed during the drilling operation. Lost circulation data will

be collected. If artesian flow is encountered and the issued permit drilling allows the performance of a flow test*, a short term test (less than 1 day) will be conducted at total depth to obtain samples of the formation water and a wellhead temperature and pressure. Drilling fluid samples will be collected as per SCAP. The drillsite geologist will maintain a log of the daily water level and lost circulation data (Appendix 3).

Geophysical Borehole Logging

The complete suite of geophysical borehole logs identified in the SCAP (temperature, caliper, resistivity, self-potential, sonic velocity and density logs) along with natural gamma, are planned to be run in the wellbore at two separate times. The first logging operation will occur prior to setting the surface casing which is planned at 500'. The second will take place at 5000' total depth. The open-hole logs (SP, caliper, resistivity and sonic) will only be run from the shoe of the surface casing to total depth. The others (temperature, gamma and density) will be run from surface to total depth. Cased holed gamma and density logging will provide data for cross-calibration between the two intended logging runs. The drillsite geologist, along with the Thermal Power Company geologist, will observe the logging operations. A comprehensive logging operation report will be prepared for each logging operation. There are two potential situations which may impact the second logging operation. The first is the inherent temperature limitation of the geophysical tools and logging cable. It may be possible to pump cool water into the wellbore to keep the in situ temperatures below the tool limitation. This would only be possible if the hole could accept the fluid. The second is related to hole conditions which may result in the setting of an intermediate string of casing. Hole conditions may preclude the logging of this immediate level. In such a case, a deep logging operation will be executed.

Maximum Temperature Reading

Three maximum recording thermometers will be run at every core recovery. These data will be collected by the drillsite geologist (Appendix 3).

Daily Drilling Report

A drilling report will be completed every day. A sample form is presented in Appendix 4.

Directional Survey

A multi-shot direction survey is planned at total depth. These data will allow for oriented core analysis. Specific hole conditions may require an additional survey.

*BLM regulations on deep thermal gradient holes state that such holes cannot be used to produce or physically test goethermal resources. Oral communications with both the California and Oregon BLM indicate that testing may be allowed if the hole is properly prepared to handle fluid flow (e.g. BOP, proper cemented casing, etc.)

"Mud" Log

A "mud" log (Appendix 3, Figure 4) will be maintained during the drilling operation. This log will provide the following principal data, summarized at a vertical scale of 1" = 100'.

1. geologic field description of core (including lithology, alteration minerology and fracture geometery assuming a vertical hole),
2. graph of penetration rate versus depth,
3. graph of measured water level versus depth,
4. lost circulation zones (including time/date, depth, total amount of fluid loss and rate of fluid loss), and
5. casing profile.

Data Collection After Drilling

Two temperature surveys are planned to be conducted one week and one month after the Thermal Gradient Hole has been completed. These surveys will be from surface to total depth.

TPC

Statement of Work

1.0 Introduction

The Cascade volcanic region has long been suspected to contain considerable geothermal potential, as evidenced by recent volcanism and other thermal expressions. There are few known surface manifestations of geothermal energy in spite of the obvious occurrence of heat sources. One possible explanation is that the downward percolation of the extensive regional cold ground water system suppresses surface evidence of underlying hydrothermal systems. However, there have been few wells drilled in the Cascades region to a sufficient depth to properly evaluate the temperature and hydrological conditions beneath the cold water zone. There is a great need for characterization identification of the deeper hydrothermal regime in order to more conclusively define the geothermal potential of the Cascades volcanic environment.

DOE's primary objectives for this cost-shared drilling project are to obtain and release to the public subsurface information, specifically:

- rock samples (core and/or drill chips),
- equilibrium temperature profiles,
- uncontaminated fluid samples,
- evidence for the existence and depth of potentially producible aquifers,
- geophysical well logs, and
- information on drilling conditions and problems in the Cascades environment.

2.0 Scope

1. The Participant, TPC, will drill a thermal gradient hole to a total depth of 5000 feet in Section 28, T8S, R8E Willamette Meridian, Marion County, Oregon. This primary task will be accomplished by 24 hours per day continuous work to achieve its completion in an estimated 60 days of rig operations.

2. The Participant will collect all required data both during and subsequent to drilling the thermal gradient hole.

3. The Partcipant will provide all data and information gathered under this Project to DOE.

4. The Participant will obtain all permits and approvals required by government regulatory agencies for the performance of this Project.

5. The Participant will perform all Project work in compliance with federal, state and local laws, rules and regulations and agency orders and guidelines.

3.0 Applicable Documents

Work performed by the Participant will be in compliance with all Federal, State, and local laws, rules and regulations, and agency orders and guidelines.

4.0 Technical Tasks

4.1 Project Management

A. Prepare and obtain DOE approval of a Project Management Plan within 30 days after award of this agreement. The plan will include a work breakdown structure and a list of deliverables

by task, identify the individuals and subcontractors responsible for each task, discuss the management techniques to be used, and include a schedule that shows the period for performance of each subtask and identifies principal milestones and decision points for each. This plan will also designate an individual or individuals who well act as principal points of contact with DOE on behalf of the Participant.

B. Submit and obtain DOE approval of a Project Institutional Plan prior to initiation of site preparation. The plan will identify items required by governmental regulatory agencies for the performance of this work, the agency whose requirement the item fulfills, and the actual or projected submittal and agency approval dates. The plan will also discuss any legal, social, or institutional problems anticipated during performance of the project and planned solutions.

C. Prepare and obtain DOE approval of a Project Drilling Plan prior to drilling. The plan shall describe:

1. Surface and subsurface conditions anticipated to be encountered during drilling, including configuration of the resource.

2. Site access.

3. Site preparation.

4. Hole design including hole size, casing size, cementing, etc.

5. Rig and equipment specifications.

6. Well containment during and after drilling including applicable regulatory requirements).

7. Drilling fluids and disposal method.

8. Hole completion.

9. Plugging and abandonment.

10. Site restoration.

11. Anticipated hole problems, if any, and proposed solutions.

12. Health, safety and environmental considerations.

13. Site facilities, if any.

14. Drilling schedule including major activities and estimated duration.

15. On-site supervision to be used during drilling, including drilling supervisor(s) and geologist(s).

D. Prepare and obtain DOE approval of a Project Data Collection Plan prior to drilling. This plan will address data collection both during drilling and after drilling. The plan will identify the types of data to be collected, the depth(s) at which each type of data will be collected, the timing of collection, and the method by which the Participant plans to collect each type of data, including type of instrument and planned calibration, where appropriate. The plan will specifically identify all logs and samples of rock and fluid that are to be collected.

E. Conduct subcontractor evaluations, select subcontractors and complete contract negotiations with selected subcontractors.

F. Perform project management in accordance with the approved Project Management Plan. In addition to close general coordination with DOE, immediate and full disclosure of any project problem areas to DOE is required, so that timely corrective action may be taken with DOE support, if necessary.

Deliverables: Approved Project Management Plan, Project Institutional Plan, Project Drilling Plans and Project Data Collection Plan.

4.2 Permitting and Environmental Reporting

A. Prepare, submit and obtain approval of any documentation required by governmental regulatory agencies for the performance of this work, including a geothermal Exploration

Permit and a Plan of Operations. A copy of all documentation provided to any governmental agency and pertinent to this project shall be provided to DOE.

B. An approved environmental document is required for this project prior to any ground disturbance. It is anticipated that an environmental assessment will be prepared by the Bureau of Land Management for this project. This environmental assessment may satisfy DOE's environmental reporting requirements. If DOE determines that a separate Environmental Evaluation Report is required prior to any ground disruptive activity, DOE will notify the Participant in writing. In that event, the Participant will prepare the Environmental Evaluation Report in accordance with DOE Environmental guidelines. If a DOE Environmental Assessment is required, the Participant will provide information required by DOE for DOE's preparation of the Environmental Assessment.

If DOE determines that an Environmental Assessment is required, DOE will notify TPC in writing. Upon such notification, TPC will provide information as required by DOE for DOE's preparation of the Environmental Assessment.

Deliverables: Approved environmental document and regulatory documentation.

4.3 Drilling

A. Confirm logistics, services and vendors with requirements outlined in the approved Project Drilling Plan.

B. Prepare drill site, access and water supply and move in drilling rig in accordance with approved Project Drilling Plan.

C. Drill a thermal gradient hole to 5000 feet TD in accordance with the approved Project Drilling Plan. The Participant shall report on drilling status daily to the designated DOE representative, so that discussions concerning the drilling operation can be made in a timely manner.

4.4 Data Collection

A. Collect the following data as a minimum in accordance with the approved Project Data Collection Plan. These data shall be provided to DOE as soon as acquired.

Rock Sampling - The drilling of the hole is designed such that a continuous core from bedrock to total depth will be obtained. It is anticipated that a 2.50" core will be recovered from the drilling of HQ (3.85" OD) size hole. If it is necessary to reduce to NQ (3.03") hole size, a 1.88" core will then be retrieved. Drill cuttings will

also be obtained from at least the upper 500 feet of the hole. The Participant's drillsite geologist will provide data collection and on-site handling of samples. DOE will provide procedures for identification and splitting of core and cuttings and will coordinate disposition and storage of the samples with the Participant.

Fluid Sampling - Daily measurements of the hydraulic head (natural water level in the hole) will be obtained as allowed during the drilling operation. Lost circulation data will be collected. If artesian flow is encountered and the issued drilling permit allows the performance of a flow test, a short-term test will be conducted at total depth to obtain samples of the formation water and well-head temperature and pressure. Drilling fluid samples will be collected as per SCAP. The drillsite geologist will maintain a log of the daily water level and lost circulation data. If no artesian flow is encountered, the Participant will still endeavor to collect samples of uncontaminated aquifer fluids at locations in the hole at which fluid production would be anticipated on the basis of lost circulation, indications of fracturing in the core or chips, geophysical well logs or other standard indicators. Potential methods for collection of these samples include swabbing, bailing, air lift, drill stem tests and pumping. The Participant will examine these and/or other fluid sampling techniques and address collection of these samples in the Project Data collection Plan.

Geophysical Borhole Logging - The complete suite of geophysical borehole logs identified in the SCAP (temperature, caliper, resistivity, self-potential, sonic velocity and density logs) along with natural gamma, will be run in the wellbore at two separate times. The first

logging operation will occur prior to setting the surface casing which is planned at 500'. The second will take place at 5000' total depth. The open-hole logs (SP, caliper, resistivity and sonic) will only be run from the shoe of the surface casing to total depth. The others (temperature, gamma and density) will be run from surface to total depth. Cased hole gamma and density logging will provide data for cross-calibration between the two intended logging runs. The drillsite geologist, along with the Thermal Power Company geologist, will observe the logging operations. A comprehensive logging operation report will be prepared for each logging operation. One set of field prints will be sent to DOE as soon as available.

Maximum Temperature Reading - Three maximum recording thermometers will be run at every core recovery. These data will be collected by the drillsite geologist.

Daily Drilling Report - A drilling report will be completed every day and submitted to DOE.

Directional Survey - A multi-shot direction survey will be made at total depth to allow for oriented core analysis. Specific hole conditions may require an additional survey.

"Mud" Log - A "mud" log will be maintained during the drilling operation. This log will provide the following principal data, summarized at a vertical scale of 1" = 100'.

1. geologic field description of core (including lithology, alteration minerology and fracture geometery assuming a vertical hole),

2. graph of penetration rate versus depth,

3. graph of measured water level versus depth,

4. lost circulation zones (including time/date, depth, total amount of fluid loss and rate of fluid loss), and

5. casing profile.

Temperature surveys

Two temperature surveys are planned to be conducted one week and one month after the thermal gradient hole has been completed. These surveys will be from surface to total depth.

Deliverable: Data and samples.

4.5 Hole Completion and Maintenance

A. Upon satisfactory completion of drilling, open-hole geophysical logging and sampling, a steel tubing string will be hung or cemented in the borehole from surface to TD and the well completed in accordance with the approved Project Drilling Plan.

B. Upon completion of the hole, DOE and the Participant shall review and discuss the data. A mutual agreement between DOE and the Participant must be reached prior to releasing the rig.

C. The Participant shall provide to DOE within 15 days of completion of the hole a schematic of the actual completed hole configuration.

D. The hole and site shall be maintained for a period of 12 months after hole completion in accordance with the approved Project Drilling Plan. The hole and site shall be made available to DOE during this period for DOE's scientific use. The will not attempt to preserve access to the site during the period of winter snow cover.

Deliverable: Completed hole configuration schematic.

4.6 Abandonment and Site Restoration

If the Participant so elects, the hole will be abandoned and the site fully restored in accordance with BLM regulations, Forest Service stipulations and the Project Drilling Plan. Alternatively, the Participant may elect to preserve the hole. and drillsite at its sole risk, cost and legal responsibility. In this instance, the Participant shall provide DOE with a copy of the plug and abandonment and site restoration plans from the approved Plan of Operations and shall provide confirmation of these activities.

Deliverables: Approved P&A and restoration plans.

5.0 Reports, Data and Other Deliverables

A. The Project Drilling Plan as required by Subtask 4.1.C.

B. The Project Data Collection Plan as required by Subtask 4.1.D.

C. The Project Management Plan as required by Subtask 4.1.A.

D. The Project Institutional Plan as required by Subtask 4.1.B.

E. All data collected by the Participant under Task 4.4.

F. Regulatory documentation and Approved Environmental document under Subtasks 4.2.A and 4.2.B.

G. Completed hole completion schematic as required by Subtask 4.5.C.

H. Approved plug and abandonment plan as required by Task 4.6.

I. Project status and management reports as identified on DOE Form CR-537, Reporting Requirements Checklist.

Chevron Resources Company
A Division of Chevron Industries, Inc.
595 Market Street, San Francisco, California
Mail Address: P.O. Box 7147, San Francisco, CA 94120-7147

April 17, 1987

Re: Clackamas Geothermal, Oregon

Dr. Gary Olhoeft
U.S. Geological Survey
P.O. Box 25046, MS 964
Denver, CO 80225

Dear Gary:

Thanks for the resistivity information on the core I sent you from the Clackamas hole. More importantly, I am pleased that you are interested in logging the hole. Mike Wright at U.U.R.I. is more or less the custodian for the well; I have asked him to call you directly. The hole is cased to 4200 feet, uncased to 4803 feet, but now contains a 2 inch pipe to total depth for temperature measurements. Mike mentioned that a workover rig might be in Oregon this summer, and could pull the pipe for your logging of the bottom 600 feet.

Attached are (1) a copy of the temperature log, (2) a report on the geophysical logging, and (3) a copy of the resistivity/IP log for the 4200-4803 foot interval.

Thanks for your interest in this project.

Sincerely,

Charles M. Swift, Jr.

cc: Mr. E. D. James
Mr. J. L. Iovenitti - Thermal Power Co.

PMW FYI

Diamond Shamrock
Thermal Power Company

W. L. D'Olier

1 October 1987

Ms. Susan M. Prestwich
Geothermal Project Manager
DOE, Idaho Operations Office
785 DOE Place
Idaho Falls, Idaho 83402

RE: Cooperative Agreement
No. DE-FC07-851D1D12614
Final Technical Report

Dear Ms. Prestwich:

Thermal Power Company herewith transmits 4 copies of the Final Technical Report for the 4800-foot Clackamas Thermal Gradient Hole. Additional single copies were separately mailed to key persons as shown below.

We enjoyed participating in the Cascade Geothermal Drilling Project, as a mutually beneficial opportunity created by DOE. Your skilled management in this joint work was especially appreciated.

Very truly yours,

W. L. D'Olier
Vice President
Geothermal Exploration

0037S/pg3/ao

cc: Hoyles - DOE
Wright - UURI ✓
Reed - DOE
Cole - Chevron

Thermal Power Company
A subsidiary of Diamond Shamrock, 601 California Street, San Francisco, California 94108
Phone 415 981-5700, Telex 34387 DIASHAM SFO

Department of Energy

Idaho Operations Office
785 DOE Place
Idaho Falls, Idaho 83402

October 9, 1987

Mr. W. L. D'Olier
Vice President
Geothermal Exploration
Thermal Power Company
601 California Street
San Francisco, CA 94108

SUBJECT: Completion of Cooperative Agreement DE-FC07-85ID12614

Dear Bill:

We received the copies of your final report. It looks fine. Thank You. Also your letter and report of October 5, 1987. I have begun formal closeout procedures on the cooperative agreement.

I, personally, wish to thank both you and your staff, particularly Joe Iovenetti, for such professionalism, cooperation, and support during the agreement. If all my projects ran this smoothly life would be much easier.

Sincerely,

Susan M. Prestwich
Project Manager
Advanced Technology Division

cc: Joe Iovenetti, Thermal Power
Marshall Reed, DOE-HQ
Jeff Hoyles, DOE-ID
Mike Wright, UURI

Diamond Shamrock
Thermal Power Company

11 April 1986

Ms Susan Prestwich
Messrs Earl G. Jones and
Ronald A. King
U. S. Department of Energy
785 DOE Place
Idaho Falls, Idaho 83402

Mr. P. M. Wright
University of Utah
391 Chipeta Way, Suite C
Salt Lake City, Utah

Gentlemen:

Enclosed are the Federal Assistance Management Summary Report and the Federal Assistance Program/Project Status Report for the reporting period January 1, 1986 through March 31, 1986.

Should you have any questions, please feel free to contact us.

Yours very truly,

W. L. D'Olier
Vice President
Geothermal Exploration

WLD/ma

enclosure

Thermal Power Company
A subsidiary of Diamond Shamrock, 3333 Mendocino Avenue, Suite 120, Santa Rosa, California 95401
Phone 707 576-7022

EARTH SCIENCE LABORATORY
UNIVERSITY OF UTAH RESEARCH INSTITUTE
391 Chipeta Way, Suite C
Salt Lake City, Utah 84108
(801) 524-3422

4-18-86
DATE

Sue Prestwich	DOE	
TO	ORG./LOCATION	TELEPHONE NUMBER

Mike Wright	UURI	
FROM	ORG./LOCATION	TELEPHONE NUMBER

THIS TRANSMITTAL CONSISTS OF 2 PAGES.
(excluding cover sheet)

VERIFICATION TELEPHONE NO. (801) 524-3437

FORM EIA-459F
(10-80)

FEDERAL ASSISTANCE PROGRAM/PROJECT STATUS REPORT

FORM APPROVED
OMB No. 1900-0127

1. Program/Project Identification No.	2. Program/Project Title	3. Reporting Period
DE-FC07-851D12614	Cascade Geothermal Drilling	1/1/86 through 3/31/86

4. Name and Address
Thermal Power Company
3333 Mendocino Avenue, Suite 120
Santa Rosa, California 95401

5. Program/Project Start Date
9/30/85

6. Completion Date
9/30/87

7. Approach Changes

☒ None

8. Performance Variances, Accomplishments, or Problems

Recipient submitted Project Institutional Plan and Environmental Evaluation Report to DOE-Idaho Operations Office on 3/11/86; they remain under DOE consideration at 3/31/86.

☐ None

9. Open Items

Recipient submitted Plan of Exploration for Clackamas 5000-Foot Thermal Gradient Hole to U. S. Bureau of Land Management, Portland on 9/26/85. Also, submitted Application for Geothermal Drilling Permit to same authority on 11/14/85. These submittals remained under BLM processing at 3/31/86.

☐ None

10. Status Assessment and Forecast

☒ No Deviation from Plan is Expected

11. Description of Attachments

☒ None

12. Signature of Recipient and Date	13. Signature of DOE Reviewing Representative and Date
W. L. D'Olier W. L. D'Olier 11 Apr 86	

(10 80)

FORM APPROVED
OMB No. 1900-0127

1. Program/Project Identification No.	2. Program/Project Title	3. Reporting Period
DE-FC07-851D12614	Cascade Geothermal Drilling	1/1/86 through 3/31/86

4. Name and Address	5. Program/Project Start Date	6. Completion Date
Thermal Power Company 3333 Mendocino Avenue, Suite 120 Santa Rosa, California 95401	9/30/85	9/30/87

7. Approach Changes

☒ None

8. Performance Variances, Accomplishments, or Problems

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☐ None

10. Status Assessment and Forecast

☒ No Deviation from Plan is Expected

11. Description of Attachments

☒ None

12. Signature of Recipient and Date	13. Signature of DOE Reviewing Representative and Date
W. L. D'Olier W.L.D'Olier 11Apr86	

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108—1295
TELEPHONE 801-524-3422

April 17, 1986

MEMORANDUM

TO: Mike Wright

FROM: Bruce Sibbett

SUBJECT: Thermal Power Company's Drilling Plan for the Clackamas Hole

Comments:

Hole Design c & d: Drilling with HQ rod with an O.D. of 3.7", through the 7" surface casing will allow the drill rods to "whip around" within the 500' of surface casing subjecting it to continuous bending stresses. 4-1/2" casing placed within the 7" casing would provide stabilization for the HQ drill string. The statement in d) "use 4-1/2" core guide casing as required." may indicate that the drilling plan does call for stabilization with 4-1/2" casing within the 7" casing during coring but it is not clear. In Appendix I, p. 1, #4, the drilling program does state that the 7" surface casing will be temporarily sleeved with 4-1/2" casing. Failure to sleeve the HQ rods to reduce the annulus in the surface casing could result in the HQ twisting off and loss of the hole.

A casing shoe could be used to drill the 4-1/2" casing into the hole bottom at 500' and the 4-1/2"-7" annulus filled with drilling mud (to stabilize the casing) before the HQ coring begins. The 500' of 4-1/2" casing can be pulled out later if it is necessary to ream out the corehole to 6" or on completion of the hole.

If 4-1/2" casing is set to some depth to control either hole conditions or cool water aquifers below the 500' of surface casing, a method of removing the 500' of 4-1/2" casing within the 7" surface casing to facilitate possible placement of a pump upon completion of the hole should be considered. Although no pump is planned in the drilling plan the possibility should be left open. This assumes that the piezometric surface of the thermal aquifer will be within 500' of the surface such that a pump could be placed in the 7" casing to draw out samples if the thermal aquifer does not flow spontaneously.

The hole design, Figure B, p. 8, indicates the 4-1/2" casing will not extend to the surface in the completed hole, and in Appendix I, #7 the 4-1/2" casing overlaps the 7" casing between 450 and 500 feet.

The drilling plan does not mention a liner hanger or how the 4-1/2" casing will be hung. After the 4-1/2" casing is set to depth and cemented, a 4-1/2" casing sleeve will be needed in the 7" casing for continued drilling. A liner hanger or some method is needed to control cementing of the lower casing, centralize the 4-1/2" in the 7" casing and align the 450 feet of 4-1/2" sleeving on top of the lower casing.

Fluid Sampling: The drilling plan doesn't specify exactly how fluid samples will be obtained. Appendix I, #8 of the Detailed Drilling Program seems to suggest the well is expected to flow spontaneously. Will airlift or pumping be considered if the well doesn't flow? If the objective of obtaining thermal fluid samples is going to be met, we will have to plan for it. However, the likelihood of the hole flowing spontaneously is very low.

The drilling plan for the Clackamas 5000-foot thermal gradient hole is much improved over the original plan and seems satisfactory.

Bruce S. Sibbett

BSS/jp

Diamond Shamrock
Thermal Power Company

January 29, 1986

U. S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, Idaho 83402

Gentlemen:

Enclosed are the Federal Assistance Management Summary Report and the Federal Assistance Program/Project Status Report for the reporting period October 1, 1985 through December 31, 1985.

Should you have any questions, please feel free to contact us.

Yours very truly,

W. L. D'Olier
Vice President
Geothermal Exploration

WLD/ma

Thermal Power Company
A subsidiary of Diamond Shamrock, 3333 Mendocino Avenue, Suite 120, Santa Rosa, California 95401
Phone 707 576-7022

FORM EIA-459F
(10-80)

FEDERAL ASSISTANCE PROGRAM/PROJECT STATUS REPORT

FORM APPROVED
OMB No. 1900-0127

1. Program/Project Identification No.	2. Program/Project Title	3. Reporting Period
DE-FC07-851D12614	Cascade Geothermal Drilling	10/1/85 through 12/31/85

4. Name and Address
Thermal Power Company
3333 Mendocino Avenue, Suite 120
Santa Rosa, California 95401

5. Program/Project Start Date
9/30/85

6. Completion Date
9/30/87

7. Approach Changes

☒ None

8. Performance Variances, Accomplishments, or Problems

Recipient submitted Project Management Plan to DOE on 10/25/85; it was approved by U. S. DOE, Idaho Operations Office in November, 1985.

Recipient submitted Plan of Exploration for Clackamas 5000-Foot Thermal Gradient Hole to U. S. Bureau of Land Management, Portland on 9/26/85. Also, submitted Application for Geothermal Drilling Permit to same authority on 11/14/85. These submittals remained under BLM processing at 12/31/85.

☐ None

9. Open Items

☒ None

10. Status Assessment and Forecast

☒ No Deviation from Plan is Expected

11. Description of Attachments

☒ None

12. Signature of Recipient and Date	13. Signature of DOE Reviewing Representative and Date
William L. Dickinson 29 Jan 86	

Idaho National Engineering Laboratory

June 2, 1986

Mrs. Susan M. Prestwich
Advanced Technology Division
Idaho Operations Office -DOE
Idaho Falls, ID 83401

REVIEW OF THERMAL POWER PLANS -SGS-16-86

Dear Susan:

At your request, I have reviewed the institutional plan, the drilling plan and the data collection plan for Thermal Power's Clackamas hole. Thermal Power should be commended for preparing a good set of plans that I feel meet the intent of DOE's requirements. I have the following specific comments:

Institutional Plan

Thermal Power has obtained all required permits and approvals for this thermal gradient hole. The final outstanding permit, the water appropriation permit, was approved in late May. This permit is based on a temporary rule allowing limited duration geothermal exploration in the Clackamas basin, and the original restrictions will apply when the permit expires in 180 days. Thermal Power's drilling schedule will require extension of the DOGAMI drilling permit which expires on July 8. Thermal Power has completed the cultural and botanical surveys required by the BLM special stipulations. No sensitive areas were identified. The Oregon Dept. of Environmental Quality will require an analyses of the drilling fluids and cuttings prior to giving approval to Thermal Power's disposal plans.

The institutional plan references DOE's requirement for an EER. Has DOE notified Thermal Power that they waive this requirement?

Drilling Plan

I did not see any problems with Thermal Power's drilling program as outlined in the plan. Their site restoration plans appear to be sufficient to meet Forest Service and BLM requirements. There are no additional restoration requirements that I think DOE should request.

EG&G Idaho, Inc. P.O. Box 1625 Idaho Falls, ID 83415

Data Collection Plan

With the Thermal Power-UURI resolution of disposition of the cuttings and core, the data collection plan should meet the requirements as outlined in the scope of work. If a high-temperature resource is encountered and the attempt to flow the hole is successful, the flow rate estimates will have to be back-calculated to the bottomhole temperature. For this reason, I would recommend that the flow test be correlated with a temperature survey.

Sincerely,

Susan

Susan G. Stiger
Renewable Energy Programs

ks

cc: J. O. Zane, EG&G Idaho

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108—1295
TELEPHONE 801-524-3422

November 25, 1985

MEMORANDUM

TO: Sue Prestwich

FROM: Bruce Sibbett

SUBJECT: Comments on Thermal Power Company Drilling Program, Clackamas Hole

There are some fundamental problems with the Clackamas 5000-foot thermal gradient hole drilling plan. It is unclear whether they really want a core hole with little casing or a 6" rotary hole cased to 4000'. I doubt that the budget can afford both. Also the program doesn't actually explain how a water sample would be obtained or how the well would be induced to flow.

The problems with the drilling program are listed below:

Bits — 10" and 5 5/8" bits are not standard sizes. They would have to use 9 7/8 or 10 5/8 and 6 or 5 7/8.

Page 1,#2 — Drilling 9 7/8" hole to 500' with an air hammer is a good idea. However, to allow for the couplings on the casing and have enough clearance in the annulus to cement the 7" casing a 10 5/8" hole would be preferred.

Page 1,#4 — "Prepare diamond coring system" suggests they will move off the rotary rig and move in coring rig. I don't know of any rotary rig which can do wireline HQ coring. Core rigs don't have the power to rotary drill a 9 7/8" hole in basalt and don't have an air compressor system. Setting 500' of 7" casing is also very difficult with a core rig. Experience on Ascension Island and Newberry Crater suggest that drilling the upper large diameter hole with a rotary rig then moving in a core rig is most cost effective when possible.

Page 2,#5 — If hole conditions become difficult drilling with HQ, opening the hole up to 6" with a rotary (?) bit will not solve the problems such as lost circulation or caving. Also they would have to switch drill rigs again because the core rig can't efficiently drill that

size hole to any depth. How will they run a "rig flow test"? It is not that easy.

Page 2, #7 I'm not sure a 50' lap between 7" and 4 1/2" casing is adequate. Also, how will they disconnect from the 4 1/2" casing? If they set the casing on the bottom cementing the annulus from the bottom is a problem. Normally a liner hanger is used which requires a greater overlap.

They can't cement 4 1/2" casing in a 6" hole because even flush joint 4 1/2" casing is 5 1/4" OD at the joins leaving only 3/8" clearance in the annulus. Irregularities in the hole and swelling clay zones, both will be there, will reduce the annulus more making it highly unlikely that cement could pass through 3500' of hole without plugging off. For a good cementing operation one would normally have 2" clearance in the annulus.

The 130 HP diesel engine for the drill rig is far to small.

RECOMMENDATIONS:

If Thermal Power really wants the hole cased to 4000 feet they should forget about coring and use a large rotary drill rig. With such an approach lost circulation will probably be a major problem. The section on "Geological...Conditions" (White, 1980) fails to mention that the drill site is mapped as Quarternary High Cascades basalt flows which may present major lost circulation problems.

The alternative is to design the hole strictly as a core hole. In that case the surface part of the hole could be rotary drilled with a 6 1/2" air hammer. This would require a good operator with a light touch to keep the hole straight which is important for the core drilling. Air drilling reduces the lost circulation problems. A 4 1/2" J55 casing would then be set and the hole cored with HQ (101mm hole).

A fluid sample may be obtained by pumping air down 2" liner pipe hung inside the HQ drill rod for air lift up the inside of the drill pipe. This method would lock control on where the produced fluids come from and puts the drill string at risk in the open hole but would be less costly than drilling a deep rotary hole and casing it.

REFERENCE:

White, C. M., 1980, Geology of the Breitenbush Hot Springs quadrangle, Oregon: Oregon Department fo Geology and Mineral Industries Special Paper 9, 26 p.

Bruce S. Sibbett

Diamond Shamrock
Thermal Power Company

April 29, 1986

Ms Susan Prestwich
DOE Project Officer
U. S. DOE, Idaho Operations Office
785 DOE Place
Idaho Falls, Idaho 83402

Re: Cooperative Agreement
No. DEFC07-851D12614
PROJECT DATA COLLECTION PLAN

Dear Ms Prestwich:

Thermal Power Company herewith submits five copies of the PROJECT DATA COLLECTION PLAN for the Clackamas 5000-Foot Thermal Gradient Hole.

Two outstanding issues remain with respect to drillsite geotechnical activities. First, the detailed geophysical borehole logging program will be formulated upon contractor selection. This process is expected to complete by 9 May 1986. The second issue is how to provide DOGAMI with a representative suite of cuttings and core. Adequate representative samples have been indicated by DOGAMI to be "...a small envelope of cuttings from each 30 ft. from the rotary drilled portion of the well plus several inches of core from each major lithology change in the cored portion of the well." Since UURI will be the repository of the cuttings and core, Thermal recommends that UURI be responsible for responding to the DOGAMI request.

We look forward to the execution of this program.

Sincerely,

Joe Iovenitti

J. L. Iovenitti
Senior Geologist

JLI/ma

cc Mr. A. Cooper, Chevron Resources Co.
Ms J. Wood, Thermal Power Co.

Thermal Power Company
A subsidiary of Diamond Shamrock, 3333 Mendocino Avenue, Suite 120, Santa Rosa, California 95401
Phone 707 576-7022

Wright

purposely left
loose

Diamond Shamrock
Thermal Power Company

14 November 1985

U. S. Department of the Interior
Bureau of Land Management
Division of Mineral Resources
P. O. Box 2965
Portland, Oregon 97201

Attention: Mr. Robert Fujimoto

Subject: Geothermal Drilling Permit Application
Clackamas 5000-Foot Thermal Gradient Hole
Federal Geothermal Lease OR 12344

Gentlemen:

We submit herewith our application for Geothermal Drilling Permit, on USGS Form 9-1957, for the Clackamas 5000-Foot Thermal Gradient Hole. This application supplements our Plan of Exploration which was delivered to your office under our letter dated September 26, 1985. We would proceed under an approved Permit, with drilling operations in June-July 1986, after obtaining additional approvals from the U. S. Department of Energy which is supporting this Thermal Gradient Hole under a Cooperative Agreement with Thermal Power Company.

Our Detailed Drilling Program is deliberately flexible in order to best respond to the actual thermal and fluid conditions found at depth and to obtain the highest quality information on the geothermal resource, if encountered.

Please contact the undersigned at 707/576-7040 for all additional comments, explanation or information which you may require in considering this application, its approval and issuance as a Permit. Your early attention will be greatly appreciated.

Yours very truly,

W. L. D'Olier
Vice President
Geothermal Exploration

RECEIVED
NOV 18 1985
ADVANCED TECHNOLOGY
BRANCH

WLD/ma

Enclosures: 5 Application Documents

Thermal Power Company
A subsidiary of Diamond Shamrock, 3333 Mendocino Avenue, Suite 120, Santa Rosa, California 95401
Phone 707 576-7022

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.

Clackamas 5000' Thermal Gradient Hole (CTGH)

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

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

1c. WELL STATUS: Proposed

2. NAME OF LESSEE/OPERATOR: Thermal Power Company

3. ADDRESS OF LESSEE/OPERATOR: 3333 Mendocino Avenue, Suite 120, Santa Rosa, California 95401

15. LOCATION OF WELL
At surface: Approximately 2200' N and 1500' W of SE Corner of Sec. 28
At proposed prod. zone: Same as Surface Location

16. DISTANCE FROM PROPOSED LOCATION TO NEAREST PROPERTY OR LEASE LINE: 1500' W of East Line of Sec. 28

17. DISTANCE FROM PROPOSED LOCATION TO NEAREST WELL, DRILLING, COMPLETED, OR APPLIED FOR ON THIS LEASE: No previous well drilled or applied for on this lease.

4. LEASE SERIAL NO.: OR 12344

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

6. UNIT AGREEMENT NAME: N/A

7. WELL NO.: CTGH-1

8. PERMIT NO.:

9. FIELD OR AREA: Squirrel Creek

10. SEC., T., R., B.& M.: Sec. 28 T8S R8E Willamette Meridian

11. COUNTY: Marion

12. STATE: Oregon

13. APPROX. STARTING DATE: 1 June 1986

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

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

19. PROPOSED DEPTH: MEASURED: 5000 TRUE VERTICAL: 5000

20. ELEVATIONS: ESTIMATED (xxk) FINAL ( ) 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
14-3/4"	11-3/4"	28 lbs.	N/A	1/4" Wall	0	30	25 cu. ft.
10" or 9-7/8"	7"	26 lbs.	Buttress	K-55	0	500	266 cu. ft.
6" or 5-5/8"	4-1/2"	11.6 lbs.	Long	K-55	450	4000	605 cu. ft.

22. PROPOSED WORK SUMMARY

Prepare 160' x 200' drillsite pad and lined sump adjacent to existing access road into clear cut parcel 30. Move in truck mounted rig. Drill 14-3/4" hole to 30' depth, run 11-3/4" conductor to bottom and cement to surface. Drill 10" hole to 500' depth; run 7" K-55 26 pound Buttress casing to bottom and cement to surface. Install casing head on 7" casing, then BOPE consisting of a double control gate and Hydril. Test BOPE per BLM regulations. Diamond core with HQ heads to 5000'. Run geophysical borehole log suite to 5000'. Open HQ hole with 6" bit to 4000' or other selected depth; run 4-1/2" K-55 11.6 pound LT&C casing to 4000', cement solid from shoe to lap in 7" casing at 450'-500' depth. Briefly flow well to obtain expected geothermal fluid samples. Hang 2-7/8" J-55 tubing string to 5000'; fill same with water. Release rig; leave CTGH-1 shut-in awaiting DOE high precision temperature log.

This will be a vertical borehole; no directional drilling/coring practices will be applied. However, borehole directional surveys will be run with the geophysical logging suite.

This deep thermal gradient hole would be drilled under a Cooperative Agreement between Thermal Power Company and the U. S. Department of Energy as part of the DOE program to 1) gather data to characterize the deep hydrothermal resource of the Cascades volcanic region and 2) transfer this data to the public in order to stimulate further development of hydrothermal resources.

(Use additional space on reverse side of form)

23.

SIGNED W. L. D'Olier TITLE Vice President, Geothermal Exploration DATE 14 November 1985

(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 270.71; 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)

THERMAL POWER COMPANY, Operator
Santa Rosa Office

14 November 1985

DETAILED DRILLING PROGRAM: CLACKAMAS 5000-FOOT THERMAL GRADIENT HOLE

Prepare the drillsite pad and lined sump in late May 1986. Install 5' x 5' x 4' deep board cellar. Move in truck mounted drill rig by 1 June 1986.

1. Drill 14-3/4" hole with tricone bit and clay-water based mud through overburden to 30-foot depth. Run 11-3/4" conductor and cement solid to surface with construction cement top poured outside the conductor.

2. Drill 9-7/8" hole with tricone bit and clay-water based mud to 500 feet depth. Use air hammer if possible. Run geophysical borehole logs. Run 7", K-55, 26 pound, Buttress coupled surface casing to 500 feet and cement solid from shoe to surface. Use Class G cement plus 40% silica flour. Pump 266 cubic feet of cement slurry, which is 250% of annulus volume to be filled.

3. Install 7" Larkin 4000 psig casing head with two side ports on 7" surface casing. Install temporary 6", 3000 psig head flange on casing head. Install BOPE consisting of a double control gate, bolted to the head flange, a MSP-2000 Hydril bolted above the gate, a hydraulic accumulator, control panel and rig floor activator. Pressure test and verify reliable BOPE operation and compliance with BLM regulations. Propose 1000 psig for 30 minutes to pressure test BOPE, casing head, weld and 7" casing. Notice BLM-Portland representative timely to allow observation/approval of this pressure test. Rig choke manifold line on one side port and kill line on other side port. See Figures 1a and 1b.

4. Prepare diamond coring system and continuously core with HQ diamond heads (3.85" outside diameter and 2.5" core diameter) to 5000 feet or greatest depth possible. This coring will be done with polymeric-water based drilling fluids which may be completely lost to the rock formations. Temporarily sleeve the 7" surface casing with 4-1/2" core guide casing to preclude rod whip.

5. If hole conditions become difficult, open corehole with 6" or 5-5/8" bit, run geophysical borehole logs and sample formation fluids by rig flow test before hanging or cementing 4-1/2", K-55, 11.6 pound casing as intermediate protection string (see 7 below re cementing). Resume HQ coring to 5000 feet or greatest depth possible. If required, reduce to NQ diamond heads (3.032" outside diameter) and continuously core to 5000 feet.

6. At 5000 feet (or more) total depth, run geophysical borehole logs from TD to 4-1/2" or 7" casing shoe. Have adequate water supply on site to pump into borehole for cooling in order not to exceed geophysical tool temperature limitations.

7. If 4-1/2" casing was not required for borehole protection to achieve 5000-foot depth, be prepared to open diamond corehole with a 6" bit and cement 4-1/2" casing at the top of the deep geothermal zone, if encountered and prospective for improved evaluation as an isolated zone. Use Class G cement, 40% silica flour and perlite. Pump 605 cu. ft. of cement slurry which is 200% of annulus volume to be filled between a 4000-foot casing shoe depth and a 4-1/2" to 7" casing lap between 450 and 500 feet.

8. Remove BOPE stack and temporary head flange. Blind flange the casing head. Obtain geothermal fluid samples from the prospective geothermal zone by short term flow test through the casing head side port and choke manifold line. Contain the geothermal fluid samples on the drillsite and in a Baker steel tank for toxicity evaluations to guide in subsequent disposals.

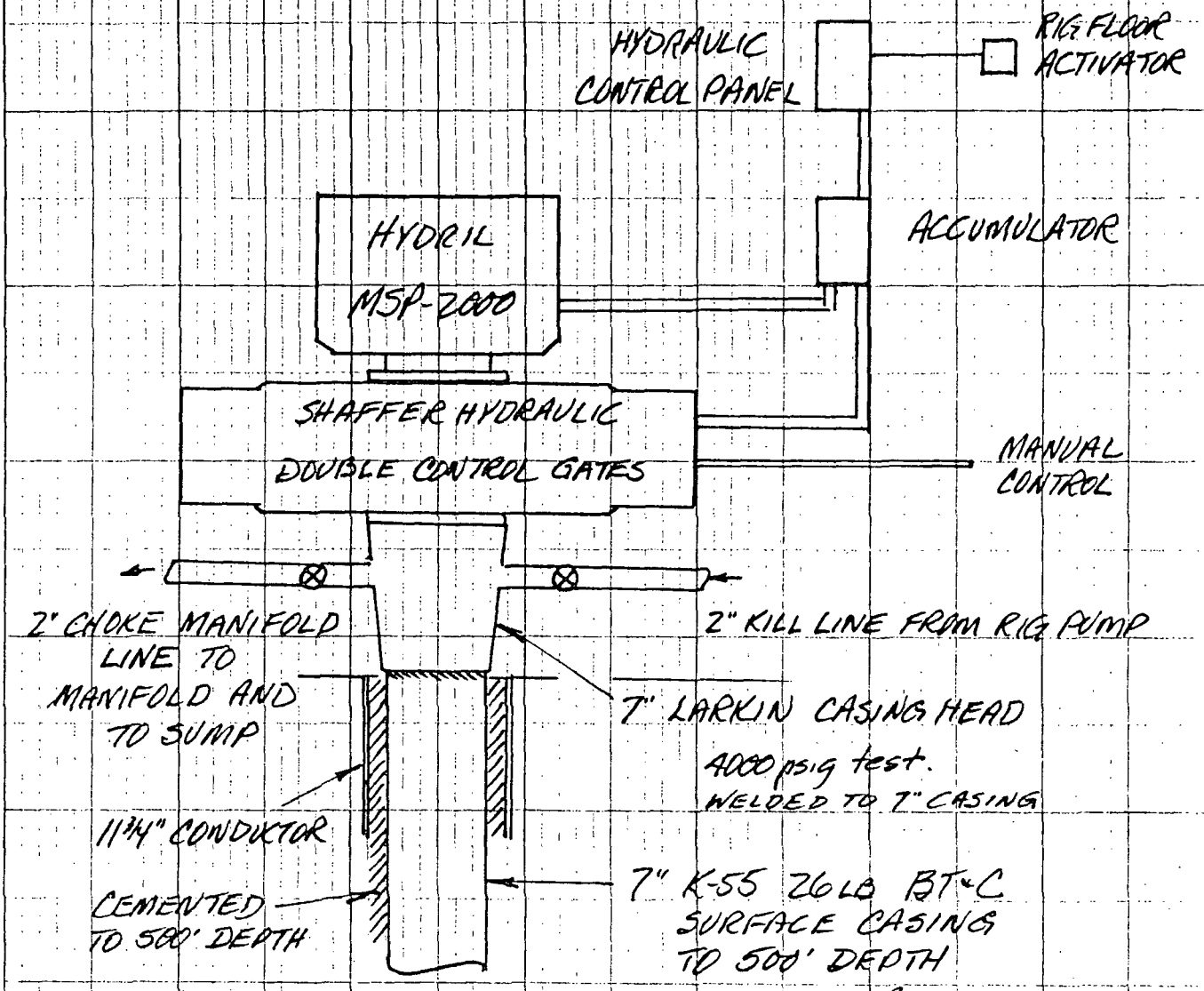
9. Run 2.875" OD J-55 tubing (solid string-water filled) to total depth and hang tubing in casing head if required for DOE high precision temperature log. Put 3" gate and lubricator connection on tubing or casing head. Release rig, fence the sump, clean and post the drillsite. Chain and lock the 3" and side port gates in the closed position. See Figure 2.

WLD/RJB/ma

Attachments - Supplemental Information and 5 Figures

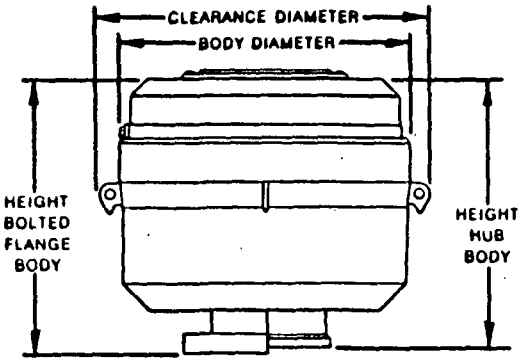
CLACKAMAS 5000' THERMAL GRADIENT HOLE

BOPE & SURFACE CONTROLS: DRILLING-CORING MODE



Diamond Shamrock
Thermal Power Company

FIGURE 1a



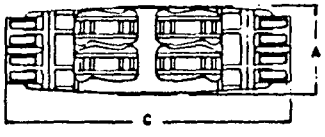
HYDRIL TYPE MSP-2000

ENGINEERING AND DIMENSIONAL DATA

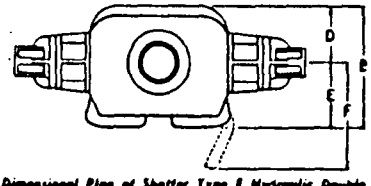
Connector Size and Pressure Rating (PSI)	Open Bore, In.	Approx. Weight, Pounds	Height Flange Body, In.	Height Hub Body, In.	Clearance Diam., In.	Body Diam., In.	U.S. Gallons for Full Piston Stroke	Piston Stroke Inches
6"-2000	7 1/16	1,850	25 1/4	...	29 1/4	25 1/8	2.85	4 1/2
8"-2000	8 1/16	2,450	30 1/4	...	32	27 1/8	4.57	5 1/2
10"-2000	11	3,520	31 1/4	...	37 1/2	32 1/2	7.43	8 1/2
20"-2000	21 1/4	14,900	52 1/2	51	58 1/2	31.05	11 1/2	

*MSP 2000 Blowout Preventers are furnished with 1" opening and closing ports. 1 1/2" or 1 1/2" are available on special request.

DIMENSIONAL AND ENGINEERING DATA ON SHAFFER TYPE E HYDRAULIC DOUBLE CONTROL GATES



Dimensional Elevation of Shaffer Type E Hydraulic Double Control Gate



Dimensional Plan of Shaffer Type E Hydraulic Double Control Gate

TYPE E DOUBLE

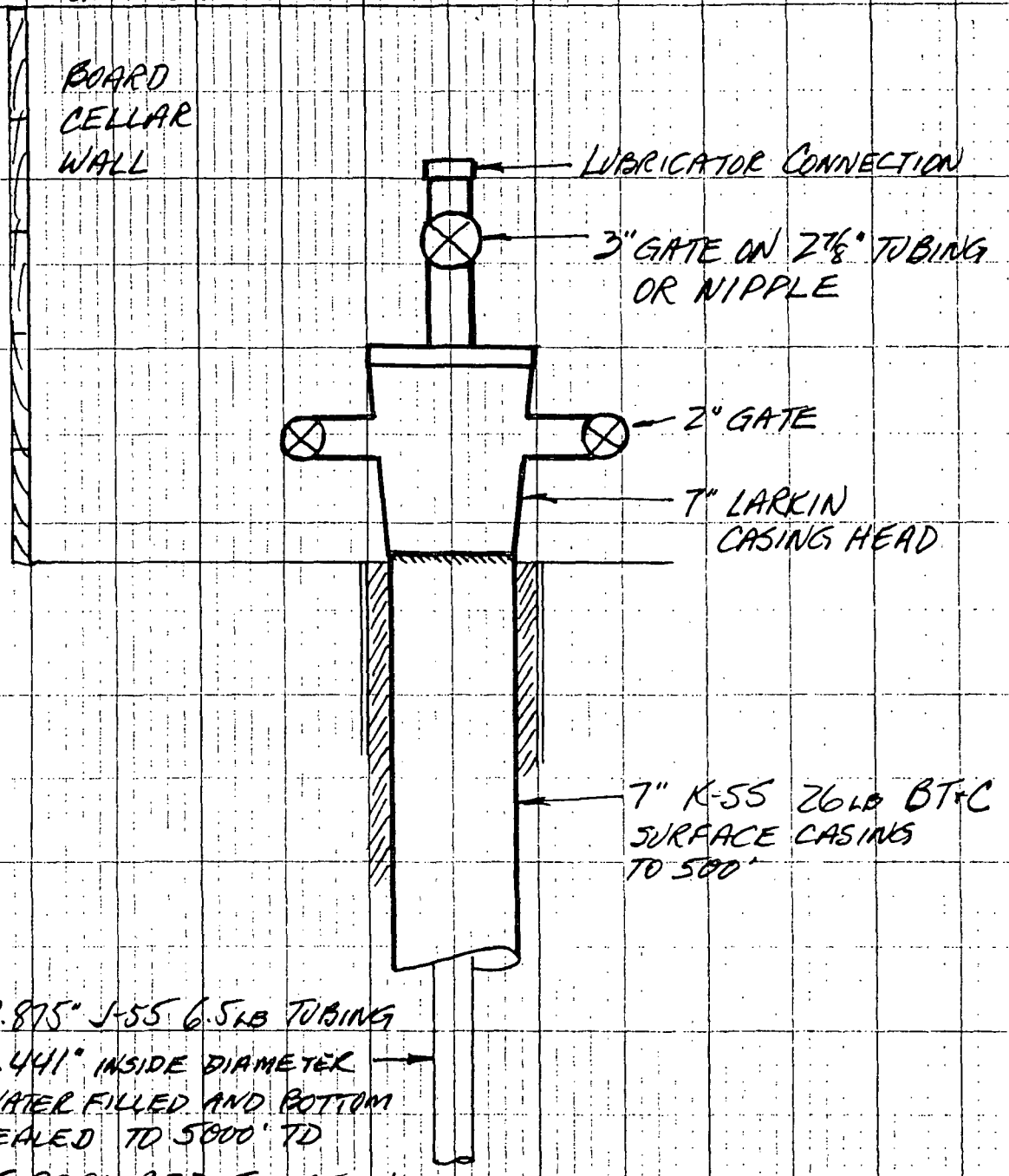
Size	Max. Service Pressure Rating, PSI	Test Pressure, PSI	Vertical Bore	Approx. Weight, Lbs.	Ram Size	A Height	B Width	C Length	D Center to Rear	E Center to Front	F Doors Open to Change Rams	Closing Ratio	Opening Ratio	U.S. Gals. Fluid to Close Rams	U.S. Gals. Fluid to Open Rams
6"	3,000	6,000	7 1/16"	4,915	C.S.O. thru 5 1/16" O.D.	25"	27 1/2"	73 1/4"	13"	14 1/2"	24 1/2"	6 to 1	2.57 to 1	2.75	2.3
6"	5,000	10,000	7 1/16"	5,735	C.S.O. thru 5 1/16" O.D.	28 1/2"	31 1/2"	74 1/2"	14"	17 1/2"	25 1/2"	6 to 1	2.57 to 1	2.75	2.3
8"	3,000	6,000	9"	5,525	C.S.O. thru 7" O.D.	25 1/2"	30 1/2"	75"	13 1/2"	16 1/2"	26 1/2"	6 to 1	1.89 to 1	2.75	2.3
8"	5,000	10,000	9"	6,705	C.S.O. thru 7" O.D.	27 1/2"	34"	79"	15 1/2"	18 1/2"	27 1/2"	6 to 1	1.89 to 1	2.75	2.3
10"	3,000	6,000	11"	6,986	C.S.O. thru 8 1/2" O.D.	27 1/2"	34 1/2"	80 1/2"	15 1/2"	18 1/2"	29 1/2"	6 to 1	1.51 to 1	3.25	2.7
10"	5,000	10,000	11"	9,465	C.S.O. thru 9 1/2" O.D.	30 1/2"	38 1/2"	85 1/2"	17 1/2"	21"	31 1/2"	6 to 1	1.36 to 1	3.25	2.7
12"	3,000	6,000	13 5/8"	10,105	C.S.O. thru 10 1/2" O.D.	30"	40 1/2"	94 1/2"	18 1/2"	22"	36 1/2"	6 to 1	1.14 to 1	3.56	2.9
14"	5,000	10,000	13 5/8"	12,245	C.S.O. thru 10 1/2" O.D.	34"	42 1/2"	94 1/2"	19 1/2"	23 1/2"	37 1/2"	6 to 1	1.14 to 1	3.56	2.9
16"	2,000	3,000	18"	8,300	C.S.O. thru 13 1/2" O.D.	27 1/2"	37 1/2"	98 1/2"	17 1/2"	20 1/2"	34 1/2"	6 to 1	1.06 to 1	3.86	3.0

Diamond Shamrock
Thermal Power Company

FIGURE 16

CLACKAMAS 5000' THERMAL GRADIENT HOLE

SURFACE COMPLETION: DOE 12-MONTH ACCESS PERIOD



- IF REQUIRED TO OBTAIN DOE HIGH PRECISION TEMPERATURE LOG

FIGURE 2

Diamond Shamrock
Thermal Power Company

THERMAL POWER COMPANY
Santa Rosa Office

Supplemental Information for Geothermal Drilling Permit
Clackamas 5000-Foot Thermal Gradient Hole

Formation Evaluation

This thermal gradient hole will be diamond cored (HQ size or 2.5" core diameter) from 500 feet to 5000 feet total depth. An 80% core recovery or better is anticipated. The geophysical wireline logs to be run from surface to total depth include hole caliper resistivity, self-potential, sonic velocity, density, natural gamma ray and temperature. A borehole deviation survey will be run at total depth to record the actual course of this intended vertical hole.

Drilling Hazards

The risk of blowout, consequent to drilling without returns, is the only significant drilling hazard posed for this thermal gradient hole. However, the prospective geothermal zone, if present and at high temperature, is confidently expected to be deeper than 3000 feet. The BOPE stack, consisting of a double control gate and Hydril, anchored to 500 feet of cemented 7" surface casing, will be in place, tested and periodically retested, ready for immediate activation at both the rig floor and at the control panel distant from the head of the borehole. Additionally, both a choke manifold line and a kill line will be connected to the casing head side ports while all drilling and coring operations proceed below 500 feet.

Drilling Equipment

A truck-mounted rig, with diamond coring depth capacity not less than 7000 feet, will be utilized on this borehole. A mast hoisting capacity of 75,000 pounds or more would be backed by a diesel engine of 130 HP. Duplex mud pumps of approximately 230 gpm capacity would be included.

Geothermal Fluid Sampling

A short term flow test will be conducted at total depth (5000'), and possibly at intermediate depth, for the collection of uncontaminated fluid samples. Surface flow measurements will be taken in the process. The choke manifold line connected to a two-inch side port on the casing head will be used to flow geothermal fluid from the borehole to a large portable steel tank (e.g. Baker Tank). The drilling sump will be used for back-up containment. At completion, the fluids in the tank and sump will be chemically analyzed. If no hazardous constitutents are present, the fluids will be sprayed along existing logging roads as directed by the U. S. Forest Service. If hazardous constitutents are indicated, a joint recommendation on disposal will be formulated by the Oregon Department of Environmental Quality and Thermal Power Company. Disposition of the fluids will be coordinated with the Forest Service, if appropriate.

Abandonment

Abandonment, if elected by the Operator as an integral part of the DOE Project, would be accomplished in September, 1987. Following removal of the tubing string from the borehole, 50-foot cement plugs would be placed across the shoe of the 4-1/2" casing, across the top of the lap between the 4-1/2" and 7" casings and from 10-foot depth to the surface. The casing head would be cut off, the board cellar removed and the cellar hole filled to ground level. The sump would be filled to ground level and the drillsite restored to a natural state as existed before drilling. Abandonment may occur at a much later date, as allowed under the terms of the existing Federal lease under the drillsite, and in such other manner as approved by the BLM.

Location

The drillsite for the proposed thermal gradient hole is located approximately 2200 feet north and 1500 feet west of the southeast corner of projected Section 28, T8S, R8E, Willamette Meridian as shown in Figure 3. Section corners are not present on this unsurveyed land. Drillsite elevation is approximately 3900 feet above sea level, as read from the Breitenbush Hot Springs 15 minute topographic map (1961). The drillsite location is within clear cut parcel 30 of the Mount Hood National Forest. Surface and bottomhole locations of the intended vertical 5000-foot borehole should be similar.

Geological, Geophysical, Hydrological Conditions

The drillsite is situated in the High Cascades portion of the Cascade Range ten miles north of the major Quaternary stratovolcano, Mt. Jefferson. This 5000-foot hole would evaluate the Clackamas geothermal prospect which lies in the northern portion of the heat flow anomaly which exceeds 100 milliwatts per meter square (Black et al, 1983). The drillsite lies in the Olallie Lake Plateau which consists of the relatively uneroded composite cones of Olallie Butte, Sisi Butte and Pinhead Butte. None of the rocks in this area exhibit reversed magnetism indicating that they are at least younger than the last magnetic reversal: 690,000 years ago. Petrochemical data for this area suggests that this region may be a growing stratovolcano. A contemporary magmatic intrusion, postulated under Olallie Butte, is taken to be the heat source for the Clackamas geothermal project.

The borehole will penetrate a sequence of volcanic rocks which are expected to contain cold water flows to depths of 3000 or 4000 feet. Below this, prospective geothermal fluids may be contained in the Miocene-Oligocene pyroclastic volcanic rocks of the Breitenbush Formation. Three principal fault directions have either been mapped or inferred (linear analysis) as offsetting these volcanic rocks. North-south trending normal faults define the Western Cascade/High Cascade boundary and control the alignment of the major volcanic cones and a conjugate set of shear faults, trending approximately N60^{o}W and N50^{o}E result from the present day north-south compression. The northwest trending faults are clearly the dominant failure plane direction and they assist thermal waters, originating at depth under the High Cascades, to migrate westward and updip to Austin and Breitenbush Hot Springs. The Clackamas 5000-foot Thermal Gradient Hole is situated at a fault intersection northwest of Olallie Butte. Maximum bottom hole temperatures of 550^{o}F are considered possible as shown in Figure 4. The reservoir, if intersected, may be of the two-phase liquid dominated type. If such a system is found, the produced fluid will have a high-steam quality. Salinities are expected to be moderate.

CLACKAMAS 5000' THERMAL GRADIENT HOLE

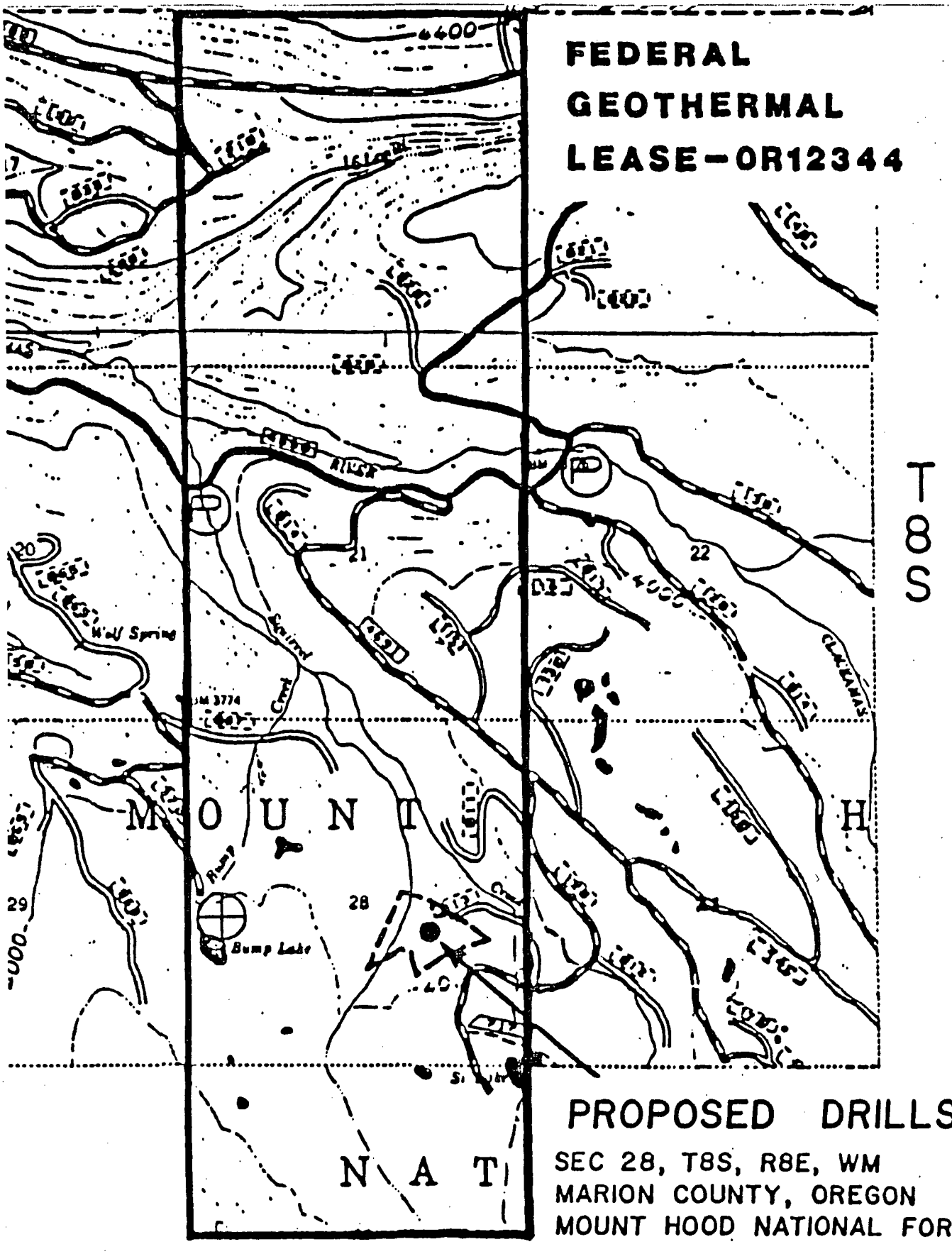


FIGURE 3

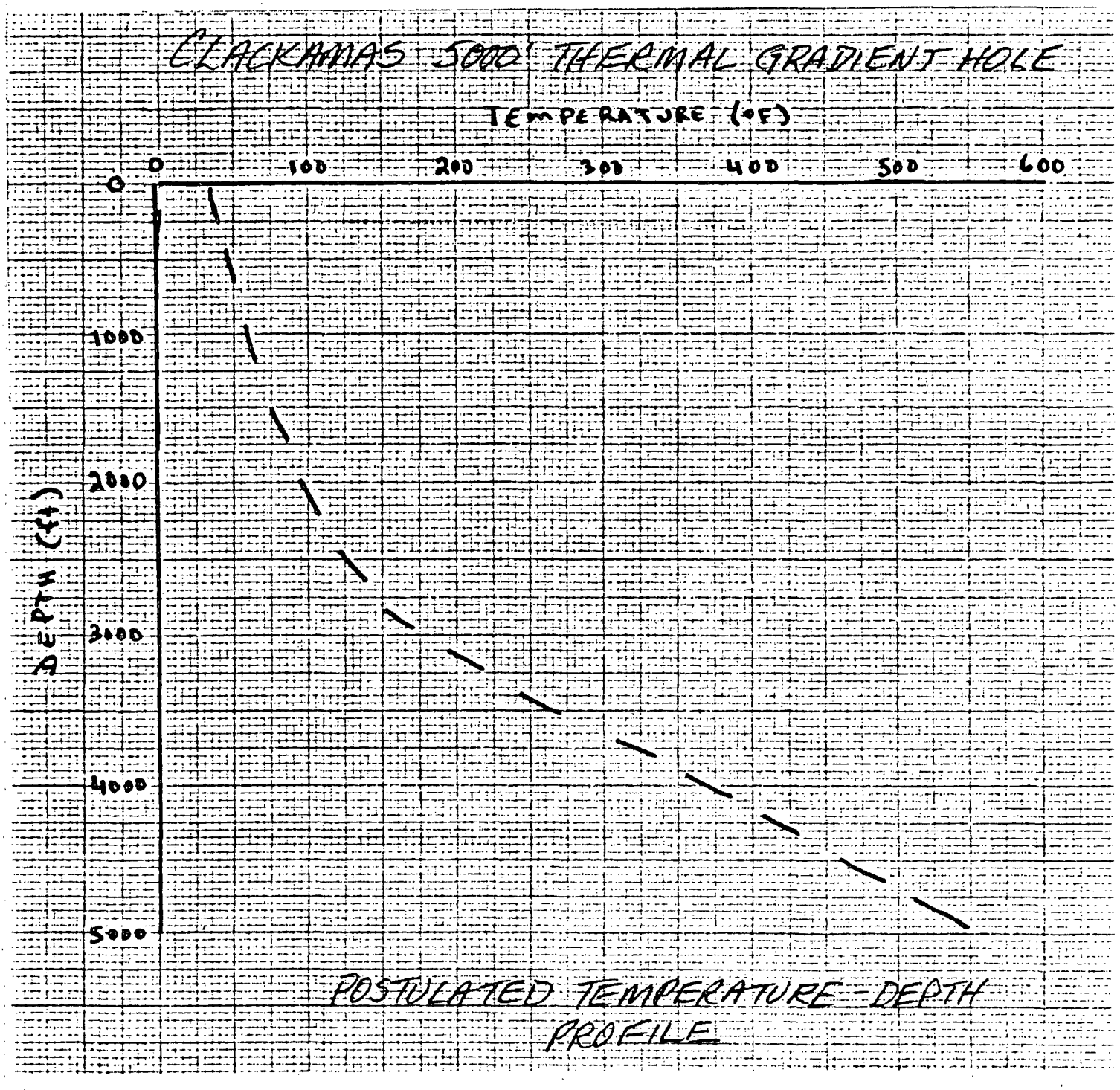


FIGURE 4

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