DRILLING PLAN

RAFT RIVER GEOTHERMAL EXPLORATORY HOLE NO. 1

DECEMBER 1974

Approved by

R. G. Bradley

R. GLENN BRADLEY, MANAGER

IDAHO OPERATIONS OFFICE

DATE 13 December 1974

Mahlon E. Gates

MAHLON E. GATES, MANAGER

NEVADA OPERATIONS OFFICE

DATE 9 December 1974

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PREPARED BY

INDUSTRIAL APPLICATIONS DIVISION

NEVADA OPERATIONS OFFICE

U. S. ATOMIC ENERGY COMMISSION

IDAHO OPERATIONS OFFICE

NEVADA OPERATIONS OFFICE

MASTER

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I. INTRODUCTION

A. Background

The Raft River Valley in south-central Idaho lies within a region that has in the past and may yet be undergoing severe tectonic stress. This stress acting on the subsurface rock at depths has caused thinning of the earth's crust and the intrusion of magmatic material into near surface formations from deep within the earth. This creates the higher heat flow observed in the Northwestern United States. At this site, the inferred intersection of two faults has apparently opened deep earth structures allowing circulation of fluids to very deep hot rock.

If wells are drilled into these circulation structures, the hot water and steam recovered may be used to power turbines for production of electricity. The Idaho Geothermal R&D Project is funded by the Idaho Operations Office of the U.S. Atomic Energy Commission and includes an attempt to recover hot water by drilling an exploratory hole to a maximum depth of 8,000 feet. Drilling is expected to begin early in January, 1975.

This document describes the program, plans, and procedures to be used in drilling and completion of the Raft River Geothermal Exploratory Hole No. 1 (RRGE-1). The other programmatic aspects of the Idaho Geothermal R&D Project, such as production testing, steam

plant design, and ultimate use of the resource, will be presented in other documents.

B. Program Description

The Idaho Geothermal R&D Project may eventually involve the drilling of many medium-temperature ($<180^{\circ}\text{C}$) water wells to exploit the power potentially available. The first deep exploratory hole will be drilled to a maximum depth of 8,000 feet in the Raft River Valley. The drill site is located in south-central Idaho approximately 72 air miles southwest of Pocatello and 37 air miles southeast of Burley near the Raft River (see Figure I-1). If sufficient resource is located in the first hole, it will be cased and completed. A second, shallower hole may then be drilled. If the first hole is unsuccessful, it will be capped for possible use as a reinjection test hole, and a second hole to a maximum depth of 8,000 feet may then be drilled. The decision to proceed with the drilling of the second hole in either case will largely depend on the availability of funding and the technical data obtained from RRGE-1.

Program direction and management of the Idaho Geothermal R&D Project is provided by the Aerojet Nuclear Company (ANC), a prime contractor to the Atomic Energy Commission's Idaho Operations Office (ID). The drilling of RRGE-1, at the request of ID/ANC, will be performed by the Reynolds Electrical and Engineering Company, Inc. (REECo), a

FIG. I-1
SITE LOCATION—
IDAHO GEOTHERMAL
R&D PROJECT

prime contractor to the Atomic Energy Commission's Nevada Operations Office (NV).

The drilling and completion of RRGE-1 will require the mobilization of an AEC drill rig to the Raft River site where REECo personnel, under the management of the NV, in accordance with ID/ANC objectives, will drill the exploratory hole. The schedule of major activities is shown in Appendix A. The drilling operation will consist of: (1) drilling a 42-inch hole to approximately 40 feet and running and cementing a 30-inch conductor pipe to the surface, (2) drilling a 26-inch hole to 900 feet and running and cementing a 20-inch casing to the surface, and (3) drilling a 12 1/4-inch hole to a maximum depth of 8,000 feet and (if a geothermal resource is located) running a combination string of 9 5/8-inch casing from 8,000 feet to approximately 800 feet and a 13 3/8-inch casing from 800 feet to the surface. The combination 13 3/8- and 9 5/8-inch casing will be cemented back to the surface in two stages.

II. GENERALIZED SITE ACTIVITIES

A. Site Preparation

The drilling will take place on a two-acre drill pad (see Figure II-1). Aerojet Nuclear Company (ANC) will provide necessary site preparation as follows:

1. Dress and level pad.
2. Excavate mud reserve pit.
3. Excavate and timber-line cellar.
4. Install and cement 30-inch conductor pipe.
5. Drill "rat" and "mouse" holes.
6. Drill and complete shallow domestic water well (~ 200 feet deep) to provide 20 to 30 gallons per minute.

B. Trailer

ANC will provide one combination living and office trailer (60 feet long, 12 feet wide). This trailer will contain cooking facilities, bunks, office furnishings, and sanitary facilities. One portion

FIG. II - 1 SITE LAYOUT

will accommodate REEC Co drilling, supervisory, and service personnel, and one portion will accommodate NV, ID, and ANC personnel.

C. Communications

1. Telephones

ANC will provide two telephone lines to the site. Both telephones will be located in the 60-foot trailer. Either telephone can be dialed into the leased line to the Idaho National Engineering Laboratory (INEL) where access to the FTS is available at all hours.

2. Radios

ANC will provide one radio net consisting of one base station and one mobile unit linking the drill site and the ANC office in Idaho Falls.

D. Power

ANC will negotiate with the Raft River Rural Electric Cooperative for the extension of power from nearby lines to the drill site. The power requirements are 75 kva at 60 Hertz and 230 volts, three phase. Further on-site distribution of power to trailers, pumps, and other facilities, as required, will be provided by ANC.

E. Fuel

ANC will provide the fuel to operate the drill rig. Fuel to the trailer will also be provided as required.

F. Vehicles

ANC will provide five vehicles with tire chains. Fuel and maintenance will also be provided by ANC. These vehicles will be apportioned in the following manner:

3 vehicles for REEC Co

1 vehicle for NV

1 vehicle located at the drill site for emergency use

G. Site Maintenance

Janitorial and repair services will be provided by ANC. This will include necessary repair and maintenance of living and office quarters, including sanitary facilities.

H. General Operational and Logistics Support

ANC will provide the following general logistical support:

1. Crafts (except drilling and associated work).

2. Clerical.

3. Office supplies.

I. Site Cleanup and Restoration

Upon completion of drilling, REECo will remove the drill rig and all rig-associated equipment. ANC will dispose of drilling fluids and backfill the mud reserve pit; dress and restore the pad.

J. Fencing

ANC will be responsible for construction of all required fencing.

III. OCCUPATIONAL HEALTH AND SAFETY

A. General

All drilling operations and other site activities will be conducted in accordance with standards of the Occupational Safety and Health Act of 1970 (OSHA), and in accordance with the rules and regulations applicable to the respective responsibilities of each participating project organizations.

All participating organizations are responsible for the health and safety of their own personnel and for conducting all activities in accordance with procedures that assure:

1. A safe and healthful environment for the employees.
2. Control and minimization of hazards to the public and to personnel of other participants.
3. Minimization of the accidental damage or loss of equipment, materials, and property.

B. First Aid

ANC will determine the location of local medical facilities and physicians in the area for use in the event of accident or illness.

Emergency transportation will be provided by ANC for injured persons of all participating organizations.

ANC will provide first-aid supplies as approved by the Director of the ID Medical Division. REECO will have personnel with first-aid training available at the site at all times. First-aid services will be available to all project participants at the site.

C. Fire Protection

Hand-operated fire extinguishers for the drill rig and associated equipment will be provided by REECO. ANC will provide extinguishers at points convenient to each significant structure or piece of equipment. Extinguisher types will be varied for control of Class A, B, or C fires, as appropriate.

D. Sanitation

ANC will provide potable water for drinking and cooking. Chemical or standard toilets will be provided and serviced, as required. Solid wastes will be disposed of in accordance with AEC regulations.

The trailer at the well location may be connected to a nonpotable water source and sewage system involving a septic tank or provided with other sanitary facilities in accordance with AEC health regulations.

IV. DRILLING OPERATIONS

A. General

The site will be prepared prior to moving the rig on, including constructing the cellar and setting and cementing the 30-inch conductor pipe to approximately 40 feet.

A 26-inch hole will be drilled with mud into the alluvium to a depth of approximately 900 feet. Twenty-inch surface pipe will be set and cemented to the surface.

A 12 1/4-inch hole will be drilled with mud to a maximum depth of 8,000 feet. If the geothermal resource is located, a combination string of 13 3/8-inch casing to 800 feet and 9 5/8-inch casing from 800 to a maximum depth of 8,000 feet will be run and cemented to the surface in two stages (see Figure IV-1).

The 26-inch and the 12 1/4-inch holes will be drilled using a centralized and stabilized assembly. One near bit reamer will be placed above the bit. The string reamer should be placed 30 feet above the bit and the stabilizer at 60 feet above the bit. If any rapid buildup of angle occurs, bit weight will be reduced to correct deviation.

Minimum annular drilling fluid velocities for the 12 1/4-inch

FIG. IV-1 RAFT RIVER GEOTHERMAL EXPLORATORY HOLE NO. 1

hole using 6 5/8-inch drill pipe will average 78 to 80 fpm depending upon formation particle sizes. The drilling fluid program should try to obtain optimum hydraulics and/or impact at the bit, utilizing a large enough flow rate to clean the hole without causing excessive hole erosion.

B. Estimated Formation Tops

All drilling, casing, and any other depth measurement will be referenced to Kelly bushing (KB). Logging and formation tops will be referenced to ground level (GL).

<u>Formation</u>	Top in True	Approximate
	Vertical	Elevation
	<u>Depth (ft.)</u>	<u>Sea Level (ft.)</u>
1. Alluvium of loose, coarse, and cemented gravel with silty clay and sand (from 15 to 40 feet is loose sand and gravel).	Surface	+4,835
2. Salt Lake Formation of sand, silt, and clay interbedded with siltstone and sandstone.	205	+4,630
3. Raft River Formation of gray sandstone and conglomerate with beds of siltstone.	600	+4,235

Formation tops below approximately 1,400 feet are undefined at this time, although zones of limestone, siltstone, sandstone, and dolomite will be encountered in drilling to 8,000 feet. A major fault zone is anticipated at a depth of 5,000 to 6,500 feet. The target of interest is the intersection of two major fault zones trending north/south and northeast/southwest.

C. Drilling Materials

ANC will be responsible for providing at the drill site the following drilling materials:

1. Casing

a. 50 feet of 30-inch casing

b. 800 feet of 13 3/8-inch casing (54 lb/ft; K-55)

c. 940 feet of 20-inch casing (94 lb/ft, H-40)

2. Drill Bits

21 each 12 1/4-inch bits

3. Wellhead Assembly

a. 2 each gate valves

- b. 1 each double-flanged spool from 20-inch flange to valve flange.

REECo will provide all other drilling materials.

D. Drilling Procedure

1. Use dry hole digger to drill 42-inch hole for 30-inch conductor pipe. Cement conductor pipe from 40 feet to surface.
2. Build timbered cellar, 8 feet wide, 12 feet long, and 8 feet deep.
3. Move-in drilling rig and rig-up.
4. Drill 15-inch hole to 900 feet and open 15-inch hole to 26 inches. Condition hole to run casing. (Appropriate notifications of scheduled BOP pressure tests will be made by ANC. Monitor return drilling mud temperature manually at 30-foot intervals from 40 feet to 900 feet.)
5. Run integrated caliper survey from 900 feet to 40 feet.

6. Run induction electric or gamma-neutron log from 900 feet to 40 feet.

7. Run 900 feet of 20-inch H-40 94 lb/ft. casing. Run guide shoe, float collar, and centralizers, if available. If not, run casing belled on bottom with centralizers. Cement to surface. Wait on cement (WOC) 24 hours.

8. Install 20-inch casing head, double-gate BOP, and a 13 3/8-inch Hydril BOP with kill line and choke line. Use dual controls.

9. Pressure test BOPs and casing with 300-psig surface pressure.

10. Drill cement and formation with 12 1/4-inch bit. Use a centralized and stabilized assembly for drilling the 12 1/4-inch hole.

11. Drill 12 1/4-inch hole to a maximum depth of 8,000 feet. Obtain cores and run drill stem tests (DST). Condition hole for running casing. Use mud logger services below 900 feet, as specified in Section IV-E. Run single-shot magnetic survey every 90 feet or every trip, whichever occurs first. (Maintain horizontal deviation to the east within 150 feet.)

12. Condition hole for logs. Run open hole logs as specified in Section IV-L.

13. Condition hole, run and cement a combination string of 13 3/8 to 9 5/8-inch casing to a maximum depth of 8,000 feet using slurry described in Section IV-G. Run stage collar, differential-fill-up shoe and collar and cement baskets (if required). Run stage cementing collar at approximately 4,000 feet. Open stage collar and circulate out any excess cement above stage collar, and WOC 12 hours then cement second stage to the surface. Land 13 3/8-inch casing in hanger in the 20-inch casing head.
14. WOC 18 hours. Drill out stage collar and circulate the hole with clear water. Remove BOP, nipple up wellhead, and pressure test casing and wellhead to 300 psi. Run cased hole logs as specified in Section IV-L. Bail hole dry and perforate casing. Acidizing and swabbing may be required.
15. Release rig.

E. Surface Equipment and Services

1. Wellhead

A Series 600 casing head will be used on the 20-inch casing with two each 2-inch outlets. The 13 3/8-inch casing will land on casing hanger in the 20-inch casing head.

2. Blowout Preventor (BOP) Equipment

A 16-inch hydraulic double-gate BOP with blind and pipe rams and bag-type BOP will be installed on the 20-inch casing for drilling the 12 1/2-inch hole to a maximum depth of 8,000 feet.

This equipment shall have a minimum working pressure of 1,000 psi.

3. Drilling Recorder

A three-pen recorder to record penetration rate, weight, and pump pressure will be used.

4. Mud Logging

A mud logging unit will be used to record the following information from 900 feet to a maximum depth of 8,000 feet.

- a. Mud temperatures (in and out)
- b. Lithologic characteristics
- c. Hydrogen sulfide and hydrocarbon gas volume with alarms

5. Mud Pit Level Monitoring

The mud pit level will be recorded at the end of each shift and immediately after any significant mud loss or gain.

F. Downhole Equipment and Services

1. 20-Inch Casing

Twenty-inch 94 lb/ft, H-40 grade ST&C casing (approximately 900 feet) will be required. Thread locking compound will be used on the joint above the belled casing.

2. 13 3/8- and 9 5/8-Inch Casing

Run 13 3/8-inch, 54 lb/ft, K-55, 8R Thread casing to 800 feet with a crossover to 7,200 feet of 9 5/8-inch, 47 lb/ft, N-80 Hydril casing run to a maximum depth of 8,000 feet. Run stage collar, differential-fill-up shoe, and collar and cement baskets (if required). Run stage collar at approximately 4,000 feet.

3. Centralizers

a. 20-Inch Casing

A centralizer will be placed approximately 20 feet above the bottom and then on every collar to the surface.

b. 13 3/8- and 9 5/8-Inch Casing

Centralizers will be located 15 feet above shoe and on every third collar.

G. Cement Systems

1. Conductor Pipe is to be cemented with plant mix.
2. 20-Inch Casing Slurry-A is to be 50/50 cement and poz. mix; no gel with 30 percent silica flour.
3. 13 3/8- and 9 5/8-Inch Casing Slurry-B should be 60 percent poz. mix with 40 percent cement and 30 percent silica flour. Friction reducer (approximately $\pm 3/4$ of 1 percent) volume requirements will be based on caliper log with 50 percent excess.

H. Drilling Fluid

The entire hole is planned to be drilled using a gel-mud system designed for high temperatures with mud weight between 8.8 and 9.5 ppg. Viscosity to be held to around 40 to 45 sec/qt unless hole conditions dictate necessary changes. Water loss should be held to 10 ml API or less. Lost circulation material will be added as necessary.

A desander/desilter will be used to maintain the proper mud weight.

I. Drill Cuttings

Two (2) sample cuttings will be obtained every 30 feet or as otherwise requested by ANC. The samples will be washed and placed in legibly labeled sample bags and stored at the drill site.

J. Coring

Six 30-foot cores will be taken at depths as determined by ANC.

Sidewall cores (25 to 30) will also be taken as determined by ANC.

K. Drill Stem Tests

Two drill stem tests (DST) are planned at depths as determined by ANC. Obtain water samples for chemical analysis.

L. Logging

1. 26-Inch Open-Hole Logs

Integrated Caliper Survey--900 feet to 40 feet.

Induction Electric--900 feet to 40 feet.

2. 20-Inch Cased-Hole Logs

Cement Bond Log--900 feet to surface, if determined necessary by NV.

3. 12 1/4-Inch Open-Hole Logs

The following logs will be taken all or in part as determined by ANC in order to deduce the formation water content and temperature and geological and hydrological data prior to installing casing.

a. Integrated Caliper Survey--TD to 900 feet.

b. Dual Induction Laterolog 8--TD to 900 feet.

c. Compensated Neutron Porosity--TD to surface.

d. Compensated Formation Density--TD to surface.

e. Temperature--TD to 900 feet.

f. Gamma Ray--TD to surface.

g. Variable Density--TD to 900 feet.

h. Compensated Gamma Ray--TD to surface.

i. Compensated Sonic--TD to 900 feet.

j. Induction Electric--TD to 900 feet.

k. Flowmeter Tests--TD to 900 feet.

l. Acoustic Televiwer--TD to 900 feet.

Some or all of the logs listed above may be run by the USGS.

4. 13 3/8- and 9 5/8-Inch Cased Hole Logs

a. Cemented Bond Log--TD to surface.

b. Gamma Ray Neutron with Casing Collar Locator--Perforation zone.

M. Directional Survey

Run magnetic single-shot survey every 90 feet or every trip, whichever occurs first.

N. Completion

The completion procedure includes bailing, perforating, and possibly acidizing and swabbing, as determined by ANC.

O. Abandonment

If ID directs the abandonment of the project because of the inability to locate sufficient geothermal resource, or for any other reasons,

development of abandonment procedures will be the joint responsibility of NV and ID. NV/REEC Co will perform abandonment work required at the drilling site and ID will be responsible for providing funding and coordinating the procedure with the appropriate parties.

Abandonment procedures will be based upon the following criteria:

- (1) prevent contamination of freshwaters or other natural resources;
- (2) prevent damage to geothermal reservoirs, (3) prevent loss of reservoir energy, and (4) protect life, health, environment, and property.

The following are general requirements which will be met:

1. A notice to abandon any geothermal resource wells will be filed with the Idaho Department of Water Resources (Department) five days prior to beginning abandonment procedures.
2. A history of geothermal resource wells (well completion report) shall be filed with the Department within 60 days after completion of abandonment procedures.
3. All wells abandoned shall be monumented and the description of the monument shall be included in the history of well report. Such monument shall consist of a four-inch diameter pipe ten feet in length, of which four feet shall be aboveground. The remainder shall be imbedded in concrete. The name, number, and location of the well shall be shown on the monument.

4. Good quality heavy drilling fluid shall be used to replace any water in the hole and to fill all portions of the hole not plugged with cement.
5. All cement plugs, with a possible exception of the surface plug, shall be pumped into the hole through drill pipe or tubing.
6. The annuli shall be cemented to straddle the interface or transition zones at the base of the groundwater aquifers.
7. A minimum of 100 feet of cement shall be emplaced straddling the interface or transition zone at the base of groundwater aquifers.
8. One hundred feet of cement shall straddle the placement of the shoe plug on all casings including conductor pipe.
9. A surface plug of either neat cement or concrete mix shall be in place from the top of the casing to at least 50 feet below the top of the casing.
10. All casing shall be cut off at least five feet below land surface.

11. Cement plugs shall extend at least 50 feet over the top of any liner installed in the well.

12. Abandonment of injection wells will be abandoned in the same manner as other wells.

V. PERMITS

The hole location is on National Resources Land administered by U.S. Bureau of Land Management (BLM). Such lands are included in the Application for Withdrawal filed by ID with the BLM in December, 1973. ID has a Cooperative Research Agreement with the local BLM office and will amend the agreement to the extent necessary, as agreed between ID and BLM. It will be the responsibility of ID to take whatever steps are necessary to clarify the state geothermal permit situation and/or the drilling permit situation. ID will provide REECo (through NV) information so they can obtain any necessary geothermal and/or drilling permits or will advise NV that none is required of REECo. REECo will have the responsibility to do whatever is required under Idaho law to enable it as a foreign (out of state) corporation to do business in Idaho.

VI. ENVIRONMENTAL ASSESSMENT

ID will prepare an environmental assessment for the project and, if required, will also prepare an environmental statement.

VII. INDUSTRIAL RELATIONS

ID will be responsible for the determination as to whether the Davis-Bacon Act applies to this project. ID will also be responsible for the industrial relations activities of ID contractors.

NV will be responsible for industrial relations activities related to NV contractors.

VIII. PUBLIC INFORMATION

All site visits and inquiries will be coordinated through the ID Public Information Officer. Press releases will be made periodically during the program (e.g., start of drilling and termination of drilling).

IX. PROGRAM MANAGEMENT

A. General

This section describes the basic authorities and responsibilities of the principal participants in the drilling operations. The principal participants include the following:

1. AEC-Idaho Operations Office.
2. AEC-Nevada Operations Office.
3. Aerojet Nuclear Company.
4. Reynolds Electrical & Engineering Co., Inc.

Figure IX-1 indicates the interrelationship between the project participants and the channels of funding and communications.

B. Atomic Energy Commission--Idaho Operations Office

The Manager, ID, shall be responsible for all project-related activities assigned to the government by Contract AT(10-1)-1375 between ID and ANC and by this document. The Manager, ID, shall also be responsible for funding the drilling operations in accordance with the procedures outlined in Section X of this drilling

FIG. IX-1 PROJECT ORGANIZATION - DRILLING OPERATIONS
IDAHO GEOTHERMAL R&D PROJECT

operations plan. In addition, the Manager, ID, shall appoint an ID Project Manager who will be the interface responsible for coordinating activities between ANC and NV/REEC Co. The ID Manager will also cause the U.S Geological Survey to perform any activities required of the USGS in the accomplishment of program objectives.

C. Atomic Energy Commission--Nevada Operations Office

The Manager, NV, shall be responsible for all project-related activities assigned to the government by Contract AT(26-1)-410 with REEC Co and this document. The Manager, NV, shall also provide an NV Project Manager responsible for all field activities described in this drilling plan which are assigned to NV.

The areas of authority and responsibility of the NV Project Manager are as follows:

1. Provide one or more contractors to conduct the drilling and completion operations as described in Section IV of this report.
2. Provide technical direction of the drilling operation.
3. Provide an NV site representative to manage all NV and NV-contractor activities.

4. Assure that the provisions for occupational health and safety are met in accordance with Section III of this report.
5. Prepare cost reports and technical documentation to the ID as described in Sections X and XI of this report.

D. Aerojet Nuclear Company

ANC will appoint a Project Manager. The ANC Project Manager will be responsible to the General Manager of ANC and the General Manager of ANC will be responsible to the Manager of ID for all project related functions being accomplished in an effective and timely manner. The ANC Project Manager will continuously monitor the activities of all the program participants so as to assure that all the participants have plans to and are accomplishing all the activities required by this drilling plan. The ANC Project Manager will also assure that the appropriate technical expertise is available to allow the tasks, as defined in this drilling plan and as stated in the Idaho Geothermal R&D Project, to be accomplished. The ANC Project Manager is further charged with the primary responsibility of accomplishing the goals of the Idaho Geothermal R&D Project.

The ANC Project Manager will appoint an ANC Field Operations Task Manager who will be responsible to the ANC Project Manager. The ANC Field Operations Task Manager responsibilities will include the following:

1. Provide technical criteria for the development of the drilling plan including identifying the requirements for technical data to be obtained during the drilling operation.
2. Provide technical program direction to the NV site representative and technical program support to REECo to assure that the objectives of the project are accomplished.
3. Provide on-site logistical support activities as specified in Section II of this report.
4. Management of ANC activities on-site.
5. Be continually aware of all drilling site-related activities and assure that the project participants are cognizant of any development which may impair the drilling program or the objectives of the Idaho Geothermal R&D Project.

E. Reynolds Electrical & Engineering Co., Inc.

REECo, under direction of NV, will provide the necessary equipment, material, and personnel to conduct the drilling operations as described in this plan. REECo will also be responsible for all procurement of materials and services directly related to drilling operations that are not assigned to ANC in Sections II and IV of this plan.

X. FUNDING AND COST REPORTING

The initial cost estimate for the drilling operation is specified in Appendix B, with funding to be provided in accordance with this estimate. Changes to the drilling operation as required by ANC technical program direction and as mutually agreed to by ID and NV will be reflected in revisions to the cost estimate with subsequent funding adjustments thereto.

Costs incurred by REECo will be reported to ID on a weekly basis by NV at the REECo work order level (see Figure X-1). It is recognized and agreed to by the parties that such costs are unofficial and subject to change when official monthly costs are reported.

A comprehensive cost report will be prepared by NV for ID at the conclusion of the drilling.

The official costs incurred will be transferred monthly to ID via nonreconciling transfer from NV.

NV will formally notify ID when the total estimated cost to complete the project exceeds the available funds.

(EXAMPLE)

REYNOLDS ELECTRICAL & ENGINEERING CO., INC.

RAFT RIVER GEOTHERMAL EXPLORATORY HOLE NO. 1
COST REPORT--W/E XX-XX-XX

Work Order No.-- <u>Description</u>	<u>Prior Weeks</u>		<u>Current Week</u>		<u>Total Cost/ Commitments</u>	<u>Estimate To Complete</u>	<u>Total Cost</u>	<u>Original Estimate</u>
	<u>Costs</u>	<u>Commitments</u>	<u>Costs</u>	<u>Commitments</u>				
9075-100--Care- taker/Watchman Services								
9075-101--Rig Up/ Mobilization								
9075-102-- Exploratory Hole Drilling								
9075-103--Logis- tical Support								
9075-104--Procure- ment, Handling and Transportation of 9 5/8-inch Casing								
9075-105--Demobil- ization and Trans- portation of Drill Rig								
Totals								

FIGURE X-1--REECO COST REPORT

XI. TECHNICAL DOCUMENTATION AND REPORTING

A. General

The documentation and reporting requirements during the drilling of the RRGE-1 will be limited to those necessary for the participants to maintain a thorough working knowledge of day-to-day operations and the final well configuration.

B. Reports

The required reports for the RRGE-1 include:

1. A daily drilling report similar to that shown in Figure XI-1.
2. A well completion report estimated to be issued within 60 days of completion of the hole. This report will document the drilling and completion procedure, and will be prepared by NV and REECO and ten copies submitted to ID/ANC.

IDAHO GEOTHERMAL R&D PROJECT
DAILY DRILLING REPORT

DATE _____ LOCATION RRGE-1

PRESENT OPERATION _____ FORMATION _____ HOLE SIZE _____

PRESENT T.D. _____ DRILLED FROM _____ FEET TO _____ FEET: MADE _____ FEET OF HOLE
IN _____ HOURS: TRIPS _____ HOURS: SERVICE RIG _____ HOURS: D.S.T. _____

HOLE SURVEY _____ HOURS: OTHER DOWNTIME: _____ HOURS

MUD LOG TEMPERATURES: MUD IN—HIGH _____ °C @ _____ FEET T.D., LOW _____ °C @ _____ FEET T.D.
MUD OUT—HIGH _____ °C @ _____ FEET T. D., LOW _____ °C @ _____ FEET T.D.

REMARKS: _____

DRILLING INFORMATION: ROTARY RPM _____ PUMP PRESSURE _____ PUMP ON HOLE _____
PUMP STROKES _____ WEIGHT ON BIT _____ #

MUD INFORMATION: WT. _____ VISCOSITY _____ PLASTIC VISCOSITY _____
WATER LOSS _____ FILTER CAKE _____ PH _____ SAND CONTENT _____

BIT INFORMATION: PRESENT BIT# _____ DEPTH IN _____ MAKE _____ TYPE _____
JET NOZZLES _____
LAST BIT RUN # _____ MAKE _____ TYPE _____
JET NOZZLES _____ DEPTH IN _____
DEPTH OUT _____ FOOTAGE _____ HOURS RUN _____
CONDITION OF BIT _____

DRILL COLLAR INFORMATION: NO. OF COLLARS IN USE _____ O.D. _____ I.D. _____

PLACEMENT OF STABILIZERS _____

FUEL CONSUMPTION: BUTANE _____ GAL. DIESEL _____ GAL.

PUMP NO. 1 LINEAR SIZE _____ PUMP NO. 2 LINEAR SIZE _____

FIGURE XI-1--DAILY DRILLING REPORT

APPENDIX A SCHEDULE OF MAJOR ACTIVITIES RRGE-1

ACTIVITY	MONTH				
	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
RIG MOBILIZATION (NV/REECO)					
SITE PREPARATION (ID/ANC)					
SITE FACILITIES (ID/ANC)					
RIG UP (NV/REECO)					
DRILL 26" HOLE TO 900' LOG & RUN 20" CASING (NV/REECO)					
DRILL 12-1/4" HOLE FROM 900' TO 8000', CORE & RUN DST's (NV/REECO)					
LOG & RUN 13-3/8" & 9-5/8" CASING TO 8000 (NV/REECO)					
BAIL DRY & PERFORATE (NV/REECO)					
RIG DOWN & DEMOBILIZE RIG (NV/REECO)					
SITE CLEANUP & RESTORATION (ID/ANC)					— NOT SCHEDULED —

APPENDIX B
COST ESTIMATE

A. <u>Site Preparation & Road Maintenance</u>		Provided by ANC
B. <u>Rat Hole Drilling/Cellar Installation</u>		Provided by ANC
C. <u>Mobilization</u>		
1. Rig down--transport to Idaho*		
2. Security watchman service	\$ 5,668	
3. Rig-up operation:		
a. 4 each 5-man crews for rig-up for 7 days	14,672	
b. Rig-up trucks--32 hrs. @ \$22.00	704	
c. 75-ton crane--32 hrs. @ \$75.00**	<u>2,400</u>	
		\$ 23,444
D. <u>Drill Rig Operational Time (@ \$2,055 day rate)</u>		
1. Drill 26-inch hole to 900 feet w/mud	5.50 days	
2. Log/run and cement 20-inch casing to 900 feet	1.50 days	
3. Drill 12 1/4-inch hole from 900 feet to 8,000 feet w/mud. Perform DSTs and obtain 6 each cores and 25 each sidewall samples (AROP-165 ft./day)	43.00 days	
4. Log/run and cement 13 3/8-inch/9 5/8-inch casing to 8,000 feet--cement to surface	3.00 days	
5. Bail dry, perforate, and run pump	<u>2.00 days</u>	
Subtotal	55.00 days	113,025
E. <u>Materials</u>		
1. Casing:		
50-foot of 30-inch casing	Provided by ANC	
800-foot of 13 3/8-inch casing	Provided by ANC	
940-foot of 20-inch casing	Provided by ANC	
7,200-foot of 9 5/8-inch casing	148,200	
Casing Crossover--13 3/8-inch to 9 5/8-inch	800	
2. Drill bits: 21 each 12 1/4-inch bits	Provided by ANC	
3. Cutters--1 set for 26-inch H.O.	1,000	
4. Stabilizers/reamers	3,000	
5. Mud, additives, and engineer	30,000	
6. 20-inch casing head and casing hanger	3,600	
7. Wellhead assembly	Provided by ANC	
8. Location signs	<u>Provided by ANC</u>	
		186,600

*Costed to RB-U-4 demobilization.

**Services of 50-ton crane, if adequate, to be furnished by ANC.

F. Services:

1. Cementing--20-inch casing	\$ 22,000	
--13 3/8- and 9 5/8-inch casing	75,000	
2. Coring--6 each 30-foot cores	12,000	
3. Sidewall Sampling--30 each samples	3,000	
4. Rental Tools	5,000	
5. Casing Crew	5,000	
6. Drilling Recorder--\$20.00 per day @ 45 days	900	
7. Mud Logging--\$250.00 per day @ 45 days	11,250	
8. Drill Stem Testing	3,000	
9. Logging and Perforating	20,000	
10. Directional Surveys	1,600	
11. Core Analysis	Provided by ANC	
12. Logistical Support:		
a. 1 each trailer, furniture, and hookup	Provided by ANC	
b. 5 each vehicles and fuel	Provided by ANC	
c. Telephone installation and service	Provided by ANC	
d. Commercial power installation and service	Provided by ANC	
e. Porta toilets w/service and janitorial	Provided by ANC	
f. Radio network	Provided by ANC	
g. Site water supply	Provided by ANC	
h. Rig fuel	Provided by ANC	
13. Miscellaneous trucking/freight	4,000	
14. Vacuum truck support	1,500	
	<u>164,250</u>	

G. Demobilization--Rig Down & Transport

1. 10-hour workdays for 4 each 5-man crews x 5 days for rig down	13,100	
2. Loading and transporting equipment to NTS	10,800	
3. Rig trucks and crane support**	5,000	
4. Freight to NTS	50,000	
5. Unloading at NTS	5,000	
	<u>83,900</u>	
Subtotal		\$571,219

H. General & Administration (current rate of 12%) 68,546

I. Contingency (@ 10%) 63,235

GRAND TOTAL \$703,000

**Services of 50-ton crane, if adequate, to be furnished by ANC.