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→ Ross



UNITED STATES  
DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY  
Area Geothermal Supervisor's Office  
Conservation Division, MS 92  
345 Middlefield Road  
Menlo Park, CA 94025

SGS  
AGSO  
Memo 4  
NV  
Churchill Co.  
11/23/77

NOV 23 1977

Memorandum

To: INTERESTED PARTIES

From: Acting Area Geothermal Supervisor

Subject: Plans of Operation, Anadarko Production Company, Federal Leases N-8355 through N-8362, Salt Wells Basin Area, Churchill County, Nevada

The Anadarko Production Company has submitted two Plans of Operation to drill thirteen (13) shallow temperature gradient holes to 150 m (500'±) and ten (10) intermediate depth temperature gradient holes to 600 m (2000'±) on the above Federal leases in the Salt Wells Basin Area of Churchill County, Nevada.

Copies of Anadarko's Plans of Operations are enclosed for your information, review, and comments.

An Environmental Analysis (EA#97) will be prepared by the Office of the Area Geothermal Supervisor for the proposed action.

We have been advised that the Carson City District, Bureau of Land Management, has culturally cleared all the proposed locations. Therefore, no field inspection is being scheduled at this time. However, you are encouraged to visit the proposed sites at your convenience. If you require more detailed instructions as to exact locations, please contact the USGS District Geothermal Supervisor, Mr. Bernie Moroz, in Reno, Nevada. Telephone: (702) 784-5676, FTS 470-5676.

We urge you to send written commentary and will appreciate hearing from you even if you are of the opinion that the existing regulations, lease terms, and operational orders provide adequate environmental protection.

The Area Geothermal Supervisor's Office will not send out a draft Environmental Analysis (EA#97) for review by interested parties nor will the Geothermal Environmental Advisory Panel (GEAP) convene as a body to conduct a formal review of the USGS Environmental Analysis. The Plan of Operation

UNIVERSITY OF UTAH  
RESEARCH INSTITUTE  
EARTH SCIENCE LAB.

Gulf Mineral Resources Co.  
Attn: E.W. Westrick  
Exploration Department  
1720 S. Bellaire St.  
Denver, CO 80222  
(303) 758-1700

Hydro-Search, Inc.  
Attn: Virgil Wilhite  
333 Flint St.  
Reno, NV 89501  
(702) 322-4172

ICF, Inc.  
Attn: Doug Fried  
1990 M St., NW  
Washington, D.C. 20036  
(202) 785-3440

Phillips Petroleum Company  
Attn: R.L. Wright  
P.O. Box 752  
Del Mar, CA 92014  
(714) 755-0131

Phillips Petroleum Company  
Energy Minerals Division  
Attn: R.T. Forest  
P.O. Box 10556  
Reno, NV 89510  
(702) 786-2273

Republic Geothermal, Inc.  
Attn: Dwight Carey  
P.O. Box 3388  
Santa Fe Springs, CA 90670  
(213) 945-3661

Republic Geothermal, Inc.  
Attn: Jim Sheidenberger  
2544 Cleveland Ave.  
Santa Rosa, CA 95401  
(707) 527-7755

Sunoco Energy Development Co.  
Attn: C.T. Clark, Jr.  
12700 Park Central Pl., Suite 1500  
Dallas, TX 75251  
(214) 233-2600, Ext. 515

Mr. Clyde E. Kuhn  
2707 Carroll St., Apt. 3  
Oakland, CA 94606  
(415) 451-3714

University of Utah Research Institute  
Earth Science Laboratory  
Attn: Phillip M. Wright  
Research Park, 391 Chipeta Way  
Salt Lake City, UT 84108  
(801) 581-5226

Mr. Jack McManera  
Law Center, Rm. 422  
University of Southern California  
Los Angeles, CA 90007  
(213) 741-7569

U.S. Bureau of Reclamation  
Attn: Lloyd Osbourne  
P.O. Box 640  
Carson City, NV 89701  
(702) 882-3436

Amax Exploration, Inc.  
Attn: Larry Hall  
4704 Harlan St.  
Denver, CO 80212  
(303) 433-6151

Occidental Geothermal, Inc.  
Attn: B.J. Wyant  
5000 Stockdale Highway  
Bakersfield, CA 93309  
(805) 327-7351

Dresser Industries  
Attn: Jim Fox  
475 17th St., Suite 1600  
Denver, CO 80202  
(303) 893-2780

Thermal Power Co.  
Attn: K.R. Davis  
601 California St.  
San Francisco, CA 94108  
(415) 981-5700, Ext. 164

Union Oil Company of California  
Geothermal Division  
Attn: Neil J. Stefanides  
Union Oil Center, Box 7600  
Los Angeles, CA 90051  
(213) 486-7740

INTERESTED PARTIES for ANADARKO PRODUCTION COMPANY, EA#97

State of Nevada  
Department of Human Resources  
Capitol Complex  
1209 Johnson Street  
Carson City, NV 89710  
(702) 885-4730

State of Nevada  
Division of State Lands  
201 S. Fall St., Rm. 338  
Capitol Complex  
Carson City, NV 89710  
(702) 885-4363

State of Nevada  
Division of State Parks  
Attn: John Meder  
Historic Preservation Officer  
201 S. Fall St., Rm. 221, Nye Bldg.  
Carson City, NV 89701  
(702) 885-4384

State of Nevada  
Division of Water Resources  
Attn: Roland Westergard  
201 S. Fall St., Capitol Complex  
Carson City, NV 89710  
(702) 885-4380

State of Nevada  
Environmental Protective Services  
Attn: Wendell McCurry/Vern Ross  
201 S. Fall St., Capitol Complex  
Carson City, NV 89710  
(702) 885-4670

State of Nevada  
Nevada Department of Fish & Game  
P.O. Box 10678  
Reno, NV 89510  
(702) 784-6214

State of Nevada  
Nevada Department of Fish & Game  
Attn: Ray Corlett, Regional Mgr.  
380 West B Street  
Fallon, NV 89406  
(702) 423-3171

State of Nevada  
Department of Energy  
1050 E. William, Suite 405  
Carson City, NV 89701  
(702) 885-5157

State of Nevada  
Nevada State Museum  
Attn: Mary Rusco, Archaeologist  
600 N. Carson Street  
Carson City, NV 89701  
(702) 885-4810

Churchill County Commission  
Attn: John Hanifan, Chairman  
10 West Williams St.  
Fallon, NV 89406  
(702) 423-5136

California Energy Co., Inc.  
Attn: Paul Storm  
P.O. Box 3909  
Santa Rosa, CA 95402  
(707) 526-1000

Chevron USA, Inc.  
Attn: J.G. Turner/Pat Smith  
P.O. Box 3722  
San Francisco, CA 94119  
(415) 894-2726/(415) 894-2301

Exploration Geologists of Nevada  
Attn: Ralph D. Mulhollen  
P.O. Box 3043  
Reno, NV 89505  
(702) 972-6791

Geothermal Power Corporation  
Attn: Frank G. Metcalfe  
P.O. Box 1186  
Novato, CA 94947  
(415) 897-7833

GeothermEx  
Attn: James B. Koenig  
901 Mendocino Ave.  
Berkeley, CA 94707  
(415) 524-9242

Getty Oil Company  
Attn: J.W. Woffington  
P.O. Box 5237  
Bakersfield, CA 93308  
(805) 399-2961

Bureau of Reclamation  
Attn: E. C. Malmstrom  
Lahontan Basin Projects Office  
P.O. Box 640  
Carson City, Nevada 89701

INTERESTED PARTIES EA#97  
ANADARKO PRODUCTION COMPANY

Plan of Operation

13 - 150m STGH's, 10 - 620m TOBSH  
Federal Leases N-8355 through N-8362  
Salt Wells Basin Area  
Churchill County, Nevada

USGS-Conservation Division  
District Geothermal Supervisor  
Attn: Bernie Moroz  
63 Keystone Ave., Suite 102  
Reno, NV  
Comm.: (702) 784-5676  
FTS: 470-5676

USGS-Conservation Division  
Office of Conservation Manager  
Western Region  
Attn: Environmental Staff  
345 Middlefield Road, MS 80  
Menlo Park, CA 94025  
Comm.: (415) 323-8111, Ext. 2093  
FTS: 467-2093

USGS-Conservation Division  
Area Geologist, Pacific Area  
Attn: Henry Cullins  
345 Middlefield Road, MS 80  
Menlo Park, CA 94025  
Comm.: (415) 323-8111, Ext. 2053  
FTS: 467-2053

Geothermal Environmental Adv. Panel  
Attn: Max Crittenden  
U.S. Geological Survey  
345 Middlefield Road, MS 75  
Menlo Park, CA 94025  
Comm.: (415) 323-8111, Ext. 2317  
FTS: 467-2317

U.S. Bureau of Land Management  
Office of the Nevada State Director  
Federal Building, Room 3008  
300 Booth Street  
Reno, NV 89502  
Comm.: (702) 784-5451  
FTS: 470-5451

U.S. Bureau of Land Management  
Attn: Theodore W. Holland  
Geothermal Specialist  
Building 50, D-310  
Denver Federal Center  
Denver, CO 80225  
Comm.: (303) 234-5098  
FTS: 234-5098

U.S. Bureau of Land Management  
Carson City District Office  
Attn: Paul Applegate  
1050 E. William St. - Suite 335  
Carson City, NV 89701  
Comm.: (702) 882-1631  
FTS: 470-5911, ask for 882-1631

U.S. Fish & Wildlife Service  
Office of Biological Services  
Attn: L.A. Mehrhoff  
4620 Overland Road, Rm. 210  
Boise, ID 83705  
Comm.: (203) 834-1931  
FTS: 554-1931

U.S. Fish & Wildlife Service  
Attn: Felix Smith  
2800 Cottage Way, Rm. E-2727  
Sacramento, CA 95825  
Comm.: (916) 484-4657  
FTS: 468-4657

U.S. Department of Energy  
Nevada Operations Office  
Attn: John O. Cummings  
P.O. Box 14100  
Las Vegas, NV 89114  
Comm.: (702) 734-3591  
FTS: 470-3591

U.S. Department of Energy  
Div. of Geothermal Energy, 3rd Floor  
Attn: Bert Barnes  
20 Massachusetts Ave., NW  
Washington, D.C. 20545  
Comm.: (202) 376-4902  
FTS: 376-4902

U.S. Environmental Protection Agency  
Environmental Monitoring & Support  
Attn: Michael O'Connell  
P.O. Box 15027  
Las Vegas, NV 89114  
Comm.: (702) 736-2969  
FTS: 595-2969

will be submitted to the panel (GEAP) as usual, however, individual agencies are requested to comment directly to the Area Geothermal Supervisor.

The panel (GEAP) will receive a copy of the completed EA for informational purposes as well as certain other parties, such as the surface managing agency, the lessee, and the USFWS. Other interested parties will not receive a copy of the completed EA unless such parties comment on the proposed action in writing or request a copy of the particular EA pursuant to the Freedom of Information Act. Copies of Environmental Analyses are available for inspection during normal business hours at the Area Geothermal Supervisor's Office, the Reno District Geothermal Supervisor's Office, and the Office of the Carson City District Manager, Bureau of Land Management.

*Barry A. Bondreau*

FC  
USGS  
AGSO  
Memo 4  
NV  
Churchill Co.  
10/14/77

**ANADARKO PRODUCTION COMPANY**  
A Panhandle Eastern Pipe Line Company Subsidiary

P.O. BOX 1330  
Houston, Texas 77001  
(713) 526-5421

October 14, 1977

Mr. Reid Stone  
Area Geothermal Supervisor  
U.S. Geological Survey  
345 Middlefield Rd., Mail Stop 92  
Menlo Park, California 94025

Mr. Norman L. Murray  
Lahontan Area Manager  
Bureau of Land Management  
1050 E. Williams St., Suite 335  
Carson City, Nevada 89701

Re: Plan of Operation, Sundry Notice  
and Notice of Intent to Conduct  
Geothermal Resource Exploration  
Operations, Churchill County,  
Nevada (Salt Wells Basin Area)

Gentlemen:

In compliance with Title 30, CFR 270.34 and 270.78, Anadarko Production Company hereby submits a Plan of Operations for Drilling of Intermediate Depth Temperature Gradient Holes, Form 3200-9, "Notice of Intent to Conduct Geothermal Resources Exploration Operations", containing the information required by Title 43, CFR 3209.1-1(b)(1), (2), (3), (4), and (6). Sundry Notice, and a copy of a Cultural Resources Investigation conducted on the area involved.

Anadarko Production Company plans to drill intermediate depth (2000') temperature gradient holes on, and around, geothermal leases which have been assigned to Anadarko in the Salt Wells Basin Area of Churchill County, Nevada. The geothermal leases affected by the proposed exploratory work are also indicated on the accompanying map:

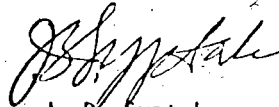
Tract #1	N8355	T17N-R30E
Tract #2	N8356	T16N-R31E
Tract #3	N8357	T17N-R31E
Tract #4	N8358	T16N-R31E; T17N-R31E
Tract #5	N8359	T17N-R31E
Tract #6	N8360	T17N-R30E
Tract #7	N8361	T16N-R31E; T16N-R32E
Tract #8	N8362	T17N-R30E

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RESEARCH INSTITUTE  
EARTH SCIENCE LAB.

Anadarko Production Company respectfully requests your approval of the proposed geothermal exploration program.

Please address all correspondence regarding this application to the attention of J. B. Syptak, Staff Geologist.

Very truly yours,



J. B. Syptak

JBS:bb

Enclosures

cc: 3 sets to USGS, Menlo Park, California (transparency under separate cover)  
3 sets to BLM, Carson City, Nevada  
1 set to Contractor

**PLAN OF OPERATION  
GEOHERMAL RESOURCE EXPLORATION OPERATIONS  
2000' TEMPERATURE GRADIENT-HEAT FLOW HOLES**

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**1. LOCATION**

Intermediate depth (2000' maximum) temperature gradient-heat flow holes will be drilled and temperatures measured on lands covered by Geothermal Leases N8355, N8356, N8357, N8358, N8359, N8360, N8361, and N8362 surrounding lands in portions of Townships T16N-R31 & 32E; T17N-R30 & 31E; T18N-R30 & 31E upon approval of the Authorized Officers of the Bureau of Land Management and the USGS. A map is enclosed showing: (1) the proposed location of the holes to be drilled; (2) the referenced leases; and (3) general topographic features.

**2. CULTURAL RESOURCE SURVEY**

A Cultural Resources Reconnaissance of the subject leases, dated November 10, 1975, has been made by personnel from the Desert Research Institute, under the direction of Dr. Don D. Fowler. A copy of Dr. Fowler's report is enclosed. As will be noted in this report, which was used in obtaining approval for shallow (10') thermal probe holes, the probability of damage to any historical locale is remote. The contractor, GeothermEx, Inc., will be requested to conduct their operations as to preserve any apparent or suspected historical location.

**3. SPECIAL CONDITIONS**

At the minimum, Anadarko will conduct its field operations subject to the following special conditions:

- a. The exact route of the Pony Express trail across the leasehold is not known; however, if evidences of the trail are encountered during operations, the lessee shall avoid disturbing the trail and shall notify the appropriate surface managing official immediately.
- b. The lessee shall avoid disturbing the Salt Mill historical site (Sec. 12, T16N-R31E).
- c. The lessee shall make every effort to avoid disturbing perennial vegetation and stands of reeds. No vehicular traffic shall be permitted through the stands of reeds.
- d. The USGS District Geothermal Supervisor, Reno, Nevada, (702) 784-5676, shall be notified prior to entry on the leased lands to conduct operations under this plan.



4. TIMING

The exact date of commencement and completion cannot be predicted due to the uncertainty of approval dates by the Supervisor of the USGS (Title 30, CFR 270.34) for lands covered by the referenced leases and the Authorized Officers of the Bureau of Land Management (Title 43, CFR 3209) for those lands not covered by the referenced leases. It is anticipated that operations will commence within 30 days following the latter of the two approvals and, thereafter, should be completed within 45 days in the absence of adverse weather conditions.

5. EQUIPMENT

Equipment to be used during the course of exploration operations are as follows: Rotary Drilling Rig, Water Truck, Support Pickup and Geophysical Van. The drilling contractor has not been selected, but the equipment used will probably be similar to a Failing 2500. Each is described in detail below:

Drilling Rig:

Type - Conventional rotary, mud or air

Maximum Rated Depth - 2500'

Mounted on - Truck, 3-axle (2-rear driven)

Gross Weight - 40,000 lbs. (Approx.)

Water Truck:

Capacity - 2000 gal.

Mounted on - Truck, 3-axle

Gross Weight - Under 8000 lbs.

Geophysical Van:

Van, 4-wheel drive

Gross Weight - Under 6200 lbs.

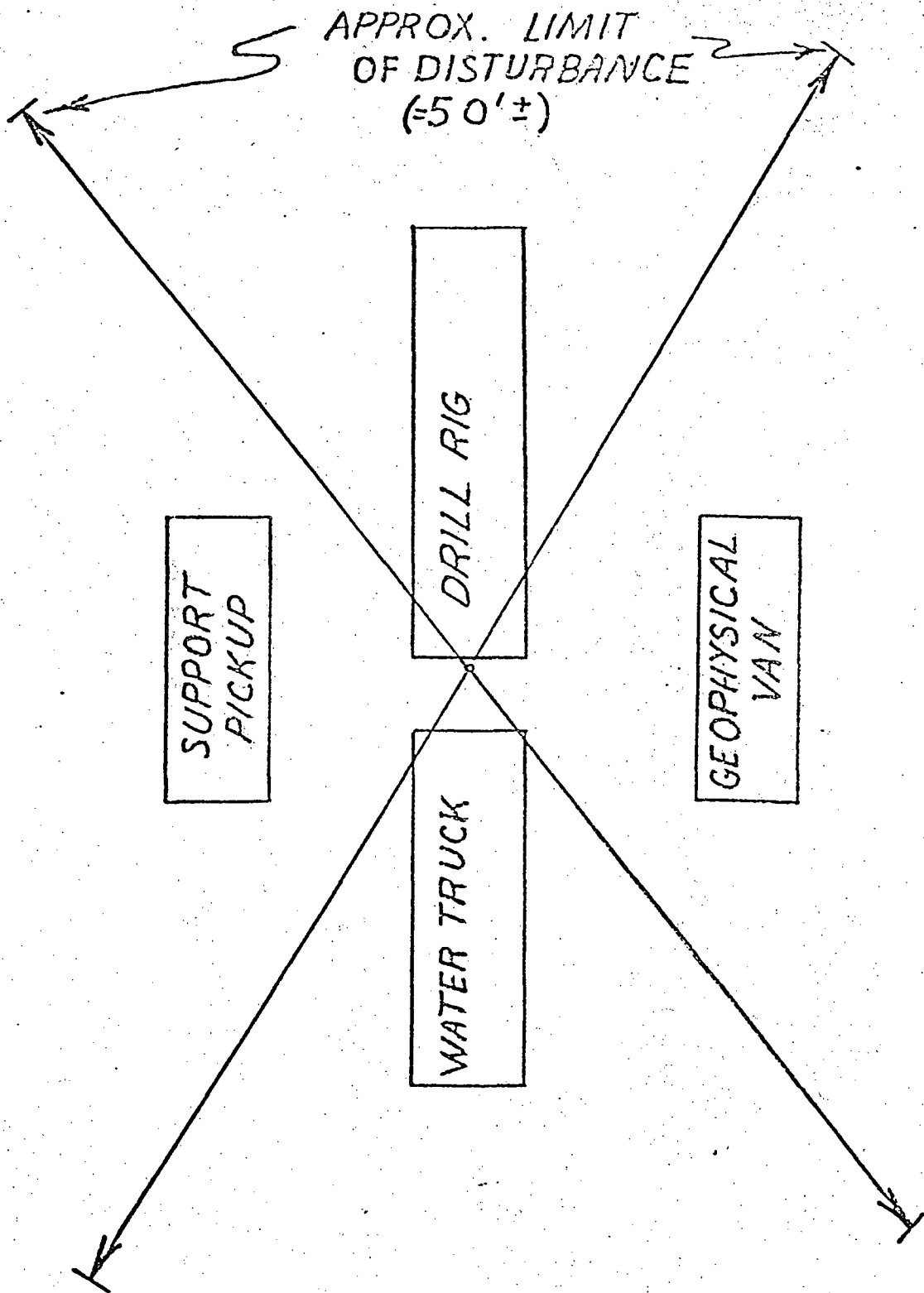


DIAGRAM C  
SCALE: 1" = 5' (approx)

During the course of drilling the gradient holes, it is likely that at various times all the above mentioned equipment will be on site. A typical arrangement for this equipment is shown in the accompanying diagram "C". Although the arrangement of equipment may change somewhat, it is expected that drilling operations will result in a disturbed area approximately 50' in radius from the hole location.

#### 6. DRILLING AND COMPLETION PROCEDURES

The heat flow holes proposed herein are scheduled to be drilled to a total depth of 2000' below ground level. Drilling will be by conventional rotary mud or air.

If mud is used, a Bentonite type drilling mud will be utilized. In addition to Bentonite mud, a supply of Barite will be on hand (and used as necessary) to control artesian flow, as well as lost circulation material to combat lost circulation zones and minimize loss of drilling fluids to formations being penetrated. In no case will poisonous or otherwise toxic drilling fluid additives be employed.

Nominal hole diameter will be 5" to 6" depending on the type of bit used (either conventional roller or drag type).

The hole will be completed in such a manner as to prevent subsurface inter-zonal migration of water and surface leakage by: (a) running a capped string of 2" black iron pipe from surface to total depth; (b) filling the annular space between the hole and the 2" pipe with heavy mud and cuttings to 200' below ground level and with cement from 10' BGL to the surface; (c) filling the 2" pipe with water; (d) placing a cap on the pipe; and (e) locking the pipe within a small 10' BGL concrete blockhouse.

#### 7. ACCESS

Access to the proposed hole location will be on existing roads and trails wherever possible. It is probable, however, that some access improvement (i.e., grading) will be necessary to reach the proposed locations. Where this is necessary, the route will take the shortest distance possible from an existing road or trail to the hole location. Removal of soil and vegetation will be kept to the minimum amount necessary to enable equipment to reach the site. All access improvements will be coordinated with the appropriate agency and we will comply with their stipulations.

#### 8. SURFACE DISTURBANCE

Other than the proposed drillsite, no other areas of potential surface disturbance exist, with the possible exception of equipment getting stuck in mud; this, however, would be along designated access routes or existing roads and trails and is a situation that will be avoided if at all possible.

9. WASTE DISPOSAL

Waste material from this exploration operation will be those wastes resulting directly from drilling operations (i.e., mud, cuttings, etc.).

Drilling mud and cuttings will be disposed of at the hole site. Drilling sites will be selected so that the discharge of mud and cuttings will not contaminate lakes and perennial or intermittent streams.

10. OPERATIONS

Several techniques will be employed to ensure that exploration operations are carried out with maximum safety to life and property and minimal impact on the environment and its attendant natural and cultural resources. These are outlined as follows:

a. Before exploration operations commence:

- (1) Hole locations will be chosen to minimize surface disturbance. The proposed well locations will be surveyed, staked and flagged in advance of field inspection.
- (2) Cross-country travel necessary to reach the hole locations will exercise due care that the routes chosen minimize surface disturbance and damage to vegetation and wildlife.
- (3) Mud pit locations will be selected so that any excavation will cause the minimum possible damage to vegetation and wildlife.

b. During drilling operations:

- (1) a fulltime graduate geologist experienced in the proposed geothermal exploration operations will be assigned to the project while drilling is being conducted.
- (2) Surface casing fitted with a 2" fill-up line and cemented into competent rock, as well as a blowout preventor (Hydril Pneumatic Annular Type, or equivalent), will be employed to ensure that formation pressures can be controlled. An H<sub>2</sub>S detector/alarm system will also be utilized during drilling operations.

- (3) No artesian flows are known to lie within the area where operations are to be conducted; however, a supply of Barite will be kept on hand for use if artesian flow is encountered.
- (4) If artesian flow occurs, the hole will be completed as detailed in Section "6", with the exception that the annular cement plug will be placed from total depth to 6" below ground level.
- (5) During drilling operations (when drilling with mud), return temperatures will be measured and recorded every 10'.
- (6) If mud return temperature reaches 180°F, all drilling operations will cease and circulation will be maintained for thirty minutes while monitoring mud temperature and mud pit volume for possible hot artesian flow or lost circulation. If neither occurs, 2" pipe will be run to total depth and the hole will be completed as in Section "6". If artesian flow is noted, the hole will be completed as in Section "10", Item b(4). If lost circulation occurs, it will be controlled with lost circulation material and completed as in Section "6".
- (7) If there should be a sudden marked increase in mud return temperature of several degrees in only a few feet, all drilling operations will cease and circulation will be maintained for thirty minutes monitoring mud temperature and mud pit volume for possible hot artesian flow or lost circulation. If neither, then drilling will continue cautiously while keeping careful watch on mud return temperature and mud pit volume. In no case will drilling operations continue after mud return temperature reaches 180°F. Depending on conditions, hole will be appropriately completed as in Section "6" or Section "10", Item b(4).
- (8) If flowing steam or hot water (> 180°F) is encountered, further drilling will stop immediately and the hole will be completed as in Section "10", Item b(4).
- (9) Every effort will be made to minimize the possibility of a fire. Ground fires will be built only in areas clear of vegetation for a radius of 10'. Internal combustion engines operated onsite will be equipped with a USFS-approved spark arrestor.

- (10) Fire fighting equipment on hand will consist of:  
(a) water truck, approximate 2000 gallon capacity, equipped with an auxiliary water pump and hose that can be used to extinguish a fire should one break out; (b) a #0 long-handled (46") shovel for each crew member; (c) a dry chemical fire extinguisher with classification 3-A:20-B:C.
  - (11) Mud and cuttings will not be discharged into the surface where such discharge could cause: (a) soil erosion; (b) pollution of surface waters or lakes and perennial or intermittent streams; (c) undue harm to wildlife or other natural resources.
  - (12) All equipment to be operated during this program has met Federal regulations with regards to noise and air pollution.
  - (13) The area where operations are to be conducted has a very low human population and, as such, it is anticipated that there will be no hazards to public health and safety.
  - (14) Every effort will be made to preserve the natural vegetation and animal life of the area by restricting equipment movement to the minimum necessary to efficiently complete the proposed operation.
  - (15) If American antiquities or other objects of historic or scientific interest including, but not limited to, historic or pre-historic ruins, fossils or artifacts are discovered in the performances of the permit, the item(s) or condition(s) will be left intact and immediately brought to the attention of the Authorized Officer.
  - (16) All equipment will be operated at a safe and reasonable speed.
- c. After drilling is completed:
- (1) The drillsite will be completely cleaned of trash and debris.
  - (2) All drill cuttings will be discharged onto the surface. Cuttings will then be blended with excavated material from mud pit; this material will then be used to back-fill the mud pit as close as practical to original ground contour.

- (3) The disturbed area will be restored as nearly as practical to its original condition.

11. ABANDONMENT

After the desired data has been obtained, the hole will be abandoned by: (a) cutting off 2" pipe at ground level; (b) filling the top 10' of 2" pipe with cement; and (c) covering the hole with dirt to original surface contour. Except as otherwise noted, all test equipment, both surface and subsurface, will be removed at the completion of the exploration operations.

12. DRILLING PROGRAM

(Note: All depths referenced to ground level.)

- a. Stake Location. Get site and access route approval from appropriate regulatory agency (BLM, USGS, etc.)
- b. Move in Drilling Equipment. Orient rig to minimize surface disturbance. Jack up rig to provide adequate clearance for casing head and blowout preventer.
- c. Spud and Drill 9-5/8" hole to 200'. Use air or regular Bentonite drilling mud (Baroid, Quik-Gel, or equivalent).
- d. Measure and record mud return temperature every 10'.
- e. Condition mud and hole for logging.
- f. Run gamma and electric logs.
- g. Run and cement 201' of 6-5/8" steel casing (land on bottom).
- h. Use 60 sacks of neat cement (20% excess). Displace cement with drilling mud. If no cement returns in annulus, perform top job as necessary to fill annulus with cement to one (1) foot below the surface.
- i. Install BOPE flange and 2" fill-up line with gate valve (below flange).
- j. Install blowout preventer, Hydrill Pneumatic Annular Type, or equivalent.
- k. After 24 hours, clean out cement to 140' and pressure test casing and blowout preventer to 500 psi for 10 minutes.
- l. If BOPE test OK, drill 5-1/8" hole to 2000' using air or regular Bentonite drilling mud (Baroid, Quik-Gel or equivalent).

- m. Measure and record mud return temperature every 10'. If mud temperature reaches 180°F, stop drilling, pull up and lay down one joint of drill pipe, continue circulating while observing pit volume for evidence of fluid entry; standby for further instructions.
- n. Upon reaching 2000', circulate and condition mud and hole for logging for no less than eight (8) hours.
- o. Run temperature, gamma, and electric logs.
- p. Land 2000' of bull plugged 2" tubing and fill 6-5/8" x 2" annulus with cement from 10' BGL to surface.
- q. Install tubing cap with pressure gauge and relief valve.
- r. Move out equipment and restore location as nearly as practical to original condition.

13. ABANDONMENT PROGRAM

(Note: All depths referenced to ground level.)

- a. Move in equipment to pull tubing and abandon hole.
- b. Check pressure gauges on tubing and annulus.
- c. If necessary, mix and pump drilling mud to fill annulus to surface.
- d. Pull 2" tubing, remove tubing head. Fluid level should drop to 175'±.
- e. Dump 10 sacks of cement, mixed with 2% CaCl, calculated to fill to 110'.
- f. After four (4) hours, test cement plug. If not set, wait additional four (4) hours and retest. If necessary, add additional cement and test until plug is set at 125' or above.
- g. When plug is OK, fill hole with mud to 10', then cement to surface.
- h. Move out equipment and restore location as nearly as possible to original condition.
- i. Get abandonment approval and liability release from appropriate regulatory agency.



UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT

Notice Number

NOTICE OF INTENT TO CONDUCT GEOTHERMAL RESOURCE  
EXPLORATION OPERATIONS

<b>Applicant(s)</b>  Anadarko Production Company	Address (include zip code) 713-526-5421 P. O. Box 1330, Houston, Tx. 77001 2777 Allen Parkway, Houston, Tx. 77019
<b>Operator</b> Same	Address (include zip code) Same
<b>Contractor(s)</b> GeothermEx, Inc. (or his sub-contractor)	Address (include zip code) 415-524-9242 Mr. James B. Koenig, President 901 Mendocino Avenue, Berkeley, Calif. 947

hereby apply for authorization to conduct exploration operations pursuant to the provisions of 43 CFR 3209 now or hereafter in force across and upon the following-described lands (give description of lands by township, attach map or maps showing lands to be entered or affected)

Portions of T16N-R31&32E; T17N-R30&31E of Churchill County, Nev.  
(See attached map for proposed hole locations).

Type of operations to be conducted (give brief description)

Intermediate depth (2000') temp. gradient holes (See attached sheets for more detail)

Exploration operations will be conducted during the period (date) from (See attached sheets)

Attached  Surety bond  Rider to Nationwide bond  Rider to Statewide bond  Bond to be furnished  
 Nationwide Bond filed in the Eastern States Office of Bureau of Land Management

Upon completion of exploration operations the undersigned agrees to notify the Authorized Officer that authorized exploration operations have been completed in conformance with the general and special terms and stipulations of the notice.

The undersigned hereby agrees (1) that he will not enter upon the described land until he has been informed in writing whether there are special stipulations applicable to his Notice of Intent, as to either time or method of operation or otherwise, and, there are such stipulations, what those stipulations are, (2) that he will comply with those special stipulations, if any; and (3) that he will not enter upon the described lands until his entry has been approved by the Authorized Officer.

The undersigned agrees to be bound by the terms and conditions of this notice to conduct exploration operations when approved by the Authorized Officer.

The undersigned agrees that the filing of this Notice under the regulations (43 CFR Subpart 3209) does not vest or confer any preference right to a geothermal resources lease.

The undersigned agrees further that all exploration operations shall be conducted pursuant to the following terms and conditions:

1. Exploration operations shall be conducted in compliance with all Federal, State, and local laws, ordinances, or regulations which are applicable to the area of operations including, but not limited to, those pertaining to fire, sanitation, conservation, water pollution, fish, and game. All operations hereunder shall be conducted in a prudent manner.
2. Due care shall be exercised in protecting the described lands from damage. All necessary precautions shall be taken to avoid any damage other than normal wear and tear to improvements on the land including, but not limited to, gates, bridges, roads, culverts, cattle guards, fences, dams, dikes, vegetative cover, improvements, stock watering, and other facilities.
3. All drill holes shall be capped when not in use and appropriate procedures shall be taken to protect against

hazards in order to protect the lives, safety, or property of other persons or of wildlife and livestock.

4. All vehicles shall be operated at a reasonable rate of speed and, in the operation of vehicles, due care shall be taken to safeguard livestock and wildlife in the vicinity of operations. Existing roads and trails shall be used wherever possible. If new roads and trails are to be constructed, the Authorized Officer must be consulted prior to construction as to location and specifications. Reclamation and/or reseeding of new roads and trails shall be made as requested by the Authorized Officer.
5. Upon expiration, conclusion, or abandonment of operation conducted pursuant to this Notice, all equipment shall be removed from the land, and the land shall be restored as nearly as practicable to its original condition by such measures as the Authorized Officer may specify. A geophysical holes shall be safely plugged. The Authorized Officer shall be furnished a Notice of Completion of Geothermal Resource Exploration Operation (Form 3200-3) immediately upon cessation of all such operations and shall be further informed of the completion of reclamation work as soon as possible.
6. Location and depth of water sands encountered shall be disclosed to the Authorized Officer.

(Continued on reverse)

Form 3200-9 (December 1973)

7. Operator shall contact the Authorized Officer, prior to actual entry upon the land in order to be appraised of practices which shall be followed or avoided in the conduct of exploration operations pursuant to the terms of this Notice and applicable regulations. Operator will conduct no operations on the land unless the attached bond is in good standing.
8. Due care shall be exercised to avoid scarring or removal of ground vegetative cover.
9. All operations shall be conducted in such a manner to avoid (a) blockage of any drainage systems; (b) changing the character, or causing the pollution or siltation of rivers, streams, lakes, ponds, waterholes, seeps, and marshes; and (c) damaging fish and wildlife resources or habitat. Cuts or fills causing any of the above-mentioned problems will be repaired immediately in accordance with specifications of the Authorized Officer.
10. Vegetation shall not be disturbed within 300 feet of waters designated by the Authorized Officer, except at approved stream crossings.
11. Surface damage which induces soil movement and/or water pollution shall be subject to corrective action as required by the Authorized Officer.
12. Trails and campsites shall be kept clean. All garbage and foreign debris shall be eliminated as required by the Authorized Officer.
13. Operator shall protect all survey monuments, witness corners, reference monuments, and bearing trees against destruction, obliteration, or damage. He shall, at his expense reestablish damaged, destroyed, or obliterated monuments and corners, using a licensed surveyor, in accordance with Federal survey procedures. A record of the reestablishment shall be submitted to the Authorized Officer.
14. Operator shall make every reasonable effort to prevent, control, or suppress any fires started by the operator, and

to report, as soon as possible, to the Authorized Officer location and size of fires, and assistance needed to suppress such fires. Operator shall inform the Authorized Officer as soon as possible of all fires, regardless of location, noted, or suppressed by independent action.

15. No work shall be done within one-half mile of a developed recreation site without specific written authority from the Authorized Officer. Any travel within one-half mile of a recreation site shall be over existing roads or trails.
16. Use of explosives within one-half mile of designated waters is prohibited unless approved, in writing, by the Authorized Officer.
17. If operations conducted under the provisions of this Notice causes any damage to the surface of the national resource lands, such as, but not limited to, soil erosion, pollution of water, injury or destruction of livestock or wildlife, or littering, operator shall, within 48 hours, file with the Authorized Officer a map showing exact location of such damage and a written report containing operator's plans for correcting or minimizing damage, if possible.
18. Violation of, or failure to comply with any of these terms and conditions shall result in immediate shutdown of field operations until deficiency is corrected. Failure to correct deficiency within the time period allowed by the Authorized Officer shall result in forfeiture of bond.
19. The Bureau of Land Management reserves the right to close any area to operators in periods of fire danger or when irreparable damage to natural resources is imminent.
20. Contractor shall be liable for assuring compliance with all terms and conditions of this Notice and all actions of his designated operator, agents, and employees.
21. Where continuation of the operation will result in irreparable damage to the land and other natural resources this Notice will be immediately cancelled by the Authorized Officer.

22. Special Stipulations:

ANADARKO PRODUCTION COMPANY	10/14/77	Same	10/14/77
<i>J. B. Syptak</i>	(Date)	(Signature of Operator)	(Date)
J. B. Syptak			

We hereby agree to the special stipulations added and made a part of this Notice to conduct exploration operations.

ANADARKO PRODUCTION COMPANY	10/14/77	Same	10/14/77
<i>J. B. Syptak</i>	(Date)	(Signature of Operator)	(Date)
J. B. Syptak			

I hereby approve this Notice to conduct exploration operations.

(Signature of Authorized Officer)	(Title)	(Date)
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9-331

DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

6. LEASE DESIGNATION AND SERIAL NO.

See below under #17

7. IF INDIAN, ALGONQUIN OR TRIBAL NAME

SUNDRY NOTICES AND REPORTS ON WELLS

(Do not use this form for proposals to drill or to deepen or plug back to a different reservoir. Use "APPLICATION FOR PERMIT" for such proposals.)

1. <input type="checkbox"/> OIL WELL <input type="checkbox"/> GAS WELL <input checked="" type="checkbox"/> OTHER Geothermal Exploration Operations	7. UNIT ASSIGNMENT NAME
2. NAME OF OPERATOR Anadarko Production Company	8. FARM OR LEASE NAME
3. ADDRESS OF OPERATOR P. O. Box 1330, Houston, Tx. 77001 (713-526-5421)	9. WELL NO.
4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements. See also space 17 below.) At surface	10. FIELD AND POOL OR LOCALITY T16N-R31&32E; T17N-R30&31E
11. SEC., T., R., N., OR BLM. AND SURVEY OR AREA	12. COUNCIL OR PARISH
13. PERMIT NO.	14. STATE
15. ELEVATIONS (Show whether OF, RT, GR, etc.)	

See maps attached to Plan of Operations

10. Check Appropriate Box To Indicate Nature of Notice, Report, or Other Data

NOTICE OF INTENTION TO:		SUBSEQUENT REPORT OF:	
TEST WATER SHUT-OFF <input type="checkbox"/>	FULL OR ALTER CASING <input type="checkbox"/>	WATER SHUT-OFF <input type="checkbox"/>	REPAIRING WELL <input type="checkbox"/>
FRACTURE TREAT <input type="checkbox"/>	MULTIPLE COMPLETS <input type="checkbox"/>	FRACTURE TREATMENT <input type="checkbox"/>	ALTERING CASING <input type="checkbox"/>
SHOOT OR ACIDIZE <input type="checkbox"/>	ABANDON* <input type="checkbox"/>	SHOOTING OR ACIDIZING <input type="checkbox"/>	ABANDONMENT* <input type="checkbox"/>
REPAIR WELL <input type="checkbox"/>	CHANGE PLANS <input type="checkbox"/>	(Other) <u>Intermediate depth temp gradient holes</u>	
(Other) <input type="checkbox"/>		(Notes: Report results of multiple completion on Well Completion or Recompletion Report and Log form.)	

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)\*

This notice will signify our interest to drill intermediate (2000') depth temperature gradient holes on Federal geothermal leases which have been issued to Anadarko Production Company in the Salt Wells Basin Area, Churchill County, Nevada. The field work will begin as soon as all required permits are approved and received.

(5) (Cont'd) N8355, N8356, N8357, N8358, N8359, N8360, N8361, N8362.

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

SIGNED J. B. Syptak TITLE Staff Geologist DATE 10/14/77

(This space for Federal or State office use)

APPROVED BY \_\_\_\_\_ TITLE \_\_\_\_\_ DATE \_\_\_\_\_

CONDITIONS OF APPROVAL, IF ANY:

\*See Instructions on Reverse Side

**ANADARKO PRODUCTION COMPANY**  
A Panhandle Eastern Pipe Line Company Subsidiary

P.O. BOX 1330  
Houston, Texas 77001  
(713) 526-5421

October 10, 1977

Mr. Reid Stone  
Area Geothermal Supervisor  
U.S. Geological Survey  
345 Middlefield Rd., Mail Stop 92  
Menlo Park, California 94025

Mr. Norman L. Murray  
Lahontan Area Manager  
Bureau of Land Management  
1050 E. Williams St., Suite 335  
Carson City, Nevada 89701

Re: Plan of Operation, Sundry Notice  
and Notice of Intent to Conduct  
Geothermal Resource Exploration  
Operations, Churchill County,  
Nevada. (Salt Wells Basin Area)

Gentlemen:

In compliance with Title 30, CFR 270.34 and 270.78, Anadarko Production Company hereby submits a Plan of Operations for Drilling of Shallow Temperature Gradient Holes, Form 3200-9, "Notice of Intent to Conduct Geothermal Resources Exploration Operations", containing the information required by Title 43, CFR 3209.1-1(b)(1), (2), (3), (4), and (6), Sundry Notice, and a copy of a Cultural Resources Investigation conducted on the area involved.

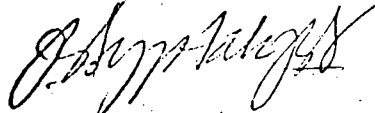
Anadarko Production Company plans to drill shallow (500') temperature gradient holes on, and around, geothermal leases which have been assigned to Anadarko in the Salt Wells Basin Area of Churchill County, Nevada. The geothermal leases affected by the proposed exploratory work are also indicated on the accompanying map:

Tract #1	N8355	T17N-R30E
Tract #2	N8356	T16N-R31E
Tract #3	N8357	T17N-R31E
Tract #4	N8358	T16N-R31E; T17N-R31E
Tract #5	N8359	T17N-R31E
Tract #6	N8360	T17N-R30E
Tract #7	N8361	T16N-R31E; T16N-R32E
Tract #8	N8362	T17N-R30E

Anadarko Production Company respectfully requests your approval of the proposed geothermal exploration program.

Please address all correspondence regarding this application to the attention of J. B. Syptak, Staff Geologist.

Very truly yours,



J. B. Syptak

JBS:bb

Enclosures - 5

cc: ✓ 3 sets to USGS, Menlo Park, Calif.  
3 sets to BLM, Carson City, Nev.  
1 set to contractor

PLAN OF OPERATION  
SHALLOW (500') TEMPERATURE HOLES

Shallow (500') temperature gradient holes will be drilled and temperatures measured on lands covered by Geothermal Leases N8355, N8356, N8357, N8358, N8359, N8360, N8361, and N8362 surrounding lands in portions of Townships T16N-R31 & 32E; T17N-R30 & 31E; T18N-R30 & 31E upon approval of the Authorized Officer of the Bureau of Land Management. A map is enclosed showing (1) the area on which the holes will be drilled; (2) the referenced leases; and (3) general topographic features.

A Cultural Resources Reconnaissance of the subject leases, dated November 10, 1975, has been made by personnel from the Desert Research Institute, under the direction of Dr. Don D. Fowler. A copy of Dr. Fowler's report is enclosed. As will be noted in this report, which was used in obtaining approval for shallow (10') thermal probe holes, the probability of damage to any historical locale is remote. The contractor, GeothermEx, Inc., will be requested to conduct their operations as to preserve any apparent or suspected historical location.

At the minimum, Anadarko will conduct its field operations subject to the following special conditions:

1. The exact route of the Pony Express trail across the leasehold is not known; however, if evidences of the trail are encountered during operations, the lessee shall avoid disturbing the trail and shall notify the appropriate surface managing official immediately.
2. The lessee shall avoid disturbing the salt mill historical site (Sec. 12, T16N-R31E).
3. The lessee shall make every effort to avoid disturbing perennial vegetation and stands of reeds. No vehicular traffic shall be permitted through the stands of reeds.
4. The USGS District Geothermal Supervisor, Reno Nevada, (702) 784-5676, shall be notified prior to entry on the leased lands to conduct operations under this plan.

Existing roads and trails will be used to the extent possible.

No campsites, air strips or other supporting facilities will be required.

None of the operations will cause any fire hazard and the crew will be requested not to smoke - or, if they do - to use extreme caution; however, sparse vegetation renders fire damage highly improbable.

The exact date of commencement and completion cannot be predicted due to the uncertainty of approval dates by the Supervisor of the USGS (Title 30 CFR 270.34) for lands covered by the referenced leases and the Authorized Officer of the Bureau of Land Management (Title 43 CFR 3209) for those lands not covered by the referenced leases. It is anticipated that operations will commence within 30 days following the latter of the two approvals and, thereafter, should be completed within 45 days in the absence of adverse weather conditions.

### Description of Operations

#### 1. Location

The location of each proposed temperature gradient well is indicated approximately on the enclosed map and the plan of operations indicates the approximate location of each wellsite and the proposed order of drilling: these wellsites will be surveyed, staked and flagged in advance of field inspection.

#### 2. Drilling Rig

The drilling contractor has not yet been selected, but the rig that will be used will probably be similar to a Mayhue 1000 or Failing 1500.

#### 3. Drilling Program

##### Hole Size & Bits:

4-3/4" tricone rock bits and drag bits will be used.

##### Casing & Cement:

The wells will be completed for temperature observation with 1" black iron pipe and cemented in the annulus from ground level to a depth of 10'.

##### Drilling Fluid:

The wells will be drilled with water. Gel (bentonite clay) will be added if required for hole cleaning. A supply of lost circulation material and weighting material will be kept on location.

##### Well Depth:

The maximum depth to which the wells will be drilled is 500'. However, well depths may be considerably less if extreme temperature, artesian water flows, hard drilling or lost circulation is encountered.

4. Drilling Fluid Sump

A steel circulating tank will be used and excess drilling fluid will be discarded into the sump. It is estimated that the excess volume will be about 10 bbls.

5. Observation Time

The wells may be used for temperature observation for about 45 days or slightly longer than the entire program which is estimated at about 30 days.

6. Abandonment

The wells will be abandoned by filling the hole with drilling mud and then cement from ground level to a depth of 10', if the well is not used for temperature observation. If the well is used for temperature observation and was completed with pipe, the pipe will be filled with cement from ground level to a depth of 10' and cut off below ground level. The ground will then be restored as best as possible to its original contours.



9-351

DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

6. LEASE DESIGNATION AND SERIAL NO.  
See below under #17

SUNDRY NOTICES AND REPORTS ON WELLS

(Do not use this form for proposals to drill or to deepen or plug back to a different reservoir. Use "APPLICATION FOR PERMIT" for such proposals.)

8. IF INDIAN, ALLOTMENT OR TRACT NAME

1. OIL WELL  GAS WELL  OTHER Geothermal Exploration Operations

7. UNIT AGREEMENT NAME

2. NAME OF OPERATOR  
Anadarko Production Company

8. FARM OR LEASE NAME

3. ADDRESS OF OPERATOR  
P. O. Box 1330, Houston, Tx. 77001 (713-526-5421)

9. WELL NO.

4. LOCATION OF WELL (Report location clearly and in accordance with any State requirements. See also space 17 below.)  
At surface See map attached with Plan of Operations

10. FIELD AND POOL, OR WELPCAT  
16N-31&32E; 17N-30&31E;  
18N-30&31E

11. SECTION, TOWNSHIP, RANGE, OR BLM, AND SURVEY OR AREA

14. PERMIT NO.

15. ELEVATIONS (Show whether DT, RT, CR, etc.)

12. COUNTY OR PARISH 13. STATE

16. Check Appropriate Box To Indicate Nature of Notice, Report, or Other Data

NOTICE OF INTENTION TO:

TEST WATER SHUT-OFF

PULL OR ALTER CASING

FRACTURE TREAT

MULTIPLE COMPLETS

SHOOT OR ACIDIZE

ABANDON\*

REPAIR WELL

CHANGE PLANS

(Other)

SUBSEQUENT REPORT OF:

WATER SHUT-OFF

REPAIRING WELL

FRACTURE TREATMENT

ALTERING CASING

SHOOTING OR ACIDIZING

ABANDONMENT\*

(Other) Shallow temperature gradient holes

(NOTE: Report results of multiple completion on Well Completion or Recompletion Report and Log form.)

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)\*

This notice will signify our intent to drill shallow (500') temperature gradient holes on and around geothermal leases which have been issued to Anadarko Production Company in the Salt Wells Basin Area of Churchill Co., Nevada. The field work will begin as soon as all required permits are approved and received.

(5) (Cont'd): N8355, N8356, N8357, N8358, N8359, N8360, N8361, & N8362

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

SIGNED

*J. B. Syptak*

TITLE Staff Geologist

DATE

10/10/77

(This space for Federal or State office use)

APPROVED BY

TITLE

DATE

CONDITIONS OF APPROVAL, IF ANY:

\*See Instructions on Reverse Side

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT

Notice Number

NOTICE OF INTENT TO CONDUCT GEOTHERMAL RESOURCE  
EXPLORATION OPERATIONS

Applicant(s) Anadarko Production Company	Address (include zip code) P. O. Box 1330, Houston, Tx. 77001 2777 Allen Parkway, Houston, Tx. 77019 (713) 526-5421
Operator Same	Address (include zip code) Same
Contractor(s) GeothermEx, Inc. (or his sub-contractor)	Address (include zip code) Mr. James B. Koenig, President 901 Mendocino Avenue, Berkeley, Ca. 94707 (415) 524-9242

hereby apply for authorization to conduct exploration operations pursuant to the provisions of 43 CFR 3209 now or hereafter in force across and upon the following-described lands (give description of lands by township, attach map or maps showing lands to be entered or affected)

Portions of: T16N-31&32E; T17N-R30&31E; T18N-R30&31E of Churchill Co., Nev.  
(See attached map for proposed hole locations)

Type of operations to be conducted (give brief description)

Shallow (500') temperature gradient holes (see attached sheets for more details)

Exploration operations will be conducted during the period (date) from (See attached sheets)

Attached  Surety bond  Rider to Nationwide bond  Rider to Statewide bond  Bond to be furnished  
Nationwide Bond filed in the Eastern States Office of Bureau of Land Management

Upon completion of exploration operations the undersigned agrees to notify the Authorized Officer that authorized exploration operations have been completed in conformance with the general and special terms and stipulations of the notice.

The undersigned hereby agrees (1) that he will not enter upon the described land until he has been informed in writing whether there are special stipulations applicable to his Notice of Intent, as to either time or method of operation or otherwise, and, if there are such stipulations, what those stipulations are, (2) that he will comply with those special stipulations, if any; and (3) that he will not enter upon the described lands until his entry has been approved by the Authorized Officer.

The undersigned agrees to be bound by the terms and conditions of this notice to conduct exploration operations when approved by the Authorized Officer.

The undersigned agrees that the filing of this Notice under the regulations (43 CFR Subpart 3209) does not vest or confer any preference right to a geothermal resources lease.

The undersigned agrees further that all exploration operations shall be conducted pursuant to the following terms and conditions:

1. Exploration operations shall be conducted in compliance with all Federal, State, and local laws, ordinances, or regulations which are applicable to the area of operations including, but not limited to, those pertaining to fire, sanitation, conservation, water pollution, fish, and game. All operations hereunder shall be conducted in a prudent manner.
2. Due care shall be exercised in protecting the described lands from damage. All necessary precautions shall be taken to avoid any damage other than normal wear and tear to improvements on the land including, but not limited to, gates, bridges, roads, culverts, cattle guards, fences, dams, dikes, vegetative cover, improvements, stock watering, and other facilities.
3. All drill holes shall be capped when not in use and appropriate procedures shall be taken to protect against

hazards in order to protect the lives, safety, or property of other persons or of wildlife and livestock.

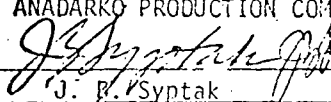
4. All vehicles shall be operated at a reasonable rate of speed and, in the operation of vehicles, due care shall be taken to safeguard livestock and wildlife in the vicinity of operations. Existing roads and trails shall be used wherever possible. If new roads and trails are to be constructed, the Authorized Officer must be consulted prior to construction as to location and specifications. Reclamation and/or reseeding of new roads and trails shall be made as requested by the Authorized Officer.
5. Upon expiration, conclusion, or abandonment of operations conducted pursuant to this Notice, all equipment shall be removed from the land, and the land shall be restored as nearly as practicable to its original condition by such measures as the Authorized Officer may specify. All geophysical holes shall be safely plugged. The Authorized Officer shall be furnished a Notice of Completion of Geothermal Resource Exploration Operations (Form 3200-3) immediately upon cessation of all such operations and shall be further informed of the completion of reclamation work as soon as possible.
6. Location and depth of water sands encountered shall be disclosed to the Authorized Officer.

(Continued on reverse)

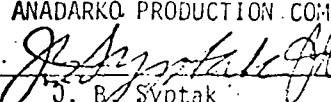
Form 3200-9 (December 1973)

7. Operator shall contact the Authorized Officer prior to actual entry upon the land in order to be apprised of practices which shall be followed or avoided in the conduct of exploration operations pursuant to the terms of this Notice and applicable regulations. Operator will conduct no operations on the land unless the attached bond is in good standing.
8. Due care shall be exercised to avoid scarring or removal of ground vegetative cover.
9. All operations shall be conducted in such a manner to avoid (a) blockage of any drainage systems; (b) changing the character, or causing the pollution or siltation of rivers, streams, lakes, ponds, waterholes, seeps, and marshes; and (c) damaging fish and wildlife resources or habitat. Cuts or fills causing any of the above-mentioned problems will be repaired immediately in accordance with specifications of the Authorized Officer.
10. Vegetation shall not be disturbed within 300 feet of waters designated by the Authorized Officer, except at approved stream crossings.
11. Surface damage which induces soil movement and/or water pollution shall be subject to corrective action as required by the Authorized Officer.
12. Trails and campsites shall be kept clean. All garbage and foreign debris shall be eliminated as required by the Authorized Officer.
13. Operator shall protect all survey monuments, witness corners, reference monuments, and bearing trees against destruction, obliteration, or damage. He shall, at his expense reestablish damaged, destroyed, or obliterated monuments and corners, using a licensed surveyor, in accordance with Federal survey procedures. A record of the reestablishment shall be submitted to the Authorized Officer.
14. Operator shall make every reasonable effort to prevent, control, or suppress any fires started by the operator, and to report, as soon as possible, to the Authorized Officer location and size of fires, and assistance needed to suppress such fires. Operator shall inform the Authorized Officer as soon as possible of all fires, regardless of location, noted, or suppressed by independent action.
15. No work shall be done within one-half mile of a developed recreation site without specific written authority from the Authorized Officer. Any travel within one-half mile of a recreation site shall be over existing roads or trails.
16. Use of explosives within one-half mile of designated waters is prohibited unless approved, in writing, by the Authorized Officer.
17. If operations conducted under the provisions of this Notice causes any damage to the surface of the national resource lands, such as, but not limited to, soil erosion, pollution of water, injury or destruction of livestock or wildlife, or littering, operator shall, within 48 hours, file with the Authorized Officer a map showing exact location of such damage and a written report containing operator's plans for correcting or minimizing damage, if possible.
18. Violation of, or failure to comply with any of these terms and conditions shall result in immediate shutdown of field operations until deficiency is corrected. Failure to correct deficiency within the time period allowed by the Authorized Officer shall result in forfeiture of bond.
19. The Bureau of Land Management reserves the right to close any area to operators in periods of fire danger or when irreparable damage to natural resources is imminent.
20. Contractor shall be liable for assuring compliance with all terms and conditions of this Notice and all actions of his designated operator, agents, and employees.
21. Where continuation of the operation will result in irreparable damage to the land and other natural resources this Notice will be immediately cancelled by the Authorized Officer.

22. Special Stipulations:

ANADARKO PRODUCTION COMPANY  
 10/10/77 Same 10/10/77  
 (Date) (Signature of Operator) (Date)

We hereby agree to the special stipulations added and made a part of this Notice to conduct exploration operations.

ANADARKO PRODUCTION COMPANY  
 10/10/77 Same 10/10/77  
 (Date) (Signature of Operator) (Date)

I hereby approve this Notice to conduct exploration operations.

(Signature of Authorized Officer) (Title) (Date)



DESERT RESEARCH INSTITUTE

University of Nevada System

Western Studies Center

Reno, Nevada 89507  
(702) 972-1653

November 10, 1975

Mr. R. H. Peacock, Chief Geophysicist  
Anadarko Production Company  
P.O. Box 1330  
Houston, TX 77001

Dear Mr. Peacock:

As per our letter of agreement of 28 October, 1975, enclosed is a report on a Preliminary Cultural Resources Reconnaissance of the Proposed Salt Wells Basin Geothermal Project, Churchill County, Nevada.

As indicated in the conclusions section of the report, we recommend that conditional clearance be granted to you to proceed with reconnaissance drilling. The conditions are standard in reports of this kind, relating to any expansion of the work into areas not covered by our field investigations.

If you have further questions, let us know.

Sincerely,

Don D. Fowler, Director  
D.R.I. Division, N.A.S.

DDF/as  
enc: report

Report on a Preliminary Cultural Resources  
Reconnaissance of the Proposed Salt Wells  
Basin Geothermal Project, Churchill County,  
Nevada

A. Introduction

In accordance with a letter of agreement between the Anadarko Production Company and the Desert Research Institute Division of the Nevada Archeological Survey, dated 23 October, 1975, a preliminary cultural resources field reconnaissance and literature search was conducted during the period 30 October through 2 November, 1975 for the area in question.

As specified in correspondence between Anadarko and the Institute, plans are to drill small thermal probe holes at, or immediately adjacent to, section corners in the area (see attached map). Accordingly, the field reconnaissance was conducted at each accessible section corner. An area of 100 meters in diameter was covered by the field crew around each section corner. Certain section corners in the middle of the mud/salt flat areas (those shown without a letter designation on the attached map) were not covered due to moist soil conditions. The probability of site locations in those locales is small.

In accordance with Bureau of Land Management guidelines for the conduct of preliminary cultural resource mitigation investigations, no artifacts were collected.

B. Cultural Resource Locales Within the Reconnaissance Area

Locale 1. At the NE corner of Sec. 14, T17N, R30E, a plywood mailbox with "U.S. Mail" stenciled on four sides was observed, together with a single broken base of a chipped stone blade or point. Ca. 15 meters E. of the mailbox are scattered pieces of badly deteriorated machine milled lumber.

Locale 2. At the NE corner of Sec. 11, T17N, R30E, an historic structure was observed. It consists of two 3 meter long parallel dry-laid rock walls and associated timbers. The walls are sand filled. The structure is apparently the remains of a small storage building of some sort. No artifacts indicating use as a dwelling were observed. There are no specific references to the structure in the historic literature. It lies well north of the Pony Express Route through the area (see below) and is apparently not related thereto.

Locale 3. Salt Mill, T16N, R31E, Sec. 12. "In 1863, the Sand Springs salt deposit was discovered. . . . The Sand Springs Company began shipping salt to the Comstock [Virginia City, Nevada] in that same year" (Mordy and McCaughey 1959:17). The mill apparently ceased to function in the 1870's and has

since fallen into decay. The remains of the mill lie approximately at the center of Sec. 12. They should be avoided by any further exploration work in the area.

C. Cultural Resource Locales Adjacent to the Reconnaissance Area

*BB*  
*line*  
Locale 4. Sand Springs Pony Express Station, T16N, R32E, Sec. 5. A Pony Express station was located at Sand Springs in the early 1860's. The site is marked by a Nevada Centennial Historic Marker. Earlier, in 1859, James Simpson, leading a Federal exploring expedition, passed through the area and named the spring "Alkali Spring" (Mordy and McCaughey 1968:17).

The approximate route of the Pony Express trail from Sand Springs westward to the Carson Sink Pony Express station (in Sec. 1, T16N, R28E) does cross the reconnaissance area (see attached map), but neither station is within the reconnaissance area (Mordy and McCaughey 1968:237).

*BB*  
*line*  
Locale 5. Archeological site, T16N, R32E, Sec. 5. NE of Sand Spring Pony Express station is an archeological site, 26CH308. The site consists of a lithic scatter, ca. 100 m<sup>2</sup> on a knoll overlooking the mud flats to the west. No collections were made, but the site has been reported to the Bureau of Land Management and the Nevada Archeological Survey. Again, the site lies outside, but adjacent to, the reconnaissance area.

*BB*  
*line*  
Locale 6. Salt Wells, T17N, R30E, Sec. 35. Early literature reported an Indian campsite at Salt Wells. A salt refinery was built at Salt Wells in 1863, and between that date and 1870, up to 250 tons of salt per month were shipped to Virginia City for use in the silver mills. After 1870 salt production declined drastically, although some borax was produced for several years thereafter (Mordy and McCaughey 1968:17).

D. Conclusions and Recommendations.

Under criteria set forth in Section 300.10 of the U.S. Advisory Council on Historic Preservation Procedures for the Protection of Historic and Cultural Properties, the following recommendations are made:

1. Locales 1 and 2 within the reconnaissance area apparently do not qualify for nomination to the National Register of Historic Places and no further mitigation measures are recommended.
2. Locale 3, Salt Mill, does appear to qualify for nomination to the Register and should be avoided during any future work in the area.
3. Since the exact route of the Pony Express trail across the reconnaissance area is not known, care should be taken to

avoid and protect any evidences of the trail which might be encountered during subsequent construction of development.

4. Locales 3-6 all appear to qualify for nomination to the Register. However, they all lie outside, although adjacent to, the reconnaissance area. Care should be taken to avoid these locales.

Based on the foregoing considerations, we recommend conditional clearance to proceed with the project; the conditions being to avoid the Salt Mill locale and to notify the Desert Research Institute Division of the Nevada Archeological Survey if any other signs of historic or prehistoric habitation are located during the initial or subsequent stages of construction and development within the lease area.

Reference Cited

Mordy, B.D., and D.L. McCaughey  
1968 Nevada Historical Sites. Reno: Desert Research Institute.

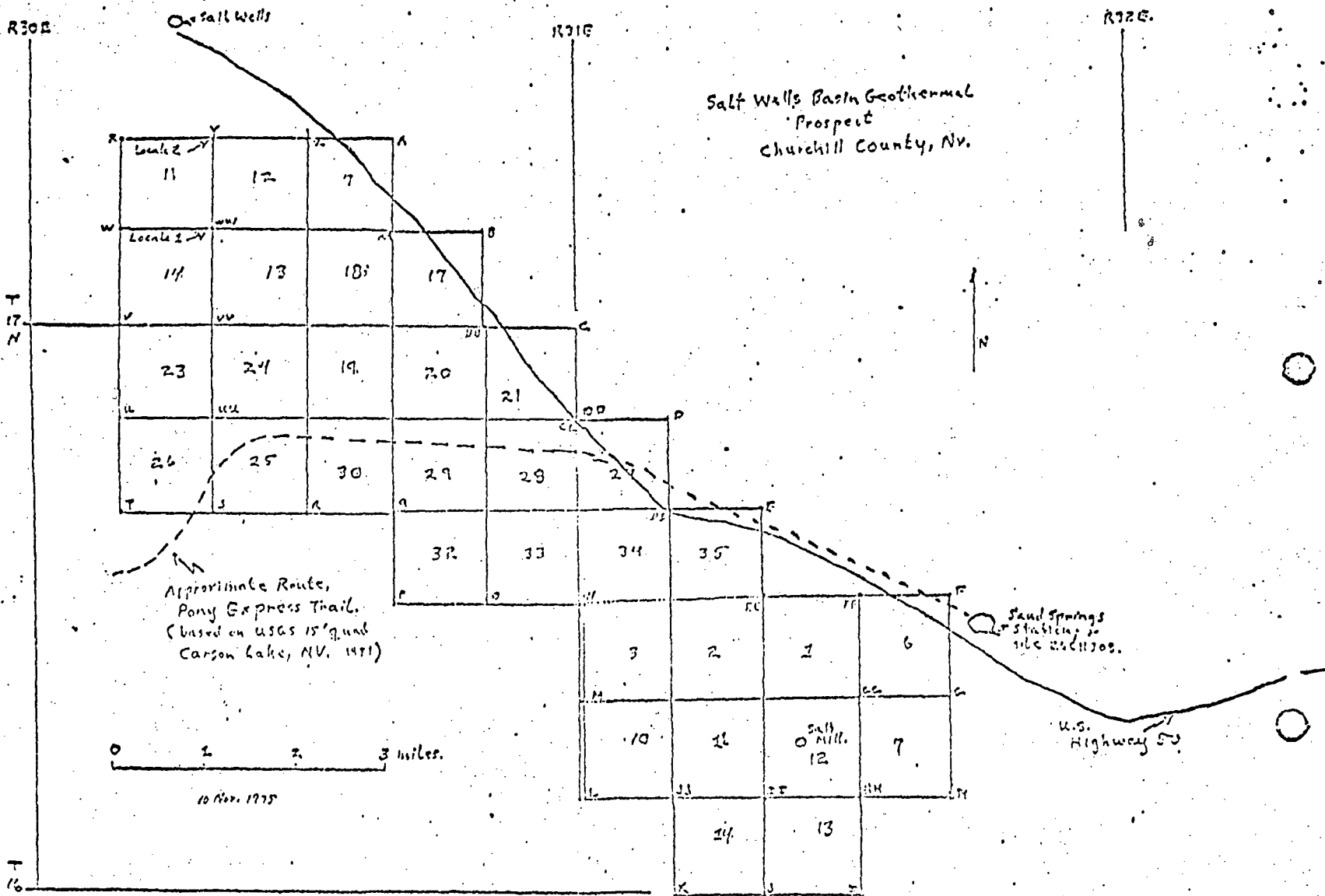
Signed: Don D Fowler  
Don D. Fowler  
Director, DRI Division  
Nevada Archeological Survey  
10 November 1975

R30E

R31E

R32E

Salt Wells Basin Geothermal Prospect  
Churchill County, NV.



Approximate Route,  
Pony Express Trail.  
(based on USGS 15' quad  
Carson Lake, NV. 1471)

0 1 2 3 miles.

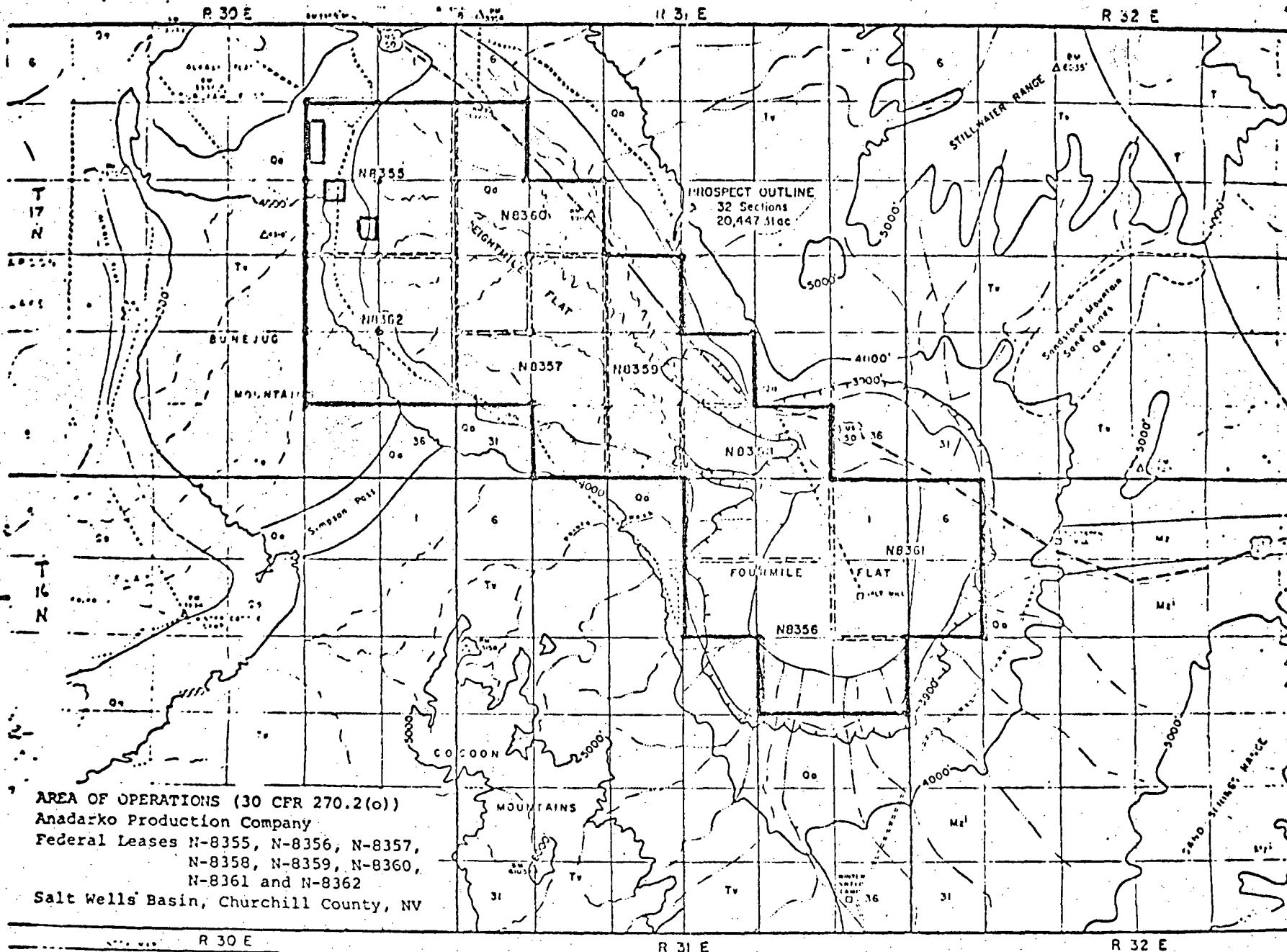
10 Nov. 1975

Sand Springs  
Station  
116 2461100.

U.S.  
Highway 50

26H





AREA OF OPERATIONS (30 CFR 270.2(o))  
 Anadarko Production Company  
 Federal Leases N-8355, N-8356, N-8357,  
 N-8358, N-8359, N-8360,  
 N-8361 and N-8362  
 Salt Wells Basin, Churchill County, NV

GEOLOGICAL LEGEND  
 Oo - Underlying Alluvium  
 Tv - Late Tertiary Volcanics

Work Copy for EA 97)  
 AGS-48-N8355

Vehicle travel restricted to existing roads and trails.

1:25000

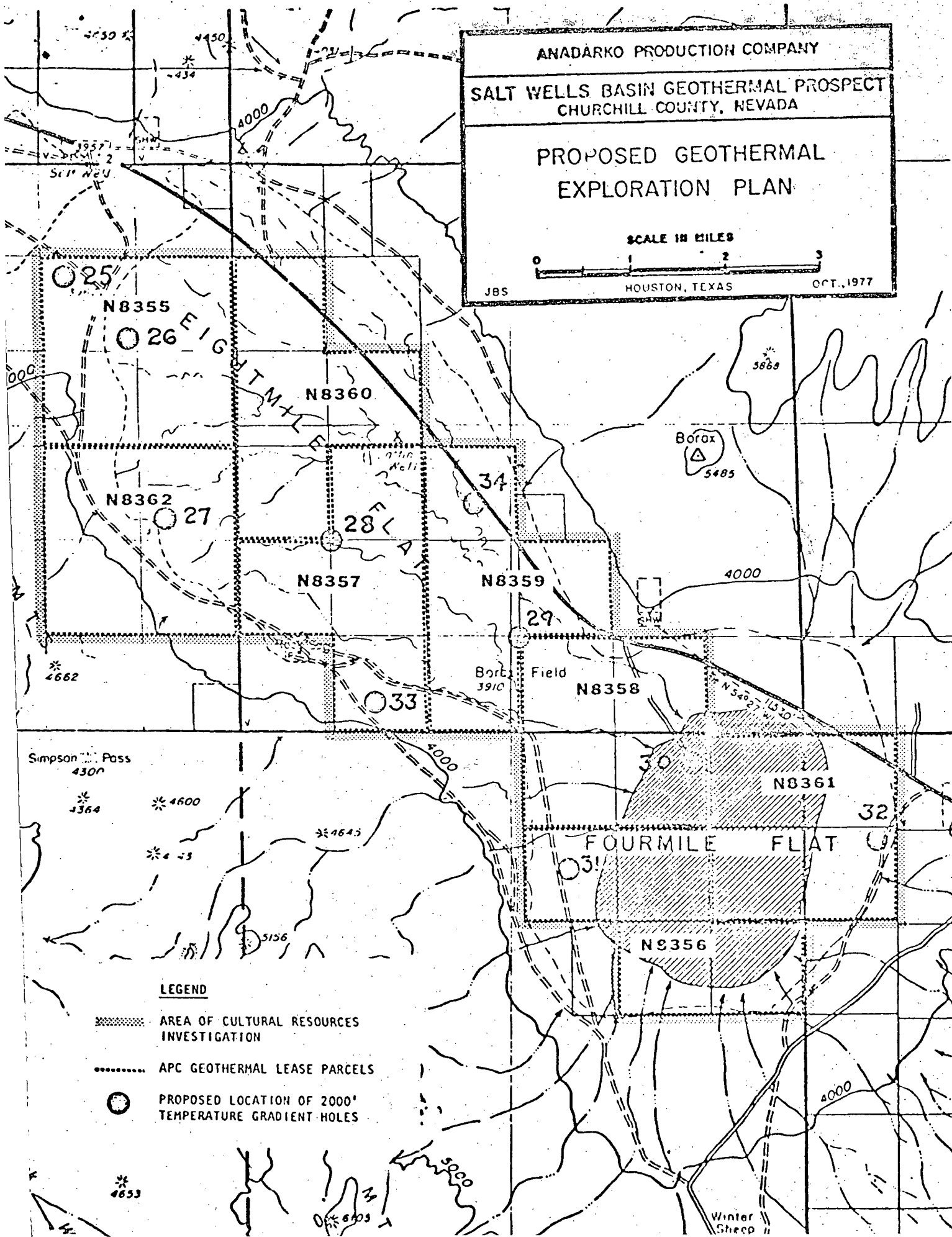
ANADARKO PRODUCTION COMPANY

SALT WELLS BASIN GEOTHERMAL PROSPECT  
CHURCHILL COUNTY, NEVADA




PROPOSED GEOTHERMAL  
EXPLORATION PLAN

SCALE IN MILES  
0 1 2 3

JBS HOUSTON, TEXAS OCT., 1977



**LEGEND**

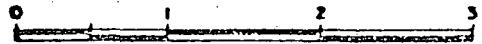
-  AREA OF CULTURAL RESOURCES INVESTIGATION
-  APC GEOTHERMAL LEASE PARCELS
-  PROPOSED LOCATION OF 2000' TEMPERATURE GRADIENT HOLES

ANADARKO PRODUCTION COMPANY

SALT WELLS BASIN GEOTHERMAL PROSPECT  
CHURCHILL COUNTY, NEVADA

PROPOSED GEOTHERMAL  
EXPLORATION PLAN

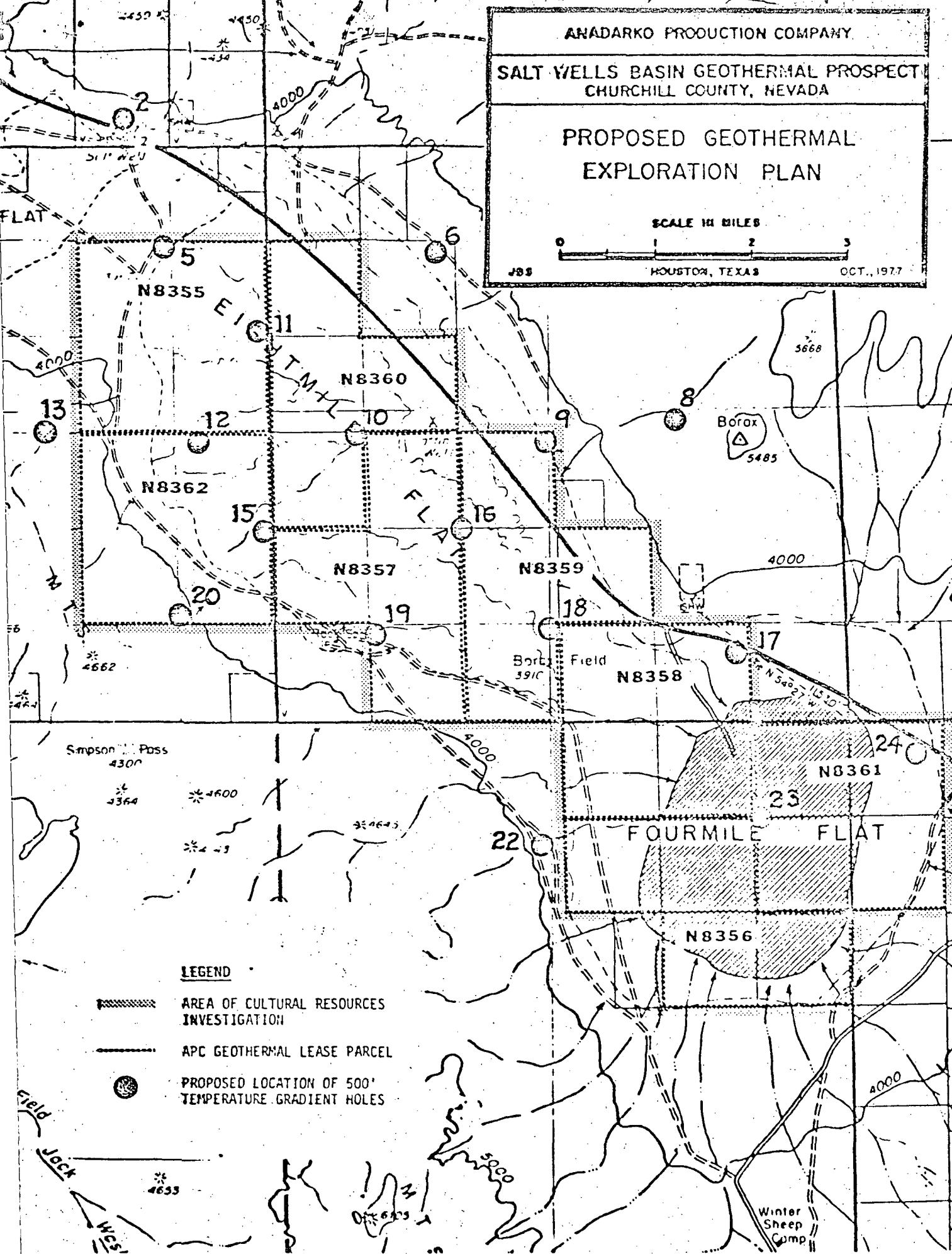
SCALE IN MILES



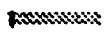
J83

HOUSTON, TEXAS

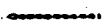
OCT., 1977



**LEGEND**



AREA OF CULTURAL RESOURCES  
INVESTIGATION



APC GEOTHERMAL LEASE PARCEL



PROPOSED LOCATION OF 500'  
TEMPERATURE GRADIENT HOLES

Field Jack  
WS

Winter Sheep  
Camp

GLO2443

AREA  
NV  
Church  
SaltWell  
PO-Anada

Proposed Plan of Operation  
United States Geothermal Lease  
Serial Nos.:  
N-8355, 8357, 8359, 8360, 8362, and  
N-20633, 20634, 21437, 25111

Salt Wells Basin  
Churchill County, Nevada

Sections:  
11-14, 22-27, 34-36, T17N, R30E  
1-3, 10-13, T16N, R30E  
7, 17-21, 28-30, 32, 33, T17N, R31E

Anadarko Production Co.  
P.O. Box 1330  
Houston, Texas 77001  
(713)526-5421

**UNIVERSITY OF UTAH  
RESEARCH INSTITUTE  
EARTH SCIENCE LAB.**

**RECEIVED**  
MAR 27 1980  
AREA GEOHERMAL SUPERVISOR'S OFFICE  
CONCENTRATION DIVISION  
U.S. GEOLOGICAL SURVEY  
MENDOCINO PARK, CALIFORNIA

March 1980

Plan proposes the drilling of three successful geothermal resource wells to evaluate the potential for geothermal resource reserves. The sites will be selected from eleven indentified sites. Drilling of the first well is scheduled to begin in August 1980.

Prepared by:

VEIZADES & ASSOCIATES

Consulting Engineers  
San Francisco, CA

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- C. ENVIRONMENT
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  - 4. Living Components
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  - 6. Archaeological and Historical Value
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APPENDIX

References

- Exhibit A - Proposed Geothermal Well Sites and Access Roads  
(topographic map)
- Exhibit B - Layout of Typical Drilling Location
- Exhibit C - Typical Geothermal Drilling Rig Specifications

Anadarko Production Co.  
Proposed Plan of Operation  
United States Geothermal Lease  
Serial Nos.:  
N-8355, 8357, 8359, 8360, 8362, and  
N-20633, 20634, 21437, 25111

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A. INTRODUCTION

Anadarko Production Company submits this Plan of Operation for the drilling of three successful exploratory geothermal resource wells in order to evaluate the potential for an adequate geothermal resource reserve underlying the land included in the U.S. Geothermal Lease N-8355, 8357, 8359, 8360, 8362, and N-20633, 20634, 21437, 25111.

The exploratory wells will be drilled as nearly vertical holes to projected depths of 3,000 to 10,000 feet.

The project has been designated as the Salt Wells Prospect and is located in the Salt Wells Basin, Churchill County Nevada.

B. WELL LOCATIONS AND ACCESS

The exploratory wells will be selected from eleven potential well locations shown on the topographic map designated as Exhibit A. The map was developed from U.S.G.S. published quadrangle maps at a scale of 1" to 2,000 feet.

The map shows the Lease boundaries, the topographic features and the drainage patterns of the land.

The lease is accessed from highway 50. From Salt

Wells, an existing dirt road traversing the lease will be improved and will be utilized as the main access to the various drilling locations.

Additional roads will be developed as required for accessing the various drilling locations.

Tentative alignments of the access roads are shown in Exhibit A.

The locations of the proposed well sites are as follows:

LOCATION OF PROPOSED EXPLORATORY WELLS

<u>WELL NO.</u>	<u>SEC., T., R.</u>	<u>LOCATION</u>
77-25	25-17N-30E	Fr SE Cor 1,250'N 950'W
44-36	36-17N-30E	Fr NW Cor 1,950'S 2,400'E
21-36	36-17N-30E	Fr NW Cor 300'S 1,300'E
47-36	36-17N-30E	Fr SW Cor 900'N 2,400'E
72-36	36-17N-30E	Fr NE Cor 1,000'S 950'W
86-36	36-17N-30E	Fr SE Cor 1,950'N 600'W
55-35	35-17N-30E	Fr SE Cor 2,250'N 2,250'W
72-35	35-17N-30E	Fr NE Cor 900'S 1,200'W
88-35	35-17N-30E	Fr SE Cor 300'N 300'W
31-2	2-16N-30E	Fr NW Cor 300'S 1,900'E
85-35	35-17N-30E	Fr SE Cor 2,500'N 250'W

It is proposed that at least three and possibly five wells may have to be drilled in order to obtain three successful wells and assess the potential of the geothermal resource.

Each succeeding well will be selected based on information developed from the wells previously drilled.

All wells will initially be field located using topographic features and then surveyed and tied to known bench marks. Existing bench marks or section corners will be located and used for elevation and location control of each well. Additional bench marks will be established to



provide the required location control of each well in accordance with the recommendations of the Geothermal Supervisor.

C. ENVIRONMENT

The proposed development lies in the gently sloping ground of the Simpson Pass, between the Bunejug and Cocoon Mountains. Ground slopes flatter than ten percent are encountered on all areas proposed for the construction of the drilling locations.

The area of the Simpson Pass is covered with aeolian sands. The adjacent hills and mountains consist of volcanic rock formations of Tertiary age.

No pronounced drainage features are present in the area. Generally, the Simpson Pass slopes drain into the Alkali Flat depression to the north-east.

Drainage ditches appear to carry water only during sustained rainfall.

The semi-arid climate and sandy soils do not promote plant growth. No topsoil has been established in the area, and only sparse grasses are encountered.

During the several visits to the area, very little wildlife has been seen.

1. Climate

The climate of the area is arid with wide variations in temperature.

The annual rainfall ranges from four to eight inches.

2. Air Quality

The air quality of the area is assumed to be good.

The main source of air quality degradation is wind blown particulate matter.

3. Noise

The remote setting of the area results in very low background noise. The only noise dominating the area is generated from low level aircraft flights from the Fallon Naval Air Station.

4. Living Components

The lack of topsoil and the semi-arid climate do not promote plant growth. The predominant plant encountered in the Simpson Pass area is the Russian thistle (Salsola Kali).

The observed wildlife in the area consists primarily of snakes, lizards and small rodents.

Larger mammals may be found in the area of Rock Springs, an area that provides the only source of water in the area.

5. Land Use

The desert-like setting of the area offers limited potential use by humans.

A small portion of the area around Rock Springs is used for livestock grazing.

The only other potential uses of the land are for limited hunting and for recreational off-road vehicle use.

6. Archaeological and Historical Value

An archaeological and historical reconnaissance

and investigation of the Simpson Pass Area (see reference 2) revealed several archaeological sites within the project area.

The sites are located and identified in Exhibit A. A description of the sites that may be impacted by the proposed development is as follows:

RECORDED SITES IN THE SIMPSON PASS AREA

<u>Site No.</u> <u>(Exhibit A)</u>	<u>Site</u> <u>Designation</u> <u>(Reference 2)</u>	<u>Description</u>	<u>Preservation</u>
1	26Ch482	Lithic scatter and lithic concentration	if possible
2	26Ch483	Stone alignments and lithic scatter	mandatory
3	26Ch587	Lithic scatter	if possible
4	26Ch588	Lithic scatter	if possible
5	26Ch589	Mano and flake	if possible
6	26Ch595	Linear depression, linear rock clearing, glass, and metal	mandatory
7	26Ch596	Stone carin and petroglyph	mandatory
8	26Ch598	Locally level, linear surface and stone retaining walls	mandatory

D. PROPOSED DEVELOPMENT

1. Scope

In order to develop the required information to assess the potential of geothermal resource of the lease, a total of three exploratory producing geothermal wells will be required.

The well sites delineated on Exhibit A have been selected upon evaluation of results obtained from an extensive shallow and deep temperature gradient program in

the area. They represent the projected wells required to develop the geothermal resource.

Initially, two drilling locations with associated access roads will be constructed. The initial sites will be selected on further evaluation of the information obtained by the temperature gradient program.

Based on information obtained from the drilling of the first and second exploratory wells, additional sites will be selected.

It is anticipated that drilling a total of five exploratory wells may be required prior to obtaining three productive wells and assessing the geothermal resources of the area.

## 2. Source of Construction Materials

The development of the drilling locations and access roads will not require the transportation or exportation of soil. All construction will be engineered to result in balanced cut and fill earthwork.

The road and drilling location surfaces must be stabilized with rock to provide adequate surfaces for transportation and support of drilling equipment. Considerable quantities of rock will be required for this work.

It is proposed that the rock required for the surface stabilization be obtained from existing rock extraction quarries located in the immediate area (see Exhibit A).

It is estimated that about 1,000 cubic yards of rock will be required to stabilize the surface of each drilling site and about 2,000 cubic yards for stabilizing each mile of access road.

The construction of the drilling locations and access roads will require a considerable amount of water. Water will also be required for the drilling operations. Presently, there is no source of water within the lease.

It is proposed that a water well be drilled at the location indicated on Exhibit A to obtain the required water.

Temporary surface piping will be used to transport water to various construction or drilling sites.

### 3. Construction Specifications

The proposed drilling locations and access roads are located on relatively flat terrain. The existing ground at the location of the proposed drilling sites slopes less than fifteen percent. The soils are sandy soils with numerous interspersed basalt rocks.

To develop each drilling location and associated temporary drilling waste discharge sump, relatively minor grading will be required, encompassing an area of approximately three acres.

All proposed grading will be designed to provide for balanced cut and fill earthwork quantities.

No vegetation or topsoil of any consequence is present at the construction sites.

All construction will be under the direction of a registered Civil Engineer, and will be based on certified drawings and specifications.

The following are minimum design parameters that will be incorporated in the design of surface drilling facilities:

- The size of each drill site will be designed to provide space for the drilling equipment.

- Engineered cut slopes on the sandy material will be no steeper than 2 horizontal to 1 vertical.
- Engineered fill slopes shall not be steeper than 3 horizontal to 1 vertical.
- Maximum road grades shall not exceed 15%.
- Roads shall not be less than 16 feet wide.
- Compaction of engineered fills shall be not less than 90%, based on ASTM Method D-1557-70, "Moisture Density Relations Test for Soils".
- Drill pad and road surfaces shall be stabilized with at least 6 inches of compacted rock surfacing.

The limits of grading will be staked prior to construction.

A layout of a typical drilling location is shown in Exhibit B.

#### 4. Support Facilities

No support facilities, such as camp sites or air strips, will be constructed within the lease area.

Construction of surface drilling facilities will be performed under contract with local contractors.

Temporary office and shop facilities required for drilling will be based in temporary buildings or trailers located within each drill site.

Personnel required for the drilling operations and other support activities will reside in housing facilities in nearby communities.

A layout of the drilling and support equipment on a typical drilling location is shown in Exhibit B.

F. LOGGING AND TESTING PROGRAM

1. Logging

Drilled holes will be logged by a geologist from surface to total depth.

Electric wireline logs will also be run from total depth to the shoe of the conductor pipe as may be indicated.

2. Testing

Tests to evaluate the temperature, fluid content and composition, porosity, permeability, and production potential will be performed during the drilling program.

3. Well Flow Testing

Upon completion of a potentially commercial

production well, short and long term flow tests will be conducted.

Disposal methods of fluids generated during these flow tests will depend on the determination of the chemical composition of the fluids and condensate produced.

If, upon chemical analysis, it is determined that the fluid contents will not be detrimental to the environment of the Alkali Flat depression, and are compatible with any existing surface or shallow ground-waters in the area, an application, supported by the fluid analysis, will be made to the Area Geothermal Supervision, USGS, seeking approval to dispose such fluids generated during short and long term testing in the Alkali Flat depression.

If the surface disposal of fluids is approved, the geothermal fluids will be transported to the depression by shallow surface channels or pipes laid on the ground.

If, however, the surface disposal proves to be undesirable, then the short term testing will be performed by utilizing existing sumps as disposal sites. The long term testing will be performed by selecting one of the wells and reinjecting the fluids from the well being tested. The transfer of fluids from the producing well to reinjection well will be performed utilizing properly anchored pipes.

#### G. ENVIRONMENTAL CONSIDERATIONS

##### 1. Environmental Assessment

The area of the proposed development has been the subject of at least three environmental analysis.

Two of the analysis, EA #32 and EA #97-8, were performed by the USGS, Conservation Division, Menlo Park, California, for the Shallow Thermal Probe program and the



deep Temperature Gradient program performed by Anadarko Production Company to evaluate the Geothermal Potential of the lease.

The third analysis was performed for a motorcycle race that took place in the area of the proposed development. This EAR is on file at the BLM office in Carson City, Nevada, and is designated as EAR #NV-030-7-02.

Also, Anadarko Production Company commissioned the Desert Research Institute of the University of Nevada to perform an archaeological and historical investigation of this leasehold.

The findings of this investigation are included in Publication No. 72008 entitled "An Archaeological and Historical Investigation of the Simpson Pass Area, Churchill County, Nevada " dated August 1979.

The findings of these studies have been evaluated and the proposed drilling locations and access roads have been selected to avoid disturbance of the critical environmental and archaeological sites indentified by these studies.

## 2. Sensitive Areas

Any specific archaeological site that is postulated in the proximity of the proposed access roads or drilling locations will be indentified and delineated in the field by an Archaeologist. If the site is found to be of significance, and is recommended for preservation, the construction will be performed so as to avoid disturbance of the site.

The same care will be taken in preserving all substantial perennial vegetation and stands of reeds.

3. Fire Prevention Measures

No fire hazards are present at the proposed area of construction.

However, no accumulation of flammable materials will be allowed on or around the construction sites or drilling locations. All personnel will be required to follow safe smoking procedures.

4. Soil Erosion and Siltation

Rainfall in the lease area is very low and water induced erosion or siltation will not be a problem.

5. Pollution Control of Surface and Ground Waters

Drilling fluids generated during the drilling operations and drill cuttings will be discharged into a waste containment structure (sump) constructed adjacent to the drilling platform.

The sump will have adequate capacity to contain all produced fluids and drill cuttings.

Accidental spillage of oil, fuel or grease around drilling equipment will be directed to the sump.

A three foot minimum freeboard will be maintained on the sump above the liquid level at all times. Minimum sump capacity within the three foot freeboard will be 1.2 M. gallons.

The sump will be lined with a two foot thick impervious soil liner having a maximum permeability of  $1 \times 10^{-6}$  cm/sec.. Local sitly soils at the Alkali Flat depression have been tested and found to meet the specified permeability requirements. If needed, such soils will be utilized for the impervious sump liners.

At the completion of drilling operations, the fluids

at each sump will be allowed to evaporate. The remaining materials in the sump will then be mixed with native soils and covered with a minimum two foot soil blanket. The area will then be graded to conform to adjacent ground contours and graded to drain.

Significant ground water resources are not known to exist in the area of the project. However, casing and cementing procedures during drilling operations will prevent contamination of any existing ground waters.

#### 6. Protection of Wildlife

The proposed construction will impact wildlife by the limited removal of habitat. Each drilling location will disturb about three acres of relatively barren area.

New access roads will disturb an additional fourteen acres of ground.

Surface disturbance will be confined only to the areas required for construction of drilling locations and access roads.

Disturbance of existing springs providing drinking water for wildlife will be avoided.

No rare or endangered species of flora or fauna are known to be present in the area.

#### 7. Air Quality

The present air quality of the area is very good.

The potential impact of the proposed development on air quality is as follows:

- Production of dust during construction of access roads and drilling locations.

- Particulate generated during air drilling.
- Possible hydrogen sulfide (H<sub>2</sub>S) emission during drilling and testing.

The dust generated during construction will be minimized by watering and by stabilization of surfaces with rock.

Particulate generated during drilling with air will be mitigated by the use of a cyclon type separator-muffler injected with water spray.

The expected hydrogen sulfide emission will be small and will have a minimum impact on the total air quality.

The potential hydrogen sulfide emission in the immediate vicinity of the drilling operations will be handled as specified under the contingency plan included in this document.

#### 8. Noise

The only community within a ten mile radius of the proposed development is a legal house of prostitution.

Noise generated by the construction and drilling activities will have substantially less impact than noise generated by traffic on highway 50 or by low flying aircraft from the Fallon Naval Air Station.

In any event, noise from construction and drilling equipment will be controlled by muffling devices as to meet OSHA standards.

#### 9. Protection Against Hazards to Public Health and Safety

All activities will be conducted in conformance to regulations safeguarding the health and safety of the

public and of employees.

- Industrial safety and OSHA regulations will be followed.
- First aid facilities will be provided.
- Radio communications will be established to provide for emergency calls.
- Hard hats will be worn by all construction and drilling personnel.
- Portable sanitary facilities will be provided through contracts with commercial operators.
- Bottled drinking water will be provided.

#### H. CONTINGENCY PLANS

##### 1. Blow-out Contingency Plan

Blow-out prevention equipment will be frequently inspected to insure that they are kept in operating condition.

In the event of an uncontrolled blow-out, an immediate effort will be taken to shut-down surface valves and blow-out preventer system.

Other steps, as appropriate, will be taken as follows:

- Arrange for transportation of injured persons to the nearest hospital.
- Restrict access to the site to all unauthorized personnel.
- Construct dikes or sumps to contain fluids.
- Try to control the blow-out with rig personnel.
- Control fluids so that erosion of the drilling location will not occur, undermining the drill rig structure.
- Report condition to the appropriate personnel.

## 2. Accidental Spill Contingency Plan

The proposed development lies in a gently sloping ground that drains into an extensive depression designated as Eightmile Flat. Any accidental spills, depending on their quantity ground slope and composition, will tend to percolate into the ground and to accumulate on depressions in the low lands.

### Types of Potential Spills in Geothermal Drilling

#### a. Drilling Muds

Muds are a mixture of water, natural clays, and chemical additives used in drilling operations to lubricate and cool the bit in the hole, and to carry cuttings out of the hole. Drilling muds are stored in tanks and sumps at the drilling locations. These sumps are open and are adequately sized to hold the volume necessary for the operations. Possible circumstance of accidental discharge are minimal, but could conceivably occur by:

- Sump overflow.
- Sump wall seepage or wall breakdown.
- Mud discharge from elsewhere on location.
- Shallow lost circulation channeling to surface.

#### b. Lubricating or Fuel Oils and Petroleum Products

The potential discharge of this type would probably be very small and from equipment used in the field. Possible locations for accidental spills are:

- Drilling equipment, fuel tanks, and machinery at and around drilling locations.

- Other miscellaneous equipment and machinery at well sites, on roads, or at generating plants and production shops.

#### Possible Water Quality Effects

##### a. Drilling Muds

- Contaminate water possibly making it unsuitable for human or wildlife consumption.
- Possible detrimental effect to flora of area.
- Increase turbidity of water by particulates in fluid or by soil erosion.

##### b. Petroleum products

- Contaminate water.
- Cover plant life

#### Plan for Cleanup and Abatement

In the event of discharges of drilling muds or petroleum products, the overall contingency plan is as follows:

The person responsible for the operation will make an immediate investigation, then call the Production Foreman and advise him of the spill. The Production Foreman will in turn call out company employees to man heavy equipment, regulate field production, or do other work as applicable for control and cleanup of spill.

##### a. Specific Procedures

- For drilling muds (Contact Drilling Foreman):

Repair sump or contain with dikes. Spread straw or hay to impede flow. Haul liquid to another sump or available tank or County approved disposal site. Dry and solidify other material, compact and bury solids where possible.

- For petroleum products:

Contain spill with available manpower. Use absorbents in stock at field warehouse and dispose of same in County approved areas.

### 3. Hydrogen Sulfide Contingency Plan

Hydrogen sulfide is present in minute amounts in geotheraml fluids. Generally, in drilling operations, the hydrogen sulfide is quickly diffused in the expanding (due to pressure reduction) and rising (due to high temperature) steam. The hydrogen sulfide concentration is further reduced by the compressed air used while drilling in the steam zone. No occupational hazard, due to high concentrations of hydrogen sulfide, has been observed by any of the various Geothermal Developers.

Colometric detection indicators for hydrogen sulfide will be available at the drilling locations . In the event the presence of hydrogen sulfide is indicated, devices will be available to measure the concentration. Should the concentration be above the maximum allowable for eight hour exposure (10 ppm) then protective measures would be taken. Depending on the concentration, these measures could include:

- Evacuation of the immediate area.
- Placement of three foot diameter fans upwind of the immediate area to increase diffusion and ventilation.
- Injection of chemicals that neutralize hydrogen sulfide in the compressed air circulated in the drilling operation.

Personnel will be instructed in the use of detection devices and appropriate protective measures. These procedures will be posted in the dog house.



I. AVAILABLE PERSONNEL AND EQUIPMENT TO ASSIST  
IN EMERGENCIES

1. Field Personnel

- Drilling Contractor Tool Pusher
- Anadarko's Drilling Supervisor
- Anadarko's Exploration Field Supervisor
- Drill Rig Personnel

2. Local Personnel

a. Earthmoving Equipment and Water Trucks

A & K Earth Movers, Inc.  
1200 Auction Road, Fallon  
Telephone: 423-4913

W.E.S. Construction Co.  
1095 E. 2nd Street, Reno  
Telephones: 322-5405  
972-0800  
358-1753

b. Welding

Precision Automotive & Machine Shop  
745 E. Stillwater, Fallon  
Telephone: 423-2756

c. Vacuum Truck Service

Ember Enterprises  
845 S. McLean Street, Fallon  
Telephone: 423-4926

d. Medical Doctors, Hospitals and Ambulance Services

Doctors

Darius F. Caffaratti, MD  
395 W. Williams, Fallon  
Telephone: 423-3126

V.E. Elliott, MD  
395 W. Williams, Fallon  
Telephone: 423-3126

Hospitals

Churchill Public Hospital  
155 N. Taylor, Fallon  
Telephone: 423-3151

St. Mary's Hospital  
235 W. 6th, Reno  
Telephone: 323-2041

Ambulances

Ground - Emergency - dial 911 or Naval Air  
Station 423-2410

Aids Ambulance, 395 W. Wells Ave., Reno  
Telephone: 329-1144

Ambulance Service, Co.,  
Sierra, 395 S. Wells Ave., Reno  
Telephone: 323-3123

Air - Aviation Services Inc.  
1880 Gentry Way, Reno  
Telephone: 825-6400

Air Nevada  
2601 E. Plumb Lane, Reno  
Telephone: 329-1660

J. COLLECTION OF BASE LINE DATA

No environmental base line data has been collected for this development area.

Anadarko Production Company will formulate a program of data collection as required to monitor critical environmental and ecological systems.

At least a year of environmental base line data will be available under this program prior to submitting a Plan for Production for this prospect.

APPENDIX

## REFERENCES

1. "Enviornmental Analysis", January 21, 1976, EA 1976 EA #32. Prepared by U.S. Department of the Interior, Geological Survey, Conservation Division, Office of the Area Geothermal Supervisor, Menlo Park, CA.
2. Hattori, Eugene M., "An Archaeological and Historical Investigation of the Simpson Pass Area, Churchill County, Nevada", August 1979, Desert Research Institute, University of Nevada System, Publication No. 72008.
3. "Enviornmental Analysis", Febraury 9, 1978, EA #97-8. Prepared by U.S. Department of the Interior, Geological Survey, Conservation Division, Office of the Area Geothermal Supervisor, Menlo Park, CA.
4. "Salt Wells Hare and Hound Motorcycle Race Environmental Analysis Record" EAR No. NV-030-7-02. Prepared by the Bureau of Land Management, District Office, Carson City, Nevada.

TYPICAL GEOTHERMAL DRILLING RIG SPECIFICATIONS

DRAWWORKS:

National 75CA Double Drum Drawworks.

ROTARY TABLE:

National 27½ MS Rotary Table

POWER:

Two Sets - GM Twin 6-110 Diesel Engines  
with Allison Torqmatic Drive Converters (1200 hp)

MAST:

127 ft. Late Style Bender - 450,000 lb. gross nominal  
capacity Mast

SUBSTRUCTURE:

(with mats)

26'6" high x 23' wide x 40' long.

TRAVELING EQUIPMENT:

Emsco 250 ton - 4 Sheave Traveling Block with Web Wilson  
Hydra-Hook Combination  
Oilwell 500 Ton Swivel  
5½ Hex Kelly

MAIN PUMP:

Ideco MM600 (7-3/4 x 16) 600 hp Duplex Pump powered by one  
set of 6-110 GM Twin Diesel Engines with Allison Torqmatic  
Drive Converters - (600 hp)

AUXILIARY PUMP:

National C-250 (7½ x 15) 370 hp Duplex Pump powered by one  
set of 6-110 GM Diesel Engines.

MUD SYSTEM:

1048 Barrel Capacity Surface Equipment with Two Medearis  
Shakers.

CENTRIFUGALS:

Two - 5 x 6 Thompson Centrifugal Pumps powered by two 50 hp  
explosion proof electrical motors.

WATER STORAGE:

524 Barrel Capacity Tank plus 750 BBLs in storage tanks.

POWER PLANTS

One - 150 KW G.E. Generator powered by a 6-110 GM Diesel Engine.  
One - 150 KW G.E. Generator powered by a 6-110 GM Diesel Engine.

BOE:

12-900 GK Hydril  
12-900 Double Shaffer  
12-900 Type D Spool  
80 gallon Hydril Accumulator with Nitrogen Bottles with  
remote electrical control station  
Blowdown Manifold - (3" - 5000 psi)

DRILL PIPE:

4½ O.D., Grade E, 16.60 lb./ft., R-2 Drill pipe.