Geothermal Division

Union Oil Company of California
Union Oil Center, Box 7600, Los Angeles, California 90051
Telephone (213) 486-6262

GEO7-500

union 76

Delbert E. Pyle
Manager of Operations

November 18, 1977

Dr. Howard Ross
Earth Sciences Laboratory
University of Utah
Research Park
391 Chipeta Way
Salt Lake City UT 84108

Gentlemen:

RE: Report of Operations
October, 1977
Cove Fort-Sulphurdale Area
Contract EG-77-C-08-1522

The grading and graveling of the location and access road for the well site CFSU No. 42-7 was completed during the month. A thirty inch diameter conductor pipe was set thirty feet below ground level and cement grouted within five and one-half yards of ready mix concrete.

The Loffland Rig No. 5 which was originally contracted for drilling the well CFSU No. 42-7 will not be available, due to previous commitments, until the latter half of December. Therefore, we called numerous contractors that have suitable drilling equipment and have tentatively obtained an alternate drilling rig from Loffland Brothers which will be available to drill one well only during the last half of November.

With the possibility of the original contracted rig being available prior to the completion of the first well, we requested from the U.S. Geological Survey and National Forest Service an inspection of the location CFSU No. 31-33. This location is approximately three miles northeasterly of well 42-7 and was selected as the possible second site for the following reasons:

1. It is situated within the thermal anomally;

2. It is far enough easterly from Forminco No. 1 so that the drilling problems encountered in drilling that well will be minimized; and

3. the results obtained from well 42-7 will have minimal affect on this location.

The lease sale on the existing federal lands within the Cove Fort-Sulphurdale Unit was conducted and the leases were awarded to another operator. The existing surface geological data and subsurface geothermal well data, Forminco Well No. 1, is being prepared to be submitted at a later date.

Yours very truly,

UNION OIL COMPANY OF CALIFORNIA

Delbert E. Pyle
Manager of Operations

DEP:jl
cc :C. Otte
L. Poli
E. Mack

Rev 10-4-77

STANDARD FORM 26, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41CFR) 1-16.101

AWARD/CONTRACT

PAGE 1 OF

1. CONTRACT (Proc. Inst. Ident.) NO.: EG-77-C-08-1522
2. EFFECTIVE DATE: 09-30-77
3. REQUISITION/PURCHASE REQUEST/PROJECT NO.: PR-G08-77-1045
4. CERTIFIED FOR NATIONAL DEFENSE UNDER BDSA REG. 2 AND/OR DMS REG. 1. RATING: N/A

5. ISSUED BY CODE:
U. S. Energy Research & Development Adm.
Nevada Operations Office
P. O. Box 14100
Las Vegas, Nevada 89114

6. ADMINISTERED BY (If other than block 5) CODE:

7. DELIVERY FOB DESTINATION [X] OTHER (See below) [ ]

8. CONTRACTOR NAME AND ADDRESS (Street, city, county, State, and ZIP code) CODE:
Union Oil Company of California
Geothermal Division
Union Oil Center
461 South Boylston Street
Los Angeles, California 90017

FACILITY CODE:

9. DISCOUNT FOR PROMPT PAYMENT: N/A

THIS IS A COPY OF THE EXECUTED DOCUMENT
CONTRACTS & PROCUREMENT DIVISION

10. SUBMIT INVOICES (4 copies unless otherwise specified) TO ADDRESS SHOWN IN BLOCK 12: In duplicate

11. SHIP TO/MARK FOR CODE:
See attached "Schedule"

12. PAYMENT WILL BE MADE BY CODE:
U. S. Energy Research & Development Adm.
Finance Division, NV
P. O. Box 14100
Las Vegas, Nevada 89114

13. THIS PROCUREMENT WAS [ ] ADVERTISED, [X] NEGOTIATED, PURSUANT TO:
[ ] 10 U.S.C. 2304 (a)( )
[X] 41 U.S.C. 252 (c)10

14. ACCOUNTING AND APPROPRIATION DATA

15. ITEM NO.	16. SUPPLIES/SERVICES	17. QUANTITY	18. UNIT	19. UNIT PRICE	20. AMOUNT
	This Contract EG-77-C-08-1522 consists of (1) Schedule (2) Appendix A, General Contract Provisions (3) Appendix B, Intellectual Property Clauses (4) Appendix C, Summary of Estimated Costs, and (5) Appendix D, Performance Schedule, all as attached hereto and made a part hereof.				

21. TOTAL AMOUNT OF CONTRACT: $2,559,258

CONTRACTING OFFICER WILL COMPLETE BLOCK 22 OR 26 AS APPLICABLE

22. [X] CONTRACTOR'S NEGOTIATED AGREEMENT (Contractor is required to sign this document and return 2 copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all the services set forth or otherwise identified above and on any continuation sheets for the consideration stated herein. The rights and obligations of the parties to this contract shall be subject to and governed by the following documents: (a) this award/contract, (b) the solicitation, if any, and (c) such provisions, representations, certifications, and specifications, as are attached or incorporated by reference herein. (Attachments are listed herein.)

23. NAME OF CONTRACTOR
BY _____ (Signature of person authorized to sign)

24. NAME AND TITLE OF SIGNER (Type or print)
Carel Otte
President

25. DATE SIGNED: 09-26-77

26. [ ] AWARD (Contractor is not required to sign this document.) Your offer on Solicitation Number _____, including the additions or changes made by you which additions or changes are set forth in full above; is hereby accepted as to the items listed above and on any continuation sheets. This award consummates the contract which consists of the following documents: (a) the Government's solicitation and your offer, and (b) this award/contract. No further contractual document is necessary.

27. UNITED STATES OF AMERICA
BY Mahlon E. Gates (Signature of Contracting Officer)

28. NAME OF CONTRACTING OFFICER (Type or print)
Mahlon E. Gates, Manager

29. DATE SIGNED: 9/30/77

U.S. GOVERNMENT PRINTING OFFICE : 1967 O—281-035

SCHEDULE

Article 1 STATEMENT OF WORK

A. Except as hereinafter modified, Union Oil Company of California's proposal dated May 27, 1977, submitted in response to RFP EY-R-08-0007 as revised August 31, 1977, is hereby incorporated into and made a part of this Contract No. EG-77-C-08-1522. The Contractor, subject to the provisions of this Contract entitled "Payment," will provide existing data as further specified in the Article entitled "Deliverables" and will use its best efforts to perform the drilling program proposed in its May 27, 1977, proposal and to acquire and deliver to ERDA the resulting new data as enumerated in the Article entitled "Deliverables."

B. The program to acquire new data encompassed by this Contract which is divided into Phases according to ERDA's participation is as follows:

Phase I - Drill Well KGRA 42-7 to approximately 10,000 feet in Section 7, T26S., R6W., S.L.B. & M. Beaver County, State of Utah. Conduct initial flow test.

Phase II - Drill 2nd KGRA Well to approximately 10,000 feet in the Cove Fort - Sulphurdale KGRA. Conduct initial flow test.

Phase III Drill 3rd KGRA Well to approximately 10,000 feet in the Cove Fort - Sulphurdale KGRA.

Phase IV - Conduct short flow test on all wells and perform physical analyses.

Phase V - Perform long term flow, interference and reservoir pressure build-up tests.

Phase VI - If required, perform subsurface well repair following long term flow and interference tests.

C. The Contractor will proceed with due diligence and reasonable dispatch to carry out the program outlined in B., above, substantially in accordance with the performance schedule attached as Appendix D. In the event that circumstances are encountered through which drilling is deemed impossible or impracticable, the Contractor, at its option, may vary the program and continue or terminate the work. In the event the Contractor elects to terminate, the ERDA will be liable only for payment in accordance with the payment provisions of this Contract for materials and services which are delivered on or before the effective date the Contractor ceases performance.

Article 2 DELIVERABLES

A. Limit on Withholding. Except as specifically identified in paragraph D hereunder, none of the Deliverable Data identified under paragraph C of this Article 2, "Deliverables," shall be withheld by the Contractor under the provisions of paragraph E, Withholding of Proprietary Data, of Article B-6, Rights in Technical Data.

B. Delivery Schedule. The Contractor shall deliver the items of Deliverable Data identified in paragraph C, hereunder, in accordance with the following schedule. The bracketed ([]) numbers preceding each item in paragraph C identifies the applicable delivery category in the schedule. Except for cores, cuttings and fluid samples, which will be provided as indicated in the schedule, six copies of each data item shall be delivered.

Schedule for Data Delivery by Category:

[1] Data to be delivered upon commencement of drilling operations in Phase II

[2] Data to be delivered within three months of the completion of each production well

[3] Data to be delivered within three months of completion of third, or final production well

[4] Data to be delivered within three months of completion of each flow test.

[5] Data to be delivered within the five months of completion of field program activity.

[6] Data to be delivered within the term of this Contract or such later time as may be provided by modification.

[7] Data obtained from investigations on or adjacent to unleased Federal lands to be delivered upon issuance of leases on these lands.

[8] Data to be delivered upon removal by the Contractor of proprietary markings, which removal and delivery shall occur upon the issuance of United States Patents covering inventions which are the subject matter of such data.

[9] Delivery to be taken from time to time on an as-produced bases by an ERDA or University of Utah representative at the location or shipped by the Contractor to the University of Utah, if requested by the Contracting Officer.

C. Deliverable Data. Data to be delivered by the Contractor resulting from the performance of its program as set forth in Article 1 "Statement of Work" shall include but not be limited to the following:

(1) Existing Surface Geological Data

a. [1] Temperature Gradient Investigation (6 holes).

b. [1] Surface Geology and Geothermal Manifestation Study.

c. [7] Additional Geological and Geophysical Data.

1) Temperature Gradient Holes Investigation (19 holes)

2) Seismic Survey

3) Resistivity Study

4) Gravity Measurements

5) Geochemical Surveys

(2) Existing Subsurface Geothermal Well Data, Forminco Well No. 1

a. [1] Complete Drilling History

b. [1] Drill cutting samples (washed, dried and identified)

c. [1] Geological Report

d. [1] Summary of Technical Conclusions from Drilling of Forminco No. 1 Well with the exception of the procedures for consolidation of caving formations, item 10 below

(3) New Subsurface Geothermal Well Data

a. [2] Drilling Technology.

b. [2] Drilling Histories.

c. [2] Formation Evaluation and Auxiliary Logs.

d. [3] Core Analysis.

e. [4] Fluid Chemical Analyses.

f. [5] Well Scaling and Corrosion.

(4) New Surface Test System Operational Data

a. [5] Pipeline Design.

b. [5] Separator Design.

c. [5] Flow Test System Design.

d. [5] Plant Scaling and Corrosion Experiments.

e. [5] Metallurgical Studies.

(5) New Reservoir Engineering Studies and/or Analysis

a. [4] Flow Testing.

b. [5] Pressure Drawdown and Buildup Analysis.

c. [5] Isotope Studies.

(6) [9] Drill Cutting Samples (washed, dried and identified).

(7) [9] Reservoir Fluid Samples (containers to be furnished by ERDA).

(8) [9] Core Samples (subject to operational priorities of Contractor for performing its program, the Contractor and ERDA or the University of Utah representative will determine the core samples to be delivered).

(9) [6] Reservoir Assessment Study and Optimum Development Plan.

(10) [8] Procedure for Consolidation of Caving Formations.

D. Data to be Withheld

It is understood and agreed that the Contractor may withhold under the provisions of paragraph E, "Withholding of Proprietary Data," of Article B-6, "Rights in Technical Data," any proprietary data contained in any Deliverable Data item identified in paragraph C above, but only until the time set for the delivery of the item by the schedule of paragraph B, at which time the item shall be delivered on a non-proprietary basis.

It is further understood and agreed that none of the following shall be delivered under this Contract:

1. Geophysical surveys utilizing scalar magnetotellurics, ground noise and microearthquake mapping, or airborne magnetic survey, all of which shall remain the property of third parties.

2. Detailed description of the experimental energy source utilized in the conduct of the seismic survey.

3. All computer programs utilized in calculations and evaluations relating to geothermal well bore and production characteristics, geothermal pipeline gathering systems and separators, and reservoir simulation, including well interference tests, and

4. All information developed by the Contractor or its subsidiaries pursuant to this Contract, or elsewhere, except:

a. Deliverable Data identified in paragraph C, above,

b. information directly know to ERDA,

c. information which is known or becomes known by the general public, through acts of parties other than ERDA,

d. information received by ERDA from a third party who did not obtain it from the Contractor under an obligation of confidence, and

e. information voluntarily released by the Contractor.

Article 3 REPORTING INSTRUCTIONS

A. A monthly Technical Progress Report shall be submitted by the Contractor within 15 days after the month end. Each report will briefly describe the activities during the past month, significant problems encountered, proposed solution to the problems and the planned activities for the coming months. Copies shall be furnished in accordance with paragraph D, below.

B. The Reservoir Assessment Study and Optimum Development Plan shall be submitted as set forth in Article 2 "Deliverables." The ERDA 76/72, Requirements and Procedures for Reporting Geothermal Information shall apply as outlined in its Section II and III. The ERDA Technical Information Center (TIC) will duplicate and distribute reports as indicated in Section IV.C., D and E of the Procedures and distribution will be in Category UC-66a, and will be so indicated on the report title page. Copies shall be furnished in accordance with paragraph D, below, including submittal of the draft final report for review and approval of the format and content. All comments will be compiled by the Contracting Officer who will notify the Contractor of approval or recommended changes to be made in the report.

C. Monthly Financial Management Report

Financial Management Reports shall be submitted by the Contractor to the Contracting Officer not later than the 15th calendar day of each month following the close of the Contractor's accounting month being reported.

The report shall contain a separate sheet(s) for each major program phase. In addition, a summary sheet shall be prepared for the total Contract.

The following sheet shall include, but not be limited to, the following information:

(1) Name and address of the Contractor, name and phone number of person preparing the report.

(2) ERDA Contract Number

(3) Reporting period (previous month for which actual costs is being reported).

(4) Actual costs incurred on an accrual basis for the previous month.

(5) Year (Federal Government fiscal year) to date actual costs incurred on an accrual basis.

(6) Cumulative actual cost incurred on an accrual basis since Contract inception through the previous month.

(7) Estimate of costs to be incurred on an accrual basis for the current month.

(8) Estimate of costs from inception to completion of the Contract.

D. Data and Report Distribution

Six copies of all deliverables and reports as described above shall be furnished by the Contractor of which two copies each shall be submitted to the following individuals and offices:

Dr. John W. Salisbury
Div. of Geothermal Energy (M/S 31220)
U. S. Energy Research & Development Administration
20 Massachusetts Avenue
Washington, D. C. 20545

Contracting Officer
U. S. Energy Research & Development Administration
Nevada Operations Office
P. O. Box 14100
Las Vegas, Nevada 89114

Dr. Howard Ross
Earth Sciences Laboratory
University of Utah Research Park
391 Chipeta Way
Salt Lake City, Utah 84108

Article 4 PAYMENT

A. For Program to Acquire New Data

(1) For performance of the work under this Contract, the Contractor shall be entitled to reimbursement for the actual costs of the materials and services furnished by third parties up to a maximum of $2,001,000; the said maximum reimbursement is subject to the Article entitled "Availability of Appropriated Funds." Listed below by each program phase are the expected costs to be reimbursed by ERDA. (See Appendix C for details of these costs by activity).

Phase		
I	Drilling KGRA Well 42-7	$ 582,000
II	Drilling KGRA Well # 2	554,000
III	Drilling KGRA Well # 3	554,000
IV	Short flow test on all Wells	55,000
V	Long term flow, interference, and pressure build-up tests	156,000
VI	Subsurface Well Repair (if required)	100,000
		$2,001,000

To be reimbursed by ERDA, the cost of these materials and services must be based on established catalog or market prices of commercial items sold in substantial quantities to the general public.

The total liability of ERDA under this paragraph A for each separate phase of the work is as set forth above, except that any funds remaining from a cost underrun of one phase may be used to offset cost

overruns in succeeding phases as performed. It is expressly understood, however, that any and all costs incurred by the Contractor in the performance of the work under this paragraph A in excess of $2,001,000, the amount to be reimbursed by ERDA, shall be borne by the Contractor up to a maximum of $2,352,500 for a total estimated program cost of $4,353,500.

(2) Payments for the categories of materials and services noted in paragraph (1) above shall be made upon the submittal of monthly invoices to ERDA, supported by copies of the paid invoices of the third parties who have performed work under this Contract which shall be accompanied by copies of delivery tickets or other documents, such as receiving reports, indicating the actual receipt of materials and services.

Each invoice shall contain the check number and date of payment of that invoice. The ERDA shall deduct from Contractor's invoices any discounts, refunds, rebates, or salvage allowances offered by vendors whether or not the Contractor has taken advantage of such benefits, except in those cases where the Contractor provides in writing a valid explanation for failure to take advantage of such deductions.

The Contractor shall assure that the prices contained in the vendor's invoices correspond with the prices in the procurement action between the Contractor and the vendor, and shall be responsible for any errors resulting in overcharges to ERDA.

The Contractor agrees to utilize and maintain acceptable accounting procedures to provide for the segregation and accounting of costs allowable to the various phases of work under this Contract.

(3) The sum of $5,000 will be withheld from the final claim for reimbursement under (2) above pending Contract completion. Said sum shall be paid to the Contractor upon delivery, acceptance and availability for public release of all data required by this Contract.

(4) The cost estimates of Appendix C for each phase of the work may change due to unforeseen circumstances. Should unforeseen circumstances be encountered or if a Contract change be recommended by one of the parties, it is agreed that both parties will meet and give good faith consideration to a Contract modification to expeditiously and equitably deal with the circumstances. Any such Contract modification must be mutually agreed to by the parties, in writing, and may deal with changes in the job description, the payment schedule for the amount of each party's contribution or any other modification.

B. For Existing Data

The ERDA agrees to purchase the existing data as defined in paragraph C (1) and (2) of the Article entitled "Deliverables" as follows:

(1) For the data defined in C (1) a. and b. and C (2), the lump sum of $490,821;

(2) For the data defined in C (1) c, the lump sum of $67,437.

Subject to the Article of this Contract entitled "Availability of Appropriated Funds," the $490,821 shall be paid to the Contractor upon delivery to and acceptance by ERDA of all the data specified upon the commencement of drilling operations in Phase II and the $67,437 shall be paid upon delivery to and acceptance by ERDA of all the data specified. Subject to the above, payments shall be made upon submittal of the Contractor's invoices detailing the data so delivered.

C. The total estimated program cost including the acquisition cost of $765,179 for existing data in paragraph B, above, is $5,118,679 of which ERDA's maximum cost is $2,559,258. The amount presently obligated by ERDA for this Contract is $582,000. Such amount may be increased unilaterally by ERDA by written notice to the Contractor and may be decreased by written agreement of the parties. In addition to the presently obligated sum of $582,000, ERDA intends, subject to appropriated funds, to obligate $1,977,258 in future Government Fiscal Years thereby increasing the total obligation to $2,559,258. The obligation of the said $1,977,258 is subject to the provisions of the Article of this Contract entitled, "Availability of Appropriated Funds."

Article 5 TERM

The term of this Contract shall be from September 23, 1977, through June 30, 1981, unless sooner terminated in accordance with the provisions of this Contract entitled "Termination for Convenience of the Government," "Availability of Appropriated Funds" or "Statement of Work."

Article 6 OWNERSHIP OF PROPERTY

It is understood that ERDA will not acquire any right, title or interest in the leased land, wells and appurtenant facilities by virtue of this Contract.

Article 7 APPENDICES

Appendix A, "General Contract Provisions," Appendix B, "Intellectual Property Clauses," (NVSS-8/77) Appendix C, "Summary of Estimated Costs" and Appendix D "Performance Schedule" which are attached hereto, and made a part of this Contract except that Appendices A and B are modified in the following particulars:

A. Article A-20, "Subcontracts" of Appendix A is amended as follows:

(1) The first sentence of paragraph a is revised to read as follows:

"a. The Contractor shall notify the Contracting Officer reasonably in advance of entering into any subcontract estimated to exceed $25,000."

(2) Paragraph e is added to read as follows:

"e. In addition to the above, the procurement of materials and services by third parties for which ERDA reimbursement is provided shall be in accordance with Procurement Instructions for Contract EG-77-C-08-1522, dated September 23, 1977, provided the Contractor by the Contracting Officer.

B. Appendix B is amended by deleting paragraph g, "Limited Rights in Proprietary Data" and paragraph h "Contractor Licensing" of Article B-6 "Rights in Technical Data" and replacing the first three 3 lines of paragraph e., Withholding of Proprietary Data" with the following:

"Except as provided in Article 2 entitled "Deliverables" the Contractor ——"

APPENDIX A

GENERAL CONTRACT PROVISIONS

ARTICLE A-1. ASSIGNMENT OF CLAIMS

a. Pursuant to the provisions of the Assignment of Claims Act of 1940, as amended (31 USC 203, 41 USC 15), if this Contract provides for payments aggregating $1,000 or more, claims for moneys due or to become due the Contractor from the Government under this Contract may be assigned to a bank, trust company, or other financing institution, including any Federal lending agency, and may thereafter be further assigned and reassigned to any such institution. Any such assignment or reassignment shall cover all amounts payable under this Contract and not already paid, and shall not be made to more than one party, except that any such assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in such financing. Unless otherwise provided in this Contract, payments to assignee of any moneys due or to become due under this Contract shall not, to the extent provided in said Act, as amended, be subject to reduction or setoff. (The preceding sentence applies only if this Contract is made in time of war or national emergency as defined in said Act and is with the Department of Defense, the General Services Administration, the Energy Research and Development Administration, the National Aeronautics and Space Administration, the Federal Aviation Agency, or any other department or agency of the United States designated by the President pursuant to Clause 4 of the proviso of Section 1 of the Assignment of Claims Act of 1940, as amended by the Act of May 15, 1951, 65 Stat. 41.)

b. In no event shall copies of this Contract or of any plans, specifications, or other similar documents relating to work under this Contract, if marked "Top Secret," "Secret," or "Confidential," be furnished to any assignee of any claim arising under this Contract or to any other person not entitled to receive the same. However, a copy of any part or all of this Contract so marked may be furnished, or any information contained therein may be disclosed, to such assignee upon the prior written authorization of the Contracting Officer.

ARTICLE A-2. BUY AMERICAN ACT

a. In acquiring end products, the Buy American Act (41 USC 10a-d) provides that the Government give preference to domestic source end products. For the purpose of this Article:

(1) "Components" means those articles, materials, and supplies which are directly incorporated in the end products;

(2) "End Products" means those articles, materials, and supplies which are to be acquired under this Contract for public use; and

(3) A "Domestic Source End Product" means (i) an unmanufactured end product which has been mined or produced in the United States and (ii) an end product manufactured in the United States if the cost of the components thereof which are mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. For the purpose of this a.(3)(ii), components of foreign origin of the same type or kind as products referred to in b.(2) or (3) of this Article shall be treated as components mined, produced, or manufactured in the United States.

b. The Contractor agrees that there will be delivered under this Contract only domestic source end products, except end products:

(1) Which are for use outside the United States;

(2) Which the Government determines are not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality;

(3) As to which the ERDA determines the domestic preference to be inconsistent with the public interest; or

(4) As to which the ERDA determines the cost to the Government to be unreasonable.

(The foregoing requirements are administered in accordance with Executive Order 10582, dated December 17, 1954.)

ARTICLE A-3. CLEAN AIR AND WATER

(Applicable only if the Contract exceeds $100,000, or the Contracting Officer has determined that the orders under an indefinite quantity contract in any one year will exceed $100,000, or a facility to be used has been the subject of a conviction under the Clean Air Act (42 USC 1857c-8(c)(1)) or the Federal Water Pollution Control Act (33 USC 1319(c)) and is listed by EPA, or the Contract is not otherwise exempt.)

a. The Contractor agrees as follows:

(1) To comply with all the requirements of Section 114 of the Clean Air Act, as amended (42 USC 1857, et seq., as amended by Public Law 91-604), and Section 308 of the Federal Water Pollution Control Act (33 USC 1251, as amended by Public Law 92-500), respectively, relating to inspection, monitoring, entry, reports, and information, as well as other requirements

specified in Section 114 and Section 308 of the Air Act and the Water Act, respectively, and all regulations and guidelines issued thereunder before the award of this Contract.

(2) That no portion of the work required by this prime contract will be performed in a facility listed on the Environmental Protection Agency list of violating facilities on the date when this Contract was awarded unless and until the EPA eliminates the name of such facility or facilities from such listing.

(3) To use his best efforts to comply with clean air standards and clean water standards at the facilities in which the Contract is being performed.

(4) To insert the substance of the provisions of this Article in any nonexempt subcontract, including this paragraph (4).

b. The terms used in this Article have the following meanings:

(1) The term "Air Act" means the Clean Air Act, as amended (42 USC 1857 et seq., as amended by Public Law 91-604).

(2) The term "Water Act" means Federal Water Pollution Control Act, as amended (33 USC 1251 et seq., as amended by Public Law 92-500).

(3) The term "clean air standards" means any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, or other requirements which are contained in, issued under, or otherwise adopted pursuant to the Air Act or Executive Order 11738, an applicable implementation plan as described in Section 110(d) of the Clean Air Act (42 USC 1857c-5(d)), an approved implementation procedure or plan under Section 111(c) or Section 111(d), respectively, of the Air Act (42 USC 1857c-6(c) or (d)), or an approved implementation procedure under Section 112(d) of the Air Act (42 USC 1857c-7(d)).

(4) The term "clean water standards" means any enforceable limitation, control, condition, prohibition, standard, or other requirement which is promulgated pursuant to the Water Act or contained in a permit issued to a discharger by the Environmental Protection Agency or by a state under an approved program, as authorized by Section 402 of the Water Act (33 USC 1342), or by a local government to ensure compliance with pretreatment regulations as required by Section 307 of the Water Act (33 USC 1317).

(5) The term "compliance" means compliance with clean air or water standards. Compliance shall also mean compliance with a

schedule or plan ordered or approved by a court of competent jurisdiction, the Environmental Protection Agency, or an air or water pollution control agency in accordance with the requirement of the Air Act or Water Act and regulations issued pursuant thereto.

(6) The term "facility" means any building, plant, installation, structure, mine, vessel, or other floating craft, location, or site of operations, owned, leased, or supervised by a contractor, subcontractor, to be utilized in the performance of a contract or subcontract. Where a location or site of operations contains or includes more than one building, plant, installation, or structure, the entire location shall be deemed to be a facility except where the Director, Office of Federal Activities, Environmental Protection Agency, determines that independent facilities are colocated in one geographical area.

ARTICLE A-4. COMPETITION IN SUBCONTRACTING

The Contractor shall select subcontractors (including suppliers) on a competitive basis to the maximum practicable extent consistent with the objectives and requirements of the Contract.

ARTICLE A-5. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT--OVERTIME COMPENSATION

This Contract, to the extent that it is of a character specified in the Contract Work Hours and Safety Standards Act (40 USC 327-333), is subject to the following provisions and to all other applicable provisions and exceptions of such Act and the regulations of the Secretary of Labor thereunder.

a. Overtime Requirements. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers, mechanics, apprentices, trainees, watchmen, and guards shall require or permit any laborer, mechanic, apprentice, trainee, watchman, or guard in any workweek in which he is employed on such work to work in excess of eight hours in any calendar day or in excess of forty hours in such workweek on work subject to the provisions of the Contract Work Hours and Safety Standards Act unless such laborer, mechanic, apprentice, trainee, watchman, or guard receives a compensation at a rate not less than one and one-half times his basic rate of pay for all such hours worked in excess of eight hours in any calendar day or in excess of forty hours in such workweek, whichever is the greater number of overtime hours.

b. Violation; Liability for Unpaid Wages; Liquidated Damages. In the event of any violation of the provisions of paragraph a., the Contractor and any subcontractor responsible therefor shall be

liable to any affected employee for his unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer, mechanic, apprentice, trainee, watchman, or guard employed in violation of the provisions of paragraph a. in the sum of $10 for each calendar day on which such employee was required or permitted to be employed on such work in excess of eight hours or in excess of the standard workweek of forty hours without payment of the overtime wages required by paragraph a.

c. Withholding for Unpaid Wages and Liquidated Damages. The Contracting Officer may withhold from the Government Prime Contractor, from any moneys payable on account of work performed by the Contractor or subcontractor, such sums as may administratively be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the provisions of paragraph b.

d. Subcontracts. The Contractor shall insert paragraphs a. through d. of this Article in all subcontracts, and shall require their inclusion in all subcontracts of any tier.

e. Records. The Contractor shall maintain payroll records containing the information specified in 29 CFR 516.2(a). Such records shall be preserved for three (3) years from the completion of the Contract.

ARTICLE A-6. CONVICT LABOR

In connection with the performance of work under this Contract, the Contractor agrees not to employ any person undergoing sentence of imprisonment except as provided by Public Law 89-176, September 10, 1965 (18 USC 4082(c)(2)) and Executive Order 11755, December 29, 1973.

ARTICLE A-7. COVENANT AGAINST CONTINGENT FEES

a. Warranty--Termination or Deduction for Breach. The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this Contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this Contract without liability or in its discretion to deduct from the contract price or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

b. Subcontracts and Purchase Orders. Unless otherwise authorized by the Contracting Officer in writing, the Contractor shall cause

provisions similar to the foregoing to be inserted in all subcontracts and purchase orders entered into under this Contract.

ARTICLE A-8. DEFINITIONS

As used throughout this Contract, the following terms shall have the meanings set forth below:

a. The term "ERDA" means the United States Energy Research and Development Administration or any duly authorized representative thereof, including the Contracting Officer, except for the purpose of deciding an appeal under the Article entitled "Disputes."

b. The term "Contracting Officer" means the person executing this Contract on behalf of the Government, and any other officer or civilian employee who is a properly designated Contracting Officer, and the term includes, except as otherwise provided in this Contract, the authorized representative of a Contracting Officer acting within the limits of his authority.

c. Except as otherwise provided in this Contract, the term "subcontract" includes purchase orders under this Contract.

ARTICLE A-9. DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA

a. The Contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran or veteran of the Vietnam era in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified disabled veterans and veterans of the Vietnam era without discrimination based upon their disability or veterans status in all employment practices such as the following: employment upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

b. The Contractor agrees that all suitable employment openings of the Contractor which exist at the time of the execution of this Contract and those which occur during the performance of this Contract, including those not generated by this Contract and including those occurring at an establishment of the Contractor other than the one wherein the Contract is being performed but excluding those of independently operated corporate affiliates, shall be listed at an appropriate local office of the State employment service system wherein the opening occurs. The Contractor further agrees to provide such reports to such local office regarding employment openings and hires as may be required.

State and local government agencies holding Federal contracts of $10,000 or more shall also list all their suitable openings with the appropriate office of the State employment service, but are not required to provide those reports set forth in paragraphs d. and e.

c. Listing of employment openings with the employment service system pursuant to this Article shall be made at least concurrently with the use of any other recruitment service or effort and shall involve the normal obligations which attach to the placing of a bona fide job order, including the acceptance of referrals of veterans and nonveterans. This listing of employment openings does not require the hiring of any particular job applicant or from any particular group of job applicants, and nothing herein is intended to relieve the Contractor from any requirements in executive orders or regulations regarding nondiscrimination in employment.

d. The reports required by paragraph b. of this Article shall include, but not be limited to, periodic reports which shall be filed at least quarterly with the appropriate local office or, where the Contractor has more than one hiring location in a State, with the central office of that State employment service. Such reports shall indicate for each hiring location (i) the number of individuals who were hired during the reporting period, (ii) the number of nondisabled veterans of the Vietnam era hired, (iii) the number of disabled veterans of the Vietnam era hired, and (iv) the total number of disabled veterans hired. The reports should include covered veterans hired for on-the-job training under 38 USC 1787. The Contractor shall submit a report within 30 days after the end of each reporting period wherein any performance is made on this Contract. The Contractor shall maintain at each hiring location copies of the reports submitted until the expiration of one year after final payment under the Contract, during which time these reports and related documentation shall be made available, upon request, for examination by any authorized representatives of the Contracting Officer or of the Secretary of Labor. Documentation would include personnel records respecting job openings, recruitment, and placement.

e. Whenever the Contractor becomes contractually bound by the listing provisions of this Article, it shall advise the employment service system in each State wherein it has establishments of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these provisions and has so advised the State employment system, there is no need to advise the State system of subsequent contracts. The Contractor may advise the State system when it is no longer bound by this Contract Article.

f. This Article does not apply to the listing of employment openings which occur and are filled outside of the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, and the Virgin Islands.

g. The provisions of paragraphs b., c., d., and e. of this Article do not apply to openings which the Contractor proposes to fill from within its own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement. This exclusion does not apply to a particular opening once an employer decides to consider applicants outside of its own organization or employer-union arrangement for that opening.

h. As used in this Article:

(1) "All suitable employment openings" includes, but is not limited to, openings which occur in the following job categories: production and nonproduction; plant and office; laborers and mechanics; supervisory and nonsupervisory; technical; and executive, administrative, and professional openings which are compensated on a salary basis of less than $25,000 per year. The term includes full-time employment, temporary employment of more than three days' duration, and part-time employment. It does not include openings which the Contractor proposes to fill from within its own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement nor openings in an educational institution which are restricted to students of that institution. Under the most compelling circumstances, an employment opening may not be suitable for listing, including such situations where the needs of the Government cannot reasonably be otherwise supplied, where listing would be contrary to national security, or where the requirement of listing would otherwise not be for the best interest of the Government.

(2) "Appropriate office of the State employment service system" means the local office of the Federal-State national system of public employment offices with assigned responsibility for serving the area where the employment opening is to be filled, including the District of Columbia, the Commonwealth of Puerto Rico, Guam, and the Virgin Islands.

(3) "Openings which the Contractor proposes to fill from within its own organization" means employment openings for which no consideration will be given to persons outside the Contractor's own organization (including any affiliates, subsidiaries, and parent companies), and includes any openings which the Contractor proposes to fill from regularly established "recall" lists.

(4) "Openings which the Contractor proposes to fill pursuant to a customary and traditional employer-union hiring arrangement" means employment openings which the Contractor proposes to fill from union halls, which is part of the customary and traditional hiring relationship which exists between the Contractor and representatives of its employees.

i. The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

j. In the event of the Contractor's noncompliance with the requirements of this Article, actions for noncompliance may be taken in accordance with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

k. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices in a form to be prescribed by the Director, provided by or through the Contracting Officer. Such notice shall state the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era for employment, and the rights of applicants and employees.

l. The Contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding that the Contractor is bound by terms of the Vietnam Era Veteran's Readjustment Assistance Act and is committed to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era.

m. The Contractor will include the provisions of this Article in every subcontract or purchase order of $10,000 or more unless exempted by rules, regulations, or orders of the Secretary issued pursuant to the Act, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for noncompliance.

ARTICLE A-10. DISPUTES

a. Except as otherwise provided in this Contract, any dispute concerning a question of fact arising under this Contract which is not disposed of by agreement shall be decided by the Contracting Officer, who shall reduce his decision to writing and mail or otherwise furnish a copy thereof to the Contractor. The decision of the Contracting Officer shall be final and conclusive unless within 30 days from the date of receipt of such copy, the Contractor mails or otherwise furnishes to the Contracting Officer a written appeal addressed to the Administration. The decision of the Administration or its duly authorized representative for the determination of such appeals shall be final and conclusive unless determined by a court of competent jurisdiction to have been fraudulent, or capricious, or arbitrary, or so grossly erroneous as necessarily to imply bad faith, or not supported by substantial evidence. In connection

with any appeal proceeding under this Article, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of its appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the Contract and in accordance with the Contracting Officer's decision.

b. This "Disputes" Article does not preclude consideration of law questions in connection with decision provided for in paragraph a. above, PROVIDED, that nothing in this Contract shall be construed as making final the decision of any administrative official, representative, or board on a question of law.

ARTICLE A-11. EMPLOYMENT OF THE HANDICAPPED

a. The Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment, and otherwise treat qualified handicappped individuals without discrimination based upon their physical or mental handicap in all employment practices such as the following: employment, upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

b. The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Rehabilitation Act of 1973, as amended.

c. In the event of the Contractor's noncompliance with the requirements of this Article, actions for noncompliance may be taken in accordance with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

d. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, Office of Federal Contract Compliance Programs, Department of Labor, provided by or through the Contracting Officer. Such notices shall state the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.

e. The Contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Contractor is bound by the terms of Section 503 of the Act, and is committed to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.

f. The Contractor will include the provisions of this Article in every subcontract or purchase order of $2,500 or more unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the Director, Office of Federal Contract Compliance Programs, may direct to enforce such provisions, including action for non-compliance.

ARTICLE A-12. EQUAL OPPORTUNITY

(The following Article is applicable unless this Contract is exempt under the rules, regulations, and relevant orders of the Secretary of Labor (41 CFR Ch 60).)

During the performance of this Contract, the Contractor agrees as follows:

a. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Contracting Officer setting forth the provisions of this Equal Opportunity Article.

b. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

c. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency Contracting Officer, advising the labor union or workers' representative of the Contractor's commitments under this Equal Opportunity Article, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

d. The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

e. The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

f. In the event of the Contractor's noncompliance with the Equal Opportunity Article of this Contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended, in whole or in part, and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in the Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

g. The Contractor will include the provisions of paragraphs a. through g. in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing such provisions, including sanctions for noncompliance; PROVIDED, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

ARTICLE A-13. EXAMINATION OF RECORDS

a. The Contractor agrees that the Comptroller General of the United States, the ERDA, or any of their duly authorized representatives shall, until the expiration of three (3) years after final payment under this Contract or such lesser time specified in either Appendix M of the Armed Services Procurement Regulations or the Federal Procurement Regulations Part 1-20, as appropriate, have access to and the right to examine any directly pertinent books, documents, papers, and records of the Contractor involving transactions related to this Contract.

b. The Contractor further agrees to include in all his subcontracts hereunder a provision to the effect that the subcontractor agrees that the Comptroller General of the United States, the ERDA, or any of their duly authorized representatives shall, until the expiration of three (3) years after final payment under the subcontract or

such lesser time specified in either Appendix M of the Armed Services Procurement Regulations or the Federal Procurement Regulations Part 1-20, as appropriate, have access to and the right to examine any directly pertinent books, documents, papers, and records of such subcontractor involving transactions related to the subcontract. The term "subcontract" as used in this Article excludes (i) purchase orders not exceeding $10,000 and (ii) subcontracts or purchase orders for public utility services at rates established for uniform applicability to the general public.

c. The periods of access and examination described in a. and b. above, for records which relate to (i) appeals under the "Disputes" Article of this Contract, (ii) litigation or the settlement of claims arising out of the performance of this Contract, or (iii) costs and expenses of this Contract as to which exception has been taken by the Comptroller General, the ERDA, or any of their duly authorized representatives, shall continue until such appeals, litigations, claims, or exceptions have been disposed of.

ARTICLE A-14. INSPECTION

The Government, through any authorized representatives, has the right at all reasonable times to inspect or otherwise evaluate the work performed or being performed hereunder and the premises in which it is being performed. If any inspection or evaluation is made by the Government on the premises of the Contractor or a subcontractor, the Contractor shall provide and shall require his subcontractors to provide all reasonable facilities and assistance for the safety and convenience of the Government representatives in the performance of their duties. All inspections and evaluations shall be performed in such a manner as will not unduly delay the work.

ARTICLE A-15. OFFICIALS NOT TO BENEFIT

No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this Contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this Contract if made with a corporation for its general benefit.

ARTICLE A-16. PAYMENT OF INTEREST ON CONTRACTORS' CLAIMS

a. If an appeal is filed by the Contractor from a final decision of the Contracting Officer under the "Disputes" Article of this Contract, denying a claim arising under the Contract, simple interest on the amount of the claim finally determined owed by the Government shall be payable to the Contractor. Such interest shall be at the rate determined by the Secretary of the Treasury pursuant to Public Law 92-41, 85 Stat. 97, from the date the Contractor furnishes to the Contracting Officer his written appeal under the "Disputes" Article of this Contract, to the date of (1) a final judgment by a

court of competent jurisdiction, or (2) mailing to the Contractor of a supplemental agreement for execution either confirming completed negotiations between the parties or carrying out a decision of a board of contract appeals.

b. Notwithstanding a. above, (1) interest shall be applied only from the date payment was due, if such date is later than the filing of appeal, and (2) interest shall not be paid for any period of time that the Contracting Officer determines the Contractor has unduly delayed in pursuing his remedies before a board of contract appeals or a court of competent jurisdiction.

ARTICLE A-17. PERMITS

Except as otherwise directed by the Contracting Officer, the Contractor shall procure all necessary permits or licenses and abide by all applicable laws, regulations, and ordinances of the United States and of the State, territory, and political subdivision in which the work under this Contract is performed.

ARTICLE A-18. RENEGOTIATION

If this Contract is subject to the Renegotiation Act of 1951, as amended, the following provisions shall apply:

a. This Contract is subject to the Renegotiation Act of 1951 (50 USC, App. 1211, et seq.), as amended, and to any subsequent act of Congress providing for the renegotiation of contracts. Nothing contained in this Article shall impose any renegotiation obligation with respect to this Contract or any subcontract hereunder which is not imposed by an act of Congress heretofore or hereafter enacted. Subject to the foregoing, this Contract shall be deemed to contain all the provisions required by Section 104 of the Renegotiation Act of 1951, and by any such other act, without subsequent contract amendment specifically incorporating such provisions.

b. The Contractor agrees to insert the provisions of this Article, including this paragraph b., in all subcontracts, as that term is defined in Section 103.g. of the Renegotiation Act of 1951, as amended.

ARTICLE A-19. SERVICE CONTRACT ACT OF 1965, AS AMENDED

This Contract, to the extent that it is of the character to which the Service Contract Act of 1965 (79 Stat. 1034, 41 USC 351) applies, is subject to the following provisions and to all other applicable provisions of the Act and regulations of the Secretary of Labor thereunder.

a. Compensation. Each service employee employed in the performance of this Contract by the Contractor or any subcontractor shall be paid

not less than the minimum monetary wage and shall be furnished fringe benefits in accordance with the wages and fringe benefits determined by the Secretary of Labor or his authorized representative, as specified in any attachment to this Contract. If there is such an attachment, any class of service employees which is not listed therein, but which is to be employed under this Contract, shall be classified by the Contractor so as to provide a reasonable relationship between such classifications and those listed in the attachment, and shall be paid such monetary wages and furnished such fringe benefits as are determined by agreement of the interested parties, who shall be deemed to be the contracting agency, the Contractor, and the employees who will perform on the Contract or their representatives. If the interested parties do not agree on a classification or reclassification which is, in fact, conformable, the Contracting Officer shall submit the question, together with his recommendation, to the Office of Special Wage Standards, Employment Standards Administration (ESA), of the Department of Labor for final determination. Failure to pay such employees the compensation agreed upon by the interested parties or finally determined by the Administrator or his authorized representative shall be a violation of this Contract. No employee engaged in performing work on this Contract shall in any event be paid less than the minimum wage specified under Section 6(a)(1) of the Fair Labor Standards Act of 1938, as amended.

b. Adjustment. If, as authorized pursuant to Section 4(d) of the Service Contract Act of 1965, as amended, the term of this Contract is more than 1 year, the minimum monetary wages and fringe benefits required to be paid or furnished thereunder to service employees shall be subject to adjustment after 1 year and not less often than once every 2 years, pursuant to wage determinations to be issued by the Employment Standards Administration of the Department of Labor as provided in such Act.

c. Obligation to Furnish Fringe Benefits. The Contractor or subcontractor may discharge the obligation to furnish fringe benefits specified in the attachment or determined conformably thereto by furnishing any equivalent combinations of fringe benefits, or by making equivalent or differential payments in cash in accordance with the applicable rules set forth in 29 CFR Part 4, subparts B and C, and not otherwise.

d. Minimum Wage. In the absence of a minimum wage attachment for this Contract, neither the Contractor nor any subcontractor under this Contract shall pay any of his employees performing work under the Contract (regardless of whether they are service employees) less than the minimum wage specified by Section 6(a)(1) of the Fair Labor Standards Act of 1938. Nothing in this provision shall relieve the Contractor or any subcontractor of any other obligation under law or contract for payment of a higher wage to any employee.

e. Obligations Attributable to Predecessor Contracts. If this Contract succeeds a contract, subject to the Service Contract Act of 1965, as amended, under which substantially the same services were furnished and service employees were paid wages and fringe benefits provided for in a collective bargaining agreement, then in the absence of a minimum wage attachment for this Contract neither the Contractor nor any subcontractor under this Contract shall pay any service employee performing any of the contract work less than the wages and fringe benefits, provided for in such collective bargaining agreements, to which such employee would be entitled if employed under the predecessor contract, including accrued wages and fringe benefits provided for under such agreement. No Contractor or subcontractor under this Contract may be relieved of the foregoing obligation unless the Secretary of Labor or his authorized representative determines that the collective bargaining agreement apppplicable to service employees employed under the predecessor contract was not entered into as a result of arms-length negotiations, or finds, after a hearing as provided for in Department of Labor regulations, 29 CFR 4.10, that the wages and fringe benefits provided for in such agreement are substantially at variance with those which prevail for services of a character similar in the locality.

f. Notification to Employees. The Contractor and any subcontractor under this Contract shall notify each service employee commencing work on this Contract of the minimum monetary wage and any fringe benefits required to be paid pursuant to this Contract or shall post a notice of such wages and benefits in a prominent and accessible place at the work site, using such poster as may be provided by the Department of Labor.

g. Safe and Sanitary Working Conditions. The Contractor or subcontractor shall not permit any part of the services called for by this Contract to be performed in buildings or surroundings or under working conditions provided by or under the control or supervision of the Contractor or subcontractor which are unsanitary or hazardous or dangerous to the health or safety of service employees engaged to furnish these services, and the Contractor or subcontractor shall comply with the safety and health standards applied under 29 CFR Part 1925.

h. Records. The Contractor and each subcontractor performing work subject to the Act shall make and maintain for 3 years from the completion of the work, records containing the information specified in subparagraphs (1) through (5) of this paragraph for each employee subject to the Act and shall make them available for inspection and transcription by authorized representatives of the Employment Standards Administration of the U.S. Department of Labor.

(1) His name and address.

(2) His work classification or classifications, rate or rates of monetary wages and fringe benefits provided, rate or rates of fringe benefit payments in lieu thereof, and total daily and weekly compensation.

(3) His daily and weekly hours so worked.

(4) Any deductions, rebates, or refunds from his total daily or weekly compensation.

(5) A list of monetary wages and fringe benefits for those classes of service employees not included in the minimum wage attachment to this Contract, but for which such wage rates or fringe benefits have been determined by the interested parties or by the Administrator or his authorized representative pursuant to the Labor Standards clause in paragraph (a) of this Article. A copy of the report required in paragraph m.(1) of this Article shall be deemed to be such a list.

i. Withholding of Payment and Termination of Contract. The Contracting Officer shall withhold or cause to be withheld from the Government Prime Contractor under this or any other Government contract with the Prime Contractor such sums as he, or an appropriate officer of the Department of Labor, decides may be necessary to pay underpaid employees. Additionally, any failure to comply with the requirements of this Article relating to the Service Contract Act of 1965 may be grounds for termination of the right to proceed with the contract work. In such event, the Government may enter into other contracts or arrangements for completion of the work, charging the Contractor in default with any additional costs.

j. Subcontractors. The Contractor agrees to insert this Article relating to the Service Contract Act of 1965 in all subcontracts. The term "Contractor" as used in this Article in any subcontract shall be deemed to refer to the subcontractor, except in the term "Government Prime Contractor."

k. Service Employee. As used in this Article relating to the Service Contract Act of 1965, the term "service employee" means guards, watchmen, and any person engaged in a recognized trade or craft, or other skilled mechanical craft, or in unskilled, semiskilled, or skilled manual labor occupations; and any other employee including a foreman or supervisor in a position having trade, craft, or laboring experience as the paramount requirement; and shall include all such persons regardless of any contractual relationship that may be alleged to exist between a Contractor or subcontractor and such persons.

l. Comparable Rates. The following classes of service employees expected to be employed under the Contract with the Government

would be subject, if employed by the contracting agency, to the provisions of 5 USC 5341 and would, if so employed, be paid not less than the following rates of wages and fringe benefits:

Employee class	)	
	)	See Comparable Rate Attachment
Monetary Wage-Fringe Benefits	)	

m. Contractor's Report

(1) If there is a wage determination attachment to this Contract, and one or more classes of service employees which are not listed thereon are to be employed under the Contract, the Contractor shall report to the Contracting Officer the monetary wages to be paid and the fringe benefits to be provided each such class of service employee. Such report shall be made promptly as soon as such compensation has been determined, as provided in paragraph a. of this Article.

(2) If wages to be paid or fringe benefits to be furnished any service employees employed by the Government Prime Contractor or any subcontractor under the Contract are provided for in a collective bargaining agreement which is or will be effective during any period in which the Contract is being performed, the Government Prime Contractor shall report such fact to the Contracting Officer, together with full information as to the application and accrual of such wage and fringe benefits, including any prospective increases, to service employees engaged in work on the Contract, and a copy of the collective bargaining agreement. Such report shall be made upon commencing performance of the Contract, in the case of collective bargaining agreements effective at such time, and in the case of such agreements or provisions or amendments thereof effective at a later time during the period of contract performance, such agreements shall be reported promptly after negotiation thereof.

n. Exemptions. This Article relating to the Service Contract Act of 1965 shall not apply to the following:

(1) Any contract of the United States or District of Columbia for construction, alteration, and/or repair, including painting and decorating of public buildings or public works.

(2) Any work required to be done in accordance with the provisions of the Walsh-Healey Public Contracts Act (49 Stat. 2036).

(3) Any contract for the carriage of freight or personnel by vessel, airplane, bus, truck, express, railway line, or oil or gas pipeline where published tariff rates are in effect, or

where such carriage is subject to rates covered by Section 22 of the Interstate Commerce Act.

(4) Any contract for the furnishing of services by radio, telephone, telegraph, or cable companies, subject to the Communications Act of 1934.

(5) Any contract for public utility services, including electric light and power, water, steam, and gas.

(6) Any employment contract providing for direct services to a Federal agency by an individual or individuals.

(7) Any contract with the Post Office Department (U.S. Postal Service), the principal purpose of which is the operation of postal contract stations.

(8) Any services to be furnished outside the United States. For geographic purposes, the "United States" is defined in Section 8(d) of the Service Contract Act to include any state of the United States; the District of Columbia; Puerto Rico; the Virgin Islands; Outer Continental Shelf Lands, as defined in the Outer Continental Shelf Lands Act; American Samoa; Guam; Wake Island; Enewetak Atoll; Kwajalein Atoll; and Johnston Island. It does not include any other territory under the jurisdiction of the United States or any United States base or possession within a foreign country.

(9) Any of the following contracts exempted from all provisions of the Service Contract Act of 1965, pursuant to Section 4(b) of the Act, which exemptions the Secretary of Labor, prior to amendment of such section by Public Law 92-473, found to be necessary and proper in the public interest or to avoid serious impairment of the conduct of the Government business:

(i) Contracts entered into by the United States with common carriers for the carriage of mail by rail, air (except air star routes), bus, and ocean vessel, where such carriage is performed on regularly scheduled runs of the trains, airplanes, buses, and vessels over regularly established routes and accounts for an insubstantial portion of the revenue therefrom.

(ii) Any contract entered into by the U.S. Postal Service with an individual owner-operator for mail service where it is not contemplated at the time the contract is made that such owner-operator will hire any service employee to perform the services under the contract except for short periods of vacation time or for unexpected contingencies or emergency situations such as illness or accident.

o. Special Employees. Notwithstanding any of the provisions in paragraphs b. through l. of this Article, relating to the Service Contract Act of 1965, the following employees may be employed in accordance with the following variations, tolerances, and exemptions, which the Secretary of Labor, pursuant to Section 4(b) of the Act prior to its amendment by Public Law 92-473, found to be necessary and proper in the public interest or to avoid serious impairment of the conduct of Government business:

(1) (i) Apprentices, student-learners, and workers whose earnings capacity is impaired by age, physical or mental deficiency, or injury may be employed at wages lower than the minimum wages otherwise required by Section 2a(1) or 2b(1) of the Service Contract Act of 1965, without diminishing any fringe benefits or cash payments in lieu thereof required under Section 2a(2) of that Act, in accordance with the procedures prescribed for the employment of apprentices, student-learners, handicapped persons, and handicapped clients of sheltered workshops under Section 14 of the Fair Labor Standards Act of 1938, in the regulations issued by the Administrator.

(ii) The Administrator will issue certificates under the Service Contract Act of 1965 for the employment of apprentices, student-learners, handicapped persons, or handicapped clients of sheltered workshops not subject to the Fair Labor Standards Act of 1938, or subject to different minimum rates of pay under the two acts, authorizing appropriate rates of minimum wages (but without changing requirements concerning fringe benefits or supplementary cash payments in lieu thereof), applying procedures prescribed by the applicable regulations issued under the Fair Labor Standards Act of 1938 (29 CFR Parts 520, 521, 524, and 525).

(iii) The Administrator will also withdraw, annul, or cancel such certificates in accordance with the regulations in Parts 525 and 528 of Title 29 of the Code of Federal Regulations.

(2) An employee engaged in an occupation in which he customarily and regularly receives more than $20 a month in tips may have the amount of his tips credited by his employer against the minimum wage required by Section 2a(1) or Section 2b(1) of the Act in accordance with the regulations in 29 CFR Part 531: Provided, however, that the amount of such credit may not exceed $1.00 per hour effective May 1, 1974; $1.05 per hour effective January 1, 1975; and $1.15 per hour after December 31, 1975.

ARTICLE A-20. SUBCONTRACTS

a. The Contractor shall notify the Contracting Officer reasonably in advance of entering into any subcontract. In the case of a proposed subcontract, the advance notification required shall include:

(1) A description of the supplies or services to be called for by the subcontract;

(2) Identification of the proposed subcontractor and an explanation of why and how the proposed subcontractor was selected, including the degree of competition obtained;

(3) The proposed subcontract price, together with the Contractor's cost or price analysis thereof.

b. The Contractor shall obtain the written consent of the Contracting Officer prior to placing any subcontract for which advance notification is required under a. above. The Contracting Officer may, in his discretion, ratify in writing any such subcontract; such action shall constitute the consent of the Contracting Officer as required by this paragraph b.

c. The Contractor shall give the Contracting Officer immediate notice in writing of any action or suit filed, and prompt notice of any claim made against the Contractor by any subcontractor or vendor which in the opinion of the Contractor may result in litigation, related in any way to this Contract, with respect to which the Contractor may be entitled to reimbursement from the Government.

d. To facilitate small business participation in subcontracting under this Contract, the Contractor agrees to provide progress payments on the fixed-price types of subcontracts of those subcontractors which are small business concerns, in conformity with the standards for customary progress payments stated in the Federal Procurement Regulations, Subpart 1-30.5, as in effect on the date of this Contract. The Contractor further agrees that the need for such progress payments will not be considered as a handicap or adverse factor in the award of subcontracts.

ARTICLE A-21. TERMINATION FOR CONVENIENCE OF THE GOVERNMENT

The Contracting Officer, by written notice, may terminate this Contract, in whole or in part, when it is in the best interest of the Government. If this Contract is for supplies and is so terminated, the Contractor shall be compensated in accordance with Part 1-8 of the Federal Procurement Regulations (41 CFR 1-8), in effect on this Contract's date. To the extent that this Contract is for services and is so terminated, the Government shall be liable only for payment in accordance with the payment provisions of this Contract for services rendered prior to the effective date of termination.

ARTICLE A-22. UTILIZATION OF LABOR SURPLUS AREA CONCERNS

a. It is the policy of the Government to award contracts to labor surplus area concerns that (1) have been certified by the Secretary of Labor (hereafter referred to as certified-eligible concerns with first or second preferences) regarding the employment of a proportionate number of disadvantaged individuals and have agreed to perform substantially (i) in or near sections of concentrated unemployment or underemployment or in persistent or substantial labor surplus areas, or (ii) in other areas of the United States, respectively, or (2) are noncertified concerns which have agreed to perform substantially in persistent or substantial labor surplus areas, where this can be done consistent with the efficient performance of the Contract and at prices no higher than are obtainable elsewhere. The Contractor agrees to use its best efforts to place its subcontracts in accordance with this policy.

b. In complying with paragraph a. of this Article and with paragraph b. of the Article of this Contract entitled "Utilization of Small Business Concerns," the Contractor, in placing its subcontracts, shall observe the following order of preference: (1) certified-eligible concerns with a first preference which are also small business concerns; (2) other certified-eligible concerns with a first preference; (3) certified-eligible concerns with a second preference which are also small business concerns; (4) other certified-eligible concerns with a second preference; (5) persistent or substantial labor surplus area concerns which are also small business concerns; (6) other persistent or substantial labor surplus area concerns; and (7) small business concerns which are not labor surplus area concerns.

ARTICLE A-23. UTILIZATION OF MINORITY BUSINESS ENTERPRISES

a. It is the policy of the Government that minority business enterprises shall have the maximum practicable opportunity to participate in the performance of Government contracts.

b. The Contractor agrees to use his best efforts to carry out this policy in the award of his subcontracts to the fullest extent consistent with the efficient performance of this Contract. As used in this Contract, the term "minority business enterprise" means a business, at least 50 percent of which is owned by minority group members or, in case of publicly owned businesses, at least 51 percent of the stock of which is owned by minority group members. For the purposes of this definition, minority group members are Negroes, Spanish-speaking American persons, American-Orientals, American-Indians, American-Eskimos, and American-Aleuts. Contractors may rely on written representations by subcontractors regarding their status as minority business enterprises in lieu of an independent investigation.

ARTICLE A-24. UTILIZATION OF SMALL BUSINESS CONCERNS

a. It is the policy of the Government as declared by the Congress that a fair proportion of the purchases and contracts for supplies and services for the Government be placed with small business concerns.

b. The Contractor agrees to accomplish the maximum amount of subcontracting to small business concerns that the Contractor finds to be consistent with the efficient performance of this Contract.

ARTICLE A-25. AVAILABILITY OF APPROPRIATED FUNDS

The duty of the Government to obligate $1,977,258 in future Government Fiscal Years under Article 4.c. hereof shall be subject to the availability of funds appropriated by the Congress which ERDA may legally spend for such purposes. Should funds not be available to meet the maximum cost to be reimbursed by the Government as stated in the Article entitled "Payment," the obligations of the parties under this Contract shall be extinguished and this Contract shall terminate.

ARTICLE A-26. ADMINISTRATION OF COST ACCOUNTING STANDARDS

For the purpose of administering Cost Accounting Standards requirements under this Contract, the Contractor shall:

a. Submit to the cognizant Contracting Officer a description of the accounting change and the general dollar magnitude of the change to reflect the sum of all increases and the sum of all decreases for all contracts containing the Cost Accounting Standards clause:

   (1) For any change in cost accounting practices required to comply with a new Cost Accounting Standard in accordance with paragraphs a.(3) and a.(4)(a) of the clause of this Contract entitled "Cost Accounting Standards" within 60 days (or such other date as may be mutually agreed to) after award of a contract requiring such change;

   (2) For any change to cost accounting practices proposed in accordance with paragraph a.(4)(b) of the clause of this Contract entitled "Cost Accounting Standards" not less than 60 days (or such other date as may be mutually agreed to) prior to the effective date of the proposed change; or

   (3) For any failure to comply with an applicable Cost Accounting Standard or to follow a disclosed practice as contemplated by paragraph a.(5) of the clause of this Contract entitled "Cost Accounting Standards" within 60 days (or such other date as may be mutually agreed to) after the date of agreement of such noncompliance by the Contractor.

b. Submit a cost impact proposal in the form and manner specified by the cognizant Contracting Officer within 60 days (or such other date as may be mutually agreed to) after the date of determination of the adequacy and compliance of a change submitted pursuant to a.(1), (2), or (3) above.

c. Agree to appropriate contract and subcontract amendments to reflect adjustments established in accordance with paragraphs a.(4) and a.(5) of the clause of this Contract entitled "Cost Accounting Standards."

d. Include the substance of this clause in all negotiated subcontracts containing the clause entitled "Cost Accounting Standards." In addition, include a provision in these subcontracts which will require such subcontractors, within thirty (30) days after receipt of award, to submit the following information to the Contracting Officer cognizant of the subcontractor's facility:

(1) Subcontractor's name and subcontract number;

(2) Dollar amount and date of award;

(3) Name of Contractor making the award; and

(4) A statement as to whether the subcontractor has made or proposes to make any changes to accounting practices that affect prime contracts or subcontracts containing the Cost Accounting Standards clause, unless such changes have already been reported. If award of the subcontract results in making a Cost Accounting Standard(s) effective for the first time, this shall also be reported.

e. In the event an adjustment is required to be made to any subcontract hereunder, notify the cognizant Contracting Officer in writing of such adjustment and agree to an adjustment in the price or estimated cost and fee of this Contract, as appropriate, based upon the adjustment established under the subcontract. Such notice shall be given within 30 days after receipt of the proposed subcontract adjustment, and shall include a proposal for adjustment to such higher-tier subcontract or prime contract, as appropriate.

f. When the Cost Accounting Standards clause and this clause are included in subcontracts, the term "Contracting Officer" shall be suitably altered to identify the purchaser.

ARTICLE A-27. COST ACCOUNTING STANDARDS

a. Unless the Cost Accounting Standards Board, or the General Services Administration in the case of nondefense contracts, has prescribed rules or regulations exempting the Contractor or this Contract from

standards, rules, and regulations promulgated pursuant to 50 USC App. 2168 (Public Law 91-379, August 15, 1970), or other statutory authority, the Contractor, in connection with this Contract, shall:

(1) By submission of a Disclosure Statement, disclose in writing its cost accounting practices as required by regulations of the Cost Accounting Standards Board. The required disclosures must be made prior to contract award unless the Contracting Officer provides a written notice to the Contractor authorizing postaward submission in accordance with regulations of the Cost Accounting Standards Board. The practices disclosed for this Contract shall be the same as the practices currently disclosed and applied on all other contracts and subcontracts being performed by the Contractor and which contain this Cost Accounting Standards Article. If the Contractor has notified the Contracting Officer that the Disclosure Statement contains trade secrets and commercial or financial information which is privileged and confidential, the Disclosure Statement will be protected and will not be released outside of the Government.

(2) Follow consistently the cost accounting practices disclosed pursuant to (1) above in accumulating and reporting contract performance cost data concerning this Contract. If any change in disclosed practices is made for purposes of any contract or subcontract subject to Cost Accounting Standards Board requirements, the change must be applied prospectively to this Contract, and the Disclosure Statement must be amended accordingly. If the contract price or cost allowance of this Contract is affected by such changes, adjustment shall be made in accordance with subparagraph (4) or (5) below, as appropriate.

(3) Comply with all Cost Accounting Standards in effect on the date of award of this Contract or if the Contractor has submitted cost or pricing data, on the date of final agreement on price as shown on the Contractor's signed Certificate of Current Cost or Pricing Data. The Contractor shall also comply with any Cost Accounting Standard which hereafter becomes applicable to a contract or subcontract of the Contractor. Such compliance shall be required prospectively from the date of applicability to such contract or subcontract.

(4) (a) Agree to an equitable adjustment (as provided in the "Changes" Article of this Contract, if any) if the contract cost is affected by a change which, pursuant to (3) above, the Contractor is required to make to its established cost accounting practices whether such practices are covered by a Disclosure Statement or not.

(b) Negotiate with the Contracting Officer to determine the terms and conditions under which a change to either a

disclosed cost accounting practice or an established cost accounting practice, other than a change under (4)(a) above, may be made. A change to a practice may be proposed by either the Government or the Contractor; PROVIDED, however, that no agreement may be made under this provision that will increase costs paid by the United States.

(5) Agree to an adjustment of the contract price or cost allowance, as appropriate, if it or a subcontractor fails to comply with an applicable Cost Accounting Standard or to follow any practice disclosed pursuant to subparagraphs (1) and (2) above and such failure results in any increased costs paid by the United States. Such adjustment shall provide for recovery of the increased costs to the United States together with interest thereon computed at the rate determined by the Secretary of the Treasury pursuant to Public Law 92-41, 85 Stat. 97, or 7 percent per annum, whichever is less, from the time the payment by the United States was made to the time the adjustment is effected.

b. If the parties fail to agree whether the Contractor or a subcontractor has complied with an applicable Cost Accounting Standard, rule, or regulation of the Cost Accounting Standards Board and as to any cost adjustment demanded by the United States, such failure to agree shall be a dispute concerning a question of fact within the meaning of the "Disputes" Article of this Contract.

c. The Contractor shall permit any authorized representatives of the head of the agency, of the Cost Accounting Standards Board, or of the Comptroller General of the United States to examine and make copies of any documents, papers, or records relating to compliance with the requirements of this Article.

d. The Contractor shall include in all negotiated subcontracts which it enters into the substance of this Article except paragraph b. and shall require such inclusion in all other subcontracts of any tier, except that this requirement shall apply only to negotiated subcontracts in excess of $100,000 where the price negotiated is not based on:

(1) Established catalog or market prices of commercial items sold in substantial quantities to the general public, or

(2) Prices set by law or regulation and except that the requirement shall not apply to negotiated subcontracts otherwise exempt from the requirement to accept the "Cost Accounting Standards" Article by reason of 331.30(b) of Title 4, Code of Federal Regulations (4 CFR 331.30(b) or 1-3.1203(a)(2) of Title 41, Code of Federal Regulations (41 CFR 1-3.1203(a)(2)).

However, if this is a contract with an agency which permits subcontractors to appeal final decisions of the Contracting Officer directly to the head of the agency or his duly authorized representative, then the Contractor shall include the substance of paragraph b. as well.

NOTE:

(1) Subcontractors shall be required to submit their Disclosure Statements to the Contractor. However, if a subcontractor has previously submitted its Disclosure Statement to a Government Contracting Officer, it may satisfy that requirement by certifying to the Contractor the date of such Statement and the address of the Contracting Officer.

(2) In any case where a subcontractor determines that the Disclosure Statement information is privileged and confidential and declines to provide it to its Contractor or higher-tier subcontractor, the Contractor may authorize direct submission of that subcontractor's Disclosure Statement to the same Government offices to which the Contractor was required to make submission of its Disclosure Statement. Such authorization shall in no way relieve the Contractor of liability as provided in paragraph a.(5) of this Article. In view of the foregoing and since the Contract may be subject to adjustment under this Article by reason of any failure to comply with rules, regulations, and standards of the Cost Accounting Standards Board in connection with covered subcontracts, it is expected that the Contractor may wish to include a clause in each such subcontract requiring the subcontractor to appropriately indemnify the Contractor. However, the inclusion of such a clause and the terms thereof are matters for negotiation and agreement between the Contractor and the subcontractor, provided that they do not conflict with the duties of the Contractor under its contract with the Government. It is also expected that any subcontractor subject to such indemnification will generally require substantially similar indemnification to be submitted by its subcontractors.

e. The terms defined in 331.2 of Part 331 of Title 4, Code of Federal Regulations (4 CFR 331.2) shall have the same meanings herein. As there defined, "negotiated subcontract" means "any subcontract except a firm, fixed-price subcontract made by a Contractor or subcontractor after receiving offers from at least two firms not associated with each other or such Contractor or subcontractor, providing (1) the solicitation to all competing firms is identical, (2) price is the only consideration in selecting the subcontractor from among the competing firms solicited, and (3) the lowest offer received in compliance with the solicitation from among those solicited is accepted."

COMPARABLE RATE ATTACHMENT

Pursuant to paragraph 1, Article A-19 of the General Contract Provisions, the following wage rates and fringe benefits would be paid by the Energy Research and Development Administration to the various classes of service employees if Section 5341 of Title 5, United States Code, were applicable:

Wage Board Employees	Rate
Air Compressor Operator	$5.57
Installing Casing (laborer)	4.28
Logging Technician	4.71
Cementing Technician	4.49
Cementing Laborer	4.07
Driller Operator	6.63
Driller Helper	5.78

The above "direct" employees would be eligible for the following fringe benefits:

1. Paid holidays — 9.

2. Sick leave at the rate of 13 days per year.

3. Vacation schedule based on length of service.

   Less than 3 years — 13 days
   3 to 15 years — 20 days
   15 years and over — 26 days

4. Participation in the health and welfare, life insurance, and retirement plan as applicable to federal employees.

APPENDIX B

INTELLECTUAL PROPERTY
(NVSS-8/77)

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APPENDIX B

INTELLECTUAL PROPERTY
(NVSS-8/77)

ARTICLE B-1. SUBCONTRACTS, PURCHASE ORDERS, AND PROCUREMENT

The Contractor shall utilize in its policies and procedures relating to subcontracts, purchase orders, and procurement hereunder, such additional ERDA procurement policies in the Patents and Data area as set forth in 41 CFR, Part 9-9, or such other policies and procedures as may be specifically directed in writing by the Contracting Officer or Patent Counsel.

ARTICLE B-2. AUTHORIZATION AND CONSENT

The Government hereby gives its authorization and consent (without prejudice to any rights of indemnification) for all use and manufacture, in the performance of this Contract or any part hereof or any amendment hereto or any subcontract hereunder (including any lower-tier subcontract), of any invention described in and covered by a patent of the United States (a) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this Contract or (b) utilized in the machinery, tools, or methods the use of which necessarily results from compliance by the Contractor or the using subcontractor with (i) specifications or written provisions now or hereafter forming a part of this Contract, or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clauses, if any, included in this Contract or any subcontract hereunder (including all lower-tier subcontracts), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

ARTICLE B-3. NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT

a. The Contractor shall report to the Contracting Officer, promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this Contract of which the Contractor has knowledge.

b. In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the performance of this Contract or out of the use of any supplies furnished or work or services performed hereunder, the Contractor shall furnish to the Government when requested by the Contracting Officer, all evidence and information in possession of the Contractor pertaining to such suit or claim. Such evidence and information

shall be furnished at the expense of the Government except where the Contractor has agreed to indemnify the Government.

c. This clause shall be included in all subcontracts.

ARTICLE B-4. REPORTING OF ROYALTIES

If any royalty payments are directly involved in this Contract or are reflected in the contract price to the Government, the Contractor agrees to report in writing to the Patent Counsel (with notification by Patent Counsel to the Contracting Officer) during the performance of this Contract and prior to its completion or final settlement the amount of any royalties or other payments paid or to be paid by it directly to others in connection with the performance of this Contract, together with the names and addresses of licensors to whom such payments are made and either the patent numbers involved or such other information as will permit identification of the patents or other basis on which the royalties are to be paid. The approval of the ERDA of any individual payments or royalties shall not stop the Government at any time from contesting the enforceability, validity, or scope of, or title to, any patent under which a royalty or payments are made.

ARTICLE B-5. PATENT INDEMNITY

The Contractor shall indemnify the Government and its officers, agents, and employees against liability, including costs, for infringement of any United States Letters Patent (except U.S. Letters Patent issued upon an application which is now or may hereafter be kept secret or otherwise withheld from issue by order of the Government) arising out of the manufacture or delivery of supplies or out of construction, alteration, modification, or repair of real property (hereinafter referred to as "construction work") under this Contract, or out of the use or disposal by or for the account of the Government of such supplies or construction work. The foregoing indemnity shall not apply unless the Contractor shall have been informed as soon as practicable by the Government of the suit or action alleging such infringement, and shall have been given such opportunity as is afforded by applicable laws, rules, or regulations to participate in the defense thereof; and further, such indemnity shall not apply to: (a) an infringement resulting from compliance with specific written instructions of the Contracting Officer directing a change in the supplies to be delivered or in the materials or equipment to be used, or directing a manner of performance of the Contract not normally used by the Contractor; (b) an infringement resulting from addition to, or change in, such supplies or components furnished or construction work performed which addition or change was made subsequent to delivery or performance by the Contractor; or (c) a claimed infringement which is settled without the consent of the Contractor, unless required by final decree of a court of competent jurisdiction.

ARTICLE B-6. RIGHTS IN TECHNICAL DATA

a. Definitions

(1) "Technical Data" means recorded information, regardless of form or characteristic, of a scientific or technical nature. It may, for example, document research, experimental, developmental, or demonstration, or engineering work, or be usable or used to define a design or process, or to procure, produce, support, maintain, or operate materiel. The data may be graphic or pictorial delineations in media such as drawings or photographs, text in specifications or related performance or design type documents, or computer software (including computer programs, computer software data bases, and computer software documentation). Examples of technical data include research and engineering data, engineering drawings and associated lists, specifications, standards, process sheets, manuals, technical reports, catalog item identification, and related information. Technical data as used herein does not include financial reports, cost analyses, and other information incidental to contract administration.

(2) "Proprietary Data" means technical data which embody trade secrets developed at private expense, such as design procedures or techniques, chemical composition of materials, or manufacturing methods, processes, or treatments, including minor modifications thereof, provided that such data:

(a) Are not generally known or available from other sources without obligation concerning their confidentiality,

(b) Have not been made available by the owner to others without obligation concerning its confidentiality,

(c) Are not already available to the Government without obligation concerning its confidentiality.

(3) "Contract Data" means technical data first produced in the course of or under the Contract, technical data which are specified to be delivered in the contract, technical data that may be called for under the "Additional Technical Data Requirements" clause of the Contract, if any, or technical data actually delivered in connection with the Contract.

(4) "Unlimited Rights" means rights to use, duplicate, or disclose technical data, in whole or in part, in any manner and for any purpose whatsoever, and to permit others to do so.

b. Allocation of Rights

(1) Government Rights. The Government shall have:

(a) Unlimited rights in contract data except as otherwise provided below with respect to proprietary data.

(b) The right to remove, cancel, correct, or ignore any marking not authorized by the terms of this Contract on any technical data furnished hereunder, if in response to a written inquiry by ERDA concerning the propriety of the markings, the Contractor fails to respond thereto within 60 days or fails to substantiate the propriety of the markings. In either case, ERDA will notify the Contractor of the action taken.

(c) No rights under this Contract in any technical data which is not contract data.

(2) Contractor Rights. The Contractor shall have:

(a) The right to withhold proprietary data in accordance with the provisions of this clause.

(b) The right to use for its private purposes, subject to patent, security, or other provisions of this Contract, contract data it first produces in the course of or under this Contract provided the data requirements of this Contract have been met as of the date of the private use of such data. The Contractor agrees that to the extent it receives or is given access to proprietary data or other technical, business, or financial data in the form of recorded information from ERDA or an ERDA contractor or subcontractor, the Contractor shall treat such data in accordance with any restrictive legend contained thereon, unless use is specifically authorized by prior written approval of the Contracting Officer.

(3) Nothing contained in the "Rights in Technical Data" clause shall imply a license to the Government under any patent or be construed as affecting the scope of any licenses or other rights otherwise granted to the Government under any patent.

c. Copyrighted Material

(1) The Contractor shall not, without prior written authorization of the Contracting Officer, establish a claim to statutory copyright in any contract data first produced in the course of or under the Contract. To the extent such authorization is

granted, the Government reserves for itself and others acting on its behalf a royalty-free, nonexclusive, irrevocable, worldwide license for governmental purposes to publish, distribute, translate, duplicate, exhibit, and perform any such data copyrighted by the Contractor.

(2) The Contractor agrees not to include in the technical data delivered under the Contract any material copyrighted by the Contractor and not to knowingly include any material copyrighted by others without first obtaining at no cost a license therein for the benefit of the Government of the same scope as set forth in paragraph c.(1) above. If such royalty-free license is unavailable and the Contractor nevertheless determines that such copyrighted material must be included in the technical data to be delivered, rather than merely incorporated therein by reference, the Contractor shall request the written authorization of the Contracting Officer to include such copyrighted material in the technical data without a license.

d. Subcontracting

It is the responsibility of the Contractor to obtain from its subcontractors technical data and rights therein, on behalf of the Government, necessary to fulfill the Contractor's obligations to the Government with respect to such data. In the event of refusal by a subcontractor to accept a clause affording the Government such rights, the Contractor shall:

(1) Promptly submit written notice to the Contracting Officer setting forth reasons for the subcontractor refusal and other pertinent information which may expedite disposition of the matter; and

(2) Not proceed with the subcontract without the written authorization of the Contracting Officer.

e. Withholding of Proprietary Data

Notwithstanding the inclusion of the "Additional Technical Data Requirements" clause in this Contract or any provision of this Contract specifying the delivery of technical data, the Contractor may withhold proprietary data from delivery, provided that the Contractor furnishes in lieu of any such proprietary data so withheld technical data disclosing the source, size, configuration, mating and attachment characteristics, functional characteristics and performance requirements ("Form, Fit, and Function" data, e.g., specification control drawings, catalog sheets, envelope drawings, etc.) or a general description of such proprietary data where "Form, Fit, and Function" data are not applicable. The Government will acquire no rights to any proprietary data so withheld except

that such data shall be subject to the "inspection rights" provisions of paragraph f., and, if included, the "limited rights in proprietary data" provisions of paragraph g. and the "Contractor licensing" provisions of paragraph h.

f. Inspection Rights

Except as may be otherwise specified in this Contract for specific items of proprietary data which are not subject to this paragraph, the Contracting Officer's representatives, at all reasonable times up to three (3) years after final payment under this Contract, may inspect at the Contractor's facility any proprietary data withheld under paragraph e. and not furnished under paragraph g. for the purposes of verifying that such data properly fell within the withholding provision of paragraph e., or for evaluating work performance.

g. Limited Rights in Proprietary Data

Except as may be otherwise specified in this Contract as technical data which are not subject to this paragraph, the Contractor shall, upon written request from the Contracting Officer at any time prior to three (3) years after final payment under this Contract, promptly deliver to the Government any "proprietary data" withheld pursuant to paragraph e. of the "Rights in Technical Data" clause of this Contract. The following legend and no other is authorized to be affixed on any "proprietary data" delivered pursuant to this provision, provided the "proprietary data" meets the conditions for initial withholding under paragraph e. of the "Rights in Technical Data" clause. The Government will thereafter treat the "proprietary data" in accordance with such legend.

LIMITED RIGHTS LEGEND

This "proprietary data," furnished under Contract No. _____ with the United States Energy Research and Development Administration (and purchase order No. _____ if applicable), may be duplicated and used by the Government with the express limitations that the "proprietary data" may not be disclosed outside the Government or be used for purposes of manufacture without prior permission of the Contractor, except that further disclosure or use may be made solely for the following purposes:

(1) This "proprietary data" may be disclosed for evaluation purposes under the restriction that the proprietary data be retained in confidence and not be further disclosed;

(2) This "proprietary data" may be disclosed to other Contractors participating in the Government's program of which this Contract is a part for information or use in connection with the work

performed under their contracts and under the restriction that the "proprietary data" be retained in confidence and not be further disclosed; or

(3) This "proprietary data" may be used by the Government or others on its behalf for emergency repair or overhaul work under the restriction that the "proprietary data" be retained in confidence and not be further disclosed.

This legend shall be marked on any reproduction of this data in whole or in part.

h. Contractor Licensing

Except as may be otherwise specified in this Contract as technical data not subject to this paragraph, the Contractor agrees that upon written application by ERDA, it will grant to the Government and responsible third parties, for purposes of practicing a subject of this Contract, nonexclusive licenses under any contract data which are proprietary data on terms and conditions reasonable under the circumstances including appropriate provisions for confidentiality; provided, however, the Contractor shall not be obligated to license any proprietary contract data if the Contractor demonstrates to the satisfaction of the Administrator or his designee that:

(1) Such data are not essential to the manufacture or practice of hardware designed or fabricated, or processes developed, under this Contract;

(2) Such data, in the form of results obtained by their use, have a commercially competitive alternative available or readily introducible from one or more other sources;

(3) Such data, in the form of results obtained by their use, are being supplied by the Contractor or its licensees in sufficient quantity and at reasonable prices to satisfy market needs, or the Contractor or its licensees have taken effective steps or within a reasonable time are expected to take effective steps to so supply such data in the form of results obtained by its use; or

(4) Such data, in the form of results obtained by their use, can be furnished by another firm skilled in the art of manufacturing items or performing processes of the same general type and character necessary to achieve the contract results.

APPENDIX C
UNION OIL OF CALIFORNIA
COVE FORT - SULPHURDALE KGRA

SUMMARY OF ESTIMATED COST
FOR PROGRAM TO ACQUIRE NEW DATA

Phase I - Drilling Well KGRA 42-7

		Estimated Total Cost	Cost to ERDA
1.	Location	$ 55,000	$ -
2.	Drilling Contractor	377,000	-
3.	Drilling Bits	66,000	66,000
4.	Drilling Mud and Chemicals	102,000	102,000
5.	Fuel	41,000	41,000
6.	Equipment Rentals	61,000	61,000
7.	Specialized Drilling Services	85,000	85,000
8.	Transportation*	31,000	31,000
9.	Casing	196,000	196,000
10.	Production Equipment	30,000	-
11.	Supervision	12,000	-
12.	Miscellaneous	4,000	-
	SUBTOTAL	$1,060,000	$582,000
	G&A	53,000	-
	TOTAL - PHASE I	$1,113,000	$582,000

Phase II - Drilling Well KGRA 2nd Well

1.	Location	$ 50,000	$ -
2.	Drilling Contractor	350,000	-
3.	Drilling Bits	65,000	65,000
4.	Drilling Mud and Chemicals	90,000	90,000
5.	Fuel	40,000	40,000
6.	Equipment Rentals	58,000	58,000
7.	Specialized Drilling Services	75,000	75,000
8.	Transportation*	30,000	30,000
9.	Casing	196,000	196,000
10.	Production Equipment	30,000	-
11.	Supervision	12,000	-
12.	Miscellaneous	4,000	-
	SUBTOTAL	$1,000,000	$554,000
	G&A	50,000	-
	TOTAL PHASE II	$1,050,000	$554,000

*Includes Water Hauling

Phase III - Drilling Well KGRA 3rd Well

		Estimated Total Cost	Cost to ERDA
1.	Location	$ 50,000	$ -
2.	Drilling Contractor	350,000	-
3.	Drilling Bits	65,000	65,000
4.	Drilling Mud and Chemicals	90,000	90,000
5.	Fuel	40,000	40,000
6.	Equipment Rentals	58,000	58,000
7.	Specialized Drilling Services	75,000	75,000
8.	Transportation*	30,000	30,000
9.	Casing	196,000	196,000
10.	Production Equipment	30,000	-
11.	Supervision	12,000	-
12.	Miscellaneous	4,000	-
	SUBTOTAL	$1,000,000	$554,000
	G&A	50,000	-
	TOTAL PHASE III	$1,050,000	$554,000

Phase IV - Short Flow Test On All Wells

Equipment and Contract Services

Choke Manifold	$ 20,000	$ -
Flow Separator - Transport	5,000	5,000
Pipes and Fittings	2,500	-
Valves and Meters	7,500	-
Installation - Contract Services	15,000	15,000
Core Analysis	15,000	15,000
Chemical Analysis	10,000	10,000
Pressure Temperature Services	10,000	10,000
Computer Services	5,000	-
SUBTOTAL - EQUIP & CONTR SERV.	$ 90,000	$ 55,000

Labor

Area, Coordinator (12 months)	$ 45,000	$ -
Reservoir Engineer (6 months)	19,000	-
Production Engineer (6 months)	19,000	-
Production Foremane (12 months)	37,000	-
Operating & Maintenance (20 months)	50,000	-
Travel & Subsidence (56 months)	56,000	-
SUBTOTAL - LABOR	$ 226,000	$ -
G&A	15,800	-
TOTAL PHASE IV	$ 331,800	$ 55,000

*Includes Water Hauling

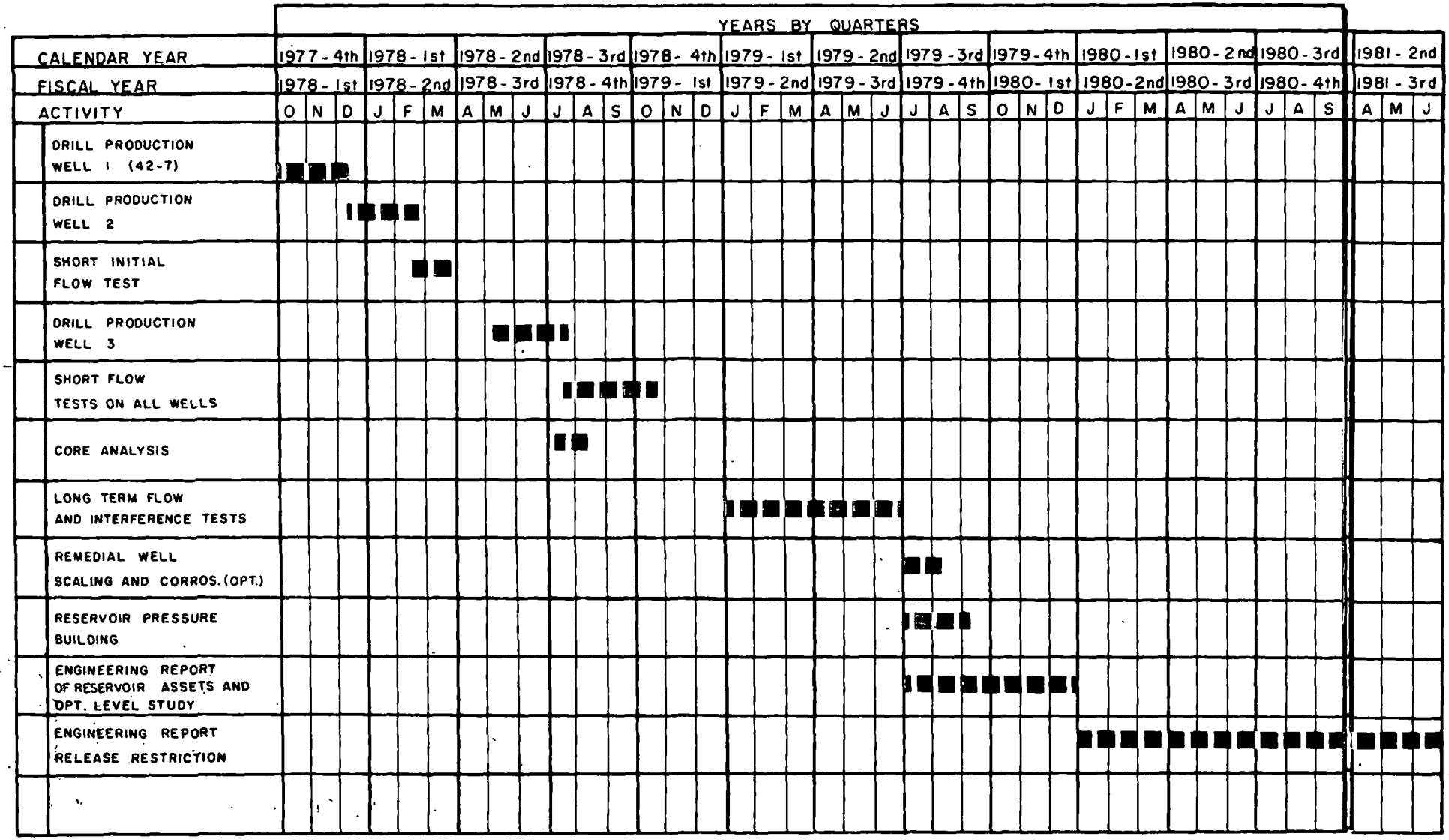
Phase V - Long Term Flow and Interference Tests

	Estimated Total Cost	Cost to ERDA
Equipment and Contract Services		
Two Injection Pumps (Rental)	$ 53,000	$ 53,000
One Separator with Controls	100,000	-
7,000 Feet Pipelines		
Purchase	30,000	-
Rental	28,000	28,000
Miscellaneous Controls and Instruments	20,000	-
Vent Tank (Rental)	10,000	10,000
Valves and Fittings	20,000	-
Installation - Contract Services	30,000	30,000
Miscellaneous	35,000	-
Chemical Analysis	10,000	10,000
Pressure and Temperature Services	10,000	10,000
Interference Test Equipment	15,000	15,000
Computer Services	15,000	-
SUBTOTAL - EQUIP & CONTR SERV.	$376,000	$156,000
Labor		
Area Coordinator (12 months)	$ 45,000	-
Reservoir Engineer (18 months)	57,000	-
Production Engineer (6 months)	19,000	-
Production Foreman (12 months)	30,000	-
Operating & Maintenance (27 months)	68,000	-
Travel & Subsidence (75 months)	75,000	-
SUBTOTAL - LABOR	$294,000	$ -
G&A	33,700	-
TOTAL PHASE V	$703,700	$156,000
Phase VI - Subsurface Well Repair	$100,000	$100,000
G&A	5,000	-
TOTAL PHASE VI	$105,000	$100,000

PERFORMANCE SCHEDULE: APPENDIX D

UNION OIL OF CALIFORNIA

COVE FORT SULPHURDALE KGRA



9/77

UNITED STATES GOVERNMENT

2-Way Memo

Subject: Utah Geothermal RFP
Union Oil Co.

DATE OF MESSAGE
September 5, 1977
DATE OF REPLY

INSTRUCTIONS
Use routing symbols whenever possible.
SENDER:
Forward original and one copy. Conserve space.
RECEIVER:
Reply below the message, keep one copy, return one copy.

To: Dr. J. W. SALISBURY
Division of Geothermal Energy (MS 31220)
Hdqtrs, ERDA

FOLD FOLD

USE BRIEF, INFORMAL LANGUAGE

Attached is a copy of Union's supplement to its proposal which sets out additional data offered as well as an explanation of the contents of the Forminco drilling history and drilling technology as offered in its proposal.

You will note by comparison of the revised project cost estimate with original proposal that there has been a substantial change inthe categories for which ERDA will reimburse Union for 3rd. party materials and services. The acceptance of the additional existing date is a factor in the changes in categories.

From Our prior review of the Union estimate, the changes in the estimated costs and the increase in the total were not unanticipated.

We are proceeding on the basis of the conversation which D. Pyle, E. Mack and I had with you on 8/19/77 and accepting the additional data for incorporation into the contract as a deliverable.

Please note the enclosure is also company "confidential", as was the original proposal.

J. B. Cotter, Chief
Energy Research Projects Branch

cc: With enclosures
Dr. S. Ward, Univ.of Utah

3. TO BE RETAINED BY ORIGINATOR

OPTIONAL FORM 27
OCTOBER 1962
GSA FPMR (41 CFR) 101 – 11.6

Union Geothermal Division

Union Oil Company of California
Union Oil Center, Box 7600, Los Angeles, California 90051
Telephone (213) 486-6260

GEO7-346

UNION 76

CONFIDENTIAL

Carel Otte
President

August 31, 1977

Mr. F. John Marriott
Contracts and Procurement
Division
United States Research and
Development Administration
Nevada Operations Office
P.O. Box 14100
Las Vegas NV 89114

Dear Mr. Marriott:

In accordance with discussions held with Union representatives in your office on August 19, 1977, the following revised and additional data is submitted to supplement our original reply to Request for Proposal, EY-R-08-0007.

1. Forminco No. 1 well data,

2. Summary of technical conclusions from the drilling of Forminco No. 1,

3. Summary of "Additional Geological and Geophysical Data" to be provided,

4. Revised estimate of project costs and proposed cost to the Government, and

5. Summary of proprietary data that will be held confidential for a limited period and additional proprietary information that is expected to be used in the program but which will not be delivered.

Yours very truly,

Carel Otte /jm

Carel Otte

CO:jl

C \

UNION OIL COMPANY OF CALIFORNIA

Geothermal Division

REQUEST FOR PROPOSAL
EY-R-08-0007

Supplement
August 31, 1977

NOTICE

The data contained in this supplement to Union Oil Company of California's original reply to Request for Proposal, EY-R-08-0007, have been submitted in confidence and contain trade secrets and/or privileged or confidential commercial or financial information, and such data shall be used or disclosed only for evaluation purposes, provided that if a contract is awarded to this proposer as a result of or in connection with the submission of this proposal, the Government shall have the right to use or disclose the data herein to the extent provided in the contract. This restriction does not limit the Government's right to use or disclose data obtained without restriction from any source, including the proposer.

CONFIDENTIAL

1. Forminco No. 1 Well Data

   a. Complete drilling history including the following:

      i. Total Depth

      ii. Hole Sizes and Depths

      iii. Drilling Fluids

      iv. Size, Weight, Grade, Type and Depth of Casing

      v. Cement Mixtures and Displacement Methods

      vi. Bit Records

      vii. Mud Log

      viii. Lithological and Penetration Logs

      NOTE: Because of hole conditions, electric logs, temperature logs and formation fluid samples were not obtained.

   b. Cut from all Ditch Cuttings Recovered

   c. Geological Report

2. Summary of Technical Conclusions from the Drilling of Forminco No. 1

The drilling and subsequent abandonment of the Forminco No. 1 well short of its target depth on the Cove Fort geothermal anomaly permitted Union to acquire important geologic and engineering data to be used in the siting, designing, drilling and completing of future wells on the geothermal anomaly:

a. Formation Fluid Pressures

The formation fluid pressures near the surface were found to be below normal. These conditions are expected to persist until the deep groundwater level is reached below the total depth of the Forminco No. 1 well. Union now estimates 1,500 feet to groundwater on the Cove Fort anomaly. Formations with high permeabilities above the groundwater table in the underpressured zone are anticipated to be zones of severe lost circulation.

b. Formation Permeability

The sedimentary carbonate formations (primarily Paleozoic in age) locally had very high permeabilities in Forminco No. 1. Severe lost circulation conditions can be expected when these permeable carbonates occur in a structural position which places them in the underpressured zone. The permeability of the Tertiary volcanic (Bullion Canyon formation) and the Upper Cretaceous-Lower Tertiary clastics (Claron formation) are much lower. No serious lost circulation occurred in these formations during the drilling of Forminco No. 1.

c. Structural Geology

To avoid serious lost circulation conditions in the underpressured zone, wells should be located where the Paleozoic carbonates are structurally below the underpressured zone. Structural relief on the surface of the Pre-Tertiary angular unconformity across the Cove Fort anomaly is large, 2,500 to 3,000 feet or more. Therefore, it may be possible to select future drilling sites where up to 3,000 feet of Tertiary volcanics and clastics are present below the surface, allowing the successful drilling of the underpressured zone without excessive lost circulation.

d. Hole Caving

The Forminco No. 1 well encountered a thick, caving hydrothermally altered dolomite zone at 797 feet. The original competent crystalline carbonate was altered to totally unconsolidated dolomite sand. The original drilling program did not anticipate such alteration and the consequent drilling problem. Caving of the dolomite formation and inability to set casing through this zone was the main cause of the abandonment of Forminco No. 1. Knowledge of this altered dolomite resulted in an intensive research effort to provide a solution to the drilling problem which, hopefully, will prevent reoccurrence of the situation which led to the abandonment of Forminco No. 1.

e. H_2S Gas

Hydrogen sulphide gas was encountered in the Forminco No. 1 well. The gas was found to be present in permeable

intervals in the underpressured zone. The gas was very low pressured and only became a drilling hazzard when severe lost circulation occurred, permitting the hole to fill with gas. As with the caving formation condition, the presence of H_2S gas has been recognized and drilling procedures are planned to control the situation.

3. Summary of "Additional Geological and Geophysical Data" to be Provided

In the original reply to "Request for Proposal", data from six temperature gradient holes and a geological report describing surface geothermal manifestations were offered. The following additional data will now be made available subject to the proprietary conditions set forth in Item 5 of this letter.

a. Temperature Gradient Holes

Data from 19 additional gradient holes completed by Union on or adjacent to the Cove Fort-Sulphurdale geothermal area (see attached map). The data consists of temperature measurements made every 25 feet in wells completed with 3/4" or 1" OD PVC pipe. The depths of the wells are generally 250 to 300 feet. The wells have been plugged and abandoned, as per G.R.O. No. 1.

b. Seismic Survey

Union Research, Brea, California conducted a shallow seismic survey for structural control and in an attempt to locate the top of the groundwater table (base underpressured zone). This survey consisted of eight lines, totalling about 5.5 line miles. Experimental energy sources were used.

c. Resistivity Survey

An electrical resistivity survey was also conducted on the Cove Fort anomaly by Phoenix Geophysics, Inc., Tucson, Arizona, in an attempt to locate the top of the groundwater table (base underpressured zone). The survey consists of three widely spaced dipole-dipole lines, totalling about 15 line miles. An electrode interval of 1,000 feet was used with reading from N=1 to N=6. In addition, seven Schlumberger depth sounding with a maximum L (AB/2) of 8,000 feet were conducted.

d. Gravity

A few gravity stations were measured to supplement existing gravity data in the Cove Fort area. Metering and data reduction and integration was performed by Union Oil personnel.

e. Geochemical Surveys

Two mercury surveys were conducted on the Cove Fort geothermal anomaly. Trace analyses for mercury were conducted on the cuttings from the temperature gradient holes, as well as several selected surface samples. The second survey was a mercury soil gas survey conducted by Applied Geophysics, Inc., Salt Lake City, Utah. This survey consists of two traverses (N-S and E-W) about 29 miles in length with about two stations per mile.

4. Revised Estimate of Project Costs and Proposed Cost to the Government are Attached as Tables II, III, IV, and V

5. Proprietary Data

a. Consolidation of Caving Formation

Union Oil Company has developed a procedure and a fluid to consolidate the caving dolomite formation which may be penetrated while drilling in the Cove Fort area.

Patent applications are being filed in the United States Patent Office and the consolidation procedure and chemical composition of the fluid will be held proprietary until such time as the patents are issued and will not be delivered under this contract.

b. Additional Geological and Geophysical Data

The "Additional Geological and Geophysical Data" to be provided are adjacent to or on Federal KGRA lands which have not been leased to date. This additional data will be held proprietary until issuance of leases on these unleased Federal lands. A lease sale is scheduled for such lands on September 27, 1977.

c. MT/Groundnoise/Microearthquake Surveys

As part of a larger reconnaissance geophysical survey the Cove Fort area was included in a survey utilizing

scalar magnetotellurics, groundnoise, and microearthquake mapping. The survey was conducted by Senturion Sciences, Inc., Tulsa, Oklahoma. The survey remains the sole property of Senturion Sciences. These geophysical data may be purchased by third parties from Senturion subject to a confidentiality obligation. This information will not be delivered under this contract.

d. Magnetic Survey

As part of a larger magnetic survey the Cove Fort area was included in an airborne magnetic survey conducted by Eureka Resource Associates, Inc., El Cerrito, California. The survey was flown at 1,000 feet terrain clearance (drape survey) with NW-W lines about 8 Km apart. This survey remains the sole property of Eureka Resource Associates, Inc. These geophysical data may be purchased by third parties from Eureka subject to a confidentiality obligation. This information will not be delivered under this contract.

e. Seismic Survey

Detailed description of the experimental energy sources used in the seismic survey referred to in paragraph 3(b) will be maintained proprietary and will not be delivered under this contract.

f. Geothermal Wellbore Computer Program

This proprietary computer program calculates flowing pressures and temperatures versus depth in geothermal wells producing steam-water mixtures. It can be used to study the effects of varying wellbore diameters and wellhead pressures on the productivity of the well; it is thus useful in optimizing the operating conditions of a geothermal well.

The program incorporates vertical two-phase flow equations coupled with heat transfer equations and thermal dynamic properties of steam and water. It embodies substantial investment of Union's field testing computer program and mathematical analysis efforts. It is expected that this computer program will be used in the project and the results will be delivered, however, the program will be kept proprietary and will not be delivered under this contract. A paper comparing pressure profiles computed by this program with profiles observed in a number of

geothermal wells will be presented at the annual meeting of the Society of Petroleum Engineers in Denver, Colorado on October 10-12, 1977.

g. Geothermal Gathering Systems Design Computer Program

This proprietary computer program calculates the pressure profile in a pipeline flowing single phase steam, single phase water or steam-water mixtures. It is used to determine pipeline sizes in a geothermal gathering systems. The program includes two phase flow correlations for horizontal and inclined flow, and equations to describe flow behavior of steam and water. It incorporates Union's technology of geothermal pipeline design developed at substantial costs of field experimentation and data analysis. It is expected that this computer program will be used in the project and the results will be delivered, however, the program will be kept proprietary and will not be delivered under this contract.

h. Interference Test Program

Union Oil Company has developed a computer program to evaluate reservoir pressure fluctuations caused by one or more production/injection wells at any point in the reservoir. The program is useful in predicting the pressure response in an idle well that is located in the same reservoir as the production/injection wells. The program is capable of handling variable production/injection rates as well as incorporating the effects of the production/injection history of all the wells in the reservoir.

The classical pressure interference theory presented in the literature is the basis for the evaluation. However, additional theory developed by Union has been included in the computer program. It is expected that this computer program will be used in the project and the results will be delivered, however, this program will be kept proprietary and will not be delivered under this contract.

i. Interpretation of Pressure Observations Due to Variable Flow Rates

Because most geothermal hot water flow testing involves some degree of flow rate variation during a test, a computer program was developed to interpret the measured

pressure observations during a variable rate flow test. Most geothermal flow tests are of such short production periods that the effects of variable flow rates are significant. This program is especially useful in the interpretation of pressure buildup (or falloff) tests and multi-rate test.

Classical pressure transient theory, along with specific well test analysis techniques developed by Union, are included in the program. The program is designed to evaluate all the conditions which Union has encountered in various geothermal areas. It is expected that this computer program will be used in the project and the results will be delivered, however, this program will be kept proprietary and will not be delivered under this contract.

j. Production Temperature Prediction Under the Influence of Reinjection

Reinjection of the heat depleted geothermal fluids in the reservoir will lead to a general migration of cooler fluids to the producers in response to flow gradients established in the field. The reinjected fluid will increase in temperature as it moves through the formation towards the producer. A computer program was designed to predict the temperature of the reinjected fluid as it migrates through the reservoir. The program enables the proper design of injection and production well sites under commercial operation. The program also calculates the temperature of the produced fluid as a function of time after injection breakthrough has occurred.

The theory involved in this evaluation procedure was developed by Union and has been generalized to accommodate all our prospective geothermal operations. It is expected that this computer program will be used in the project and the results will be delivered, however, this program will be kept proprietary and will not be delivered under this contract.

k. Reservoir Assessment Study and Optimum Development Plan

In accordance with the August 19th discussion, this final engineering report on the Cove Fort project will be maintained as proprietary data until thirty months after completion of the long-term flow and interference test.

In addition to the proprietary data described in this paragraph 5, Union reserves as proprietary all information that is developed in connection with Union's or its subsidiaries' operations pursuant to the proposed Contract or elsewhere except:

1. Data Union specifically designated to be delivered to ERDA pursuant to this reply to Request for Proposal, EY-R-08-0007,

2. Information directly known to ERDA,

3. Information which is known or becomes known by the general public through acts of parties other than ERDA, and

4. Information received by ERDA from a third party who did not obtain it from Union under an obligation of confidence.

Union may from time-to-time, upon ERDA's request or Union's own initiative voluntarily release additional information which Union no longer regards as proprietary, but Union shall be under no obligation to do so.

PROJECT COST RECAP

Fiscal Year 1977	Total Cost	Cost to Government	Cost to Union
Drilling	$1,060,000	$ 582,000	$ 478,000
G & G (Original Proposal)	13,550	13,550	-
G & A	53,677	-	53,677
TOTAL:	$1,127,227	$ 595,550	$ 531,677
Fiscal Year 1978			
Prior Activities: Forminco No. 1	$ 647,755	$ 477,271	$ 170,484
G & G (Additional Data)	67,437	67,437	-
Drilling	2,000,000	1,108,000	892,000
Testing	316,000	55,000	261,000
G & A	151,560	-	151,560
TOTAL:	$3,182,752	$1,707,708	$1,475,044
Fiscal Year 1979			
Subsurface Well Repair	$ 100,000	$ 100,000	-
Testing	670,000	156,000	514,000
G & A	38,700	-	38,700
TOTAL:	$ 808,700	$ 256,000	$ 552,700
PROJECT TOTAL	$5,118,679	$2,559,258	$2,559,421

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FISCAL YEAR 1977

Drilling
New Work
Drilling Well KGRA 42-7

		Total Cost	Cost to Government
1.	Location	$ 55,000	$ -
2.	Drilling Contractor	377,000	-
3.	Drilling Bits	66,000	66,000
4.	Drilling Mud and Chemicals	102,000	102,000
5.	Fuel	41,000	41,000
6.	Equipment Rentals	61,000	61,000
7.	Specialized Drilling Services	85,000	85,000
8.	Transportation*	31,000	31,000
9.	Casing	196,000	196,000
10.	Production Equipment	30,000	-
11.	Supervision	12,000	-
12.	Miscellaneous	4,000	-
	TOTAL	$1,060,000	$ 582,000
G & A		53,000	-
		$1,113,000	$ 582,000
G & G			
	Original Proposal	14,227	13,550
TOTAL FISCAL YEAR 1977		$1,127,227	$ 595,550

* Includes Water Hauling

CONFIDENTIAL

FISCAL YEAR 1978

Drilling
New Work
Drilling Well KGRA 2nd Well

		Total Cost	Cost to Government
1.	Location	$ 50,000	$ -
2.	Drilling Contractor	350,000	-
3.	Drilling Bits	65,000	65,000
4.	Drilling Mud and Chemicals	90,000	90,000
5.	Fuel	40,000	40,000
6.	Equipment Rentals	58,000	58,000
7.	Specialized Drilling Services	75,000	75,000
8.	Transportation*	30,000	30,000
9.	Casing	196,000	196,000
10.	Production Equipment	30,000	-
11.	Supervision	12,000	-
12.	Miscellaneous	4,000	-
	TOTAL	$1,000,000	$ 554,000

Drilling Drilling Well KGRA 3rd Well (Costs Same as KGRA 2nd Well)		$1,000,000	$ 554,000

* Includes Water Hauling

CONFIDENTIAL

FISCAL YEAR 1978

Testing
Equipment and Contract Services

	Total Cost	Cost to Government
Choke Manifold	$ 20,000	$ -
Flow Separator - Transport	5,000	5,000
Pipes and Fittings	2,500	-
Valves and Meters	7,500	-
Installation - Contract Services	15,000	15,000
Core Analysis	15,000	15,000
Chemical Analysis	10,000	10,000
Pressure Temperature Services	10,000	10,000
Computer Services	5,000	-
	$ 90,000	$ 55,000

Labor

Area, Coordinator (12 months)	$ 45,000	$ -
Reservoir Engineer (6 months)	19,000	-
Production Engineer (6 months)	19,000	-
Production Foreman (12 months)	37,000	-
Operating & Maintenance (20 months)	50,000	-
Travel & Subsidence (56 months)	56,000	-
	$ 226,000	$ -

Prior Activities

Forminco No. 1	$ 647,755	$ 477,271
G & G "Additional Data"	67,437	67,437
	$ 715,192	$ 544,708
Total	3,031,192	1,707,708
G & A	151,560	-
Total Fiscal Year 1978	$3,182,752	$1,707,708

CONFIDENTIAL

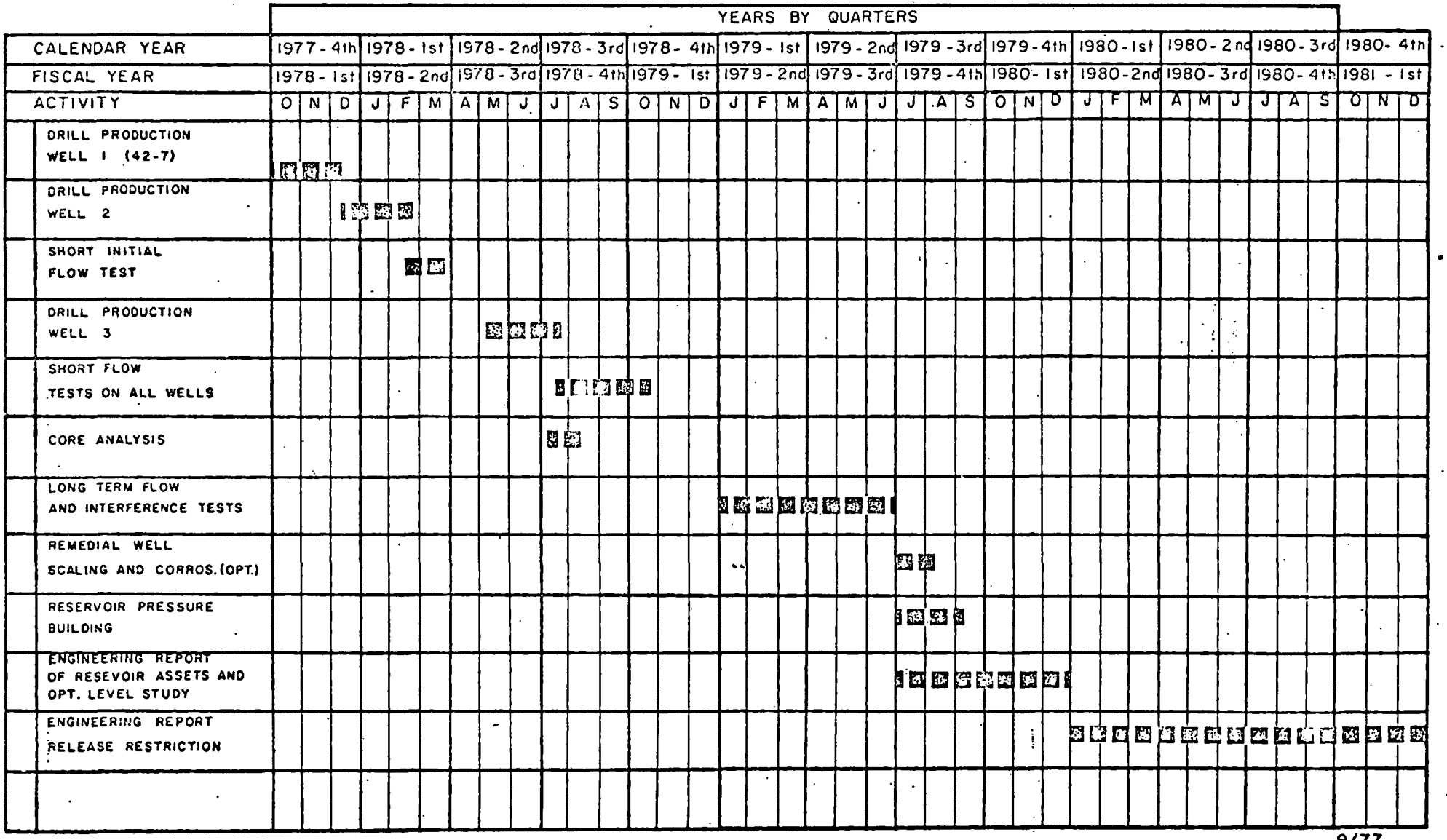
FISCAL YEAR 1979

	Total Cost	Cost to Government
Subsurface Well Repair	$ 100,000	$ 100,000
Testing		
Equipment and Contract Services		
Two Injection Pumps (Rental)	53,000	53,000
One Separator with Controls	100,000	-
7,000 Feet Pipelines Purchase	30,000	-
Rental	28,000	28,000
Miscellaneous Controls and Instruments	20,000	28,000
Vent Tank (Rental)	10,000	10,000
Valves and Fittings	20,000	-
Installation - Contract Services	30,000	30,000
Miscellaneous	35,000	-
Chemical Analysis	10,000	10,000
Pressure and Temperature Services	10,000	10,000
Interference Test Equipment	15,000	15,000
Computer Services	15,000	-
	$ 376,000	$ 156,000
Labor		
Area Coordinator (12 months)	$ 45,000	-
Reservoir Engineer (18 months)	57,000	-
Production Engineer (6 months)	19,000	-
Production Foreman (12 months)	30,000	-
Operating & Maintenance (27 months)	68,000	-
Travel & Subsidence (75 months)	75,000	-
	$ 294,000	$ -
G & A	38,700	-
Total Fiscal Year 1979	$ 808,700	$ 256,000
Grand Total - Project	$5,118,679	$2,559,258

Rec. 9-13-77 KHE

UNION OIL OF CALIFORNIA

COVE FORT SULPHURDALE KGRA



9/77

Union

Article PAYMENT

A. For Program To Acquire New Data

(1) For performance of the work under this Contract, the Contractor shall be entitled to reimbursement for the actual costs of the materials and services furnished by third parties up to a maximum of $2,001,000; the said maximum reimbursement is subject to the Article entitled "Availability of Appropriated Funds." Listed below by each program phase are the expected costs to be reimbursed by ERDA. (See Appendix C for details of these costs by activity).

Phase		
I	Drilling KGRA Well 42-7	$ 582,000
II	Drilling KGRA Well # 2	554,000
III	Drilling KGRA Well # 3	554,000
IV	Short flow test on all Wells and perform core analyses	55,000
V	Long term flow and interference tests, pressure build up and prepare final engineering report	156,000
VI	Subsurface well repair (if required)	100,000
		$2,001,000

To be reimbursed by ERDA, the cost of these materials and services must be based on established catalog or market prices of commercial items sold in substantial quantities to the general public.

The total liability of ERDA under this paragraph A for each separate phase of the work is as set forth above, except that any funds remaining from a cost underrun of one phase may be used to offset cost overruns in succeeding phases as listed above. It is expressly understood, however, that any and all costs incurred by the Contractor in the performance of the work under this Paragraph A in excess of $2,001,000, the amount to be reimbursed by ERDA, shall be borne by the Contractor up to a maximum of $2,375,510 for a total estimated program cost of $4,376,510.

(2) Payments for the categories of materials and services noted in Paragraph (1) above shall be made upon the submittal of monthly invoices to ERDA, supported by copies of the paid invoices of the third parties who have performed work under this Contract which shall be accompanied by copies of delivery tickets or other documents, such as receiving reports, indicating the actual receipt of materials and services.

Each invoice shall contain the check number and date of payment of that invoice. The ERDA shall deduct from Contractor's invoices any discounts, refunds, rebates, or salvage allowances offered by vendors whether or not the Contractor has taken advantage of such benefits, except in those cases where the Contractor provides in writing a valid explanation for failure to take advantage of such deductions.

The Contractor shall assure that the prices contained in the vendor's invoices correspond with the prices in the procurement action between the Contractor and the vendor, and shall be responsible for any errors resulting in overcharges to ERDA.

The Contractor agrees to utilize and maintain acceptable accounting procedures to provide for the segregation and accounting of costs allowable to the various phases of work under this Contract.

(3) The sum of $5,000 will be withheld from the final claim for reimbursement under (2) above pending Contract completion. Said sum shall be paid to the Contractor upon delivery, acceptance and availability for public release of all data required by this Contract.

(4) The cost estimates of Appendix C for each phase of the work may change due to unforeseen circumstances. Should unforeseen circumstances be encountered or if a Contract change be recommended by one of the parties, it is agreed that both parties will meet and give good faith consideration to a Contract modification to expeditiously and equitably deal with the circumstances. Any such Contract modification must be mutually agreed to by the parties, in writing, and may deal with changes in the job description, the payment schedule (for example, a transfer of funds from a later phase to an earlier phase), the amount of each party's contribution (subject to authorization of additional funds by each party) or any other modification necessary to complete the Contract.

B. For Existing Data

Upon completion of Phase I, above, the delivery to and acceptance by ERDA of the Phase I data, and the commencement of drilling operations in Phase II, the ERDA agrees to purchase the existing data as defined in the Article entitled "Deliverables" for the lump sum amount of $558,258 subject to the provisions of the Article of this Contract entitled "Availability of Appropriated Funds." The acquisition cost of this data is $728,742.

Payment shall be made upon delivery to and acceptance by ERDA of such data and submittal of the Contractor's invoice, in duplicate, detailing the data so delivered.

C. The total estimated program cost including the acquistion cost of existing data in Paragraph B, above, is $5,118,679 of which ERDA's maximum cost is $2,558,258. The amount presently obligated by ERDA for this Contract is $582,000. Such amount may be increased unilaterally by ERDA by written notice to the Contractor and may be decreased by written agreement of the parties. In addition to the presently obligated sum of $582,000, ERDA shall obligate $1,976,258 in future Government Fiscal Years thereby increasing the total obligation to $2,558,258. The obligation of the said $1,976,258 is subject to the provisions of the Article of this Contract entitled, "Availability of Appropriated Funds."

UNION

ARTICLE -- DELIVERABLES

A. Limit on Withholding. Except as specifically identified in paragraph D hereunder, none of the Deliverable Data identified under paragraph C of this Article ____, Deliverables, shall be withheld by the contractor under the provisions of paragraph E, Withholding of Proprietary Data, of Article B-6, Rights in Technical Data.

B. Delivery Schedule. The contractor shall deliver the items of Deliverable Data identified in paragraph C, hereunder, in accordance with the following schedule. The bracketd ([]) numbers preceding each item in paragraph C identifies the applicable delivery category in the schedule. Except for cores, cuttings and fluid samples, which will be provided as indicated in the schedule, six copies of each data item shall be delivered.

Schedule for Data Delivery by Category:

[1] Data to be delivered within one month after completion of first production well,

[2] Data to be delivered within three months of the completion of each production well,

[3] Data to be delivered within three months of completion of third, or final production well,

[4] Data to be delivered within three months of completion of each flow test.

[5] Data to be delivered within the five months of completion of field program activity,

[6] Data to be delivered within the term of this contract or such later

time as may be provided by modification.

[7] Data to be delivered upon removal by the contractor of proprietary markings, which removal and delivery shall in any event occur prior to the expriation of the initial term of this contract.

[8] Delivery to be taken from time to time on an as-produced basis by an ERDA or University of Utah representative at the location or shipped by the contractor to the University of Utah, if requested by Contracting Officer.

(Insert long page) Para C.

C. Deliverable Data; Data to be delivered by the contractor resulting from the performance of its program as set forth in the referenced RFP and its supplement shall include but not be limited to the following:

Article – Statement of Work, the ... thereto

1. Surface Geological Data, Existing

   a. {1} Temperature Gradient Investigation (6 holes).

   b. {1} Surface Geology and Geothermal Manifestation Study.

   c. {1} Additional Geological and Geophysical Data.

      1) Temperature Gradient Holes Investigation (19 holes)

      2) Seismic Survey

      3) Resistivity Study

      4) Gravity Measurements

      5) Geochemical Surveys

2. Subsurface Geothermal Well Data, Forminco Well No. 1, Existing.

   a. {1} Complete Drilling History

   b. {1} Drill cutting samples (washed, dried and identified)

   c. {1} Geological Report

   d. {1} Summary of Technical Conclusions from Drilling of Forminco No. 1 Well with the exception of the procedure for consolidation of caving formations, item 11 below

3. Subsurface Geothermal Well Data.

   a. {2} Drilling Technology.

   b. {2} Drilling Histories.

   EVALUATION AND AUXILIARY

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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

DON L. ASH
APR 11 1977

APR - 7 1977

Memorandum

To: INTERESTED PARTIES

From: Area Geothermal Supervisor

Subject: Environmental Analysis prepared on the proposed Plans of Operation of Phillips Petroleum Company and Union Oil Company, Millard and Beaver Counties, Utah

Please find attached the draft Environmental Analysis (EA #57) on Phillips Petroleum Company's and Union Oil Company's proposed Plans of Operation (P.o.O.) for the drilling of eight (8) and twenty-three (23) deep exploratory geothermal test wells, respectively, in the Cove Fort - Sulphurdale area, Millard and Beaver Counties, Utah. Please note that Phillips Petroleum Company no longer plans the subsurface injection of geothermal fluids under this proposal.

All of Appendix B-2 (Union Oil Company's Archaelogical Clearance) and most of Appendices A-1 (Phillips Petroleum Company's P.o.O.), A-2 (Union Oil Company's P.o.O.), and B-1 (Phillips Petroleum Company's Archaelogical Clearance) have already been sent to you under separate cover memorandum of January 10 and February 15, 1977. Please label the pages of these appendices with the appropriate numbers and insert them in the designated places of the EA.

A Geothermal Environmental Advisory Panel (GEAP) meeting will be held at 2:00 PM on April 21 in the Conference Room of the Rodeway Inn, in Richfield, Utah, to consider these proposals, and you are cordially invited to attend. This office also urges you to send written comments by April 29, 1977 to:

Area Geothermal Supervisor
USGS, Conservation Division
345 Middlefield Road MS 92
Menlo Park, CA 94025

If you have any questions concerning this matter, please do not hesitate to contact Sie Ling Chiang in this office (FTS 467-2848; commercial (415) 323-8111 Ext. 2848). All comments will receive serious consideration in the finalization of this EA.

Enclosure

EA #57
(U-28948, U-29553)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION
OFFICE OF THE AREA GEOTHERMAL SUPERVISOR
MENLO PARK, CALIFORNIA

ENVIRONMENTAL ANALYSIS

Prepared for Geothermal Leases U-28947, U-28948, U-29215A, Phillips Petroleum Company; and U-29553 through U-29558, Union Oil Company Cove Fort-Sulpurdale KGRA, Utah.

Previous EA:
None

DON L. ASH
APR 11 1977

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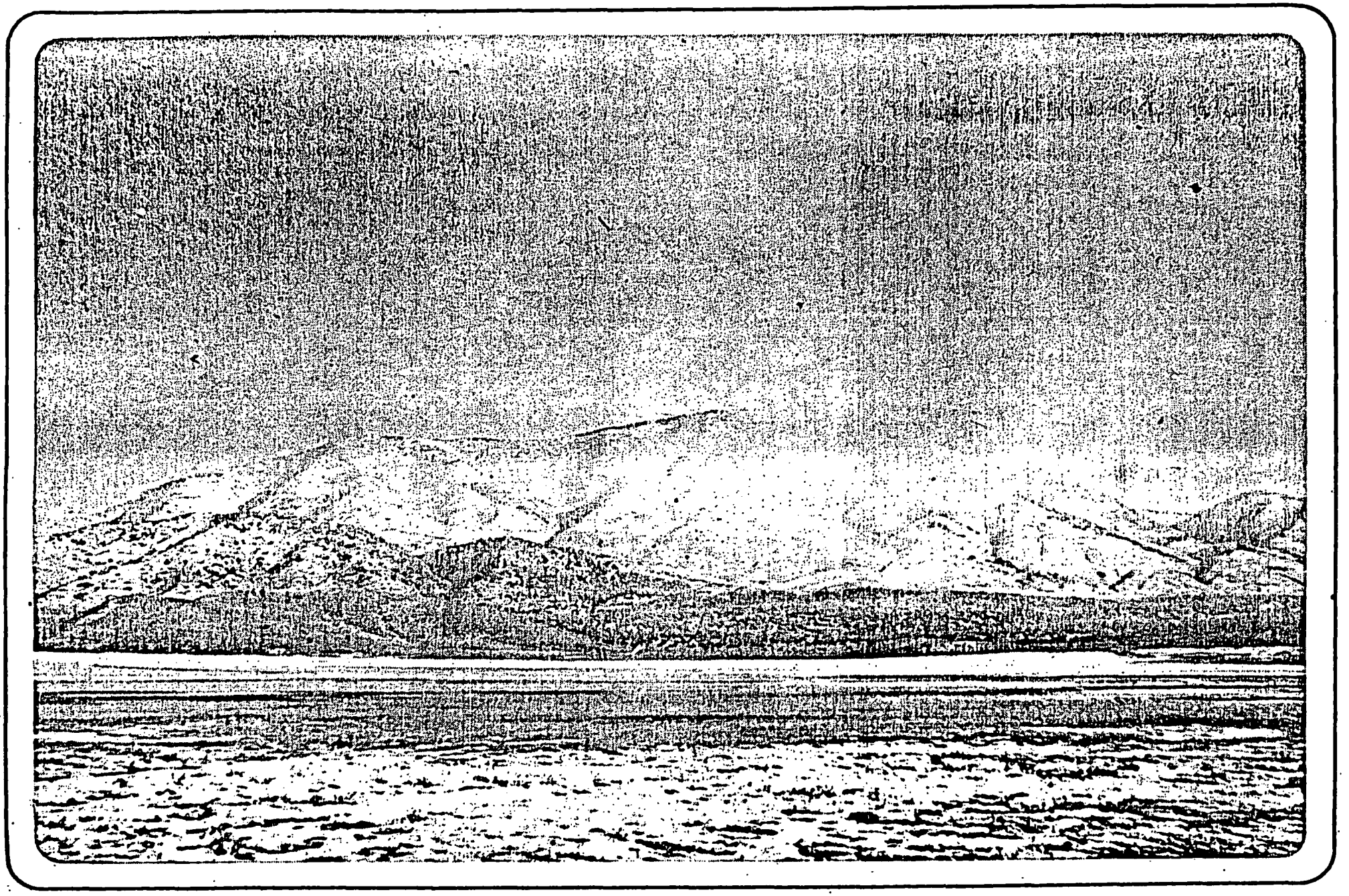
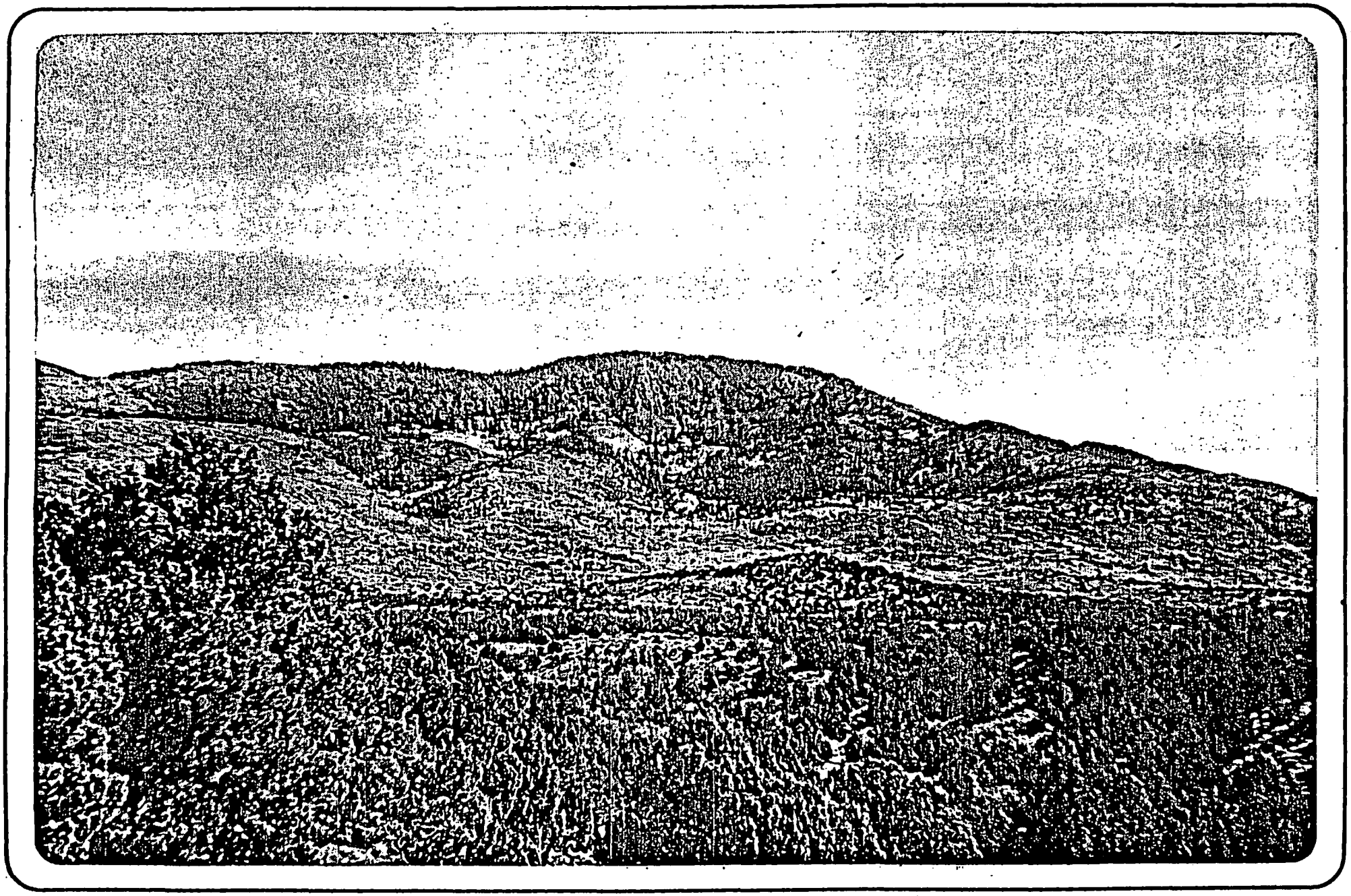


View southeast of the southwest end of the Pavant uplift (Dog Valley Peak) from Interstate Highway 15.



View south of the northern portion of the Tushar uplift from the southwest end of the Pavant uplift.

INTRODUCTION

On December 22, 1976, and February 22, 1977, Plans of Operation (P.o.O.) (Appendix A-1, A-2) and archaeological reports (Appendices B-1, B-2) were filed with the Area Geothermal Supervisor's office of the U.S. Geological Survey by Phillips Petroleum Company and Union Oil Company, respectively, outlining geothermal exploration activities proposed for the Cove Fort - Sulphurdale KGRA area, Millard and Beaver Counties, Utah (Fig. 1). This Environmental Analysis (EA) is designed to evaluate the environmental effects of the proposed actions in accordance with the Geothermal Steam Act of 1970, subsequent rules and regulations, and Sections 102 (2) (C) of the National Environmental Policy Act of 1969. The objective of the EA is to identify the existing environment, identify potential environmental impacts, outline measures for mitigating or eliminating such impacts, and determine if the proposal constitutes a major Federal action, thus necessitating an Environmental Impact Statement. Although the proposals are site specific, the EA provides lease-wide coverage and addresses and considers environmental impacts and mitigating measures on a scale appropriate for each particular environmental parameter.

BACKGROUND AND DESCRIPTION OF PROPOSED ACTION

Resource Development History

The most extensive known geothermal resource development in the Cove Fort - Sulphurdale area has been limited to recent drilling of 1) a deep exploratory test well on private lands by Union Oil Company in 1975, and 2) numerous shallow temperature gradient holes.

Location

The proposed area of geothermal activity is located in the Cove Fort - Sulphurdale KGRA, Utah, in T.25 and 26S., R.6 and 7W., SLCPM (Fig. 1, 2). The proposed area of activity forms a north-south-trending elongate belt which passes near and through the communities of Cove Fort and Sulphurdale, respectively, measures approximately 15 by 5 kilometers, and is traversed by the east-west Millard-Beaver County line. The area is accessible via Interstate Highways 15 and 70 and numerous improved and unimproved dirt roads.

Except for access construction, activities proposed by Phillips Petroleum Company are designed to occur on their leases within the Fish Lake National Forest which is managed by the Forest Service. Union's similar proposal involves activities on their leases within the Fish Lake National Forest and also on National Resource Land managed by the Bureau of Land Management.

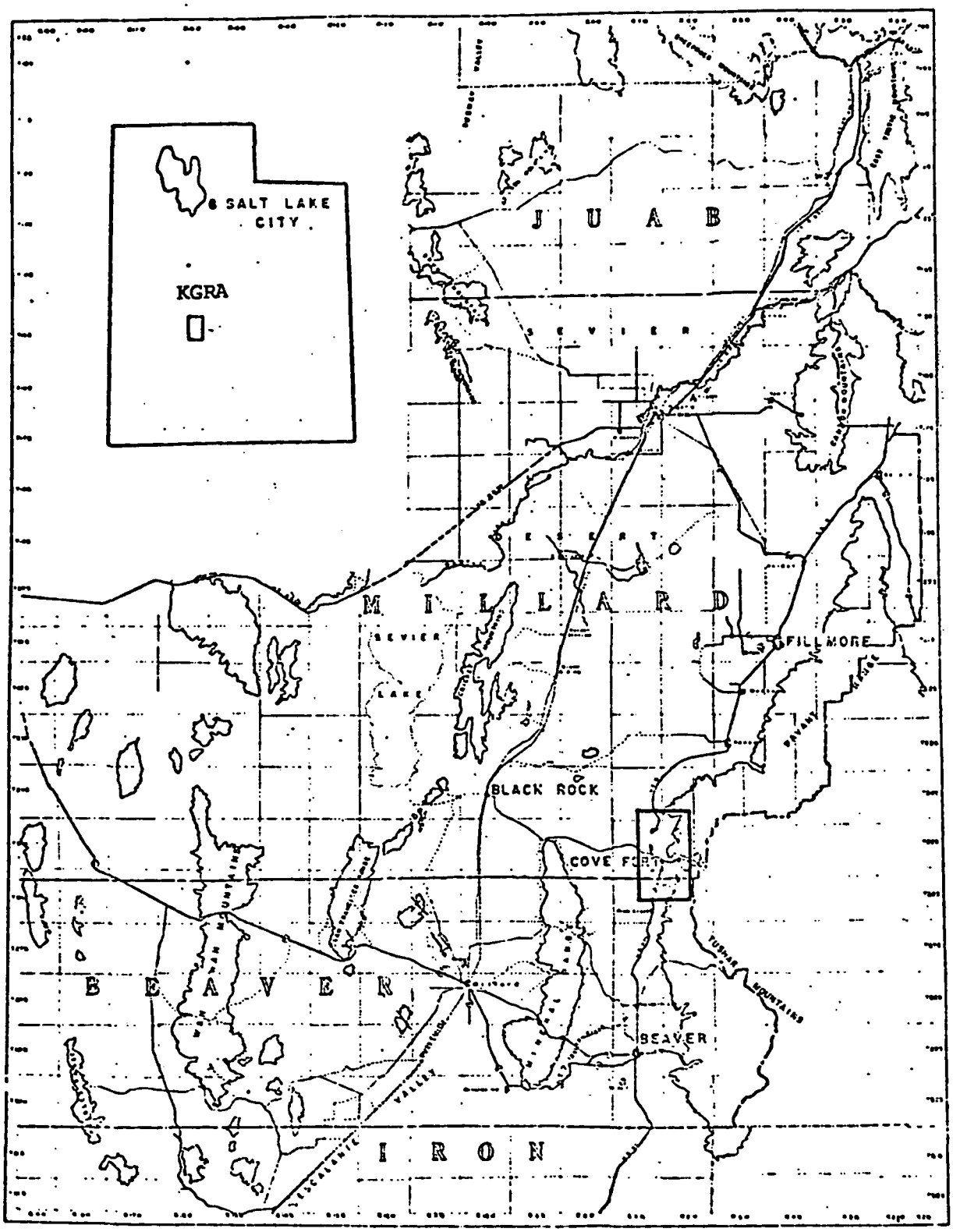


Figure 1. Generalized location of the Cove Fort-Sulphurdale KGRA, Millard and Beaver Counties, Utah (Modified from Rodriquez, 1960).

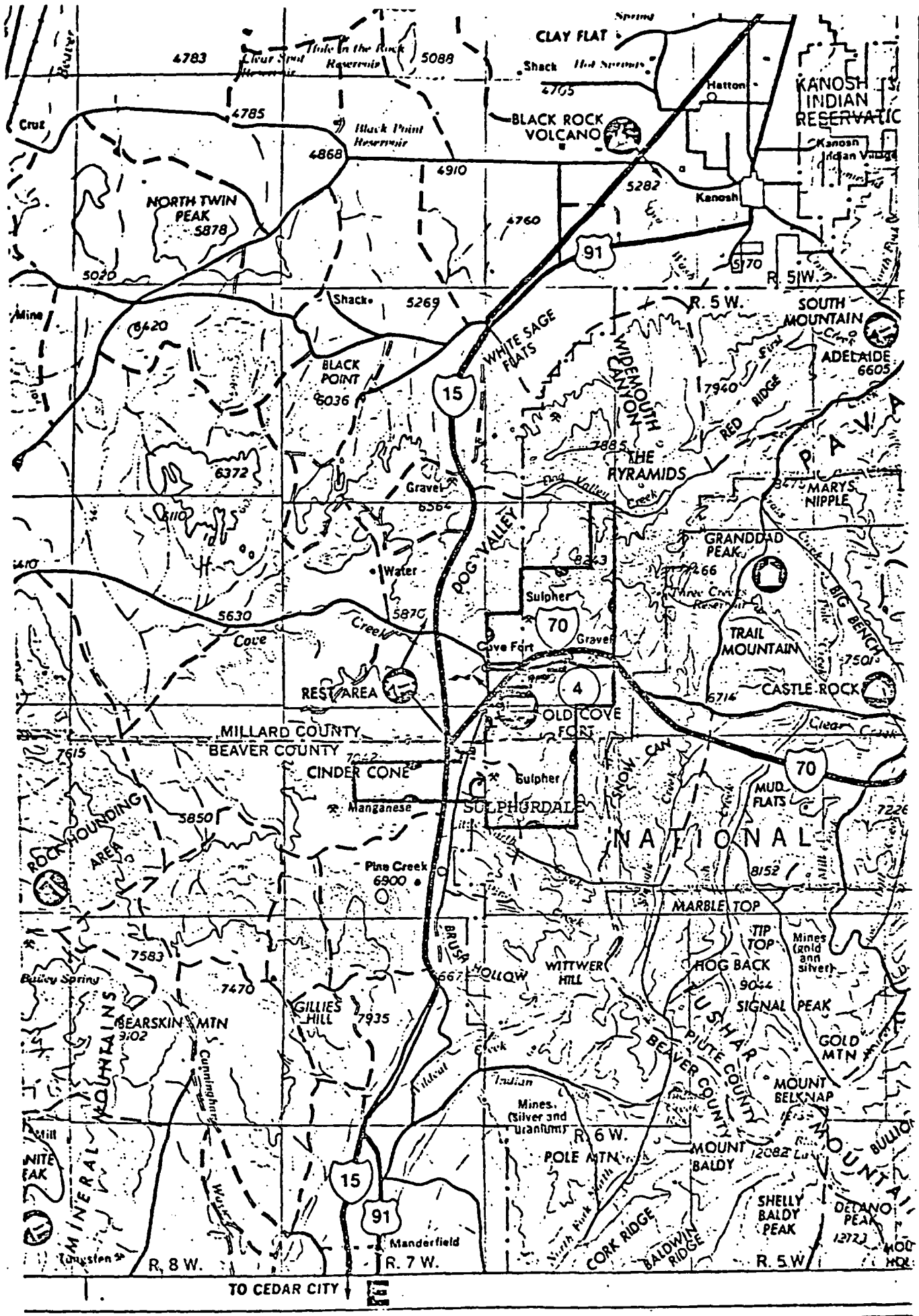


Figure 2. Location of the Cove Fort-Sulphurdale area and approximate extent of EA concern.

Description of the Plans of Operation

Phillips Petroleum Company's Plan of Operation. In order to test a speculative geothermal reservoir(s) in the Cove Fort - Sulphurdale area, Phillips Petroleum Company proposes the drilling of up to eight ± 3,000 m geothermal test wells on the firm's Federal geothermal leases U-28948, U-28947, and U-29215A (Fig. 3; Appendix A-1). Drill pads, varying in size from 0.8 to 1.6 ha, would be constructed and would include a reserve pit. In the event a blowout occurs, and the geothermal reservoir is of the water dominated type, earthern dikes would be constructed in drainage areas downslope of the drill site.

Unimproved Forest Service roads provide most of the immediate access to the proposed area of operation, requiring approximately 16,000 m of improvement in accordance with Forest Service specifications. In addition, construction of a total of about 1,980 m of new road for access to four of the wells, and maintenance of about 760 m of old Utah Highway 13 which fronts Interstate Highway 70 would be necessary. Except for a total of about 1 km of new road and 0.5 km of unimproved road, the proposed access does not lie within Phillips' lease boundaries (Appendix A-1).

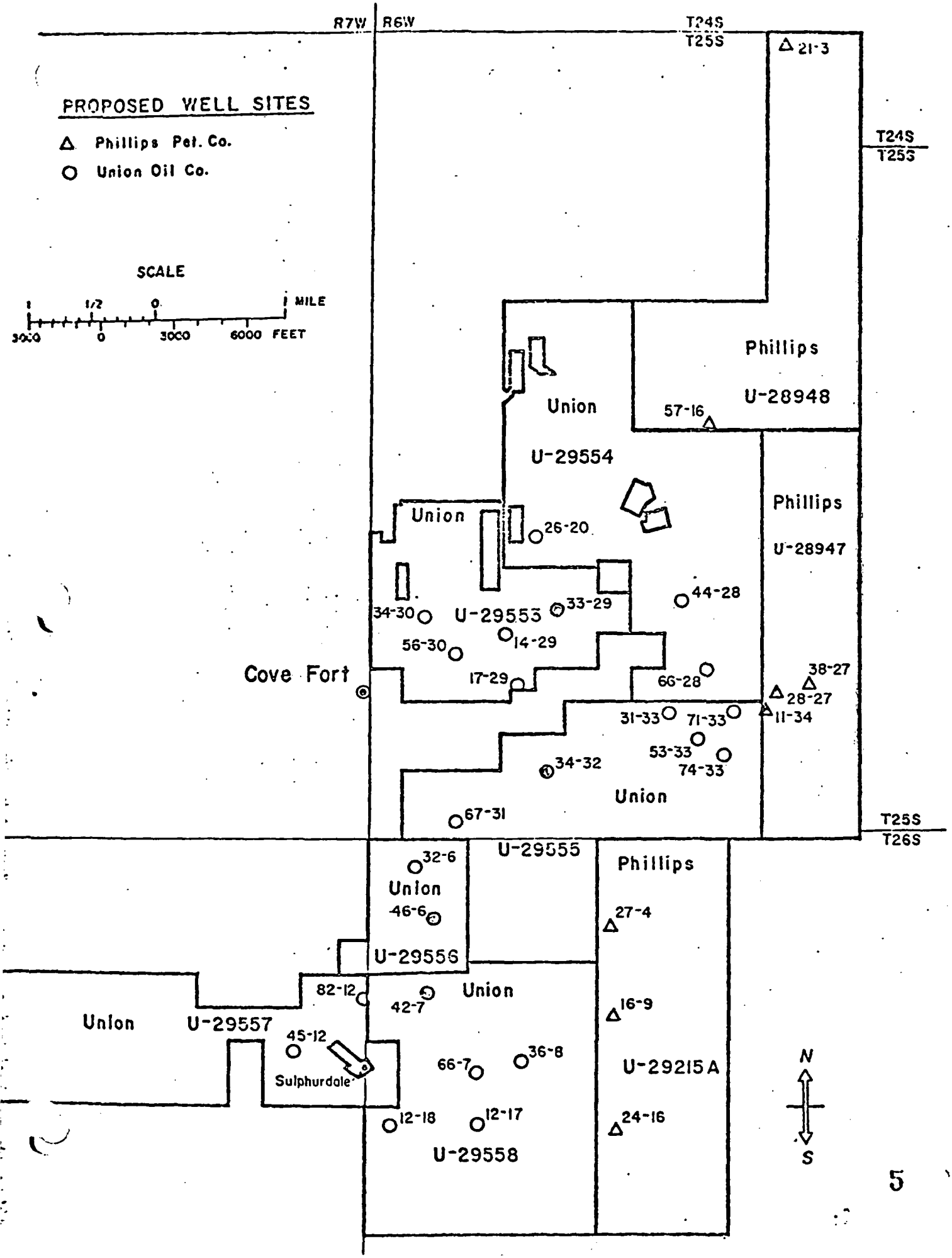
Drilling operations would utilize a rotary drill rig which would probably use a mud fluid. This fluid would be circulated through the reserve pit, the surface of which would be gel-sealed with 0.1 kg (0.25 lb) per square foot of drilling-type natural bentonitic clay. The fluid could be salvaged and used in subsequent drilling operations, used to maintain roads, or evaporated to dryness in the reserve pit. The dried reserve pit, cuttings, mud, and any residue would be buried.

Road construction material would be acquired through county sources. Water supplies for the proposed operation would be trucked in after being purchased from Formingo, Inc., operators of a mine near Sulphurdale. Much of this water (210 to 350 m^3 per day per well) would be incorporated in the drilling mud.

The wells would be designed to test the geothermal reservoir via short term flow tests. During short term flow tests on liquid dominated systems, the geothermal fluid would be discharged into the nearby reserve pit and testing would last only for the period it takes to fill the pit. The contained fluid would be evaporated to dryness and any residue would be buried when the pit is reclaimed. In the event that the geothermal system is vapor dominated, the steam would be vented to the atmosphere during testing and the residual condensate would be allowed to evaporate upon disposal into the reserve pit.

Accumulated garbage and other waste products would be disposed of at an appropriate dumping facility.

FEDERAL GEOTHERMAL LEASES AND PROPOSED WELL SITES
Figure 3. OF EA CONCERN IN THE COVE FORT-SULPHURDALE AREA



Upon approval, Phillips Petroleum Company hopes to initiate drilling activities under the P.o.O. in early 1977. It is expected that the wells would be drilled one at a time, and although the sequence is unknown at this time, the first well to be drilled would probably be either 18-27 or 11-34. The operations would employ about 20 persons per well, working in three shifts. Additional personnel could be employed at various drilling stages. On-site personnel would normally number no more than five to ten at any given time.

Union Oil Company's Plan of Operation. Union Oil Company proposes the drilling and possible testing of up to twenty-three ± 3,000 m geothermal test wells on the firm's Federal geothermal leases U-29553 through U-29558 (Fig. 3; Appendix A-2). Drill pads, similar in size to those proposed by Phillips, would include a sump, reserve, muffling, and clarifying pits (Appendix A-2). Subsequent operations could include the use of a pipeline for injection operations and will either be placed along existing road rights-of-way or will be portable, being pulled by men on foot from one location to another, resulting in no significant surface disturbance. P. 6 - TESTING & SAMPLING Schedule.

Unimproved Forest Service and Bureau of Land Management roads provide the majority of the access within the area of operation and would require approximately 10.5 km (6.5 mi) of improvement. In addition, four new roads totalling nearly 2.5 km would need to be constructed in order to provide access to several well sites. All road construction operations would meet the requirements of the appropriate surface management agency.

Drilling operations would utilize a rotary drill rig which is expected to incorporate a mud fluid but could also utilize an air-mud, air-water, or foam system if lost circulation problems are encountered. X These drilling fluids would be circulated through a sump having a three-foot freeboard and a surface lined with a two-foot thick clay lining possessing a permeability rate that shall not exceed 1×10^{-6} cm/sec. Fluids discharged to the pit, in some cases including geothermal effluent, would be allowed to evaporate, and the remaining residue would be neutralized and either mixed with natural soils and buried, or trucked to an approved dump.

Road construction material would be acquired through a recognized and approved construction contractor. Water supplies for drilling operations would be acquired from Forminco, Inc., operators of a mine near Sulphurdale. According to Union, the quality is "near potable." A detailed analysis would be submitted to the Supervisor prior to use.

After completion of a well, short and long term flow tests could occur, lasting from about one day to possibly two to four months. The very shortest test would discharge geothermal fluids for the time period it takes to fill the reserve pit. Longer tests would necessitate injection of the fluid into the geothermal reservoir via another nearby geothermal well, in which case a pipeline would serve as the transporting medium. An energy dissipator (H-bar spreader) would be utilized to prevent deterioration of the pit.

Accumulated garbage and other waste products would be disposed of in an approved dump.

It is expected that the wells would be drilled one at a time, the sequence of which is unknown at this time. The site plans for the first four wells to be drilled (33-29, 42-7, 46-6, and 34-32) have been included in the P.o.O. (Appendix A-2- Exhibit E). The operations would employ about 20 persons per well, working in three shifts. Additional personnel could be employed at various drilling stages, and to work on pipelines and other facilities. On-site personnel would normally number no more than five to ten at any given time.

BASELINE ENVIRONMENT

Geology and Topography

Regionally, the area of interest is located along the very eastern edge of the northeast-trending disturbed belt of southwest Utah (Fig. 4). The disturbed belt, believed to have formed in Laramide time, can be traced from Alberta, Canada through Montana, Wyoming, Idaho, Utah, and Nevada (King, 1969), and serves as the tectonic contact between the Cordilleran miogeosyncline and foreland. In southwest Utah, it also essentially marks the physiographic boundary of the Basin and Range province on the west and Colorado Plateau on the east.

The disturbed belt is characterized by folds and westward dipping thrust faults, and in southwest Utah, Eocambrian and Cambrian rocks have been thrust on top of younger strata (Crosby, 1973). Superimposed upon the southwest Utah disturbed belt are north-trending tensional Basin and Range tectonic styles and a westward-trending transverse igneous belt which extends into Nevada and is characterized by thick accumulations of Oligocene and Miocene silicic volcanics (Crosby, 1973), rhyolite and basalt flows of Quaternary age (Leise, 1957), possible calderas (Crosby, 1973), and thermal springs (Heylmun, 1966). This igneous belt may be structurally controlled (Crosby, 1973), and appears to be coincident with both the westward off-shoot of the Intermountain Seismic Belt which trends north-south from Montana to Arizona (Smith and Sbar, 1974), and the smaller Black Rock offset zone (Fig. 4) which displays right lateral movement (Crosby, 1973). This entire structural element has been hypothesized as representing the southern margin of the westward migrating Great Basin subplate, one of the components of the larger North American Plate (Smith and Sbar, 1974).

Locally, the area of interest lies on the southwest end of the Pavant uplift (The Pyramids) and the western flank of the Tushar uplift (Fig. 1,2). The Pavant and Tushar uplifts serve as the extreme southeast and eastern limit to the Black Rock Desert (Pavant basin) and Beaver basin, respectively. Immediate elevations range from about 1,830 m in the basin lowlands to approximately 2,510 and 3,020 m in the Pavant and Tushar uplifts. Volcanic centers in the bordering basins rise as high as 300 m (Cinder Crater) above the basin floors. In the uplifts, the terrain varies from gentle along the lower elevation to steep at the higher peak altitudes and in areas traversed by V-shaped drainage channels.

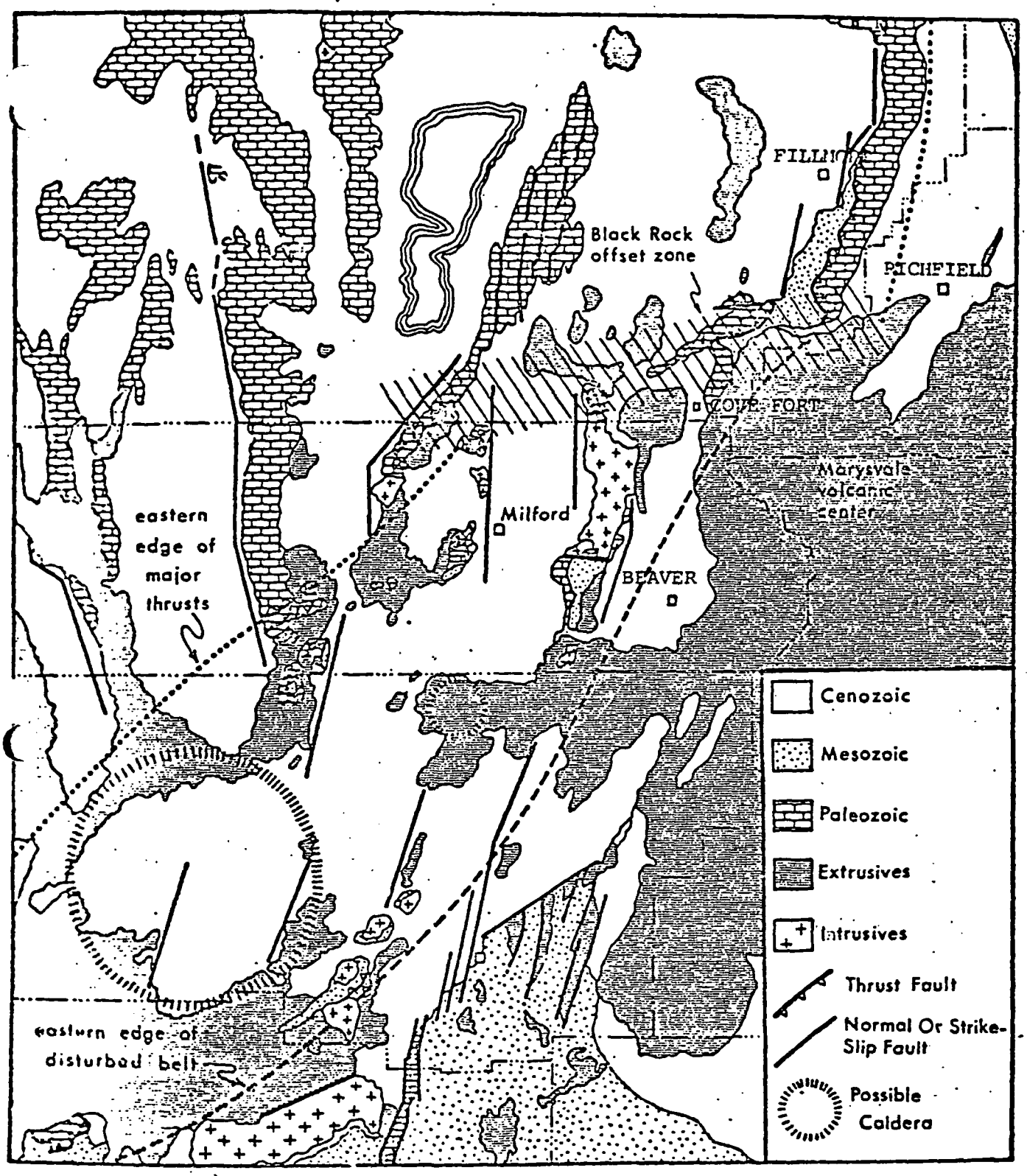


Figure 4. Tectonic map of southwestern Utah. (Modified from Crosby, 1973)

The area of interest is composed of highly fractured igneous and sedimentary rocks ranging from Cambrian to Quaternary in age (Fig. 5). Thick, regional Tertiary and Quaternary volcanics which interfinger in a complex fashion and are made up of various lithologies and textures (Callaghan, 1939) compose much of the subject Pavant uplift and basin lowlands, and the entire exposed Tushar uplift. Southwest dipping, mostly overturned sedimentary strata composed chiefly of sandstones and carbonates and ranging in age from Cambrian through Tertiary, progressively crop out with elevation in the Pavant uplift. Quaternary alluvium, colluvium, and gravels can be observed in drainages and basin lowlands.

The Cenozoic volcanics and sediments have concealed much of the geologic structures of the area. However, northeast-trending folds and thrust faults indicative of the disturbed belt are still preserved in the Pavant uplift, and enough evidence exists to assess the superimposed Basin and Range structures which are still forming. An east-west cross section passing through the Pavant uplift, the Cricket uplift located 48 km to the west, and the intervening Pavant basin reveals a horst-graben-horst structural relationship (Crosby, 1959). A similar structural relationship may exist between the Tushar uplift, the adjacent Beaver basin, and the Mineral uplift on the west. And, based on gravity data, at least one small north-south-trending graben is postulated beneath the Beaver basin (U.S. Geological Survey staff report, 1975). These grabens are probably composed of equivalent strata found in the neighboring uplifts.

Like most Basin and Range structures, there is no evidence of large dominating faults which tectonically separate the Pavant and Tushar uplifts from the adjoining basins. However, many associated northward-trending normal faults of small linear extent can be observed at the margin of the uplifts and in the adjacent basins (Fig. 5).

Vertical displacement along the southwest extent of the Pavant uplift is attributed to a series of normal step faults and is considered a minimum of 1,691 m (Crosby, 1959). A similar series of step faults was recognized along the west flank of the Tushar uplift by Rodriquez (1960).

Thermal springs and landslide debris can be observed in association along a fault zone which extends from Dog Valley to south of Sulphurdale (BLM, 1975). The presence of landslide debris is believed to indicate fault movement during recent times (Rodriquez, 1960).

Geologic Hazards

With respect to geothermal operations, the following seven geologic processes are considered potential hazards in the Cove Fort - Sulphurdale area: 1) flash floods, 2) snow avalanche, 3) slope stability, 4) volcanism, 5) subsidence, 6) blowouts, and 7) seismicity.

Geol Hazards (2)

EXPLANATION

SEDIMENTARY UNITS

CENOZOIC

Quaternary

- **Qoy** — Relatively younger alluvial deposits; chiefly along active streams.
- **Qao** — Relatively older alluvial deposits; on terraces above active streams.
- **Qa** — Undifferentiated alluvium.
- **Qag** — Colluvium and alluvium; mostly stony and unfit for agricultural crops.

Tertiary

- **Tsr** — Sevier River Formation--Gray partly consolidated coarse conglomerate with volcanic debris. Pliocene?
- **Tbk** — Bald Knob Formation--Light gray siltstone, local in Sevier Valley. Late Eocene?

MESOZOIC

Cretaceous

- **Kpr** — Price River Formation--Sandstone and mudstone, fluvial and marine.

Jurassic

- **Jna** — Navajo Sandstone--Cross-bedded, massive-appearing eolian sandstone.

Triassic

- **Trc** — Chinle Formation or Group--Variegated nonmarine sediments, chiefly red. Upper Triassic.
- **Trs** — Shinarump Formation--Conglomeratic sandstone.
- **Trm** — Moenkopi Formation or Group--Siltstone and sandstone, usually red.

PALEOZOIC

Pennsylvanian

- **Pka** — Kaibab Limestone--Light-colored cherty limestone, dolomite and evaporites. Leonardian.
- **Pco** — Coconino Sandstone--Light-colored, cross-bedded, nonmarine sandstone. May include Supai-equivalents, (Queantoneap).
- **Ppk** — Pakoon Limestone--Mostly gray, dolomitic limestone with chert bands. Wolfcampian.
- **PPo** — Oquirrh Formation or Group--Quartzite, limestone, dolomite, sandstone and shale. Lower Permian and Pennsylvanian.

Mississippian

- **Mr** — Redwall Limestone--Gray limestone with brown to red bedded chert. Lower Mississippian.

Devonian

- **Dg** — Guilmette Formation--Chiefly cliff-forming limestone but with much dolomite, sandstone, and argillaceous carbonates. Middle and Upper Devonian.
- **Dsi** — Simonson Dolomite--Alternating light- to dark-gray, fine- to coarse-grained dolomite. Middle Devonian.
- **Ds** — Sevy Dolomite--Very light colored, dense distinctly bedded unfossiliferous dolomite. Lower Devonian?

Ordovician

- **Os** — Silurian and Ordovician undivided--Mostly Laketown and Fish Haven Dolomites.
- **Oes** — Eureka and/or Swan Peak Quartzite--Light-colored, vitreous quartzite and hard sandstone. Middle Ordovician.
- **Op** — Pogonip Formation or Group--Limestone, silty limestone, olive shale and intraformational conglomerate. Lower and Middle Ordovician.

Cambrian

- **Co** — Ophir Shale or Group--Olive-green, micaceous shale and dark limestone. Middle Cambrian.
- **Ct** — Tintic Quartzite--White, pink and yellow, relatively pure quartzite and sandstone, some conglomerate. Middle and Lower? Cambrian.

IGNEOUS UNITS

CENOZOIC

Quaternary

Extrusive Units

- **Qb** — Quaternary basalt

Tertiary

- **T2bf** — Late Tertiary basalt and basaltic andesite flows.
- **T2af** — Late Tertiary andesite-trachyte-latite flows.
- **T2rf** — Late Tertiary rhyolite-dacite-quartz latite flows.
- **Tvmb** — Mount Belknap Volcanics--Elsewhere composed of an upper gray unit and a lower red unit. The gray unit is a rhyolitic flow or extrusive dome, the red unit is a rhyolitic welded tuff (Callaghan and Parker, 1962). Miocene.
- **Tvdh** — Dry Hollow Latite--Comprised of tuff, latite, and basaltic andesite (Callaghan and Parker, 1961). Miocene?
- **Tvbc** — Bullion Canyon Volcanics--Comprised of latites and phroxene andesites. Pyroclastics predominate in the upper part and flows predominate in the lower part (Callaghan and Parker, (1961). Oligocene.

Intrusive Unit

- **Tig** — Tertiary granitoid rocks.

MAP SYMBOLS

X PHILLIPS' WELL SITE

Volcanic cone

UNION'S WELL SITE

Contact

Fault, dashed where inferred

Thrust fault, barbs on side of thrust sheet

Modified from: Hintze, L. F., 1963, Geologic map of southwestern Utah: Utah State Land Board.

References

Hintze, L. F., 1963, Geologic map of southwestern Utah: Utah State Land Board.

Callaghan, E., and Parker, R. L., 1961, Geology of the Kanosh quadrangle, Utah: Geol. Survey Geol. Quad. Map GQ-155.

_____1962, Geology of the Delano Peak quadrangle, Utah: Geol. Survey Geol. Quad. Map GQ-153.

_____1962, Geology of the Sevier quadrangle, Utah: Geol. Survey Geol. Quad. Map GQ-156.

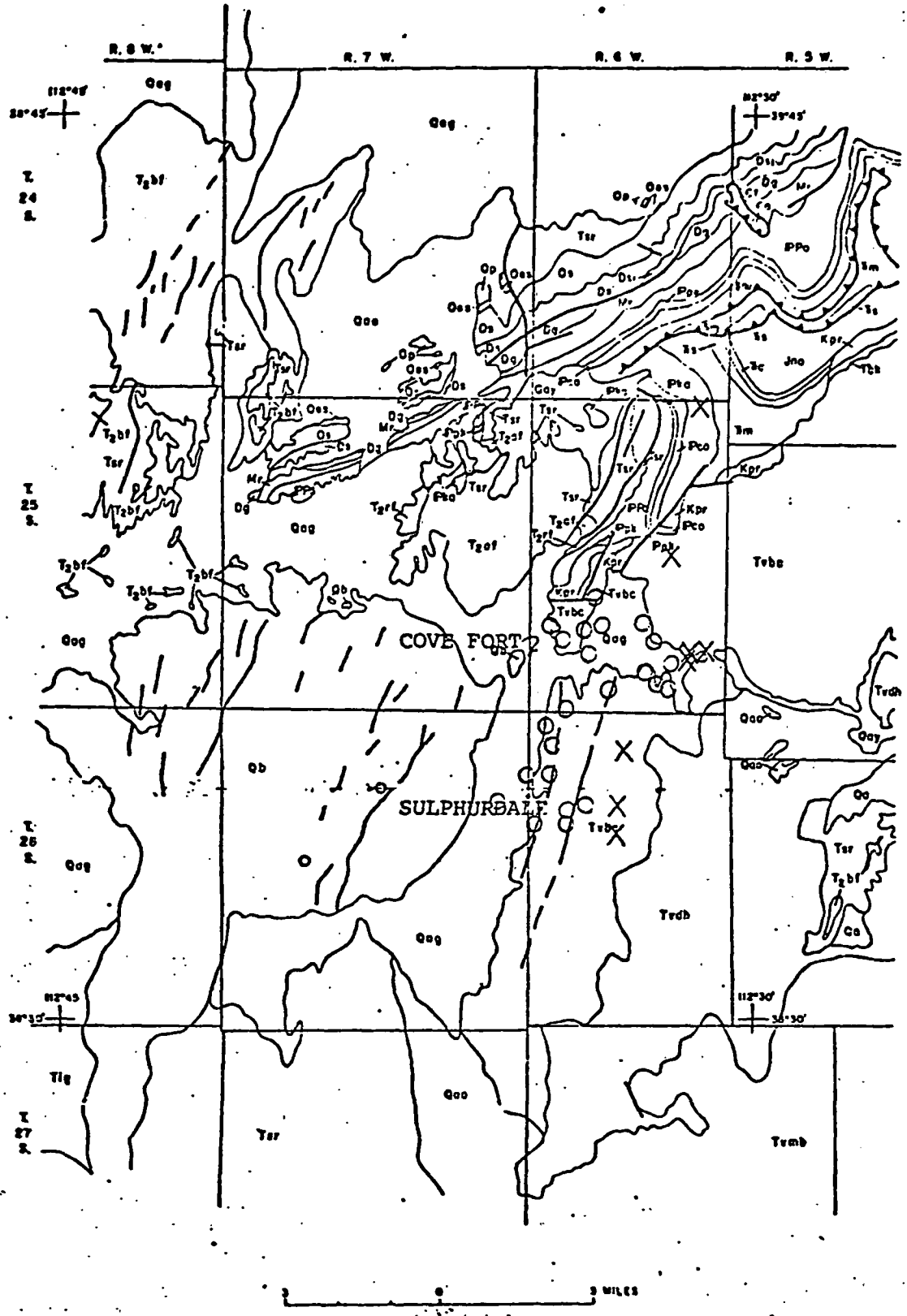


Figure 5. Generalized geologic map of the Cove Fort-Sulphurdale area showing the proposed well site locations. (Union -0; Phillips -X)

Flash Floods. Flash flooding is a problem throughout mountainous areas of the western United States. Utah has long been noted for cloudburst flooding which has historically been concentrated in the mountain ranges extending southward from the Salt Lake City - Logan area to the Arizona border (Woolley, 1946), a belt which encompasses the area of interest. Flash floods have occurred in the towns of Kanosh and Beaver located a few kilometers to the north and south of the area of interest, respectively.

Woolley (1946) fails to report any observation of flash flooding in the Cove Fort - Sulphurdale vicinity from 1850 to 1938, and no report of such activity was made by the Soil Conservation Service in a recently (1973) completed document on water and related land resources of the Beaver River Basin. However, although no mention was made of flooded drainage channels, cloudbursts of sufficient intensity to flood the lower grass lands have been observed in the area (Marion Bigler, pers. comm., 1977).

As flash flooding cannot be conclusively ruled out, necessary precautions should be formulated to protect against such catastrophic events.

Slope Stability. Landslides have been sighted in the area along certain fault traces (Rodriquez, 1960) of the lower Tushar uplift. Two large landslide masses, both composed of volcanics, have been recognized by Union Oil Company— one located about 1.6 km south of Sulphurdale and another located mostly in the west half of Sec. 3, T.26S., R6W., just south and above a cluster of Union-proposed well sites (31-33, 71-33, 53-33, 74-33, and 66-28). Precipitation, which is often a contributor to landslides, probably rapidly dissipates into the subsurface in the volcanic areas.

Most of the drill sites are located on relatively flat and gentle terrain of the lower elevations and appear to be on solid ground. In fact, the majority of the well sites surrounding Sulphurdale are located on gently sloping, smooth terrain which at one time appears to have smoothly and gradually merged with the adjacent valley floor but has since been elevated by recent faulting. Although the three southernmost well sites of Phillips Petroleum Company are situated in high country which is characterized by rugged terrain, none are located directly on the sides of steep slopes. Two of Phillips' well sites (27-4 and 24-16) are located in somewhat gently sloping ravines, and the other site (16-9) is positioned on top of a ridge which displays a moderate plunge at that point.

The fragile nature of the area as defined by its tectonic features, possible incompetent volcanic rock layers, and topography, combine to make the area potentially prone to slope instability if improperly manipulated by nature or man. Activities which necessitate undercutting of slopes, particularly those composed of unconsolidated material and/or possessing precipices, or construction on incompetent materials, may prove to be a serious hazard. Such activities should consider stability problems on a case-by-case basis.

Snow Avalanches. Snow avalanches are commonplace throughout relatively steep mountainous regions that receive generous amounts of snow pack. Not only are the forces generated by these mobile snow masses devastating to objects in their path, but fast moving powder avalanches are capable of creating turbulent winds exerting pressures up to 490 kg/m^2 (Rodgers and others, 1974).

Slopes possessing average gradients of 30 to 45 degrees are the most prone to avalanche production, although avalanches can occur on shallower or steeper inclines. Generally, avalanche paths are easily recognized by a dramatic change in type or age of vegetation due to the often repeated occurrences along the same route. However, many years of quiescence may heal what was once an obvious avalanche scar.

The high, mountainous area of Cove Fort - Sulphurdale possesses many slopes of adequate gradient that, given sufficient amounts of snow fall, would be capable of producing avalanches. In fact, erosional scars which are probably the result of snow avalanche activity can be easily observed in the higher mountain elevations.

Volcanism. Like many geothermal areas, the Cove Fort - Sulphurdale area is not far removed in geologic time from volcanic activity (see Geologic section). The large volume of volcanic rock in the area attests to the intense magmatic activity which has occurred over the past few geologic epochs, the latest event occurring about one million years ago. However, as there is a lack of recent historical volcanic activity, the likelihood of volcanism occurring within the life of the proposal is extremely remote.

Subsidence. Ground subsidence can be a problem in areas of fluid removal, including the extraction of shallow potable ground water such as experienced in the Milford area, about 45 air km southwest of the Cove Fort - Sulphurdale area (Mower and Cordova, 1973). Subsidence has also been experienced in oil fields and at the Wairakei geothermal field in New Zealand.

The younger tapped sources, such as Tertiary and Quaternary unconsolidated deposits, have a tendency to ~~attribute~~ more to subsidence than the older deeper, well-consolidated and relatively stable rocks. SP

Although subsurface water is extracted for irrigation and domestic use, subsidence has not been reported in the Cove Fort - Sulphurdale area. And to date, sufficient data is not available to assess this type of geologic hazard.

Blowouts. Blowouts are always a possibility when drilling any deep wells, and the encountering of conduits containing hot pressurized fluids or steam increases this possibility. A blowout was experienced on a well drilled in the nearby Roosevelt Hot Springs area to the west; however, blowout prevention mechanisms were lacking as part of the drilling equipment.

Seismicity. Because of the presence of recent faults and its location within the Intermountain Seismic Belt, earthquakes pose one of the most realistic geologic hazards in the Cove Fort - Sulphurdale area. This intermountain seismic belt is noted for earthquake swarms as exemplified by the November 11, 1971 occurrence near Cedar City, Utah, in which four hours of tremors with magnitudes up to 4.5 on the Richter scale were recorded, followed by up to 300 events per day (Crosby, 1973). These Intermountain Seismic Belt tremors result from both normal and strike-slip fault movements (Smith and Sbar, 1974). These components have been recognized along faults in the Cove Fort - Sulphurdale area and regionally along the encompassing Black Rock Offset Zone (Crosby, 1973).

Locally, earthquake activities with Mercalli intensities as great as V have been felt in the Beaver and Cove Fort areas (Williams and Tapper, 1953; Cook and Smith, 1967), and much more agressive activity has been reported along the Sevier and Tushar fault zones just 40 km to the east (Cook and Smith, 1967; Sbar and others, 1972). A seismic monitoring program performed in the Cove Fort - Sulphurdale area during several periods in 1974 and 1975 defined up to 10 earthquakes per day which ranged up to 4.19 in magnitude (Olson and Smith, 1976). This seismic activity establishes this country as one of the most intensive areas ever monitered, recognizing a large cluster of shallow swarm-like earthquakes in the immediate area of Cove Fort which define fault boundaries (Fig. 6). Whether the cause of these seismic events results from regional crustal movements, pressure from geothermal fluids, upward movement of underlying magmatic bodies, or some combination of these forces cannot be speculated at this time (R.B. Smith, pers. comm., 1977).

Additional physical evidence supporting somewhat recent movement along certain faults in the area are their deep "V" shaped traces, constricted outlets, and associated landslides (Rodriquez, 1960). All facilities should avoid faults considered active or potentially active.

Soils

Soil associations for the Cove Fort-Sulphurdale area are shown in Figure 7. A brief description of each is given in Table 1.

Air Quality and Noise

Ambient air quality and noise data were gathered during a field investigation trip conducted September 28-30, 1976. The methods and results of these investigations are presented in Appendix D, Environmental Base Line Report.

Air samples were taken at several stations, measuring H_2S, SO_2, NO_x, and particulates (see Figure 1 in Appendix D for locations). All parameters were either below detection limits or well below state and Federal standards. One H_2S reading of 0.034 ppm, however, (station 57A12, located near a sulfur prospecting pit) exceeded the odor or nuisance threshold of 0.030 ppm, the

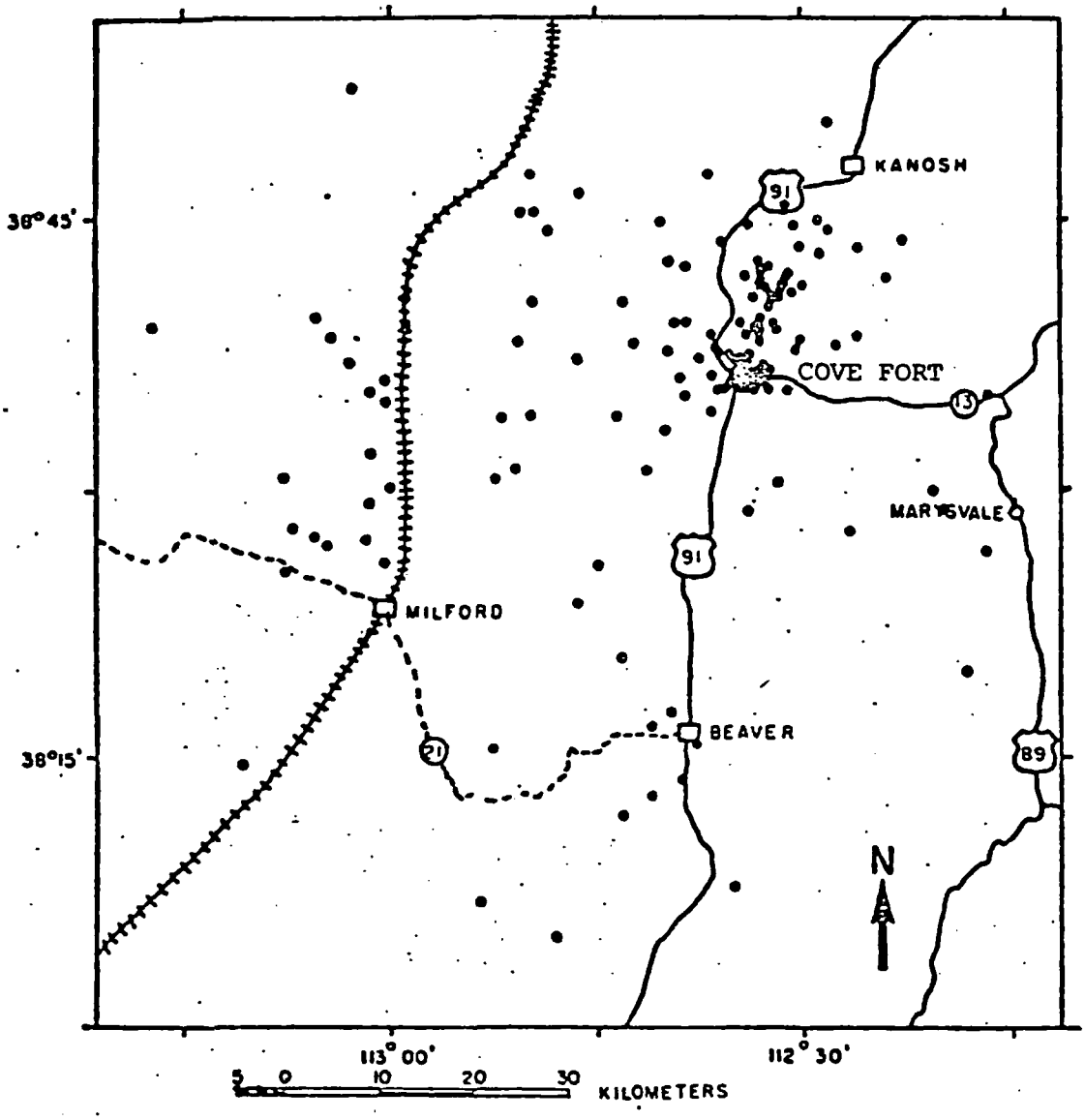


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Figure 6. Epicenter map for the Cove Fort-Sulphurdale area. Note the large cluster of earthquakes in the immediate area of Cove Fort. (Modified from Olson and Smith, 1976).

Table 1 Description of the soil associations in the Cove Fort-Sulphurdale area (see Fig. 7)*

No.

7 In the fine-loamy, nonacid, mesic family of Ustic Torrifluvents; slopes 0-20% at elevation 1,875 m; moderately deep, high erosion hazard, moderate permeability, rapid surface runoff; suitable for range and seeding; 1.5 m profile holds 5-10 cm water.

68 In the loamy-skeletal, mixed family of Typic Argiborolls; forming on lower mountain slopes (up to 60% at elevation 2190 m to 2560 m) in volcanic rocks; deep, moderately eroded, moderately high to high erosion hazard, moderately slow permeability, rapid surface runoff; suitable for limited grazing; 1.5 m profile holds 15 cm water.

70 In the clayey-skeletal, mixed family of Typic Calciborolls; forming on alluvial fans and valley fill derived from mixed rocks; slopes 5-10% at 2190 m to 2310 m; 1.5 m profile holds 20 cm water; deep, moderately eroded, moderately high erosion hazard, slow permeability, rapid surface runoff; suitable for grazing if chained and reseeded.

71 In the loamy, mixed family of Lithic Haploborolls; forming on Mt. slopes in residuum and colluvium from latite rocks; slopes to 80% at elevation 2060 m to 2310 m; deep, moderately eroded, erosion hazard moderately high, permeability slow, surface runoff rapid; 1.5 m profile holds 20 cm water; suitable for grazing if chained and reseeded.

75 Forming on tilted beds of sedimentary rock derived from mixed sedimentary and volcanic rocks; slopes 30 - 75% at elevation 1875 m to 2500 m; very shallow to deep;, severely eroded, erosion hazard high, runoff rapid; very shallow soils hold 1 cm water and deep soils 12 cm water; suitable for watershed and very limited grazing.

78 In the fine-loamy, mixed family of Argic Cryoborolls; forming on Mt. slopes in residuum and colluvium from volcanic rocks; slopes 40 - 80% at elevation 1940 m to 2810 m; deep, moderately eroded, moderate erosion hazard, moderate permeability, medium runoff; 1.5 m profile holds 28 cm water; suitable for grazing, watershed and sulfur mining.

79 In the loamy-skeletal, mixed family of Aridic Entic Haploborolls; forming on stream terraces in alluvium from volcanic rocks; slopes 5% at elevation 2000 m to 2190 m; deep, moderately eroded, erosion hazard moderate, moderate permeability, runoff medium to rapid; 1.5 m profile holds 20 cm water; suitable for grazing, if reseeded, and sulfur mining.

84 In the sandy-skeletal, mixed family of Cryorthents; forming on Mt. slopes in rhyolitic rocks; slopes 50 - 70% at elevation of 2500 m to 2810 m; moderately deep to deep, slightly eroded, moderately high to high erosion hazard, moderately slow permeability, rapid runoff; 1.5 m profile holds 15 cm water; suitable for watershed, timber production, recreation and limited grazing.

88 In the clayey-skeletal, mixed, frigid family of Argixerolls; forming on ridges in residuum derived from intermediate volcanic, limestone and calcareous sandstone; slopes 40 - 70% at elevations of 2190 m to 2500 m; deep, moderately eroded, moderate to high erosion hazard, moderately slow permeability, runoff medium to rapid; 1.5 m profile will hold 13 cm water; suitable only for watershed.

89 In the loamy-skeletal, mixed frigid family of Lithic Haploxerolls; slopes to 80% at elevation of 2125 m to 2500 m; shallow, moderately eroded, moderately high erosion hazards, rapid permeability, rapid runoff; will hold about 2.5 cm water; suitable for watershed and limited grazing.

111 Comprised of soils from various families; forming principally in materials from mixed igneous rocks; slopes 1 - 10% at elevation 1810 m to 2125 m; deep, well drained, moderately eroded; 1.5 m profile will hold 13 to 25 cm water; suitable for grazing, especially if chained and reseeded, and limited dry and irrigated cropland.

122 Comprised of soils from various families; forming on mountain slopes in residuum and colluvium derived from igneous and sedimentary rock; slopes 10 - 45% at elevation 1810 m to 2810 m; very shallow to deep; well drained, severely eroded in most areas; shallow soils hold 1-6 cm water and 1.5 m profile of deeper soils holds 7 - 25 cm water; suitable for limited grazing and watershed.

141 Comprised of 50% Haploxerolls, 35% Calcixerolls and 15% Argixerolls; forming in material from mixed sedimentary, quartzite and igneous rocks; slopes 1 - 6% on alluvial fans with a westerly exposure at elevation 1500 to 1875 m; deep, well drained, slight to moderate erosion; 1.5 m profile holds 13 -28 cm water; suitable for dry and irrigated cropland.

*Source: USDA, 1972 (Appendix I)

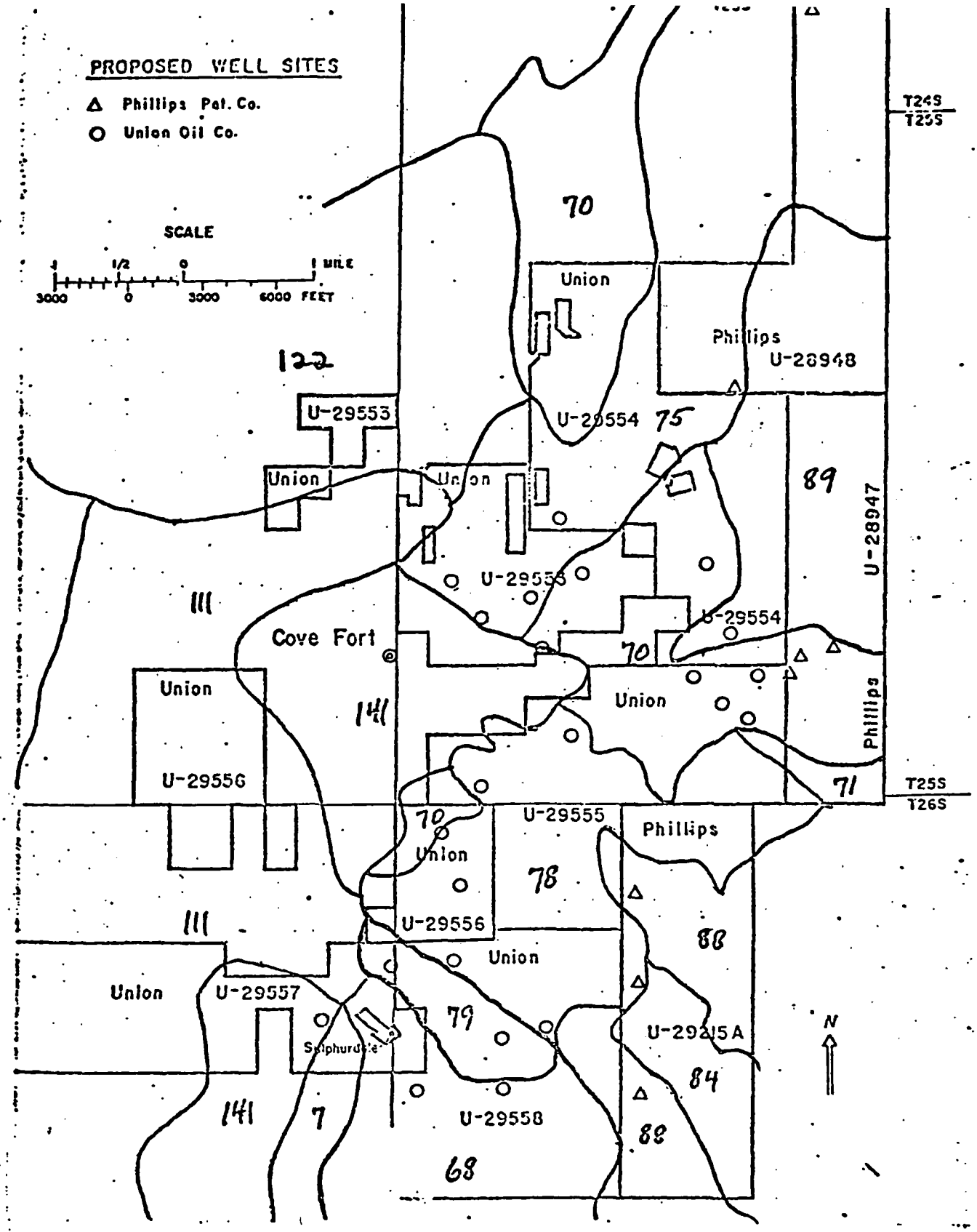


Figure 7.. Soils association in the Cove Fort-Sulphurdale area. For descriptions, see Table 1 . (From USDA, 1972,. Appendix I)

California state ambient standard. There are no Federal or Utah state standards for H_2S. H_2S "rotten egg" odor was readily detectable at the Sulphurdale mine and various prospect pits in the area.

The background noise in the study area is below 55 dBA.

Climate

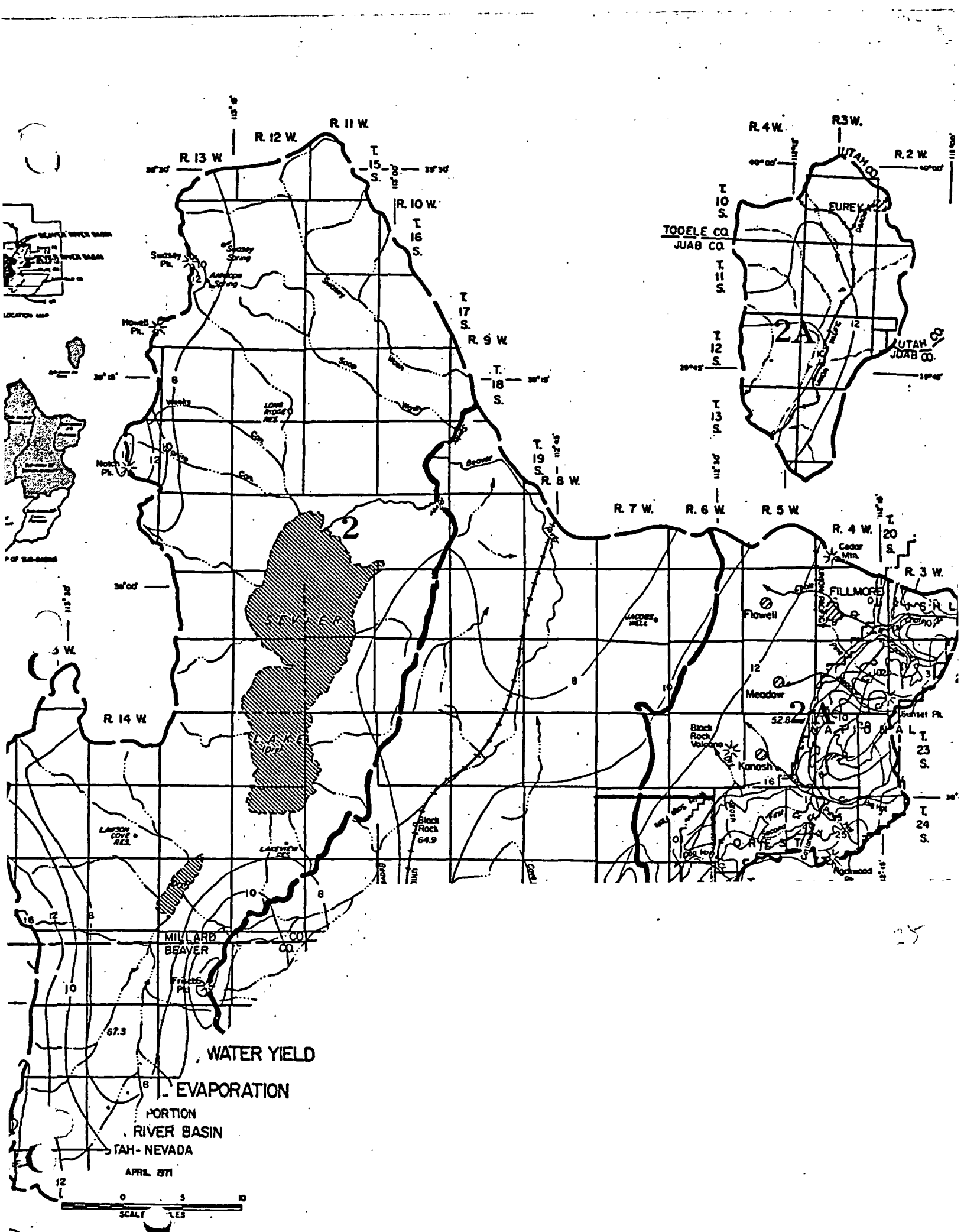
Mean annual precipitation for the Cove Fort-Sulphurdale area ranges from over 100 cm in the Tushar Mountains to the southeast to about 15 cm in the Sevier Lake area to the northwest (see Fig. 8). Two major storm patterns influence precipitation; frontal storms from the Pacific Northwest during winter and spring, and thunderstorms from the south and southwest in late summer and early fall. Less than 10 percent of the annual precipitation falls during June and July. Within the study area mean annual precipitation ranges from 28 cm west of the National Forest boundary to 63 cm at the eastern edge of the study area (BLM, 1975; USDA, 1973).

Temperature extremes vary from 38°C to subzero, with daily fluctuations as great as 22°C. Mean monthly temperatures range from 2.2°C in January to 23.3°C in July. Yearly frost-free periods vary from 107 days at Beaver to the south to 156 days at Fillmore to the north. Average annual water surface evaporation ranges between 100 - 150 cm (see Fig. 8). Prevailing winds are from the southwest at 11 to 19 km per hour (USDA, 1973).

Hydrology

The Cove Fort-Sulphurdale area lies on the east-central edge of the Beaver River basin, which drains approximately 21,052 km^2 (see Fig. 8). The main drainage feature within the basin is the Beaver River whose headwaters are on the southwestern slopes of the Tushar Mountains, 20 to 30 km south of the Cove Fort-Sulphurdale area. The river is impounded in the Minersville Reservoir and all water released from the dam is used for irrigation and stock watering. Runoff from the irrigated fields south of Milford and intermittent tributary runoff from the Mineral Mountains, flow northward through Escalante Valley to Sevier Lake, a dry playa 80 km northwest of Cove Fort. For most of the year, however, the river is dry.

Locally, Cove Creek is the major drainage feature, having its headwaters in the canyons separating the Pavant Range to the north and the Tushar Mountains to the south. It flows westward, reaching the Beaver River 30 km away, but only during years of very heavy rainfall. Crest-stage records for 1962-1968, recorded 8 km west of Cove Fort, reveal no flow for four of the seven years and a maximum flow of 170 l/sec in 1967 (USDI, 1963 - 1969). Dog Valley Creek, which drains a gap in the Pavant Range about 9 km north-northeast of Cove Fort, is the only other major intermittent stream in the area. Its flow is entirely absorbed by the alluvium in Dog Valley, a small, closed basin 7 km north of Cove Fort. Sulphur Creek and Little North Creek, as well as several unnamed creeks, have intermittent flows which drain the western slopes of the Tushar Mountains south of Cove Fort. The average annual water yield within the study area is about 2.5 cm (see Fig. 8). to surface streams?


R. 13 W.
R. 12 W.
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UTAH CO.
TOOELE CO.
JUAB CO.
MILLARD CO.
BEAVER CO.
SEVIER
LAKE
Fillmore
Flowell
Meadow
Kanosh
Cedar Mtn.
Black Rock Volcano
Black Rock
64.9
67.3
52.8
Notch Pk.
Howell Pk.
Frisco Pk.
Sunset Pk.
Eureka
Lookout Pass Rd.
Lookout Pass Res.
Lower Ridge Res.
Lake Creek Res.
Jacobs Well
Rockwood
WATER YIELD
EVAPORATION
PORTION
RIVER BASIN
TAH- NEVADA
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SCALE
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5
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n U.S.D.A., 1973)

Wildlife

Over 50 species of birds, 14 species of reptiles and 31 species of mammals inhabit the Cove Fort-Sulphurdale area. Principal game animals include mule deer, elk, mountain lions, cottontail rabbits, mourning doves, chuckars, sage grouse, band tailed pigeons, blue grouse and ruffed grouse. Table 2 indicates the status of selected species within the Beaver River Basin. Antelope, beaver, pheasant, and turkeys, however, do not inhabit the Cove Fort-Sulphurdale area. Figure 10 shows the habitats of various game species, including summer and winter mule deer habitat. Almost all drill sites lie within the critical deer winter habitat.

Mule deer have the greatest economic value. Portions of two deer herd units #55 and 56A, lie within the study area. Though population size is limited by the amount of winter range available, the four springs in the area provide water year-round, significantly increasing the area's carrying capacity. This is one of the most popular hunting areas in the state (BLM, 1975). Elk have been sighted in the area, but are believed to be strays from herds inhabiting areas well outside the study area.

Coyote and bobcat are the major predator species. Both are trapped and their pelts sold at high prices. Coyotes are killed regularly, as they are considered a nuisance.

Due to the lack of perennial surface water, the only fish in the area are trout which have been planted in a man-made pond near the Forminco mining operations at Sulphurdale.

Two endangered species, the American peregrine falcon (Falco peregrinus anatum) and the prairie falcon (Falco mexicanus), may inhabit the area on a transient basis. No known nesting sites have been recorded. Several other raptorial birds which are important in controlling local rodent populations (BLM, 1975) do nest in the area, however. Their nesting sites are not known at present.

Current and Anticipated Land Uses

Recreation. Hunting, mostly of deer, is the most popular recreational pursuit in the area. As mentioned in the section on wildlife, portions of two deer herd units lie within the study area. The 1976 hunting season for both herd units (bucks only) lasted seven days from October 23 to October 29. Except for the cultivated lands, nearly the entire area is used for deer hunting. Driving for pleasure is another popular past-time, often done in conjunction with visits to historic Old Cove Fort (BLM, 1975).

Cultural Resources. Between 8,000 and 11,000 years of cultural deposition may be represented in the study area, based on lithic materials such as Clovis and Folsom points found in central Utah. The dominant culture in the area, however, was the Fremont, composed of five phases, occupying the area from 900 A.D. or earlier to 1300 A.D. These people may have migrated to the area or may have been descendants of the "Desert Culture" which developed in the arid west after the last glaciation. (BLM, 1975).

TABLE 2--Selected wildlife species evaluation by occurrence and trend, Beaver River Basin, 1970

Species	Occurrence[a]	Trend[b]
Animals		
Mule deer	Abundant	Static
Elk	Uncommon	Static
Antelope*	Uncommon	Declining
Coyote	Uncommon	Static
Kit fox	Common	Static
Mountain lion	Rare	Declining
Beaver*	Common	Increasing
Bobcat	Uncommon	Declining
Birds		
Golden eagle	Common	Declining
Band-tailed pigeon	Uncommon	Static
Mourning dove	Abundant	Increasing
Blue grouse	Uncommon	Static
Ruffed grouse	Common	Static
Pheasant*	Common	Declining
Chuckar	Common	Increasing
Sage grouse	Uncommon	Declining
Predatory hawks	Common	Declining
Turkey*	Uncommon	Static

a Abundant - More abundant than in other areas of western states
Common - Same as other western states
Uncommon - Less abundant than other western states
Rare - A rarity, species infrequently seen, often not for several years

b Based on recent (10-15 year) estimates

* Do not occur within study area

(Source: USDA, 1973)

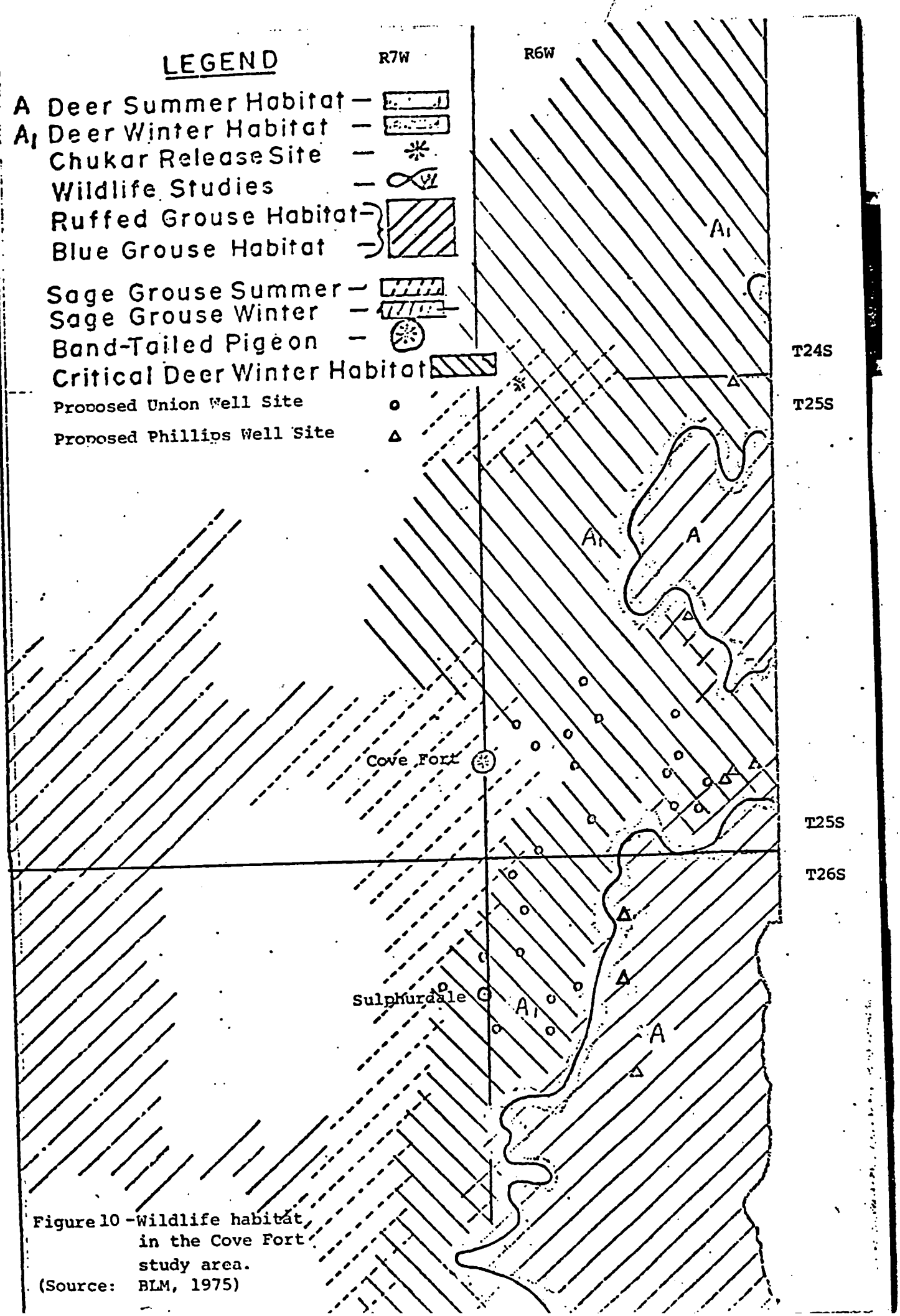

Figure 10 -Wildlife habitat in the Cove Fort study area.
(Source: BLM, 1975)

The abundance of deer, due largely to the springs located in the area, suggests a favorable hunting area for prehistoric peoples. It is therefore surprising that only very limited evidence of transient occupation, mostly lithic debris, was discovered during the archaeological survey of the proposed drill sites and access routes. The archaeologists' reports are included in Appendices B-1 and B-2.

Grazing. Livestock grazing by cattle and sheep is an important land use in the area. A total of 7,693 Animal Unit Months (AUM's) of forage capacity is provided. Grazing occurs year-round (BLM, 1975).

Forestry. As mentioned in the section on vegetation, small stands of harvestable timber occur in the extreme southeast corner of the study area, on unleased land. There is, at present, no direct access to these stands (BLM, 1975).

Aesthetics. Objective evaluation of the scenic qualities of landscape is difficult, but satisfactory results may be acheived by considering the variety in form, line, color and texture which characterizes the landscape. Landscapes lacking variety in these parameters will tend to be dull and monotonous, whereas mountainous country, for instance, with variations in vegetation, running water and exposed rock tend to be more exciting to the eye.

The Cove Fort-Sulphurdale area could be classified as moderatley scenic, as the often snow-capped Tushar Range provides a dramatic background to the lower pinon–juniper covered western slopes. The browse shrub community, which generally occurs at a higher elevation than the pinon-juniper, provides striking color contrasts in the fall when the Gambel's oak leaves begin to turn. The chained areas, however, present an unnatural aspect of disturbed land dotted with piles of dead pinon and juniper. The borders of chained areas often add unnatural straight lines to otherwise rolling land.

Mining. The Cove Fort-Sulphurdale area has undergone extensive mineral exploration and over the years several mineral commodities have been exploited. Elemental sulfur, deposited along faults and fractures by ascending geothermal fluids rich in hydrogen sulfide and iron, can be observed in a fault zone extending from Sulphurdale to just north of Cove Fort (Rodriquez, 1960). Presently, Forminco, Inc., is open-pit mining the sulfur deposits at Sulphurdale in Sec. 7, T.26S., R.6.W., and recently ore reserves were estimated to be 4.845 million tons, of which 17.55 percent is sulfur (Rodriquez, 1960). Forminco and other mining claimants have located mining claims thorughout the western flank of the Tushar uplift and southwest tip of the Pavant uplift (BLM, 1975).

Fluorite also occurs as veins along the faults and fractures of the Pavant and Tushar uplifts, and often exists as a gangue mineral associated with the sulfur (Crosby, 1959). Crosby (1959) reported the existence of an operating fluorite mine 2.4 km north of Cove Fort. The mine has apparently since closed.

The industrial minerals of building stone and scoria, and sand and gravel have also been exploited from volcanic cones southwest of Cove Fort and from nearby alluvial deposits, respectively. However, they are not commercial commodities at the present time (BLM, 1975).

Physical evidence indicating the presence of such resources as uranium, lead, zinc, phosphate, iron, and alunite have also initiated exploration activities in the area, but none have proven successful. Because of the favorable stratigraphy known to exist in the area, the presence of subsurface oil and gas is considered a strong possibility (Crosby, 1959).

Socio-Economic Characteristics

The area of interest is located within Beaver and Millard Counties, Utah, neither of which boast cities or metropolitan areas (Fig. 1). Although there are several small towns scattered throughout the counties, none are located within the Cove Fort - Sulphurdale area. The towns of Beaver (Beaver County) and Fillmore (Millard County) constitute the nearest populus centers of the two counties to the area of interest, being situated about 37 km to the south and 56 km to the north, respectively. The small, unincorporated communities of Sulphurdale and Cove Fort lie along the western margin of the area of interest.

The population for Beaver and Millard Counties could be considered low by many standards (Table 3), and is extremely sparse at the area of interest, limited to possibly a few families at Cove Fort (BLM, 1975) and any on-site personnel during mining operations at Sulphurdale. Like many western-rural regions, the majority of these sparse counties' populations are clustered at centers such as Beaver (approx. 1,450) and Fillmore (approx. 1,800) which provide many services and amenities, and possess a predominatly Mormon social structure. An overall gradual increase in population occured in both counties from 1971 to 1975.

Table 3 Populations of Millard and Beaver Counties, Utah, 1971-1975. (From Watanabe, 1976 and BLM, 1975)

	1971	1972	1973	1974	1975	1971-75 % change
Millard	7,200	7,700	7,700	7,900	8,200	16.3
Beaver	3,800	4,100	4,100	4,200	4,200	9.1

The 1971-75 civilian labor force within the counties varied from 43 to 45 percent of the actual population, but remained essentially in direct proportion to the changing population (Table 4) as the 1975 unemployment reached 8.4 percent for Beaver County and 6.3 percent for Millard County (Table 5). Just over half of the work force is employed in the various nonagricultural businesses listed in Table 6. The mining operation at Sulphurdale, tourism and limited services at Cove Fort, and agriculture in the valley areas compose the apparent employment in the area of interest.

Table 4 Selected business statistics for Millard and Beaver Counties. (From Watanabe, 1976, and BLM, 1975)

MILLARD	1971	1972	1973	1974	1975	Percent Change 1974-75
Population (est.)	7,200	7,700	7,700	7,900	8,200[a]	3.8
Av. Civilian labor force (est.)	3,120	3,124	3,151	3,202	3,608[a]	12.7
Av. nonagricultural employment	1,683	1,737	1,671	1,694	1,834[a]	8.3
Av. monthly non-agricultural wage ($)	403	420	443	519	559[a]	7.7
Annual nonagricultural payroll ($000)	8,132	8,764	8,893	10,548	12,302[a]	16.6
Number of new car and truck regristrations[b]	481	544	547	na	397	na
Total personal income ($000) (est.)	19,874	22,000	24,800	32,500	38,300[a]	17.8
Per Capita income	2,620	2,857	3,221	4,113	4,671	13.7
State of Utah Av.	3,400	3,704	4,100	4,500	4,800	6.7
Percent of State av.	77	77	79	91	97	
BEAVER						
Population (est.)	3,800	4,100	4,100	4,200	4,200[a]	0.0
Av. Civilian labor force (est.)	1,730	1,772	1,855	1,895	1,924[a]	1.5
Av. nonagricultural emp.	994	1,040	1,071	1,096	1,015[a]	-7.4
Av. mo. " wage $s.	425	472	492	559	580[a]	3.8
Annual " payroll ($)	5,068	5,884	6,319	7,348	7,065[a]	-3.9
No. new car & truck regs.	187	234	263	na	143	na
No. new dwelling units[c]	15	37	42	30	52	73.3
Residential constr. ($)[c]	156	624	803	747	1,366	82.9
Nonresidential contr. ($)[c]	394	432	658	1	1,757	999.0[d]
Total constr. ($)[c]	911	1,084	1,462	770	3,172	311.9
Total pers. income ($) (est.)	10,735	12,700	14,300	17,300	16,800[a]	-2.9
Per capita income	2,825	3,097	3,487	4,119	4,000	-2.8
Percent of State av.	83	84	85	92	83	

NOTES: [a]Preliminary. [b]Excludes out-of-state purchases. [c]Reporting areas only-see Utah Construction Report. [d]Change of over 999%. na-Not available.

Table 5 Civilian Labor Force Employment Rate for Millard and Beaver Counties, Utah. (From Utah Dept. of Employement Security)

Millard County	Civ. Labor Force	Employed	Unemployed	Percent Unemployed
1971	3,120	2,910	210	6.7
1972	3,050	2,910	140	4.6
1973	3,050	2,900	150	4.9
1974 (Dec.)	3,410	3,226	184	5.4
1975	3,626	3,399	227	6.3
Beaver County				
1971	1,730	1,620	110	6.4
1972	1,790	1,680	110	6.1
1973	1,830	1,720	110	6.0
1974 (Dec.)	1,760	1,612	148	8.4
1975	1,938	1,775	163	8.4

Table 6 1975-1976 employment within nonagricultural businesses for Millard and Beaver Counties, Utah. (From Utah Dept. of Employment Security, 1976).

Millard County	1975	1976	Percent Change
Manufacturing	234	211	-9.8
Mining	52	60	15.4
Construction	63	34	-46.0
Trans., Comm., Util.	155	160	3.2
Trade	506	518	2.4
Fin., Ins., Real Estate	41	57	39.0
Services	137	169	23.3
Government	550	543	1.3

Beaver County			
Manufacturing	108	108	0.0
Mining	30	21	-30.0
Construction	28	33	17.9
Trans., Comm., Util.	153	150	-2.0
Trade	272	312	14.7
Fin., Ins., Real Estate	28	30	7.1
Services	115	144	25.2
Government	264	281	6.4

Overall total personal and per capita income of the last few years have increased in Millard and Beaver Counties, although income in Beaver County did drop slightly from 1974 to 1975, mostly as a result of a drop in pay in the nonagricultural realm (Table 4). During the 1971-1975 period, the personal and per capita income of Beaver county remained at a nearly constant ratio to the State totals, while statistics for Millard County show an increase in both categories. Per capita income for both counties remained below the state average.

IMPACT EVALUATION AND MITIGATING MEASURES

In order to fully evaluate the possible impact on many environmental parameters of the Cove Fort - Sulphurdale area and identify any necessary mitigating measures, specific construction plans, particularly for each well site, must be reviewed. Such plans for several Union Oil Company well sites which are reasonably expected to undergo drilling operations and plans for all of Phillips Petroleum Company well sites have been submitted with the P.o.O.'s. These plans have been closely examined in this EA process. Submission to the Supervisor of similar detailed well site plans with the Application for Permit to Drill (APD) would be required on every remaining well site before it is to undergo any surface disturbance activities. If approval or conditional approval is granted for those well sites without specific plans, such approval would be considered general in nature and contingent upon closer examination by the Supervisor of the specific well site plans. These closer examinations could result in additional mitigating measures and stipulations being imposed by the Supervisor.

Physical Characteristics

Geologic Hazards. With respect to the proposals and the seven possible geologic processes previously discussed, only volcanism is not considered a potential hazard in the Cove Fort - Sulphurdale area. Catastrophic forces resulting from flash floods, snow avalanches, and unstable slopes; subsidence created via geothermal fluid production; a blowout resulting from an encounter of the well bore and geothermal conduits; and seismicity induced via natural forces or geothermal development are all possible geologic impacts which may result in loss of life and/or property. The lack of detailed geologic information makes it extremely difficult to fully assess these geologic hazards.

Probably the most effective safeguard against flash flooding would be the siting of surface facilities, including roads, on high stable grounds above drainage channels. Certainly all well sites should avoid major drainage channels. Although all of the drill sites and roads are not ideally situated in this manner, most appear to be safe from flash floods. However, all proposed access routes, drill sites, and other surface facilities should be examined carefully, and where necessary, well engineered drainage systems should be employed in reflection of particular needs. In addition, well planned routes to safe areas should be part of the operations safety program for all involved.

The dearth of data on snow avalanche activity in the Cove Fort - Sulphurdale area makes it extremely difficult to assess this geologic impact. As with the flash flood problem, probably the most effective safeguard against snow avalanches would be the siting of roads, drill sites, and surface facilities on high stable ground, above and out of the destructive path of the avalanche. Construction plans of surface facilities, particularly those of the high country, should be examined carefully for potential avalanche problems, and where necessary, precautionary measures should be employed to guard against such catastrophic events.

According to GRO Order 4, Sec. 5, all operating plans shall give proper consideration to the potential hazards of slope instability. If such conditions are determined to exist, design of proposed roads, drill sites, and surface facilities shall be approved by and constructed under the supervision of a qualified engineer or engineering geologist satisfactory to the Supervisor. Some site plans have been submitted and carefully reviewed and it has been found that they are adequate. Other site plans would be submitted for review by the Supervisor in the future, once it is known that the well would definitely be drilled.

Local networks of horizontal and vertical control must be established by the lessees prior to prolonged production of the reservoir in order to monitor for possible subsidence and lateral deformation (GRO Order 4, Sec. 8). To minimize the risk of subsidence, injection programs may be initiated to maintain formation pressures within the reservoir. And if subsidence is determined by the Supervisor to present a significant hazard to operations or adjoining land use, then the Supervisor may require remedial action, including but not limited to increased injection rates of waste or other fluids, reduced production rates, or a suspension of production (GRO Order 4, Sec. 8).

The Cove Fort-Sulphurdale area possesses many faults and fractures which are capable of acting as geothermal conduits and may contain geothermal medium under high pressures. And many of the well sites are located along a known north-south-trending fault zone at the lower slopes of the Pavant and Tushar uplifts. Hence, the potential for a well blowout exists, but such a risk can be minimized through use of blowout prevention equipment. Such equipment is required by Sec. 2 of GRO Order 2 and full compliance with this provision should minimize the danger of such an occurrence. It is also possible that the geothermal wells may encounter active faults which could be triggered during an earthquake. These fault movements could shear the casing, resulting in an underground blowout which can be very difficult to control. Since there is a dearth of geologic information necessary to assess the probability of this occurring, such examination will be made by the Supervisor through the review of Applications for Permit to Drill when more information would be available.

Seismicity may be induced by geothermal development via production and injection programs. Production, without injection programs, can significantly decrease the reservoir pressures, allowing for a settling or subsidence of the overlying rock which induces seismic activity. The resultant increased rock

compaction may produce a stronger mass which may be capable of withstanding more stress, hence increasing the possibility of a larger than expected naturally-induced earthquake.

Although injection programs established at The Geysers and Imperial Valley of California and the Valles Caldera of New Mexico have not reported induced seismicity, pressure injected fluids can increase fluid subsurface pore pressures, and near some fault zones, it has been speculated that such pressure buildups have triggered release of natural stresses along existing fractures (Healy and others, 1968; Raleigh and others, 1975). However, it is not always necessary to inject fluids into the subsurface under greater than existing reservoir pressures as the geothermal reservoir is often at about or less than hydrostatic pressures and fluids can be fed by gravity flow. Although it has not been demonstrated, it seems possible that actual introduction of fluids, particularly those under pressure, may also produce seismic activity via frictional flow or if expansion of the reservoir is realized.

In locales such as the Cove Fort - Sulphurdale area which are accustomed to frequent, natural seismic activity, it may be very difficult to discern seismic activity which is artificially induced. However, where induced seismicity associated with the development of geothermal resources is determined, then the Supervisor may require the lessee to install such monitoring devices as necessary to adequately qualify the effect thereof. If induced seismicity is determined to represent a significant hazard, the Supervisor may require remedial actions, including, but not limited to, reduced production rates, increased injection of waste or other fluids, or suspension of production (GRO Order 4, Sec. 8).

Soils. The erosion hazard of the soils to be disturbed (see Fig. 7) ranges from moderate to high. Annual precipitation, however, is low; about 45 cm. Rains are not concentrated in any particular season or month, but heavy thunderstorms do occur in late summer and early fall. These storms can cause considerable erosion to exposed soils. Therefore, all disturbed soils should be reseeded as early as possible 1) after initial site construction, 2) after restoration of the reserve pit, and 3) after final abandonment and restoration of each site.

Phillips has stated that "disturbed areas shall be restored as near as possible to the original form and reseeded in accordance with Forest Service specifications" (P.o.O., Appendix A-1). They do not, however, propose to revegetate cut and fill slopes upon completion of initial grading. This is essential since up to 30 years or more may separate initial drill pad construction and final restoration. Union, on the other hand, states that "upon completion of grading, cut and fill slopes are seeded to control erosion" (P.o.O., Appendix A-2). They do not, however, state that sites will be restored and revegetated upon abandonment of their drill sites. In order to remedy this situation and ensure minimal soil erosion, it shall be stipulated that disturbed soils be reseeded according to methods recommended by the Fish Lake National Forest Supervisor and the Fillmore District Manager, BLM, on their respective lands. This stipulation shall also apply to ultimate restoration of the land after a well has been abandoned and the drill pad restored "as near as reasonably possible to its original condition" as per 30 CFR 270.45.

LOCATION & ROADS P.2

LTR DTD. 4-18-77 MAKES THIS ADDITION

Air Quality and Noise. Local air quality could be impaired by:

1. Increased suspended particulates due to earth moving operations and traffic to and from the drill sites.

2. Increased hydrocarbons, NO_2, NO_3, CO and other pollutants associated with exhaust emissions from cars, trucks, generators and air compressor engines.

3. Increased H_2S and other noncondensible gases (CO_2, CH_4, NH_3, for example) which are sometimes associated with geothermal effluents.

Emissions from 1 and 2 above would be minor and temporary in nature. H_2S emissions, however, can be problematic, causing both a health hazard and an odor nuisance due to the characteristic "rotten egg" smell of H_2S. At The Geysers in northern California, concentrations as high as 1,000 ppm have been encountered during drilling. The maximum allowable concentration for safe working conditions is 20 ppm (Sax, 1951).

There are no Federal or state H_2S standards in Utah. H_2S in a dry environment like the Cove Fort-Sulphurdale area, however, behaves as follows (Schieler, 1975):

$$H_2S \xrightarrow{O_2} SO_2 \xrightarrow{Sun} SO_3$$

Thus, one part of H_2S will be oxidized to one part of sulfur oxide, although the exact rate of reaction is not known and presumably varies considerably with temperature and wind conditions. Compliance with the Federal primary ambient air quality standard for SO_2 of 0.03 ppm (annual average), however, should indicate that H_2S emissions are below that level as well. Surveillance of ambient air quality to ensure compliance with Federal, state and local regulations can be imposed by the Supervisor when deemed necessary (30 CFR 270.34, 41).

Noise would be generated during the following stages of exploration:

1. Construction of drill pads and access roads.

2. Well drilling

3. Well testing.

4. Vehicular traffic.

In accordance with GRO Order No. 4, Section 11.C, noise emissions must be attenuated to a maximum of 65 dB(A) measured at the lease boundary line, or 0.5 miles (0.8 km) from the source, whichever is greater. The lessee is required (GRO Order No. 4, Sec. 11.B, D) to monitor and measure noise levels as deemed necessary by the Supervisor using an octave band noise analyzer with an A-weighted frequency response.

In the event that mud circulation is lost or hot rock is encountered during drilling, it may be necessary to convert to drilling with compressed air. Considerable noise may be generated during air drilling such that a suitable muffling device is usually necessary to attenuate noise emissions to acceptable levels. The lessees have indicated in their Plans of Operation that such mufflers will be used. Drilling with compressed air also tends to generate considerable dust, requiring the use of a dust separator or some means of water washing the blooie line discharge. These problems will be addressed as Special Conditions.

Vegetation. Drill pad and access road construction would require clearing of vegetation over an area of approximately 35 ha. About ½ of the disturbance would occur within the pinon-juniper association, ¼ within the chained pinon–juniper area and ¼ within the browse shrub community. Approximately 25-30 km of unimproved Forest Service road would serve as access to the various drill sites, requiring widening and improvement in certain places which have not been clearly identified. The resulting disturbance, however, would be relatively minor.

The lessees propose to revegetate all disturbed areas (except roadways) to prevent erosion and restore habitat. It shall be stipulated that reseeding will be done in accordance with BLM and Forest Service specifications, as applicable.

Done as per our LTR. DTD. 4-19-77 See P.O. Addition & Revision

Wildlife. Of the three habitat types mentioned above, the browse shrub community has the highest value to wildlife, as it provides good cover and contains the greatest diversity of plant species. Chained pinon-juniper would rank second although habitat value would vary from area to area according to the success of revegetation efforts. Least valuable is the pinon-juniper association, which offers good cover but has little forage value. This latter association, as mentioned above, would receive the greatest amount of disturbance. Revegetation of the drill pads and road edges would improve the habitat value in this area by providing openings of nutritious grasses and perhaps shrubs.

As shown in Figure 9, all but four proposed drill sites lie within deer winter habitat. At The Geysers field in northern California, deer have become accustomed to geothermal activity and use suitable habitat in the proximity of geothermal equipment. The increased heat associated with geothermal activity warms surrounding soil and makes possible early spring growth of grasses and forbs on and near the drill pad, providing attractive areas for wildlife in winter months. It is difficult, however, to predict whether this factor will offset the loss or degradation of habitat due to construction and noise. At The Geysers, deer have declined in numbers over recent years.

Not true / ? winter

As there are no known nesting areas for peregrine or prairie falcons within the vicinity, the proposed action would have no measurable effect on these two endangered species. Other raptors known to inhabit the area may be frightened away by the noise and human activity, at least temporarily. On the other hand, the rodents and other animals displaced by construction activity could supplement local food supply for raptors and other predators as well.

Water. The potential impacts on local water resources of drilling deep geothermal wells are:

1. Possible stream sedimentation as a result of drill site and access road construction. The likelihood and severity depend on the slope of the terrain, proximity to surface water, amount of rainfall, erodibility of the soil, design of the pad and roads, and success of revegetation efforts.

2. Drilling of each well requires approximately 230,000 liters of water. (1446.6 Bbls.) 850 Bbls. Required To Fill Hole w/ 10,000' T.D.

3. Possible seepage of fluids through the sump, contaminating shallow ground water.

4. Possible interzonal communication of ground water leading to contamination of freshwater zones.

5. Possible spillage or escape, as in a blowout, of toxic materials, eventually reaching surface water.

These impacts may be avoided or mitaged in the following ways:

1. Erosion and subsequent stream sedimentation can be avoided or minimized by proper site location (away from streams or lakes) and by proper revegetation of disturbed areas (see Soils). None of the sites, as currently proposed, lie close to a natural drainage.

2. The lessees have indicated in their P.o.O.'s that water for drilling would be purchased from local sources.

3. Proper sealing of all drilling sumps and test pits would ensure total containment of all fluids and thus provide full protection against ground water degradation. Such lining requirements will be imposed as a Special Condition.

4. The well casing requirements of GRO Order No. 2 effectively prevent interzonal communication of potentially useable ground water aquifers. Every drilling program must conform to these standards or the Permit to Drill will not be issued by the Supervisor.

5. GRO Order No. 2 also requires installation and frequent testing of blowout prevention equipment at all wells. These tests are conducted in the presence of USGS personnel to ensure that the equipment functions properly. Spillage of fluids from the sump can be prevented by requiring a minimum free-board of 60 to 90 cm above the fluid line. This will be imposed as a Special Condition. Disposal of drilling fluids from the sumps would be either via evaporation and mixing of the residual sludge with the native soil, or would be picked up by vacuum truck and used to maintain roads, provided no toxic substances had been added to the drilling fluids (see plans of Operation, Appendix A). Drilling fluid which may be reused would be salvaged accordingly.

Testing of each well produces large quantities of potentially toxic fluid which must be either stored in an impermeable pit or injected. Chemical analyses of geothermal fluids are required by Section 10 of GRO Order #4 and the method of disposal will be based on the result of such analyses. To preserve test pit lining integrity, energy dissipators will be required as a Special Condition on all discharge lines.

If an injection and testing program is contemplated, the additional potential impacts on both shallow and deeper ground waters are possible. Prior to initation of an injection program, the lessee must submit the proposal for approval by the Supervisor. However, if the Office of the Area Geothermal Supervisor determines that additional, significant surface disturbance will result from injection operations, an appropriate P.o.O. will be required of the lessee and an EA on the subject proposal will ensue.

Land Uses

Recreation. At present, deer hunting is the only recreational land use of any significance in the Cove Fort area. The construction of new roads and improvement of existing roads would provide better access to presently remote areas. While this may benefit hunters to some extent, the improved access invites more human disturbance, possibly to the detriment of game animal populations.

Aesthetics. Sight-seeing does occur in the area, but is not a major recreational pursuit. It occurs more as a result of people in cars passing through the area, rather than as an intentional, planned activity. Therefore the area is not highly sensitive from an aesthetic standpoint.

The proposed action will inflict scars on the landscape although many would not be visible from Interstate Highways 15 and 70, the principal roads in the area. Successful revegetation would eventually camouflage the disturbed sites, but 20 years or more would probably be required before the original flora can reestablish itself. If a producible resource were encountered, pipeline routes and power plants would add to the aesthetic degradation.

Cultural resources. Archaeological surveys of all areas to be disturbed were performed by a qualified professional archaeologist. Many traces of lithic debris were discovered, mostly imported obsidian and high grade chalcedony flakes. Only one find produced potentially diagnostic evidence of prehistoric use, that being a fragment of a bifacial metate (a food processing tool). Although the fragment was not in good condition, it may be regarded, at least tenuously, as indicative of the presence of either Parowan or Sevier Fremont people. One fairly large concentration of lithic debris (12 m in diameter) was discovered adjacent to Phillips' access route to site 16-9. Sufficient mitigation to preserve this site (42 Be 189 on Fig. 11) for future investigation can be achieved if the road at this point is dropped down the slope to a point at which the uphill edge of the road runs 1.5 m south of the present centerline markers. Phillips has indicated that this would create no significant increase in the grade of the access road. This matter will be addressed as a Special Condition.

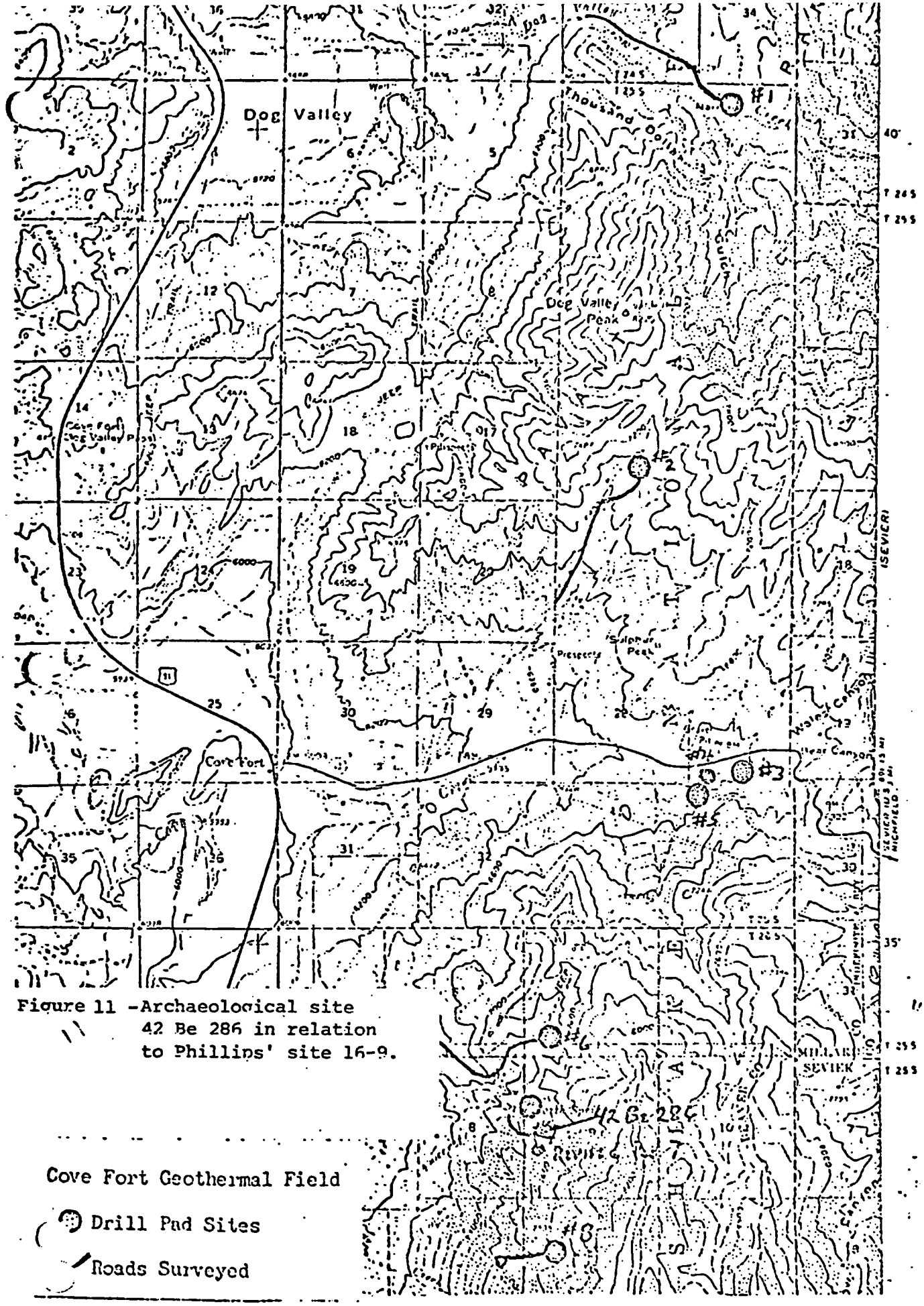

Figure 11 -Archaeological site 42 Be 286 in relation to Phillips' site 16-9.

Grazing. Impacts on grazing will be minor and perhaps beneficial if revegetation of disturbed areas increases the overall forage value of the land.

Forestry. There will be no impact on any commercial timber in the area.

Mining. Since much of the known mineralization of the Cove Fort-Sulphurdale area is attributed to similar geothermal targets--namely faults, fractures, and hydrothermal solutions--the occurrence of minable mineral commodities, particularly sulfur, may present a conflict with geothermal development. Many of the well sites are located along the same north-south fault zone in which sporadic sulfur deposits occur (Fig. 12).

Active mining operations, such as Forminco's open-pit mine at Sulphurdale, would probably not be compatible with geothermal operations. Hence, the geothermal operation should be selectively sited where it would not interfere with possible surface or underground mining.

Socio-Economic Characteristics

It is expected that, at most, a maximum of two drilling operations (one by Phillips and one by Union) would be in progress at any one time, resulting in employment of about 40 persons. Construction of pipelines and related facilities may necessitate a few additional personnel. It is possible that some of these individuals would be recruited from the local population. Temporarily, the rest of the crew would probably utilize the more than adequate amenities afforded at Beaver and/or Fillmore. Thus, it is not expected that a significant impact to the socio-economic structure of the area will ensue as the result of the proposals. However, it should be noted that concern has been expressed over the socio-econonomic impacts that would develop in Beaver County if the Cove Fort - Sulphurdale area undergoes eventual geothermal development concurrently with the nearby Roosevelt Hot Springs KGRA and the alunite mining activities of southern Beaver County (BLM, 1975).

SPECIAL STIPULATIONS AND CONDITIONS

All operations in the area are subject to requirements of Rules and Regulations (30 CFR 270), Geothermal Resource Operational (GRO) Orders, and Special Stipulations and Conditions associated with the leases. However, the following recommended Special Conditions stemming from this EA are felt necessary to provide additional adequate environmental protection. Environmental protective measures proposed by Phillips Petroleum Company and Union Oil Company can be found in Appendices A-1 and A-2.

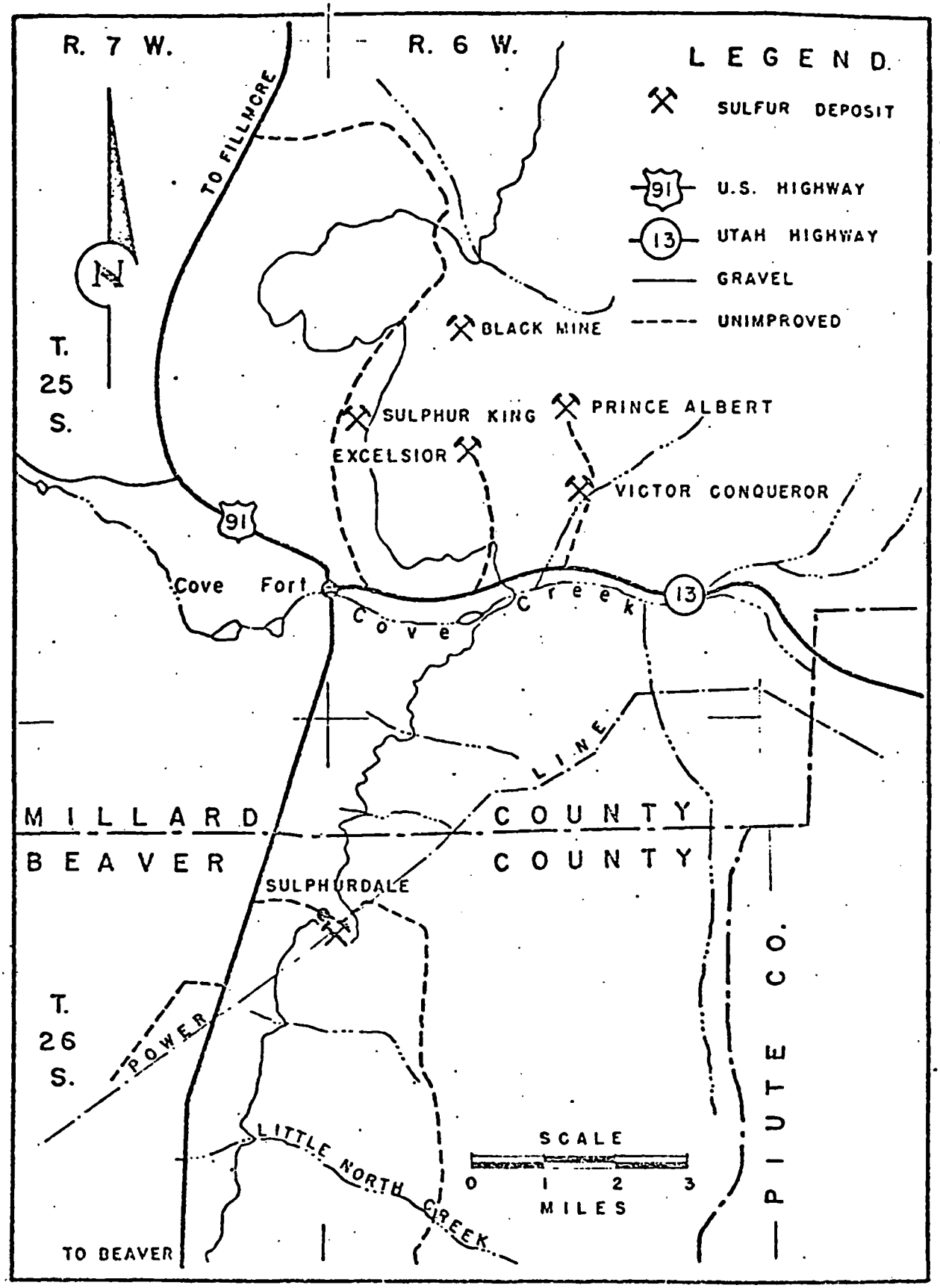

Figure 12 -Principle sulfur deposits of the Cove Fort-Sulphurdale area. (From Rodriquez, 1960)

1. Although it does not appear to be a critical issue, the BLM has recommended that Union Oil Company well site 12 (34-30) should be moved to the southwest of the present proposed location for a distance of about 92 m or just enough to locate off the hillside. Prior to initiating surface disturbance at this new site, this stipulation would necessitate the operator notifying the District Geothermal Supervisor and BLM and providing for a joint meeting in the field so that a mutual agreement on a satisfactory location can be made. If the new area has not been previously examined for cultural resources, then an archaeological report will also be necessary prior to surface disturbance. And in order to protect any cultural resources discovered by such an examination, it may be necessary for the Supervisor to impose additional mitigating measures. This issue will be discussed in the GEAP meeting.

2. Method of disposal of produced geothermal fluids will be determined by the Supervisor based on the chemical analysis of the fluid submitted by the lessee in accordance with Section 10 of GRO Order No. 4 and the instruction memo (Appendix E).

3. As a minimum, a 60-cm freeboard will be required for all test pits and sumps constructed by Phillips Petroleum Company.

4. For six months or less, all pits utilized for liquid storage must have as a minimum either 1) a 16-cm lining possessing a permeability rate that shall not exceed 1×10^{-6} cm/sec, or 2) any other impervious liner acceptable to the Supervisor. If the pits are to be lined according to 1) above, then 2.7 cm of lining must be added for each additional month of fluid storage beyond the 6-month period.

5. Prior to initiating proposed activities under the subject Plan of Operations, Phillips Petroleum Company must submit:

1) the quality of water to be used
2) H_2S and NH_3 contingency plans

6. In the event that drilling should proceed with compressed air, the lessee shall install an approved dust separator, as necessary, to comply with the Utah State standard for discharges of particulate matter. Furthermore, the lessee shall install a muffling device to reduce noise emissions to less than 65 dBA, as measured at the lease line or 0.8 km from the source, whichever is greater.

7. In order to avoid any disturbance to archaeological site 42 Be 286, Phillips' proposed access route to site 16-9 shall be dropped down the slope to a point at which the uphill edge of the road runs 1.5 m south of the present centerline markers.

8. Prior to flow testing any of the wells into a sump or test pit, an energy dissipation system acceptable to the Supervisor shall be installed by Phillips Petroleum Company to prevent rupturing the impermeable pit lining.

9. Reseeding of disturbed areas and areas to be reclaimed shall be performed according to methods prescribed by the Fish Lake National Forest Supervisor and the Fillmore District Manager, BLM, as applicable to their respective lands. Those areas which are disturbed and are not needed for continuing operations, such as cut and fill slopes and reserve pits, will be reseeded following cessation of surface disturbing activity. Drill pads, roads and other areas utilized for continuing operations will be reseeded following cessation of use.

10. Unless otherwise authorized by the Supervisor, Phillips Petroleum Company must compact sides and bottoms of sumps, site pads, and road grade material to 90% maximum density by ASTM D-1557. Fill material will be placed in not greater than 16-cm lifts, will be benched and keyed into existing surface, and compacted to 90%. In order to contain any on-site pollutants, the drill pads of Phillips Petroleum Company must be sloped so that they drain to the sump or reserve pits.

ALTERNATIVES TO THE PROPOSED ACTION

The following are alternatives to the proposed action:

1. Do not approve the proposal.

2. Conditional approval.

In lieu of the fact that the environmental impacts resulting from the proposed action can be satisfactorily mitigated (see below), the alternative of disapproving the action would not be reasonable.

The conditional approval alternative is felt to be the best course of action to pursue. With due consideration given to Regulations (30 CFR 270), Geothermal Resource Operational (GRO) Orders, and the Lease Special Stipulations and Conditions, the proposal is deficient in ways with which to mitigate or protect some environmental impacts identified in this document. Thus, Special Conditions one through ten were formulated in order to adequately mitigate or protect the various components of the environment.

ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Obviously, the removal of vegetation for road and pad construction cannot be avoided. This will in turn result in a minor loss of some wildlife and wildlife habitat. Subsequent unavoidable impacts would be the visual impairment by operations and increased public usage via the newly created access. In addition, impairment to air and noise pollution will occur, but neither should increase beyond the accepted standards. After usage, which could be for a long time duration if commercial steam production is achieved, equipment removal, regrading, and reseeding procedures should mitigate or enhance much of the disturbed land.

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IMPACT SUMMARY AND IMPACT EVALUATION MATRIX

Anticipated impacts on the environment within the Cove Fort-Sulphurdale area and measures to be taken to mitigate or eliminate those impacts are presented in Table 7. This table is only a summary and is not intended to either replace or diminish the importance of the foregoing discussion.

An Impact Matrix is displayed in Table 8. It permits a rapid perusal of the phases of activity contemplated in the Plans of Operation submitted by Phillips Petroleum Company and Union Oil Company and areas of the environment upon which each phase of activity may have impact.

TABLE 7

Date: 4/1/

Area: Cove Fort-Sulphurdale

IMPACT SUMMARY

Lease: U-28948

Lessee: Phillips Petroleum Company

Current Proposal: Two + 3,000 m deep geothermal exploratory wells

EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Surface Disturbance	Well sites approx. 1.0 to 1.6 ha would be constructed for two deep, expl. wells (21-3 and 57-16). Within Forest Service Specifications a total of about 1 km of new access would be constructed. An additional 400m of new road and 4.4 km of existing road necessitating improvement would be required on non-company leased lands.	No Previous Activity	GRO Order No. 4, P.o.O., Special Conditi 1.
Surface and Subsurface Water Quality	The deep wells to be drilled would penetrate the shallow aquifer. If the well is improperly cased, then some intercommunication between the shallow aquifer and geothermal reservoir could occur. Toxic geothermal fluids could be discharged to reserve (test) pits and infiltrate down to and contaminate the shallow aquifer.	No previous activity	GRO Order No. 2, P.o.O., Special Condition 2, 3, 5, 8, 10.

TABLE 7 (cont'd.)

Date: 4, 77

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-28948
Lessee: Phillips Petroleum Company
Current Proposal: Two ± 3,000m deep geothermal exploration wells
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Biota	Up to 3.2 and 0.5 ha would be cleared for pad and road construction, respectively. A temporary loss of wildlife habitat would ensue and activities could disturb and destroy animal life. It is possible that toxic material would be used in drilling fluids.	No Previous Activity	GRO Order No. 4 Special Condition 9
Air and Noise Quality	During drilling operations, noise would emanate from the rig and transportation activities. If air is utilized as a drilling medium, particulate emissions could occur. Combustion engines and traffic would also contribute to atmospheric pollutants.	Negligible	GRO Order No. 4, Special Condition 6.
Safety	Drilling operations could encounter geothermal conduits that could supply sufficient pressure to cause a blowout. H_2S and NH_3 may also be encountered.	No Previous Activity	GRO Order No. 2, P.O Special Condition 5.

TABLE 7 (cont d.)

Date: /77

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-28947
Lessee: Phillips Petroleum Company
Current Proposal: Three ± 3,000 m deep geothermal exploratory wells
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Surface Disturbance	Well sites approx. 1.0 to 1.6 ha would be constructed for three deep, expl. wells (28-27, 38-27, and 11-34). A total of about 760m of existing access would be maintained.	No Previous Activity	GRO Order No. 4, P.o.O., Special Con 1.
Surface and Subsurface Water Quality	The deep wells to be drilled would penetrate the shallow aquifer. If the well is improperly cased, then some intercommunication between the shallow aquifer and geothermal reservoir could occur. Toxic geothermal fluids could be discharged to reserve (test) pits and infiltrate down to and contaminate the shallow aquifer.	No previous activity	GRO Order No. 2, P.o. Special Condition 2, 4, 5, 8, 10.

TABLE 7 (cont'd.)

Date: 4/ /7

Area: Cove Fort-Sulphurdale
Lease: U-28947
Lessee: Phillips Petroleum Company
Current Proposal: Three ± 3,000 m deep geothermal exploration wells
EA Number: 57

IMPACT SUMMARY

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Biota	Up to 4.8 ha would be cleared for pad construction. A temporary loss of wildlife habitat would ensue and activities could disturb and destroy animal life. It is possible that toxic materials would be used in drilling fluids.	No Previous Activity	GRO Order No. 4 Special Condition 9.
Air and Noise Quality	During drilling operations, noise would emanate from the rig and transportation activities. If air is utilized as a drilling medium, particulate emissions could occur. Combustion engines and traffic would also contribute to atmospheric pollutants.	Negligible	GRO Order No. 4, Special Condition 6.
Safety	Drilling operations could encounter geothermal conduits that could supply sufficient pressure to cause a blowout. H_2S and NH_3 may also be encountered.	No Previous Activity	GRO Order No. 2, P.O.O Special Condition 5.

TABLE 7 (cont'd.)

Date: 4/1/

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-29215A
Lessee: Phillips Petroleum Company
Current Proposal: Three ± 3,000 m deep geothermal exploration wells
EA Number: #57

Environmental Parameter	Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Surface Disturbance	Well sites approx. 1.0 to 1.6 ha. would be constructed for three deep, expl. wells (27-4, 16-9, and 24-16). Within Forest Service Specs. a total of about 150 m of new access would be constructed and 500 m of existing road will be improved. An additional 300 m of new road and 11. 6 km of existing road necessitating improvement would be required on non-company leased lands.	No previous activity	GRO Order No. 4, P.o.O., Special Condition 1.
Surface and Subsurface Water Quality	The deep wells to be drilled would penetrate the shallow aquifer. If the well is improperly cased, then some intercommunication between the shallow aquifer and geothermal reservoir could occur. Toxic geothermal fluids could be discharged to reserve (test) pits and infiltrate down to and contaminate the shallow aquifer.	No previous activity	GRO Order No. 2, P.o.O., Special Conditions 2, 3, 4, 5, 8, 10.

Date: 4/1 '77

Area: ve rt-Sulphurdale

IMPACT SUMMARY

Lease: U-29215A

Lessee: Phillips Petroleum Company

Current Proposal: Three ± 3,000 m deep geothermal exploration wells

EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Biota	Up to 4.8 and 0.06 ha would be cleared for pits and road construction, respectively. Additional disturbance from road construction would occur on non-company leased lands. A temporary loss of wildlife habitat would ensue and activities could disturb and destroy animal life. It is possible that toxic materials would be used in drilling fluids.	No Previous Activity	GRO Order No. 4 Special Condition 9
Air and Noise Quality	During drilling operations, noise would emanate from the rig and transportation activities. If air is utilized as a drilling medium, particulate emissions may occur. Combustion engines and traffic would also contribute to atmospheric pollutants.	Negligible	GRO Order No. 4, Special Condition 6
Safety	Drilling operations could encounter geothermal conduits that could supply sufficient pressure to cause a blowout. H_2S and NH_3 may also be encountered.	No previous activity	GRO Order No. 2, P.O. Special Condition 5

TABLE 7 (cont'd.)

Date: 4/1/7

Area: Cove Fort-Sulphurdale
Lease: U-29215A
Lessee: Phillips Petroleum Company
Current Proposal: Three ± 3,000 m deep geothermal exploratory wells
EA Number: 57

IMPACT SUMMARY

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Archaeology	The proposed access route to drillsite 16-9 traverses a large area of concentrated lithic debris, requiring protection to enable additional archaeological investigation.	No Previous Activity	Lease term No. 18, Special Condition 7

TABLE 7 (cont'd.)

Date: 4/1,

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-29553
Lessee: Union Oil Company
Current Proposal: Five ± 3,000 m deep geothermal exploratory wells
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Surface Disturbance	Well sites approx. 1.0 to 1.6 ha would be constructed for five deep, expl. wells (34-30, 56-30, 17-29, 14-29, and 33-29). Within Forest Service and BLM Specifications, a total of about 1.1 km of new access would be constructed. An additional 2.3 km of existing road necessitating improvement would be required.	No Previous Activity 34-30 (12) 56-30 (1) 17-29 (6) 14-29 (3) 33-29 (4) 33-29 (4) 42-29 (12) 44-32 (12)	GRO Order No. 4, P.o.O., Special Condition 1.
Surface and Subsurface Water Quality	The deep wells to be drilled would penetrate the shallow aquifer. If the well is improperly cased, then some intercommunication between the shallow aquifer and geothermal reservoir could occur. Toxic geothermal fluids could be discharged to reserve (test) pits and infiltrate down to and contaminate the shallow aquifer.	No previous activity	GRO Order No. 2, P.o.O. Special Condition 2, 3, 5, 8, 10.

Date:

Area: Cove Fort-Sulphurdale

IMPACT SUMMARY

Lease: U-29553
Lessee: Union Oil Company
Current Proposal: Five ± 3,000 m deep geothermal exploratory wells.
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Biota	Up to 8.0 and 0.5 ha would be cleared for pad and road construction, respectively. Some additional disturbance from road construction would occur via improvement of existing roads. A temporary loss of wildlife habitat would ensue and activities could disturb and destroy animal life. It is possible that toxic materials would be used in drilling fluids.	No Previous Activity	GPO Order No. 4, Special Condition 9.
Air and Noise Quality	During drilling operations, noise would emanate from the rig and transportation activities. If air is utilized as a drilling medium, particulate emissions could occur. Combustion engines and traffic would also contribute to atmospheric pollutants.	Negligible	GPO Order No. 4, Special Condition 6.
Safety	Drilling operations could encounter geothermal conduits that could supply sufficient pressure to cause a blowout. H_2S and NH_3 may also be encountered.	No previous activity	GPO Order No. 2, D.O.O., Special Condition 5.

TABLE 7 (cont'd.)

Date: 4/1

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-29554
Lessee: Union Oil Company
Current Proposal: Three ± 3,000 m deep geothermal exploratory wells
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Surface Disturbance	Well sites approx. 1.0 to 1.6 ha would be constructed for three deep, expl. wells (26-20, 44-28, and 66-28). Within Forest Service Specifications, a total of about 790m of new access would be constructed. An additional 0.97 km of existing road necessitating improvement would be required.	No Previous Activity	GRO Order No. 4, P.o.O., Special Condition 1.
Surface and Subsurface Water Quality	The deep wells to be drilled would penetrate the shallow aquifer. If the well is improperly cased, then some intercommunication between the shallow aquifer and geothermal reservoir could occur. Toxic geothermal fluids could be discharged to reserve (test) pits and infiltrate down to and contaminate the shallow aquifer.	No previous activity	GRO Order No. 2, P.o. Special Condition 2, 4, 5, 8, 10.

Date: 4/1/

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-29554
Lessee: Union Oil Company
Current Proposal: Three ± 3,000 m deep geothermal exploratory wells
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Biota	Up to 4.8 and 0.4 ha would be cleared for pad and road construction, respectively. Some additional disturbance from road construction would occur via improvement of existing roads. A temporary loss of wildlife habitat would ensue and activities could disturb and destroy animal life. It is possible that toxic materials would be used in drilling fluids.	No Previous Activity	GRO Order No. 4, Special Condition 9.
Air and Noise Quality	During drilling operations, noise would emanate from the rig and transportation activities. If air is utilized as a drilling medium, particulate emissions could occur. Combustion engines and traffic would also contribute to atmospheric pollutants.	Negligible	GRO Order No. 4, Special Condition 6.
Safety	Drilling operations could encounter geothermal conduits that could supply sufficient pressure to cause a blowout. H_2S and NH_3 may also be encountered.	No previous activity	GRO Order No. 2, P.O.O., Special Condition 5.

T 57 (cont'd.)

Date: 4/1/

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-29555
Lessee: Union Oil Company
Current Proposal: Six ± 3,000 m deep geothermal exploratory wells
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Surface Disturbance	Well sites approx. 1.0 to 1.6 ha. would be constructed for six deep, expl. wells (31-33, 71-33, 53-33, 34-32, 74-33, and 67-31). Within Forest Service Specifications, a total of about 4.6 km of existing road necessitating improvement would be required. In addition, an existing road segment would be improved by Phillips Petroleum Co. to reach their lease to the east.	No Previous Activity	GRO Order No. 4, P.o.O., Special Condition 1.
Surface and Subsurface Water Quality	The deep wells to be drilled would penetrate the shallow aquifer. If the well is improperly cased, then some intercommunication between the shallow aquifer and geothermal reservoir could occur. Toxic geothermal fluids could be discharged to reserve (test) pits and infiltrate down to and contaminate the shallow aquifer.	No previous activity	GRO Order No. 2, P.o.O., Special Condition 2, 3, 5, 8, 10.

TABLE 7 (cont'd.)

Date: 4/1/77

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-29555
Lessee: Union Oil Company
Current Proposal: Six ± 3,000 m deep geothermal exploratory wells
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Biota	Up to 9.6 ha would be cleared for pad construction. Some additional disturbance from road construction would occur via improvement of existing roads. A temporary loss of wildlife habitat would ensue and activities could disturb and destroy animal life. It is possible that toxic materials would be used in drilling fluids.	No Previous Activity	GRO Order No. 4, Special Condition 9.
Air and Noise Quality	During drilling operations, noise could emanate from the rig and transportation activities. If air is utilized as a drilling medium, particulate emissions could occur. Combustion engines and traffic would also contribute to atmospheric pollutants.	Negligible	GRO Order No. 4, Special Condition 6.
Safety	Drilling operations could encounter geothermal conduits that could supply sufficient pressure to cause a blowout. H_2S and NH_3 may also be encountered.	No Previous Activity	GRO Order No. 2, P.o.O., Special Condition 5.

TAB 7 (cont'd.)

Date: 4/1/

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-29556
Lessee: Union Oil Company
Current Proposal: Two + 3,000 m deep geothermal exploratory wells
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Surface Disturbance	Well sites approx. 1.0 to 1.6 ha would be constructed for two deep, expl. wells (32-6, and 46-6). Within Forest Service Specifications, a total of about 600m of new access would be constructed. 2.0 km of existing road necessitating improvement would be required.	No Previous Activity	GRO Order No. 4, P.o.O., Special Condition 1.
Surface and Subsurface Water Quality	The deep wells to be drilled would penetrate the shallow aquifer. If the well is improperly cased, then some intercommunication between the shallow aquifer and geothermal reservoir could occur. Toxic geothermal fluids may be discharged to reserve (test) pits and infiltrate down to and contaminate the shallow aquifer.	No previous activity	GRO Order No. 2, P.o.O., Special Condition 2, 3, 5, 8, 10.

TABLE 7 (cont'd)

Date: 4/1/

Area: Cove Fort-Sulphurdale

IMPACT SUMMARY

Lease: U-29556

Lessee: Union Oil Company

Current Proposal: Two ± 3,000 m deep geothermal exploratory wells

EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Biota	Up to 3.2 and 0.3 ha would be cleared for pad and road construction, respectively. Some additional disturbance from road construction would occur via existing roads. A temporary loss of wildlife habitat would ensue and activities could disturb and destroy animal life. It is possible that toxic materials would be used in drilling fluids.	No Previous Activity	GRO Order No. 4, Special Condition 9.
Air and Noise Quality	During drilling operations, noise would emanate from the rig and transportation activities. If air is utilized as a drilling medium, particulate emissions could occur. Combustion engines and traffic would also contribute to atmospheric pollutants.	Negligible	GRO Order No. 4, Special Condition 6.
Safety	Drilling operations could encounter geothermal conduits that could supply sufficient pressure to cause a blowout. H_2S and NH_3 may also be encountered.	No previous activity	GRO Order No. 2, P.O.C Special Condition 5.

57

5

TABLE 7 (cont'd.)

Date: 4/1/77

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-29557
Lessee: Union Oil Company
Current Proposal: Two ± 3,000 m deep geothermal exploratory wells
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Surface Disturbance	Well sites approx. 1.0 to 1.6 ha would be constructed for two deep, expl. wells (82-12, and 45-12). Within BLM Specifications, a total of about 2.3 km of existing road necessitating improvement would be required.	No Previous Activity	GRO Order No. 4, P.o.O., Special Condition 1.
Surface and Subsurface Water Quality	The deep wells to be drilled would penetrate the shallow aquifer. If the well is improperly cased, then some intercommunication between the shallow aquifer and geothermal reservoir could occur. Toxic geothermal fluids may be discharged to reserve (test) pits and infiltrate down to and contaminate the shallow aquifer.	No previous activity	GRO Order No 2, P.o.O., Special Condition 2, 3, 5, 8, 10..

Date: 4/1/7.

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-29557
Lessee: Union Oil Company
Current Proposal: Two - 3,000 m deep geothermal exploratory wells.
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Biota	Up to 4 ha would be cleared for pad construction. Additional disturbance from road construciton will occur via improvement of existing roads. A temporary loss of wildlife habitat would ensue and activities could disturb and destroy animal life. It is possible that toxic material would be used in drilling fluids.	No Previous Activity	GRO Order No. 4, Special Condition 9.
Air and Noise Quality	During drilling operations, noise would emanate from the rig and transportation activities. If air is utilized as a drilling medium, particulate emissions could occur. Combustion engines and traffic would also contribute to atmospheric pollutants.	Negligible	GRO Order No. 4, Special Condition 6.
Safety	Drilling operations could encounter geothermal conduits that could supply sufficient pressure to cause a blowout. H_2S and NH_3 may also be encountered.	No previous activity	GRO Order No. 2, P.o.O., Special Condition 5.

TABLE 7 (cont'd.)

Date: 4/1/7.

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-29558
Lessee: Union Oil Company
Current Proposal: Five ± 3,000 m deep geothermal exploratory wells
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Surface Disturbance	Well sites approx. 1.0 to 1.6 ha would be constructed for five deep, expl. wells (42-7, 66-7, 36-8, 12-18, and 12-17). Within Forest Service Specifications, a total of about 6.6km of existing road necessitating improvement would be required. In addition, other existing road segments will be improved by Phillips Petroleum Co. to reach their lease to the east.	No Previous Activity	GRO Order No. 4, P.o.O., Special Condition 1.
Surface and Subsurface Water Quality	The deep wells to be drilled would penetrate the shallow aquifer. If the well is improperly cased, then some intercommunication between the shallow aquifer and geothermal reservoir could occur. Toxic geothermal fluids could be discharged to reserve (test) pits and infiltrate down to and contaminate the shallow aquifer.	No previous activity	GRO Order No. 2, P.o.O., Special Condition 2,3,4, 5, 8, 10.

60.

Date: 4/1/

IMPACT SUMMARY

Area: Cove Fort-Sulphurdale
Lease: U-29558
Lessee: Union Oil Company
Current Proposal: Five ± 3,000 m deep geothermal exploratory wells
EA Number: 57

Environmental Parameter	Possible and/or Unavoidable Impact of Current Proposal	Cumulative Effects (to date) of Geothermal Activities	Mitigating Measures
Biota	Up to .8 ha would be cleared for pad construction. Some additional disturbance from road construction would occur via improvement of existing roads. A temporary loss of wildlife habitat would ensue and activities could disturb and destroy animal life. It is possible that toxic materials would be used in drilling fluids.	No Previous Activity	GPO Order No. 4, Special Condition 9.
Air and Noise Quality	During drilling operations, noise would emanate from the rig and transportation activities. If air is utilized as a drilling medium, particulate emissions could occur. Combustion engines and traffic would also contribute to atmospheric pollutants.	Negligible	GPO Order No. 4, Special Condition 6.
Safety	Drilling operations could encounter geothermal conduits that could supply sufficient pressure to cause a blowout. H_2S and NH_3 may also be encountered.	No previous activity	GPO Order No. 2, P.O.O., Special Condition 5.

Table 8

IMPACT MATRIX

/ minor impact
major impact

	Construction				Pollution				Drilling Production					Transport Operations			Accidents		Other
	Roads, bridges, airports	Transmission lines, pipelines	Dams and impoundments	Others (pump stations, compressor stations, etc.)	Burning, noise, junk disposal	Liquid effluent discharge	Subsurface disposal	Others (toxic gases, noxious gas, etc.)	Well drilling	Fluid removal (Prod. wells, facilities)	Secondary Recovery	Noise or obstruction of scenic views	Mineral processing (ext. facilities)	Others	Trucks	Pipelines	Others	Spills and leaks	Operational failure	
Forestry																				
Grazing	/		/					/	/			/			/			/	/	
Wildness																				
Agriculture																				
Residential-Commercial																				
Mineral Extraction	/								/											
Recreation	/		/					/	/			/			/			/	/	
Scenic Views	/		/					/	/			/			/			/	/	
Parks, Reserves, Monuments																				
Historical Sites	/																			
Unique Physical Features																				
Birds	/		/					/	/			/			/			/	/	
Land Animals	/		/					/	/			/			/			/	/	
Fish																				
Endangered Species																				
Trees, Grass, Etc.	/		/					/	/			/						/	/	
Surface Water																				
Underground Water																				
Air Quality	/		/					/	/						/				/	
Erosion	/		/															/	/	
Other																				
Effect on Local Economy	/		/						/						/					
Safety and Health								/	/						/			/	/	
Others																				

DETERMINATION

I conclude that the requested action does not constitute a major Federal action significantly affecting the quality of the human environment in the sense of NEPA, Section 102(2)(C).

Area Geothermal Supervisor _____ Date _____

Referred to the Regional Conservation Manager this date.

I concur and so determine that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment in the sense of NEPA, Section 102(2)(C).

Conservation Manager
Central Region _____ Date _____

REFERENCES

Bigler, M., Jan. 28, 1977, Personal communication: Service station proprietor, Cove Fort, Utah.

Callaghan, E., 1939, Volcanic sequence in the Marysvale region in southwest-central Utah: Am. Geophysical Union Trans., pt. 3, p. 438-452.

_____, and Parker, R. L., 1961, Geology of the Monroe quadrangle, Utah: U.S. Geol. Survey Geologic Quad Map GQ-155.

_____, 1962, Geology of the Delano Peak quadrangle, Utah: U.S. Geol. Survey Geologic Quad. Map GQ-153.

_____, 1962, Geology of the Sevier quandrangle, Utah: U.S. Geol. Survey Geologic Quad. Map GQ-156.

Cook,K. L., and Smith, R. B., 1967, Seismicity in Utah, 1850 through June 1965: Seismol. Soc. Am. Bull., v. 57, p. 689-718.

Crosby, G.W., 1959, Geology of the south Pavant Range, Millard and Sevier counties, Utah: BYU Geol. Studies, v. 6, no. 3, 59p.

_____, 1973, Regional structure in southwestern Utah: Utah Geol. Association Pub. 3, p. 27-32.

Healy, J. H., Ruby, W. W., Griggs, D. T., and Raleigh, C. B., 1968, The Denver earthquakes: Seismic, v. 161, p. 1301-1310.

Helymun, E. B., 1966, Geothermal power potential in Utah: Utah Geol. and Min. Survey Spec. Studies 14, 28p.

Hintze, L. F., 1963, Geologic map of southwestern Utah: Utah State Land Board.

King, P. B., 1969, The tectonics of North America: U. S. Geol. Survey Prof. Paper 628, 695p.

Leise, H. C., 1957, Geology of the northern Mineral Range, Millard and Beaver counties, Utah: Univ. Utah unpub. M.S. thesis, 88p.

Mower, R. W., and Cordova, R. M., 1973, Ground-water in the Milford area, Utah: Utah Geol. Assoc. Pub. 3, p. 63-72.

Olson, T. L., and Smith, R. B., 1976, Earthquake studies of the Roosevelt Hot Springs and the Cove Fort areas, Utah: Univ. Utah Dept. Geol. and Geophy., Final Nat. Sci. Found. Rpt. under contr. GI-43741, v. 4, 83 p.

Raleigh, C. B., Healy, J. H., and Bredehoeft, J. D., 1973, Faulting and crustal stress at Rangely, Colorado: in Flow and Fracture of Rocks, AGU Monograph No. 16, p. 275-284.

Rodgers, W. P., Lading, L. R., Hornbaker, A. L., Schwachow, S. D., Hart, S. S., Shelton, D. C., Scroggs, D. L., and Soule, J. M., 1974, Guidelines and criteria for identification and land-use controls of geologic hazard and mineral resource areas: Colo. Geol. Survey Spec. Pub. No. 6, 146p.

Rodriguez, E. L., 1960, Economic geology of the sulfur deposits at Sulphurdale, Utah: Univ. Utah unpub. M.S. thesis, 68p.

Sax, N. I., 1951, Handbook of Dangerous Materials: Reinhold Corp., New York, N.Y., 848p.

Sbar, M.L., Barazangi, M., Dorman, J., Scholts, C. H., and Smith, R. B., 1972, Tectonics of the intermountain seismic belt, western Untied States: Microearthquake seismicity and composite fault plane solutions: Geol. Soc. Am. Bull., v. 82, p. 2979-2990.

Schieler, L., 1975, Geothermal effluents, their toxicity, and prioritization: in proceedings of the Environmental Protection Agency workshop on sampling geothermal effluents, October, 1975, Environmental Protection Agency Environmental Laboratory, Las Vegas, Nevada.

Smith, R. B., 1977, Personal communication: Prof., Dept. of Geol. and Geophysics, Univ. Utah.

Smith, R. B. and Sbar, M. L., 1973, Contemporary tectonics and seismicity of the western United States with emphasis on the intermountain seismic belt: Geol. Soc. Am. Bull., v. 85, no. 7, p. 1205 - 1218.

U. S. Bureau of Land Management, 1975, Environmental analysis record Cove Fort - Sulphurdale geothermal area: open-file report, Warm Springs Resource Area office, Fillmore, Utah, 59p.

U. S. Geol. Survey, 1975, Cove Fort-Sulphurdale known geothermal resource area, Millard and Beaver Counties, Utah: open-file staff report, Menlo Park, Ca., 8p.

U. S. Dept. of Agriculture, Soil Conservation Service, 1972, Natural resource inventory, Beaver River basin, Utah-Nevada: Appendix I, Soils Supplement, open-file report, Salt Lake City, Utah, 83p.

_____, 1973, Summary report, water and related land resources, Beaver River Basin, Utah and Nevada: open-file report, Salt Lake City, Utah, 140 p.

Utah Dept. of Employment Security, 1971-1976, Employment news letters.

Watanabe, K., 1976, Selected business statistics - Utah counties: Utah Econ. and Bus. Review, v. 36, No. 3, p. 1-9.

Williams, J. S., and Tapper, M. L., 1953, Earthquake history of Utah, 1850-1949: Seismol. Soc. Am. Bull., v. 43, no. 3, p. 191-218.

Woolley, R. R., 1946, Cloudburst floods in Utah, 1850-1938, U. S. Geol. Survey Water Supply Paper 994, 128p.

This report was prepared by

William M. Riley
Jon Durham

Under the supervision of
Sie Ling Chiang
Chief, Environmental and Safety Section

APPENDIX A-1

Phillips Petroleum Company's
Plan of Operation

PHILLIPS PETROLEUM COMPANY
DEL MAR, CALIFORNIA 92014
BOX 752 714 755-0131

NATURAL RESOURCES GROUP
Energy Minerals Division
Geothermal Operations

March 28, 1977

Mr. Barry Boudreau
USGS – Conservation Division
345 Middlefield Road – Mail Stop 92
Menlo Park, CA 94025

Dear Barry:

Enclosed please find a partial submittal to the Supervisor's request for additional information to supplement our proposed Plan of Operation to drill eight geothermal wells at Sulphurdale-Cove Fort, Utah. We were delaying submittal of this information awaiting supporting material from our contract engineering firm, Bulloch Brothers, in Cedar City; however, we are submitting information available at this time in order for the Plan to be as complete as possible when the GEAP Committee meets in April.

Items 1 and 2 in the Supervisor's letter refer to anticipated improvements of existing roads and design of new access roads. Survey materials including engineering drawings are being furnished by Bulloch Brothers and will be forwarded under separate cover as soon as they are submitted to us. You may anticipate that road construction will meet your requirements inasmuch as the specifications required of us by the U. S. Forest Service are considerably more rigorous than any we have encountered previously.

Items 3 and 4 refer to our Section V in the Plan wherein we discuss use of narrow corridors of land for construction of temporary reinjection pipelines and the use of some of the proposed wells as reinjectors. We have concluded that it is not possible to plan such a system for production and reservoir flow testing at this time. Section V should be deleted; we will submit another Plan of Operation to cover proposed testing activities at a time when information from the drilling program is available.

The remaining information requested is furnished herewith; namely, a description of our anticipated drilling mud program, duration of flow tests and a description of the topography and drainage patterns in the vicinity of each drill site and associated access roads.

Please call if you require additional information at this time.

Sincerely yours,

Gary W. Crosby

Gary W. Crosby
Exploration Director

GWC/skb

Enclosures

AMMENDMENT TO
PROPOSED PLAN OF OPERATION
TO DRILL GEOTHERMAL TEST WELLS
ON UNITED STATES GEOTHERMAL LEASES
U-28948, U-28947, U-29215
BEAVER AND MILLARD COUNTIES, UTAH

Phillips Petroleum Company
Geothermal Operations

San Diego, California

March 28, 1977

TOPOGRAPHIC FEATURES AND DRAINAGE PATTERNS

Physiography of the Sulphurdale-Cove Fort-Dog Valley area is structurally controlled. Its not being assignable to any specific classification is a consequence of its being situated at the boundary between the Basin and Range and Colorado Plateau provinces, and due to inclusion of the forward edge of the fold and thrust belt. Landforms are further complicated by late Cenezoic volcanic flows, pyroclastic deposition and hydrothermal activity. The following description of the physiography is referenced to the topographic map, Exhibit "A."

Site #21-3: This well site is located on a gently northwest sloping bench on the south side of Dog Valley Creek. On the north side of the bench 280 feet from the well site, is an escarpment approximately 50 feet high which forms the bank of the Creek. The wooded escarpment slopes slightly less than the angle of repose. Local relief is only about 100 feet; relief in a radius of one mile is 900 feet and is marked by distinct ridge lines except the southeast where there is a tendency to a weak dendritic pattern. The most prominent drainage, Dog Valley Creek, is intermittent; all other drainages are shallow gullies. The half mile of new access road will have to negotiate the escarpment separating the Creek and bench.

Site #57-16: The well site is located near a gentle saddle in a broad, open, gently sloping head of a minor drainage. The local area is in the headwaters of several minor tributaries that drain south to Cove Creek. All drainages are intermittent. Local relief is approximately 250 feet, but ridges to the north and west attain elevations 1300 feet above the well location within a little more than a mile horizontal distance. One quarter mile of new road will be constructed to access this site. The road will follow a low drainage divide.

Site #28-27, 38-27 and 11-34: These three sites are closely clustered within a half mile of each other, and are in the flattest area of the eight proposed wells. Man has further leveled the sites in connection with highway construction. The sites are approximately 2/10 mile south of the intermittent Creek. The relatively flat area along the Creek vaguely resembles a flood

plain, but is rather an erosional basin formed in relatively less resistant volcanics. The sites, therefore, are not subject to flooding. At a third to half mile distance to the southeast is the base of an irregular ridge that rises 500-600 feet above the well locations. Access to these sites already exist by the old highway that follows Cove Creek.

Site #27-4: The site is planned for a small gently sloping area formed by the intersection of two small intermittent drainages. The pad will preserve or displace slightly these minor drainages, but not block them. Both drainages head one half mile north and east of the site; thus, flooding potential is minor owing to the location being near the edge of the drainage basin. Local relief is about 350 feet; however, the land rises irregularly to the east to the 9000 foot plus peaks and ridges of Tushar Mountains. Access is by an existing Jeep Trail that follow the drainage west from the site.

Site #16-9: This proposed well is sited one quarter mile south of North Spring on ground that is generally sloping 8° to the west-northwest. Grade decreases gradually downslope and increases upslope to about the angle of repose in an escrapment one mile east of the site. The location is approximately 1200 feet above the valley to the west containing Highway 15. The ridges to the east reach elevations 1800 feet above the site. The west facing slope of the Tushar Mountains is sculptured by minor west draining rills, where local relief is 80 to 90 feet at most. Access will be by the aqueduct road to North Spring and then by 2/10 miles of new road. The road will not intersect any major drainages.

Site #24-16: The topography at this location has a description similar to Site #24-16. It is 4/10 mile north-northeast of South Spring and utilizes the South Spring aqueduct road.

4. PROPOSED MUD PROGRAM

Surface Hole: Bentonite will be mixed until a 32-38 viscosity is attained, then 3 - 4 lbs/bbl. Flosal will be added; and Maintained with a ratio of one (1) sack Flosal to four (4) sacks bentonite. This is a low solids, good hole cleaning, minimum erosion type mud.

Bentonite is an absorptive and colloidal clay. Flosal is a mineral consisting of a fibrous silky serpentine, consisting of platelets of felted, short-length fiber. A desander in good working order will be used while drilling surface hole.

Below Surface Casing: Below the surface casing, the surface mud will be diluted with water and we will use a desilter. Proper flow properties can be maintained with water, Flosal, bentonite and a desilter. If lost circulation occurs, cotten seed hulls and Fibertex will be used for sealing purposes.

Below 9 5/8" Casing: Fresh water will be used as drilling fluid. In the event of lost circulation, water will be aerated to obtain returns. Whenever it is necessary to control penetrated formations, fresh water with minimum salt addition will be used.

EXHIBIT E

Duration of flow tests to be conducted under this Plan of Operation will be limited by the capacity of the pits. It is anticipated, therefore, that a maximum duration for any flow test under this Plan will be approximately 72 hours.

APPENDIX A-2

Union Oil Company's
Plan of Operation

Union Geothermal Division

Union Oil Company of California
1250 Coddingtown Center, P.O. Box 6854
Santa Rosa, California 95406
Telephone (707) 542-9543

UNION 76

February 24, 1977

U.S. Geological Survey
Office of the Area Geothermal Supervisor
Suite 400, Room 401
2465 East Bayshore Road
Palo Alto, California 94303

RE: Union Oil Company of California Report - "Proposed Plan of Operation to Drill Geothermal Test Wells, Cove Fort - Sulphurdale Unit, United States Geothermal Leases U-29553, U-29554, U-29555, U-29556, U-29557, and U-29558.

Gentlemen:

Please find enclosed, in triplicate, the following supplemental pages to the above referenced report.

1. LOCATION AND ROADS, Page 10.
2. CONTINGENCY PLAN, Pages 4 and 5.
3. CONTINGENCY PLAN, CONTINGENCY PLAN FOR H_2S AND NH_3 SAFETY, (Total Section).
4. GENERAL SAFETY PRACTICES, Page 4.

These pages are to supersede and replace the corresponding pages and section of the current report.

It is our understanding that the questions regarding the Archeology Report have been resolved by discussions between Dr. Richard Thompson (Archeologist) and Mr. Ted Hudson (U.S.G.S.).

Very truly yours,

UNION OIL CO. OF CALIFORNIA

Don L. Ash
District Drilling Superintendent

KL/cc

IV.

B. Continued-----
impurities from the drill sites into any creeks or bodies of water.

C. Fish and Wildlife:
All requirements of the area regulatory agencies will be complied with to avoid dislocation of wildlife and/or contamination of groundwaters.

D. Noise and Air Quality:
Noise levels will be maintained within guidelines specified by Federal Occupational Safety Health Act Standards. Air quality will comply with local Air Pollution Control Standards.

An adequate supply of water will be maintained at the sites for use in controlling dust during construction and drilling operations.

a. Water for the purpose of dust control, drilling, and construction will be obtained from FORMINCO MINING CO. and will be trucked to the sites as required. Although all water is near potable, a detailed water analysis will be submitted to the Area Geothermal Supervisor prior to use.

E. Safeguards to Public Health:
All unattended equipment left, following the drilling operation, felt to be of a hazardous nature, will be secured with a chain link fence. Wells, upon completion, will be fenced. Supervisory personnel will be on the sites during the course of operations. All requirements for casing and blowout prevention will be followed.

DISTRICT SUPERINTENDENT WILL:

1. Brief his immediate supervisor (District Manager) on the situation and corse of action underway.

   Vane E. Suter - District Operations Manager
   Office: (707) 542-9543
   Home : (707) 527-5236

2. Notify the following agencies or regulatory bodies as soon as practical and work closely with them in all phases of operations.

   1. United States Geological Survey
      District Geothermal Supervisor
      Room 442, Post Office Bldg.
      Salt Lake City, Utah
      Office: (801) 524-5245
      Res. : (801) 532-2642

   2. United States Forest Service
      Fishlake National Forest Service
      Fillmore Rangers Office
      Fillmore, Utah
      (801) 743-5721

   3. Bureau of Land Management
      Department of Interior
      Area Office (Richfield District)
      Fillmore, Utah
      (801) 743-6811

   4. Bureau of Land Management
      Beaver River Resource Area Office
      154 N. Main Street
      P. O. Box 208
      Cedar City, Utah 84720
      (801) 586-9722

5. Department of Natural Resources
Division of Water Rights
State Engineer
442 State Capital
Salt Lake City, Utah
(801) 328-6071

6. United States Geological Survey
Conservation Division - Western Region Area
Geothermal Supervisor
2465 East Bayshore
Suite 400 - Second Floor
Palo Alto, California 94303
(415) 323-8111

7. Utah State Fish and Game Department
Regional Office
622 North Main
Cedar City, Utah
(801) 586-6803

4. Specific Procedures:

a. For drill water:
Contain spillage with dikes if possible haul to disposal sump or well by vacuum or water trucks.

HYDROGEN SULFIDE (H_2S) AND AMMONIA (NH_3)

CONTINGENCY PLAN

UNION OIL COMPANY OF CALIFORNIA

GEOTHERMAL DIVISION

COVE FORT, SULPHURDALE PROSPECT

BEAVER - MILLARD COUNTIES

UTAH

Don L. Ash

HYDROGEN SULFIDE (H_2S) AND AMMONIA (NH_3)

CONTINGENCY PLAN

INTRODUCTION

It is Union Oil Company's intent to provide a safe working place, not only for it's own employees but also for those of other firms whose services will aid in the drilling, evaluation and hopefully, the development of the Cove Fort - Sulphurdale Prospect.

There is a possibility of encountering toxic Hydrogen Sulfide gas within the boundaries of this Prospect. The Union Oil Company and the drilling contractor will make every effort to provide adequate safeguards against harm to persons on the rig and in the immediate vicinity from the effects of Hydrogen Sulfide which may, under emergency conditions be released to the atmosphere.

An extremely remote possibility of encountering ammonia gas, particularly at toxic levels, also exists. Even though it poses an almost negligible potential danger, and is considerably less toxic than H_2S under similar conditions, NH_3 (gas) will be treated under the same stringent contingency plan in order to provide maximum personnel safety in the unlikely event an emergency situation would occur.

The Union Oil Company intends to keep all formations over balanced so that no intrusions of gas will occur. However, we have provided plans in the event of an emergency so that it could be handled

safely and with a minimum of trouble. It is anticipated that if H_2S and/or NH_3 gas is encountered it will be low pressure and its reaching the surface would most likely be a result of lost circulation.

This plan provides for personnel safety programs, precautionary measures, safety equipment, emergency procedures and general information necessary to safely operate in a sour gas area. To be effective, the plan requires the co-operation and effort of each person participating in the drilling of the well(s). Each person must know his responsibilities and duties, not only under normal operations, but while operating under emergency situations. The person should therefore familiarize himself with the location and operation of all safety equipment and see that his own equipment is properly stored, easily accessible at all times, and routinely maintained.

GENERAL INFORMATION

The drilling contractor's personnel, necessary service company personnel, and Union Oil Company personnel will be thoroughly trained in the use of breathing equipment, emergency procedures, individual and group responsibilities, and first aid. The Union Oil Company and the drilling contractor will keep a list, at the drill site, of all personnel who have been through special training programs.

All personnel shall undergo an eardrum examination before assignment

to this area. Persons with perforated eardrums are prohibited from working in a Hydrogen Sulfide environment.

Two briefing areas shall be designated at each drill site. These areas will be situated to provide one briefing area that would be upwind of the well at any given time.

Smoking will be allowed only in designated areas.

All personnel, without exception when coming on the drill site must proceed directly to the Union Oil Company's drilling foreman or the drilling contractors supervisor for assignment of breathing apparatus and instruction and orientation briefing. Each person will be required to read the "H_2S and NH_3 Contingency Plan" and verify that he has read and understands the procedures by signing the form provided. The signed form will be forwarded to the Union Oil drilling supervisor, or his designated representative.

A list of emergency stations and phone numbers of personnel and agencies to be contacted in case of an emergency will be posted at the following Places:

1. Union Oil drilling supervisor's trailer.
2. Drilling contractors supervisor's trailer.
3. Drilling crew's change house.
4. Briefing areas - if briefing area is not one of the above.

Evacuation Plan

Upon completion of each drill site an alternate escape route (one other than the main access road) and evacuation procedures, applicable to the particular drill site, will be outlined to all personnel.

All Non-essential personnel will be evacuated when extreme danger to life exists. The evacuation will be under the supervision of a person designated by the Union Oil Drilling Foreman.

1. Do not panic!
2. Be aware of wind direction.
3. Follow instructions.

Hydrogen Sulfide And Ammonia - Contingency Plan

PHYSICAL EFFECTS OF HYDROGEN SULFIDE

TABLE "A"

CONCENTRATION			
PERCENT (%)	PPM	GRAINS/ 100 STD. FT.^{3}	PHYSICAL EFFECTS
0.001	10	.65	Obvious and upleasant odor.
0.002	20	1.30	Safe for 8 hours exposure.
0.01	100	6.48	Kills smell in 3 to 15 minutes; may sting eyes and throat..
0.02	200	12.96	Kills smell shortly; stings eyes and throat.
0.05	500	32.96	Dizziness; breathing ceases in a few minutes; needs prompt artificial respiration.
0.07	700	45.36	Unconscious quickly; death will result if not rescued promptly.
0.10	1000	64.80	Unconscious at once; followed by death within minutes.

Hydrogen Sulfide And Ammonia - Contingency Plan

Self contained breathing equipment and resuscitators will be readily available for emergency use. Approved first aid kits will be located at both briefing areas.

Approved blowout prevention equipment will be installed, maintained, and frequently tested.

An adequate degasser, manifolded to permit gas exhaust to be piped to one of two burning pits. Gas will always be vented to the pit downwind of the rig.

Explosion proof electric fans (bug blowers) will be positioned to insure adequate circulation in critical areas, should gas be encountered.

Wind socks or streamers will be positioned so as to be in easy view of rig floor, and both briefing areas during both night and daylight hours.

Warning signs will be available for posting on the access road to the location. "No Smoking" signs will be posted.

TRAINING

A training and information session will be conducted covering the following:

1. Location of H_2S and NH_3 safety equipment, portable fire extinguishers and H_2S and NH_3 detectors.

TRAINING - Continued-

2. Proper use of H_2S and NH_3 detectors.
3. General information on breathing equipment including length of time it can be worn, testing for leaks around face and hose connections, warning signals when pressure is depleting, maintenance and storage procedures.
4. Proper use of oxygen resuscitators.
5. Importance of wind direction when dealing with H_2S and NH_3.
6. Procedure for rescuing a person overcome by H_2S and/or NH_3.
7. Responsibilities and duties during an emergency.
8. Condition I, II and III alerts.

A drill, with breathing equipment, will be conducted with each crew, including the mud loggers and mud engineer. The purpose of the drill is to instruct the crew in the use of breathing equipment and H_2S and NH_3 emergency procedures.

The drill will include the following personnel.

1. Rig crew.
2. Mud Engineer.
3. Mud Logger
4. Service Company Personnel assigned to essential duty during an emergency.
5. Drilling Contractor's Supervisor.
6. Union Oil Company Supervisor.
7. Union Oil Company Geologist.

Hydrogen Sulfide And Ammonia - Contingency Plan

The following procedure will be used for drills:

1. All personnel will be informed that a drill is to be staged.
2. The mud logger will initiate the drill by manually activating the alarm system.
3. The rig crew, mud logger, mud engineer and drilling supervisors will put on their breathing equipment. All other personnel will report to the proper briefing station.
4. Once breathing equipment is on, the driller will pull off bottom, shut down pumps and check for flow.
5. The driller shall proceed as if the well is flowing and simulate well shut-in procedures.
6. Mud logger will continue to monitor his equipment.
7. The mud engineer will perform a mud check for weight, funnel viscosity and run a "Hach Test" to determine the Sulfide concentration.
8. Drilling supervisors will observe to make sure all personnel know their duties. Make corrections where needed.

PROCEDURES FOR OPERATING CONDITIONS

When H_2S has been detected in the drilling fluid and/or NH_3 has been detected, will be performed under one of the three conditions as listed.

CONDITION I = POTENTIAL DANGER

Alarms H_2S Less than 10 PPM - None

NH_3 Less than 100 PPM - None

OCEDURES FOR OPERATING CONDITIONS - Continued -

OPERATIONS

Drilling operations in zones that may contain Hydrogen Sulfide or Ammonia. This condition will be in effect continuously from the commencement of drilling unless it is necessary to go to Condition II.

GENERAL ACTION

1. Be alert for condition changes.
2. Run a "Hach Test" on drill fluid routinely.
3. Check all safety equipment and monitors for proper functioning. Keep equipment available and working.
4. Conduct drills and familiarization programs.

CONDITION II = MODERATE DANGER

ALARM = Horn or Siren actuates at 10 PPM for H_2S.

= Horn or Siren Actuates at 100 PPM for NH_3.

GENERAL ACTIONS

1. The following personnel will immediately put on their breathing equipment.
   a. All personnel on rig.
   b. All personnel in area of mud pits.
2. Notify Drilling Supervisors.
3. Follow instructions of Drilling Supervisors.

GENERAL ACTIONS - Continued -

4. Immediately begin to ascertain the source of the H_2S and/or NH_3 and take the required steps to suppress the gas. Drilling will not proceed until the source is determined, the well is circulated and the gas is controlled.
5. The supervisors will make sure all non-essential personnel are out of the potential danger area.
6. Check all gas monitoring devices and increase gas monitoring activities with the portable hand operated gas detector units.
7. The Union Oil foreman will assess the situation, outline a control program and assign duties to each person or group as required to bring the situation under control.
8. Signs to be posted on access road to location indicating:

"DANGER - HYDROGEN SULFIDE - H_2S"

AND/OR

"DANGER - POISON GAS"

9. Access to drill site to be limited to authorized personnel only.
10. Notify District Drilling Superintendent.

Don . Ash - Bus: (707) 542-9543

Res: (707) 539-9314

CONDITION III - EXTREME DANGER TO LIFE

ALARM = Horn or Siren

= Blinking Lights

CONDITION III - Continued------

CHARACTERIZED BY:

Critical well operations, well control problems, poisonous gas above threshold levels (as defined under toxicity of various gases); and in the extreme, loss of well control.

GENERAL ACTIONS

1. All personnel will put on their protective breathing equipment.
2. All personnel not required for well control proceed to upwind briefing area for evacuation instructions.
3. Follow instructions of Drilling Supervisors.
4. The Union Oil Company Supervisor will assess the situation, outline a control program and assign duties to each person or group as required to bring the situation under control.
5. Notify District Drilling Superintendent

Don L. Ash - Bus: (707) 542-9543
Res: (707) 539-9314

District Superintendent will:

1. Brief his immediate Supervisor of the situation:

Vane E. Suter - District Operations Manager
Bus: (707) 542-9543
Res: (707) 527-5236

ENERAL ACTIONS - Continued -

2. Notify United States Geological Survey
   District Geothermal Supervisor
   Salt Lake City, Utah
   Bus: (801) 524-5245
   Res: (801) 532-2642

3. United States Forest Service
   Fishlake National Forest
   Fillmore, Utah
   Bus: (801) 743-5721

4. Bureau of Land Management
   Department of Interior
   Fillmore, Utah
   Bus: (801) 743-6811

5. Bureau of Land Management
   Department of Interior
   Cedar City, Utah
   Bus: (801) 586-9722

6. EXTREME EMERGENCY:

A. IF there is no hope of containing well under prevailing conditions and there is a definite threat to human life and property.

1. Initiate Emergency Evacuation Plan (See page 11).
2. Refer to Contingency Plan for Uncontrolled Blowout.
3. Time and circumstances permitting, the District office should be notified of the situation.
4. As a last resort the well is to be ignited (Poison Gas).

6. Extreme Emergency - Continued----------

B. INSTRUCTIONS FOR IGNITING THE WELL:

1. Two people are required for the actual igniting operation. Both men will wear self-contained breathing units and will have 200 foot retrieval ropes tied around their waists. One man is responsible for checking the atmosphere for explosive gases with Explosimeter. The other is responsible for lighting the well. Keep personnel not assigned special duties within the "Safe Briefing Area". Those in the "Safe Briefing Area" will be alert to the needs of the two men assigned to ignite the well. Should either of these men be overcome by fumes, they will immediately pull him to safety by the retrieval ropes.

2. The primary method for igniting the well is a 25mm meteortype flare gun. It has a range of approximately 500 feet. If this method fails or well conditions are such that a safer or better method is apparent, then the alternate should be used.

3. If the well is ignited, the burning Hydrogen Sulfide will be converted to Sulfur Dioxide which is also poisonous. Therefore, DO NOT ASSUME THAT

6. B.

3. Continued -

THE AREA IS SAFE AFTER THE GAS IS IGNITED. CONTINUE TO OBSERVE EMERGENCY PROCEDURES AND FOLLOW THE INSTRUCTIONS OF SUPERVISORS.

7. Initiate program to kill, plug and abandon well.

RESCUE

While drilling operations have made extensive preparations for personnel safety, all personnel should be aware of first aid procedures in the event someone becomes careless. First aid for H_2S and/or NH_3 victims is based primarily on:

(A) Move the victim to fresh air immediately.

1. Warning - Do not jeopardize your own safety. Always wear a self-contained breating apparatus while attempting rescue.

2. If people are trapped or unconscious in an ammonia vapor cloud, the ammonia vapor in their immediate area can be reduced considerably by use of a water fog or spray. Since ammonia is soluble in water, a water fog or spray is effective in removing the gas from the surrounding atmosphere. A fog nozzle can be attached to a fire hose and the fire hose turned on, playing the stream of spray or fog through the ammonia vapor cloud. This water fog will react with the ammonia vapor to form an ammonium hydroxide (NH_4OH) fog, which condenses as it cools and will fall to the ground. This technique could also be used to

RESCUE - Continued -

(A) 2. protect personnel trying to approach a leaking line or valve to make repairs or to shut down equipment.

Left ?? part 3 - see pg 22 original plan

Done 4-14-77

See P.O. Plan Contingency P. 26

Also Letter in Front of Book.

Hydrogen Sulfide And Ammonia - Contingency Plan

EMERGENCY EVACUATION PLANS

A. Personnel will assemble at the most upwind briefing area for instruction.

B. Notify the following:

Sheriff - Millard County

Telephone Number (801) 743-5302

Sheriff - Beaver County

Telephone Number (801) 438-2862

(801) 387-2750

Ambulance and Hospitals

Ambulance Service

Beaver, Utah

Telephone Number (801) 438-2651

Hospital

Beaver, Utah

Telephone Number (801) 438-2416

Doctors

DR. TERRY Beaver, Utah

Telephone Number (801) 438-2844

(801) 438-2416

EMERGENCY EVACUATION PLANS - Continued

Doctors

DR. ALLEN Richfield, Utah

Telephone Number (801) 896-5427

Residences within three-mile radius keyed to location map

MAP REFERENCE	RESIDENTS	TELEPHONE
A	Unknown	(801) Cove Fort 1
B	Gordon Ford	(801) 438-5693

SEE ADDITIONAL LISTINGS INCLUDED IN EMERGENCY PERSONNEL AND SERVICES.

Hydrogen Sulfide And Ammonia - Contingency Plan

UNION OIL COMPANY

TITLE	NAME	LOCATION	TELEPHONE
DISTRICT MANAGER	Vane E. Suter	Santa Rosa, CA.	(707) 542-9543 Res: (707) 527-5236
DISTRICT DRILLING SUPERINTENDENT	Don L. Ash	Santa Rosa, CA.	(707) 542-9543 Res: (707) 539-9314
DRILLING ENGINEER			
DRILLING FOREMAN			
DRILLING FOREMAN			

DRILLING CONTRACTOR

TITLE	NAME	LOCATION	TELEPHONE
DIVISION MANAGER			
DRILLING SUPERINTENDENT			

UNION OIL COMPANY

DATE: _____

I, _____, an employee of _____

_____, have been given a copy of

"The Union Oil Company's Contingency Plan For H_2S and NH_3",

have read it, and thoroughly understand it.

_____

Signature

VI. CONTINGENCY PLAN FOR UNCONTROLLED BLOWOUT

When the means to shut in or control the flow from a well is lost, the Union Oil Drilling Supervisor is to:

1. Initiate appropriate control procedures, (Procedures will vary greatly depending on the magnitude of the problem).

   (a) If any injuries have occurred, dispatch all injured personnel to the nearest medical facility by the fastest transportation available.

AMBULANCE SERVICE

Ground - Beaver, Utah (801) 438-2651

Air - Richfield, Utah (801) 896-5484

HOSPITAL

Beaver Valley - Beaver, Utah (801) 438-2416

Sevier Valley - Richfield, Utah (801) 896-4425

DOCTORS

Dr. Terry - Beaver, Utah (801) 438-2844
438-2416

Dr. Allen - Richfield, Utah (801) 896-5427

5. He is to be certain that all safety practices and procedures are being followed and that all members of the drilling crew are performing their assigned duties correctly.

6. Attempt to control the well at the rig site with rig personnel and supervisors, under the direction of the field drilling superintendent.

7. If fluid flow is of an uncontained nature, attempt containment with required equipment to construct sumps and/or dikes as rapidly as possible and as needed.

8. Attempt to construct and/or fabricate and install any well head facilities required to contain fluid flow at the well or casing head.

9. Maintain a continuing inspection of the pad area immediately around the well site, subject to erosion, that may cause a failure to the drilling rig structure. Take necessary steps to avert areas of possible erosion by excavation and rebuilding of the area as indicated.

10. Following complete containment of the well, initiate steps to return the area to its normal state prior to the blowout or fluid flow, such as re-seeding with similar and approved vegetation.

(b) If there is a threat to any local residents the sheriff should be notified as soon as possible.

Beaver County Sheriff Department

Beaver, Utah Office: (801) 438-2862

Home : (801) 387-2750

Millard County Sheriff Department

Fillmore, Utah (801) 743-5302

2. Secure and maintain control of access roads to area to eliminate entry of unauthorized personnel.

3. Contact District Drilling Superintendent, and advise of situation. District Superintendent will follow same procedure as stated in Major Spill Contingency Plan.

Don L. Ash - District Drlg. Supt.

Office: (707) 542-9543

Home : (707) 539-9314

4. Initiate any further or supplemental steps which may be necessary or advisable based on consultation with the Drilling Superintendent.

II. INJURIES

In the event of injuries that may occur, connected with the Union - Geothermal Operation, Union Oil procedures will be followed, with specific and immediate attention given to proper air and/or LAND transportation to a medical facility as required.

Refer to Emergency Phone Numbers, Emergency Personnel and Services.

Copies of accident reports from Union Oil Company, and/or the contractor employing the injured individual will be submitted to the Utah State Health Department and other organizations as required.

UNION OIL COMPANY

DATE: _____

I, _____, an employee of _____

_____, have been given a copy of

"The Union Oil Company's Contingency Plan For H_2S and NH_3",

have read it, and thoroughly understand it.

_____

Signature

24. EQUIPMENT OPERATION

All personnel will follow State and Federal Safety Regulations and maintain a minimum clearance of 10 feet from overhead high voltage.

25. ELECTRIC HAND TOOLS

Portable electric hand tools with exposed non-current carrying metal parts shall be grounded unless the portable tools are protected by an approved system of double insulation.

26. SAFETY MEETINGS

All personnel will attend and participate in the monthly Safety Meeting.

27. SANITATION

Sanitary Facilities will be provided at all locations during drilling operations.

28. DRINKING WATER

Bottled water will be used for all human consumption.

NOTE: All personnel will be required to read and understand the "Contingency Plan" section of this report.

Union Geothermal Division

Union Oil Company of California
1250 Coddingtown Center, P.O. Box 6854
Santa Rosa, California 95406
Telephone (707) 542-9543

UNION 76

L. Smith
Engineer

March 11, 1977

U.S. Geological Survey
Office of the Area Geothermal
Supervisor
Suite 400
2465 East Bayshore Road
Palo Alto, California 94303

ATTN: Dr. Sie Ling Chiang, Chief,
Environmental and Safety Section

RE: Union Oil Company of California Report - "Proposed Plan of Operations to Drill Geothermal Test Wells, Cove Fort-Sulphurdale Unit, U.S. Geothermal Leases U-29553 through U-29558" - Additional information.

Dear Dr. Chiang:

This letter responds to your request for additional information as required per your memo to file of February 23, 1977. Enclosed is a letter from Don L. Ash which supersedes his letter of February 10, 1977 clarifying some aspects of the project description and confidentiality status.

In order of your memo of February 23:

It is intended that the testing programs described in the sections labelled "General Testing Procedure for an Exploratory Well" and "Proposed Geothermal Well Testing, Cove Fort Prospect, Cove Fort, Utah" be considered an integral part of the Plan of Operations.

The rig test is conducted in the manner described. The energy of the fluids as they enter the sump, is dissipated

by an H-bar spreader (see figure) designed by Union Oil and demonstrated effective in Imperial Valley, New Mexico and the Phillipines.

If the sump capacity remaining after completion of the drilling phase is insufficient to accomodate the fluids from the rig test, the required amount of sump contents will be removed and hauled to an approved dump site prior to the test.

Neither fluids from the drilling phase nor from the testing program will be allowed to reach a level in the sump exceeding the minimum freeboard of three feet.

The reservoir analysis testing consists of short term and long term tests as described in the section on "Proposed Geothermal Well Testing...."

If existing road rights-of-way are not used for the reinjection line/s (as noted the diameter will be determined from the rig test) the technique of pulling a welded line from one location to the other will be used. This technique involves no vehicular traffic over the course, but rather a cable is used and the pipe is guided by men on foot. No significant surface disturbance results from this procedure.

Archaeology

The northernmost portion of route A-10, which lies beyond a fence, will not be used.

The route of the new road to site 5 shown on the archaeology map is the proposed access to that site. The old road will not be altered.

The road to site 12 shown on the archaeology map is incorrect. The location shown in exhibit B was designated prior to the archaeological survey and is the route actually surveyed by the archaeologist.

Locations and Sumps

Specifications and design criteria are outlined in the attached memo by Ron Chappell. Included is a "typical" detailed site plan as requested. I believe it was agreed by Barry Boudreau, Bruce Hellier and yourself that detailed plans for the remaining specific sites would be required only when there is significant deviation from the specifications and criteria presented with the enclosed plan.

ank you for the specificity of your questions and concerns. Please contact us for any further questions you may have.

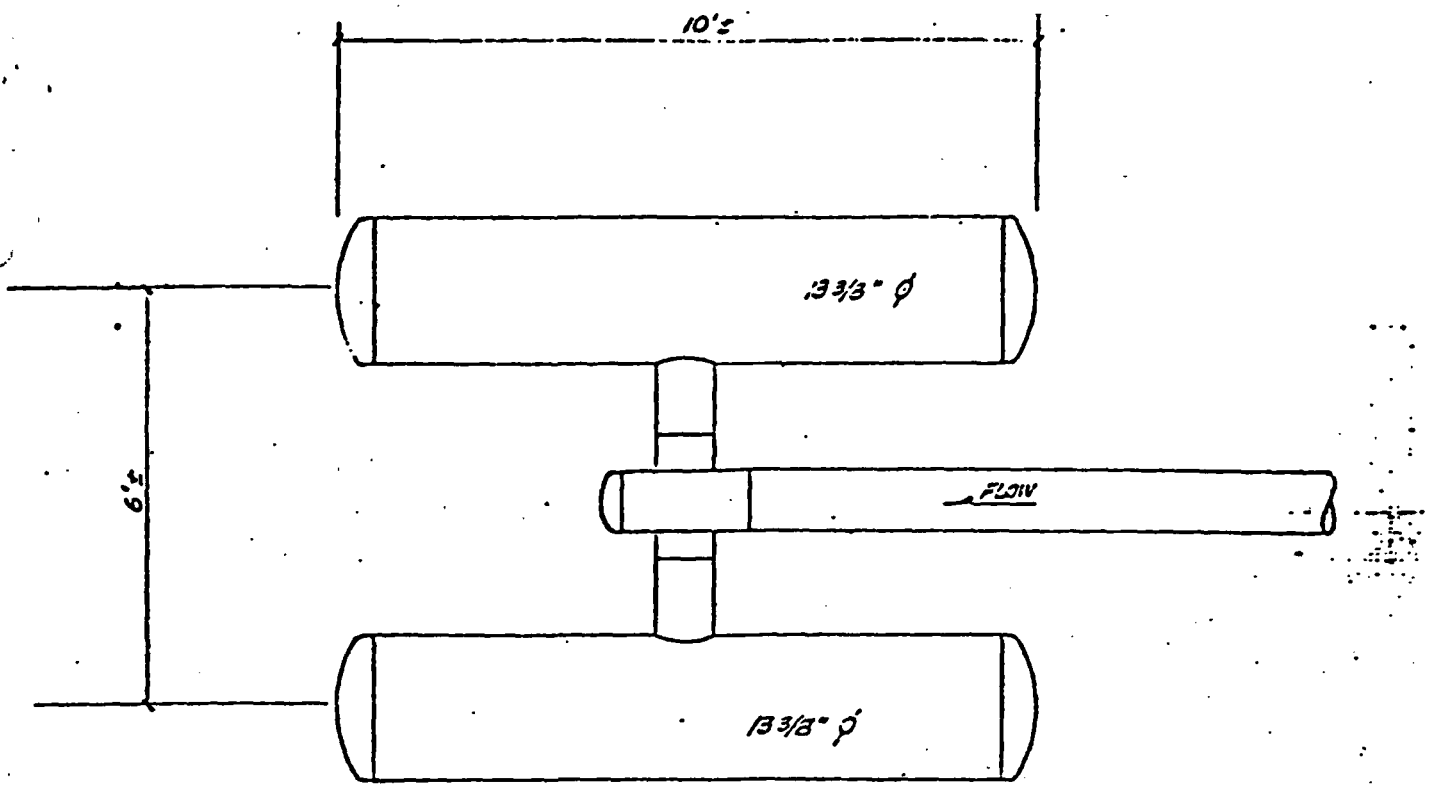
Very truly yours,

UNION OIL COMPANY OF CALIFORNIA

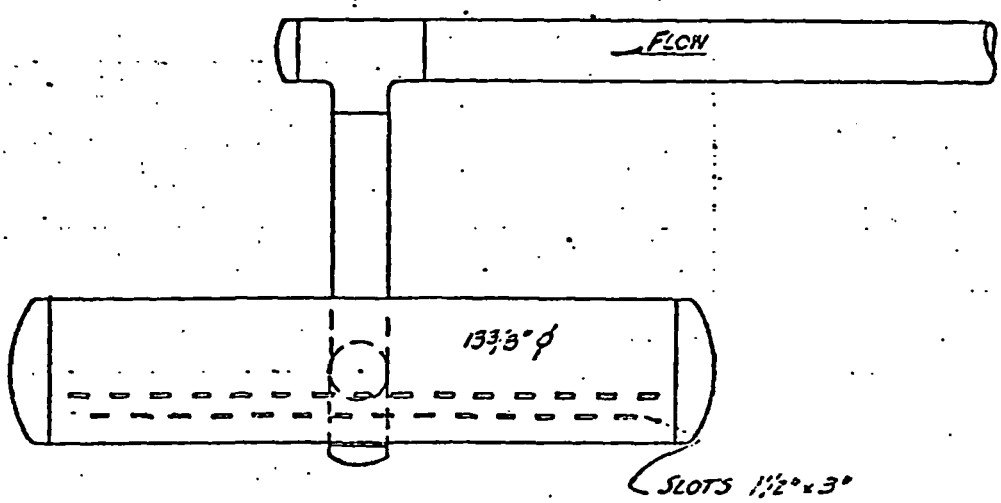
Warren A. Smith

Warren A. Smith

WAS/ljl
Encls.: Don L. Ash letter
Drawing Number 1323
Memo - Ron Chappell, including "typical" detailed site plan



TOP VIEW



SIDE VIEW

DATE	UNION	DRAWN
	UNION OIL COMPANY OF CALIFORNIA - GEOTHERMAL DIVISION	FOR: W. J. J.
	H-BAR ENERGY DISSIPATER	BY:
		DATE:
		SCALE: NONE
		DRAWING NUMBER

Union Geothermal Division

Union Oil Company of California
1250 Coddingtown Center, P.O. Box 6854
Santa Rosa, California 95406
Telephone (707) 542-9543

UNION 76

March 7, 1977

U.S. Geological Survey
Office of the Area Geothermal Supervisor
Suite 400, Room 401
2465 East Bayshore Road
Palo Alto, California 94303

RE: Union Oil Company of California Report - "Proposed Plan of Operation to Drill Geothermal Test Wells, Cove Fort - Sulphurdale Unit, United States Geothermal Leases U-29553, U-29554, U-29555, U-29556, U-29557, and U-29558.

lemen:

This letter is submitted as an addendum to the above referenced report and may be cited as authority for the additions and changes listed below. It also supersedes our letter dated February 10, 1977.

1. LOCATION AND ROADS, EXHIBIT "C", INDIVIDUAL WELL LOCATIONS. All section lines contained on the twenty-three individual well location plats in this section are tied to the U.S. Land Net as shown by the official map on file in the office of the Surveyor General, Salt Lake City, Utah. The elevations are tied to the U.S. Geological Survey Datum.

   The initial twenty-three exploratory wells are planned to be drilled as straight holes with only a reasonable, random deviation of the bottom hole location from the surface location as measured in horizontal distance from section corners. However, in the event that the intended bottom hole location cannot be reached or if the well produces at sub-commercial production rates, the well may be redrilled to another bottom hole location within a 2000 foot radius measured horizontally from the well's surface location.

   The terrain and knowledge gained of sub-surface geology and reservoir characteristics, through drilling and testing of the exploratory wells, will undoubtedly dictate the drilling of directional wells during the development stage.

2. As of this date, February 10, 1977, the confidential classifications previously assigned to the following sections or exhibits are hereby removed and considered deleted.

   a. "Location and Roads", Exhibit "A" (a-1, Topographic Map), (a-2, Well Locations and Lease Boundaries), and (a-3, Drainage Patterns and Existing Roads).

   b. "Location and Roads", Exhibit "B" (Location Map, Roads).

   c. "Location and Roads", Exhibit "C", Individual Well Locations (Well Numbers 1 thru 23).

   d. "Location and Roads", Exhibit "D", (Summary).

   e. "Location and Roads", Exhibit "E", (Surface Contours, Sump, and Equipment Location.

   f. "Location and Roads", Exhibit "F", (Archaeological Report and Archaeological Maps).

Only the Cove Fort - Sulphurdale Unit Area Geologic Map, Millard and Beaver Counties, Utah, contained in "Locations and Roads", Exhibit "F", will remain classified as confidential.

Very truly yours,

UNION OIL CO. OF CALIFORNIA

Don L. Ash
District Drilling Superintendent

KBL/cc

UNION 76

March 24, 1977

TO: Warren A. Smith

FM: Ronald E. Chappell

RE: "PROPOSED PLAN OF OPERATION TO DRILL GEOTHERMAL TEST WELLS, COVE FORT - SULPHURDALE UNIT"

As we have discussed, attached are revised wellsite plans and typical wellsite and road cross sections. These attachments describe the limits of cut and fill, indicate the sump capacities, and specify the cut and fill steepnesses.

Also attached are our roadway and drillsite specifications for the Cove Fort - Sulphurdale prospect.

REC/mc

Attachments

Ronald E Chappell

EARTHWORK AND CONSTRUCTION

SPECIFICATIONS

Cove Fort - Sulphurdale Prospect

SECTION I - INTRODUCTION

1.1 General: The following specifications will be followed for drill site and road construction at Union Oil Company's drill sites at the Cove Fort - Sulphurdale Prospect. These specifications are of a general nature and may require deviations on a case-by-case basis. Special construction requirements shall be described on the plans for individual drill sites.

1.2 Supervision: Work proposed will be under the supervision of a Civil Engineer and/or an Engineering Geologist to inspect earthwork construction and to assure that suitable materials are placed to design requirements and in conformance with these specifications.

SECTION 2 - PLANNING

2.1 Drill Site Locations: Drill sites shall be selected utilizing natural topographic features such as ridges, benches, shoulders and valleys which provide relatively flat areas of sufficient size to accommodate the drilling facility. The site shall be engineered to balance cuts and fills, thereby minimizing changes in natural contours, excavation operations and disturbance of vegetation. Areas of both inactive and active landslides are to be avoided, or if unavoidable, engineered in such a manner to insure the safe drilling and operation of geothermal wells.

2.2 Road Locations: Access roads shall follow existing trails where possible, in keeping within good design and construction practices. Road widths shall be limited to the width required for use and for safe equipment operation. In general, road widths shall be 15 feet and designed to accommodate single-lane traffic. Turnouts shall be provided at strategic locations. Roads shall follow natural contours of the land.

SECTION 3 - EARTHWORK

3.1 Clearing shall consist of the removal of organic growth such as brush, grass, weeds, and other vegetation and debris and the disposal of such material designated for removal,

including timber, brush, rubbish, and other matter occurring within the areas to be cleared. Construction areas for excavation and fill operations at the drill site shall be stripped of all vegetation and organic soils. Brush and tree growth shall be stockpiled and burned, or buried in spoil areas.

3.2 Earth Fills: All fill areas shall be benched and keyed into undisturbed ground. Embankments shall be placed in six to eight inch lifts, moistened as required, and compacted by tamping rollers or other approved compacting equipment to 90% of ASTM D-1557-70, "Moisture Density Relations Test for Soils". Road fill slopes shall not exceed 3:1 and drill site fill slopes shall not exceed 2:1.

3.3 Excavations: The engineer will determine in the field the disposition of excavated material, including stockpiling of certain materials excavated for later use. Excavated materials free of organic materials and debris may be used in berms and for mud sump-disposal site liners, providing such materials are approved by the engineer.

Cut slopes shall not exceed 1.5:1. Steeper slopes may be employed on a case-by-case basis by the engineer where sound and durable rock is encountered. The top portion of the cut shall be rounded to eliminate a sharp break between the cut and the existing vegetation. The face of the cut shall be roughened or benched to enhance revegetation.

SECTION 4 - DRAINAGE AND EROSION CONTROL

4.1 Access Road and Drill Site Pad: Access road surfaces shall be out-sloped or sloped toward the fill side so that there will be a minimum interuption of natural drainage patterns. All slopes shall be seeded for erosion control as provided herein. The portion of drill pad which will contain equipment capable of dripping oil or fuel shall be sloped toward the sump. The remaining drill pad shall be sloped to drain toward the cut. The slopes shall be approximately two feet per one hundred feet. Drainage swales on the upslope side of the drill site shall be sloped to drain at a gradient between 1% and 2%, or greater with approval by the engineer.

Sand/cement filled bags shall be installed as energy disipaters where required to reduce flow velocities and prevent erosion. Culverts where necessary shall be installed with sand/cement-filled sand bag headwalls at the entrance, stilling basins at the exit, and shall be extended to existing natural drainage areas.

SECTION 5 - REVEGETATION OF GRADED AREAS

5.1 General: Access road and drill site cut and fill slopes and other areas exposed by grading shall be revegetated with approved grasses. Areas to be revegetated shall be determined by the engineer.

The revegetative effort shall be done in late summer or early fall, prior to winter snows.

5.2 Fertilizers: For areas to be revegetated, 14-14-14 granular fertilizer shall be applied at the rate of 300 lbs per acre.

5.3 Grasses: Grass seeds shall be applied at 60 lbs. per acre. The seed mix shall be as follows, depending on availability:

Blando Brome, Wymera Ryegrass or Common Ryegrass	50 lbs per acre
Red Leafed Clover	10 lbs per acre

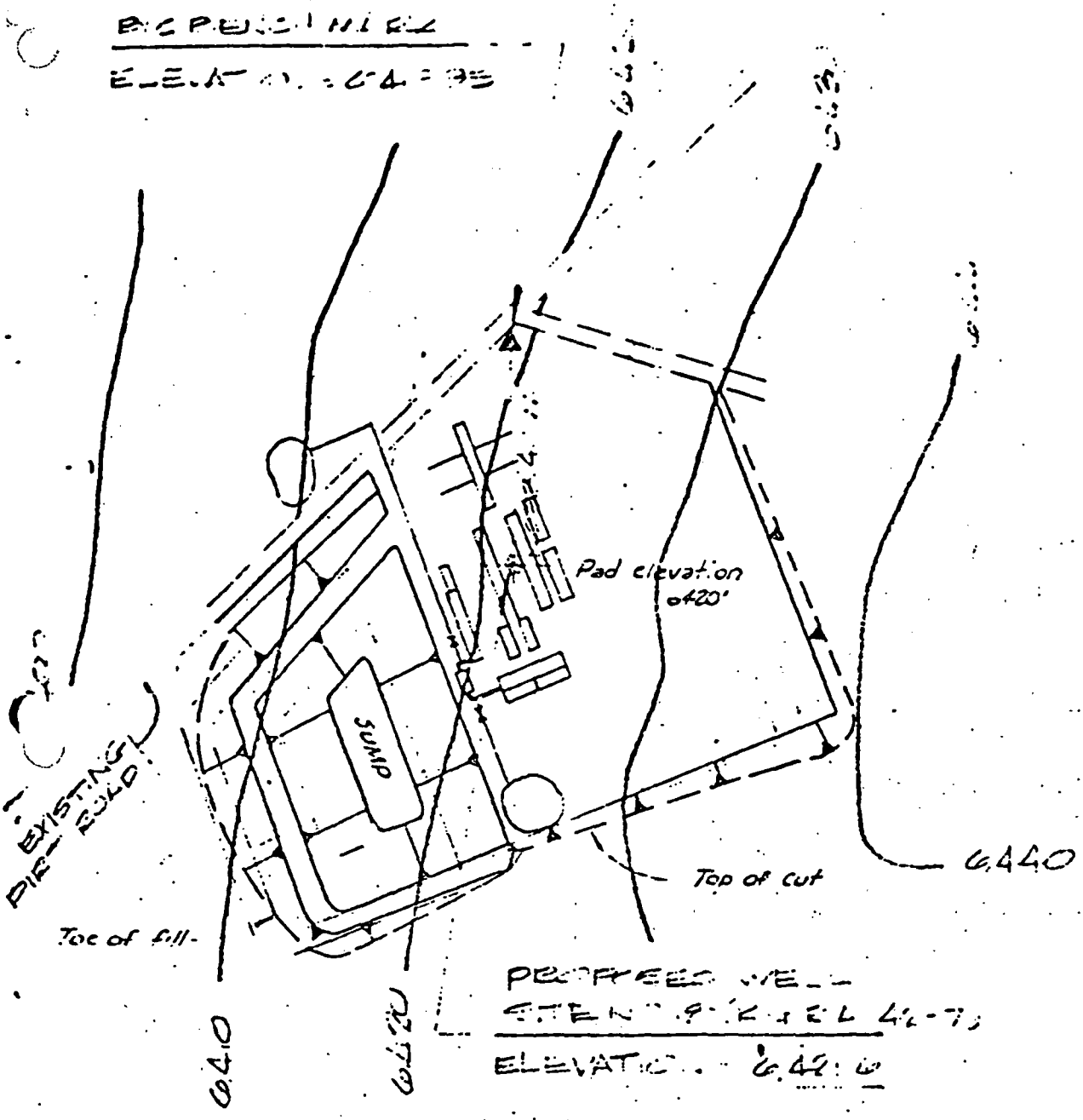
SECTION 6 - PREPARATION OF MUD SUMP-DISPOSAL AREAS

6.1 General: The disposal site will have the natural characteristics or will be engineered in such a manner to preclude the seepage or migration of any leached and deleterious materials contained within the sump to usable surface and groundwater.

6.2 Impervious Liner: An impervious soil lining conforming to the inside pit configuration shall be placed in such a manner to resist accidental damage from pumping and other operations. The soil in the sump shall be thoroughly compacted to 90% of ASTM D-1557-70 prior to placement of the liner. A two-foot-thick clay lining of materials approved by the engineer shall then be applied. The lining will be placed in six-inch layers using soil having a suitable clay content. The lining material shall be moistened to optimum moisture content and compacted to at least 95% of ASTM D-1557-70. Each layer will be compacted by means of a sheepsfoot or other suitable compacting roller. The surface of the clay lining will be finished by track-walking with a track-laying tractor. The permeability of the lining as placed shall not exceed 1×10^{-6} centimeters per second.

The slopes of the containment areas shall not exceed 2:1 and the bottom width shall not be less than five feet. A minimum three foot freeboard shall be maintained at all times.

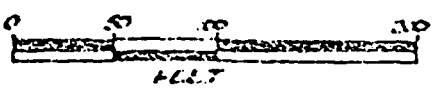
6.3 Drill Site Disposal Area Abandonment: Upon completion of drilling operations at drill site locations, the mud sump-waste disposal area shall be dewatered by solar evaporation or by pumping with the final drying of the waste material by solar evaporation. When the moisture content of the waste material is reduced to 30% or less, the sump contents shall be mixed with native soils and the sump back-filled. A two-foot-high compacted berm shall be installed between the sump area and the drill site location pad to prevent water from running off the pad onto the sump. The surface of the disposal area shall be sloped to drain, graded for an attractive appearance, and revegetated as specified herein.



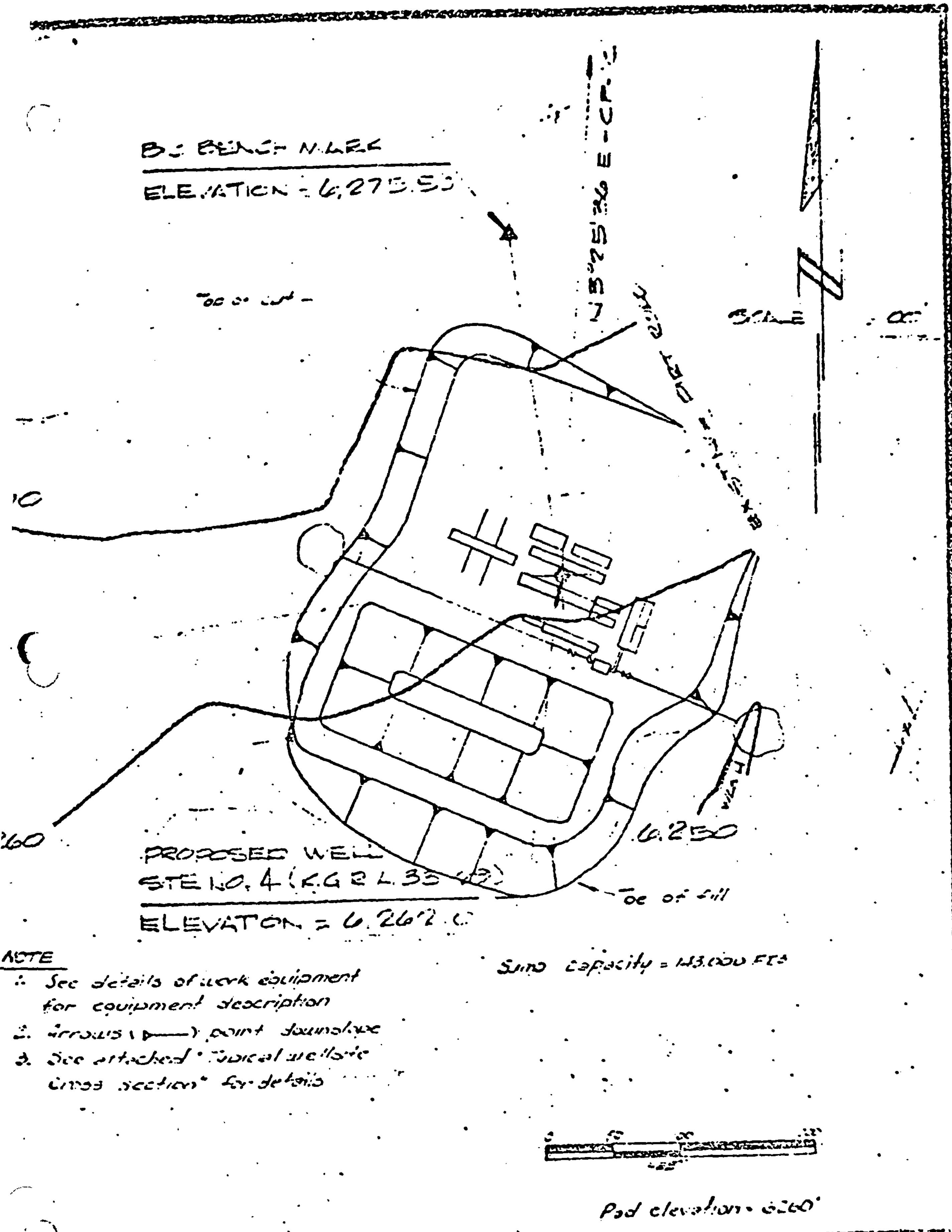
NOTE:

1. See details of work completed for equipment identification
2. Arrows (▶——) point downslope
3. See attached "Typical wellsite Cross Section" for details

SCALE 1"=50'



BULLOCH BROS.
ENGINEERING INC.
CEDAR CITY, UTAH

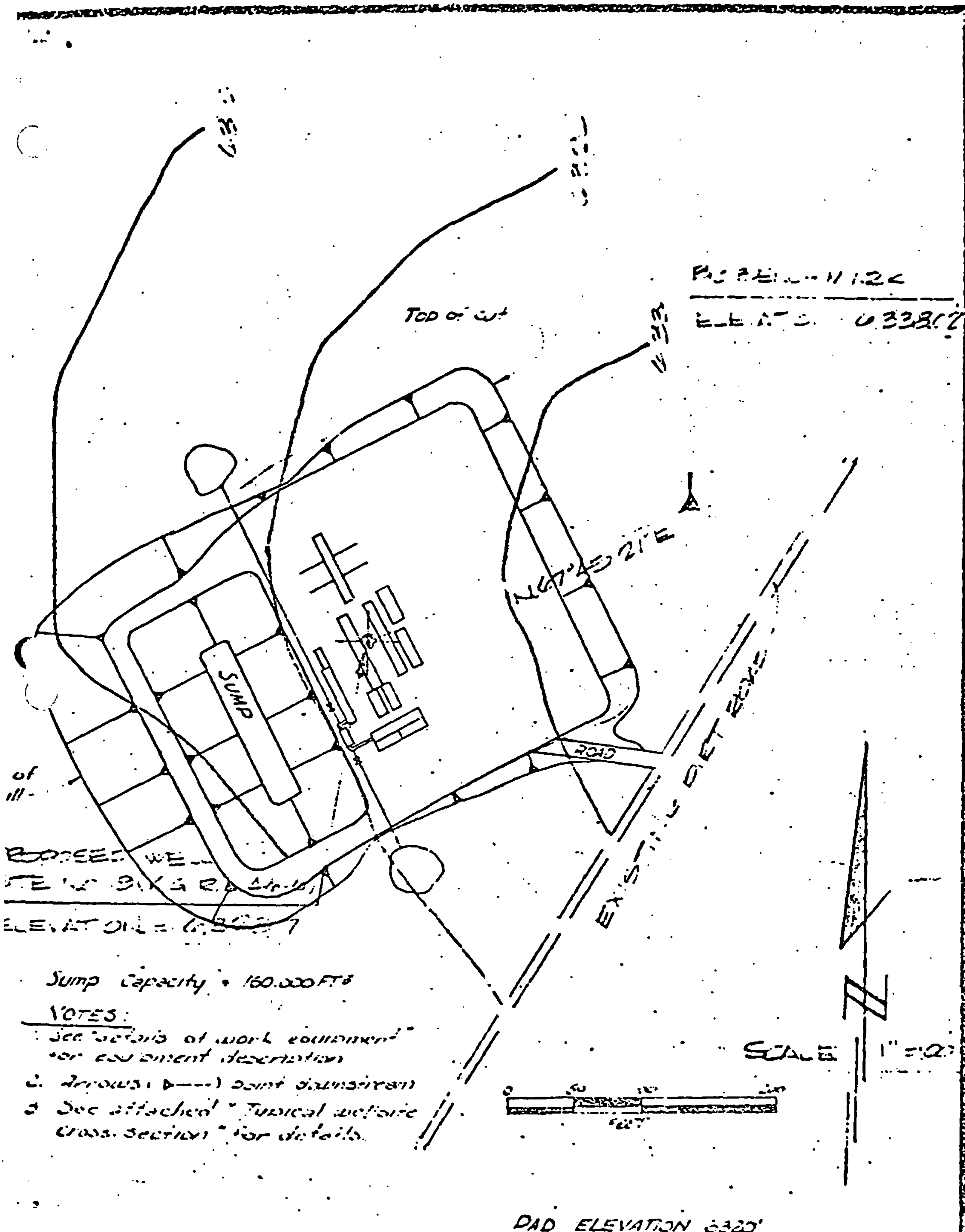


BULLOCH BROS.
ENGINEERING INC.
CEDAR CITY, UTAH

TOPOGRAPHIC MAP
OF
WELL SITE No4

UNION OIL CO.
... CALIF

SCALE 1" = ...
DRAWN ...



Sump Capacity = 160,000 FT³

NOTES:
1. See "details of work equipment" for equipment description
2. Arrows (→) point downstream
3. See attached "Typical wellsite cross section" for details.

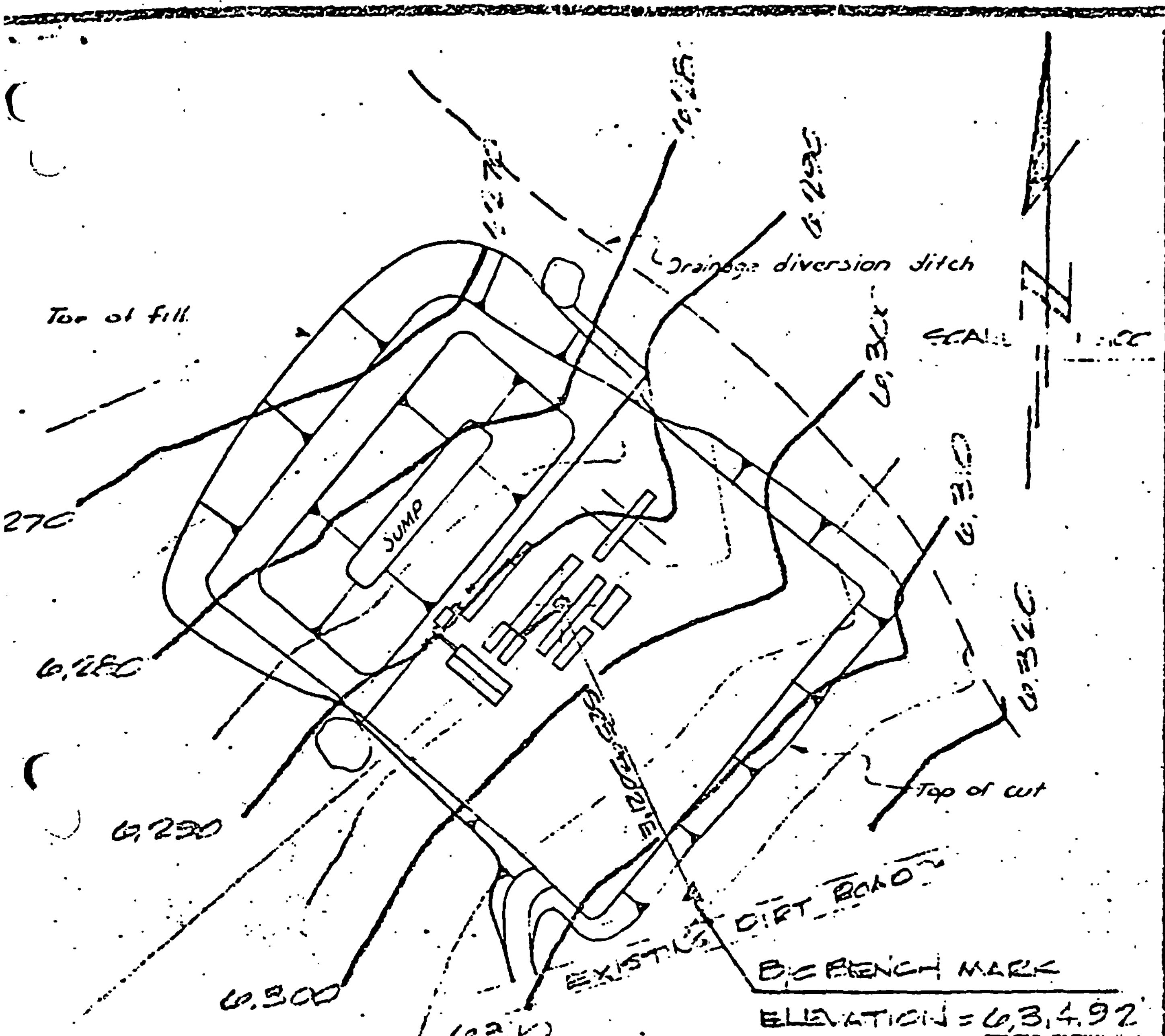
SCALE 1"=100'

BULLOCH BROS.
ENGINEERING INC.
CEDAR CITY, UTAH

TOPOGRAPHIC MAP OF WELL SITE No 9

SCALE

DRAWN



PROPOSED WELL
SITE NO. 22 (K G E A 34-32)

ELEVATION = 6,293.3

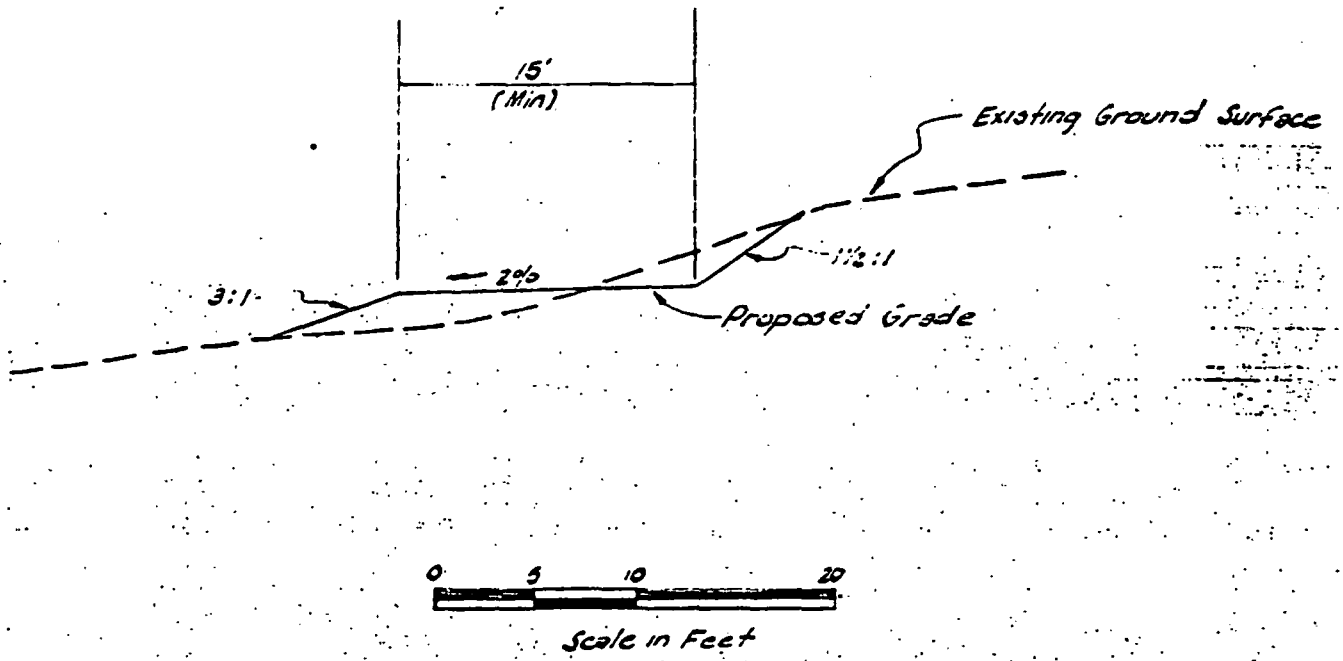
Sump Capacity = 143,000 FT³

0 50 100 200
FEET

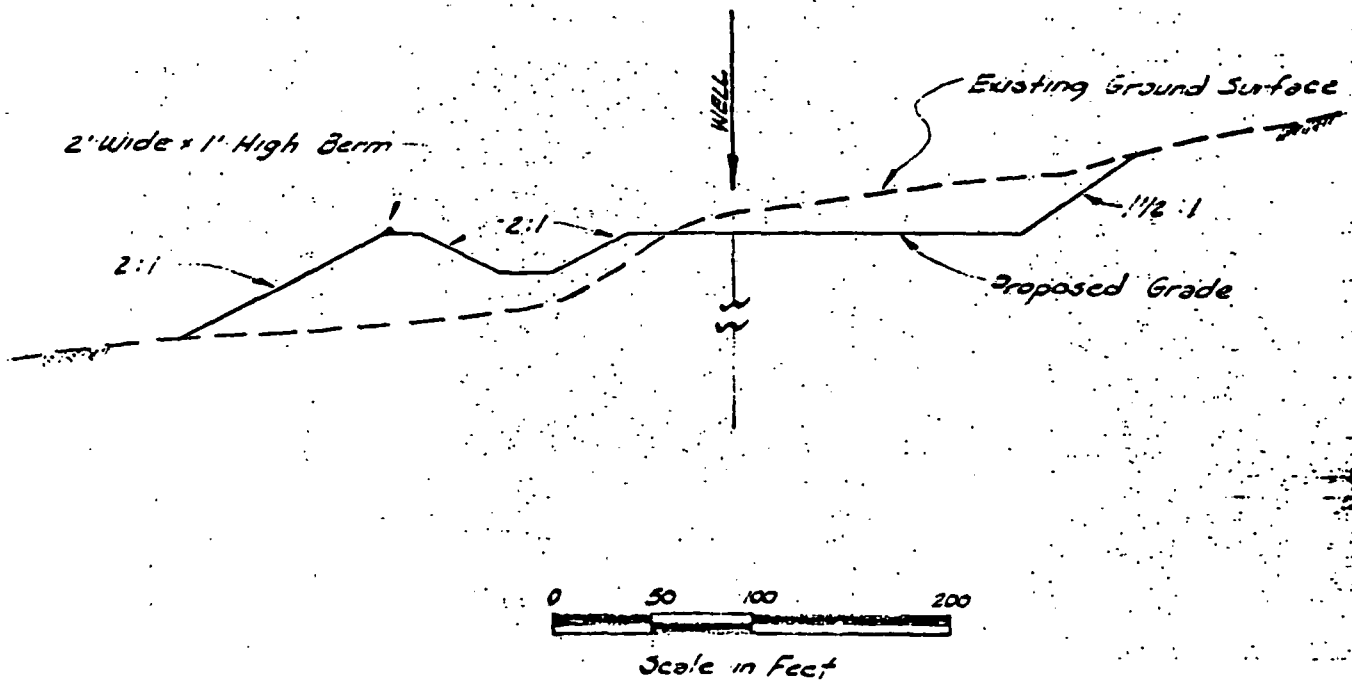
Pad elevation = 6290'

NOTES:
See details of work equipment for equipment identification.
See attached "Typical wellsite cross section" for detail.

BULLOCH BROS. ENGINEERING INC. CEDAR CITY, UTAH	TOPOGRAPHIC MAP OF WELL SITE No. 22	UNION OIL CO. SANTA FE, CALIF. SCALE



TYPICAL ROAD CROSS SECTION



TYPICAL DRILL SITE CROSS SECTION

REVISED	DATE

UNION OIL COMPANY OF CALIFORNIA - GEOTHERMAL DIVISION

TYPICAL SECTIONS
COVE FORT PROJECT UTAH

DRAWN	
FOR:	P.E.C.
BY:	
DATE:	
SCALE:	
DRAWING NUMBER	

APPENDIX B-1

Phillips Petroleum Company's
Archaeological Clearance

ITERNATIONAL LEARNING AND RESEARCH, INC.

484 SOUTH 300 EAST / CEDAR CITY, UTAH 84720

LEY P. LARSEN

WARD A. THOMPSON

A BETH THOMPSON

December 19, 1976

Dr. David "A" Gillio
Area Archeologist
Fishlake National Forest
170 North Main Street
Richfield, Utah 84701

Dear Dr. Gillio:

This note is a supplement to the recently submitted, An Archeological Survey of Eight Drill Sites in the Cove Fort Geothermal Field in the Fishlake National Forest of Beaver and Millard Counties, Utah. This report was prepared at the request of the Phillips Petroleum Co. of San Diego, California. In the report it was noted that drill site #7 was located on a piece of high ground between two level areas, one around North Spring and a smaller area that appeared to surround a smaller spring. Since the completion of that report, representatives of the U.S. Forest Service and the Phillips Company have agreed that this site should be moved as a precaution against damage to the water supply.

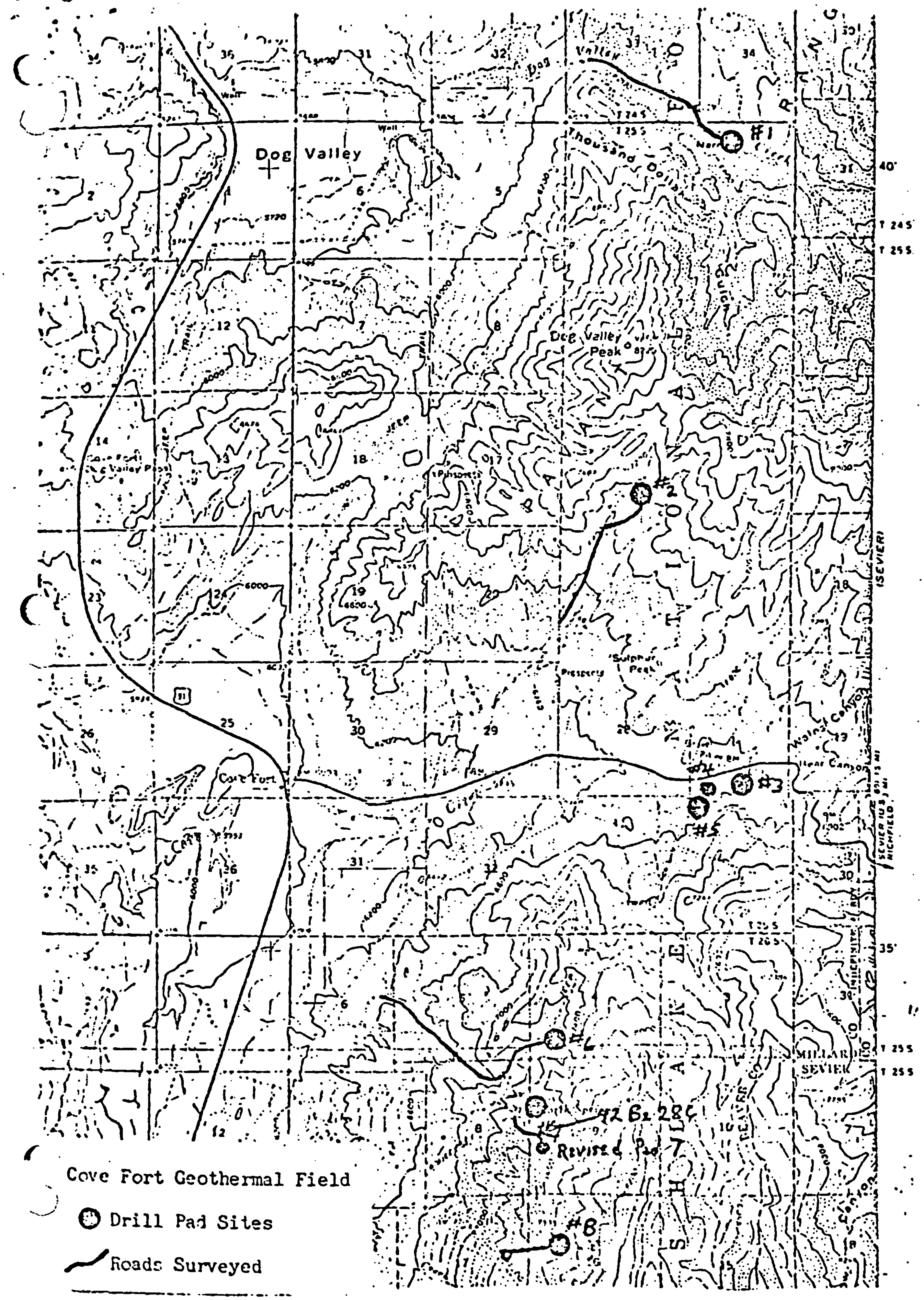
At the request of Phillips, therefore, the writer conducted an archeological survey of about one third of a mile of new access road and of a drill site approximately 300 yards square. The road and the site are marked on the accompanying map. The work was authorized by a permit issued by the U.S. Forest Service and by Utah State Antiquities Permit No. 203. The road coverage was completed by walking some 10 feet to the right of the centerline markers on the way to the pad and then by walking the same distance from the markers on the opposite side during the return trip. The drill site was examined through the use of a series of walking passes spaced at 12 meter intervals until the entire area was covered.

While no evidence of prehistoric sites were identified at the drill site, a lithic concentration some 12 meters in diameter was found just above the proposed right-of-way for the access road at a point some 200 meters north northwest of the drill site. Located on the southern slope of a ridge with an incline of from 20° to 30°, the actual site area proved to be nearly level, apparently formed by a small rock outcrop. Material identified included a rather heavy biface fragment, an obsidian flake, a small core, and several cryptocrystalline flakes. A minimal test probe of about 5 cm. to frozen ground failed to produce any subsurface cultural material nor any evidence of midden.

At this writing it would appear that sufficient mitigation will be accomplished if the road at this point is dropped down the slope to a point at which the uphill edge of the road runs 5 feet south of the present centerline markers. This step will leave the site undisturbed while representatives of the Phillips Co. indicate this would create no significant increase in the grade over the final few hundred yards to the site.

Sincerely,

Richard A. Thompson


Dog Valley
Thousand Dollar
Dog Valley Peak
Sulphur Peak
Cove Fort
Cove Creek
Wales Canyon
Bear Canyon
MILLARD
SEVIER
#1
#2
#3
#4
#5
#6
#8
Revised Pad 7
Cove Fort Geothermal Field
Drill Pad Sites
Roads Surveyed

APPENDIX B-2

Union Oil Company's
Archaeological Clearance

APPENDIX C

Coordination and Correspondence

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Area Geothermal Supervisor's Office
Conservation Division, MS 92
345 Middlefield Road
Menlo Park, CA 94025

SEP 21 1976

Memorandum

To: INTERESTED PARTIES

From: Acting Area Geothermal Supervisor

Subject: Plans of Operation, Phillips Petroleum Company and Union Oil Company, Cove Fort-Sulphurdale Area, Fishlake National Forest, Millard and Beaver Counties, Utah

Both Phillips Petroleum Company and Union Oil Company propose to submit Plans of Operation to conduct geothermal exploration operations in the Cove Fort-Sulphurdale area (Map 1).

Phillips' plan will entail drilling five exploratory wells to depths of 5,500'± on Federal Leases U-28947, U-28948, and U-29215A. Three alternate drilling sites have also been chosen. Location of the well sites and alternate sites are shown on Map 2.

Union's plan will entail drilling 24 exploratory wells to depths of 10,000'± on Federal Leases U-29553, U-29554, U-29555, U-29556, U-29557, and U-29558. Location of these well sites are also shown on Map 2.

Copies of the Plans of Operation will be forwarded to you upon receipt from Phillips and Union.

A joint field inspection of the well sites and access roads has been scheduled for October 5, 1976. The inspection party will meet at Cove Fort at 9:00 a.m. Mr. Ken Bull, District Geothermal Supervisor, USGS, will be the field inspection coordinator. Any questions or requests for further information should be addressed to Mr. Bull, 350 South Main, Room 442, Salt Lake City, Utah 84111, Tel: (801) 524-5245 (FTS 588-5245). More detailed maps showing well sites and access roads will be available at the field inspection.

We realize that a complete copy of the Plan of Operation is normally forwarded with an inspection trip announcement. In this case, however, we feel that completing the inspection prior to the onset of winter weather is an overriding concern.

An environmental analysis will be prepared by this office for the proposed actions. We would like to receive any comments you may have concerning the proposed actions. A closing date for accepting these comments will be established when the Plans of Operations are distributed.

Dwayne E. Hull

Attachments

[illegible]

U. S. Department of [illegible]
ATTN: Floyd [illegible]
Beaver, Utah 84713
([illegible]-2372)

Office of the [illegible]
U. S. [illegible]
ATTN: [illegible]
[illegible]
[illegible]
[illegible]
FTS: [illegible]

[illegible]

[illegible]

[illegible]
Salt Lake City, Utah [illegible]
[illegible]

INTERESTED PARTIES
EA #57
Phillips Petroleum Company/Union Oil Company
Cove Fort-Sulphurdale/Fishlake National Forest
Beaver and Millard Counties, Utah

Regional Director, Region 6
U. S. Fish & Wildlife Service
Denver Federal Center
P. O. Box 25486
Denver, Colorado 80225
FTS: 234-2209

Area Office
U. S. Fish and Wildlife Service
ATTN: Lewis Richardson
Federal Building, Room 2222
125 S. State Street
Salt Lake City, Utah 84138
FTS: 588-5637 (801-524-5637)

U. S. Fish & Wildlife Service
Geothermal Coordinator (ATTN: W. Spaulding)
2800 Cottage Way, Room E-2720
Sacramento, California 95825
FTS: 468-4657 (916-484-4657)

U. S. Department of Agriculture
ATTN: Floyd Bartlett
Beaver, Utah 84713
(801-438-2372)

Office of the Area Geologist
U. S. Geological Survey, Cons. Div.
ATTN: Gary Galyardt
Bldg. 25, Rm 1322
Denver Federal Center
Denver, Colorado 80225
FTS: 234-4435 (303-234-4435)

Federal Energy Administration
ATTN: Charles E. Denton
Post Office Building, Room 464
350 South Main Street
Salt Lake City, Utah 84101
FTS: 588-4108 (801-524-4108)

Donald Alvord, District Geologist
U. S. Geological Survey, Cons. Div.
Federal Building, Room 8422
125 S. State Street
Salt Lake City, Utah 84128
FTS: 588-5643 (801-524-5643)

Senator Jake Garn
Federal Building, Room 4227
125 S. State Street
Salt Lake City, Utah 84138
FTS: 588-5933 (801-524-5933)

Senator Frank E. Moss
Federal Building, Room 5430
125 S. State Street
Salt Lake City, Utah 84138
FTS: 588-5935 (801-524-5935)

Representative Allan T. Howe
Federal Building, Room 2311
125 South State Street
Salt Lake City, Utah 84138
FTS: 588-5583 (801-524-5583)

Wildlife Resources Division
ATTN: Earl Spark
1596 West North Temple
Salt Lake City, Utah 84116

Utah Division of Health
Environmental Health Service Branch
ATTN: Lynn Thatcher, Director
44 Medical Drive
Salt Lake City, Utah 84113
(801-533-6121)

Utah Geological & Mineral Survey
ATTN: Dan Mc Millan
USGS Bldg., University of Utah
Salt Lake City, Utah 84112
(801-581-6831)

Water Rights Division
ATTN: Dee Hansen, State Engineer
Room 442 State Capitol
Salt Lake City, Utah 84114

Natural Resources Department
ATTN: Clifford Colling
Room 438 State Capitol
Salt Lake City, Utah 84114
(801-533-5356)

Water Resources Division
ATTN: Brice Montgomery, Geologist
Room 435 State Capitol
Salt Lake City, Utah 84114
(801-533-5401)

State Planning Commission
ATTN: Dave Conine
Room 118 State Capitol
Salt Lake City, Utah 84114
(801-533-6491)

Oil, Gas & Mining Division
ATTN: Patrick Driscoll
Chief, Petroleum Engineer
1588 West North Temple
Salt Lake City, Utah 84116
(801-533-5771)

Department of Geology
ATTN: Jim Whelan
University of Utah
Salt Lake City, Utah 84112
(801-581-7162)

Beaver County News
ATTN: N.E. "Red" Wilson
P. O. Box 368
Milford, Utah 84751
(801-387-2881)

EPA Las Vegas Office
P. O. Box 15027
ATTN: Don Gillmore
Las Vegas, Nevada 89114
FTS: 585-2969, Ext 241

Mr. Max Crittenden, Chairman
Geothermal Environmental Advisory Panel
345 Middlefield Road
Menlo Park, California 94025
FTS: 467-2317

Val Finlayson
Director of Research
Utah Power & Light Co.
1407 West North Temple
Salt Lake City, Utah 84110
(801-350-3722)

Conservation Manager, Central Region
U. S. Geological Survey, Cons. Div.
7200 West Alameda Avenue
Lakewood, Colorado 80226
FTS: 234-2855

Environmental Protection Office
Regional Office Region VIII
ATTN: John Hermann
1860 Lincoln Street
Denver, Colorado 80203
FTS: 327-4904

Dr. Richard E. Turley
State Science Advisor
3008 MEB
University of Utah
Salt Lake City, Utah 84112
(801-581-6479)

District Manager
Bureau of Land Management
850 N. Main Street
P. O. Box 768
Richfield, Utah 84701
FTS: 588-2237 (801-896-5401)

Warm Springs Resources Area Office
Bureau of Land Management
ATTN: Mark Bailey
P. O. Box 778
Fillmore, Utah 84631
FTS: 588-5500 (801-743-6811)

State Director
Bureau of Land Management
University Club Building
136 E. South Temple
Salt Lake City, Utah 84111
FTS: 588-5433

District Geothermal Supervisor
U. S. Geological Survey, Cons. Div.
Post Office Bldg., Rm 443
350 S. Main Street
Salt Lake City, Utah 84101
FTS: 588-5245

U. S. Forest Service, USDA
Forest Supervisor, Fishlake National Forest
ATTN: Lynn Findley
170 No. Main Street
Richfield, Utah 84701
FTS: 584-8241 (801-896-4491)

U. S. Forest Service, USDA
ATTN: Glenn Quigley
P. O. Box 265
Fillmore, Utah 84631
(801-743-5721)

Regional Forester, Intermountain Region
U. S. Forest Service, USDA
ATTN: Bill Johnson
324 25th Street
Ogden, Utah 84401
FTS: 586-6264 (801-586-6264)

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

Getty Oil Company
ATTN: J. F. Woffington
P. O. Box 5237
Bakersfield, California 93308
(805-399-2961)

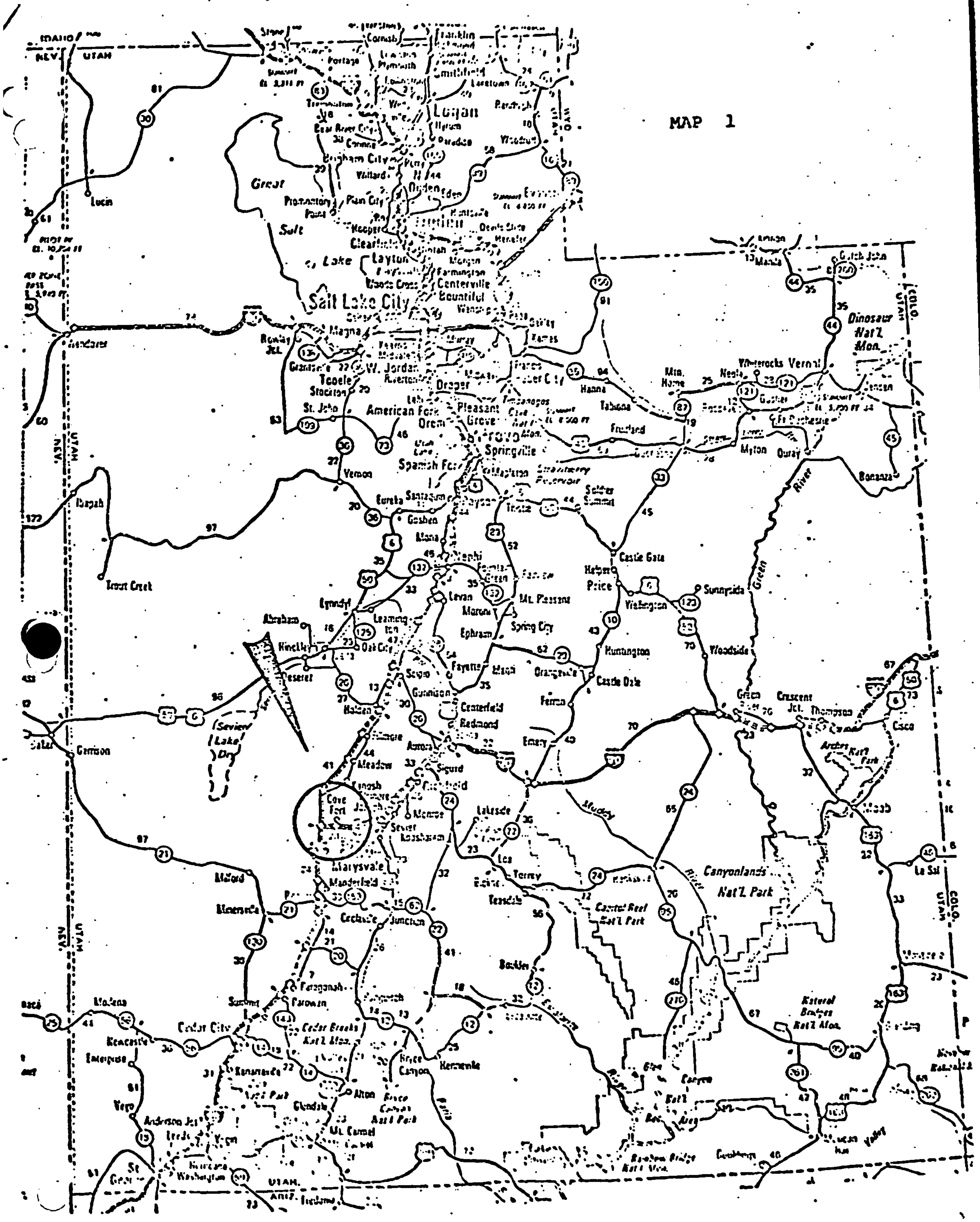
Sunoco Energy Development Co.
ATTN: E. R. Sausser
12700 Park Central Place, Suite 1500
Dallas, Texas 75251
(214-744-4300)

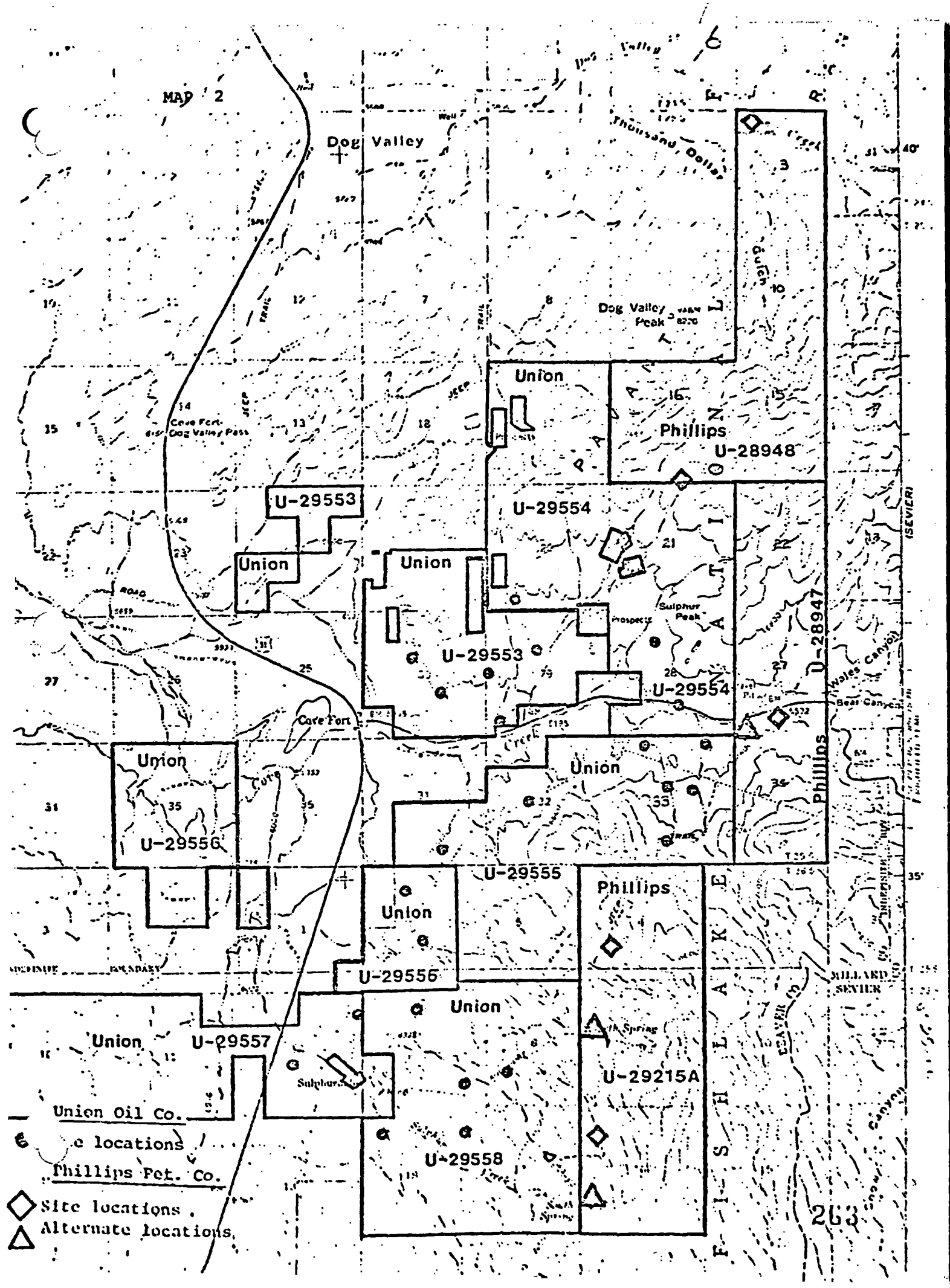
Union Oil Company
ATTN: Don Ash
1250 Coddingtown Center
P. O. Box 6854
Santa Rosa, California 95406
(707-542-9543)

Chevron Oil Company
Minerals Staff
ATTN: E. G. Dobrick
P. O. Box 7643
San Francisco, California 94120
(415-894-2476)

bcc: Cons. Mgr. Chron
Chron
Subj. 1760 (U-28948 PoO Folder - APD 0039) (U-29553 PoO Folder)
ENV (EA #57)
ENG
Cons. Mgr., CR (ATTN: Environmental Staff (Don Libbey))

MAP 1


Logan
Salt Lake City
Great
Salt
Lake
Brigham City
Ogden
Layton
Centerville
Bountiful
Magna
Tooele
W. Jordan
Draper
American Fork
Pleasant Grove
Orem
Provo
Springville
Spanish Fork
Payson
Nephi
Price
Castle Gate
Helper
Vernal
Dinosaur Nat'l. Mon.
Green River
Moab
Arches Nat'l Park
Canyonlands Nat'l Park
Capitol Reef Nat'l Park
Natural Bridges Nat'l. Mon.
Cedar City
Cedar Breaks Nat'l. Mon.
Bryce Canyon
Marysvale
Cove Fort
Fillmore
Delta
Milford
Beaver
Parowan
Panguitch
Kanab
St. George
Monticello
Blanding
Ouray
Roosevelt
Duchesne
Mt. Pleasant
Ephraim
Manti
Richfield
Salina
Gunnison
Green River
Crescent Jct.
Thompson
Cisco
La Sal
Hanksville
Loa
Torrey
Escalante
Boulder
Sevier Lake Dry
Wendover
Lucin
Ibapah
Garrison
Eureka
Vernon
Modena
Enterprise
Veyo
Hurricane
Washington
Glen Canyon
UTAH
NEV.
IDAHO
COLO.
ARIZ.


MAP 2
Dog Valley
Dog Valley Peak
Thousand Dollar
Union
Phillips
U-28948
U-29553
U-29554
U-29556
U-29555
U-29557
U-29215A
U-29558
U-28947
Cove Fort
Cove Fort-Dog Valley Pass
Sulphur Peak
Prospect
Wales Canyon
Bear Canyon
Sulphur Spring
Union Oil Co.
Site locations
Phillips Pet. Co.
Site locations
Alternate locations

United States Department of the Interior

GEOLOGICAL SURVEY
Geothermal District Supervisor
Conservation Division
Post Office Building - Room 443
350 South Main Street
Salt Lake City, Utah 84101

OCT 12 1976

MEMORANDUM

TO: Interested Parties

FROM: District Geothermal Supervisor Salt Lake City, Utah

SUBJECT: Plans of Operation, Phillips Petroleum Company and Union Oil Company Cove Fort - Sulphurdale Area, Fishlake National Forest, Millard and Beaver Counties, Utah.

The following is a list of those persons who participated in the field investigation of the 31 proposed Geothermal exploration well locations in the Cove Fort - Sulphurdale Area. The investigation was conducted on October 5-6, 1976. Thank you for your participation.

Ken Bull	District Geothermal Supervisor	U.S.G.S.
Ellis T Hammett	Petroleum Engineer	U.S.G.S.
Gary Galyardt	Geologist	U.S.G.S.
Bill Riley	Environmental Scientist	U.S.G.S.
Larry Bauer	Geologist	U.S.G.S.
Max D. Crittenden	Geologist	U.S.G.S.
Norman P Stark	R-4 Minerals	U.S.F.S.
Jim Butler	R-4 Energy Den. Officer	U.S.F.S.
Lynn Findlay	Forester	U.S.F.S.
J Wayne Brasher	Range Con.	U.S.F.S.
Stephen M Rushton	Fishlake N.F.	U.S.F.S.
Bruce W. Reese	Range Con.	U.S.F.S.
Ralph C Cisco	Forest Supervisor	U.S.F.S.
Richard G Harris	Forest Engineer	U.S.F.S.
L Glen Quigley	District Ranger	U.S.F.S.
Dee B Thomas	Hydrologist	U.S.F.S.
Paul Hightree	Forester	U.S.F.S.
Floyd Bartlett	Beaver Ranger	U.S.F.S.
Brent Porter	Forester	U.S.F.S.
Fredrick Fuller	Beaver	U.S.F.S
Steve Marcus	Geologist	BLM
Walter Cass	Geologist	BLM
Mark Bailey	Area Manager	BLM
Gerald R Muhlestein	Surface Protection Spec.	BLM
Bill Miller	Surface Protection Spec.	BLM
Lanny R Ream	Geologist	BLM
Tom Hare	Soil Cons.	BLM
W M Spaulding	Geothermal Envir. Advisor	U.S.F.W.
Lewis Richardson	Biologist	U.S.F.W.
Hal Beecker	Regional Energy Leader	U.S.F.W.

Bill Adams	Geologist	E.P.A.
Grant K Jense	Game Biologist	U. Div. of Wildlife Resources
Carol Petersen	Geologist	U. Geol. & Min.Survey
Richard Lenzer	Geologist	Phillips Petroleum Co
Bob Radin	Drlg. Supt.	Union Oil Co.
Steven J Maione	Geologist	Union Oil Co.
Wayne A. Shaw	Geologist	Getty Oil Co.

Kenneth W. Bull

cc: Cons. Mgr., Central Region, Denver, Colorado
Area Supervisor, Menlo Park, California
All Participants

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Area Geothermal Supervisor's Office
Conservation Division, MS 92
345 Middlefield Road
Menlo Park, CA 94025

JAN 10 1977

Memorandum

To: INTERESTED PARTIES

From: Area Geothermal Supervisor

Subject: Plan of Operation, Phillips Petroleum Company, Cove Fort-Sulphurdale Area, Millard and Beaver Counties, Utah

Please find attached Phillips Petroleum Company's Plan of Operation for the proposed drilling of up to eight ± 10,000-foot geothermal test wells in the Cove Fort-Sulphurdale area. As you will recall, per the September 21, 1976 memo from this office, the Environmental Analysis field inspection for this and a similar Union Oil Company proposal was previously conducted on October 5, 1976. Note that the proposal alludes to the operations which were not previously made known, namely the construction of injection wells, an injection pipeline(s), and pilot plant sites. Clarification of these and other items in the proposal have been requested and will be forwarded to you upon receipt of same. A copy of Union Oil Company's Plan of Operation detailing the drilling of twenty-four ± 10,000-foot geothermal exploratory test wells will also be forwarded upon receipt of same.

Again, we would appreciate any comment you may have concerning the proposed action. A closing date for accepting these comments will be established when Union Oil Company's Plan of Operation is in hand.

Attachment

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Area Geothermal Supervisor's Office
Conservation Division, MS 92
345 Middlefield Road
Menlo Park, CA 94025

FEB 15 1977

Memorandum

To: INTERESTED PARTIES

From: Area Geothermal Supervisor

Subject: Plan of Operation, Union Oil Company, Cove Fort-Sulphurdale Area, Millard and Beaver Counties, Utah

Please find attached Union Oil Company's Plan of Operation (P.o.O.) for the proposed drilling of up to twenty-three (23) ± 10,000-foot geothermal test wells in the Cove Fort-Sulphurdale area. Note, as stated in the September 21, 1976 memorandum from this office, Union originally proposed the drilling of twenty-four wells but has since eliminated one location.

As you may recall, per the September 21, 1976 memorandum, a single Environmental Analysis (EA) will be done on the Union Oil Company and a similar Phillips Petroleum Company proposal involving the Cove Fort-Sulphurdale area. In addition, arrangements were made through this memo for an appropriate field inspection of both areas of operation which took place on October 5, 1976. Since the field inspection, the Phillips' P.o.O. has been received and was forwarded to you via another memorandum dated January 10, 1977.

To date, additional P.o.O. information requested of Phillips Petroleum Company has not been received. This data, plus any further information expected of Union Oil Company, will be forwarded to you upon receipt of same.

As stated in previous pertinent correspondence, this office is soliciting comments on both the Union and Phillips proposed P.o.O.'s and would appreciate receiving your response by March 7, 1977 at the following address:

Area Geothermal Supervisor's Office
USGS - Conservation Division
345 Middlefield Road
Menlo Park, CA 94025
Tel: FTS-467-2848, Comm. 415-323-8111, ext. 2848

Thank you very much for your time and effort.

Kenneth Stone

Getty Oil Company | P.O. Box 5237, Bakersfield, California 93308 • Telephone (805) 399-2961

California Exploration and Production Division

November 1, 1976

Area Geothermal Supervisor
Conservation Division, MS-92
U. S. Geological Survey
345 Middlefield Road
Menlo Park, California 94025

Re: Cove Fort-Sulphurdale and
Roosevelt Hot Springs Areas
Utah Field Surveys, October 6-7, 1976

Dear Sir:

The field trips were carried out with very minimum lost time. Each location was well marked and the representatives of Union Oil and Phillips Petroleum, along with Ken Bull, District Geothermal Supervisor from Salt Lake City, [illegible]aged to move the group of participants from one location to another with [illegible]e time for questions.

Both areas are remote, sparsely settled, and lacking in most qualities which are equated with aesthetic beauty. Pointless arguments were kept to a minimum at each drill site. Such things as "which way a sump will face", "whether or not a casing stub is unsightly", "can the drilling rig be seen from the highway three miles away" were some of the items which were resolved without too much controversy between operator and Government representatives.

Both of the proposed projects were well documented and would be under the supervision of experienced personnel. Union and Phillips have considerable experience and drilling expertise in geothermal operations and will follow guidelines and regulations according to their Plan of Operations. As an operator's representative, I can see no reason why the drilling permits should be held up.

Mr. Bull is to be commended for a well organized and well scheduled field trip.

Very truly yours,

GETTY OIL COMPANY

Wayne A. Shaw

Wayne A. Shaw
Geologist

WAS:js

Getty Oil Company | P.O. Box 5237, Bakersfield, California 93308 · Telephone: (805) 399-2961

California Exploration and Production Division

December 1, 1976

U. S. Department of the Interior
Geological Survey
Conservation Division, MS 92
345 Middlefield Road
Menlo Park, California 94025

Attention: Area Geothermal Supervisor

Re: Plans of Operation, Phillips Petroleum Company and Union Oil Company, Cove Fort-Sulphurdale Area, Fishlake National Forest, Millard and Beaver Counties, Utah

Gentlemen:

On September 23, 1976, Getty Oil Company received notification from your office that the above companies had proposed to submit Plans of Operation to Conduct Geothermal Exploration Operations in the captioned area, and that copies of the finalized Plans of Operation would be forwarded to interested parties upon your receipt of same.

If copies of subject Plans of Operation are now available, we would appreciate your supplying us with copies of same.

Very truly yours,

GETTY OIL COMPANY

Dan W. Sparks
Landman

...s:js

United States Department of the Interior

GEOLOGICAL SURVEY
Box 25046
Denver Federal Center
Denver, Colorado 80225

IN REPLY REFER TO:

January 25, 1977

Memorandum

To: Area Geothermal Supervisor

From: Gary L. Galyardt, Geologist, CRMA

Subject: Leasable mineral report for the Cove Fort geothermal area, Utah

The entire Cove Fort KGRA is considered to be valuable prospectively for oil and gas. In addition, sulfur mining is active. A possible conflict between sulfur mining and geothermal exploration is apparent. The geothermal operator must take care so as not to site geothermal operations where they may interfere with possible surface or underground mining.

Gary L Galyardt
Gary L. Galyardt

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
82 North 100 East
Cedar City, Utah 84720

2800
March 2, 1977

Mr. Reid Stone
Area Geothermal Supervisor
USGS - Conservation Division
345 Middlefield Road
Menlo Park, California 94025

Dear Mr. Stone:

Thank you for the opportunity to review and comment on the plans of operation - geothermal test wells, Phillips Petroleum Company/Union Oil Company, Cove Fort- Sulphurdale, Beaver and Millard Counties, Utah.

Although the majority of the proposed geothermal test wells will be drilled on National Forest land, the operation will mainly affect our neighbor to the north, Fishlake National Forest. We foresee no impacts direct or indirect on Dixie National Forest, and have no comments on the plans of operation.

Reviewing the plans has helped us understand and appreciate the problems experienced by industry and Government during geothermal exploration. This information should serve us well, when and if the geothermal potential of Dixie National Forest is explored.

Sincerely,

Ralph S. Rawlinson

RALPH S. RAWLINSON, Chief
Branch of Lands Management

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
170 North Main
Richfield, Utah 84701

Area Geothermal Supervisor's Office
USGS-Conservation Division
345 Middlefield Road
Menlo Park, CA 94025

Gentlemen:

We have reviewed the Plans of Operation submitted by Phillips Petroleum Company and Union Oil Company for the proposed activity in the Cove Fort-Sulpherdale Area. The plans appear to be adequate from our standpoint, however, we do recommend the following minor changes or additions:

1. Union Plan - page 4, Site 2 shows unimproved road but is designated B-1. "B" designations are for new roads, which this is. Description should indicate "new construction" not "existing unimproved".

2. Union Plan - Page 9, IV, Restoration Program, subheading A, states that road location or road work will be performed according to BLM manual 9110.

   Please add the following: "Any road work, including location, construction, reconstruction and maintenance, on National Forest land will be done in accordance with Forest Service standards and specifications."

3. Throughout the contingency plans where contacts for the Forest Service are listed, the Beaver District Ranger, Beaver, Utah, Office telephone (801) 4382372, Home telephone 801-438-5000, should be included also. Also at the present time the local doctor in Beaver, Utah is Dr. Henrie rather than Dr. Terry.

4. In Union's Plan they show access from the north, via road A-10, to well sites 20, 21, & 22. Eventho, maps indicate a road abutting the freeway, there are no facilities for entering or leaving the freeway at that point. Access will have to be from the south via roads A-12 and A-10 unless permission is received from the Utah Department of Transportation.

We appreciate your sending the various materials to us and the opportunity to comment. We look forward to working with you further as activities develop.

Sincerely,

Bruce W. Reese

BRUCE W. REESE, Chief
Branch of Minerals Management

cc: Beaver R.D.
Fillmore R.D.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

GEOTHERMAL ENVIRONMENTAL OFFICE
2800 Cottage Way, Room E-2720
Sacramento, California 95825

March 7, 1977

Memorandum

To: Area Geothermal Supervisor,
Geological Survey, Menlo Park

From: Geothermal Environmental Advisor

Subject: Plans of Operations--Union Oil Company and Phillips Petroleum Company--Cove Fort-Sulphurdale Area, Millard and Beaver Counties

In addition to the comments provided by Area Manager Robert H. Shields dated February 28 (copy enclosed), it is noted that the Plan of Operation proposed by Phillips Petroleum Company does not include locations, layouts, dimensions, etc., for reserve pits and sumps as required by CFR 30, Section 270.34. More importantly, several of the Phillips' drill sites are in close proximity to springs and developed water collection areas. The specific plans and measures to protect these important water sources should be part of the final Plan of Operation and the Environmental Analysis. Hopefully, these missing details are part of the materials you have already requested the Company provide as referred to in your January 10, letter.

We appreciate the opportunity to comment and the draft Environmental Analysis and revised Plan of Operation should be sent to the Area Manager, U.S. Fish and Wildlife Service, Salt Lake City, and the Utah State Division of Wildlife Resources, for review an comment as soon as they are available.

Richard M. Goulding Jr.

Enclosure

Copy to: FWS, AM, Robert Shields, Salt Lake City
FWS, RAL, Hal Boeker, Denver
GEAP, Max Crittenden, Menlo Park

(ES) February 28, 1977

Memorandum

To: Area Geothermal Supervisor Reid T. Stone
USGS - Conservation Division
Menlo Park, California

From: Area Manager
U. S. Fish and Wildlife Service
Salt Lake City, Utah

Subject: Plan of Operations, Union Oil Company, Cove Fort-Sulphurdale Area, Millard and Beaver Conties, Utah

Comments on the above plan of operation are offered in response to your memorandum of February 15, 1977.

While the plan seems to be quite comprehensive, you may wish to incorporate the following suggested changes or additions:

Pages

LOCATIONS AND ROADS

IV. Restoration Program (Location & Roads)

9,10 B. Pollution of Surface Groundwater: - Delete words "...of any impurities...." from second sentence this section.

10 C. Fish and Wildlife: - Add the following sentence to this paragraph: "Habitat restoration activities, including obliterating and revegetating various or all project vehicular access routes, pads, and other locations will be done in cooperation with the Utah State Division of Wildlife Resources." (UWR)

3/3

Pages (CONTINGENCY PLAN)

EMERGENCY ACCIDENTAL SPILLS AND DISCHARGES CONTROL PROCEDURES

IV. Plan for Clean-up and Abatement

-5- '6. Utah State Division of Wildlife Resources', vice "Utah State Fish and Game Department"

-29- 32 "10. Following complete containment...such as re-seeding with similar and approved vegetation 'in cooperation with the Utah State Division of Wildlife Resources.' "

PROPOSED GEOTHERMAL WELL TESTING (TESTING & SAMPLING SCHEDULE)

WATER DISPOSAL

8 Immediately following the last sentence at the bottom of this page, add the following two sentences: "....The line may be utilized...future production system. 'All injection lines will be constructed directly to the closest possible injection point in order to minimize impacts upon surface environments. Developable potable water underlying State or Federal lands will be brought to the attention of the Director, DWR, whether or not energy development ensues.'" It is expected, of course, that analyses of such usable water will be made available to the DWR and to our Service.

We appreciate the opportunity to comment.

Robert H. Stroh

cc: DGS K. W. Bull, SLC, Ut.
DWR, SLC, Ut.

bc: ✓GEA W. M. Spaulding, SAC. DA
RD-6 (OBS) H. M. Boeker

LDR:cjd 2/28/77

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

Fillmore, Utah 84631

IN REPLY REFER TO

3200

March 7, 1977

Area Geothermal Supervisor's Office
USGS - Conservation Division
345 Middlefield Road
Menlo Park, CA 94025

Dear Mr. Stone:

We have reviewed the plan of operation for both Union Oil Company and Phillips Petroleum Company for the Cove Fort area. We are not directly involved with the site proposed by Phillips's company. Our comments pertain to the four sites proposed by Union Oil Company located on national resource lands and are very brief.

There were not detailed drawings of these four sites (No's 1,12,13 and 23). However, from our experience with Union Oil company and the information gained on the field trip we do not expect or forsee any major problem.

We do recommend that the location at site #12 be moved a short distrance to the southwest. This will eliminate considerable cut and fill as the surface is not as steep. The move would be about 100 yards or just enough to locate off the side hill. We have no particular comment on the other three sites.

Sincerely yours,

Mark E. Bailey

Mark E. Bailey
Area Manager
Warm Springs Resource Area

Save Energy and You Serve America!

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT

ENVIRONMENTAL MONITORING AND
SUPPORT LABORATORY
P.O. BOX 15027
LAS VEGAS, NEVADA 89114
702/736-2969 (FTS:595-2969)

March 21, 1977

Our Reference: MSA

Mr. Reid Stone
Area Geothermal Supervisor's Office
U.S.G.S., Conservation Division
345 Middlefield Road
Menlo Park, CA 94025

Dear Mr. Stone:

We have reviewed Union Oil Company's Plan of Operation for the proposed drilling of up to twenty-three ± 10,000-foot geothermal test wells in the Cove Fort-Sulphurdale, Utah, area and Republic Geothermal's plan for a shallow temperature gradient hole near Thermo Hot Springs, Utah.

In our opinion, adequate environmental protection precautions have been included in these plans for the proposed drilling and testing operations. We would appreciate being informed as to the progress of these projects recognizing, of course, the constraints arising from proprietary interests.

Sincerely yours,

William Adams

William Adams, Earth Scientist
Monitoring Systems Design
and Analysis Staff
Monitoring Systems Research
and Development Division

cc:
Donald Gilmore, MSA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII
1860 LINCOLN STREET
DENVER, COLORADO 80203

MAR 2 8 1977

REF: 8EA

Area Geothermal Supervisor's Office
U.S.G.S. - Conservation Division
345 Middlefield Road
Menlo Park, California 94025

Dear Sir/Madam:

Although the Region VIII Office of the Environmental Protection Agency did not participate in the field inspection of the Phillips and Union geothermal areas of operation on October 5, 1976 in the Cove Fort - Sulphurdale area, both plans of operation have been reviewed by staff and comments are attached for your consideration. As the majority of this office's comments are in the form of questions, your aid in answering these questions will allow us to further assess both proposed plans of operation. Until this office has the opportunity to review the additional information necessary to answer the questions posed in the attachments, reservations exist concerning the environmental impacts of the proposed operations.

I thank you for this opportunity to participate in the review of these documents and look forward to further involvement with your agency with respect to geothermal development in Region VIII.

Please direct any responses or comments concerning this letter to Jon Herrmann of my staff (FTS: 327-5914).

Sincerely,

Cooper H. Wayman
Director
Office of Energy Activities

Attachments: A/S

COMMENTS ON THE PLAN OF OPERATION, UNION OIL COMPANY,
COVE FORT - SULPHURDALE AREA, MILLARD AND BEAVER COUNTIES, UTAH

Section I

p.2
Will the clay linings for containment ponds be adequate to minimize geothermal effluent infiltration into ground waters? Have soil tests been performed at the pond sites to determine what would be an adequate clay lining?

p.3
Who will determine the extent of road improvements necessary in order to reach some of the drill sites? Will this be done by BLM and the Forest Service?

p.9-10
What precautions will be taken to prevent runoff of pollutants from the drillsite? Will the perimeter of the site be trenched?

Will the contamination pits be fenced? This may be necessary in order to keep wildlife from consuming the well effluents.

How will the wells be cased? This information is necessary to assure that ground water contamination does not occur.

Exhibit B, Exhibit C
This information was not in EPA's copy of the P.O.O. Will it be forthcoming?

Energy Accidental Spills and Discharges, Control Procedures, p.4
Any discharge of oil or hazardous substance into navigable waters should be reported to the National Response Center at (800) 424-8802.

General Test Procedure for an Exploration Well - Drill Rig Test, p.1
"The rig test consists of flowing the well through a temporary venting system, flashing the steam to the atmosphere and collecting the water for proper disposal." What is considered "proper" disposal? Will it be disposed of in the containment pond or will a discharge permit be needed?

p.6
Are details available on injection wells? Will injection wells be constructed in the same manner as production wells?

Attachment

COMMENTS ON THE PLAN OF OPERATION, PHILLIPS PETROLEUM COMPANY, COVE FORT-SULPHURDALE AREA, MILLARD AND BEAVER COUNTIES, UTAH

Section VII

p.6

Is ¼ pound per square foot of bentonitic clay gel adequate to minimize geothermal effluent infiltration into ground waters? Have soil tests been performed at the pit sites to determine what would constitute an adequate clay lining?

"The water will be removed from the production well site via pipeline to an injection well and returned to a suitable underground horizon." What is considered suitable? Are details on injection wells available?

Section VIII

p.8

How will the wells be cased? This information is necessary to assure that ground water contamination does not occur.

APPENDIX D

Environmental Base Line Report

EBR #6
Cove Fort-Sulphurdale

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION
OFFICE OF THE AREA GEOTHERMAL SUPERVISOR
MENLO PARK, CALIFORNIA

ENVIRONMENTAL BASE LINE REPORT

Prepared for Field Investigations on Ambient Air Quality, Noise and Water Quality in the Cove Fort-Sulphurdale, Utah, KGRA, to supplement EA #57 and Subsequent EA's for this area

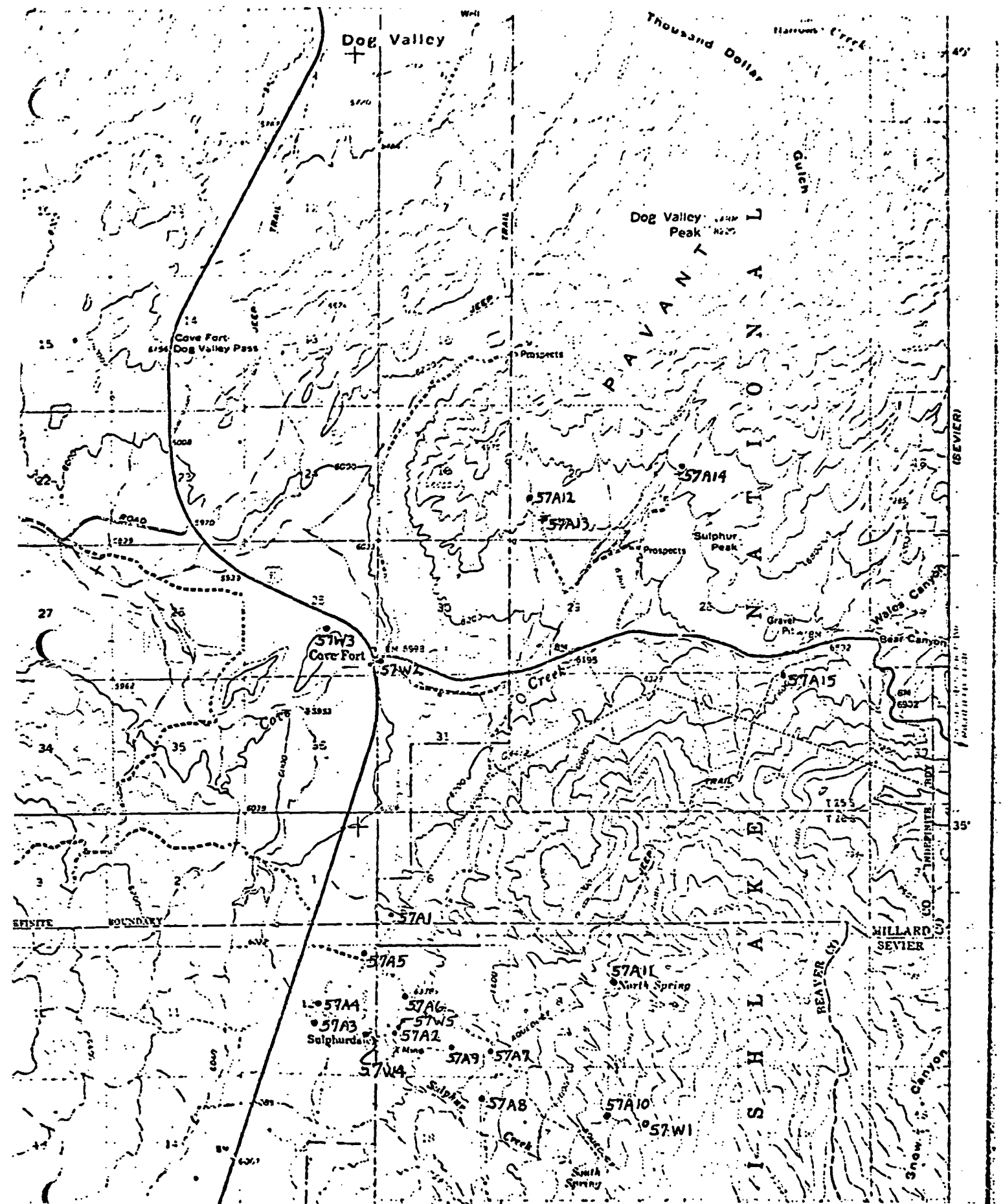


Figure 1 - Cove Fort-Sulphurdale Area. Ambient Air and Water Sampling Stations.

INTRODUCTION

A data gathering and field investigation trip to the Cove Fort-Sulphurdale, Utah, area was conducted September 28-30, 1976. The primary purpose of the trip was to collect ambient air, water, and noise data. It should be noted that the data collected during this short trip is at best a grab sample of the ambient conditions in the subject area.

Air Quality Data Collection and Analyses

The following describes the equipment and procedures used to collect the samples. A detailed description of the equipment can be found in EBR #2 which is included in EA #43.

A 5-Gas Sampler (bubbler) by Research Appliance Co., RAC, was used to collect ambient air samples to determine SO_2, H_2S, NO_x, and NH_3. By bubbling the ambient air through specific fixing reagents, at a known flow rate, concentrations of the above gases can be determined. Reagents were stored in ice prior to and after the sampling periods. Impinger tubes were wrapped in aluminum foil to retard photo chemical reactions. Samples for H_2S and SO_2 were then analyzed by the California State Department of Health Air and Industrial Hygiene Laboratory in Berkeley, California. The NO_x and NH_3 samples were analyzed by LFE Environmental Analysis Laboratories Division, Richmond, California.

In addition to the H_2S samples taken using the bubbler, Hydrogen Sulfide detectors (H_2S Tabs) by Metronics Associated, Inc., were used in the field as a semi-quantitative measurement to locate areas of natural H_2S emissions and the areal extent of H_2S in the vicinity of prospect pits and the Sulphurdale mine. The Tabs have a chemically treated pad which develops a brown stain when exposed to H_2S in the ambient air. The darkness of the stain is proportional to the H_2S dosage.

Total suspended particulates (TSP) were sampled using a high volume sampler fabricated by General Metal Works Inc. The high volume sampler was furnished for the study by the Great Basins Unified Air Pollution Control District, Bishop, California. The sampler was calibrated using a manometer and flow restrictor prior to and after sampling.

Meteorological Data

Meteorological data including temperature, humidity, and wind direction and speed, were measured using hand-held instruments. The measurements were at random and generally were made during each visit to a station. Table I presents the meteorological conditions at the stations during these visits. The nearest meteorological station to the subject area is at the Milford

Utah Airport. Monthly summaries of local climatological data collected at Milford are available from the U.S. Department of Commerce, National Climatic Center, Asheville, North Carolina.

Noise Data

Sound levels were measured in decibels (dB) using the A scale of a type 1565-B General Radio Sound-Level Meter. Measurements recorded were below 55 dBA except near roads. Background noise levels are low in the KGRA.

SUMMARY OF RESULTS

Noise

The background noise in the area is below 55 dBA and normally is only exceeded by the activities of man.

Ambient Air

Monitoring station locations (Fig. 1) were selected to gather representative samples for the KGRA during the limited time frame of the trip. Station 57A1 was located in an area free from prospect pits and the influence of the Sulphurdale mine. Samples from station 57A1 were below detection limits for H_2S, SO_2, and NO_x. Particulates were well below the Utah State and National Standards (Attachment A). Station 57A2 was located by the spring-fed pond used for the water supply at Sulphurdale and was near the major natural emission of hydrogen sulfide of the subject area. Bubbler samples from this station were below detection limits for SO_2, NO_x, and H_2S, even though there was an obvious H_2S odor. H_2S tabs recorded an average H_2S reading of .019 ppm during 26 hours of exposure. H_2S tabs at stations 57A3 and 57A4 located along the Sulphurdale road had readings of 0.003 and 0.001 ppm averaged over 24 and 59 hours exposure. Station 57A12 located near a prospect pit has the highest H_2S reading of o.034 ppm averaged over 46.5 hours. Prospect pits in the area and the Sulphurdale mine have obvious H_2S emissions which have the characteristic rotten egg odor. These emissions appear to dissipate rapidly from the source as shown by the data collected (Table 3 & 4) at the various sampling stations.

Water Quality

Water quality data analysis are presented in Table 2. Locations of the sample stations are shown on Figure 1.

Station 57W1 is a spring box constructed to feed one of the aqueducts that supply water to the Sulphurdale water supply pond (Station 57W5). The spring water in this area is potable and of good quality.

Stations 57W2 and 57W3 are ground water wells that supply Cove Fort and pastured farm animals. This water is potable and of good quality.

Station 57W4 is a ground water well drilled in an attempt to locate a water supply for Sulfurdale. This water proved to be unfit for this purpose. The sulfur mine has been operating since the early 1900's and it is possible this aquifer has been polluted by the waste water from the mining operation. The water is warm 37.9°C, therefore, it is possible that this water has always been of poor quality. Well spacing is such that it is impossible, at this time, to plot the extent of this ground water.

METEOROLOGICAL DATA

STATION NUMBER	DATE	TIME 24 hr. CLOCK	TEMPERATURE °F WET	DRY	RELATIVE HUMIDITY %	WIND DIRECTION FROM	WIND SPEED MPH
57A1	9/28/76	0655	51	57	66	calm	0
57A1	9/29/76	0930	54	65	48	calm	0
57A1	"	1515	55	79	18	calm	0
57A2	"	1630	54	76	21	N 55° W	0-4
57A2	9/30/76	1945	50	61.5	44	calm	0

TABLE 2 pg. 1 of 2
Cove Fort-Sulphurdale
Water Analysis* Data

Station	57W1	57W2	57W3
Location	T. 26S., R. 6W., Sec. 16, NW, SE, NW.	T. 25S., R. 6W., Sec. 30, SW, SW, SW.	T. 25S., R. 7W., Sec. 25, SW, NW, SE.
Parameter	ppm	ppm	ppm
B	<0.1	<0.1	0.15
AS	0.006	0.016	0.25
Se	<0.0005	<0.0005	<0.0005
Cn	<0.003	<0.003	0.005
Mn	0.010	<0.002	≤0.002
Fe	0.43	0.031	0.042
Co	<0.002	<0.001	<0.001
Ni	<0.001	<0.001	<0.001
Cu	0.006	0.002	0.005
Zn	0.006	0.003	0.033
Hg	<0.0007	<0.0005	<0.0005
Pb	0.004	<0.0005	<0.0005
Ag	<0.005	<0.005	<0.005
Cd	<0.005	<0.005	<0.005
Ti	<0.01	<0.01	<0.01
Sn	<0.007	<0.007	<0.007
Rb	0.03	---	---
Sr	0.003	---	---
Bi	≤0.007	---	---
PH	7.7	8.04	**
Conductivity	**	836	**

*Analysis method X-ray Fluorescence.
** Field Equipment inoperative.

TABLE 2 pg. 2 of 2
Water Analysis* Data
Cove Fort-Sulphurdale Unit Area

Station 57W5		Station 57W4
Spring Fed Pond		Warm Water Well
Location T. 26s., R. 6W., Sec. 12, SE, NE, SE.		Location T. 26S., R. 6W., Sec. NE, NW, SW.
Parameter	ppm	ppm
Ca	30.	600
Mg	10.	220
Na	26.	190
K	0.9	13
OH	0	---
HCO_3	104.	0
CO_3	0	0
Cl	35.5	110
No_3-N	<0.1	---
NO_3	<0.5	---
NH_4	<0.025	---
NO_2	<0.001	---
SO_4	10	4700
S	<0.1	---
Fe	<0.05	---
Mn	<0.01	---
F	0.4	0.2
Na	---	190
B	---	<0.2
pH	8.2	3.8
TDS	218.	5903
Temp °C	---	37.9°C

* Analysis method unknown
Analysis data furnished by Mr. Gordon M. Ford President Forminco Inc., Sulphurdale, Utah.

Table 3
Cove Fort-Sulphurdale
Ambient Air Data

Station #	Location	Sample #	Type of Sample	Date	Time	Total Time (min)	Parts per million H_2S	SO_2	NO_x	NH_3	ug/m^3 Particulates	Remarks
57A1	Power line access road		Bubbler	9/28	1545	1410	<.01	<.01	<.01			Power line access road
57A1	T. 25S., R. 6W, Sec. 6 SW, NW, SE		Hi Vol	9/28	1600	988					19.9	
57A2	Mine (sulfur) T. 26S., R. 6W, Sec. 7 SW, NW, NW		Bubbler	9/29	1620		x	x	x	x		Loss directed to pump Failure
57A2	"		Hi Vol	9/29	1635	1595					32.35	
57A2	"		Bubbler	9/30	0950	479	<.01					Sulfur Mine
57A2	"		"	9/30	1000	499	<.01					
57A2	"		"	9/30	0950	509		<.01	<.01			

Figure 1 - Sample Station Locations Ambient Air and Water

Table 4 pg. 1 of 2

Cove Fort-Sulphurdale

Ambient Air H_2S Tab Data

STATION NO.	LOCATION	H_2S TAB NO.	DATE	TIME	READING DATE	READING TIME	TOTAL TIME HRS.	GRADE	H_2S CONCENTRATION (PPM) AVERAGED OVER TOTAL TIME	REMARKS
57A 3	T. 26S., R. 7W, Sec. 12 NE, NE, SW.	1	9/28/76	0770	9/29/76	0700	24	0.5	0.003	S. of Sulfu dale Rd.
57A 3	"	1	"	"	9/30/76	1800	59	0.5	0.001	
57A 4	"	2	"	"	"	1800	59	0.5	0.001	N. of Sulfu dale Rd.
57A 5	T. 26S., R. 7W, Sec. 12, SW, NE, NE.	3	"	0900	"	1500	54	0.0	0.0	
57A 6	T. 26S., R. 6W, Sec. 7, SW, SE, NW	4	"	0915	"	1515	54	0.0	0.0	
57A 7	T. 26S., R. 6W, Sec. 7, SE, NE, SE.	5	"	0930	"	1530	54	0.0	0.0	
57A 8	T. 26S., R. 6W, Sec 17, SW, NW, NW.	6	"	0945	"	1545	54	0.0	0.0	
57A 9	T. 26S., R. 6W, Sec. 7, NW, SW, SE.	7	"	1000	"	1600	54	0.0	0.0	
57A 10	T. 26S., R. 6W, Sec. 16, SE, SW, NW.	8	"	1030	"	1630	54	0.0	0.0	
57A 11	T. 26S, R. 6W, Sec. 9, SW, SW, NW.	9	"	1100	"	1700	54	0.0	0.0	

STATION NO.	LOCATION	H_2S TAB NO.	DATE	TIME	READING DATE	READING TIME	TOTAL TIME HRS.	GRADE	H_2S CONCENTRATION (PPM) AVERAGED OVER TOTAL TIME	REMARKS
57A12	T. 25S., R. 6W, Sec. 20, NE, SW, SW.	10	9/28/76	1230	9/30/76	1100	46.5	3.5	0.034	Prospect pit strong H_2S odor.
57A13	T. 25S., R. 6W, Sec. 20, SW, SE, SW.	11	"	1330	"	1130	46	0.0	0.0	
57A14	T. 25S., R. 6W, Sec 21, NW, NE, SW.	12	"	1330	"	1100	45.5	0.0	0.0	
57A15	T. 25S., R. 6W, Sec, 27, SW, SW, SW.	13	"	1445	"	1145	45	0.0	0.0	
57A1	T. 25S., R. 6W, Sec. 6, SE, SW, SW.	14	"	1545	9/28/76	2145	6	0.0	0.0	Inside High-Vol shelter
57A1	"	14	"	1545	9/30/76	1545	48	0.0	0.0	
57A2	T. 26S., R. 6W, Sec. 7, SW, NW, SW.	15	"	2150	9/29/76	0650	9.0	0.0	0.0	
57A2	"	16	9/29/76	1630	9/29/76	1830	26	0.5	0.019	Inside High-Vol @ Sulfur dale station Sulfurmine station insi Hi-Vol.

AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	UTAH STATE STANDARDS[1]		National Standards[2]		
		Concentration[3]	Method[4]	Primary[1,5]	Secondary[1,6]	Method[7]
Oxidant (Ozone)			Ultraviolet Photometry	[illegible] (0.08 ppm)	Same as Primary Std	[illegible] Method
Carbon Monoxide				–	Same as Primary Standards	Non Dispersive Infrared Spectroscopy
	8 hour			10 mg/m³ (9 ppm)		
	1 hour			40 mg/m³ (35 ppm)		
Nitrogen Dioxide	Annual Average			100 ug/m³ (0.05 ppm)	Same as Primary Standards	Chemiluminescence Modified EPA Saltzman Reagent Chemiluminescence
				–		
Sulfur Dioxide	Annual Average			80 ug/m³ (0.03 ppm)	–	Paramagnetism Method
	24 hour			365 ug/m³ (0.14 ppm)	–	
	3 hour			–	1300 ug/m³ (0.5 ppm)	
	1 hour			–	–	
Suspended Particulate Matter	Annual Geometric Mean			75 ug/m³	60 ug/m³	High Volume Sampling
				260 ug/m³	150 ug/m³	
Sulfates	24 hour		AIHL Method No. 61	–	–	–
Lead			AIHL Method No. 54	–	–	–
Hydrogen Sulfide			Cadmium Hydroxide Stractan Method	–	–	–
Hydrocarbons (Corrected for Methane)			–	160 ug/m³ (0.24 ppm)	Same as Primary Standards	Flame Ionization Detection Using Gas Chromatography
Ethylene	8 hour		–	–	–	–
	1 hour					
Visibility Reducing Particles	1 observation		(9)	–	–	–

NOTES:

1. *UTAH STATE IS INCORPORATING NATIONAL STANDARDS UNTIL STATE STANDARDS ARE ADOPTED.*
2. National standards, other than those based on annual averages or annual geometric means, are not to be exceeded more than once per year.
3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury. All measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of Hg (1,013.2 millibars); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.
4. [illegible]
5. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health. Each state must attain the primary standards no later than three years after that state's implementation plan is approved by the Environmental Protection Agency (EPA).
6. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standards within a "reasonable time" after implementation plan is approved by the EPA.
7. Reference method as described by the EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the EPA.
8. Prevailing visibility is defined as the greatest visibility which is attained or surpassed around at least half of the horizon circle, but not necessarily in continuous sectors.

APPENDIX E

Determination of Physical and Chemical Parameters of Produced Geothermal Effluents

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Area Geothermal Supervisor's Office
Conservation Division, MS 92
345 Middlefield Road
Menlo Park, CA 94025

JAN - 7 1977

To: Geothermal Lessees and Operators

From: Area Geothermal Supervisor

Subject: Determination of Physical and Chemical Parameters of Produced Geothermal Effluents (liquids and gases)

We have received requests from operators to clarify the requirements in the subject area as stated in GRO Order No. 4, Sections 8C, 9A(3), and 10 specifying requirements for compliance and data acquisition under "Reservoir Data", "Air Quality", and "Water Quality". The statements, however, are rather general and do not interrelate. This letter is intended to clarify to the extent possible at this time, these statements.

The following should serve as guidelines to data acquisition related to geothermal effluents as required by GRO Order No. 4 for each completed well:

1. Production test data (Section 8C, Reservoir Data) should include but not be limited to the following:

   Steam/water ratio, surface pressure and temperature, enthalpy, mass flow rate, and geothermometric parameters including Ca, Na, K, and SiO_2.

2. Non-condensible gases (Section 9A(3), Air Quality) should include but not be limited to the following:

   (a) Total non-condensible gases as a percent by weight of steam production; and individual gases SO_x, CH_4 CO_2, NH_3, H_2S, either as a percent by weight of steam production or percent of total non-condensible gases, and radon-222 as defined in Section 3(b) of this notice.

3. Separated fluids and their condensates (Section 10, Water Quality) should be analyzed individually. Parameters should include but not be limited to the following:

(a) Major, minor and trace elements recorded as mg/l, and other physical parameters listed: Ag, As, B, F, Cd, Cu, Hg, Mn, Ni, Pb, Sb, Se, Zn, Li, SO_4, NH_4, CO_3, HCO_3, specific conductance, pH, and TDS. Collection and analysis of samples shall generally be according to methods published by EPA, USGS, ASTM Standards, or Standard Methods (12th Edition). The methods and equipment used will be included in the report. Analyses by State-certified laboratories are preferred.

(b) Radioactivity. Section 10, Water Quality:
Radioactive content and the determination of radioactivity in produced geothermal fluids and gases should include: radon-222 in Picocuries per liter (pCi/l) in the non-condensible gas phase; radium-226 in pCi/l and natural uranium as mg/l in the liquid phase. Gross alpha and beta activity determinations are recommended along with the above parameters for the first analysis to provide a reference in determining the need for a complete analysis for the annual compliance requirement. If the alpha and beta counts are the same or lower in later samples, the more detailed analysis may not be required.

Recommended analysis methods and detection limits are listed in the following table:

PARAMETER	UNITS	METHOD	MINIMUM DETECTION LIMIT
1) Radon 222	pCi/l	Lucas Cell	1 pCi/l or less
2) Radium 226	pCi/l	Radon Emanation	1 pCi/l or less
3) Natural Uranium	mg/l	Fluorometric	0.5 mg/l or less

Sampling and analysis methods do vary; therefore, descriptions of the methods used should be submitted with the results.

Several agencies have researched sampling and analysis techniques for radioactivity in geothermal liquids and gases. We have contacted the following agencies for information; the list is included for your information and is not to be construed as complete.

1. Central Laboratory (Radio Chem. Lab.) (Vick Janser, 303-234-2404)
U. S. Geological Survey, WRD
Building 15
Denver Federal Center
Lakewood, CO 80225

2. Pacific Gas & Electric Company
Department of Engineering Research
San Ramon, California 94583
Note: PG&E has used several consulting laboratories

3. Lawrence Berkeley Laboratory (Harold Wallenburg, (843-2730))
University of California
Berkeley, CA 94720

4. National Environmental Research Center (Michael F. O'Connel and Art Jarvis, 702-736-2969)
Office of Research and Development
U. S. Environmental Protection Agency
Las Vegas, NV 89114

Attached is a list of participants in an EPA Intercomparison Program on determination of radioactivity. This was a voluntary program and the labs were not rated or certified.

If clarification on the above is needed please contact our office.

Reid M. Stone

PARTICIPANTS (OTHER THAN EPA AND STATES) IN EMSL-LV INTERCOMPARISON PROGRAM

I. Reactors and National Laboratories:

INTERCOMPARISON STUDY

Laboratory or Facility	Milk	Tritium in Water	Tritium in Urine	Radium-226 in Water	Air Filter	Diet	Gross α & β in Water	Gamma in Water
Argonne	X	X	X		X		X	X
Los Alamos	X	X			X	X	X	X
Lawrence Livermore	X	X		X		X		X
Sandia		X	X	X	X		X	X
Vermont Yankee	X	X					X	X
Yankee Atomic	X	X			X			
Maine Yankee		X		X	X		X	X
General Electric (IL)		X						X
General Electric (CA)							X	X
General Electric (FL)		X			X			
Knolls Atomic Laboratory		X			X		X	X
Rochester Gas & Electric	X	X	X			X	X	X
Con Edison	X	X			X		X	X
Pacific Gas & Electric	X	X						X
Arkansas Light & Power	X				X		X	X
Carolina Power & Light	X				X			X
Colorado Public Service		X			X		X	X
Duke Power								X
Consumer Power					X			
9-Mile Point Reactor					X		X	X
duPont	X	X			X	X	X	X
Westinghouse (Bettis)	X				X		X	X
Dow Chemical		X	X		X		X	X
Babcock & Wilcox		X			X		X	X
Nuclear Engineering		X			X		X	
Exxon (WY)				X	X		X	
Atlantic Richfield				X	X		X	
United Nuclear								X
TOTAL	12	18	4	5	20	4	19	22

Private Commercial Labs:

INTERCOMPARISON STUDY

Laboratory or Facility	Milk	Tritium in Water	Tritium in Urine	Radium-226 in Water	Air Filter	Diet	Gross α & β in Water	Gamma in Water
RMC (Radiation Mgt.)	X	X					X	X
Interex	X	X			X		X	X
LFE	X	X	X	X	X		X	X
Eberline	X	X			X	X	X	X
Ind. Bio-Test	X	X		X	X		X	X
U.S. Testing	X	X	X	X	X	X	X	X
NUS		X						X
CEP			X	X	X	X	X	X
Teledyne			X	X	X			X
Hazen Research				X			X	
Accu-Labs				X			X	
Thorton Labs				X				
Pomeroy-Johnson				X			X	
McGuire Environmental	—	—	—	—	X	—	X	X
TOTAL	6	7	4	9	8	3	11	10

III. Other Federal Agencies:

INTERCOMPARISON STUDY

Laboratory or Facility	Milk	Tritium in Water	Tritium in Urine	Radium-226 in Water	Air Filter	Diet	Gross α & β in Water	Gamma in Water
Air Force (Wright-Patterson)	X	X	X	X	X	X	X	X
USGS	X	X		X				
Army - Ft. Belvoir	X	X			X		X	X
Walter Reed	X	X						
Env. Hyg. Agency		X	X	X			X	
HEW - NERHL	X							
TVA	X	X	—	—	—	—	X	X
TOTAL	6	6	2	3	2	1	4	3

V. Universities:

INTERCOMPARISON STUDY

Laboratory or Facility	Milk	Tritium in Water	Tritium in Urine	Radium-226 in Water	Air Filter	Diet	Gross α & β in Water	Gamma in Water
Arizona	X							
Miami	X							
Colorado State	X	X					X	X
Florida	X	X		X	X		X	X
Georgia Tech	X				X	X	X	X
Iowa State		X			X			X
Emory		X			X		X	X
Yale		X	X					
Washington					X	X		X
Madison College								X
TOTAL	5	5	1	1	5	2	4	7

V. International Labs:

INTERCOMPARISON STUDY

Laboratory or Facility	Milk	Tritium in Water	Tritium in Urine	Radium-226 in Water	Air Filter	Diet	Gross α & β in Water	Gamma in Water
Canada	X	X			X	X	X	
New Zealand	X							
Ontario Hydro	X	X	X					X
TOTAL	3	2	1	-	1	1	1	1

APPENDIX F

Special Lease Stipulations and Conditions

In addition to lease terms and requirements contained in the lease form, the lessee shall comply with the following special conditions and stipulations unless they are modified by mutual agreement of the lessee, the Supervisor (USGS) and the authorized officer (BLM or USFS).

1. The lessee shall provide a complete inventory and evaluation of archeological and historical values on lands to be disturbed or occupied. This will be prepared by a competent archeologist, acceptable to the authorized officer, in advance of any surface disturbance.

2. All survey monuments, witness corners, reference monuments and bearing trees will be located by the lessee in advance of surface disturbance and protected against destruction, obliteration or damage. Any markers accidentally damaged or obliterated by the lessee or his operator must be re-established in accordance with instructions of the responsible agency at the expense of the lessee.

3. Natural drainage systems shall not be blocked. No cuts or fills shall be made in or near streams which will result in siltation or accumulation of water or debris.

4. The lessee shall make every possible effort to prevent, control or suppress any fire on national resource lands within the operating area. Reports of uncontrolled fire must be immediately sent to the authorized officer of the appropriate land management agency.

5. If considered necessary by the authorized officer of the surface management agency and the Supervisor, the lessee will be required to temporarily fence areas to alleviate hazards to humans, livestock or wildlife or to allow establishment of vegetation on disturbed areas.

6. Existing waters in pipelines, storage tanks, ponds, reservoirs or streams shall not be used by the lessee for the operation of the lease unless specifically approved by the authorized officer.

7. The authorized officer or the Supervisor may require the lessee to install cattleguards on roads at fence crossings.

8. The use of existing roads or trails and the construction of all new roads necessary for exploration or development activities shall receive appropriate approval prior to construction by the authorized officer or the Supervisor. They may determine the location and set forth the road standards and construction methods employed. Maintenance of such roads shall be the responsibility of the lessee unless otherwise approved.

9. No drilling will be allowed within 400 feet of any surface waters, including springs, seeps or reservoirs. This distance may be varied when specifically approved in writing by the authorized officer of the surface management agency and the Supervisor. (not applicable to lease U-29557)

10. On critical deer winter areas, exploration work, such as drilling and associated activities will not be allowed during December through April unless specifically approved in writing by the authorized officer of the surface management agency and the Supervisor.

11. The lessee shall take special precaution to prevent hydrogen-sulfide gas emissions encountered during exploration activities on the lease. At termination of activities on the lease, the lessee will be responsible for elimination of hydrogen-sulfide gas emissions created by any operation activities.

12. Notwithstanding any provision of this lease to the contrary, any drilling, construction, or other operation on the leased lands that will disturb the surface thereof or otherwise affect the environment, hereinafter called "surface disturbing operation," conducted by lessee shall be subject, as set forth in this stipulation, to prior approval of such operation by the Area Geothermal Supervisor in consultation with appropriate surface management agency and to such reasonable conditions, not inconsistent with the purposes for which this lease is issued, as the Supervisor may require to protect the surface of the leased lands and the environment.

13. Prior to entry upon the land or the disturbance of the surface thereof for drilling or other purposes, lessee shall submit for approval two (2) copies of a map and explanation of the nature of the anticipated activity and surface disturbance to the Area Geothermal Supervisor, as appropriate, and will also furnish the appropriate surface management agency with a copy of such map and explanation.

An environmental analysis will be made by the Geological Survey in consultation with the appropriate surface management agency for the purpose of assuring proper protection of the surface, the natural resources, the environment, existing improvements, and for assuring timely reclamation of disturbed lands.

14. Upon completion of said environmental analysis, the Area Geothermal Supervisor, as appropriate, shall notify lessee of the conditions, if any, to which the proposed surface disturbing operations will be subject.

15. The lease will be subject to Form 3109-3, Stipulation for Lands Under Jurisdiction of Department of Agriculture, as to the lands within the Fishlake National Forest.

Form 3109-3
(June 1971)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

U 29553

STIPULATION FOR LANDS UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE*

The lands embraced in this lease or permit being under the jurisdiction of the Secretary of Agriculture, the lessee or permittee hereby agrees:

(1) To conduct all operations authorized by this lease or permit with due regard for good land management, not to cut or destroy timber without first obtaining permission from the authorized representative of the Secretary of Agriculture, and to pay for all such timber cut or destroyed at the rates prescribed by such representative; to avoid unnecessary damage to improvements, timber, crops, or other cover; unless otherwise authorized by the Secretary of Agriculture, not to drill any well, carry on operations, make excavations, construct tunnels, drill, or otherwise disturb the surface of the lands within 200 feet of any building standing on the lands and whenever required, in writing, by the authorized representative of the Secretary of Agriculture to fence or fill all sump holes, ditches, and other excavations, remove or cover all debris, and so far as reasonably possible, restore the surface of the lands to their former condition, including the removal of structures as and if required, and when required by such representative to bury all pipelines below plow depth.

(2) To do all in his power to prevent and suppress forest, brush, or grass fires on the lands and in their vicinity, and to require his employees, contractors, subcontractors, and employees of contractors or subcontractors to do likewise. Unless prevented by circumstances over which he has no control, the lessee or permittee shall place his employees, contractors, subcontractors, and employees of contractors and subcontractors employed on the lands at the disposal of any authorized officer of the Department of Agriculture for the purpose of fighting forest, brush, or grass fires on or originating on the lands or on adjacent areas or caused by the negligence of the lessee or permittee or his employees, contractors, subcontractors and employees of contractors and subcontractors, with the understanding that payment for such services shall be made at rates to be determined by the authorized representative of the Secretary of Agriculture, which rates shall not be less than the current rates of pay prevailing in the vicinity for services of a similar character: *Provided*, that if the lessee or permittee, his employees, contractors, subcontractors, or employees of contractors or subcontractors, caused or could have prevented the origin or spread of said fire or fires, no payment shall be made for services so rendered.

During periods of serious fire danger to forest, brush, or grass, as may be specified by the authorized representative of the Secretary of Agriculture, the lessee or permittee shall prohibit smoking and the building of camp and lunch fires by his employees, contractors, subcontractors, and employees of contractors or subcontractors within the area involved except at established camps, and shall enforce this prohibition by all means within his power: *Provided*, that the authorized representative of the Secretary of Agriculture may designate safe places where, after all inflammable material has been cleared away, campfires may be built for the purpose of heating lunches and where, at the option of the lessee or permittee, smoking may be permitted.

The lessee or permittee shall not burn rubbish, trash, or other inflammable materials *except* with the consent of the authorized representative of the Secretary of Agriculture and shall not use explosives in such a manner as to scatter inflammable materials on the surface of the lands during the forest, brush, or grass fire season, *except* as authorized to do so or on areas approved by such representative.

The lessee or permittee shall build or construct such fire lines or do such clearing on the lands as the authorized representative of the Secretary of Agriculture decides is essential for forest, brush, and grass fire prevention which is or may be necessitated by the

* This form of stipulation may be used in connection with leases and permits issued under the Acts of February 25, 1920, as amended (30 U.S.C. 181 *et seq.*); August 7, 1947 (30 U.S.C. 351 *et seq.*), February 7, 1927, as amended (30 U.S.C. 281 *et seq.*); April 17, 1926, as amended (30 U.S.C. 271 *et seq.*); June 28, 1944 (58 Stat. 483–485); September 1, 1949 (30 U.S.C. 192c); June 30, 1950 (16 U.S.C. 508b); or under the authority of any of the Acts cited in Section 402 of the President's Reorganization Plan No. 3 of 1946 (5 U.S.C. 133y–16, Note).

ercise of the privileges authorized by this lease or rmit, and shall maintain such fire tools at his headarters or at the appropriate location on the lands as ... ned necessary by such representative.

)... the location, design, construction, and maintene... all authorized works, buildings, plants, iterways, roads, telegraph or telephone lines, pipeies, reservoirs, tanks, pumping stations, or other ructures or clearance, the lessee or permittee all do all things reasonably necessary to prevent reduce to the fullest extent scarring and erosion of e lands, pollution of the water resources and any mage to the watershed. Where construction, operaon, or maintenance of any of the facilities on or nnected with this lease or permit causes damage to e watershed or pollution of the water resources, the ssee or permittee agrees to repair such damage and take such corrective measures to prevent further llution or damage to the watershed as are deemed cessary by the authorized representative of the cretary of Agriculture.

) If in the opinion of the authorized representative of e Secretary of Agriculture, the lands are valuable for atershed protection, the lessee or permittee shall prode for control of surface runoff and return the affected ea ... s productive condition as practicable.

) ... ay the lessor or permitter or his tenant or the ... wner or his tenant, as the case may be, for ay and all damage to or destruction of property caused y the lessee's or permittee's operations hereunder; save and hold the lessor or permitter or the surface wner or their tenants harmless from all damage or laims for damage to persons or property resulting from e lessee's or permittee's operations under this lease permit.

) To recognize existing uses and commitments, in e form of Department of Agriculture grazing, timber utting, and special use permits, water developments, itch, road, trail, pipeline, telephone line, and fence ghts-of-way and other similar improvements, and to onduct his operations so as to interfere as little as ossible with the rights and privileges granted by these ermits or with other existing uses.

(7) To install and maintain cattle guards to prevent the passage of livestock in any openings made in fences by the lessee or permittee or his contractors to provide access to the lands covered by this lease or permit for automotive and other equipment.

(8) If lessee or permittee shall construct any camp on the lands, such camp shall be located at a place approved by the authorized representative of the Secretary of Agriculture, and such representative shall have authority to require that such camp be kept in a neat and sanitary condition.

(9) To comply with all federally-approved rules and regulations of the Secretary of Health, Education, and Welfare governing the emission of pollutants into the air from activities which are embraced in this lease or permit.

(10) To comply with all the rules and regulations of the Secretary of Agriculture governing the national forests or other lands under his jurisdiction which are embraced in this lease or permit.

(11) Unless otherwise authorized, prior to the beginning of operations to appoint and maintain at all times during the term of this lease or permit a local agent upon whom may be served written orders or notices respecting matters contained in this stipulation, and to inform the authorized representative of the Secretary of Agriculture, in writing, of the name and address of such agent. If a substitute agent is appointed, the lessee or permittee shall immediately so inform the said representative.

(12) To address all matters relating to this stipulation to

Forest Supervisor

at

Fishlake National Forest
170 North Main
Richfield, Utah 84701

who is the authorized representative of the Secretary of Agriculture, or to such other representative as may from time to time, be designated, provided that such designation shall be in writing and be delivered to the lessee or permittee or his agent.