

CONFIDENTIAL

This document contains confidential information which is proprietary to Union Oil Co. of Calif. The contents of this document are not to be revealed to any person without the express written consent of Union Oil Co. of California.

INDEX

SECTION

PAGE

I LOCATIONS AND ROADS

Construction Plans . . . . .	1
Existing Roadways and Proposed New Roadways .	3
Archaeological Report . . . . .	9
Restoration Program . . . . .	9
Soil Erosion . . . . .	9
Pollution of Surface Groundwater . . . . .	9
Fish and Wildlife . . . . .	10
Noise and Air Quality . . . . .	10
Safeguards to Public Health . . . . .	10
Solid Waste Disposal Plans . . . . .	11

EXHIBITS:

- Exhibit A - Topographic Map, Lease Boundaries and Drainage Patterns
- Exhibit B - Location Map (Roads)
- Exhibit C - (c-1 thru c-23) - Individual Well Locations
- Exhibit D - Summary
- Exhibit E - (e-1 thru e-4) - Surface Contours, Sump and Equipment Location
- Exhibit F - Archaeological Report and Geological Map

II DETAILS OF WORK

Drilling Procedure . . . . .	1
Section A - Mud Program and Safety Data Sheets	1
Section B - Cementing Guide . . . . .	1
Section C - B.O.P. Requirements and Testing Procedure with Diagrams . . . . .	1
Inspection Checklist for B.O.P.	
Contractor's Drilling Foreman Inspection Checklist for B.O.P.	

SECTION

PAGE

II DETAILS OF WORK - Continued

Section D - Casing Specifications and Details 1  
Equipment . . . . . 1  
Rig Layout  
Fluid Flash Separator  
Testing, Logging Program, and Plug and  
Abandonment

III CONTINGENCY PLAN

Introduction . . . . . 1  
Potential Locations Where Discharge  
Incidents Might Occur . . . . . 1  
Possible Water Quality Effects . . . . . 2  
Plan For Clean-up and Abatement . . . . . 2  
Confirmation of Telephone Notification to  
Agencies and Regulatory Bodies . . . . . 7  
Contingency Plan for H<sub>2</sub>S Safety . . . . . 8  
Contingency Plan for Uncontrolled Blowout . . . . . 27  
Injuries . . . . . 30

IV EMERGENCY PHONE NUMBERS

Emergency Personnel and Services . . . . . 1

V TESTING AND SAMPLING SCHEDULE

General Testing Procedure . . . . . 1  
Drilling Rig Test . . . . . 1  
Reservoir Analysis Test . . . . . 1  
Logging Program . . . . . 2  
Formation Testing . . . . . 2  
Proposed Geothermal Well Testing . . . . . 3

VI DISPOSAL PROGRAM

Well Water Discharge . . . . . 1

SECTION

PAGE

VII

GENERAL SAFETY PRACTICES

Safety Practices . . . . .	1
Noise and Dust Control . . . . .	5
Continuous Gas Monitoring Equipment . . . . .	5
Equipment Requirements . . . . .	6
Fire . . . . .	9

## LOCATIONS AND ROADS

- I CONSTRUCTION PLANS
- II EXISTING ROADWAYS AND PROPOSED NEW ROADWAYS
- III ARCHAEOLOGICAL REPORT
- IV RESTORATION PROGRAM
  - 1. Soil Erosion
  - 2. Pollution of Surface Groundwater
  - 3. Fish and Wildlife
  - 4. Noise and Air Quality
  - 5. Safeguards to Public Health
- V SOLID WASTE DISPOSAL PLANS
- VI EXHIBITS
  - Exhibit "A" - Topographic Map
  - Exhibit "B" - Location Map
  - Exhibit "C" - Individual Well Locations
  - Exhibit "D" - Summary
  - Exhibit "E" - Surface Contours, Sump and  
Equipment Location
  - Exhibit "F" - Archaeological Report and  
Geological Map

I. CONSTRUCTION PLANS

The Union Oil Company of California, Geothermal Division, proposes to drill up to twenty-three geothermal test wells on leased Federal lands in the vicinity of the Cove Fort KGRA, Utah. The planned well locations are shown in Exhibit "A" (a-1 thru a-3) which depicts topography of the leased land and surrounding land, lease boundaries, drainage patterns, and existing roads, Exhibit "B" which depicts existing roads, proposed new roads, elevations and sections, and Exhibit "C" (c-1 thru c-23) which depicts individual well locations in feet and direction from the nearest section or tract line. These well locations along with KGRA well no., Federal Lease Number, and site number are summarized in Exhibit "D". The wells are to be drilled to 10,000'+. Placement of equipment at four locations is shown in Exhibit "E" (e-1 thru e-24) along with surface contours, sump and location details. Plans for equipment layout on the existing nineteen locations will be submitted on completion. The surveyed well locations as described in Exhibit "A" through "E" may, in RARE cases, be moved a short distance within the survey location boundaries to minimize excavation required and allow for more efficient placement of equipment.

Firebreaks, if they exist, will be maintained. Construction of Right-of-ways will be installed with 10 foot clearance to comply with the Regional Division of the U.S. Forestry Service Division requirements.

Drill sites are selected utilizing natural topographic features such as ridges, benches, shoulders and valleys. The sites and roads are engineered to balance cuts and fills, minimizing disturbances of natural terrain. Roads follow existing trails whenever possible. Swales and culverts will be installed wherever necessary to maintain the natural flow of rainfall runoff.

Construction areas are stripped of vegetation. Fills are keyed into existing ground and compacted to 90% of ASTM D-1557-70. Upon completion of grading, cut and fill slopes are seeded to control erosion.

Drilling waste containment ponds constructed with each site are lined with a clay lining, compacted to 95% of ASTM D-1557-70.

No road building material will be obtained from Federal lands. When needed, building material will be acquired through the construction contractor from a recognized and approved source.

II. EXISTING ROADWAYS AND PROPOSED NEW ROADWAYS

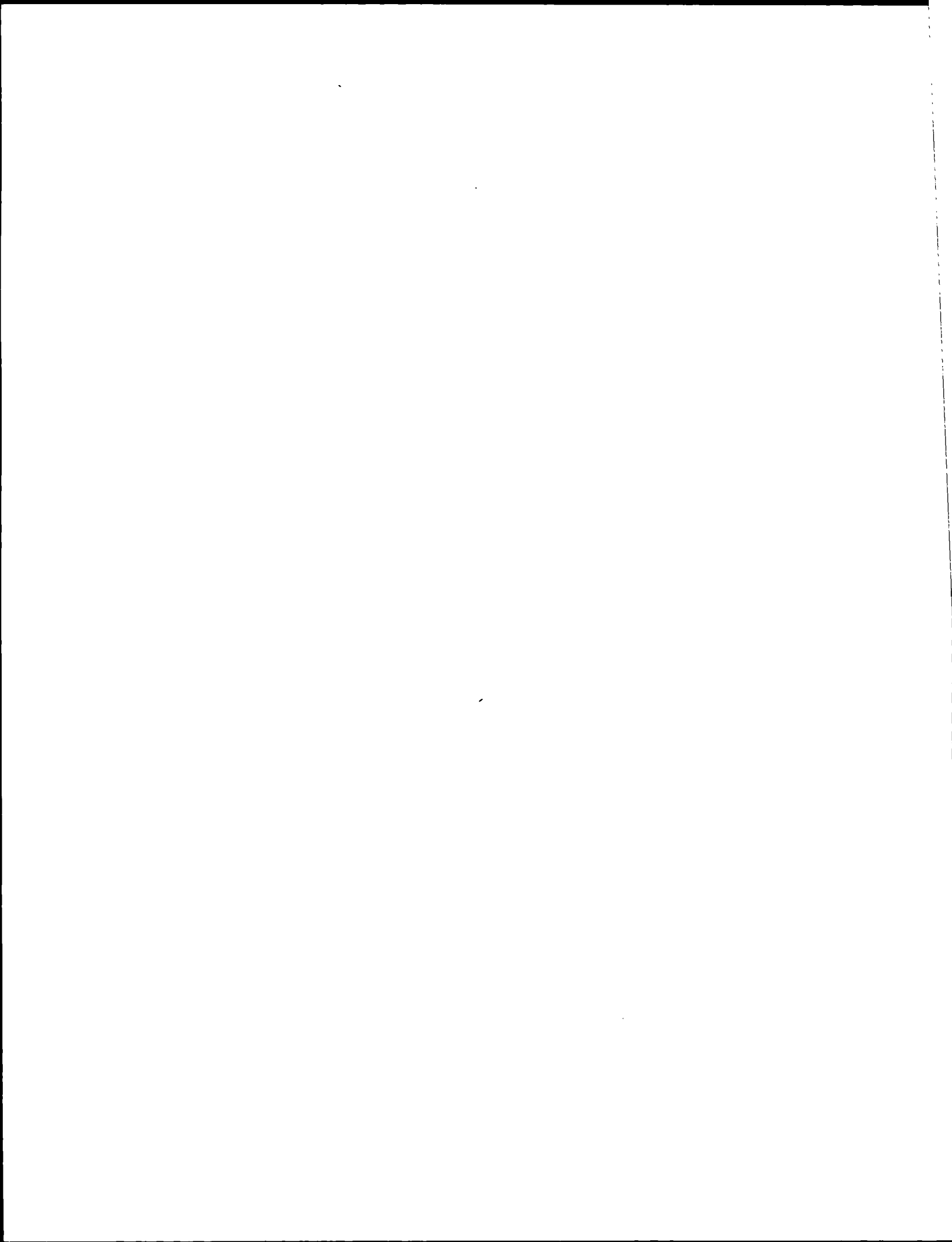
-3-

Access to the Federal Leases will be primarily over existing roads which will be upgraded and maintained in an acceptable manner with the addition of culvert pipes and aggregate where advisable. Roads will be rebuilt to resist erosion and allow passage of equipment at specified points while maintaining the same approximate width and configuration. Some new road construction will be necessary.

The proposed new roads on Forest Service land will be jointly flagged by Forest Service and Union Oil Company Personnel, and will be built in accordance with specifications set by the U.S.D.A. Forest Service. Plans and profile will be submitted for approval by the U.S.D.A. Forest Service prior to the beginning of any road construction. The same procedure will be followed in the case of BLM land; roads will be jointly flagged by BLM and Union Oil Company Personnel, followed by submission, by Union Oil Company, of plans and profile for approval by BLM prior to beginning any road construction. In both cases, proposals for building will also be submitted to the U.S.G.S. for approval.

Access roads have been classified into two types:

Type 1 - Existing, unimproved access roads. These are tracks or trails which may require some degree of improvement for utilization as access roads.





Type 1 - Continued ---

This type road is shown as a double dashed line in Exhibit "B", and each segment is given the letter "A" followed by a hyphen and a number for identification.

Type 2 - New access road. Construction of several short segments of road is necessary to provide access to well sites in areas devoid of pre-existing roads. This road type is shown as a shaded area on Exhibit "B" and is designated with the letter "B" followed by a hyphen and a number for identification.

The access roads to each site are described below:

SITE 1, KGRA Well No. 56-30

Access will be by use of approximately 1600 feet of unimproved BLM road segment A-1.

SITE 2, KGRA Well No. 14-29

Access will be by use of approximately 2700 feet of unimproved Forest Service road segment B-2.

SITE 3, KGRA Well No. 26-20

Access will be by use of approximately one mile of unimproved Forest Service road segment A-1.

SITE 4, KGRA Well No. 33-29

Access will be by use of approximately 3000 feet of unimproved Forest Service road segment A-1.

SITE 5, KGRA Well No. 44-28

Access will be by use of approximately 1700 feet of unimproved Forest Service road segment A-4 and 2500 feet of new road segment B-2.

SITE 6, KGRA Well No. 17-29

Access will be by use of approximately 400 feet of unimproved Forest Service road segment A-3.

SITE 7, KGRA Well No. 66-28

Access will be just off of the Utah State Highway 13 approximately 100 feet.

SITE 8, KGRA Well No. 71-33

Access will be by approximately 2400 feet of unimproved Forest Service road segment A-7 and 1600 feet of segment A-8.

SITE 9, KGRA Well No. 74-33

Access will be by use of approximately one mile of unimproved Forest Service road segment A-7.

SITE 10, KGRA Well No. 53-33

Access will be by use of approximately 4500 feet of unimproved Forest Service road segment A-7 and 1600 feet of segment A-9.

SITE 11, KGRA Well No. 31-33

Access will be by use of approximately 4500 feet of unimproved Forest Service road segment A-7 and 3500 feet of segment A-9.

SITE 12, KGRA Well No. 34-30

Access will be by use of approximately 1500 feet of unimproved BLM road segment A-18 and 1500 feet of new road segment B-3.

SITE 13, KGRA Well No. 45-12

Access will be by use of approximately 500 feet of road segment A-14 leading from U.S. 91 to Sulphurdale.

SITE 14, KGRA Well No. 12-18

Access will be by use of approximately 6000 feet of unimproved Forest Service road segment A-15.

SITE 15, KGRA Well No. 12-17

Access will be by use of approximately 5000 feet of unimproved Forest Service road segment A-12 and 6000 feet of segment A-13.

SITE 16, KGRA Well No. 36-8

Access will be by use of approximately 6000 feet of unimproved Forest Service road segment A-12, 4000 feet of segment A-13, and 2000 feet of segment A-16.

SITE 17, KGRA Well No. 66-7

Access will be by use of approximately 5000 feet of unimproved Forest Service road segment A-12 and 3000 feet of segment A-13.

SITE 18, KGRA Well No. 42-7

Access will be by use of approximately 5000 feet of unimproved Forest Service road segment A-12 and 1000 feet of segment A-10.

SITE 19, KGRA Well No. 46-6

Access will be by use of approximately 2 miles of unimproved Forest Service road segment A-10.

SITE 20, KGRA Well No. 32-6

Access will be by use of approximately 2 miles of unimproved Forest Service road segment A-10 and 2000 feet of new road segment B-4.

SITE 21, KGRA Well No. 67-31

Access will be by use of approximately one mile of unimproved Forest Service road segment A-10.

SITE 22, KGRA Well No. 34-32

Access will be by use of approximately one mile of unimproved Forest Service road segment A-10 and 4000 feet of segment A-11.

SITE 23, KGRA Well No. 82-12

Access will be by use of approximately 3000 feet of unimproved BLM road segment A-12.

III. ARCHAEOLOGICAL REPORT

As specified in each Geothermal Lease, an approved competent Archaeologist has examined the lands to be disturbed. His report, providing an inventory and evaluations of archaeological and historical values along with a Geological map of the area is included as Exhibit "F". Union Oil Company is prepared to follow the recommendations of the consulting Archaeologist in regards to the construction of drill sites and roads.

IV. RESTORATION PROGRAM

A. Soil Erosion

Culverts will be installed and efforts toward road improvement and elimination of road problems will be made on existing access roads. Since the terrain in the area of all locations does not encompass severe sloping, there will be a minimal disturbance of any vegetation or area outside of the existing roadways.

Any road and/or location work will be performed in accordance with recognized engineering requirements as specified in BLM manual, Section 9110, "Roads, Trails, and Landing Fields".

B. Pollution of Surface Groundwater:

All location or site drainage will be contained and confined to the sump or reserve pit. All necessary precautions will be taken to prevent run off of any

Restoration Program

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.

Adequate supplies of water will be maintained at the sites for use in controlling dust during construction and drilling operations.

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.

V. SOLID WASTE DISPOSAL PLANS

A. Solid Wastes:

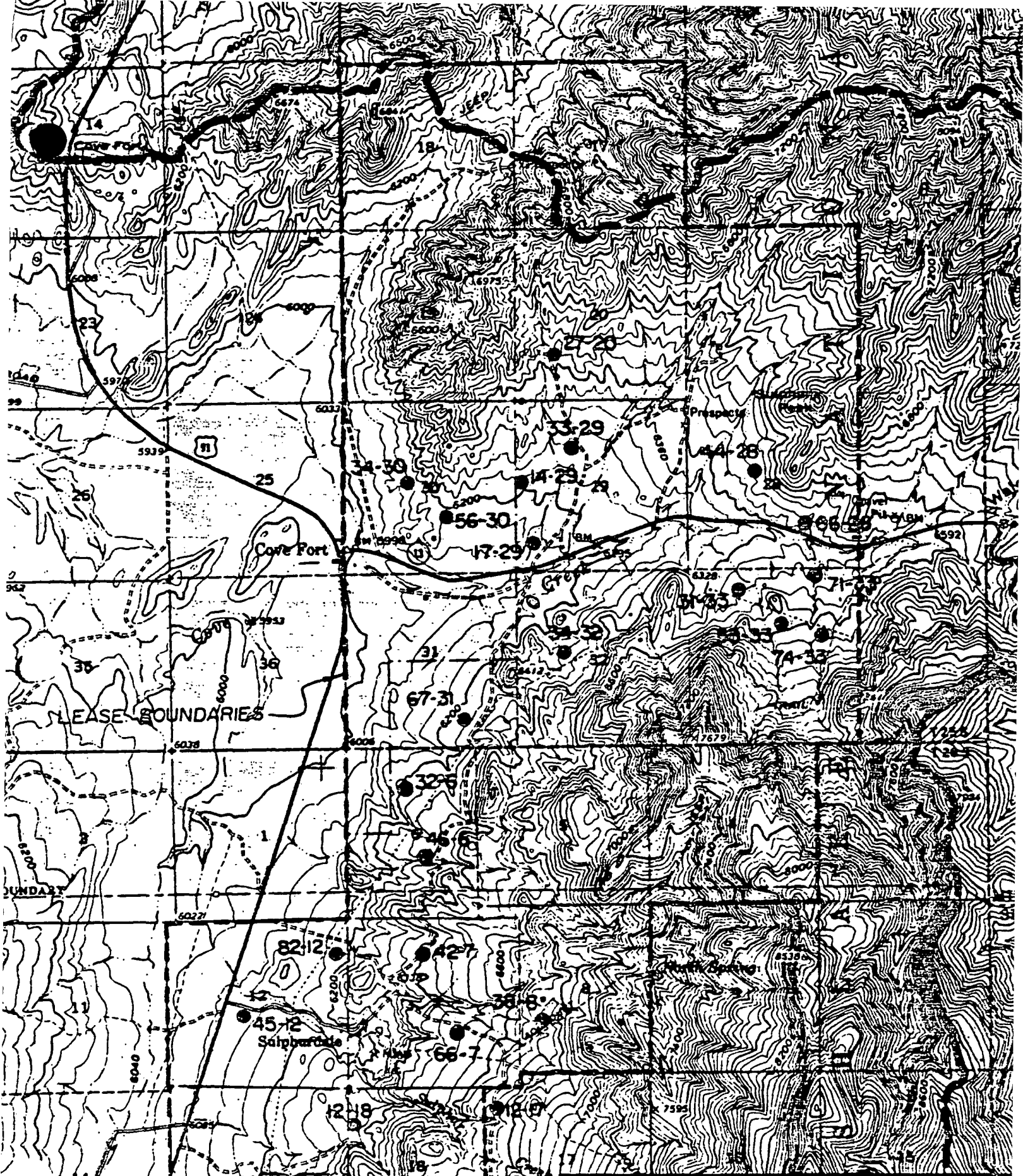
The area will be kept clean and all solid waste will be removed and transported to an approved dump .

Note:

Storage of equipment and supplies will be on lands leased from Forminco Inc., Sulphurdale, Utah.



EXHIBIT "A" - TOPOGRAPHIC MAP, LEASE BOUNDARIES, AND DRAINAGE PATTERNS



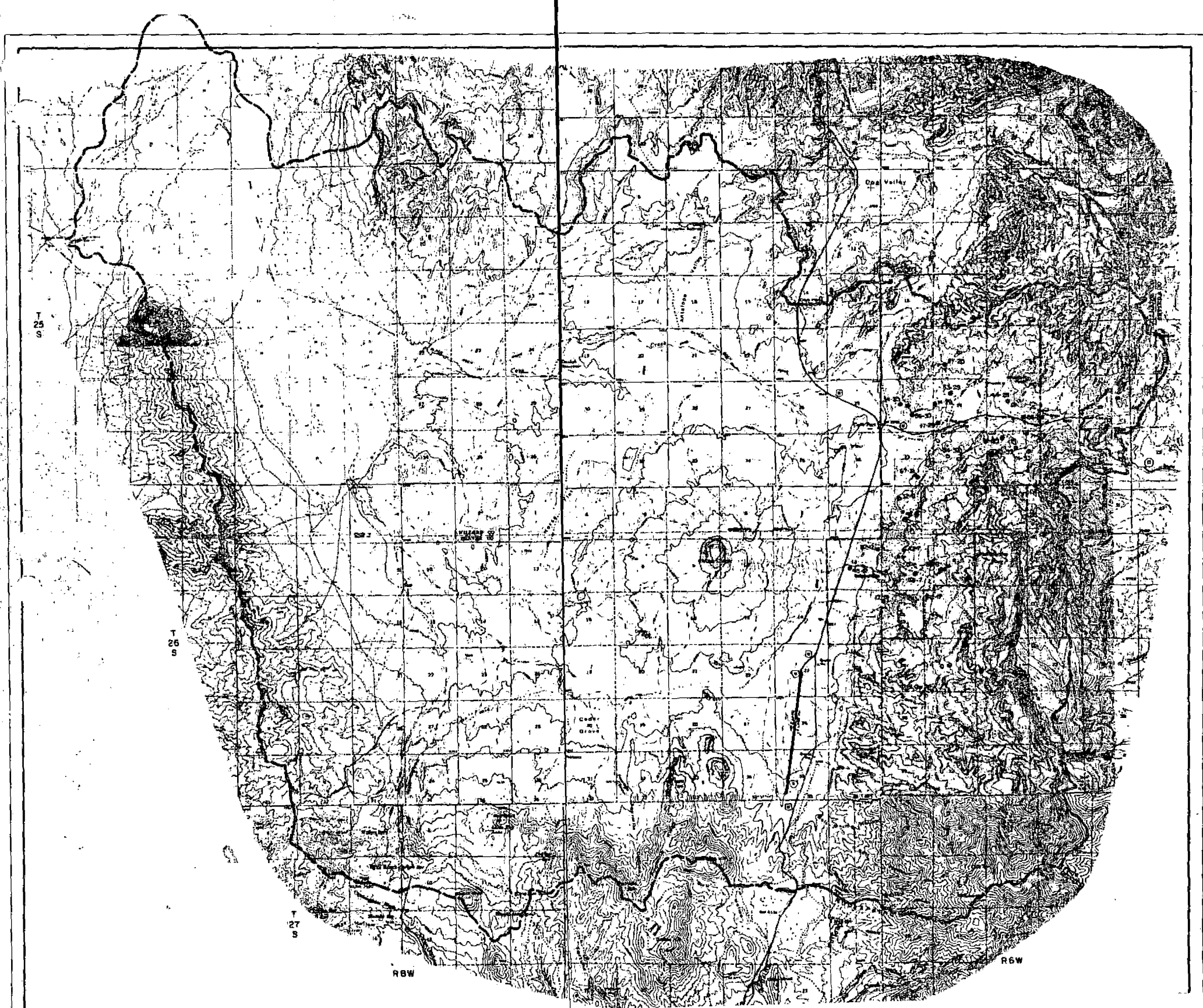
**UNION**

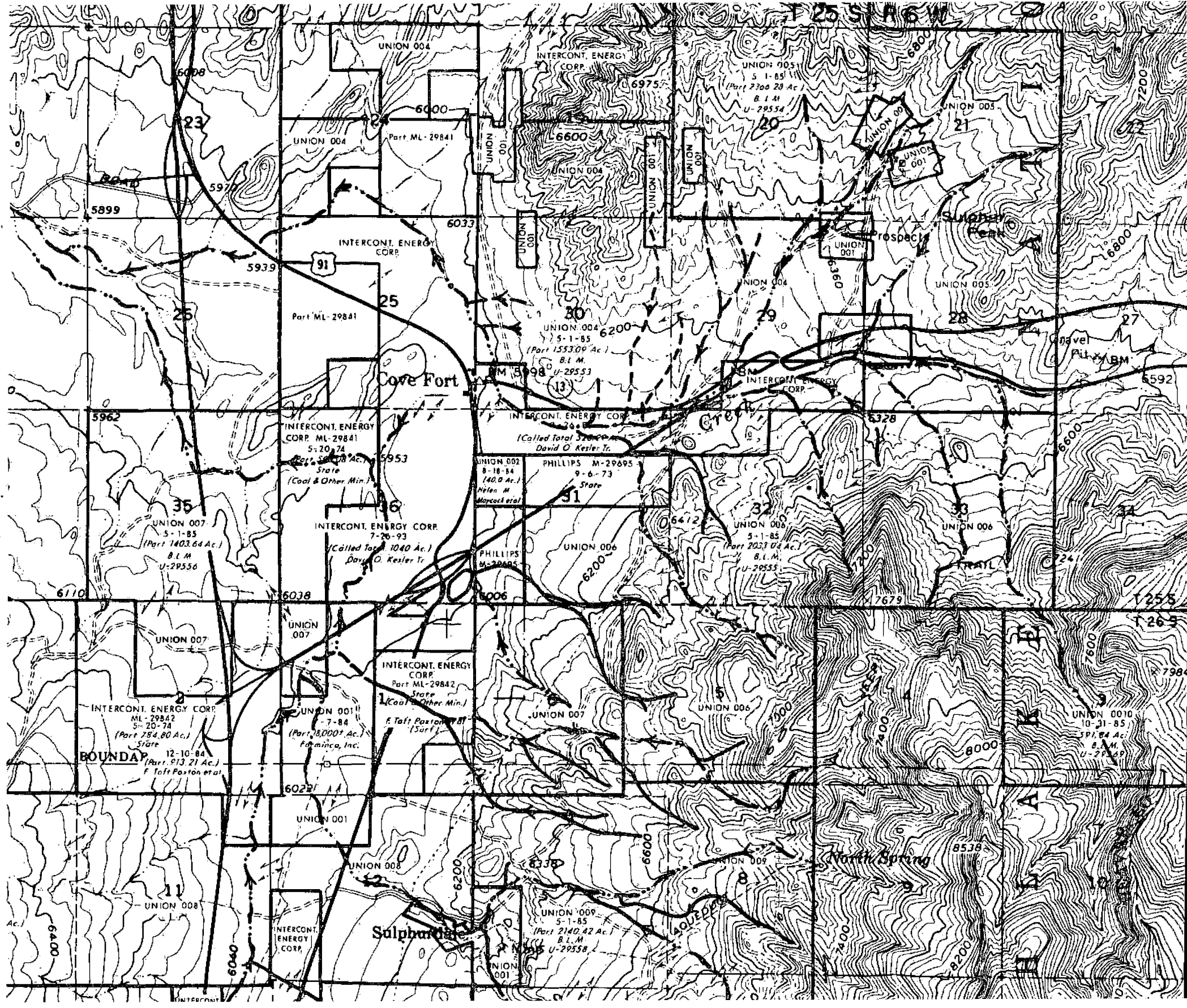
o-2

WELL LOCATIONS & LEASE BOUNDARIES

COVE FORT PROSPECT

UTAH





UNION 004

INTERCONT. ENERGY CORP.  
6975

UNION 005  
5-1-85  
(Part 2300.28 Ac.)  
B.L.M.  
U-29554

UNION 004 Part ML-29841

UNION 001

UNION 004  
L6600

UNION 001

UNION 001

UNION 001

UNION 005

5899

INTERCONT. ENERGY CORP.

6033

UNION 001

UNION 001

UNION 001

UNION 004

UNION 001

UNION 005

Part ML-29841

Cove Fort

UNION 004  
5-1-85  
(Part 1553.09 Ac.)  
B.L.M.  
U-29553

13

UNION 004

INTERCONT. ENERGY CORP.

28

5962

INTERCONT. ENERGY CORP. ML-29841  
5-20-74  
(Part 5000 Ac.)  
State  
(Coal & Other Min.)

5953

INTERCONT. ENERGY CORP.  
(Called Total 3700 Ac.)  
David O. Kesler Jr.

UNION 002  
8-10-84  
(40.0 Ac.)  
Helen M. Harcock et al.

PHILLIPS M-29695  
9-6-73  
State

31

UNION 007  
5-1-85  
(Part 1403.64 Ac.)  
B.L.M.  
U-29556

INTERCONT. ENERGY CORP.  
7-26-93  
(Called Total 1040 Ac.)  
David O. Kesler Jr.

5953

PHILLIPS M-29695

UNION 006

UNION 006  
5-1-85  
(Part 2023.04 Ac.)  
B.L.M.  
U-29555

UNION 006

6110

6038

6006

6412

7679

1258

UNION 007

UNION 007

INTERCONT. ENERGY CORP.  
Part ML-29842  
State  
(Coal & Other Min.)

UNION 007

UNION 006

INTERCONT. ENERGY CORP. ML-29842  
5-20-74  
(Part 784.80 Ac.)  
State

BOUNDARY

12-10-84  
(Part 913.21 Ac.)  
F. Taft Paxton et al.

UNION 001  
7-84  
(Part 8,000 Ac.)  
F. Taft Paxton et al.  
F. Taft Paxton et al.  
(State)

6029

UNION 001

UNION 008

UNION 009  
5-1-85  
(Part 2140.42 Ac.)  
B.L.M.  
U-29558

UNION 009

North Spring

8538

UNION 008

INTERCONT. ENERGY CORP.

Sulphur Dale

UNION 001

6040

INTERCONT.

EXHIBIT "C" - INDIVIDUAL WELL LOCATIONS

OPERATOR: Union Oil of California  
 P.O. Box 6854  
 Santa Rosa, Ca 95405

WELL NUMBER: Number 1 (KGRA-56-30)

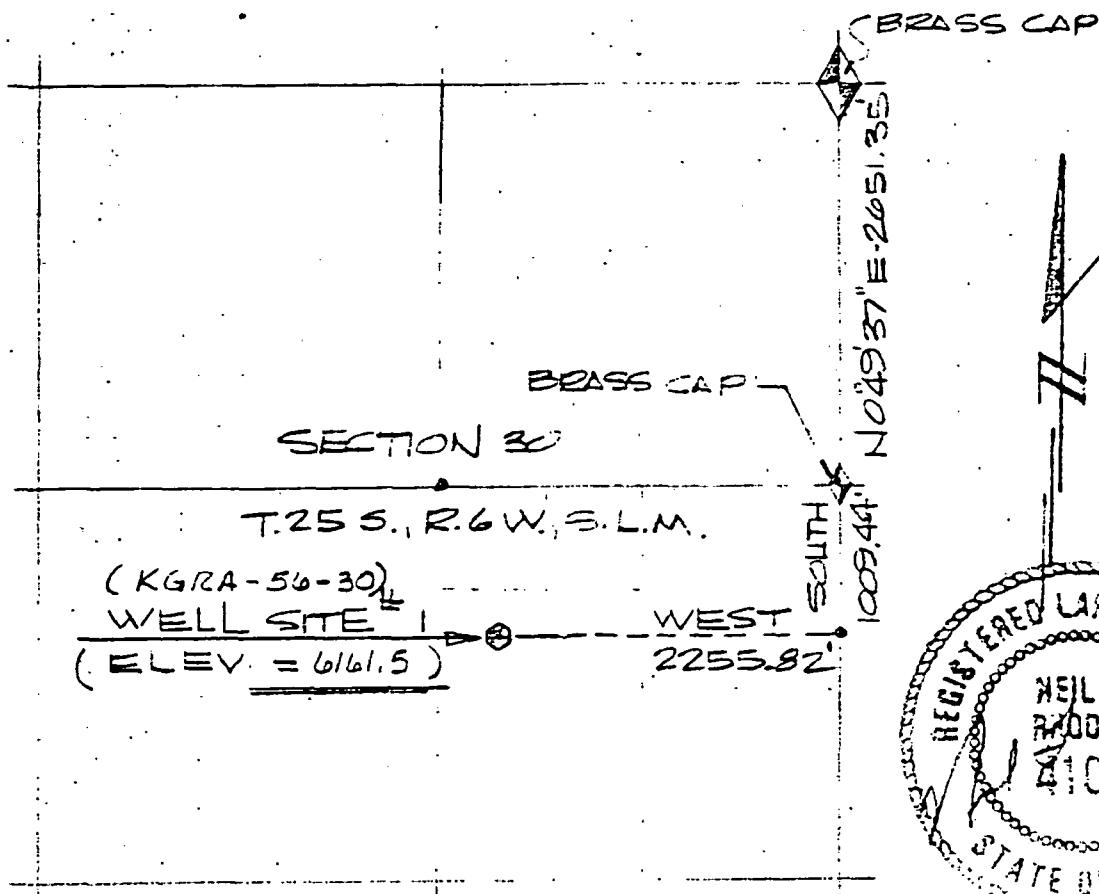
LOCATION: Section 30, T25S, R6W, SLM

COUNTY: Millard

STATE: Utah

ELEVATION: (Ground level) 6,161.5 ft. above  
 mean sea level.

Bench mark = brass cap with steel post alongside;  
 239 feet Westerly from well number 1  
 wellhead = elev. 6,155.50



**BULLOCH BROS.**  
**ENGINEERING INC.**  
 CEDAR CITY, UTAH

WELL LOCATION  
 MAP FOR  
 UNION OIL CO.  
 SANTA ROSA CALIF.

DATE 1/17/76  
 DECEMBER 1976

SCALE 1" = 1320'  
 DRAWN J. TRAMER

OPERATOR: Union Oil of California  
P.O. Box 6854  
Santa Rosa, Ca 95405

WELL NUMBER: Number 2 (KGRA-14-29)

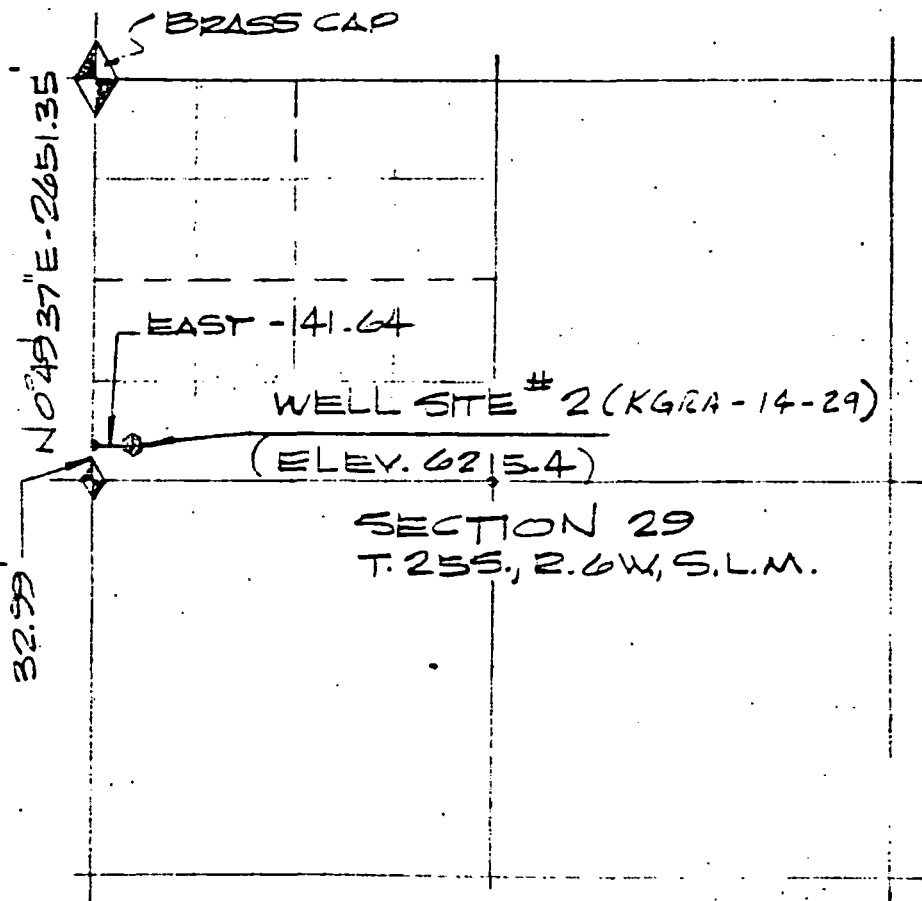
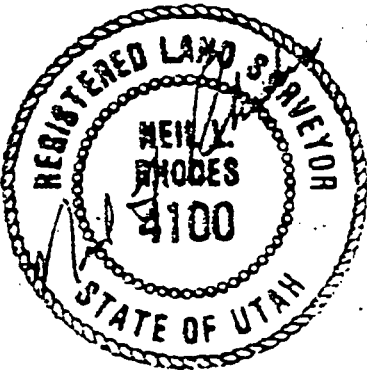
LOCATION: Section 29, T25S, R6W, SLM.

COUNTY: Millard

STATE: Utah

ELEVATION: (Ground level) 6,215.4 feet above  
mean sea level.

Bench mark = brass cap with steel post alongside;  
163 feet Westerly from Wellsite #2  
wellhead = elev. 6,228.85



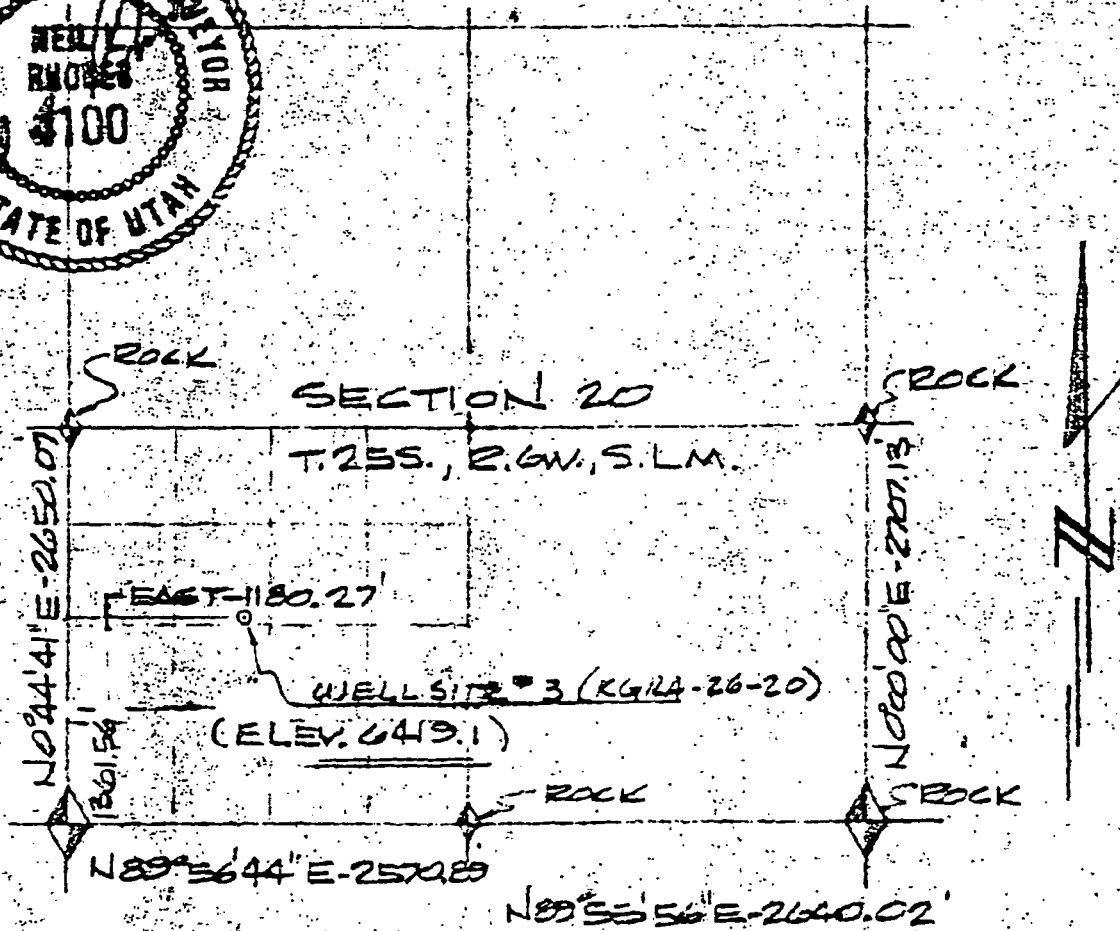
**BULLOCH BROS.  
ENGINEERING INC.**  
CEDAR CITY, UTAH

WELL LOCATION  
MAP FOR  
**UNION OIL CO.**  
SANTA ROSA, CALIF.

REV'D 1/17/77  
DECEMBER, 1976

SCALE 1" = 1320'  
DRAWN J. TRIMMER

**OPERATOR:** Union Oil of California  
 P.O. Box 6854  
 Santa Rosa, Ca. 95405  
  
**WELL NUMBER:** Number 3 (KGRA-26-20)  
  
**LOCATION:** Section 20, T25S, R6W, SLM  
  
**COUNTY:** Millard  
  
**STATE:** Utah  
  
**ELEVATION:** (Ground level) 6,419.1 feet above  
 mean sea level.  
 Bench mark = brass cap with steel post alongside;  
 119 feet Southeast from Well site #3  
 wellhead = elev. 6,429.07



**BULLOCH BROS.**  
**ENGINEERING INC.**  
 CEDAR CITY, UTAH

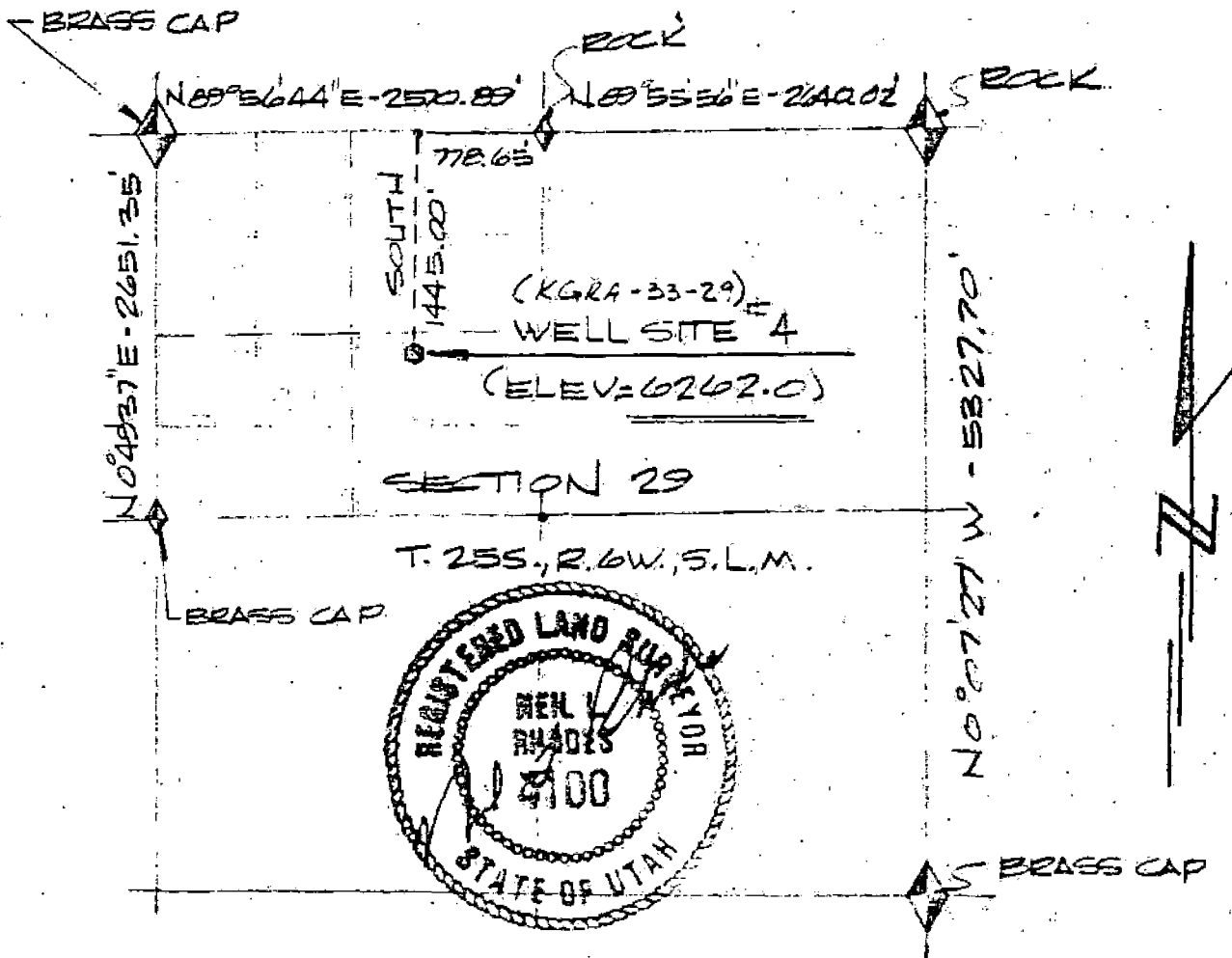
WELL LOCATION  
 MAP FOR  
**UNION OIL CO.**  
 SANTA ROSA, CALIF.

REV'D 1/4/77  
 DECEMBER, 1976  
 SCALE 1" = 1320'  
 DRAWN J. TRIMMER



**OPERATOR:** Union Oil of California  
 P.O. Box 6854  
 Santa Rosa, Ca 95405  
  
**WELL NUMBER:** Number 4 (KGRA-33-29)  
  
**LOCATION** Section 29, T25S, R6W, SLM  
  
**COUNTY** Millard  
  
**STATE:** Utah  
  
**ELEVATION:** (Ground level) 6,262.0 feet above  
 mean sea level.

Bench mark = brass cap with steel post alongside;  
 249 feet Northeasterly from wellsite #4  
 wellhead = elev. 6,275.50

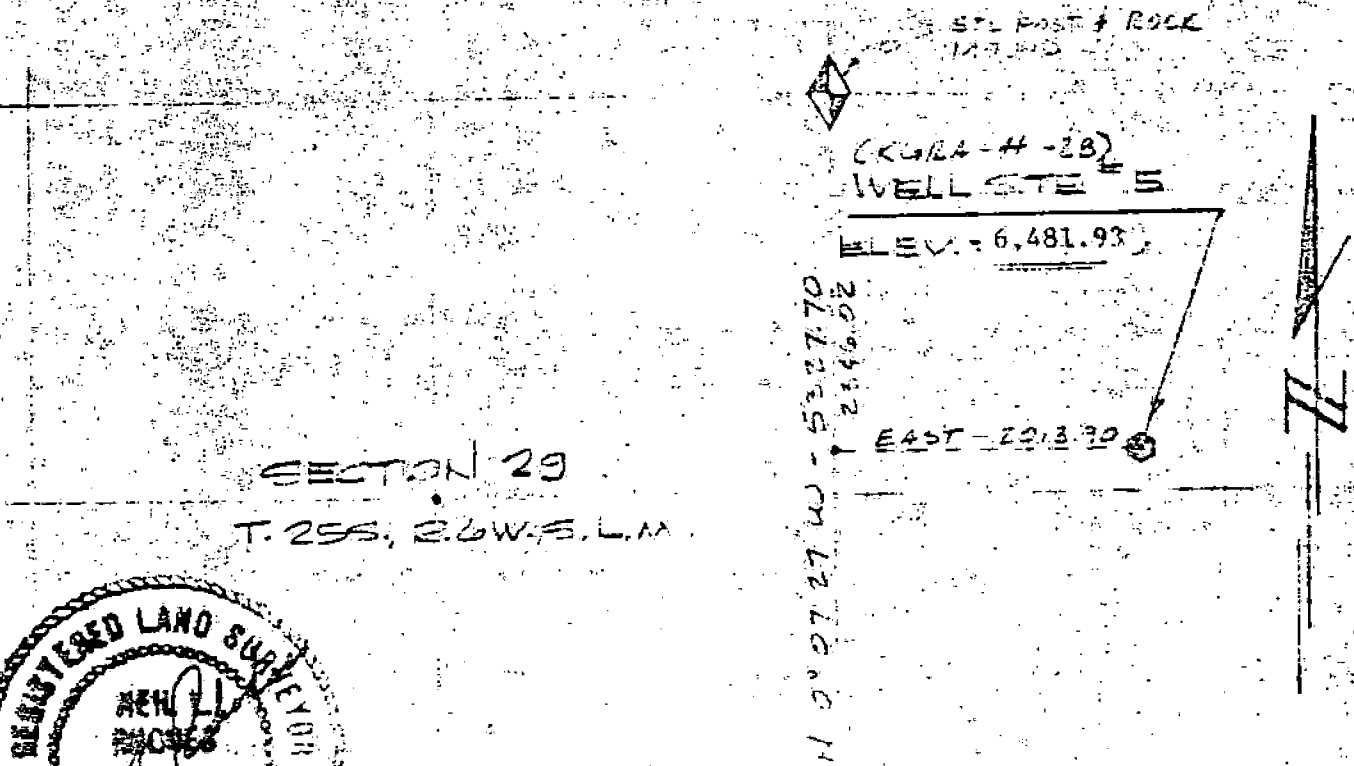


**BULLOCH BROS.**  
**ENGINEERING INC.**  
 CEDAR CITY, UTAH

WELL LOCATION  
 MAP FOR  
 UNION OIL CO.  
 SANTA ROSA, CALIF.

REV'D 1/17/77  
 FEBRUARY 2, 1976  
 SCALE 1" = 1320'  
 DRAWN J. TRIMMER

**OPERATOR:** Union Oil of California  
 P.O. Box 6854  
 Santa Rosa, Ca 95405  
  
**WELL NUMBER:** Well Number 5 (KGRA-44-28)  
  
**LOCATION:** Unsurveyed area, T25S, R6W, SLM  
  
**COUNTY:** Millard  
  
**STATE:** Utah  
  
**ELEVATION:** (Ground level) 6,481.93 feet above  
 mean sea level.  
 Bench mark = brass cap with steel post alongside:  
 273 feet Southerly from Well #5  
 wellhead = elev: 6,509.26



SECTION 29  
 T. 25S, R. 6W, S. 14N



<b>BULLOCH BROS.</b> <b>ENGINEERING INC.</b> CEDAR CITY, UTAH	WELL LOCATION MAP FOR <b>UNION OIL CO.</b>	REVISION 1/5/57 DECEMBER 1956
	SANTA ROSA, CALIF.	SCALE 1" = 1225' DRAWN BY T. J. MERR

OPERATOR:

Union Oil of California  
P.O. Box 6854  
Santa Rosa, Ca 95405

WELL NUMBER:

Number 6 (KGRA-17-29)

LOCATION:

Section 29, T25S, R6W, 61M

COUNTY:

Millard

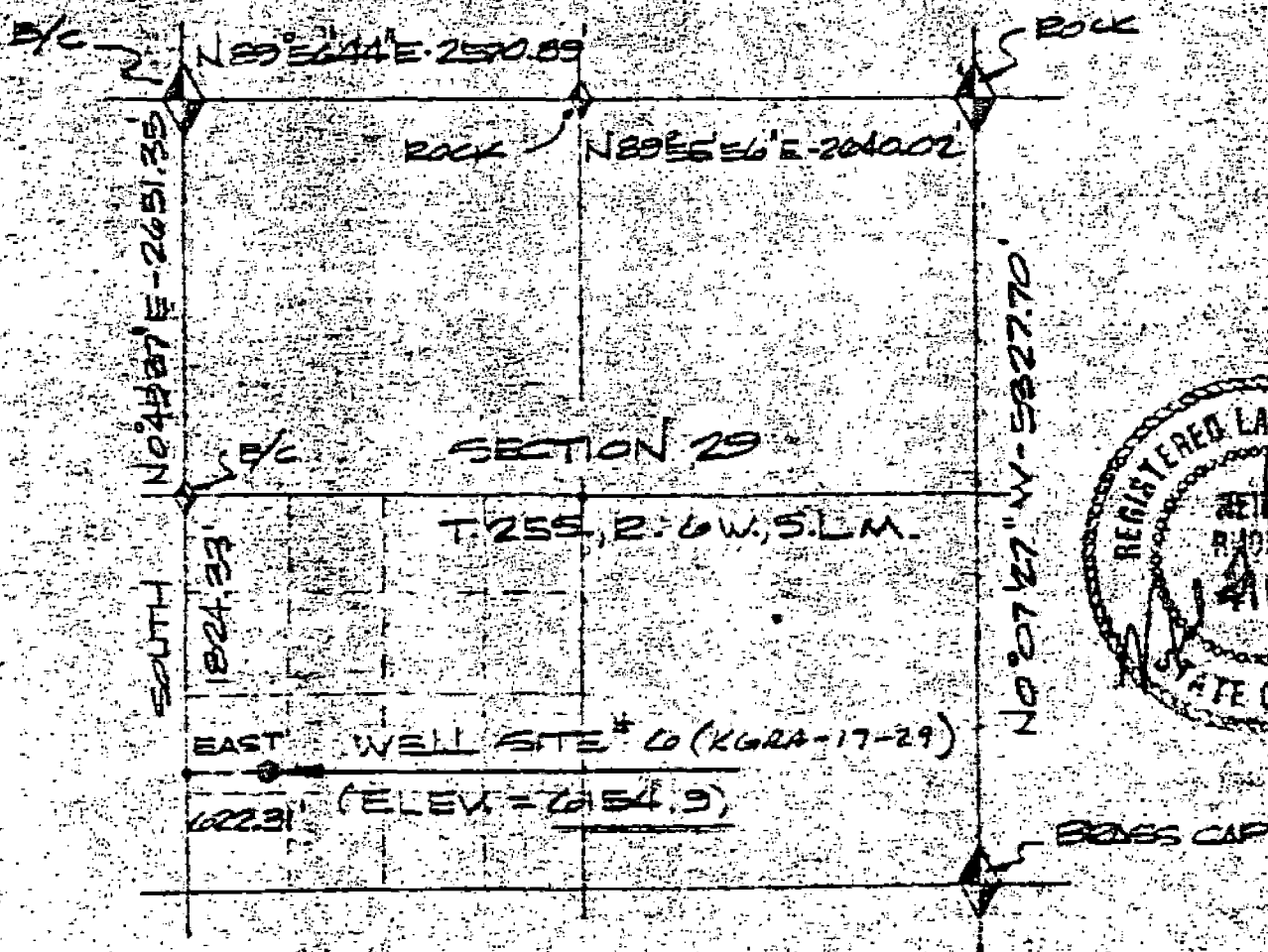
STATE:

Utah

ELEVATION:

(Ground level) 6,154.9 feet above  
mean sea level.

Bench mark = brass cap with steel post alongside;  
170 feet Southwesterly from Well #6  
wellhead = elev. 6,152.09



**BULLOCH BROS.**  
**ENGINEERING INC.**  
CEDAR CITY, UTAH

WELL LOCATION  
MAP FOR  
**UNION OIL CO.**  
SANTA ROSA, CALIF.

REV'D 1/17/77  
DECEMBER, 1976  
SCALE 1" = 1320'  
DRAWN J. TRIMMER

OPERATOR: Union Oil of California  
P.O. Box 6854  
Santa Rosa, Ca 95405

WELL NUMBER: Number 7 (KGRA-66-23)

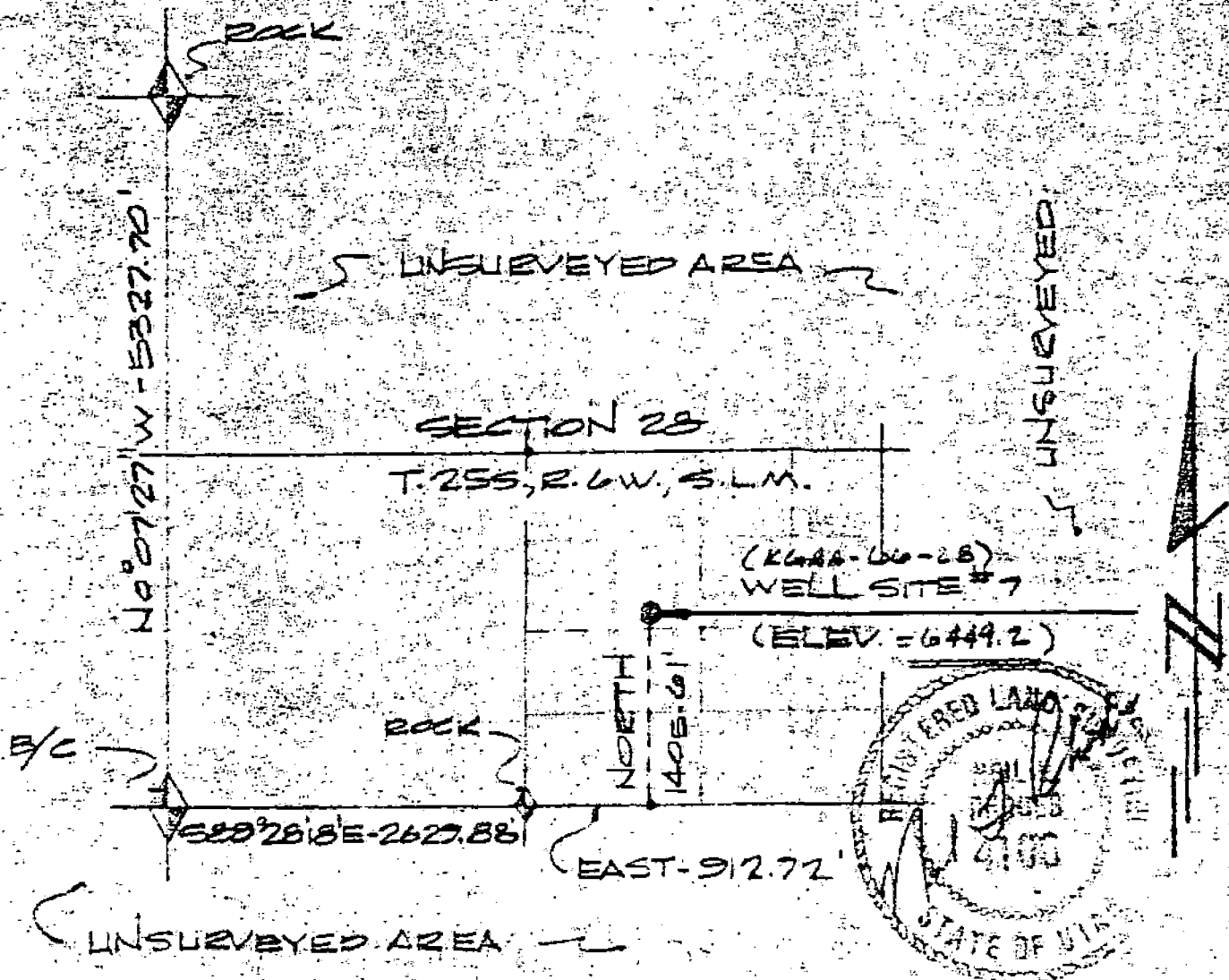
LOCATION: Section 28, T25S, R6W, S1M

COUNTY: Millard

STATE: Utah

ELEVATION: (Ground level) 6,449.2 ft. above  
mean sea level.

Bench mark = brass cap with steel post alongside;  
174 feet Southwesterly from Well #7  
wellhead = elev. 6,439.45.



**BULLOCH BROS.**  
**ENGINEERING INC.**  
CEDAR CITY, UTAH

WELL LOCATION  
MAP FOR  
**UNION OIL CO.**  
SANTA ROSA, CALIF.

REV'D 1/17/77  
DECEMBER, 1976  
SCALE 1" = 1320'  
DRAWN J. TRIMMER

OPERATOR: Union Oil of California  
P.O. Box 6854  
Santa Rosa, Ca 95405

WELL NUMBER: Number 8 (KGRA-71-33)

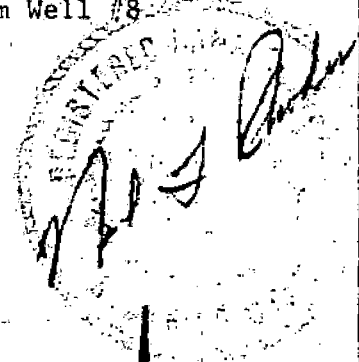
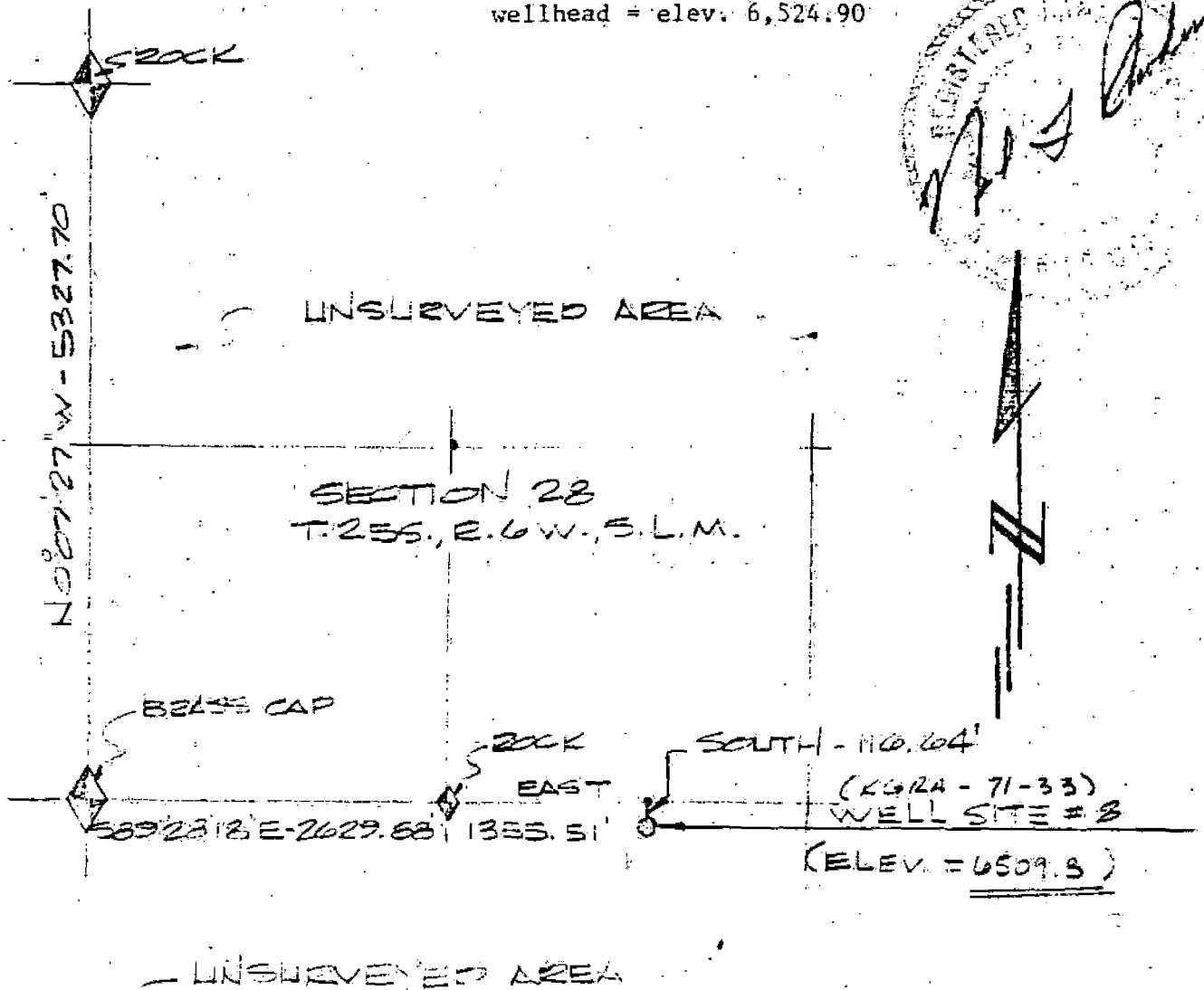
LOCATION: Unsurveyed area; T25S, R6W, SLM

COUNTY: Millard

STATE: Utah

ELEVATION: (Ground level) 6,509.8 ft. above mean sea level.

Bench mark = brass cap with steel post alongside;  
231 feet Northwesterly from Well #8  
wellhead = elev. 6,524.90



**BULLOCH BROS.**  
**ENGINEERING INC.**  
CEDAR CITY, UTAH

WELL LOCATION  
MAP FOR  
UNION OIL CO.  
SANTA ROSA, CALIF.

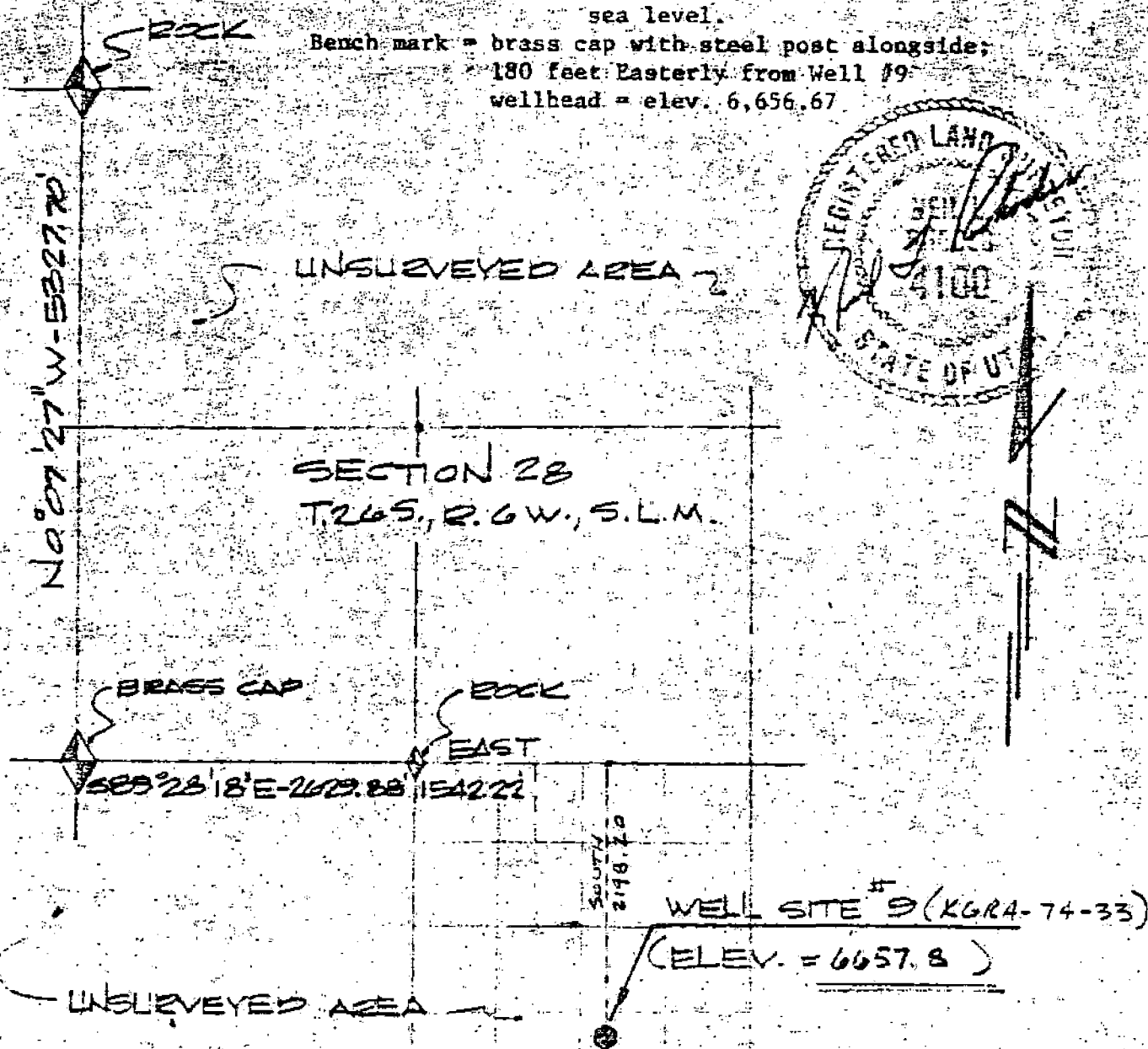
REV'D 11/24/74  
DECEMBER, 1976

SCALE 1" = 132.5'

DRAWN J. ZIMMER

**OPERATOR:** Union Oil of California  
 P.O. Box 6854  
 Santa Rosa, Ca 95405  
**WELL NUMBER:** Number 9 (KGRA-74-33)  
**LOCATION:** Unsurveyed area, T25S, R6W, S1M  
**COUNTY:** Millard  
**STATE:** Utah  
**ELEVATION:** (Ground level) 6,657.8 ft. above mean sea level.

Bench mark = brass cap with steel post alongside;  
 180 feet Easterly from Well #9  
 wellhead = elev. 6,656.67



**BULLOCH BROS.**  
**ENGINEERING INC.**  
 CEDAR CITY, UTAH

WELL LOCATION  
 MAP FOR  
 UNION OIL CO.  
 SANTA ROSA, CALIF.

REV'D 1/17/77  
 DECEMBER, 1976  
 SCALE 1" = 1320'  
 DRAWN J. TRIMMER

OPERATOR:

Union Oil of California  
P.O. Box 6854  
Santa Rosa, Ca 95405

WELL NUMBER:

Number 10 (KGRA-53-33)

LOCATION:

Unsurveyed area, T25S, R6W, S1M

COUNTY:

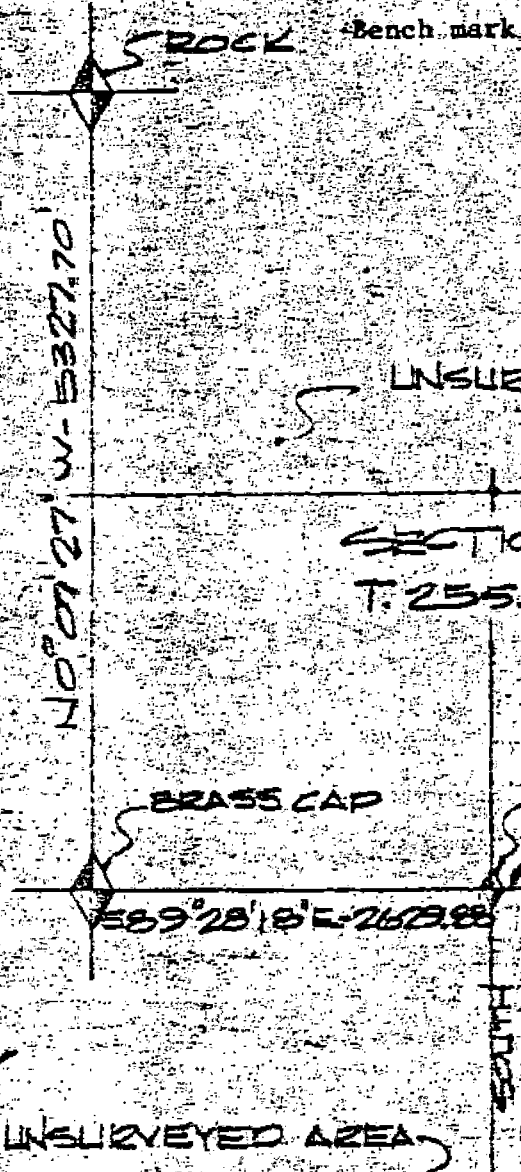
Millard

STATE:

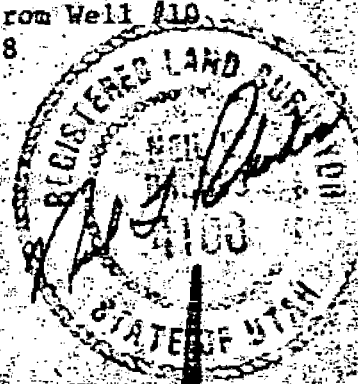
Utah

ELEVATION:

(Ground level) 6,607.8 ft. above  
mean sea level.



Bench mark - brass cap with steel post alongside;  
365 feet Northwesterly from Well #10  
wellhead = elev. 6,602.18



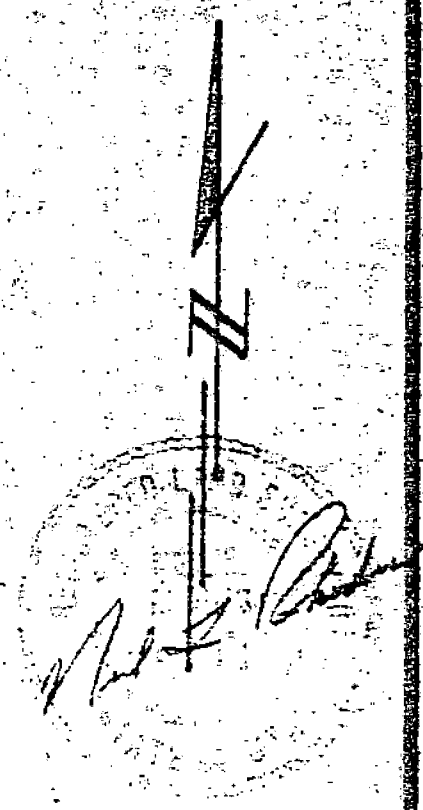
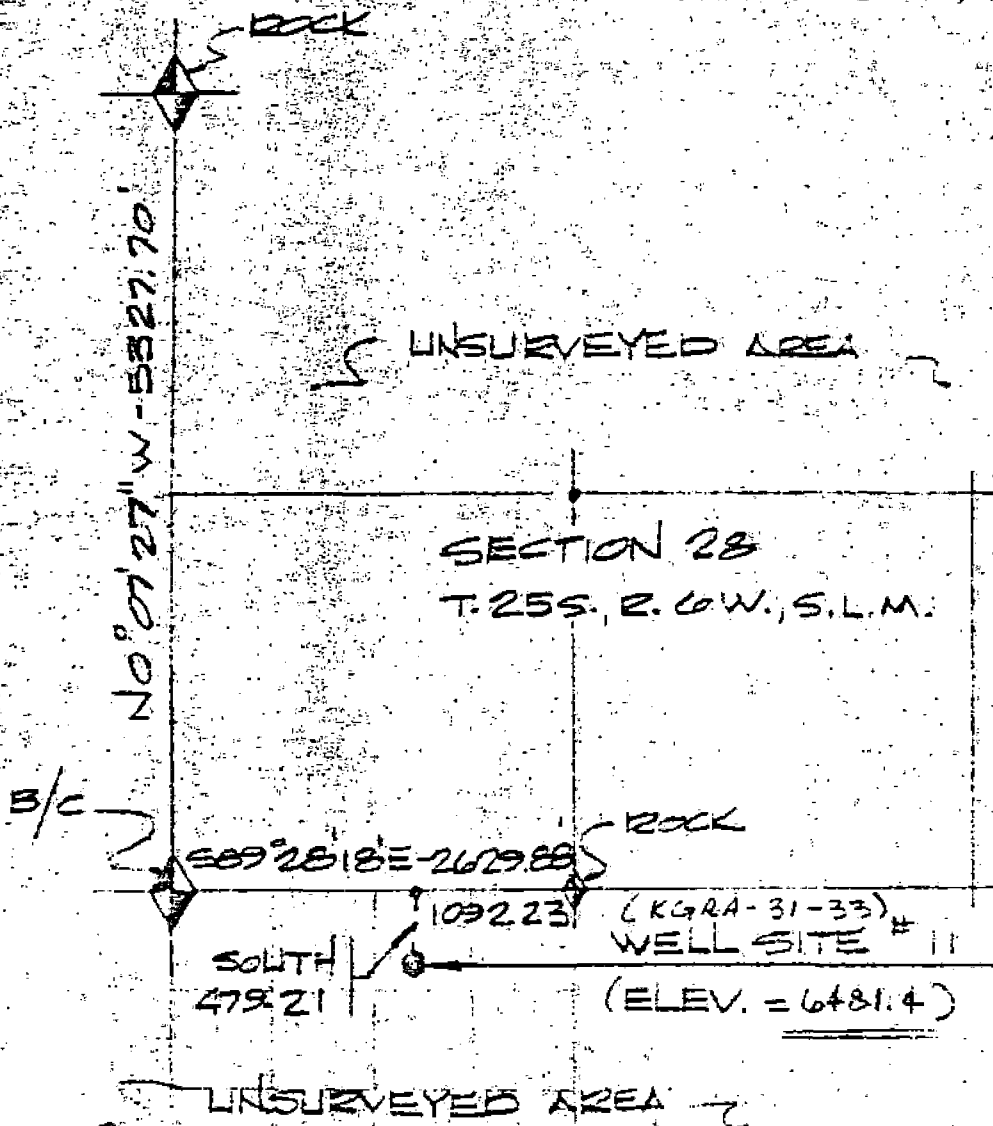
**BULLOCH BROS.  
ENGINEERING INC.**  
CEDAR CITY, UTAH

WELL LOCATION  
MAP FOR  
**UNION OIL CO.**  
SANTA ROSA, CALIF.

REV'D 1/17/77  
DECEMBER, 1976  
SCALE 1" = 320'  
BROWN L. TRIMMER

**OPERATOR:** Union Oil of California  
 P.O. Box 6854  
 Santa Rosa, California 95405  
**WELL NUMBER:** Number 11 (KGRA-31-33)  
**LOCATION:** Unsurveyed, T25S, R6W, SLM  
**COUNTY:** Millard  
**STATE:** Utah  
**ELEVATION:** (Ground level) 6,481.4 feet above  
 mean sea level.

Bench mark = brass cap with steel post alongside;  
 301 feet Southerly from Well #11  
 wellhead = elev. 6,496.23



**BULLOCH BROS.**  
**ENGINEERING INC.**  
 CEDAR CITY, UTAH

WELL LOCATION  
 MAP FOR  
 UNION OIL CO.  
 SANTA ROSA, CALIF.

REV'D 11/17/77  
 DECEMBER, 1976  
 SCALE 1" = 1320'  
 DRAWN BY TRIMMER



OPERATOR:

Union Oil of California  
P.O. Box 6854  
Santa Rosa, California 95405

WELL NUMBER:

Number 12 (KGRA-34-30)

LOCATION:

Section 30, T25S, R6W, S1M

COUNTY:

Millard

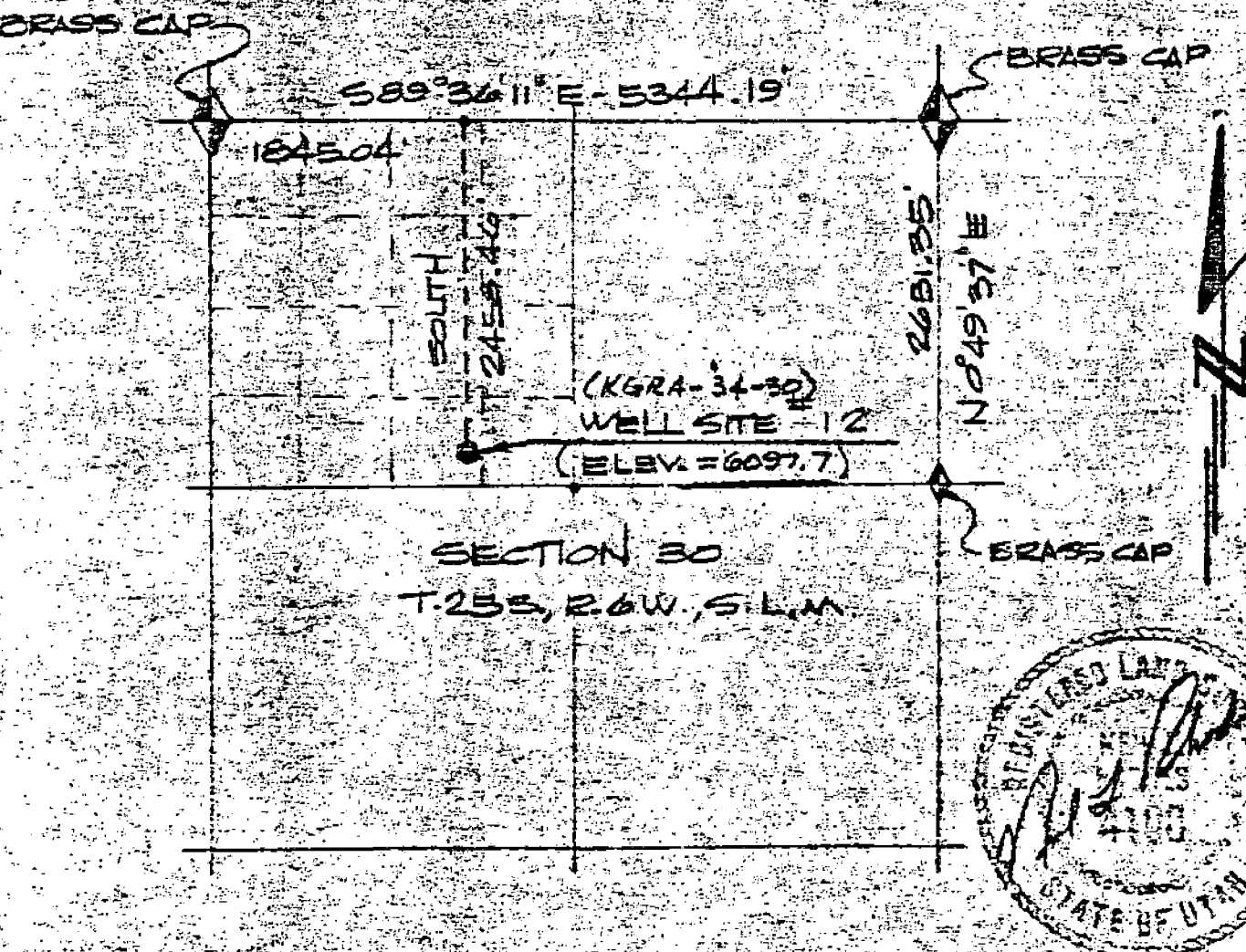
STATE:

Utah

ELEVATION:

(Ground level) 6,097.7 feet above  
near sea level.

Bench mark = brass cap with steel post alongside;  
150 feet Easterly from Well #12  
wellhead = elev. 6,117.52



**BULLOCH BROS.**  
**ENGINEERING INC.**  
 CEDAR CITY, UTAH

WELL LOCATION  
 MAP FOR  
 UNION OIL CO.  
 SANTA ROSA, CALIF.

REV'D 1/17/77  
 DECEMBER, 1976  
 SCALE 1" = 1320'  
 DRAWN J. TRIMMER

OPERATOR:

Union Oil of California  
P.O. Box 6854  
Santa Rosa, California 95405

WELL NUMBER:

Number 13 (KGRA-45-12)

LOCATION:

Section 12, T26S, R7W, SLM

COUNTY:

Beaver

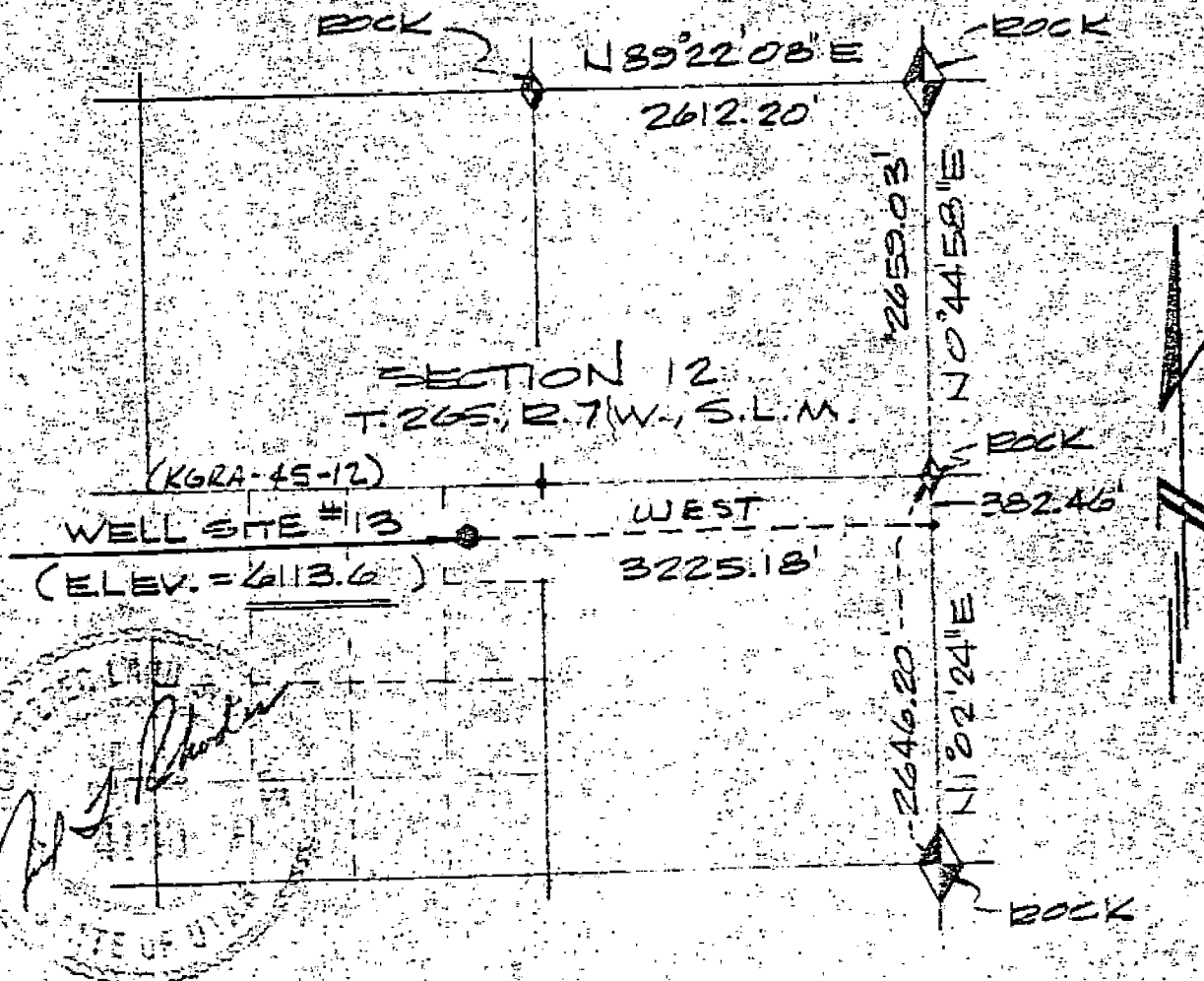
STATE:

Utah

ELEVATION:

(Ground level) 6,113.6 feet above  
mean sea level.

Bench mark = brass cap with steel post alongside;  
318 feet Easterly from Well #13  
wellhead = elev. 6,105.45



**BULLOCH BROS.  
ENGINEERING INC.**  
CEDAR CITY, UTAH

WELL LOCATION  
MAP FOR  
**UNION OIL CO.**  
SANTA ROSA, CALIF.

REV'D 1/20/77  
DECEMBER, 1976  
SCALE 1" = 320'  
DRAWN J. TRIMMER

OPERATOR:

Union Oil of California  
P.O. Box 6954  
Santa Rosa, California 95405

WELL NUMBER:

Number 14 (KCRA-12-18)

LOCATION:

Section 18, T26S, R6W, S1M

COUNTY:

Beaver

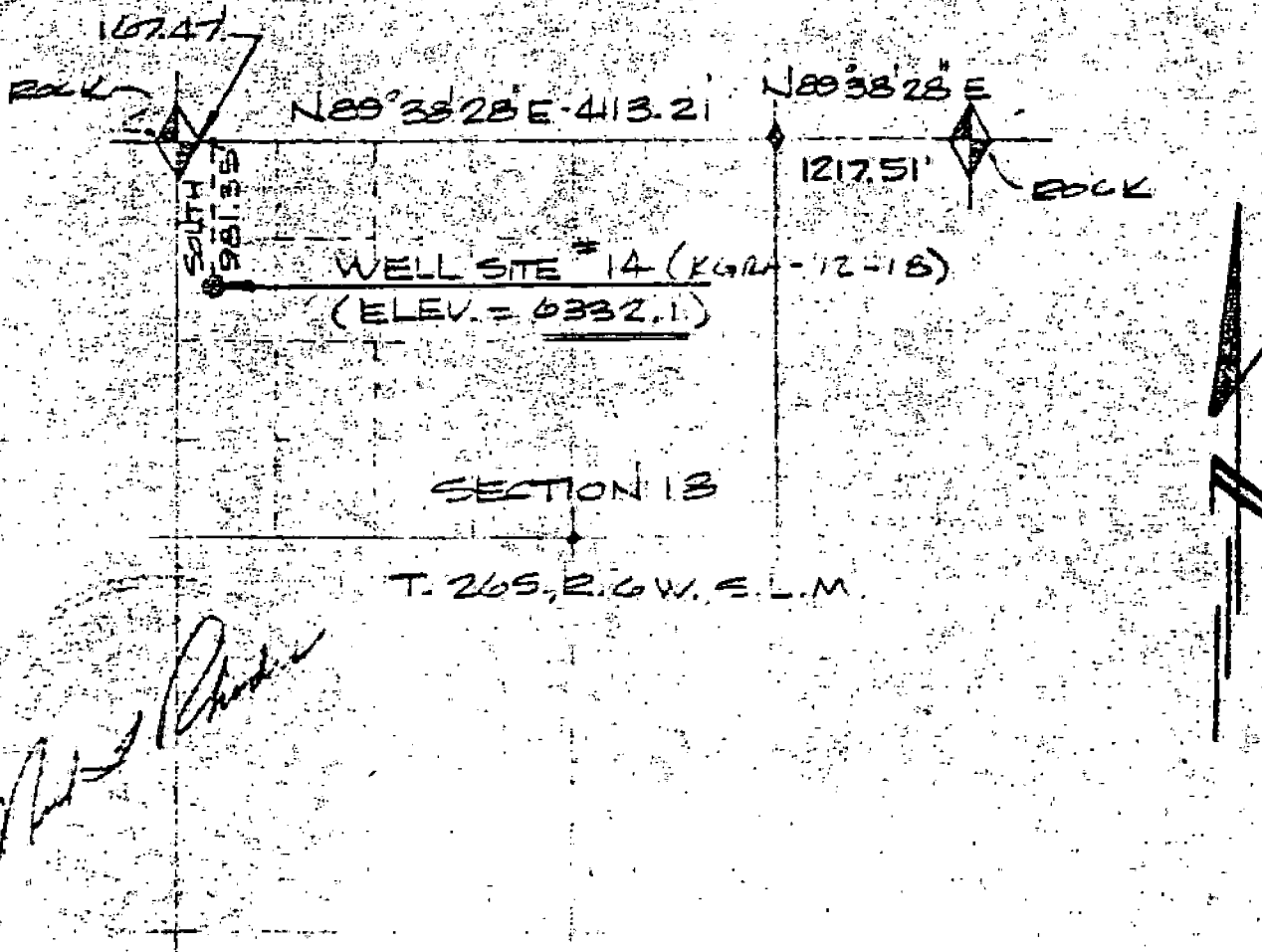
STATE:

Utah

ELEVATION:

(Ground level) 6,332.1 feet above  
mean sea level

Bench mark = brass cap with steel post alongside;  
274 feet Southeasterly from Well #14  
wellhead = elev. 6,346.57



**BULLOCH BROS.  
ENGINEERING INC.**  
CEDAR CITY, UTAH

WELL LOCATION  
MAP FOR  
**UNION OIL CO.**  
SANTA ROSA, CALIF.

REVISED / 11/77  
DECEMBER, 1976  
SCALE 1" = 1320'  
DRAWN J. TEJMEZ

OPERATOR:

Union Oil of California  
P.O. Box 6854  
Santa Rosa, California 95405

WELL NUMBER:

Number 15 (KGRA-12-17)

LOCATION:

Section 17, T26S, R6W, SLM

COUNTY:

Beaver

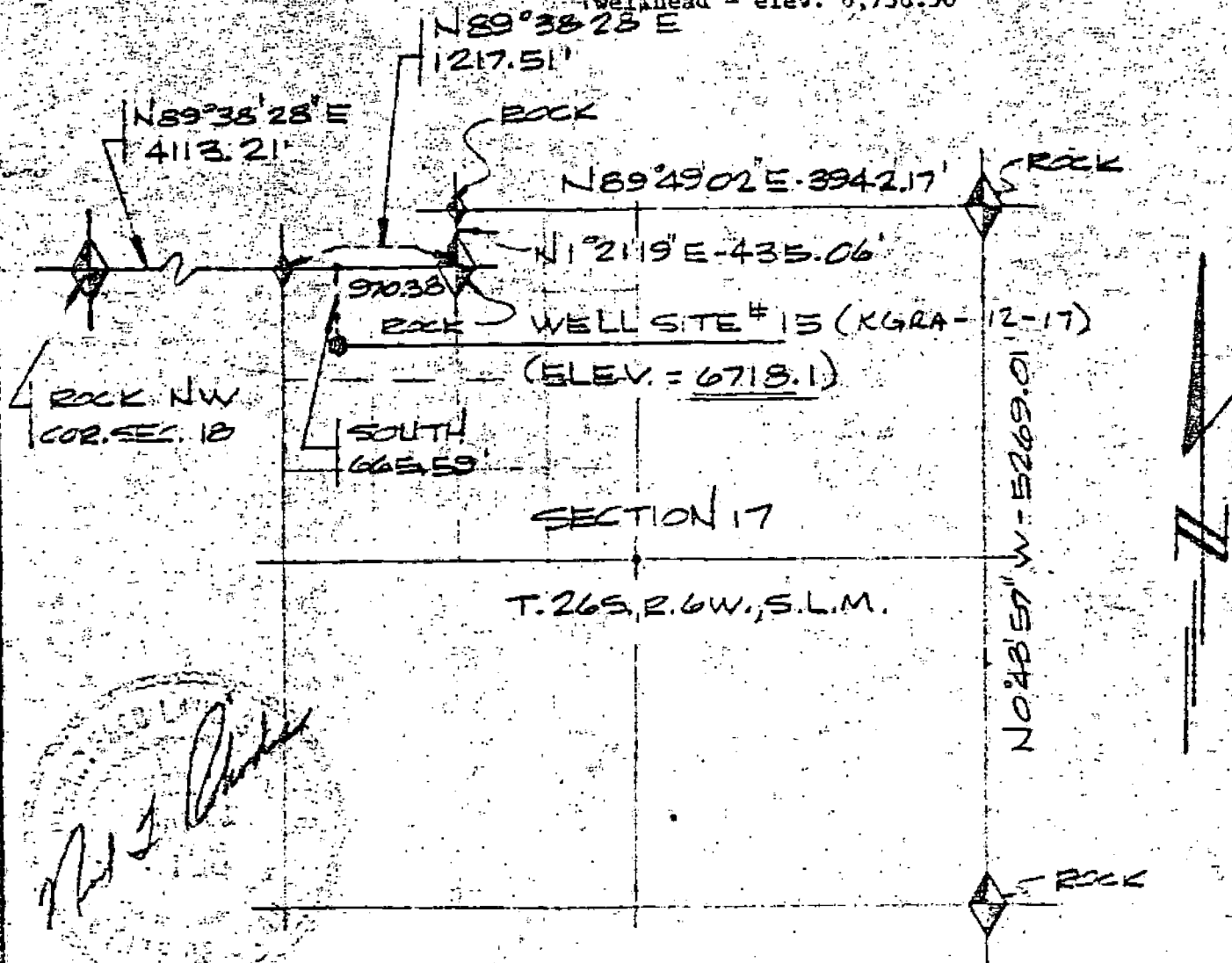
STATE:

Utah

ELEVATION:

(Ground level) 6,718.1 feet above  
mean sea level.

Bench mark = brass cap with steel post alongside;  
feet Southeasterly from Well #15  
wellhead = elev. 6,736.50



**BULLOCH BROS.  
ENGINEERING INC.**  
CEDAR CITY, UTAH

WELL LOCATION  
MAP FOR  
UNION OIL CO.  
SANTA ROSA, CALIF.

REVIS 1/17/77  
DECEMBER, 1976  
SCALE 1" = 1320'  
DRAWN J. ZIMMER

OPERATOR:

Union Oil of California  
P.O. Box 6854  
Santa Rosa, Ca 95405

WELL NUMBER:

Number 16 (KGRA-36-8)

LOCATION:

Section 8, T26S, R6W, S1M

COUNTY:

Beaver

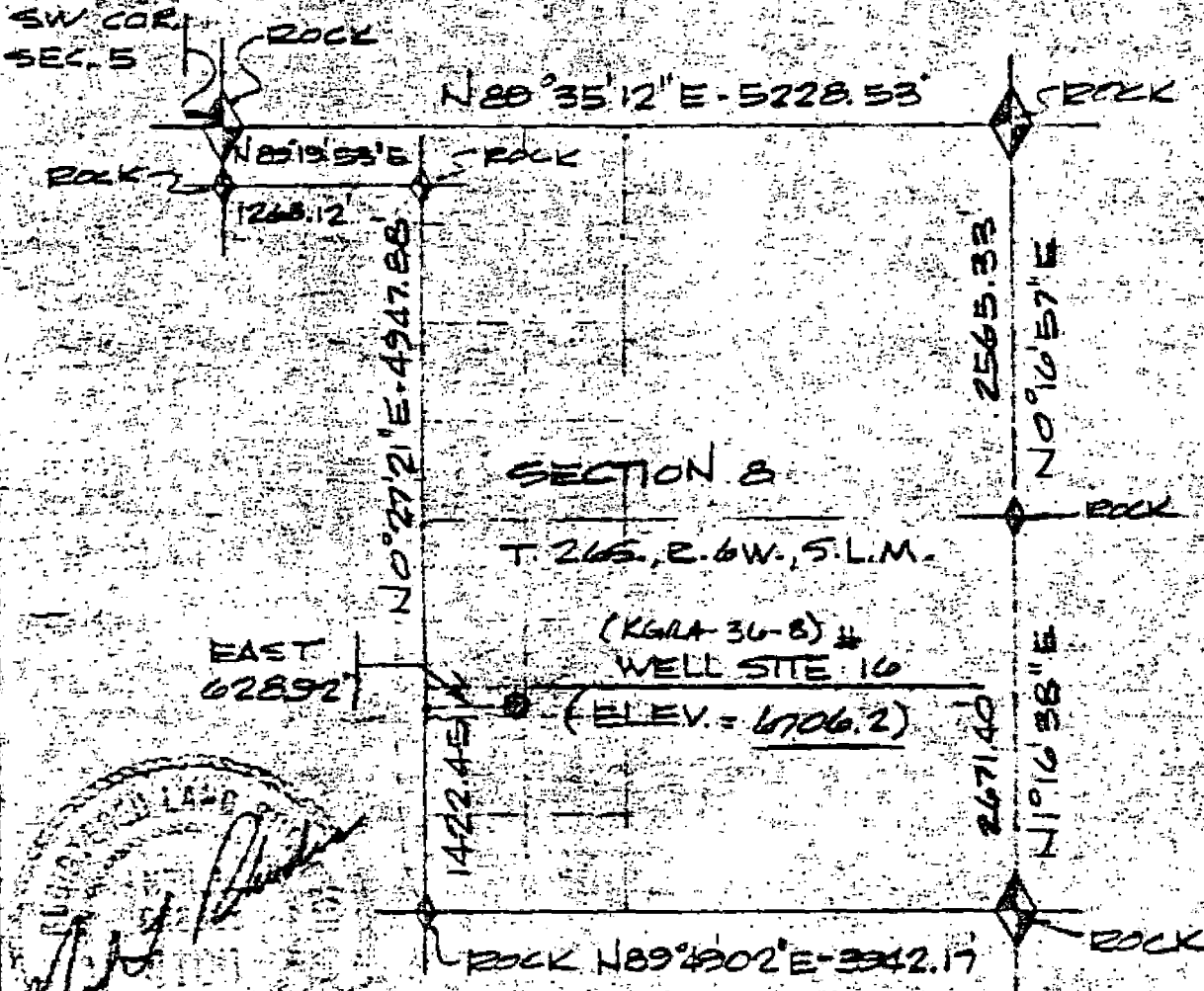
STATE:

Utah

ELEVATION:

(Ground level) 6,706.2 feet above  
mean sea level.

Bench mark = brass cap with steel post alongside;  
191 feet Southeasterly from Well #16  
wellhead = elev. 6,722.88



**BULLOCH BROS.**  
**ENGINEERING INC.**  
CEDAR CITY, UTAH

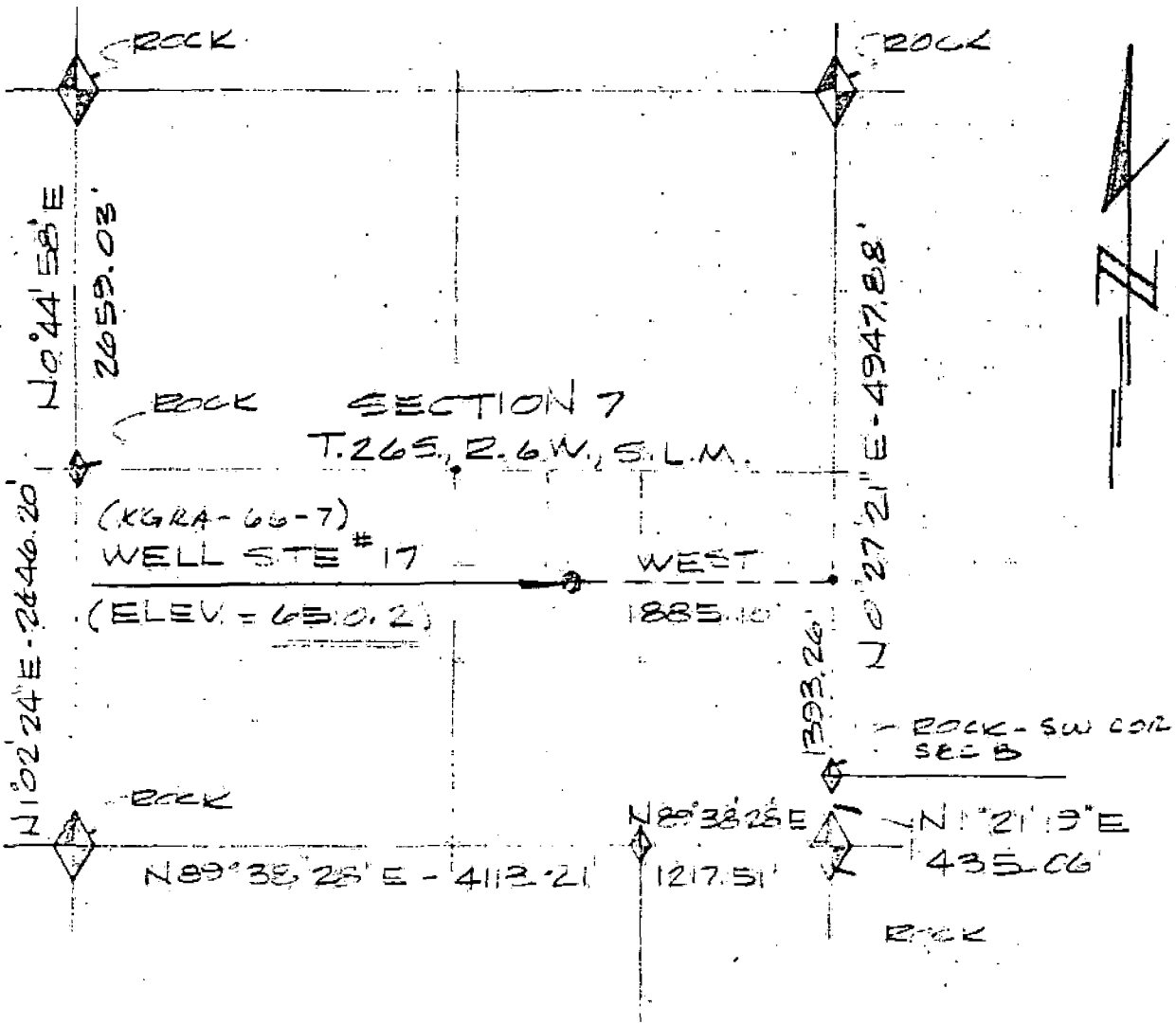
WELL LOCATION  
MAP FOR  
**UNION OIL CO.**  
SANTA ROSA, CALIF.

REV'D 7/17/77  
DECEMBER, 1976  
SCALE 1" = 1320'  
DRAWN J. TRIMMER

OPERATOR: Union Oil of California  
 P.O. Box 6854  
 Santa Rosa, Ca 95405  
 WELL NUMBER: Number 17 (KGRA-66-7)  
 LOCATION: Section 7, T26S, R6W, SLM  
 COUNTY: Beaver  
 STATE: Utah  
 ELEVATION: (Ground level) 6,510.2 feet above  
 mean sea level.

Bench mark = brass cap with steel post, alongside;  
 187 feet Easterly from Well #17  
 wellhead = elev. 6,522.98

*Handwritten signature: Neil J. Bulloch*



**BULLOCH BROS.**  
**ENGINEERING INC.**  
 CEDAR CITY, UTAH

WELL LOCATION  
 MAP FOR  
 UNION OIL CO.  
 SANTA ROSA, CALIF.

REVD 1/17/77  
 DECEMBER, 1976  
 SCALE 1" = 1320'  
 DRAWN J. TEMMERER

OPERATOR:

Union Oil of California  
P.O. Box 6854  
Santa Rosa, Ca 95405

WELL NUMBER:

Number 18 (KGRA-42-7)

LOCATION:

Section 7, T26S, R6W, SLM

COUNTY:

Beaver

STATE:

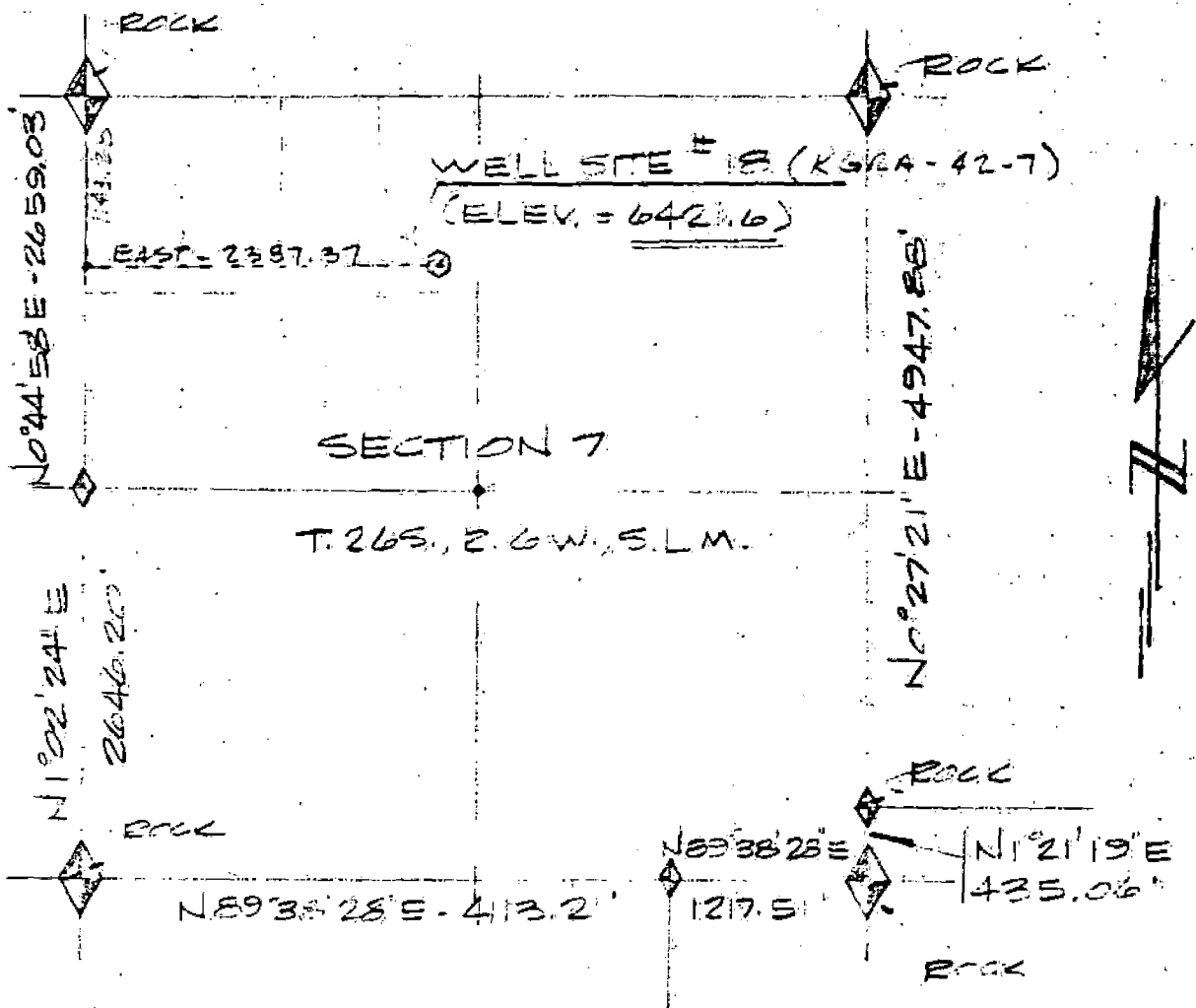
Utah

ELEVATION:

(Ground level) 6,421.6 feet above  
mean sea level.

Bench mark = brass cap with steel post alongside;  
132 feet Northeastly from Well #18  
wellhead = elev. 6,419.95

*Handwritten signature: M. S. ...*



**BULLOCH BROS.  
ENGINEERING INC.**  
CEDAR CITY, UTAH

WELL LOCATION  
MAP FOR  
UNION OIL CO.  
SANTA ROSA, CALIF.

REV'D 1/17/76  
DECEMBER, 1976  
SCALE 1" = 1320'  
DRAWN J. TRIMMER

OPERATOR: Union Oil of California  
P.O. Box 6854  
Santa Rosa, California 95405

WELL NUMBER: Number 19 (KGRA-46-6)

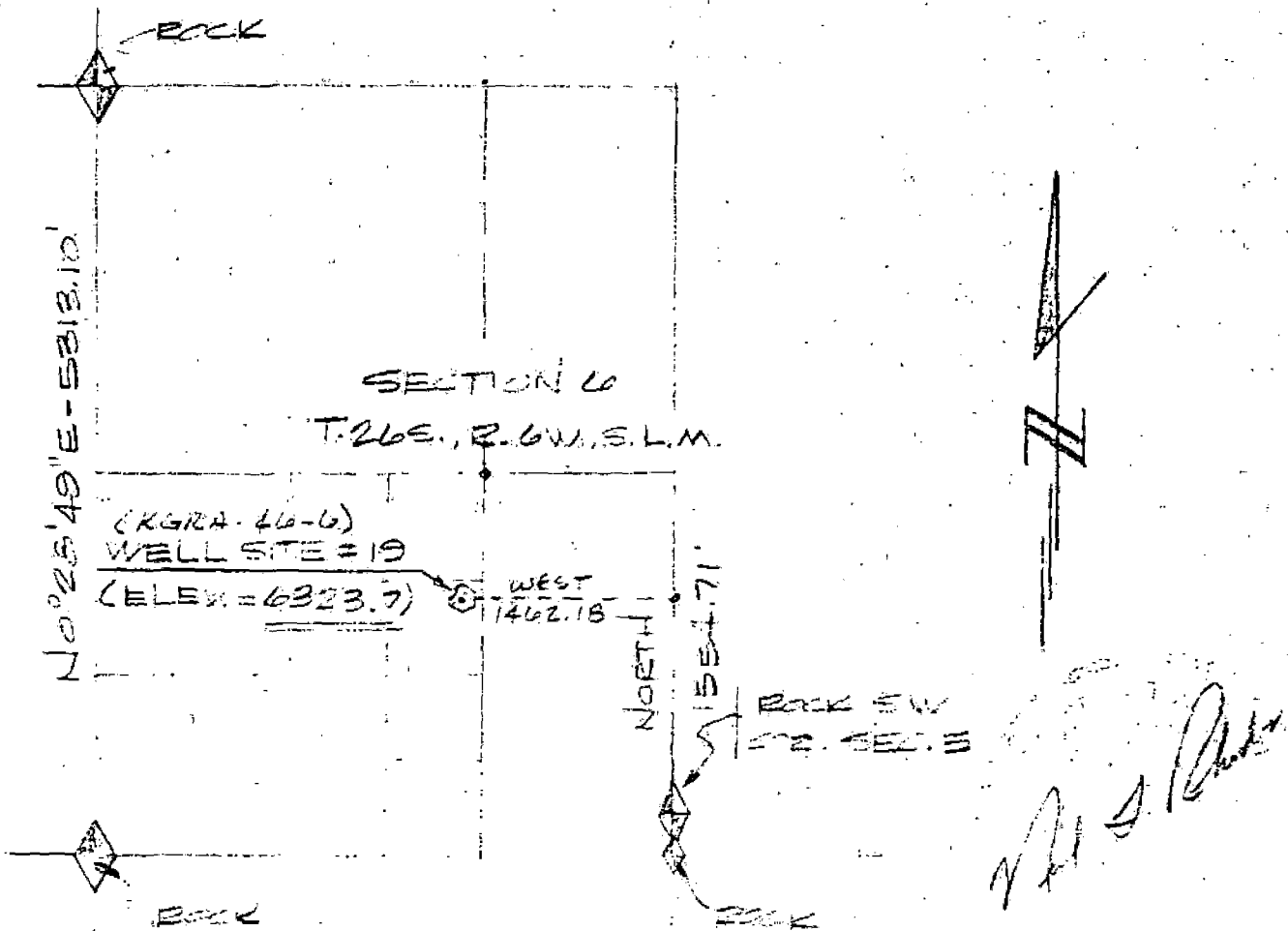
LOCATION: Section 6, T26S, R6W, SLM

COUNTY: Millard

STATE: Utah

ELEVATION: (Ground level) 6,323.7 feet above  
mean sea level

Bench mark = brass cap with steel post alongside;  
261 feet Northeastly from Well #19  
wellhead = elev. 6,338.02



**BULLOCH BROS.**  
**ENGINEERING INC.**  
CEDAR CITY, UTAH

WELL LOCATION  
MAP FOR  
**UNION OIL CO.**  
SANTA ROSA, CALIF.

SEPTEMBER 1976  
SCALE 1" = 13221'  
DRAWN J. TIMMER



OPERATOR: Union Oil of California  
 P.O. Box 6854  
 Santa Rosa, California 95405

WELL NUMBER: Number 20 (KGRA-32-6)

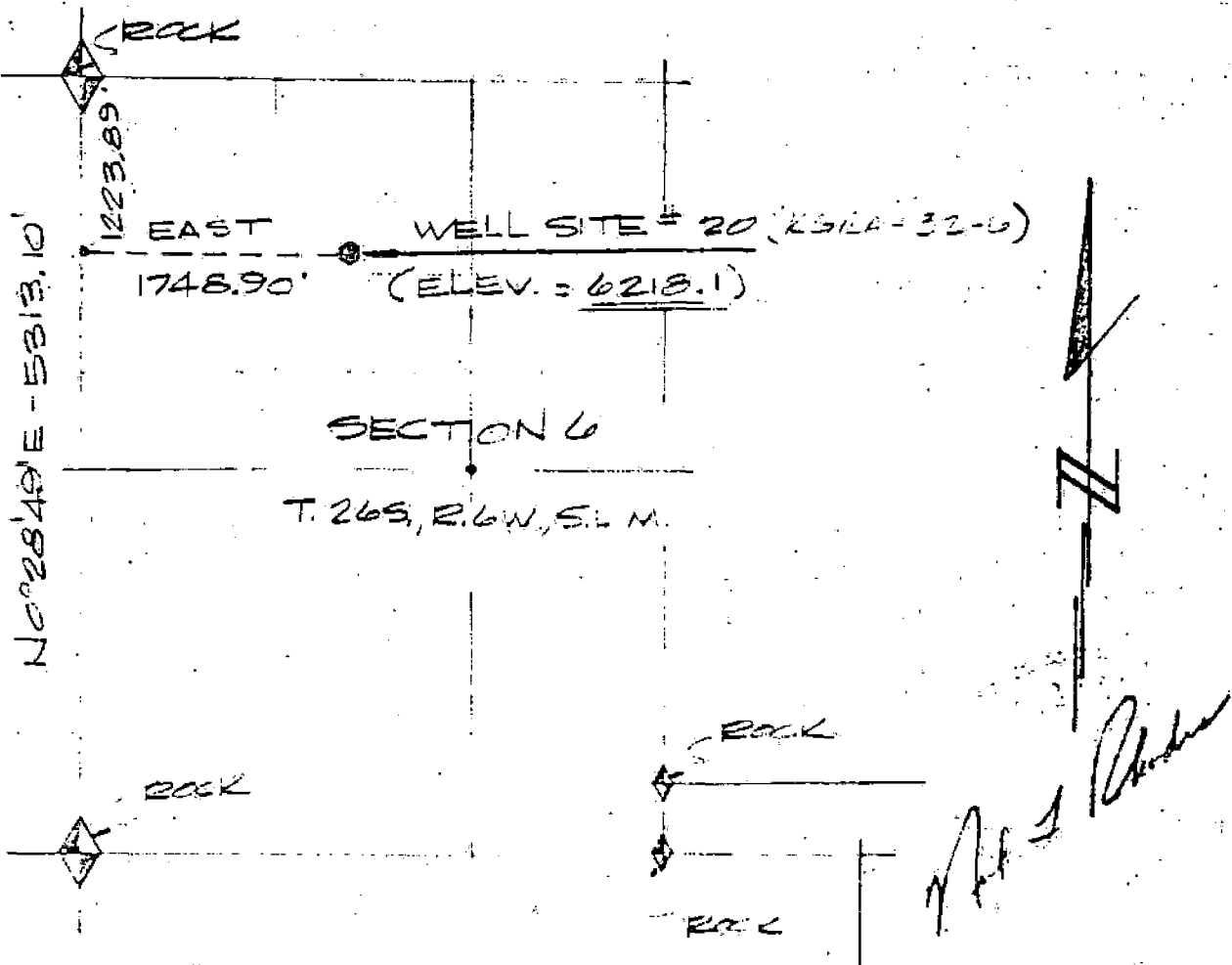
LOCATION: Section 6, T26S, R6W, SLM

COUNTY: Millard

STATE: Utah

ELEVATION: (Ground level) 6,218.1 feet above  
 mean sea level.

Bench mark = brass cap with steel post alongside;  
 264 feet Southeasterly from Well #20  
 wellhead = elev. 6,237.67



**BULLOCH BROS.**  
**ENGINEERING INC.**  
 CEDAR CITY, UTAH

WELL LOCATION  
 MAP FOR  
 UNION OIL CO.  
 SANTA ROSA, CALIF.

REVISED TO  
 DECEMBER, 1976  
 SCALE 1" = 1320'  
 DRAWN J. TRIMMER

OPERATOR: Union Oil of California  
 P.O. Box 6854  
 Santa Rosa, California 95405

WELL NUMBER: Number 21 (KGRA-67-31)

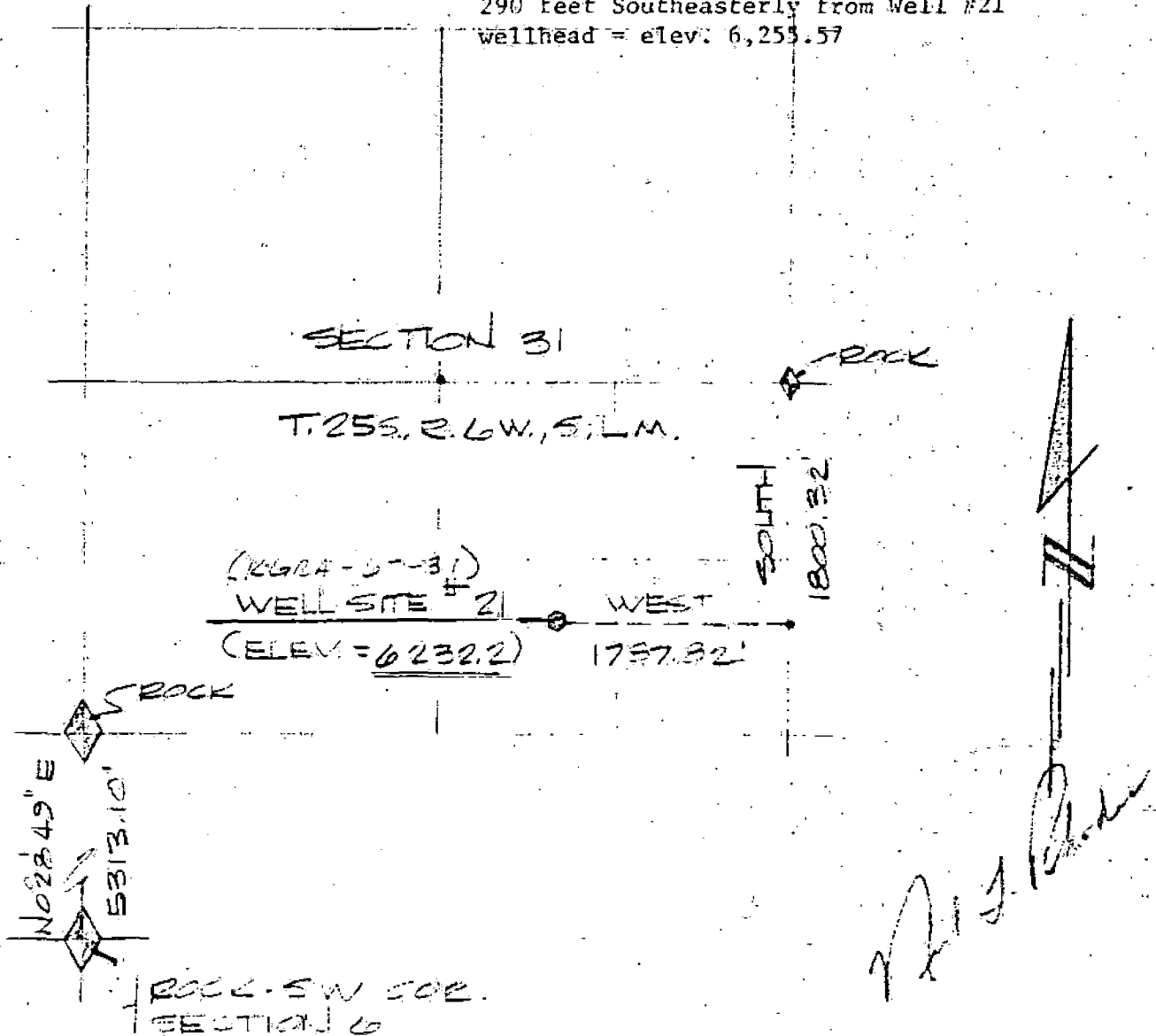
LOCATION: Section 31, T25S, R6W, S1M

COUNTY: Millard

STATE: Utah

ELEVATION: (Ground level) 6,232.2 feet above  
 mean sea level.

Bench mark = brass cap with steel post alongside;  
 290 feet Southeasterly from Well #21  
 wellhead = elev: 6,255.57



<b>BULLOCH BROS.</b> <b>ENGINEERING INC.</b> CEDAR CITY, UTAH	WELL LOCATION MAP FOR UNION OIL CO.	REV'D 1/1/77 DECEMBER, 1976
	SANTA ROSA OILFIELD	SCALE 1" = 200'
	DRAWN J. T. HINES	

**OPERATOR:** Union Oil of California  
 P.O. Box 6854  
 Santa Rosa, California 95405  
**WELL NUMBER:** Number 22 (KGRA-34-32)  
**LOCATION:** UNSURVEYED AREA, T25S, R6W, SLM  
**COUNTY:** Millard  
**STATE:** Utah  
**ELEVATION:** (Ground level) 6,293.3 feet above  
 mean sea level  
 Bench mark = brass cap with steel post alongside:  
 191 feet Southeasterly from Well #22  
 wellhead = elev. 6,314.92

*Handwritten signature*

SECTION 29

E/4 SW COR.  
SECTION 28

S89°28'18"E  
2629.88'

UNSURVEYED AREA

BOX  
S/4 COR.  
SEC. 28

NORTH 124.20' — EAST 1587.95' — WELL SITE # 22 (KGRA-34-32)  
 (ELEV. = 6293.3)

E/4 COR.  
SEC. 31

UNSURVEYED AREA

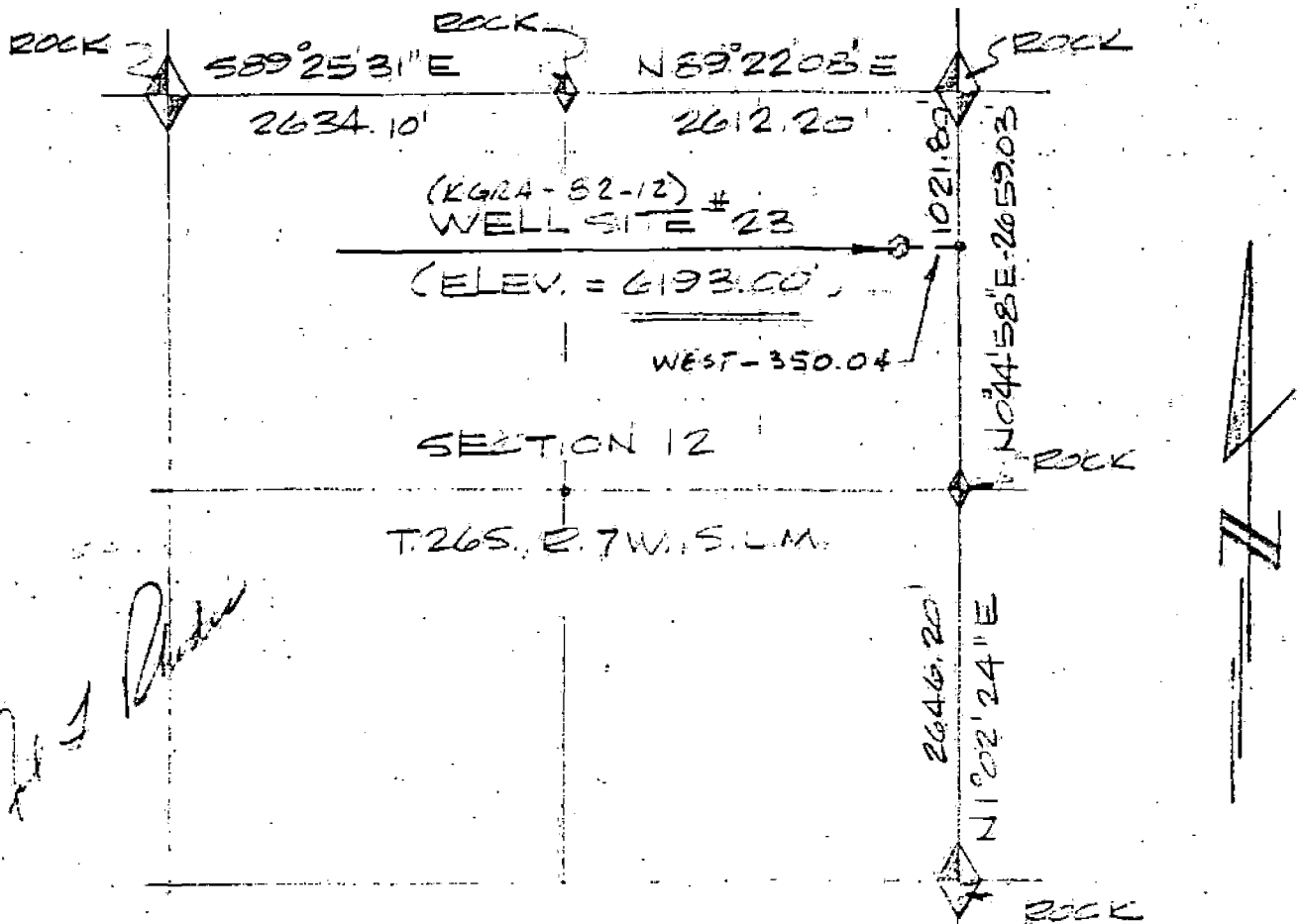
**BULLOCH BROS.**  
**ENGINEERING INC.**  
 CEDAR CITY, UTAH

WELL LOCATION  
 MAP FOR  
**UNION OIL CO.**  
 SANTA ROSA, CALIF.

REV'D. 1/17/77  
 DECEMBER, 1976  
 SCALE 1" = 1320'  
 DRAWN J. TRIMMER

OPERATOR: Union Oil of California.  
 P.O. Box 6854  
 Santa Rosa, California 95405  
 WELL NUMBER: Number 23 (KGRA-82-12)  
 LOCATION: Section 12, T26S, R7W, SLM  
 COUNTY: Beaver  
 STATE: Utah  
 ELEVATION: (Ground level) 6,193.0 feet above  
 mean sea level.

Bench mark = brass cap with steel post alongside;  
 357 feet Northerly from Well #23  
 wellhead = elev. 6,186.42



**BULLOCH BROS.**  
**ENGINEERING INC.**  
 CEDAR CITY, UTAH

WELL LOCATION  
 N.L.P. FOR  
 UNION OIL CO.  
 SANTA ROSA CALIF.

REV'D 1/20/77  
 DECEMBER, 1976  
 SCALE 1" = 1335'  
 DRAWN J. TRIMMER

EXHIBIT "D" - SUMMARY

UNION OIL COMPANY OF CALIFORNIA  
 COVE FORT PROSPECT (UTAH)  
 SURVEYED LOCATIONS - FEDERAL LEASES

CONFIDENTIAL

This document contains confidential information which is proprietary to Union Oil Co. of Calif. The contents of this document are not to be re-ferred to any person without the express written consent of Union Oil Co. of California.

<u>SITE NO.</u>	<u>KGRA WELL NUMBER</u>	<u>FEDERAL LEASE NUMBER</u>	<u>ELEVATION FEET MSL</u>	<u>LOCATION</u>
1	56-30	U-29553	6161.5	S. 1009.44' and W. 2255.82' From E $\frac{1}{4}$ Corner Section 30, T25S-R6W, SLM
2	14-29	U-29553	6215.4	N. 0° 49' 37" E. 32.99' and E.141.64' From W $\frac{1}{4}$ Corner Section 29, T25S-R6W, SLM
3	26-20	U-29554	6419.1	N. 0° 44' 41" E. 361.56' and E.1180.27' From SW Corner Section 20, T26S-R6W, SLM
4	33-29	U-29553	6262.0	S. 89° 56' 44" W. 778.65' and S.1445.0' From N $\frac{1}{4}$ Corner Section 29, T25S-R6W, SLM
5	44-28	U-29554	6481.9	S. 0° 07' 27" E.2346.02' and E. 2013.9' From the NE Corner Section 19, T25S-R6W, SLM
6	17-29	U-29553	6154.9	S. 1824.33' and E.622.31' From W $\frac{1}{4}$ Corner Section 29, T25S-R6W, SLM
7	66-28	U-29554	6449.2	E. 912.72' and N.1405.61' From S $\frac{1}{4}$ Section 28, T25S-R6W, SLM

Cove Fort Prospect (Utah)  
 Surveyed Locations - Federal Leases

<u>SITE NO.</u>	<u>KGRA WELL NUMBER</u>	<u>FEDERAL LEASE NUMBER</u>	<u>ELEVATION FEET MSL</u>	<u>LOCATION</u>
8	71-33	U-29555	6509.8	E.1355.51' and S.116.64' From S $\frac{1}{4}$ Corner Section 28, T25S-R6W, SLM
9	74-33	U-29555	6657.8	E.1542.22' and S.2198.2' From S $\frac{1}{4}$ Corner Section 28, T25S-R6W, SLM
10	53-33	U-29555	6607.8	E.267.26' and S.1663.83' From S $\frac{1}{4}$ Corner Section 28, T25S-R6W, SLM
11	31-33	U-29555	6481.4	N. 89° 28' 18" W.1092.23' and S.479.21' From S $\frac{1}{4}$ Corner Section 28, T25S-R6W, SLM
12	34-30	U-29553	6097.7	S. 89° 36' 11" E.1845.04' and S.2458.46' From NW Corner Section 30, T25S-R6W, SLM
13	45-12	U-29557	6113.6	S. 1° 02' 24" W.382.46' and E.3225.18' From E $\frac{1}{4}$ Corner Section 12, T26S-R7W, SLM
14	12-18	U-29558	6332.1	N. 89° 38' 28" E.167.47' and S.981.35' From NW Corner Section 18, T26S-R6W, SLM
15	12-17	U-29558	6718.1	S. 89° 38' 28" W.970.38' and S.665.59' From SE Corner Section 7, T26S-R6W, SLM
16	36-8	U-29558	6706.2	N. 0° 27' 21" E.1422.45' and E.628.92' From SW Corner Section 8, T26S-R6W, SLM
17	66-7	U-29558	6510.2	N. 0° 27' 21" E.1393.26' and W.1885.10' From SW Corner Section 8, T26S-R6W, SLM
18	42-7	U-29558	6421.6	S. 0° 44' 58" W.1143.28' and E.2387.37' From NW Corner Section 7, T26S-R6W, SLM

CONFIDENTIAL  
 This document contains confidential information which is proprietary to Union Oil Co. of Calif. The only use of this document is for the purpose of being furnished to any person with whom it is being discussed by Union Oil Co. of Calif.

Cove Fort Prospect (Utah)  
 Surveyed Locations - Federal Leases

-3-

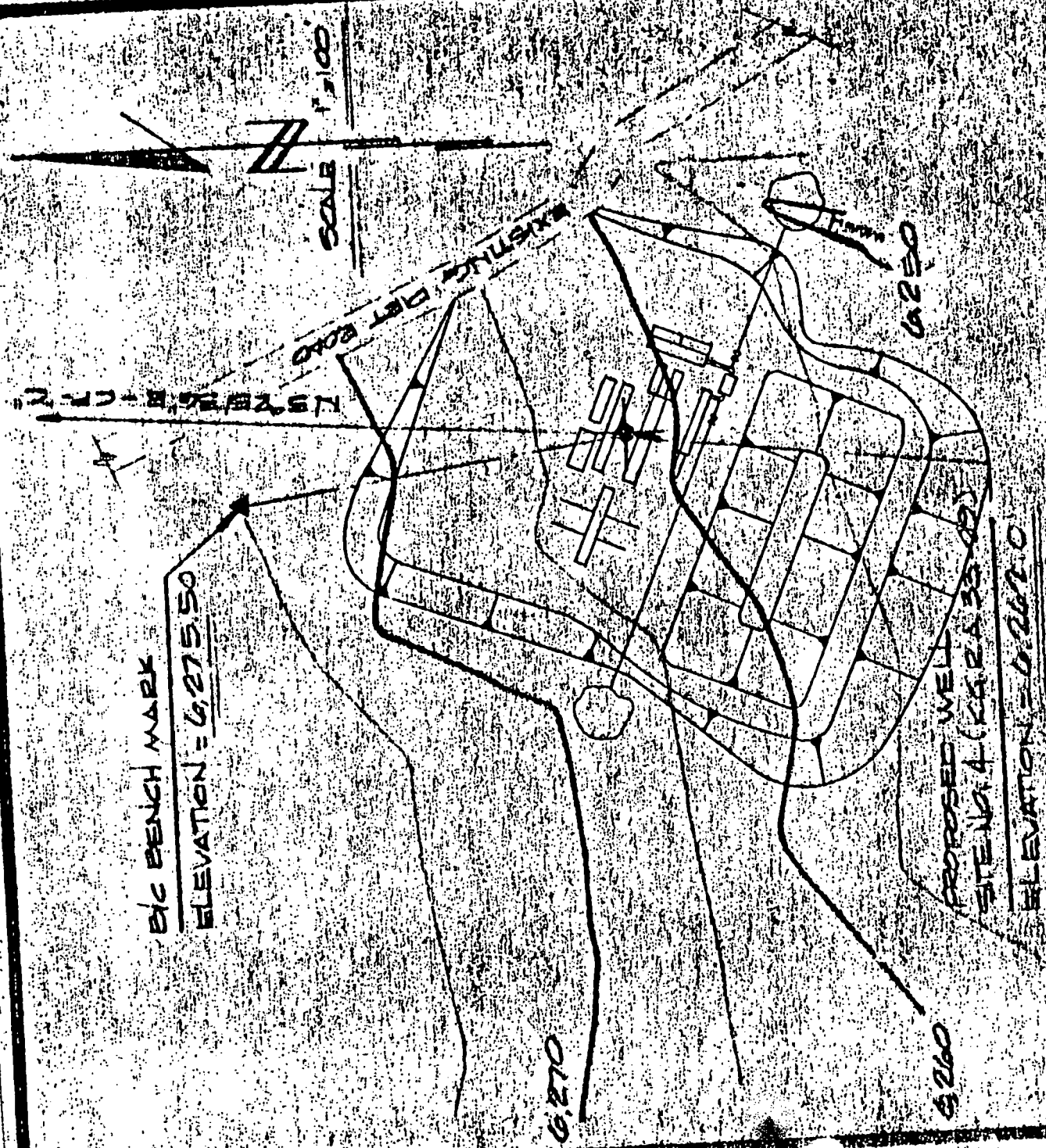
<u>SITE NO.</u>	<u>KGRA WELL NUMBER</u>	<u>FEDERAL LEASE NUMBER</u>	<u>ELEVATION FEET MSL</u>	<u>LOCATION</u>
19	46-6	U-29556	6323.7	N.1554.71' and W.1462.18' From SW Corner Section 5, T26S-R6W, SLM
20	32-6	U-29556	6218.1	S. 0° 28' 49" W.1223.89' and E.1748.9' From NW Corner, Section 6, T26S-R6W, SLM
21	67-31	U-29555	6232.2	S.1800.32' and W.1787.82' From E½ Corner Section 31, T25S-R6W, SLM
22	34-32	U-29555	6293.3	N.124.2' and E.1587.95' From E½ Corner Section 31, T25S-R6W, SLM
23	82-12	U-29557	6193.0	S. 0° 44' 58" W.1021.80' and W.350.04' From NE Corner Section 12, T26S-R7W, SLM

CONFIDENTIAL

This document contains confidential information which is proprietary to Union Oil Co. of Calif. The contents of this document are not to be revealed to any person without the express written consent of Union Oil Co. of California.



EXHIBIT "E" - SURFACE CONTOURS, SUMP, AND EQUIPMENT LOCATION



B/C BENCH MARK  
 ELEVATION = 6,275.50

SCALE 1" = 100'

EXISTING PAT. ROAD

PROPOSED WELL  
 SITE NO. 4 (K.G. 2A 33-29)  
 ELEVATION = 6,267.0

Pad elevation = 6260'

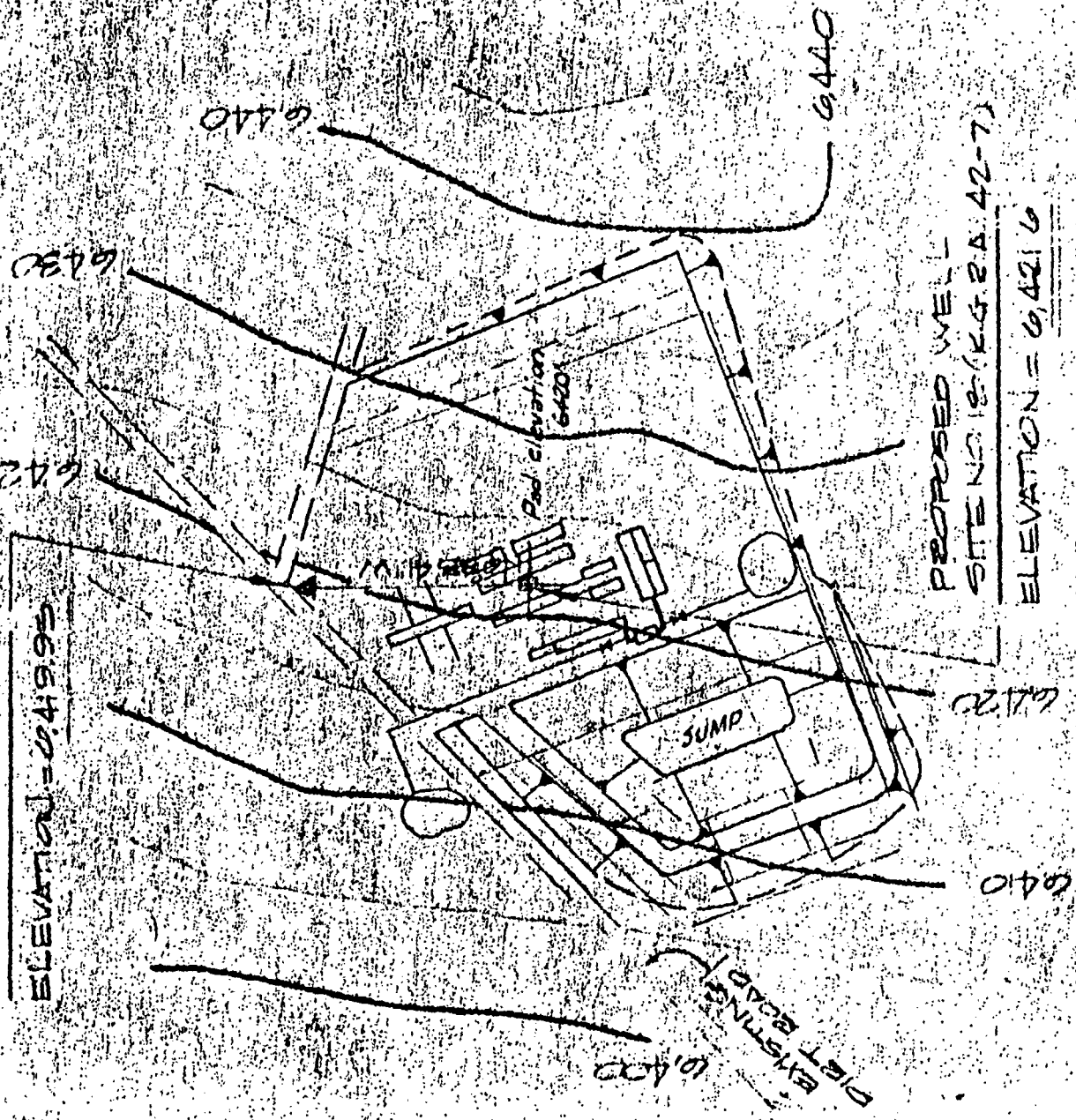
See details of work equipment  
 for equipment description.

**BULLOCH BROS.  
 ENGINEERING INC.**  
 CECIL CITY, UTAH

TOPOGRAPHIC MAP  
 OF  
**WELL SITE NO. 4**  
 (K.G. 2A 33-29)

UNION OIL CO.  
 SANTA RITA, CALIF.  
 SCALE 1" = 100'  
 DRAWN J. TEJEMEE

EXIST. BENCH MARK  
ELEVATION = 6419.95



PROPOSED WELL  
SITE NO. 18 (K.G. 2.A. 42-7)  
ELEVATION = 6421.6

SCALE  
1"=10'

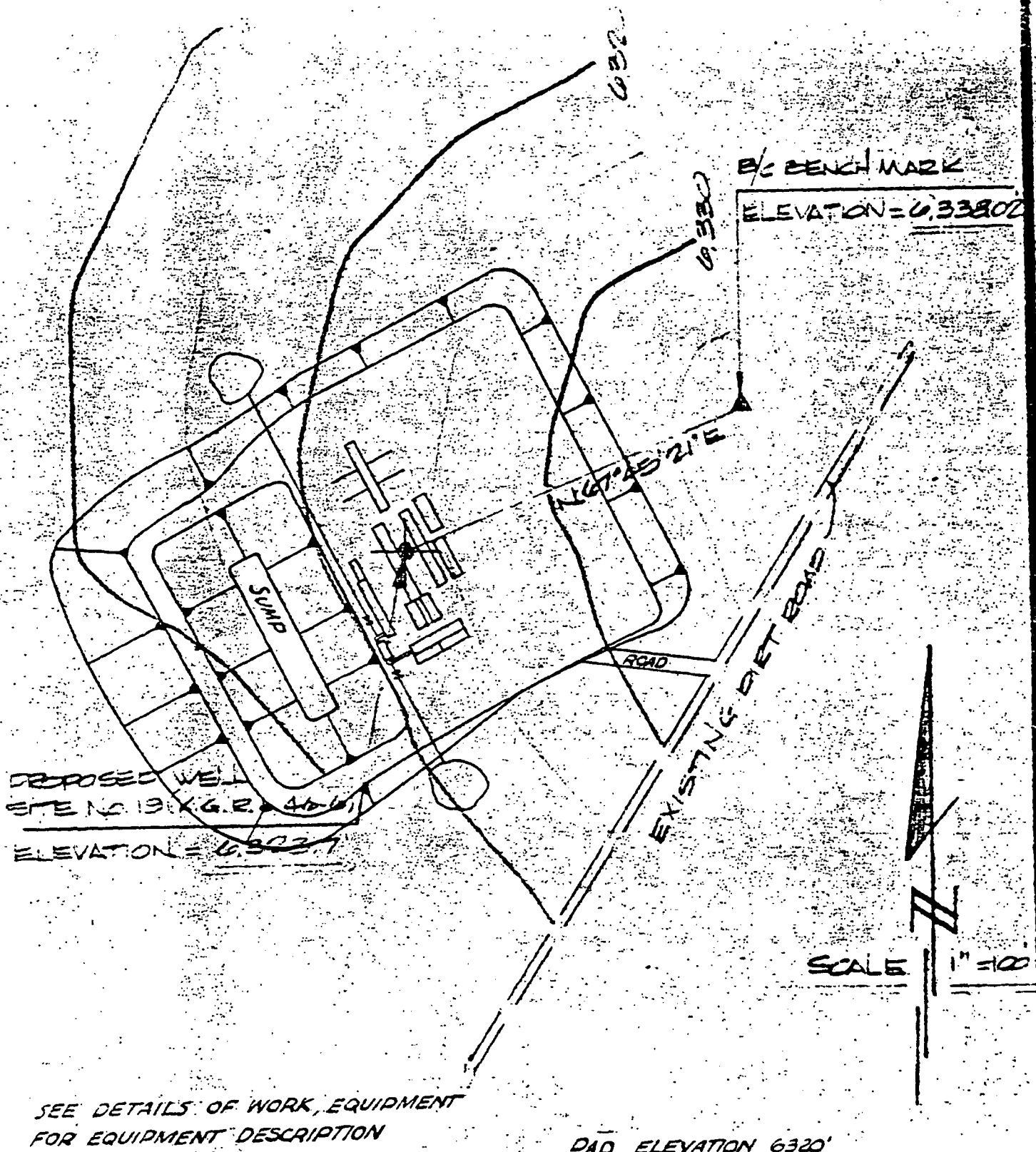
See details of work equipment  
for equipment identification

**BULLOCH BROS.  
ENGINEERING INC.**

CEDAR CITY, UTAH

TOP-SHEAR'S NAME  
WELLS TENDIS  
K 5 2 6 4 2 7

UNION STATE  
STATE OF UTAH  
SCALE 1"=10'  
DRAWN J. TEMMER



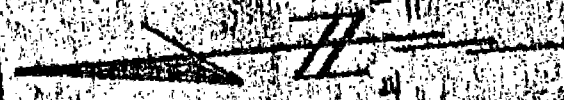
SEE DETAILS OF WORK, EQUIPMENT FOR EQUIPMENT DESCRIPTION

PAD ELEVATION 6320'

**BULLOCH BROS.**  
**ENGINEERING INC.**  
 CEDAR CITY, UTAH

TOPOGRAPHIC MAP  
 OF  
 WELL SITE NO. 19  
 (K.G.R. 46-6)

UNION C. L. CO.  
 S.W. 1/4 R. 24 S. 10 T. 12 N. R. 10 E.  
 SCALE 1" = 100'  
 DRAWN BY TEINER



SCALE

Drainage diversion ditch



PROPOSED WELL  
SITE NO. 12 (K.G. 24-32)  
ELEVATION = 6293.3

BENCH MARK  
ELEVATION = 6314.92

See details of work equipment for  
equipment identification.

Pad elevation = 6290'

<p><b>BULLOCH BROS. ENGINEERING INC.</b> CEDAR CITY, UTAH</p>	<p>TOPOGRAPHIC MAP OF WELL SITE NO. 12 (K.G. 24-32)</p>	<p>UNION OIL CO. SANTA BEA, CALIF. SCALE 1" = 50' TRAN. # 21112</p>
---	---	---

EXHIBIT "F" - ARCHAEOLOGICAL REPORT AND GEOLOGICAL MAP

AN ARCHEOLOGICAL SURVEY OF DRILL SITES AND ROADS IN THE  
COVE FORT GEOTHERMAL FIELD IN  
MILLARD AND BEAVER COUNTIES, UTAH

Submitted to the  
United States Forest Service  
to the  
Bureau of Land Management  
and to the  
Antiquities Section of the  
Utah State Division of History

by  
Richard A. Thompson  
in behalf of the  
Union Oil Company of California,  
Los Angeles, California

November 20, 1976

AN ARCHEOLOGICAL SURVEY OF DRILL SITES AND ROADS IN THE  
COVE FORT GEOTHERMAL FIELD IN  
MILLARD AND BEAVER COUNTIES, UTAH

This paper reports the results of an archeological survey undertaken at the request of the Geothermal Division of the Union Oil Co. of Los Angeles, California. The areas examined in this work are contained within the Cove Fort Geothermal Field of Millard and Beaver Counties, Utah. The greater portion of the field lies within the boundaries of the Fishlake National Forest but a strip of land along its western edge is administered by the Cedar City and the Richfield Districts of the Bureau of Land Management. The survey was authorized by a permit issued by the United States Forest Service, by Department of the Interior Antiquities Permit No. 75-UT-022, and by Utah State Antiquities Permit No. 203.

The project called for an examination of 23 drill pad sites averaging between 2 1/2 and 3 acres each. Surveys were also made along 6 1/2 miles of existing roads and tracks planned for regrading and over slightly less than 1 1/2 miles of projected new road. All drill sites had been previously flagged at the drill point and at each corner of the site area. Centerline stakes were also set for all proposed new roads. Existing roads for which improvement is planned were not flagged but were marked on the project map.

The entire survey was done by the writer. Pad sites were examined by making a series of walking passes over each site at 12 meter intervals. In each case the first pass was made directly along one boundary in order to provide some coverage just outside the area. Passes were then continued in each direction at the intervals indicated until the opposite boundary of the site was reached.

In order to survey routes for proposed new roads, the writer walked each route at a point 5 meters to one side of the centerline stakes. The process was repeated on the opposite side of the stakes on the return. This provided fairly intensive coverage of a corridor between 20 and 25 meters wide.

Existing roads were examined by walking along one side of the road in one direction and then returning on the opposite side. Since these roads were not flagged, the survey expanded its coverage at the point of any sharp curves where significant realignment might be required in order that the road would



be able to accommodate the heavy equipment that will be brought into the area. An examination of roads previously graded by this and by other exploration companies has shown that their concern has consistently been for the improvement of road surfaces and the reduction of sharp turns. Beyond this, there has been no attempt to significantly widen roads.

The westerly flowing intermittent Cove Creek divides the Cove Fort Geothermal Field rather naturally into northern and southern sections. Map #1 in this report delineates the project details for the northern section. For convenience in presentation, however, it also includes drill sites #8 through #11 which properly belong in the southern section since they are located south of Cove Creek. The southern portion of the project area is covered in Map #2.

There appears to be some limestone in the project area but the dominant geological formation seems to involve igneous materials with which the writer is unfamiliar. Basalts were observed only to the west of the old highway route of U.S. 91 which extends along the western edge of the Cove Fort Field. The entire geothermal field extends from the lowest slopes of the eastern side of Cove Fort Valley up to the base of the higher ranges further east. This eastern boundary is marked by the Pavant Range in the northern section and by the Tushar Mountains in the south. The entire area was once covered by a fairly dense juniper-pinon stand but selected units in the Fishlake National Forest have been chained and some were seeded a number of years ago.

In the northern section, the western boundary of the chained area follows the line dividing sections 30 and 29. It extends from drill site #6 in the southwest to a point just north of pad #3 in the north. From there the edge of the chained area follows an irregular course to a point just east of site #5. From this point the chaining boundary runs west roughly parallel to old State Route 4 and the modern I-70 back to pad #6.

In the southern section, just south of Cove Creek, drill site #8 is located in a gravel pit which is at the western end of a narrow chained and seeded area about three quarters of a mile long. Also in the southern section is an extensive chained zone that begins at a steep wash located on the south side of drill site #19 and which extends north to a point about one quarter of a mile north of pad #21. The eastern edge of this chaining unit roughly parallels the road connecting drill sites #19, #20, and #21 at a point about 100 meters east of the road. The chaining extends as far west as the National Forest boundary.

In the northern section, drill sites #1 and #12 are on lands administered by the Richfield District of the Bureau of Land Management. In the southern section, meanwhile, pads #13 and #23 are on the lands of the Cedar City District of the Bureau of Land Management. All other sites and all of the roads surveyed fall within the jurisdiction of the Fishlake National Forest.

The very extensive juniper-pinon stand which, even after considerable chaining, dominates these lands in combination with scrub oak and assorted browse plants, supports one of the more populous deer herds in the southwestern part of the state. The stability of the size of this herd is undoubtedly abetted by the presence of at least four springs in the southern section. In addition to North and South Springs, two that are unnamed on the maps appear to provide year round water. Although at least three of these springs currently supply water to the mine at Sulphurdale, all have some overflow at their source which would seem to be more than adequate for the game of the area.

With the abundance of game, the availability of water, the possibility of pine nut harvests as well as other floral and faunal assets that may not have been apparent during the course of this work, some abundance of cultural resources was expected. It was assumed that an area such as this should produce some indication of human use at least as early as the late archaic. The position of the district further suggested that there might be evidence of use, if not occupation, by Parowan and/or Sevier Fremont peoples. Finally, there seemed to be reason to expect at least some of the characteristically dim traces of Southern Paiute use.

Even these rather modest expectations were rather rudely destroyed when it was found that the entire project produced only two sites indicative of prehistoric activity. One of these, 42-Be-298 (Map #2), was found by accident outside the project area on the last day of work in the field. The second site, marked B (Map #1) was located some 200 meters west of drill site #9 directly under the Sigurd-Cedar City power transmission line. It had been recorded and tested by a team from Brigham Young University during their 1975 survey of the line. The actual site number is not yet available since the site records search was not completed at the time this paper was prepared.

Site 42-Be-298 is located in the southeastern corner of the SE 1/4 of section 12, T26S, R6W. A substantial concentration of both obsidian and chalcedony flakes lay on a gentle slope of mixed sand and gravel in a slightly open area in what is otherwise a dense juniper-pinon stand. Some sage brush

and scrub oak was noted along with a few examples of unidentified browse plants. The site area, which was not collected, was some 20 meters in diameter. While some flakes were utilized, no artifacts or artifact fragments could be found. Secondary and tertiary flakes predominated while cores and primary flakes were lacking.

While as many as two or three flakes were found at a number of drill sites, notably on #2, #4, #17, #18, #19, and #23, each flake proved to be an isolated find without other cultural debris in association. At only two drill pads, #12 and #14, could a significant number of flakes be found within reasonable proximity to each other. Even in these instances the scatter was rather diffuse. In both instances the flakes were found near the eastern or upslope edges of the trace and in both cases the flakes were confined to the shallow, sandy drainage swales. It seemed likely that this material was moving down slope with the runoff of each rain. Although attempts were made to find uphill sources of this debris, both efforts proved fruitless. At each pad, a point was selected in an area where flakes appeared to be most numerous. A 30 x 30 x 30 cm test probe was then made. No evidence of midden or of subsurface cultural debris was found. On the basis of this it was concluded that neither scatter could properly be termed an archeological site.

During the course of the entire survey, only a single find produced potentially diagnostic evidence of prehistoric use or function beyond that contained in any collection of chipping detritus which included occasional utilized flake. In the northern unit on the right-of-way of a proposed road extending west from drill pad #2, a fragment of a bifacial metate was found in the bottom of a rather deep wash. The material proved to be a dense, dark gray, non-basalt stone. Although none of the edges remained, the even wear of the two very smooth use surfaces suggested an artifact more carefully fabricated than is customary with hunters and gatherers. Thus, at least tenuously, the fragment may be regarded as indicative of the presence of either Parowan or Sevier Fremont.

One remaining instance of possible evidence of human activity remains. In the northern section a long, low ridge of ground runs between drill sites #2 and #4. At scattered points along this hill a number of apparent cores were noted. These seem to be made of quartz and the manner in which this material fractures makes it difficult to establish modification by human agency with certainty. Circumstantially, however, these blockish cores may be presumed to be the result of human modification because it was found that all or nearly

all of the stream polished cortex had been removed from most specimens. Such a degree of alteration might occur in nature but human modification would appear to be more probable. No function for these cores is postulated.

With the promise of good resources in vegetation and game and with at least adequate water in some of the area, the surprisingly limited nature of the evidence of prehistoric activity should have an explanation. On the basis of study thus far, the entire geothermal field would seem to have been but lightly used. It remains, then, to ask if any survey data suggests variables that might account for such limited activity.

Only a more comprehensive study of the area holds any promise of definitive answers but some points do seem to be suggestive. First is the matter of the flaked stone observed. Nearly all flakes were either of obsidian or of high grade chalcedony. The obsidian included the mahogany form while the chalcedony is characterized by its smooth and rather "soapy" texture which is the trait of good flakes containing few impurities. Neither of these materials is native to the area. The obsidian almost certainly comes from the Mineral Mountain sources some 12 to 15 miles to the west. While other sources of chalcedony may exist, those known at this writing are found in the Beaver and Parowan valleys to the south.

Secondly, the conditions of the present assignment did not make possible a detailed examination of the floor of Cove Fort Valley. While the location of the pioneer Cove Fort itself argues that springs in the hills produced a year around supply of culinary water, the present day emphasis on dry farming in the valley suggests the possibility that water resources may never have been sufficient to support settlements of Fremont horticulturalists. Verification of this assumption would require a survey of the valley floor where evidence could be detected in spite of extensive agricultural disturbance.

The water factor further suggests alternatives to the Cove Fort area for prehistoric man. The well-watered Beaver Valley lies a short 25 miles to the south. From that valley the perennial Beaver River flows west for 20 miles and then swings north in the Escalante Valley and runs for nearly 50 miles creating the great swamp and seasonal lake areas at Beaver Bottoms and at Clear Lake along the way before it merges with the waters of the Sevier River. Similarly, the area of modern day Fillmore, 25 miles north of Cove Fort, has more water than does the geothermal field and its surrounding country. Thus, given the fact that other areas close at hand had more generous water supplies, and, given the fact that those areas were also well-stocked with game and with substantial quantities of good grade lithic resources, the apparently attractive Cove Fort area must thus be viewed as an exploitive region of secondary value at best.

The pioneer Cove Fort, now a privately owned historical museum, is, of course, evidence of significant historical activity. The limits of that activity can be noted, however, in the fact that the fort always remained a way station and that it never became the nucleus for extensive settlement. It thus seems possible that variables limiting modern use also limited prehistoric use. Thus it is not so surprising that, on the slopes of the northern and southern sections of the project area, evidence of pioneer use remains minimal. One or two of the buildings at the Sulphurdale Mine appear to date from the later part of the 19th century but these were beyond the scope of this work and an examination of the structures would require carefully arranged advanced permission from officials of a company that actively discourages visitors.

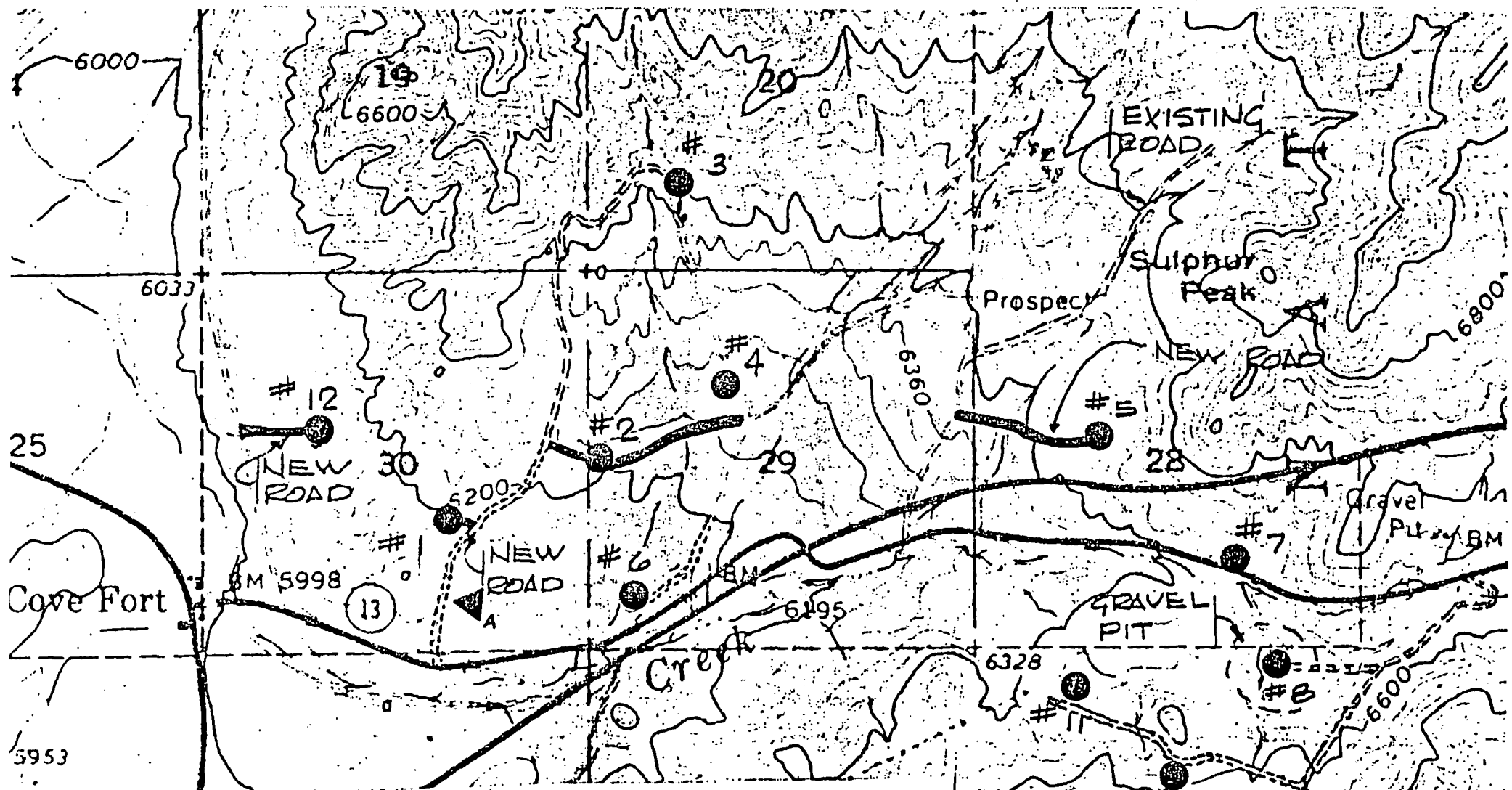
A final item of historical significance should be noted. At the site marked C on Map #2 just south of drill site #16 in the SW 1/4 of Sec. 8, T26, R6W, is a collection of from 10 to 12 sections of 14 foot wooden pipe which might be called "barrel stave," pipe. The pipe was made by fitting together long, slender strips of wood to form a tube which was then bound by bands of heavy steel wire.

Remnants of similar pioneer water systems have been pulled up in several southwestern Utah towns during the last few years. The time period during which this pipe was made and used is not known but it would appear likely that it dates from the last quarter of the 19th century and perhaps into the first quarter of the 20th. It does represent, however, an effective and ingenious technique for reducing the consumption of expensive metal and substituting more readily available local wood and local labor. As such, this pipe might well be salvaged and retained as potential exhibit material for displays of early Utah technology in some of the state historical museums.

A second source of this pipe also exists. While the material discussed above is within the Fishlake National Forest, another source exists on land administered by the Richfield District of the Bureau of Land Management. In the SE 1/4 of Sec. 30, T25S, R8W (noted in Map #1 as site A), a road extends north from the route of old Utah Highway 4 towards drill site #1. For over one quarter of a mile on either side of this road, the ground for about 100 meters on either side of the road has become an almost continuous dump. At nearly any point within the area, the thousands and thousands of cans once containing a single brand of motor oil attest a more prosperous era for the now decaying service station at the Cove Fort Junction.

No great time was spent in examining this debris since most of it lies several meters back from the road itself. The impression gained, however, is that very little of this material dates from a point in time much before the late 1920s or the early 1930s. One exception to this, however, is at the point marked A on Map #1. Here, east of the road near a pile of boulders, will be found fragments of eight or ten partial lengths of the same wooden "barrel stave" pipe. Although in poor condition, these samples may also have some historic value.

The lack of prehistoric or historic sites means, of course, that no mitigation is required prior to the proposed exploration activity by the Union Oil Co. of California.



Map #1 Cove Fort Geothermal Field -- Northern Section

● Drill Pad Sites

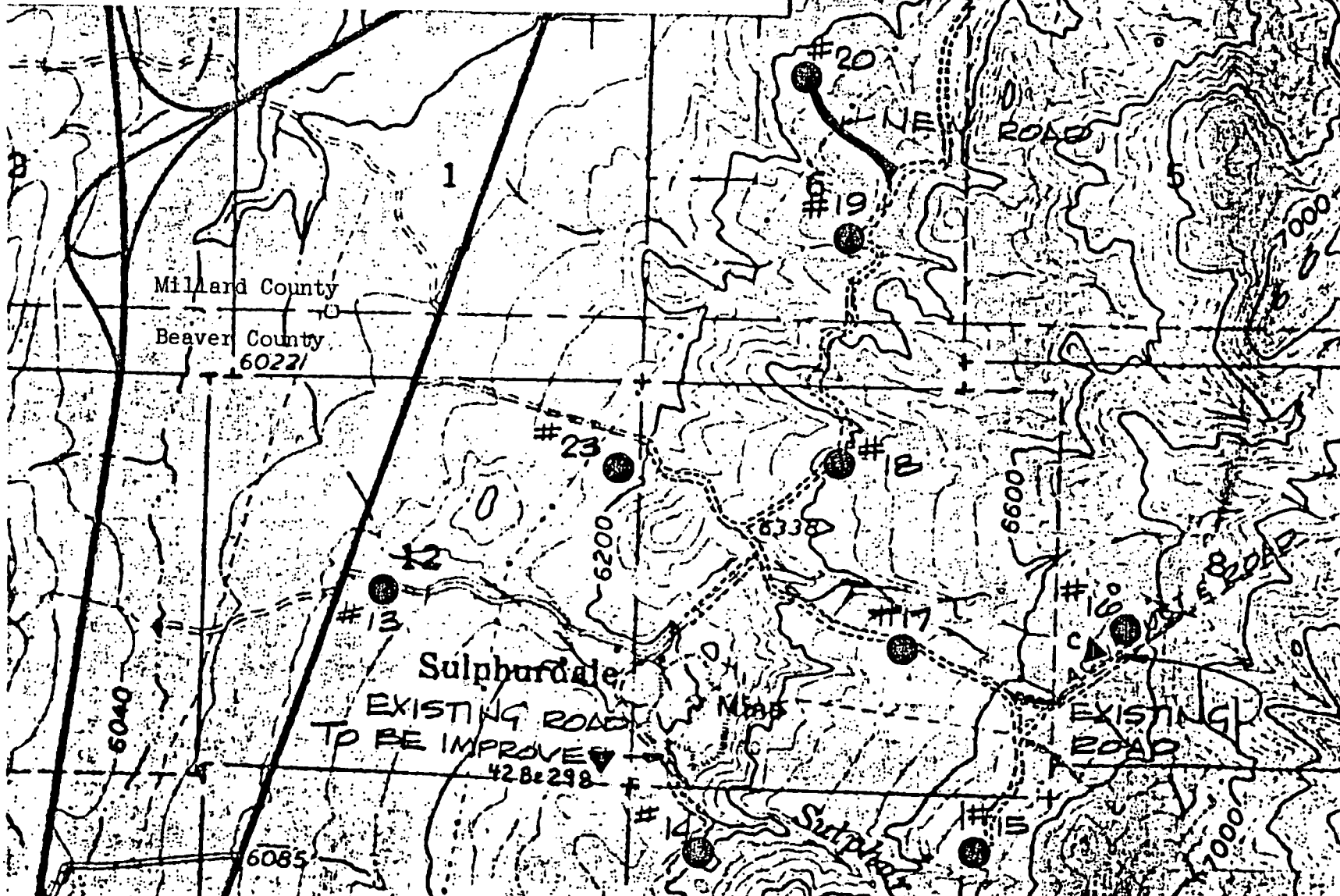
▲ Historic or Prehistoric Sites

— New Roads Surveyed

- - - Existing Roads Surveyed

Map #2 Cove Fort Geothermal Field -- Southern Section

- Drill Pad Sites
- ▲ Historic or Prehistoric Sites
- New Roads Surveyed
- ⋯ Existing Roads Surveyed





DETAILS OF WORK

- I DRILLING PROCEDURE
- II EQUIPMENT
- III TESTING, LOGGING PROGRAM, AND PLUG AND ABANDONMENT

DRILLING PROCEDURE

Section "A" - Mud Program and Safety Data Sheets

Section "B" - Cementing Guide

Section "C" - B.O.P. Requirements and Testing Procedure  
with Diagrams (Figures 1-6)

Inspection Checklist For B.O.P.

Contractor's Drilling Foreman Inspection  
Checklist For B.O.P.

Section "D" - Casing Specifications and Details

UNION OIL CO. OF CALIFORNIA  
GEOTHERMAL DIVISION

DRILLING PROCEDURE

CONFIDENTIAL

This document contains confidential information which is proprietary to Union Oil Co. of Calif. The contents of this document are not to be revealed to any person without the express written consent of Union Oil Co. of California.

LOCATION: 348.47m (1143.28') South and 727.67m (2387.37') East of the Northwest Corner of Section 7, T26S-R6W, SLM.

ELEVATION: 1957m (6421.6') G.L.  
Approximately 1963m (6441.6') K.B.

1. Set 76.2cm (30") pipe at 7.6m (25'+) G.L. Cement with ready-mix. Drill rat and mouse holes.
2. Install 2.12m (7') x 2.12m (7') x 1.52m (5') deep cellar.
3. Move in and rig-up rotary tools, including mud cooling tower. Rig-up mud loggers complete with three station (cellar, shakers and rig floor) H<sub>2</sub>S monitors with audible alarms. Weld extension on 76.2cm (30") pipe. Install flowline.
  - a. Notify U.S.G.S. 24 hours prior to commencement of drilling operations.
  - b. Record commencement of dayrate and spud time (hours) on tour and daily reports.
4. Spud 66cm (26") hole with pilot hole opener. Drill sufficient hole to assure that the hole is centered with the 76.2cm (30") pipe. Drill 44.4cm (17-1/2") hole to 76.2m (250'+). Use a

4. Continued -----

fresh water and gel mud as outlined in Section III.

- a. Deviation surveys shall be taken at 30m (100') and 76.2m (250'+) or as required.
  - b. Catch, bag and label six complete sets of samples at 6.1m (20') intervals.
  - c. Monitor and record flowline and suction temperatures continuously.
  - d. Log depths of any lost circulation zones.
  - e. Control lost circulation with LCM; if severe, cement as required.
5. Open 44.4cm (17-1/2") hole to 66cm (26").
- a. Control lost circulation with LCM; if severe, cement as required to assure a competent cement job for the 20" casing.
6. Run and cement 50.8cm (20"), 139.9kg (94#), K-55, buttress casing at 76.2m (250'+). See Section  D  for casing design and safety factors.

6.

- a. Centralize joints no. 1-3 and 5.
- b. No float equipment on 50.8cm (20") conductor casing. Underdisplace by 15 lineal feet.
- c. Cement as outlined in Section B.

7. Wait on cement three hours. Land casing. Weld on 50.8cm (20"), 137.9 Bar (2000 PSI) S.O.W. flange. Install drilling spool, blowdown line, kill line, 50.8cm (20") - 137.9 BAR (2000 PSI) Shaffer hydraulic single gate, and 50.8cm (20") 137.9 BAR (2000 PSI) annular preventer (Hydril) as shown in Figure No. 1, Section C.

8. Close annular preventer and test preventer and casing as outlined in B.O.P. testing procedures, Section C.

- a. Notify U.S.G.S. in ample time to permit witnessing of B.O.E. test.

9. Drill 44.4cm (17-1/2") hole 457m+ (1500'+) using mud as a circulating medium. See Section A for mud program.

- a. Catch, bag and label six complete sets of samples at 6.1m (20') intervals.

9.

- b. Record depth of any lost circulation zones, amount and kind of fluid lost in each zone.
- c. Cure lost circulation as outlined in Section A.
- d. Monitor and record flowline and suction temperatures continuously.
- e. Deviation surveys to be taken as directed. Distance between survey stations not to exceed 76m (250').
- f. Maximum recording thermometers are to be run with each survey. Record temperature and supporting data on temperature build-up data form.

10. Run and cement 34cm (13-3/8"), 81.1kg (54.5#), K-55 buttress casing at 457m (1500'+). See Section D for casing design and safety factors.

- a. Thread lock all connections and tack weld bottom of casing collars on bottom four joints.
- b. Run cement guide shoe on bottom of joint no. 1 and a flapper (disc type) insert float valve between joints no. 1 and no. 2.

10.

- c. Centralize joints nos. 1-2-3 and every fourth joint.
- d. Use Jet Lube "Kopr-Kote" geothermal thread lube on all joints.

11. Cement casing as outlined in Section B.

12. Monitor annulus for fall back of cement. Do not permit any water and/or mud to enter or remain in the 50.8cm (20") x 34cm (13-3/8") annulus. Maintain cement top at surface.

13. Wait on cement four hours before releasing casing. Remove annular preventer, drilling spool and casing flange. Weld on 30.4cm (12") Series 900 X 34cm (13-3/8") S.O.W. casing head. Test between welds to 68.9 BARS (1000 psi). Do not exceed collapse rating of casing 77.9 BARS (1130 psi). Install 30.4cm (12") - 206.8 BAR (3000#) X 30.4cm (12") 206.8 BAR (3000#) drilling spool, 30.4cm (12") 206.8 BAR (3000#) hydraulic double gate B.O.P., 30.4cm (12") - 206.8 BAR (3000#) annular preventer, kill and choke manifold and lines in accordance with Figure 3, Section No. C.

14. Test B.O.P.E. as outlined under Item II (13-3/8" Casing) of the B.O.P. testing procedure, Section 3.

14.

- a. Notify U.S.G.S. in ample time to witness test.
- b. B.O.E. tests and results to be logged on tour sheet and the daily drilling report.

15. Drill 31.1cm (12-1/4") hole to 975.3m+ (3200'+) using a circulating medium (to be determined by hole conditions) as outlined in Item III Section A.

- a. Survey hole as required. Intervals between surveys not to exceed 91.4m (300'). Maximum recording thermometers are to be run with each survey. Record temperature and supporting data on "Temperature Build-up Data" form.
- b. Catch, bag and label six sets of 6m (20') samples.
- c. Flowline and suction temperatures will be monitored and recorded continuously.
- d. Mud temperatures to be controlled, as required, either by retention or by use of a cooling tower.

16. Circulate to cool and condition hole for logs. Run electric logs as follows:



## 16. Continued-----

Temperature Log	-	Surface to T.D.
DIL-8	-	T.D. to shoe of 34cm (13-3/8") csg.
Dipmeter	-	T.D. to shoe of 34cm (13-3/8") csg.
Neutron-Gamma Ray	-	T.D. to Surface

17. Run 24.4cm (9-5/8") 53.57 kg/m (36#), K-55 buttress casing on liner hanger with tie-back receptacle. Hang liner hanger at 396m (1300') with shoe at 975m $\pm$  (3200' $\pm$ ). Shoe to be hung a minimum of 1m (3') off bottom.

- a. Thread lock all connections on bottom four joints.  
Bottom of first four casing collars to be tack welded.
- b. Run flapper float shoe on bottom of joint no. 1 and flapper type float collar on top of joint no. 2. If a multi-stage cement job is planned a differential fill float shoe and latch-in float collar will be required.
- c. Centralize joint nos. 1-2-3 and every fourth joint.
- d. If multi-stage cement job, place F.O. cementer as dictated by hole conditions.

NOTE: Jewelry design and placement will vary to match hole conditions.

18. Cement 24.4cm (9-5/8") liner as outlined in Section B.
  - a. If severe lost circulation zones are evident, cement liner in two stages by using one F.O. cementer placed as hole conditions dictate.
19. Lay down liner setting tools. Run O.E.D.P. 15m (50'+) below liner top and circulate out excess cement.
20. Pressure test liner lap with surface pressure plus fluid hydrostatic to equal a 1.26 kg/m (0.85 lb/ft.) gradient at liner top. Cement should be in place a minimum of 14 hours prior to testing.
  - a. Squeeze cement if necessary. See Section B for cement slurry.
21. Test B.O.E. as outlined under Item No. III of the B.O.P.E. Test Procedure, Section B.
  - a. Notify U.S.G.S. in ample time to witness test.
  - b. Log results of test on tour sheet and daily drilling report. Written report to be submitted to U.S.G.S. within 30 days.
22. Drill out floats and cement with stripped bottom hole

22. Continued-----  
assembly and 22.2cm (8-3/4") bit. Trip for an appropriate bottom hole assembly.
23. Drill a 22.2cm (8-3/4") to 3048m+ (10,000'+) with a mud or other circulating medium. (To be determined by hole conditions) as outlined in Item IV Section A.
- a. Survey hole as required. Intervals between surveys not to exceed 91.4m (300'). Maximum recording thermometers are to run with each survey.
  - b. Catch, bag and label six sets of 6m (20') samples.
  - c. Flowline and suction temperatures to be monitored and recorded continuously.
  - d. Mud temperatures to be controlled as required, either by retention or by use of a cooling tower.
  - e. If flowline temperatures exceed 76.6°C (170°F.) a rotating head will be installed.
  - f. Log depths of fluid losses, lost circulation and kicks.

24. Circulate to condition and cool hole for logs. Run electric logs as follows:

Temperature Log	-	Surface to T.D.
DIL-8	-	T.D. to shoe of 24.4cm (9-5/8") csg
Dipmeter	-	T.D. to shoe of 24.4cm (9-5/8") csg
Neutron-Gamma Ray	-	T.D. to shoe of 24.4cm (9-5/8") csg

25. Run and set a drillable bridge plug, in the 24.4cm (9-5/8") liner, 15m (50') below depth of 34cm (13-3/8") casing shoe.
- a. Displace mud with water from liner top to surface.
26. Test bridge plug and liner lap with pressure plus hydrostatic equal to 1.26 kg/m (0.85 lb/ft.) gradient.
- a. Squeeze cement if required.
- b. Clean out with bit and casing scraper.
27. Run 24.4cm (9-5/8"), 59.53 kg/m (40#) K-55 buttress casing from top of 24.4cm (9-5/8") liner to the surface.
- a. Stab-in mandrel to be 24.4cm (9-5/8") x 127cm (50") with port collar with four 3.17cm (1-1/4") cementing ports.

27.

- b. Run flapper float collar on top of first joint above port collar.
- c. Centralize joint no. 2 and every third joint.
- d. Use Jet Lube "Kopr-Kote" geothermal thread lube on all connections.
- e. Tag top of liner hanger with port collar. Pick up 30.48cm (1 foot) to assure cementing liner in tension.

NOTE: It is imperative that the 24.4cm (9-5/8") casing be centered in the 34cm (13-3/8") casing to permit installation of the pack-off assembly and the Brewster expansion spool.

28. Cement 24.4cm (9-5/8") tie-back casing as outlined in Item 5 Section B.

- a. Monitor 24.4cm (9-5/8") x 34cm (13-3/8") annulus for cement fallback. Maintain cement top at surface.

29. Install 30.4cm (12") - 206.8 BAR (3000#) x 25.4cm (10") - 138 BAR (2000#) expansion spool complete with packoff and two 7.6cm (3") - 206.8 BAR (3000#) flanged outlets with

29. Continued-----  
7.6cm - 206.8Bar WKM valves.
30. Install 25.4cm (10") - 138 BAR (2000#) WKM master valve and 25.4cm (10") - 138 BAR (2000#) x 30.4cm (12") - 206.8 BAR (3000#) drilling spool complete with side outlets and valves.
31. Reinstall B.O.P.E. as described in Figure B, Section No. C. Test B.O.P.E. as outlined under Item IV of the B.O.P.E. Testing Procedure, Section C.
- a. Notify U.S.G.S. in ample time to permit witnessing of test.
32. Clean out cement and float to top of bridge plug with stripped bottom hole assembly and 22.2cm (8-3/4") bit. Drill out bridge plug and push to bottom. Circulate and condition hole for production liner.
33. Run and hang a 17.8cm (7") combination blank and slotted liner from 945m<sup>+</sup> to T.D. Intervals to be covered by slotting casing will be determined from electric logs.
- NOTE: A more detailed completion procedure will be submitted after evaluation of all available data.
34. Lay down drill pipe and tools. Remove B.O.P.E.

35. Install well head. See Section No. C.
36. Rig down and move out rotary tools.
37. Test well as directed. A detailed test procedure will be submitted after evaluation of available data.

TEMPERATURE BUILDUP DATA

WELL NAME \_\_\_\_\_ DATE \_\_\_\_\_

DRILLED DEPTH IN FEET \_\_\_\_\_

DEPTH OF TEMPERATURE TOOL IN FEET \_\_\_\_\_

TYPE OF TEMPERATURE SURVEY: a) MAXIMUM RECORDING THERM. \_\_\_\_\_

b) AMARADA TYPE \_\_\_\_\_

CIRCULATION TIME AT SURVEY DEPTH IN HOURS ( $T_k$ ) \_\_\_\_\_

MUD TEMPERATURE IN ( $^{\circ}$ F) \_\_\_\_\_

MUD TEMPERATURE OUT ( $^{\circ}$ F) ( $T_m$ ) \_\_\_\_\_

	TEMPERATURE RUN						
	1	2	3	4	5	6	7
Time Since Last Circulation in Hours ( $\Delta t$ )							
Recorded Temperature in $^{\circ}$ F ( $T_{ws}$ )							
Time Temperature Tool at Datum in Minutes							

REMARKS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



CONFIDENTIAL

This document contains confidential information which is proprietary to Union Oil Co. of Calif. The contents of this document are not to be revealed to any person without the express written consent of Union Oil Co. of California.

UNION OIL CO. OF CALIFORNIA  
GEOHERMAL DIVISION

PROPOSED MUD PROGRAM  
Cove Fort Prospect

Hopefully the entire hole may be drilled with accepted oilfield type drilling fluids as a circulating medium. However, if lost circulation problems are found to exist, an air-mud, air-water or foam circulating system may be employed. In each case careful attention has been given to the elimination of harmful toxicity. A complete mud program with product or chemical analysis is attached, covering all possible materials that might be used in the system.

Suggested mud properties and general instructions are listed by hole size intervals.

I.	<u>CONDUCTOR HOLE</u>	66cm (26")			
	<u>DEPTH</u>	<u>WEIGHT</u>	<u>VISCOSITY</u>	<u>FLUID LOSS</u>	<u>PH</u>
	0 -250'	8.4-9.0 lb/gal	As Required	N.A.	10.5-11.0

Remarks.

Drill conductor interval with gel, caustic soda and water with sufficient viscosity and yield point to clean hole.

If lost circulation occurs during this interval, pill treatments of LCM (cottonseed hulls, mica, nut plug, etc.) should be used to regain returns. If lost circulation is severe, cement as required.

To insure that maximum safety conditions are met the mud system will be monitored continually for hydrogen sulfide.

II.	<u>SURFACE HOLE</u>	44.4cm (17-1/2")			
	<u>DEPTH</u>	<u>WEIGHT</u>	<u>VISCOSITY</u>	<u>FLUID LOSS</u>	<u>PH</u>
	250-1500	8.8-10 lb/gal 66#/ft. <sup>3</sup> - 75#/ft. <sup>3</sup>	45 - 55	8.0 - 12cc	10.5 - 11.5m

<u>MATERIAL</u>	P.V. as per AFD (Annular Flow Dynamics)
QUEBRACHO	Gels 2/6
BENTONITE	Y.P. as per AFD
TANNATHIN	Solids 4-12%
CAUSTIC SODA	Bentonite 18-22 (#/Bbl.)
CYPAN	
BARITE (If Needed)	

II. SURFACE HOLE - Continued-----

Commencing with this interval the desander and desilter should be utilized to maintain minimum mud weights for maximum penetration rates. Adjust mud rheology and/or rig hydraulics to maintain laminar flow in the annulus for maximum hole cleaning and minimum hole erosion.

If lost circulation occurs, sweep treatments of one or more of the following: cottonseed hulls, mica, nut plug and Kwik-Seal are recommended to regain returns. If lost circulation persists, a "Diaseal-M" or cement squeeze may be required to regain circulation.

Corrosion and hydrogen sulfide protection should be initiated through this interval and continued to total depth with additions of Zinc Carbonate, Sodium Sulfide, Unisteam and a water soluble organic phosphate scale inhibitor.

III. INTERMEDIATE HOLE 31.1cm (12-1/4")

<u>DEPTH</u>	<u>WEIGHT</u>	<u>VISCOSITY</u>	<u>FLUID LOSS</u>	<u>PH</u>
1500-3200	8.8-10 lb/gal 66#/ft. <sup>3</sup> - 75#/ft. <sup>3</sup>	45-55	8.0 - 10cc	10.5 - 11.5m

<u>MATERIAL</u>	P.V. as per AFD
BENTONITE	Y.P. as per AFD
QUEBRACHO	Gels 2/6
TANNATHIN	Solids 4-12%
CAUSTIC SODA	Bentonite 18-22 (#/BB1.)
CYPAN	
BARITE (If Needed)	

Lost circulation and corrosion to be controlled as described for the 44.4cm hole.

Should well bore temperatures creating gelation problems be encountered the system will be changed over to a Sepiolite ("Thermal Gel") base system.

SYSTEM NO. 2 (Sepiolite)

<u>DEPTH</u>	<u>WEIGHT</u>	<u>VISCOSITY</u>	<u>FLUID LOSS</u>	<u>PH</u>
?-3200'	9.0-9.3 67#/ft. <sup>3</sup> - 69.5#/ft. <sup>3</sup>	40-45	8.0 - 10cc	10.5 - 11.5m

III. INTERMEDIATE HOLE - Continued -----

MATERIALS

SEPIOLITE	P.V.	as per AFD
BENTONITE	Y.P.	as per AFD
CYPAN	Gels	1/2
RESINEX	Solids	6%
CAUSTIC SODA	Bentonite	4 lb./Bbl

IV. PRODUCTION HOLE            22.2cm (8-3/4")

<u>DEPTH</u>	<u>WEIGHT</u>	<u>VISCOSITY</u>	<u>PH</u>
3200-10,000'±	8.5	28	11.0m
	63.5#/ft. <sup>3</sup>		

Drill the float collar and shoe with the existing mud system, then displace with fresh water. Add 20#/Bbl salt to the fresh water. Pretreat and maintain adequate corrosion and hydrogen sulfide inhibitors in drilling fluid.

If air misting becomes necessary because of brine water loss to the well bore, additions of liquid ammonia will be injected into the standpipe to neutralize any hydrogen sulfide gas vapors that might be encountered.

If it becomes necessary to mud up, the sepiolite system described under System No. 2 of the Intermediate Hole will be used.

GENERAL INSTRUCTIONS

1. A minimum of 1,000 sacks of Barite will be readily available at all times during drilling operations.
2. If hole conditions in the surface or intermediate holes dictate the use of foam as a circulating medium the following basic mixture will be used:  
 1-1/2% Sulfatex-Sal per 10 Bbls water with sufficient ammonium hydroxide and inhibitors to control hydrogen sulfide and corrosion. Inject this solution into air stream of 300 - 375 CFM at rate of 12 GPM. Density of the mixture should be 2.0 to 2.5 lb/ft.<sup>3</sup> A detailed Foam Drilling Procedure will be available at the drill site.

3. Pretreatments for hydrogen sulfide will begin at spud with addition of 2 lbs/Bbl zinc carbonate and adjusted as conditions dictate. A "HACH" test for hydrogen sulfide in the mud system will be run on a routine basis.
4. Corrosion rings will be installed in the Kelly saver sub and the first joint above the drill collars. These rings will be changed at 100 ± hour intervals and monitored for type and severity of corrosion. Hopefully, arrangements can be made to correctly weight and evaluate the "Rings" on location.
5. For maximum corrosion protection, a catalyzed sodium sulfite oxygen scavenger, will be injected into the pump suction in quantities to maintain concentrations of sulfite at 100 - 300 PPM at the flowline. SI-1000, a water soluble organic phosphate scale inhibitor may be used in conjunction with sodium sulphite to prevent scale buildup on tubular goods, SI-1000 concentrations should be maintained at 10 - 20 PPM at the flowline, as hole conditions dictate.

In addition, Magco Inhibitor 202, a water soluble filming amine, will be used, if conditions warrant, to coat the drill string on trips.

Inhibitors may change from time to time as a result of continuing research.

#### EQUIPMENT

1. Three station (shakers, cellar and rig floor) hydrogen sulfide gas detectors (0-100 PPM) with audio warning device will be in continuous operation during drilling operations.
2. Drager multi gas detectors (hand operated) will be available for spot checks.
3. Degasser, desilter and desander.
4. High-low level mud pit indicator complete with visual and audio warning device.
5. Temperature recorder, with chart for continuous monitoring of flowline and suction temperatures.



DRESSER INDUSTRIES, INC.  
 PETROLEUM & MINERALS GROUP  
 P. O. BOX 6504  
 HOUSTON, TEXAS 77005

PMS-630-2

The body of this form is an exact duplicate of OSHA Form # 20 Material Safety Data Sheet

# MATERIAL SAFETY DATA SHEET

SECTION I			
MANUFACTURER'S NAME MANUFACTURED FOR DRESSER INDUSTRIES, INC.		EMERGENCY TELEPHONE NO. 713-784-7868	
ADDRESS (Number, Street, City, State, and ZIP Code) P.O. BOX 6504, HOUSTON, TEXAS 77005			
CHEMICAL NAME AND SYNONYMS DIATOMACEOUS EARTH & MAGNESIUM SILICATES		TRADE NAME AND SYNONYMS DIASEAL-M	
CHEMICAL FAMILY NON-CRYSTALLINE SILICATE		FORMULA	

SECTION II HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST	THIS SECTION NOT APPLICABLE		ALLOYS	THIS SECTION NOT APPLICABLE	
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
NATURAL DIATOMACEOUS EARTH				80	80mg/M <sup>3</sup>
MAGNESIUM SILICATES				10	
(TLV)(JULY 1,1976 2 fibers >5µ in length/cc					

SECTION III PHYSICAL DATA			
BOILING POINT (°F.)	NA	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	NA
VAPOR PRESSURE (mm Hg.)	NA	PERCENT VOLATILE BY VOLUME (%)	NA
VAPOR DENSITY (AIR=1)	NA	EVAPORATION RATE (_____=1)	NA
SOLUBILITY IN WATER	NA		
APPEARANCE AND ODOR	GRAY POWDER - NO ODOR		

SECTION IV FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	N/A	FLAMMABLE LIMITS	LeI UeI
EXTINGUISHING MEDIA	N/A		
SPECIAL FIRE FIGHTING PROCEDURES	NON-FLAMMABLE		
UNUSUAL FIRE AND EXPLOSION HAZARDS			

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the

**SECTION V - HEALTH HAZARD DATA**

THRESHOLD LIMIT VALUE  
 MAGNESIUM SILICATES (JULY 1, 1976) 2 fibers >5µ in length/cc  
 EFFECTS OF OVEREXPOSURE  
 LONG TERM HIGH CONCENTRATIONS MAY CAUSE PULMONARY DISEASES

EMERGENCY AND FIRST AID PROCEDURES  
 NONE

**SECTION VI - REACTIVITY DATA**

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	XX	NONE

INCOMPATIBILITY (Materials to avoid)  
 NONE KNOWN

HAZARDOUS DECOMPOSITION PRODUCTS  
 NONE KNOWN

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID:
	WILL NOT OCCUR	XX	NONE

**SECTION VII - SPILL OR LEAK PROCEDURES**

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED  
 VACUUM CLEAN UP OR WET SWEEPING

WASTE DISPOSAL METHOD  
 DISPOSE OF IN A SEALED CONTAINER LABELED, "CAUTION, CONTAINS ASBESTOS FIBERS, AVOID BREATHING ASBESTOS DUST, MAY CAUSE SERIOUS BODILY HARM".

**SECTION VIII - SPECIAL PROTECTION INFORMATION**

RESPIRATORY PROTECTION (Specify type)  
 NIOSH APPROVED PROTECTION FOR PNEUMOCONIOSIS

VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL (General) ACCEPTABLE PREFERABLE	OTHER

PROTECTIVE GLOVES

EYE PROTECTION  
 FOR EMPLOYEE COMFORT

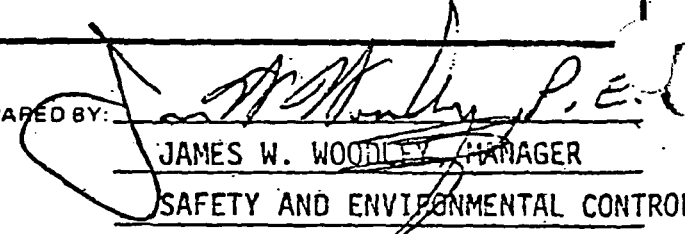
OTHER PROTECTIVE EQUIPMENT

**SECTION IX - SPECIAL PRECAUTIONS**

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING  
 N/A

OTHER PRECAUTIONS  
 N/A

DRESSER INDUSTRIES  
 PETROLEUM & MINERALS GROUP

PREPARED BY:  P.E.  
 JAMES W. WOODLEY, MANAGER  
 SAFETY AND ENVIRONMENTAL CONTROL

DATE PREPARED revised 10/11/76



DRESSER INDUSTRIES, INC.  
 PETROLEUM & MINERALS GROUP  
 P. O. BOX 6504  
 HOUSTON, TEXAS 77005

PMS-630-2

# MATERIAL SAFETY DATA SHEET

The body of this form is an exact duplicate of OSHA Form # 20 Material Safety Data Sheet

SECTION I	
MANUFACTURER'S NAME Manufactured for Dresser Industries, Inc.	EMERGENCY TELEPHONE NO. 713-784-7873
ADDRESS (Number, Street, City, State, and ZIP Code) P.O. Box 6504 Houston, Texas 77005	
CHEMICAL NAME AND SYNONYMS Zinc Carbonate	TRADE NAME AND SYNONYMS Zinc Carbonate
CHEMICAL FAMILY	FORMULA ZnCO <sub>3</sub>

SECTION II HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE N/A			METALLIC COATINGS N/A		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
Non-Toxic					

SECTION III PHYSICAL DATA	
BOILING POINT (°F.)	SPECIFIC GRAVITY (H <sub>2</sub> O=1)
VAPOR PRESSURE (mm Hg.)	PERCENT VOLATILE BY VOLUME (%)
VAPOR DENSITY (AIR=1)	EVAPORATION RATE (_____ =1)
SOLUBILITY IN WATER Insoluble	
APPEARANCE AND ODOR White crystalline powder	

SECTION IV FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	FLAMMABLE LIMITS	LeI	UeI
EXTINGUISHING MEDIA			
SPECIAL FIRE FIGHTING PROCEDURES self-extinguishing			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the information. The information is offered solely for your consideration, investigation and verification.

PRINTED IN USA

**SECTION V HEALTH HAZARD DATA**

THRESHOLD LIMIT VALUE **No TLV established.**

EFFECTS OF OVEREXPOSURE  
**Non-Toxic**

EMERGENCY AND FIRST AID PROCEDURES

**SECTION VI REACTIVITY DATA**

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	XX	None

INCOMPATIBILITY (Materials to avoid) **None known**

HAZARDOUS DECOMPOSITION PRODUCTS **CO & CO<sub>2</sub>**

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	XX	None

**SECTION VII SPILL OR LEAK PROCEDURES**

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

**Regular clean-up**

WASTE DISPOSAL METHOD **Sanitary disposal**

**SECTION VIII SPECIAL PROTECTION INFORMATION**

RESPIRATORY PROTECTION (Specify type) **Non-Toxic**

VENTILATION	LOCAL EXHAUST	No	SPECIAL
	MECHANICAL (General)	No	OTHER

PROTECTIVE GLOVES EYE PROTECTION **For employee comfort.**

OTHER PROTECTIVE EQUIPMENT

**SECTION IX SPECIAL PRECAUTIONS**

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING **Keep in cool dry place.**

OTHER PRECAUTIONS

DRESSER INDUSTRIES  
PETROLEUM & MINERALS GROUP

PREPARED BY:

*Henry J. Smahlik*  
**Henry J. Smahlik**  
**Industrial Hygienist**

DATE PREPARED March 22, 1976





DRESSER INDUSTRIES, INC.  
 PETROLEUM & MINERALS GROUP  
 P. O. BOX 6504  
 HOUSTON, TEXAS 77005

PMS-630-2

# MATERIAL SAFETY DATA SHEET

## SECTION I

MANUFACTURER'S NAME Manufactured for Dresser Industries, Inc.		EMERGENCY TELEPHONE NO. 713-784-7873
ADDRESS (Number, Street, City, State, and ZIP Code) P.O. Box 6504 Houston, Texas 77005		
CHEMICAL NAME AND SYNONYMS Sodium sulfate	TRADE NAME AND SYNONYMS OS-1	
CHEMICAL FAMILY Sulfurous & acid salts	FORMULA Na <sub>2</sub> SO <sub>3</sub>	

## SECTION II HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST N/A			ALLOYS N/A		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
N/A					

## SECTION III PHYSICAL DATA

BOILING POINT (°F.)		SPECIFIC GRAVITY (H <sub>2</sub> O=1)	2.63
VAPOR PRESSURE (mm Hg.)		PERCENT VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (_____ =1)	
SOLUBILITY IN WATER Completely			
APPEARANCE AND ODOR	White to off-white - no odor		

## SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel
EXTINGUISHING MEDIA			
SPECIAL FIRE FIGHTING PROCEDURES			
N/A			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the information. The information is offered solely for your consideration, investigation and verification.

PRINTED IN USA

**SECTION V HEALTH HAZARD DATA**

THRESHOLD LIMIT VALUE: No TLV established.

EFFECTS OF OVEREXPOSURE: By ingestion, causes vomiting & possible circulatory & visual disturbance & collapse

EMERGENCY AND FIRST AID PROCEDURES: Induce vomiting

**SECTION VI REACTIVITY DATA**

STABILITY	UNSTABLE		CONDITIONS TO AVOID	None
	STABLE	XX		
INCOMPATIBILITY (Materials to avoid)		None known		
HAZARDOUS DECOMPOSITION PRODUCTS		None known		
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID	None
	WILL NOT OCCUR	XX		

**SECTION VII SPILL OR LEAK PROCEDURES**

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Clean up dry as much as possible, flush remainder with water, neutralize with soda-ash or sodium carbonate.

WASTE DISPOSAL METHOD: Dry disposal in sanitary landfill.

**SECTION VIII SPECIAL PROTECTION INFORMATION**

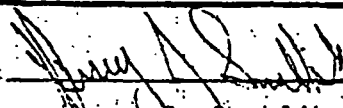
RESPIRATORY PROTECTION (Specify type)		NIOSH approved for nuisance dusts	
VENTILATION	LOCAL EXHAUST	Where dust is a problem	SPECIAL
	MECHANICAL (General)		OTHER
PROTECTIVE GLOVES	Good practice	EYE PROTECTION	Good practice
OTHER PROTECTIVE EQUIPMENT			

**SECTION IX SPECIAL PRECAUTIONS**

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Store in cool, dry place,

OTHER PRECAUTIONS: Keep container sealed tightly.

DRESSER INDUSTRIES  
PETROLEUM & MINERALS GROUP

PREPARED BY:   
Henry J. Smalik

DATE PREPARED: March 22, 1976

Industrial Hygienist



DRESSER INDUSTRIES, INC.  
 PETROLEUM & MINERALS GROUP  
 P. O. BOX 6504  
 HOUSTON, TEXAS 77005

PMS-630-2

The body of this form is an exact duplicate of OSHA Form # 20 Material Safety Data Sheet

# MATERIAL SAFETY DATA SHEET

SECTION I	
MANUFACTURER'S NAME MANUFACTURED FOR DRESSER INDUSTRIES, INC.	EMERGENCY TELEPHONE NO. 713-784-7868
ADDRESS (Number, Street, City, State, and ZIP Code) P. O. BOX 6504, HOUSTON, TEXAS 77005	
CHEMICAL NAME AND SYNONYMS	TRADE NAME AND SYNONYMS INHIBITOR 202
CHEMICAL FAMILY ORGANIC ACID	FORMULA PROPRIETARY

SECTION II. HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS	THIS SECTION	
VEHICLE			METALLIC COATINGS	NOT	
SOLVENTS	IPA	5%	400ppm	FILLER METAL PLUS COATING OR CORE FLUX	APPLICABLE
ADDITIVES			OTHERS		
OTHERS	ALIPHATIC AND AROMATIC HYDROCARBONS	65%			
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
THIS SECTION NOT APPLICABLE					

SECTION III. PHYSICAL DATA				
BOILING POINT (°F.)	78°C (INITIAL)	173°F	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	.924
VAPOR PRESSURE (mm Hg.)		UNK.	PERCENT VOLATILE BY VOLUME (%)	NA
VAPOR DENSITY (AIR=1)		NA	EVAPORATION RATE (=1)	NA
SOLUBILITY IN WATER		NONE		
APPEARANCE AND ODOR	DARK LIQUID			

SECTION IV. FIRE AND EXPLOSION HAZARD DATA				
FLASH POINT (Method used)	80°F TCC	27°C	FLAMMABLE LIMITS	UNK
EXTINGUISHING MEDIA	DRY CHEMICAL, FOAM, CO <sub>2</sub>			
SPECIAL FIRE FIGHTING PROCEDURES	DO NOT USE WATER.			
KEEP AWAY FROM HIGH TEMPERATURES, FLAMMABLE LIQUID				

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the information without investigation and verification.

**SECTION V. HEALTH HAZARD DATA**

NONE ESTABLISHED BY ACGIH. USE 400 ppm for IPA

EFFECTS OF OVEREXPOSURE  
PROLONGED EXPOSURE MAY CAUSE EYE AND SKIN IRRITATION.

EMERGENCY AND FIRST AID PROCEDURES.

GASTRIC LAVAGE IF SWALLOWED. REMOVE INDIVIDUAL TO FRESH AIR.

**SECTION VI. REACTIVITY DATA**

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	XX	HIGH TEMPERATURES AND SPARKS OR OPEN FLAME STRONG OXIDIZING AGENTS
INCOMPATIBILITY (Materials to avoid) STRONG OXIDIZING AGENTS			
HAZARDOUS DECOMPOSITION PRODUCTS NONE			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	XX	

**SECTION VII. SPILL OR LEAK PROCEDURES**

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

USE ABSORBENT MATERIAL TO CLEAN UP EXCESS MATERIAL. DO NOT FLUSH WITH WATER, DUE TO EPA REGULATION DISALLOWING DISCHARGE OF OILY MATERIAL.

WASTE DISPOSAL METHOD DISPOSE OF ABSORBENT MATERIAL IN APPROVED LANDFILL

**SECTION VIII. SPECIAL PROTECTION INFORMATION**

RESPIRATORY PROTECTION (Specify type) NA		
VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL (General) SUGGESTED	OTHER NA
PROTECTIVE GLOVES RUBBER GLOVES		EYE PROTECTION CHEMICAL GOGGLES
OTHER PROTECTIVE EQUIPMENT NA		

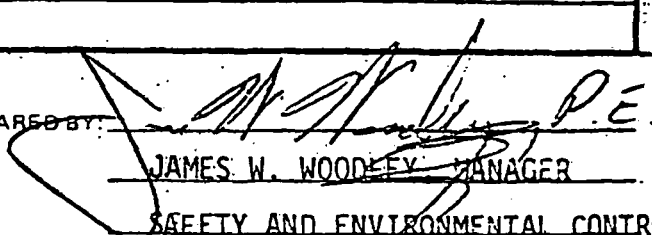
**SECTION IX. SPECIAL PRECAUTIONS**

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

AVOID OPEN FLAMES, HIGH TEMPERATURES, AND STRONG OXIDIZING AGENTS.

OTHER PRECAUTIONS

DRESSER INDUSTRIES  
PETROLEUM & MINERALS GROUP

PREPARED BY:  P.E.  
JAMES W. WOODLEY, MANAGER

DATE PREPARED REVISED 10/11/76

SAFETY AND ENVIRONMENTAL CONTROL



DRESSER INDUSTRIES, INC.  
 PETROLEUM & MINERALS GROUP  
 P. O. BOX 6504  
 HOUSTON, TEXAS 77005

PMS-630-2

# MATERIAL SAFETY DATA SHEET

SECTION I			
MANUFACTURER'S NAME Manufactured for Dresser Industries, Inc.		EMERGENCY TELEPHONE NO. 713-784-7873	
ADDRESS (Number, Street, City, State, and ZIP Code) P.O. Box 6504 Houston, Texas 77005			
CHEMICAL NAME AND SYNONYMS Polyacrylate, phosthonate, glycerol & water		TRADE NAME AND SYNONYMS SI-1000	
CHEMICAL FAMILY Unknown		FORMULA Mixture	

SECTION II - HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE	N/A		METALLIC COATINGS	N/A	
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
None					

SECTION III - PHYSICAL DATA			
BOILING POINT (°F.)	> 212°F	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	1.125
VAPOR PRESSURE (mm Hg.)	N/A	PERCENT VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR=1)	N/A	EVAPORATION RATE (_____ = 1)	
SOLUBILITY IN WATER	Soluble		
APPEARANCE AND ODOR			

SECTION IV - FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	> 200°F	FLAMMABLE LIMITS	LeI UeI
EXTINGUISHING MEDIA		Unknown	
Water, dry chemical			
SPECIAL FIRE FIGHTING PROCEDURES			
None			
UNUSUAL FIRE AND EXPLOSION HAZARDS			
None			

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the information. The information is offered solely for your consideration, investigation and verification.

PRINTED IN USA

**SECTION V HEALTH HAZARD DATA**

THRESHOLD LIMIT VALUE No TLV established.

EFFECTS OF OVEREXPOSURE May irritate eyes.

EMERGENCY AND FIRST AID PROCEDURES  
 Eye-flush with water  
 Skin-flush with soap & water  
 Ingestion-induce vomiting & seek medical aid.

**SECTION VI REACTIVITY DATA**

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	XX	None
INCOMPATIBILITY (Materials to avoid)		None known.	
HAZARDOUS DECOMPOSITION PRODUCTS		None known	
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	XX	None

**SECTION VII SPILL OR LEAK PROCEDURES**

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Flush with water

WASTE DISPOSAL METHOD Absorb & incinerate

**SECTION VIII SPECIAL PROTECTION INFORMATION**

RESPIRATORY PROTECTION (Specify type)			Not normally recommended
VENTILATION	LOCAL EXHAUST		SPECIAL
	MECHANICAL (General)	Not necessary	OTHER
PROTECTIVE GLOVES	Vinyl gloves	EYE PROTECTION	Splash goggles or face shield
OTHER PROTECTIVE EQUIPMENT			

**SECTION IX SPECIAL PRECAUTIONS**

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Store away from heat & open flame

OTHER PRECAUTIONS

DRESSER INDUSTRIES  
 PETROLEUM & MINERALS GROUP

PREPARED BY:

*Henry J. Smahlik*  
 Henry J. Smahlik  
 Industrial Hygienist

DATE PREPARED March 22, 1976



# MATERIAL SAFETY DATA SHEET

## SECTION I

MANUFACTURER'S NAME <b>Dresser Minerals Division, Dresser Industries, Inc.</b>		EMERGENCY TELEPHONE NO. <b>713-781-5900</b>
ADDRESS (Number, Street, City, State, and ZIP Code) <b>P. O. Box 6504, Houston, Texas 77005</b>		
CHEMICAL NAME AND SYNONYMS <b>Montmorillonite, Bentonite, Colloidal clay</b>		TRADE NAME AND SYNONYMS <b>Magcogel</b>
CHEMICAL FAMILY <b>Non-metallic mineral - clay</b>	FORMULA (Empirical) <b>(OH)<sub>7</sub> Si<sub>8</sub> (Al)<sub>3.34</sub> Mg<sub>0.66</sub> O<sub>20</sub> · Sodium Heavy Na<sub>0.66</sub></b>	

## SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
THIS SECTION NOT APPLICABLE					

## SECTION III - PHYSICAL DATA

BOILING POINT (°F.)	N.A.	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	2.6
VAPOR PRESSURE (mm Hg.)	N.A.	PERCENT VOLATILE BY VOLUME (%)	N.A.
VAPOR DENSITY (AIR=1)	N.A.	EVAPORATION RATE (_____ = 1)	N.A.
SOLUBILITY IN WATER	No		
APPEARANCE AND ODOR <b>Odorless finely ground powder - normally greenish yellow - color varies</b>			

## SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS		
	Lel	Uel	
EXTINGUISHING MEDIA	THIS SECTION NOT APPLICABLE		
SPECIAL FIRE FIGHTING PROCEDURES	NO FIRE OR EXPLOSION HAZARD		
UNUSUAL FIRE AND EXPLOSION HAZARDS			

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the information. The information is offered solely for your consideration, investigation and verification.

**SECTION V - HEALTH HAZARD DATA**

THRESHOLD LIMIT VALUE SEE ATTACHED ADVISORY BULLETIN

EFFECTS OF OVEREXPOSURE SEE ATTACHED ADVISORY BULLETIN

EMERGENCY AND FIRST AID PROCEDURES

NOT APPLICABLE

**SECTION VI - REACTIVITY DATA**

STABILITY	UNSTABLE	--	CONDITIONS TO AVOID	NONE KNOWN
	STABLE	Yes		

INCOMPATIBILITY (Materials to avoid) NONE KNOWN

HAZARDOUS DECOMPOSITION PRODUCTS NONE

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	NONE KNOWN

**SECTION VII - SPILL OR LEAK PROCEDURES**

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Usual clean-up methods for dry powdery material.

WASTE DISPOSAL METHOD

Usual disposal methods for dry powdery material.

**SECTION VIII - SPECIAL PROTECTION INFORMATION**

RESPIRATORY PROTECTION (Specify type)  
U. S. Bureau of Mines respirator for mineral dust - See Section V.

VENTILATION	LOCAL EXHAUST TO maintain A.C.G.I.H. T.L.V.	SPECIAL
	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES May be used for employee cleanliness.	EYE PROTECTION May be used for employee comfort.
--	---

OTHER PROTECTIVE EQUIPMENT NONE

**SECTION IX - SPECIAL PRECAUTIONS**

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE  
Maintain airborne dust level below T.L.V. for nuisance dust - or A.C.G.I.H. T.L.V. where free silica particles are found in airborne dust.

OTHER PRECAUTIONS

DRESSER INDUSTRIES  
PETROLEUM & MINERALS GROUP

DATE PREPARED July 27, 1972

PREPARED BY:

  
James W. Woodley, P.E., C.S.P., Ma  
Safety and Environmental Control



## TOXICITY DATA ON MAGCOGEL

### A BIOASSAY - MAGCOGEL - A DRILLING FLUID ADDITIVE

#### INTRODUCTION:

Magcogel is a naturally occurring ore consisting of a sodium montmorillonite, colloidal clay commonly known as bentonite. It is water insoluble, however, it is a hydrophilic clay. It is used as an additive to develop controlled viscosity, gel strengths, and filtration rates of water base drilling fluids. It may be dehydrated in fresh water for use as a viscosifying and fluid loss control agent in certain brine systems.

It is considered to be non-toxic to man as it can be used as a bulk laxative and a base for preparations which may be used on the skin. The toxic effects of bentonite on aquatic life (both marine and fresh water species) are of great importance and the following tests were conducted to determine the acute fish toxicity of Magcogel.

#### PROCEDURE:

Fish kill studies applying the Acute Fish Toxicity Test of the American Public Health Association were conducted using a current production sample of Magcogel. All tests were conducted by an independent testing laboratory.

#### TEST RESULTS AND CONCLUSIONS:

Test results are listed as  $TL_m$  (Median Tolerance Limit) which represents the concentrations of the material tested that causes fatalities in 50% of the test organisms (Mollienisias latipinna-Sailfin Molly) for a specified period of time.

Magcogel is normally used in concentrations of 5-35 pounds/barrel which corresponds approximately to 5,770 - 40,384 ppm. This product is a fine particle-sized, high yield clay that wets fairly readily and disperses well in a seawater media. It forms an extremely viscous gel at high concentrations which increases with time in a freshwater media, and it virtually restricts any mobility of the test organisms.

#### A. FRESHWATER\*

24 - 96 hour  $TL_m$  = 14,500 ppm

#### B. SEAWATER

24 - 96 hour  $TL_m$  = > 100,000 ppm

Any higher concentrations would exceed the practical limits of the test method.

\*Due to the formation of an extremely viscous gel in freshwater, a loss of viability in the test organisms occurred, and thus obscures the standard consideration of "toxicity". This loss of viability can be attributed to mechanical blockage of gill function.



# MATERIAL SAFETY DATA SHEET

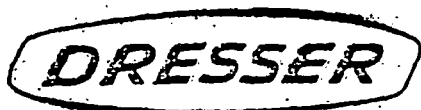
SECTION I	
MANUFACTURER'S NAME <b>Dresser Minerals Division, Dresser Industries, Inc.</b>	EMERGENCY TELEPHONE NO. <b>713-781-5900</b>
ADDRESS (Number, Street, City, State, and ZIP Code) <b>P. O. Box 6504, Houston, Texas 77005</b>	
CHEMICAL NAME AND SYNONYMS <b>Lignite, Leonardite Brown Coal</b>	TRADE NAME AND SYNONYMS <b>Tannathin</b>
CHEMICAL FAMILY <b>Natural sub-coal mineral</b>	FORMULA <b>C<sub>192</sub>H<sub>148</sub>ON<sub>3</sub>S(COOH)<sub>10</sub>(OH)<sub>10</sub>(CO)<sub>9</sub>(OCH<sub>3</sub>)</b>

SECTION II - HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST	<b>THIS SECTION</b>		ALLOYS	<b>THIS SECTION</b>	
VEHICLE	<b>NOT</b>		METALLIC COATINGS	<b>NOT</b>	
SOLVENTS	<b>APPLICABLE</b>		FILLER METAL PLUS COATING OR CORE FLUX	<b>APPLICABLE</b>	
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
<b>THIS SECTION NOT APPLICABLE</b>					

SECTION III - PHYSICAL DATA			
BOILING POINT (°F.)	<b>N.A.</b>	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	<b>1.0-1.8</b>
VAPOR PRESSURE (mm Hg.)	<b>N.A.</b>	PERCENT VOLATILE BY VOLUME (%) (@ 10% moisture content)	<b>44.8</b>
VAPOR DENSITY (AIR=1)	<b>N.A.</b>	EVAPORATION RATE ( = 1)	<b>N.A.</b>
SOLUBILITY IN WATER	<b>Negligible</b>		
APPEARANCE AND ODOR	<b>Odorless, soft earthy brown to black coal-like powder.</b>		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	<b>Auto ignition temperature - 302°F</b>	FLAMMABLE LIMITS	<b>N.A.</b>
EXTINGUISHING MEDIA	<b>Class A Combustible - Use water</b>		
SPECIAL FIRE FIGHTING PROCEDURES	<b>Usual procedure for Class A Fire extinguishment.</b>		
UNUSUAL FIRE AND EXPLOSION HAZARDS	<b>May react to strong oxidizing agents.</b>		

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the information. The information is offered solely for your consideration, investigation and verification.



DRESSER INDUSTRIES, INC.  
 PETROLEUM & MINERALS GROUP  
 P. O. BOX 6504  
 HOUSTON, TEXAS 77005

PMS-630-2

# MATERIAL SAFETY DATA SHEET

SECTION I	
MANUFACTURER'S NAME Dresser Minerals Division, Dresser Industries, Inc.	EMERGENCY TELEPHONE NO. 713-781-5900
ADDRESS (Number, Street, City, State, and ZIP Code) P. O. Box 6504, Houston, Texas 77005	
CHEMICAL NAME AND SYNONYMS Lignite, Leonardite Brown Coal	TRADE NAME AND SYNONYMS Tannathin
CHEMICAL FAMILY Natural sub-coal mineral	FORMULA $C_{192}H_{148}O_{13}S(COOH)_{10}(OH)_{10}(CO)_9(OCH_3)$

SECTION II HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST	THIS SECTION		ALLOYS	THIS SECTION	
VEHICLE	NOT		METALLIC COATINGS	NOT	
SOLVENTS	APPLICABLE		FILLER METAL PLUS COATING OR CORE FLUX	APPLICABLE	
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
THIS SECTION NOT APPLICABLE					

SECTION III PHYSICAL DATA			
BOILING POINT (°F.)	N.A.	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	1.0-1.8
VAPOR PRESSURE (mm Hg.)	N.A.	PERCENT VOLATILE BY VOLUME (%) (at 10% moisture content)	44.8
VAPOR DENSITY (AIR=1)	N.A.	EVAPORATION RATE (at 20°C)	N.A.
SOLUBILITY IN WATER	Negligible		
APPEARANCE AND ODOR	Odorless, soft earthy brown to black coal-like powder.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	Auto Ignition Temperature - 302°F	FLAMMABLE LIMITS	Let Uel
		N.A.	
EXTINGUISHING MEDIA	Class A Combustible - Use water		
SPECIAL FIRE FIGHTING PROCEDURES	Usual procedure for Class A Fire extinguishment.		
UNUSUAL FIRE AND EXPLOSION HAZARDS	May react to strong oxidizing agents.		

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the information. The information is offered solely for your consideration, investigation and verification.

PRINTED IN U.S.A.



DRESSER INDUSTRIES, INC.  
 PETROLEUM & MINERALS GROUP  
 P. O. BOX 6504  
 HOUSTON, TEXAS 77005

PMS-630-2

# MATERIAL SAFETY DATA SHEET

SECTION I	
MANUFACTURER'S NAME MANUFACTURED FOR DRESSER INDUSTRIES, INC.	EMERGENCY TELEPHONE NO. 713-784-8026
ADDRESS (Number, Street, City, State, and ZIP Code) P. O. BOX 6504, HOUSTON, TEXAS 77005	
CHEMICAL NAME AND SYNONYMS TANNIN, TANNIC ACID	TRADE NAME AND SYNONYMS MC QUEBRACHO
CHEMICAL FAMILY TANNIN	FORMULA C <sub>7</sub> H <sub>5</sub> O <sub>4</sub>

SECTION II HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST THIS SECTION			ALLOYS THIS SECTION		
VEHICLE NOT			METALLIC COATINGS NOT		
SOLVENTS APPLICABLE			FILLER METAL PLUS COATING OR CORE FLUX APPLICABLE		
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
THIS SECTION NOT APPLICABLE					

SECTION III PHYSICAL DATA			
BOILING POINT (°F) DECOMPOSES	215°C	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	---
VAPOR PRESSURE (mm Hg.)	NA	PERCENT VOLATILE BY VOLUME (%)	NA
VAPOR DENSITY (AIR=1)	NA	EVAPORATION RATE (_____ = 1)	NA
SOLUBILITY IN WATER	MOD	pH	3.8
APPEARANCE AND ODOR REDDISH BROWN CRYSTALLINE MATERIAL			

SECTION IV FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used) > 300°	FLAMMABLE LIMITS NA	Lel	Uel
EXTINGUISHING MEDIA WATER			
SPECIAL FIRE FIGHTING PROCEDURES NONE			
UNUSUAL FIRE AND EXPLOSION HAZARDS NONE			

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the information. The information is offered solely for your consideration, investigation and verification.

PRINTED IN USA

**SECTION V HEALTH HAZARD DATA**

THRESHOLD LIMIT VALUE  
 NONE ESTABLISHED BY A.C.G.I.H. - USE A.C.G.I.H. T.L.V. FOR NUISANCE DUST -  
 EFFECTS OF OVEREXPOSURE NONE 30 M.P.P.C.F. OR 10 mg/M<sup>3</sup>

EMERGENCY AND FIRST AID PROCEDURES NONE

**SECTION VI REACTIVITY DATA**

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	NONE KNOWN
INCOMPATIBILITY (Materials to avoid) NONE KNOWN			
HAZARDOUS DECOMPOSITION PRODUCTS USUAL PRODUCTS OF INCOMPLETE COMBUSTION SUCH AS SMOKE, CO -- IF FIRE OCCURS.			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	NONE

**SECTION VII SPILL OR LEAK PROCEDURES**

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

USUAL CLEAN UP PROCEDURES FOR DRY, GRANULAR MATERIAL

WASTE DISPOSAL METHOD

USUAL DISPOSAL FOR DRY MATERIALS

**SECTION VIII SPECIAL PROTECTION INFORMATION**

RESPIRATORY PROTECTION (Specify type)  
 U.S. BUREAU OF MINES APPROVED LATEX FOAM DUST MASK -- IF PROLONGED EXPOSURE.

VENTILATION	LOCAL EXHAUST MAY BE USED FOR COMFORT.	SPECIAL
	MECHANICAL (General)	OTHER
PROTECTIVE GLOVES MAY BE USED FOR CLEANLINESS	EYE PROTECTION DUST GOGGLES.	
OTHER PROTECTIVE EQUIPMENT		

**SECTION IX SPECIAL PRECAUTIONS**

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

AVOID CONTACT WITH FIRE -- AVOID DUSTY CONCENTRATION.

OTHER PRECAUTIONS

DRESSER INDUSTRIES  
 PETROLEUM & MINERALS GROUP

PREPARED BY: Robert W. Bevins  
 Robert W. Bevins, Manager  
 Safety & Environmental Control

DATE PREPARED JANUARY 9, 1974

## TOXICITY DATA ON MC QUEBRACHO

### A BIOASSAY - MC QUEBRACHO - A DRILLING FLUID ADDITIVE

#### INTRODUCTION:

MC Quebracho is a moderately water soluble tannin used as a drilling fluid additive. It is a powerful organic dispersing agent composed of 100 % active materials for controlling viscosity, gel strength, and improving wall cake properties. It functions equally well in low pH, high pH, and lime treated mud systems. As a protective colloid it aids in overcoming the effects of cement in low pH systems.

The toxic effects of tannin on aquatic life (both marine and fresh water species) are of great importance; hence, the following tests were conducted in order to determine the acute fish toxicity of MC Quebracho.

#### PROCEDURE:

Fish kill studies applying the Acute Fish Toxicity Test of the American Public Health Association were conducted using a current field sample of MC Quebracho. All tests were conducted by an independent testing laboratory.

#### TEST RESULTS AND CONCLUSIONS:

The test results are listed as  $TL_m$  (Median Tolerance Limit) which represents a concentration which caused fatalities in 50% of the test organisms (*Mollienisias latipinna*-Sailfin Molly) for a specified period of time.

MC Quebracho is normally used in concentrations ranging from 2-5 pounds/barrel. This corresponds approximately to 6,000 - 15,000 ppm depending on viscosity.

#### A. FRESHWATER

24 - 72 hour  $TL_m$  = 140 ppm

96 hour  $TL_m$  = 135 ppm

#### B. SEAWATER

24 hour  $TL_m$  = 170 ppm

48 - 96 hour  $TL_m$  = 158 ppm



DRESSER INDUSTRIES, INC.  
 PETROLEUM & MINERALS GROUP  
 P. O. BOX 6504  
 HOUSTON, TEXAS 77005

PMS-630-2

**ADVISORY**  
 This data has been assembled to reflect the potential hazards associated with using Caustic Soda as a drilling fluid additive. Use of Caustic Soda for any other purpose may require additional safety information not reported in this Data Sheet.

# MATERIAL SAFETY DATA SHEET

SECTION I	
MANUFACTURER'S NAME Manufactured for Dresser Industries, Inc.	EMERGENCY TELEPHONE NO. 713-781-5900
ADDRESS (Number, Street, City, State, and ZIP Code) P. O. Box 6504, Houston, Texas 77005	
CHEMICAL NAME AND SYNONYMS Caustic, Caustic Soda, Lye, Sodium Hydroxide	TRADE NAME AND SYNONYMS Caustic Soda - Flake
CHEMICAL FAMILY Alkali	FORMULA NaOH

SECTION II - HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
THIS SECTION NOT APPLICABLE					

SECTION III - PHYSICAL DATA			
BOILING POINT (°F.)	2534°F	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	2.13
VAPOR PRESSURE (mm Hg.)	N.A.	PERCENT VOLATILE BY VOLUME (%)	N.A.
VAPOR DENSITY (AIR=1)	N.A.	EVAPORATION RATE (_____ = 1)	N.A.
SOLUBILITY IN WATER	100%		
APPEARANCE AND ODOR	Odorless - white to gray flakes or powder.		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	NOT APPLICABLE	FLAMMABLE LIMITS	
EXTINGUISHING MEDIA	NOT APPLICABLE		
SPECIAL FIRE FIGHTING PROCEDURES	NOT APPLICABLE		
UNUSUAL FIRE AND EXPLOSION HAZARDS	Use of water in fire fighting may generate enough heat to cause splattering of the material.		

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the information. The information is offered solely for your consideration, investigation and verification.

PRINTED IN U.S.A.

### SECTION V. HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE 1971 A.C.G.I.H. T.L.V. = 2 mg/M<sup>3</sup>

EFFECTS OF OVEREXPOSURE  
Irritation to the respiratory tract and severe burns to skin and eyes.

EMERGENCY AND FIRST AID PROCEDURES  
Remove from exposure, remove contaminated clothing and shoes immediately, flush all affected parts of the body with copious quantities of water and get medical care if needed.

### SECTION VI. REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID Rapid dilution and mixing with organic compounds
	STABLE	X	

INCOMPATIBILITY (Materials to avoid)  
Acids, chlorinated hydrocarbons, zinc, aluminum or magnesium, and Groups II or III.

HAZARDOUS DECOMPOSITION PRODUCTS  
NOT APPLICABLE

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	NOT APPLICABLE

### SECTION VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED  
Shovel up large quantities, flush remaining with large quantities of water and neutralize remaining traces with acetic acid. Final traces (after above measures) may be removed by covering with sodium bicarbonate.

WASTE DISPOSAL METHOD  
Neutralize and dilute with large quantities of water before discharging into streams, onto ground or into sewers.

### SECTION VIII. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)  
U. S. Bureau of Mines approved respirator for caustic dust.

VENTILATION	LOCAL EXHAUST If required to maintain T.L.V.	SPECIAL
	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES  
Rubber gauntlet type gloves

EYE PROTECTION  
Close fitting chemical goggles.

OTHER PROTECTIVE EQUIPMENT  
Rubber soled shoes and protective clothing.

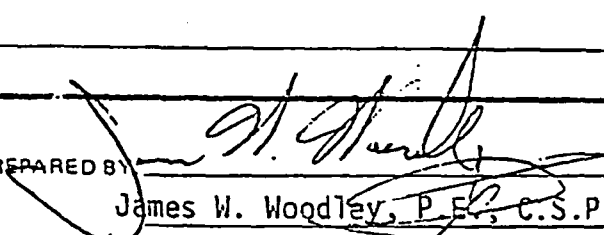
### SECTION IX. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING  
Keep containers tightly closed, store in cool and dry place, clean up spills, wear protective clothing and equipment -- avoid contact.

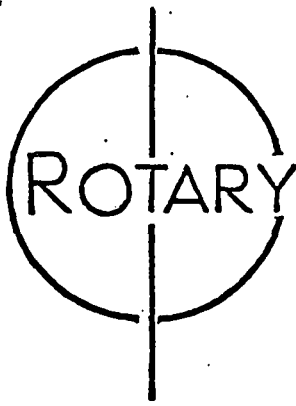
OTHER PRECAUTIONS  
Do not store near hydrocarbons.

DRESSER INDUSTRIES  
PETROLEUM & MINERALS GROUP

DATE PREPARED August 2, 1972

PREPARED BY   
James W. Woodley, P.E., C.S.P., Manager  
Safety and Environmental Control





# ROTARY DRILLING SERVICES, INC.

P. O. BOX 45286

PHONE 622-3013

TULSA, OKLAHOMA 74146

## NOTICE

This is to certify that TS-6429 listed on the attached U.S. Department of Labor Material Safety Data Sheet is the product sold under our trade name of BEN-EX.

ROTARY DRILLING SERVICES, INC.

by:

Lloyd M. Bartlett

Notarized by:

Agatha J. Jenkins

## SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE N.A.

## EFFECTS OF OVEREXPOSURE

Irritation of skin, eyes and upper respiratory passages.

## EMERGENCY AND FIRST AID PROCEDURES

In case of skin contact, wash with soap and water. In case of eye contact, flush with water.

## SECTION VI REACTIVITY DATA

STABILITY	UNSTABLE	X	CONDITIONS TO AVOID
	STABLE		

INCOMPATIBILITY (Materials to avoid) None

HAZARDOUS DECOMPOSITION PRODUCTS CO, CO<sub>2</sub>, NH<sub>3</sub>

HAZARDOUS POLYMERIZATION	MAY OCCUR	X	CONDITIONS TO AVOID
	WILL NOT OCCUR		

## SECTION VII SPILL OR LEAK PROCEDURES

## STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Return material to container. Avoid excessive dusting during clean-up and remove ignition sources. Wet down with water if necessary.

## WASTE DISPOSAL METHOD

Sanitary land fill or incinerate.

## SECTION VIII SPECIAL PROTECTION INFORMATION

## RESPIRATORY PROTECTION (Specify type)

U.S. Bureau of Mines approved dust mask.

VENTILATION	LOCAL EXHAUST	SPECIAL	N.A.
	Local Ventilation		
	MECHANICAL (General)	OTHER	N.A.
	N.A.		

PROTECTIVE GLOVES Cotton EYE PROTECTION Chemical safety goggles

OTHER PROTECTIVE EQUIPMENT

## SECTION IX SPECIAL PRECAUTIONS

## PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Avoid skin and eye contact. Avoid inhalation of dust. Store in dry place.

OTHER PRECAUTIONS

While the information and recommendations set forth herein are believed to be accurate as of the date hereof, MONSANTO COMPANY MAKES NO WARRANTY WITH RESPECT THERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.

Expiration Date: \_\_\_\_\_

Expires: July 30, 1972

# MATERIAL SAFETY DATA SHEET

## SECTION I

Addyston, Ohio

MANUFACTURER'S NAME <b>MONSANTO COMPANY</b>		EMERGENCY TELEPHONE NO. <b>(513) 941-2400</b>
ADDRESS (Number, Street, City, State, and ZIP Code) <b>800 North Lindbergh Boulevard, St. Louis, Missouri 63166</b>		
CHEMICAL NAME AND SYNONYMS <b>Vinyl Acetate/Maleic Anhydride Copolymer Compound</b>		TRADE NAME AND SYNONYMS <b>Lytron TS-6429 Powder</b>
CHEMICAL FAMILY <b>Vinyl Acetate Copolymer</b>	FORMULA <b>N.A.</b>	

Cover  
BEN-EX  
BEN-EX  
RAPIDRI  
*J.P.*

## SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES % TLV (Units)

Not hazardous by definition in 29 CFR, section 1501.2 which pertains to this data sheet.

## SECTION III PHYSICAL DATA

BOILING POINT (P.P.)	N.A.	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	1.2
VAPOR PRESSURE (mm Hg.)	N.A.	PERCENT VOLATILE BY VOLUME (%)	0
VAPOR DENSITY (AIR=1)	N.A.	EVAPORATION RATE (_____=1)	N.A.
SOLUBILITY IN WATER	Appreciable		

APPEARANCE AND ODOR Fine white, amorphous powder, slight acrid odor.

## SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	N.A.	FLAMMABLE LIMITS	N.A.	LoL	UoL
---------------------------	------	------------------	------	-----	-----

EXTINGUISHING MEDIA Water fog, dry chemicals, CO<sub>2</sub>  
SPECIAL FIRE FIGHTING PROCEDURES None

ADDITIONAL FIRE AND EXPLOSION HAZARDS  
Possibility of dust explosion at minimum explosive concentration of 0.025 oz./cu. ft.



DRESSER INDUSTRIES, INC.  
 PETROLEUM & MINERALS GROUP  
 P. O. BOX 6504  
 HOUSTON, TEXAS 77005

PMS-630-2

# MATERIAL SAFETY DATA SHEET

SECTION I			
MANUFACTURER'S NAME Manufactured for Dresser Industries, Inc.		EMERGENCY TELEPHONE NO. 713-784-7873	
ADDRESS (Number, Street, City, State, and ZIP Code) P.O. Box 6504 Houston, Texas 77005			
CHEMICAL NAME AND SYNONYMS Sodium Polyacrylate		TRADE NAME AND SYNONYMS Cypan	
CHEMICAL FAMILY Acrylate Polymer	FORMULA N/A		

SECTION II - HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST This			ALLOYS This		
VEHICLE Section			METALLIC COATINGS Section		
SOLVENTS N/A			FILLER METAL PLUS COATING OR CORE FLUX N/A		
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
This Section N/A					

SECTION III - PHYSICAL DATA			
BOILING POINT (°F.)	N/A	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	N/A
VAPOR PRESSURE (mm Hg.)	N/A	PERCENT VOLATILE BY VOLUME (%)	5%
VAPOR DENSITY (AIR=1)	N/A	EVAPORATION RATE (_____ = 1)	N/A
SOLUBILITY IN WATER	Appreciable		
APPEARANCE AND ODOR	Off-white flakes - no odors		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	N/A	FLAMMABLE LIMITS	Lel Uel
EXTINGUISHING MEDIA	Water		
SPECIAL FIRE FIGHTING PROCEDURES	None		
UNUSUAL FIRE AND EXPLOSION HAZARDS	None		

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the information. The information is offered solely for your consideration, investigation and verification.

**SECTION V HEALTH HAZARD DATA**

THRESHOLD LIMIT VALUE	No TLV established by NIOSH.
EFFECTS OF OVEREXPOSURE	None expected
EMERGENCY AND FIRST AID PROCEDURES	None required. Ordinary measures of personal hygiene should be adequate.

**SECTION VI REACTIVITY DATA**

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	XX	
INCOMPATIBILITY (Materials to avoid)	None specific.		
HAZARDOUS DECOMPOSITION PRODUCTS	Thermal decomposition may produce CO and CO <sub>2</sub>		
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID.
	WILL NOT OCCUR	XX	None

**SECTION VII SPILL OR LEAK PROCEDURES**

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED	Sweep area & dispose in waste container. Flush area with water.
WASTE DISPOSAL METHOD	Incinerate or bury in landfill.

**SECTION VIII SPECIAL PROTECTION INFORMATION**

RESPIRATORY PROTECTION (Specify type)	NIOSH approved for nuisance dusts when necessary		
VENTILATION	LOCAL EXHAUST	Preferable	SPECIAL None
	MECHANICAL (General)	Acceptable	OTHER None
PROTECTIVE GLOVES	For employees cleanliness	EYE PROTECTION	Safety goggles
OTHER PROTECTIVE EQUIPMENT	None		

**SECTION IX SPECIAL PRECAUTIONS**

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING	None
OTHER PRECAUTIONS	None

DRESSER INDUSTRIES  
PETROLEUM & MINERALS GROUP

PREPARED BY:

*A. Robert Moulton, Jr.*  
Supervisor

DATE PREPARED March 22, 1976

Environmental Engineering



DRESSER INDUSTRIES, INC.  
 PETROLEUM & MINERALS GROUP  
 P. O. BOX 6504  
 HOUSTON, TEXAS 77005

PMS-630-2

# MATERIAL SAFETY DATA SHEET

SECTION I	
MANUFACTURER'S NAME Manufactured for Dresser Industries, Inc.	EMERGENCY TELEPHONE NO. 713-781-5900
ADDRESS (Number, Street, City, State, and ZIP Code) P. O. Box 6504, Houston, Texas 77005	
CHEMICAL NAME AND SYNONYMS Mica	TRADE NAME AND SYNONYMS Magco Mica
CHEMICAL FAMILY Complex Silicate	FORMULA $H_2KA1_3(SiO_4)_3$

SECTION II - HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST	THIS SECTION		ALLOYS	THIS SECTION	
VEHICLE	NOT		METALLIC COATINGS	NOT	
SOLVENTS	APPLICABLE		FILLER METAL PLUS COATING OR CORE FILLER	APPLICABLE	
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
THIS SECTION NOT APPLICABLE					

SECTION III - PHYSICAL DATA			
BOILING POINT (°F.)	N.A.	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	2.80
VAPOR PRESSURE (mm Hg.)	N.A.	PERCENT VOLATILE BY VOLUME (%)	N.A.
VAPOR DENSITY (AIR=1)	N.A.	EVAPORATION RATE (_____ =1)	N.A.
SOLUBILITY IN WATER	N.A.		
APPEARANCE AND ODOR	Odorless -- small white flakes		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	FLAMMABLE LIMITS	Lel	Uel
EXTINGUISHING MEDIA	THIS SECTION NOT APPLICABLE		
SPECIAL FIRE FIGHTING PROCEDURES	NO FIRE OR EXPLOSION HAZARD		
UNUSUAL FIRE AND EXPLOSION HAZARDS			

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the information. The information is offered solely for your consideration, investigation and verification.

PRINTED IN USA

**SECTION V - HEALTH HAZARD DATA**

THRESHOLD LIMIT VALUE

Maintain A. C.G.I.H. T.L.V. of 20 M.P.P.C.F.

EFFECTS OF OVEREXPOSURE

May cause a pulmonary fibrosis if breathed in continuous concentrations above the the T.L.V. for a number of years. Infrequent exposures while adding mica to drill-

EMERGENCY AND FIRST AID PROCEDURES

ling fluids are not likely to cause injury due to the negligible exposure. If mica gets in the eye - the eye should be washed out and not rubbed.

**SECTION VI - REACTIVITY DATA**

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	NONE KNOWN
INCOMPATIBILITY (Materials to avoid)		NONE KNOWN	
HAZARDOUS DECOMPOSITION PRODUCTS		NONE KNOWN	
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR		
NOT APPLICABLE			

**SECTION VII - SPIEL OR LEAK PROCEDURES**

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Usual clean up methods for dry materials.

WASTE DISPOSAL METHOD

Usual disposal methods for dry materials.

**SECTION VIII - SPECIAL PROTECTION INFORMATION**

RESPIRATORY PROTECTION (Specify type)

U. S. Bureau of Mines approved respirator for mica dust.

VENTILATION	LOCAL EXHAUST If required to maintain T.L.V.	SPECIAL
	MECHANICAL (General)	OTHER
PROTECTIVE GLOVES For cleanliness		EYE PROTECTION To protect eyes from Mica particles.
OTHER PROTECTIVE EQUIPMENT		

**SECTION IX - SPECIAL PRECAUTIONS**

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

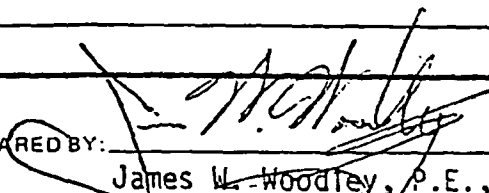
SEE ABOVE

OTHER PRECAUTIONS

SEE ABOVE

DRESSER INDUSTRIES  
PETROLEUM & MINERALS GROUP

DATE PREPARED July 31, 1972

PREPARED BY:   
James W. Woodley, P.E., C.S.P., Mana

Safety and Environmental Control



DRESSER INDUSTRIES, INC.  
 PETROLEUM & MINERALS GROUP  
 P. O. BOX 6504  
 HOUSTON, TEXAS 77005

PMS-630-2

# MATERIAL SAFETY DATA SHEET

SECTION I	
MANUFACTURER'S NAME Manufactured for Dresser Industries, Inc.	EMERGENCY TELEPHONE NO. 713-781-5900
ADDRESS (Number, Street, City, State, and ZIP Code) P. O. Box 6504, Houston, Texas 77005	
CHEMICAL NAME AND SYNONYMS Pulverized cellulose-lignin, ground nut shells	TRADE NAME AND SYNONYMS Nut Plug - all grades
CHEMICAL FAMILY Organic	FORMULA Complex cellulose

SECTION II - HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS	THIS SECTION		BASE METAL	THIS SECTION	
CATALYST	NOT		ALLOYS	NOT	
VEHICLE	APPLICABLE		METALLIC COATINGS	APPLICABLE	
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
THIS SECTION NOT APPLICABLE					

SECTION III - PHYSICAL DATA			
BOILING POINT (°F.)	N.A.	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	1.35
VAPOR PRESSURE (mm Hg.)	N.A.	PERCENT VOLATILE BY VOLUME (%)	N.A.
VAPOR DENSITY (AIR=1)	N.A.	EVAPORATION RATE (_____ = 1)	N.A.
SOLUBILITY IN WATER	Negligible		
APPEARANCE AND ODOR	Odorless - light brown granulated solid.		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Cup) 380°F	FLAMMABLE LIMITS	LeI	UeI
Water is not a fire extinguisher. Although this material does not readily burn with a flame.			
Special fire fighting procedures: Use standard methods for combatting Class A - Smoldering fires.			
UNUSUAL FIRE AND EXPLOSION HAZARDS			
NONE			

This information is given without any warranty or representations, and Dresser assumes no legal responsibility for the information nor for any injury or damages which may result from the use of the information. The information is offered solely for your consideration, investigation and verification.

PRINTED IN USA



**SECTION V. HEALTH HAZARD DATA**

THRESHOLD LIMIT VALUE  
 Maintain T.L.V. for nuisance dust per A.C.G.I.H. if working in confined space for  
 EFFECTS OF OVEREXPOSURE long periods of time: 30 M.P.P.C.F. or 10 mg/M<sup>3</sup>. No known  
 health exposure.

EMERGENCY AND FIRST AID PROCEDURES

NOT APPLICABLE

**SECTION VI. REACTIVITY DATA**

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	NONE KNOWN

INCOMPATIBILITY (Materials to avoid) NONE KNOWN

HAZARDOUS DECOMPOSITION PRODUCTS  
 Usual products of incomplete combustion -- Smoke, CO, etc.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	NOT APPLICABLE

**SECTION VII. SPILL OR LEAK PROCEDURES**

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Usual clean up for dry inert material

WASTE DISPOSAL METHOD

Usual disposal for dry inert material

**SECTION VIII. SPECIAL PROTECTION INFORMATION**

RESPIRATORY PROTECTION (Specify type)  
 U. S. Bureau of Mines approved respirator if in dusty atmosphere.

VENTILATION	LOCAL EXHAUST May be required-if in dusty atmosphere.	SPECIAL
	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES May be used for employee cleanliness. EYE PROTECTION May be used for employee comfort.

OTHER PROTECTIVE EQUIPMENT

**SECTION IX. SPECIAL PRECAUTIONS**

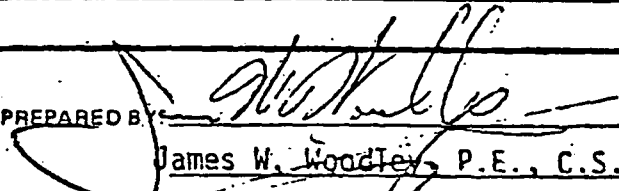
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

NONE KNOWN

OTHER PRECAUTIONS

DRESSER INDUSTRIES  
 PETROLEUM & MINERALS GROUP

DATE PREPARED July 31, 1972

PREPARED BY   
 James W. Woodley, P.E., C.S.P., Manager  
 Safety and Environmental Control

**WAGE AND LABOR STANDARDS ADMINISTRATION**  
Bureau of Labor Standards

# MATERIAL SAFETY DATA SHEET

## SECTION I

<b>MANUFACTURER'S NAME</b> Amoco Oil Company		<b>EMERGENCY TELEPHONE NO.</b>
<b>ADDRESS (Number, Street, City, State, and ZIP Code)</b> 910 South Michigan Ave.		
<b>CHEMICAL NAME AND SYNONYMS</b> Misc vegetable and polymer fibers		<b>TRADE NAME AND SYNONYMS</b> KWIK-SEAL
<b>CHEMICAL FAMILY</b>	<b>FORMULA</b>	

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					
<b>HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES</b>				<b>%</b>	<b>TLV (Units)</b>

<b>BOILING POINT (°F.)</b>	<b>SPECIFIC GRAVITY (H<sub>2</sub>O=1)</b>	
<b>VAPOR PRESSURE (mm Hg.)</b>	<b>PERCENT VOLATILE BY VOLUME (%)</b>	
<b>VAPOR DENSITY (AIR=1)</b>	<b>EVAPORATION RATE</b> (_____ = 1)	
<b>SOLUBILITY IN WATER</b>		
<b>APPEARANCE AND ODOR</b>		

<b>FLASH POINT (Method used)</b>	<b>FLAMMABLE LIMITS</b>	<b>LeI</b>	<b>UeI</b>
<b>EXTINGUISHING MEDIA</b> Water			
<b>SPECIAL FIRE FIGHTING PROCEDURES</b>			
<b>UNUSUAL FIRE AND EXPLOSION HAZARDS</b>			

THRESHOLD LIMIT VALUE

10 mg/M<sup>3</sup>

EFFECTS OF OVEREXPOSURE

EMERGENCY AND FIRST AID PROCEDURES

SECTION VIII REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATIBILITY (Materials to avoid)

HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID:
	WILL NOT OCCUR		

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Return to container.

WASTE DISPOSAL METHOD

Complete combustion - check local ordinance for compliance

SECTION VIII REACTIVITY DATA

RESPIRATORY PROTECTION (Specify type) If high concentration of dust cannot be avoided, use respirator designed to remove particulate matter. (See TLV above).

VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES

EYE PROTECTION

OTHER PROTECTIVE EQUIPMENT

SECTION VIII REACTIVITY DATA

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

OTHER PRECAUTIONS

Occupational Safety & Health Adm.

MATERIAL SAFETY DATA SHEET

SECTION I	
MANUFACTURER'S NAME <b>TEXTILANA DIVISION OF HENKEL INC.</b>	EMERGENCY TELEPHONE NO. <b>213-772-6381</b>
ADDRESS (Number, Street, City, State, and ZIP Code) <b>12607 CERISE AVE. HAWTHORNE, CA 90250</b>	
CHEMICAL NAME AND SYNONYMS <b>Ammonium salt of Sulfated Alcohol Ethoxylate</b>	TRADE NAME AND SYNONYMS <b>SULFOTEX SAL</b>
CHEMICAL FAMILY <b>Alcohol Sulfate</b>	FORMULA <b>R-O-SO<sub>3</sub> NH<sub>4</sub></b>

SECTION II HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS	<b>Ethanol</b>	<b>13.5-15%</b>	FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)

SECTION III PHYSICAL DATA			
BOILING POINT (°F.)	<b>165</b>	SPECIFIC GRAVITY (H <sub>2</sub> O=1) 25°C	<b>1.014</b>
VAPOR PRESSURE (mm Hg.)		PERCENT VOLATILE BY VOLUME (%)	<b>37-40</b>
VAPOR DENSITY (AIR=1)		EVAPORATION RATE (_____ = 1)	
SOLUBILITY IN WATER	<b>miscible</b>		
APPEARANCE AND ODOR	<b>Light yellow to white liquid with mild alcoholic odor.</b>		

SECTION IV FIRE AND EXPLOSION HAZARD DATA		
FLASH POINT (Method used) <b>Pensky-Martens, 86°F; 152°F COC</b>	FLAMMABLE LIMITS	Let   Uel <b>Not determined</b>
EXTINGUISHING MEDIA <b>Alcoholic foam, CO<sub>2</sub>, dry chemical, water</b>		
SPECIAL FIRE FIGHTING PROCEDURES <b>None</b>		
UNUSUAL FIRE AND EXPLOSION HAZARDS <b>None</b>		

## SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: Not determined

EFFECTS OF OVEREXPOSURE: May cause irritation to eyes and skin if not removed immediately

### EMERGENCY AND FIRST AID PROCEDURES

Wash skin and eyes thoroughly with copious amounts of water. For eyes, wash at least 15 minutes. Get medical aid. If ingested, vomiting may be induced. Get medical aid if possible.

## SECTION VI REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	-

INCOMPATIBILITY (Materials to avoid): elevated temperatures, acid conditions, quaternary ammonium compounds

### HAZARDOUS DECOMPOSITION PRODUCTS

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	-

## SECTION VII SPILL OR LEAK PROCEDURES

### STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Wash down with large quantities of water. May cause some problems with foaming.

### WASTE DISPOSAL METHOD

Incinerate or pass through a standard sewage treatment facility. Be sure that all Federal, State and local regulations are met.

## SECTION VIII SPECIAL PROTECTION INFORMATION

### RESPIRATORY PROTECTION (Specify type)

Not ordinarily required

VENTILATION	LOCAL EXHAUST If used at high temperature	SPECIAL --
	MECHANICAL (General) Satisfactory	OTHER --

PROTECTIVE GLOVES: Rubber	EYE PROTECTION: Chemical goggles
---------------------------	----------------------------------

OTHER PROTECTIVE EQUIPMENT: Protective coveralls if spills are likely

## SECTION IX SPECIAL PRECAUTIONS

### PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Avoid contact with skin and eyes; avoid storing product at elevated temperature or at extremes of high or low pH for best product quality.

### OTHER PRECAUTIONS

None

7331

DRESSER INDUSTRIES, INC.  
 PETROLEUM & MINERALS GROUP  
 P. O. BOX 6504  
 HOUSTON, TEXAS 77005

PMS-630

# MATERIAL SAFETY DATA SHEET

## SECTION I

MANUFACTURER'S NAME <b>MANUFACTURED FOR DRESSER INDUSTRIES, INC.</b>		EMERGENCY TELEPHONE NO. <b>713-784-7873</b>
ADDRESS (Number, Street, City, State, and ZIP Code) <b>P. O. BOX 6504, HOUSTON, TEXAS, 77005</b>		
CHEMICAL NAME AND SYNONYMS <b>HYDRATED MAGNESIUM SILICATE</b>		TRADE NAME AND SYNONYMS <b>GEO-GEL</b>
CHEMICAL FAMILY <b>CLAY MINERAL</b>	FORMULA <b>(Si<sub>2</sub>) (Mg<sub>3</sub>) O<sub>30</sub> (OH)<sub>2</sub> (H<sub>2</sub>O)<sub>4</sub></b>	

## SECTION II HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)	
PIGMENTS			BASE METAL			
CATALYST	THIS SECTION NOT APPLICABLE		ALLOYS	THIS SECTION NOT APPLICABLE		
VEHICLE			METALLIC COATINGS			
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX			
ADDITIVES			OTHERS			
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES					%	TLV (Units)
THIS SECTION NOT APPLICABLE						

## SECTION III PHYSICAL DATA

BOILING POINT (°F.)	NA	SPECIFIC GRAVITY (H <sub>2</sub> O=1)	2.2-2.4
VAPOR PRESSURE (mm Hg.)	NA	PERCENT VOLATILE BY VOLUME (%)	15.7%
VAPOR DENSITY (AIR=1)	NA	EVAPORATION RATE (_____ = 1)	NA
SOLUBILITY IN WATER			
APPEARANCE AND ODOR			

## SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) <b>NONE</b>	FLAMMABLE LIMITS	Lcl	Ucl
EXTINGUISHING MEDIA	<b>NA</b>		
SPECIAL FIRE FIGHTING PROCEDURES			
<b>NA</b>			
UNUSUAL FIRE AND EXPLOSION HAZARDS			
<b>NA</b>			

NO. OF... ESTABLISHED BY ACGIH  
 EFFECTS OF OVEREXPOSURE  
 NONE KNOWN

EMERGENCY AND FIRST AID PROCEDURES  
 SHOULD MATERIAL GET INTO EYES - FLUSH WITH WATER. DO NOT RUB EYES IN  
 ORDER TO PREVENT IRRITATION.

SECTION VI REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	XX	NONE KNOWN
INCOMPATIBILITY (Materials to avoid)			
HAZARDOUS DECOMPOSITION PRODUCTS			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR		

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED  
 SWEEP UP AS A DRY POWDERY MATERIAL. DO NOT FLUSH WITH WATER AS IT  
 BECOMES VERY SLIPPERY WHEN WET.

WASTE DISPOSAL METHOD  
 SAFE FOR LANDFILLS.

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)		
RECOMMENDED NIOSH APPROVED FOR NUISANCE DUSTS		
VENTILATION	LOCAL EXHAUST	SPECIAL
	MECHANICAL (General)	OTHER
PROTECTIVE GLOVES	EYE PROTECTION	
NOT REQUIRED	FOR EMPLOYEE COMFORT	
OTHER PROTECTIVE EQUIPMENT		
NONE REQUIRED		

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE  
 STORE IN DRY AREA. DO NOT GET BAGS MOIST OR WET.

OTHER PRECAUTIONS

COMPANY NAME DRISSEN INDUSTRIES, INC. PREPARED BY:  
 NOVEMBER 10, 1976

*[Handwritten Signature]*  
 JAMES W. HODGINS

UNION OIL COMPANY OF CALIFORNIA

CEMENTING GUIDE

COVE FORT PROSPECT

Cement Slurries for use at the Cove Fort Prospect - These Slurries are to be used in the following cases unless alternate instructions are given, or hole conditions indicate a departure from the Slurries listed below. Slurries are entirely based upon previous results and research and will be changed as often as current research dictates necessary.

Any variance from these Slurries must be cleared with the District office.

1. 20" Conductor, depth approximately 200' - 300'.

Type of cement:

Class "B" with 2% to 3%  $\text{CaCl}_2$ . In rare cases, hole temperatures may dictate the use of less than 2%  $\text{CaCl}_2$ . A minimum of 75% excess is recommended to get cement returns to surface.

Water Ratio: 0.67 ft.<sup>3</sup>/sack  
Slurry Weight: 118#/ft.<sup>3</sup>  
Yield: 1.15 ft.<sup>3</sup>/sack

2. 13-3/8" Surface String, depth approximately 1000' - 1500'.

Type of cement:

- a. Class "B" 1-1 Perlite cement (1 ft.<sup>3</sup> cement to 1 ft.<sup>3</sup> Perlite) with 40% Silica Flour (by wt. of cement only) 0.5% CFR-2, 2% Gel and the required percentage of Retarder based on pumping time and hole temperature. 75% excess Slurry is recommended to get cement returns to surface. Hole conditions may dictate using more than the 75% excess.

Water Ratio: 1.30 ft.<sup>3</sup>/sack  
Slurry Weight: 100#/ft.<sup>3</sup> (surface wt.)  
Yield: 2.12 ft.<sup>3</sup>/sack

CONFIDENTIAL

This document contains confidential information which is proprietary to Union Oil Co. of Calif. The contents of this document are not to be revealed to any person without the express written consent of Union Oil Co. of California.



2. Continued-----

- b. A tail in "shoe", Slurry of "B" cement with 40% Silica Flour (by wt. of cement only) and 0.75% CFR-2 with Retarder as required should be run.

Water Ratio: 0.86 ft.<sup>3</sup>/sack  
Slurry Weight: 118#/ft.<sup>3</sup>  
Yield: 1.57 ft.<sup>3</sup>/sack

3. 9-5/8" Liner, depth approximately 3000' to 4500'.  
Lap to be 200'±.

Type of cement:

- a. Class "B" 1-1 Perlite cement (1 ft.<sup>3</sup> cement to 1 ft.<sup>3</sup> Perlite) with 40% Silica Flour (by wt. of cement only), 2% Gel, 0.5% CFR-2 and the required percentage of Retarder based on hole temperature and pumping time. 50% to 75% excess Slurry is recommended in order to bring cement above the liner lap or hanger. Hole conditions may dictate using more than 75% excess.

Water Ratio: 1.30 ft.<sup>3</sup>/sack  
Slurry Weight: 100#/ft.<sup>3</sup> (surface wt.)  
Yield: 2.12 ft.<sup>3</sup>/sack

- b. Tail in with Class "B" cement premixed with 40% Silica Flour (by weight of cement only), 0.75% CFR-2, and the required percentage of Retarder.

Water Ratio: 0.86 ft.<sup>3</sup>/sack  
Slurry Weight: 118#/ft.<sup>3</sup>  
Yield: 1.57 ft.<sup>3</sup>/sack

4. Liner Lap Squeeze.

Type of cement:

- a. Class "B" cement premixed with 40% Silica Flour (by wt. of cement only) and 0.75% CFR-2.

Water Ratio: 0.86 ft.<sup>3</sup>/sack  
Slurry Weight: 118#/ft.<sup>3</sup>  
Yield: 1.57 ft.<sup>3</sup>/sack

4. Continued-----

- b. Class "B" cement premixed with 40% Silica Flour (by wt. of cement only) 0.75% CFR-2 and densified.

Water Ratio: 0.78 ft.<sup>3</sup>/sack  
Slurry Weight: 121#/ft.<sup>3</sup>  
Yield: 1.49 ft.<sup>3</sup>/sack

5. 9-5/8" Liner Tie Back String, depth approximately 900' - 1300'.

Type of cement:

- a. Class "B" cement with 40% Silica Flour (by wt. of cement only), 2% Gel and 0.75% CFR-2. Retarder is not required in most areas. 20% excess Slurry is recommended.

Water Ratio: 0.81 ft.<sup>3</sup>/sack  
Slurry Weight: 121#/ft.<sup>3</sup>  
Yield: 1.53 ft.<sup>3</sup>/sack

6. Lost Circulation Plugs.

Type of cement:

- a. A 168 ft. HOWCO mix of Gel-Gilsonite (batch mixed - 100 lbs Gel, 600 lbs. Gilsonite), followed by 1-1-1 sand, Perlite, "B" cement (100 lbs sand, 1 ft.<sup>3</sup> Perlite, 1 ft.<sup>3</sup> cement), with 0.50% CFR-2 should be used where extensive lost circulation exists. This Slurry must be batch mixed in a blender.

Water Ratio: 1.05 ft.<sup>3</sup>/sack  
Slurry Weight: 121#/ft.<sup>3</sup>  
Yield: 2.22 ft.<sup>3</sup>/sack

7. Sidetrack Plugs - Plug Backs.

Type of cement:

- a. A HOWCO mix of "B" cement with 40% Silica Flour (by wt. of cement only), with 0.75% CFR-2 and required Retarder. This Slurry must be batch mixed in a blender.

7. Continued-----

Water Ratio:	0.78 ft. <sup>3</sup> /sack
Slurry Weight:	121#/ft. <sup>3</sup>
Yield:	1.49 ft. <sup>3</sup> /sack

GENERAL

Excess cement should be mixed in all cases to assure complete coverage of the casing strings.

NOTE:

In any event that returns to the surface are not obtained during cementing of the 13-3/8" surface string or the 9-5/8" tie-back string, a detailed procedure for a top job, sandback, or alternate plan of action, as determined necessary, must have approval of the District office prior to proceeding.

UNION OIL COMPANY OF CALIFORNIA  
 PROPOSED CEMENTING PROGRAM  
 (Applies to Casing Program)

<u>CASING SIZE</u>	<u>CU. FT. SLURRY TOTAL</u>	<u>CU. FT. EXCESS</u>	<u>TOP CEMENT COLUMN</u>	<u>HOLE SIZE</u>	<u>TYPE CEMENT</u>	<u>REMARKS</u>
20"	691	254	Surface	26"	"B"	"B" cement to be accelerated with 2% to 3% CaCl <sub>2</sub> .
13-3/8"	1809*	651	Surface	17-1/2"	"B"	"B" cement, 1-1 Perlite with 40% Silica Flour, 0.5% CFR-2, 2% Gel and required Retarder.
9-5/8" Liner	927*	266	1300'	12-1/4"	"B"	"B" cement, 1-1 Perlite with 40% Silica Flour, 0.5% CFR-2, 2% Gel and required Retarder.
9-5/8" Tie-Back	600	94	Surface	13-3/8" Casing	"B"	"B" cement, 1-1 Perlite with 40% Silica Flour, 0.75% CFR-2 and 2% Gel.

\*Last 200 cu. ft. with 40% Silica Flour, 0.75% CFR-2 and Retarder as required.

All Cement to be retarded to acceptable specifications.

UNION OIL CO. OF CALIFORNIA  
GEOTHERMAL DIVISION

CONFIDENTIAL

This document contains confidential information which is proprietary to Union Oil Co. of Calif. The contents of this document are not to be revealed to any person without the express written consent of Union Oil Co. of California.

BOP TESTING PROCEDURE

I. 20" CONDUCTOR CASING

- A. Install a 20" - 2000, 20" slipweld casing head on 20", 94#, K-55 buttress casing stub. Weld casing head inside and outside. Test between welds to 500 PSI. (Do not exceed collapse pressure - 520 PSI)
- B. Install a 20" drilling spool with two 3" outlets immediately above the casing head. Install a 20" - 2000 Shaffer hydraulic single gate BOP with blind rams on the 20" drilling spool. Install a 20" - 2000 hydril BOP on top of the 20" - 2000 Shaffer hydraulic gate. Install flow nipple (to be replaced with Grant 20" rotating head if necessary).
- C. Test BOP's prior to drilling out of 20" casing as follows:
  1. Displace mud through drill pipe at 90' with cold water, flushing all mud lines with cold water.
  2. Pull and stand back drill pipe. Pick up and run a large sub with bit inside hydril preventer. Close hydril with bit immediately below rubber element.
  3. Test (pumping through Kelly) 20" casing, Kelly and rotary hose, BOP, kill and choke valves and casing head to 500 PSI for 30 minutes. Bleed off pressure and open hydril.
  4. Remove tools from hole. Close CSO rams in single gate. Test casing head, single gate, wing valves and kill line to 500 PSI for 30 minutes. Pump through kill line. Bleed off pressure and open CSO rams.
  5. Close kill line valve on drilling spool. Test lines and manifold to 1000 PSI.

I. 20" CONDUCTOR CASING - Continued-----

C.

6. Test down stream (diverter line) valve for operation and flow to mud tank.
7. Drilling spool with 3" outlets to be installed immediately above the 20" - 2000 slipweld flange and below the 20" - 2000 single gate.

II. 13-3/8" CASING

- A. Install a 12" Series 900 x 13-3/8" slipweld casing head on 13-3/8", 54.5#, K-55 buttress casing stub. Test between welds to 1000 PSI. (Do not exceed collapse pressure - 1130 PSI).
- B. Install a 12" - 3000 x 12" - 3000 drilling spool on 12" -3000 casing head. Install a 3" kill line and a 3" choke line to the side outlets of the drilling spool. Install a 12" - 3000 (Series 900) hydraulic double gate BOP with drill pipe rams and blind rams on top of drilling spool. Install a 12" hydril, 900 Series (3000 PSI) on top of the hydraulic double gate. Install a drilling nipple and flow nipple. (To be replaced with a 12" - 900 Grant rotating head if temperature exceeds 71.1°C (160°F)).
- C. Test BOP's prior to drilling out of 13-3/8" casing as follows:
  1. Displace mud through drill pipe at 90' with cold water, flushing all mud lines with cold water.
  2. Close drill pipe rams with lower tool joint of top single immediately under pipe ram.
  3. Test (pumping through Kelly) 13-3/8" casing, Kelly and rotary hose, BOP, kill and choke valves and casing head to 1500 PSI for 30 minutes. Bleed off pressure and open rams.
  4. Test 12" hydril on 13-3/8" surface casing to 1500 PSI.
    - a. Run a large sub with bit inside hydril preventer. Close hydril with bit immediately below rubber element. Pump through Kelly to test hydril, casing, etc.

II. 13-3/8" CASING - Continued

5. Remove tools from hole. Close blind rams in double gate. Test casing head, double gate, wing valves, kill and choke lines to 1500 PSI for 30 minutes. Pump through kill line. Bleed off pressure and open blind rams.
6. Test Kelly cock to 1500 PSI.
  - a. Observe accumulator operation during closing and opening. Record the time required for each closure and for pressure recovery to normal. Note and correct any questionable functions. Inspect and make repairs to any line leaks.
7. Operate double gate, choke and kill valves when out of hole with drill string.
8. Test complete BOP assembly weekly. Record all pressure - time data. Make repairs as required prior to resuming operations and record same.
9. If a Grant rotating head is required for aerated drilling operations, use only high temperature rubber pack-off assemblies.

III. 9-5/8" LINER

- A. Following installation of the 9-5/8" casing string liner, test B.O.P.E. with the same testing procedure as employed on the 13-3/8" casing, to 1500 PSI.

IV. 9-5/8" LINER TIE-BACK

- A. Following installation of the 9-5/8" tie-back string, remove the 12" - 3000 x 12" - 3000 drilling spool and install a 12" - 3000 x 10" - 2000 expansion spool complete with pack off and two 3" - 3000 flanged outlets with 3" - 3000 WKM valves on top of the 12" casing head. Install a 10" - 2000 WKM master valve on top of the expansion spool. Install a 10" - 2000 x 12" - 3000 drilling spool complete with side outlets and valves on top of 10" - 2000 WKM master valve. Reinstall B.O.P.E. as required for 13-3/8" casing. Test B.O.P.E. with the same testing procedure as employed on the 13-3/8" casing to 1500 PSI.

V. GENERAL

- A. A tested maintained full opening drill pipe safety valve shall be kept in readiness in an open position on the rig floor.
- B. B.O.P. drills will be conducted and recorded on a weekly basis for each crew.
- C. See enclosed drawings for detailed B.O.P. stacks and choke manifold.



BOP DETAIL AND TEST SPECIFICATIONS

<u>BOP</u>	<u>CASING SIZE</u>	<u>COLLAPSE PSI</u>	<u>BURST PSI MIN. YIELD</u>	<u>CASING DEPTH</u>	<u>TEST PSI</u>		<u>REMARKS</u>
					<u>TOP</u>	<u>BOTTOM</u>	
20"-2000 Shaffer Hydraulic single gate (blind rams). 20"-2000 hydril.	20"	520	2110	250	500	625	Test between welds on csg. head to 500 PSI Limited by collapse PSI of 520. Burst S.F. = 3.38
12"-3000 Series 900 Shaffer Hydraulic double gate (drill pipe and blind rams). 12"-3000 Series 900 Hydril.	13-3/8"	1130	2730	1500	1500	2250	Test between welds on csg. head to 1000 PSI Limited by collapse PSI of 1130. Burst S.F. = 1.21
12"-3000 Series 900 Shaffer Hydraulic double gate (drill pipe and blind rams). 12"-3000 Series 900 Hydril.	9-5/8"/36#	2020	3520	3200	1500	3100	Burst S.F. = 1.14
12"-3000 Series 900 Shaffer Hydraulic double gate (drill pipe and blind rams). 12"-3000 Series 900 Hydril.	9-5/8"/40#	2570	3950	1300	1500	2150	Burst S.F. = 1.84

NOTE: All tests are to be made prior to drilling out of casing.

## UNION OIL COMPANY OF CALIFORNIA

## GEOHERMAL DIVISION

COMPANY DRILLING FOREMAN'S  
INSPECTION CHECK LIST FOR BLOWOUT PREVENTER EQUIPMENT

BLOWOUT PREVENTERS

The following equipment has been tested with water. List time interval, test pressure and results.

1. Hydril \_\_\_\_\_
2. Pipe rams \_\_\_\_\_
3. Blind rams \_\_\_\_\_
4. Choke manifold valves \_\_\_\_\_
5. Kill line and valves \_\_\_\_\_
6. Kelly cock \_\_\_\_\_
7. Standpipe valves \_\_\_\_\_
8. Safety valves \_\_\_\_\_
9. Rotary hose \_\_\_\_\_

MISCELLANEOUS CHECK LIST

1. Are choke lines installed properly? \_\_\_\_\_
2. Are hand wheels installed and braced? \_\_\_\_\_
3. Can rams be locked in closed position from outside substructure?  
\_\_\_\_\_
4. Are all outlets equipped with high pressure fittings? \_\_\_\_\_
5. Are relief lines of large capacity available, if needed to hold pressure down on surface casing? \_\_\_\_\_
6. Do valves operate properly? \_\_\_\_\_
7. Are handles installed and within easy reach? \_\_\_\_\_
8. Are BOP's properly braced? \_\_\_\_\_
9. Are bolts in all bolt holes? \_\_\_\_\_
10. Do all bolts have nuts? \_\_\_\_\_
11. Are all threads filled? \_\_\_\_\_
12. Are choke lines and emergency flowline tied into mud gas separator?  
\_\_\_\_\_
13. Can gas separated from the mud be safely discharged or flared?  
\_\_\_\_\_
14. Are there separate fill-up and kill lines? \_\_\_\_\_

15. What chokes are in manifold? L. \_\_\_\_\_ R. \_\_\_\_\_
16. Chokes on location (No. & Size) \_\_\_\_\_
17. Indicate below the position of the rams in the BOP stack.
- |        | <u>Ram</u> | <u>Size</u> |
|--------|------------|-------------|
| Upper  | _____      | _____       |
| Middle | _____      | _____       |
| Lower  | _____      | _____       |
18. Does each crew have regularly scheduled BOP drills? \_\_\_\_\_
19. Are "on bottom" drills, "while tripping" drills, "drill collar" drills, and "out-of-hole" drills held at intervals, and are the times and results entered on the daily drilling report? \_\_\_\_\_
20. Are pit level indicator, flow sensor and stroke counter working properly? \_\_\_\_\_
21. Do alarms work and are they set close enough to sense immediate loss or gain? \_\_\_\_\_
22. Is there a specified procedure for hole filling (number of stands) and is this done more often when drill collars and heavy-wate pipe are pulled? \_\_\_\_\_
23. Are charts posted on the rig showing barrels to be pumped from pits with various amounts of pipe removed from hole? \_\_\_\_\_  
How is hole fill-up measured? \_\_\_\_\_
24. Are crews instructed as to procedures during trip if swabbing or lost circulation is detected? \_\_\_\_\_
25. Has each crew been instructed on proper emergency back-up operation of BOP system using nitrogen bottles? \_\_\_\_\_
26. Are maximum surface pressures allowed in well specified and posted? \_\_\_\_\_
27. Has mud program been posted on location? \_\_\_\_\_
28. Is sufficient mud stock available? \_\_\_\_\_
29. The BOP equipment conforms to specifications with the following approved exceptions: \_\_\_\_\_
29. Indicate time in seconds to perform the following:
- a. Open choke manifold \_\_\_\_\_ Sec.
  - b. Close Hydril \_\_\_\_\_ Sec.
  - c. Close pipe rams \_\_\_\_\_ Sec.
  - d. Close blind rams \_\_\_\_\_ Sec.

Check accumulator pressure before and after above operations and record:

Before \_\_\_\_\_ PSI, After \_\_\_\_\_ PSI.

Signed: \_\_\_\_\_  
Company Drilling Engineer or  
Drilling Foreman

**CONTRACTORS DRILLING FOREMAN'S INSPECTION CHECK LIST FOR BLOWOUT PREVENTER EQUIPMENT**

WELL NAME AND NUMBER \_\_\_\_\_

DATE: \_\_\_\_\_

SIZE CASING: \_\_\_\_\_

SIZE AND SERIES OF BLOWOUT PREVENTER: \_\_\_\_\_

The following list is to be checked by the Contractor's Drilling Foreman, signed and turned in to the Union Oil Co. Drilling Foreman as soon as possible after nipping up blowout preventers. It must be done prior to drilling out shoe.

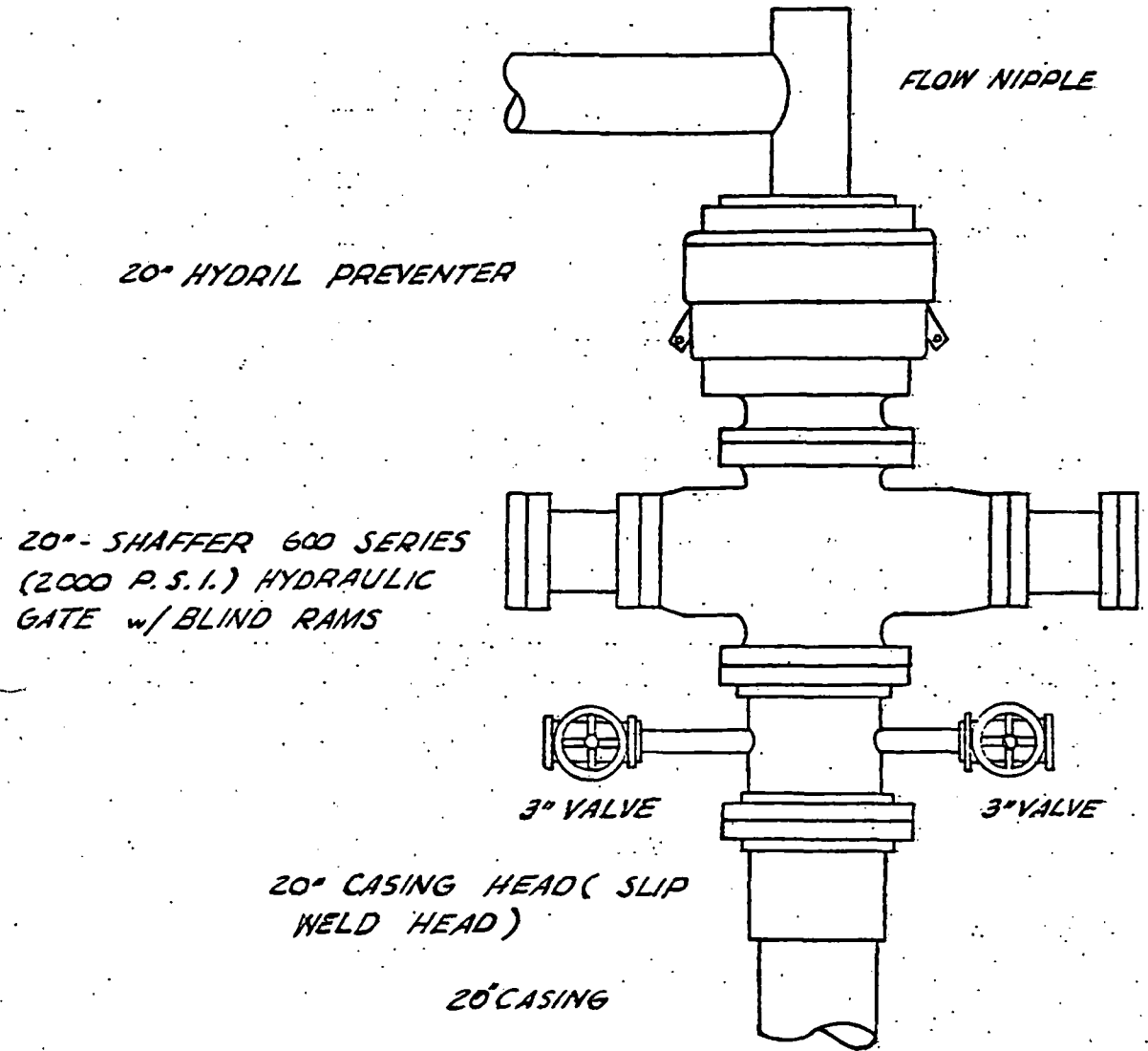
1. Are Kelly cocks in working order? \_\_\_\_\_  
Is Kelly cock wrench available and easily located? \_\_\_\_\_
2. Is a Lower Kelly cock with lifting device on the floor? \_\_\_\_\_  
Cross-over subs to drill collars? \_\_\_\_\_ . Inside BOP? \_\_\_\_\_
3. Is the accumulator fluid level O.K.? \_\_\_\_\_
4. Is a test plug available? \_\_\_\_\_
5. Are BOP hand wheels installed and properly braced? \_\_\_\_\_
6. Are kill line, fill-up line, and choke line properly installed according to specifications? \_\_\_\_\_
7. Are all outlets equipped with high pressure fittings? \_\_\_\_\_
8. Does equipment hold accumulator pressure without leaking or unusual amount of pump operation? \_\_\_\_\_
9. Does accumulator pump operate without leaking? \_\_\_\_\_
10. Are BOP's properly braced to prevent wobble as drilling proceeds? \_\_\_\_\_
11. Casing head inspection:
  - a. Did all bolts have nuts? \_\_\_\_\_
  - b. Were all nut threads filled? \_\_\_\_\_
  - c. Did you see nuts tightened by application of hammer or wrench? \_\_\_\_\_

This equipment has been tested to \_\_\_\_\_ PSI with \_\_\_\_\_ and  
was found to be in good order. (type of fluid)

Signed by:

Contract Foreman \_\_\_\_\_

Representing \_\_\_\_\_  
(Contractor)



20" HYDRIL PREVENTER

20" - SHAFFER 600 SERIES  
(2000 P.S.I.) HYDRAULIC  
GATE w/ BLIND RAMS

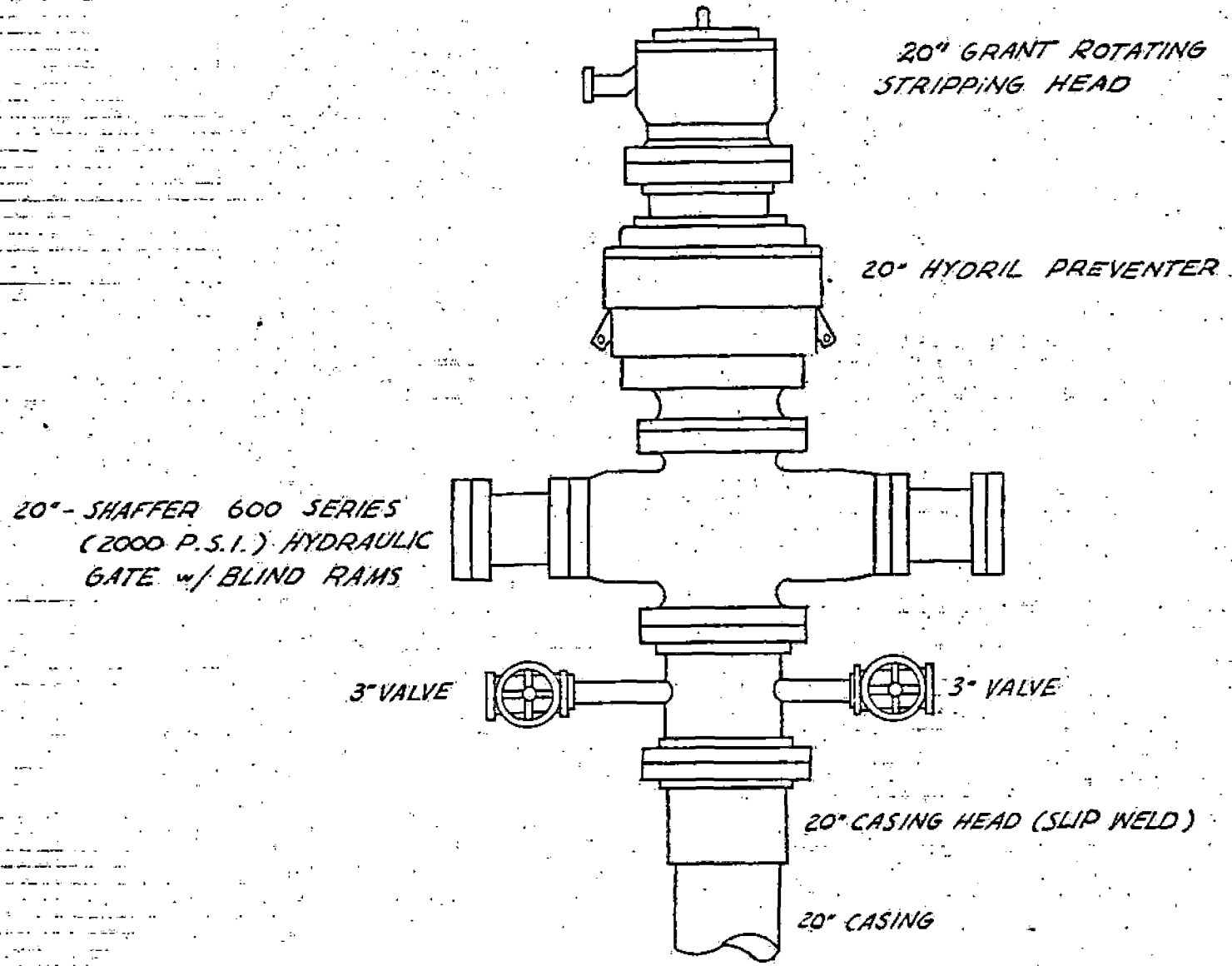
3" VALVE

3" VALVE

20" CASING HEAD (SLIP  
WELD HEAD)

20" CASING

REVISIONS	DATE	<b>UNION</b> <small>76</small>	DRAWN
			FOR: D.A.
		UNION OIL COMPANY OF CALIFORNIA - GEOTHERMAL DIVISION	BY: J.D.S.
		B.O.P. INSTALLATION FOR USE ON 20" CASING STRING	DATE: 1-30-77
			SCALE:
			DRAWING NUMBER 11-2 C



20" - SHAFER 600 SERIES  
(2000 P.S.I.) HYDRAULIC  
GATE w/ BLIND RAMS

3" VALVE

3" VALVE

20" CASING HEAD (SLIP WELD)

20" CASING

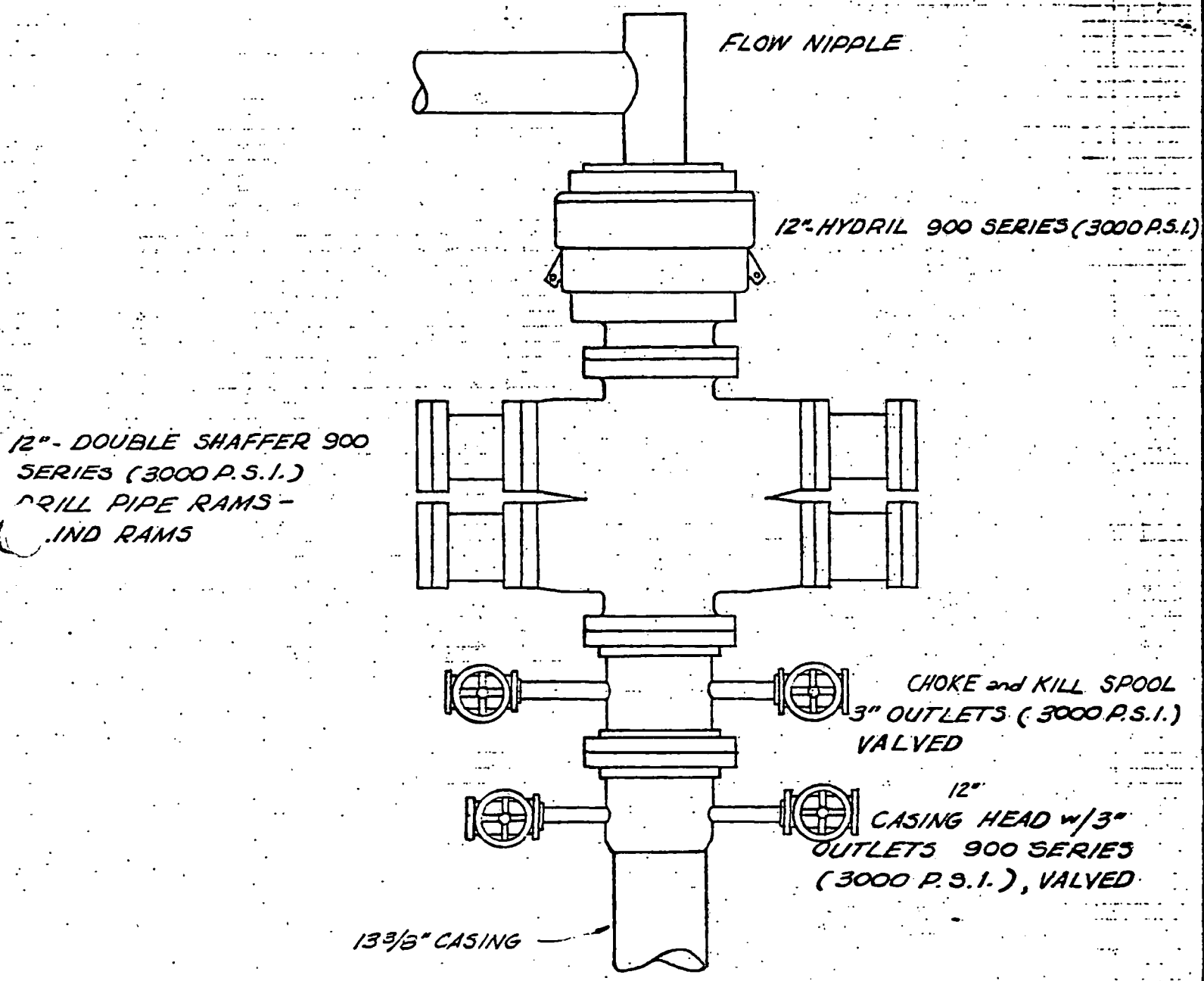
REVISED	DATE



UNION OIL COMPANY OF CALIFORNIA - GEOTHERMAL DIVISION

B.O.P. INSTALLATION FOR USE  
ON 20" CASING STRING

DRAWN
FOR: D.A.
BY: L.D.C.
DATE: 1-30-77
SCALE: NONE
DRAWING NUMBER
1142 3



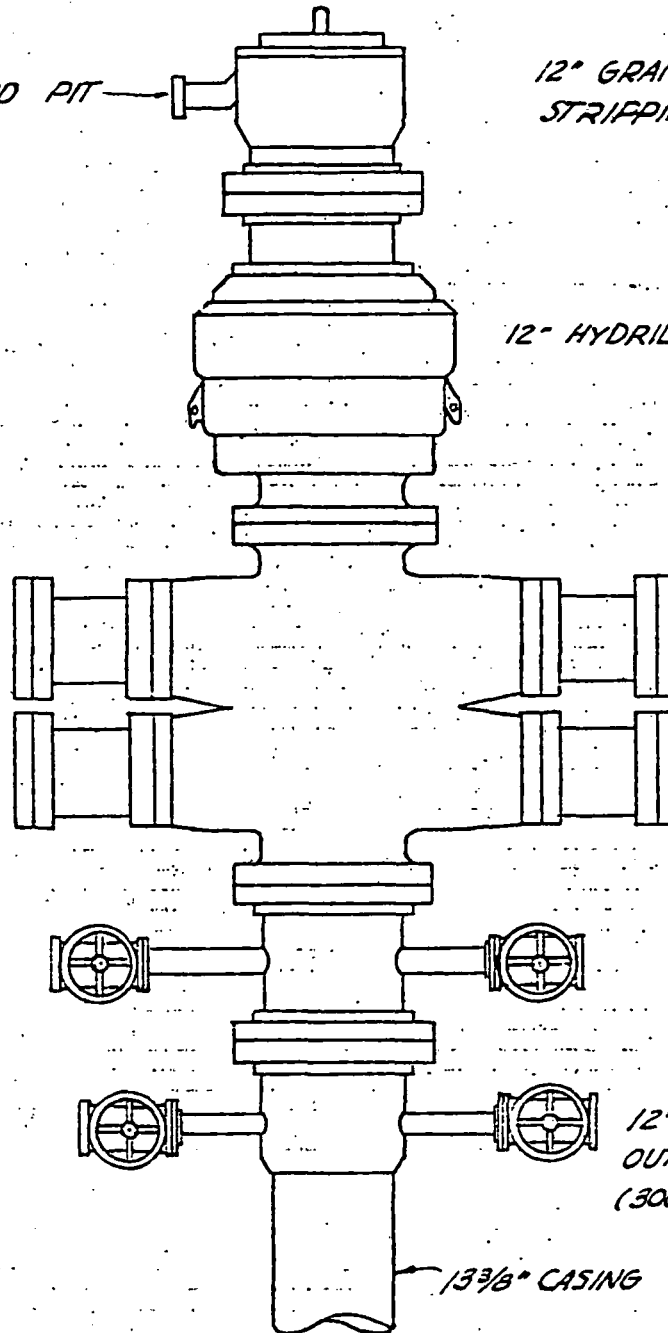
REVISIONS	DATE	<b>UNION</b> 76	DRAWN
			FOR: B.W.R.
		UNION OIL COMPANY OF CALIFORNIA - GEOTHERMAL DIVISION	BY: L.D.C.
		13 3/8" B.O.P. HYDRIL DOUBLE GATE INSTALLATION FOR DRILLING BELOW 13 3/8" CSG.	DATE: 3/9/76
			SCALE: NONE
			DRAWING NUMBER 1143 B

FLOW TO MUD PIT

12" GRANT ROTATING STRIPPING HEAD

12" HYDRIL 900 SERIES (3000 P.S.I.)

2" - DOUBLE SHAFFER 900 SERIES (3000 P.S.I.) DRILL PIPE RAMS - BLIND RAMS



CHOKER and KILL SPOOL  
3" OUTLETS (3000 P.S.I.)  
VALVED.

12" CASING HEAD w/3" OUTLETS 900 SERIES (3000 P.S.I.), VALVED

1 3/8" CASING

REVISION	DATE

**union** 76

UNION OIL COMPANY OF CALIFORNIA - GEOTHERMAL DIVISION

1 3/8" B.O.P. HYDRIL DOUBLE GATE w/

ROTATING HEAD FOR DRILLING BELOW 1 3/8" C56.

DRAWN

FOR: D.A.

BY: L.D.C.

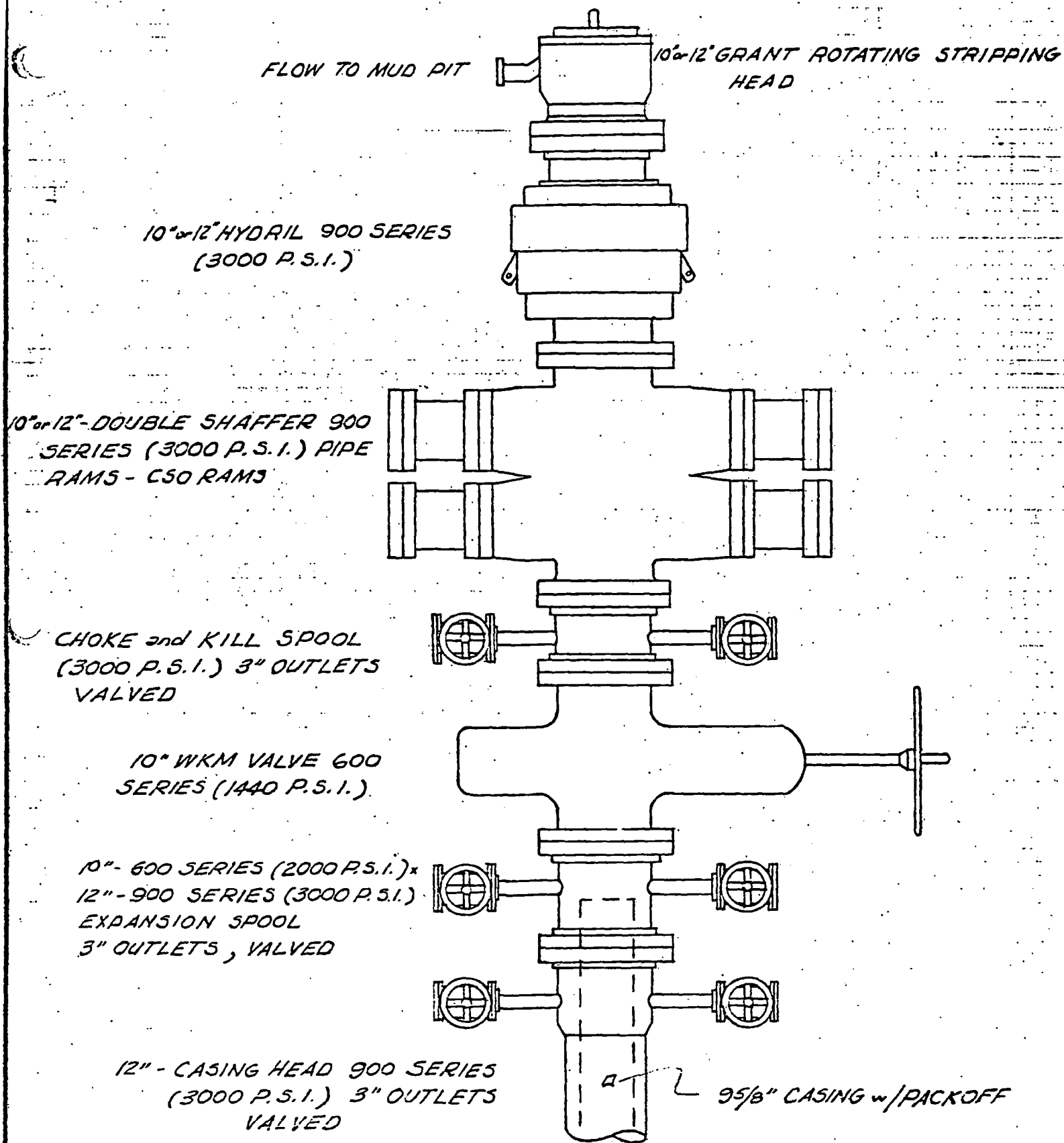
DATE: 1-30-77

SCALE: NONE

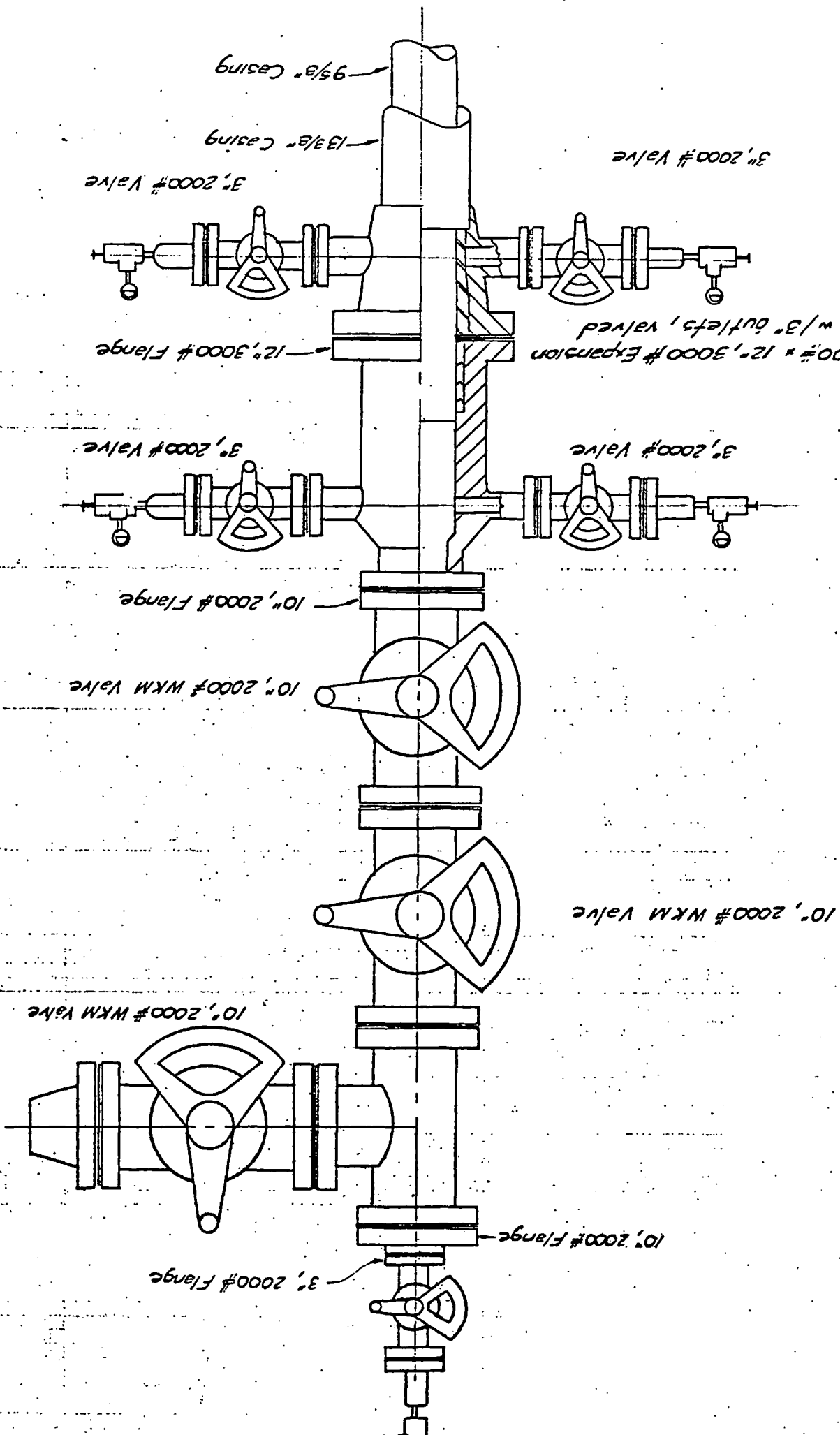
DRAWING NUMBER

1143 A





REVISED	DATE	<b>UNION</b> <small>76</small>	DRAWN
.L.	1-30-77		FOR: S.W.R.
		UNION OIL COMPANY OF CALIFORNIA - GEOTHERMAL DIVISION	BY: L.D.C.
		13 3/8" - 9 5/8" B.O.P. INSTALLATION (HYDRIL	DATE: 3/9/76
		DOUBLE GATE) FOR DRILLING BELOW 9 5/8" CSG.	SCALE: NONE
			DRAWING NUMBER
			1146



UNION OIL COMPANY OF CALIFORNIA  
 PROPOSED CASING PROGRAM (GENERAL)  
 Cove Fort Prospect (Utah)

CASING SIZE	TYPE JOINT	GRADE CASING	WEIGHT/ FT.	MUD WT./ CU. FT.	FROM/ TO	TOTAL AMOUNT	SAFETY FACTORS		
							COLLAPSE	BURST	TENSILE
20"	Butt	K-55	94#	72	0/250'	250'	4.16	16.88	62.94
13-3/8"	Butt	K-55	54.5#	72	0/1500'	1500'	1.51	3.64	10.43
9-5/8"	Butt	K-55	36#	72	1300/3200'	1900'	1.26	2.20	8.25
9-5/8"	Butt	K-55	40#	72	0/1300'	1300'	3.95	6.08	12.12
7"	8 RD	K-55	26#	72	1800/T.D.	*	NOT APPLICABLE		

\*7" slotted liner may be installed for formation control, and hung inside the 9-5/8" casing, uncemented. Formation conditions will dictate number and size of slots. Actual amount of 7" liner required will be determined following well test.

CASING SPECIFICATIONS

CASING SIZE	TYPE JOINT	GRADE	WEIGHT/FT.	PSI COLLAPSE	PSI BURST MIN. YIELD	TENSILE LBS. MIN. YIELD
20"	Butt	K-55	94#	520	2110	1,480,000
13-3/8"	Butt	K-55	54.5#	1130	2730	853,000
9-5/8"	Butt	K-55	36#	2020	3520	564,000
9-5/8"	Butt	K-55	40#	2570	3950	630,000

CONFIDENTIAL

This document contains confidential information which is proprietary to Union Oil Co. of Calif. The contents of this document are not to be released to any person without the express written consent of Union Oil Co. of California.

I EQUIPMENT

Typical land rig capable of 10,000 feet of drilling with acceptable safety features and required auxiliary equipment.

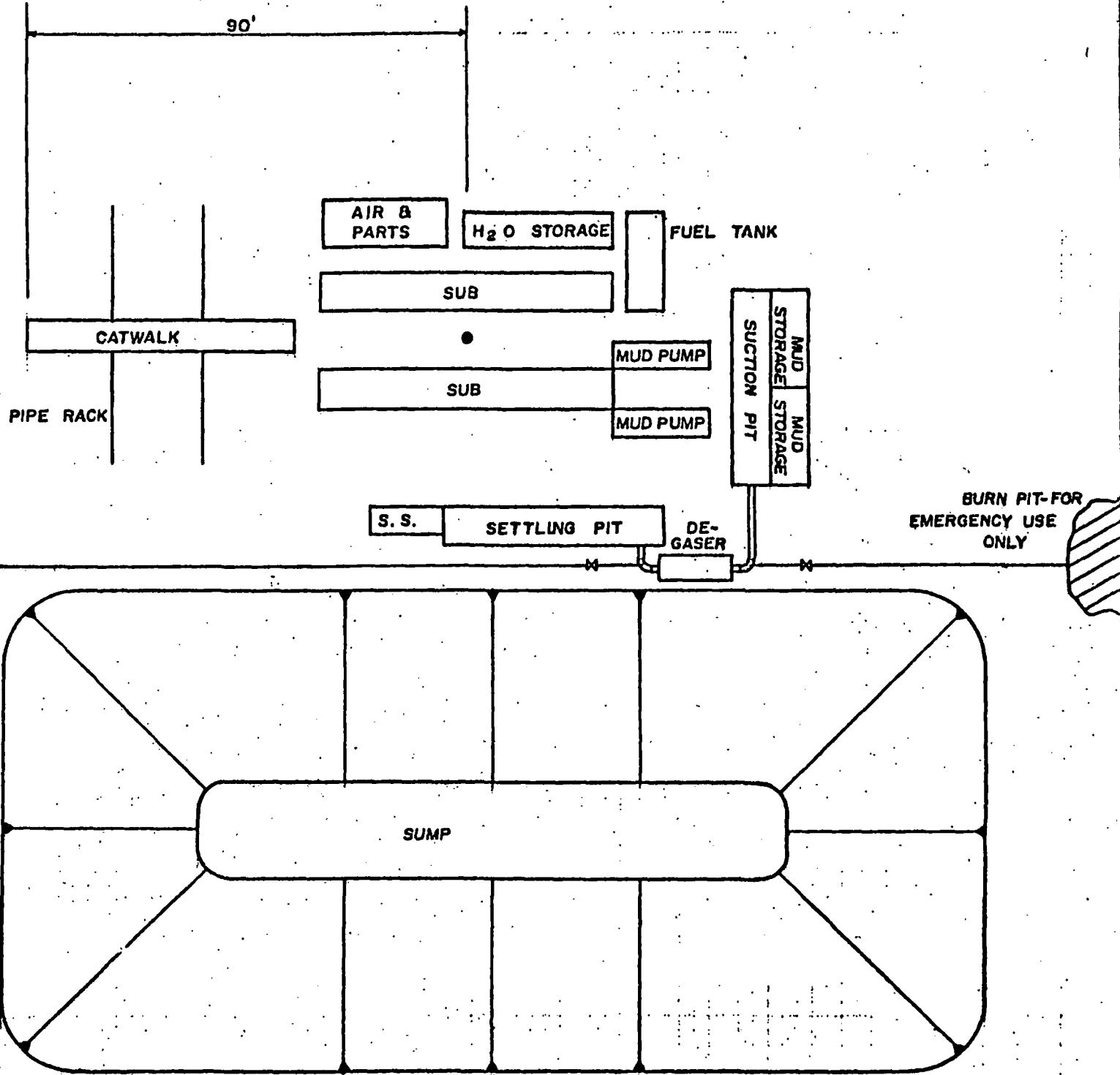
The specific rig is not known at this time, but actual specifications will be submitted prior to the start of operations complete with a diagram indicating the position of the individual equipment items.

A typical rig layout is attached.

EQUIPMENT

- A. RIG LAYOUT
- B. FLUID FLASH SEPARATOR

3



REVISED	DATE

**UNION**

UNION OIL COMPANY OF CALIFORNIA - GEOTHERMAL DIVISION

TYPICAL RIG LAYOUT

**DRAWN**

FOR: K. L.

BY: L. O. C.

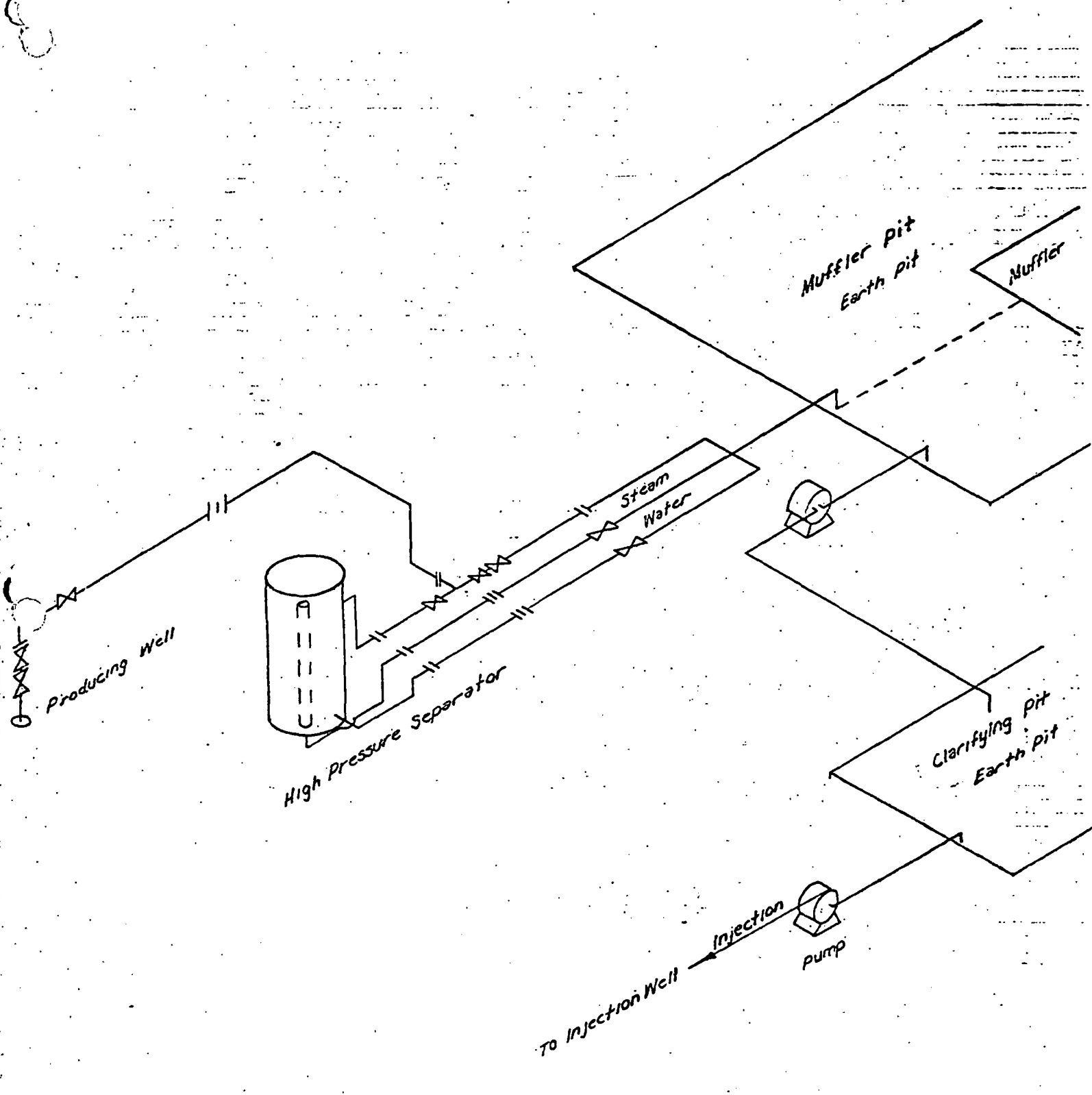
DATE: 2-2-77

SCALE: 1" = 30'

DRAWING NUMBER

BURN PIT-FOR EMERGENCY USE ONLY

BURN PIT-FOR EMERGENCY USE ONLY



USED	DATE



UNION OIL COMPANY OF CALIFORNIA - GEOTHERMAL DIVISION

GEOTHERMAL WELL TEST FACILITIES

COVE FORT,

UTAH

DRAWN
FOR: R.R.
BY: L.D.C.
DATE: 4-21-76
SCALE: NONE
DRAWING NUMBER
1162

TESTING, LOGGING, AND PLUG AND ABANDONMENT



CONFIDENTIAL

This document contains confidential information which is proprietary to Union Oil Co. of Calif. The contents of this document are not to be released to any person without the express written consent of Union Oil Co. of Calif.

I.

## GENERAL TESTING PROCEDURE FOR AN EXPLORATION WELL

### Drill Rig Test

After drilling and completing the geothermal well, a short flow test is conducted before disassembling the rig. The purpose of this test is to insure the proper installation and functioning of the completion equipment and to estimate the production capacity for the surface equipment needed for subsequent testing. 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. Wellhead flowing pressures and temperatures are recorded; and, upon concluding the test, wellbore pressure and temperature data may be collected. Total mass flow rate is monitored during the test. This test generally requires less than one day to complete.

### Reservoir Analysis Test

Upon determining the approximate production capacity from the drill rig test, surface testing equipment is installed and connected to the well. See details of work, Section C, Figure 6 for well head configuration. The test apparatus consists of a separator to segregate and measure the steam and water for individual analysis, a storage system to collect the water and condensed steam for proper disposal, and measuring and sampling devices to determine the fluid properties while flowing.

The general test procedure consists of flowing the well through the surface testing equipment until the well has cleaned up and has obtained stable reservoir flow conditions. During this production period the wellhead flow conditions are monitored as well as the separate steam and water conditions. Samples of steam condensate and water are periodically collected for chemical and corrosion analysis. Steam quality and water scaling tendencies are also investigated. Heat exchanger tests on steam and water may also be conducted. After the well has flowed for a sufficient time at stable conditions to gather the necessary data, the well is shut-in and downhole pressure and temperature recording devices are run in the well to the reservoir depth record post production transient phenomena. This entire test can be conducted within 10 days under proper conditions; however, extended test periods of over a month may be required to obtain the pertinent data.

GENERAL WELL LOGGING PROGRAM

<u>HOLE DEPTH</u>	<u>CASING</u> <u>SIZE</u>	<u>DEPTH</u>	<u>TYPE LOG</u>	<u>INTERVAL</u> <u>FROM</u>	<u>LOGGED</u> <u>TO</u>
3,200'±	13-3/8"	0'/1500'±	TEMPERATURE LOG	3,200'±	0
			DIL-8	3,200'±	1,500'±
			CONTINUOUS DIPMETER	3,200'±	1,500'±
			NEUTRON-GAMMA RAY	3,200'±	0'
10,000'±	13-3/8"	0'/1300'±	TEMPERATURE LOG	10,000'±	0'
			9-5/8"	1300'±/3200'±	DIL-8
			CONTINUOUS DIPMETER	10,000'±	3,200'±
			NEUTRON-GAMMA RAY	10,000'±	3,200'±

## PLUG AND ABANDONMENT

Plug and Abandonment procedures will follow details and rules set forth in U.S.G.S. orders (Geothermal Resources Operational Order No. 3).

## CONTINGENCY PLAN

### EMERGENCY ACCIDENTAL SPILLS AND DISCHARGES CONTROL PROCEDURES

- I INTRODUCTION
- II POTENTIAL LOCATIONS WHERE DISCHARGE INCIDENTS MIGHT OCCUR
- III POSSIBLE WATER QUALITY EFFECTS
- IV PLAN FOR CLEAN-UP AND ABATEMENT
- V CONFIRMATION OF TELEPHONE NOTIFICATION TO AGENCIES AND REGULATORY BODIES
- VI CONTINGENCY PLAN FOR H<sub>2</sub>S SAFETY
- VII CONTINGENCY PLAN FOR UNCONTROLLED BLOWOUT
- VIII INJURIES

**EMERGENCY ACCIDENTAL SPILLS & DISCHARGES**  
**CONTROL PROCEDURES**

I. Introduction

Cove Fort Prospect is located approximately 20 - 25 miles north of Beaver, Utah, in sparsely populated moderately rugged hills and canyons. The countryside is used for cattle grazing, mining, watershed, and for hunting.

II. Potential Locations Where Discharge Incidents Might Occur

A. Potential locations for accidental spills are:

1. Drilling Rigs.
2. Water ponds, or mud pits.
3. Pipelines at wells or drillsites.

B. Drilling Muds - Muds are a mixture of water, chemicals, and solid particles used in drilling operations to lubricate and cool the bit in the hole, and to carry cuttings out of the hole. Drilling muds are stored in sumps at the drilling locations. These sumps are open and are adequately sized to hold the volume necessary for the operation. Potential circumstances of discharge are minimal, but could occur by:

1. Sump overflow.
2. Sump wall seepage or wall breakdown.
3. Mud discharge from elsewhere on location.
4. Shallow lost circulation channeling to surface.

- C. Lubricating or fuel oils and petroleum products -  
A discharge of this type would probably be very small and from equipment used in the field. Potential locations for accidental spills are:
1. Drilling equipment and machinery at and around drilling locations.
  2. Other miscellaneous equipment and machinery at well sites and on roads.
- D. Construction/maintenance debris - Minor consideration, usually able to be cleaned up on the job. Potential locations are the same as for lubricating or fuel oils, (C), above.

### III. Possible Water Quality Affects

- A. Condensate or drilling muds.
1. Contaminate water possibly making it unsuitable for human or wildlife consumption.
  2. Possible detrimental affect to flora of area.
  3. Increase turbidity of water by particulates in fluid or by soil erosion.
- B. Petroleum products.
1. Contaminate water.
  2. Cover wildlife and plant life.
- C. Construction debris - possibly increase turbidity.

### IV. Plan for Clean-up and Abatement

In the event of discharges of condensate, drilling muds, petroleum products or construction debris, the overall

contingency plan for the Cove Fort Field, Beaver and Millard County, Utah, is as follows:

- A. The person responsible for the operation will make an immediate investigation, then call the Field Drilling Foreman and advise him of spill. The Field Drilling Foreman will in turn call out heavy equipment, regulate field operations, or do other work as applicable for control and clean-up of spill. If spill is small (i.e., less than 250 gallons) and easily containable without endangering watershed, Field Drilling Foreman will direct and supervise complete clean-up and return to normal operations.
- B. If spill is larger than 250 gallons, or is not easily contained, or endangers or has entered watershed, Field Drilling Foreman will proceed to take necessary action to curtail, contain and clean-up spill, and notify personnel as follows:
1. Call out heavy equipment, regulate field production, etc.
  2. Call for contract vacuum trucks or water pump trucks.
  3. Call District Drilling Superintendent, and advise of spill.

Don L. Ash

Office : (707) 542-9543

Home : (707) 539-9314

THE DISTRICT SUPERINTENDENT WILL:

1. Brief his immediate supervisor (District Manager) on the situation and course 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. Department of Natural Resources  
Division of Water Rights  
State Engineer  
442 State Capital  
Salt Lake City, Utah  
(801) 328-6071

5. 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

6. 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.

4.

b. For drilling mud:

Repair sump or contain with dikes.

Haul liquid to another sump or available tank or approved disposal site.

Dry and solidify other material, compact and bury solids where possible.

c. For petroleum products:

Contain spill with available manpower.

Use absorbents and dispose of same in County approved area.

d. For construction debris:

Pick up or otherwise contain and remove to disposal area.

5. Have source of spill repaired at earliest practical time.

6. Continue working crews, equipment and vacuum trucks on clean-up until all concerned agencies are satisfied.

C. Cove Fort Field Information:

Field Drilling Supervisor

Responsible for carrying out overall Contingency Plans.

1. Field Personnel:

Union Oil Company Drilling Supervisor

2. All others as needed.

3. Office Personnel - notify one of the following at  
(707) 542-9543 or:

Don Ash - District Drlg. Supt. . . . . (707) 539-9314

Vane Suter - District Manager . . . . . (707) 527-5236

4. Advise livestock owners and affected parties if spill  
affects cattle or property.

5. Outside contractors for crews and equipment, if  
necessary:

Howard Construction Co. . . . . Shop (801) 676-2312

Home (801) 676-8862

Any other available construction firms in area, as  
needed.

V. Confirm Telephone Notification to Agencies and Regulatory  
Bodies

Telephone notification shall be confirmed by the District  
Drilling Superintendent in writing within two (2) weeks of  
telephone notification, containing:

1. Reason for discharge or spillage.
2. Duration and volume of discharge.
3. Steps taken to correct problem.
4. Steps taken to prevent re-occurrence of problem.

HYDROGEN SULFIDE (H<sub>2</sub>S) AND AMMONIA (NH<sub>3</sub>)

CONTINGENCY PLAN

UNION OIL COMPANY OF CALIFORNIA  
GEOHERMAL DIVISION

COVE FORT, SULPHURDALE PROSPECT  
BEAVER - MILLARD COUNTIES  
UTAH

Don L. Ash

## HYDROGEN SULFIDE (H<sub>2</sub>S) AND AMMONIA (NH<sub>3</sub>)

### CONTINGENCY PLAN

#### INTRODUCTION

It is Union Oil Company's intent to provide a safe working place, not only for its own employees but also for those of other firms whose services will aid in the drilling, 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<sub>2</sub>S under similar conditions, NH<sub>3</sub> (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

## Hydrogen Sulfide And Ammonia - Contingency Plan

safely and with a minimum of trouble. It is anticipated that if H<sub>2</sub>S and/or NH<sub>3</sub> 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

## Hydrogen Sulfide And Ammonia - Contingency Plan

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<sub>2</sub>S and NH<sub>3</sub> 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 contractor's supervisor's trailer.
3. Drilling crew's change house.
4. Briefing areas - if briefing area is not one of the above.

## Hydrogen Sulfide And Ammonia - Contingency Plan

### 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			PHYSICAL EFFECTS
PERCENT (%)	PPM	GRAINS/ 100 STD. FT. <sup>3</sup>	
0.001	10	.65	Obvious and unpleasant odor.
0.002	20	1.30	Safe for 8 hours exposure.
0.01	100	6.48	Kills smell in 3 to 15 minutes; may sting eyes and throat.
0.02	200	12.96	Kills smell shortly; stings eyes and throat.
0.05	500	32.96	Dizziness; breathing ceases in a few minutes; 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

PHYSICAL EFFECTS OF AMMONIA GAS

TABLE "B"

<u>CONCENTRATION</u>		<u>PHYSICAL EFFECTS</u>
<u>PERCENT (%)</u>	<u>PPM</u>	
0.005	50	Odor detectable. Prolonged repeated exposure produces no injury.
0.01-0.02	100-200	No adverse effect for average worker. Exposure produces some discomfort but no lasting effects.
0.03-0.07	300-700	Produces nose and throat irritation and eye irritation with tearing. Exposure should be avoided but usually no serious aftereffect with short infrequent exposures.
0.17-0.30	1700-3000	Produces convulsive coughing and severe eye irritation. Dangerous for even short exposure. May be fatal.
0.5-1.0	5000-10,000	Produces respiratory spasm; rapid asphyxia. Exposure is rapidly fatal.

## Hydrogen Sulfide And Ammonia - Contingency Plan

### TOXICITY OF VARIOUS GASES

TABLE "C"

<u>COMMON NAME</u>	<u>CHEMICAL FORMULA</u>	<u>SPECIFIC GRAVITY (SG) SG AIR=1</u>	<u>THRESHOLD<sup>1</sup> LIMIT</u>	<u>HAZARDOUS<sup>2</sup> LIMIT</u>	<u>LETHAL<sup>3</sup> CONCENTRATION</u>
HYDROGEN CYANIDE	HCN	0.94	10ppm	150 ppm/hr	300 ppm
<u>HYDROGEN SULFIDE</u>	H <sub>2</sub> S	1.18	10ppm <sup>4</sup> 20ppm <sup>5</sup>	250 ppm/hr	600 ppm
<u>SULFUR DIOXIDE</u>	SO <sub>2</sub>	2.21	5ppm	-	1000 ppm
CHLORINE	Cl <sub>2</sub>	2.45	1ppm	4 ppm/hr	1000 ppm
CARBON MONOXIDE	CO	0.97	50ppm	400 ppm/hr	1000 ppm
CARBON DIOXIDE	CO <sub>2</sub>	1.52	5,000ppm	5%	10 %
METHANE	CH <sub>4</sub>	0.55	90,000ppm	(9%) Combustible above 5% in Air	-
AMMONIA GAS	NH <sub>3</sub>	0.597	100ppm	1700ppm	5000 ppm

## Hydrogen Sulfide And Ammonia - Contingency Plan

### TOXICITY OF VARIOUS GASES - Continued

<sup>1</sup>Threshold Limit - concentration at which it is believed that all workers may be repeatedly exposed day after day without adverse effects.

<sup>2</sup>Hazardous Limit - concentration that may cause death.

<sup>3</sup>Lethal Concentration - concentration that will cause death with short-term exposure.

<sup>4</sup>Threshold Limit = 10 PPM - 1972 ACGIH (American Conference of Governmental Industrial Hygienists).

<sup>5</sup>Threshold Limit = 20 PPM - 1966 ANSI acceptable ceiling concentration for eight-hour exposure (based on 40-hour week) is 20 PPM. OSHA Rules and Regulations (Federal Register, Volume 37, No. 202, Part II, dated October 18, 1972).

### SAFETY EQUIPMENT

Automatic "Hydrogen Sulfide" continuous monitoring detectors with audio alarms will be placed at the shale shakers and on the rig floor. Portable hand operated H<sub>2</sub>S detectors can also be utilized for detection of Sulphur Dioxide and ammonia, and H<sub>2</sub>S, SO<sub>2</sub>, and NH<sub>3</sub> detector ampules, will be readily available for spot checks.

## 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<sub>2</sub>S and NH<sub>3</sub> safety equipment, portable fire extinguishers and H<sub>2</sub>S and NH<sub>3</sub> detectors.

## Hydrogen Sulfide And Ammonia - Contingency Plan

### TRAINING - Continued-

2. Proper use of H<sub>2</sub>S and NH<sub>3</sub> 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<sub>2</sub>S and NH<sub>3</sub>.
6. Procedure for rescuing a person overcome by H<sub>2</sub>S and/or NH<sub>3</sub>.
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<sub>2</sub>S and NH<sub>3</sub> 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<sub>2</sub>S has been detected in the drilling fluid and/or NH<sub>3</sub> has been detected, will be performed under one of the three conditions as listed.

CONDITION I = POTENTIAL DANGER

Alarms H<sub>2</sub>S Less than 10 PPM - None

NH<sub>3</sub> Less than 100 PPM - None

# Hydrogen Sulfide And Ammonia - Contingency Plan

## PROCEDURES 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<sub>2</sub>S.

= Horn or Siren Actuates at 100 PPM for NH<sub>3</sub>.

### 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.



Hydrogen Sulfide And Ammonia - Contingency Plan

GENERAL ACTIONS - Continued -

4. Immediately begin to ascertain the source of the H<sub>2</sub>S and/or NH<sub>3</sub> 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<sub>2</sub>S"  
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

Hydrogen Sulfide And Ammonia - Contingency Plan

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

Hydrogen Sulfide And Ammonia Contingency Plan

GENERAL 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

## Hydrogen Sulfide And Ammonia - Contingency Plan

### 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 meteorite 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

## Hydrogen Sulfide And Ammonia - Contingency Plan

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 breathing 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 the ground. This technique could also be used to

Hydrogen Sulfide And Ammonia - Contingency Plan

RESCUE - Continued -

- (A) 2. protect personnel trying to approach a leaking line or valve to make repairs or to shut down equipment.

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

Hydrogen Sulfide And Ammonia - Contingency Plan

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

<u>TITLE</u>	<u>NAME</u>	<u>LOCATION</u>	<u>TELEPHONE</u>
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

<u>TITLE</u>	<u>NAME</u>	<u>LOCATION</u>	<u>TELEPHONE</u>
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<sub>2</sub>S and NH<sub>3</sub>",

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.

## VIII. 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 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.

**EMERGENCY PHONE NUMBERS**

**I EMERGENCY PERSONNEL AND SERVICES**

EMERGENCY PERSONNEL AND SERVICES

<u>SERVICE OR INDIVIDUAL</u>	<u>LOCATION</u>	<u>PHONE NUMBERS</u>
Doctor (local) <u>DR. TERRY</u>	Beaver	(801) 438-2844 438-2416
Doctor (local) <u>DR. ALLEN</u>	Richfield	(801) 896-5427
Doctor (local) <u>DR. SYMOND</u>	Milford	(801) 387-2471 387-2411
Hospital (local) <u>BEAVER VALLEY</u>	Beaver	(801) 438-2416
Hospital (local) <u>SEVIER VALLEY</u>	Richfield	(801) 896-4425
Ambulance Service (ground)	Beaver	(801) 438-2651
Ambulance Service (air)	Richfield	(801) 896-5484
BLM Representative <u>MR. MUHLESTEIN</u>	Fillmore	(801) 743-6811
District Ranger <u>MR. QUIGLEY</u>	Fillmore	(801) 743-5721
Beaver County Representative	County Clerk	(801) 438-2352
Millard County Representative	County Clerk	(801) 743-6223
Sheriff Department	Beaver	(801) 438-2862
Highway Patrol	Richfield Cedar City	(801) 896-4311 586-9445



EMERGENCY PERSONNEL AND SERVICES

<u>SERVICE OR INDIVIDUAL</u>	<u>LOCATION</u>	<u>PHONE NUMBERS</u>
U.S.G.S. District Supervisor <u>MR. KEN BULL</u>	Salt Lake City	(801) 524-5245
Division of Water Rights <u>MR. HANSEN</u>	Salt Lake City	(801) 328-6071
U.S.G.S. Western Regional Supervisor <u>MR. REID STONE</u>	Palo Alto, CA.	(415) 323-8111

## TESTING AND SAMPLING SCHEDULE

### I GENERAL TESTING PROCEDURE FOR AN EXPLORATORY WELL

Drill Rig Test

Reservoir Analysis Test

Logging Program

Formation Testing

### II PROPOSED GEOTHERMAL WELL TESTING

This document contains confidential information which is proprietary to Union Oil Co. of Calif. The contents of this document are not to be revealed to any person without the express written consent of Union Oil Co. of California.

I.

## GENERAL TESTING PROCEDURE FOR AN EXPLORATION WELL

### Drill Rig Test

After drilling and completing the geothermal well, a short flow test is conducted before disassembling the rig. The purpose of this test is to insure the proper installation and functioning of the completion equipment and to estimate the production capacity for the surface equipment needed for subsequent testing. 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. Wellhead flowing pressures and temperatures are recorded; and, upon concluding the test, wellbore pressure and temperature data may be collected. Total mass flow rate is monitored during the test. This test generally requires less than one day to complete.

### Reservoir Analysis Test

Upon determining the approximate production capacity from the drill rig test, surface testing equipment is installed and connected to the well. See details of work, Section C, Figure 6 for well head configuration. The test apparatus consists of a separator to segregate and measure the steam and water for individual analysis, a storage system to collect the water and condensed steam for proper disposal, and measuring and sampling devices to determine the fluid properties while flowing.

The general test procedure consists of flowing the well through the surface testing equipment until the well has cleaned up and has obtained stable reservoir flow conditions. During this production period the wellhead flow conditions are monitored as well as the separate steam and water conditions. Samples of steam condensate and water are periodically collected for chemical and corrosion analysis. Steam quality and water scaling tendencies are also investigated. Heat exchanger tests on steam and water may also be conducted. After the well has flowed for a sufficient time at stable conditions to gather the necessary data, the well is shut-in and downhole pressure and temperature recording devices are run in the well to the reservoir depth record post production transient phenomena. This entire test can be conducted within 10 days under proper conditions; however, extended test periods of over a month may be required to obtain the pertinent data.

## LOGGING PROGRAM

Flowline temperatures will be monitored and logged from Surface to T.D.

Temperature permitting, the following logs will be run from 1500' to total depth.

1. Temperature log.
2. Dual Induction - LL8.
3. Compensated Neutron Log, Gamma Ray with Caliper.
4. Continuous Dipmeter.

## FORMATION TESTING

If a potentially commercial geothermal reservoir is indicated, testing equipment including a separator, meter runs, instrumentation, etc., will be installed. Intervals to be tested will be opened to the wellbore by conventional casing perforations. Test flows, to evaluate productivity and formation fluids, will be to surface pits. At the conclusion of testing, the fluid will be reinjected into the reservoir.

### CONFIDENTIAL

This document contains confidential information which is proprietary to Union Oil Co. of Calif. The contents of this document are not to be revealed to any person without the express written consent of Union Oil Co. of California.

PROPOSED GEOTHERMAL WELL TESTING

COVE FORT PROSPECT

COVE FORT, UTAH

CONFIDENTIAL

This document contains confidential information which is proprietary to Union Oil Co. of Calif. The contents of this document are not to be revealed to any person without the express written consent of Union Oil Co. of California.

Union Oil Co. of California  
Geothermal Division  
Santa Rosa, California

April 9, 1976

## INTRODUCTION

A short production test will be run on each well, after completion of drilling, but before the drilling rig leaves the location. These tests, normally referred to as rig tests, involve flowing each well into the drilling reserve pit and measuring the time until the pit fills up. The total amount of fluid produced is usually less than three casing volumes for each well. The rig test is satisfactory as a production rate indicator, but inadequate to measure true well and reservoir potential. Additional testing is required to obtain the quantitative data necessary to evaluate the geothermal resource. The additional testing will involve large reservoir withdrawals over an extended period of time.

Therefore, in order to conduct this additional testing and obtain a meaningful flow test, a second well is required. This second, or injection well, will serve to accommodate the produced effluent from the initial well. In this manner, both wells may be produced, satisfactorily tested and both serve as a producer and an injection well.

The above testing procedure will require a pipeline connecting the two wells. Design of any such line will be determined during rig tests. This proposed design will be submitted in detail to the U.S.G.S. and/or the BLM and USDA Forest Department for approval prior to commencement of any work. A third well may also be utilized as an observation well.

## TESTING PROGRAM

The well testing program will be divided into two phases, short term, and long term. The short term tests are designed to give thumbnail indication of production rates and problems.

The information gained during these tests will be used to design and/or modify production facilities to allow the long term, partially unattended flow tests required for reservoir evaluation. One well will be selected as a water disposal well, another as a production well and a third well, if available, as an observation well.

### SHORT TERM TESTS

Production facilities, including a test separator, test manifold, muffling pit, reserve pit, and pumps will be set up on each well and the well produced for approximately three weeks. The well will then be shut-in and the production equipment moved to the next well to test. This process will be repeated until all wells have been tested. The short tests will require 24 hour attended operation to monitor well and equipment performance.

The effluent from the wells will be piped to a manifold which can be used to divert the flow to a muffling pit or to a test separator. Normal procedure is to kick the well off through the muffler, then turn the production through the test separator when the well flow stabilizes. The steam and water will be individually metered downstream of the test separator and discharged into the muffler. The steam will be allowed to vent to the atmosphere and the water will be contained in the reserve pit. Approximately 30% of the total mass

flow from the well is expected to flash and be vented to the atmosphere.

The water will be pumped from the reserve pit through the pipeline to one of the other wells for reinjection into the reservoir. The pipeline will be designed on the basis of information derived from the rig tests. Alternate designs being considered are:

(1) A welded steel line following the shortest feasible path between wells, or (2) Threaded and coupled pipe strung along existing road rights-of-way. In the event welded steel pipe is used an attempt will be made to pull it from one location to another to eliminate the necessity of large amounts of brush removal for right-of-way.

Union's drawing No. 1162 indicates the flow schematic of the primary production facilities. The goals and information desired from the short term tests are as follows:

1. Well Productivity
  - a. Mass flow rate, steam fraction, water fraction.
  - b. Enthalpy, temperature, pressure.
  - c. Production rate decline.
  - d. Other reservoir data as may be obtainable.
  
2. Reservoir Fluid Characteristics
  - a. Chemical analysis of water and non-condensable gases.
  - b. Ratio of water to non-condensable gases.



3. Production Equipment Performance
  - a. Design, size and performance of production equipment.
  - b. Problem evaluation for scale, corrosion and sand.
4. Assertion of viability of geothermal resource to determine advisability of further exploratory drilling.

#### LONG TERM TESTS

The long term tests are designed to provide more knowledge of reservoir characteristics. The information from the short tests will be utilized for well selections, and to modify production facilities if the need arises. Either of the wells may be produced for a period of 2 to 4 months. One idle well will be monitored for indications of reservoir interference. Produced water will be reinjected into the reservoir through the remaining well. It may be necessary to utilize the idle well for some injection if the injection well will not accept all of the water.

The production facilities are expected to be similar to those used for the short term tests except for the addition of more sophisticated automated control equipment designed for unattended operation.

The goals and information desired from the long term tests are as follows:

1. Determination of reservoir and production characteristics over a long time period with sizeable reservoir withdrawals.

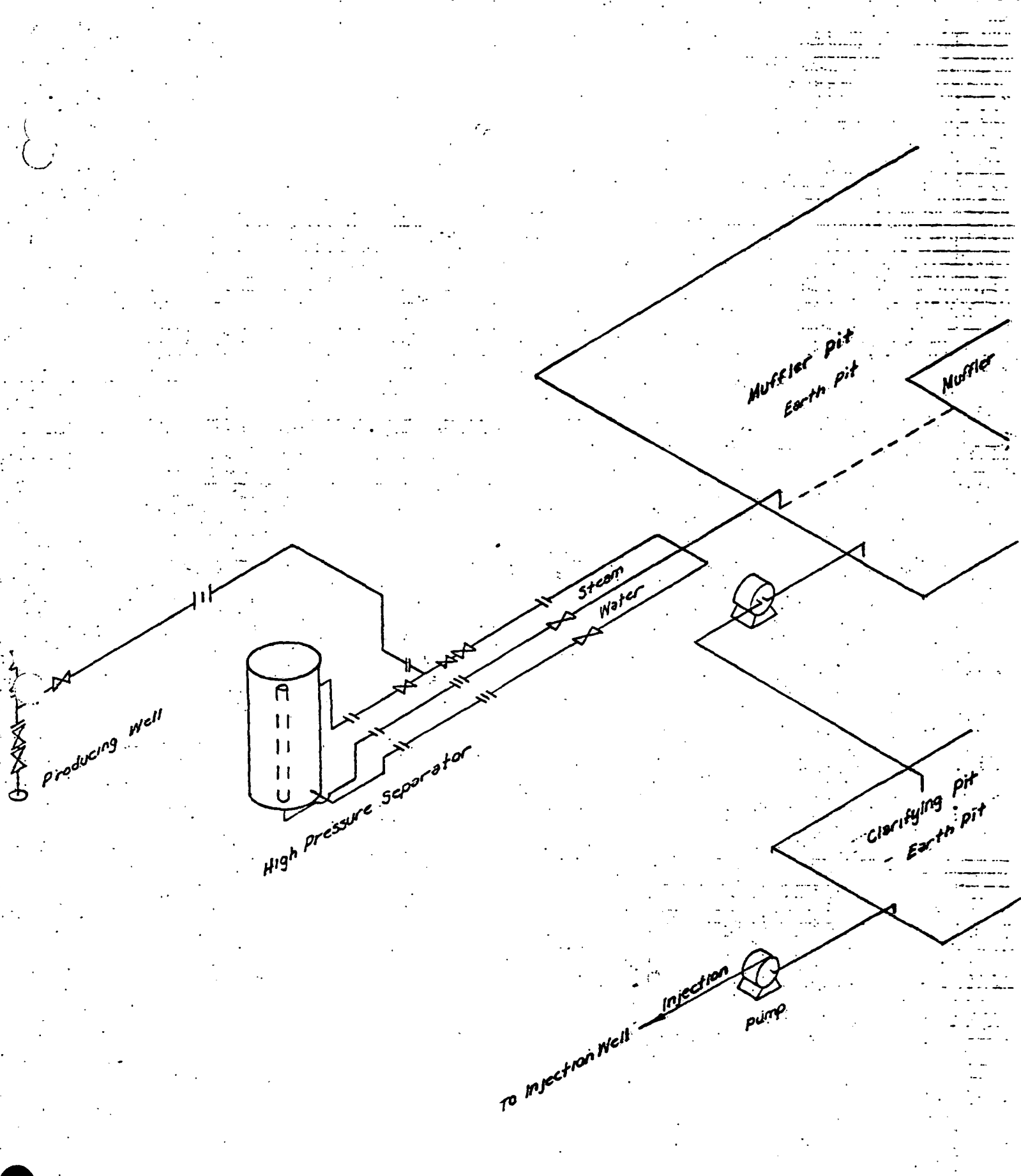
2. Determination of effectiveness of applied solutions to production problems encountered in short term tests.
3. Determination of feasibility of commercial power generation.

The long term test criteria may be extended to other wells if the short term tests encourage the drilling of additional wells, and these wells are completed within the necessary time frame.

#### WATER DISPOSAL

The salt content of water produced during the well tests will require that the water be reinjected into the reservoir. The water produced during the above proposed testing will be injected into the reservoir through one or both of the idle wells. Injection characteristics of the wells will be monitored to determine future injection well requirements and possible injectivity problems.

Any proposal for a pipeline installation as stated above, will be submitted to the appropriate personnel for approval and will be installed in such a manner as to cause minimal interference with other operations. It will be buried at road crossings, but will be laid above ground in other areas. Cleared areas and existing road right-of-ways will be used in as much as possible to minimize vegetation disturbance. The line will be pulled through vegetated areas where possible to eliminate rights-of-ways or vegetation disturbance. The line may be utilized for future tests or incorporated into a future production system.



REVISED	DATE

**union**  
 UNION OIL COMPANY OF CALIFORNIA - GEOTHERMAL DIVISION  
 GEOTHERMAL WELL TEST FACILITIES  
 COVE FORT, UTAH

<b>DRAWN</b>
FOR: P.R.
BY: L.C.C.
DATE: 4-21-76
SCALE: NONE
DRAWING NUMBER
1162

## DISPOSAL PROGRAM

### I WELL WATER DISCHARGE

#### A. Drilling Fluids

## I WELL WATER DISCHARGE

Geothermal well water discharge will be stored in the sump or reserve pit (located at each site) and allowed to evaporate. Any remaining residue following evaporation will be neutralized and either mixed native soils and buried or trucked to an approved dump site.

The sump or reserve pit will be lined with an appropriate thickness of treated native soils or imported clay material to meet the requirements of the Utah State Water Quality Control Board.

### A. Drilling Fluids:

Drilling muds will be stored in the reserve pit and disposed of in the same manner as geothermal well fluids as described in the above paragraph.

To reduce the possibility of erosion of the interior slopes of the reserve pit, construction will be in accord with recognized engineering practice with an allowance of a three foot free-board from the top of the dike to the surface of the wastewaters.

Upon completion of operations, and after all waste waters have been removed, the sump will be buried, graded, and revegetated.

## GENERAL SAFETY PRACTICES

- I SAFETY PRACTICES
- II NOISE AND DUST CONTROL
- III CONTINUOUS GAS MONITORING EQUIPMENT WILL BE PROVIDED WITH THREE STATION SENSORS
- IV EQUIPMENT REQUIREMENTS
- V FIRE

UNION OIL COMPANY OF CALIFORNIA  
GEOTHERMAL DIVISION  
SANTA ROSA DISTRICT

SAFETY PRACTICES

The following general safety regulations and such additional regulations issued by Field, Area, or District authority are for your protection.

1. REPORTING PERSONAL INJURIES

All on the job personal injuries, even of a minor nature, must be reported on Union Oil Company Form 642 no later than the end of the shift in which the injury occurred.

2. SMOKING

Smoking will be permitted only in authorized smoking areas.

3. OPEN FLAMES

Open flames are not permitted within 100 feet of the rig.

4. CLOTHING

All employees shall be clothed in a manner which will not impair their safety.

5. HAZARDOUS CHEMICALS

Safety equipment as prescribed by Field, Area, or District authority, shall be worn when handling chemicals.

6. EYE AND HEARING PROTECTION

Adequate eye and face protection devices will be worn when grinding, welding, chipping, pouring chemicals or wherever flying particles may cause eye injury. Hearing protection devices will be worn where required.

7. SAFETY SHOES

Steel-toed safety shoes should be worn by all employees except supervisors, office employees and those unable to do so by reason of physical deformity.



8. SAFETY HATS

Safety hats must be worn by employees and visitors in accordance with the rules established for the particular Field, Area, or District.

9. SAFETY BELTS

Safety belts will be worn on all above ground work as prescribed by Field, Area, or District.

10. SEAT BELTS

While driving company automotive equipment, seat belts must be worn at all times by driver and passengers if vehicle is so equipped.

11. HORSEPLAY

Horseplay or practical jokes will not be permitted.

12. TOOLS

Only tools in good working condition and designed for the particular job being performed shall be used.

13. ELECTRICAL

Only qualified and designated employees shall work on electrical lines and equipment. All rig lighting should be vapor and/or explosive proof. Well heads, blowout preventers and cellar should be illuminated with flood lights located as far away as possible maintaining proper illumination.

14. MACHINERY

Repairs shall not be made on machinery until power is positively locked out at the electrical disconnect. Prime movers, machine or equipment capable of movement, shall be effectively blocked or secured while repairs are being made. All engines should be equipped with explosion resistant or explosion proof ignition systems and water injection system for exhaust. All engine exhaust should be welded to insure a closed system.

15. GUARDS

Guards must not be removed while equipment is operating and must be in place before start-up.

16. HOUSEKEEPING

Good housekeeping is an aid to safety. All employees will keep tools, equipment and area clean and orderly.

17. ACCIDENT PREVENTION RESPONSIBILITY

Each employee is responsible for prevention of accidents to men working under his supervision. It is his responsibility to train these employees in the safest and most efficient way to work. It is the further responsibility of each employee to correct or report to his supervisor any unsafe condition or practice which he may observe.

18. VIOLATIONS

Employees who violate these safety regulations or others issued by the Field, Area, or District will be subject to disciplinary action.

19. SAFETY HATS

All personnel will wear safety hats while on the project.

20. GAMBLING, LIQUOR AND NARCOTICS

There will be no gambling, intoxicating liquor, or narcotics on Company owned, leased, or operational properties.

21. EAR PROTECTION

All personnel working in high noise level areas as designated by the Company are required to wear hearing protectors at all times.

22. WELDING IN FIELD AREAS

No welding will be done without fire watch with extinguisher. Welding is not to be permitted on the rig unless authorized. If welding is required, approval is required from the Drilling Supervisor.

23. SAFE DRIVING

All personnel will drive with caution on the project. Where steam conditions limit vision, personnel will use vehicle headlights and proceed slowly through the area.

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.

NOTE: All personnel will be required to read and understand the "Contingency Plan" section of this report.

II. NOISE AND DUST CONTROL

1. Regulations require that noise levels not exceed 65 dBA at a distance of 457m (1500 feet) from the noise source. Also, vegetation surrounding the drill site must not be excessively degraded from well emissions.
2. Noise levels will be monitored with an approved sound survey instrument at selected points around the drill site to verify compliance with noise level regulations. These checks will be made on a regular basis during periods of peak noise emission from the drill site. The results will be recorded and made available to all parties with interest in the area if desired.

III. CONTINUOUS GAS MONITORING EQUIPMENT WILL BE PROVIDED WITH THREE STATION SENSORS.

1. Refer to "Hydrogen Sulfide" Contingency Plan.

#### IV. EQUIPMENT REQUIREMENTS

The following list of surface equipment is considered a minimum requirement for geothermal drilling operations (also air drilling, if needed). Additional equipment will be used as needed.

1. Blowout Prevention equipment should conform to specifications set forth in Details of Work, Drilling Procedure, Section C. In addition, the following should be provided or followed.
  - a. Water nozzles or sprinklers should be installed to spray on the preventer stack to control temperatures and help preserve rubber elements when circulating temperatures become excessive.
  - b. Only high temperature elements should be used in the rotating head.
  - c. Ram elements should be checked for temperature damage on every trip and be replaced as needed.
2. An accumulator system should be provided with the following minimum specifications:
  - a. Should be of sufficient size to close all of the hydraulically operated equipment, with pumps shut off, and have a minimum of 69 BARS (1000 PSI) remaining on the accumulator.
  - b. A backup of Nitrogen bottles or an air compressor driven independently from the rig should be provided. Piping should be such that the nitrogen can be routed through a pressure regulator directly to preventor stack, by-passing the accumulator.
  - c. Two operating stations should be provided. These should normally be the main unit (with four way valve) and a remote unit at the driller's station. The main unit should be at least 15m (50 feet) from well bore in a convenient location.

## Equipment Requirements

- d. All piping should be 2.54cm (1 inch) minimum steel lines with 207 bars (3000 psi) working pressure. No rubber line should be used. Sufficient swivels should be used to prevent undue stress.
3. Drill string floats are to be used with air drilling to reduce bleed-down time when making connections, and to strip out when the well is flowing.
4. All engines are to be equipped with explosion resistant ignition and explosion-proof or water injection exhaust.
5. All rig lighting is to be vapor and/or explosion proof. Underfloor lights should provide good illumination of well head equipment, but should be located as far from the well head assembly as possible.
6. Rig pumps are to remain connected to the standpipe during air drilling and be ready to operate. Tanks should be filled with mud or water of sufficient volume to fill the well bore. Excess fluid volumes must be provided for hole erosion or losses in loading the hole.
7. The air line from the compressors should have the following:
  - a. A positive displacement chemical pump is required for injecting liquids into the air stream. This pump should be capable of injection rates from 1.6 to 4.8m<sup>3</sup> (10 to 30 barrels) per hours. A calibrated chemical mixing tank is also required with a minimum capacity of 1.6m<sup>3</sup> (10 barrels). The pump should be motor/engine driven - air pumps are not satisfactory due to excessive air use.
  - b. A 24-hour recording orifice meter to meter air volumes.
  - c. An air pressure gauge shall be installed in the standpipe at a location clearly visible to the driller. A gauge should also be clearly visible to compressor operator.
  - d. An adjustable choke shall be installed in the air supply line adjacent to the standpipe. This choke shall be used for minor pressure corrections. Air will be regulated to the rig at the normal pressure range.
  - e. Be large in diameter to minimize friction loss.
  - f. Contain a pressure-relief valve to guard against pressure too high for the compressors and other equipment.

## Equipment Requirements

- g. Install a check valve to prevent any liquids from being pumped back into the compressor.
- h. Have connection to a line going to the Bradenhead for reverse circulation if needed.
- i. Connect through a release line to the bleed line so that the compressors need not be taken off the line during connections. A 3-way valve or two standard valves for this purpose allow the crew to control air flow from the floor at all times.

The following additional blowout prevention equipment should also be on the rig floor at all times:

- 1. An inside blowout preventer.
- 2. A full opening drill string safety valve in the open position. Separate valves shall be maintained to fit all pipe in the drill string.
- 3. A Kelly cock shall be installed below the swivel and a full opening Kelly cock of such design that it can be run through the blowout preventers shall be installed at the bottom of the Kelly.

In addition, the mud system shall be such that a positive indication can be obtained as to mud volumes required to fill the hole on trips, and other monitoring equipment as follows:

- Mud Temperature
- Air Temperature
- H<sub>2</sub>S Monitor Flowline, Floor and Cellar
- Mud Pit Levels - Flowline Monitor
- Mud Viscosimeter
- Hydrocarbon Gas Monitor

V FIRE

- A. All local, county, state, and federal fire protection standards applicable to Union's activities will be observed.
  
- B. Vegetation on the drill sites is sparse and will be cleared only to the extent needed for proper operation. Smoking will only be allowed in designated areas.
  
- C. Exhaust stacks from all engines in service will be equipped with muffling systems recognized and approved for use in the area. (See attached safety practices - Section I)
  
- D. Water and suitable fire extinguishing equipment will be available at the drill site.



Note:

Union Oil Company is prepared to submit, upon notification to do so, any further information not included herein which is required. Union Oil Company is also prepared to carry out provisions for monitoring deemed necessary to ensure compliance with regulations and to participate in the collection of data concerning existing air and water quality, noise, seismic and land subsidence activities, in accordance with CFR 270.34 (k) and the January 1977 Guidelines for acquiring this data.

REQUEST FOR PROPOSAL

EY-R-08-0007

"Geothermal Reservoir Assessment  
Case Study"

BY

UNION OIL COMPANY OF CALIFORNIA  
Geothermal Division

May 27, 1977

## INTRODUCTION

The Union Oil Company of California's Geothermal Division submits a geothermal reservoir assessment case study in accordance with Request for Proposal (RFP) No. EY-R-08-0007, for work accomplished and to be accomplished on their leases in the Cove Fort - Sulphurdale, Known Geothermal Resource Area.

Data contained in this proposal shall not be used or disclosed, except for evaluation purposes, provided that if a contract is awarded to this purpose, as a result of or in connection with the submission of the proposal, the Government shall have the right to use or disclose any data to the extent provided in the contract. This restriction does not limit the Government's right to use or disclose any technical data obtained from another source without restriction.

# I N D E X

	<u>PAGE</u>
A. PROPOSER'S NAME AND ADDRESS	1
B. TECHNICAL PROPOSAL	1 - 23
1. <u>Investiation Site or Area</u>	
a. Legal Description	1 - 4
b. Status of Ownership/Assessibility	4 - 5
c. General Geology	5 - 8
d. Site Selection	9
2. <u>Program Data Offered</u>	
a. Subsurface	10 - 11
b. Surface	11 - 12
c. Reservoir Engineering Studies	12 - 13
3. <u>Program Description</u>	
a. Subsurface	13 - 15
b. Surface Investigations	16
c. Reservoir Engineering Studies	16 - 19
4. <u>Schedule</u>	
a. 1977 Fiscal Year	20
b. 1978 Fiscal Year	21
c. 1979 Fiscal Year	22

5.	<u>Environmental Evaluation</u>	23
C. COSTS		
1.	<u>Estimated or Actual Cost</u>	23
2.	<u>Proposed Cost to the Government</u>	
a.	Table II	23 (b)
b.	Table III	23 (c&d)
c.	Table IV	23 (e&f)
d.	Table V	23 (g)
D. BUSINESS AND DEVELOPMENT		
1.	<u>Experience</u>	24 - 25
2.	<u>Principal Project Personnel</u>	25 - 39
3.	<u>Plan of Operation</u>	39 - 40
4.	<u>Primary Business and Technical Contracts</u>	40 - 43
5.	<u>Acceptability of the General Provisions</u>	43
6.	<u>Program Technical Scope</u>	43
7.	<u>Proposer's Financial Capability</u>	43
8.	<u>Representations and Certifications</u>	43

Attachment "A" - Proposed Plan of Operation.  
Attachment "B" - Environmental and Exploration Review, 1.  
Attachment "C" - Environmental and Exploration Review, 2.  
Attachment "D" - 1976 Annual Report.

## PROPOSAL

### A. PROPOSER'S NAME AND ADDRESS

Union Oil Company of California  
Union Geothermal Division  
Union Oil Center  
461 South Boylston Street  
Los Angeles, California 90017

Union Oil Company of California is a corporation organized and existing under the laws of the State of California, having its principal office and place of business in Los Angeles, California. Dr. Carel Otte, Vice President and Manager of the Geothermal Division is authorized to commit the Company to the proposed contract.

### B. TECHNICAL PROPOSAL

#### 1. Investigation Site or Area

##### a. Legal description - Section, Township, etc.

Proposer is sole and exclusive geothermal lessee in and to the following identified geothermal leases and agreements within the Cove Fort - Sulphurdale Known Geothermal Resource Area, to wit:

Geothermal Resource Lease (U-29553) dated June 1, 1975, between the U.S.A., as Lessor, and Union Oil Company of California, as Lessee, covering the following lands:

##### T.25S., R.6W., Salt Lake Meridian

Section 19: Lots 3, 4, 5, 7, 8, 9, 10, NE $\frac{1}{4}$ SW $\frac{1}{4}$ ,  
W $\frac{1}{2}$ SE $\frac{1}{4}$ ;

Section 29: Lots 1, 2, 3, SE $\frac{1}{4}$ NE $\frac{1}{4}$ , W $\frac{1}{2}$ NE $\frac{1}{4}$ , NW $\frac{1}{4}$ ,  
N $\frac{1}{2}$ SW $\frac{1}{4}$ , NW $\frac{1}{4}$ SE $\frac{1}{4}$ ;

Section 30: Lots 1, 2, 3, 5, 6, 7, W $\frac{1}{2}$ NE $\frac{1}{4}$ , SE $\frac{1}{4}$ NE $\frac{1}{4}$ ,  
E $\frac{1}{2}$ SW $\frac{1}{4}$ , SE $\frac{1}{4}$ .

##### T.25S., R.7W., Salt Lake Meridian

Section 24: Lots 7 to 11, inclusive, SW $\frac{1}{4}$ NE $\frac{1}{4}$ ,  
NE $\frac{1}{4}$ SW $\frac{1}{4}$ .

Geothermal Resource Lease (U-29554) dated June 1, 1975, between the U.S.A., as Lessor, and Union Oil Company of California, as Lessee, covering the following lands:

T.25S., R.6W., Salt Lake Meridian

- Section 17: Lots 1 to 6 inclusive, E $\frac{1}{2}$ , N $\frac{1}{2}$ NW $\frac{1}{4}$ , SE $\frac{1}{4}$ SW $\frac{1}{4}$ ;  
 Section 20: Lots 1 to 5 inclusive, N $\frac{1}{2}$ NE $\frac{1}{4}$ , SW $\frac{1}{4}$ NE $\frac{1}{4}$ , NW $\frac{1}{4}$ , E $\frac{1}{2}$ SW $\frac{1}{4}$ , W $\frac{1}{2}$ SE $\frac{1}{4}$ ;  
 Section 21: All (excluding mining claims);  
 Section 28: N $\frac{1}{2}$ , E $\frac{1}{2}$ SW $\frac{1}{4}$ , SW $\frac{1}{4}$ SW $\frac{1}{4}$ , SE $\frac{1}{4}$ .

Geothermal Resources Lease (U-29555) dated June 1, 1975, between the U.S.A., as Lessor, and Union Oil Company of California, as Lessee, covering the following lands:

T.25S., R.6W., Salt Lake Meridian

- Section 31: E $\frac{1}{2}$ SW $\frac{1}{4}$ , SE $\frac{1}{4}$ ;  
 Section 32: NE $\frac{1}{4}$ , S $\frac{1}{2}$ NW $\frac{1}{4}$ , S $\frac{1}{2}$ ;  
 Section 33: All.

T.26S., R.6W., Salt Lake Meridian

- Section 5: All.

Geothermal Resource Lease (U-29556) dated June 1, 1975, between the U.S.A., as Lessor, and Union Oil Company of California, as Lessee, covering the following lands:

T.25S., R.7W., Salt Lake Meridian

- Section 35: All.

T.26S., R.6W., Salt Lake Meridian

- Section 6: All. no in case for

T.26S., R.7W., Salt Lake Meridian

- Section 1: Lot 4, SW $\frac{1}{4}$ NW $\frac{1}{4}$ , SE $\frac{1}{4}$ SE $\frac{1}{4}$ ;  
 Section 2: Lots 2, 3, SW $\frac{1}{4}$ NE $\frac{1}{4}$ , SE $\frac{1}{4}$ NW $\frac{1}{4}$ .

Geothermal Resources Lease (U-29557) dated May 1, 1975, between the U.S.A., as Lessor, and Union Oil Company of California, as Lessee, covering the following lands:

T.26S., R.7W., Salt Lake Meridian

Section 9: All;  
 Section 10: All;  
 Section 11:  $W\frac{1}{2}NE\frac{1}{4}$ ,  $SE\frac{1}{4}NE\frac{1}{4}$ ,  $W\frac{1}{2}$ ,  $SE\frac{1}{4}$ ;  
 Section 12: Lots 1, 2, 3, 5, 7, 8, 9, 10,  $SE\frac{1}{4}NW\frac{1}{4}$ ,  $NE\frac{1}{4}$ .

Geothermal Resources Lease (U-29558) dated June 1, 1975, between the U.S.A., as Lessor, and Union Oil Company of California, as Lessee, covering the following lands:

T.26S., R.6W., Salt Lake Meridian

Section 7: Lots 1, 2,  $E\frac{1}{2}$ ,  $E\frac{1}{2}W\frac{1}{2}$ ;  
 Section 8: All;  
 Section 17: Lots 1, 2, 3,  $N\frac{1}{2}NE\frac{1}{4}$ ,  $E\frac{1}{2}NW\frac{1}{4}$ ,  $SW\frac{1}{2}NW\frac{1}{4}$ ,  $S\frac{1}{2}$ ;  
 Section 18: All.

Geothermal Resources Lease (U-29369) dated November 1, 1975, between the U.S.A., as Lessor, and Union Oil Company of California, as Lessee, covering the following lands:

T.26S., R.6W., Salt Lake Meridian

Section 3: All.

Geothermal Lease and Agreement dated July 8, 1974, between Forminco, Inc., as Lessor, and Union Oil Company of California, as Lessee, covering the following lands:

T.26S., R.7W., S.L.B.&M.

Section 12: Lot 4 and  $NE\frac{1}{4}NW\frac{1}{4}$ ;

T.26S., R.6W., S.L.B.&M.

Section 7: Lots 3 and 4;



T.26S., R.7W., S.L.B.&M.

Section 1: E $\frac{1}{2}$ NW $\frac{1}{4}$ , SW $\frac{1}{4}$ , less 8.71 acres for  
State road;

Washington Lode Mining and Mill Site Claim, Lot  
Nos. 57A and 57B;  
Newark Lode Mining Claim, Lot No. 58;  
Conqueror Sulphur Lode, Lot No. 46;  
The Victor Sulphur Mine, Lot No. 51 (a);  
Mayme Hinckley Lode Mining Claim, Lot No. 56;  
Emperor Lode Mining Claim, Lot No. 52;  
Boston Sulphur Mine, Lot No. 48;  
Utah Lake Lode Mining Claim, Lot No. 53;  
West Mariposa Lode Mining Claim, Lot No. 55;  
New York Sulphur Mine, Lot No. 47;  
Philadelphia Sulphur Mine, Lot No. 49;  
Salt Lake Lode Mining Claim, Lot No. 54;  
Sulphur King Lode, Lot No. 44;  
Excelsior Lode, Lot No. 38;  
Mammoth Mine, Lot No. 37;  
Utah Sulphur Lode, Lot No. 45;  
Mariposa Mine, Lot No. 43;  
Queen Victoria Lode Mining Claim, Lot No. 50;  
Prince Albert Mine, Lot No. 42;  
Sulphurdale Mining Company Claims Nos. 1-4, incl.;  
7, 9, 10, 11; 12-22, incl.; 23, 24, 25, 26;  
23-34, incl.;  
KAP Claims Nos. 1-18, incl.; 18A, 19, 20, 21, 22,  
23, 24, 25 & 26;  
Morrissey Claims Nos. 1-7, incl.; 5, 8, 9, 10-31,  
incl.; 32-42, incl.; and  
Neale Fluorspar Lode Mining Claims Nos. 1-10, incl.

Geothermal Lease and Agreement dated August 19, 1974,  
between Helen M. Maycock, et al, as Lessor, and Union  
Oil Company of California, as Lessee, covering the  
following lands:

T.25S., R.6W., Salt Lake Meridian

Section 31: Lot 2 (SW $\frac{1}{4}$  of NW $\frac{1}{4}$ ).

## b. Status of ownership/assessability.

As shown in the above paragraph a., the defined lands  
are subject to active geothermal leases and agreements

between the U.S.A. and/or the property owners of record and Union Oil Company of California. Pursuant to the terms and conditions of the said instruments, proposer is granted the sole and exclusive right to explore for, drill for, test, develop, operate, produce, extract, and remove hot water, steam and thermal energy from the said leased lands together with such rights of way and easements across said lands as are necessary to carry out all geothermal exploration and development activities for same.

c. General Geology

Located where the Tushar and Pavant Ranges merge, the proposed Cove Fort - Sulphurdale geothermal anomaly is located along the west edge of the Utah High Plateau province (Plate III). The Pavant Range to the north is a tilted structural block located within the broad disturbed belt present east of the decollement thrusting formed during Mesozoic time in response to the Sevier orogeny in western Utah (Armstrong, 1968). Prior to the Sevier orogeny, the Cove Fort area was adjacent to the Las Vegas-Wasatch hinge along which most Paleozoic and Lower Mesozoic formations thicken westward into the Cordilleran geosyncline (Bissell, 1974). Deposition within the eastern edge of the Cordilleran geosyncline at Cove Fort is composed of a basal clastic sequence consisting of Upper Precambrian, Lower and Middle Cambrian quartzite and argillite, overlain by a carbonate sequence consisting of Paleozoic and Lower Mesozoic dolomite and limestone, with minor shale, siltstone, sandstone and chert (Crosby, 1959, Stewart and Poole, 1974, Poole, 1974, and Bissell, 1974). The Tushar Range to the south is a moderately tilted, sedimentary block which has been submerged by the Marysvale volcanic pile located southeast of Cove Fort, one of the largest Tertiary igneous centers in the West (Molley and Kerr, 1962). The age of the bulk of the volcanics of Marysvale center is Oligocene and Miocene (Fleck, et al, 1975). Since Miocene time, older structures and formation contacts have been obscured by the breakup of the region by normal faults, which generally trend N-S and NE-SW and Late Tertiary and Quaternary volcanics which are largely basalt erupted from many local vents in the Basin and Range province (Condie and Barsky, 1972, and Hoover, 1974).

The Cove Fort quadrangle has had limited geologic mapping. However, adjacent quadrangles to the east, south and southeast have been mapped in detail by Callaghan and Parker (1961, 1962a, 1962b). Crosby (1959), Rodrigues (1960), Zimmerman (1961), and Caskey and Shuey (1975) have partially mapped and described the structure and stratigraphy of the Cove Fort quadrangle.

### Stratigraphy

Table I summarizes the stratigraphic section estimated to be present within the proposed geothermal unit area.

### Paleozoic Rocks

Over 10,000 feet of Paleozoic rocks are present in the unit area. Only the upper 2,500 feet of the section crop out in the nearby southern Pavant Range (Crosby, 1959). Descriptions of the remainder of the unexposed section is obtained from regional studies by Stewart and Poole (1974), Poole (1974), and Bissell (1974). The basal Upper Precambrian, Lower and Middle Cambrian section is well over 2,000 feet thick and is composed of quartzite and argillite. The combined Middle to Upper Cambrian, Ordovician, Silurian, Devonian, Mississippian, and Pennsylvanian section is over 7,000 feet thick and is composed almost entirely of carbonates. Dolomite is the dominant rock type, but the section contains some limestone, shale and sandstone. The Permian section is about 200 feet thick and is composed of an upper limestone (Kaibab limestone), a middle sandstone (Coconino sandstone) and a lower sandy, dolomitic limestone (Pakoon limestone).

### Mesozoic Rocks

Nearly 3,500 feet of Lower Mesozoic rocks are present on outcrop in the southern Pavant Range, northeast of Cove Fort (Crosby, 1959). The youngest unit is the Triassic-Jurassic? Navajo sandstone. Most of the lower Mesozoic section is expected to be missing in the subsurface within the proposed unit area due to pre-Tertiary uplift and erosion of the ancestral Pavant Range during Middle to Late Mesozoic time.

TABLE I

## GENERALIZED STRATIGRAPHIC SECTION OF THE COVE FORT - SULPHURDALE UNIT AREA, UTAH

<u>ESTIMATED THICKNESS</u>	<u>AGE</u>	<u>FORMATION</u>	<u>DOMINANT LITHOLOGY</u>
0 - 2,000'	Tertiary (Late Oligocene-Miocene?)	Bullion Canyon volcanics	Latitic to andesitic ash flow tuffs, flows, breccias and tuffs
0 - 1,000'	Late Cretaceous Early Tertiary	Unnamed (Claron fm.?)	Conglomerates, sandstones, and shales
0 - 1,750'	Triassic-Jurassic(?)	Navajo sandstone	Quartzose to quartzitic sandstones
0 - 275'	Triassic	Chinle formation	Shales and sandstones
0 - 425'	Triassic	Shinarump	Chert-pebble conglomerate
0 - 1,000'	Triassic	Moenkopi formation	Red siltstones, shales and argillaceous limestones
0 - 1,000'	Permian	Kaibab limestone	Limestone, minor sandstones
0 - 500'	Permian	Coconino sandstone	Sandstones, quartzitic
0 - 500'	Permian	Pakoon limestone	Limestone, dolomitic
0 - 900'	Pennsylvanian	Oquirrh formation	Limestone, quartzitic, dolomitic
1,200'	Mississippian	Redwall limestone	Limestone

6(a).

CONFIDENTIAL

TABLE I (con'd)

<u>ESTIMATED THICKNESS</u>	<u>AGE</u>	<u>FORMATION</u>	<u>DOMINANT LITHOLOGY</u>
1,500'	Devonian	Cove Fort quartzite Guilmette formation  Simonson dolomite Sevy dolomite	Quartzite (83') Dolomite, with limestones and quartzites Dolomite Dolomite
500'	Silurian- Ordovician	Fish Haven dolomite	Dolomite
1,000'	Ordovician	Swan Peak-Eureka quartzite Pogonip limestone	Quartzite  Limestone, shale
2,500'	Cambrian	Unnamed	Carbonates, dolomite
2,000'+	Cambrian	Tintic quartzite	Quartzite

6(b).

**CONFIDENTIAL**

**CONFIDENTIAL**

### Tertiary Rocks

Locally overlying the beveled and eroded Lower Mesozoic and Upper Paleozoic rocks is a sequence of sandy conglomerate and boulder conglomerate of Late Cretaceous-Early Tertiary(?) age. This stratigraphic interval is expected to thicken rapidly away from any positive Mesozoic structural high, such as the ancestral Pavant Range. Callaghan and Parker (1962b) have mapped this same clastic section in the adjoining Sevier quadrangle and found it to thicken abruptly eastward across the quadrangle from 400 to over 5,000 feet in thickness. The 150 to 300 foot thick quartzite conglomerate found on outcrop in the southern Pavant Range is the updip termination of this thick clastic wedge present to the east.

The rocks of the Bullion Canyon volcanics represent the earliest Tertiary volcanics in the Cove Fort area. The Bullion Canyon volcanics, which is at least 5,000 feet thick in the Marysvale area, is composed of latitic to andesitic tuffs, flows and agglomerates of late Oligocene age (Callaghan and Parker, 1962b, and Bassett, et al, 1963). The correlation of the Bullion Canyon volcanics at Cove Fort is problematic. Studies by Fleck, et al, (1975) and Caskey and Shuey, (1975) suggest that the Middle Tertiary volcanic rocks at Cove Fort consists of two intertonguing rock assemblages that were deposited contemporaneously but derived from different sources. The west assemblage consists almost entirely of regional ash-flow tuffs derived from the Great Basin sources to the west and the southeastern assemblage of lava flows, volcanic breccias and ash-flow tuffs derived and distributed around the Marysvale volcanic pile. The Bullion Canyon volcanics strike south and southwest through the unit area, continuing a south-west-trending arc of Bullion Canyon volcanics mapped by Callaghan and Parker (1962b) in the northwest part of the Sevier quadrangle, west of the Cove Fort quadrangle.

South of Cove Creek, the Bullion Canyon volcanics is overlain by the Dry Hollow formation, a unit of Miocene age composed of brownish red to gray, porphyritic, latitic lava flows and tuffs (Bassett, et al, 1963). The contact between the Dry Hollow formation and the Bullion Canyon volcanics is not well defined east of Sulphurdale.

**CONFIDENTIAL**Structure

North of Cove Creek, the unit area is centered on the tilted horst block of the southern Pavant Range. Carbonate rocks as old as the Pennsylvanian Oquirrh formation (and possibly Mississippian rocks) are exposed on the west face of the fault block which dips 15 to 35 degrees east-southeast. The west side of the Range is sharply defined by a normal fault which faults the Upper Paleozoic section up against Middle Tertiary volcanics to the west. The eastern and southern flanks of the Range are overlapped by outcrops of both the Upper Cretaceous(?) - Lower Tertiary quartzitic conglomerate and the Bullion Canyon volcanics. The apparent thinning of these two stratigraphic units around the southern Pavant Range indicates that the area was a positive element by Late Cretaceous time in response to the Sevier orogeny of western Utah. South of Cove Creek, the structure of the unit area is a tilted fault block of Middle Tertiary volcanics which dip 10 to 15 degrees east-southeast.

The normal fault which bounds the west side of the southern Pavant Range continues southward across Cove Creek and bifurcates into two or more normal faults of apparently lesser displacements. Alluvium, colluvium and landslide deposits on outcrops of the Bullion Canyon volcanics tend to obscure the fault traces near Sulphurdale. On the down faulted block to the west, the Middle Tertiary volcanics are overlain by an undetermined thickness of faulted and tilted volcanic boulder conglomerate and water-laid tuff (possibly the Sevier River formation of Late Tertiary age). This clastic sequence outcrops in a small area just west of Cove Fort and shows a marked angular unconformity with the overlying, slightly faulted basalt of the Cove Fort volcanic field (Condie and Barsky, 1972). Most of the basalt of the Cove Fort volcanic field was derived from a vent located near the base of the cinder cone located in Sections 9 and 10, T26S, R7W, three miles west of Sulphurdale. This basalt field may be, in part, as young as 30,000 years B.P. (Zimmerman, 1961).

d. Site Selection

The criteria for selecting the drill sites in the Cove Fort geothermal area is based on the following sets of data:

Heat Flow

Temperature data was obtained from seventeen temperature gradient holes drilled to a maximum depth of 300 feet. Temperature gradients range from 16 to 20 degrees F per 100 feet (292 to 365 degrees C/km) in the area of proposed drilling, greatly exceeding the temperature gradients outside the area of interest. The "background" temperature data range downward from 8 degrees F per 100 feet to a minimum of 2 degrees F per 100 feet only a few miles from the area of anomalously high temperatures and gradients (Plate I).

Surface Geothermal Manifestations

Intense hydrothermal alteration, mineralization, H<sub>2</sub>S gas seeps and warm springs are present in a six mile long by two mile wide area east of Cove Fort (Plate II), which is coincident with the high heat flow anomaly. Hydrothermal alteration and mineralization (primarily native sulphur) occurs along or adjacent to the normal faults which trend north-south. Hydrogen sulphide gas seeps are also present in areas of intense alteration, possibly indicating a vapor-dominated system at depth. A few fresh-water warm springs occur in the higher elevations.

Abnormally high levels of mercury were found in outcrop samples from the altered and mineralized area. Trace analyses exceed 10,000 ppb for mercury. Mercury is believed to be an excellent geochemical indicator of hydrothermal activity.

In conclusion, the coincidence of the heat flow anomaly and the various surface geothermal manifestations make a strong geologic case for selecting this area for geothermal exploration.

2. Program Data Offered



a. Subsurface

Existing Data

- 1) Drilling technology for hostile, high temperature, low pressure and corrosive environment in the Cove Fort - Sulphurdale KGRA area.
- 2) Complete drilling history including all subsurface data such as lithological, mud and penetration logs from our existing well Forminco No. 1.

New Data

In all, three wells are planned to be drilled under this program. The first well planned is KGRA 42-7 located in Section 7, T26S, R6W, SLM, Beaver County, State of Utah, as submitted to the United States Geological Survey by Union Oil Company of California's Proposed Plan of Operations to drill geothermal test wells, in the Cove Fort - Sulphurdale Unit on the Company's United States Geothermal Leases U-29554, U-29555, U-29556, U-29557 and U-29558. The two follow-up wells locations will be contingent upon the results of Well 42-7 and located at two of the remaining twenty-two locations as submitted in the above Proposed Plan of Operations.

The following new data, gathered from the three wells is offered:

- 1) Drilling technology including but not limited to the drilling fluid design, cementing, bit selection and the casing policy. Considerable new information is expected to be gained in this category because this KGRA presents one of the most hostile geothermal environments encountered anywhere.
- 2) Drilling histories including all subsurface data such as lithological, mud and penetration logs.
- 3) Electric logs as discussed under B.3.a.6).

- 4) Core analysis as discussed under B.3.a.4).
- 5) Chemical analyses as discussed under B.3.a.8).
- 6) Our interpretation in the form of an engineering report covering the drilling history of each well to be completed at the end of the project.
- 7) After the long-term flow test and if scaling and/or corrosion appear to have been indicated in the well bore, a small repair rig would be moved in to evaluate the scaling and corrosive factors that had occurred. The cost of this work would be approximated at \$100,000 and if work deemed necessary, it would be negotiated at that time.

b. Surface

Geological Data

Most of the existing geological data were obtained and the temperature gradient holes drilled on and around the anomaly and the surface geothermal manifestations. These existing data are offered as a part of the proposal. The results of the gradient holes and the surface manifestations are discussed in Section B.1.c., and B.1.d. and presented on Plates I and II.

Operational Data

Considerable new information is expected to be gained on the handling of geothermal fluids at the surface. The following data gathered at the surface are offered:

1) Pipeline Design

Pipelines will be laid to carry fluid from the separators at the production wells to the injection well.

2) Separator Design

Separators will be designed on the basis of  
a) expected flow rate of the well, b) reservoir fluid enthalpy, c) the wellhead pressure, and  
d) the corrosive and scaling nature of the fluid.

**CONFIDENTIAL**3) Scaling Experiments

Several experiments will be performed on the brine to evaluate the scaling and corrosion characteristics in the surface pipes and in the production/injection wells.

4) Metallurgical Studies

Corrosive effects of the brine on various metals will be studied in an effort to improve the performance of separators and turbines.

5) Design of Flow Tests

The surface layout of various equipments such as separators, pipelines, tanks, valves, and pressure and temperature observation ports will be designed taking into consideration the natural topography and chemical nature of the fluid.

## c. Reservoir Engineering Studies

## 1) Designing and conducting flow tests to find:

- well potential,
- fluid chemistry, and
- pressure and temperature surveys under flowing conditions.

## 2) Pressure Drawdown Analysis and Pressure Buildup Analysis.

## 3) Reservoir Interference Test, if possible, for reservoir evaluation:

- interpretation of interference test,
- interpretation of variable flow rate well test,
- prediction of production temperature in the presence of injection wells.

## 4) Coring and Core Analysis

## 5) Isotope Studies

**CONFIDENTIAL**

- 6) Recommend an optimum development plan using a numerical simulator.

### 3. Program Description

#### a. Subsurface

##### 1) Existing Data

Complete drilling history and complete records of well Forminco No. 1 located 311' westerly, thence 822' southerly from the northeast corner of Section 29, T25S., R.6W, S.L.B.&M., in Beaver County, State of Utah.

The well was spudded July 26, 1976, and drilled 17½" hole with mud to 910' with considerable lost circulation. Ran in and cemented 13-3/8", 54.5 pound per foot, K-55, buttress casing at 822'. Drilled 12½" hole, 1,004' with mud, considerable lost circulation and stuck drill pipe in hole while cementing for this lost circulation. Plugged back and side-tracked hole at 833'. Directionally drilled 12½" hole with air, foam, and aerated mud to 1,052'. We were unable to keep hole open and plugged well with cement from 836' to surface and the well abandoned August 31, 1976.

The well was drilled by Loffland Brothers Drilling Company for Union Oil Company of California.

##### New Data

Three new wells to be drilled to a total depth of approximately 10,000 feet. The first well planned is KGRA 42-7 located in Section 7, T26S., R6W., S.L.B.&M., Beaver County, State of Utah, as submitted to the United States Geological Survey by Union Oil Company of California's Proposed Plan of Operations to drill geothermal test wells, in the Cove Fort - Sulphurdale Unit on the Company's United States Geothermal Leases U-29554, U-29555, U-29556, U-29557 and U-29558. The two follow-up wells locations will be contingent upon the results of Well 42-~~7~~, and located at two of the remaining twenty-two locations as submitted in the above Proposed Plan of Operations.

**CONFIDENTIAL**2) Drilling and Completion Procedures

We are attaching as Appendix "A", a proposed drilling procedure submitted by Union Oil Company of California to the United States Geological Survey for permit approval of the drilling of the above three wells. These procedures cover the objectives of the program and the methods of accomplishing them. All the information needed in B.3.a.2) through B.3.a.9) is contained in the appendix although the sequence of presentation is slightly changed.

For your convenience, we indicate below the relevant page numbers or the parts of the appendix that discuss the parameters listed in the instructions.

a) Total Depth

Approximately 10,000 feet each.

b) Hole Sizes and Depths

Hole sizes and depths are discussed in Section II, Pages 1 through 9 of Appendix "A".

c) Drilling Fluids

The mud program in Section II, Part A of the Appendix.

d) Casing

A discussion on casing is given in Section II, Part D of the Appendix.

e) Cementing

See Section II, Part B of the Appendix.

3) Mud Logging

Standard mud logging units will be installed. We will include extra safety precautions as indicated in Section III of the Appendix.

4) Coring and Analysis

We plan to core the second and the third well. Three cores from each of the two wells will be drilled. The cores will be inspected for detailed analyses for the fluid flow and thermal properties of the reservoir rock. A complete discussion of the analyses will be given in Section B, 3(c) entitled Reservoir Engineering Studies.

5) Drill Stem Testing

We do not recommend and hence do not plan a drill stem test.

6) Logging

Please see Section 5, Page 2, of the Appendix.

7) Flow Testing

A discussion of rig test and the initial flow testing is given in Section V of the Appendix.

8) Fluid Chemistry

A substantial number of geothermal fluid samples will be collected at the well-heads and at different points along the pipelines. The samples will be analyzed completely for chemical and isotopic data. The chemical data are important for proper design of injection facilities and the surface fluid handling capability. The isotopic data are expected to provide information about the reservoir.

9) Wellbore Treatments

We do not plan any wellbore treatment at this stage. However, if any problems are encountered, suitable wellbore treatments will be designed.

**CONFIDENTIAL****b. Surface Investigations****1) Completed Investigation**

We are offering the results of a completed investigation. Two techniques were used to carry out the surface investigations: (1) temperature gradient holes and (2) surface geothermal manifestations. The results of the two techniques are discussed in Section B.1. (c) and (d) and are presented on Plate I and II.

Seventeen temperature gradient holes, each about 300 feet deep, were drilled by Boyles Brothers Drilling Company, Salt Lake City, Utah for Union Oil Company of California, in 1974. The data were interpreted by Union Oil Company of California.

The surface geothermal manifestations were mapped by the Union Oil Company of California geologists in 1974 and 1975.

**2) Type of Survey**

See b.1) above.

We feel that adequate surface investigations have been performed. The next logical step is the confirmation of surface investigations by deep drilling. As such, no new surveys are planned.

**c. Reservoir Engineering Studies****1) New Data**

The reservoir engineering studies will be based on new data gathered under this program.

**2) Measurements and Analyses**

The following measurements and analyses will be used in the reservoir engineering studies:

**a) Core Analyses**

The following tests are planned.

1. Porosity

Measure both matrix (connected pores) and bulk porosity (all pores) using water (as opposed to helium).

2. Density

Grain density and bulk density.

3. Permeability

To water (preferably simulated or actual brine) at high temperature and pressures. Permeability can be measured either by steady flow or by transient pressure depletion, depending on the magnitude of permeability. We need both horizontal and vertical permeability.

4. Specific Heat

Brine saturated rock at elevated temperature.

5. Thermal Conductivity

Brine saturated rock at elevated temperature.

6. Coefficient of Thermal Expansion

We need bulk coefficient of expansion or contraction. The change in temperature should be gradual so as not to cause rock cracking.

7. S-wave and P-wave

Under varying confining pressure.

8. Compaction

Under (a) brine saturation, (b) high temperature, (c) fixed overburden pressure, (d) fixed horizontal pressure, but (e) varying pore pressure, (f) both increasing and decreasing pore pressure.



The highest pore pressure is equal to a gradient of 0.4 psi/ft. The smallest value is either the saturation pressure corresponding to the assigned temperature, so that the water does not flash or 500 psi, whichever is more. We need increasing and decreasing pore pressure to study the hysteresis effect and to estimate recovery of bulk volume by reinjection.

### 9. Triaxial Deformation

The objective of the test is to determine Young's modulus, bulk modulus, shear modulus and Poisson's ratio. The tests are helpful in designing hydraulic stimulation.

#### b) Logging

Logging is discussed under B.3.a.3.

#### c) Flow Tests

Flow tests are discussed under B.3.a.7.

#### d) Fluid Chemistry

Fluid chemistry is discussed under B.3.a.8.

#### e) Pressure Drawdown Tests

#### f) Pressure Buildup Tests

#### g) Interference Test

Various existing computer programs will be used to interpret the data. The programs have been developed by Union Oil Company of California. Three programs are mentioned below:

#### a) Interpretation of Interference Test

The program calculates pressure changes at one or more observation wells due to activity at one or more production/injection wells. Variable rates (including shut-in) and production/injection history in the field prior to the onset of interference test are included in the program.

b) Interpretation of Pressure Observations Due to Variable Flow Rates

The program helps in the interpretation of pressure observations at a well which has a variable flow rate. The program permits an arbitrary, but known, rate change. Pressure buildup tests and two rate tests are special cases that can be handled by the program.

c) Prediction of Production Temperature in the Presence of Injection Wells

The fluid advances in response to flow gradients established in the field. Heat loss/gain calculations are superposed on flow calculations to determine temperature of produced fluid. The program calculates the temperature of produced fluid as a function of time in the presence of injection wells. The program helps in designing the location and rates of injection.

Based on the data collected and the analyses made, an optimum development plan for Cove Fort - Sulphurdale KGRA, will be prepared.

4. Schedule

A schedule indicating the sequence of proposed program investigation activities is shown on the attached sheets on a yearly basis. The schedule includes drilling three wells, core analyses, flow testing and reservoir evaluation testing.

- Drilling reports will be issued within 90 days of the completion of each well.
- A detailed geological report will be issued within 90 days of the completion of the third well.
- A report on core analyses will be issued within a month after it is received.
- A report on flow testing will be issued within 90 days of completion of flow tests on all the wells.
- A complete engineering report will be issued at the end of the project in September, 1979.

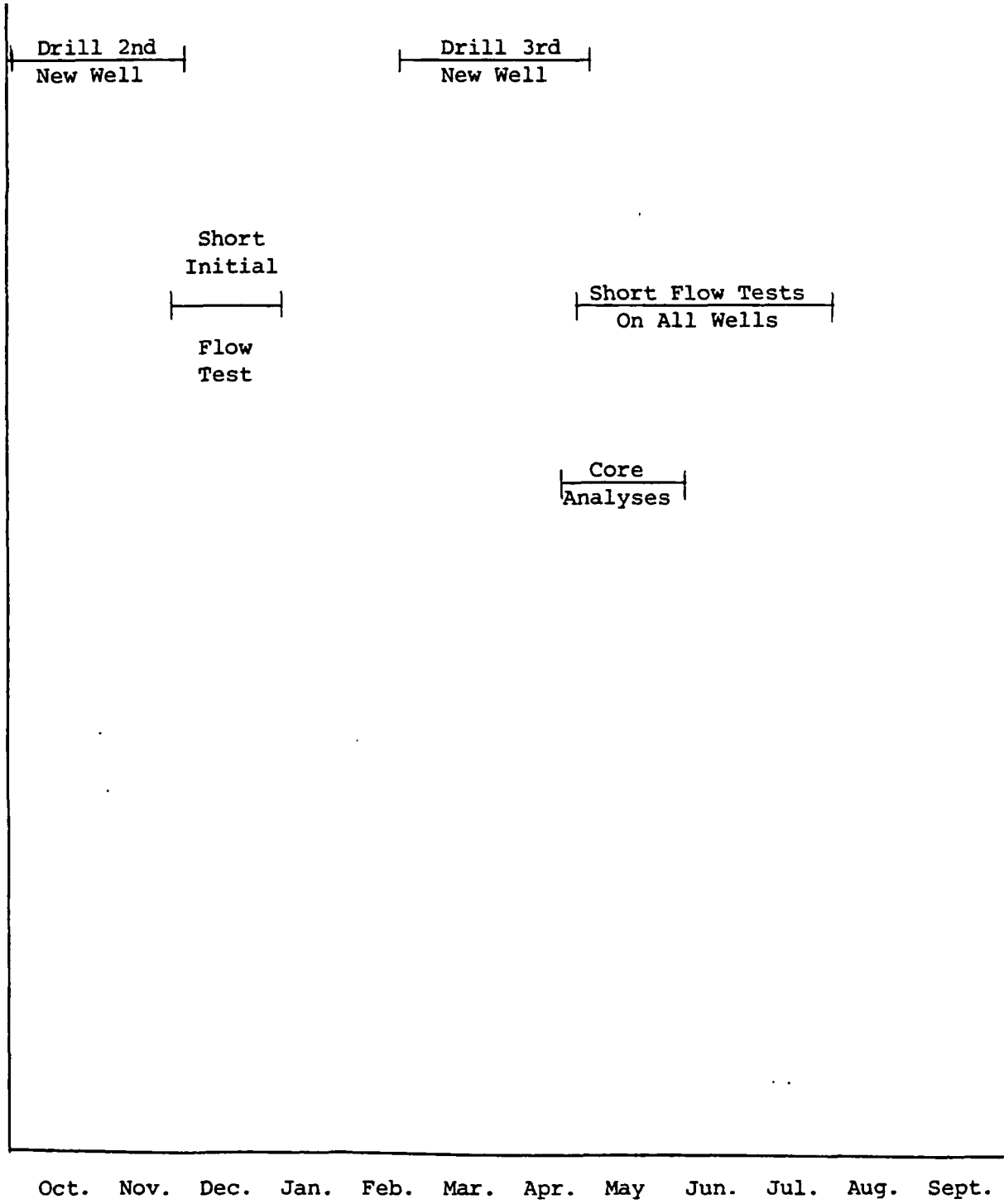
SCHEDULE  
Fiscal Year 1977

Forminco No. 1  
Previously Drilled

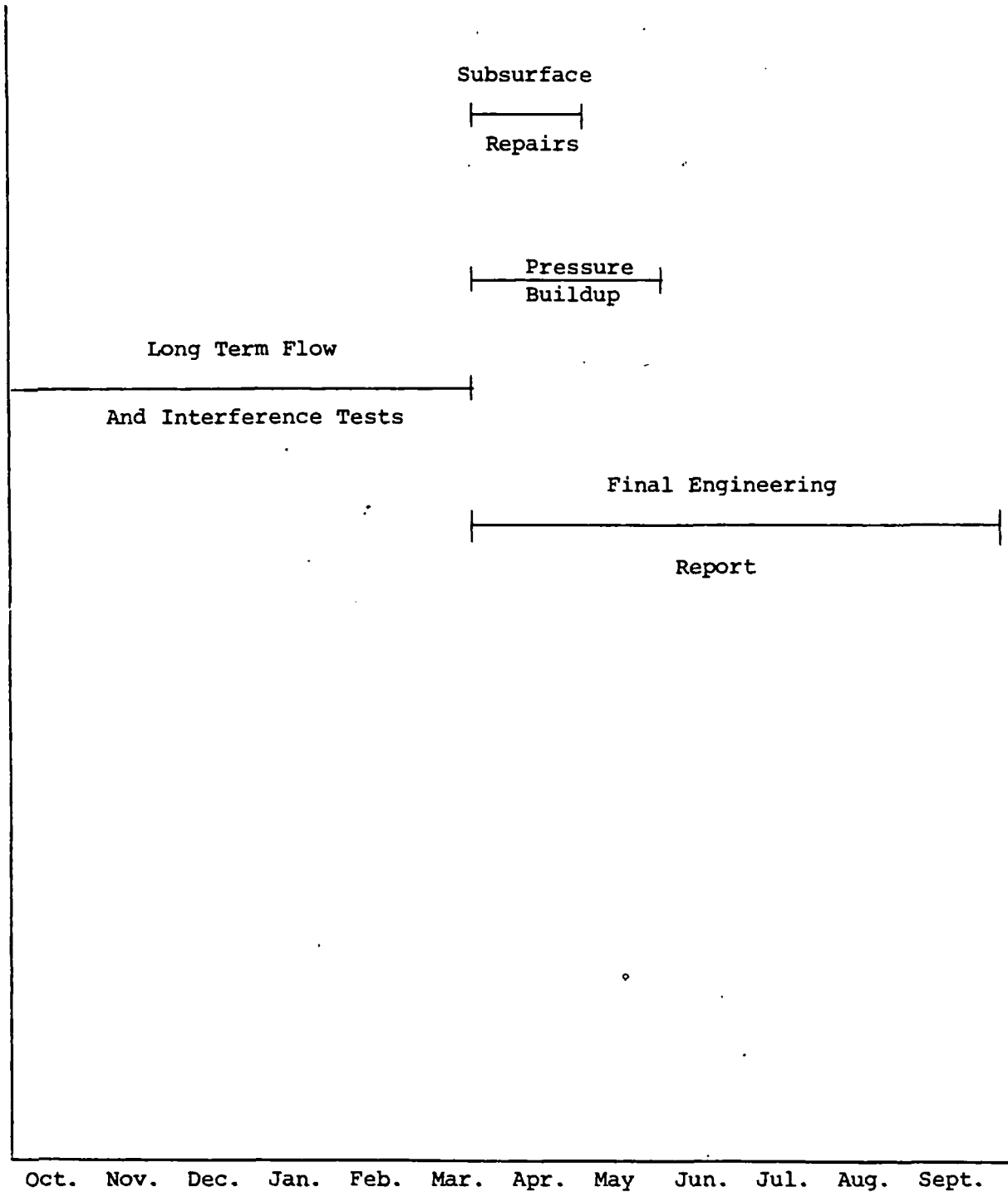
Drill Well  
42-7

Oct. Nov. Dec. Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sept.

Schedule (cont'd.)  
Fiscal Year 1978



Schedule (cont'd.)  
Fiscal Year 1979



The proposal being submitted can be published if a contract is awarded. The intermediate reports can be published when they are submitted. We do ask that the publication of the final engineering report be withheld for two (2) years after its submittal.

5. Environmental Evaluation

a. Description

The environmental impact of this proposal is within the acceptable limits or can be mitigated by the protective measures which are thoroughly discussed by the Geothermal Environmental Advisory Panel in their memorandum to the Area Geothermal Supervisor dated May 12, 1977. This memorandum is enclosed as Appendix B.

b. Analysis

An environmental analysis of the proposed Plan of Operation was prepared for the Area Geothermal Supervisor and is enclosed as Appendix C.

c. Conflicts

There are no significant conflicts with the existing land use patterns and programs. They are thoroughly discussed in Appendices B and C.

C. COST

1. Estimated or Actual Total Cost

See attached "Contract Pricing Proposal", GSA Optional Form 60, as well as Table II, which follows.

2. Proposed Cost to the Government

Please see attached Tables III, IV and V.

**CONTRACT PRICING PROPOSAL**  
*(RESEARCH AND DEVELOPMENT)*

Office of Management and Budget  
Approval No. 29-RO184

This form is for use when (i) submission of cost or pricing data (see FPR 1-3.807-3) is required and (ii) substitution for the Optional Form 59 is authorized by the contracting officer.

PAGE NO.

NO. OF PAGES

NAME OF OFFEROR  
**Union Oil Company of California**

SUPPLIES AND/OR SERVICES TO BE FURNISHED  
**"Geothermal Reservoir Assessment  
Case Study"  
Cove Fort, Utah K.G.R.A.**

HOME OFFICE ADDRESS  
**461 S. Boylston Street  
Los Angeles, California 90017**

DIVISION(S) AND LOCATION(S) WHERE WORK IS TO BE PERFORMED  
**Geothermal - Cove Fort, Utah**

TOTAL AMOUNT OF PROPOSAL  
**\$ 2,309,785**

GOV'T SOLICITATION NO.  
**EY-R-08-0007**

**DETAIL DESCRIPTION OF COST ELEMENTS**

1. DIRECT MATERIAL <i>(Itemize on Exhibit A)</i>	EST COST (\$)	TOTAL EST COST <sup>1</sup>	REFER-ENCE <sup>2</sup>
a. PURCHASED PARTS			
b. SUBCONTRACTED ITEMS			
c. OTHER—(1) RAW MATERIAL			
(2) YOUR STANDARD COMMERCIAL ITEMS			
(3) INTERDIVISIONAL TRANSFERS <i>(At other than cost)</i>			
<b>TOTAL DIRECT MATERIAL</b>			
2. MATERIAL OVERHEAD <sup>3</sup> <i>(Rate % X \$ base = )</i>			
3. DIRECT LABOR <i>(Specify)</i>	ESTIMATED HOURS	RATE/HOUR	EST COST (\$)
<b>TOTAL DIRECT LABOR</b>			
4. LABOR OVERHEAD <i>(Specify Department or Cost Center)<sup>4</sup></i>	O.M. RATE	X BASE =	EST COST (\$)
<b>TOTAL LABOR OVERHEAD</b>			
5. SPECIAL TESTING <i>(Including field work at Government installations)</i>		EST COST (\$)	
<b>TOTAL SPECIAL TESTING</b>			
6. SPECIAL EQUIPMENT <i>(If direct charge) (Itemize on Exhibit A)</i>			
7. TRAVEL <i>(If direct charge) (Give details on attached Schedule)</i>		EST COST (\$)	
a. TRANSPORTATION			
b. PER DIEM OR SUBSISTENCE			
<b>TOTAL TRAVEL</b>			
8. CONSULTANTS <i>(Identify—purpose—rate)</i>		EST COST (\$)	
<b>TOTAL CONSULTANTS</b>			
9. OTHER DIRECT COSTS <i>(Itemize on Exhibit A)</i>			
10. <b>TOTAL DIRECT COST AND OVERHEAD</b>			
11. GENERAL AND ADMINISTRATIVE EXPENSE <i>(Rate % of cost element Nos. )<sup>5</sup></i>			
12. ROYALTIES <sup>6</sup>			
13. <b>TOTAL ESTIMATED COST</b>			
14. FEE OR PROFIT			
15. <b>TOTAL ESTIMATED COST AND FEE OR PROFIT</b>			

SEE ATTACHED TABLE 1 THROUGH 5





## INSTRUCTIONS TO OFFERORS

1. The purpose of this form is to provide a standard format by which the offeror submits to the Government a summary of incurred and estimated costs (and attached supporting information) suitable for detailed review and analysis. Prior to the award of a contract resulting from this proposal the offeror shall, under the conditions stated in FPR 1-3.807-3 be required to submit a Certificate of Current Cost or Pricing Data (See FPR 1-3.807-3(h) and 1-3.807-4).

2. In addition to the specific information required by this form, the offeror is expected, in good faith, to incorporate in and submit with this form any additional data, supporting schedules, or substantiation which are reasonably required for the conduct of an appropriate review and analysis in the light of the specific facts of this procurement. For effective negotiations, it is essential that there be a clear understanding of:

- a. The existing, verifiable data.
- b. The judgmental factors applied in projecting from known data to the estimate, and
- c. The contingencies used by the offeror in his proposed price.

In short, the offeror's estimating process itself needs to be disclosed.

3. When attachment of supporting cost or pricing data to this form is impracticable, the data will be described (with schedules as appropriate), and made available to the contracting officer or his representative upon request.

4. The formats for the "Cost Elements" and the "Proposed Contract Estimate" are not intended as rigid requirements. These may be presented in different format with the prior approval of the Contracting Officer if required for more effective and efficient presentation. In all other respects this form will be completed and submitted without change.

5. By submission of this proposal the offeror grants to the Contracting Officer, or his authorized representative, the right to examine, for the purpose of verifying the cost or pricing data submitted, those books, records, documents and other supporting data which will permit adequate evaluation of such cost or pricing data, along with the computations and projections used therein. This right may be exercised in connection with any negotiations prior to contract award.

## FOOTNOTES

1 Enter in this column those necessary and reasonable costs which in the judgment of the offeror will properly be incurred in the efficient performance of the contract. When any of the costs in this column have already been incurred (e.g., on a letter contract or change order), describe them on an attached supporting schedule. Identify all sales and transfers between your plants, divisions, or organizations under a common control, which are included as other than the lower of cost to the original transferrer or current market price.

2 When space in addition to that available in Exhibit A is required, attach separate pages as necessary and identify in this "Reference" column the attachment in which the information supporting the specific cost element may be found. No standard format is prescribed; however, the cost or pricing data must be accurate, complete and current, and the judgment factors used in projecting from the data to the estimates must be stated in sufficient detail to enable the Contracting Officer to evaluate the proposal. For example, provide the basis used for pricing materials such as by vendor quotations, shop estimates, or invoice prices; the reason for use of overhead rates which depart significantly from experienced rates (reduced volume, a planned major re-arrangement, etc.); or justification for an increase in labor rates (anticipated wage and salary increases, etc.). Identify and explain any contingencies which are included in the proposed price, such as anticipated costs of rejects and defective work, or anticipated technical difficulties.

3 Indicate the rates used and provide an appropriate explanation. Where agreement has been reached with Government representatives on the use of forward pricing rates, describe the nature of the agreement. Provide the method of computation and application of your overhead expense, including cost breakdown and showing trends and budgetary data as necessary to provide a basis for evaluation of the reasonableness of proposed rates.

4 If the total cost entered here is in excess of \$250, provide on a separate page the following information on each separate item of royalty or license fee: name and address of licensor; date of license agreement; patent numbers, patent application serial numbers, or other basis on which the royalty is payable; brief description, including any part or model numbers of each contract item or component on which the royalty is payable; percentage or dollar rate of royalty per unit; unit price of contract item; number of units; and total dollar amount of royalties. In addition, if specifically requested by the contracting officer, a copy of the current license agreement and identification of applicable claims of specific patents shall be provided.

5 Provide a list of principal items within each category indicating known or anticipated source, quantity, unit price, competition obtained, and basis of establishing source and reasonableness of cost.

CONTINUATION OF EXHIBIT A—SUPPORTING SCHEDULE AND REPLIES TO QUESTIONS II AND V.



FISCAL YEAR  
1977

<u>Drilling</u>	<u>\$</u>	
Forminco No. 1 (Previously Drilled)	596,255	
KGRA Well No. 42-7	<u>900,000</u>	
	1,496,255	
<u>G&amp;A</u>	<u>74,800</u>	\$1,571,055

FISCAL YEAR  
1978

<u>Drilling</u>		
KGRA Well No. 2	942,000	
KGRA Well No. 3	<u>942,000</u>	
	1,884,000	
<u>Equipment &amp; Control Services</u>	85,000	
<u>Labor</u>	226,000	
<u>G&amp;A</u>	<u>109,700</u>	\$2,304,700

FISCAL YEAR  
1979

<u>Drilling</u>		
Well Repair	100,000	
<u>Equipment &amp; Contract Services</u>	455,000	
Labor	294,000	
<u>G&amp;A</u>	<u>42,500</u>	\$ 891,500
<u>GRAND TOTAL</u>		<u>\$4,767,255</u>

FISCAL YEAR 1977

Existing Work  
Drilling Forminco No. 1

	<u>TOTAL COST</u>	<u>COST TO GOVERNMENT</u>
1. Location	\$ 24,956	
2. Drilling Contractor	139,765	
3. Drilling Bits	29,606	\$ 29,606
4. Drilling Mud & Chemicals	46,611	46,611
5. Fuel & Water	6,128	
6. Equipment Rentals	29,506	
7. Specialized Drilling Services	200,299	200,299
8. Transportation	39,774	
9. Casing	22,269	22,269
10. Production Equipment	5,334	
11. Unanticipated Drilling Expense	55,347	
12. Miscellaneous	9,798	
	<u>609,393</u>	
Less Bottom Hole Contributions	- 13,138	
TOTAL	<u>\$596,255</u>	<u>\$298,785</u>

FISCAL YEAR 1977

New Work  
Drilling Well KGRA 42-7

	<u>TOTAL COST</u>	<u>COST TO GOVERNMENT</u>
1. Location	\$ 44,000	
2. Drilling Contractor	307,750	\$153,875
3. Drilling Bits	61,000	61,000
4. Drilling Mud & Chemicals	56,000	56,000
5. Fuel & Water	5,000	
6. Equipment Rentals	55,000	55,000
7. Specialized Drilling Services	140,000	70,000
8. Transportation	30,000	
9. Casing	150,250	75,125
10. Production Equipment	30,000	
11. Supervision	17,000	
12. Miscellaneous	4,000	
TOTAL	<u>\$900,000</u>	<u>\$471,000</u>
G&A	74,800	
 TOTAL FISCAL YEAR 1977	 \$1,571,055	 \$769,785

FISCAL YEAR 1978New Work  
Drilling Well KGRA 2nd Well

	<u>TOTAL COST</u>	<u>COST TO GOVERNMENT</u>
1. Location	\$ 44,000	
2. Drilling Contractor	322,500	\$161,250
3. Drilling Bits	71,000	71,000
4. Drilling Mud & Chemicals	60,000	60,000
5. Fuel & Water	5,000	
6. Equipment Rentals	58,000	58,000
7. Specialized Drilling Services	149,250	74,625
8. Transportation	30,000	
9. Casing	150,250	75,125
10. Production Equipment	30,000	
11. Supervision	18,000	
12. Miscellaneous	4,000	
TOTAL	<u>\$942,000</u>	<u>\$500,000</u>

Drilling Well KGRA 3rd Well  
(Costs same as KGRA 2nd Well)

	\$942,000	\$500,000
--	-----------	-----------

FISCAL YEAR 1978Equipment & Contract Services

	<u>TOTAL COST</u>	<u>COST TO GOVERNMENT</u>
Choke Manifold	\$ 20,000	\$ 20,000
Flow Separator	5,000	5,000
Pipes & Fittings	2,500	2,500
Valves & Meters	7,500	7,500
Installation	5,000	5,000
Core Analysis	15,000	15,000
Fluid Samples	5,000	5,000
Chemical Analysis	10,000	10,000
Pressure Temperature Services	10,000	10,000
Computer Services	5,000	5,000
	<u>\$ 85,000</u>	<u>\$ 85,000</u>

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
	<u>\$226,000</u>

G&A

	<u>109,700</u>
--	----------------

TOTAL FISCAL YEAR 1978

\$2,304,700\$1,085,000

FISCAL YEAR 1979

## TABLE V

	<u>TOTAL COST</u>	<u>COST TO GOVERNMENT</u>
<u>Drilling</u>		
Well Repair (if needed)	\$100,000	\$ 50,000
<u>Equipment &amp; Contract Services</u>		
2 Injection Pumps	120,000	120,000
1 Separator with controls	100,000	100,000
7000' Pipe Lines	70,000	70,000
Misc. Controls & Instruments	20,000	20,000
Vent Tank	15,000	15,000
Valves & Fittings	20,000	20,000
Installation	20,000	20,000
Miscellaneous	35,000	
Fluid Samples	5,000	5,000
Chemical Analysis	10,000	10,000
Pressure & Temperature Services	10,000	10,000
Interference Test Equipment	15,000	15,000
Computer Services	<u>15,000</u>	<u>                    </u>
	\$455,000	\$405,000
<u>Labor</u>		
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)	<u>75,000</u>	
	\$294,000	
<u>G&amp;A</u>	<u>42,500</u>	<u>                    </u>
TOTAL FISCAL YEAR 1979	\$891,500	\$455,000
GRAND TOTAL	\$4,767,255	\$2,309,785



## D. BUSINESS AND MANAGEMENT

### 1. Experience

The Union Oil Company of California, Geothermal Division headquarters are located in the home office in Los Angeles and two district offices are located 1) in Santa Rosa, California and 2) Makati, Rizal, Philippines. Two area offices are based out of the Santa Rosa District office and they are 1) Brawley, California and 2) the Baca Location No. 1, New Mexico. Two area offices are based out of the Makati, Rizal, Philippines office and they are 1) Tiwi and 2) Bulalo - both located on the Island of Luzon.

At the present time, the Geothermal Division directly employs 125 people of which 77 are professional (primarily engineers and geologists) and the remaining 48 are comprised of technicians, secretaries, clerical and field operating personnel. This group is well qualified to undertake the complete operations involved in the drilling and producing of geothermal wells. Members of the group have been involved in drilling and completion of over 185 wells during the past 15 years, excluding the numerous temperature gradient holes that have been completed.

The particular value of this group is its broad experience in the drilling, completion and operation of geothermal wells completed from fractured and porous reservoirs consisting of metamorphosed, volcanic and sedimentary rocks, with produced fluids being in either liquid or vapor-dominated states.

Another accomplishment of this Division is that it operates in The Geysers field, California, supplying geothermal steam to eleven power plants which generate 502 megawatts of electricity. Two additional plants are presently under construction which will add another 220 megawatts and an additional two 110 megawatt power plants are under consideration by Pacific Gas and Electric Company.

In the Philippines we are exploring and developing two geothermal areas in which three power plants are under construction for a total of 330 megawatts and an additional 110 megawatt power plant is being considered by the National Power Corporation.

In the Brawley, California and Baca Location No. 1, New Mexico areas, we have also submitted proposals to the local utility companies for the construction of one power plant in each area.

## 2. Principal Project Personnel

The individual members of the Geothermal Division who will be primarily involved in the proposed project are Messers. Delbert E. Pyle, Donald L. Ash, Olin D. Whitescarver and Philip H. Messer. They will act in the following capacities:

D.E. Pyle	Coordinator
D.L. Ash	Drilling Supervisor
O.D. Whitescarver	Production Supervisor
P.H. Messer	Reservoir Engineering Supervisor

Their resumes are as follows:

### DELBERT E. PYLE

18816 Killoch Way  
Northridge, CA 91324

### MILITARY

1942 - 1946	<u>United States Navy</u> Machinist - MM 2/c
-------------	---

### EDUCATION

1948	<u>Compton Junior College</u> AA Engineering
1951	<u>University of Southern California</u> BE Petroleum Engineering
1959	<u>A.A.O.D.C.</u> Blow Out Prevention

EXPERIENCE

1950 - 1952

Union Oil Company of California  
Pacific Coast Division  
 Dominguez, California

Position: Part-time Janitor;  
 Laboratory Assistant  
 in Core Lab.; Utility-  
 man; Well Puller;  
 Pumper; Truck Driver.

1952 - 1953

Union Oil Company of California  
Pacific Coast Division  
 Santa Fe Springs, California

Position: Engineer Trainee

Duties:

Individual well economic studies,  
 de-emulsification of tank bottoms  
 (method patented); production  
 engineering; petroleum engineering  
 on well sites.

1953 - 1955

Union Oil Company of California  
Pacific Coast Division  
 Bakersfield, California

Position: Petroleum Engineer

Duties:

Reservoir engineering (oil & gas  
 reserve estimates); Union repre-  
 sentative at Unit meetings;  
 engineering Mt. Poso waterflood  
 and individual reservoir studies.

1955 - 1958

Union Oil Company of California  
Pacific Coast Division  
 Coalinga, California

Position: Petroleum Engineer

Duties:

Coalinga Nose Unit reservoir engineering including engineering for State injunction against Coalinga Nose Unit; reservoir, subsurface and drilling engineering at Gujarral Hills.

1958 - 1960

Union Oil Company of California  
Pacific Coast Division  
Bakersfield, California

Position: District Drilling Engr.

Duties:

Supervising all drilling and well repair work in San Joaquin and Sacramento Valleys.

1960 - 1967

Union Oil Company of California  
Foreign Operations  
Toowoomba, Queensland, Australia

Position: Field Superintendent

Duties:

Supervising and planning all drilling, well repair, production, reservoir and subsurface engineering in Australia and operation and maintenance of Moonie P/line. Union's representative to State and Federal Governments, regarding engineering matters including representative of industry in drafting Petroleum Operating and Safety Regulations. Relieving Resident Manager in his absence.

1967 - 1971

Union Oil Company of California  
Geothermal Division  
Santa Rosa, California

Position: District Mgr. of Oper.

Duties:

Supervising and planning all drilling, well repair, production, reservoir engineering for the Geothermal Division, mainly in The Geysers field, California.

Responsible for initiating the type of drilling that is used today. Co-designed the method for reducing corrosion-erosion on subsurface tubulars. This method was patented.

1971 - Present

Union Oil Company of California  
Geothermal Division  
Los Angeles, California

Position: Manager of Operations

Duties:

Responsible for over-seeing all geothermal operations for District and area offices as well as planning and organizing two new areas, one located in New Mexico and the other in Manila, Philippines.

Designed the technology for aerated-aqueous drilling fluids utilized in geothermal drilling. Method patented.

\*

DONALD L. ASH

5376 Sharon Court  
Santa Rosa, CA 95405

MILITARY

1944 - 1946

United States Navy  
V-12 Program

EDUCATION

1940's

University of Washington  
 Major: General Engineering  
 Degree: None

Various Management and job related schools during the past 30 years.

EXPERIENCE

1947 - 1957

Pure Oil Company  
 Worland, Wyoming

Position:

Worked and trained in maintenance, production, transportation and drilling. Worked on location in Wyoming, Montana, North Dakota, Colorado, New Mexico and Utah.

Duties:

During this period, had the opportunity to work directly with Mr. Red Adair in capping Worland Unit Well No. 23 (20% H<sub>2</sub>S) which had blown out and caught fire. Subsequently, was offered job by Mr. Adair.

1957 - 1958

Pure Oil Company  
 Division Office  
 Denver, Colorado

Position: Production Foreman

Duties:

Supervised all facets of drilling, completion and repair of wells, construction of tank batteries, production facilities, setting of Pumping Units, transportation of crude oil to pipeline station.

1958 - 1959

Pure Oil Company  
Transferred  
District Office  
Cortez, Colorado

Position: Production Foreman

Duties:

Worked Aneth, White Mesa and East Aneth fields. Other duties same as when located in Denver.

Special Achievements:

Designed and supervised installation of tank bottom treating and cleaning facilities for 3,000 bbls crude oil storage tanks.

Drilling time and total costs were near records in the Aneth Field.

1959 - 1960

Pure Oil Company  
Four Corners District  
Cortez, Colorado

Position: Production Foreman

Duties:

Supervise all exploratory drilling in Four Corners District.

Supervised drilling, completion, testing and initial construction of production facilities for successful exploratory wells in the Northwest Lisbon Field (Southeastern Utah) and Southeast Lisbon Field (Southwestern Colorado). The discovery well in Northwest Lisbon Field was voted the greatest find in 1959, in the United States of America by the American Petroleum Institute.

November 1959 to March 1960  
was acting District Superin-  
tendent for Four Corners  
District.

1960 - 1964

Pure Oil Company  
District Office moved from Cortez,  
Colorado to Moab, Utah

Position: Production Foreman

Duties:

Supervised drilling and production  
in Four Corners District. Designed  
drilling programs. Trouble-  
shooter for all drilling and direct  
supervision of exploratory wells.  
Supervised three drilling foremen.

1964 - 1966

Pure Oil Company  
Geothermal  
Brawley, California

Position: Production Foreman

Duties:

Supervised drilling, testing, and  
completion of three geothermal  
test wells in Imperial Valley.  
Construction of test facilities,  
injection system of eleven month  
flow test and pilot plant evalu-  
ation. Evaluated surface and  
downhole equipment during test.  
Secured drilling contractor and  
supervised deepening of one well  
and drilling of another geothermal  
well in Nevada.

Special Note:

Pure Oil Company merged with Union  
Oil Company of California in 1965.



Position: Promoted to Drilling Superintendent.

Duties:

Worked with Oil and Gas - Western Region on drilling plans for Offshore - Cook Inlet, Alaska.

Supervised drilling, completion and testing of exploratory geothermal well in The Geysers field, California.

1966 - 1971

Union Oil Company of California  
Anchorage, Alaska

Position: Drilling Superintendent

Duties:

Supervised drilling and completion of first five wells drilled from the Monopad Platform, Cook Inlet, Alaska. Supervised drilling of gas wells in Kenai, Alaska.

Supervised moving and rigging up of rig to drill Company's first well on the North Slope.

Supervised rigging up of drilling equipment on two-rig Grayling Platform. Designed 48 well directional drilling program for the Grayling Platform. Designed drilling, casing and completion programs for Grayling Platform.

Directly supervised the shake-down of Platform and drilling of the first wells from the Grayling Platform.

Directly supervised controlling of blowouts and other major problems encountered during drilling of wells from the Monopod and Grayling Platforms and in the Kenai Gas Field.

1971

Union Oil Company of California  
Geothermal Division  
Imperial Valley, California

Position: Drilling Superintendent

(Loaned to the Geothermal Division.)

Duties:

Supervised P & A of two wells and a plug back and recompletion of another geothermal well in the Imperial Valley, California

1971 - Present

Union Oil Company of California  
Geothermal Division  
Santa Rosa, California

Position: Transferred to the Geothermal Division.  
District Drilling Superintendent and General Management of the Drilling Department

Duties:

Specify and select material, equipment and contractors. Coordinate and supervise Field Operations to assure compliance with specifications. Develop operating policy. Prepare budget.

Submit monthly reports of drilling activities and related special operations, progress reports and expenditures. Prepare and submit required drilling and completion reports to State and Federal Agencies.

Design and program remedial work on problem wells. Employment training, and supervising drilling supervisors. Engineering, planning and drilling of geothermal wells in the Western United States. Design drilling, casing and completion programs. Work with Service Companies and Union Oil Company of California's Research Department to develop new and improved drilling, cementing and completion techniques.

Total Geothermal wells drilled to date under my Supervision:

Big Geysers	=	79
Imperial Valley	=	14
New Mexico	=	8
Nevada	=	5
Utah	=	<u>1</u>
TOTAL:		107

Total Geothermal wells reworked to date under my Supervision:

Big Geysers	=	44
Imperial Valley	=	6
New Mexico	=	<u>12</u>
TOTAL:		62

Supervised the controlling and subsequent P & A of two uncontrolled wells in the Big Geysers field.

\*

OLIN D. WHITESCARVER

442 Oak Lake Avenue  
Santa Rosa, CA 95405

MILITARY

1958 - 1959

United States Army  
Corps of Engineers  
1st Lieutenant - Highest Rank

EDUCATION

1954 - 1958

Colorado School of Mines  
BS Petroleum Engineer

EXPERIENCE

1959 - 1963

Pure Oil Company  
Production Division  
Southern California

Position: Petroleum Engineer

Duties:

Various assignments throughout the Southern Producing Division of the Pure Oil Company. Responsible for property evaluation; well drilling, completion, and remedial programs, design and installation of production facilities; corrosion control.

1963 - 1966

Pure Oil Company  
Oil and Gas Division  
Lafayette District

Position: Area Production Engineer

Duties:

Responsible for evaluation of developed and undeveloped properties; recommendation and supervision of well drilling, completion and remedial programs, design and installation of field production facilities.

Special Note:

Pure Oil Company merged with Union Oil Company of California in 1965.

1966 - 1973

Union Oil Company of California  
Oil and Gas Division  
New Orleans District

Position: Offshore Area Production  
Engineer

Duties:

Responsible for design, installation and startup of offshore production facilities, well completion and remedial programs.

1973

Union Oil Company of California  
Oil and Gas Division  
Lafayette District

Position: Senior Production  
Engineer

Duties:

Reviewed and coordinated District Engineering activities. Coordinated joint activities with other operators.

1973 - Present

Union Oil Company of California  
Geothermal Division  
Santa Rosa, California

Position: District Production  
Superintendent

Duties:

Overall responsibility for production facility engineering, installation and operation.

Special Achievements:

Hold one patent for Geothermal Steam Production Device.

Past Section Chairman, South Louisiana Section, SPE/AIME.

PHILIP H. MESSER

2140 Alejandro Drive  
Santa Rosa CA 95405

EDUCATION

1965 - 1969

Stanford University  
BS Mechanical Engineering

1969 - 1971

Stanford University  
BS Petroleum Engineering

MS Petroleum Engineering

EXPERIENCE

1971 - 1973

Standard Oil Company of California  
Western Operations  
Production Department  
La Habre, California

Position: Engineer

Duties:

Design, modification and update  
of computer programs in the  
computer design group.

Position: Production Engineer

Duties:

Responsible for three active water  
flood projects. Activities in-  
cluded oil production pump  
sizing, injection allocation,  
water quality control, secondary  
recovery performance studies,  
annual project reports, mainte-  
nance of maximum deficient pro-  
duction, design and supervision  
of remedial work, acid stimulation,  
their zone isolation and mechan-  
ical alterations of injection wells.

1973 - 1974

Chevron Oil Company  
Western Division  
Production Department  
Lafayette, Louisiana

Position: Production Engineer

Duties:

Responsible for maintaining maximum efficient production for primary and secondary recovery of gas, condensate and oil.

Design and supervision of remedial and redrill work, preparing annual reserve review and bottomhole pressure reports as well as well-completion reports, production forecasting, correspondence with State and Federal regulatory agencies.

1974 - 1975

Chevron Oil Company  
Western Division  
Drilling Department  
Lafayette, Louisiana

Position: Drilling Engineer

Duties:

Responsible for supervising drilling, completion, and workover operations. Areas include the land rigs in South Texas, inland barge rigs in South Louisiana, and platform, jackup and floater rigs in the Gulf.

1975 - Present

Union Oil Company of California  
Geothermal Division  
Santa Rosa, California

Position: Reservoir Engineer

Duties:

Responsibilities include the design, execution and analysis of well testing in the Imperial Valley, California.

Have conducted a number of geothermal studies involving pressure buildup analyses, brine reinjection, reserves determination, two-phase flow measurement, brine scaling tendencies and wellbore damage.

Special Achievements:

Designed and evaluated the first successful geothermal injection well stimulation program.

Co-authored a technical paper which evaluates this stimulation test and it will be presented at the National Meeting of the Society of Petroleum Engineers in Denver, Colorado, this fall.

A member of the Union Oil Company of California, Research Task Force which has been investigating the chemical and physical behavior of Imperial Valley geothermal brines for the past year.

Co-authored "Calculation of Bottomhole Pressures for Deep, Hot, Sour, Gas Well" which was published in January, 1974, by the Journal of Petroleum Technology.

\*

3. Plan of Operation

When the permit to drill the KGRA Well No. 42-7 is approved by the United States Geological Survey (approximately



June 15, 1977), as submitted in the Proposed Plan of Operation (Appendix A), Union Oil Company of California will obtain bids from various drilling contractors that have the proper equipment available to drill this well. After selection of the most economical drilling bid, we will commence drilling the first well on/or about August 1, 1977. After completion, the results will be evaluated to determine the merits in proceeding with the project. If the results are encouraging, the site of the second well will be selected and the drilling will commence immediately.

If decided to proceed with the project, the necessary equipment for the first initial flow test will be designed, obtained, and the first short flow test will commence November/December, 1977.

Upon completion of the second well and the initial flow testing, these results will be evaluated to determine whether to proceed with the project. In the event the results merit continuation, the location of the third well will be selected and the well drilled. At the same time necessary equipment design will be started for the long-term flow and interference test.

After completion of the third well, further short-term testing of all wells will be conducted and studied, in order to finalize the equipment needed for the long-term flow test. Subsequently the equipment will be ordered.

Approximately September 1978, the long-term flow and interference tests will be conducted over a six-month period. In the succeeding six-months, the reservoir pressure rebound will be observed and the final reservoir and production reports will be prepared.

4. Primary Business and Technical Contacts

Dresser Industries, Inc.  
P.O. Box 6504  
Houston TX 77005  
TEL: (713) 784-8502

Mr. Roy Wolke  
Manager Geothermal Operations

- - -

Oilwell  
Division of U.S. Steel Corporation  
1335 First National Bank Building  
Denver CO 80202  
TEL: (303) 623-3001

Mr. R.C. Craig  
Manager of Sales

- - -

Hughes Tool Company  
510 Midland Savings Building  
Denver CO 80202  
TEL: (303) 266-2668

Mr. O.R. Rogers  
Regional Manager

- - -

Smith Tool Company  
1570 Denver Club Building  
Denver CO 80202  
TEL: (303) 623-8195

Mr. H.W. Autrey  
Regional Manager

- - -

Loffland Brothers Drilling Company  
3010 South Harvard Avenue  
Tulsa OK 74101  
TEL: (918) 747-1361

Mr. W.E. Schultz  
President

- - -

Brewster Company, Inc.  
P.O. Box 1095  
Shreveport LA 71163  
TEL: (318) 222-3254

Mr. Paul McGlasson  
Regional Manager

- - -

Halliburton Services, Inc.  
P.O. Box 1431  
Duncan OK 73533  
TEL: (405) 255-3760

Mr. B. Diggs Brown  
Vice President

- - -

Howard Construction Company  
P.O. Box 187  
Panguitch UT 84759

Mr. Bruce Howard  
Owner

- - -

Schlumberger Well Services  
1450 Metro Bank Building  
475 17th Street  
Denver CO 80202

Mr. J.H. Smith  
General Manager

- - -

Flint Engineering and Construction Company  
324 Petroleum Building  
Billings MT 59101

Mr. Coy Rowland  
General Manager

- - -

Bariod Division, N.L. Industries, Inc.  
1555 Tremont Place, Suite 210  
Denver CO 80202  
TEL: (303) 623-7361

Mr. D.R. Henson  
Manager of Operations

- - -

Christensen Diamond Products Company  
1937 South Third, West  
Salt Lake City UT 84110  
TEL: (801) 789-3413

Mr. Hugh Gunn  
Manager of Marketing

- - -

5. Acceptability of the General Contract Provisions

Union Oil Company of California accepts the provisions of the proposed Contract Schedule and General Provisions as included in the Request for Proposal.

6. Program Technical Scope

We have reviewed the Program Technical Scope set forth in the Request for Proposal.

- All the data furnished in the proposal may be published only if a contract is awarded.
- All the data furnished in the progress reports issued during the contract period may be published.
- An engineering report, analyzing all the data will be prepared at the end of the project and is expected to be submitted in September, 1979. We do ask that the publication of the final engineering report be delayed by two years from the time of submittal.

7. Proposer's Financial Capability

Union Oil Company of California has the financial capability, working capital and other resources to perform the proposed contractual obligation without assistance from any outside source. The enclosed annual statement for 1976 shows the Company's financial position. (See Appendix D).

8. Representations and Certifications - GSA Form 19B

GSA Form 19B, Representations and Certifications, attached.

\* \* \*

REPRESENTATIONS  
AND CERTIFICATIONS  
(Construction Contract)  
(For use with SF 19 and 21)

NAME AND ADDRESS OF BIDDER (No., Street, City, State, and ZIP Code)

UNION OIL COMPANY OF CALIFORNIA  
461 So. Boylston  
Los Angeles, CA 90017

DATE OF BID

May 27, 1977

*In negotiated procurements, "bid" and "bidder" shall be construed to mean "offer" and "offeror."*

The bidder makes the following representations and certifications as a part of the bid identified above. (Check appropriate boxes.)

1. SMALL BUSINESS

He  is,  is not, a small business concern. (For this purpose, a small business concern is a business concern, including its affiliates, which (a) is independently owned and operated, (b) is not dominant in the field of operation in which it is bidding on Government contracts, and (c) had average annual receipts for the preceding 3 fiscal years not exceeding \$7,500,000. For additional information see governing regulations of the Small Business Administration.)

2. CONTINGENT FEE

(a) He  has,  has not, employed or retained any company or person (other than a full-time bona fide employee working solely for the bidder) to solicit or secure this contract, and (b) he  has,  has not, paid or agreed to pay any company or person (other than a full-time bona fide employee working solely for the bidder) any fee, commission, percentage or brokerage fee, contingent upon or resulting from the award of this contract; and agrees to furnish information relating to (a) and (b) above as requested by the Contracting Officer. (For interpretation of the representation, including the term "bona fide employee," see Code of Federal Regulations, Title 41, Subpart 1-1.5.)

3. TYPE OF ORGANIZATION

He operates as an  individual,  partnership,  joint venture,  corporation, incorporated in State of California

4. INDEPENDENT PRICE DETERMINATION

(a) By submission of this bid, each bidder certifies, and in the case of a joint bid each party thereto certifies as to his own organization, that in connection with this procurement:

(1) The prices in this bid have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;

(2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, in the case of a bid, or prior to award, in the case of a proposal, directly or indirectly to any other bidder or to any competitor; and

(3) No attempt has been made or will be made by the bidder to induce any other person or firm to submit or not to submit a bid for the purpose of restricting competition.

(b) Each person signing this bid certifies that:

(1) He is the person in the bidder's organization responsible within that organization for the decision as to the prices being bid herein and that he has not participated, and will not participate, in any action contrary to (a) (1) through (a) (3) above; or

(2) (i) He is not the person in the bidder's organization responsible within that organization for the decision as to the prices being bid herein but that he has been authorized in writing to act as agent for the persons responsible for such decision in certifying that such persons have not participated, and will not participate, in any action contrary to (a) (1) through (a) (3) above, and as their agent does hereby so certify; and (ii) he has not participated, and will not participate, in any action contrary to (a) (1) through (a) (3) above.

(c) This certification is not applicable to a foreign bidder submitting a bid for a contract which requires performance or delivery outside the United States, its possessions, and Puerto Rico.

(d) A bid will not be considered for award where (a) (1), (a) (3), or (b) above, has been deleted or modified. Where (a) (2) above, has been deleted or modified, the bid will not be considered for award unless the bidder furnishes with the bid a signed statement which sets forth in detail the circumstances of the disclosure and the head of the agency, or his designee, determines that such disclosure was not made for the purpose of restricting competition.

THE FOLLOWING NEED BE CHECKED ONLY IF BID EXCEEDS \$10,000 IN AMOUNT.

5. EQUAL OPPORTUNITY

He  has,  has not, participated in a previous contract or subcontract subject to the Equal Opportunity Clause herein, the clause originally contained in Section 301 of Executive Order No. 10925, or the clause contained in Section 201 of Executive Order No. 11114; he  has,  has not, filed all required compliance reports; and representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained prior to subcontract awards. (The above representation need not be submitted in connection with contracts or subcontracts which are exempt from the clause.)

NOTE.—Bids must set forth full, accurate, and complete information as required by this invitation for bids (including attachments). The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

SUPPLEMENT TO REPRESENTATIONS AND CERTIFICATIONS

8. CERTIFICATION OF EMPLOYMENT OF HANDICAPPED

The offeror certifies with respect to the Employment of the Handicapped clause as follows:

- a. He  has, / / has not previously been awarded a contract which included the clause. *(If affirmative, execute b.)*
- b. The time specified for contract performance  exceeded 90 days, / / did not exceed 90 days. *(If more than 90 days, execute c.)*
- c. The amount of the contract was / / less than \$500,000,  more than \$500,000, and he  has, / / has not published his program for the employment of the handicapped. *(If more than \$500,000, execute d.)*
- d. He / / has, / / has not submitted the required annual report to the Assistant Secretary of Labor for Employment Standards.  
*(not a current requirement)*
- e. He  has, / / has not made a good faith effort to effectuate and carry out his affirmative action program.
- f. He will not award subcontracts to persons or concerns that have not published programs and submitted annual reports as required by the clause.

9. AFFIRMATIVE ACTION PROGRAM

The following paragraphs are added:

- a. The bidder or proposer represents that he (a)  1. has developed and has on file, / / 2. has not developed and does not have on file at each establishment an affirmative action program as required by the rules and regulations of the Secretary of Labor (41 CFR Part 60-1 and 60-2), or that he (b) / / has not previously had contracts subject to the written Affirmative Action Program requirement of the Secretary of Labor.

If such a program has not been developed, the bidder will complete the following:

**6. PARENT COMPANY AND EMPLOYER IDENTIFICATION NUMBER**


Each bidder shall furnish the following information by filling in the appropriate blocks:

(a) Is the bidder owned or controlled by a parent company as described below?  Yes  No. (For the purpose of this bid, a parent company is defined as one which either owns or controls the activities and basic business policies of the bidder. To own another company means the parent company must own at least a majority (more than 50 percent) of the voting rights in that company. To control another company, such ownership is not required; if another company is able to formulate, determine, or veto basic business policy decisions of the bidder, such other company is considered the parent company of the bidder. This control may be exercised through the use of dominant minority voting rights, use of proxy voting, contractual arrangements, or otherwise.)

(b) If the answer to (a) above is "Yes," bidder shall insert in the space below the name and main office address of the parent company.

NAME OF PARENT COMPANY	MAIN OFFICE ADDRESS (No., Street, City, State, and ZIP Code)
------------------------	--

(c) Bidder shall insert in the applicable space below, if he has no parent company, his own Employer's Identification Number (E.I. No.) (Federal Social Security Number used on Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941), or, if he has a parent company, the E.I. No. of his parent company.

EMPLOYER IDENTIFICATION NUMBER OF	 PARENT COMPANY 951315450	BIDDER UNION OIL COMPANY OF CALIF.
-----------------------------------	---	---------------------------------------

**7. CERTIFICATION OF NONSEGREGATED FACILITIES**

(Applicable to (1) contracts, (2) subcontracts, and (3) agreements with applicants who are themselves performing federally assisted construction contracts, exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause.)

By the submission of this bid, the bidder, offeror, applicant, or subcontractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. He certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The bidder, offeror, applicant, or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. He further agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that he will retain such certifications in his files; and that he will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

**NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES**

A Certification of Nonsegregated Facilities must be submitted prior to the award of a subcontract exceeding \$10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

The bidder does / /, does not / / employ more than 50 employees and has / /, has not / / been awarded a contract subject to Executive Order 11246 in the amount of \$50,000 or more since July 1, 1968. If such a contract has been awarded since July 1, 1968, give the date of such contract, but do not list contracts awarded within the last 120 days prior to the date of this representation.

- b. The bidder or proposer represents (a) that a full compliance review of the bidder's employment practices /X/ has, / / has not been conducted by an agency of the Federal Government; that such compliance review / / has, \*/ / has not been conducted for the bidder's known first-tier subcontractors with a subcontract of \$50,000 or more and having 50 or more employees and (b) that the most recent compliance reviews were conducted as follows:

<u>NAME OF CONTRACTOR</u>	<u>DATE</u>	<u>FEDERAL AGENCY</u>
---------------------------	-------------	-----------------------

(include known first-tier subcontractors)

SEE ATTACHED CONTINUATION SHEET

- c. The bidder or proposer represents that if the bidder has 50 or more employees and if this Contract is for \$50,000 or more, and that for each subcontractor having 50 or more employees and a subcontract for \$50,000 or more, and if he has not developed one, a written affirmative action plan will be developed for each of its establishments within 120 days from commencement of the Contract. A copy of the establishment's plan shall also be maintained at the establishment within 120 days from the date of commencement of the Contract.

The Affirmative Action Compliance Program will cover the items specifically set out in 41 CFR Part 60-2 and shall be signed by an executive of the Contractor.

- d. Where the bid of the apparent low responsible bidder is in the amount of \$1 million or more, the bidder and his known first-tier subcontractors which will be awarded subcontracts of \$1 million or more will be subject to full, preaward equal opportunity compliance reviews before the award of the Subcontract for the purpose of determining whether the bidder and his subcontractors are able to comply with the provisions of the equal opportunity clause.
- e. The bidder or proposer, if he has 100 or more employees, and all subcontractors having 100 or more employees are required to submit the Government Employer Information Report SF 100 (EEO-1), within 30 days after award, unless such report has been filed within 12 months preceding award. The EEO-1 report is due annually on or before March 31.

\*DO NOT KNOW



<u>NAME OF CONTRACTOR</u>	<u>DATE</u>	<u>FEDERAL AGENCY</u>
Union Oil Co. of Cal. Home Office	10/18-20/76	Interior
Union Oil Co. of Cal. Oil & Gas (Ventura, Cal.)	3/15/77	Interior
Union Oil Co. of Cal. Cont. Div. Marketing	3/17/77	Interior
Union Oil Co. of Cal. Oil & Gas (Lafayette, La. Dist.)	5/16/77	Interior

Plus 7 additional onsite reviews conducted by Interior during the past 12 months..

10. CLEAN AIR AND WATER CERTIFICATION.

(Applicable if the bid or offer exceeds \$100,000 or ERDA has determined that orders under an indefinite quantity contract in any 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 is not otherwise exempt.)

The bidder or offeror certifies as follows:

- a. Any facility to be utilized in the performance of this proposed contract has  / has not  / been listed on the Environmental Protection Agency list of violating facilities.
- b. He will promptly notify the Contractor, prior to award, of the receipt of any communication from the Director, Office of Federal Activities, U. S. Environmental Protection Agency, indicating that any facility which he proposes to use for the performance of the Contract is under consideration to be listed on the EPA list of violating facilities.
- c. He will include substantially this certification, including this paragraph c., in every non-exempt subcontract.

11. MINORITY BUSINESS ENTERPRISE

The offeror represents that he  / is  is not a minority business enterprise. A minority business enterprise is defined as 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 purpose of this definition, minority group members are Negroes, Spanish-speaking American persons, American-Orientals, American-Indians, American-Eskimos, and American-Aleuts.

12. DISCLOSURE STATEMENT--COST ACCOUNTING PRACTICES AND CERTIFICATION

Any subcontract in excess of \$100,000 resulting from this solicitation except (1) when the price negotiated is based on (a) established catalog or market prices of commercial items sold in substantial quantities to the general public, or (b) prices set by law or regulation,

or (2) subcontracts which are otherwise exempt (see 4 CFR 331.30(b) and FPR §1-3.1203(a)(2)) shall be subject to the requirements of the Cost Accounting Standards Board. Any offeror submitting a proposal, which, if accepted, will result in a subcontract subject to the requirements of the Cost Accounting Standards Board must, as a condition of contracting, submit a Disclosure Statement as required by regulations of the Board. The Disclosure Statement must be submitted as a part of the offeror's proposal under this solicitation (see (I) below) unless (i) the offeror, together with all divisions, subsidiaries, and affiliates under common control, did not receive net awards exceeding the monetary exemption for disclosure as established by the Cost Accounting Standards Board (see (II) below); (ii) the offeror exceeded the monetary exemption in the Federal fiscal year immediately preceding the year in which this proposal was submitted but, in accordance with the regulations of the Cost Accounting Standards Board, is not yet required to submit a Disclosure Statement (see (III) below); (iii) the offeror has already submitted a Disclosure Statement disclosing the practices used in connection with the pricing of this proposal (see (IV) below); or (iv) postaward submission has been authorized by the Contracting Officer. See 4 CFR 351.70 for submission of a copy of the Disclosure Statement to the Cost Accounting Standards Board.

**CAUTION:** A practice disclosed in a disclosure statement shall not, by virtue of such disclosure, be deemed to be a proper, approved, or agreed to practice for pricing proposals or accumulating and reporting contract performance cost data.

**CHECK THE APPROPRIATE BOX BELOW:**

I. Certificate of Concurrent Submission of Disclosure Statement(s)

The offeror hereby certifies that he has submitted, as a part of his proposal under this solicitation, copies of the disclosure statement(s) as follows: (i) original and one copy to the cognizant contracting officer; and (ii) one copy to the cognizant contract auditor.

DATE OF DISCLOSURE  
STATEMENT(S)

May 27, 1977

NAME(S) AND ADDRESS(ES) OF COGNIZANT  
OFFICER(S) WHERE FILED

James B. Cotter  
2753 So. Highland  
Las Vegas, Nevada 89114

The offeror further certifies that practices used in estimating costs in pricing this proposal are consistent with the cost accounting practices disclosed in the disclosure statement(s).

II. Certificate of Monetary Exemption

The offeror hereby certifies that he, together with all divisions, subsidiaries, and affiliates under common control, did not receive net awards of negotiated national defense prime contracts totaling \$30 million or more during Federal Fiscal Year 1971; and did not receive

net awards of negotiated national defense prime contracts subject to Cost Accounting Standards totaling more than \$10 million in any of the Federal Fiscal Years 1972, 1973, 1974, or 1975; and net awards of negotiated national defense prime contracts and subcontracts subject to Cost Accounting Standards totaling more than \$10 million in Federal Fiscal Year 1976, or in any subsequent Federal fiscal year preceding the year in which this proposal was submitted.

**CAUTION:** Offerors who submitted or who currently are obligated to submit a Disclosure Statement under the filing threshold established by the Cost Accounting Standards Board for a Federal fiscal year prior to the one immediately preceding the year in which this proposal was submitted may be eligible to claim this exemption if they have received notification of final acceptance of all deliverable items on all their prime contracts and subcontracts containing the Cost Accounting Standards clause.

(X) III. Certificate of Interim Exemption

The offeror hereby certifies that (i) he first exceeded the monetary exemption for disclosure, as defined in (II) above, in the Federal fiscal year immediately preceding the year in which this proposal was submitted, and (ii) in accordance with the regulations of the Cost Accounting Standards Board (4 CFR 351.40(f)), he is not yet required to submit a Disclosure Statement. The offeror further certifies that if an award resulting from this proposal has not been made by March 31 of the current Federal fiscal year, he will immediately submit a revised certificate to the Contracting Officer, in the form specified under (I) above or (IV) below, as appropriate, to verify his submission of a completed Disclosure Statement.

**CAUTION:** Offerors may not claim this exemption if they are currently required to disclose because they exceeded monetary thresholds in Federal fiscal years prior to Fiscal Year 1976. Further, the exemption applies only in connection with proposals submitted prior to March 31 of the year immediately following the Federal fiscal year in which the monetary exemption was exceeded.

( ) IV. Certificate of Previously Submitted Disclosure Statement(s)

The offeror hereby certifies that the Disclosure Statement(s) were filed as follows:

DATE OF DISCLOSURE  
STATEMENT(S)

NAME(S) AND ADDRESS(ES) OF COGNIZANT  
OFFICER(S) WHERE FILED

---

---

---

---

The offeror further certifies that practices used in estimating costs in pricing this proposal are consistent with the cost accounting practices disclosed in the Disclosure Statement(s).

13. ADDITIONAL COST ACCOUNTING STANDARDS APPLICABLE TO EXISTING CONTRACTS--  
CERTIFICATION

- a. Cost accounting standards will be applicable and effective as promulgated by the Cost Accounting Standards Board to any award as provided in the Federal Procurement Regulations Subpart 1-3.12. If the offeror presently has contracts or subcontracts containing the Cost Accounting Standards clause, a new standard becomes applicable to such existing contracts prospectively when a new contract or subcontract containing such clause is awarded on or after the effective date of such new standard. Such new standard may require a change in the offeror's established cost accounting practices, whether or not disclosed. The offeror shall specify by an appropriate entry below, the effect on his cost accounting practice.
- b. The offeror hereby certifies that an award under this solicitation / / would, /X/ would not, in accordance with paragraph a.(3) of the Cost Accounting Standards clause require a change in his established cost accounting practices affecting existing contracts and subcontracts.

NOTE:

If the offeror has checked "would" above, and is awarded the contemplated contract, he will also be required to comply with the clause entitled "Administration of Cost Accounting Standards."

Firm: UNION OIL COMPANY OF CALIFORNIA

Name:  Date 5-27-77  
Dr. Carel Otte

Title: Vice President & Manager  
Geothermal Division