NVO-1528-7

GRUY FEDERAL, INC.

INVESTIGATION AND EVALUATION OF GEOPRESSURED-GEOTHERMAL WELLS

DETAILED REENTRY PROGNOSIS FOR GEOPRESSURE-GEOTHERMAL ~~TESTING~~ OF DR. M. O. MILLER NO. 1 WELL

GRUY FEDERAL, INC.
2500 TANGLEWILDE, SUITE 150
HOUSTON, TEXAS 77063

713/785-9200

APRIL 21, 1978

PREPARED FOR THE
DEPARTMENT OF ENERGY
DIVISION OF GEOTHERMAL ENERGY
UNDER CONTRACT EG-77-C-08-1528

The Gruy Companies

...Since 1950

DISCLAIMER

GRUY FEDERAL, INC.

CONSULTANTS IN ENERGY SYSTEMS

April 21, 1978

2500 TANGLEWILDE, SUITE 150
HOUSTON, TEXAS 77063
713/785-9200

1911 JEFFERSON DAVIS HWY., SUITE 500
ARLINGTON, VIRGINIA 22202
703/979-2955

Mr. Ronald T. Stearns
Engineering and Construction Division
DOE/Nevada Operations Office
P. O. Box 14100
Las Vegas, Nevada 89114

Dear Mr. Stearns:

With this letter we are forwarding the Gruy Federal, Inc. recommendation, together with detailed reentry and testing procedures for testing the geopressured-geothermal potential of well Geo^2 L-10. This well was drilled and completed as Union Oil of California, Dr. M. O. Miller No. 1 in 1965.

This is an ideal candidate from the standpoint of sand development and bottom hole temperature. Also negotiations with the owners are proceeding well. We think we can conclude a reasonable arrangement with them.

The negative factors are the location preparation costs, the amount of 7-inch casing which will be required for the tie-back liner and the fact that thus far we have not been able to secure the services of a rig capable of handling the anticipated hook load.

This candidate is proposed as:
(1) an addition to L-3 (McCall)
(2) an alternate to or addition to L-2 (Watkins-Miller)

Very truly yours,

R. J. Dobson

Richard J. Dobson
Vice President,
Special Programs

RJD:mw
Enclosures

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GEOPRESSURED-GEOTHERMAL REENTRY PROSPECT L-10

SECOND LAKE AREA

CAMERON PARISH, LOUISIANA

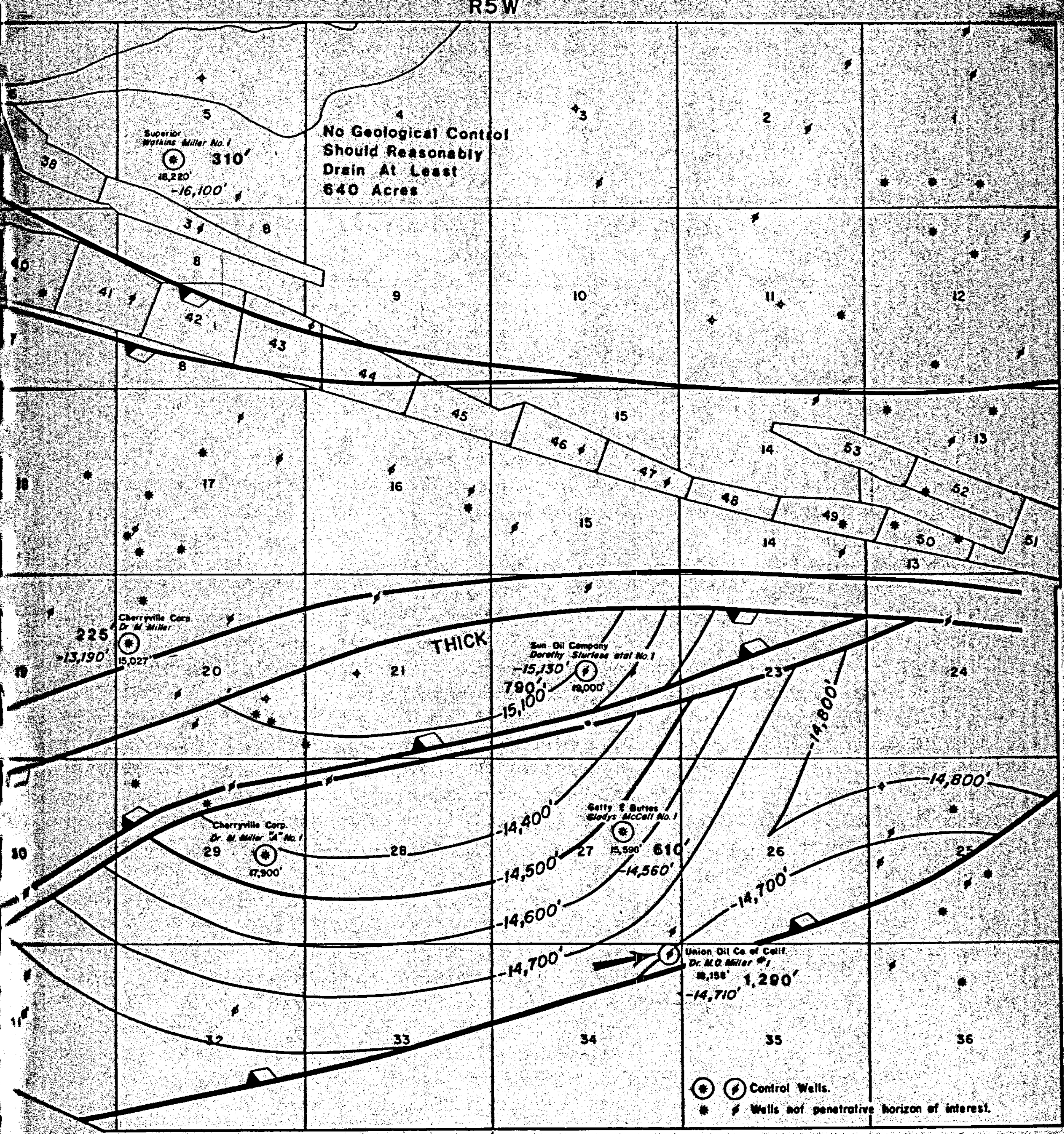
Introduction

This Gruy Federal Type I-A prospect was drilled as the Union Oil Company of California, Dr. M. O. Miller No. 1 and is located in Section 34, T15S, R5W, Cameron Parish, Louisiana. The land belongs to the heirs of Dr. Miller and is unleased. The well site is approximately 350 feet southwest of the northwest corner of Section 34 and approximately 4,000 feet south-southeast of Prospect L-3, Buttes Gas and Oil Co. et al, Gladys McCall No. 1. The former well site is accessible by approximately 2.8 miles of canal levee on which a board road would have to be constructed. In addition, there are two wooden bridges in fair condition to be crossed which will require minor repairs. The well was drilled to a total depth of 18,158 feet and plugged and abandoned as a dry hole mid 1965.

Geology

The potential Geo^2 aquifer is a thick lower Miocene (Marginulina ascensionensis) sand body from 16,350 feet to 17,130 feet which correlates with the Geo^2 aquifer in the Gladys McCall No. 1. This interval contains at least 650 feet (83%) of net sand with the interval from 16,380 - 16,740 containing 360 feet of virtually unbroken sand. (In addition, there is 250 net feet of additional sand between the top of the main sand and the estimated 300° F depth of 15,400 feet.) The measured mud temperature at 17,050 feet was 294° F (146°C) five hours after circulation which would indicate an aquifer temperature of 318° F (159° C) based upon correction factor developed for south Louisiana by the AAPG. During drilling operations through these sands, the maximum mud weight was 17.7 pounds per gallon which would suggest that the static aquifer pressure is approximately 15,800 psi (assuming 1,000 psi overbalance).

A sonic log on the well was obtained from the operator (Union Oil Company of California) and sent to H. J. Gruy and Associates in Dallas for analysis. An average cementation factor of 1.6 was computed for the sand section which



Designates Net Sand
Penetrated at 300° F+

GRUY FEDERAL, INC.
Houston, Texas

Crab Lake Field Area
Cameron Parish, Louisiana

STRUCTURE: TOP OF POROSITY
AT FIRST GEO^2 SAND
IN LOWER MIOCENE SECTION

suggests that the sand is only slightly cemented. The porosity of the large sand section from 16,380 - 16,740 feet is fairly uniform at 15 percent. The 15,700-foot sand has approximately 46 net feet of sand with an average porosity of 17.4 percent. Although these porosities seem low when compared with those from shallower sands, they are not uncommon for deep, geopressured sands in south Louisiana. No core analyses are available on this well, however, the average permeability should range between 20 and 60 millidarcies. The selection of the final perforating interval will be deferred until additional logs have been run; however, present plans include testing the top of the 16,400 feet sand.

Mechanical Condition

The enclosed diagrammatic sketch illustrates both the current mechanical condition of the well and the proposed configuration for testing. The present condition of the well was obtained from the plugging and abandonment report filed with the Department of Conservation and verified from the drilling, completion, and plugging reports of the operator.

From the drilling report, however, it was learned that this well presents an additional reentry hazard. Prior to abandoning the well, a single shot formation test was run in the 7-inch OD casing at 15,705.5 feet. The test recovered 5,000 cc of salt water. The operator then ran a sliding valve drillable cementer and set it at 15,503 feet. The formation was broken down with 5,500 psi surface pressure using 17.2 pound per gallon mud and the formation held 4,800 psi with the pumps off (estimated BHP = 19,900 psi). When they attempted to squeeze cement, the SVDC packer began leaking. They pulled out of the packer, displaced cement and the well started flowing. The Hydril was closed and the measured casing pressure was 900 psi, which indicates a pressure of approximately 12,700 psi at 13,300 feet. The mud weight was raised to 19.5 pounds per gallon and a Baker Model K bridge plug was set at 13,300 feet. If the assumption is made that the 19.5 pound per gallon mud created a 1,500 psi overbalance at 13,300 feet, the pressure below the bridge plug could be as high as 12,900 psi. This circumstance does not create a severe operational problem, but special precautions must be taken when the bridge plug is being drilled.

In order to prepare the well for testing, it will be necessary to tie into the 7-inch OD liner and run the casing to surface.

Reentry Technique

A detailed reentry and recompletion prognosis is attached. In designing the equipment and specifying the procedures, the primary consideration was the safety of the operation and the experience of prudent operators who have successfully penetrated and produced from geopressured-geothermal gas reservoirs in this area.

Casing Design - The 7-inch tie back string was designed using the following design factors:

Burst = 1.10
Collapse = 1.13
Joint strength = 1.60
Yield = 1.50

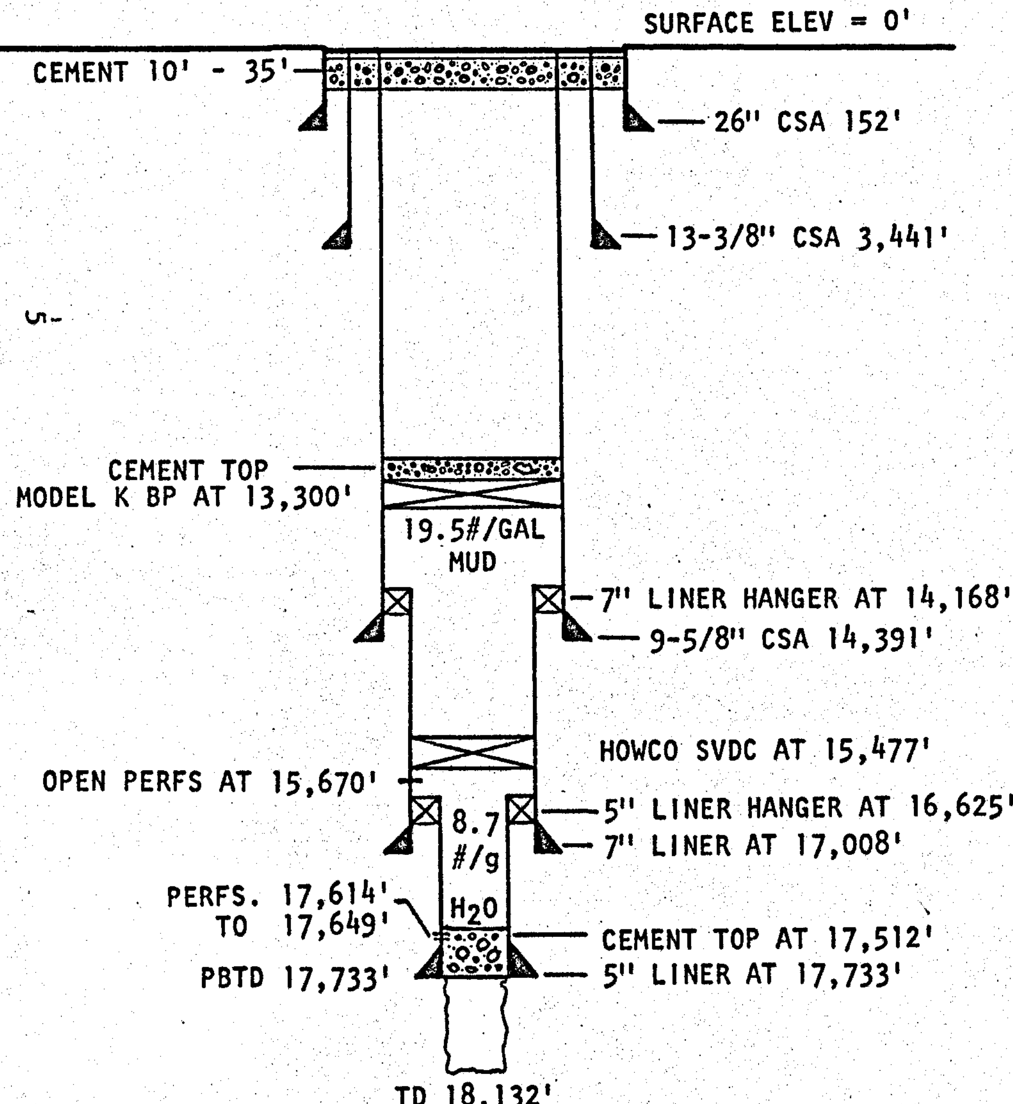
The burst pressure under operating conditions was computed by assuming that the casing would be exposed internally to the static aquifer pressure with no fluid outside the casing. Similarly the collapse pressure under operating conditions was calculated assuming that the pipe was exposed externally to the column of 17.7 pound per gallon mud with the casing empty. The loss in collapse resistance as a function of tensile loading was incorporated into the casing design.*

* Standard API threads were selected rather than Hydril threads for the following reasons:

1. They satisfied all the design constraints.
2. The 7-inch casing will not be exposed to the aquifer pressure except in the case of a tubing leak.
3. Hydril threads will add $80,000 to the cost of the well.
4. The double make-up required for running Hydril will add to the rig time.
5. The higher joint loss owing to thread damage that will occur during the recovery of the Hydril pipe.
6. Hydril pipe is not available immediately.

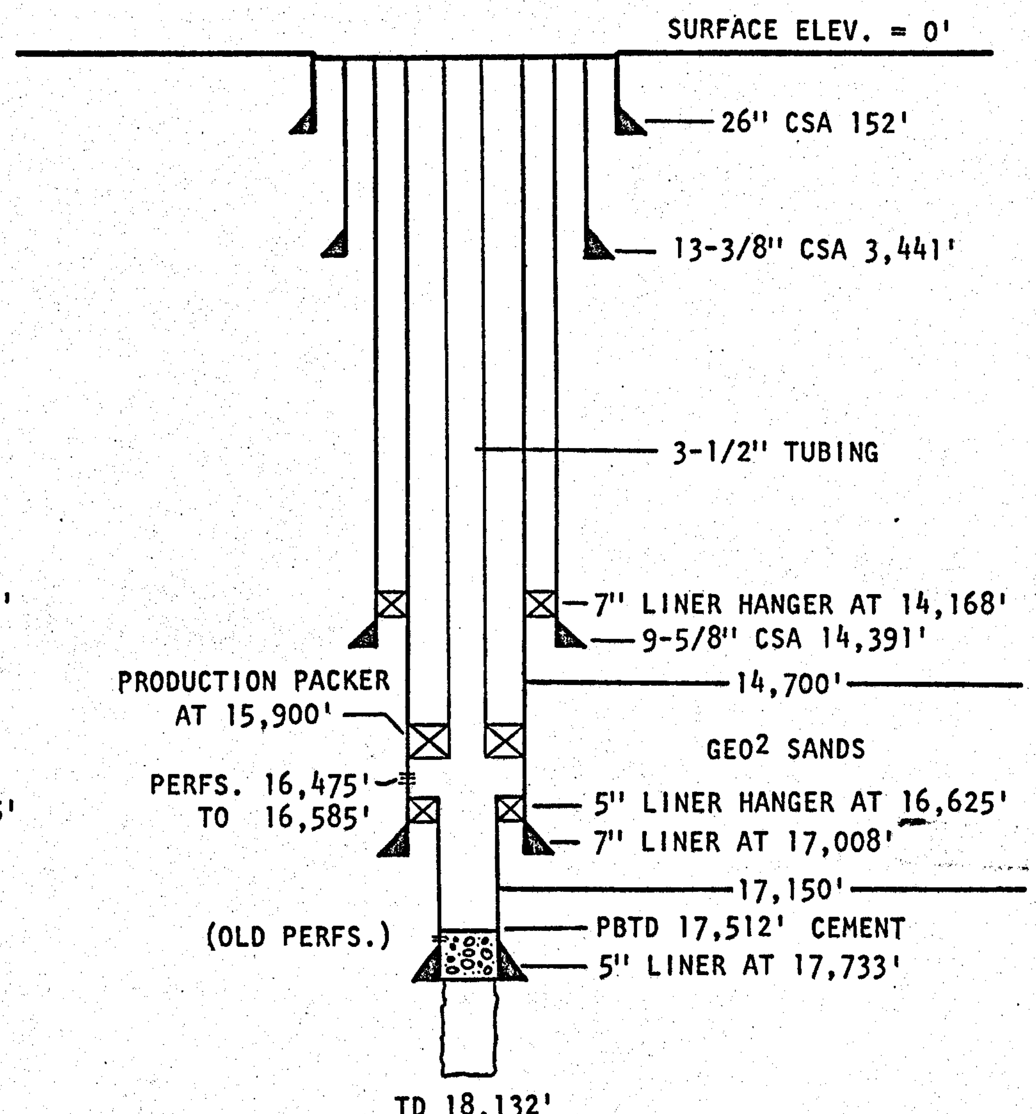
UNION OIL OF CALIFORNIA
DR. M. O. MILLER NO. 1
PRICE LAKE AREA
CAMERON PARISH, LOUISIANA

PRESENT STATUS



UNION OIL OF CALIFORNIA
DR. M. O. MILLER NO. 1
PRICE LAKE AREA
CAMERON PARISH, LOUISIANA

PROPOSED TEST CONFIGURATION



Tubing Design - The tubing selected was a tapered string consisting of 2-7/8 inch, 8.70 pound per foot to run inside the 5-inch OD casing liner and 3-1/2 inch, 12.70 pound per foot, P-105, PH-6 Hydril threaded tubing.

The 2-7/8 inch OD tubing is necessary to fit into the 5-inch OD liner and still allow clearance for the tubing gun to pass through the seal assembly and landing nipples. The portion of the tubing which seats in the packer will be equipped with a seal assembly to allow for approximately 10 feet of expansion and contraction during flowing and plugging operations. A landing nipple and a circulating valve will be placed above the seals to permit communication between the tubing and casing if it becomes necessary. A schematic drawing of the bottom hole tubing assembly is attached.

Blowout Preventers - The enclosed well prognosis sets out the necessary safeguard specifications and procedures for surface blowout prevention as they have been adopted and gathered by IADC, API and most prudent operators in the Geo^2 area. A diagrammatic sketch of the BOP hook-up and choke manifold which we propose for use is also enclosed.

Logging - Because the sands of interest are already behind the 5-inch OD casing, open hole logs cannot be run. Cased hole logs; namely, the gamma ray, cement bond, and collar locator are desirable to establish the integrity of the cement and as a benchmark for perforating.

Perforating - The perforating will be accomplished with a 2-1/8 inch high-temperature, through tubing jet perforating gun with four shots per foot and zero phasing. When fired this jet creates a casing entry diameter of approximately 0.31 inches and an effective core penetration of approximately 3-1/2 inches beyond the cement sheath. Assuming 100 percent firing efficiency, this configuration should provide a productivity equal to 79 percent of the open hole productivity.

In selecting the fraction of the net sand to perforate, the perforated interval length was designed to achieve a productivity equal to 1/3 of the open hole productivity. In the Dr. M. O. Miller No. 1 well, this productivity can be accomplished by perforating approximately 110 feet.

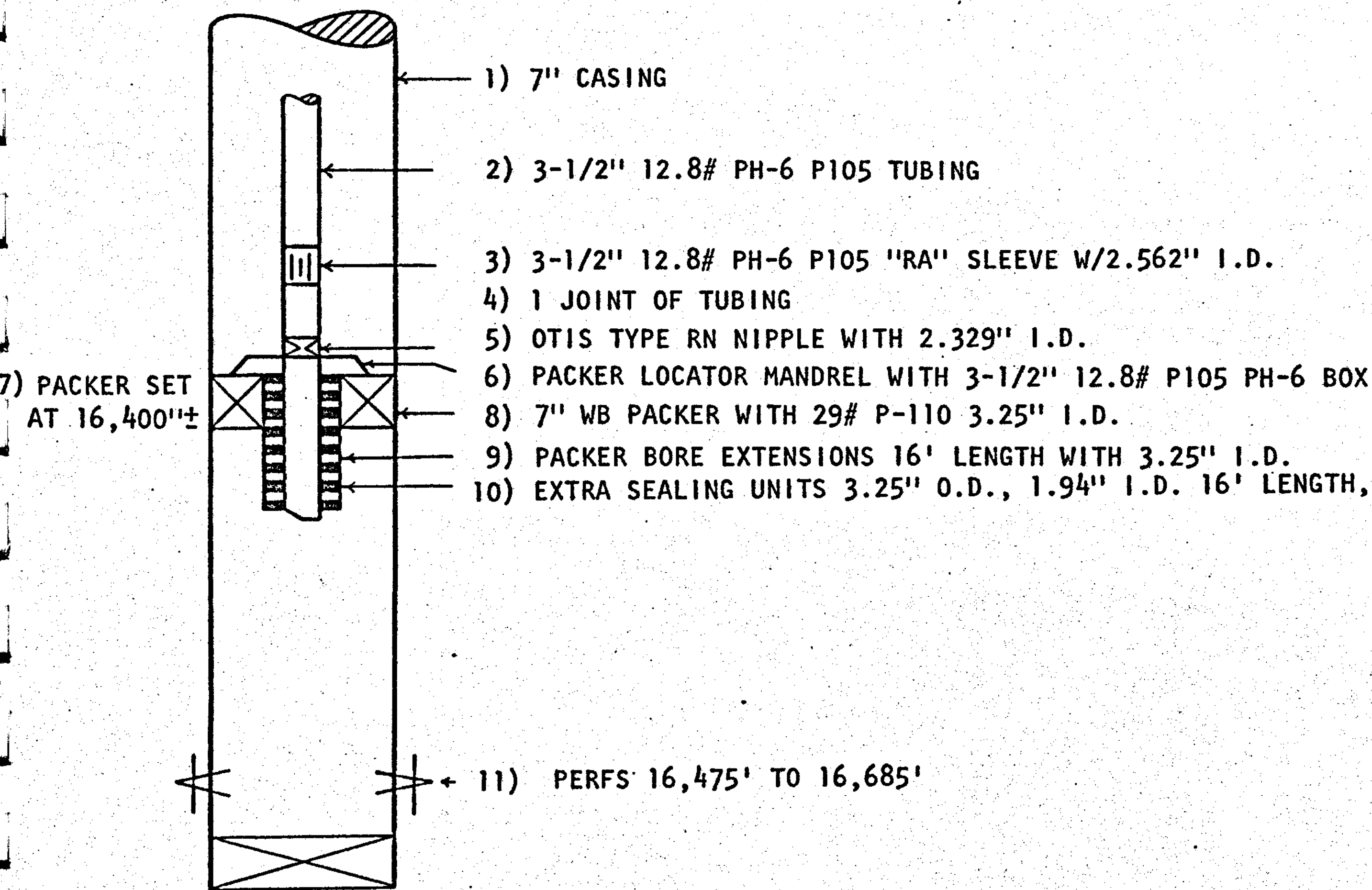
UNION OIL OF CALIFORNIA

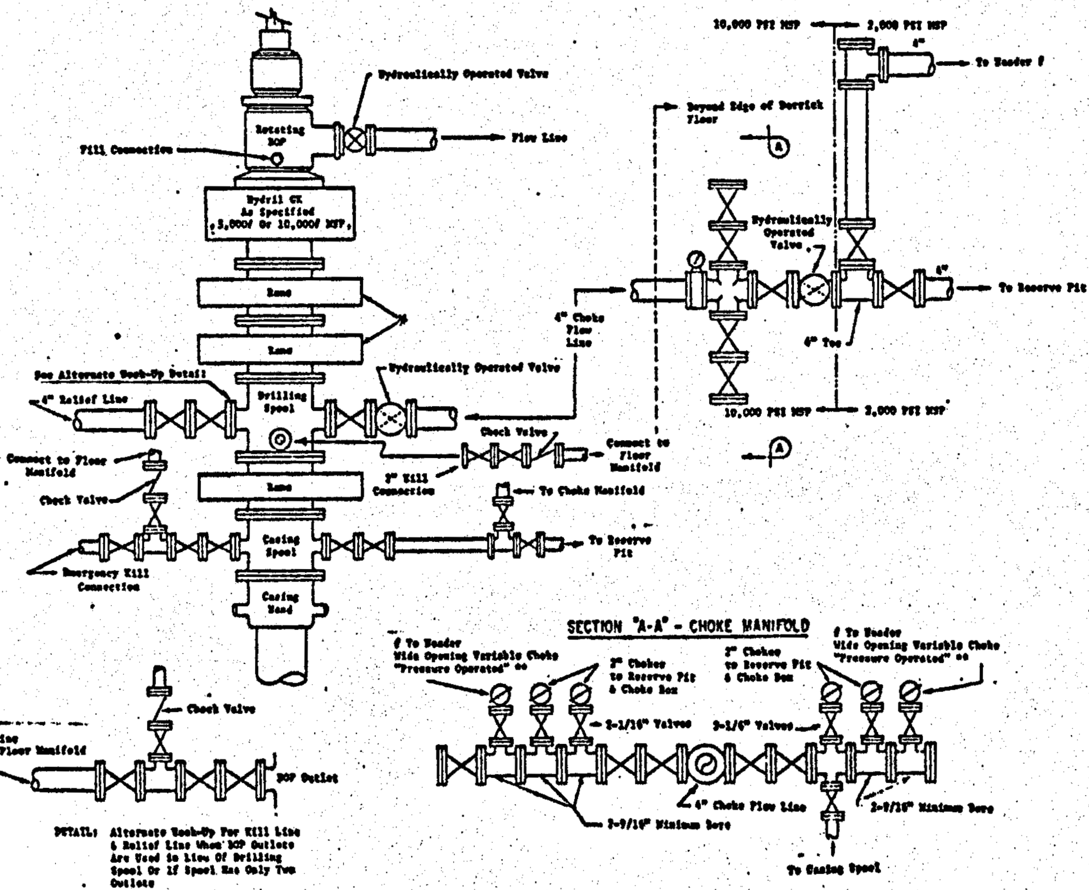
DR. M. O. MILLER NO. 1

PRICE LAKE AREA

CAMERON PARISH, LOUISIANA

BOTTOM HOLE TUBING ASSEMBLY





8.

Minimum operating equipment for preventers will be as follows: (1) multiple pumps, driven by a continuous source of power, capable of fluid charging the total accumulator volume within twenty minutes; and (2) accumulators with a pre-charge of nitrogen at not less than 750 psi and capable of receiving a fluid charge from the (charging) pumps. Fluid charge volume shall be the amount required to increase accumulator pressure from nitrogen pre-charge pressure to rated pressure. Charging pumps are to be connected to the hydraulic operating system which is to be a closed system. When requested, an additional remote and equivalent source of power shall be available to operate the pumps. The pressurized fluid volume stored in the accumulators shall be sufficient to close all pressure operated devices simultaneously within 20 seconds with charging pumps shut down. Minimum accumulator pressure shall be 1500 psi initially and not less than 1200 psi when all preventors are closed.

The closing manifold and remote closing manifold (floor-mounted) will have a separate control for each pressure operated device. Each control will be labeled to designate which pressure device it controls and to show open and closed positions. A pressure reducer and regulator is to be provided for the Hydril GK. Hydraulic oil shall be used as the operating fluid. One-inch size seamless steel piping shall be used to connect the closing unit to the preventors. Piping is to be tested to maximum rated pump pressure. The choke manifold, the four-inch choke flowline and the four-inch relief line shall be supported by metal stands or reinforced concrete. The choke lines shall be anchored. No sharp bends or curves will be permitted in the choke flowline from the preventers to the pits. Header to have three way outlet: (1) to reserve pit, (2) to choke box, (3) to separator. Easy and safe access will be maintained to the choke manifold. If deemed necessary, walkways and stairways will be provided in and around choke manifold. All valves throughout the assembly shall be selected for operation in the presence of oil, gas and drilling fluids. Valves connected adjacent to the drilling spool and all ram-type preventers will be equipped with stem extensions, universal joints, if needed, and operating wheels which are to extend beyond edge of derrick substructure. Any other valves within the limits of the derrick substructure will be so equipped when requested.

Wellhead Design - The wellhead has been designed and a detailed sketch will follow in one of the additional submittals. The tree is rated to a working pressure of 15,000 psi and all valves have stainless steel vertical runs with packing and seals for high temperature fluids. The tree consists of two 3-1/2 inch master gate valves and a 3-1/2 inch swab valve. Between the master gate valve and the swab valve is a double wing assembly to house the choke bodies. One wing will contain a positive choke and the other will contain an adjustable choke. Each wing will consist of a Hi-Lo safety valve and a conventional wing valve. This specific design limits the anticipated high pressures to the tree assembly, thus permitting lighter weight pipe for all surface pipes and fittings.

General Comments

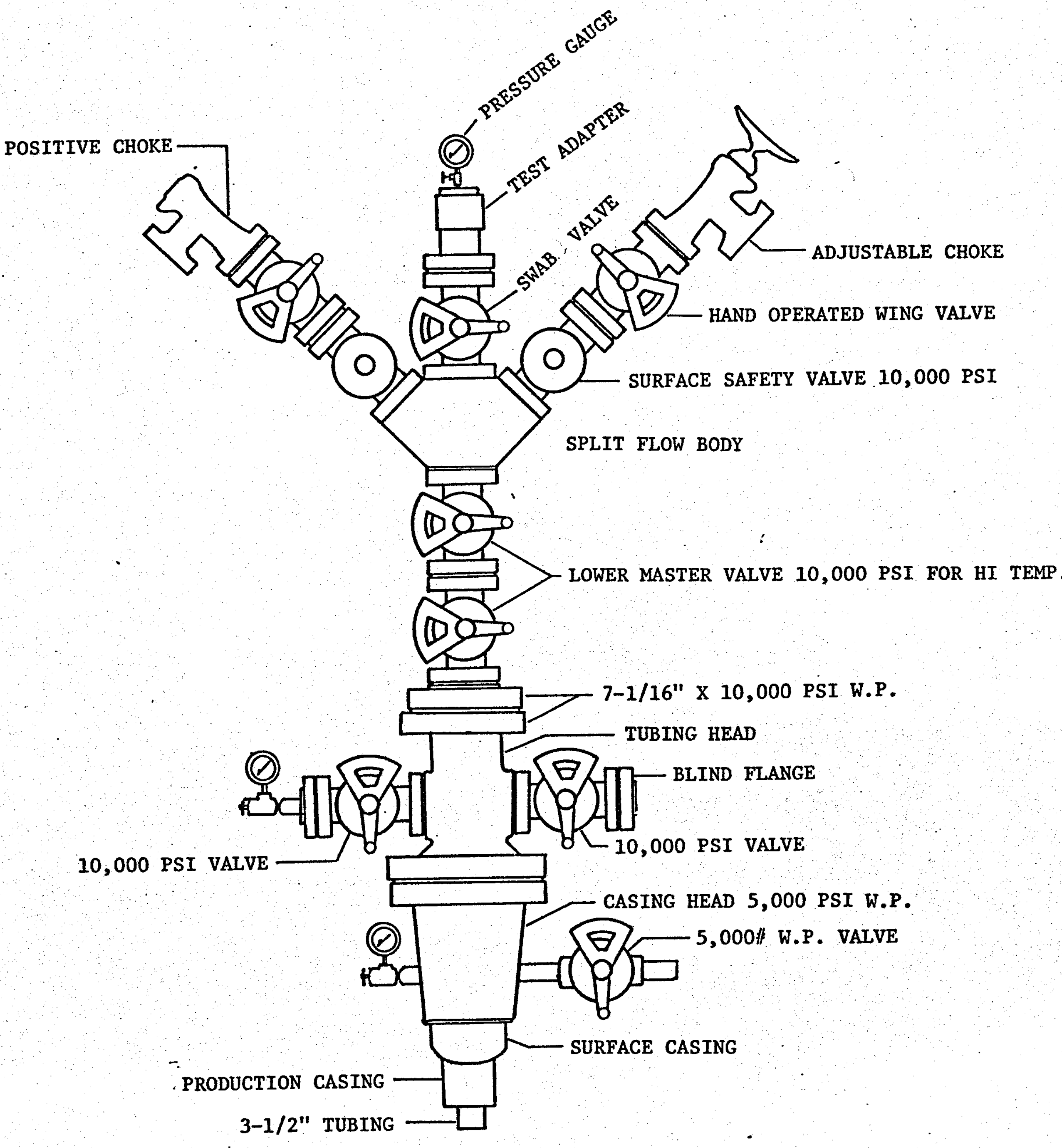
The No. 1 Dr. M. O. Miller well has been proposed as a Geo^2 test prospect for the following reasons:

(1) A known thick, hot and apparently permeable lower Miocene section exists.

(2) The land is presently unleased and the landowners have indicated a willingness to cooperate.

(3) The well has penetrated the same sands as the No. 1 Gladys McCall and either well can be selected depending upon which landowner we can negotiate the best contractual arrangement.

GEO^2 CHRISTMAS TREE
TO BE ADAPTED FOR ALL REENTRY WELLS
BY GRUY FEDERAL, INC.



WELL PROGNOSIS

for

UNION OIL OF CALIFORNIA DR. M. O. MILLER No. 1
Price Lake Area

Operational Day	
	1. Prepare location.
	2. Dig out and inspect 9-5/8" casing, extend to proper elevation and weld on casinghead.
1st	3. Move in and rig up.
4th	4. Pick up 3-1/2" drill pipe and drill out cement from 10' to 35'. Nipple up 9-5/8" casing and install Blowout Preventers.
	5. Continue in hole with 4-1/2" drill pipe and drill collars conditioning mud in hole to top of cement on Model K bridge plug at 13,300'.
5th	6. Test 9-5/8" OD casing to the equivalent of 19.5#/gal. mud. Repair casing, if necessary, by cement squeeze.
6th	7. Drill out cement, if necessary, to 13,300' and increase mud weight to 19.5#/gal. and test Blowout Preventers.
7th	8. Drill out cement and Baker Model K bridge plug located at 13,000'.
9th	9. Make trip and pick up 2600' of 3-1/2" OD if drill pipe and condition hole inside 7" OD liner to top of HOWCO SVDC plug at 15,477'. Condition mud and drill out HOWCO plug and condition hole to top of 5" OD liner at 16,625'.
11th	10. Make trip and run HRC squeeze tool and squeeze old perforations at 15,679', then reverse out excess cement.
	11. Drill out cement and condition hole to top of 5" OD liner at 16,625'.
	12. Run cement bond and GR depth control log from TD of 17,700' through 13,400' or to top of cement behind 9-5/8" OD casing.
	13. On basis of bond log block squeeze above and below proposed completion interval and drill out cement if squeeze jobs are required.

Operational Day	
16th	14. Make trip and dress off the tieback sleeve on top of 7" OD liner then lay down drill pipe.
17th	15. Rig up and run 7" casing from bottom up as follows:

From	To	Size	Weight/ ES	Grade	Type Ends	Section Length
14,168'	13,400'	7" OD	38#	P110	LT & C	768'
13,400'	11,400'	7" OD	35#	P110	LT & C	2,000'
11,400'	100'	7" OD	32#	P110	LT & C	11,300'
100'	0'	7" OD	38#	P110	LT & C	100'

	16. Allow casing to hang free in hole for one hour for temperature stabilization, latch onto tieback sleeve pull stretch in casing to allow for heat expansion with well flow. Hang casing in slips and nipple up BOP
20th	17. Pick up full completion string of 3-1/2" OD12.70#/ft. PH6 Hydril tubing with test tool and go in hole to at least 16,620" and displace mud in hole with 10#/gal. CaC/2 water. Set test tool and test 7" casing and tieback connection to 7,500 psi for 30 minutes. If test OK, proceed to step 19. If test not OK, proceed to correct leak in casing in best manner dictated by such leak.
21st	18. Rig up wire line unit and run production packer in 7" OD casing at approximately 15,900'.
	19. Make up bottom hole completion assembly with 30 feet section of packer seals and one joint of blank tubing with no-go nipple below seals and with landing collar above seals. Run circulating sleeve in closed position two joints above packer location sub and run landing nipple one joint above packer. Go in hole testing each joint of tubing to 10,000 psi. Allow at least one hour time for tubing string to expand to equilibrium temperature conditions. Space out tubing and test packer to 6,500 psi differential from bottom and 5,000 psi on top.
23rd	20. Set tubing in packer with full tension from pipe weight when locator sub sets on packer top. Remove blowout preventers, install christmas tree and hang tubing off at surface. Nipple up christmas tree, set retrievable plug in bottom of tree and test same to 1,000 psi, then remove test plug from tree. Release rig.

Operational Day	
24th	21. Move out rig.
26th	22. Complete moving out rig.
27th	23. Operations on Dr. M. O. Miller No. 1 suspended while drilling salt water disposal well.
37th	24. Resume operations and rig up wire line after completion of work on disposal well.
38th	25. Go in hole with through tubing perforating gun (maximum 46' length) and perforate the interval from 16,475 to 16,685' with four shots per foot. Note: This perforating will be done with a pressure differential to the well bore; therefore, the wellhead pressure should instantly increase substantially when the perforating gun is fired. The wing valves on the christmas tree should be closed before perforating is done.
	26. Repeat trips with perforating gun until the casing is perforated four shots per foot through entire completion interval selected. Release perforating unit.
39th	27. Hook up production unit and place well on test.

GENERAL PROCEDURE FOR BLOWOUT PREVENTION:

1. Use BOP design as attached. The minimum assembly will consist of three preventers. The bottom and middle preventers may be Cameron QRC, Cameron Type F or Shaffer Hydraulic Single, and the upper preventer will be Hydril GK. Double preventers or space savers may be used if approved by the company supervisor. An accumulator with a closing unit is required. Accumulator reservoir pressure shall be sufficient to close all preventers simultaneously in 20 seconds with the charging pumps closed down. Minimum accumulator pressure shall be 1,500 psi initially and not less than 1,200 psi when all preventers are closed.

2. When nippling up production casing, test BOP's and choke manifold to 7,500 psi with cold water, or as specified by the company representative. BOP's will be tested at least once each day thereafter when working in open hole and once each week otherwise.

3. Have a full opening safety valve and Gray inside BOP with drill pipe connections on the rig floor.

4. Have extra pipe rams on location at all times while drilling or completing.

5. Locate all choke manifolds, lines and valves at the side of and away from the substructure. Adequately support and tie down the choke assembly.

ESTIMATED REENTRY COST
for
UNION OIL OF CALIFORNIA DR. M. O. MILLER NO. 1

CAMERON PARISH, LOUISIANA

Activity		Estimated Amount	
1.	Lease acquisition and legal fees	$ 20,000	
2.	Rig transportation cost	15,000	
3.	Location preparation	195,000	
4.	Rig time - 26 days	124,800	
5.	Bits	3,000	
6.	Mud and chemicals	40,000	
7.	Casinghead	2,000	
8.	Christmas tree	70,000	(1)
9.	Casing patch	6,000	
10.	Rental tools and equipment	20,000	
11.	3-1/2" drill pipe rental	20,000	
12.	Trucking	10,000	
13.	Gamma ray and collar locator	6,000	
14.	Cement and services	7,000	
15.	Perforating	30,000	
16.	14,700' of 3-1/2" P-105 12.95# PH-6 Hydril tubing	303,000	(2)
17.	Packer and subsurface completion equipment	15,000	
18.	11,400' of 7" tieback casing per prognosis	249,000	(3)
19.	Supervision	7,500	
20.	Miscellaneous	40,000	
21.	Contingencies	45,000	
	Total	$ 1,228,300	

(1) Requires minor shopping to reuse on other Geo^2 wells.

(2) Approximately 80% can be reused on other Geo^2 wells.

(3) Will incorporate all available tubing in stock at Intracoastal City, Louisiana and effectively reduce cost requirements.

SALT WATER DISPOSAL WELL
FOR
NO. 1 Dr. M. O. Miller

The available electrical logs covering the shallow sands from ground surface through a depth of 5,000 feet indicate the fresh water sands to extend to approximately 900 feet and that adequate sand to accommodate salt water disposal occur above 4,500 feet. In view of these data the following well prognosis and estimated cost is submitted.

Operational Day		
0	1.	Drive 13-3/8" OD casing to refusal of ± 125 feet.
27th	2.	Move in and rig up water well rig.
29th	3.	Drill 12-1/8" hole to 1,200 feet.
30th	4.	Run 1,200 feet of 9-5/8" 35.0# H-40 casing with guide shoe on bottom and a float collar one joint above bottom. Use one centralizer per 100 feet of casing for bottom 500 feet and cement casing to surface.
32nd	5.	Drill 8-3/4" hole below surface casing to 4,500 feet.
34th	6.	Run induction electric and density logs and SWC if desired.
35th	7.	Run 5-1/2" OD 15.5# J-55 casing with guide shoe on bottom and float collar two joints above bottom. Run centralizers on every other joint of casing for bottom 500 feet. Cement casing with sufficient cement to get returns at the surface.
36th	8.	Make trip with 2-7/8" work string and condition hole to float collar at approximately 4,420 feet and displace mud in hole with water. Lay down work string.
37th	9.	Nipple up 5-1/2" casing and install christmas tree.
	10.	Test casing and tree to 2,000 psi surface pressure with water in hole.
38th	11.	Rig down and move out water well rig.
40th	12.	Run gamma ray - cement bond log from total depth to 1,200 feet and block squeeze with cement, if necessary to obtain good bond.

Operational Day		
	13.	Rig up wireline unit and run gamma ray-collar log from bottom to 1,200 feet.
	14.	Perforate approximately 50 feet of the lowest clean sand determined from electrical logs with four shots per foot using a casing bullet gun and rig down wireline unit.
41st	15.	Test injectivity of well with rig pumps or pump truck to achieve 10,000 barrels per day injection rate at 150 psi or less. If injection rate is not sufficient, select and perforate additional sand interval or consider treatment with mud cleanout acid, or both, if deemed necessary.

Estimated Cost

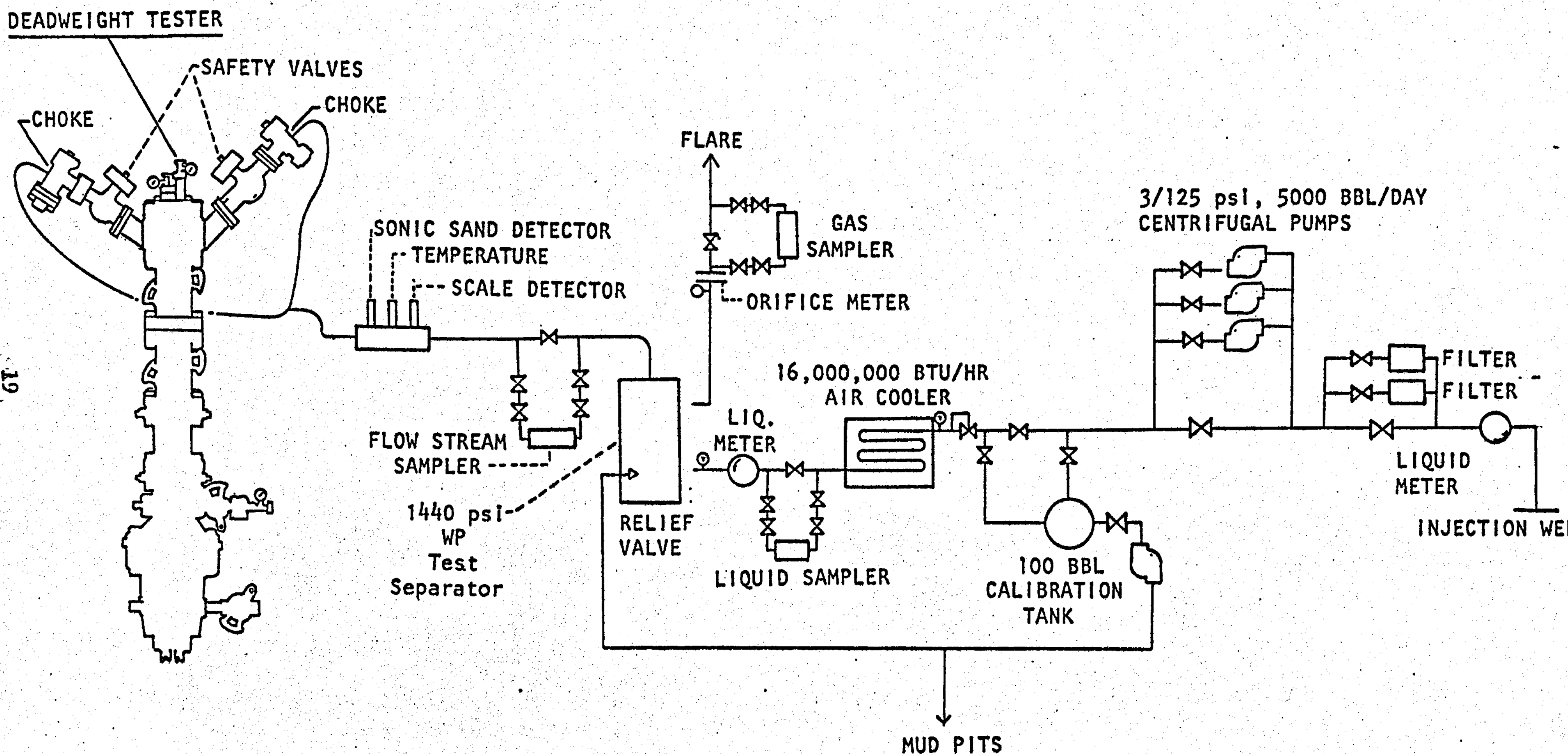
1.	Move in rig, drill to 2,500 feet and set two casing strings.	$ 36,000
	130 feet of 13-3/8" 65# J-55 plain end casing	3,600
	1,200 feet of 9-5/8" 35# H-40 casing ST & C or LT & C	18,200
	4,500 feet of 5-1/2" 15.5# J-55 ST & C or LT & C	30,960
	Stand by rig	3,000
	Cement and Services	14,000
	Electric logging	12,000
	Perforating	4,000
	Wellhead equipment	3,000
	Stimulation	2,500
	Miscellaneous supplies and rentals	5,000
	Trucking	1,500
	Contingencies	14,000
	TOTAL WELL COST	$ 149,760

TEST PROGNOSIS

for
Dr. M. O. Miller
Second Lake Area

Operational Day		
42nd	1.	Move in and nipple up test equipment. Hydraulically test all systems with water to 400 psi.
45th	2.	Run two Amerada RPG-3 pressure gauges with 24 hour clocks and 15,000 psi full-scale deflection to 16,060 feet, stopping for fifteen minutes each 3,000 feet. Hang bombs for two hours and record surface pressure with deadweight tester. Retrieve pressure bombs.
	3.	Hook up two-pen pressure recorder to tubing upstream from the choke and to the casing to observe for tubing or packer leaks.
	4.	Place well on production through adjustable choke at low setting and record surface flowing pressure every thirty minutes by deadweight tester.
	5.	Record gas and liquid flow rates by calibrating the liquid turbine meter with the test tank.
46th	6.	Gradually increase the flow rate in increments until either the maximum flow rate from the well or 10,000 barrels per day is achieved. Continue to flow at this rate for 24 hours while recording surface temperature, pressure, and gas and liquid production. If maximum flow rate of well not sufficient, do one of the following: (1) acidize (2) perforate more interval
47th	7.	Shut well in and measure surface pressure build-up with deadweight tester.
48th	8.	When wellbore pressure has stabilized, run two Amerada RPG-3 pressure bombs with five day clocks and latch into landing nipple at bottom of tubing.
49th	9.	Place well on production at 1,000 barrels per day, for 24 hours, monitor surface pressure, temperature and flow rates and take the following samples: (a) Two, one liter, full well stream samples for chemical analysis.

Operational Day		
		(b) Three, one liter, separator liquid samples.
		(c) Two, one liter, separator gas samples.
50th	10.	Increase flow rate to 4,000 barrels per day for 24 hours and sample as before.
51st	11.	Increase flow rate to 7,000 barrels per day for 24 hours and sample as before.
52nd	12.	Increase flow rate to 10,000 barrels per day for 24 hours and sample as before.
53rd	13.	Shut well in, measure build-up for 24 hours, then retrieve pressure bombs.
54th	14.	Place well on production at low rate and gradually increase rate over a 12-hour period until it reaches 10,000 barrels per day.
	15.	Flow well at this rate for two weeks while measuring surface pressure, temperature and flow rates.
	16.	Sample as before prior to shutting well in.
67th	17.	Shut well in and run two pressure gauges to 16,060 feet and record until deadweight tester at surface indicates static conditions have been reached.
68th	18.	Pull pressure gauges, release test equipment and move same out.
	19.	Proceed with plug and abandonment operations.



SURFACE TESTING FACILITIES

Gruy Federal, Inc.

ESTIMATED TESTING COST

for

No. 1 Dr. M. O. Miller
Second Lake Area

Activity	Estimated Amount
Two phase separator	$ 16,800
Air cooler	12,600
3 centrifugal pumps	4,200
110 barrel calibration tank	60
Sand detector and manifold	3,900
200' of 3" flow lines	2,850
2-3" expansion loops with unions	900
2 pen 10,000 psi recorder	600
Deadweight pressure gauge	600
Portable quartz iodide lights	600
Temperature recorder 0-400°	600
Trailer house for personnel	900
Supervision and labor	39,600
Sampling	1,500
Pressure gauges and wireline units	10,000
TOTAL	$ 95,710

UNION OIL OF CALIFORNIA DR. M. O. MILLER NO. 1

CAMERON PARISH, LOUISIANA

Analyses Required for Geo^2 Water and Gas

Chemical Analysis of Water

A. Metals
   1. Copper
   2. Zinc
   3. Boron
   4. Arsenic
   5. Chromium
   6. Mercury
   7. Lead
   8. Cadmium

B. Solids
   1. Dissolved
   2. Total

C. Hardness
   1. Calcium Carbonate
   2. Magnesium Carbonate

D. Others
   1. Carbonate
   2. Bicarbonate
   3. Chloride
   4. Iron
   5. Sulfate
   6. Dissolved Silicate

UNION OIL OF CALIFORNIA DR. M. O. MILLER NO. 1

CAMERON PARISH, LOUISIANA

Chemical Analysis of Vapor

A. Hydrocarbons (percent)

1. Methane
2. Ethane
3. Iso-propane
4. Normal Propane
5. Iso Butane
6. Normal Butane
7. Pentane
8. C_6+

B. Other

1. Hydrogen Sulfide
2. Carbon Dioxide
3. Fadon

Chemical Properties of Water

1. Density
2. Compressibility
3. Conductivity
4. Viscosity
5. pH

Recombination PVT Analysis

1. Solution gas-water ratio
2. Formation volume factor for water
3. Supercompressibility factor of gas

UNION OIL OF CALIFORNIA DR. M. O. MILLER NO. 1
CAMERON PARISH, LOUISIANA

Analytical Costs for Geo^2 Water and Gas

Recombination	
2 samples per well	\$ 10,000
Chemical Analysis of Water	
5 samples per well	750
Total	\$ 10,750

PLUGGING AND ABANDONMENT PROCEDURE

for

UNION OIL OF CALIFORNIA DR. M. O. MILLER NO. 1

CAMERON PARISH, LOUISIANA

1. Move in and rig up pulling unit capable of plugging and abandonment.
2. Nipple up pump trucks to well head.
3. Squeeze cement perforations.
4. If squeeze pressure is not obtained, overdisplace cement into formation with water and repeat squeeze cementing until successful.
5. When squeeze pressure is obtained, unbolt christmas tree from tubing hanger, pick up tubing out of packer, and reverse excess cement.
6. Remove tree and install BOP's.
7. Pull and lay down tubing.
8. Run free point indicator and cut off 7" OD casing with chemical cutter above indicated free point.
9. Pull and lay down 7" casing.
10. Pick up tubing and run in hole.
11. Set cement plug 100' in and 100' out of 7" OD casing.
12. Pull tubing and set a plug from 50' to surface.
13. Cut off 9-5/8" casing 3' below ground level and weld on plate.
14. Release rig.
15. Send tubing and casing to pipeyard for inspection and repair.
16. Send christmas tree to shop for overhaul.

ESTIMATED PLUGGING COSTS
for
UNION OIL OF CALIFORNIA DR. M. O. MILLER NO. 1
CAMERON PARISH, LOUISIANA

Activity	Amount
Pulling unit at $1,000/day	$ 10,000
Rental tools at $500/day	5,000
Trucking	3,000
Cement and services	4,000
Supervision	2,000
Contingencies	2,400
Total	$ 26,400

SITE-SPECIFIC ENVIRONMENTAL INFORMATION CHECKLIST
GEOPRESSURED-GEOTHERMAL WELL TEST PROGRAM
GRUY FEDERAL, INC.
NO. L-10
(Drilled as Union Oil of California-Dr. M.O. Miller No. 1)
Cameron Parish, Louisiana

A. GENERAL

1. Is the proposed site located in the area covered by the "Gulf Coast Programmatic Environmental Assessment, Geothermal Well Testing, the Frio Formation of Texas and Louisiana "October 1977?

   Yes X No ___ If no, explain.

2. Has a Federal, state and/or local environmental assessment been conducted previously for the proposed test well or other wells in the area?

   Yes ___ No X If yes, provide a copy, if available.

3. Have all required permits, licenses, and/or agreements for proposed project been obtained?

   Yes ___ No X If no, explain.

   Cannot be applied for until arrangements with landowner have been finalized.

4. Does the project site fall within the habitat of rare or endangered species?

   Yes ___ No X If yes, explain.

5. Are known archeological sites, histroic sites, or natural landmarks within or visible from the site area?

   Yes ___ No X If yes, explain.

6. Will expected continuous noise levels from site operations be 65 dBA or less at the nearest residence?

   Yes X No ___ If no, explain.

B. SITE CONSTRUCTION

1. Will additional land clearing be required for the test well (e.g., drill pad, road construction, mud reserve pits, pipeline)?

   Yes ___ No X If yes, describe.

2. Will additional land clearing be required for the disposal well (e.g., drill pad, reserve pits, utilities, road construction, pipeline)?

   Yes ____ No _X_ If yes, describe.

3. Will the site and related roads be treated to minimize dust?

   Yes ____ No _X_ If no, explain.

   Road and work site to be boarded.

4. Are portable sanitary facilities or an approved septic system to be used at the site?

   Yes _X_ No ____ If no, explain.

5. Will liquid and solid wastes be disposed in accordance with local regulations?

   Yes _X_ No ____ If no, explain.

6. Will erosion control be required for excavated areas?

   Yes ____ No _X_ If yes, explain.

7. Will dredge spoil be deposited in swamp forest or marshland?

   Yes _X_ No ____ If yes, explain. Copy B-7 for Watkins-Miller.

8. Upon completion of proposed test program, will the site be restored to as natural a condition as possible by regrading, filling, and reseeding?

   Yes _X_ No ____ If no, explain.

C. WELL TESTING AND SAFETY

1. Is fluid production from the well during testing expected to be 2 weeks or less in duration per formation?

   Yes ____ No _X_ If no, explain.

   Test expected to require 4 weeks.

2. Is the total dissolved solids of the produced geopressure fluid expected to be 90,000 mg/1 or less?

   Yes _X_ No ____ If no, explain.

3. Is the volume of geopressure fluid to be produced and injected expected to be 3,000,000 barrels or less?

   Yes _X_ No ____ If no, explain.

4. Is the temperature of produced geoperssured fluid expected to be $260^{\circ}C$ or less?

   Yes _X_ No ____ If no, explain.

5. Will the gas content of the produced fluid be flared?

   Yes _X_ No ____ If no, explain.

6. Will blowout preventers rated to at least 10,000 PSI be used?

   Yes _X_ No ____ If no, explain.

7. Will production tubing rated to at least 20,000 PSI, be used?

   Yes ____ No _X_ If no, explain. See Watkins-Miller for inconsistency.

8. Can safety valves be operated from remote locations?

   Yes _X_ No ____ If no, explain.

9. Will the test tree be rated to at least 10,000 PSI?

   Yes _X_ No ____ If no, explain.

10. Will a test well directional survey be conducted?

    Yes ____ No _X_ If yes, at what interval? ____feet. If no, explain.

    Well already drilled and cased.

11. Will a lined pond be used to hold all liquid effluents and production fluids that are not injected?

    Yes _X_ No ____ If no, explain.

12. Has an injection permit been obtained?

    Yes ____ No _X_ If no, explain.

    Cannot be applied for until arrangements are finalized with landowner.

13. Will H_2S monitors be located onsite?

    Yes ____ No _X_ If no, explain.

    No history of H_2S.

14. Will fire extinguishers be located onsite?

    Yes _X_ No ____

    If no, explain.

15. Do contingency plans exist for evacuating personnel should a blowout occur or high levels of H_2S be detected?

    Yes _X_ No ____ If no, explain.

16. Will high-pressure engineering and mud logging personnel be onsite during production well drilling operations.
Yes ____ No _X_ If no, explain.
No mud logging personnel, because well is already cased, however, high pressure engineering personnel will be on site at all times.

GRUY FEDERAL, INC.

CONSULTANTS IN ENERGY SYSTEMS

May 3, 1978

2500 TANGLEWILDE, SUITE 150
HOUSTON, TEXAS 77063
713/785-9200

1911 JEFFERSON DAVIS HWY., SUITE 500
ARLINGTON, VIRGINIA 22202
703/979-2955

Mr. Glen A. Stafford
Program Manager, Resource Engineering
Department of Energy
20 Massachusetts Ave.
Washington, D. C. 20545

Dear Mr. Stafford:

The attached electric log was omitted from the Gruy Federal, Inc. Report NVO-1528-7 " Detailed Reentry Prognosis for Geopressure-Geothermal Testing of Dr. M. O. Miller No. 1 Well". This log should be considered as part of that report.

Very truly yours,

R J Dobson

Richard J. Dobson
Vice President,
Special Programs

RJD:jf
Copies to:

Mr. Keith Westhusing
Mr. Ronald T. Stearns
Mr. Bennie G. DiBona
Mr. Glen A. Stafford✓
Mr. Ronald R. Loose
Mr. Raymond H. Wallace, Jr.
Dr. Louis B. Werner
Mr. Ronald S. Toms
Mr. Joseph N. Fiore
Mr. Don G. Bebout
Mr. Rudolph A. Black

SCHLUMBERGER INDUCTION-ELECTRICAL LOG
SCHLUMBERGER WELL SURVEYING CORPORATION
Houston, Texas

COMPANY: UNION OIL COMPANY OF CALIFORNIA
WELL: DR. M. O. MILLER
FIELD: [illegible]
COUNTY: CAMERON STATE: LOUISIANA
LOCATION: 330' S & 330' W of the NE/C of Sec. 34.
Rev. 107532 Per. 91771
Sec. 34 Twp. 15S Rge. 5W
Other Services:

Permanent Datum: MSL, Elev.
Log Measured From KB, 22.1 Ft. Above Perm. Datum
Drilling Measured From KB
Elev.: K.B. D.F. G.L.

Date	4-4-65	4-16-65	5-7-65	5-16-65
Run No.	1	2	3	4
Depth—Driller	14,000	14,420	15,596	16,603
Depth—Logger	14,009	14,427	15,609	16,623
Btm. Log Interval	14,008	14,426	15,608	16,622
Top Log Interval	3,467	14,008	14,423	15,608
Casing—Driller	13-3/8 @ 3467	13-3/8 @ 3467	9-5/8 @ 14419	9-5/8 @ 14419
Casing—Logger	3,467	3467	14,423	14,423
Bit Size	12-1/4	12-1/4	8-7/16	8-7/16
Type Fluid in Hole	Low Lime	CARBONOX	LO pH (1% Oil)	Low pH
Dens. / Visc.	11.5 / 58	12.6 / 57	17.2 / 58	17.7 / 61
pH / Fluid Loss	12.0 / 4.2 ml	10.5 / 0.9 ml	9.5 / 6.4 ml	10.0 / .4 ml
Source of Sample	CIRC	CIRC	PIT	CIRC
R_m @ Meas. Temp.	0.61 @ 100 °F	0.40 @ 103 °F	0.47 @ 90 °F	0.72 @ 82 °F
R_{mf} @ Meas. Temp.	0.36 @ 100 °F	0.37 @ 70 °F	0.27 @ 78 °F	0.15 @ 290 °F
R_{mc} @ Meas. Temp.	1.15 @ 100 °F	1.5 @ 78 °F	0.98 @ 78 °F	0.30 @ 290 °F
Source: R_{mf} / R_{mc}	M / M	M / M	FP / FP	C / C
R_m @ BHT	0.27 @ 220 °F	0.23 @ 222 °F	0.15 @ 278 °F	0.19 @ 290 °F
Time Since Circ.	4 Hrs.	3 Hrs.	6 Hrs.	5 Hrs.
Max. Rec. Temp.	220 °F	222 °F	278 °F	290 °F
Equip. / Location	2566 / LCT	[illegible]	[illegible]	2569 / LCT

SCHLUMBERGER INDUCTION-ELECTRICAL LOG
SCHLUMBERGER WELL SURVEYING CORPORATION
Houston, Texas

COMPANY
WELL
FIELD
COUNTY STATE
LOCATION
Sec. Twp. Rge.
Other Services:

Permanent Datum: , Elev.
Log Measured From , Ft. Above Perm. Datum
Drilling Measured From
Elev.: K.B. D.F. G.L.

Date	5-22-65	6-3-65	6-9-65	6-14-65
Run No.	5	6	7	8
Depth—Driller	17,035	17,518	18,010	18,158
Depth—Logger	17,051	17,529	18,023	18,166
Btm. Log Interval	17,050	17,528	18,022	18,165
Top Log Interval	16,622	17,048	17,528	17,048
Casing—Driller	@ 14419	7 @ 17034	7 @ 17034	7 @ 17034
Casing—Logger	14,423	17,048	17,048	17,048
Bit Size	8-7/16	6-1/16	6-1/16	6-1/16
Type Fluid in Hole	Low pH	Med. pH Sodium	Med. pH Sodium 3% Oil	216 NO-SUL.
Dens. / Visc.	17.7 / 65	17.7 / 78	17.7 / 68	17.5 / 60
pH / Fluid Loss	10.0 / 5.6 ml	10.0 / 6.8 ml	10.0 / 2.0 ml	9.5 / 5.2 ml
Source of Sample	CIRC	PIT	CIRC	PIT
R_m @ Meas. Temp.	0.33 @ 84 °F	0.613 @ 106 °F	0.9 @ 86 °F	0.81 @ 100 °F
R_{mf} @ Meas. Temp.	0.18 @ 294 °F	0.42 @ 106 °F	0.57 @ 100 °F	0.61 @ 100 °F
R_{mc} @ Meas. Temp.	0.36 @ 294 °F	0.92 @ 106 °F	1.38 @ 100 °F	1.31 @ 100 °F
Source: R_{mf} / R_{mc}	C / C	C / C	C / C	M / M
R_m @ BHT	0.24 @ 294 °F	0.21 @ 311 °F	0.25 @ 319 °F	@ °F
Time Since Circ.	4 Hrs.	5 Hrs.	6 Hrs.	5 Hrs.
Max. Rec. Temp.	294 °F	311 °F	319 °F	°F
Equip. / Location	4534 / LCT	2569 / LCT	4533 / LCT	3709 / H.I.