GRUY FEDERAL, INC.

INVESTIGATION AND EVALUATION OF
GEOPRESSURED-GEOTHERMAL WELLS

DETAILED COMPLETION PROGNOSIS
FOR GEOPRESSURED-GEOTHERMAL WELL OF OPPORTUNITY
PROSPECT NO. 6

BEULAH SIMON NO. 2 WELL

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

APRIL 6, 1979

Prepared for the
Department of Energy
Division of Geothermal Energy
Under Contract No. EG-77-C-08-1528

G
The Gruy Companies
... Since 1950

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

GRUY FEDERAL, INC.

CONSULTANTS IN ENERGY SYSTEMS

April 6, 1979

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

1911 JEFFERSON DAVIS HWY., SUITE 500
ARLINGTON, VIRGINIA 22202
703/920-0113

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

Re: Contract EG-77-C-08-1528
Geopressured-Geothermal Program
Beulah Simon No. 2 Well

Dear Mr. Stearns:

With this letter we are forwarding a recommendation to acquire and test the well which has been drilled by Southport Exploration, Inc. et al as the Beulah Simon No. 2 in Section 26, Township 11S, Range 2E, Vermilion Parish, Louisiana. A detailed completion and testing plan accompanies this recommendation.

As of the date of this letter, the following steps have been taken:

1. The well was offered by the operator, logs were examined, and tentative approval was given by Mr. Westhusing.
2. Option and permit arrangements were finalized with the operator and the land and mineral owners.

Inasmuch as the well is equipped with 9-5/8 inch intermediate casing, it will be necessary to tie back the 7-5/8 inch liner to the surface, as well as install a 5-1/2 inch liner in open hole.

Estimated costs for this project are summarized as follows:

Estimated total cost to complete well	\$ 1,843,750
Inventory	- 709,000
Estimated net cost to complete well	<u>1,134,750</u>
Estimated cost to drill and complete disposal well	211,900
Estimated cost to conduct test program*	209,090
Estimated cost to plug and abandon	<u>131,100</u>
TOTAL	\$ 1,686,840

*Includes analytical costs

GRUY FEDERAL, INC.

Mr. Ronald T. Stearns
April 6, 1979
Page two

The operator recently moved off location but did not pull the intermediate casing. It was cut off below ground level.

The well work can commence shortly after approval is obtained. The rig situation has eased and we expect minimum delay in obtaining a qualified drilling contractor. The well will be shut in unperforated until the surface test facilities are available at the conclusion of the Fairfax Foster Sutter No. 2 test.

We think we have a good prospect which can be tested at a reasonable cost and recommend your early approval of this proposal.

Yours very truly,

GRUY FEDERAL, INC.

Richard J. Dobson
Vice President, Operations

RJD:cas
Enclosure

cc: To Messrs:

Bebout
Carwile
Cotter
Wallace
Westhusing

INVESTIGATION AND EVALUATION OF
GEOPRESSURED-GEOTHERMAL WELLS

DETAILED COMPLETION PROGNOSIS
FOR GEOPRESSURED-GEOTHERMAL WELL OF OPPORTUNITY
PROSPECT NO. 6

BEULAH SIMON NO. 2 WELL

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

APRIL 6, 1979

Prepared for the
Department of Energy
Division of Geothermal Energy
Under Contract No. EG-77-C-08-1528

TABLE OF CONTENTS

	<u>Page</u>
Introduction	1
Geology	1
Petrophysics	5
Proposed WOO Deal	6
Mechanical Condition	6
Tubing Design	8
Casing Design	8
Blowout Preventers	11
Logging	11
Perforating	11
Wellhead Design	12
Disposal Well	12
Well Test Procedure	14
Completion Prognosis	16
Well Prognosis, Saltwater Disposal Well	20
Test Prognosis	23
Analysis Required for Geo ² Water and Gas	26
Plugging and Abandonment Procedure	28
Site Specific Environmental Information Checklist . . .	30

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	Location Map	2
2	Structure Map, Top of Camerina Sand	4
3	Current and Proposed Completion Status	7
4	Bottomhole Tubing Assembly	9
5	Geo ² Christmas Tree	13
6	Surface Testing Facilities	15

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Estimated Completion Cost	19
2	Estimated Cost of Saltwater Disposal Well	22
3	Estimated Testing Cost	25
4	Analytical Costs for Geo ² Water and Gas	27
5	Estimated Plugging Costs	29

GRUY FEDERAL, INC.

GEOPRESSURED-GEOTHERMAL WELL-OF-OPPORTUNITY PROSPECT NO. 6 COSSINADE FIELD AREA VERMILION PARISH, LOUISIANA

Introduction

This well of opportunity (WOO) geopressured-geothermal prospect has been drilled to 15,265 feet by Southport Exploration, Inc. (Southport) as the Beulah Simon No. 2 Well. The well is located in Section 26, T11S, R2E, Vermilion Parish, Louisiana, approximately four miles northeast of the town of Kaplan. The wellsite is shown on the enclosed section of USGS topographic sheet, "Lafayette, La." (Figure 1), and is accessible by State Highway 13 from Interstate Highway 10.

The well was drilled approximately one mile east of the Southport et al. Beulah Simon No. 1 Well in the Cossinade Field. The Beulah Simon No. 1 Well is producing natural gas from a zone which is separate and distinct from the target reservoir in the No. 2 Well.

Geology

The Beulah Simon No. 2 Well penetrated a thick geopressured-geothermal aquifer of Camerina (upper Oligocene) age through the interval 14,254 to 14,762 feet. There is no hydrocarbon production from this sand or fault block. The nearest productive well (Beulah Simon No. 1) is completed in a thin gas-bearing sand at approximately 14,500 feet. This completion sand is not correlative with any of the existing sands in the subject well and should not interfere with a Geo² testing operation.

FIGURE 1

CROWLEY, LA.
N3000-W9215/15
1955

LAFAYETTE, LA.
N3000-W9200/15
1955

IS 7544 III-SERIES V785

TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1955

GRUY FEDERAL, INC.
HOUSTON, TEXAS
LOCATION MAP
COSSINAIDE FIELD AREA
VERMILION PARISH, LOUISIANA

Figure 2 is a structural interpretation of the top of the Camerina sand with available well control indicated. Seismic data obtained by the original operator was made available in their Tulsa office. The seismic data and available well control are in agreement and required only minor changes to incorporate additional control obtained from the Beulah Simon No. 2 and Dow-Thomas Wells.

The Beulah Simon No. 2 is bounded to the north, south, and west by regional down-to-the-coast growth type faults. It appears that the subject well is in a small saddle with anticlinal structures to the north (LeLeux), southwest (Kaplan), and southeast (Abbeville).

Net Camerina sand thicknesses are shown for six wells in the area on the overlay.

The geological data and interpretation indicate:

1. A drainage area of at least 3-1/2 to 4 square miles uncomplicated by faulting.
2. The subject well is in an area of maximum sand development in the Camerina section. The total net sand thickness varies from approximately 100 to 266 feet in individual wells.
3. The Camerina section proposed for Geo² testing is nonproductive in the immediate area.

The well penetrated the objective aquifer using a mud weight of 17.7 #/gal. The bottomhole formation pressure is assumed to be 400 psi overbalanced by the hydrostatic pressure of the mud column, thus indicating a bottomhole pressure of approximately 13,000 psi. The maximum recorded mud temperature was 256°F (125°C), which corresponds to an aquifer temperature of 285°F (141°C) based on A.A.P.G. correction factors.

Petrophysics

Insufficient petrophysical data were available from the subject well for fully analyzing the properties of the aquifer. The only log available was an ISF/Sonic, which in this type of formation is not an adequate porosity log. The Beulah Simon No. 1 Well, about a mile away, was logged with a density log; therefore, the logs of Simon No. 1 and Simon No. 2 were used in the analysis. In the Beulah Simon No. 1 the formation water resistivity was determined using resistivity from the induction log and porosity from the density log. This apparent water resistivity was then used with the logs of the No. 2 Well to obtain an equivalent density log porosity. It can be assumed that the salinity of the formation waters does not change appreciably over the short distance between the two wells.

The raw porosity obtained from the density log has to be corrected for shale content. The gamma ray log was utilized to estimate the shale correction factor. A correlation between SP and gamma ray was determined for the No. 1 Well and this correlation was used in interpreting the data for the No. 2 Well, on the assumption that the electrical properties and the mineralogical composition of the aquifer will remain constant over the short distance between wells.

The interpretation of both logs was accomplished by manual digitization of the logs on a 2-foot interval. The logs on the No. 1 Well were used to determine the water resistivity and gamma ray-SP correlation. These data were then used with the digitized data from the No. 2 Well to obtain corrected porosity and permeability.

The Beulah Simon No. 2 had 80 feet of sand in the upper zone with an average porosity of 14.5 percent and an average permeability of 2.3 md. The zone of interest is the lower member which is of better quality, having 186 feet of net sand with an average porosity of 18.7 percent and a permeability of 6.8 md. The bottom 48 feet of the lower sand has an average porosity of 22.4 percent and an average permeability of 12.5 md.

The lower 48 feet has a capacity of about 600 md-ft which should be sufficient to sustain a flow rate of 10,000 B/D with the geopressured conditions of flow. The total sand zone of 266 feet has a porosity of 17.4 percent and a permeability of 5.45 md with a capacity of 1500 md-ft.

Proposed WOO Deal

Several discussions have been held with Southport representatives regarding a proposed takeover of the Southport Beulah Simon No. 2 Well. When the well was nonproductive at total depth, the operator was unable to share the rig commitment because of pressing lease obligations. This made it impossible to arrange for use of the drilling rig on the well; however, the operator assured us of having taken all precautions in temporarily abandoning the well to permit our moving another rig on to the well and completing it for Geo² testing with a minimum of problems. We are soliciting bids for a rig and anticipate no problems in finding one. We propose to assume the board road rentals. We have proposed, and the operator has agreed, to a payment of \$50,000 for use of the wellbore and rights of ingress and egress to the site, the joint interest partners having indicated concurrence. Gruy will be obligated to plug and abandon the well in compliance with the Department of Conservation regulations and to clean up the wellsite area. Salvable 9-5/8" casing will be returned to the operator.

The land and mineral owners have accepted a one-year agreement for use of the well and the surrounding acreage for a sum of \$15,000.

Mechanical Condition

Figure 3 illustrates the present condition of the well and the proposed completion configuration. Information on the present condition of the well was obtained from Southport's records.

FIGURE 3
GRUY FEDERAL, INC.
(SOUTHPORT EXPLORATION, INC.)
BEULAH SIMON ET AL NO. 2
COSSINADE FIELD AREA
VERMILION PARISH, LOUISIANA

Tubing Design

Tubing has been selected on the basis of anticipated flow capacity and pressure requirements and with joint connections that will withstand reuse in subsequent wells. To met these requirements, we have specified a string of 3-1/2" OD 12.95 #/ft, P-105 grade tubing, and 2-7/8" OD, 8.70 #/ft, P-105 tubing. These amounts and grades are in inventory at Intercoastal City, Louisiana.

The tubing string will be equipped with a seal assembly on the production tube which extends through the production packer. A sufficient length of the seal assembly (approximately 10') will be run to allow for expansion and contraction of the tubing within the packer element as a result of changing temperatures during operations. A landing nipple will be provided to receive the subsurface pressure gauges during testing operations. A sliding-sleeve circulating valve will be placed in the tubing string immediately above the seal element in order to permit selective communication between the tubing and casing, should this become necessary. The bottom-hole tubing assembly is shown in Figure 4.

Casing Design

The following tabulation gives the sizes, weights, and grades of casing presently in the well and the design of the proposed liner and tieback casing to be run.

Surface Casing

<u>From</u> <u>(ft)</u>	<u>To</u> <u>(ft)</u>	<u>OD</u> <u>(inches)</u>	<u>Weight</u> <u>(#/ft)</u>	<u>Grade</u>	<u>T&C</u>
0	2400	13-3/8	54.5	J-55	ST&C
2400	3500	13-3/8	61.0	K-55	ST&C

FIGURE 4

GRUY FEDERAL, INC.
(SOUTHPORT EXPLORATION, INC.)
BEULAH SIMON NO. 2
COSSINADE FIELD AREA
VERMILION PARISH, LOUISIANA

9

BOTTOMHOLE TUBING ASSEMBLY

Protection Casing

<u>From (ft)</u>	<u>To (ft)</u>	<u>OD (inches)</u>	<u>Weight (#/ft)</u>	<u>Grade</u>	<u>T&C</u>
0	2300	9-5/8	43.5	N-80	Buttress
2300	2800	9-5/8	43.5	N-80	LT&C
2800	5300	9-5/8	47.0	N-80	LT&C
5300	10,800	9-5/8	47.0	S-95	LT&C
10,800	12,100	9-5/8	47.0	N-80	LT&C

Liner

<u>From (ft)</u>	<u>To (ft)</u>	<u>OD (inches)</u>	<u>Weight (#/ft)</u>	<u>Grade</u>	<u>T&C</u>
11,900	13,800	7	38.0	N-80	FJ

Proposed Liner

<u>From (ft)</u>	<u>To (ft)</u>	<u>OD (inches)</u>	<u>Weight (#/ft)</u>	<u>Grade</u>	<u>T&C</u>
15,261	11,861	5-1/2	20.0	P-110	SFJ

Equipment

Brown Oil Tool hanger with tieback sleeve.

Brown Oil Tool fill-up float collar and float shoe.

Cement

Halliburton Class H cement + 35% coarse silica flour + 3% KCl and 42 lbs. Hi-Dense #3 per sack + 0.6% Halad-22A + 0.75 CFR-2 + 1/4 lb per sack D-Air 1 and retarder as necessary for adequate placement time. Water ratio 5.60 gals per sack. Slurry weight = 18.0 #/gal.

Proposed Tieback Casing

<u>From (ft)</u>	<u>To (ft)</u>	<u>OD (inches)</u>	<u>Weight (#/ft)</u>	<u>Grade</u>	<u>T&C</u>
0	2100	7	38.0	P-110	LT&C
2100	11,861	7	38.0	S-95	LT&C

Equipment

Brown Oil Tool tieback stinger with 3 sets pressure activated seals.
Brown Oil Tool orifice float collar.

Blowout Preventers

The BOP hookup, test procedures, and maintenance program will conform with the specifications set out in the Gruy Standard Test Procedures and Maintenance Program dated November 1978. W. C. Goins, a widely recognized authority on well control, is retained by Gruy Federal. He will specify and inspect blowout preventer installations and operating procedures, and will be available for consultation.

Logging

Open-hole logs have already been run and will not be duplicated. The cased-hole logs (gamma-ray, cement bond, and collar locator) are necessary to establish the integrity of the cement and to provide a benchmark for perforating. The gamma ray-neutron log through the Geo² zone is required by the Louisiana Department of Conservation.

Perforating

Perforating will be accomplished with a 1-11/16" high-temperature, through-tubing jet perforating gun with four shots per foot and zero phasing. This jet creates a casing entry diameter of approximately 2" beyond the cement sheath. Assuming 100 percent firing efficiency, this configuration should provide a productivity equal to 70 percent of the open-hole productivity.

It is recommended that the perforated interval be the bottom 48 feet of the lower sand.

The well will be perforated with CaCl₂ water in the hole so that a pressure differential from the formation to the wellbore will exist. When the first gun is fired, water from the formation will expand into the wellbore,

equalizing the pressure on both sides of the casing. Perforating with this fluid in the hole instead of drilling mud will eliminate the damage caused by mud filtrate invasion and the subsequent buildup of mud cake on the porous medium. This is also a safe way in which to perforate the geopressed zones because the christmas tree will be installed and tested prior to experiencing pressure on the well.

Wellhead Design

Figure 5 is a sketch of a Geo² christmas tree designed for the Gruy-DOE program by the WKM Well Systems Division. The tree has a rated working pressure of 10,000 psi. All valves have T-24 steel vertical runs with packing and seals for high-temperature fluids (360°F). The tree consists of two 3-1/16" master gate valves and a 3-1/16" swab valve. Between the master gate valve and the swab valve is a double wing assembly to house the choke bodies. One wing contains a positive choke, the other an adjustable choke. Each wing consists of a Hi-Low safety valve and a conventional wing valve. This specific design is adequate to safely operate with the maximum anticipated shut-in wellhead pressure of 6500 psi to 7000 psi.

Disposal Well

The chief geologist for the Louisiana Department of Conservation has informed Gruy that the Department will approve an application for Geo² saltwater disposal in the sands between 2000 and 2500 feet. Criteria for the selection of disposal aquifers include (1) minimum acceptable disposal depth of 2000 feet as specified by the Louisiana Department of Conservation, and (2) maximum acceptable depth as determined necessary to obtain adequate disposal sands. The disposal well is proposed to be drilled from the same turnaround board matting as the test well.

GEO² CHRISTMAS TREE

FIGURE 5

WELL TEST PROCEDURE

SOUTHPORT BEULAH SIMON NO. 2

This well test procedure was established to provide the maximum amount of information on reservoir rock and fluids which can be obtained within the fixed time frame and the limitations of the available equipment.

The only bottomhole pressure device capable of operating at the expected temperatures and pressures is a 15,000 psi (full scale deflection) Amerada RPG-3 bourdon tube pressure gauge. This gauge has no surface readout capability and has various clocks, from 12 hours to 7 days, available. The maximum accuracy of the bomb is ± 0.25 percent (37.5 psi) under controlled calibration conditions. These limitations determine the scope of meaningful transient tests that can be conducted.

Before testing commences it will be necessary to flow the well into a reserve pit in order to clean the perforations of mud and foreign solids. After this has been accomplished, the well will be shut in to measure the static reservoir pressure. The well will then be placed on production through the test equipment at a low rate in order to establish the drawdown characteristics at a safe level. Every 24 hours the rate will be increased until the choke size that allows flow at 10,000 barrels per day is determined. The well will be shut in and the pressure buildup recorded. These data will be analyzed to determine the flow capacity of the formation and the skin effect or formation damage.

During each flow period, full flow stream samples will be taken and analyzed for chemical composition. Separator gas-water ratios will be carefully metered to detect changes as a function of the flow rate and samples taken for laboratory recombination studies.

After the well has returned to static conditions, it will be flowed at a rate of 10,000 barrels per day for approximately two weeks. The pressure data from this flow can be used to verify the reservoir parameters computed from the buildup analysis.

SURFACE TESTING FACILITIES
Gruy Federal, Inc.

FIGURE 6

COMPLETION PROGNOSIS

SOUTHPORT-BEULAH SIMON NO. 2 WELL

OPERATIONAL DAY	OPERATION
1st	1. Prepare location.
4th	2. Install wellhead on cut-off casing. Weld on casing about 3' below ground level.
8th	3. Move in drilling rig and rig up.
9th	4. Test BOP and choke manifold.
10th	5. Pick up bit, drill collars, and drill pipe. RIH.
17th	6. Clean out cement in 9-5/8" casing to top of 7-5/8" liner at 11,931'. Circulate and condition mud to 17.8 #/gal. POH. Make up 6-5/8" bit and GIH. Clean out 7-5/8" liner to top "EZ" plug at 13,790'. Drill out plug and cement, wash and ream to TD of 15,261'. Circulate and condition mud to 17.8 #/gal.
18th	7. Make short trip into 7-5/8" liner. If hole free, POH.
20th	8. If log is required to determine desired cement volume prior to running liner, GIH with 6-5/8" bit to condition hole to 15,261'. Run log. Make short trip into 7-5/8" liner. If hole free, continue out of hole to run liner. If hole is not free, consult Houston office for instructions. Oil base mud may be required in open hole. If so, certain modification in the following step will be required.
24th	9. Pick up 3400' of 5-1/2" OD, 20 #/ft, SFJ-P110 casing (liner) with guide shoe and float collar on bottom and a B.O.T. tieback sleeve on top. Hang liner at approximately 11,861' with 75' overlap above the 7-5/8" liner. Circulate bottoms up to determine condition of mud. Rig up cement truck. Circulate cement around 5-1/2" liner and reverse out excess. Release liner hanger and pull out of hole. The liner should be equipped with centralizers at selected positions opposite full gauge in sand section.

- 26th 10. Go in hole with 8-3/4" bit to top of cement plug. Circulate and clean out to top of 5-1/2" liner. Circulate to condition mud. Pull out of hole.
- 28th 11. Pick up 8-1/2" squeeze tool and go in hole to 11,850' to test seal on 9-5/8" - 5-1/2" annulus. Test top of liner to 4500 psi differential to wellbore.
- 30th 12. Squeeze top of liner, if required.
- 31st 13. Go in hole with 8-3/4" bit to top of cement in 9-5/8" casing. Clean out cement to top of 5-1/2" liner. Circulate to condition mud. Pull out of hole.
- 32nd 14. Go in hole with 4-1/2" bit to top of 5-1/2" liner. Circulate, clean out, and wash to top of float collar in 5-1/2" liner. Pull out of hole.
- 33rd 15. Run cement bond-gamma-ray log with casing collar locator from float collar to 11,861'.
- 34th 16. If necessary to effect good bond, go in hole with wireline tools and perforate 5-1/2" liner 2' with 4 shots per foot across top of Geo² sand. Rig down wireline unit.
- 37th 17. Pick up 4-1/2" squeeze tool. Go in hole to 14,530'. Squeeze perforations with cement to 5000 psi. Reverse out excess cement. Pull out of hole with squeeze tool.
18. Nipple down BOP. Install 7" casing spool, nipple up BOP and choke manifold and pressure test.
- 38th 19. Go in hole with washover shoe to top of 5-1/2" liner. Circulate and wash over liner setting sleeve to polish same. Pull out of hole.
- 40th 20. Pick up 7" x 5-1/2" tieback and 7" tieback casing. Go in hole and engage 5-1/2" liner. Hang off tieback with maximum recommended tension.
- 41st 21. Run in hole with 6-3/4" squeeze packer to test 5-1/2" tieback sleeve to 4500 psi.

22. If block squeezing is not required in 5-1/2" liner, proceed with prognosis. However, if squeezing is required, go to step 23.
- 43rd 23. Set storm packer at 3000'. Nipple down BOP. Nipple up 10,000 psi WKM tubing spool and test body to 10,000 psi. Nipple up BOP and test. Recover storm packer.
- 45th 24. Pick up 4-1/2" bit and scraper. Go in hole and drill out block squeeze cement as directed. Depending on location of block squeezes, a separate bit and scraper run may be required. Circulate and condition mud to 17.8 #/gal. Pull out of hole.
- 46th 25. Rig up and perforate Geo² sand as determined from electric logs.
- 48th 26. Set Otis "WA" packer on wireline. Depending on hole conditions, it may be necessary to set packer on drill pipe.
- 52nd 27. Pick up production tubing (2-7/8" OD 8.70#, P-105 and 3-1/2" OD 12.75#, P-105, with seal rings) with landing nipple below 10' of seals and circulating nipple above seals. Go in hole testing each joint above the slips to 10,000 psi.
- 54th 24. Space out in Otis "WA" packer. Install tree, pull perforated production tube 1/2 way out of packer bore. Circulate 17.8 #/gal mud out of annulus with 11.5 #/gal CaCl₂ water. Bolt down christmas tree.
- 55th 29. Flow well through an adjustable choke to the pits at a rate to remove the mud below the packer and until the effluent is clear. Observe pressures.
- 56th 30. Set wireline blanking plug in the Otis nipple at 3000' and install a blanking plug in the Canfield bushing in the christmas tree.
- 60th 31. Release rig, rig down, and move off location.

TABLE 1ESTIMATED COMPLETION COST
SOUTHPORT-BEULAH SIMON NO. 2 WELL

<u>Activity</u>	<u>Estimated Cost</u>
1. Lease acquisition and legal fees	\$ 75,000
2. Casing tie back to ground level	10,000
3. Rig mobilization and demobilization	90,000
4. Site preparation	14,000
5. Rig time, 40 days @ \$6500/D	260,000
6. Bits	7,000
7. Mud and chemicals	92,000
8. Christmas tree, including surface safety controls	111,000*
9. Casing patch, including mills, equipment and services	12,000
10. Rental tools and equipment, 40 days @ \$3500/D	140,000
11. Trucking (other than rig and tubular goods)	53,000
12. Cement and services	45,000
13. Open-hole logging	
14. Cased-hole logging	21,000
15. Perforating	45,000
16. Tubular goods	598,000*
17. Packer and subsurface equipment	17,000
18. Contract labor and site maintenance	67,000
19. Supervision and drilling engineers	71,000
20. Drill fresh water well and complete	6,000
21. Miscellaneous supplies, materials and equipment	30,000
22. Insurance	32,000
23. Material handling at 1.3%, except items 1 and 18	21,450
24. G&A, 18% of items 1 and 19	26,300
	<hr/>
TOTAL	\$1,843,750

*In stock.

Less items in stock:

Christmas tree	\$ 111,000
Tubular goods	598,000
	<hr/>
	\$ 709,000

709,000

NET COST \$1,134,750

WELL PROGNOSIS
BEULAH SIMON
SALTWATER DISPOSAL WELL NO. 2
VERMILION PARISH, LOUISIANA

<u>OPERATIONAL DAY</u>	<u>OPERATION</u>
58th	1. Drive 13-3/8" OD PEB casing to refusal at approximately 125'.
59th	2. Move in contract water well rig, unload and rig up same. Drill rat hole and mouse hole.
60th	3. Drill 12-1/4" hole to 1200' and run 1200' of 9-5/8" 37 #/ft H-40 R-3 casing with guide shoe on bottom and float collar 1 jt. above bottom. Use one centralizer per each 100' of casing through bottom 500'. Use sufficient cement to circulate same to surface allowing 150 percent of theoretical annular volume.
61st	4. Nipple up blowout preventers while waiting on cement.
62nd	5. Drill 8-3/4" diameter hole below surface casing to 2500'.
63rd	6. Run ISF-Sonic log with caliper from 2500' to 1200'. 7. Make trip with drill pipe and condition hole to 2500'. Rig up equipment preparatory to running production casing. POH and lay down drill pipe.
64th	8. Run 5-1/2" 15.5 #/ft J-55 R-3 casing to 2500' with shoe on bottom and float collar 1 jt. above bottom. Use centralizers on every other joint from bottom to a height that will allow a minimum of two centralizers inside the 9-5/8" surface casing. Cement 5-1/2" casing with sufficient cement to circulate to surface. Nipple up BOP's while waiting on cement. 9. Pick up 2-7/8" work string. Condition hole to top of float collar in 5-1/2" casing and POH.
65th	10. Rig up wireline truck and run gamma-ray cement bond log from top of float collar to approximately 1000'. If bond log indicates need for cement squeeze, perforate 1-1/2' above and 1-1/2' below base of injection sand for a total of 3' of perforations.

- 66th 11. GIH with 5-1/2" squeeze tool with 1 jt. of tail pipe and squeeze perforations at base of perforations. Reverse out excess cement.
12. Reset squeeze tool so that tail pipe is 30' above top of injection sand. Repeat perforating procedure using through-tubing perforating gun. Proceed to squeeze perforations.
- 67th 13. POH. Lay down squeeze tool. Pick up bit, go in hole and drill out cement from both block squeeze jobs. Condition hole with bit to top of float collar.
14. Test block squeeze perforations to 1500 psi for 30 mins. If test satisfactory, displace all mud from hole with water, lay down 2-7/8" work string, remove BOP, and install wellhead.
- 68th 15. Rig down drilling rig and move off location.
16. Rig up wireline unit and perforate well with 4 holes/ft. in interval to be selected from electric log.
- 69th 17. Test injectivity of well with separator back pressure to achieve desired injection rate. If injection rate is not sufficient with available back pressure, select and perforate additional sand interval, or consider treatment with mud cleanout acid or both if deemed necessary.

TABLE 2
ESTIMATED COST
SALTWATER DISPOSAL WELL
SOUTHPORT BEULAH SIMON NO. 2

<u>Activity</u>	<u>Estimated Cost</u>
1. Prepare site for rig	\$ 6,000
2. Turnkey rig cost to move in rig, drive conductor casing, set surface casing, drill to 2500' and set 5-1/2" casing	65,000
3. Day rates - 15 days @ \$2400/day	36,000
4. 125' of 13-3/8" 65 #/ft J-55 P.E. beveled pipe FOB location	2,400
5. 1200' of 9-5/8" 36 #/ft H-40 ST&C FOB location	14,200
6. 2500' of 5-1/2" 15.5 #/ft J-55 ST&C FOB location	13,300
7. Float equipment and centralizers	3,000
8. Mud, chemicals, and completion fluid	5,000
9. Cement and services	12,500
10. Perforating	8,500
11. Wellhead equipment	5,000
12. Stimulation	2,500
13. Miscellaneous supplies and rentals	11,000
14. Trucking	7,000
15. Open-hole and cased-hole logs	9,000
16. Supervision - 15 days @ \$500/day	7,500
17. Material handling @ 1.3% (except item 16)	2,650
19. G&A, 18% item 16	<u>1,350</u>
TOTAL	\$ 211,900

TEST PROGNOSIS
FOR
SOUTHPORT BEULAH SIMON NO. 2

<u>OPERATIONAL DAY</u>	<u>OPERATION</u>
69th day	1. Move test equipment. Make necessary connections from the wellhead to the inlet of the test equipment and from the outlet of the test equipment to the saltwater disposal well. Lay the gas flare line to a point at least 100' downwind from the test facilities.
72nd	2. Run two Amerada RPG-3 pressure gauges with one 12 hr. and one 24 hr. clock and 15,000 psi full-scale deflection to 13,500', stopping first in lubricator for deadweight tester calibrations, then for 15 mins. each 3000'. Hang gauges for two hours and record surface pressure with deadweight tester. Retrieve pressure gauges. 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 30 mins. by deadweight tester. 5. Record gas and liquid flow rates by calibrating the liquid turbine meter with the test tank.
73rd	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 hrs. while recording surface temperature, pressure, and gas and liquid production. If maximum flow rate of well not sufficient, either acidize or perforate more interval.
74th	7. Shut well in and measure surface pressure buildup with deadweight tester.
76th	8. When wellbore pressure has stabilized, run two Amerada RPG-3 pressure gauges with five-day clocks and latch into landing nipple at bottom of tubing. Run Hewlett-Packard quartz crystal pressure gauge 100' above Amerada gauges.

- 79th 9. Place well on production at 1000 barrels per day for 24 hrs. Monitor surface pressure, temperature, and flow rates, and take the following samples:
- (a) Two one-liter full well stream samples for chemical analysis.
 - (b) Three one-liter separator liquid samples.
 - (c) Two one-liter separator gas samples.
- 80th 10. Increase flow rate to 4000 barrels per day for 24 hrs. and sample as before.
- 81st 11. Increase flow rate to 7000 barrels per day for 24 hrs. and sample as before.
- 82nd 12. Increase flow rate to 10,000 barrels per day for 24 hrs. and sample as before.
- 83rd 13. Shut well in, measure buildup for 24 hrs., then retrieve pressure gauges.
- 84th 14. Place well on production at low rate and gradually increase rate over a 12 hr. period until it reaches 10,000 barrels per day.
15. Flow well at this rate for nine days while measuring surface pressure, temperature and flow rates.
16. Sample as before prior to shutting well in.
- 87th 17. Shut well in and run two pressure gauges to lowest landing nipple in production string or packer as the case may be and hang off pressure gauges. Record until deadweight tester at surface indicates static conditions have been reached.
- 88th 18. Pull pressure gauges, release test equipment and move out.
19. Proceed with plugging and abandonment of well.

TABLE 3ESTIMATED TESTING COST
FOR
SOUTHPORT BEULAH SIMON NO. 2 WELL

<u>Activity</u>	<u>Estimated Amount</u> <u>(per test)</u>
1. 23,400,000 BTU/hr. air cooler	\$ 12,200
2. Two data headers with sonic sand detector, temperature recorder, scale detector and flow stream sample and bypass connections	900
3. Test separator with control valves and flow meters, gas meter, and meter run and sample connections	25,200
4. Calibration tank	1,200
5. Two centrifugal pumps	9,000
6. Two water filters	1,800
7. Two 2-pen pressure recorders	1,200
8. Trailer house	900
9. Portable lights	600
10. Air compressor	900
11. Deadweight tester	600
12. Flow lines and manifolding	12,900
13. Wireline unit	2,700
14. Two pressure recording gauges with two 24-hr. clocks	3,900
15. Two 5-day clocks for pressure gauges	600
16. High temperature lubricator	5,300
17. Mast truck	3,800
18. Generator	9,000
19. Fuel, subsistence, replacement parts and supplies	5,000
20. Transportation and trucking	5,000
21. Contract labor	51,900
22. Supervision	27,000
23. Material and handling (1)	2,400
25. G&A (2)	14,200
TOTAL	\$ 198,200

(1) Charged at a rate of 1.3% on all items except 21 and 22.

(2) Charged at a rate of 18% on items 21 and 22.

ANALYSIS REQUIRED FOR GEO² WATER AND GAS

SOUTHPORT BEULAH SIMON NO. 2 WELL

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

Chemical Analysis of Vapor

A. Hydrocarbons (percent)

1. Methane
2. Ethane
3. Propane
4. Isobutane
5. Normal butane
6. Isopentane
7. Pentane
8. C₆⁺

B. Other

1. Hydrogen sulfide
2. Carbon dioxide
3. Radon
4. He
5. N₂
6. O₂

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

TABLE 4ANALYTICAL COSTS FOR GEO² WATER AND GAS

SOUTHPORT BEULAH SIMON NO. 2

	<u>Estimated Cost Per Test</u>
Recombination	
2 samples per well	\$ 10,000
Chemical Analysis of Water	
5 samples per well	750
Material handling at 1.3%	<u>140</u>
Total Per Well	\$ 10,890

PLUGGING AND ABANDONMENT PROCEDURE
FOR
SOUTHPORT BEULAH SIMON NO. 2

1. Set back pressure valves in landing nipple below packer and allow well pressure to reduce to zero. Move in and rig up pulling unit capable of plugging and abandonment. Remove christmas tree and install BOP's and test same. Remove back pressure valves from tubing and tree.
2. Nipple up pump trucks to tubing and casing, pull production tube out of packer and circulate well.
3. Mix 100 sacks cement and displace same to bottom of tubing, then pull tubing up above cement and dress off plug by reverse circulation.
4. WOC 12 hours.
5. Observe for pressure buildup while WOC for 12 hours before pulling tubing from hole. Lay down tubing with thread protectors installed.
6. Run in hole with chemical casing cutter and cut 7" casing below tie-back sleeve at a point determined by freepoint survey. Pull and lay down 7" casing with thread protectors installed.
7. Run in hole with work string and set cement plug 100' in and 100' out of cut-off 5-1/2" casing.
8. Cut off 9-5/8" casing at a point determined by freepoint survey and lay down casing with thread protectors installed.
9. Cut 13-3/8" and 16" casing 3 feet below ground level and spot cement from surface to 50'. Weld cover plate over pipe.
10. Release rig.
11. Send tubing and casing to pipe yard for inspection and repair.
12. Send christmas tree to shop for overhaul.

NOTE: The recovered 9-5/8" casing should be returned to Southport Exploration, Inc.

TABLE 5

ESTIMATED PLUGGING AND ABANDONMENT COSTS
FOR
SOUTHPORT BEULAH SIMON NO. 2 WELL

<u>Activity</u>	<u>Amount</u>
1. Wireline unit @ \$50/hr., 24 hrs.	\$ 1,200
2. Move in rig - rig up, 3 days @ \$5500/day	16,500
3. Nipple down christmas tree and nipple up BOP, 2 days @ \$5500/day	11,000
4. Squeeze well and reverse out cement - 1 day @ \$5500/day	5,500
5. Pull and lay down tubing - 2 days @ \$5500/day	11,000
6. Cut 7" casing at 11,800' + and pull - 1 day @ \$5500/day	5,500
7. Cut 9-5/8" casing at 4500' and pull - 1 day @ \$5500/day	5,500
8. Set plugs - 1 day @ \$5500/day	5,500
9. Rig down and move out - 2 days @ \$5500/day	11,000
10. Wireline services	2,500
11. Cement and services	6,300
12. Supervision @ \$600/day	7,200
13. Trucking	20,000
14. Miscellaneous	20,000
15. Material handling - 1.3% of all except item 12	950
16. G&A @ 18% of items 12 and 15	<u>1,450</u>
TOTAL	\$ 131,100

SITE-SPECIFIC ENVIRONMENTAL INFORMATION CHECKLIST
GEOPRESSURED-GEOTHERMAL WELL TEST PROGRAM

WELL: SOUTHPORT-BEULAH SIMON NO. 2

LOCATION: Section 26, T11S, R2E, Vermilion 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.

Land and mineral permits agreed on, operator contract negotiated.
In process of amending or obtaining state permits for geothermal as contrasted to oil and gas exploration.

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, historic 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 X No If no, explain.

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 of 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__ No X If yes, explain.

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.

Total test period expected to be about 4 weeks, which will include time well is shut in for pressure buildup.

2. Are the total dissolved solids of the produced geopressure fluid expected to be 90,000 mg/l 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 geopressured fluid expected to be 260°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.

3-1/2" tubing to be used has pressure rating of 18,000 psi; maximum expected pressure is approximately 13,000 psi.

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.

Operation consists of re-entering original plugged and abandoned hole.

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.

Permit is being prepared.

13. Will H₂S monitors be located on site?

Yes No X If no, explain.

No H₂S in wells drilled in area.

14. Will fire extinguishers be located on site?

Yes X No If no, explain.

15. Do contingency plans exist for evacuating personnel should a blow-out occur or high levels of H₂S be detected?

Yes X No If no, explain.

16. Will high-pressure engineering and mud logging personnel be on site during production well drilling operations?

Yes X No If no, explain.

Schlumberger		ISF/SONIC	
FIELD PRINT		COMPANY SOUTHPORT EXPLORATION, INC.	
WELL BEULAH SIMON No 2		FIELD COSSINADE	
COUNTY VERMILION		STATE LOUISIANA	
LOCATION 330' ESL & 2200' FWL TO LOC., SEC 26		Other Services:	
API SERIAL NO 162407		SEC 26	TWP 11S
RANGE 2E			
Permanent Datum: B.H.F. ; Elev.: N/A		Elev.: K.B. N/A	
Log Measured From R.K.B. 24.0 Ft. Above Perm. Datum		D.F. N/A	
Drilling Measured From R.K.B.		G.L. N/A	
Date	3-9-79		
Run No.	THREE		
Depth-Driller	15,231		
Depth-Logger	15,265		
Btm. Log Interval	15,261		
Top Log Interval	13,831		
Casing-Driller	7 3/4 @ 13,910	@	@
Casing-Logger	13,931		
Bit Size	6.5		
Type Fluid in Hole	LIGNO		
Dens. Visc.	17.7 49		
pH Fluid Loss	10 2.0 ml		
Source of Sample	CIRC. PIT		
Rm @ Meas. Temp.	1.06 @ 87°F	@	°F
Rmf @ Meas. Temp.	.567 @ 70°F	@	°F
Rmc @ Meas. Temp.	1.59 @ 87°F	@	°F
Source: Rmf Rmc	MEAS CALC		
Rm @ BHT	.378 @ 256°F	@	°F
Circulation Stopped	2200 on 3-8		
Logger on Bottom	0500 on 3-9		
Max. Rec. Temp.	256°F		
Equip. Location	8021 N.I.		
Recorded By	AUSHERMAN		
Witnessed By Mr.	CLASSEN		

SCALE CHANGES		Type log		Depth		Scale Up Hole Scale Down	
RUN NO.	THREE	Service Order No.	34274	Fluid Level	FULL	Salinity, PPM CL.	2800
Ind. Panel	LEM-BB 56	Ind. Cartridge	IRC-QB 189	Ind. Sonde	IRS-VA 189	Speed - F.P.M.	80
Memorizer Panel		Sonic Panel	SLM-BB 134	Sonic Cartridge	SLC-CA 599		
		Sonic Cartridge	SLS-RA 2022	Oscil. Panel	SOM-AA 46		
		G.R. Panel		G.R. Cartridge			
		Caliper		TTR No.			
CALIBRATION DATA		SBR		Corrected - Depth		G.R. Background	
SBR		2.29				G.R. CPS	
		0.5				Time Constant	
LOGGING DATA		G.R. Scale				G.R. T.C.	

REMARKS:	
Run PARAMETERS: Δt ₁ = 55.6 Δt ₂ = 189 Cath = 100	
SP DRIFT CAUSED BY SURFACE CONDITIONS	

All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to Clause 4 of our General Terms and Conditions as set out in our current Price Schedule.	
Sonde Error	
SBR	0.5
LSS (check if run)

DT (US/F) 50.00	
ILD (OHMM) 2000.	
SFLC(OHMM) 2000.	