GL000572

PRELIMINARY DRAFT

Appendix F

WELL TEST RESULTS
(Mesquite Group, Inc.)

PRELIMINARY DRAFT

WELL TEST ENGINEERING REPORT ON THE STATE 2-14 WELL TEST

JUNE 1 - JUNE 25, 1988

SALTON SEA SCIENTIFIC DRILLING PROGRAM

for

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WELL TEST ENGINEERING REPORT ON THE
STATE 2-14 WELL TEST
JUNE 1 - JUNE 25, 1988
SALTON SEA SCIENTIFIC DRILLING PROGRAM

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ADDENDA

WELL TEST ENGINEERING REPORT ON THE STATE 2-14 WELL TEST JUNE 1 - JUNE 25, 1988 SALTON SEA SCIENTIFIC DRILLING PROGRAM

1.0 Summary and Results

A 19-day step-rate flow test of the State 2-14 well, the Salton Sea Scientific Drilling Program (SSSDP) well, was carried out from June 1 to June 20, 1988. In the first 13 days there were three rate steps of two to seven days' duration with flow rates from 121,000 lbm/hr to 410,000 lbm/hr. During the final six days there was an attempt to achieve stable operation at 750,000 lbm/hr, but operational problems and limitations of the brine injection system prevented extended operation at that rate. A flow rate of 768,000 lbm/hr was achieved on June 15, but this high flow rate was maintained for less than one hour before problems with the separator level control forced curtailment. Through the remaining five days, pump mechanical failures and persistent problems with cavitation in the brine pumps reduced the brine disposal capacity which became the governing factor on the well flow rate. Near the end of the test, it was possible to increase the flow rate and maintain an average of 425,000 lbm/hr for the last 25 hours.

For purposes of reservoir engineering analysis and obtaining representative chemical samples, the test was scheduled as a series of rate steps (constant-rate flow periods), with stepwise rate increases separating the periods. The planned duration of the periods, based on a conservative estimate of the time required to reach essentially stable operation, was originally seven days. Early in the test, when it was recognized that the well was characteristically very quick to stabilize, the plan was revised to make three-day rate steps with a six-day flow period at the end of the test.

The operational problems mentioned above resulted in some frequent flow rate changes and shortened rate steps in the last six days. However, most of the data acquired during that period are useful for defining the production characteristics of the well.

During the first rate step, the well was produced at an average of 121,000 lbm/hr. This was significantly lower than the planned initial rate of 200,000 to 250,000 lbm/hr, but this low flow rate was necessary because the test facility was not entirely complete and the residual brine had to be retained in the brine pond until the injection system was operational on June 4th. Budgetary and schedule constraints made it imperative that the test start as scheduled, and the injection system was completed while the test operations proceeded.

After the injection system was operational, the flow rate was held at about 113,000 lbm/hr average until June 8, a day after the separator was placed into service and direct flow measurements of the separated steam and brine were possible.

Late on June 8, the flow rate was increased to 250,000 lbm/hr and the succeeding rate steps were shortened. For the second rate step, the well was produced at an average rate of 228,000 lbm/hr for 3 1/2 days. Figure 1-1 is a plot of flow rate and wellhead conditions during the test.

Downhole temperature and pressure profile surveys were run on June 5, 12, 14 and 20. Pressure drawdown was recorded at the rate increases on June 12 and 14, and the pressure buildup was recorded for 44 hours after the final shut-in on June 20.

It was planned that after the flow test and pressure buildup period the well would be produced again at a high flow rate (>1,000,000 lbm/hr) directly to the brine pond. The purpose was to define a higher point on the deliverability curve, within the expected commercial operating range. However, the well would not flow spontaneously when the valves were opened, and two attempts to induce flow were unsuccessful. This was probably because the wellbore had cooled during the shut-in and not an indication of well damage or depletion. In the attempts to induce flow, common techniques of pressurizing the well with air at the wellhead and displacing brine from the wellbore with fresh water were employed. More effective methods, such as nitrogen lift or allowing the well to heat up for a few days with fresh water in the wellbore, would have involved more time and expense and were precluded by budget constraints.

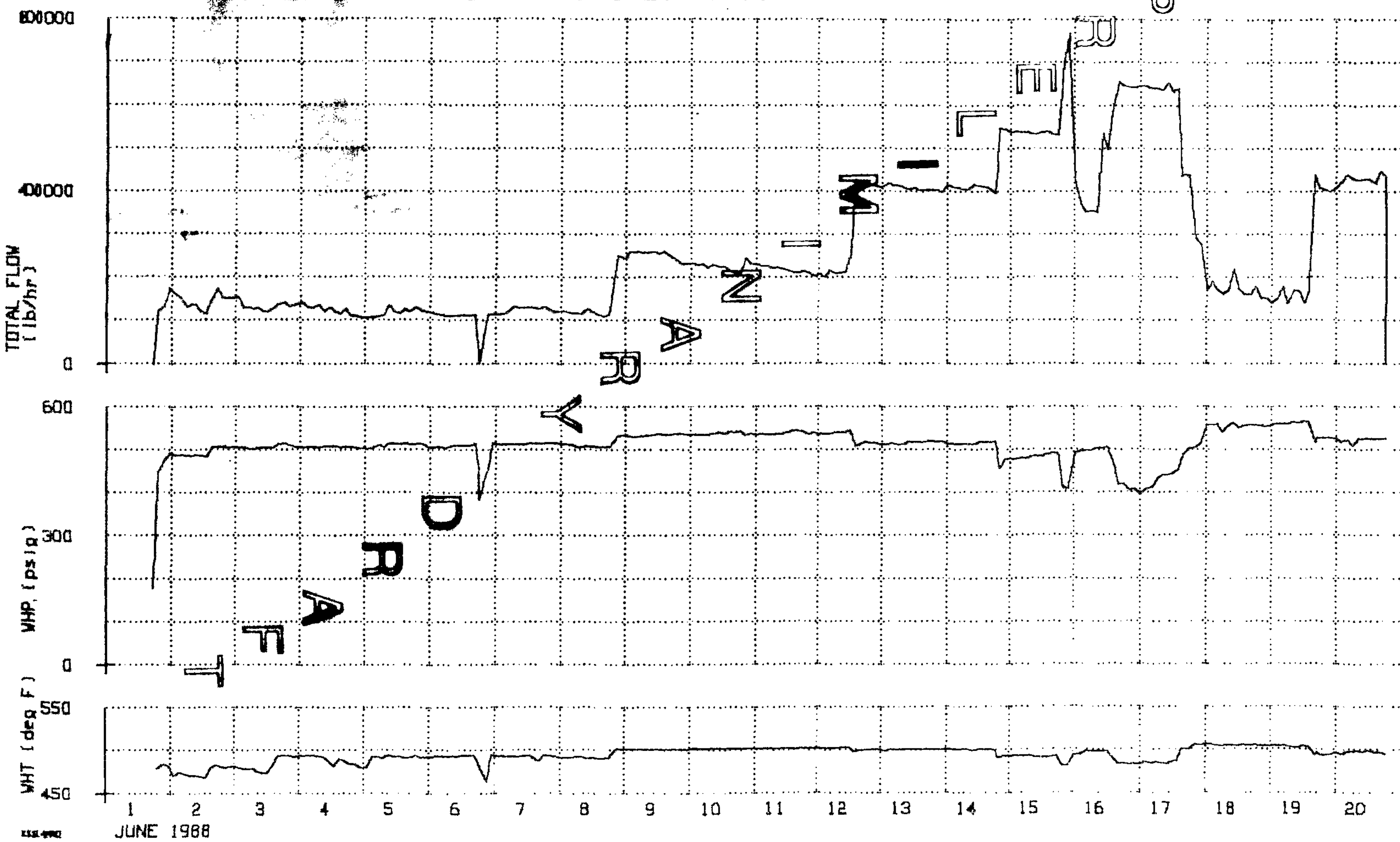
On August 8, 1988, 44 days after the end of testing operations, Kennecott attempted to run a casing caliper log in the State 2-14 well and discovered a constriction in the production casing near the surface. A caliper logging tool with clearance for a minimum hole diameter of 3 1/2-inches stopped in the constriction about 26 inches below the top of the 9 5/8-inch production casing. A television camera having a 2 1/8-inch outside diameter was run in the well a week later and passed through the constriction. The television image was impaired by turbidity in the water, but was reported to have shown a buildup of whitish scale (Tinsley, 1988). Further limited attempts to inspect and sample the suspected scale deposit were unsuccessful. As a result, the cause of the constriction has not been established with certainty. It is considered most likely that the constriction formed during the 19-day flow test, in which case it would have impaired the well's deliverability. Although the effect on well deliverability cannot be quantified with certainty, analysis of the deliverability data indicates that the constriction (assuming it existed at the time) did not seriously alter the test results. Also, it is virtually certain that it was not the cause of the well's failure to flow again spontaneously for a high-rate flow test.

The test data and analyses yielded the results summarized below:

a. Reservoir engineering analysis of the pressure build-up test indicates that the near-well reservoir has a transmissivity of about 233,600 md-ft and a skin factor of +23.1. This is indicative of a highly productive

FIGURE 1-1

WELL TEST OF STATE 2-14 JUNE 1-20 1988



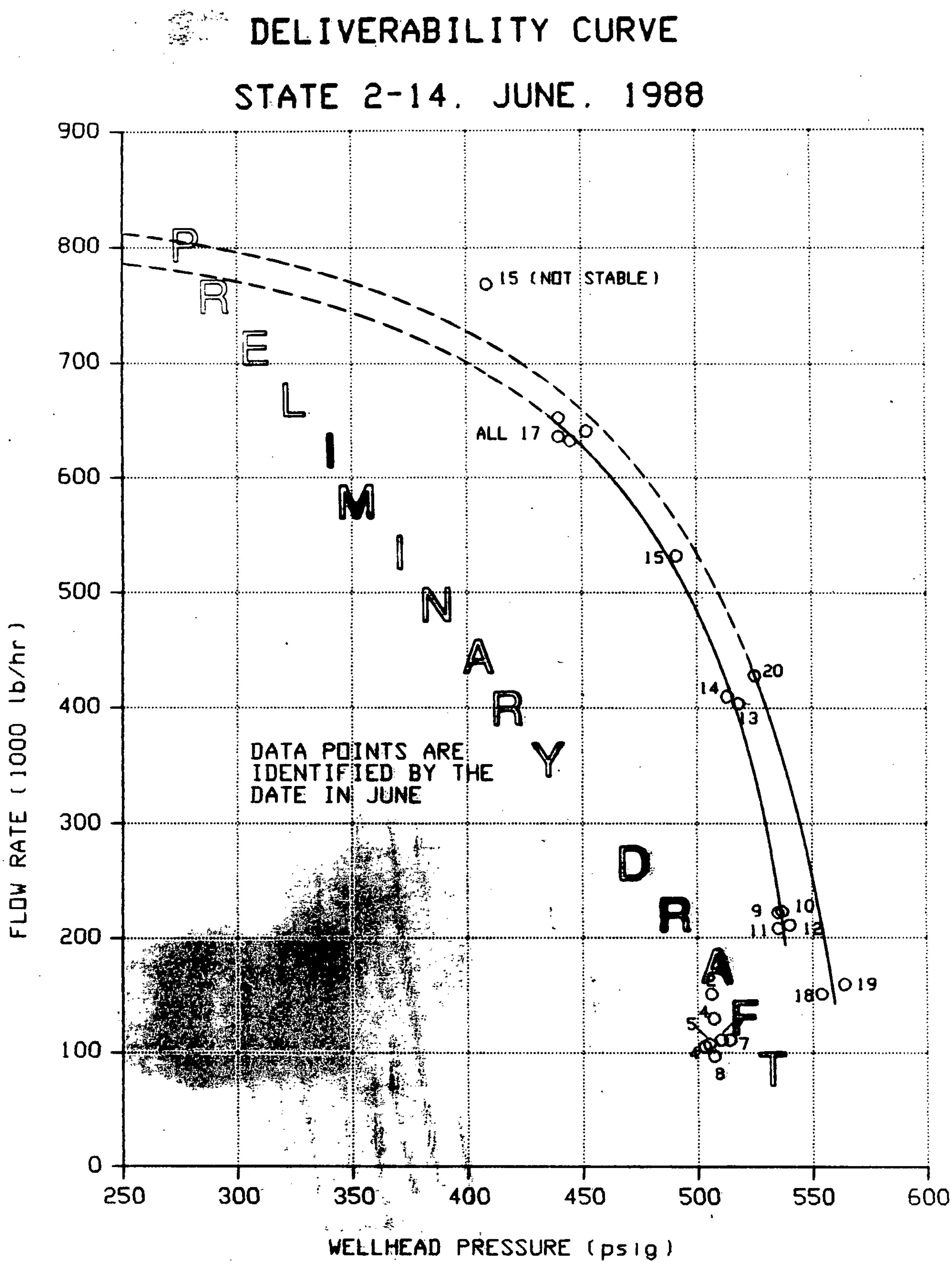
reservoir with substantial near-well impairment, probably caused by the drilling and workover operations.

b. The deliverability curve (Figure 1-2) and the inflow performance curve (Figure 1-3) defined by the rate steps show that the well has a high productivity and is capable of flow rates greater than 800,000 lbm/hr, at 250 psig wellhead pressure. At 800,000 lbm/hr, the well would yield approximately 12 Mwe in a dual-flash power plant.

c. Analysis of the June 5 temperature survey data indicates flash initiation at a depth of about 3,200 feet and a temperature of 570 ^{o}F. Based on analyses of brine samples collected from the flowline and thermodynamic flash calculations, the pre-flash brine TDS is about 247,000 mg/kg, and the steam flash to atmospheric pressure is about 26 percent.

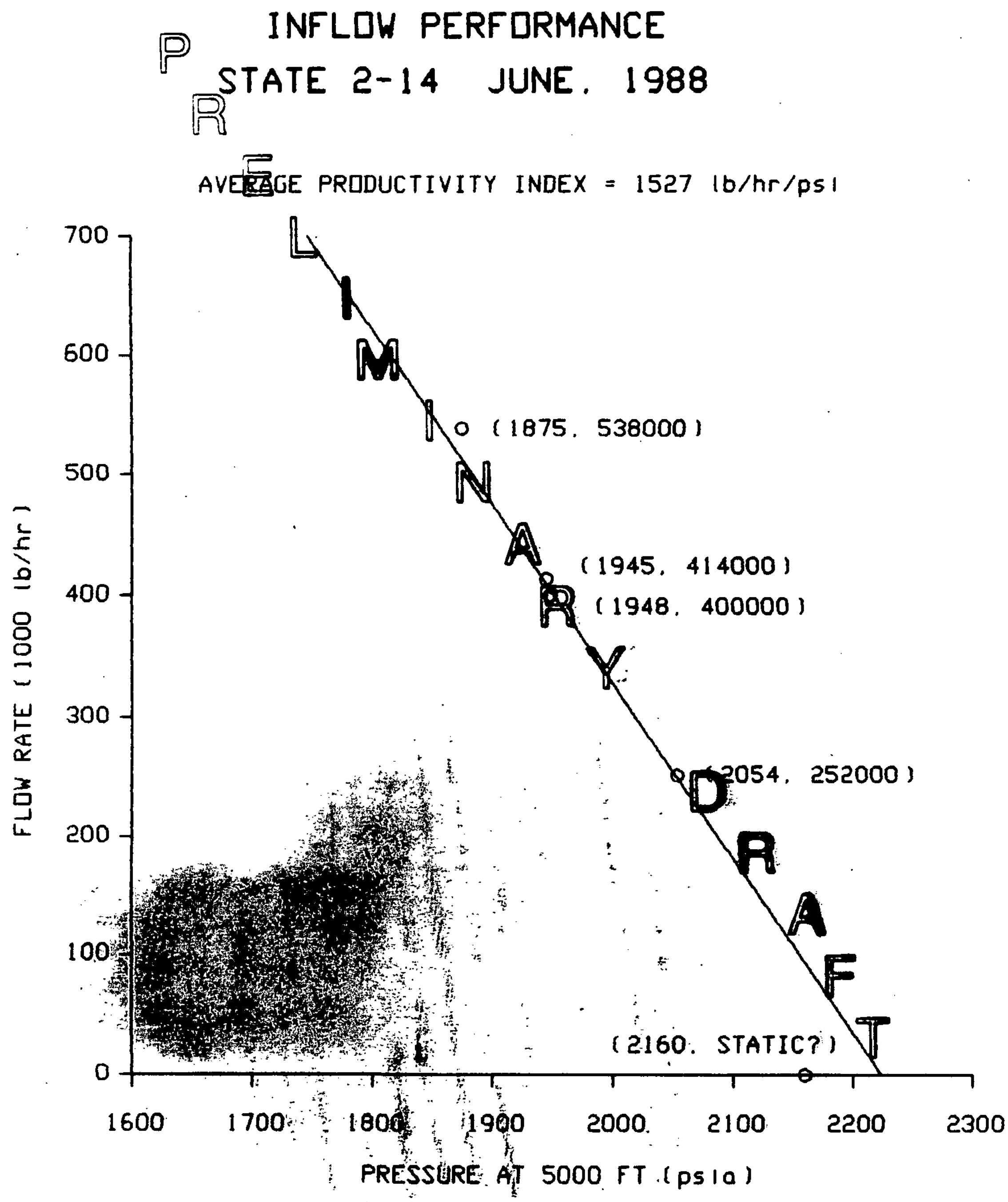
d. Well productivity improved during the course of the test. On at least two occasions (June 3 and 5) there were rapid increases of 7 and 12 psi in the wellhead pressure which were not associated with any rate change. This strongly suggests that the productivity suddenly improved. Another improvement is evident in Figure 1-2, where the deliverability for the last three days (June 18-20) is shown to be better than it was earlier in the test. Such increases in productivity are unusual and probably resulted from cleaning of blockages inside the wellbore or in nearby formation fractures by the brine flow.

FIGURE 1-2



KS214DC

FIGURE 1-3


INFLOW PERFORMANCE
STATE 2-14 JUNE, 1988
AVERAGE PRODUCTIVITY INDEX = 1527 lb/hr/psi
PRELIMINARY DRAFT
(1875, 538000)
(1945, 414000)
(1948, 400000)
(2054, 252000)
(2160, STATIC?)
FLOW RATE (1000 lb/hr)
0
100
200
300
400
500
600
700
PRESSURE AT 5000 FT (psia)
1600
1700
1800
1900
2000
2100
2200
2300

2.0 Introduction

The long-term flow test of the State 2-14 well was originally planned as a 30-day step-rate test with three rate steps scheduled as follows:

Step No.	Planned Duration (days)	Planned Flow Rate (lbm/hr total mass)
1	7	200,000 - 250,000
2	7	400,000 - 500,000
3	16	600,000 - 750,000

The plan is diagrammed in Figure 2-1.

This was the first long-term test of the well. Three previous tests, during and after drilling, were done with a very simple test facility and were limited to 54, 37, and 12 hours duration, respectively, by the storage capacity of the brine pond. To adequately test the well, a more elaborate test facility, such as the one used for this test, was required. It provides the necessary capability of brine injection and the advantages of steam/brine separation for separate metering and sampling of the two phases.

Experience in commercial geothermal operations in the Salton Sea field has shown that long-term production tests are plagued with operational problems caused by scale deposition and heavy precipitation of silica and salts from the brine. Handling and injecting the brine and keeping the instrumentation in operation can be particularly difficult. Many features of the flow test facility and test plan were designed to circumvent these problems and allow stable operation of the well through the planned schedule of rate steps. At best, long-term tests with temporary flow test facilities are troublesome; invariably there are deviations from the test plan and uncertainties in the data caused by operational problems.

The objectives of the test were defined as follows:

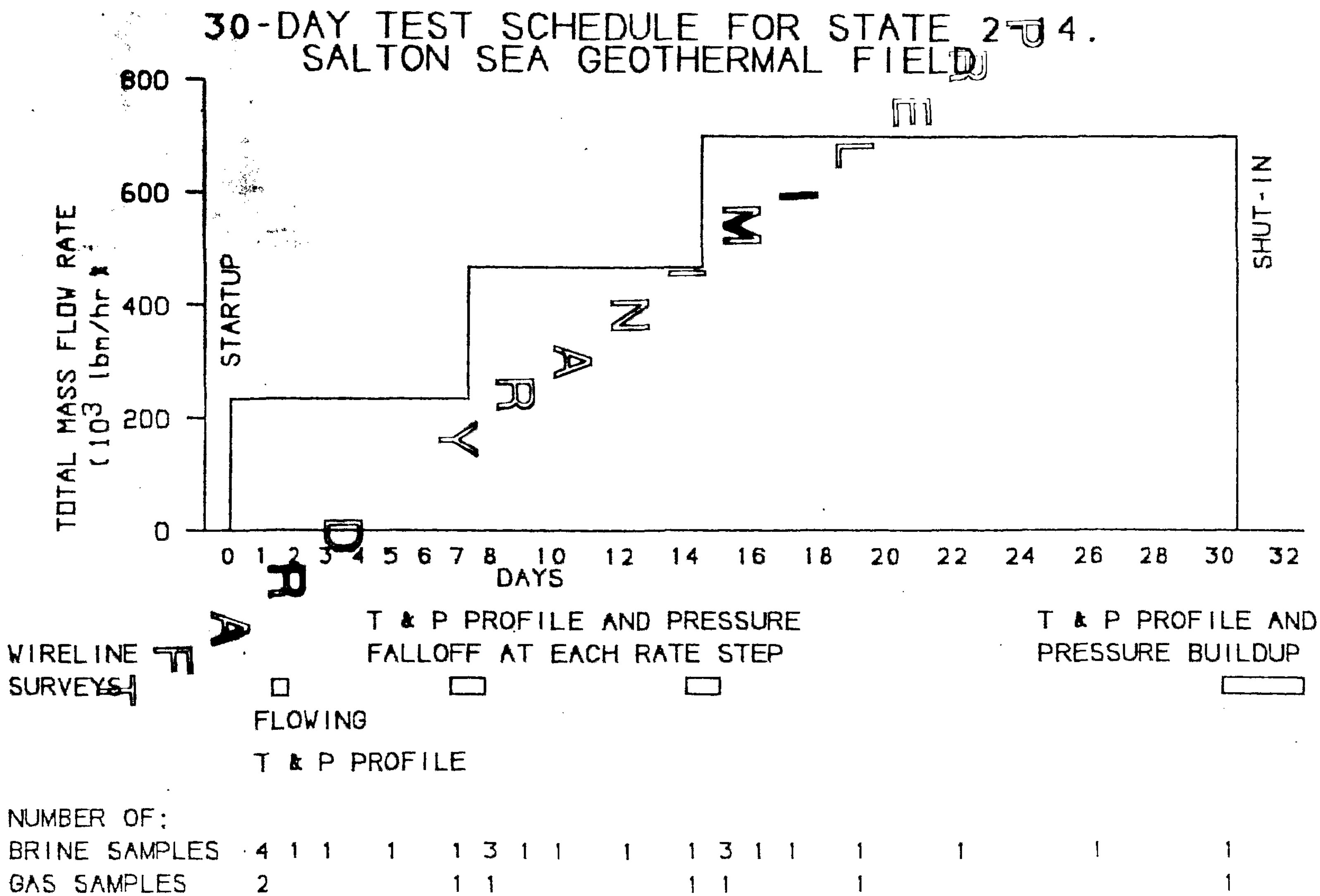
a. Demonstrate the long-term producibility of the well and reservoir.

b. Obtain the necessary production data and downhole measurements to perform a reservoir engineering analysis of the well's performance and the near-well reservoir properties.

c. Obtain samples of the brine, steam and noncondensible gases for chemical analyses necessary to characterize the reservoir fluid and calculate its physical and thermodynamic properties. Analyze for changes in composition associated with rate changes.

d. Measure the preflash temperature of the brine, and obtain other data necessary to calculate the enthalpy of the produced fluid and the rate of energy production.

FIGURE 2-1


30-DAY TEST SCHEDULE FOR STATE 2-14.
SALTON SEA GEOTHERMAL FIELD
TOTAL MASS FLOW RATE
(10^3 lbm/hr)
800
600
400
200
0
STARTUP
SHUT-IN
0 1 2 3 4 5 6 7 8 10 12 14 16 18 20 22 24 26 28 30 32
DAYS
WIRELINE SURVEYS
FLOWING T & P PROFILE
T & P PROFILE AND PRESSURE FALLOFF AT EACH RATE STEP
T & P PROFILE AND PRESSURE BUILDUP
NUMBER OF:
BRINE SAMPLES 4 1 1 1 1 3 1 1 1 1 3 1 1 1 1 1 1
GAS SAMPLES 2 1 1 1 1 1 1

e. Provide an opportunity for other experimenters to perform tests in conjunction with the flow test.

It was not within the scope of the test to measure well-to-well pressure response, calculate areal reservoir properties or estimate reservoir size.

The step-rate test is a standard reservoir engineering method of obtaining the downhole transient pressure response data for determination of reservoir properties and a deliverability curve for the well, (i.e., a graph of production rate vs. wellhead pressure). The planned duration of each rate period was estimated to be adequate for the well to reach essentially stable operation with respect to flow rate, pressure, and chemistry at each step. The schedule of increasing rates also made the operation of the flow test facility easier by allowing a step-wise approach to the higher rates.

A total of five downhole pressure and temperature surveys were planned to acquire data for reservoir engineering analysis and characterization of the brine before flash. Production logs, which might normally be run to delineate and quantify zones of inflow, were not planned because the mechanical condition of the well is such that logging tools should not be run deeper than 5,500 feet.

The planned flow rate and duration of each step were revised during the test on the basis of a number of factors, including well deliverability, time required for the well to stabilize after each rate change, test facility performance, and injection system capacity. The order and magnitudes of the rate steps were chosen to provide a broad range of rates for reservoir engineering analyses, to allow for shakedown of the test facilities, and to permit preliminary evaluation of the well at a low flow rate.

The first flow rate period was for the planned 7-day duration, but at less than the planned flow rate. By the eighth day of the test, several factors had come to light or had been confirmed, influencing plans for the remainder of the test. These factors were:

a. The remaining budget would not support a full 30-day test.

b. The State 2-14 well was confirmed to be a very high productivity well, and its flow conditions stabilized within hours after a rate change. Therefore, for purposes of reservoir engineering and defining the well's deliverability, shorter duration flow steps would suffice.

c. The well was clearly capable of very high flow rates, and to define its deliverability in a useful range of flow rates, three additional rate steps (for a total of four) were considered necessary. The total time for the series of rate steps was reduced to 19 days, from the original 30-day plan.

d. The maximum flow rate of the well would be constrained by the test facility; therefore, the full flow rate potential of the well should be determined by a maximum rate flow directly to the brine pond. To accomplish this without compromising the planned reservoir and well performance analyses, the test at maximum flow rate was scheduled as a separate test following the planned series of rate steps and shut-in period. Because the brine production would exceed injection capacity, this test was to be of only a few hours duration, as determined by the maximum injection rate and brine pond capacity.

The revised test schedule is shown below. The second rate step was underway at the time of this revision.

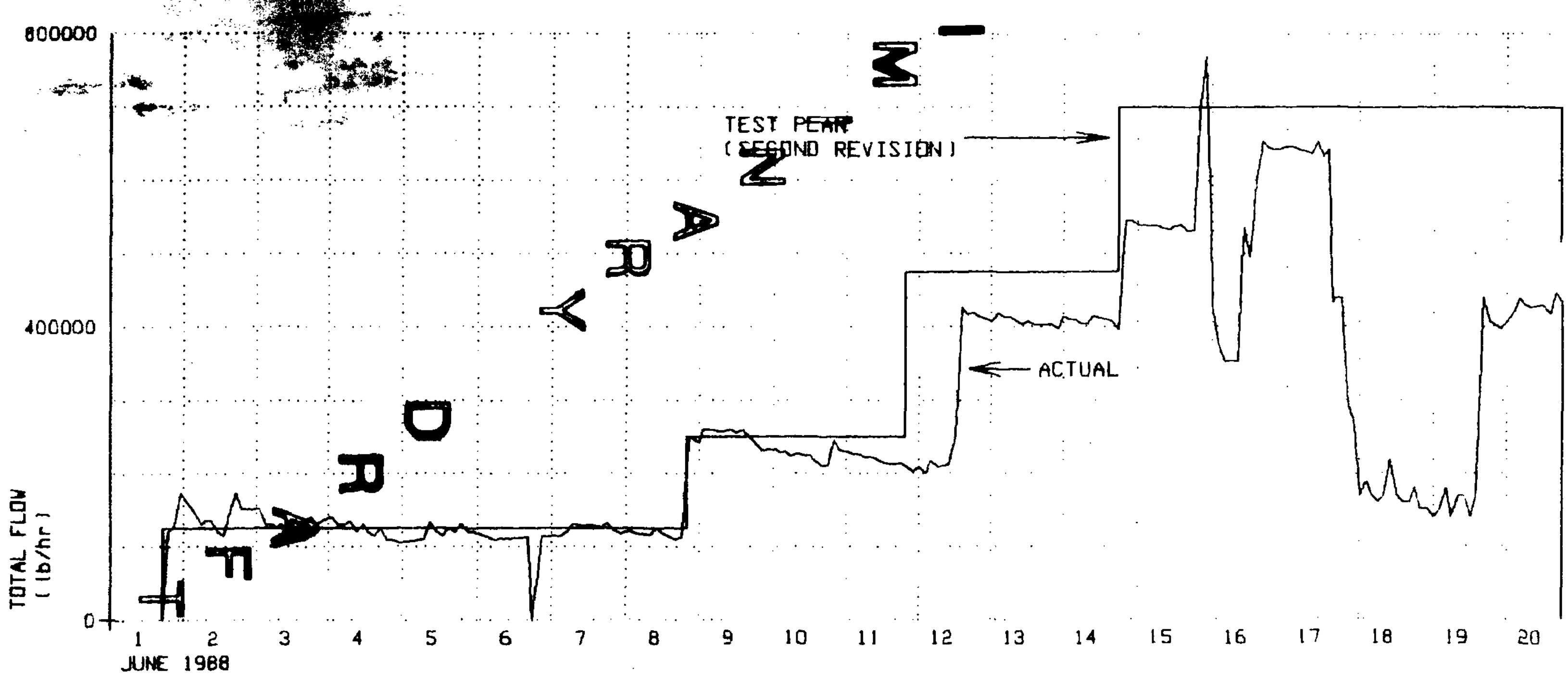
Step No.	Duration (days)	Flow Rate (lbm/hr total mass)	Start Date	End Date
1	7	125,000	6/1	6/8
2	3	250,000	6/8	6/11
3	3	[illegible]50,000 - 500,000	6/11	6/14
4	3	650,000 - 750,000	6/14	6/17
-	2	Shut in to monitor pressure buildup	6/17	6/19
-	<1	Maximum rate flow directly to pit	6/20	6/20

Soon after the above revision, the test funding was increased and the final rate step was extended another three days to a shut-in on June 20, 1988. This was the second and last revision of the test plan. It is shown graphically in Figure 2-2, superimposed on the actual flow rate history.

The detailed discussion which follows describes the test facilities and operations, documents the production, injection, and downhole survey data, and presents the basic reservoir engineering analyses.

FIGURE 2-2

REVISED TEST PLAN VS. ACTUAL FLOW RATE HISTORY
STATE 2-14, JUNE 1-20, 1988



3.0 Description of Testing

This section describes features of the test facility and test operations pertinent to acquisition of data for reservoir engineering analysis.

3.1 Test Facility

The test facility is shown schematically in Figure 3-1. Following the flow path through the facility, the components and operation are as follows:

- A 10-inch flowline from the wellhead was connected to a gate valve used as a manual throttling valve at the inlet to the facility. This valve was used to control the flow rate of the well.

- The two-phase brine/steam flow was normally routed through the separator. However, manifolding was provided to allow diversion directly through a blooie line to the brine pond or through either or both of the atmospheric separators, i.e., the atmospheric flash tank and the vent silencer.

- During normal operation, the separator was typically operated at about 200 psig. The nominal ratings of the separator were 750,000 lbm/hr and 500 psig. Steam from the separator flowed through an orifice meter and a steam back-pressure control valve and was vented to atmosphere in the vent silencer.

- Brine from the separator was routed through either of two parallel piping runs, each with an orifice flow meter, a liquid level control valve to maintain separator level, and a fixed throttling orifice to reduce the pressure drop across the control valve. Leg A had an orifice plate for brine rates up to about 400,000 lbm/hr, and Leg B was set up for brine rates up to about 900,000 lbm/hr.

- Downstream of the fixed throttling orifice, the brine pressure dropped to near atmospheric, resulting in a secondary flash. The two-phase mixture flowed to the atmospheric flash tank in which the steam was vented to atmosphere and the brine flowed by gravity into a weirbox. Steam vented in the atmospheric flash tank could not be metered, but rates could be calculated on the basis of the theoretical flash to atmosphere from separator conditions.

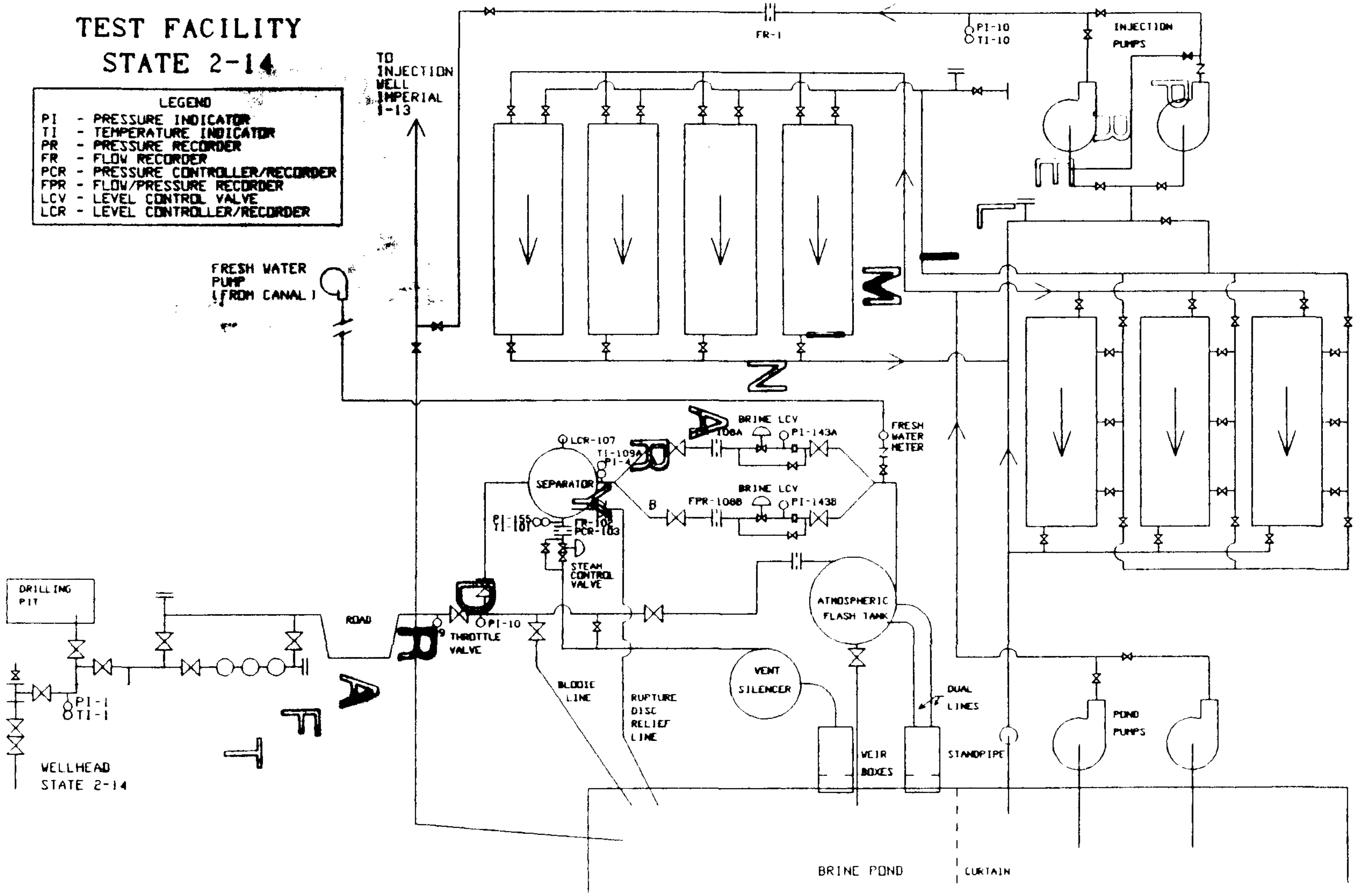
- Fresh water from an irrigation canal was metered and injected upstream of the atmospheric flash tank to prevent salt precipitation.

- Flow through the weirbox was discharged to the brine pond. The weir served as a redundant measure of the flow rate, after corrections for dilution water flow and steam flash.

- The brine pond provided residence time for precipitation and settling.

FIGURE 3-1

TEST FACILITY
STATE 2-14



- Two pumps transferred brine from the brine pond through seven 500-barrel steel tanks piped in parallel. It was intended that additional settling of solids take place in these tanks. Three of the tanks were originally designed as gravity sand filters, but they were used only as settling tanks for this test.

- Brine was pumped from the tanks through an orifice meter run and approximately 3/8 mile of 8-inch pipeline to the Imperial 1-13 well, which served as the injector. The brine was not filtered before injection because: (1) budget limitations precluded installation of the filter media and piping and (2) the risk of plugging the injection well was recognized and accepted before the test.

Table 3-1 is a list of the test instrumentation. The instrument identification numbers in the list and on the data sheets correspond to the identification tags that were on the instruments. The identification numbers PI-10 and TI-10 were inadvertently used in two places, but the gauges were clearly identified by their locations, and it was not a source of confusion.

TABLE 3-1

INSTRUMENTATION FOR 19-DAY TEST OF STATE 2-14

Location	Instrument No.	Description
Wellhead expansion spool	PI-0	0-1000 psi pressure gauge, liquid-filled
Flowline downstream of wellhead	PR-1	Pressure recorder 0-600 psi
	PI-1	0-600 psi pressure gauge, liquid-filled
	TI-1	150°-750°F dial thermometer
Throttling valve on east side of road		
Upstream	PI-9	0-600 psi pressure gauge, liquid-filled
	TI-9	50-500°F dial thermometer (not used)
Downstream	PI-10	0-600 psi pressure gauge, liquid-filled
	TI-10	50-500°F dial thermometer (not used)
Separator level	LCR-107	Circular chart recorder
Separator, brine outlet	PI-4	0-600 psi pressure gauge
	TI-109A	50-500°F dial thermometer
Brine orifice run		
Brine leg A	FPR-108A	Circular chart recorder, 0-100 in. water differential (red pen) and 0-500 psi static range (blue pen)
Brine leg B	FPR-108B	Circular chart recorder, 0-100 in. water differential (red pen) and 0-500 psi static range (blue pen)
Downstream of L.C.V.		
Brine leg A	PI-143A	0-400 psi pressure gauge, liquid-filled
Brine leg B	PI-143B	0-400 psi pressure gauge, liquid-filled

Location	Instrument No.	Description
Steam outlet from separator	PI-155	0-600 psi pressure gauge
	PCR-103	Circular chart recorder/controller 0-600 psi
	TI-101	50-500°F dial thermometer
	FR-102	Circular chart recorder, 0-200 in. water differential range (Changed to 0-300 in. water on 6/15/88.)
Weir box at outlet of atmospheric flash tank	Weir Level	Sight gauge
Brine pond	Pond Level	Sight gauge
Fresh water supply	F.W. meter	Totalizing water meter
East Brine tank	Brine Tank Level	Sight gauge
Injection pump discharge	PI-10	0-400 psi pressure gauge
Upstream of injection orifice run	TI-10	0-250°F dial thermometer
Injection orifice run	FR-1	Circular chart recorder, 0-1[illegible] in. water differential
Injection wellhead	PI-141	0-400 psi pressure gauge
	TI-140	0-250°F dial thermometer

3.2 Test Operations and Data Acquisition

3.2.1 Overview

The State 2-14 well was flow tested in a series of rate steps for 19 days beginning June 1, 1988, and finishing June 20, 1988. The flow rate history is illustrated in Figure 1-1, and a listing of the test data is given in Addendum A (Table A-1).

The test was planned and conducted as a step-rate test, but parts of it deviated from the ideal of long, constant-rate flow periods. Although the well itself showed no appreciable pressure decline, there was a tendency for the flow rate to drift downward, probably because of scale deposition in the throttle valve. Occasional adjustments of the throttle valve were required to restore the desired rate. This is a common occurrence in Salton Sea field testing and did not affect the validity of the test.

The only serious problems with maintaining desired flow rates occurred during the last five days when high flow rates were attempted and the brine injection system could not keep up. This introduced some uncertainty to the classical semi-log interpretation of the pressure buildup data, which assumes a stable flow rate prior to shut-in. However, multiple regression analysis using a computer code which could accomodate the variable rate history did not improve the interpretation (discussed later in Section 4.3.2), indicating that other uncertainties in the data and assumed reservoir model were dominant.

The highest flow rate of 768,000 lbm/hr was maintained for less than one hour because of a separator control problem. Therefore, the deliverability data at that rate do not represent a fully stabilized condition. However, stable flow was achieved at rates up to 640,000 lbm/hr. As discussed previously, the attempts on June 23 and 24 to flow the well for a short, high-rate test were unsuccessful.

The separator was operated near 200 psig throughout most of the test. This pressure was chosen based on consideration of the following factors:

a. The brine is known to deposit silica scale more rapidly when it flashes to low pressures. Because rapid scale buildup in the brine meter runs and level control valves should be avoided, an operating separator pressure of about 200 psig or above was specified. This choice was based on observations of scaling behavior on previous SSSDP tests and other Salton Sea field flow tests.

b. Operating at higher pressures would result in a greater fraction of the steam flow being released in the secondary flash to the atmospheric flash tank. This could result in carryover from the atmospheric flash tank at high flow rates, and would result in less of the steam flow being metered.

As shown in Figure 1-1, the well was initially produced at about 121,000 lbm/hr. This was significantly lower than the planned initial rate of 200,000 to 250,000 lbm/hr. This lower flow rate was desirable because produced fluid had to be retained in the brine pond until the injection system was completed. Ideally, test startup would have awaited completion of the injection system, but budgetary and schedule constraints made it imperative that the test start on June 1 as scheduled.

Once the injection system was operational, the production flow rate was held at about 113,000 lbm/hr average until June 8, a day after the separator was placed into service and direct flow measurements of the separated steam and brine were possible.

Late on June 8, the flow rate was increased to 250,000 lbm/hr, and the succeeding rate steps were shortened as discussed in Section 2.0. During this second rate step the well produced at and average rate of 228,000 lbm/hr for 3 1/2 days. For the third rate step it produced at an average rate of 410,000 lbm/hr for slightly more than two days and reached stable flow conditions. During the last six days of flow there were four periods of about one day's duration each, during which the well's flow rate was maintained approximately constant. Although the planned six-day final rate step was not achieved, the four one-day flow periods provided deliverability data at flow rates up to 640,000 lbm/hr.

After the flow test and pressure buildup, an unsuccessful attempt was made to produce the well at a high flow rate (>1,000,000 lbm/hr) directly to the brine pond. The purpose was to define a higher point on the deliverability curve, within the expected commercial operating range. However, when the valves were opened the well would not flow spontaneously. This was probably because the wellbore had cooled during the shut-in period, with a resulting increase in brine density in the wellbore. It is not an indication that the well was damaged or depleted. There were two additional attempts on June 23 and 24 to induce flow, but neither was successful. First the well was pressurized at the wellhead with compressed air, the pressure was held for two hours, and then the valves were opened. In the second attempt, fresh water was injected to displace the denser brine from the wellbore, the well was allowed to heat up for nine hours, and the valves were opened again. On each attempt the well flowed briefly and died without achieving flashing flow. These methods of inducing flow are common techniques and were chosen to minimize costs. More effective methods, such as nitrogen lift or allowing the well to stand for a few days with fresh water in the wellbore, were ruled out by time and budget constraints.

3.2.2 Data Acquisition

Readings from the instruments listed in Table 3-1 were recorded manually on data forms every two hours, or more frequently when conditions were changing. The data sheets are included in Addendum B. Data from those forms were manually entered into a computer file, which is listed as the "Raw Data" in Addendum A (Table A-2). Many of the readings were of value only for operating information, but certain parameters, listed below, were important to the interpretation and analyses of the test results.

- Wellhead pressure, measured on flowline near wellhead (State 2-14)
- Wellhead temperature measured on flowline near wellhead (State 2-14)
- Steam flow from the separator
- Steam pressure at the separator outlet
- Steam temperature at the separator outlet
- Brine flow from the separator
- Brine temperature at the separator outlet
- Weirbox sight gauge
- Injection flow rate (to Imperial 1-13)
- Injection flowline pressure (at Imperial 1-13)

Calibration checks were performed on these instruments, as discussed in Section 3.3.

Downhole temperature and pressure profile surveys were run on June 5, 12, 14 and 20. Pressure drawdown was recorded at the rate increases on June 12 and 14, and the pressure buildup was recorded for 44 hours after the shut-in on June 20.

3.2.3 Test Operations Summary

The test operations are summarized below. The more detailed Daily Test Operations Reports are in Addendum C.

June 1

Well had been shut since April, 1988, and had 183 psig pressure on the wellhead. (Wellbore was full of fresh water which had been injected to cool the well for logging in April.) Opened well at 17:30 and began flow. As flow became stronger, cut well back to prevent fluid discharge from blooie line damaging the pit divider curtain. After well was on for approximately 25 minutes, switched well flow through atmospheric flash tank (AFT) to measure brine flow rate in weirbox. Rate reached 478,000 lbm/hr brine (after flash to atmosphere) at 18:00 and then was throttled back to 90,000 lbm/hr at 19:05. Well flow gradually increased without any valve adjustment to 121,000 lbm/hr brine by midnight.

Flowing well through AFT because separator and brine handling portions of the facility are not yet ready.

June 2, 3, & 4

Continued to flow well at between 90,000 and 120,000 lbm/hr brine through the AFT and into the brine pond. Workers continuing to assemble facility, i.e., the brine pumps and the injection system pumps. Some work also done on the separator and fresh water dilution system.

Operations problems during this period consisted mainly of a gradual flow rate decline, probably due to scaling or plugging of the throttle valve. The flow rate decline was corrected by cycling the valve or by opening it slightly. Other problems included a discrepancy in the two wellhead thermometers. Investigation revealed that one thermowell extended farther into the flowstream than the other. By using the deeper thermowell and insulating the pipe surrounding it, readings became consistent. Check of thermometer at this point with an RTD showed dial thermometer reading 2°F low. Salt formed in weirbox and on weirplate, making readings difficult.

On June 4 the injection system was completed and injection of fluid from the brine pond and storage tanks into Imperial 1-13 well began. On June 4 the fresh water diluent system was complete enough to allow a water hose to be placed into the weirbox. This prevented additional salt buildup and dissolved the already deposited salt in the weirbox and the lines from the AFT.

<u>June 5, 6, & 7</u>

Continued to flow well at about 90,000 lbm/hr brine rate. On June 5, Pruett ran a pressure and temperature survey. Survey time was shortened due to scale buildup on capillary tube and concern about not being able to get back out of the well with tools. Switched flow through separator, but operated at atmospheric pressure. Modified weirbox to prevent leakage around the sides and bottom of weirplate, and added an outfall trough to extend the outfall farther out in the brine and to prevent berm erosion.

At 17:30 on June 6, a small leak developed on the main flowline just downstream of the throttle valve. The well was shut in, and a patch was welded over the leak area. Flow resumed at 20:28.

On June 7, pressured the separator to 200 psig and placed it in service. Metered brine and steam through orifice meters for the first time, although steam meter operation was suspect. It was found that the pressure taps were plugged and the recorder was not zeroed. These problems were corrected.

<u>June 8</u>

Continued to flow well at approximately 96,000 lbm/hr post-flash brine rate, or about 117,000 lbm/hr total mass flow until 19:55. Increased rate at 19:55 to 250,000 lbm/hr total mass flow. Separator operation satisfactory except for a 40-minute period during which the controls had to be operated manually because the instrument air compressor was down.

<u>June 9</u>

Continued to flow well at average rate of 250,000 lbm/hr total mass flow until 19:20, when rate was curtailed due to salt buildup in the outlet lines of the AFT. This buildup restricted the brine flow from the AFT and caused it to fill up and start overflowing. Added fresh water upstream of AFT, and it dissolved the salt. At 20:05 reopened throttle valve, and by 21:30, operations were back to normal except that flow rate was a little lower at 232,500 lbm/hr total mass flow.

June 10

Flowed at average rate of 225,000 lbm/hr, although flow rate gradually declined, apparently due to plugging of throttle valve. Actuated throttle valve periodically to dislodge the scale and allow plugging particles to pass through the valve. After actuation, the rate would increase to nearly 240,000 lbm/hr. Recalibrated all chart recorders.

June 11

Flow rate gradually declined from 230,000 lbm/hr to 208,500 lbm/hr during day due to scale buildup in throttle valve or flowline. Attempted to run pressure and temperature survey prior to a planned rate increase, but pressure sensing tubing (capillary tubing) plugged. Aborted survey and postponed rate increase.

June 12

Began day with flow rate at 208,400 lbm/hr and declining. Made throttle valve adjustment at 02:48 and increased flow rate to 216,000 lbm/hr, but it continued to decline. By 10:00, flow rate had fallen back to 211,000 lbm/hr. Ran temperature and pressure survey beginning at 09:55. Hung capillary tubing at 5,000 feet at 12:12, and by 12:35 pressure had stabilized. During the period 13:14-13:22, opened throttle valve and increased flow rate up to 415,000 lbm/hr. Flow rate immediately started a gradual decline, reaching 408,200 lbm/hr by the end of the day.

June 13

At 00:22 increased flow rate to 420,000 lbm/hr. Rate promptly resumed its decline, and by 22:00 it was down to 398,000 lbm/hr. During the gradual flow rate decline, wellhead pressure and downhole pressure at 5,000 feet, as measured by the capillary tubing transducer, were increasing. This indicated that the well was not drawing down, as a rate decline might normally suggest. Increased flow rate again at 22:25. At midnight the flow rate was 414,800 lbm/hr.

Pulled capillary tubing and temperature instruments from the well.

June 14

Maintained flow rate at between 404,000 lbm/hr and

415,500 lbm/hr by adjusting throttle valve to compensate for scale buildup.

Ran temperature and pressure survey on capillary tubing prior to scheduled rate change. Temperature survey complete and capillary tube chamber at previous setting depth of 5,000 feet at 18:01. Increased flow rate to 545,000 lbm/hr between 19:37 and 20:00. Also increased separator pressure from normal 200 psig to 250 psig in order to keep steam flow meter reading within range.

By 24:00 flow rate had declined to 538,000 lbm/hr

<u>June 15</u>

Flowed well between 532,000 and 538,600 lbm/hr until 19:25 when the rate was increased. An instrument technician increased the steam meter range by changing the differential spring and recalibrating the meter. This range change allowed the separator pressure to be reduced to about 200 psi and the steam flow to remain within the chart range.

Pulled capillary tubing and temperature instrument from well.

Experienced difficulty in transferring fluid from the brine pond into the settling tanks and from the tanks into the injection well at adequate rates to keep up with the increased well flow rate. At 20:02, the flow rate was 696,000 lbm/hr. By 20:30, it was 768,000 lbm/hr, but operational problems with the separator level controller and control valve made it necessary to throttle back. Day ended with flow rate at 425,000 lbm/hr.

<u>June 16</u>

Rate gradually declined to 352,000 lbm/hr until 04:00 and remained near that rate until 08:40 when it was increased to 540,000 lbm/hr. Around 12:00, the separator level control system was placed back in operation.

From 13:38 to 15:00 gradually increased flow rate up to 644,500 lbm/hr and kept it there until end of day.

Continued to have problems with brine pond-to-tank transfer pumps, and the level in brine pond continued to rise.

<u>June 17</u>

Day began with well flowing 645,800 lbm/hr. By 14:00 flow rate had declined slightly to 641,200 lbm/hr. At 14:13 rate was cut to 435,000 lbm/hr due to problems with the brine pond pumps and a high level in the brine pond. The flow rate was further reduced in incremental steps, and by 22:50, it was down to 170,200 lbm/hr. Pumps remained a problem. Experienced operational difficulties with both the pond-to-tank pumps and injection pumps. Injection well injectivity appears to have declined approximately 30 percent during the last two days.

June 18

Flowed well at between 160,000 and 180,000 lbm/hr all day while trying to solve injection pump problems. Made several modifications without positive result. Also started having problems with Leg B brine meter.

June 19

Well flowed an average 160,000 lbm/hr from start of day until 15:40. During the period between 15:40 and 16:30 gradually increased flow rate to 425,000 lbm/hr, but by midnight it had gradually declined to 407,000 lbm/hr.

Problems with injection pumps continued after repair and reconfiguration. Pumps pulled pond level down below solids level and transferred some sludge into the tanks and probably into the injection well also. Injectivity appears to have declined by about 20 percent today.

June 20

Increased well flow rate to 426,000 lbm/hr shortly after start of day and kept it near that rate until well was shut in at 17:54. Prior to shut-in, ran capillary tubing and temperature instrument in the well and hung at 5,000 feet. Downhole pressure at 472,000 lbm/hr flow rate was 1,965.45 psia; and 33 minutes after shut-in of well, it reached a high of 2,128.2 psia.

Injectivity of injection well continued to decline.

June 21

Well shut-in. Capillary tube pressure declined to 2,125.59 psia at 08:00, down 2.6 psi from the high of 2,128.2 psia. Purged capillary tube; verified that reading was correct and that there was not a leak in the tube or chamber. Suspect that cooling of Helium in capillary tube increased density by 2.6 psi or more, accounting for decline at surface readout.

Added and mixed 660 gallons of 12N HCl to brine tanks to dissolve some of the solids.

Removed instrumentation from steam and brine lines. Moved static pressure recorder from separator to injection wellhead for injection falloff test.

June 22

In State 2-14, capillary tube pressure reading 2,123.47 psia at 08:00, down 2.12 psi from yesterday. Injected acidified fluid from tanks into Imperial 1-13.

June 23

Pulled capillary tubing, chamber and temperature instruments from well. Ran in hole with fluid sampler on braided wireline at 2,500 feet. Opened well valve and attempted to flow well. Well bled off trapped gas, flowed a small amount of brine and died. Ran in hole with sampler to 5,000 feet and pulled out of hole.

Depressed well fluid level with air by pressuring casing to 105 psig at the wellhead. Opened flowline valve, blew off gas, would not flow. Pumped 11,000 gallons of fresh water into well. Will allow water to heat up in wellbore and try again tomorrow.

Injected canal water from tanks into Imperial 1-13.

June 24

At 07:05, pressure on wellhead was 45 psig. Added additional pressure by pressuring with air to 110 psig. Opened valve, well flowed for a short time then died.

Injected fresh water from tanks into Imperial 1-13. Rigged up wireline unit and ran in hole to 1,300 feet (ground level reference) with pressure and temperature tools and hung for injection falloff survey. Injected into well for approximately 2 hours and 15 minutes at a rate of approximately 190,000 lbm/hr.

June 25

Pulled tools from Imperial 1-13. Reset tools and ran traverse survey at 20 ft/min from surface to 1,470 feet, where tools stopped.

Put 6,060 gallons of fresh water into State 2-14, then shut in.

3.3 Data Quality Control

The following steps were taken to assure data quality:

a. All flow and pressure recorders were calibrated by Instrument Specialists Company before the test and at times during the test as shown in Table 3-2.

b. All pressure gauges were calibrated before the test. The gauges at the wellhead (PI-1) and steam discharge from the separator (PI-155) were checked against a test gauge at operating conditions during the test. The test gauge was an Ashcroft 0-600 psi gauge with 0.25 percent accuracy. The check readings are documented in Table 3-3, and pressures listed in the Flow Test Data table (Table A-1) are adjusted accordingly.

TABLE 3-2

METER CALIBRATIONS

DATE	Wellhead Pressure PR-1	Steam Flow FR-102	Steam Pressure PCR-103	Separator Level LCR-107	Brine Leg "A" FPR-108A	Brine Leg "B" FPR-108B	Injection Flow FR-1	COMMENTS
May '88	X	X	X	X	X	X	X	Before start of test
6/10/88		X			X	X	X	
6/15/88		X						Changed range spring

TABLE 3-3

TEMPERATURE AND PRESSURE INSTRUMENT CHECKS

	Operating Instruments			Test Instruments			
DATE	Instrument Number	Press. (PSIG)	Temp. (°F)	Test Gauge (PSIG)	RTD (°F)	ASTM Therm. (°F)	Correction
6/3	TI-1		490		492		+2°F
6/7	TI-101		410			400	-10°F
6/10	TI-101		414			402	-12°F
6/10	TI-109A		409			409	0
6/11	PI-1	540-545		535-540			-5 psi
6/11	PI-155	207		208			+1 psi

c. The bimetal dial thermometers could not be calibrated in the field before the test. However, several check readings on the critical parameters were taken at operating conditions during the test, and the gauge readings were adjusted accordingly. There were two instruments used as standards. One was a Wahl platinum RTD digital thermometer, and the other was an ASTM mercury thermometer. The check readings are documented in Table 3-3.

d. Weirbox sight gauge readings were taken at normal data recording intervals. Although the weir is inherently less accurate than the orifice meters, it was potentially important as a redundant measurement of the brine flow rate.

Early in the test (until June 7), when the separator was not in operation, the weir provided the primary flow measurement. Until injection started on June 4, brine pond level measurements were used to check the cumulative brine production calculated from weir flow readings.

e. Pruett Industries recalibrated their Kuster temperature instruments after the June 5, 1988, survey and then corrected the June 5 readings accordingly. The Kuster KPG gauge has an advertised accuracy of $\pm 2^{o}F$, although the results typically suggest that this standard is not achieved under field conditions. Temperature surveys are discussed in Section 4.2.

f. Pruett Industries measured downhole pressures with a Paroscientific digital quartz pressure transducer on a helium-filled capillary tube. The transducer used has a range of 0-3000 psia, an advertised accuracy of 0.01 percent of full scale, and a repeatability of 0.005 percent of full scale. Probably the greatest source of inconsistency from survey to survey is in the measurement to the 5,000-foot datum. This inconsistency was minimized by Pruett using the same unit on all of the State 2-14 runs. The repeatability of the depth measurement is probably about 0.1 percent.

The correction for the pressure of the static helium column in the capillary tube was calculated by Pruett from the measured temperature profile and the measured pressure at the surface. This correction was typically about 24 psi and would be expected to be quite precise, except during the pressure buildup when the well was shut in and cooling off. This problem is discussed further in Section 4.3.2.

A significant unknown during the test was the rate of scale deposition in the brine meter runs and its effect on the brine flow rate measurements. After the test ended, the orifice plates and piping were disassembled and inspected to measure the scale buildup and estimate the magnitude of the effect. Results are discussed in Section 3.4.

Another form of data quality control was a routine of frequent review of the data for evidence of instrument malfunctions, as well as data reduction and review for the daily test operations reports. These efforts resulted in quick recognition and correction of flow recorder problems, inconsistent temperature gauge readings, and several occurrences of scale-plugged pressure ports. Initially, temperature readings were influenced several degrees by wind and ambient temperature. This problem was corrected by insulating around thermowells and using only the thermowells with adequate penetration into the flow stream.

There was a major problem with the steam orifice meter that was not discovered until after the test. Post-test analysis of the brine and steam flow data led to some suspicion of a problem with the steam orifice meter. When the required brine chemistry and final corrections to the downhole temperature data were available, the theoretical flash fraction at the separator was calculated to be 14.0 percent for average test conditions. By comparison, flash fractions at the separator calculated from flow data reported in the daily test operations reports were typically in the range of 20 to 21 percent. As a result, the orifice plate was removed for inspection and some debris was found in the pipe on top of the orifice plate, obstructing an estimated 20 to 40 percent of the flow area. The orifice plate was installed as one of the last activities during construction. The pieces of metal or scale debris were apparently dislodged upstream and carried to the orifice plate when flow was first diverted through the separator. An empirical meter coefficient was determined for the steam flow meter to achieve a match between the indicated and theoretical flash fraction at the separator. Using a value 41 percent less than the steam meter coefficient for an unobstructed orifice gave a consistent match throughout the test, indicating that the orifice plate was already blocked by the time steam flow was first being recorded. The method of calculating flash fraction is discussed in Section 3.4.

3.4 Data Reduction

Flows, pressures and temperatures in Table A-1 were calculated from the raw data (Table A-2) by the methods detailed in Addendum D. Corrections to temperature and pressure readings are based on instrument checks listed in Table 3-3.

As discussed in Section 3.3, the separator steam flow, as originally measured, was erroneously high because there was debris lodged against the orifice plate which partially blocked the flow. To obtain a reasonable estimate of the true steam flow, a correction factor was derived which achieved a match with the theoretical steam flash fraction. Specifically, the steam meter coefficient was adjusted to match the average of the steam flash fractions at the separator (calculated as #7 in Addendum D) to the average of the theoretical flash fractions from the enthalpy condition representing an average of the four downhole temperature surveys. Flash fractions for a range of separator pressures were calculated using a computer model for hypersaline brines (Addendum E). The model was calibrated by the physical and chemical data collected during the test.

Average temperature at 3,750 feet on the four downhole temperature surveys = 572.6°F

Average of the flow rates for the temperature surveys (Table 3-4) = 291,000 lbm/hr

Wellbore heat loss between 3,750 feet and surface (Addendum E) = 2.07×10^6 Btu/hr

Average heat loss from flowline to separator (Addendum F) = 0.5×10^6 Btu/hr

(Both of the above heat loss rates are relatively insensitive to flow rate.)

Effective preflash brine temperature = brine temperature at 3750 feet minus temperature change corresponding to enthalpy losses in wellbore and flowline

$$= 572.6^{o}F - \frac{(2.07 + 0.5) \times 10^6 \text{ Btu/hr}}{291{,}000 \text{ lbm/hr} \times 0.825 \text{ Btu/lbm}^{o}F}$$

$= 562^{o}F$

The theoretical flash fraction from 562°F, calculated as in Addendum E, as a function of separator pressure is:

Pressure (psia)	Flash Fraction
217.4	0.1392
214.9	0.1399
212.4	0.1406

The theoretical flash fraction to atmospheric pressure = 0.2664.

Ideally, the total steam flow to atmosphere could be calculated by subtracting brine flow at the weir (Table A-1 Column 12) from the total flow. However, this procedure involves a substantial uncertainty because the result is the difference of two large numbers, each subject to some uncertainty. The total flow is the sum of brine and steam flows, each measured by an orifice meter. These would each be expected to have an accuracy of about ±5 percent under favorable conditions. The weir is inherently less precise, and there is more scatter to the readings because the brine flow commonly cycled up and down slightly with the action of the control valve. The orifice meter readings taken from the recorder chart were each averaged over the cycle, but the weir readings were spot readings. Therefore, the weir flow data were not used to calculate steam flow.

The normal procedure would be to measure steam flow from the separator and calculate the secondary flash to atmosphere thermodynamically. For this test, however, the flash fractions were determined entirely by calculation as described previously. The calculated flash fraction at the separator for average test conditions is 0.140 and the total flash to atmosphere is 0.266.

TABLE 3-4

SUMMARY OF TEMPERATURE/PRESSURE PROFILE SURVEYS

DATE	RUN NO.	START IN HOLE	ON BOTTOM	FLOW RATE (LBM/HR)	TEMP AT 5000' (°F)
6/05/88	01	13:00	14:36	117,000	575.1
6/12/88	02	09:55	12:12	211,000	568.9
6/14/88	03	15:08	18:01	404,000	573.6
6/20/88	04	14:20	16:40	432,000	582.0

As would be expected, when the total steam flow to atmosphere is calculated as the difference of total flow and weir flow, the scatter is so great that the individual numbers are useless. However, if the cumulative total flow and cumulative weir flow for the whole test are used to calculate an overall average, a flash fraction of 0.20 results. Considering the uncertainties in the measurements, this is in reasonable agreement with the theoretical flash fraction of 0.266.

Scale buildup on the brine orifice plates is a common problem, and its effect on the readings is largely undetermined during the test. It is principally for this reason that the weirbox was used as a backup measurement of the brine flow. After the test, the brine orifice plates were removed and inspected, and although there was scale on the plates, it was relatively minor. Each of the plates (Leg A and Leg B) had a scale deposit which effectively reduced the orifice bore and rounded the edges. Both plates, when clean, had standard, sharp-edged orifices. Post-test observations of the orifice plates are summarized as follows:

Leg	Original Orifice Bore (inches)	Average Bore Diameter Reduction By Scale (inches)	Approximate Radius of Curvature on the Entrance (inches)
A	4.800	0.375	0.188
B	7.1464	0.25	0.125

Scale on the pipe in the meter runs after the test was about 1/4 inch thick, which is negligible.

Qualitatively, rounding at the entrance and bore diameter reduction have offsetting effects on the meter coefficient. Calculations presented in Addendum V show that the observed scale buildup would cause indicated Leg A flow rates to be 3.9 percent higher than actual and indicated Leg B rates to be 2.6 percent higher than actual. Since these values are small, and within the expected accuracy of the meters, the effect of scale deposition could be neglected. Thus, the orifice meters were used for calculating brine flow, rather than the weir, during all portions of the test when they were operational.

4.0 Downhole Surveys and Transient Pressure Testing

Downhole pressure and temperature surveys were run during the flow test to fulfill the following objectives:

- Measure stabilized flowing pressure at the 5,000-foot datum at various flow rates to define the well's inflow performance (Figure 1-3).

- Record the downhole transient pressure response to flow rate changes and the pressure buildup at the end of the test. These data are used to calculate near-well reservoir properties (Sections 4.3.1.3 and 4.3.2.).

- Measure the flowing temperature and pressure profiles between the surface and 5,000 feet at various flow rates to provide data for thermodynamic flash calculations, to determine the depth at which flashing begins and to establish the relationship, if any, of brine temperature to flow rate.

Typically, a well test would involve a static downhole temperature and pressure survey to establish equilibrium shut-in conditions before the start of flow. This was not done immediately prior to the June 1988 test of State 2-14 because: 1) a suitable static survey had been run on November 18, 1987; and 2) well conditions immediately before the flow test were such that static survey data would have been misleading. Brine in the wellbore had been displaced by fresh water in April, 1988, to cool the well for a casing inspection log. The lower density fluid in the wellbore would have distorted the downhole pressure measurements relative to measurements in a brine-filled wellbore during the test. The November 18, 1987, survey was run 79 days after the last previous flow test and is more nearly representative of static conditions than any survey that could have been run immediately before the June 1988 test.

Production logs to define the inflow(s) within the openhole production interval would have been desirable, but were ruled out because of the risk of losing logging tools. The casing was suspected to be in poor condition below about 5,500 feet, and the condition of the open borehole (below 6,000 feet) was questionable after the August, 1987, redrill attempt. Figure 4-1 is a diagram of the State 2-14 well.

4.1 Description of Surveys

The following downhole surveys were run during the test:

June 5 - Flowing temperature and pressure profile, 500 - 5,000 feet

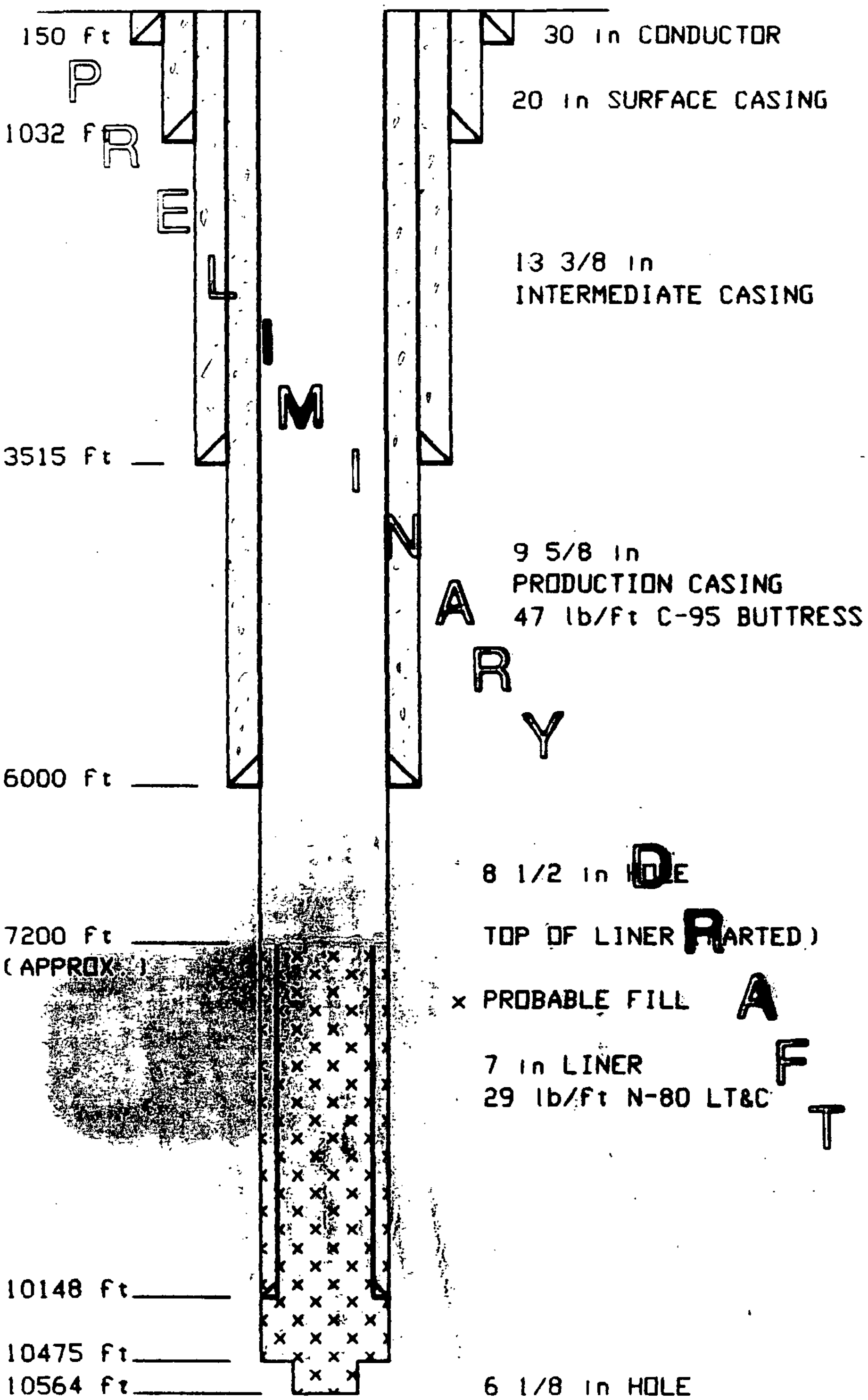
June 12 - Flowing temperature and pressure profile, 500 - 5,000 feet, and pressure drawdown at 5,000 feet during rate change

June 14 - Flowing temperature and pressure profile, 500 - 5,000 feet, and pressure drawdown at 5,000 feet

FIGURE 4-1

WELL DIAGRAM STATE 2-14

(ALL DEPTHS ARE REFERENCED TO KB, 29 ft AGL)



during rate change

June 20 - Flowing temperature and pressure profile, 500 - 5,000 feet, and pressure buildup at 5,000 feet.

The survey data and plots are in Addendum G. All temperature surveys were run with Amerada-type Kuster instruments. All pressure data were obtained with a helium-filled capillary tube run downhole, connected to a Paroscientific digital quartz pressure transducer at the surface. Downhole pressure data in Addendum G for the June surveys are in units of psia and have been corrected for the gravity head of the helium column at flowing temperature conditions in the wellbore.

In each of the surveys, pressure and temperature were both recorded on the same trip in the hole by running the Kuster temperature instrument in tandem with the capillary tube chamber. Outside diameters of the temperature instruments and chambers were 1.25 and 1.50 inches, respectively.

4.2 Flowing Temperature and Pressure Profiles

Four temperature and pressure profile surveys were run during the flow test, each at a different flow rate. The data are used in Addendum E as a basis for selecting the flash initiation conditions and to estimate enthalpy losses from the wellbore. As described in Addendum E, these values and chemical analyses of brine samples from the flowline are used in a computer model to perform flash calculations and determine the pre-flash brine composition. Results based on the June 5 survey data show a brine with a flash initiation temperature near 572°F, a pre-flash TDS near 247,000 mg/kg, and a CO_2 content near 3,900 mg/kg (total flow basis). The calculated steam flash to atmospheric pressure is 25.5 percent. The average flash initiation temperature for the four surveys is 572.6°F and the average flash fraction to atmospheric pressure is 26.6 percent.

Temperatures measured at 5,000 feet, shown in Table 3-4, vary within a range of 13°F. For all four surveys, the apparent depth of flash initiation is above 5,000 feet, so the measured values should reflect the combined temperature of the inflows, except for a minor heat loss correction. The variation of temperature among surveys is greater than would be expected unless it resulted from changes in the distribution of inflow among production zones of differing temperature. However, the variations of temperature in Table 3-4 do not appear related to either flow rate or time, factors which could control the inflow distribution. Subject to any insight which may be drawn from chemistry data, it is presumed that the scatter in the temperature data reflects inaccuracies in the Kuster instruments.

The depth of flash initiation is indicated on a temperature survey plot by a departure from the straight line (single-phase flow/conductive heat loss) profile in the lower portion of the well. In general, for a constant brine composition and temperature, flash depth is a direct function of wellbore pressure drawdown, and therefore, flashing occurs deeper at higher flow rates. The flash depths interpreted from the four temperature surveys in the State 2-14 well are listed below.

DATE	FLOW RATE (lbm/hr)	DEPTH OF FLASH INITIATION (ft)
6/05/88	117,000	3,160
6/12/88	211,000	3,400
6/14/88	404,000	4,000
6/20/88	432,000	3,600

Depths of flash initiation on June 14 and June 20 deviate somewhat from expected values. Based on the average well productivity observed (Figure 1-3), and assuming constant brine properties, the flash depth on June 14 would have been predicted at 3,600 feet instead of the observed 4,000 feet, and the flash depth on June 20 would have been predicted at 3,800 feet instead of the observed 3,600 feet. The flash depth being greater than expected on June 14 could result from an increase in brine temperature or a temporary increase in non-condensible gas content. If any of the observed increases in well deliverability were due to additional fractures opening up, then either the temperature or gas content of the brine could have changed. A change in gas content appears more likely. The shallower than expected flash initiation on June 20 is consistent with the observation of an improved well deliverability in the last three days.

4.3 Transient Pressure Tests and Analyses

Transient pressure testing in wells is conducted for two main purposes: i.e.; (1) to determine the production capabilities and characteristics of the well; and (2) to assess reservoir properties and long-term behavior of the reservoir. The best test to determine well parameters is a multi-rate test where sufficient time is allowed after a change in flow rate for the pressure to stabilize. More useful information for reservoir analysis is obtained if the well can be flowed at a constant rate for a relatively long time. Flow tests are usually designed to accomplish both purposes simultaneously to save money and time, which means that the well is flowed in successively increasing flow rate steps at the beginning of the test and then allowed to flow at a constant high rate for as long as is economically and operationally feasible.

During a test of this design, downhole pressure and temperature measurements are made before and during each rate change, along with surface measurements of flow rate, temperature, and pressure, and a final downhole pressure build-up. These data are used to calculate well deliverability or flow rate available at varying wellhead pressures, productivity or flow rate at varying downhole pressures, and important reservoir parameters such as transmissivity, reservoir storage capacity, reservoir temperature, and enthalpy. From a carefully planned test under some reservoir conditions, reservoir size and the nature of reservoir boundaries and flow regimes can be determined as well. These latter types of information are usually best obtained from a long period of constant flow.

The test of State 2-14 was originally planned as two seven-day flow rate steps followed by a final extended flow for 16 days at the highest rate that could be maintained through the test facility. Unfortunately, operating problems and budget constraints prevented obtaining an extended flow period at a high, constant rate. The interpretation of the data obtained was also complicated by several unscheduled changes in flow rate occasioned by operating problems, as well as by the apparent continued improvement in well deliverability during the course of the test. Nonetheless, the test yielded quantitative data about well deliverability and productivity. In addition, qualitative and semiquantitive statements about the well and near-well reservoir parameters can be made which, while less certain, will aid in expanding understanding of the reservoir and in interpretation of chemical and geologic data obtained from this and previous well tests.

4.3.1 Well Behavior

Well behavior data were obtained from surface and downhole pressure measurements and from flow measurements. Wellhead pressure measurements were used to plot a deliverability curve and predict deliverability at different wellhead pressures. Pressure transients measured downhole during step rate changes were used to plot a productivity curve and calculate a productivity index.

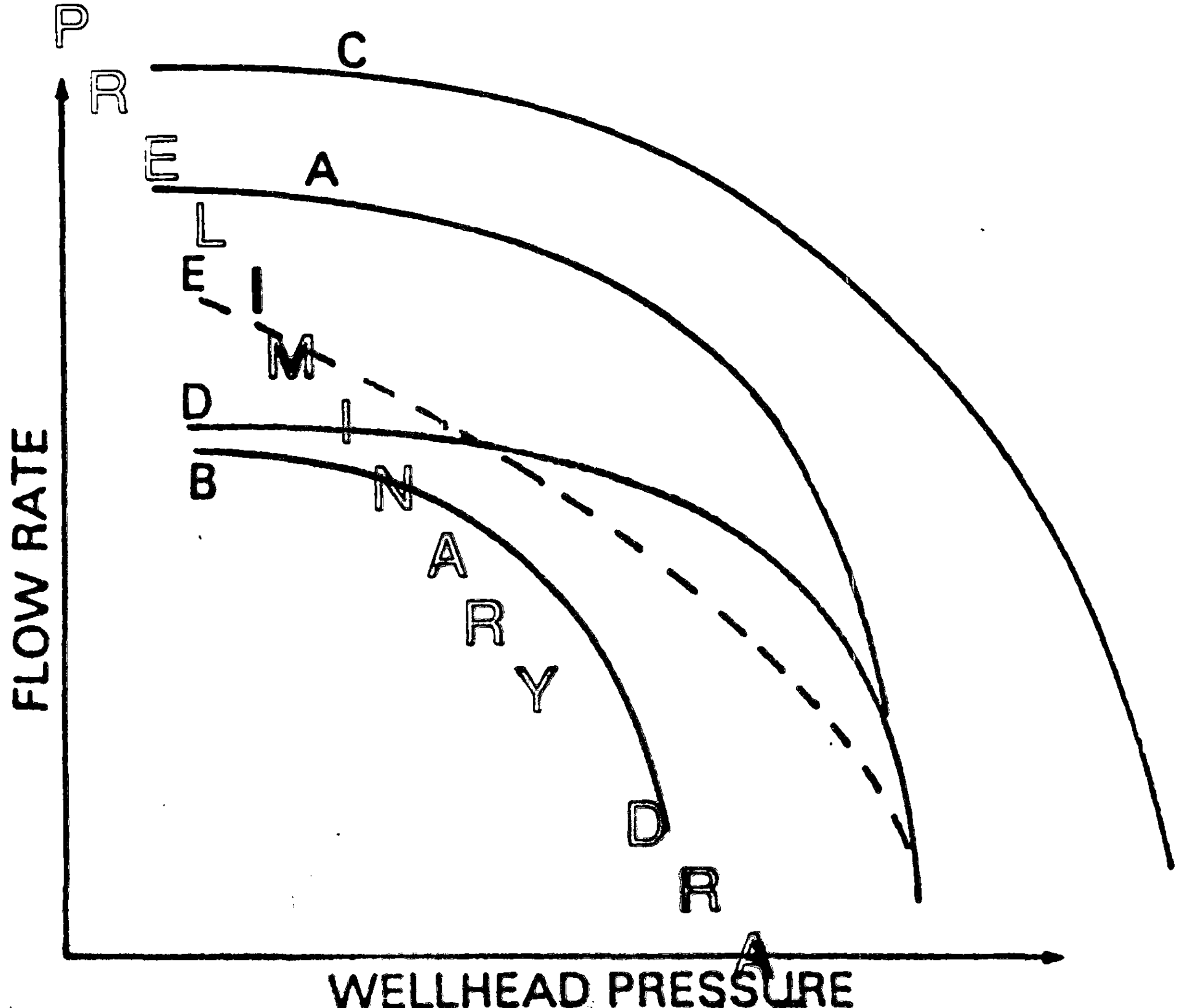
4.3.1.1 Deliverability

Deliverability of geothermal wells is generally depicted as a plot of flow rate vs. wellhead pressure. Wellhead pressure is controlled by reservoir pressure, fluid enthalpy, flow rate, wellbore flow characteristics, heat losses in the wellbore, and fluid chemistry. As a result, the relationship between reservoir pressure and wellhead pressure is not a simple one, and fluid deliverability at the wellhead can not be easily predicted from downhole pressure measurements.

The Salton Sea reservoir is a single-phase, liquid-dominated reservoir with flow induced by decreasing density in the fluid column as boiling takes place in the wellbore. Flow characteristic of an extensively fractured formation having significant matrix storage capacity is typical. Some representative deliverability curves for this kind of reservoir are shown in Figure 4-2. Curve A represents a liquid reservoir with high permeability. Curve B represents a relative decrease in reservoir temperature, pressure or gas content. Curve C shows the effect of either an increase in reservoir temperature or gas content or an increase in reservoir pressure. Curve D shows the effect of scaling in the wellbore, and curve E shows the effect of a lower reservoir permeability.

Figure 1-2 shows the deliverability curve for the State 2-14 well. The date of each data point plotted in the figure is written beside it. Data for June 2-17 represent pressure and flow rate measurements made during step rate increases. Data for June 18-20 represent data collected at the end of the test after the highest flow rate step. Several points should be noted about this plot:

FIGURE 4-2



Example Deliverability curves: form of the variation of mass flow with wellhead pressure. (From "Geothermal Reservoir Engineering", Grant, et al, 1982; in part after James, 1980a, 1981.)

1. The well was not tested at high enough rates to determine the maximum flow rate at typical commercial operating wellhead pressures of 250-350 psig. However, by projecting the general shape of the curve to lower wellhead pressures, an estimate of the flow rate in the commercial operating range can be made. The dashed line represents the shape of the projected curve. An estimated 770,000 lbm/hour total flow could be expected at 350 psig and, less certainly, about 810,000 lbm/hr could be produced at 250 psig.

2. The increased well deliverability observed later in the test suggests that the well improved during the course of the test. It is likely that flowing the well at higher rates cleaned up drilling solids from the reservoir rock and also may have opened up either the old or new leg of the wellbore.

3. At very low flow rates, deliverability curves often show a curve toward the origin just before the lowest sustainable flow. Points on this deliverability curve for the low flow rates at the beginning of the test are more likely representative of wellbore damage followed by clean up after high flow rates.

4.3.1.2 <u>Productivity</u>

The productivity index (PI) of a well is usually defined as the flow rate change per unit change in downhole pressure. PI is the slope of the inflow performance curve, which is a plot of flow rate vs. downhole pressure. The inflow performance, or productivity, represents the production capability of the reservoir as it is affected by well completion. The influence of fluid enthalpy, chemistry, and gas content are generally not large in a single-phase reservoir.

Well productivity was assessed using pressure measurements made in the liquid column at 5000 feet in State 2-14. This is above the probable primary entry zone at about 6200 feet. During flowing conditions this should not influence the reliability of either productivity or pressure drawdown measurements, because the temperature in the flowing single-phase liquid column would be subject to only small amounts of cooling between 6200 and 5000 feet due to heat losses.

Figure 1-3 shows flow rate plotted against downhole pressure for four stabilized flow rates. An average productivity index of 1527 lbm/hour/psi was found using these data. The productivity curve is a straight line through the four flowing points, which would be expected from a reservoir producing single-phase liquid from only matrix permeability. However, since well improvement was noted from other data collected during testing, this productivity may be conservative. For reservoirs with only matrix permeability, the static pressure should also fall on this line. No static pressure survey was run prior to the beginning of the test, so a static survey from August, 1987, following recompletion of the well and a 12-hour flow test was used. The point at 5,000 feet does not fall on the extrapolated productivity curve.

Fractured reservoirs often show a non-linear relationship between pressure and flow rate. The Salton Sea reservoir, being extensively fractured, but also having significant matrix storage capacity, typically exhibits characteristics of both linear and radial inflow.

4.3.1.3 "Skin"

Downhole pressure drop includes not only pressure changes in the reservoir under flowing conditions, but also pressure changes due to pressure losses as fluid enters the wellbore, i.e.,"skin effects", and changes due to differences in the amount of fluid stored in the wellbore, i.e., "wellbore storage". These pressure losses are characteristic of the wellbore and near-wellbore and are proportional to flow rate. In geothermal wells it is often very difficult to separate these pressure losses from each other, and they are generally lumped together and calculated as a "skin factor".

Horner plot analysis of the buildup data yielded a calculated skin factor, s, of +23.1 where:

$$s = a \left[\frac{p_{1\,hr} - p_{wf}}{m} - \log \left(\frac{k}{\phi \mu c r_w^2} \right) + b \right]$$

s = skin factor
$p_{1\,hr}$ = pressure at 1 hour after shut-in
p_{wf} = flowing bottom hole pressure
m = slope of semi-log straight line (on a plot of pressure vs. log of time)
k = permeability
ϕ = porosity
μ = viscosity
c = compressibility of system
r_w = radius of wellbore
a, b = unit coefficients

Positive values of the skin factor indicate large pressure drops as the fluid enters the wellbore. These can be caused by wellbore damage during drilling, pressure drop across liners or through perforations, partial penetration completions, and in some cases, closing of fractures as pressure decreases and/or turbulent flow as large volumes of fluid enter the wellbore at very high rates. Many wells in the Salton Sea geothermal field show high apparent positive skin factors, even though they are extensively fractured and would normally be expected to exhibit negative skin factors. Morris, Campbell and Petty (1985) have suggested that turbulent flow in the formation may be the dominant factor in this effect. In the case of State 2-14, it seems very likely that the well has sustained major wellbore damage during drilling and recompletion. However, it is also probable that the high flow rates in this well contribute to the apparent skin effect by causing non-Darcy flow conditions.

4.3.2 Reservoir Behavior

Two measurements of well drawdown were made during rate changes on June 12 and June 14, 1988. Figures 4-3 and 4-4 show the variation of the observed pressures versus time from the initiation of the rate change.

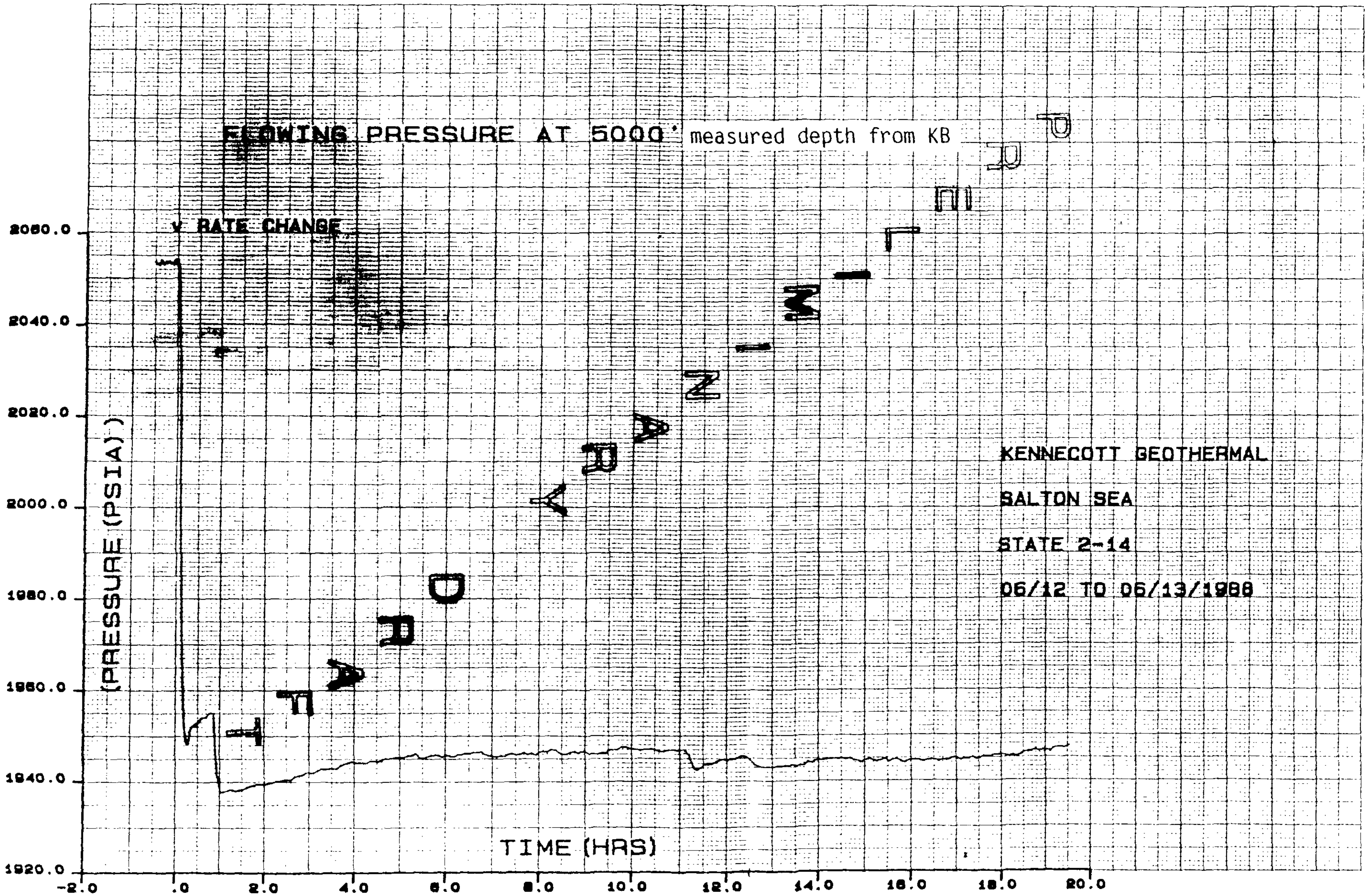
Figure 4-3 shows that following the rate change from 210,000 lbm/hr to 414,000 lbm/hr, the well showed an initial drawdown of 104.1 psi, then recovered rapidly and began to drawdown again. The maximum drawdown of 113.6 psi was reached one hour and 35 minutes following the rate change. Following this maximum drawdown, the well again began to recover. Small adjustments in the flow rate immediately following the rate change may explain some of this observed recovery, but during most of the 19.5 hours following the change, the rate remained fairly constant, increasing only slightly. During this period the well recovered a total of 9.5 psi when it would have been expected to continue drawing down.

Figure 4-4 shows the second drawdown measurement which was made on June 14 when the flow rate increased from about 404,000 lbm/hr to 538,000 lbm/hr. Following an initial drawdown of 115.5 psi the well recovered a total of 42 psi. Since the well was flowing at a nearly constant rate and no dramatic enthalpy changes were observed, this pressure recovery following drawdown due to a rate change is further evidence for improvement of the well. Unfortunately, it makes both drawdown curves impossible to analyze accurately for quantitative reservoir parameters.

Prior to shut-in of the well on June 20, pressure measurements were again made. The well was shut in at 17:54, but due to the effects of wellbore storage and the slow rate at which the valves could be turned, the beginning of build up was not observed downhole until 18:00. Figure 4-5 shows a plot of pressure at 5000 feet versus time. Following an initial very rapid build up of 163 psi, the downhole pressure began to drop and continued to drop slowly for the next 44.5 hours, when measurement was ended. This drop in pressure is most likely due to cooling of the fluid between the bottom of the pressure tool and the inflow zone, and is therefore largely the result of brine density changes in the wellbore. There is also a possibility that two or more inflow zones feed this well and that differential pressure depletion between the zones could result in crossflow after shut-in. However, crossflow generally causes the downhole pressure to increase and decrease over shorter time periods than the 44.5 hours of this build up. Another possible explanation of this drop in pressure could be interference from the neighboring field area under production by Magma Power Company. Well testing was going on in a newly completed Magma well during the period of build up; however, the distance to the Magma well is more than a mile. The testing of the Magma well is not likely to have had an effect on the State 2-14 well, given the high permeabilities and storage capacity in this reservoir.

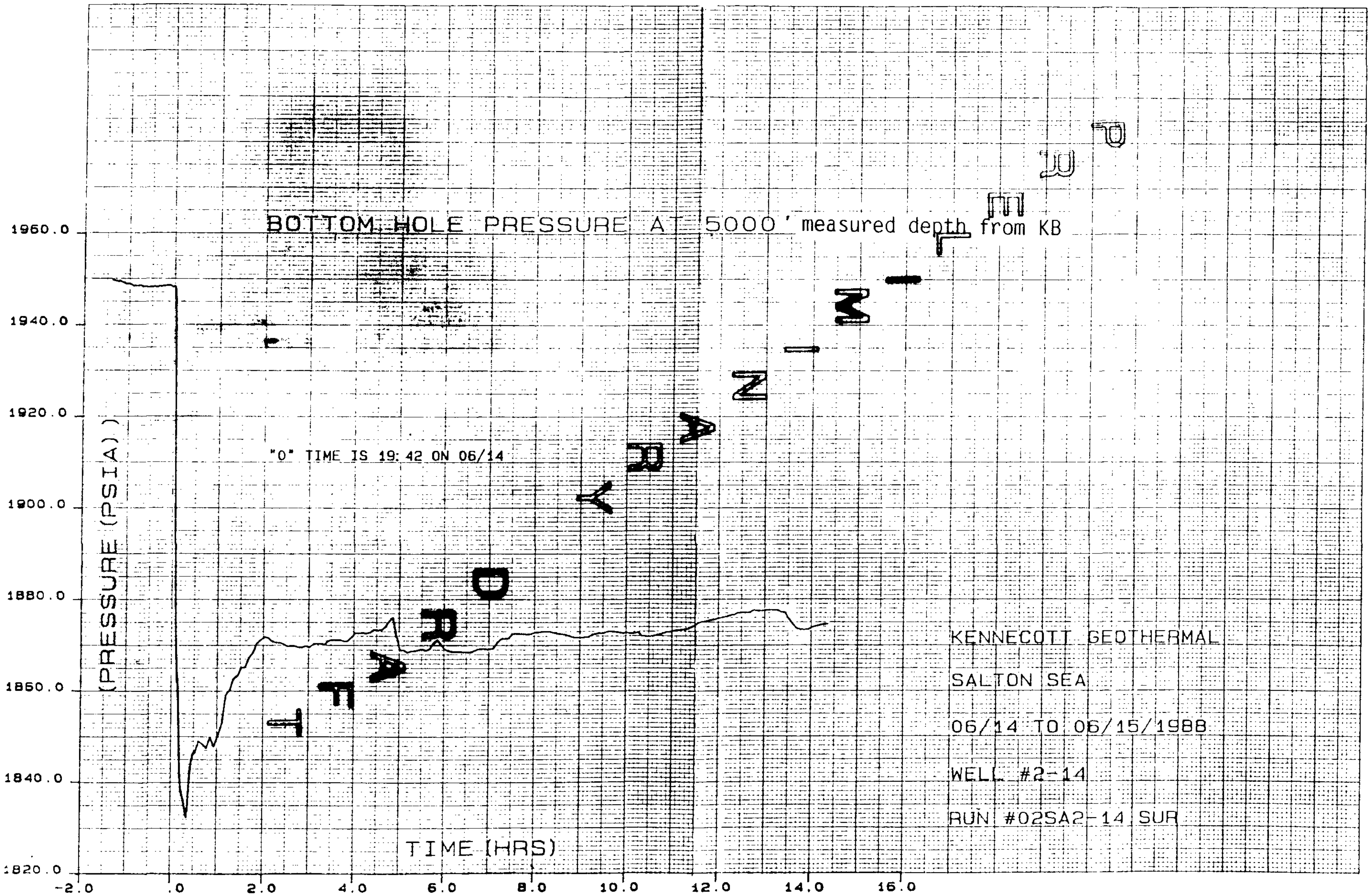
As a result of the drop in pressure only 1.5 hours after shut-in, the build up data are not amenable to analysis for detecting reservoir boundaries. However, a semi-quantitative estimate of reservoir parameters and skin effect in the well was made using a semi-log plot. Figure 4-6 shows pressure plotted against log time, with the semi-log straight line required for

FIGURE 4-3



FLOWING PRESSURE AT 5000' measured depth from KB
RATE CHANGE
KENNECOTT GEOTHERMAL
SALTON SEA
STATE 2-14
06/12 TO 06/13/1988
(PRESSURE (PSIA))
TIME (HRS)
2060.0
2040.0
2020.0
2000.0
1980.0
1960.0
1940.0
1920.0
-2.0
.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0

FIGURE 4-4



BOTTOM HOLE PRESSURE AT 5000' measured depth from KB
"0" TIME IS 19:42 ON 06/14
(PRESSURE (PSIA))
TIME (HRS)
KENNECOTT GEOTHERMAL
SALTON SEA
06/14 TO 06/15/1988
WELL #2-14
RUN #02SA2-14 SUR
PRELIMINARY DRAFT
1960.0
1940.0
1920.0
1900.0
1880.0
1860.0
1840.0
1820.0
-2.0
.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0

FIGURE 4-5

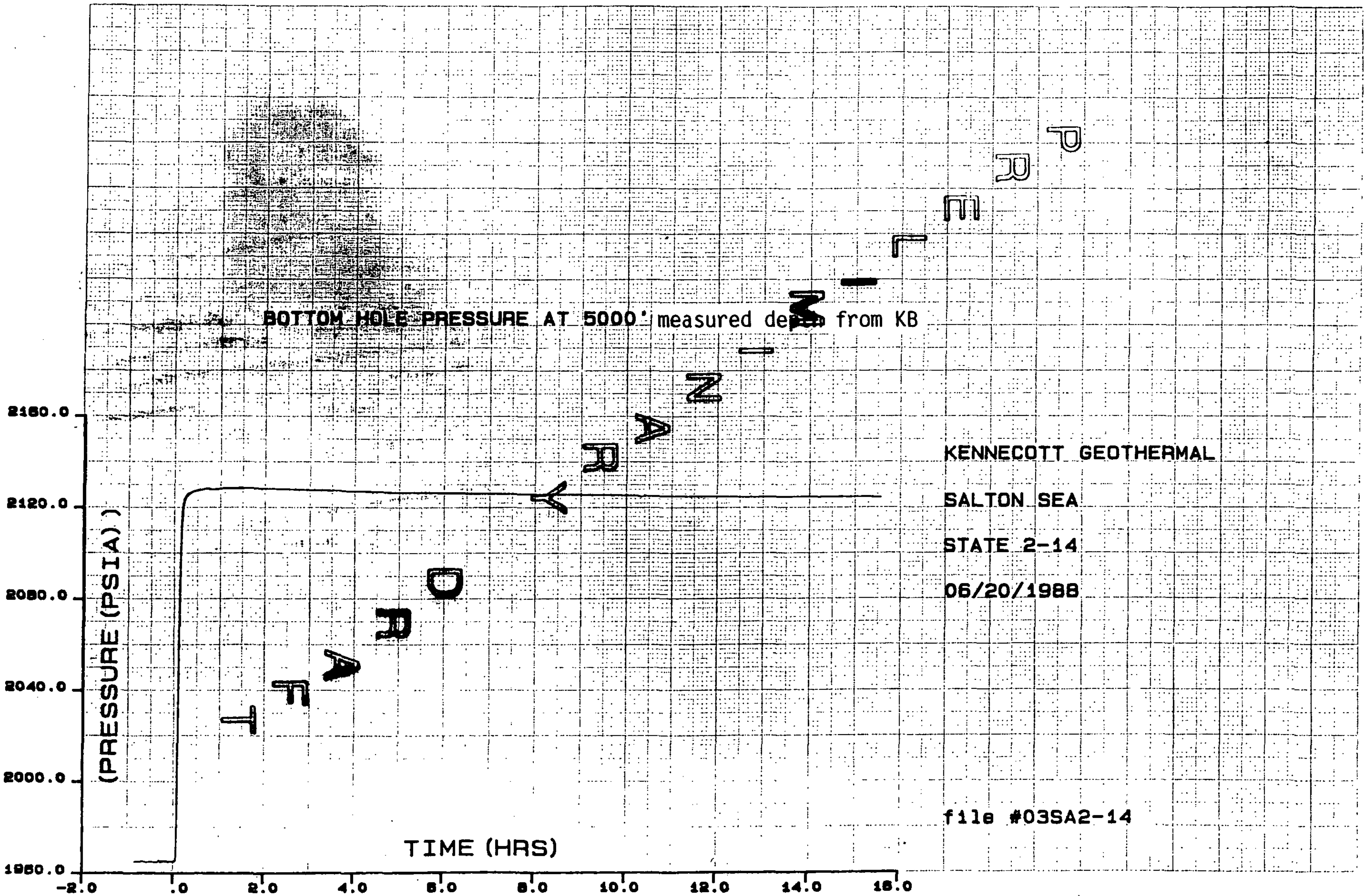
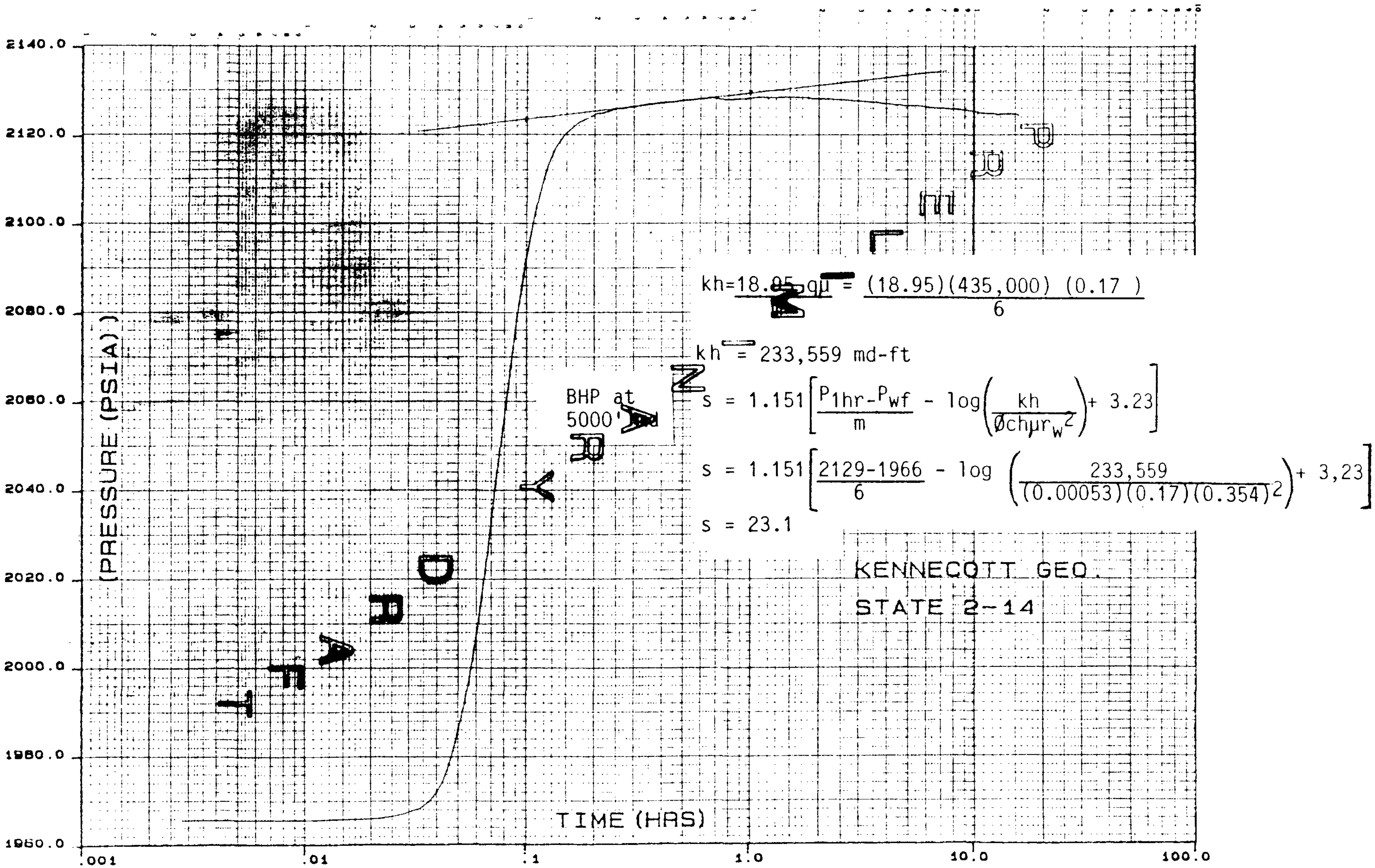

BOTTOM HOLE PRESSURE AT 5000' measured depth from KB
KENNECOTT GEOTHERMAL
SALTON SEA
STATE 2-14
06/20/1988
file #03SA2-14
PRELIMINARY DRAFT
(PRESSURE (PSIA))
TIME (HRS)
2160.0
2120.0
2080.0
2040.0
2000.0
1960.0
-2.0
.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0

FIGURE 4-6



$$kh = \frac{18.95\, q\mu}{m} = \frac{(18.95)(435,000)(0.17)}{6}$$

$$kh = 233,559 \text{ md-ft}$$

$$s = 1.151\left[\frac{P_{1hr} - P_{wf}}{m} - \log\left(\frac{kh}{\emptyset c h \mu r_w^2}\right) + 3.23\right]$$

$$s = 1.151\left[\frac{2129-1966}{6} - \log\left(\frac{233,559}{(0.00053)(0.17)(0.354)^2}\right) + 3,23\right]$$

$$s = 23.1$$

SEMI-LOG PRESSURE BUILDUP PLOT

analysis showing only for a brief period prior to the pressure dropoff. A transmissivity or "kh" of 233,600 md-ft was calculated using the final flow rate of approximately 435,000 lbm/hr. The skin factor of +23.1 previously discussed was also calculated from this plot.

Pressure response matching using the nonlinear, multiple regression computer code ANALYZE was also attempted, because this code can accomodate the variable flow rate history of the test. Using the "kh" and "skin" calculated from the Horner plot as initial estimates of reservoir properties and the entire drawdown and buildup history as input, ANALYZE calculated a transmissivity ("kh") of $1x10^8$ md-ft, a storage coefficient ("Øch") of 0.00053 ft/psi and a "skin" of +13.3. Using the buildup only resulted in a kh of $1x10^8$ md-ft, a storage coefficient 0.00051 ft/psi and a skin of +12.4. This result for kh is extremely high and a good match of the response curve was not achieved, particularly for the drawdown segments (Figure 4-7 A-C). This suggests that reservoir anisotropy or wellbore storage effects dominate response and/or the input data available are insufficiently accurate to allow a good match using this computer code. Use of these kh values for quantitative prediction of future reservoir behavior is not recommended.

The reservoir and well parameters indicate qualitatively, at least, that the reservoir has high permeability and adequate storage capacity and is therefore capable of producing at high flow rates for extended periods. However, because the data are not amenable to boundary analysis, neither the life of the reservoir nor the total production capacity can be estimated. Nearby shallower portions of the same reservoir tapped by Magma Power and UNOCAL have produced for long periods with little observed pressure drawdown, but no detailed data are available to the public from these wells.

4.3.3 Injection Well Behavior

The Imperial 1-13 well was used as an injector throughout the test. Figure 4-8 shows a plot of injectivity, defined as flow rate per psi of pressure at the wellhead versus cumulative injection. Table 4-1 shows daily and cumulative injection by date. From the time that injection started, the injectivity began to decline. The injectivity decrease shown by the Imperial 1-13 well is typical for a well undergoing formation plugging. In most cases of injection well plugging, suspended solids enter the formation, coating the walls of the pores. Solids are filtered from the solution by the porous medium, reducing the permeability of the formation near the wellbore and forming a filter cake on the wellbore face. The filter cake, once formed, acts as a fine filter, removing smaller and smaller particles from the fluid and further reducing the injectivity of the well. The filter cake produces the effect of a variable skin factor, with the additional problem that the formation near the wellbore may have been damaged by the entry of solids prior to formation of the filter cake. Decrease in injectivity is generally geometric. The curve for Imperial 1-13 displays this pattern.

FIGURE 4-7 (A-C)

SALTON SEA FIELD, KENNECOTT LEASE
STATE 2-14 FLOW TEST, JUNE 1-23, 1988
COMPUTER ANALYSIS OF DRAWDOWN AND BUILDUP DATA
PARAMETER ESTIMATES:

kh = 1.0×10^{8}
Øch = 5.3×10^{-4}
skin= 13.3

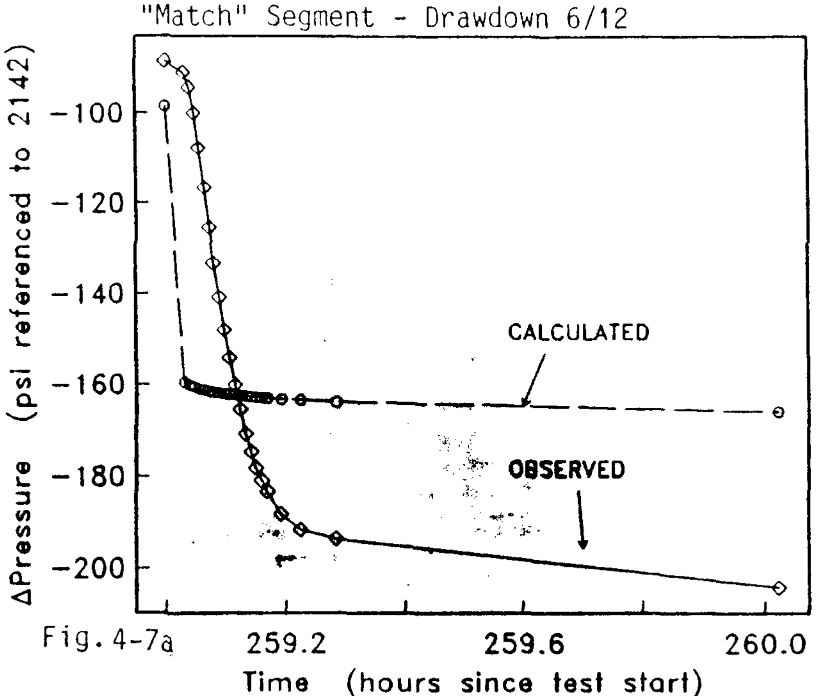


Fig. 4-7a

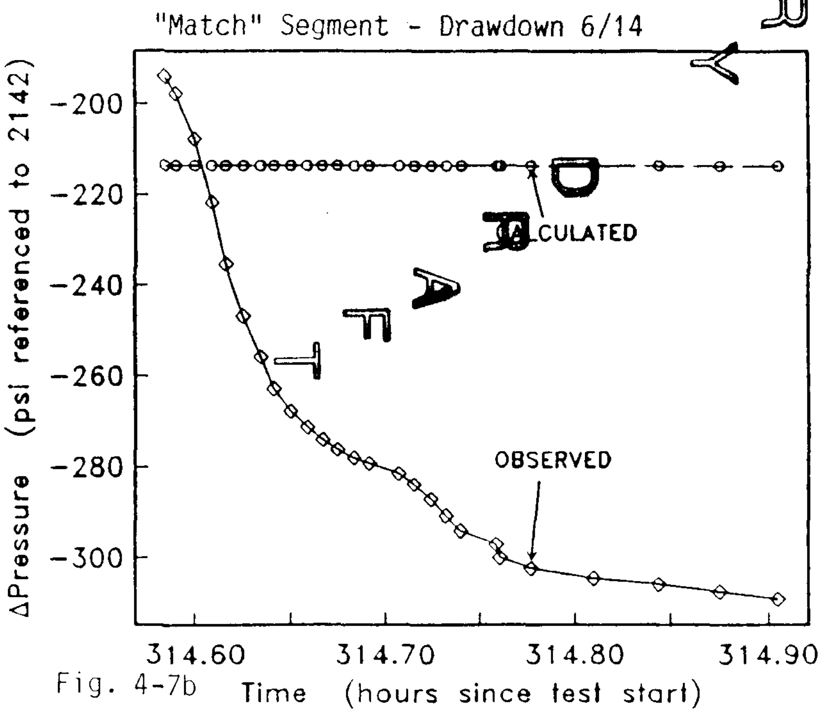


Fig. 4-7b

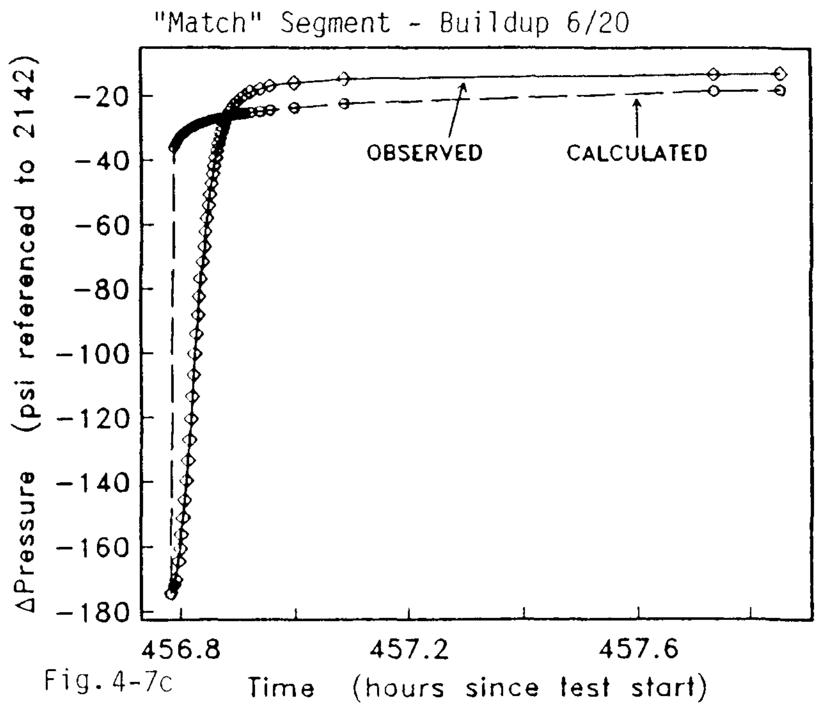


Fig. 4-7c

FIGURE 4-8

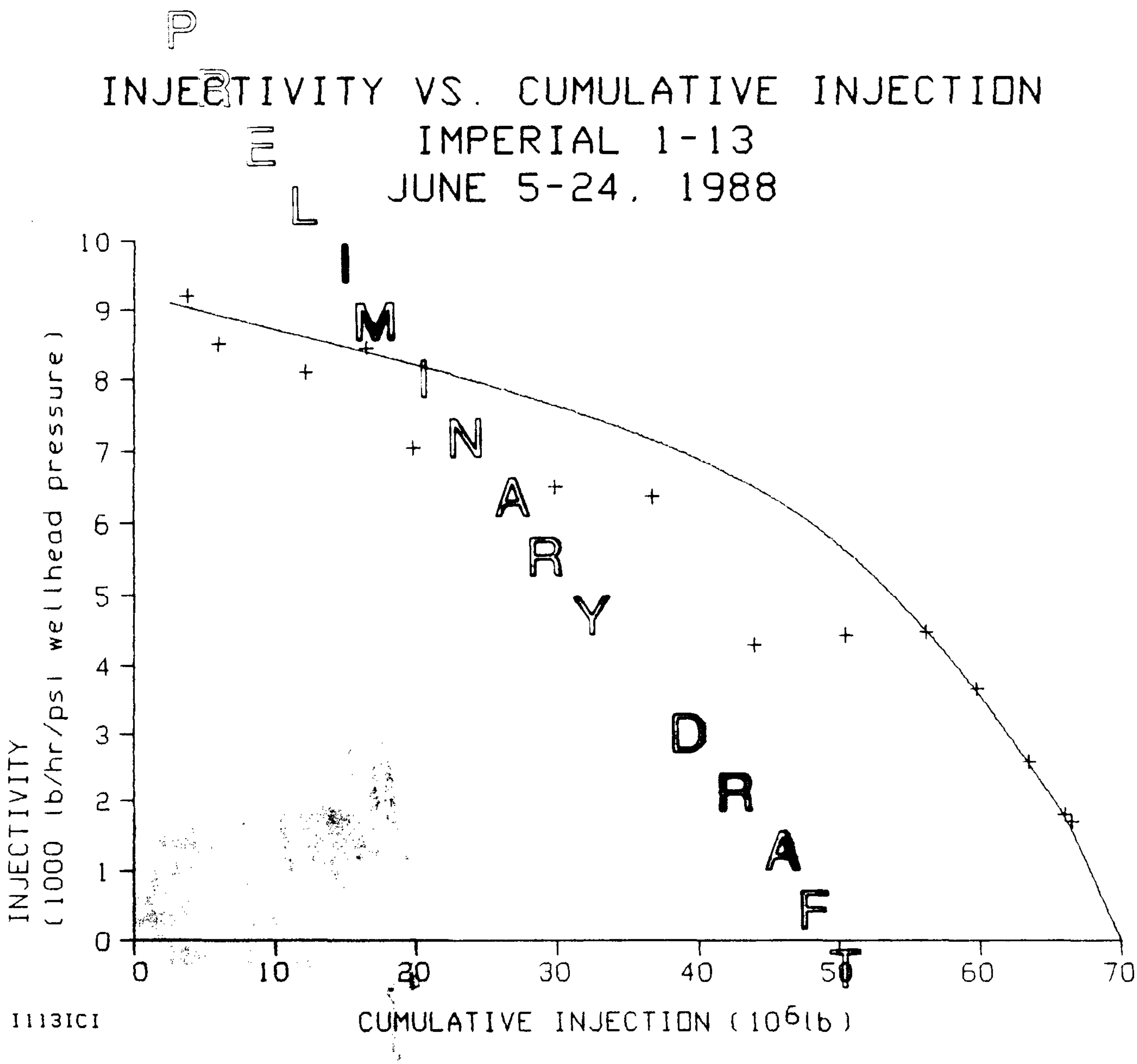

INJECTIVITY VS. CUMULATIVE INJECTION
IMPERIAL 1-13
JUNE 5-24, 1988
PRELIMINARY DRAFT
INJECTIVITY
(1000 lb/hr/psi wellhead pressure)
10
9
8
7
6
5
4
3
2
1
0
0
10
20
30
40
50
60
70
CUMULATIVE INJECTION (10^6 lb)
I113ICI

TABLE 4-1

INJECTION SUMMARY
KENNECOTT IMPERIAL 1-13
June 4 - June 24, 1988

DATE	MASS INJECTED (10^3 lb)	CUMULATIVE MASS INJECTED (10^3 lb)
6/1	0	0
6/2	0	0
6/3	0	0
6/4	838	838
6/5	5,225	6,063
6/6	243	6,306
6/7	1,130	7,436
6/8	2,307	9,743
6/9	3,798	13,541
6/10	2,578	16,119
6/11	4,145	20,264
6/12	3,412	23,676
6/13	5,107	28,783
6/14	5,882	34,665
6/15	6,497	41,162
6/16	7,326	48,488
6/17	5,705	54,193
6/18	6,1[illegible]	60,343
6/19	5,521	65,864
6/20	3,846	69,710
6/21	794	70,504
6/22	1,471	71,975
6/23	0	71,975
6/24	639	72,614

Although at times brine was taken out of the holding pond and directly injected without allowing for settling, these periodic increases in injected solids did not alone cause the injection well to plug. Injection of unfiltered brine from the start of the test resulted in a decrease in injectivity. Even with the settling in the brine holding tanks, suspended solids sufficient to cause plugging were injected into the well.

After shut-in of the State 2-14 well, the brine remaining in the holding pond was injected into the Imperial 1-13 well. The portion of this fluid held in the tanks at the time of shut-in was treated with 12N hydrochloric acid. The seven tanks held an estimated 107,016 gallons of brine at the time the acid was added. The acid was added as evenly as possible to each tank and agitated with a small pump. The tanks were allowed to stand overnight, and the brine was injected the next day mixed with added fluid from the holding pond. During the injection of this acidified brine, continued build-up of wellhead pressure was observed. No improvement in injectivity resulted from this acidification of the injection well. In fact, the injectivity decreased during injection of this fluid from 2970 lbm/hr/psi to 1900 lbm/hr/psi.

The Imperial 1-13 well was known to have problems with sand infill from the formation during drilling and completion. Therefore, the injection zone probably has matrix permeability. Further sand inflow may have reduced the injectivity of the well during this test, but the largest impact on the injectivity appears to have been plugging by suspended solids precipitated by the produced brine.

4.4 Caliper Logging Attempt

On August 8, 1988, 44 days after the end of testing operations, Kennecott attempted to run a casing inspection caliper log in the State 2-14 well. Details of the operation are documented in Addendum H. Two different caliper tools were run and both encountered a constriction that stopped the tools in the 9 5/8-inch casing about 26 inches below the top of that casing string. The caliper tools, having clearances for minimum hole diameters of 7 1/4-inches and 3 1/2-inches, both stuck at approximately the same place and had to be pulled free. The constriction, or at least the top of it, occurs where the 9 5/8-inch casing comes through the casing head.

On August 15, 1988, a television camera having a diameter of 2 1/8-inches was run through the wellhead and through the constriction in the 9 5/8-inch casing to a point about 2 feet below where the caliper tools stuck. Although the video image was impaired by turbidity in the water, it shows what is thought to be a heavy buildup of whitish scale (presumed to be calcium carbonate). There was an attempt to obtain a sample of the scale by dislodging it with a hydroblaster. However, the hydroblaster pipe bent when it was inserted downhole and the attempt was aborted because there was no replacement immediately available. The upper portion of the wellhead had been dismantled to run the caliper and television logs, but there was no whitish scale to sample in those parts. None of the attempts at logging or sampling was successful at positively identifying the scale or defining the profile of the constriction, and budget constraints prevented further efforts.

The discovery of a constriction in the casing prompts several questions regarding its origin and possible effects on the flow test. Apparently the constriction did not exist at the time of the casing inspection log in April, 1988. The most reasonable conclusion is that it formed during the 19-day flow test. Two possibilities are that (1) it is a partial collapse in the 9 5/8-inch casing which may have occurred at the beginning of the test, or (2) it is simply a scale buildup. Normally, a heavy scale buildup would be reflected in a declining well deliverability, but the deliverability actually increased as the test progressed. This implies either that the constriction formed very early in the flow test, or that factors increasing the deliverability more than offset the increasing flow resistance.

The question of whether or not calcium carbonate scale could reasonably be expected from the standpoint of the brine chemistry is not within the scope of this report. However, the abrupt nature of the constriction in a region where the pressure gradient would not be expected to be extreme suggests that it is not a normal scale buildup. Likewise, there are problems with the hypothesis of a casing collapse. It is difficult to envision a mechanism for a collapse failure within the wellhead. Collapse is a well-known means of failure of production casing strings or tieback strings downhole where a pocket of water trapped in the annular cement expands thermally and exerts pressure on the casing. However, this mode of failure is not likely to have occurred in the State 2-14 wellhead because the annular space was vented to relieve the pressure of thermal expansion. Also, there was no collapse in the three previous flow tests of the well and one would not have been expected in this test. Other causes such as weakening of the 9 5/8-inch casing by corrosion, or a mechanical problem in the wellhead, are possible explanations.

Because the profile through the restriction is not known, it is not possible to quantify the flow resistance, but it is of interest to explore its possible significance. The minimum dimension through the constriction is known to be greater than 2 1/8-inches and less than 3 1/2-inches. Assuming that the equivalent minimum inside diameter of the constriction is 3.0 inches, flow velocities shown below are calculated for average conditions of the last 25 hours of flow.

<u>Average Flow Conditions at the Wellhead:</u>

- Flow rate = 425,000 lbm/hr
- Wellhead pressure = 540 psia
- Steam mass fraction = 0.0700 (Table E-7)
- Specific volume of the steam/brine mixture (assumed homogeneous) = 0.677 cu ft/lbm (Table E-7)

<u>Calculated Velocities:</u>

- Flow velocity in clean 9 5/8-inch casing = 19.5 ft/sec
- Flow velocity in 3-inch diameter = 163 ft/sec

The velocity in the assumed constriction is less than the critical velocity of 250 ft/sec for those conditions, and therefore the constriction did not constitute a critical choke. However, the pressure loss could still be significant. Assuming a round, venturi-shaped constriction only a few feet long, with a 3-inch diameter throat and the flow conditions stated above, the pressure drop would be in the range of 40 to 50 psi. However, deliverability data (Figure 1-2) indicate the flow restriction is less severe than that. For example, the actual wellhead pressure on June 17 at 640,000 lbm/hr flow rate is greater than could have existed if the constriction were as severe as the hypothetical case described above. Therefore, if the constriction existed at the end of the flow test as it does now, its minimum clearance is probably larger than three inches or its cross-section is elongate, having a larger flow area than a round venturi.

Further evidence that the flow restriction was not severe is obtained from the pressure surveys (Addendum G). Extrapolations of the four downhole pressure profiles to the surface do not reveal any gross mismatches with the measured wellhead pressures. Although the extrapolations are not precise, a large, localized pressure drop would be expected to create a significant discontinuity in the pressure profiles.

On the basis of the following observations, it is concluded that the constriction was not the cause of the well's failure to flow spontaneously for the high-rate flow test on June 23 and 24, 1988.

1. In the attempt to initiate flow on June 24, after the well had been shut in overnight with fresh water in the wellbore, the well produced the fresh water back at a peak rate of 120,000 lbm/hr, but the flow diminished and the well died before achieving flashing flow. The nature of this initial flow of water was normal, and it was expected that flashing would start in the wellbore accompanied by an increasing flow rate. The fact that flashing flow did not start is an indication that the well had not been allowed to heat up long enough after injecting the fresh water.

2. Assuming the constriction existed at the end of the 19-day flow test, it did not impose a large pressure drop at that time, at a flow rate of 425,000 lbm/hr. During the attempt to initiate flow on June 24, the pressure drop through the same constriction at the much lower flow rate of 120,000 lbm/hr would have been negligible because the pressure drop through any constriction is a strong function of flow rate and is not significant at low flow velocities.

Facts and tentative conclusions about the casing constriction are summarized as follows:

1. It formed sometime after the casing inspection log in April, 1988, and before the attempt to run a casing caliper log on August 8, 1988. The most probable time is during the 19-day flow test.

2. The downhole video inspection is not definitive, but shows the constriction to have the appearance of a buildup of whitish scale.

3. **The** 2 1/8-inch diameter television camera passes through **the** constriction, but caliper logging tools with **clearances** for minimum hole diameters of 3 1/2-inches **and** 7 1/4-inches stuck at about 26 inches below the top of the 9 5/8-inch casing string.

4. Although it has the appearance of a scale buildup, there is a possibility that a partial casing collapse is at least a contributing factor. Information is incomplete and there are questionable aspects to both hypotheses. Further study of the problem using the available information is probably not worthwhile. Instead, it is recommended that the well be killed and that the tree be removed down to the top of the lower master valve to allow visual inspection and sampling. Further work to describe the constriction and remove it would be guided by the findings at that point.

5. If the constriction existed near the end of the flow test, its effect on the well deliverability cannot be quantified with certainty, but apparently it was not severe. By comparison of wellhead pressures at 640,000 lbm/hr (on June 17) and 425,000 lbm/hr (average for the last 25 hours) the upper bound on pressure drop through the restriction is about 20 psi at the 425,000 lbm/hr flow rate. The downhole pressure profiles, as discussed above, suggest the actual pressure drop was less.

   Because the pressure drop imposed by the constriction was relatively small, wellbore flow modeling is not likely to yield the precision necessary for a refined estimate of the effect on deliverability.

6. The **constriction was** not the cause of the well's failure to flow **spontaneously** for the attempted high-rate flow test on **June 23 and 24,** 1988.

5.0 References

ASME, 1971; "Fluid Meters - Their Theory and Application", Sixth Edition

Grant, Malcolm A., Donaldson, Ian G., and Bixley, Paul F., "Geothermal Reservoir Engineering, Academic Press"; 1982

Kreith, Frank; "Principles of Heat Transfer", International Textbook Co.; 1958

Marks, Lionel S.; "Mechanical Engineers' Handbook", Sixth Edition, McGraw-Hill; 1958

Morris, C.W., Campbell, D.A., and Petty, S.; "Analysis of Wells in Naturally Fractured Formations with Rate-Sensitive Flow", paper SPE 14169 presented at the 1985 SPE *Technical* Conference and Exhibition, Las Vegas, NV; 1985

Tinsley, Glen E., Letter to Mr. Jake Rudisill, Geysers Geothermal Co., regarding attempt to run caliper log in the State 2-14 well, August 16, 1988.

PRELIMINARY DRAFT

ADDENDUM A

LISTINGS OF TEST DATA

TABLE A-1
FLOW TEST DATA
STATE 2-14
June 1 - June 20, 1988

DATE	TIME	WHP	WHT	SEP.	SEP.	SEPARATOR FLOW		SEP.	TOTAL	CUM.TOT.	WEIR	CUM.WEIR	INJEC.
				PRES	TEMP	STEAM	BRINE	FLASH	FLOW	FLOW	BOX FLOW	FLOW	FLOW
		psig	F	psig	F	lb/hr	lb/hr		lb/hr	klb	lb/hr	klb	lb/hr
06/01	17:07	178							0	0	0	0	0
06/01	19:00	450	479						119,601	113	89,438	84	0
06/01	21:03	474	483						129,705	368	96,993	275	0
06/01	23:00	490	483						172,750	663	129,182	496	0
06/02	01:00	487	470						161,607	997	120,850	746	0
06/02	03:02	487	474						150,714	1,315	112,704	983	0
06/02	05:55	486	471						129,705	1,719	96,993	1,286	0
06/02	07:12	486	470						134,900	1,889	100,878	1,413	0
06/02	09:04	488	470						134,900	2,141	100,878	1,601	0
06/02	11:00	486							119,601	2,387	89,438	1,785	0
06/02	13:01	485	468						114,692	2,623	85,766	1,962	0
06/02	15:03	506	480						150,714	2,893	112,704	2,163	0
06/02	17:00	507	483						172,750	3,208	129,182	2,399	0
06/02	19:00	507	480						150,714	3,532	112,704	2,641	0
06/02	21:00	505	480						150,714	3,833	112,704	2,866	0
06/02	23:00	506	481						150,714	4,135	112,704	3,092	0
06/03	00:58	505	480						150,714	4,431	112,704	3,314	0
06/03	02:59	505	478						129,705	4,714	96,993	3,525	0
06/03	05:03	502	478						129,705	4,982	96,993	3,725	0
06/03	07:05	502	478						124,659	5,240	93,220	3,919	0
06/03	08:00	503	476						129,705	5,357	96,993	4,006	0
06/03	10:12	505	473						119,601	5,631	89,438	4,211	0
06/03	12:00	505	473						119,601	5,847	89,438	4,372	0
06/03	14:05	503	480						0	5,971		4,465	0
06/03	16:01	513	492						134,900	6,100	100,878	4,562	0
06/03	18:03	514	494						140,078	6,382	104,750	4,773	0
06/03	20:06	509	493						129,705	6,659	96,993	4,979	0
06/03	22:05	506	492						134,900	6,921	100,878	5,176	0
06/04	01:02	507	494						140,078	7,327	104,750	5,479	0
06/04	03:00	506	494						129,705	7,592	96,993	5,677	0
06/04	05:00	506	494						129,705	7,851	96,993	5,871	0
06/04	07:00	506	493						134,900	8,11[illegible]	100,878	6,069	0
06/04	09:00	508	492						119,601	8,371	89,438	6,260	0
06/04	11:20	508	486						129,705	8,661	96,993	6,477	0
06/04	13:03	508	482						119,601	8,875	89,438	6,637	0
06/04	15:02	507	490						114,692	9,108	85,766	6,811	0
06/04	17:06	507	487						124,659	9,355	93,220	6,996	0
06/04	19:00	506	484						109,774	9,578	82,089	7,162	0
06/04	21:01	505	484						109,774	9,799	82,089	7,328	0
06/04	23:03	503	479						104,967	10,017	78,494	7,491	0
06/05	01:09	501	480						106,167	10,239	79,392	7,657	301,622
06/05	03:04	505	492						107,370	10,444	80,291	7,810	259,460
06/05	04:55	511	492						108,572	10,644	81,190	7,959	467,028
06/05	06:58	505	490						109,774	10,867	82,089	8,127	162,163
06/05	09:15	514	494						134,858	11,147	100,847	8,335	0
06/05	11:00	514	492						119,601	11,369	89,438	8,502	278,920
06/05	13:08	513	492						114,652	11,619	85,737	8,689	136,217

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DATE	TIME	WHP psig	WHT F	SEP. PRES psig	SEP. TEMP F	SEPARATOR FLOW STEAM lb/hr	SEPARATOR FLOW BRINE lb/hr	SEP. FLASH	TOTAL FLOW lb/hr	CUM.TOT. FLOW klb	WEIR BOX FLOW lb/hr	CUM.WEIR FLOW klb	INJEC. FLOW lb/hr
06/05	15:00	515	491						124,619	11,842	93,190	8,856	129,730
06/05	17:00	513	491						119,601	12,087	89,438	9,038	308,109
06/05	19:12	513	494						129,705	12,361	96,993	9,244	155,676
06/05	21:02	513	491						119,601	12,589	89,438	9,414	314,595
06/05	23:10	507	492						119,601	12,845	89,438	9,605	155,676
06/06	01:05	506	492						116,325	13,071	86,988	9,774	136,217
06/06	03:04	506	493						113,050	13,298	84,539	9,944	0
06/06	05:45	505	49[illegible]						109,774	13,597	82,089	10,168	0
06/06	08:00	510	49[illegible]						110,238	13,845	82,436	10,353	97,298
06/06	10:10	510	492						110,703	14,084	82,784	10,532	0
06/06	12:15	510	494		250				111,167	14,315	83,131	10,705	0
06/06	14:11	510	494						111,633	14,530	83,479	10,866	0
06/06	16:25	512	494						112,097	14,780	83,826	11,053	0
06/06	17:40	439							0	14,850	0	11,105	0
06/06	17:58	383							0	14,850	0	11,105	0
06/06	21:03	455	464						113,259	15,025	84,695	11,236	0
06/06	23:00	514	494						113,723	15,246	85,042	11,401	0
06/07	01:08	513	493		263				114,188	15,489	85,390	11,583	0
06/07	03:00	512	493		262				114,652	15,703	85,737	11,743	0
06/07	05:00	513	492	186	404	17,024	102,863	0.14	119,886	15,938	96,993	11,925	0
06/07	07:00	512	492	212	414	17,659	113,[illegible]	0.14	130,808	16,188	89,438	12,112	0
06/07	09:05	513	492	208	412	17,546	111,092	0.14	128,638	16,458	100,847	12,310	0
06/07	10:00	512	493	209	413	17,442	111,092	[illegible]	128,533	16,576	85,737	12,396	0
06/07	13:00	514	493	210	412	17,546	111,092	0.14	128,638	16,962	89,438	12,658	0
06/07	16:08	514	487	211	410	19,796	106,977	0.16	126,773	17,362	89,438	12,939	194,595
06/07	18:03	514	493	213	412	20,247	111,092	0.15	131,339	17,610	68,037	13,089	0
06/07	20:03	514	493	212	411	20,203	102,863	0.16	123,066	17,864	74,953	13,232	0
06/07	22:03	514	492	209	405	18,628	98,748	0.16	117,[illegible]	18,104	85,737	13,393	334,055
06/08	01:04	512	491	207	402	17,827	102,863	0.15	120,690	18,464	82,088	13,646	285,406
06/08	04:00	511	491	204	400	17,707	98,748	0.15	116,455	[illegible]811	89,438	13,898	285,406
06/08	06:00	506	492	207	404	17,469	98,748	0.15	116,217	19,044	85,737	14,073	285,406
06/08	07:55	507	492	207	405	18,544	96,691	0.16	115,235	19,26[illegible]	93,190	14,245	194,595
06/08	10:10	508	490	204	400	19,131	106,977	0.15	126,108	19,53[illegible]	82,088	14,442	0
06/08	12:05	508	491	202	398	19,044	98,748	0.16	117,792	19,771	[illegible],438	14,606	0
06/08	16:03	507	490	198	394	18,868	90,519	0.17	109,387	20,222	[illegible]8,037	14,918	0
06/08	18:01	506	491	199	396	18,912	94,634	0.17	113,546	20,441	68,[illegible]	15,052	0
06/08	21:00	530	501	212	404	27,371	222,183	0.11	249,554	20,982	129,[illegible]	15,346	0
06/08	23:55	535	501	212	406	23,061	218,069	0.10	241,129	21,698			0
06/09	01:05	532	501	206	404	36,772	222,183	0.14	258,955	21,990	187,691	15,993	0
06/09	03:15	530	501	210	403	36,983	222,183	0.14	259,166	22,551	193,587	16,406	0
06/09	04:05	530	501	207	403	36,983	222,183	0.14	259,166	22,767	187,691	16,565	0
06/09	06:15	532	501	209	402	36,850	220,126	0.14	256,976	23,326	187,691	16,972	0
06/09	08:00	534	501	208	402	36,850	220,126	0.14	256,976	23,776	193,587	17,306	0
06/09	10:30	535	501	210	402	37,195	222,183	0.14	259,378	24,421	197,270	17,794	272,433
06/09	12:15	537	501	207	402	36,506	218,069	0.14	254,574	24,871	197,270	18,139	259,460
06/09	14:10	535	501	207	403	36,983	222,183	0.14	259,166	25,363	187,691	18,508	259,460
06/09	20:30	537	501	202	401	33,251	197,496	0.14	230,747	26,915	187,691	19,697	275,676

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DATE	TIME	WHP	WHT	SEP. PRES	SEP. TEMP	SEPARATOR FLOW STEAM	SEPARATOR FLOW BRINE	SEP. FLASH	TOTAL FLOW	CUM.TOT. FLOW	WEIR BOX FLOW	CUM.WEIR FLOW	INJEC. FLOW
		psig	F	psig	F	lb/hr	lb/hr		lb/hr	klb	lb/hr	klb	lb/hr
06/09	23:05	535	501	198	392	34,962	197,496	0.15	232,458	27,513	187,691	20,182	265,947
06/10	01:05	535	502	199	392	34,962	197,496	0.15	232,458	27,978	172,547	20,542	278,920
06/10	02:20	535	502	199	391	34,421	193,382	0.15	227,802	28,266	180,383	20,763	278,920
06/10	04:00	[illegible]	502	200	393	34,408	195,439	0.15	229,847	28,647	185,256	21,067	0
06/10	05:55	[illegible]	502	202	395	32,956	189,267	0.15	222,223	29,080	176,941	21,414	0
06/10	08:00	537	502	201	397	33,299	193,382	0.15	226,681	29,548	180,326	21,787	0
06/10	10:30	540	502	201	408	30,263	193,382	0.14	223,644	30,111	173,968	22,230	0
06/10	12:20	537	502	201	409	30,049	193,382	0.13	223,430	30,521	179,938	22,554	0
06/10	14:11	541	502	198		30,052	185,152	0.14	215,204	30,926	181,193	22,888	0
06/10	16:15	540	502	198	401	29,343	181,038	0.14	210,381	31,366	151,801	23,232	0
06/10	18:10	543	502	197	397	29,628	181,038	0.14	210,666	31,770	162,498	23,533	212,757
06/10	20:10	533	502	209	396	30,090	213,954	0.12	244,044	32,224	193,115	23,889	220,541
06/10	22:05	537	502	207	[illegible]	29,233	201,611	0.13	230,843	32,679	183,562	24,250	220,541
06/11	00:08	535	502	207	393	28,510	201,611	0.12	230,121	33,152	181,655	24,624	415,136
06/11	02:10	537	502	208	395	28,574	197,496	0.13	226,070	33,616	184,545	24,997	395,677
06/11	04:05	535	502	210	393	28,339	197,496	0.13	225,835	34,049	178,502	25,344	402,163
06/11	06:15	535	502	209	394	[illegible]	193,382	0.13	221,657	34,534	179,133	25,732	0
06/11	07:50	537	502	208	395	28,574	193,382	0.13	221,956	34,885	178,188	26,015	0
06/11	10:00	537	502	208	397	29,081	190,900	0.13	219,981	35,364	171,912	26,394	0
06/11	12:13	540	502	208	400	29,081	[illegible]	0.14	214,233	35,845	162,465	26,765	0
06/11	14:05	545	502	208	399	29,153	183,095	0.14	212,249	36,243	168,665	27,074	162,163
06/11	16:05	545	502	206	399	29,167	[illegible]	0.14	212,262	36,667	169,821	27,412	240,001
06/11	18:20	540	502	203	391	28,252	185,153	0.13	213,404	37,146	169,648	27,794	252,974
06/11	20:15	535	502	202	387	27,117	181,038	0.13	208,155	37,550	169,417	28,119	265,947
06/11	22:05	540	502	202	385	26,760	174,866	0.13	201,626	37,926	165,602	28,426	271,136
06/12	00:05	535	502	207	390	27,428	181,038	0.13	208,466	38,336	170,168	28,762	269,190
06/12	02:22	537	502	208	391	27,128	172,809	0.14	199,937	38,802	168,203	29,148	269,190
06/12	04:02	537	502	202	388	28,902	187,210	0.13	216,111	39,149	183,528	29,441	0
06/12	06:30	540	502	201	385	28,835	178,981	0.14	207,818	39,672	178,428	29,888	0
06/12	08:08	540	502	199	386	29,056	181,038	0.14	210,094	[illegible]	178,544	30,179	0
06/12	10:00	540	503	203	398	30,044	181,038	0.14	211,082	40,496	184,378	30,518	252,974
06/12	12:08	545	503	201	392	29,549	222,711	0.12	252,260	40,900	[illegible]	30,886	233,514
06/12	14:11	507	497	214	395	58,265	367,958	0.14	426,223	41,596	[illegible]	31,354	376,217
06/12	16:00	512	499	211	395	58,943	358,275	0.14	417,218	42,362	[illegible]	31,894	368,433
06/12	18:05	518	500	212	396	60,540	358,275	0.14	418,814	43,233	[illegible]	32,523	324,325
06/12	20:03	515	500	213	396	60,673	353,433	0.15	414,106	44,052	290,950	33,109	0
06/13	00:03	513	500	211	387	59,647	348,592	0.15	408,238	45,697	292,090	34,275	355,460
06/13	02:06	513	499	214	389	60,424	358,275	0.14	418,698	46,544	295,323	34,877	348,974
06/13	04:02	514	500	214	392	60,653	353,433	0.15	414,086	47,349			259,460
06/13	06:08	511	500	213	390	60,063	353,433	0.15	413,496	48,218			162,163
06/13	08:02	512	500	213	391	60,139	348,592	0.15	408,731	48,999	291,533	36,618	291,893
06/13	10:11	517	500	213	408	60,139	343,750	0.15	403,889	49,873	291,452	37,245	0
06/13	11:55	517	500	213	400	59,910	348,592	0.15	408,502	50,577	293,495	37,752	324,325
06/13	14:03	517	500	214	406	60,042	343,750	0.15	403,792	51,443	291,553	38,376	295,136
06/13	16:03	518	500	213	400	59,834	343,750	0.15	403,584	52,251	307,197	38,975	194,595
06/13	18:05	519	500	213	394	59,758	343,750	0.15	403,508	53,071	292,198	39,584	361,947
06/13	20:06	518	500	214	392	60,042	343,750	0.15	403,792	53,885	293,963	40,175	0

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DATE	TIME	WHP psig	WHT F	SEP. PRES psig	SEP. TEMP F	SEPARATOR FLOW STEAM lb/hr	SEPARATOR FLOW BRINE lb/hr	SEP. FLASH	TOTAL FLOW lb/hr	CUM.TOT. FLOW klb	WEIR BOX FLOW lb/hr	CUM.WEIR FLOW klb	INJEC. FLOW lb/hr
06/13	22:15	519	500	211	392	59,019	338,909	0.15	397,928	54,747			149,190
06/14	00:05	513	500	215	391	61,322	353,433	0.15	414,755	55,492	320,148	41,398	149,190
06/14	02:02	513	500	215	391	60,939	348,592	0.15	409,530	56,296	321,913	42,024	142,703
06/14	04:03	513	500	215	392	61,092	348,592	0.15	409,683	57,122	301,321	42,653	282,163
06/14	05:53	513	500	214	392	60,806	343,750	0.15	404,556	57,868	294,852	43,199	259,460
06/14	08:02	513	500	213	392	61,055	343,750	0.15	404,805	58,738	274,024	43,811	246,487
06/14	10:01	513	499	215	394	62,089	353,433	0.15	415,523	59,552	316,614	44,396	272,433
06/14	11:57	517	500	216	395	63,244	348,592	0.15	411,835	60,352	330,167	45,022	259,460
06/14	14:05	517	500	216	384	62,859	347,623	0.15	410,482	61,229	317,065	45,712	240,001
06/14	16:07	517	500	216	391	62,859	343,750	0.15	406,609	62,059	319,624	46,359	214,055
06/14	18:07	519	500	219	391	62,744	334,067	0.16	396,811	62,863	328,948	47,008	252,974
06/14	20:09	456	490	268	402	80,529	464,789	0.15	545,318	63,821	450,970	47,801	285,406
06/14	22:06	476	492	266	[illegible]	79,818	464,789	0.15	544,606	64,883			214,055
06/15	00:06	480	492	264	405	78,258	459,947	0.15	538,205	65,966	439,660	49,560	285,406
06/15	02:07	476	492	265	406	78,398	459,947	0.15	538,346	67,052			298,379
06/15	04:06	480	492	265	407	78,113	459,947	0.15	538,060	68,119			376,217
06/15	06:25	480	492	264	407	[illegible]	459,947	0.14	537,921	69,365	414,186	52,256	480,000
06/15	08:04	485	493	247	408	74,378	459,947	0.14	534,325	70,250	396,232	52,925	314,595
06/15	10:00	485	491	260	429	77,191	[illegible]	0.15	532,297	71,281	414,482	53,709	347,028
06/15	12:07	485	491	260	410	77,697	459,947	0.14	537,644	72,413	477,700	54,653	347,028
06/15	14:02	489	491	260	408	78,710	[illegible]	0.15	538,658	73,445	414,062	55,508	0
06/15	16:00	490	491	260	418	78,710	453,169	0.15	531,879	74,498	467,667	56,375	0
06/15	18:02	491	492	260	416	78,710	453,169	[illegible]	531,879	75,579	447,200	57,305	337,298
06/15	20:02	410	481	263	410	93,770	602,289	0.13	696,059	76,807	581,612	58,334	421,623
06/15	22:03	409	481	263	409	90,833	677,817	0.12	768,650	78,284	606,278	59,531	415,136
06/16	00:08	491	493	200	410	58,531	366,221	0.14	424,752	79,527	453,192	60,635	415,136
06/16	02:08	495	494	187	400	54,097	319,503	0.14	373,600	80,325	432,941	61,521	421,623
06/16	04:10	499	498	175	397	51,760	300,591	0.15	[illegible]	81,063	421,567	62,390	544,866
06/16	06:07	497	498	176	397	51,896	301,379	0.15	353,275	81,751	384,029	63,175	402,163
06/16	08:19	503	498	175	397	51,760	300,591	0.15	352,351	[illegible]	385,163	64,021	405,406
06/16	10:22	504	498	216	415	71,952	463,804	0.13	535,756	83,438	403,654	64,830	205,440
06/16	12:02	505	498	237	415	74,860	421,215	0.15	496,075	84,298	378,612	65,482	337,298
06/16	14:04	473	491	223	416	86,758	508,363	0.15	595,121	85,407	473,600	66,348	337,298
06/16	16:25	417	483	252	423	91,386	561,620	0.14	653,006	86,874	[illegible]	67,518	421,623
06/16	17:57	419	484	253	424	92,577	551,937	0.14	644,514	87,868	[illegible]	68,304	0
06/16	19:58	405	482	244	422	90,005	551,937	0.14	641,942	89,166	[illegible]	69,342	0
06/16	21:59	407	483	243	422	89,304	551,937	0.14	641,240	90,460	507,106	70,384	321,082
06/17	00:03	397	483	243	421	89,003	556,778	0.14	645,781	91,789			356,758
06/17	02:08	406	485	244	421	88,674	556,778	0.14	645,452	93,135	510,145	72,495	210,811
06/17	04:17	412	484	244	420	88,173	551,937	0.14	640,110	94,516	509,619	73,592	246,487
06/17	06:00	430	485	243	420	87,803	551,937	0.14	639,739	95,615	503,702	74,461	324,325
06/17	08:06	440	484	240	420	86,198	550,000	0.14	636,198	96,955	611,297	75,632	0
06/17	10:04	440	483	241	421	90,981	561,620	0.14	652,601	98,222	597,157	76,820	343,785
06/17	12:05	445	486	246	420	90,353	542,254	0.14	632,606	99,518	536,665	77,964	343,785
06/17	13:46	452	487	234	420	89,236	551,937	0.14	641,172	100,590			0
06/17	15:08	476	500	223	415	61,344	372,799	0.14	434,143	101,325	401,090	79,394	220,541
06/17	16:00	491	500	225	414	61,036	377,641	0.14	438,677	101,703	400,249	79,741	330,812

DATE	TIME	WHP psig	WHT F	SEP. PRES psig	SEP. TEMP F	SEPARATOR FLOW STEAM lb/hr	SEPARATOR FLOW BRINE lb/hr	SEP. FLASH	TOTAL FLOW lb/hr	CUM.TOT. FLOW klb	WEIR BOX FLOW lb/hr	CUM.WEIR FLOW klb	INJEC. FLOW lb/hr
06/17	18:00	501	500	223	415	60,782	377,641	0.14	438,423	102,580	385,143	80,526	0
06/17	20:02	505	506	219	412	41,221	251,761	0.14	292,982	103,324	242,564	81,165	369,731
06/17	22:01	515	505	217	408	32,988	242,078	0.12	275,066	103,887	198,014	81,602	284,109
06/18	00:08	557	506	216	407	24,960	145,247	0.15	170,207	104,358			0
06/18	02:05	557	506	220	407	25,175	164,613	0.13	189,788	104,709	153,808	82,317	330,812
06/18	03:55	560	505	221	410	25,228	145,247	0.15	170,475	105,040	135,489	82,582	330,812
06/18	06:04	541	504	220	409	25,175	135,563	0.16	160,738	105,396			324,325
06/18	08:04	555	505	221	408	25,228	145,247	0.15	170,475	105,727	155,901	83,187	304,866
06/18	10:03	563	505	221	407	26,080	193,662	0.12	219,742	106,114	147,355	83,487	0
06/18	12:09	550	504	219	407	25,121	145,247	0.15	170,368	106,523	155,901	83,806	298,379
06/18	14:02	555	505	221	405	25,228	135,563	0.16	160,792	106,835	156,292	84,100	291,893
06/18	16:14	559	505	219	406	25,121	135,563	0.16	160,685	107,189	170,573	84,459	434,596
06/18	18:01	557	505	219	[illegible]	25,121	154,930	0.14	180,051	107,493	158,791	84,753	389,190
06/18	20:02	555	504	221	406	25,228	125,880	0.17	151,109	107,827	152,433	85,067	363,244
06/18	22:02	554	504	218	405	25,068	125,880	0.17	150,948	108,129	146,777	85,366	363,244
06/19	00:00	557	504	216	404	24,512	116,197	0.17	140,709	108,416	153,011	85,661	0
06/19	02:01	560	504	217	403	24,565	125,880	0.16	150,445	108,709	134,639	85,951	382,704
06/19	04:09	560	504	217	400	24,115	154,930	0.13	179,045	109,061	140,419	86,244	311,352
06/19	05:42	560	504	216	400	24,063	116,197	0.17	140,261	109,308	134,346	86,457	343,785
06/19	08:11	563	502	212	400	23,855	145,247	0.14	169,101	109,692	146,199	86,806	0
06/19	10:03	562	502	201	398	23,270	145,24[illegible]	0.14	168,517	110,007	140,419	87,073	0
06/19	12:01	566	504	215	396	24,011	116,190	0.17	140,209	110,311	149,667	87,358	350,271
06/19	13:42	565	503	210	394	23,749	145,247	0.14	168,996	110,571	149,667	87,610	353,514
06/19	16:15	516	494	223	398	61,531	377,641	0.1[illegible]	439,172	111,346	450,526	88,376	360,001
06/19	17:02	527	497	223	395	59,660	367,958	0.14	427,618	111,686	433,309	88,722	350,271
06/19	18:01	527	494	222	396	59,534	348,592	0.15	408,126	112,097	452,639	89,157	343,785
06/19	21:59	527	494	223	401	58,726	338,909	0.15	397,635	113,695	343,325	90,736	334,055
06/20	00:02	525	497	221	400	58,479	348,592	0.14	407,07[illegible]	[illegible]4,520	383,207	91,481	334,055
06/20	02:01	517	494	223	399	61,531	358,275	0.15	419,806	115,340	364,827	92,222	330,812
06/20	04:03	523	497	224	400	61,660	377,641	0.14	439,301	116,[illegible]	343,163	92,942	350,271
06/20	06:08	510	498	225	400	61,600	367,958	0.14	429,558	117,118	344,994	93,659	207,568
06/20	07:58	525	499	223	400	58,726	367,958	0.14	426,684	117,903	[illegible]0,890	94,306	246,487
06/20	10:02	525	497	223	401	60,875	367,958	0.14	428,833	118,787	3[illegible]8,583	95,070	210,811
06/20	11:43	525	499	223	401	60,595	367,958	0.14	428,552	119,509	354,[illegible]89	95,688	246,487
06/20	14:18	525	497	221	398	60,340	358,275	0.14	418,614	120,603	34[illegible],838	96,590	0
06/20	16:02	525	497	221	400	60,340	386,763	0.13	447,103	121,353	355,367	97,196	233,514
06/20	17:21	525	495	224	400	60,722	374,420	0.14	435,142	121,934	445,910	97,723	162,163
06/20	17:54					0	0		0	122,054	0	97,846	0

TABLE A-2
RAW DATA
STATE 2-14 FLOW TEST
June 1 - June 20, 1988

DATE	TIME	PI-1 (whp)	TI-1 (wht)	PI-155 (sep.P)	TI-109A (sep.T)	FR-102 (steam meter)	FR-108 (brine meter)	WEIR BOX level	FRESH WATER gpm	DPR-1 (injec. meter)	METER COEFFICIENTS STEAM	BRINE	INJEC.
06/01	17:07	183						0.00					
06/01	19:00	455	477					2.25					
06/01	21:[illegible]	479	481					2.38					
06/01	23:00	495	481					2.88					
06/02	01:00	492	468					2.75					
06/02	03:02	492	472					2.63					
06/02	05:55	49[illegible]	469					2.38					
06/02	07:12	49[illegible]	468					2.44					
06/02	09:04	493	468					2.44					
06/02	11:00	491						2.25					
06/02	13:01	490	466					2.19					
06/02	15:03	511	478					2.63					
06/02	17:00	512	481					2.88					
06/02	19:00	512	478					2.63					
06/02	21:00	510	478					2.63					
06/02	23:00	511	479					2.63					
06/03	00:58	510	478					2.63					
06/03	02:59	510	476					2.38					
06/03	05:03	507	476					2.38					
06/03	07:05	507	476					2.31					
06/03	08:00	508	474					2.38					
06/03	10:12	510	471					2.25					
06/03	12:00	510	471					2.25					
06/03	14:05	508	478										
06/03	16:01	518	490					2.44					
06/03	18:03	519	492					2.50					
06/03	20:06	514	491					2.38					
06/03	22:05	511	490					2.44					
06/04	01:02	512	492					2.50					
06/04	03:00	511	492					2.38					
06/04	05:00	511	492					2.38					
06/04	07:00	511	491					2.44					
06/04	09:00	513	490					2.25					
06/04	11:20	513	484					2.38					
06/04	13:03	513	480					2.25					
06/04	15:02	512	488					2.19					
06/04	17:06	512	485					2.31					
06/04	19:00	511	482					2.13					
06/04	21:01	510	482					2.13					
06/04	23:03	508	477					2.06					
06/05	01:09	506	478							4.65			64865
06/05	03:04	510	490							4.00			64865
06/05	04:55	516	490							7.20			64865
06/05	06:58	510	488					2.13		2.50			64865
06/05	09:15	519	492					2.44					64865
06/05	11:00	519	490					2.25		4.30			64865
06/05	13:08	518	490					2.19		2.10			64865
06/05	15:00	520	489					2.31		2.00			64865

TABLE A-2

DATE	TIME	PI-1 (whp)	TI-1 (wht)	PI-155 (sep.P)	TI-109A (sep.T)	FR-102 (steam meter)	FR-108 (brine meter)	WEIR BOX level	FRESH WATER gpm	DPR-1 (injec. meter)	METER COEFFICIENTS STEAM	BRINE	INJEC.
06/05	17:00	518	489					2.25		4.75			64865
06/05	19:12	518	492					2.38		2.40			64865
06/05	21:02	518	489					2.25		4.85			64865
06/05	23:10	512	490					2.25		2.40			64865
06/06	01:05	511	490							2.10			64865
06/06	03:04	511	491										64865
06/06	05:45	[illegible]	491					2.13					64865
06/06	08:00	[illegible]	491							1.50			64865
06/06	10:10	515	490										64865
06/06	12:15	515	492		250								64865
06/06	14:11	515	492										64865
06/06	16:25	517	492										64865
06/06	17:40	444											64865
06/06	17:58	388											64865
06/06	21:03	460	462										64865
06/06	23:00	519	492										64865
06/07	01:08	518	491		263								64865
06/07	03:00	517	491		[illegible]			2.19					64865
06/07	05:00	518	490	186	404		2.50	2.38				41145	64865
06/07	07:00	517	490	212	414		2.75	2.25				41145	64865
06/07	09:05	518	490	208	412		2.70	2.44				41145	64865
06/07	10:00	517	491	209	413		2.70	2.19				41145	64865
06/07	13:00	519	491	210	412		2.70	2.25				41145	64865
06/07	16:08	519	485	210	410	2.75	2.60	2.25		3.00	7015	41145	64865
06/07	18:03	519	491	212	412	2.80	[illegible]	1.88			7015	41145	64865
06/07	20:03	519	491	211	411	2.80	2.50	2.00			7015	41145	64865
06/07	22:03	519	490	208	405	2.60	2.40	2.19		5.15	7015	41145	64865
06/08	01:04	517	489	206	402	2.50	2.50	2.13		4.40	7015	41145	64865
06/08	04:00	516	489	203	400	2.50	2.40	2.25		4.40	7015	41145	64865
06/08	06:00	511	490	206	404	2.45	2.40	2.19		4.40	7015	41145	64865
06/08	07:55	512	490	206	405	2.60	2.35	2.31		[illegible]	7015	41145	64865
06/08	10:10	513	488	203	400	2.70	2.60	2.13			7015	41145	64865
06/08	12:05	513	489	201	398	2.70	2.40	2.25			7015	41145	64865
06/08	16:03	512	488	197	394	2.70	2.20	1.88			7015	41145	64865
06/08	18:01	511	489	198	396	2.70	2.30	1.88			7015	41145	64865
06/08	21:00	535	499	209	404	3.80	5.40	2.88			7015	41145	64865
06/08	23:55	540	499	210	406	3.20	5.30				7015	41145	64865
06/09	01:05	537	499	206	404		5.40	3.88	25.0		7015	41145	64865
06/09	03:15	535	499	210	403		5.40	3.95	25.0		7015	41145	64865
06/09	04:05	535	499	207	403		5.40	3.88	25.0		7015	41145	64865
06/09	06:15	537	499	209	402		5.35	3.88	25.0		7015	41145	64865
06/09	08:00	539	499	208	402		5.35	3.95	25.0		7015	41145	64865
06/09	10:30	540	499	210	402		5.40	3.81	25.0	4.20	7015	41145	64865
06/09	12:15	542	499	207	402		5.30	3.81	25.0	4.00	7015	41145	64865
06/09	14:10	540	499	207	403		5.40	3.88	25.0	4.00	7015	41145	64865
06/09	20:30	542	499	202	401		4.80	3.88	25.0	4.25	7015	41145	64865
06/09	23:05	540	499	198	392		4.80	3.88	25.0	4.10	7015	41145	64865
06/10	01:05	540	500	199	392		4.80	3.88	51.2	4.30	7015	41145	64865

TABLE A-2

DATE	TIME	PI-1 (whp)	TI-1 (wht)	PI-155 (sep.P)	TI-109A (sep.T)	FR-102 (steam meter)	FR-108 (brine meter)	WEIR BOX level	FRESH WATER gpm	DPR-1 (injec. meter)	METER COEFFICIENTS STEAM	BRINE	INJEC.
06/10	02:20	540	500	199	391		4.70	4.00	54.7	4.30	7015	41145	64865
06/10	04:00	540	500	200	393		4.75	4.06	54.9		7015	41145	64865
06/10	05:55	540	500	202	395		4.60	3.95	53.8		7015	41145	64865
06/10	08:00	542	500	201	397		4.70	4.00	54.8		7015	41145	64865
06/10	10:30	545	500	198	408	4.30	4.70	4.00	65.8		7015	41145	64865
06/10	12:20	542	500	198	409	4.27	4.70	4.06	64.1		7015	41145	64865
06/10	14:11	546	500	195		4.30	4.50	4.00	53.3		7015	41145	64865
06/10	16:15	545	500	195	401	4.20	4.40	3.63	53.8		7015	41145	64865
06/10	18:10	548	500	194	397	4.25	4.40	3.75	51.8	3.28	7015	41145	64865
06/10	20:10	538	500	206	396	4.20	5.20	4.13	50.0	3.40	7015	41145	64865
06/10	22:05	542	500	204	393	4.10	4.90	4.00	49.2	3.40	7015	41145	64865
06/11	00:08	540	500	204	393	4.00	4.90	4.00	52.5	6.40	7015	41145	64865
06/11	02:10	542	500	205	395	4.00	4.80	4.00	47.5	6.10	7015	41145	64865
06/11	04:05	540	500	[illegible]	393	3.95	4.80	3.95	51.1	6.20	7015	41145	64865
06/11	06:15	540	500	208	394	3.95	4.70	3.94	48.3		7015	41145	64865
06/11	07:50	542	500	205	395	4.00	4.70	3.56			7015	41145	64865
06/11	10:00	542	500	205	397	4.07	4.60	3.95	62.5		7015	41145	64865
06/11	12:13	545	500	205	[illegible]	4.07	4.50	4.00	85.7		7015	41145	64865
06/11	14:05	550	500	205	399	4.08	4.45	4.13	92.3	2.50	7015	41145	64865
06/11	16:05	550	500	203	399	4.10	4.45	4.13	90.3	3.70	7015	41145	64865
06/11	18:20	545	500	200	391	4.00	4.50	4.13	90.6	3.90	7015	41145	64865
06/11	20:15	540	500	199	387	3.85	4.40	4.13	91.0	4.10	7015	41145	64865
06/11	22:05	545	500	199	385	3.80	4.25	4.13	97.6	4.18	7015	41145	64865
06/12	00:05	540	500	204	390	3.85	4.40	4.13	89.7	4.15	7015	41145	64865
06/12	02:22	542	500	205	391	3.80	4.20	4.13	93.1	4.15	7015	41145	64865
06/12	04:02	542	500	199	388	4.10	4.55	4.31	93.0		7015	41145	64865
06/12	06:30	545	500	198	385	4.10	4.35	4.25	93.0		7015	41145	64865
06/12	08:08	545	500	196	386	4.15	4.40	4.25	92.8		7015	41145	64865
06/12	10:00	545	501	200	390	4.25	4.40	4.31	[illegible]	3.90	7015	41145	64865
06/12	12:08	550	501	198	392	4.20	2.30	4.00	89.0	3.60	7015	96831	64865
06/12	14:11	512	495	202	395	8.05	3.80	5.56	89.0	3.80	7015	96831	64865
06/12	16:00	517	497	199	395	8.19	3.70	5.63	95.3	3.68	7015	96831	64865
06/12	18:05	523	498	199	396	8.40	3.70	5.63	83.8	5.00	7015	96831	64865
06/12	20:03	520	498	200	396	8.40	3.65	5.50	88.0		7015	96831	64865
06/13	00:03	518	498	198	387	8.30	3.60	5.50	86.0	5.48	7015	96831	64865
06/13	02:06	518	497	201	389	8.35	3.70	5.50	80.4	5.38	7015	96831	64865
06/13	04:02	519	498	201	392	8.38	3.65		88.9	4.00	7015	96831	64865
06/13	06:08	516	498	200	390	8.32	3.65		91.7	2.50	7015	96831	64865
06/13	08:02	517	498	200	391	8.33	3.60	5.50	87.0	4.50	7015	96831	64865
06/13	10:11	522	498	200	408	8.33	3.55	5.44	76.8	0.00	7015	96831	64865
06/13	11:55	522	498	200	400	8.30	3.60	5.38	63.6	5.00	7015	96831	64865
06/13	14:03	522	498	201	406	8.30	3.55	5.50	87.0	4.55	7015	96831	64865
06/13	16:03	523	498	200	400	8.29	3.55	5.56	70.0	3.00	7015	96831	64865
06/13	18:05	524	498	200	394	8.28	3.55	5.50	85.8	5.58	7015	96831	64865
06/13	20:06	523	498	201	392	8.30	3.55	5.50	82.8	0.00	7015	96831	64865
06/13	22:15	524	498	199	392	8.20	3.50		80.8	2.30	7015	96831	64865
06/14	00:05	518	498	202	391	8.45	3.65	5.75	78.3	2.30	7015	96831	64865
06/14	02:02	518	498	202	391	8.40	3.60	5.75	75.2	2.20	7015	96831	64865

TABLE A-2

DATE	TIME	PI-1 (whp)	TI-1 (wht)	PI-155 (sep.P)	TI-109A (sep.T)	FR-102 (steam meter)	FR-108 (brine meter)	WEIR BOX level	FRESH WATER gpm	DPR-1 (injec. meter)	METER COEFFICIENTS STEAM	BRINE	INJEC.
06/14	04:03	518	498	202	392	8.42	3.60	5.56	80.2	4.35	7015	96831	64865
06/14	05:53	518	498	201	392	8.40	3.55	5.50	81.2	4.00	7015	96831	64865
06/14	08:02	518	498	200	392	8.45	3.55	5.31	87.3	3.80	7015	96831	64865
06/14	10:01	518	497	202	394	8.55	3.65	5.75	84.4	4.20	7015	96831	64865
06/14	11:57	522	498	202	395	8.70	3.60	5.88	81.7	4.00	7015	96831	64865
06/14	14:05	522	498	202	384	8.65	3.59	5.75	83.6	3.70	7015	96831	64865
06/14	16:07	522	498	202	391	8.65	3.55	5.75	79.2	3.30	7015	96831	64865
06/14	18:07	524	498	204	391	8.60	3.45	5.88	83.8	3.90	7015	96831	64865
06/14	20:09	461	488	250	403	10.00	4.80	7.13	91.7	4.40	7015	96831	64865
06/14	22:06	481	490	248	406	9.95	4.80		100.0	3.30	7015	96831	64865
06/15	00:06	485	490	246	405	9.80	4.75	6.88	65.8	4.40	7015	96831	64865
06/15	02:07	481	49[illegible]	247	406	9.80	4.75		64.4	4.60	7015	96831	64865
06/15	04:06	485	490	248	407	9.75	4.75		61.6	5.80	7015	96831	64865
06/15	06:25	485	490	247	407	9.75	4.75	6.63	65.2	7.40	7015	96831	64865
06/15	08:04	490	491	247	408		4.75	6.50	74.3	4.85	7015	96831	64865
06/15	10:00	490	489	248	429	7.95	4.70	6.63	64.7	5.35	8592	96831	64865
06/15	12:07	490	489	248	410	8.00	4.75	6.88	0.0	5.35	8592	96831	64865
06/15	14:02	494	489	248	[illegible]	8.10	4.75	6.25	0.0	0.00	8592	96831	64865
06/15	16:00	495	489	248	418	8.10	4.68	7.00	40.0	0.00	8592	96831	64865
06/15	18:02	496	490	248	416	8.10	4.68	7.13	99.2	5.20	8592	96831	64865
06/15	20:02	415	479	246	410	9.60	6.22	8.13	56.6	6.50	8592	96831	64865
06/15	22:03	414	479	247	409	9.[illegible]	7.00	8.25	37.5	6.40	8592	96831	64865
06/16	00:08	496	491	191	410	6.[illegible]2		6.88	42.4	6.40	8592	96831	64865
06/16	02:08	500	492	179	400	6.50		6.75	55.0	6.50	8592	96831	64865
06/16	04:10	504	496	168	397	6.40		6.63	52.4	8.40	8592	96831	64865
06/16	06:07	502	496	169	397	6.40		6.25	52.0	6.20	8592	96831	64865
06/16	08:19	508	496	168	397	6.40		6.25	50.0	6.25	8592	96831	64865
06/16	10:22	509	496	204	415	8.08		6.50	61.4	3.20	8592	96831	64865
06/16	12:02	510	496	225	415	8.05	4.35	6.25	[illegible].3	5.20	8592	96831	64865
06/16	14:04	478	489	206	416	9.60	5.25	7.19	64.5	5.20	8592	96831	64865
06/16	16:25	422	481	235	423	9.55	5.80	7.63	62.[illegible]	6.50	8592	96831	64865
06/16	17:57	424	482	236	424	9.65	5.70	7.50	72.4	0.00	8592	96831	64865
06/16	19:58	410	480	227	422	9.55	5.70	7.63	54.6	0.[illegible]	8592	96831	64865
06/16	21:59	412	481	227	422	9.48	5.70	7.50	64.2	4.95	8592	96831	64865
06/17	00:03	402	481	227	421	9.45	5.75		60.7	5.50	8592	96831	64865
06/17	02:08	411	483	228	421	9.40	5.75	7.50	59.1	3.25	8592	96831	64865
06/17	04:17	417	482	228	420	9.35	5.70	7.50	60.0	3.80	~~8592~~	96831	64865
06/17	06:00	435	483	22[illegible]	420	9.33	5.70	7.44	58.5	5.00	8592	96831	64865
06/17	08:06	445	482	224	420	9.22	5.68		53.6	0.00	8592	96831	64865
06/17	10:04	445	481	224	421	9.70	5.80		53.3	5.30	8592	96831	64865
06/17	12:05	440	484	229	420	9.55	5.60	7.75	60.7	5.30	8592	96831	64865
06/17	13:46	457	485	217	420	9.65	5.70		64.9	0.00	8592	96831	64865
06/17	15:08	481	498	215	415	6.78	3.85	6.50	65.9	3.40	8592	96831	64865
06/17	16:00	496	498	217	414	6.72	3.90	6.50	67.3	5.10	8592	96831	64865
06/17	18:00	506	498	215	415	6.72	3.90	6.38	72.5	0.00	8592	96831	64865
06/17	20:02	510	504	215	412	4.60	2.60	4.88	74.6	5.70	8592	96831	64865
06/17	22:01	520	503	214	408	3.70	2.50	4.38	77.7	4.38	8592	96831	64865
06/18	00:08	562	504	215	407	2.80	1.50		82.0	0.00	8592	96831	64865

PRELIMINARY DRAFT

TABLE A-2

DATE	TIME	PI-1 (whp)	TI-1 (wht)	PI-155 (sep.P)	TI-109A (sep.T)	FR-102 (steam meter)	FR-108 (brine meter)	WEIR BOX level	FRESH WATER gpm	DPR-1 (injec. meter)	METER COEFFICIENTS STEAM	BRINE	INJEC.
06/18	02:05	562	504	219	407	2.80	1.70	3.88	83.6	5.10	8592	96831	64865
06/18	03:55	565	503	220	410	2.80	1.50	3.56	73.9	5.10	8592	96831	64865
06/18	06:04	546	502	219	409	2.80	1.40		76.0	5.00	8592	96831	64865
06/18	08:04	560	503	220	408	2.80	1.50	3.88	80.0	4.70	8592	96831	64865
06/18	10:03	568	503	219	407	2.90	2.00	3.75	78.0	0.00	8592	96831	64865
06/18	12:09	555	502	218	407	2.80	1.50	3.88	80.0	4.60	8592	96831	64865
06/18	14:02	[illegible]	503	220	405	2.80	1.40	3.88	80.0	4.50	8592	96831	64865
06/18	16:14	564	503	218	406	2.80	1.40	4.13	89.0	6.70	8592	96831	64865
06/18	18:01	562	503	218	405	2.80	1.60	3.88	75.0	6.00	8592	96831	64865
06/18	20:02	560	502	220	406	2.80	1.30	3.88	86.0	5.60	8592	96831	64865
06/18	22:02	559	502	217	405	2.80	1.30	3.75	79.0	5.60	8592	96831	64865
06/19	00:00	562	502	215	404	2.75	1.20	3.88	85.0	0.00	8592	96831	64865
06/19	02:01	565	502	216	403	2.75	1.30	3.75	100.0	5.90	8592	96831	64865
06/19	04:09	565	502	[illegible]	400	2.70	1.60	3.75	90.0	4.80	8592	96831	64865
06/19	05:42	565	502	215	400	2.70	1.20	3.63	84.0	5.30	8592	96831	64865
06/19	08:11	568	500	211	400	2.70	1.50	3.75	80.0	0.00	8592	96831	64865
06/19	10:03	567	500	200	398	2.70	1.50	3.75	90.0	0.00	8592	96831	64865
06/19	12:01	571	502	214	[illegible]	2.70	1.20	3.75	74.0	5.40	8592	96831	64865
06/19	13:42	570	501	209	394	2.70	1.50	3.75	74.0	5.45	8592	96831	64865
06/19	16:15	521	492	215	398	[illegible]	3.90	7.13	92.5	5.55	8592	96831	64865
06/19	17:02	532	495	215	395	6.60	3.80	6.88	76.8	5.40	8592	96831	64865
06/19	18:01	532	492	214	396	6.60	3.60	7.00	66.0	5.30	8592	96831	64865
06/19	21:59	532	492	215	401	6.50	3.50	6.13	101.0	5.15	8592	96831	64865
06/20	00:02	530	495	213	400	6.50	[illegible]	6.13	32.0	5.15	8592	96831	64865
06/20	02:01	522	492	215	399	6.80	[illegible]	6.13	63.9	5.10	8592	96831	64865
06/20	04:03	528	495	216	400	6.80	3.90	5.88	60.0	5.40	8592	96831	64865
06/20	06:08	515	496	217	400	6.78	3.80	5.88	56.0	3.20	8592	96831	64865
06/20	07:58	530	497	215	400	6.50	3.80	6.06	60.0	3.80	8592	96831	64865
06/20	10:02	530	495	215	401	6.73	3.80	6.13	40.0	3.25	8592	96831	64865
06/20	11:43	530	497	215	401	6.70	3.80	6.00	60.0	3.80	8592	96831	64865
06/20	14:18	530	495	213	398	6.70	3.70	5.88	58.0	[illegible]	8592	96831	64865
06/20	16:02	530	495	213	400	6.70	9.40	6.00	59.0	3.60	8592	41145	64865
06/20	17:21	530	493	216	400	6.70	9.10	6.88	55.0	2.50	8592	41145	64865
06/20	17:54					0.00	0.00	0.00	0.0	0.00	8592	41145	64865

P R E L I M I N A R Y D R A F T

ADDENDUM B

DATA SHEETS

Dent Dean
Jeff Logston

STARTUP DATA SHEET
KENNECOTT STATE 2-14

DATE 6-1-88
PAGE 1 / 2
(overlaps page 2)

(Pit marker - 1st Black mark btn 9" from btm 7" for Tape)

TIME	WELLHEAD PI-1 PRESS. (psig)	WELLHEAD TI-1 TEMP (°F)	THROTTLE VALVE UPSTREAM PRESS/Temp (psig)(°F)	THROTTLE VALVE DOWNSTREAM PRESS/T (psig)(°F)	PIT LEVEL (inches)	AFT WEIR LEVEL (inches)	V.S. WEIR LEVEL (inches)	COMMENTS
1707	183	Ambient			0			STATIC Began opening WH Valves
1718	163				0			Opened wing valve
1723			173					
1730	171							Began opening Throttle
1736								217
1738	43	268						heating up rapidly
1740	121	320						Began throttling back; casing growth 3/4"
1742								Began into ATF
1750	215	398						csg growth 8-10"
1800	370	455						Blew rupture disc on WH valve. Switched to other disc
1830	445	475						
1833					2			Reduced flow 1 turn on throttle valve
1900	455	477						
1905					2½"	2¼"		
1930			445P / 470T	29? / 275T	3" (21¼)	2¼		Leak underneath weir box. Switched to vent silencer
1957	460-465	465 / 478	455P / 466T	30P / 272T	3¼ (21½)	1¾" →	Some leak by weir plate	Switched back to ATF put plastic in outfall ...
2103	479	468 / 481	470P / 471T	30P / 270T	4⅛ (22⅜)	2⅜		
2158	485	469 / 481	473P / 473T	24P / 267T	5" (23¼)	2¾		
2300	495	469 / 481	482 / 475T	— ?	5¾ (24)	2⅞		Broke salt off weir plate
2400	496	469 / 480	483 / 476	24 / 260	6½ (24¾)	2¾		Leak between two master valves

(Pit level column notes: "← Rise above starting level"; "Reading on tape measure →")

STARTUP DATA SHEET

KENNECOTT STATE 2-14

DATE 6/1/88
PAGE 2/2
(Overlaps page 1)

TIME	WELLHEAD PRESS. (psig)	WELLHEAD TEMP (°F)	THROTTLE VALVE UPSTREAM PRESS (psig)	THROTTLE VALVE DOWNSTREAM PRESS/T (psig)/°F	PIT LEVEL (inches)	AFT WEIR LEVEL (inches)	V.S. WEIR LEVEL (inches)	COMMENTS	
1738			15	12/235°				Throttled back	
1742			162	31/268°				Throttled back too much then opened again	
1746			120	23/251°				Started opening to AFT.	
1750			195	40/290°				Valve to AFT open. Closing Blooie Line.	
1757			330	95/358°		6 5/8"	no flow	All flow thru AFT	
1800			350	100/368		6 7/8	" "		
1805			360	103/363°		6 7/8	" "		st
1806			390	85/345°		5 3/8	" "	Pinch one WHEEL	st
1813			405	80/345°		5 5/8	" "		st
1822	470	475	410	80/345°		5 3/8	" "	PR Disc on M/C-1 failed	st
1830			425	85/345°		5 3/8	" "		st
1833	—		—	—		—	" "	PINCHED Turn 1/4 1 WHEEL	st
1838			440	45/315°	up 2" from 0	3 1/4	" "		st
1845			480	50/319°		3 1/8	" "		st
1900			495	50/320°		3 0	" "		st
1900	—	—	—	—	—	T	—	Pinched 1/2 turn 1 Wheel	st
1907			440	25/270°		2 7/8	✓		st
							✓		

moved to Sheet #1

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6/2/88

PAGE: 1 / 1

		Wellhead		Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG:				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-9 PSIG	TI-9 °F	PI-13 PSIG	TI-13 °F	PI-103 PSIG	TI-103 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-[illegible] °F	TI-109A PSIG	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0000	496	469	483	466	24	260										
0100	0100	492	468	482	466	21	254										
0200	0158	492	467	484	465	20	275										
0300	0302	492	469	486	466	19	269										
0400	0357	493	469	485	465	19	269										
0500	0458	493	467	483	463	16	265										
0600	0555	491	466	483	462	15	263										
0700	0712	491	465	483	462	17	262										
0800	0800	493	465	484	462	17	257										
0900	0904	493	465	484	462	17	255										
1000	1000	493	466	484	462	18	255										
1100	1100	491	464	482	461	17	25[illegible]										
1200	1156	490	464	481	461	16	253										
1300	1301	490	463	480	460	16	251										
1400	1402	504	466	486	462	26	270										
1500	1503	511	468	505	46[illegible]	25	267										
1600	1608	512	478	505	4[illegible]	23	266										
1700	1700	512	481*	507	465	23	263		* TI-1 was moved								
1800	1800	512	479	507	464	25	260		to TW-1A								
1900	1900	512	478	507	465	23	277										
2000	1958	511	478	506	465	22	276										
2100	2100	510	478	503	464	22	275										
2200	2200	511	480	505	465	23	273										
2300	2301	511	479	505	465	22	272										

Flowing Directly to AFT

SHIFT SUPERVISOR C. E. [illegible] (signature) 6-2-88 (date) 0100 (time)

SHIFT SUPERVISOR R V Verity (signature) 6/3/88 (date) 0530 (time)

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6/2/88

PAGE: 1/1

		L.P. Brine	AFT Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank #1	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead	
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DFM-1 Red Pen	PI-141 PSIG	TI-140 oF
0000	0000		2 3/4	6 1/2									
	0100		2 3/4	7 1/8									
0200	0158		2 3/4	7 3/4									
	0302		2 5/8	8 1/2									
0400	0357		2 5/8	9									
	0458		2 5/8	9 1/2									
0600	0555		2 3/8	10									
	0712		2 7/16	10 7/8									
0800	0800		2 7/16	11 3/8									
	0904		2 7/16	11 3/4									
1000	1000		2 3/8	12 1/2									
	1100		2 1/4	13									
1200	1156		2 5/16	13 1/4									
	1301		2 3/16	13 3/4									
1400	1402		2 3/4	14 3/8									
	1503		2 5/8	14 3/4									
1600	1608		2 3/4	15 1/2									
	1700		[illegible]7/8	16									
1800	1800		2 3/4	16 1/2									
	1900		2 5/8	17									
2000	1958		2 5/8	17 1/2									
	2100		2 5/8	18 1/4									
2200	2200		2 5/8	18 3/4									
	2301		2 5/8	19 1/4									

Not in Operation

SHIFT SUPERVISOR C. E. [illegible] (signature) 6-2-88 (date) [illegible] (time)

SHIFT SUPERVISOR R V Verity (signature) 6/3/88 (date) 0530 (time)

DRAFT

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-3-88

PAGE: 1/1

		Wellhead		Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG:				
Nominal Time	Actual Time	PI-1 PSIG	TW-1A TI-1 °F	PI-9 PSIG	TI-9 °F	PI-10 PSIG	TI-10 °F	PI-103 PSIG	TI-103 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-[illegible] °F	TI-109A PSIG	FR-108 Red Pen	FR-108 Blue Pen	PI-143 PSIG
0000	0002	510	478	505	465	22	276										
	0058	510	478	504	465	22	275										
0200	0159	510	477	503	464	20	274										
	0259	510	476	500	465	20	275										
0400	0407	507	476	500	464	19	272										
	0503	507	476	498	464	19	276										
0600	0605	507	476	499	464	19	267										
	0705	507	476	499	464	19	266										
0800	0800	508	474	500	464	18	264										
1000	1012	510	471	501	464	19	2[illegible]										
1200	1200	510	471	501	464	20	261										
	1300	509	471	500	464	19	260										
1400	1405	508	478	500	464	19	258	MERCURY THERMOMETER READ 485°									
	1500	515	483*	507	463	23	267	PUT INSULATION AROUND THERMOMETER									
1600	1601	518	490	512	465	24	262	MERCURY THERM - 486° F									
	1705	518	491	51[illegible]	465	25	257	RTD ... 492° F							40½" Dn to wat...		
1800	1803	519	492	511	465	22	257								Cellar		
	1900	517	[illegible]	509	465	23	254								Cellar	40¼"	
2000	2006	514	491	506	464	20	253								✓		
	2105	511	491	505	464	21	250									40"	
2200	2205	511	490	505	464	22	252								WALKED PIT PERIMETER		OK
	2304	512	491	506	465	21	251								Cellar	39"	

Flowing 2-14 to AET

CONFIDENTIAL

SHIFT SUPERVISOR C. E. [illegible] 6-4-88 0145
signature date time

SHIFT SUPERVISOR R V Verity 6/4/88 0630
signature date time

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-3-88

PAGE: 1 / 1

		L.P. Brine	AFT ↓ Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank #1	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead	
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF
0000	0002		2 5/8	19 3/4	—								
	0058		2 [illegible]/8	20 1/4	top of	[illegible]							
0200	0159		2 1/2	20 3/4	1/2 of	white							Slushy SALT Forming in wellhead
	0259		2 3/8	21 1/4	Top of	White							
0400	0407		2 3/8	21 3/4	1/2 of	blk							
	0503		2 3/8	22 1/4	Btm of	Red							
0600	0605		2 3/8	22 3/4	Middle	of Red							
	0705		2 5/16	23	Near top	of Red							
0800	0800		2 3/8										
1000	1012		2 1/4										
1200	1200		2 1/4	25 1/4	~~Btm~~ of	Red							
	1330		2 3/16	26 1/4	Top of	Red							
1400													
1600	1515		2 3/8	27	3/4 of	white							
	1615		2 7/16	27 1/2	1/4 of	Black							
1800	1710		2 7/16	27	3/4 of	white	Filling TANKS from Pit						
	1805		2 1/2	25 1/2	1/4 of	Red	✓	✓	✓	✓			
2000	1912		2 7/16	24 1/4	Black	white Interface		✓ ✓	✓	✓			
	2012		2 3/8	24 1/2	1/4	Black		TANKS Full					
2200	2110		2 7/16	25 1/4	Btm of	Red							
	2207		2 1/2	25 3/4	Middle of	Red							
	2308		2 5/8	26	3/4 of	Red							

SHIFT SUPERVISOR C.E. [illegible] (signature) 6-4-88 (date) 0145 (time)

SHIFT SUPERVISOR R V V[illegible] (signature) 6/4/88 (date) 0630 (time)

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-4-88

PAGE: 1 / 1

	Wellhead			Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG:				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-~~12~~ 9 PSIG	TI-~~12~~ 9 °F	PI-~~13~~ 10 PSIG	TI-~~13~~ 10 °F	PI-103 PSIG	TI-103 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI- °F	TI-109A PSIG	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0004	514	492	507	465	21	253	Flowing directly to AFT					Cellar	34"	Dn To Fluid		
	0102	512	492	506	465	21	250						—	32½	—	— —	
0200	0158	514	492	506	465	21	249										
	0300	511	492	506	465	21	242										
0400	0405	511	492	505	465	20	243										
	0500	511	492	504	465	20	245										
0600	0615	511	490	504	465	20	235										
	0700	511	491	505	465	21	235						Cellar –	36½"	Dn to	fluid	
0800	0800	512	491	505	465	20	233										
	0900	513	490	506	465	21	235						Cellar –	36"	Down to	fluid	(~12" ...)
1000	1000	513	491	507	465	22	2[illegible]										
	1120	513	484	506	464	21	229										
1200	1215	513	480	506	464	21	231						Cellar	35"	Down to	fluid	
	1303	513	480	506	464	20	227										
1400	1409	513	486	506	464	20	237										
	1502	512	488	507	[illegible]	21	237						Cellar	34"	Dn to	Fluid	
1600	1605	513	485	506	463	20	222										
	1706	512	485	—	—	—	—										
1800	1812	512	487	506	464	20	223						Cellar	33"	Dn to	Fluid	
	1900	511	[illegible]	—	—	—	—										
2000	2001	[illegible]	483	505	463	20	217										
	2101	510	482	502	463	19	213						Cellar	32½	Dn To	Fluid	
2200	2201	510	482	501	463	19	209										
	2303	508	477	499	463	17	206						✓	32"	✓	— —	

Started pit pump 2332   Started In. pump 2347

SHIFT SUPERVISOR C E Fisher (signature) 6-5 (date) 0030 (time)   SHIFT SUPERVISOR R V Verity (signature) 6/5/88 (date) 0530 (time)

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-4-88

PAGE: 1 / 1

		L.P. Brine	AFT Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank #1	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead	
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	~~DFR~~-1 Red Pen	PI-141 PSIG	TI-140 oF
0000	0010		2 1/2	26 1/2	1/4 of	white					BOTH OUTLET LINES from AFT TO WEIR BOX PLUGGED 75% ... SALT		
	0105		2 1/2	27	3/4 of	white							
0200	0202		2 1/2	27 1/2	1/4 of	Black							
	0300		2 3/8	28	3/4 of	Blk							
0400	0405		2 7/16	28 1/2	1/4 of	Red							
	0500		2 3/8	28 3/4	1/2 of	Red							
0600	0618		2 1/2	29 1/2	1/4 of	White							
	0709		2 7/16	30	3/4 of	White							
0800	0803		2 3/8	30 1/2	1/4 of	Blk							
	0909		2 1/4	30 3/4	~1/2 of	Blk							
1000	1006		2 3/16	31 1/4	~Btm of	Red							
	1125		2 3/8	31 1/2	~1/4 of	Red	← Transferred more brine to Tanks						
1200	1220		2 1/4	31 1/2	1/4 of	Red		1200		106	Started Injection at 1145 hrs Brine flow recorder not hooked up. (WALKED PIT BANK-OK).		
	1320		2 1/4	31 3/4	1/2 of	Red							
1400	1411		2 3/16	31 3/4	1/2 of	Red					Just Refilled Ins. Tanks		
	1505		2 3/16	32	3/4 of	Red		195# | 108°					
1600	1611		2 1/4	32	3/4 of	Red	10 1/2	118 | 105					
	1708		2 3/16	31	3/4 of	Black	11 1/2	SD AT 1712					
1800	1817		2 1/4	31	3/4 of	Black	17"	Restart at 1800			Working on WEIR Box		
	1910		2 1/8	30 1/2	1/4 of	Black							
2000	2061		2 1/8	31 1/8	7/8 of	Black	12 3/4	ALL Pumps Shut Off					
	2107		2 1/8	31 1/2	1/4 of	Red							
2200	2205		2 1/8	32 1/4	TOP of	Red		Started pit pump at 2332					
	2307		2 1/16	32 1/2	1/4	White		Started booster pump at 2347					

SHIFT SUPERVISOR C. E. [illegible] (signature) 6-5 (date) 0030 (time)

SHIFT SUPERVISOR R. V. Verity (signature) 6/5/88 (date) 0530 (time)

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-5-88

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		Wellhead		Throttle Valve				Steam				Sep. Level		High Pressure Brine, LEG:			
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-~~12~~ 9 PSIG	TI-~~12~~ 9 °F	PI-~~13~~ 10 PSIG	TI-~~13~~ 10 °F	PI-103 PSIG	TI-103 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI °F	TI-109A PSIG	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0022	50[illegible]	479	500	403	18	212							Cellar	31 3/4	Dn to Fluid	
	0109	506	478	500	462	16	208	—									
0200	0222	505	478	497	463	16	203							Cellar	31"	Down to fluid	
	0304	510	490	501	464	18	205										
0400	0400	517	490	510	465	20	198										
	0455	516	490	510	464	20	200										
0600	0608	520	492	513	465	23	203										
	0658	520	488	513	465	24	203	Yellow Mercury therm 487.5									
0800	0755	519	491	513	465	25	209										
	0915	519	492	512	465	27	221	Yellow mercury therm 487.5						walked pit brine - ok			
1000	1005	519	491	512	465	27	2[illegible]										
	1100	519	490	512	465	25	216										
1200	1205	519	492	511	465	25	215	RTD +11°									
	1308	518	490	510	467	25	217	Yellow mercury therm 487°									
1400	1410	518	489	511	—	2[illegible]	—										
	1500	520	489	513		23								Cellar	29"	Dn to Fluid	
1600	1600	519	489	51[illegible]		24											
	1700	518	489	51[illegible]		24											
1800	1805	518	490	512		24								Cellar	[illegible]7"	Dn to Fluid	
	1912	518	492	512		22											
2000	2001	518	489	510		21											
	2102	518	489	510		21											
2200	2200	517	489	509		20											
	2310	512	490	508		20											

SHIFT SUPERVISOR C. E. [illegible] (signature) 6-6-88 (date) 0002 (time)

SHIFT SUPERVISOR R V [illegible] (signature) 6/6/88 (date) 0450 (time)

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-5-88

PAGE: 1 / 1

		L.P. Brine	AFT Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead		
Nominal Time	Actual Time	PI-146 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DFR-1 Red Pen	PI-141 PSIG	TI-140 oF	Remarks
0000	0026		Not in USE	31 1/4	Btm of red		16	—	94	105	4.6 Blue pen			
	0117			30	3/4 of white		14 0123		82	105	4.65			
0200	0225			28 1/4	Btm of red						4.4			
	0308			26 3/4	1/2 of white		13 1/2				4.0			
0400	0404		~~1 3/4~~	25 1/2	1/4 of Red						4.6			
	0500			Pit level gauge			23	130		100	7.2 Blue pen			
0600	0620		2 1/4	is salted up and cannot be read.			16	120		100	red pen 7.2			
	0700		2 1/8				13 3/4				2.5 ← Pump Cavitating			S.D. inj @0701
0800	0800		2 1/4	✓			18	100		98	6.2			Restart inj. 0753
	0920		2 7/16				14	0		—	0 S.D.			
1000	1010		2 5/16	✓			29	0			0 S.D.			
	1105		2 1/4				18	43		98	4.3			SD pump @11:15
1200	1210		2 1/8	✓			17	0		98	2.3			inj. on Vacuum
	1315		2 3/16				20	0		100	2.1			
1400	1418		2 5/16	✓	Running		21 1/2	0 SD		101	2.0			
	1504		2 5/16		✓		22 1/2	0 SD		101	2.0			
1600	1604		2 1/4	✓	✓		25 1/16	0 SD		100		1610 STARTed Inj pump		
	1706		2 1/4		✓		13 1/2	45		98	4.75	1710 SD pump		
1800	1808		2 1/4	✓	✓		16 1/2	0 SD		97	2.3	GRAVITATING into well		
	1917		2 3/8		✓		20"	0 SD		96	2.4			
2000	2006		2 5/16	✓	✓		27 1/2			90	2.2	2010 STARted inj pump		
	2105		2 1/4		✓		22"	40		89	4.85	Pump running		
2200	2205		2 5/16	✓	✓		12 1/2	20-20 — pump loosing suction		95	5.0	2210 SD pump		
	2315		2 1/4		✓		18	0		91	2.4			

SHIFT SUPERVISOR [illegible] (signature) 6-6-88 (date) 0002 (time)

SHIFT SUPERVISOR [illegible] (signature) 6/6/88 (date) 0450 (time)

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-6-88
PAGE: 1 / 1

	Wellhead			Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG: A (north)				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-~~12~~ 9 PSIG	TI-~~12~~ 9 °F	PI-~~13~~ 10 PSIG	TI-~~13~~ 10 °F	PI-~~103~~ 155 PSIG	TI-~~103~~ 101 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	TI-[illegible]4 °F	TI-109A PSIG	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0005	512	490	506		20											
	0105	511	490	505		20							Cellar 26" Dn to Fluid				
0200	0158	511	491	505		21						0130 [illegible] outs AFT [illegible] VS to [illegible] Diverter Connections					
	0304	511	491	505		27											
0400	0400	510	491	502		28											
0600	0545	510	491	503		24		Started diverting flow thru separator at 0630									
										Not in Service	Not in Service	Not in Service			Not in Service	Not in Service	
0800	0800	515	491	509		20											
1000	1010	515	490	509		20											
1200	1215	515	492	509		24		7±	250				10±	250			
1400	1411	515	492	509		18							Cellar [illegible]" Dn to Fluid Blooie Line Partially open - working on AFT [illegible]				
1600	1625	517	492	510		19			254								
1800	1720	SHUT well - Small Leak Developed in Flowline Downstream of Throttle Valve															
	1740	444 - Repairing leak By welding the Sole on Pipe															
2000	1758	388															
	2028	OPENED VALVE And Began Flowing Again															
	2103	460	462	459	456												
2200	2210	515	491	508				6	252								
	2300	519	492	510				6	252								

SHIFT SUPERVISOR C. E. [illegible] (signature) 6-7-88 (date) 0027 (time)

SHIFT SUPERVISOR R V Verity (signature) 6/7/88 (date) 0530 (time)

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-6-88

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		L.P. Brine	AFT Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank #1	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead	
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	~~PI-127 PSIG~~	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF
0000	0008 0108		2 1/4	Too Low To Read	Running Lost Suction		21 1/2 13 1/2	—	0 SD 0 SD	89 90	2.2 2.1	well on VACUUM Pumping from pit + Putting into Storage tanks	
0200	0202		in V.S.		S.D. at 0115		13"		SD	—	S.D.	STOPPED GRAVITATING	
0400			back to AFT 0435		S.D.								
0600	0545		2 1/8 Out of		S.D.		5,800 gal					Ran booster pump 0730 - 0750 Then S.D. and allowing	
0800	0800		service to weld in weir plate		S.D.		7 1/2" 1320 gal				1.5	well to inject on vacuum.	
1000	1005		And Extend outfall plate		S.D.		6 3/4"			82	0		
1200	1220						6 1/2				0		
1400	1415				SD		6 1/4			—	0		
1600	1630				SD		6 1/4			—	0		
1800													
2000													
2200													

SHIFT SUPERVISOR [illegible] signature — 6-7-88 date — 0027 time

SHIFT SUPERVISOR [illegible] signature — 6/7/88 date — 0530 time

Comparative readings at 1130 hrs on steam temp at outlet of separator: (PI-155 = 211 psig)
TI-101 dial thermometer 410 °F
ASTM mercury thermom. 400 °F White mercury thermom = 400 °F

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

State 2-14 cellar
at 0100, 21½" down to wtr
at 1418, 20" down to wtr
at 2105, 20½" down to wtr

DATE: 6-7-88
PAGE: 1 / 1

		Wellhead		Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG: A (north)				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-~~12~~ 9 PSIG	TI-~~12~~ 9 °F	PI-~~13~~ 10 PSIG	TI-13 °F	PI-~~103~~ 155 PSIG	TI-~~103~~ 101 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-? °F	TI-109A PSIG	FR-108 Red Pen	PR-108 (1000#) Blue Pen	PI-143 PSIG
0000	0015	519	491	511		15			252					264			
	0108	518	491	511		17			252					263			
0200	0300	517	491	509		18			251					262			
0400	0400	517	490	509		155		158	389		Working	68	164	389	2.5	14.4	93
	0500	518	490	509		188		186	404	[illegible]		67	192	404	2.5	17.6	103
0600	0605	515	489	509		190		187	403	178		70	192	405	2.7	17.6	126
	0700	517	490	509		215		212	412	200		68	220	414	2.75	20.2	122
0800	0800	517	490	509		217		214	414	206		70	223	415	2.75	20.2	130
	0905	518	490	510		212		[illegible]	412	200		66	218	412	2.7	20.2	110
1000	1000	517	491	510		212		209	413	203		69	218	413	2.7	20.2	136
	1130								410								
1200								209									
	1300	519	491	511		214		210	412	202	Y	[illegible]	220	412	2.7	20.2	127
1400	1418	519	491	511		213		210	412	201		80	218	411	3.0	20.2	110
	1500										2.8						
1600	1608	519	485 ?	511		216		210	412	202	2.75	65	224	410	2.6	20	105
1800	1803	519	491	~~513~~		221		212	413	203	2.8	64	226	412	2.7	20.6	135
	1902	520	[illegible]	512		220		212	413	203	2.8	64	226	412	2.8	20.4	108
2000	2003	516	491	510		216		211	413	200	2.8	64	224	411	2.5	20.4	100
	2105	516	491	510		216		211	411	199	2.7	[illegible]	222	[illegible]	2.4	20.0	130
2200	2203	519	490	511		211		208	405 (windy)	194	2.6	63	216	405	2.4	19.9	135
	2302	518	488	510		208		206	406	192	2.5	64	214	404	2.4	19.9	125

SHIFT SUPERVISOR C E [illegible] (signature) 6-7-88 (date) 2355 (time)

SHIFT SUPERVISOR R V [illegible] (signature) 6/7/88 (date) 1500 (time)

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-7-88

PAGE: 1/1

		L.P. Brine	AFT Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank #1	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead	
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF
0000					S.D		5 1/2"	S.D.	0				
0200	0300		2 3/16										
0400	0400 0500		2 3/8 2 3/8										
0600	0610 0715		2 3/8 2 1/4										
0800	0820 0910		2 [illegible] 2 7/16										
1000	1005		2 3/16		Ran 1								
1200	1305		2 1/4		pit pump and S.D.		14"						
1400	1430		2 1/4		Pit [illegible] running		27"						
1600	1623		2 1/4		S.D.		12 3/4 — No feed tanks equalized		← 20	98	3.0		1640 Pump SD Lost Suction a few minutes before
1800	1810 1908		1 7/16 3/18 2 1/16		SD		9 1/4		SD.		—		
				WEIR Box reading fluctuates			9' with Brine		SD Control valve — opening & closing				
2000	2010 2115		1 7/8 - 2 1/8 2 1/8	(2010) Started —	west pump		10 32		73	103	5.3		2050 37" in tank started [illegible]
2200	2206 2305		2 1/16 1 7/8	Started Inj pump Both running			14" 28 1/2	←	71 71	[illegible] 107	5.15 5.3	56 —	105° —

2315 - SD East pump

SHIFT SUPERVISOR C. E. [illegible] (signature) 6-7-88 (date) 2315 (time)

SHIFT SUPERVISOR R V [illegible] (signature) 6/7/88 (date) 1500 (time)

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

Wtr in collar 21" down at 0215

DATE: 6-8-88
PAGE: 1 / 1

	Wellhead			Throttle Valve				Steam				Sea Level	High Pressure Brine, LEG: A North				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-~~12~~ 9 PSIG	TI-~~12~~ 9 °F	PI-~~13~~ 10 PSIG	TI-13 °F	PI-~~103~~ 155 PSIG	TI-~~109~~ 101 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-4 °F	TI-109A PSIG	FR-108 Red Pen	1000 F PR-108 Blue Pen	PI-143 PSIG
0000	0003 0104	517 517	489 489	510 509		206 206		204 206	405 406	190 191	2.5 2.5	63 [illegible]	212 211	400 402	2.5 2.5	19.9 19.9	104 131
0200	0215	516	489	510		205		204	~~404~~	191	2.5	64	210	401	2.4	19.5	130
0400	0400	516	489	509		204		203	404	191	[illegible]	65	209	400	2.4	19.5	126
0600	0600	511	490	505		209		206	410	197	2.45	64	212	404	2.4	19.5	95
0800	0755	512	490	509		210		206	412	200	2.6	64	222	405	2.35	20.0	123
1000	1010	513	488	507		207		[illegible]	410	195	2.7	64	214	400	2.6	19.5	117
1200	1205	513	489	506		206		201	407	195	2.7	64	213	398	2.4	19.5	95
1400	In meeting																
1600	1603 1700	512 512	488 486	507 506		204 204		197 198	407 407	190 189	2.7 2.7	64 64	208 209	394 394	2.2 2.3	19.0 19.0	95 114
1800	1801 1909	511 511	489 488	505 506		204 206		198 202	408 408	189 190	2.7 2.8	64 64	211 212	396 395	2.3 2.3	19.0 19.0	113 113
2000	Changing Rcrs 1950–2030 Hrs 2100	530-5?0	499	520-530		215		209	417	195	3.8	64	219	404	5.4	20.0	187
2200	MAJOR UPSET 2200 LOST SUPPLY AIR TO CONTROLLERS 2355	540	499	520-530		214		210	416	192	3.2	64	214	406	5.3	21.0	195

SHIFT SUPERVISOR C-E Fish (signature) 6-9-88 (date) 0050 (time)

SHIFT SUPERVISOR R V Verity (signature) 6/9/88 (date) 0420 (time)

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-8-88

PAGE: 1 / 1

Nominal Time	Actual Time	L.P. Brine PI-144 PSIG	AFT Weir Box Level Inches	Brine Pond Level Inches	Pond Pump PI-127 PSIG	Fresh Water F.W. Meter gallons	Brine Tank #1 Level Inches	Booster Pump Dischg PI-129 PSIG	Injection Pump Dischg PI-10 PSIG	Injection Pump Dischg TI-10 oF	Injection Flow Meter DPR-1 Red Pen	Imperial 1-13 Injection Wellhead PI-141 PSIG	Imperial 1-13 Injection Wellhead TI-140 oF
0000	0007 0109		1 3/4-2 1/4 2 1/8	—	EAST Running ✓		33 30 1/2	70 42	S.D.	108 108	5.3 [illegible].4	(0035)	Reduced Inj Pump RPM: Noise in pump
0200	0223		2 1/4		✓		28 1/2	45		[illegible]	4.4		
0400	0405		2 1/4		✓		26 1/2	47		97	4.4		
0600	0608		2 3/16		✓		27	43		93	4.4	33	94
0800	0805		2 5/16		S.D. ~0830		12	0830 cavitating S.D. 0818 & closed inj line valve		95	3.0		Booster pump started cavitating at 0806.
1000	1020		2 1/8										
1200	1210		2 1/4				9	0			0		
1400													
1600	1610 1710		1 7/8 1 7/8	—			8 1/4 8 1/4	0 0		— —	— —	— —	No Fresh wate. available (canal out)
1800	1805 1913		1 7/8 1 7/8				8 1/4 8 1/4	— —		— —	— —	— —	
2000	2105		2 7/8										
2200	2359		SALTED UP										

SHIFT SUPERVISOR C. E. Frech (signature) 6-9-88 (date) 0050 (time)

SHIFT SUPERVISOR R V Veitz (signature) 6/7/88 (date) 0420 (time)

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-9-88

PAGE: 1 / 1

		Wellhead		Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG: 14 [illegible]				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-~~12~~ 9 PSIG	TI-~~12~~ 9 °F	PI-~~18~~ 10 PSIG	TI-13 °F	PI-~~103~~ 155 PSIG	TI-~~103~~ 101 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-4 °F	TI-109A PSIG	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0105	535-540	499	520-530		213		206	417	192	8.1 BAD	64	214	404	5.4	19.9	195
0200	0210	532-41	499	520-530		214		208	418	195	3.05	64	214	405	5.4	19.9	196
	0315	532-38	499	525-32		212		210	416	195	3.0	64	214	403	5.4	19.9	199
0400	0405	530-39	499	520-530		211		207	416	196	3	64	213	403	5.4	20.0	196
0600	0615	535-40	499	522-528		211		209	416	198	2.95	64	215	402	5.35	20.0	196
0800	0800	537-40	499	525-532		212		208	418	200	3.1	64	217	402	5.35	20.0	194
1000	1030	538-42	499	530-535		215		210	417	202	3.3	64	220	402	5.4	20.0	196
1200	1215	540-45	499	536-40		217		207	417	201		64	220	402	5.3	20.0	195
1400	1410	538-545	499	536-40		217		207	417	200	BAD	64	222	403	5.4	20.0	195
1600	1507	540-45	499	535-40		218		198	417	189			211	382	upset	—	—
1700	UPSET																
1800	EVERYTHING ON HAND (MANUAL) OPERATION - LOST AIR COMP																
2000	2030	540-45	499	535-40		212		202	414	190	BAD 3.95	NOT WORKING	218	401	4.8	19.6	191
2200	2201	540-45	500	530-38		208		202	410	188			209	396	4.6	19.9	188
	2305	538-41	499	530-38		208		198	405	186			208	392	4.7	19.7	187

SHIFT SUPERVISOR C.E. [illegible] (signature) 6-10-88 (date) 0005 (time)

SHIFT SUPERVISOR R.V. Verity (signature) 6/10/88 (date) 0320 (time)

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-9-88

PAGE: 1/1

* Fresh H2O [illegible] in Weir Box

Nominal Time	Actual Time	L.P. Brine PI-144 PSIG	AF. Weir Box Level Inches	Brine Pond Level Inches	Pond Pump PI-127 PSIG	Fresh Water F.W. Meter gallons	Brine Tank #1 Level Inches	Booster Pump Dischg PI-129 PSIG	Injection Pump Dischg PI-10 PSIG	Injection Pump Dischg TI-10 oF	Injection Flow Meter DPR-1 Red Pen	Imperial 1-13 Injection Wellhead PI-141 PSIG	Imperial 1-13 Injection Wellhead TI-140 oF
0000	0105	—	3 7/8*	—	SD	—	8 3/4	SD.	S.D.	—	—	—	—
0200	0220 0320		3 7/8* 3 15/16										
0400	0410		3 7/8										
0600	0620		3 7/8				12½						
0800	0814		3 15/16	started east pump at 0813			15		0.	92		Opened butterfly at 54 to allow inj. on vacuum	
1000	1035		3 13/16		SD. east, running west			48		118	4.2		
1200	1225		3 13/16				25	50/70		127	4.0	20	132
1400	1410		3 7/8		1200 RPM		34	80		134	4.0		
1600	1407		5 1/2 (separator standing)		900 RPM		30½	70		134	3.8	20 (At 1640)	137° (At 1640)
1800													
2000	2030		3 7/8		W 1000 RPM	5200	27	60		126	4.25	36	129
2200	2205 2305		3 7/8 3 7/8	inc [illegible]	W 1000 1120		24 25½	60 55		126 125	4.2 4.1		

Notes on the sheet:
- 1000–1200: butterfly pinched back and booster pump speeded up to maintain flow
- 1200: butterfly [illegible] open

SHIFT SUPERVISOR [signature] date 6-10-88 time 2005

SHIFT SUPERVISOR R V Verity date 6/10/88 time 0320

20

TEMP CALIB CHECKS

Steam at Sep Outlet	1117 hrs	12:30 hrs
TI-101 dial thermom	415°	414
ASTM Mercury thermom	—	402
Digital T/C	399°	—

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

Brine at Sep Outlet	11:30	12:40
TI-109A dial therm	408	409
ASTM merc. therm	—	409
Digital T/C	404	—

DATE: 6-10-88
PAGE: 1 / 1

	Wellhead			Throttle Valve				Steam				Sep. Level	High Pressure Brine. LEG: 1st North				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-~~12~~ 9 PSIG	TI-12 °F	PI-~~13~~ 10 PSIG	TI-13 °F	PI-~~103~~ 155 PSIG	TI-~~105~~ 101 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-4 ~~°F~~ (PSIG)	TI-109A ~~(PSIG)~~	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0005	535-540	499	530-35		[illegible]		[illegible]	408	185	—	—	207	393	4.9	20.0	
	0105	538-544	500	530-35		[illegible]		199	406	185			206	392	[illegible]	[illegible]	
0200	0220	538-45	500	530-35		207		199	407	185			208	391	4.7	19.5	187
0400	0400	538-42	500	530-36		207		200	411	188			209	393	4.75	19.5	188
0600	0555	538-42	500	530-35		206		202	412	190			209	395	4.6	19.5	186
0800	0800	541-45	500	535-38		208		201	415	193			213	397	4.7	19.5	187
1000	1030	543-48	500	535-40		210		198	415	193	4.3		214	408	4.7	Changed to L-10 chart	183
1200	1220	540-45	500	535-40		210		198	414	192	4.27		214	409	4.7	4.4	184
1400	1411	545-48	500	540-44		209		195	413	191	4.3		211	[illegible]	4.5	4.4	185
1600	1615	543-48	500	541-46		208		195	412	189	4.2		209	401	4.4	4.4	182
1800	1810	545-50	500	540-45		207		194	413	185	4.25		209	397	4.4	4.4	182
2000	2010	536-42	500	530-40		216		206	4ve	192	4.2		217	396	5.2	4.5	196
2200	2205	540-45	500	530-36		216		204	406	191	4.1		217	39[illegible]	4.9	4.45	
	2306	535-45	500	525-40		214		205	406	191	4.1		214	393	5.0	4.45	195

SHIFT SUPERVISOR C E Frol... (signature) 6-11-88 (date) 0005 (time)

SHIFT SUPERVISOR R V Verity (signature) 6/11/88 (date) 0330 (time)

Weir box sample at 2130 hrs cooled to 60°F has sp. gr. = 1.26. No salt precip. Dilution water = 52 gpm

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

This reading is from tape measure. Subtract 18¼" to get rise above orig. starting level.

DATE: 6-10-88

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Nominal Time	Actual Time	L.P. Brine PI-144 PSIG	4FT Weir Box Level Inches	Brine Pond Level Inches	Pond Pump PI-127 PSIG	Fresh Water F.W. Meter gallons	Brine Tank #1 Level Inches	Booster Pump Dischg PI-129 PSIG	Injection Pump Dischg PI-10 PSIG	Injection Pump Dischg TI-10 oF	Injection Flow Meter DPR-1 Red Pen	Imperial 1-13 Injection Wellhead PI-141 PSIG	Imperial 1-13 Injection Wellhead TI-140 oF
0000	0010		3 7/8	26 ½	W 1100	17400 51.7	26½	45		120	4.[illegible]	35	121
	0110		3 7/8	26"	W 1100	20500 51.2	26½	45		116	4.3		
0200	0230		4	below mark line	W 1200 Lost Sec S.D. 0330	24,600 54.7 gpm	19½	47 S.D. 0330		—	4.3 0	-	-
0400	0405		4 1/16	✓		29,800 54.9 gpm	11		Butterfly fully open		0		
0600	0558		3 15/16	26½		36,000 53.8 gpm	11				0		Walked pit ink - ok
0800	0808		4	29	Ran	43,000 54.8 gpm	11½				0		
1000	1034		4	31¼	0955-1015	51,000 65.[illegible]					0		
1200	1225		4 1/16	33½		~~58~~ 58,300 66.4	30				0		Ran 5-8 min By Chart
1400	1410		4	35 5/8	SD	65,900 53.3	32	SD			0		Started Inj at 1400 SD Bef. 1422 Reading
1600	1620	Building Level in Separator	3 5/8	39		72300	32½						Started Inj 1720 Started Pond Pump 1755
1800	1812		3 3/4	Limited [illegible] 39½	W 1175	78100 51.8	25	55		129	3.35		1838 LOST Generator
2000	2012	Loosing Level in Separator	4 1/8	[illegible] 37½	E.	84100 50.0	33	Closed Pump Dis 15	C = 130 (Flow 0)		3.4	25	112
2200	2130 2205		4	37	E.SD E start	90000 51.2 49.2	16	22		122	3.4	15	120
	2310		4	35	E	93200	32	12		115	3.4		

SHIFT SUPERVISOR C E [illegible] (signature) 6-11-88 (date) 0003 (time) 48.7

SHIFT SUPERVISOR R V [illegible] (signature) 6/11/88 (date) 0330 (time)

At 1015 hrs test gauge reads 5psi less than PI-1.
At 1045 hrs : PI-155 = 207psi ; Test gauge = 208psi

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-11-88

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	Wellhead			Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG: [illegible]				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-~~12~~ 9 PSIG	TI-12 °F	PI-~~13~~ 13 PSIG	TI-13 °F	PI-~~108~~ 155 PSIG	TI-~~108~~ 101 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-6 (°F)	TI-109A ~~PSIG~~	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0008	538-45	500	520-35		211		204	406	191	4.0		[illegible]	393	4.9	4.45	184
0200	0210	540-45	500	530-[illegible]		211		205	410	190	4.0		213	395	4.8	4.45	194
0400	0405	540 port is plugged	500	530-35		211		207	410	193	3[illegible]		211	393	4.8	4.45	189
0600	0615	540	500	525-32		213		206	411	196	3.95		210	394	4.7	4.45	184
0800	0750	542	500	525-32		212		205	414	198	4.0		213	395	4.7	4.45	185
1000	1000	540-45	500	530-40		212		205	416	200	4.07		214	397	4.6	4.45	178
1200	1213	542-48	500	535-40		216			418	200	4.07			400	4.5	4.45	180
1400	1405	548-52	500	542-46		21[illegible]		205	418	200	4.08		214	399	4.45	4.45	176
1600	1605	548-52	500	536-42		216		203	417	198	4.1		216	399	4.45	4.45	174
1800	1820	540-48	500	536-45		208		200	—	188	4.0		209	391	4.5	4.45	175
2000	2015	538-45	500	530-40		204		199	405	186	3.85		206	387	4.4	4.4	170
2200	2205	540-50	500	530-40		204		199	404	182	3.8		204	385	4.25	4.4	176
	2305	540-45	501	525-40		204		199	405	182	3.8		204	385	4.2	4.4	185

SHIFT SUPERVISOR C-E. [illegible] (signature) 6-11-88 (date) 2357 (time)

SHIFT SUPERVISOR R V Verity (signature) 6/11/88 (date) 1450 (time)

Inlet to weir box, Temp = 108°C = 226°F at 1220 hr

Rise above original starting level

Tape meas. (XX) reading

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-11-88

PAGE: 1/1

Nominal Time	Actual Time	L.P. Brine PI-144 PSIG	AFT Weir Box Level Inches	Brine Pond Level Inches	Pond Pump PI-127 PSIG	Fresh Water F.W. Meter gallons	Brine Tank Level Inches	Booster Pump Dischg PI-129 PSIG	Injection Pump Dischg PI-10 PSIG	Injection Pump Dischg TI-10 oF	Injection Flow Meter DPR-1 Red Pen	Imperial 1-13 Injection Wellhead PI-141 PSIG	Imperial 1-13 Injection Wellhead TI-140 oF	
0000	0015		4	16 (34½)	E	[illegible]500 525	20	87 ↔	87	114	6.4			Both Inj Pumps Running
0200	0215		4	10¾ (29)	E	102600 47.5	30	76	76	11[illegible]	6.1			
0400	0413		3 15/16	(25") (below mud line)	S.D. E Start W	108200 51.1 gpm	23½	75 S.D. both pumps at 0453	75	108	6.2 (6.1)	(45)	(108)	at 0450
0600	0624		3 15/16	6¾ (25)	S.D. W at 0500	114900 48.3 gpm	18	0	0		0			
0800	0758		3 9/16 Fresh wtr S.D.	8¾ (27)		119,440 F.W. Shut down	18½	0	0		0			
1000	1025		3 15/16	12 (30½)		127,700 62.5 gpm	19½	0	0		0			
1200	1225		4	14¾ (33)		1[illegible]200 85.71 gpm	20½	0	0		0			
1400	1424		4⅛	16¾ (35)	East Running	145,400 92.3 gpm	20	S.D.	<10 Started 1345	107	25		Started inj @ 1345	
1600	1608		4 1/8	1[illegible]4	E Running	155000 90.37 gpm	25½	Running 30	SD.		3.7			
1800	1823		4 1/8	14¾ 33	E Running	167200 90.6 gpm	8"	SD 1825 Restarted 1840 50	SD	— —	— 3.9		SD Inj pump 1825 Restarted 1840	
2000	2020		4 1/8	11 29¼	E Running	177800	35	48	SD	117	4.1		SD Pond Pump 2025 Started 2120	
2200	2210 2308		4 1/8 4 1/8	10½ 28¾ 9½ 27¾	E	188500 gpm (97.6) 194200	28 30	48 45	SD SD	109 106	4.1 4.18		Inj Pump Cavitated 2135-2150 ±	

87.9 gpm 103,300 gal 24 hr = 72 GPM avg

SHIFT SUPERVISOR C E [illegible] (signature) 6-11-88 (date) 2357 (time)

SHIFT SUPERVISOR R V Verity (signature) 6/11/88 (date) 1450 (time)

Rise above orig. starting Level

Tape measure reading

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-12-88

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		L.P. Brine	AFT Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead	
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF
0000	0006		4 1/8	8 1/4 (26 1/2)	E	199300 89.7 gpm	28 1/2	45	SD	105	4.1	29	105
0200	0231		4 1/8	Below mud line	S.D. at 0234	212,300 93.1 gpm	27	50 S.D. 0239	SD	[illegible]	4.15		
0400	0413		4 5/16	7 3/4 (26)		221,800 93.0 gpm	24	S.D.			0		
0600	0636		4 1/4	11 3/4 (30)		235,100 93.0 gpm	25 1/2				0		
0800	0816		4 1/4	13 3/4 (32)		244,400 92.8 GPM	26 1/2		Started 1000		0		
1000	1007		4 5/16	16 1/4 (34 1/2)	E	254,700 91 GPM	[illegible]		30	101	3.9	Started inj. at 1000.	
1200	1221		4	14 1/4 32 1/2	E	[illegible]900	32		44	104	3.6	30	121
1400	1420		5 9/16 5 9/16	13 1/4 31	E	89 GPM 277500	28 1/2	Started ABT 1335 84	84	120	5.8		1404 - Increase Again slightly
1600	1506 1607		5 5/8 5 5/8	11 3/4 (30) 10 1/2 (29)	E W	282000 95.3 287700	32 30	82 84	82 84	126 127	5.65 5.68	52	135° Walked to tank
1800	1810		5 5/8	Below msmt Point	W. SD	83.8 gpm 298200	30 1/2	70	70	136	5.0		SD Inj Pumps AT 1847 hrs
2000	2007		5 1/2	12 3/4 31	SD	308330 88	12	SD	SD	—	—		
2200	2210		5 1/2	16 3/4 (35)		83.7 gpm 318600	12	SD	SD	—	—		

2345 STARTED Inj Pumps

SHIFT SUPERVISOR C. E. Fe[illegible] 6-13-88 0031
signature date time

SHIFT SUPERVISOR ____________
signature date time

Rise above orig. starting Level

Tape measure reading

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-12-88

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Nominal Time	Actual Time	L.P. Brine PI-144 PSIG	AFT Weir Box Level Inches	Brine Pond Level Inches	Pond Pump PI-127 PSIG	Fresh Water F.W. Meter gallons	Brine Tank Level Inches	Booster Pump Dischg PI-129 PSIG	Injection Pump Dischg PI-10 PSIG	Injection Pump Dischg TI-10 oF	Injection Flow Meter DPR-1 Red Pen	Imperial 1-13 Injection Wellhead PI-141 PSIG	Imperial 1-13 Injection Wellhead TI-140 oF
0000	0006		4 1/8	8¼ (26½)	E	199300 89.7 gpm	28½	~~45~~	SD	105	4.1	29	105
0200	0231		4 1/8	Below mud line	S.D. at 0234	212,300 93.1 gpm	27	50 S.D. 0239	SD	1[illegible]	4.15		
0400	0413		4 5/16	7¾ (26		221,800 93.0 gpm	24	S.D.			0		
0600	0636		4¼	11¾ (30		235,100 93.0 gpm	25½				0		
0800	0816		4¼	13¾ (32		244,400 [illegible] GPM	26½		Started 1000		0		
1000	1007		4 5/16	16¼ (34½)	E	254,700 91 GPM	3[illegible]		30	101	3.9	Started inj. at 1000.	
1200	1221		4	14¼ 32½	E	2[illegible]900	32		44	104	3.6	30	121
1400	1420		5 9/16 5 9/16	13¼ 31	E	89 GPM 277500	28½	Started ABT 135 89	89	120	5.8		1404 - Inc Rate Again slightly
1600	1506 1607		5 5/8 5 5/8	11[illegible](30) 10¼ (29)	E W	282000 95.3 287700	32 30	82 84	82 84	126 127	5.65 5.68	52	135° Washed at Tank
1800	1810		5 5/8	Below msmt Point	W. SD	83.8 gpm 296000	30½	70	70	136	5.0		SD Inj Pumps AT 1847 Hrs
2000	2007		5½	12¾ 31	SD	308330 88	12	SD	SD	—	—		
2200	2210		5½	16¾ (35)		83.7 gpm 318600	12	SD	SD	—	—		

2345 Started Inj Pumps

SHIFT SUPERVISOR C. E. Fred 6-13-88 0021
signature date time

SHIFT SUPERVISOR ______________ ______ ______
signature date time

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-13-88

PAGE: 1/1

	Wellhead			Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG: B South				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-9 PSIG	Sep tube PSIA	PI-10 PSIG	TI-13 °F	PI-155 PSIG	TI-101 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-4 °F	TI-109A PSIG	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0003	512-21	498	480-510	1947.04	216		198	406	185	8.3	[illegible]	211	387	3.6	4.5	194
0200	0106 0206	515-19	497	490-510	1945.0 1943.1	220		201-2	408	189	8.35	64	212	389	3.7	4.5	195
0400	0402	518-20	498	490-510	1944.53	214		201	410	189	[illegible]8	64	213	392	3.65	4.5	194
0600	0604	512-518	498	490-510	1945.25	218		200	411	189	8.32	64	212	390	3.65	4.5	189
0800	0802	515-520	498	490-510	1946.65	220		200	[illegible]	192	8.33	64	217	391	3.6	4.5	192
1000	1011	520-525	498	500-510	Out of hole 1000	220		200	412	193	8.33	64.5	217	408	3.55	4.55	196
1200	Adjusted 1155	Throttle 520-525	valve 1120 498	500-510		225		200	412	194	8.3	64	217	400	3.6	4.56	202
1400	1403	520-25	498	500-15		22[illegible]		201	416	193	8.3	64	216	406	3.55	4.55	202
1600	1603	521-26	498	490-519		226		200	413	192	8.29	60	217	400	3.55	4.55	202
1800	1805	521-28	498	500-516		224		200	415	191	8.28	64	219	394	3.55	4.55	198
2000	2006	521-26	498	490-515		221		201	416	189	8.3	63	216	392	3.55	4.55	195
2200	2211	521-27	498	490-515		219		199	411	185	8.2	64	214	392	3.5	4.53	197

SHIFT SUPERVISOR C.E. Frod (signature) 6-14-88 (date) 0001 (time)

SHIFT SUPERVISOR [illegible] (signature) 6/14/88 (date) 0640 (time)

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-13-88

PAGE: 1/1

		L.P. Brine	AFT Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tanks	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead	
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF
0000	0008		5 1/2	18 3/4 (37)	RPM W 1500	86.4 328800	24	72	72	130	5.48		Started Inj @2345 Opened throttle 0020
0200	0226		5 1/2	18 1/4 (35 1/2)	W1500	(11100) 80.4 339900	16 1/2	74	74	127	5.38		inc. Pond pump 1700 0230
0400	0415		too much steam around weir box	W1800 ↓0445 1700	(9600) 88.0 349500	12	21	20	160	3-5			0315 - Circulating Inj Pump Injection off - 0415 on - 0500
0600	0500 0615		Around weir box to get Reading		W1800	(11100) 92.5 360600	18 3/4			125	3.3-0500-0520 5.5-0520-0530 4.5-0530-0600 8.5-0600-0615	0	125
0800	0818		5.5	15 3/4 (34)	E	(10700) 87.0 371300	16.5	55	55	126	4.2-0615-0630 2.0-0630-0650 6.2-0650-0705 4.9-0705-0730	30	130
1000	1023		5 7/16	16 1/4 (34 1/2)	W1300	(9600) 76.6 3809[illegible]	13	0	0	125	4.2-0730-0745 2.6-0745-0755 4.5-0755-0845 3.9-0845-0945		
1200	12:10		5 3/8	16 3/4 (35)	E — W 850	1140-1200 (63.0) 397700	32	62	62	171	3.5-0945-1015 0 1015-1109 3.2 1109-1800 5.9 1800-	0	
1400	1405		5 1/2	15 3/4 (34)	W 50 Running	397700 (9100) 89.0 70	30	57	50	139	4.55		1410 Short in Gen may Loose Control Air. Control valve on manual operation
1600	1615		5 9/16	14 3/4 (35)	E-50 W-800	406800 (9700) 85.8	31	50	20	138	3.0		Control Valve Back on Auto 1605±
1800	1704 1808		5 1/2	15 1/4 (33 1/4)	E Started @1812 W-1300	416500	15 1/2	Started @ 1715 - 50 84	50	138	5.58	18	138
2000	2010		5 1/2	12 3/4 (31)	E 50 W 800	(10100) 82.8 426600 80.8	32			Throttle Pinched 137			
2200	2215		Too much steam around box	13 3/4 (32)	W-800	436700	30 1/2	50	50	140	2.3		2227 opened throttle valve after Readings

SHIFT SUPERVISOR A.E. Frohs (signature) 6-14-88 (date) 0001 (time)

SHIFT SUPERVISOR Paul McSpadden (signature) 6/14/88 (date) 0640 (time)

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-14-88

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Nominal Time	Actual Time	Wellhead PI-1 PSIG	Wellhead TI-1 °F	Throttle Valve PI-9 PSIG	Throttle Valve °F	Throttle Valve PI-10 PSIG	Throttle Valve TI-13 °F	Steam PI-155 PSIG	Steam TI-101 °F	Steam PCR-103 Chart Reading	Steam FR-102 Chart Reading	Sep. Level LCR-107 Chart Reading	High Pressure Brine, LEG: B South PI-4 °F	TI-109A PSIG	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0005	515-20	498	490-509		223		202	412	188	8.45	64	215	391	3.65	4.55	198
0200	0202	515-20	498	495-505		218		202	414	188	8.4	6[illegible]	214	391	3.6	4.6	196
0400	0403	515-20	498	490-500		220		202	417	190	8.42	[illegible]4.5	215	392	3.6	4.5	196
0600	0553	515-20	498	490-510		224		201	417	190	8.4	64.5	213	392	3.55	4.55	197
0800	[illegible]2	515-20	498	495-505		218		200	415	191	[illegible]45	65	218	392	3.55	4.55	198
1000	1001	515-20	497	490-510		230		202	[illegible]	195	8.55	96	220	394	3.65	4.55	205
1200	1157	520-25	498	500-510		225		202	417	195	8.7	64	220	395	3.6	4.55	207
1400	1405	520-25	498	498-511		226		202	413	194	8.65	64	218	~~384~~	3.59	4.55	207
1600	1607	520-25	498	496-516		226		20[illegible]	416	193	8.65	64	219	391	3.55	4.6	211
1800	1807	521-28	498	498-516	Bubble Tube PSI	225		204	416	192	8.6	64	221	391	3.45	4.55	206
2000	2009	460-62	488	429-33	(1801 Hrs) 1833.0	280		25[illegible]	435	240	10.0	64	267	403	4.8	5.0	258
2200	2104	479	489	440-45	1863.54	276		247	434	238	10.0	69	265	406	4.8	5.0	255
	2206	481	490	444-50	1870.4	277		248	432	234	9.95	64	264	406	4.8	5.0	254
	2310				1871.3												

SHIFT SUPERVISOR C. E. [illegible] (signature) 6-15-88 (date) 0030 (time)

SHIFT SUPERVISOR Paul W. [illegible] (signature) 6/15/88 (date) 0829 (time)

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-14-88
PAGE: 1 / 1

		L.P. Brine	AFT Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tanks	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead	
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF
0000	0010		5 3/4	15 1/2 (33 3/4)	W 800	445700 9100 (75.2)	30	SD	50	140	2.5		
0200	0211		5 3/4	17 1/4 (35 1/2)	W 800	454800 9700 (80.2)	29 1/2	SD	40	[illegible]	2.2		
0400	0412		5 9/16	17 1/2 (36)	E W 1450	464500 9100 (81.25)	19 1/2	65	65	145	4.35	44	194
0600	0604		5 1/2	16 1/2 (34 3/4)	off	473600 11000 (87.3)	29	SD	50	145	4		
0800	0810		5 9/16	16 3/4 (35)	E W 950	484600 10,800 (84.4)	25	45	50	195	3.8	35	191
1000	1018		5 3/4	15 3/4 (34)	E	4954[illegible] 9900 81.[illegible]	31	SD	55	150	4.2		
1200	1207		5 7/8	16 1/2 (34.5)	E	[illegible]4300 11070 (83.6)	30.5	SD	60	147	4	40	150
1400	1415		5 3/4	15 1/2 (33 3/4)	E	515000 (9500) (79.2)	31	45	50	146	3.7		
1600	1615		5 3/4	[illegible] (35)	W-1350	524500 (9500) 83.8	29	42	50	136	3.3		Fresh water meter out of service 30± min to tie up new line
1800	1812 1902		5 7/8	17 1/2 (35 3/4)	W-1375	534300	21 1/2	SD	54	139	3.9		1801 Pruett AT 500
2000	2019		7 1/8	17 1/2 (36)	E [illegible] W -	(19100) 108.5 gpm	26 1/4	70	50	139	4.4		1937 Open throttle one turn 1947 Open throttle Increase Sep. press to 250
2200	2108 2215		Too Steamy Around Box	17 1/2 (36) 18 1/2 (37)	E W 1350 E+W	553400 557680	26 1/2 18	100 SD	100 42	137 142	5.75 3.3		

SHIFT SUPERVISOR C. S. [illegible] 6-15-88 0030
signature date time

SHIFT SUPERVISOR Paul W. [illegible] 6/15/88 0834
signature date time

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-15-88

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		Wellhead		Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG; B South				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-[illegible] PSIG	[illegible]	PI-[illegible] PSIG	TI-13 °F	PI-[illegible] PSIG	TI-[illegible] °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-4 (P)	TI-109A (PSIG)	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0006	485	490	450-55	1873.73	[illegible]		246	431	232	9.85	64	26[illegible]	405	4.75	5.0	252
0200	0207	[illegible]	490	448	1868.69	275		[illegible]	433	235	[illegible]	[illegible]	263	406	4.75	5.0	253
0400	0400 0503	[illegible]	490	445-455	1872.97	274		248	434	235	9.79	[illegible]	262	402	4.75	5.0	252
0600	0625	485	490	452	18[illegible].30	27[illegible]		247	436	238	[illegible]	65	262	407	[illegible]	5.0	25[illegible]
0800	0804	490	491	455	1877.00	274		247	437	240	[illegible]	65	267	408	4.75	5.05	25[illegible]
0950 - [illegible]																	
1000	1000 1059	490	489	455	[illegible]	275		248 24[illegible]	[illegible]	[illegible]	[illegible]	65	262	429	4.7 4.75	5.05	25[illegible]
1200	1207	490	489	455	note 1100 hrs	274		248	432	240	8.0	6[illegible].5	265	410	4.75	5.0[illegible]	260
1400	1402	494	489	460-456 457	[illegible]	276		[illegible]48	433	237	8.1	64.5	263	408	4.75	5.04	260
1600	1600	495	489	450-460 457		[illegible]		[illegible]	433	239	8.1	64.5	261	418	4.68	[illegible]	261
1800	1802	496	490	458		282		248	437	238	8.1	64.5	264	416	4.68	5.04	262
2000	2002 2109	415 415	479 478	362 364		292 286		246 244	437 430	233 233	9.6 9.2	424	[illegible]	410 410	6.22 5.80	5.0 5.0	225 24
2200	2203	414	479	358		275		247	433	236	9.3	520	261	409	6.8 6.7 (to Avg)	5.0	44

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DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6-15-8[illegible]

PAGE: 1/1

		L.P. Brine	AFT Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead		
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF	Remarks
0000	0012		6 7/8	17"L BC?	E Running? W 1300	565300	24	80	80	150	4.4	72	150	
0200	0210			37 1/4	E-SD W-1500	572900	29		85	[illegible]	4.6			
0400	0415 0503		6.5	38 37 1/2	E-	580600	30	120	120	150	5.8 5.6	72	151	
0600	0633 0712		6 5/8	36 3/4 36	E- W-1100	589600	23 20	165	165	162	7.4 7.4			
0800	0814		6.5	35.5	E- W-1250	597100	27.25	90	90	145	4.85	65	172	
1000	1013		6 5/8	36	E- W-800	604800	[illegible]	108	0.5	170	5.35			
1200	1213		6 7/8	35.5	E- W-1450	[illegible]00	19.5	55	0.5	170	5.55	42	17[illegible]	no fresh water
1400	1414		8 1/4	38	SD	604800	10.5	SD (reads 42)	SD	SD	0 no flow	SD		Salton ... carryover from brine tank?
1600	1609		7"	40	E-Running W-SD	609400	10.75	SD	SD	SD	0	SD		Not injecting fresh water on pond pump on
1800	1810		8 1/4	40	E-Running W-SD	621400	24.25	SD	42	150	5.20			Some carryover
2000	2012 2123		8 1/8	42 41 1/2	E W-975 W-1350	628900 630700	31.75 28.0	SB SB	55 126	150 152	6.5 6.8			Increased rate at 19:25 Having trouble controlling?
2200	2212		8 1/4	41 1/2	E-Running W-1350	632800	31.5	SD	127	151	6.4			

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signature date time

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6/16/88
PAGE: KF 1

		Wellhead		Throttle Valve				Steam				Sep. Level	High Pressure Brine LEG: R				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-12 PSIG	TI-12 °F	PI-13 PSIG	TI-13 °F	PI-~~100~~ 155 PSIG	TI-~~108~~ 101 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-4 °F	TI-109A PSIG	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0008	496	491	463		221		191	408	154	682	53	173	410	Off Scale	431	152
0200	0208	500	492	475		200		179	402	15[illegible]	650	46	171	400	9.77	40	165
0400	0410	504	496	478		200		168	401	150	6.4	40	168	[illegible]	9.75	4.0	165
0600	0607	502	498	480		199		169	399	155	6.4	40	168	397	9.75	4.0	165
0800	0819	508	496	482		200		168	405	155	6.4	42	163	397	9.[illegible]	4.0	165
1000	1022	504	496	486		234		20[illegible]	418	193	8.08	48	217	415	0.5	0.5	220
1200	1151 1202	510	498	488		236		225	415	193	8.05 8.05	61	226	415	4.4 4.35		222
1400	1404	498	489	432		253		206	421	187	9.6	34	228	416	5.25		235
1600	1605	422	481	385		271		235	430	225	9.55	63	248	423	5.80		251
1800	1757	424	482	38[illegible]		277		236	432	225	9.65	62	256	424	5.7		251
2000	1958	410	480	387		269		227	429	225	9.55	63	248	422	5.7		242
2200	2159	412	481	385		269		227	429	222	9.48	63	245	422	5.7		240

See attached sheet for ADD'L points during rate chg

SHIFT SUPERVISOR Paul B. [illegible] 6/17/88 0255
signature date time

SHIFT SUPERVISOR ____________ ________ ________
signature date time

Steam = 14600 Ch $\sqrt{\frac{P+15}{215}}$ Inj = 64200 Ch

Brine = 97,600 Ch Sep = PI-4

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6/16/88

PAGE: ___/___

	Wellhead			Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG:				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-12 PSIG	Time → TI-12 °F	PI-13 PSIG	Water TI-13 °F	PI-103 PSIG	TI-103 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	−8 PI-4 °F	TI-109A PSIG	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
Rate: Inc	1338	496	511	488	1340	236	683200	202	418	191	8.0	64	222	415	4.25	TOTAL	227
0000	1352	489	490	453		254		211		9.1		65	235	420	5.1		
0200	1404	478		432	1413	253	685400	197		9.6					5.25		
										139K					512K	651K	
0400	1616	422	481														
0600																	
0800																	
1000																	
1200																	
1400																	
1600																	
1800																	
2000																	
2200																	

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DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-1A

DATE: 6/16/88
PAGE: 1 / 1

		L.P. Brine	Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank #1	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead		
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141, PSIG	TI-140 oF	46
0000	0017		6 7/8	42?	E-On W-1300	638100	15 1/4	SD	117	150	6.4	0.0	146	Level controller on separator not working throttled back at 11:02 to 11:15
0200	0217		6 3/4	41 1/2?	E-On W≈1000	644700	29.5	SD	145	150	6.5			
0400	0440		6 5/8	-10 from top in tape	E-on W-on	652200	33	200	200	150	8.4			
0600	0622		6 1/4	-14	E-on W-1100	652500	32	135	115	160	6.2	90	160	
0800	0830		6 1/4	-15	E-on W-1200	663900	32	140	140	167	6.25			
1000	1037		6 1/2	-16	E-on	67[illegible]00	[illegible]	SD	82	165	7.2 / 5.4	7.8	166 (1115 hrs)	
1200	1152		6[illegible]	-16	E-on W-1100	676300	32	165	SD	165	5.2			
1400	1413		7 3/16	-16 1/2	W-1100	6[illegible]400	29	100	SD	172	5.2			
1600	1625		7 5/8	-16	E-on W-1150	693700	19 3/4	148	148	162	6.5			
1800	1803		7 1/2	-12 1/2	E-ON W-SD	700800	8 3/4	SD	SD 0	175	0	0	170	opened C-Valve at 17:30 Suction pump clogged No injection
2000	2002		7 5/8	-7	E-ON W-1150	707300	20	SD	SD	138	0			
2200	2205		7 1/2	-6	E-ON SD	715200	25 3/4		97	157	4.95			

SHIFT SUPERVISOR Paul K Jenkins 6/17/88 0205
signature date time

SHIFT SUPERVISOR ______
signature date time

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6/17/88

PAGE: 1

	Wellhead			Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG:				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-12 PSIG	TI-12 °F	PI-13 PSIG	TI-13 °F	PI-103 PSIG	TI-103 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-4 °F	TI-109A PSIG	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0003	402	481	386		266		227	429	210	9.45	.63	244	421	5.75		242
0200	0208	411	483	385		266		228	429	212	9.4	72	245	421	5.75		244
0400	0417	417	482	387		266		228	426	213	9.25	67	244	420	5.7		242
0600	0600	455	483	390		268		227	429	213	9.33	66	244	420	5.7		245
0800	0806	445	482	392		267		224	430	215	9.22	68	242	420	5.68		245
1000	1004	445	481	377		276		228	432	215	9.7	74	248	421	5.8		248
1200	1205	442	484	392		[illegible]		229	430	210	9.55	.72	240	420	5.6		240
1400 (Cut rate - 1415)	1446 1508	457 481	485 498	395 512?		270 [illegible]		217 215	429 426	208 204	9.65 6.75	66 61	240 233	420 415	5.9 3.85		242 229
1600	1600	496	498	515		241		217	427	202	6.72	62	229	414	3.9		222
1800 (cut rate 1920)	1800	506	500	515		241		[illegible]	426	200.5	6.7	62	[illegible]	415	3.9		223
2000 (Cut rate 2105)	2002	510 gage 522 chart	504	525		222		[illegible]	422	200.0	4.6	61	226	412	2.6		183
2200 (Cut rate 2250)	2201	520 545	503	555		219		214	415	150	3.7	61	221	408	2.5		152

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DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6/17/94

PAGE: 1/1

		L.P. Brine	Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank #1	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead	
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF
0000	0007		Can't Get in	-4.5	E-ON W-SD	722600	30.5		105	160	5.5	82	167
0200	0219		7 1/2 (break 1/2" below top 1st blk drip)	-3.5 below	E-1750	730400	32.5	55		[illegible]	3.25		
0400	0424		7 1/2	-2	E on W1200	737900	16	62		149	3.8	55	147 (0457)
0600	0610		7 7/16	-1.5	E on W1600	744100	12	100		144	5.0		
0800	0815		8 3/8	+5.5	no suction	750800	7	off	off	100	0	0	
1000	1017		8 1/4 loaded a lot of salt off weir	+7.5	E W1000	757300	31	100		143	5.3	74	145
1200	1214		7 3/4	+8	E on W1100	764400	31	100		150	5.3		
1400	1351 / 1513		6 1/2	12 Tape / -24	E [illegible] W on 90	770700 / 776100	5.5	off	off / 65	140 / 152	0 / 3.9		
1600	1655		6 1/2	Tape -24	E ON W SD	779600	26		110	152	5.1	72	151
1800	1805		Salt in weir 5/8 [illegible]	-23	E-ON W-SD	788300	22 1/4	SD	SD	140	SD		
2000	2007		4 7/8	-23	E-ON W=ON	797400	32 3/4	SD	112	151	5.7	81	151
2200	2208		4 3/8	-25	E=ON W-ON	806800	26	92	92	149	4.8		

Reduced rate at 19:20 pond too high
2105 Reduced rate again

SHIFT SUPERVISOR ______________________ ________ ________
signature date time

SHIFT SUPERVISOR ______________________ ________ ________
signature date time

DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6/18/88
PAGE: 1/1

		L.P. Brine	Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank #1	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead	
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF
0000	0016		4 7/8	-2.5	E-ON W-SD	817300	18	SD	SD	137	SD	SD	
0200	0212		3 7/8	-3.5	E-ON W-ON	827000	36 3/4		95	[illegible]	5.1		
0400	0403		3 9/16	-6	E-on W-no suck	835200	34		1[illegible]	130	5.3		
0600	0615			-9	E-on W-off	844100 75 gpm	32	100	100	127	5.5 5.0	80	150
0800	0818		3 7/8	-11	E on W off	852800 80 gpm	32	95	SD	126	4.7		
1000	1019		3 3/4	-13	off	78 gpm 8624[illegible]		SD	SD		0		
1200	1219		3 7/8	-12	E-on	~~872200~~ [illegible] gpm	33		94	149	4.6		
1400	1318 1410		3 7/8	-12 1/2 -13	E on	881100 80 gpm	37	96		125	4.6 4.5		
1600	1643		4 1/8	~~-14~~	E-ON W-ON	891800 89	32	142	142	125	6.7		
1800	1808		3 7/8	-16 1/2	E-ON W-SD	900800	26 3/4	138	138	125	6.0	84	128
2000	2008		3 7/8	-18	E-ON	911100	24.5	135	135	125	5.6		
2200	2211		3 3/4	-21	E-OFF W-OFF	920600	8.5	SD	SD	117	SD	SD	

Fixing WHP gage

Having trouble w/pond pump
Changing suction on Booster pump

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DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6/18/88

PAGE: 1/1

		L.P. Brine	Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank #1	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead	
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF
0000	0016		4 7/8	-2.5	E-ON W-SD	817300	18	SD	SD	137	SD	SD	
0200	0212		3 7/8	-3.5	E-ON W-ON	827000	36 3/4		95	[illegible]	5.1		
0400	0403		3 9/16	-6	E-on W-no suck	835200	34		1[illegible]	130	5.3		
0600	0615			-9	E-on W-off	844100 75 gpm	32	100	100	127	5.5 5.0	80	150
0800	0818		3 7/8	-11	E on W off	852800 80 gpm	32	95	SD	126	4.7		
1000	1019		3 3/4	-13	off	78 gpm 8624[illegible]	[illegible]	SD	SD		0		
1200	1219		3 7/8	-12	E-on	~~872200~~ [illegible] gpm	33		94	149	4.6		
1400	1318 1410		3 7/8	-12 1/2 -13	E [illegible]	881100 80 gpm	37	96		125	4.6 4.5		
1600	1643		4 1/8	~~-14~~	E-ON W-ON	891800 89	32	142	142	125	6.7		
1800	1808		3 7/8	-16 1/2	E-ON W-SD	900800	26 3/4	138	138	125	6.0	84	128
2000	2008		3 7/8	-18	E-ON	911100	24.5	135	135	125	5.6		
2200	2211		3 3/4	-21	E-OFF W-OFF	920600	8.5	SD	SD	117	SD	SD	

Fixing WHP gage

Having trouble w/pond pump. Changing suction on Booster pump

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G 512
TC 522

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6/19/88
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		Wellhead		Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG: B				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-12 PSIG	TI-12 °F	PI-13 PSIG	TI-13 °F	PI-103 PSIG (155)	TI-103 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-4 °F	TI-109A PSIG	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0000	562	502	560		215		215	419	199	2.75	61	320	404	1.2		108
0200	0201	565	502	557		225		216	419	200	2.75	61	220	403	1.5		106
0400	0409	565	502	560		220		216	415	198	[illegible]	61	220	400	1.5		128
0600	0542	565	502	555		218		215	417	197	2.7	61	220	400	1.9		124
0800	0811	568	500	560		210		211	416	200	2.7	61	220	400	0		120
1000	1003	567	500	562		220		21[illegible]	415	200	2.7	61	225	398	2.0		109
1200	1201	571	502	555		211		214	414	198	2.7	61	217	396	1.0		110
1400	1342	570	501	560		2[illegible]		209	413	195	2.7	60	215	394	0.5		123
1600	1615	521 PS 521	492	554		255		215	424	202	6.8	58	225	398	3.9		225
1800	1702 1801	532 532	495 492	516 [illegible]		241 240		215 214	424 425	213 212	6.6 6.6	61 61	229 230	395 396	3.8 3.8		222
2000	2000	532	496	514		239		215	426	210	6.6	61	230	400	3.5		220
2200	2159	532	495	512		236		215	425	210	6.5	61	226	401	3.5		212

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DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6/19/88

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		L.P. Brine	Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank #1	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead		
Nominal Time	Actual Time	PI-144 PSIG	Level: Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF	
0000	0012		3 7/8	-21 1/2	E-on W-SD	930800	26	SD	SD	SD	SD	SD		
0200	0208		3 3/4	-22	E-on W-SD	941400	34 3/4		140	120	5.9	broke coupling		New Injector on line 2 pumps working
0400	0419		3 3/4	-20	E-on W-SD	955400 90gpm	31	100		140	4.8	new coupling - slow startup		
0600	0550		3 5/8	mud	E-on W-SD	961200 84gpm	29 1/2	130	130	160	5.3	97	160 (base)	
0800	0817		3 3/4	4"	E-SD W-on	973500 80 gpm	28	SD	SD	—	0			
1000	1010		3 3/4	5 1/2"	off	982400 90gpm	34	SD	SD	—	0			
1200	1207		3 3/4	7 1/2	E-on W-on	992100 74gpm	26 1/2	on	99	110 125	3.7 4.9	94 101	112 (1219 hrs) 115 (1255 hrs)	
1400	1353		3 3/4	4 1/2	E-SD W-on	1000000 74gpm	28 1/2	on	130	140	5.45 5.5	96	124 1427	
1600	1624		7 1/8	Mud	E-SD W-ON	1011100	18 3/4	ON in series	140	138	5.55			Increasing Rate 15:40 1630
1800	1707 1813		6 7/8	mud	E-SD W-on	1014600 1018300	12 28 3/4	ON	122 112	150 153	5.4 5.5	90	152	
2000	2007		6 1/4	Mud	E-ON W-SD	1026000	33	ON	114	160	5.2			2129
2200	2206		6 1/8	Mud	E-ON W-SD	1038000	26	ON	120	165	5.15	94		

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1300 hrs — sample at weir 230.5°F
Diluted 50-50 S.G. 1.138 at 80°

DATA SHEET NO. 1A
FLOW TEST DATA
KENNECOTT STATE 2-14

8.5

DATE: 6/20/88

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Low Pressure Leg at 16:45

		Wellhead		Throttle Valve				Steam				Sep. Level	High Pressure Brine, LEG: B + A				
Nominal Time	Actual Time	PI-1 PSIG	TI-1 °F	PI-12 PSIG	TI-12 °F	PI-13 PSIG	TI-13 °F	PI-~~105~~ 155 PSIG	TI-103 °F	PCR-103 Chart Reading	FR-102 Chart Reading	LCR-107 Chart Reading	PI-4 °F	TI-109A PSIG	FR-108 Red Pen	PR-108 Blue Pen	PI-143 PSIG
0000	0002	530	495	510		232		213	424	208	6.5	61	222	~~400~~	3.6		212
0200	0201	522	492	502		235		215	424	210	6.8	61	226	399	3.7		218
0400	0403	528	495	505		240		216	425	221	6.8	62	227	400	3.9		218
0600	0608	515	496	505		240		217	425	212	6.78	62	228	400	3.8		218
0800	0758	530	497	505		230		215	9 425 TC 407	~~214~~	6.5	62	231	9 400 TC ~~408~~	3.8		211
1000	1002	530	495	510		242		215	42[illegible]	215	6.73	61	230	401	3.8		223
1200	1140	530	497	510		235		215	423	215	6.7	61	230	401	3.8		225
1400	1418	530	495	510		240		213	423	213	6.7	61	229	398	3.7		220
1600	1602	530	495	510		245		213	424	212	6.7	61	229	400	LP leg 9.4		Changing 210
1800	1721 1754	530	493	509		243		216	425	214	6.7	up + down 61	232	400	9.1		
2000		Shut-in				- 17:54											
2200																	

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DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

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Nominal Time	Actual Time	L.P. Brine PI-144 PSIG	Weir Box Level Inches	Brine Pond Level Inches	Pond Pump PI-127 PSIG	Fresh Water F.W. Meter gallons	Brine Tank #1 Level Inches	Booster Pump Dischg PI-129 PSIG	Injection Pump Dischg PI-10 PSIG	Injection Pump Dischg TI-10 oF	Injection Flow Meter DPR-1 Red Pen	Imperial 1-13 Injection Wellhead PI-141 PSIG	Imperial 1-13 Injection Wellhead TI-140 oF	
0000	0008		6 1/8	Mud	E-ON W-ON	1041800	35	ON	120	166	5.65	0049 100	165	Increased rate of 0041
0200	0207		6 1/8	Mud		1049460	32 1/4	ON	122	174	5.1			
0400	0411		5 7/8	Mud	E-on W-on	1057100 60 gpm	31	ON	135	175	5.4 4.0	89	171 (0525)	
0600	0614		5 7/8	Mud	E on W on	1064700 56 gpm	23 1/2	ON	85	172	3.4 3.2	80 83	175 (0532) 168 (0600)	
0800	0821		6 1/16	-1/2	E on W on	1072000 60 gpm	24	on	92	167 171	3.8			
1000	1008		6 1/8	+1	E on W off	1078400 40 gpm		on	95	167	3.25	84	168 (1021)	
1200	1150		6	1 1/2	E on W off	1084600 [illegible] gpm	36	on	110	160	3.8	Dave Molnier - 300,000 ppm Cl. Fluid		
1400	1424	200? valve leaks	5 7/8	(4 1/2)?	E off W off	1093500 58 gpm	29	SD	SD	142	0			Pruett. RIH 14:20
1600	1613	210	6	-2	[illegible]	1099900 59 gpm	33 1/2	ON	65	132	3.6			changing from pp to LP brine 16:45
1800	1731	215	6 7/8	pipe 23 1/2	E ON	1104200 55 gpm	25 3/4		55	135	2.5			
2000														
2200														

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DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: 6/24/88
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		L.P. Brine	Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank #1	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead	
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF
0000													
0200													
0400													
0600													
0800	Injected fresh water 0915-0950												
1000	0945							200			4.7	155	93
1200													
1400													
1600													
1800													
2000													
2200													

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Imperial 1-13
DATA For Injection Fall off SURVEY

DATA SHEET NO. 1B

DATE: 6-24-88

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		L.P. Brine	Weir Box	Brine Pond	Pond Pump	Fresh Water	Brine Tank #1	Booster Pump Dischg	Injection Pump Dischg		Injection Flow Meter	Imperial 1-13 Injection Wellhead		
Nominal Time	Actual Time	PI-144 PSIG	Level Inches	Level Inches	PI-127 PSIG	F.W. Meter gallons	Level Inches	PI-129 PSIG	PI-10 PSIG	TI-10 oF	DPR-1 Red Pen	PI-141 PSIG	TI-140 oF	
~~0000~~	1830												STArted Inj	
	1900						Dn: 11							
~~0200~~	1905										3.2		Inc Boost pump 100 RPm	
	1915						Dn 14		165		3.2			
~~0400~~	1930						Dn 17		170		3.1	165	93	
	1937								[illegible]		3.6		Inc Inj Pump RPm	
~~0600~~	1945						ON 20		180		3.45			
	2000						DN 23½		185		3.4			
~~0800~~	2015						DN 26		180		3.55			
	2030						ON 28¼		180		3.5			
~~1000~~	2045								180		3.42	180	91°F	2048 start shutting in butterfly Valve
~~1200~~														
~~1400~~														
~~1600~~														
~~1800~~														
~~2000~~														
~~2200~~														

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ADDENDUM C

DAILY WELL TEST REPORTS

NOTES REGARDING DAILY WELL TEST REPORTS

1. Pressure and temperature data are uncorrected readings, except as noted on each report.

2. Brine flow rates in the daily reports were calculated using meter coefficients which were calculated before the test using an estimated brine density of 1.2. Flow rates in Table A-1 were recalculated from the raw data using the true brine properties.

3. Steam flow rates in the daily reports are erroneously high because of the orifice meter problem described in Section 3.3.

4. Some daily reports are marked "REVISED". The revisions consisted soley of correcting typographical errors and revising unclear wording. Neither the data nor the intended meaning was changed.

5. Units of flow rate shown as lb/hr in the reports mean pounds mass per hour.

MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 01, 1988

Day #0 of test

(This report and succeeding reports cover the period from midnight to midnight.)

Began 30-day flow test of State 2-14 today. Before starting flow, SIWHP =183 psig. (Wellbore was full of canal water because water had been injected to cool the well for logging last April.)

Checked facility and instrumentation and discussed startup procedure. Flowline throttle valve closed, wellhead valves open, and other valves arranged to divert all flow through blooie line to large pit.

Began opening throttle valve at 1730 hrs. Well achieved flashing flow by 1735 hrs and continued to heat up and flow stronger. Throttled well back to prevent damage to pit divider by flow from blooie line.

At 1746 hrs started opening bypass to AFT and closing valve to blooie line. At 1757 hrs all flow was going directly to AFT and brine flow (after flash to atmos.) was being measured in weir box. Brine flow peaked at 478,000 lb./hr at 1800 hrs, then started throttling well back. At 1800 hrs, WHP = 370 psig; WHT = 455°F (TI-1). Gradually reduced rate to 90,000 lb/hr brine at 1905 hrs.

At 1930 hrs it was discovered that brine was starting to erode pit bank around outlet of weir box. Diverted flow to vent silencer and layed plastic apron under weir discharge. At 1957 hrs repair complete and switched flow back to AFT.

Well continued to flow at average brine rate of 121,000 lb/hr through midnight. At midnight, WHP = 496 psig.; WHT = 469°F by TI-1 and 480°F by TI-1A. (Will check TI's later with mercury thermometer). As of midnight, cumulative brine production (after flash to atmosphere) was 950,000 lb. Pit level rise = 6.5 inches since start of test.

Salt is forming on weir plate and is being chipped off before each reading.

MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 02, 1988

Day #1 of test

Continued to flow well directly to AFT, measuring brine flow rate in weir box and gauging the pit.

Summary of Flow Data

Time	WHP (psig)	WHT (@ TW-1A) (°F)	Brine Flow (lb / hr)
0000	496	480	120,800
0800	493	469	100,900
1355 - Opened throttle valve 1/4 turn			
1600	512	478	120,800
2400	510	478	112,800

Rate declines slowly at a constant throttle valve setting, probably because of scale buildup in the valve.

Investigated discrepancy in WHT readings between TI-1A and TI-1. Switched positions of the two dial thermometers and found they were in fairly good agreement, indicating that the discrepancy is due to the thermowells, not the dial thermometers. TW-1A extends further into the flowline because it has no lagging extension. Removed dial thermometer from TW-1 and will use only TW-1A. Still, WHT readings are somewhat erratic and unconfirmed. Wind causes readings to be lower. Plan to wrap insulation around pipe at thermowell. Waiting on ASTM mercury thermometer to check dial thermometer.

As of midnight, cumulative brine production (after flash to atmosphere) was 3,565,000 lb. Pit level rise = 19 3/4 inches since start of test.

Salt is forming on the weir plate and is being chipped off before each reading. Also, salt sludge is collecting in bottom of weir box and is being shoveled out occasionally. Expect to have dilution water system ready on June 03, 1988.

MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 03, 1988

Day #2 of test

Continued to flow well directly to AFT, measuring brine flow rate in weir box and gauging the pit and tanks.

Time	WHP (psig)	WHT* (°F)	Brine Flow (lb/hr)
0000	510	-	112,800
0800	508	-	97,000
1600	518	492	100,800
2400	514	494	104,700

*See comments below regarding temperature corrections.

Well producted at a nearly constant rate all day with no throttle valve adjustments. Between 1405 and 1440 hrs wellhead pressure and temperature increased by 7 psi and 5°F with no significant change in flow rate. The increase is apparently due to a change in downhole conditions, either in the wellbore or reservoir zones feeding the well.

At 1330 hrs insulation was installed around the pipe and thermowell at TW-1A. Insulation increased the dial thermometer readings by 7°F. Additional insulation was wrapped around the base of the thermometer.

Removed TI-1 from TW-1A and measured temperature with platinum RTD digital thermometer. Temperature was 492°F with RTD and 490°F with dial thermometer (both measuements with insulation around pipe and thermowell.) Temperature values in the above table are TI-1 readings plus 2°F to correct to RTD reading.

Installation of pumps and piping to transfer brine from pit to tanks was completed. From 1700 to 2000 hrs, transferred 75,000 gallons of brine (about 750,000 lb) from pit to tanks. Will hold brine in tanks until injection system is ready (expected June 04, 1988).

As of midnight, cumulative brine production (after flash to atmosphere) was 5,907,000 lb. Pit level has risen 26½" since start of test.

Salt is forming on the weir plate and salt sludge is collecting in the weir box, but sludge buildup diminished late in the day.

Temperature gauges upstream and down stream of the the throttling valve (TI-9 and TI-10) are intended only for operating information and should be ignored for other purposes. Readings are affected by wind and ambient temperature.

MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 04, 1988

Day #3 of test

Continued to flow well directly to AFT,measuring brine flow rate in weir box and gauging the pit and tanks.

Summary of Flow Data

Time	WHP (psig)	WHT* (°F)	Brine Flow (lb/hr)
0000	514	494	104,700
0800	512	493	97,000
1600	513	487	89,400
2400	509	481	89,400 (est)

*Temperature value shown is TI-1 reading plus 2° F.

Well produced at a gradually declining rate all day with no throttle valve adjustments. Decline is probably due to scale buildup in the throttle valve. As of midnight, cumulative brine production (after flash to atmosphere) was 8,151,000 lb.

Installation of injection booster pump was completed and injection into Imperial 1-13 started at 1145 hrs. Injection flow rates were calculated from tank gaugings until flow recorder was hooked up at 1300 hrs. Injectivity of Imperial 1-13 was poor at first, but improved rapidly (normal behavior). Injection data are given on the attached supplemental data sheet. SIWHP on Imperial 1-13 before injection was 50 psig.

Fresh water (canal water) piping system was completed. Washed and chipped away salt from weir box outfall and began to clean out weir box and outlets from AFT at about midnight. Outlets from AFT were almost totally salted off.

SUPPLEMENTAL DATA SHEET
For Startup of Injection

June 04, 1988

Time Period	Avg Press. at Inect. Pump (psig)	Avg. IWHP (psig)	Average Inject. Rate gpm	lb/hr	Cum. Inject. (lb)
1145-1331	200	195	75	44,800	79,000
1331-1340	295	260	461	277,200	42,000
1450-1712	195	185	460	276,000	653,000
2347-2400	100	-	492	295,000	64,000
					838,000

MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 05, 1988

Day #4 of test

Continued to flow well directly to AFT, measuring brine flow rate in weir box and gauging the pit and tanks.

Time	WHP (psig)	WHT * (°F)	Brine Flow (lb/hr)
0000	509	481	82,100 (est.)
0800	519	493	89,400
1600	519	491	89,400
2400	512	492	89,400

* Temperature values shown are TI-1 readings plus 2° F.

Well produced at a nearly constant rate all day with no throttle valve adjustments. Between 0300 and 0320 hrs wellhead pressure and temperature increased by 12 psi and 12° F with no significant change in flow rate. This is similar to the change that occurred on June 03, and is apparently due to a change in downhole conditions, either in the wellbore or zones feeding the well.

As of midnight, cumulative brine production (after flash to atmosphere) was 10,253,000 lb.

Weirbox was out of service from midnight until 0600 hrs while cleaning out salt and plugging leaks that developed around weir plate.

Pruett Industries arrived on location at 1100 hrs to run pressure and temperature survey in State 2-14. Made up Kuster temperature tool, cap tube chamber and sinker bar on cap tubing and rigged up lubricator. Started in hole at 1300 hrs. Made temperature stops every 500 ft. down to 5,000 ft., then made pressure stops coming out of hole. Twice while pulling out of hole, cap tubing got stuck in lubricator packoff (at 1300 and 1069 ft.) because of minor scale buildup on tubing. Both times, tubing was freed by loosening packoff. For remaining surveys, Pruett will bring hydraulic packoff instead of mechanical packoff. Pressure and temperature data are given below.

Temperature Data

Depth from KB (feet)	(°F)
500	517.8
1000	530.6
1500	545.5
2000	562.6

Pressure Data

Depth from KB (feet)	psia
0	529.80
1300	727.22
1600	791.56
1800	840.90

Temperature Data

Depth from KB (feet)	(°F)
2500	577.4
3000	585.7
3500	588.7
4000	590.3
4500	591.5
5000	593.2

Pressure Data

Depth from KB (feet)	psia
2000	896.53
2250	974.06
2500	1063.56
3000	1268.87
3500	1484.75
4000	1699.81
4500	1919.20
5000	2140.19

Injected brine into Imperial 1-13 at various rates for most of the day. Injection data are summarized on the attached sheet.

NMSU expermenters finished sampling today.

June 05, 1988

SUMMARY OF INJETION INTO IMPERIAL 1-13

Time Period	Avg. Press at Inj. Pump (psig)	Avg. Inj. Rate gpm	Avg. Inj. Rate lb/hr	Cum Inj. (thousand lb)
0000-0415	80	471	282,000	1,198
0415-0630	120	750	450,000	1,013
0630-0701	0	407	244,000	126
0701-0753	-	0	0	0
0753-0840		640	385,000	302
0840-1020	-	0	0	0
1020-1035	-	663	398,000	100
1035-1115		460	276,000	184
1115-1610	0	225	135,000	664
1610-1710	45	492	295,000	295
1710-2010	[illegible]	246	148,000	444
2010-2210	40	523	314,000	628
2210-2400	0	246	148,000	271
				5,225

MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 06, 1988

Day #5 of test

Continued to flow well directly to AFT until flow was diverted through separator at 0630 hrs. Temporarily, separator was run at low pressure, with steam control valve fully open and bypass open around brine level control valve, while modifications to the weir box were done. Brine flow rate was constant at 89,400 lb/hr. Average WHP = 513 psig, Average WHT = 493°F.

At 1712 hrs a small leak was discovered in the 2-phase flowline, immediately downstream of the throttle valve. Leak was apparently caused by erosion. Well was S.I. at 1720 hrs and leak was repaired by welding a half sole patch on the pipe. Well was opened up again at 2028 hrs and wellhead pressure and temperature stabilized at previous conditions by 2200 hrs. After flowline leak was repaired, welder resumed work on weir box. Throttle valve setting was not disturbed and flow rate measurements taken after weir box was back in service early on June 07, 1988 confirm that flow rate was constant throughout the day.

As of midnight, cumulative brine production (after flash to atmosphere) was 12,358,000 lb.

Injected brine into Imperial 1-13 off and on between midnight and 0800. Refer to attached injection data summary.

Personnel from PNL arrived and began rigging up for sampling.

Shut-in WHP readings on State 2-14 were as follows:

Time	Press. (psig)
1740	444
1758	388
1813	352
1855	285
1942	285
2024	238

INJECTION DATA SUMMARY

IMPERIAL 1-13

June 06, 1988

Time Period	Avg. Press at Inj Pump (psig)	Avg Injection Rate gpm	Avg Injection Rate lb/hr	Mass Injected (thous lb)
0000-0115	0	230	138,000	172
0115-0730	0	0	0	0
0730-0750	-	250	150,000	50
0750-0815?	0	84?	50,000?	21
0803-2400	0	0	0	0
				243

MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 07, 1988

Day #6 of test

Continued to flow well through separator at low pressure until modifications to weir box were complete. From 0245 to 0400, level control on separator was put in operation and pressure was increased up to planned operating condition of approximately 200 psig. Brine flow is through the "A" (north) metering leg.

Well produced at a nearly constant rate all day. Production data are summarized as follows:

Time	WHP (psig)	WHT* (°F)	Sep Press (PI-155) (psig)	Stm Flow from Sep lb/hr	Brine Flow from Sep lb/hr	Brine Flow at Weir lb/hr
0000	517	492	-	-	-	-
0800	517	492	214	N/A	123,750	89,440
1600	519	493	210	33,480	117,000	89,440
2400	517	491	204	30,000	112,500	89,440

*Temperature values shown are TI-1 readings plus 2°F.

Flow rates of steam and brine at the end of the day appear to be consistent with expected levels of flash, but flash calculations have not been done yet.

As of midnight, cumulative brine production (after flash to atmosphere) was 14,595,000 lb.

Injected brine into Imperial 1-13 as required to keep pit level down. Refer to attached injection data summary. Based on tank gauge readings, the capacity of the west pit pump is more than 300,000 lb/hr.

Personnel from EMSI (contractor for EPRI) returned to the site and collected samples from steam and brine lines at the separator.

INJECTION DATA SUMMARY

IMPERIAL 1-13

June 07, 1988

Time Period	Avg Press at Inj Pump (psig)	Avg IWHP (psig)	Avg Inj Rate gpm	Avg Inj Rate lb/hr	Mass Injected (thousand)
0000-1620	0	0	0	0	0
1620-1637	20	15	310	186,000	53
1637-2050	0	0	0	0	0
2050-2400	72	56	567	340,000	1,077
					1,130

MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 08, 1988

Day #7 of test

Continued to flow well at average of 136,000 lb/hr total mass rate until 1955 hrs when flow rate was increased to approximately 300,000 lb/hr. At 1955 hrs opened throttle valve 1/2 turn, allowed separator conditions to restabilize, then opened throttle valve an additional 1/4 turn to achieve desired rate. Brine flow is through the "A" (north) metering leg. Production data are summarized as follows:

Time	WHP (psig)	WHT* (°F)	Sep Pres (PI-155) (psig)	Stm Flow from Sep (lb/hr)	Brine Flow from Sep (lb/hr)	Total Flow lb/hr	Brine Flow at Weir lb/hr
0000	517	491	20[illegible]	30,000	112,500	142,500	82,100***
0800	512	492	206	30,160	105,750	135,910	89,440
1600	512	490	197	31,900	99,000	130,900	68,000***
2400	540	~~499~~ 501	210	38,960**	238,500	300,000**	202,100

* Temperature values shown are TI-1 readings plus 2°F.

** Steam orifice meter appears to be out of calibration. The indicated steam flow is unreasonably low. The total flow of 300,000 lb/hr is an estimate based on the measured brine rate and expected flash.

*** Weir box readings at 0000 and 1600 were lower than average because brine LCV was cycling.

The steam backpressure control valve is being operated manually because it sticks and moves in jerks on the pneumatic actuator. Manual operation is very satisfactory because well flow is stable. When rate was increased, the bypass valve around the brine LCV and fixed choke had to be opened slightly because of excessive pressure drop across the choke.

At about 2150 hrs generator ran out of fuel - lost lights and instrument air and separator dumped. Generator and instrument air compressor were back on line and separator operation was back to normal by 2230 hrs.

As of midnight, cumulative brine production (after flash to atmosphere) was 17,064,000 lb.

Injected brine into Imperial 1-13 from 0000-0810. Average rate was 282,500 lb/hr (470 gpm); average pump discharge pressure = 45 psig; average IWHP = 35 psig. Total mass injected = 2,307,000 lb.

Personnel from UURI collected samples from steam and brine lines at separator before the rate change. They expect to return for more samples on last day of test. EMSI also sampled before rate change.

MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 09, 1988

Day #8 of Test

Continued to flow at average rate of 283,000 lb/hr. Canal water was being added at weir box; but salt was building up in outlets of AFT enough to restrict brine flow from AFT and causing excessive carryover. Carryover was noticeable after 1400 hrs and was worse during minor separator upset at 1530 hrs.

At 1700 hrs motor on instrument air compressor went out, causing another separator upset. By 1800 hrs separator pressure and level were restored to normal with steam backpressure control valve and brine level control valve on manual operation. Well flow is stable and separator level is held constant with occasional valve adjustments.

Because of salt problem, a temporary connection was made to inject canal water upstream of the AFT at the downstream end of the brine metering skid. Started injection at that point at 1910 hrs. Fresh water apparently dislodged salt and plugged outlets of AFT. At 1920 hrs brine started coming over the top of the AFT. Immediately closed throttle valve 3/4 turn and opened blooie line to pit to reduce flow to AFT. Continued fresh water injection and by 2000 hrs AFT was unplugged.

At 2005 hrs reopened throttle valve and by 2130 hrs had restored normal operation.

Brine flow recorder appeared to be responding slowly, so at 2100 hrs the flange taps were rodded out. Recorder was working OK.

Brine flow is through the "A" (north) metering leg. Production data are summarized as follows:

Production Summary

Time	WHP* (psig)	WHT** (°F)	Sep Press (PI - 155) (psig)	Steam (lb/hr) from	Brine (lb/hr) separater	Total Flow (lb/hr)	Brine Flow at Weir*** (lb/hr)
0000	540	501	208	59,500**	224,100	283,600**	202,000
0800	538	501	208	59,000**	222,000	281,000**	202,000
1500	542	501	208	59,500**	224,000	283,600**	202,000
2400	538	501	200	52,900**	199,200	252,100**	172,000***

* Temperature values shown are TI-1 readings plus 2°F.

** Steam orifice meter appears to be out of calibration. Steam flow and total flows shown above are estimates based on the measured brine flow and expected flash.

*** Weir box brine rate at 2400 hrs is corrected for fresh water injection rate and resulting steam condensation.

As of midnight, cumulative brine production (after flash to atmosphere) was 21,831,000 lb.

Injected brine into Imperial 1-13 from 0930 hrs through midnight. Average rate was 262,000 lb/hr (436 gpm). Average IWHP = 30 psig; Average IWHT = 133°F.

Brine flow rates from the separator June 07, and June 08, are in error because wrong meter coefficient was applied. Reported flows should be reduced by 7.8 percent. Revised summary of flow rate data for those dates will accompany tomorrows report.

Analyses by Unocal of samples taken June 09, 1988, at separator:

Brine: TDS = 293,374 ppm, Cl = 176,025 ppm

Steam Condensate: TDS = 8 ppm, Cl = 6 ppm.

KENNECOTT STATE 2-14

1220 hrs 6-10-88

Brine flow at sep= 4.7 x 41,500 = 195,050 lb/hr

Steam flow at sep= 4.27 x 11,900 = 50,813

TOTAL 245,863 lb/hr

Flash at sep= $\frac{50,813}{245,863}$ = .207

Brine at weir box, less diluent =
212,000 - 55 x 575 = 180,375

Secondary Flash = $\frac{195,050 - 180,375}{195,000}$ = .075

WHP = 542 psig WHT = 502

Brine temp at sep. outlet = ~~414~~ 409°F ← Agrees with ASTM Mercury Therm.
Brine press at sep outlet = 214 psig

Steam temp at sep outlet = 414°F Bimetal Dial Therm.

Steam temp at sep outlet = 402°F ASTM Mercury Therm.

Steam press at sep outlet = 198 psig

MESQUITE GROUP, INC.

WELL TEST REPORT

June 10, 1988

Day #9 of test

Continued to flow at average rate of 246,000 lb/hr. Brine and steam rates were gradually declining, probably due to scale buildup in the throttling valve. At 1940 hrs opened throttle valve 1/2 turn then closed back 1/2 turn to clear scale buildup. Flow rate increased to earlier rate.

Brine flow is through " A " (north) metering leg. Production data are summarized as follows

Time	WHP (psig)	WHT* (°F)	Sep.Press (PI-155) (psig)	Stm Flow from sep (lb/hr)	Brine Flow from sep (lb/hr)	Total flow (lb/hr)	Brine Flow at Weir *** lb/hr
0000	540	501	200	52,900**	199,200	252,100**	172,000
0800	543	502	201	51,850**	195,050	246,900**	180,950
1600	545	502	195	50,000	182,600	232,600	152,400
2400	542	502	204	[illegible],600	203,350	250,950	184,400

* Temperature values shown are TI-1 readings plus 2°F.

** Steam orifice meter was not in service for readings at midnight and 0800 hrs. Steam flows and total flows at those times are estimates based on the measured brine flow and the flash fraction calculated from later readings.

*** Weir box brine rate is corrected for fresh water injection rate and resulting steam condensation.

Instrument technician from Instrument Specialists arrived before 0800 hrs to troubleshoot steam flow recorder. He recalibrated the recorder and the flange taps were rodded out. Meter was back on line by 1000 hrs. Calibration on all other flow recorders was checked.

As of midnight, cumulative brine production (after flash to atmosphere) was 25,969,000 lb.

Injection Data Summary

Imperial 1-13

Time Period	Avg Press at Inject Pump (psig)	Avg IWHP (psig)	Avg Inject Rate gpm	Avg Inject Rate lb/hr	Mass Injected (thous. lb)
0000-0330	45	35	460	276,000	966
0330-1400	0	0	0	0	0
1400-1422	45	-	460	276,000	37

Time Period	Avg Press at Inject Pump (psig)	Avg IWHP (psig)	Avg Inject Rate gpm	Avg Inject Rate lb/hr	Mass Injected (thous lb)
1422-1720	0	0	0	0	0
1720-2322	22	15	364	218,000	1,315
2322-2400	87	50	685	411,000	260
					2,578

Between 1230 and 1245 hrs checked temperatures at brine and steam outlets of the separator with the following results:

		Dial Thermometer	ASTM Mercury Thermometer
Steam	(TI-101)	414°	402°
Brine	(TI-109A)	409°	409°

TI-101 readings should be corrected by subtracting 12° F. Readings on data sheets are all direct readings with no corrections applied.

At 2130 hrs took sample of brine from weir box and measured its specific gravity. Sp. gr. = 1.26 at 60°F. At the time sample was taken brine flow from separator was 207,500 lb/hr and dilution water was being added at 52 gpm.

KENNECOTT STATE 2-14

CORRECTED PRODUCTION DATA FOR

June 7 and 8, 1988

	Time	WHP (psig)	WHT* (°F)	Sep Press (PI - 155) (psig)	Stm Flow from Sep** (lb/hr)	Brine Flow from Sep lb/hr	Total Flow** (lb/hr)	Brine Flow at Weir (lb/hr)
6/7	0000	517	492	-	-	-	-	N/A
	0800	517	492	214	30,330	114,100	144,430	89,440
	1600	519	493	210	28,680	107,900	136,580	89,440
	2400	517	491	204	27,580	103,750	131,330	89,440
6/8	0000	517	491	204	27,580	103,750	131,330	89,440
	0800	512	492	206	25,920	97,520	123,440	89,440
	1600	512	490	197	24,270	91,300	115,570	68,040
	2400	540	501	208	59,500	224,100	283,600	202,100

MESQUITE GROUP$ INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 11, 1988

Day #10 of test

Continued to flow at average rate of 240,000 lb/hr. Brine and steam rates were gradually declining, probably due to scale buildup in the throttle valve or flowline. (early on June 12, the rate was increased slightly to adjust for the decline.)

Brine flow is through "A" (north) metering leg. Production data are summarized as follows:

Time	WHP (psig)	WHT* (°F)	Sep Press (PI-155) (psig)	Stm Flow from Separ (lb/hr)	Brine Flow from Separ (lb/hr)	Total Flow (lb/hr)	Brine Flow ** at Weir (lb/hr)
0000	542	502	204	47,600	203,350	250,950	184,400
0800	542	502	205	47,600	195,050	242,650	178,200
1600	550	502	203	48,790	184,680	233,470	169,700
2400	540	502	204	45,820	182,600	228,420	171,400

* Temperature values shown are TI-1 readings plus 2°F.

** Weir box brine rate is corrected for fresh water injection rate and resulting steam condensation.

Downhole pressure and temperature survey and flowrate increase were scheduled for today. Pruett arrived at 1245 hrs and rigged up for survey. Made up Kuster temperature tool and cap tube chamber, rigged up wireline BOP and lubricator and ran in hole to 1,000 feet. Tried to purge cap tube, but tube was plugged. Pulled out of hole, cut off 100 ft of cap tube and blew helium through tube okay. Picked up tools and lubricator again, ready to run in hole. Tried to purge cap tube again, but tube was plugged. Tried to clear tube - no results. Layed down lubricator. Pruett ordered pressure intensifier from Bakersfield to blow out obstruction, however that will take 24 hours. In order to minimize delay, decision was made to run survey tomorrow morning with a different spool of cap tubing. Pruett crew left the site at 2200 hrs. Rate change is postponed until then.

As of midnight, cumulative brine production (after flash to atmosphere) was 30,192,000 lb.

Injected brine into Imperial 1-13 as required to keep pit level down. Refer to attached injection data summary.

Time Period	Avg Pres at Inj Pump (psig)	Avg IWHP (psig)	Avg Injet Rate gpm	Avg Injet Rate lb/hr	Mass Injected (thousand lb)
0000-0135	87	50	690	414,000	656
0135-0152	-	-	567	340,000	96
0152-0453	75	45	653	392,000	1,183
0453-1345	0	0	0	0	0
1345-1500	10		267	160,000	200
1500-1825	30	20	395	237,000	810
1825-1848	0	0	0	0	0
1848-2115	50	28	428	257,000	630
2115-2150	0	0	0	0	0
2150-2400	46	[illegible]	438	263,000	570
					4,145

SALTON SEA SCIENTIFIC DRILLING PROJECT

KENNECOTT STATE 2-14

Revised Test Plan

June 11, 1988

Background

A flow test of State 2-14 was begun on June 1, 1988. It was originally planned as a 30-day step-rate test with three planned rate steps defined as follows:

Step No.	Planned Duration (days)	Planned Flow Rate (lb/hr total mass)
1	7	200,000 - 250,000
2	7	400,000 - 500,000
3	16	600,000 - 750,000

The test began on June 1, 1988, and the first flow period was completed on schedule in seven days, ending on June 8, when the flow rate was increased. During the first flow period the well was produced at an average rate of 150,000 lb/hr. The rate was constrained to less than the planned 200,000 lb/hr minimum because it was necessary to store the produced brine in the pit until injection facilities were completed. The second step is under way with the well producing at 250,000 lb/hr.

During the time since the original test plan was finalized, several factors have come to light or have been confirmed which influence plans for the remainder of the test. These factors are:

1. The remaining budget will not support a full 30-Day test.
2. State 2-14 is a very high productivity well and its flow conditions are found to stabilize within hours after a rate change. Therefore, for purposes of reservoir engineering and defining the well's deliverability characteristic, shorter flow steps will suffice.
3. The well is clearly capable of very high flow rates and in order to define its deliverability in a useful range, three additional rate steps (including the one which began on June 8) will be needed.
4. While at least one experimenter (UURI) was counting on rate steps of at least seven days' duration, most are in favor of compressing the schedule.
5. There is broad interest in a short, maximum rate flow directly to the pit for several hours. The only way this can be accomplished without compromising the planned reservoir and well performance analyses is to do it as a separate test after the step - rate test and final shut-in period are over.

Revised Test Plan

The recommended plan is for a 19-Day testing program defined as follows:

Revised Test Plan (cont'd)

Step No.	Duration (Days)	Flow Rate (lb/hr Total Mass	Start Date	End Date
1*	7	150,000	6/1	6/8
2**	3	250,000	6/8	6/11
3	3	450,000 - 500,000	6/~~12~~ 11	6/~~13~~ 14
4	3	650,000 - 750,000	6/14	6/17
-	2	Shut in to monitor pressure buildup	6/17	6/19
-	1	Maximum rate flow directly to pit	6/20	6/20

* Step No. 1 completed

** Step No. 2 underway

Each flow rate increase except the one on June 8, will be accompanied by a downhole pressure and temperature survey as specified in the original program. A profile survey and pressure buildup test will also be conducted at the end of the fourth flow period, as specified in the original plan.

MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 12, 1988

Day #11 of test

Well was flowing at 228,4000 lb/hr at midnight, with rate declining gradually due to scale in throttle valve. At 0248 made small throttle valve adjustment and rate restabilized at 237,600 lb/hr but continued declining slowly. This rate adjustment was small to avoid an effect on the pressure and temperature survey scheduled for later.

Between 1150 and 1200 hrs, brine flow from the separator was switched to the south meter run (leg "B") in anticipation of increasing the flow rate.

Pruett arrived on location at 0630 hrs, rigged up, and ran pressure/temperature survey in State 2-14 with cap tubing and Kuster temperature tool. Started in hole at 0955 hrs. Profile survey was complete and tools were hung at 5,000 ft at 1212 hrs to monitor pressure drawdown. Cap tube pressure stabilized by 1235 hrs.

At 1314 - 1322 hrs opened throttle valve 1 turn to increase flow rate. Planned rate was 450,000 to 500,000 lb/hr. Rate stabilized at 460,000 lb/hr.

Production data are summarized as follows:

Time	WHP** (psig)	WHT* (°F)	Sep Press (PI-155) (psig)	Stm Flow From Sep (lb/hr)	Brine Flow From Sep (lb/hr)	Total Flow (lb/hr)	Brn Flow*** at Weir (lb/hr)
0000	535	502	204	45,820	182,600	228,420	171,400
0800	541	502	196	49,390	182,600	231,990	178,700
1200	545	503	198	49,980	182,600	232,580	179,600
1400	508	498	193	95,800	370,900	466,700	296,260
1600	510	499	190	97,460	361,100	458,560	298,512
2400	511	500	198	98,770	351,360	450,130	291,870

* Temperature values shown are TI-1 readings plus 2°F.

** Pressure values shown are PI-1 readings less 5 psi.

*** Weir box brine rate is corrected for fresh water injection rate and resulting condensation.

Downhole pressure at 5000 ft was 2053 psia before flow rate change and 1945 psia after.

Injection Data Summary

Imperial 1-13

June 12, 1988

Time Period	Avg Press at Inj Pump (psig)	Avg IWHP (psig)	Avg Injected Rate (gpm)	Avg Injected Rate lb/hr	Mass Injected (thous lb)
0000-0239	45	29	444	266,000	705
0239-1000	Shut off				
1000-1340	39	~~30~~ 3	407	244,000	895
1340-1705	85	52	610	366,000	~~1616~~ 1250
1705-1850	70	-	535	321,000	562
1850-2400	Shut off				
				TOTAL	3412

MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 13, 1988

Day #12 of Test

The well was flowing 450,000 lb/hr at midnight, with rate declining gradually due to scale in the throttle valve. The well head pressure was 513 psig. The valve was adjusted at 0022 hrs and the rate restabilized at 460,000 lb/hr. By 2200 hrs the rate had declined to 439,000 lb/hr and wellhead pressure was up to 519 psig so the throttle valve was adjusted at 2225 hrs and the rate was 457,000 lb/hr with a wellhead pressure at 513 psig at midnight.

The capillary tubing remained in the well from yesterday to measure the pressure drawdown at the higher rate. Pruett personnel arrived on site at 0800 hrs and pulled the tubing and Kuster temperature instruments from the well by 1000 hrs and rigged down.

Production Summary Kennecott State 2-14

Time	WHP* (psig)	WHT** (°F)	Sep Press (PI-155) (psig)	Stm Flow (lb/hr) From Separator	Brn Flow (lb/hr) From Separator	Total flow (lb/hr)	Brine*** at Weir (lb/hr)
0000	513	500	198	98,[illegible]00	351,000	450,000	335,000
0800	512	500	200	99,100	351,000	450,000	292,000
1600	518	500	200	98,600	346,000	445,000	307,000
2400	513	500	202	101,000	356,000	457,000	320,000

* WHP = PI-1 reading - 5 psi

** WHT = TI-1 reading + 2°F

*** Weir box brine rate is corrected for fresh water injection rate and resulting steam condensation.

Attachement to June 13, 1988 Daily Report

INJECTION SUMMARY

IMPERIAL 1-13

June 13,1988

Time Period	Avg Inj Rate lb/hr	(thous lb) Mass Injected
0000-0320	347,000	1154
0320-0420	270,000	270
0420-0500	0	
0500-0600	308,160	308
0600-0650	160,500	134
0650-1015	270,000	921
1015-1105	0	
1105-1200	238,000	238
1200-1330	318,000	477
1330-1420	292,000	243
1420-1520	360,000	360
1520-1710	193,000	160
1710-1950	360,000	240
1950-2400	144,000	602

TOTAL 5107

MESQUITE GROUP, INC.
WELL TEST REPORT
KENNECOTT STATE 2-14
June 14, 1988
(REVISED)

Day #13 of Test

Well was flowing 457,000 lb/hr at midnight with a wellhead pressure of 513 psig. By 0800 hrs., the flow had declined to 447,000 lb/hr due to scale buildup. The throttle valve was adjusted at 0900 hrs and the flow rate increased to 458,000 lb/hr. The wellhead pressure remained at 513 psig. Continued to operate at near this rate until the rate change later in day, although several throttle valve adjustments were necessary to maintain it. These adjustments were necessary to compensate for what is believed to be scale build in the pipeline or valves. Downhole measurements support this conclusion as capillary tube measurements obtained after it was rerun in the hole were just a few points different from when it was pulled the previous day, indicating very little change in the reservoir conditions.

Pruett personnel arrived on location at 1300 hrs, rigged up, and ran pressure/temperature survey with capillary tubing and Kuster temperature tool. Started in hole at 1508 hrs, made stops every 500' for temperature measurements, and arrived at final setting depth of 5000' at 1801 hrs. Repurged tubing, hooked up computer and began recording downhole pressure data.

Ready to make rate change at 1830 hrs. Waited on EMSI to take final brine and steam samples then increased the rate at 1937 hrs by opening the throttle valve (1) turn. While stabilizing rate, increased separator pressure from 200 to 250 psig in order to make steam meter read in range. Plan to operate at this pressure until steam meter can be recalibrated for higher range tomorrow. Steam meter now reading maximum. Total flow after rate change 600,000 lb/hr±. This is below the scheduled 650-750,000 lb/hr but carryover from atmospheric flash tank and limitations of pond and injection pumps make it a prudent one.

Production Summary

Time	WHP* (psig)	WHT** oF	Sep Press (PI-155) psig	Flows from Sep. Steam (lb/hr)	Flows from Sep. Brine (lb/hr)	Total Flow (lb/hr)	Brine Flow at Weir*** (lb/hr)
00:00	513	500	202	101,000	356,000	457,000	320,000
08:00	513	500	200	100,600	346,000	447,000	274,000
10:00	513	499	202	102,000	356,000	458,000	316,000
18:00	519	500	204	119,000	337,000	457,000	329,000
20:00	456	490	250	131,000	468,000	600,000	451,000
24:00	480	492	246	128,000	464,000	592,000	440,000

* WHP = PI-1 reading - 5 psi.

** WHT = TI-1 reading + 2 °F

*** Weirbox brine rate is corrected for fresh water injection rate and resulting steam condensation.

Injection Summary

Imperial 1-13

June 14, 1988

Time Period	Average Inj Rate	Mass Injected (thous lb)
0000-0300	144,000	432
0300-1920	257,000	4100
1920-2400	289,000	1350

MESQUITE GROUP, INC.
WELL TEST REPORT
KENNECOTT STATE 2-14
June 15, 1988
(REVISED)

Day #14 of Test

At just after midnight the well was flowing at an average rate of 592,000 lb/hr and stayed near that rate until changed at 19:25. The pit level gained 5" during the day due to operational problems (maintaining suction) of the pumps. When they had suction, they would pull the level down or at least stay even, but keeping them primed was most difficult. Suspect this problem is caused by the short circuiting of the hot produced fluid directly to the pump suction over the sagged pit curtain.

The Instrument Specialists Co. technician arrived before 07:30 and replaced the 200-inch w.c. differential spring in the steam rate recorder with a 300-inch w.c.spring. The addition of this spring will allow the vessel pressure to be reduced to the original pressure of around 200 psig and still keep the steam flow recorder pen within the chart range. This reduction will cause a higher percentage of the brine to flash and be measured by the steam flow meter and reduce the flow and velocity in the brine run and AFT which should help the carryover problem.

Since the previous rate increases had not had a significant effect on the WHP, it was decided to increase the rate to 725,000 lb/hr. At 19:25 the throttle valve was opened (1/2) turn. By 20:00 the WHP had dropped to 410 psig and the total flow increased to 720,000 lb/hr. The level control on the separator was not working correctly and the liquid level was fluctuating. The carryover from the atmospheric flash tank was excessive. At 23:02 and 23:25 hrs the throttle valve was pinched to reduce flow. At 0050 hrs (6-16) the level in the separator went past the top of the sight glass so the level control bypass valve was opened. A short time later the level control valve went wide open and emptied the separator through the brine line. The level indicator still read high and the brine meter was off scale. Separator control was put on manual and the brine meter was not working. Plan to repair everything after daybreak 6/16.

MESQUITE GROUP, INC.
WELL TEST REPORT
KENNECOTT STATE 2-14
June 15, 1988
(REVISED)

Day #14 of Test Continued

Production Summary

Time	WHP* (psig)	WHT** °F	Sep Press (PI-155) psig	Flows from Sep. Steam (lb/hr)	Flows from Sep. Brine (lb/hr)	Total Flow (lb/hr)	Brine Flow at Weir*** (lb/hr)
00:00	480	492	246	128,000	465,000	592,000	440,000
10:00	485	4[illegible]	247	128,000	459,000	587,000	414,000
18:00	491	492	248	131,000	457,000	588,000	447,000
20:00****	410	481	246	154,000	566,000	720,000	581,000
22:00****	409	481	247	149,000	673,000	822,000	606,000
24:00****	491	493	221	92,000	N/A	N/A	N/A

* WHP = PI-1 reading - 5 psi
** WHT = TI-1 reading + 2°F
*** Corrected for fresh water injection and condensation
**** Unstable flow

Pruett personnel arrived at 09:50 and pulled cap tubing out of well. The final pressure at 10:00 at 5,000' was 1,875 psia. They were out of the hole and in the lubricator by 11:00, but the lubricator was salted up and they didn't get off the wellhead until 14:00.

MESQUITE GROUP, INC.
WELL TEST REPORT
KENNECOTT STATE 2-14
June 16, 1988
(REVISED)

Day #15 of Test

At midnight, as stated in yesterday's report, the separator control and the brine meter were not working. The estimated flow rate was 590,000 lb/hr and the WHP was 491 psig. By 12:00 the rate had declined to 548,000 lb/hr and the WHP increased to 505 psig. At this time the separator controller and brine meter were back in operation and from 13:38 until 15:00 the throttle valve was opened in small increments and the flow gradually increased to 707,000 lb/hr. At 17:30 the pond pumps lost suction and there was no injection until 21:30 when the suction lines were cleaned and the pumps reprimed. However, one pump would not start and was left down. At midnight the flow was steady at 707,000 lb/hr with WHP of 406 psig.

Production Summary

Time	WHP* (psig)	WHT** oF	Sep Press (PI-155) psig	Flows from Sep. Steam (lb/hr)	Flows from Sep. Brine (lb/hr)	Total Flow (lb/hr)	Brine Flow at Weir*** (lb/hr)
					****	****	
00:00	491	493	221	92,000	516,000	608,000	453,000
12:00	505	498	225	124,000	424,000	548,000	378,000
14:00	473	491	206	142,000	512,000	654,000	361,000
18:00	414	484	236	152,000	556,000	709,000	502,000
24:00	406	483	227	146,000	561,000	707,000	510,000

* WHP = PI-1 reading - 5 psi
** WHT = TI-1 reading + 2 ^{o}F
*** Corrected for fresh water injection and condensation
**** Estimated

SALTON SEA SCIENTIFIC DRILLING PROJECT

KENNECOTT STATE 2-14

REVISED TEST SCHEDULE

June 16, 1988

Date	Activity
6/16	Increase flow rate to 700,000 lb/hr
6/17	Reduce rate as needed to avoid carry over
6/18	Continue to flow well
6/19	Run PT survey with capillary tubing and Kuster temperature tool. Shut in well between 1200 and 2400 hrs with cap tube in well to measure buildup
6/20	Watch buildup
6/21	Open well and flow at 200,000 lb/hr. Rig up DMSTE, Pruett and make two runs with downhole fluid sampler.
6/22	Open well for maximum flow.
6/23	Run depth determination survey in Imperial 1-13 to and run capillary tubing in well. Inject into Imperial 1-13.
6/24	Inject into Imperial 1-13.
6/25	END

MESQUITE GROUP, INC.
WELL TEST REPORT
KENNECOTT STATE 2-14
June 17, 1988
(REVISED)

Day #16 of Test

Just after midnight the total flow was 707,000 lb/hr and the WHP 406 psig. From midnight to 14:00 the flowrate gradually declined and the WHP gradually increased. Did not attempt to adjust rate because of other operational problems.

The pond pump which would not start at 21:30 on 6/16, was finally started at 03:00 on 6/17. However, suction problems remained and the pit continued to rise. Shortly after getting the second pond pump started one of the injection pumps lost the coupling between the pump and motor and was out of service.

By 14:13 hrs the pond level was too high and the flow rate was cut to 482,000 lb/hr. Further problems with the pit pumps necessitated additional reductions to 323,000 lb/hr at 19:20, 300,000 lb/hr at 21:05, and 189,000 at 22:50. It remained there until the end of the day.

The injectivity of the injection well has dropped approximately 30% since the 15th when the fresh water pump was down for 4 hours. This was probably due to salt deposition and may not be permanent.

Pruett wireline service informed us that a recalibration of the temperature tools used in some of the surveys showed a discrepancy and the results will be recalculated.

Production Summary

Time	WHP* (psig)	WHT** oF	Sep Press (PI-155) psig	Flows from Sep. Steam (lb/hr)	Flows from Sep. Brine (lb/hr)	Total Flow (lb/hr)	Brine Flow at Weir*** (lb/hr)
00:00	406	483	227	146,000	561,000	707,000	510,000
14:00	452	487	217	146,000	556,000	703,000	N/A
18:00	491	500	215	101,000	381,000	482,000	385,000
20:00	491	506	215	69,000	254,000	323,000	242,000
22:00	560	505	215	56,000	244,000	300,000	198,000
24:00	557	506	219	43,000	146,000	189,000	N/A

* WHP = PI-1 reading - 5 psi. Is not reading correctly.
** WHT = TI-1 reading + 2 ^{o}F
*** Weir flow corrected for fresh water injection and condensation.

MESQUITE GROUP, INC.
WELL TEST REPORT
KENNECOTT STATE 2-14
June 18, 1988
(REVISED)

Day #17 of Test

Continued to flow well at about 200,000 lb/hr while waiting on a replacement injection pump. It finally arrived and was promptly put into service. However, it did not help, as the pumps appeared to be suction limited. Continued to look for reasons for limitation. Connected one injection pump to a different outlet on the suction header but there was no improvement. Will continue to make changes in attempt to correct problem.

The wellhead pressure gauge did not work properly for a while. The sensing port was rodded out and the gauge resumed proper readings.

The brine flow recorder on Leg B, after the rate was reduced, fluctuated greatly even when the well flow appeared to be stable. Will check out as time permits.

The injectivity of Imperial 1-13 has improved about 10% since the 16th. The proportion of fresh water being injected is large and is probably dissolving the salt that was deposited on the 15th.

Production Summary

Time	WHP* (psig)	WHT** oF	Sep Press (PI-155) psig	Flows from Sep. Steam (lb/hr)	Flows from Sep. Brine (lb/hr)	Total Flow (lb/hr)	Brine Flow at Weir*** (lb/hr)
00:00	557	506	219	43,000	146,000	189,000	239,000
10:00	563	505	219	44,000	151,000	195,000	147,000
18:00	557	505	218	43,000	166,000	208,000	159,000
24:00	557	504	215	42,000	117,000	159,000	153,000

* WHP = PI-1 reading - 5 psi.
** WHT = TI-1 reading + 2 ^{o}F
*** Weir flow corrected for fresh water injection and condensation.

MESQUITE GROUP, INC.
WELL TEST REPORT
KENNECOTT STATE 2-14
June 19, 1988
(REVISED)

Day #18 of Test

Well flow continued at a low rate of 150,000 lb/hr while the injection pumps were being reconfigured again to try and correct the suction problem. The reconfiguration was complete by 02:00, but when the second pump was started the coupling broke on the other pump. A coupling was removed from the stand-by pump, and used to replace the broken one. It was operational before 04:00. The suction problem remained and the injection rate did not increase.

The pond level was pulled down to below the sludge line by 06:00 and some sludge was transferred into the injection tanks and probably into the injection well as the injectivity appears to have declined by about 20% and the wellhead pressure risen. The injection pumps were unable to buck the increased pressure and maintain adequate flow. By noon the pumps were put into series in order to increase their pressure output.

The rate was increased to 483,000 lb/hr with a WHP of 416 psig from 15:40 to 16:30 and then gradually declined to 449,000 lb/hr by midnight with a WHP of 525 psig.

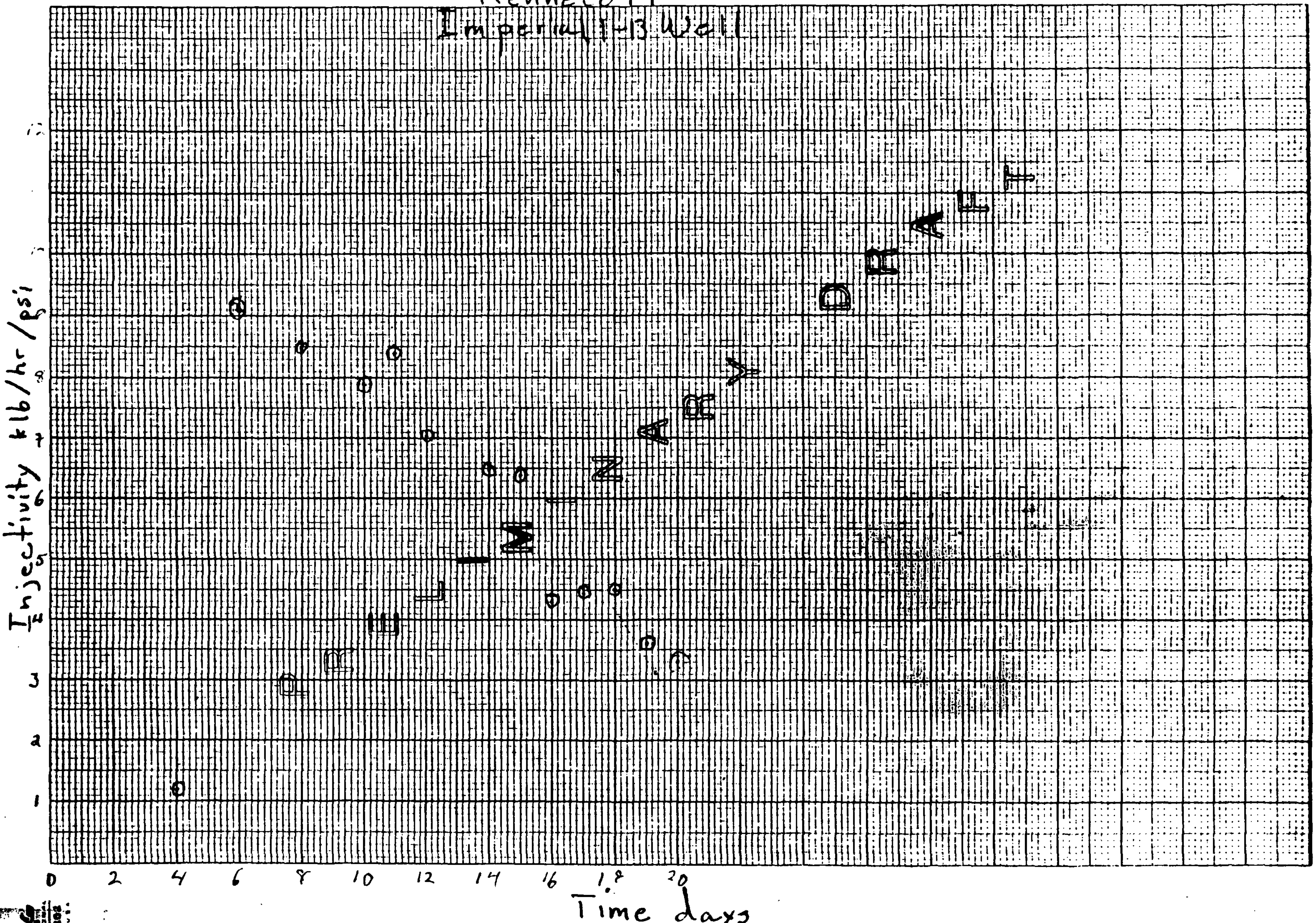
Tomorrow Pruett will run in the hole with capillary tubing to record pressure build up when the well is shut in.

Production Summary

Time	WHP* (psig)	WHT** oF	Sep Press (PI-155) psig	Flows from Sep. Steam (lb/hr)	Flows from Sep. Brine (lb/hr)	Total Flow (lb/hr)	Brine Flow at Weir*** (lb/hr)
00:00	557	504	215	41,500	117,000	159,000	153,000
14:00	566	504	214	40,700	97,600	138,000	150,000
16:30	516	494	215	103,000	381,000	483,000	451,000
24:00	525	497	213	98,000	351,000	449,000	383,000

* WHP = PI-1 reading - 5 psi.
** WHT = TI-1 reading + 2 °F
*** Weir flow corrected for fresh water injection and condensation. The sight gauge seems to be out of zero, and will be checked when well is shut in.

Injectivity with time
Kennecott
Imperial 1-13 Well



MESQUITE GROUP, INC.
WELL TEST REPORT
KENNECOTT STATE 2-14
June 20, 1988
(REVISED)

Day #19 of Test

Well was flowing 449,000 lb/hr at a WHP of 525 psig at midnight. At 00:41 the throttle valve was opened slightly to compensate for scale buildup and maintain flow.

At 12:12 the second injection pump blew a plug and had to be shut down. Both pond suction pumps were then shut down and the pond began filling.

Pruett wireline personnel arrived on site and began rigging up at 12:45. Started in the hole with capillary tubing and a temperature instrument at 14:20 and reached 5,000 ft at 16:40. Downhole pressure at 5,000 ft was 1,965.45 psia.

EPRI arrived on site at 16:00 to take final gas samples and finished sampling at 17:30.

At 15:00 noticed pressure on the shut in Brine A leg of 210 psig. It was also hot which indicated a leakage by the stop valves. Since at times the weir box flow had been higher than the orifice meter flows on leg B decided to switch back through A leg and see if the rate changed significantly. Did this at 15:45. Measured flow on B leg 361,120 lb/hr and on A leg 377,650 lb/hr. Not a significant difference, 4%.

The well was shut-in at 17:54. Pressure at 5,000 ft built-up from 1,965.45 psia to 2,128.20 psia in 33 minutes.

Production Summary

Time	WHP* (psig)	WHT** oF	Sep Press (PI-155) psig	Flows from Sep. Steam (lb/hr)	Flows from Sep. Brine (lb/hr)	Total Flow (lb/hr)	Brine Flow at Weir*** (lb/hr)
00:00	525	497	213	97,800	351,000	449,000	383,000
06:00	510	498	217	103,000	371,000	474,000	345,000
12:00	525	499	215	101,000	371,000	472,000	355,000

* WHP = PI-1 reading - 5 psi.
** WHT = TI-1 reading + 2 ^{o}F
*** Weir flow corrected for fresh water injection and condensation.

Injectivity of Imperial 1-13 continues to decline. At midnight injectivity was 3,900 lb/hr/psi. At 06:00 it was 2,600 lb/hr/psi.

MESQUITE GROUP, INC.
WELL TEST REPORT
KENNECOTT STATE 2-14
June 21, 1988
(REVISED)

Day #20 of Test

At 08:00 the downhole pressure in State 2-14 was 2125.59 psia, down 2.2 psi from 21:30 on 6/20/88. Pruett purged the helium in the capillary tubing at about 10:15. By 11:00 the pressure had stabilized at 2,125.65. The decrease in pressure may be due to either cooling of fluids below the tool or interzonal flow. Downhole pressure will continue to be observed until June 22, 1988.

At 11:00 the State 2-14 wellhead pressure was 84 psig.

Testing of the sludge from the brine pond with hydrochloric acid showed that some of the solids dissolved. Twelve 55-gallon drums of 12_N HCl were added proportionally to all (7) brine tanks, agitated with a small pump and allowed to settle overnight. At 17:00 the pH of the fluid was 1.0, no fluid was injected.

Instrumentation from the steam and brine lines is being rigged down. Steam separator static pressure recorder moved to injection wellhead for injection test.

Time	Injection Rate
00:00	192,600 lb/hr
06:00	173,340 lb/hr

At shut-in the injectivity was 2,500 lb/hr/psi.

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MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 22, 1988

Day 21, 1988

Downhole pressure in State 2-14 at 5000' was 2123.47 at 0800. No flow planned for today. Continued to monitor pressure through the night.

Injection of acidified brine from tanks started at 10:42. Injection rate averaged 270,000 lb/hr. Wellhead pressure was 135 psig at 14:15 hrs when injection stopped for pump repairs. Injectivity was 1900 lb/hr psi when injection stopped.

Restarted injection at 15:15. Injected from 15:15 to 17:45 and 18:40 to 19:07.

Imperial 1-13 Injection Data

Time	WHP	Flow	Temp
11:00	93	276,000	105
13:00	113	263,000	101
14:00	135	257,000	105
16:00	93	192,600	-
17:00	97	179,760	-
19:00	98	160,500	-

Total mass injected this day = 1,472,000 lb.

MESQUITE GROUP, INC.

WELL TEST REPORT

KENNECOTT STATE 2-14

June 23, 1988

Pruett pulled cap tubing and temperature bomb at 07:00. Temperature chart was good, but data were not available at report time. Pruett reported that their Kuster temperature elements had been recalibrated and that temperature data from surveys early in the test will be revised.

Pruett crew from Bakersfield rigged up braided line unit to run downhole sampler. RIH to 2500' at 11:30. Opened well - flowed a small amount of brine and died.

Pruett RIH to 5000' to collect sample, then POH trying to swab well in. Well did not flow.

Rented air compressor and pressured up well with air to 105 psig. Waited 2 hours, then opened well at 17:00. Well flowed a small amount of brine and died. Decided to back well down with canal water and leave it shut in to heat up until tomorrow morning.

Connected fresh water hose to flowline and pumped in 11,000 gallons of canal water between 19:35 and 23:40. Final WHP = 8 psig. Shut in well to allow it to heat up.

Injected canal water from tanks into Imperial 1-13 from 15:10 to 15:30. Estimated average rate = 100,000 lb/hr; average WHP = 60 psig. Estimated mass injected = 33,000 lb.

MESQUITE GROUP, INC.
WELL TEST REPORT
KENNECOTT STATE 2-14
June 24, 1988

State 2-14 SIWHP = 45 psig at 06:55. Starting at 07:05, pressured up at wellhead with air. Pressure was up to 110 psi at 07:35 - shut down compressor and left wellhead shut in. Pressure was 115 psi at 08:05 then started to decline slowly. At 08:54 (with SIWHP - 112 psi) opened well through AFT. Well flowed for about 10 minutes and died. Peak WHT = 242°F; peak flow rate through weir box was 120,000 lb/hr.

Checked availability of coil tubing and nitrogen units. None available until tomorrow. Decided to abort the downhole sampling and high rate flow test.

Injected fresh water from tanks into Imperial 1-13 from 09:15 to 09:50. Average rate was 251,500 lb/hr; IWHP = 155 psig IWHT = 93°F.

Pruett slickline unit arrived at 16:00 and rigged up on Imperial 1-13 for injection falloff survey. RIH with Kuster pressure and temperature tools and hung at 1,300' GL (ground level reference). Tools in place at 17:15 hrs.

Started injection at 18:30 hrs, lost suction to pumps at 18:32 hrs then regained it at approximately 18:36. Injected at 208,000 lb/hr until 18:50 hrs when it became apparent that this rate could not be sustained for the estimated two hours. Cut rate to 181,000 lb/hr and injected at a slightly declining rate until 17:37 hrs when rate was down to 166,000 lb/hr. Increased rate to 187,000 lb/hr and injected at that average rate until injection complete at 20:48. Injection wellhead pressure was 165 psig at 165,000 lb/hr and 180 at 187,000 lb/hr. Average injection temperature 92°F. Downhole tools left in Imperial 1-13 for falloff.

Put an estimated 800 gallons of fresh water into State 2-14.

MESQUITE GROUP, INC.
WELL TEST REPORT
KENNECOTT STATE 2-14 AND IMPERIAL 1-13
June 25, 1988
(Final Daily Report)

POH with tools from Imperial 1-13, obtained pressure and temperature charts. Reset tools and made traverse survey with two temperature and 1 pressure instruments at 20' per minute from surface to 1,470' (GL) where tools set down. POH. Rigged down and left site.

Put an estimated 5,260 gallons of fresh water into State 2-14 until wellhead pressure came up to meet pump discharge pressure at 60 psig and injection stopped. Shut off pump and shut in well. Total fresh water put into well since attempt to flow 6,060 gallons.

ADDENDUM D

DATA REDUCTION METHODS

ADDENDUM D

DATA REDUCTION METHODS

Parameters in Addendum A, Table A-1, are defined and calculated as shown below.

1. Wellhead Pressure (WHP) in psig = PI-1 reading -5 psi*

2. Wellhead temperature (WHT) in ^{o}F = TI-1 reading +2 ^{o}F*

3. Separator pressure in psig = PI-155 reading +1 psi* + pressure drop across the steam metering orifice. (The resulting value approximates the pressure at the brine/steam interface in the separator.)

4. Separator temperature in ^{o}F = TI-109A reading. (This value neglects any temperature loss in the steam piping from the separator to the thermometer.)

5. Steam Flow in lbm/hr = FR-102 reading on a 0-10 square root chart x

$$7{,}015 \times \left[\frac{\text{Separator Pressure} + 15}{215}\right]^{0.5}$$

for the period from 13:00 on June 7 to 08:04 on June 15 when FR-102 had a 200-inch differential range spring, or

$$8{,}592 \times \left[\frac{\text{Separator Pressure} + 15}{215}\right]^{0.5}$$

after 10:00 on June 15 when FR-102 had a 300-inch differential range spring. (Separator pressure in the above equations is defined in #3 above.)

From 05:00 to 13:00 on June 7, the brine orifice meter was in operation, but not the steam meter. During that period,

$$\text{Steam Flow} = \text{Brine} \times \left[\frac{\text{Separator flash}}{\text{1-Separator flash}}\right]$$

6. Brine Flow = FR-108 reading x 41,145 lbm/hr (Leg A)
   96,831 lbm/hr (Leg B)

* Correction to match "standard". Refer to Table 3-3.

These orifice factors were calculated by the ASME method (ASME, 1971) for the following conditions:

<u>FR-108A</u>
Dia. Pipe = 11.938 in.
Dia. Orifice = 4.8 in.
Temp. = 414 ^{o}F
Pres. = 229 psia
Salinity = .2933 wt. frac.
Density = 65.88 lbm/ft3
Chart Full Scale = 100 in. water
Reading = 1
FLOW RATE = 41144.72 lbm/hr

<u>FR-108B</u>
Dia. Pipe = 11.938 in.
Dia. Orifice = 7.1464 in.
Temp. = 414 ^{o}F
Pres. = 229 psia
Salinity = .2933 wt. frac.
Density = 65.88 lbm/ft3
Chart Full Scale = 100 in. water
Reading = 1
FLOW RATE = 96830.56 lbm/hr

From 00:08 to 10:22 on June 16 the brine meter was not functioning. During that period

$$\text{Brine flow} = \text{Steam flow} \times \left[\frac{1\text{-Separator flash}}{\text{Separator flash}}\right]$$

7. $$\text{Separator Flash} = \frac{\text{Steam Flow}}{\text{Total Flow}}$$

8. From June 1 to 03:00 on June 7:
$$\text{Total Flow} = \text{Weir Flow} \times \left[\frac{12}{(1-0.2552)}\right]$$

The weirbox was the only flow measurement available in this interval. The theoretical flash to atmosphere is 0.2552 for a preflash temperature of 545 ^{o}F and preflash TDS= 247,000 ppm. The 545 ^{o}F effective pre-flash temperature was calculated as follows:

		(°F)
Temperature at 3,750 feet from the June 5, 1988 survey (Addendum G)		571.8

Less effective temperature loss in wellbore

$$= \frac{\text{Wellbore heat transfer rate}}{\text{Brine specific heat x flow rate}}$$

$$= \frac{-2.07 \times 10^6 \text{ Btu}}{0.825 \text{ Btu/(lbm-}^\circ\text{F) x 117,000 lbm/hr}} \qquad = -21.4$$

Less effective temperature loss in surface piping

$$= \frac{-0.5 \times 10^6 \text{ Btu}}{0.825 \text{ Btu/(lbm-}^\circ\text{F) x 117,000 lbm/hr}} \qquad = -5.2$$

Effective pre-flash temperature = 545.2

From 05:00 on June 7 through June 20:
Total Flow = Brine Flow + Steam Flow

9. Cumulative Flow = Cumulative total flow from the start of the test.

10. Weir Flow = (Weirbox level)$^{1.5}$ x 26500 - (GPM fresh water x578)

26,500 is the coefficient for a 14.75-inch square-notch weir and a specific gravity of 1.2. The factor 578 is the conversion from gpm of fresh water to lbm/hr times the factor 1.156 to account for steam condensed by the addition of cool water.

From June 1 to 03:00 on June 7, any gaps in the weir box readings were filled in by interpolation. Gaps occurred because sometimes there was too much steam blowing around the weirbox to approach it.

11. Cumulative Weir Flow = Cumulative flow through the weir from start of test. This number does not include dilution water or the steam condensed by it. It represents only brine from the well, after the flash to atmosphere, as if there were no dilution water added.

[redacted]

12. Injection Flow = DPR-1 reading

This orifice factor was calcul 1971) for the following conditions:

<u>FR-1</u>
Dia. Pipe = 7,981 in.
Dia. Orifice = 5.5 in.
Temp. = 170^oF
Pres. = 100 psia
Salinity = .3378 wt. fra
Density = 75.93879 lbm/f
Chart Full Scale = 100 i
Reading = 1
FLOW RATE = 64865.25 lbm,

[redacted]

[redacted]

PRELIMINARY DRAFT

ADDE

BRINE DATA AND

[redacted]

ADDENDUM E

SALTON SEA SCIENTIFIC DRILLING PROJECT
WELL STATE 2-14
BRINE DATA AND STEAM FLASH MODEL

FOR JUNE 5, 1988

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TABLES

FIGURE

ADDENDUM E

BRINE DATA AND STEAM FLASH MODEL FOR JUNE 5, 1988

SALTON SEA SCIENTIFIC DRILLING PROJECT WELL STATE 2-14

SUMMARY

A computer model for thermophysical properties of hypersaline brines has been calibrated by the physical and chemical data collected during a flow test of State 2-14. This report focuses mainly on assembling an internally consistent set of data for June 5, 1988, the fourth day of the flow test. The model incorporates thermophysical properties of NaCl brines having a range of TDS values that spans those observed in the geothermal fluids. It also models the pressures of multiple gases in any proportions.

Brine samples were collected from the flowline on June 3, 4, and 5 and from the weirbox on June 5. Downwell measurements of temperature and pressure on June 5 provide a basis for selecting the flash initiation conditions and an estimate of enthalpy losses from the wellbore.

Results show a brine with flash initiation temperature near 570°F, pre-flash TDS near 247,000 mg/kg, CO_2 content possibly near 3900 mg/kg (total flow basis), and a steam yield near 25 weight percent of total flow. Scale and sludge formation is estimated to be about 1400 mg/kg or nominally 100 pounds per megawatt·hour of produced electricity.

ADDENDUM E

BRINE DATA AND STEAM FLASH MODEL
FOR JUNE 5, 1988

SALTON SEA SCIENTIFIC DRILLING PROJECT
WELL STATE 2-14

INTRODUCTION

The purposes of this addendum are to establish a pre-flash composition of the brine and present computations that show the evolution of the brine through the wellbore and surface facility with computational results matched to measured data where they are available.

Brine samples were taken on June 3, 4, and 5 from the two-phase flowline near the wellhead. An additional sample of brine was taken from the weirbox on June 5. Sampling was done on these days to support a set of experiments by Dr. Dennis Darnall, New Mexico State Univesity, Las Cruces, New Mexico. Other sampling by EPRI was done later, but results are not available at the time of this writing.

Downwell measurements of temperature and pressure are available for one of the sampling days, June 5, and also for June 12, 14, and 20.

At the time of these samplings, the steam separator was not in operation, nor was diluent (canal) water being added to the brine stream.

No data on gas collections during the June 1988 testing were available at the time of this writing. However, gas data and complete brine compositions are available for the flow test of December 1985, when the well was produced from depth of 6200 feet.

The computations used with these data for hypersaline brines are more complicated than for other geothermal samples. Density differences must be accounted for among native fluids, preserved samples, and analytical standards. Flash calculations must account for the high and changing salt content of the evolving residual liquid which yields steam. One sample, from the weirbox, lost some material due to supersaturation of some components, but it was possible to mathematically reconstitute that composition, simultaneously giving a quantitative measure of solids deposition.

SAMPLING

The weirbox sample was obtained by dipping a container into the active flow stream. Some of that fluid was then suction filtered and an aliquot placed into a pre-weighed sample bottle containing dilute acid. The sample was clearly not complete since suspended solids, mostly related to silica precipitation, were visibly abundant and provided the main motive for filtering. Solid sodium chloride was abundant in the weirbox as a consequence of steam losses which resulted in its supersaturation. Additional sodium chloride precipitated from the sample while filtering.

Samples from the flowline were taken with a Teflon-lined probe/cooling coil assembly. Access was through a gate valve on the flowline about 40 feet from the wellhead. The probe, 1/4-inch O.D. stainless steel, was inserted into the flow space of the flowline through an access valve assembly located at a 3-o'clock position on the horizontal flowline. Flowline temperatures at the sampling point were essentially those of the wellhead, near 492° F.

Although the flowline carried a mixture of steam and brine, it was intended to locate the tip of the probe near the pipe wall where a continuous liquid phase might be encountered. Cooled brine discharging from the coil end was directed into a pre-weighed sample container containing dilute nitric acid.

At the time of flowline sampling, the attempt to obtain steam-free brine appeared successful. It was possible to adjust the probe tip position so that no gas bubbles (effervescence) were associated with the discharge from the sampling assembly. Success is further indicated by the essential identity of apparent in situ concentrations for the brine samples collected on successive days. Additionally, the relative difference in salt contents of the sample from the flowline and the weirbox (after adjustment for precipitation) are in good correspondence to what would be expected from steam release between the two locations. Scale deposition in the probe/coil sampling equipment appeared minor and is not considered further.

DATA

Results of the chemical analyses are presented in Table 1A. Other data for computing dilution factors and densities of samples as delivered to the analyst are given in Tables 1C and 1D. The purposes and applications of the dilution and density factors are explained in subsequent sections.

Analyses for most reported elements were made by inductively coupled plasma (ICP) with comparative standards matching the approximate brine composition. In addition, ammonium was determined by specific ion electrode and chloride and bromide by titration. Sulfate and bicarbonate were not determined. Other experience with the Salton Sea resource indicates their concentrations are negligible. The ICP scan tests for 37 elements, 16 were above detection limits.

Measured downwell temperatures and pressures versus depth are given in Table 2A and Figure 1, which are based on data in Appendix D. Temperature data were obtained by Kuster gauge. Listed temperature values are derived from a calibration of the tool made after the measurement run. Pressures were measured with a capillary tubing assembly with surface readout. Temperature and pressure tools were run simultaneously on the same line. Point measurements were obtained by stopping the tools at pre-selected depths. This allowed tools to equilibrate at each reported point. Temperatures are believed accurate to ±3°F and pressures to ±0.3 psi.

Surface temperatures and pressures were monitored by calibrated dial thermometers and bourdon-type gauges. Data were recorded manually. Temperature gauge calibration was done in the field using a platinum resistance thermometer (PRT) as a reference. Some early complications with external cooling of the thermometer wells were solved by insulating them. Surface data are reported in Appendix D. The temperature on June 5 is taken as 492°F at the wellhead and the sampling point. Pressures ranged from 503 to 513 psig.

Brine flow rates were indicated by measurements at the weirbox, including adjustments for steam loss. The steam separator was not in service on June 5; therefore, separate measurements of steam and brine are not available. Mechanical conditions that invalidate the steam flow data were discovered after the test. This absence of steam measurements is a major motive for the steam flash modeling of this section.

DATA TREATMENT

A principal objective of data treatment is to determine the pre-flash concentration of the brines that is consistent with measured concentrations in partially flashed samples and with other data. Five kinds of adjustments to data are required to accomplish this objective. The last of the five involves computing steam yields, including allowance for enthalpy losses between the measured temperature at the flash point in the wellbore and the temperature at the surface sampling point. The proprietary computer program FLAGASA was used to support this report. It has been designed to deal with steam flash from gassy, briny liquids, especially of the Salton Sea resource type.

The flash computations of FLAGASA are best applied to analytical results that have been accurately adjusted to represent the field concentrations. These adjustments account for: (1) Raw analytical results show small mismatches between the electrically positive and negative components. The mismatch is resolved by increasing the concentrations of selected components. (2) Field preservation of the samples involved acidification and dilution with dilute nitric acid. Since nitrates are not a part of natural geothermal fluids, they are not analyzed and are inconsequential to the fluid description. However the dilution effect must be accounted for. (3) Analytical results are presented in units of mg/l, which are unworkable for salty brines that involve large changes in temperature, hence molar volume. Conversion to units like mg/kg are required. (4) The weirbox sample involved losses of material and that sample must be mathematically reconstructed before it can be used as a reference with the flash computations.

Charge Balance

Analytical data in Table 1A show an excess of positive charge. For each analysis, a balance is forced by reducing the concentrations of cation (+) species. The total amount of charge reduction needed for overall balance is distributed among the several species in proportion the the fraction of total charge each species represents in the analysis. Results are given in Table 1B.

The negative species (anions) were not adjusted. Only chloride and bromide are reported. Since bromide is minor, this is equivalent to accepting the chloride as a reference material. This is reasonable because the chloride analysis is inherently one of the most accurate in the set.

Density Computation

The analytical results are presented in units of mg/l whereas only weight fractions (i.e. mg/kg) are practical for describing brines that flash. The difference can be accounted for by the density of the sample <u>as delivered to the analyst</u> in the acidified form. Dividing the mg/l results by density (kg/l) yields the useful weight fractions.

Those sample densities were not measured, but they can be computed from the analytical results; the process is indicated in Table 1C. The procedure takes advantage of the brine being dominated by chlorides. Specifically, the density of a mixed-salt brine can be represented by a pure NaCl brine of different weight concentration.

Density factors given in Table 1C are used to generate the concentration of a fictitious NaCl brine which has the same density as the mixed salt brine sample. Specifically, the factors represent the number of ppm of Na (as chloride) which have the same effect on solution density as one ppm of cation X (as chloride). Values are based on data given in CRC (1986). Unit values are used (Table 1C) when there is insufficient data to evaluate a density factor.

The product of density factor and measured concentration of X yields the mg/l of Na required for equal density. Summing the products yields an equivalent concentration for the mixture, which can be converted to a molar basis. Density of the mixed-salt brine can then be determined by entering a table for (pure) NaCl brine densities at the appropriate molar concentration. Values for g/ml in Table 1C are also based on CRC (1986).

Dilution Factors

Dilution factors for the brine samples account for the dilution and acidification made in the field at the time of sampling. Data for computing those factors and the results are given in Table 1E. The dilution factor (dil) is a multiplier for the analytical result, converting the lab-sample concentrations to a field basis. Additional dilutions were made in the analytical laboratory so that the concentrations of components in the analyzed aliquots were 'on scale' for the analytical methods. Those laboratory dilutions are made on a volume, not weight, basis and are not detailed here. They are presumed accounted for in the reported analytical results.

Apparent Field Concentrations

In situ concentrations for all components are given by X*dil/dens, where X is a reported analytical concentration, 'dil' is a dilution factor, and 'dens' is a sample density as described above. Results are listed in Table 1C; units are mg/kg.

The uniformity of results for the flowline samples is remarkable -- many components show variations much smaller than one percent relative, which in some cases is better than the expected analytical precision. It deserves note that the dilution factors were unknown to the analyst, hence the analyses were appropriately 'blind'.

Such small contrasts indicate that steam was not contaminating the brine samples obtained by the probe. The effect of inadvertent amounts of steam in the samples would be erratic results in the analysis. Furthermore, the similarity among the flowline results for three successive days indicates a remarkable uniformity of the produced fluid. That indicates it is probably free of contamination by other fluids introduced into the well by drilling, completion, or injection/disposal.

Reconstruction of the Weirbox Sample

The weirbox sample (Code 254) was known to have lost considerable silica and iron from solution before collection, as well as sodium chloride. It deserves note that deposition of NaCl at atmospheric flash conditions requires special accomodations, such as addition of fresh water, to sustain fluid production.

Additional materials were lost during filtering. However, not all of the 19 measureable components are depleted during flashing, cooling, filtering, etc. Specifically, lithium, boron, manganese, bromide, and others are known or thought to be unaffected. Thus, they can be used as references.

Usually, chloride is a reliable reference, partly because the chloride analysis is one of the most accurate. In this case, however, reconstruction of the chloride content is necessary, and that can be done by involving the element/chloride ratios of the flowline samples with the weirbox sample data.

If no losses occurred between the flowline sampling point and the weirbox, the ratios of components would be the same at both locations, regardless of the steam releases. The procedure used here for reconstruction involves simultaneous adjustment of the chloride and ${}^\wedge X$ concentrations in the weirbox sample to obtain a match with the X/Cl ratio indicated by the flowline samples. Specifically, equation (1) applies:

$$(X/Cl)_{FL} = [(X+{}^\wedge X)/(Cl+{}^\wedge Cl)]_{WB} \qquad (1)$$

where ${}^\wedge X$ and ${}^\wedge Cl$ are test increments for the weirbox sample. For a single increment ${}^\wedge Cl$, the ppm amounts of each ${}^\wedge X$ are found which cause a match with the $(X/Cl)_{FL}$ ratio for the flowline samples. The test values for $(X/Cl)_{FL}$ are the average for the three flowline samples.

In Table 3A, a trial is shown for the case where ^Cl = 10,700 ppm. Column headed 'Change in X' is the ^X value which establishes the equality in equation 1 when ^Cl = 10,700. The column labeled 'Resid X' is an internal test to show that the selected ^X does yield the equality.

Other descriptors of ^X are also presented. The column 'Chg in X' shows the size of ^X in relation to X+^X and indicates the relative magnitude of ^X. The column 'Chg in sigma units' is the ratio of ^X/$(sigma)_X$, where $(sigma)_X$ is the standard deviation of X for the three flowline samples. It is especially useful to note which and how many components change by less than 3 sigma units, for these are the tracers which are not lost due to flashing or cooling.

Selections of ^Cl are tested by reviewing which and how many components are changed by less than three sigma units when the $(X/Cl)_{FL}$ ratio values are established for (X+^X)/(Cl+^Cl). For example, when ^Cl = 10,700 (Table 3A) there are eight components for which ^X values are smaller than 3-sigma; manganese, zinc, strontium, boron, lithium, barium, magnesium, and bromide.

Alternatively, when ^Cl = 11,000 or 10,500 (results not shown), only seven components are fitted to the corresponding $(X/Cl)_{FL}$ values by changes smaller than 3-sigma. Other, more extreme choices for ^Cl give still poorer correspondences. Accordingly, the changes shown in the trial for ^Cl = 10,700 are considered the best estimates for depositional losses from the weirbox sample.

It seems significant that lead, arsenic, cadmium, and copper have lost relatively high percentages of their initial concentrations (Table 3A). They are possibly not related to the silica deposition, but they may be related to sulfide reactivity.

Iron **losses** are mostly related to the silica deposition, but **may** also be involved with sulfide. It is useful to note that sulfide is scarce in this brine (generally too little to smell), and probably less than 15 ppm. **Thus** there is not enough to go around to all the 'missing' iron and also react with the copper, cadmium, etc.

Ammonium **is** partly lost to the steam in a distribution effect that is fairly well understood and dependent mainly on pH during flashing.

Behaviors of calcium and potassium are not clear. They are not suspected of deposition during flashing, so are expected to be good tracers. However, in this case, they appear to have increased significantly in concentration, but sources are not apparent, suggesting analytical problems. The apparent increases are substantial in terms of both relative percent of material and sigma units.

Net Concentrations

The reconstructed composition of the weirbox sample is shown in Table 3B, along with the flowline data repeated from Table 1E. Values for the weirbox sample represent what would have been contained in weirbox brine if no deposition had occurred. These are the proper compositions to compare directly with others. It is possible to make comparisons element by element, or with the sum of a set of elements, for example, the sum of all components. These values are useable as input to the steam flash model.

Flash Initiation Temperature

The most precise method for estimating the flash initiation temperature is to plot measured (downwell) temperatures and pressures versus one another. Below the flash initiation point (FIP) in the wellbore both temperature and pressure change independently but linearly with depth; hence their mutual relationship is highly linear. Above the FIP, temperature and pressure change in non-linear ways, partly due to physical aspects of boiling and partly due to the exsolving of non-H_2O gases. In a plot of temperature versus pressure, the FIP is indicated by where the plotted points diverge from a straight line indicted by data in the one-phase liquid zone. Figure 1 is such a plot and suggests flash initiation occured between 570 and 570.5^oF. The temperature 570.2^oF and 1360 psia are the flash initiation conditions. They correspond to a depth of 3160 feet for the flow conditions on June 5. Those values are used in the flash model.

Effective Flash Temperature

Although the temperature of flash initiation can be determined accurately, it does not completely serve the flash model. The computed amounts of steam cannot be realistically referenced to the flash initiation temperature. Conductive heat loss from the wellbore and the surface piping causes the actual steam formation to be less than what may be computed according to the measured flash initiation temperature. This effect is modeled by using an 'effective' flash initiation temperature which is lower than the value determined graphically (Figure 1).

The difference between actual and effective flash initiation temperatures corresponds to the heat losses up to the point of interest, especially the sampling locations. The 'effective' flash initiation temperature decreases down the fluid flow path. Consequently, its value at a specific point of interest is uncertain in proportion to the uncertainty of the cumulative heat losses up to that point.

As a practical matter, the heat losses through the wellbore and piping do not change greatly with a change in fluid mass flow rate. However, the consequences to effective flash temperature are almost directly proportional to fluid flow rate because the relatively constant rate of heat loss from the wellbore, etc., affects a variable mass of material.

Wellbore Heat Losses

In the lower part of the wellbore the heat loss can be estimated with good accuracy from the temperature change in the zone of one-phase liquid flow. Data and computed results are shown in Table 2B. The four downwell surveys, all reached a depth of 5000 feet and involved temperature measurements at 4000 and 5000 feet, as well as at other places. By inspection of graphed data, the flash initiation was always shallower than 4000 feet. Thus the records can be interpreted in a straightforward way. Table 2B is based on the downwell surveys which yield four estimates of the heat loss, at four different flow rates. All are in the vicinity of 565°F, at which point a brine of about 24 weight percent dissolved solids has a heat capacity near 0.825 Btu/lb·degF. The average enthalpy change and heat loss value of 354 Btu/hr·ft from Table 2B refers to the section between 5000 and 4000 feet depth where the hole was drilled by a 12 1/4-inch bit.

At shallower levels in the hole the heat loss per linear foot of wellbore is greater, depending on several factors of wellbore construction, rock type, and temperature gradients away from the wellbore axis. However, experience has shown that the relative rates of heat loss between two sections of wellbore that carry the same fluid are proportional to the drilled hole diameter. Using that principal, the measured heat loss rate for the 5000 to 4000 ft zone is used to estimate heat loss along the other sections of the wellbore.

Table 2C indicates the depths in the well versus bit size and shows the rates of heat loss. The value 1.90×10^6 Btu/hr applies to the section of wellbore above 3160 feet. A ^T value of 19.6°F is used for modeling the steam flash for

June 5, when the flow rate was 117,000 lb/hr. That is, the effective flash temperature of 570.2 - 19.6 = 550.6°F, applies.

Heat Losses from the Surface Facility

Additional heat losses occur in the surface facility. These were estimated for pipe-like surfaces exposed to a 20-mph wind and a temperature differential of 415°F (Appendix F). Integration over the estimated metal surface area of the facility indicated a heat loss of 1.14×10^6 Btu/hr. This value is severe, but reasonable for some nighttime occasions. At lesser wind speeds the heat loss is almost linearly less.

At low wind speed a mechanism of natural convection becomes dominant, but provides a minimum rate of heat loss. A value of 265,000 Btu/hr has been estimated for this condition. That amount induces an additional 2.7°F impact on the effective flash temperature between wellhead and atmospheric separator when the total fluid flow rate is 117,000 lb/hr. Thus, the effective flash temperature at the weirbox is 570.2 - 19.6 - 2.7 = 547.9°F.

FLASH MODEL FOR THE BRINE

The main purpose of the steam flash model is to derive a steam fraction of flow at the brine sampling point. When accomplished, the measured brine compositions can be adjusted to a pre-flash, reservoir basis. Secondary purposes include reviewing the reasonableness of several numerical quantities that were estimated.

Results from the foregoing section are used as input to the calculational model for steam yield. The brine composition values work in the model in two ways. First, they provide an estimate for the salt effect on thermodynamic properties involved with flashing. Secondly, they serve as references for salt concentrations which are to be matched by the model at appropriate temperatures.

In principle, the pre-flash composition is obtained by iteration beginning with an estimated pre-flash salt content that is 'concentrated' according to calculated steam losses up to the sampling points. The correct selection of a pre-flash salt content is indicated by a match between the computed and measured concentrations from the flowline and/or the weirbox.

Thermodynamic Data for Heavy Brines

Computing steam yield from produced fluids is an elementary aspect in the geothermal industry. Steam tables list appropriate properties of pure water that are accurate for some geothermal resources. However, thermodynamic properties of the heavy brines of the Salton Sea resource are not adequately described by ordinary steam tables.

Thermodynamic data are available for pure NaCl brines for the temperature range of the Salton Sea resource. Tabular data are awkward to use because the limited number of tables do not provide a convenient way to track the continuously increasing salt content of a real flashing brine.

It is possible to use the tabular data to fit equations of a convenient form to provide a means for handling the flash relationships between any pair of temperatures. That is the approach used here. Equations for brine enthalpy, brine density, and enthalpy of vaporization are based on tabular data in Haas (1976) and incorporated into the computer model. Related equations for specific volume of steam and pressures due to non-H_2O gases are derived from other sources (Ellis and Golding, 1963; Himmelblau, 1960; Wisenburg and Guinasso, 1979).

Use of NaCl thermodynamics for the Salton Sea geothermal brines remains an approximation. The mixed salt composition is far from simple NaCl. Specifically, sodium ions balance only about 55 percent of the electrical charge of the chloride. That is, the Salton Sea brines differ from a pure NaCl brine in the sense of having about 45 percent of the sodium replaced by other components. The magnitude of the thermodynamic effect due to this substitution has not been clearly reported from laboratory studies. One field experiment showed that the difference may be significant (Michels, 1986b). However, in this review, the thermodynamics for pure NaCl solutions are used for the steam flash model.

Modeling Gases

In addition to the salt effects on temperature and vapor pressure of H_2O, the presence of dissolved gases is important to the brine and steam. Particularly, at flash initiation, the pressures of dissolved gases add to the vapor pressure of H_2O, increasing the measured pressure by hundreds of psi from pure water or simple NaCl brines.

No data on the gas content of fluids produced from the June 1988 testing are available at the time of this writing. Data are available from the December 1985 test, however (Michels, 1986a). Furthermore, the model may be used to test whether the gas contents observed in 1985 are approximately the same as in current production as well as to test for more appropriate estimates. With the model, computed pressures can be adjusted by selecting different gas contents to match the observed flash initiation pressure with the computed pressure. The model also computes the contribution of non-H_2O gases to total pressure at any point along the two-phase flow path.

Determining Pre-Flash TDS -- The Non-Adiabatic Model

After the flash initiation temperature and wellbore enthalpy losses have been identified, the model may be used to determine the pre-flash total dissolved solids (TDS), based on the TDS of the flowline sample. The model also gives a relevant estimate of flowline pressure that can be compared with measured values.

Table 4 is a computer output showing many physical properties of the brine and steam mixture at selected temperatures. All are referenced to an effective flash initiation temperature of 550.6°F, as discussed above. The pre-flash TDS, 246,729 mg/kg, was selected so that the computed TDS at 492°F (sampling temperature) matches the TDS value of 261,865 mg/kg in Table 3B for sample 173. The pre-flash TDS determined in this way is considered the best estimate. The pre-flash value, 246,729 mg/kg, is applied in other runs of the model that focus on other aspects of the fluid flow path.

The model also computes the partial pressures of all gases and the total pressure at any selected temperature along the flowpath, for example, at the near-wellhead sampling point, (492°F). These are shown in Table 4. Observed pressures at the wellhead on June 5 ranged from 516 to 528 psia which may be compared with the computed pressure of 540 psia. The computed partial pressures of non-H_2O gases is 21.7 psi. The mismatch between computed and observed total pressure may be partly due to an improper assignment of gas content to the brine. The inaccuracy of the H_2O pressure computation is harder to estimate due to modeling the mixed-salt brine as NaCl brine. Pressures of non-H_2O gases are negligible at the atmospheric discharge point.

The flash initiation pressure indicated in Table 4 has no significant meaning beyond indicating the pressure that would exist if flash initiation occurred at 550°F. Note that the concept of 'effective' flash temperature has the actual flash initiation occur at the measured conditions, but by the time fluid arrives at the sample point, the amount of steam, etc., corresponds to a lower effective flash temperature.

Using the composition of the weirbox sample in the flash model has two applications. By assigning an appropriate heat loss, one can obtain an estimate of the pre-flash composition that is independent of the flowline sample. Using the temperature impact described earlier (570.2 - 19.6 - 2.7 = 547.9) and matching the reconstructed weirbox composition (Table 3B) yields a pre-flash TDS of 248055 mg/kg. This latter value appears also in Table 3C. It may be used with the 246,729 mg/kg to obtain an average, 247,392±938 mg/kg.

Alternatively, one may use the pre-flash TDS based on the flowline sample with the heat loss appropriate for the weirbox. This approach yields a computed weirbox TDS of 330,879 mg/kg (Table 5) which is smaller than the observed value of 332,474 mg/kg (Table 3B). The difference, 1595 mg/kg, represents the net effect of all errors involved in the analyses and in the model between the two reference temperatures (flowline and weirbox).

The size of that error may be expressed in several forms. For example, the observed difference in TDS between flowline and weirbox samples is 70,609 mg/kg (Table 3B samples 173 vs. 254). The computed contrast is 69,014 mg/kg. The values differ by 2.3 relative percent. This is equivalent to a mis-estimate of steam yield of 0.0045 percent on a total flow basis.

For comparison, steam rates measured with orifice meters are uncertain by about 5 relative percent, or 1.25 units for a steam yield of 25 weight percent. Thus, the FLAGASA computation is internally consistent to a precision much above what can be expected from direct measurements in the field.

The full compositions of the pre-flash brines are given in Table 3 along with the composition obtained from the December 1985 flow test (Michels, 1986b). There are several minor differences that are beyond the scope of this report.

Results for an Adiabatic Model of Steam Flashing

An idealized case for modeling involves the adiabatic or no-heat-loss assumption. Table 6 has the same form as Tables 4 and 5 but uses the undegraded flash initiation temperature as a basis for computation. The apparent flash fractions are somewhat higher. The pre-flash TDS used for Table 6 is the value from Table 4; there is no merit in seeking a unique pre-flash TDS value for the adiabatic computation. Similarly, the mismatches between computed and observed TDS values at flowline and weirbox positions have no significant meaning.

One merit of the adiabatic computation is that it provides a basis for estimating gas contents of the fluid. The vapor pressure of H_2O over brine at 570.2°F is not sufficient to account for the measured pressure. Accordingly, a gas content was introduced into the model which causes the computed pressure to match the measured value. Specifically, the model mixture of CO_2, CH_4, and N_2 conforms to the proportions observed in the flow test of December 1985. However, to match the June 5 flash pressure, a greater gas content was required, 3702 ppm of CO_2 versus 1660 ppm, with the other gases in the same proportions. The larger amount remains reasonable for the Salton Sea resource and may be accepted as a valid estimate until directly measured values become available.

No estimate for H_2S content is provided. In all reasonable cases for the Salton Sea resource, it would have a pressure component too small to discern among the other components of pressure.

Steam Yields from the Brine

An estimate of the **maximum** steam yield for a single stage process may be based on the adiabatic model. From Table 6, this is 27.4 weight percent at atmospheric pressure. The probable steam percentage obtainable for a commercial venture is less than that, depending on the actual heat losses encountered from the wellbore and surface equipment. There also is a need to make steam separation at higher than atmospheric pressure for engineering reasons, further reducing the amount available for commercial purposes.

On the other hand, the non-adiabatic case described in Table 5 over-estimates the effect of heat losses on steam yield because the modeled flow rate is relatively low compared to a commercial rate. However, it does not incorporate surface heat losses nor a higher-than-atmospheric separation pressure that would be encountered in a commercial process.

Table 7 shows the results for assuming a brine production rate of 420,000 lb/hr and an enthalpy loss of 2.22×10^6 Btu/hr between flash point and a low pressure steam separation point. These conditions represent a reasonable commercial application of State 2-14. The computed one-stage steam yield is 25.17 weight percent at 23 psia (250°F). Yields at other nearby pressures are given in Table 7. The nominal value of 25 weight percent is suggestive of what might be available for exploitation. Important complications exist, one involves the tendency of the brine to deposit NaCl at atmospheric flash conditions, described in the following section.

A two-stage steam separation plant might be practical for resource development. That option yields a slightly higher net percentage of steam recovered from the brine compared to a single stage flash over the same temperature range. Modeling related to evaluating such options is possible but was not pursued at this time.

Implications for NaCl Deposition

Deposition of NaCl at atmospheric flash conditions cannot be tolerated in a commercial situation. In later stages of the June flow test, canal water was added to the brine upstream the atmospheric flash. This prevented NaCl supersaturation and enabled the test to continue.

Alternatives to canal water addition are available. One (RGI 1985) involves well completions that tap two thermal resources, one dilute, so that the mixed production from the well does not deposit NaCl at the surface, even though the non-dilute member would cause deposition if produced alone. Furthermore, partially flashed brine from the combined-fluid well could be blended with brine from saltier wells that feed the same surface facility. That would serve a similar function that canal water served in the flow test, but with no negative impact on enthalpy and steam yield.

Clearly, the one-stage steam yield quantified in this preliminary modeling is only a rough approximation for how State 2-14 might actually be developed.

Scale and Sludge Deposits

Deposition from the June 1988 test was significant. Scale fragments were recovered from the flowline after the test which had thicknesses of nominally 1/2 inch. They are not considered further in this report. In practice, deposited solids may occur as adherent scales to be periodically removed from pipelines, etc., or as suspended solids, grown in a crystallizer or reactor/clarifier-type device and recovered as a sludge. Either way, they constitute a solid waste, and the collection and disposal will represent significant plant features.

Reconstruction of the composition of the weirbox sample gives a quantitative estimate for the amount of materials that will become solids. The amount may be estimated from the data given in Table 3A. Specifically, the apparent sludge-forming materials are iron, silica, lead, arsenic, cadmium, and copper. The listed mg/kg amounts are on a basis of flashed brine.

The silica deposit will incorporate chemically bound water to give an approximate relation of $SiO_2 \cdot 2H_2O$. Hence, the listed mg/kg amount of SiO_2 underestimates the expected weight of its solids. The other metals will also be associated in scale with items not listed in the reconstruction. Furthermore, a waste sludge will contain several percent of moisture, either as residual brine or as water used to displace the brine.

Collectively, the brine sample reconstruction indicates that about 930 mg/kg of materials (post-flash brine basis) will deposit. The recovered amounts of sludge, etc, will be more than that by a factor of about two. That corresponds to about 1400 mg/kg of solids, on a basis of pre-flash brine, that would require disposal.

That amount may be put in terms of power production by relating to it the energy recovered from associated steam. Nominally, for a 25 percent steam yield and 18,000 pounds of steam per megawatt·hr, disposable solids will amount to about 100 pounds per megawatt·hr.

CONCLUSIONS

A model that is internally and logically consistent with the observations is presented in this addendum. The bases for calibrating the model are described in detail, particularly in regard to identifying the fluid composition.

The model is used to compute some useful results that were not or could not be measured. Selected results are provided as computer printouts.

Brine from the State 2-14 well has a pre-flash TDS of about 247,000 mg/kg that may be produced with an effective flash temperature near 563°F. Under those conditions it would yield about 25 weight percent steam at 23 psia (250°F). The brine has a tendency to deposit NaCl at atmospheric flash conditions and eliminating such deposition may have an impact on steam yield. Other solids, mainly siliceous sludges with heavy metal accompaniments, will deposit at a rate of about 1400 mg/kg or approximately 100 pounds per megawatt-hour of electricity produced.

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ADDENDUM E

BRINE DATA AND STEAM FLASH MODELING

SALTON SEA SCIENTIFIC DRILLING PROJECT

TABLE 1: BRINE COMPOSITIONS

	---A---				---B---			
	------Analytical Data-----				------Charge Balanced------			
Day	6/3	6/4	6/5	6/5				
Time	1855	1414	1355	0630				
Code	180	182	173	254	180	182	173	254
Type	line	line	line	atmos				
Temp (F)	494	492	492	225				
	----milligrams per liter---				----milligrams per liter---			
Sodium	34062	31988	29100	69775	33238	31527	28820	67661
Calcium	17238	16050	14575	39800	16821	15819	14435	38594
Potassium	10640	9962	9131	24440	10383	9819	9043	23699
Iron	1051	991	898	2232	1026	977	889	2164
Manganese	928	865	800	2096	906	853	792	2032
Zinc	320	299	276	723	312	295	273	701
Silica	301	282	260	148	294	278	257	144
Strontium	254	240	220	579	248	237	218	561
Boron	252	236	217	567	246	233	215	550
Lithium	134	126	115	302	131	124	114	293
Ammonium	246	238	212	536	240	235	210	520
Barium	67.7	66.2	69.0	176.0	66.1	65.2	68.3	[illegible]
Lead	60.0	58.3	53.0	130.0	58.5	57.5	52.5	[illegible]
Magnesium	28.1	25.4	23.7	61.8	27.4	25.0	23.5	59.9
Arsenic	9.57	8.63	8.56	17.80	9.34	8.51	8.48	17.26
Cadmium	1.49	1.28	1.19	1.65	1.45	1.26	1.18	1.60
Copper	1.00	1.11	1.10	1.38	0.98	[illegible]	1.09	1.34
Chloride	94000	88900	81300	202000	94000	[illegible]	81300	202000
Bromide	61	59	55	146	[illegible]	59	55	146
Sum of ppm	159655	150397	137316	343733	[illegible]	[illegible]	136777	339442
Anion eqs.	2.652	2.508	2.294	5.700	2.652	2.508	2.294	5.700
Cation eqs.	2.718	2.545	2.316	5.878	2.652	2.508	2.294	5.700
Chrg Balance diff/sum	0.012	0.007	0.005	[illegible]	.000	.000	.000	.000

	---C---				
	-------Density Computation-------				
	Density factor	180 line	182 line	173 line	254 atmos
		-----mg Na per liter----- -for equal density affect-			
Sodium	1.000	34062	31988	[illegible]	69775
Calcium	1.228	21168	19709	[illegible]	48874
Potassium	0.642	6831	6396	5862	15690
Iron	1.303	1369	1291	1170	2908
Manganese	0.742	689	642	594	1555
Zinc	1	[illegible]	299	276	723
Silica	1	301	282	260	148
Strontium	[illegible]	177	167	153	403
Boron	1	252	236	217	567
Lithium	1	134	126	115	302
Ammonium	1	246	238	212	536
Barium	0.873	59.1	57.8	60.2	153.6
Lead	1	60.0	58.3	53.0	130.0
Magnesium	1	28.1	25.4	23.7	61.8
Arsenic	1	9.6	8.6	8.6	17.8
Cadmium	1	1.49	1.28	1.19	1.65
Copper	1	1.00	1.11	1.10	1.38
	Eq Na mg/l	65708	61527	56005	141849
	Eq mol/l	2.857	2.675	2.435	6.167
	g/ml	1.1088	1.1021	1.0933	1.2268

	---E---			
	---Apparent in situ Concentrations---			
	6/3	6/4	6/5	6/5
	1855	1414	1355	0630
	180	182	173	254
	line	line	line	atmos
	--milligrams per kilogram-			
Sodium	56092	55830	55495	64135
Calcium	28387	28013	27795	36583
Potassium	17522	17387	17413	22465
Iron	1731	1730	1713	2052
Manganese	1528	1510	1526	1927
Zinc	527	522	526	665
Silica	496	492	496	136
Strontium	418	419	420	532
Boron	415	412	414	521
Lithium	221	220	219	278
Ammonium	405	415	404	493
Barium	111	116	132	162
Lead	99	102	101	119
Magnesium	46.3	44.3	45.2	56.8
Arsenic	15.8	15.1	16.3	16.4
Cadmium	2.45	2.23	2.27	1.52
Copper	1.65	1.94	2.10	1.27
Chloride	154796	155162	155042	185673
Bromide	100	103	105	134
Sum of ppm	262913	262496	261865	315951

	---D---			
	--------Dilution Factor Computation--------			
	180	182	173	254
Bottle Weights				
empty	11.136	11.107	11.189	11.35
w/acid	41.120	41.126	41.166	16.66
w/smpl	77.422	73.629	68.798	58.28
Diln fctr	1.826	1.924	2.085	1.128

Elements at less than detection limits:

12 Al	5 Ce	2.5 Ni	2.5 Ti
1 Ag	0.5 Co	2.5 Sn	120 U
2 Au	2.5 Cr	15 Sb	25 V
0.02 Be	2.5 La	30 Te	2.5 W
50 Bi	12 Mo	50 Th	2.5 Zr
0.01 Cs	0.01 Rb		

ADDENDUM E
BRINE DATA AND STEAM FLASH MODELING
SALTON SEA SCIENTIFIC DRILLING PROJECT

TABLE 2: DOWNWELL TEMPERATURES, PRESSURES, AND HEAT LOSS RATES

----A----

------------Measured Temperatures and Pressures--------------

Depth feet	--June 5--- F	psig	--June 12-- F	psig	--June 14-- F	psig	--June 20-- F	psig
0		529.8						
500	503.2		503.6		501.6		507.4	
1000	516.0		511.1	678.8	512.8	657.3	520.0	659.4
	1300	727.2						
1500	530.5		523.8		525.0		531.8	
1600		791.6						
1800		840.9						
2000	546.8	896.5	536.8	870.2	535.7	832.1	545.7	837.0
2250		974.1						
2500	560.5	1063.6	553.9		551.0		559.2	
3000	568.3	1268.9	559.7	1196.0	562.4	11[illegible]	573.0	1121.9
3500	571.0	1484.7	565.8		568.2		579.5	
4000	572.5	1699.8	565.5	1625.5	57[illegible]	1535.2	580.9	1540.3
4500	573.6	1919.2	567.5		57[illegible]		581.8	
5000	575.1	2140.2	568.9	2053.9	573.6	1974.9	582.0	1968.6

----B----

--------Heat Loss Computation--------

--Interval 5000 to 4000 feet--

Date	T5000-T4000 deg F	Rate lb/hr	L Btu/hr ft
June 5	2.6	117000	251
June 12	2.4	208000	412
June 14	1.1	402000	365
June 20	1.1	420000	381
		Average	352
		Std. Dev.	61

C = 0.825 Btu/lb degF at 565F
L = ^T*R*C/^Z = Btu/hr ft

----C----

---Heat Losses Along the Wellbore---

Depth	Bit Dia	L	^Z	L*^Z Btu/hr
5000				
	12.25	354	1485	525690
3515				
	17.5	506	2483	1255689
1032				
	26	751	882	662688
150				
	36	1040	150	156049
0				

Sum above 3515 ft: 2074426 Btu/hr

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1 August 1988

ADDENDUM E

BRINE DATA AND STEAM FLASH MODELING

SALTON SEA SCIENTIFIC DRILLING PROJECT

TABLE 3: PRE-FLASH BRINE COMPOSITIONS

---A---

-----Reconstitute Sample 254-------

Trial ^Cl = 10700

	Apparent comp mg/kg	Change in X mg/kg	Resid X mg/kg	% Chg in X	Chg in sigma units	
Sodium	64135	-6567	0	8.6	-26.9	
Calcium	36583	1027	0	-2.6	4.2	*
Potassium	22465	369	0	-1.5	6.3	*
Iron	2052	-133	0	5.6	-15.9	
Manganese	1927	-1	0	.0	-0.1	**
Zinc	665	-0.6	.0	0.1	-0.3	**
Silica	136	-490	0.5	76.8	-291.7	
Strontium	532	1.5	.0	-0.3	2.9	**
Boron	521	-2.8	.0	0.5	-2.2	**
Lithium	278	-1.1	.0	0.4	-2.0	**
Ammonium	493	-25	-0.4	4.5	-4.9	
Barium	162	9.9	-0.4	-6.0	1.1	*
Lead	119	-7.9	.0	5.7	-6.3	
Magnesium	57	-0.5	.0	0.8	-0.6	**
Arsenic	16	-3.5	.0	16.4	-6.8	
Cadmium	2	-1.4	.0	45.9	-14.5	
Copper	1	-1.1	.0	44.4	-[illegible].9	
Chloride	185673	-10700	0	5.0	-70[illegible]	
Bromide	134	4	.0	-2[illegible]	2.2	*
Sum of ppm	315951	-16523	0	4.[illegible]	-38.3	

** Best tracers

* Other elements not lost during flashing

---B---

----------- NET CONCENTRATIONS -----------

Code	180	182	173	254
Type	line	line	line	atmos
Temp	494	492	492	225
	--milligrams per kilogram--			
Sodium	56092	55830	5549[illegible]	70702
Calcium	28387	28013	2779[illegible]	35556
Potassium	17522	17387	17413	22096
Iron	1731	1730	1713	2185
Manganese	1528	1510	1526	1928
Zinc	527	522	526	665
Silica	496	492	496	626
Strontium	418	419	420	531
Boron	415	412	414	524
Lithium	221	220	219	279
Ammonium	405	415	404	518
Barium	111	116	132	152
Lead	99	102	101	127
Magnesium	46	44	45	57
Arsenic	15.8	15.1	16.3	20
Cadmium	2.5	2.2	2.3	2.9
Copper	1.6	1.9	2.1	2.4
Chloride	154796	155162	155042	196373
Bromide	100	103	105	130
Sum of ppm	262913	262496	261865	332474
Flash Fraction			0.0578	0.2539

---C---

--PRE-FLASH CONCENTRATIONS--

	June 15, 1988 Based on: 173	254	Dec 30 1985 avg	% diff
Sodium	52287	52750	52661	0.2
Calcium	26188	26528	26515	.0
Potassium	16407	16485	16502	-0.1
Iron	1614	1630	1552	4.8
Manganese	1437	1438	1385	3.7
Zinc	496	496	506	-2.0
Silica	467	467	>475	
Strontium	395	396	405	-2.3
Boron	390	391	357	8.7
Lithium	207	208	190	8.6
Ammonium	381	386	336	13.0
Barium	124	113	194	-71.2
Lead	95	95	95	.0
Magnesium	43	43	36	15.8
Arsenic	15.4	15		
Cadmium	2.1	2		
Copper	2.0	2		
Chloride	146080	146512	153668	-4.9
Bromide	99	97		
Sum of ppm	246729	248055	254877	-2.8

Don Michels Associates

1 August 1988

ADDENDUM E
BRINE DATA AND STEAM FLASH MODELING
SALTON SEA SCIENTIFIC DRILLING PROJECT

TABLE 4: COMPUTATION OF COMPOSITION AND PHYSICAL PROPERTIES
FOR FLASHING GEOTHERMAL FLUIDS

FLAGASA STEAM FLASH MODEL
STATE 2-14 (Kennecott)
BASED ON WELLBORE DATA FOR JUNE 5, 1988
and BRINE DATA FOR JUNE 5, 1988
FLOW RATE: 117,000 lb/hr, total fluid

EFFECTIVE FLASH TEMP: 550.6 F

			INITIAL VAPOR PRESSURES	
PRE-FLASH	TDS	246729 ppm	H2O	882.4
	CO2	3701.8 ppm	CO2	293.5
	CH4	44.6 ppm	CH4	14.4
	N2	78.05 ppm	N2	24.0
Excess Enthalpy		0		
Equiv. wt % Steam		0.00	Total:	1214 psia

This computation conforms to:
Heat losses to the weirbox
NaCl thermodynamics
Temp loss = 19.6 F
Salinity mismatch
at flowline 0 mg/kg
at weirbox -574 mg/kg

DEG F	STEAM MASS FRACTION	BRINE SP VOL	NET SP VOL	VAPOR VOLUME FRAC	TDS ppm	WEIGHT FRACTION OF INITIAL GAS REMAINING IN LIQUID CO2	CH4	N2	ppm OF GASES IN VAPOR PHASE CO2	CH4	N2	----PARTIAL PRESSURES---- CO2	CH4	N2	H2O	TOTAL PSIA	KPA	DEG C
550.6	0.0000	0.01630	0.0163	0.000	246729	1.000	1.000	1.000	0	0	0	293.5	14.4	24.0	882.4	1214	8370	288.1
493	0.0570	0.01587	0.0581	0.743	261656	0.060	0.031	0.019	57492	757	1340	19.9	0.7	0.7	522.9	544	3751	256.1
492	0.0578	0.01586	0.0591	0.747	261865	0.059	0.030	0.019	56863	748	1323	19.5	0.7	0.7	518.0	539	3714	255.6
491	0.0587	0.01585	0.0602	0.752	262119	0.057	0.030	0.018	56111	737	1304	19.0	0.6	0.7	513.0	533	3676	255.0
407	0.1295	0.01527	0.2459	0.946	283446	0.010	0.004	0.002	27513	343	601	3.8	0.1	0.1	211.1	215	1483	208.3
406	0.1302	0.01526	0.2496	0.947	283656	0.010	0.004	0.002	27385	341	598	3.8	0.1	0.1	208.7	213	1466	207.8
226	0.2544	0.01413	5.3945	0.998	330910	.000	.000	.000	14337	175	307	0.2	.0	.0	15.1	15	105	107.8
225	0.2566	0.01413	5.5391	0.998	331900	.000	.000	.000	14215	174	304	0.2	.0	.0	14.8	15	103	107.2
224	0.2573	0.01412	5.6529	0.998	332191	.000	.000	.000	14180	173	303	0.1	.0	.0	14.5	15	101	106.7

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13 Nov 1988

ADDENDUM E
BRINE DATA AND STEAM FLASH MODELING
SALTON SEA SCIENTIFIC DRILLING PROJECT

TABLE 5: COMPUTATION OF COMPOSITION AND PHYSICAL PROPERTIES FOR FLASHING GEOTHERMAL FLUIDS

FLAGASA STEAM FLASH MODEL
STATE 2-14 (Kennecott)
BASED ON WELLBORE DATA FOR JUNE 5, 1988
and BRINE DATA FOR JUNE 5, 1988
FLOW RATE: 117,000 lb/hr, total fluid

EFFECTIVE FLASH TEMP: 547.9 F
PRE-FLASH TDS 246729 ppm
CO2 3701.8 ppm
CH4 44.6 ppm
N2 78.05 ppm
Excess Enthalpy 0
Equiv. wt % Steam 0.00

INITIAL VAPOR PRESSURES
H2O 862.6
CO2 293.9
CH4 14.7
N2 24.4
Total: 1196 psia

This computation conforms to:
Heat losses to the weirbox
NaCl thermodynamics
Temp loss = 22.3 F
Salinity mismatch
at flowline -742 mg/kg
at weirbox -1595 mg/kg

DEG F	STEAM MASS FRACTION	BRINE SP VOL	NET SP VOL	VAPOR VOLUME FRAC	TDS ppm	WEIGHT FRACTION OF INITIAL GAS REMAINING IN LIQUID CO2	CH4	N2	ppm OF GASES IN VAPOR PHASE CO2	CH4	N2	----PARTIAL PRESSURES---- CO2	CH4	N2	H2O	TOTAL PSIA	KPA	DEG C
547.9	0.0000	0.01628	0.0163	0.000	246729	1.000	1.000	1.000	0	0	0	293.9	14.7	24.4	862.6	1196	8241	286.6
493	0.0544	0.01587	0.0561	0.733	260910	0.063	0.033	0.020	59998	793	1405	20.7	0.7	0.7	523.2	545	3759	256.1
492	0.0551	0.01586	0.0571	0.737	261123	0.061	0.032	0.020	59296	783	1386	20.3	0.7	0.7	518.3	540	3722	255.6
491	0.0560	0.01585	0.0581	0.743	261376	0.060	0.031	0.019	58476	771	1365	19.8	0.7	0.7	513.3	534	3684	255.0
407	0.1271	0.01527	0.2414	0.945	282639	0.010	0.004	0.002	28030	350	613	3.9	0.1	0.1	211.2	215	1484	208.3
406	0.1277	0.01526	0.2451	0.946	282849	0.010	0.004	0.002	27896	348	609	3.8	0.1	0.1	208.8	213	1467	207.8
226	0.2521	0.01413	5.3462	0.998	329905	.000	.000	.000	14465	177	309	0.2	.0	.0	15.1	15	105	107.8
225	0.2543	0.01413	5.4895	0.998	330879	.000	.000	.000	14341	175	307	0.2	.0	.0	14.8	15	103	107.2
224	0.2550	0.01412	5.6024	0.998	331169	.000	.000	.000	14305	175	306	0.1	.0	.0	14.5	15	101	106.7

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13 Nov 1988

ADDENDUM E
BRINE DATA AND STEAM FLASH MODELING
SALTON SEA SCIENTIFIC DRILLING PROJECT

TABLE 6: COMPUTATION OF COMPOSITION AND PHYSICAL PROPERTIES
FOR FLASHING GEOTHERMAL FLUIDS

FLAGASA STEAM FLASH MODEL
STATE 2-14 (Kennecott)
BASED ON WELLBORE DATA FOR JUNE 5, 1988
and BRINE DATA FOR JUNE 5, 1988
FLOW RATE: 117,000 lb/hr, total fluid

EFFECTIVE FLASH TEMP:	570.2 F	INITIAL VAPOR PRESSURES		
PRE-FLASH TDS	246729 ppm	H2O	1036.5	
CO2	3701.8 ppm	CO2	290.5	
CH4	44.6 ppm	CH4	12.5	
N2	78.05 ppm	N2	20.8	
Excess Enthalpy	0			
Equiv. wt % Steam	0.00	Total:	1360 psia	

This computation conforms to:
Heat losses to the weirbox
NaCl thermodynamics
Heat loss = none
Salinity mismatch
at flowline: 5528 mg/kg
at weir box: 7065 mg/kg

DEG F	STEAM MASS FRACTION	BRINE SP VOL	NET SP VOL	VAPOR VOLUME FRAC	TDS ppm	WEIGHT FRACTION OF INITIAL GAS REMAINING IN LIQUID CO2	CH4	N2	ppm OF GASES IN VAPOR PHASE CO2	CH4	N2	----PARTIAL PRESSURES---- CO2	CH4	N2	H2O	TOTAL PSIA	KPA	DEG C
570.2	0.0000	0.01645	0.0165	0.000	246729	1.000	1.000	1.000	0	0	0	290.5	12.5	20.8	1036.5	1360	9377	299.0
493	0.0767	0.01587	0.0727	0.799	267220	0.045	0.023	0.014	[illegible]4084	568	1002	15.3	0.5	0.5	520.7	537	3702	256.1
492	0.0773	0.01586	0.0737	0.801	267393	0.044	0.023	0.014	43793	564	995	15.1	0.5	0.5	515.8	532	3666	255.6
491	0.0782	0.01585	0.0749	0.805	267652	0.043	0.022	0.014	43356	558	984	14.8	0.5	0.5	510.8	527	3630	255.0
407	0.1476	0.01527	0.2783	0.953	289463	0.009	0.003	0.002	24254	301	527	3.4	0.1	0.1	210.1	214	1473	208.3
406	0.1483	0.01526	0.2823	0.954	289675	0.009	0.003	0.002	24158	300	525	3.4	0.1	0.1	207.7	211	1456	207.8
226	0.2710	0.01413	5.7472	0.998	338432	.000	.000	.000	13473	165	288	0.1	.0	.0	15.0	15	104	107.8
225	0.2733	0.01413	5.9014	0.998	339539	.000	.000	.000	13357	163	285	0.1	.0	.0	14.7	15	102	107.2
224	0.2740	0.01412	6.0218	0.998	339845	.000	.000	.000	13326	163	285	0.1	.0	.0	14.4	15	100	106.7

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13 Nov 1988

ADDENDUM E
BRINE DATA AND STEAM FLASH MODELING
SALTON SEA SCIENTIFIC DRILLING PROJECT

TABLE 7: COMPUTATION OF COMPOSITION AND PHYSICAL PROPERTIES FOR FLASHING GEOTHERMAL FLUIDS

FLAGASA STEAM FLASH MODEL
STATE 2-14 (Kennecott)
BASED ON WELLBORE DATA FOR JUNE 5, 1988
and BRINE DATA FOR JUNE 5, 1988
FLOW RATE: 117,000 lb/hr, total fluid

EFFECTIVE FLASH TEMP: 563.5 F
PRE-FLASH TDS 246729 ppm
CO2 3701.8 ppm
CH4 44.6 ppm
N2 78.05 ppm
Excess Enthalpy 0
Equiv. wt % Steam 0.00

INITIAL VAPOR PRESSURES
H2O 981.7
CO2 291.5
CH4 13.2
N2 21.9
Total: 1308 psia

This computation conforms to:
Heat losses
to low pressure separator
NaCl thermodynamics
Temp loss = 6.7 F

mg/kg
mg/kg

DEG F	STEAM MASS FRACTION	BRINE SP VOL	NET SP VOL	VAPOR VOLUME FRAC	TDS ppm	WEIGHT FRACTION OF INITIAL GAS REMAINING IN LIQUID CO2	CH4	N2	ppm OF GASES IN VAPOR PHASE CO2	CH4	N2	----PARTIAL PRESSURES---- CO2	CH4	N2	H2O	TOTAL PSIA	KPA	DEG C
563.5	0.0000	0.01640	0.0164	0.000	246729	1.000	1.000	1.000	0	0	0	291.5	13.2	21.9	981.7	1308	9018	295.3
493	0.0700	0.01587	0.0677	0.782	265288	0.049	0.026	0.016	47910	621	1097	16.6	0.6	0.6	521.5	539	3717	256.1
492	0.0706	0.01586	0.0687	0.785	265475	0.048	0.025	0.015	47332	615	1087	16.3	0.6	0.6	516.5	534	3680	255.6
260	0.2437	0.01433	2.9374	0.996	326244	0.001	.000	.000	14950	183	320	0.3	.0	.0	27.2	28	190	126.7
255	0.2485	0.01430	3.2406	0.997	328313	0.001	.000	.000	14669	179	314	0.3	.0	.0	25.0	25	174	123.9
250	0.2517	0.01427	3.5572	0.997	329735	0.001	.000	.000	14484	177	310	0.2	.0	.0	23.0	23	160	121.1
245	0.2549	0.01424	3.9091	0.997	331154	0.001	.000	.000	14305	175	306	0.2	.0	.0	21.1	21	147	118.3
225	0.2674	0.01413	5.7736	0.998	336805	.000	.000	.000	13648	167	292	0.1	.0	.0	14.7	15	103	107.2
224	0.2683	0.01412	5.8952	0.998	337181	.000	.000	.000	13607	166	291	0.1	.0	.0	14.4	15	101	106.7

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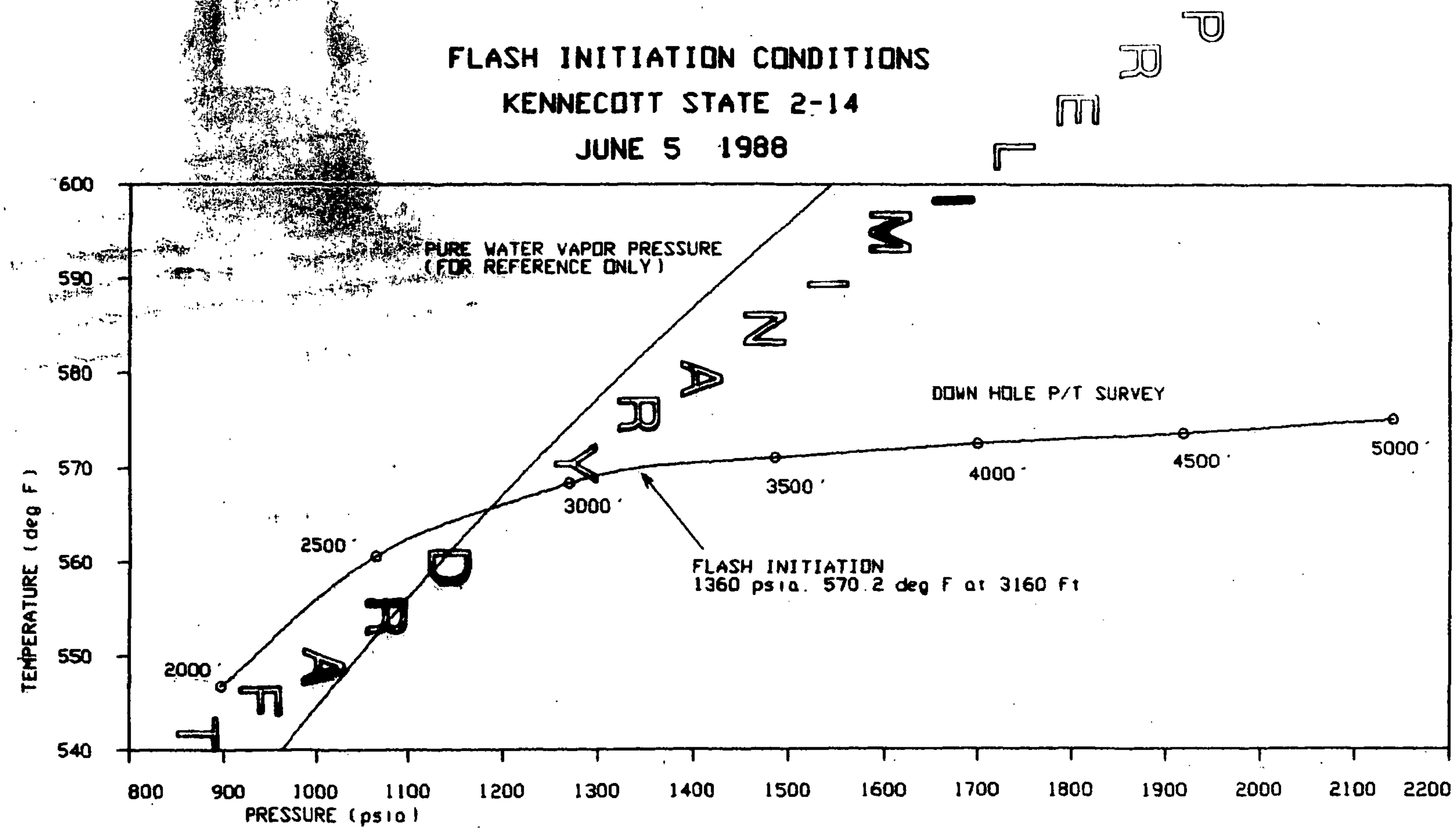
13 Nov 1988

APPENDIX E

BRINE DATA AND STEAM FLASH MODELING
SALTON SEA SCIENTIFIC DRILLING PROJECT

FIGURE 1



PRELIMINARY DRAFT

ADDENDUM F

MISCELLANEOUS SUPPORTING CALCULATIONS

ADDENDUM F

MISCELLANEOUS SUPPORTING CALCULATIONS

A. Effect of Scale Buildup on Brine Orifice Plates

1. Effect of bore diameter reduction

Flow rate through a clean orifice =

$$m = \left(\frac{\pi d^2 \, Fa}{4}\right)\left(\frac{C}{\sqrt{1-B^4}}\right)\sqrt{2g_c\,\rho(p_1-p_2)}$$

(ASME, 1971, eqn No. I-5-29)

Where:
- m = mass rate of flow, lbm/sec
- d = diameter of orifice bore, feet
- D = inside diameter of pipe, feet
- Fa = thermal expansion factor
- C = orifice discharge coefficient
- B = d/D
- g_c = 32.174 lbm-ft/lbf-sec^2
- p_1 = upstream pressure, lbf/ft^2
- p_2 = downstream pressure, lbf/ft^2
- ρ = fluid density, lbm/ft^3

Rearranging the equation,

$$m = \frac{\pi F_a}{4} \times C \times \left(\frac{1}{d^4} - \frac{1}{D^4}\right)^{-1/2} \times (2g_c\rho\Delta p)^{1/2}$$

$$\frac{dm}{dd} = \frac{\pi F_a}{2} \times C \times \left(\frac{1}{d^4} - \frac{1}{D^4}\right)^{-3/2} \times d^{-5} \times (2g_c\rho\Delta p)^{1/2}$$

$$\frac{\Delta m}{m} = 2\left(\frac{1}{d^4} - \frac{1}{D^4}\right)^{-1} \times d^{-5} \times \Delta d$$

For Leg A: d = 4.8 in., D = 12 in., Δd = -0.375 in. $\quad \frac{\Delta m}{m}$ = [illegible].160

For Leg B: d = 7.1464 in., D = 12 in., Δd = -0.25 in. $\quad \frac{\Delta m}{m} = -0.080$

2. Effect of rounded edge on orifice

From Marks, 1958, page 3-64, the effect of rounding the upstream edge is described by:

$$\frac{\Delta m}{m} = 3.1 \times \frac{r}{d}$$

Where r = radius of rounding, inches

For Leg A: r = 0.188 in., d = 4.80 in. $\quad \frac{\Delta m}{m} = 3.1 \times \frac{0.188}{4.8} = 0.121$

For Leg B: $r = 0.125$ in., $d = 7.1464$ in. $\frac{\Delta m}{m} = 3.1 \times \frac{0.125}{7.1464} = 0.054$

3. Combined effect

$$\frac{\Delta m}{m} = \frac{\Delta m}{m} \text{ (for rounding)} + \frac{\Delta m}{m} \text{ (for diameter reduction)}$$

For Leg A:

$$\frac{\Delta m}{m} = 0.121 - 0.160 = -0.039 = -3.9\%$$

For Leg B:

$$\frac{\Delta m}{m} = 0.054 - 0.080 = -0.026 = -2.6\%$$

B. Estimates of Heat Loss From Flowline

1. Forced convection

Estimated worst case (greatest heat loss) conditions:

Ambient temperature (T_a) = 75°F
Wind velocity (V) = 29.33 ft/sec (20 mph) perpendicular to pipe
Temperature at outer surface of pipe (T_s) = 490°F
Pipe O.D. (D_o) = 10.75 in. = 0.896 ft
Flowline length (L) = 200 ft

Properties of air at approximate mean temperature (300°F), taken from Kreith, 1958:

Thermal conductivity (k) = 0.0193 Btu/hr-ft-°F
Kinematic Viscosity (v) = 0.000306 sq. ft/sec

From Kreith, 1958, eqn #9-3:

$Nu = 0.0239 \times R_D^{0.805}$ for $40{,}000 < R_D < 400{,}000$
where,

R_D = Reynolds number

Nu = Nusselt number = $\frac{h_c D_o}{k}$

h_c = convective heat transfer coefficient

$$R_D = \frac{VD_o}{v} = \frac{29.33 \text{ ft/sec} \times 0.896 \text{ ft}}{0.000306 \text{ sq. ft/sec}} = 85{,}900$$

$$Nu = 0.0239 \times R_D^{0.805} = 224$$

$$h_c = \frac{Nu\ k}{D_o} = \frac{224 \times 0.0193 \text{ Btu/hr-ft-}^{\circ}\text{F}}{0.896 \text{ ft}}$$

$$= 4.826 \text{ Btu/hr-sq ft-}^{\circ}\text{F}$$

Rate of heat loss = $q = h_c A \Delta T = h_c \pi D_o L(T_s - T_a)$

$= 4.826 \dfrac{\text{Btu}}{\text{hr-sq ft } ^\circ\text{F}} \times \pi \times 0.896 \text{ ft} \times 200 \text{ ft} \times (490-75^\circ\text{F})$

$= 1.13 \times 10^6$ Btu/hr

2. Free convection

Estimated conditions for least heat loss:

$T_a = 100^\circ\text{F}$

$V = 0$

$T_s = 490^\circ\text{F}$

$D_o = 10.75$ in. = 0.896 ft

$L = 200$ ft

Properties of air at approximate mean temperature (300°F), taken from Kreith, 1958:

$K = 0.0193$ Btu/hr-ft-°F

Prandtl number (Pr) = 0.71

$\dfrac{gB\rho^2}{\mu^2} = 0.444 \times 10^6$ 1/°F- cu ft

(part of Grashof number)

From Kreith, 1958, eqn #7-28:

$Nu = 0.53 \, (Gr \, Pr)^{0.25}$

where Gr = Grashof number.

$Nu = 0.53 \times (1.245)^{0.25} = 56.0$

$h_c = \dfrac{Nu \, k}{D_o} = \dfrac{56 \times 0.0193 \text{ Btu/hr-ft-}^\circ\text{F}}{0.896 \text{ ft}}$

$= 1.206$ Btu/hr-ft-°F

$q = h_c \pi D_o L (T_s - T_a)$

$= 1.206 \times \pi \times 0.896 \times 200 \times (490-100)$

$= 264{,}700$ Btu/hr

3. Estimate average heat loss from flowline = 500,000 Btu/hr.

PRELIMINARY DRAFT

ADDENDUM G

DOWNHOLE SURVEYS

NOTES REGARDING DOWNHOLE SURVEYS

1. All temperature data are in units of degrees Fahrenheit.

2. For the static survey on November 18, 1987, the depth reference datum is ground level and all pressure data are in units of psig.

3. For all surveys in June, 1988, the depth reference datum is K.B., 29 feet above ground level, and pressure data are in units of psia.

PRUETT INDUSTRIES INC.
8915 ROSEDALE HWY, BAKERSFIELD CA. 93312
(805) 589-2768

PRELIMINARY DRAFT

SUB-SURFACE TEMPERATURE SURVEY

CO.	KENNECOTT GEOTHERMAL	RUN 01 FIELD	SALTON SEA	WELL	2-14 STATE
EFF DEPTH		WELL STAT	STATIC	TOOL HUNG	
CASING	-	CASING PRESS		ON BOTTOM	
LINER	-	TUBING PRESS		OFF BOTTOM	
DATE	871118	ELEMENT RANGE	56 - 661	ZERO POINT	GRD
ELEVATION		ZONE		SHUT-IN	
MAX TEMP		PICK-UP	6754'	ON-PROD	
PERF		CAL SER NO.	28339	MPP	
TUBING					
UNITS	ENGLISH	PURPOSE	STATIC TEMPERATURE		

SURVEY DATA

CO. KENNECOTT GEOTHERMAL RUN 01 FIELD SALTON SEA WELL 2-14 STATE

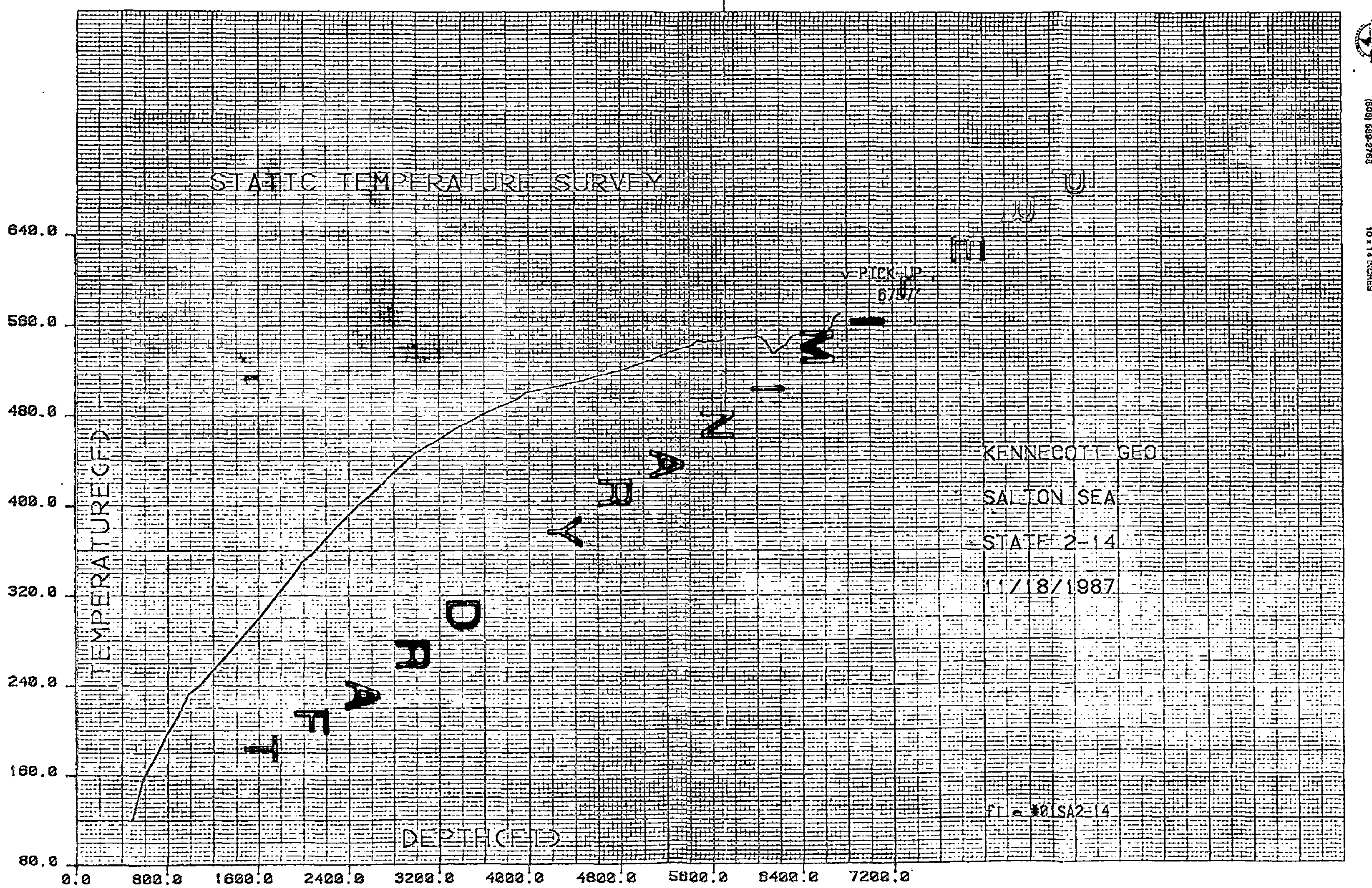
TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	500	120.6	0.000	1:00	3500	475.2	0.000
1:00	600	157.2	0.000	1:00	3600	480.7	0.000
1:00	700	176.4	0.000	1:00	3700	485.4	0.000
1:00	800	195.8	0.000	1:00	3800	490.1	0.000
1:00	900	212.0	0.000	1:00	3900	494.2	0.000
1:00	1000	232.7	0.000	1:00	4000	500.6	0.000
1:00	1100	241.0	0.000	1:00	4100	502.8	0.000
1:00	1200	252.4	0.000	1:00	4200	504.8	0.000
1:00	1300	264.4	0.000	1:00	4300	506.8	0.000
1:00	1400	276.3	0.000	1:00	4400	509.7	0.000
1:00	1500	287.3	0.000	1:00	4500	511.1	0.000
1:00	1600	298.3	0.000	1:00	4600	514.7	0.000
1:00	1700	310.4	0.000	1:00	4700	517.0	0.000
1:00	1800	323.0	0.000	1:00	4800	519.4	0.000
1:00	1900	335.4	0.000	1:00	4900	522.7	0.000
1:00	2000	349.8	0.000	1:00	5000	526.7	0.000
1:00	2100	357.9	0.000	1:00	5100	530.2	0.000
1:00	2200	369.4	0.000	1:00	5200	535.0	0.000
1:00	2300	380.4	0.000	1:00	5300	538.6	0.000
1:00	2400	390.5	0.000	1:00	5400	541.2	0.000
1:00	2500	400.7	0.000	1:00	5440	542.9	0.000
1:00	2600	409.2	0.000	1:00	5480	546.4	0.000
1:00	2700	417.7	0.000	1:00	5500	546.4	0.000
1:00	2800	427.8	0.000	1:00	5540	546.0	0.000
1:00	2900	437.0	0.000	1:00	5600	546.4	0.000
1:00	3000	446.5	0.000	1:00	5660	545.7	0.000
1:00	3100	452.4	0.000	1:00	5700	547.4	0.000
1:00	3200	457.9	0.000	1:00	5800	548.1	0.000
1:00	3300	464.3	0.000	1:00	5900	549.5	0.000
1:00	3400	470.6	0.000	1:00	6000	549.9	0.000

SURVEY_DATA

CO. KENNECOTT GEOTHERMAL   RUN 01 FIELD SALTON SEA   WELL 2-14 STATE

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	6020	550.6	0.000	1:00	6340	551.6	0.000
1:00	6060	549.5	0.000	1:00	6400	552.7	0.000
1:00	6100	545.3	0.000	1:00	6500	551.6	0.000
1:00	6140	538.9	0.000	1:00	6600	553.4	0.000
1:00	6160	536.0	0.000	1:00	6640	554.2	0.000
1:00	6180	535.6	0.000	1:00	6680	560.5	0.000
1:00	6200	537.9	0.000	1:00	6700	565.5	0.000
1:00	6240	540.9	0.000	1:00	6720	568.2	0.000
1:00	6280	543.6	0.000	1:00	6754	571.1	0.000
1:00	6300	548.1	0.000	0:00	0	0.0	0.000

BY C. WEAVER



STATIC TEMPERATURE SURVEY
PICK-UP
6757'
KENNECOTT GEO
SALTON SEA
STATE 2-14
11/18/1987
file #01SA2-14
TEMPERATURE(F)
DEPTH(FT)
640.0
560.0
480.0
400.0
320.0
240.0
160.0
80.0
0.0
800.0
1600.0
2400.0
3200.0
4000.0
4800.0
5600.0
6400.0
7200.0
BAKERSFIELD, CA
10 x 10 to ½ INCH
10 x 14 INCHES

PRUETT INDUSTRIES INC.
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SUB-SURFACE PRESSURE SURVEY

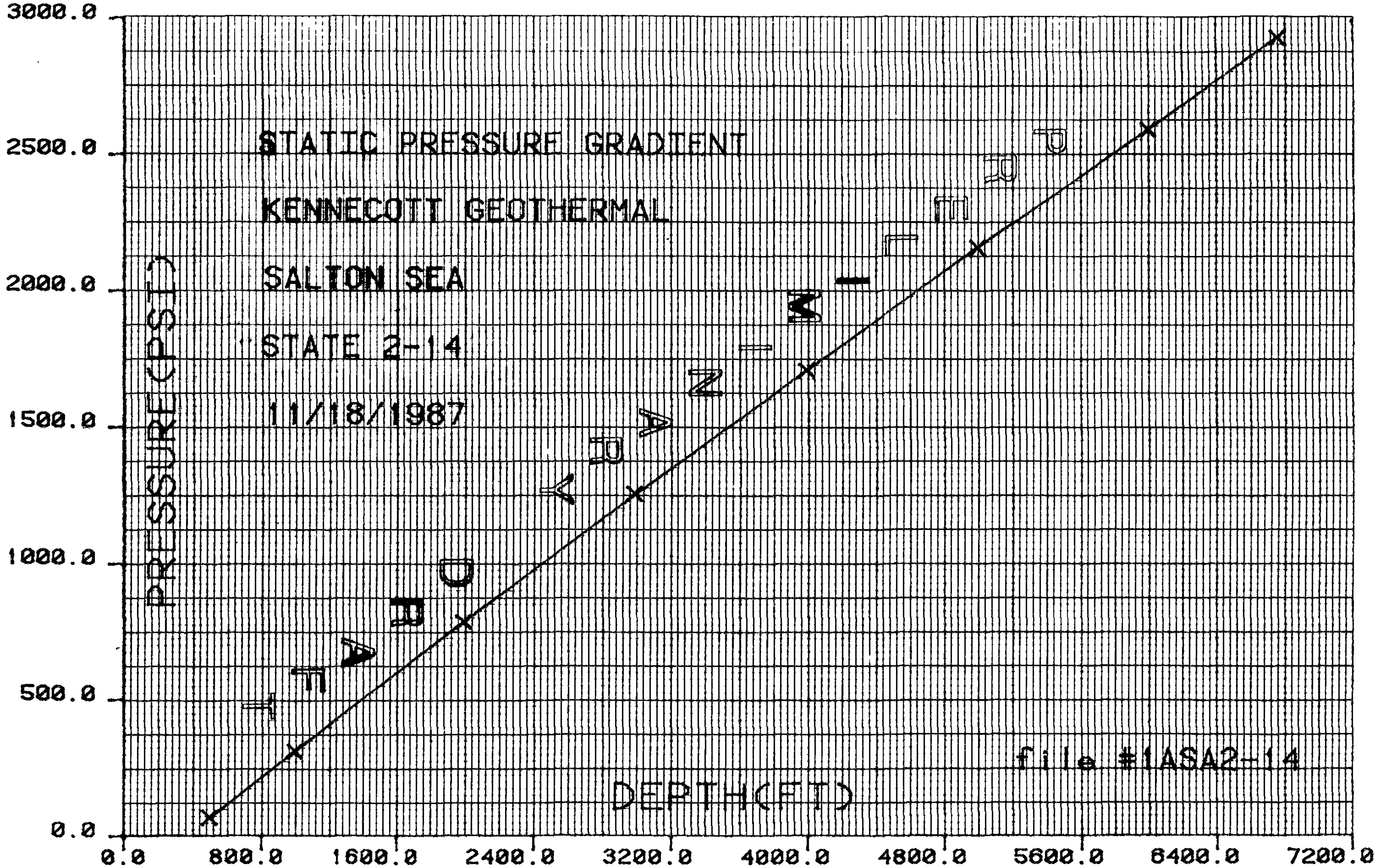
CO.	KENNECOTT GEOTHERMAL	RUN 1A FIELD	SALTON SEA	WELL 2-14 STATE	
EFF DEPTH		WELL STAT	STATIC	TOOL HUNG	
CASING	-	CASING PRESS		ON BOTTOM	
LINER	-	TUBING PRESS		OFF BOTTOM	
DATE	871118	ELEMENT RANGE	0 - 3969	ZERO POINT	GRD
ELEVATION		ZONE		SHUT-IN	
MAX TEMP		PICK-UP	6754'	ON-PROD	
PERF		CAL SER NO.	22335-4A	MPP	
TUBING					
UNITS	ENGLISH	PURPOSE	STATIC PRESSURE		

SURVEY DATA

CO. KENNECOTT GEOTHERMAL RUN 1A FIELD SALTON SEA WELL 2-14 STATE

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	500	66.9	0.000	1:00	4000	1711.2	.456
1:00	1000	310.3	.487	1:00	5000	2160.6	.449
1:00	2000	785.3	.475	1:00	6000	2597.1	.436
1:00	3000	1255.3	.4[illegible]	1:00	6754	2935.3	.449

BY C. WEAVER


STATIC PRESSURE GRADIENT
KENNECOTT GEOTHERMAL
SALTON SEA
STATE 2-14
11/18/1987
PRESSURE(PSI)
DEPTH(FT)
file #1ASA2-14
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
0.0
800.0
1600.0
2400.0
3200.0
4000.0
4800.0
5600.0
6400.0
7200.0

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SUB-SURFACE TEMPERATURE SURVEY

CO.	KENNECOTT GEOTHERMAL	RUN 01 FIELD	SALTON SEA	WELL 2-14 STATE	
EFF DEPTH		WELL STAT	FLOWING	TOOL HUNG	
CASING	-	CASING PRESS		ON BOTTOM	
LINER	-	TUBING PRESS		OFF BOTTOM	
DATE	060586	ELEMENT RANGE	273 - 654	ZERO POINT	29'
ELEVATION		ZONE		SHUT-IN	
MAX TEMP		PICK-UP	N/A	ON-PROD	
PERF	-	CAL SER NO.	28739A	MPP	
TUBING	-				
UNITS	ENGLISH	PURPOSE	FLOWING TEMPERATURE		

SURVEY DATA

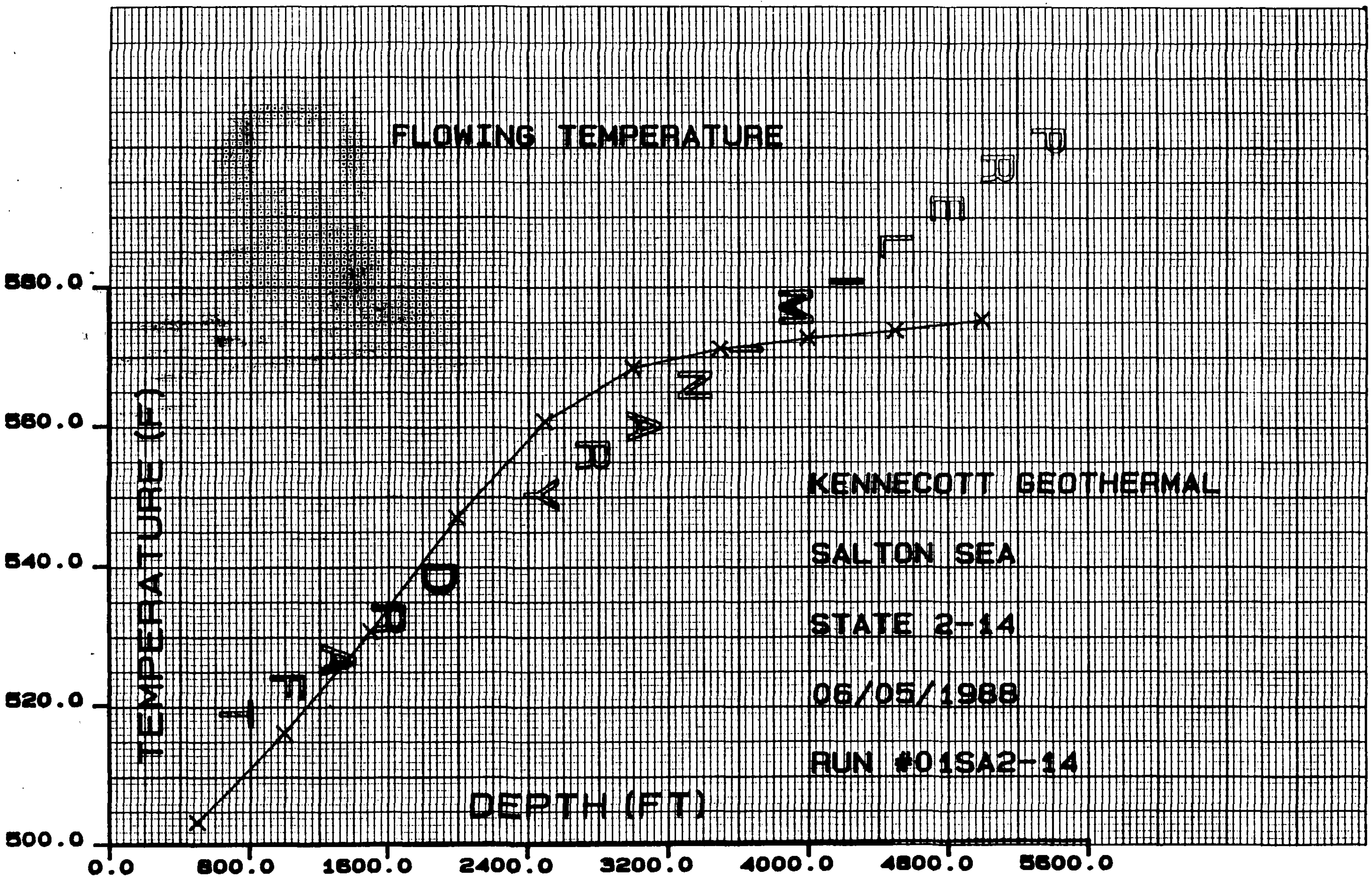
CO. KENNECOTT GEOTHERMAL RUN 01 FIELD SALTON SEA WELL 2-14 STATE

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	500	503.2	0.000	1:00	3000	568.3	.015
1:00	1000	516.0	.026	1:00	3500	571.0	.006
1:00	1500	530.5	.02[illegible]	1:00	4000	572.5	.003
1:00	2000	546.8	.033	1:00	4500	573.6	.002
1:00	2500	560.6	.028	1:00	5000	575.1	.003

BY C. WEAVER

BAKERSFIELD, CA
(805) 589-2768

10 × 10 TO ½ INCH
6 × 9 INCHES



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SUB-SURFACE PRESSURE SURVEY

CO.	KENNECOTT GEOTHERMAL	RUN 1A FIELD	SALTON SEA	WELL 2-14 STATE	
EFF DEPTH		WELL STAT	FLOWING	TOOL HUNG	
CASING	-	CASING PRESS		ON BOTTOM	
LINER	-	TUBING PRESS		OFF BOTTOM	
DATE	060588	ELEMENT RANGE	0 - 5001	ZERO POINT	
ELEVATION		ZONE		SHUT-IN	
MAX TEMP		PICK-UP		ON-PROD	
PERF		CAL SER NO.	P1234	MPP	
TUBING					
UNITS	ENGLISH	PURPOSE	FLOWING PRESSURE		

SURVEY DATA

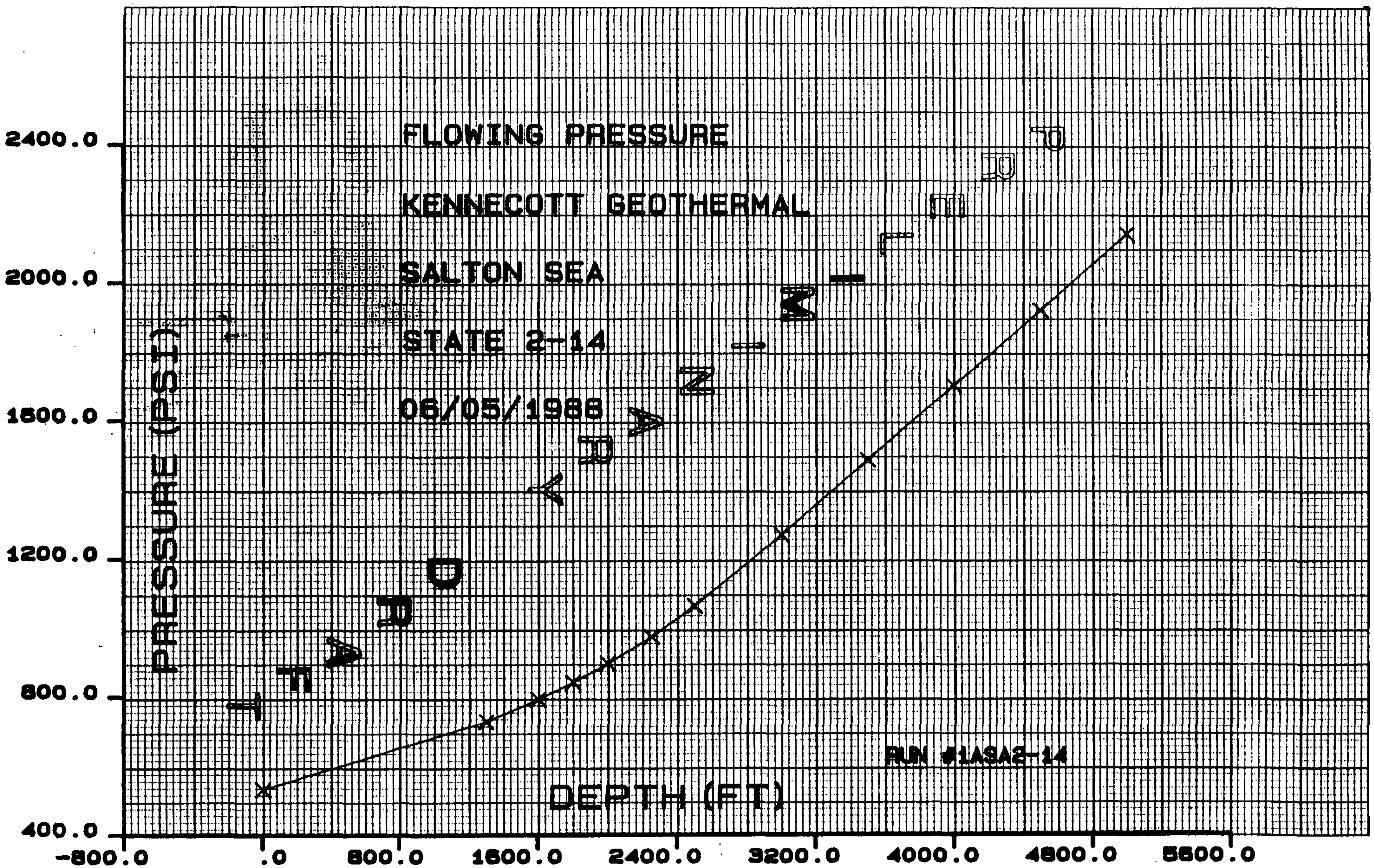
CO. KENNECOTT GEOTHERMAL RUN 1A FIELD SALTON SEA WELL 2-14 STATE

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	0	529.8	0.000	1:00	2500	1063.6	.358
1:00	1300	727.2	.152	1:00	3000	1268.9	.411
1:00	1600	791.6	.214	1:00	3500	1484.7	.432
1:00	1800	840.9	.[illegible]7	1:00	4000	1699.8	.430
1:00	2000	896.5	.278	1:00	4500	1919.2	.439
1:00	2250	974.1	.310	1:00	5000	2140.2	.442

BY C. WEAVER

PRELIMINARY DRAFT

BAKERSFIELD, CA (805) 589-2768 | 10 x 10 TO ½ INCH 6 x 9 INCHES



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SUB-SURFACE TEMPERATURE SURVEY

CO.	KENNECOTT GEOTHERMAL	RUN 02 FIELD	SALTON SEA	WELL	2-14STATE
EFF DEPTH		WELL STAT	FLOWING	TOOL HUNG	
CASING	-	CASING PRESS		ON BOTTOM	
LINER	-	TUBING PRESS		OFF BOTTOM	
DATE	061285	ELEMENT RANGE	58 - 651	ZERO POINT 29'	
ELEVATION		ZONE		SHUT-IN	
MAX TEMP		PICK-UP	N/A	ON-PROD	
PERF		CAL SER NO.	283399	MPP	
TUBING					
UNITS	ENGLISH	PURPOSE	FLOWING TEMPERATURE		

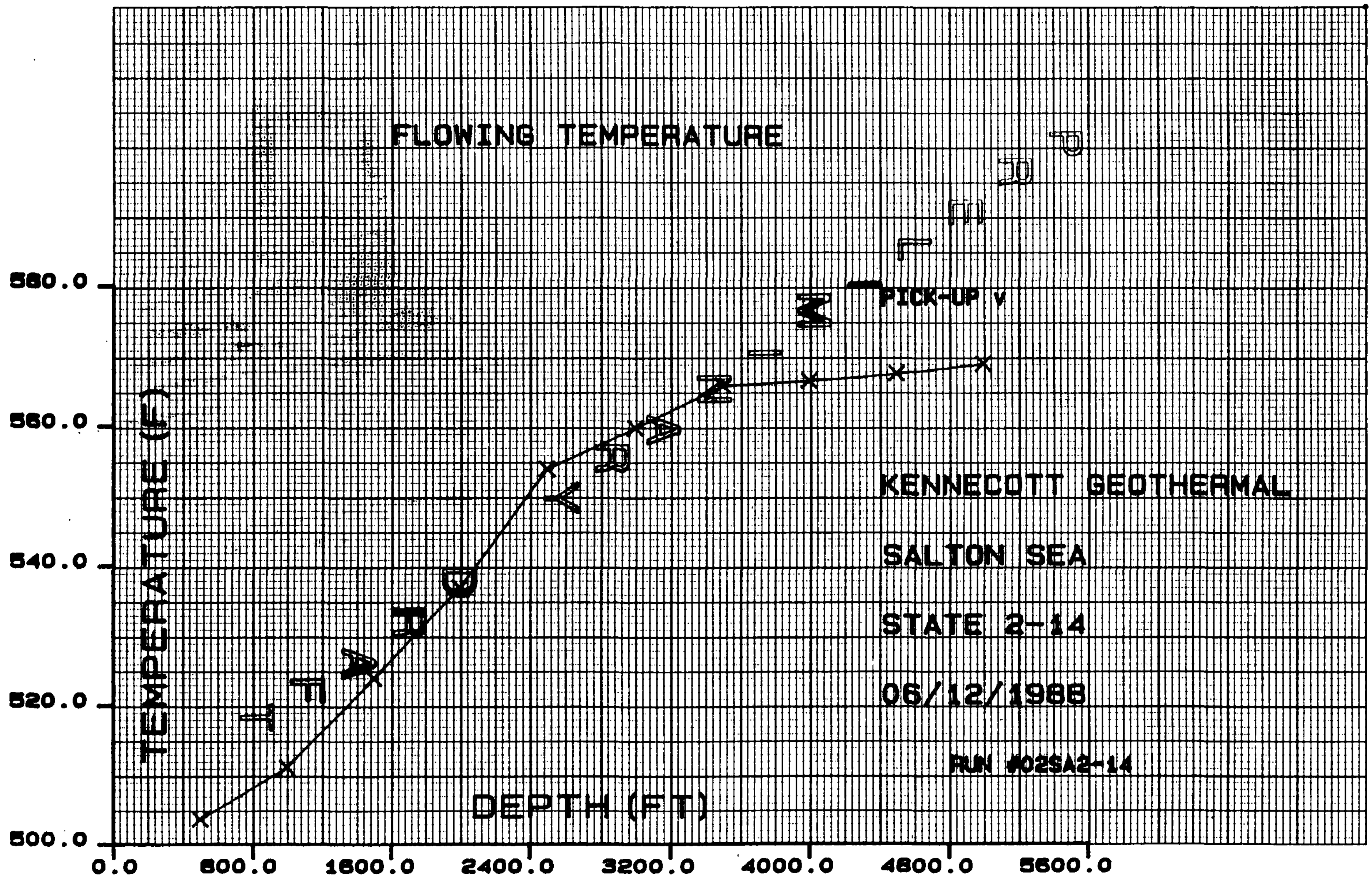
SURVEY DATA

CO. KENNECOTT GEOTHERMAL RUN 02 FIELD SALTON SEA WELL 2-14STATE

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	500	503.6	0.000	1:00	3000	559.7	.012
1:00	1000	511.1	.015	1:00	3500	565.8	.012
1:00	1500	523.8	.025	1:00	4000	566.5	.001
1:00	2000	536.8	.026	1:00	4500	567.5	.002
1:00	2500	553.9	.034	1:00	5000	568.9	.003

BY C. WEAVER

BAKERSFIELD, CA
(805) 589-2768
10 × 10 TO ½ INCH
6 × 9 INCHES



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SUB-SURFACE PRESSURE SURVEY

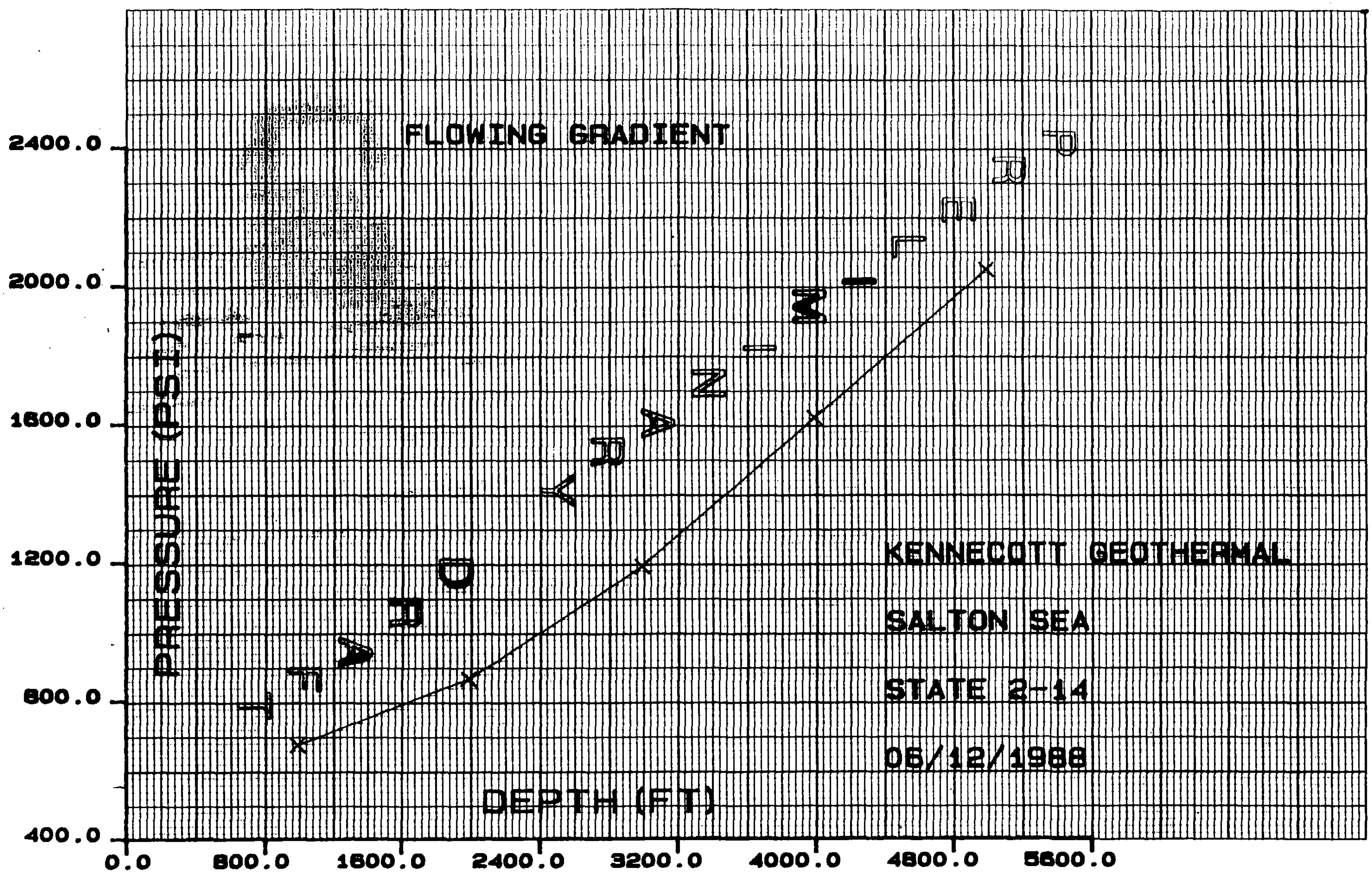
CO.	KENNCOTT GEO.	RUN 2A FIELD	SALTON SEA	WELL	2-14 STATE
EFF DEPTH		WELL STAT	FLOWING	TOOL HUNG	
CASING	-	CASING PRESS		ON BOTTOM	
LINER	-	TUBING PRESS		OFF BOTTOM	
DATE	061288	ELEMENT RANGE	0 - 5001	ZERO POINT	29
ELEVATION		ZONE		SHUT-IN	
MAX TEMP		PICK-UP		ON-PROD	
PERF		CAL SER NO.	P1234	MPP	
TUBING					
UNITS	ENGLISH	PURPOSE	FLOWING GRADIENT		

SURVEY DATA

CO. KENNCOTT GEO. RUN 2A FIELD SALTON SEA WELL 2-14 STATE

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	1000	678.8	0.000	1:00	4000	1625.5	.430
1:00	2000	870.2	.191	1:00	5000	2053.9	.428
1:00	3000	1196.0	.326	0:00	0	0.0	0.000

BAKERSFIELD, CA (805) 589-2768 — 10 × 10 TO ½ INCH, 6 × 9 INCHES



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SUB-SURFACE TEMPERATURE SURVEY

CO.	KENNECOTT GEOTHERMAL	RUN 03 FIELD	SALTON SEA	WELL 2-14 STATE	
EFF DEPTH		WELL STAT	FLOWING	TOOL HUNG	
CASING	-	CASING PRESS		ON BOTTOM	
LINER	-	TUBING PRESS		OFF BOTTOM	
DATE	051488	ELEMENT RANGE	58 - 651	ZERO POINT	29'
ELEVATION		ZONE		SHUT-IN	
MAX TEMP		PICK-UP	N/A	ON-PROD	
PERF		CAL SER NO.	28339A	MPP	
TUBING					
UNITS	ENGLISH	PURPOSE	FLOWING TEMPERATURE		

SURVEY DATA

CO. KENNECOTT GEOTHERMAL RUN 03 FIELD SALTON SEA WELL 2-14 STATE

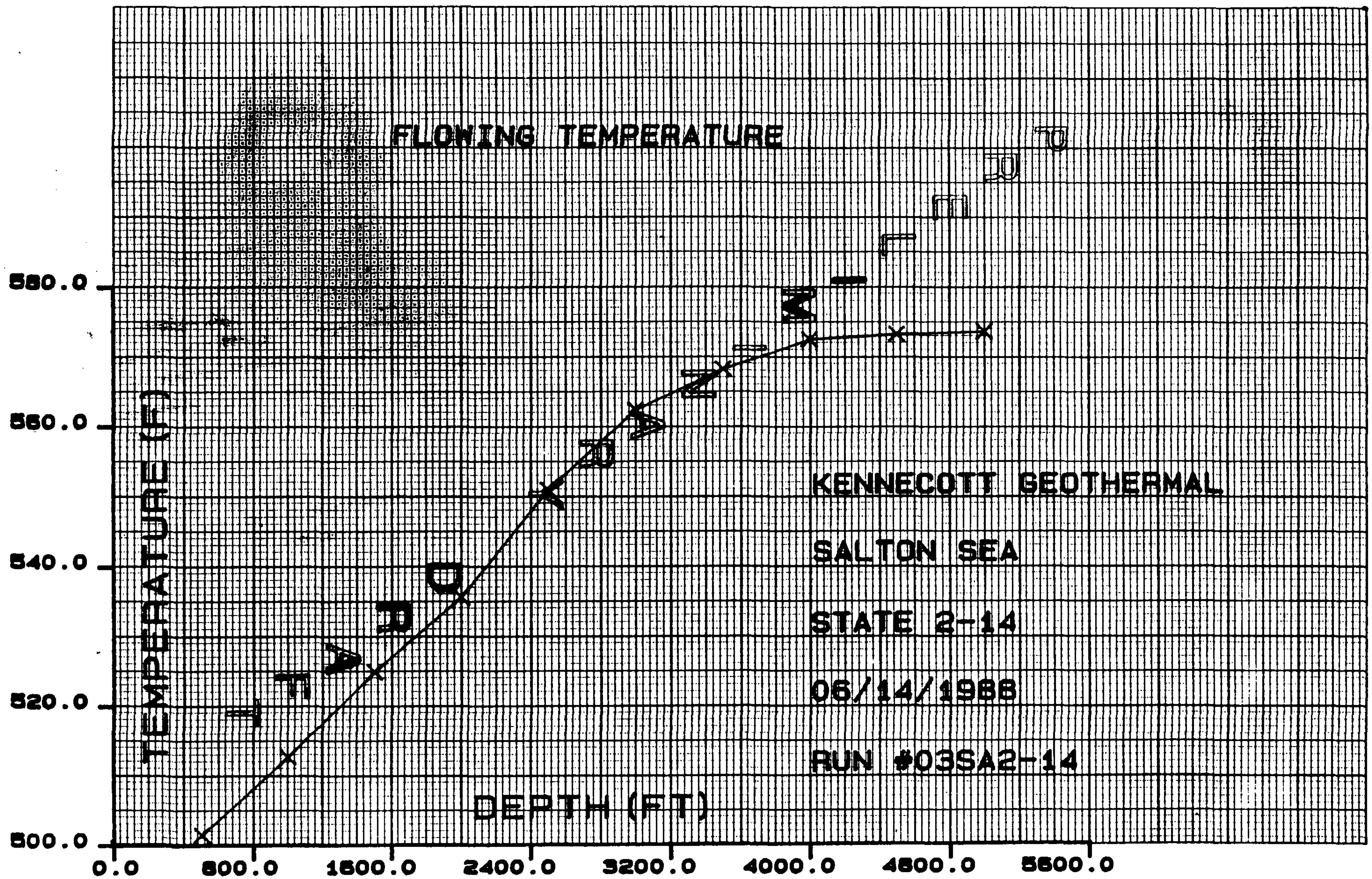
TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	500	501.6	0.000	1:00	3000	562.4	.023
1:00	1000	512.8	.022	1:00	3500	568.2	.012
1:00	1500	525.0	.024	1:00	4000	572.5	.009
1:00	2000	535.7	.021	1:00	4500	573.2	.001
1:00	2500	551.0	.031	1:00	5000	573.6	.001

BY C. WEAVER

PRELIMINARY DRAFT

BAKERSFIELD, CA
(805) 589-2768

10 × 10 TO ½ INCH
6 × 9 INCHES



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SUB-SURFACE PRESSURE SURVEY

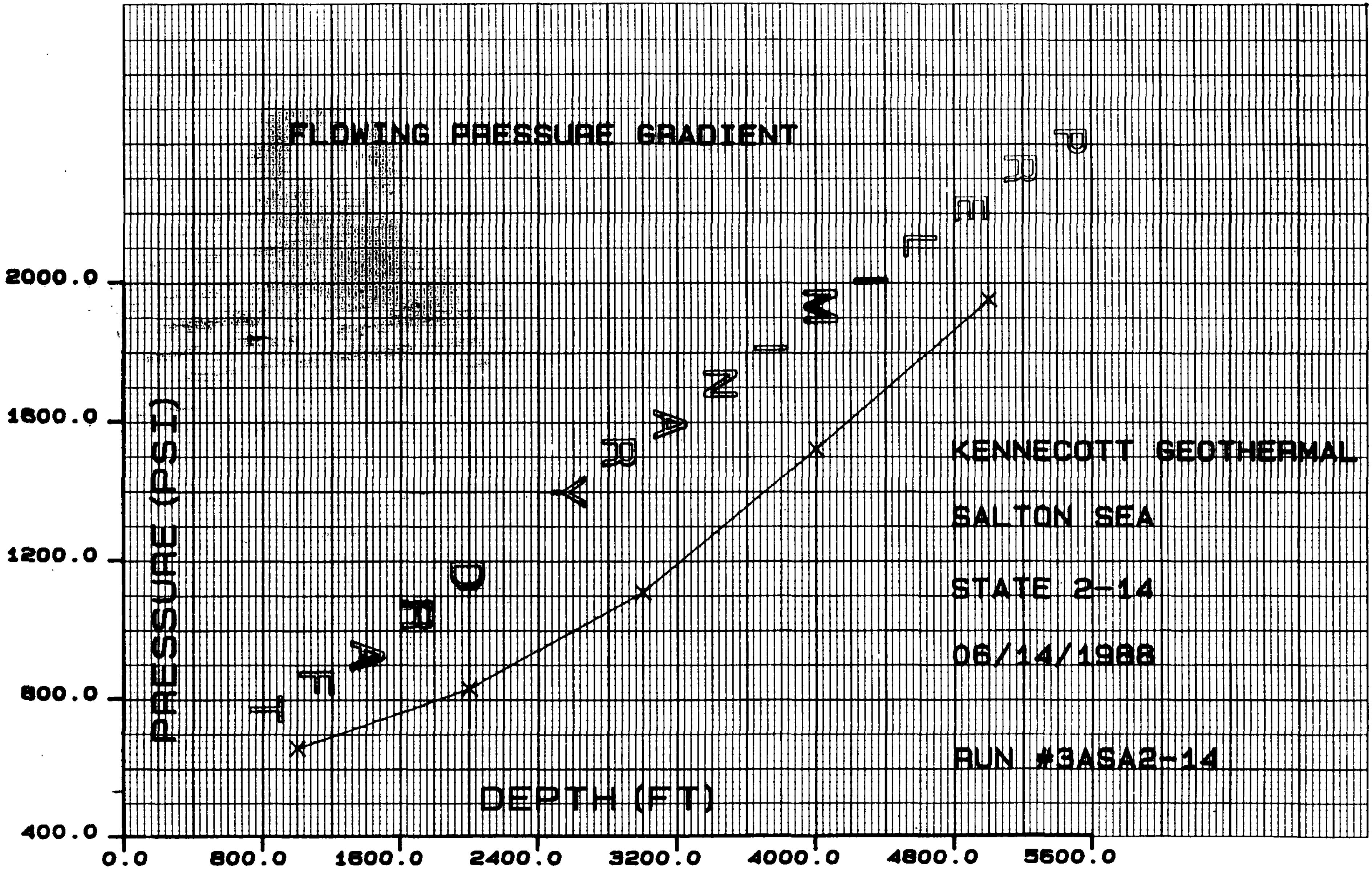
CO.	KENNECOTT GEOTHERMAL	RUN 3A FIELD	SALTON SEA	WELL	2-14 STATE
EFF DEPTH		WELL STAT	FLOWING	TOOL HUNG	
CASING	-	CASING PRESS		ON BOTTOM	
LINER	-	TUBING PRESS		OFF BOTTOM	
DATE	061488	ELEMENT RANGE	0 - 5001	ZERO POINT	29'
ELEVATION		ZONE		SHUT-IN	
MAX TEMP		PICK-UP	N/A	ON-PROD	
PERF	-	CAL SER NO.	P1234	MPP	
TUBING	-				
UNITS	ENGLISH	PURPOSE	FLOWING GRADIENT		

SURVEY DATA Revised (7/28/88)

CO. KENNECOTT GEOTHERMAL RUN 3A FIELD SALTON SEA WELL 2-14 STATE

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	1000	655.6	0.000	1:00	4000	1519.6	.413
1:00	2000	827.7	.172	1:00	5000	1950.2	.431
1:00	3000	1106.2	.278	0:00	0	0.0	0.000

C. WEAVER


FLOWING PRESSURE GRADIENT
KENNECOTT GEOTHERMAL
SALTON SEA
STATE 2-14
06/14/1988
RUN #3ASA2-14
PRESSURE (PSI)
DEPTH (FT)
2000.0
1600.0
1200.0
800.0
400.0
0.0
800.0
1600.0
2400.0
3200.0
4000.0
4800.0
5600.0

PRUETT INDUSTRIES INC.
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SUB-SURFACE TEMPERATURE SURVEY

CO.	KENNECOTT GEOTHERMAL	RUN 04 FIELD	SALTON SEA	WELL	2-14 STATE
EFF DEPTH		WELL STAT	FLOWING	TOOL HUNG	
CASING	-	CASING PRESS		ON BOTTOM	
LINER	-	TUBING PRESS		OFF BOTTOM	
DATE	062088	ELEMENT RANGE	273 - 654	ZERO POINT	29'
ELEVATION		ZONE		SHUT-IN	
MAX TEMP		PICK-UP	N/A	ON-PROD	
PERF		CAL SER NO.	28739A	MPP	
TUBING					
UNITS	ENGLISH	PURPOSE	FLOWING TEMPERATURE		

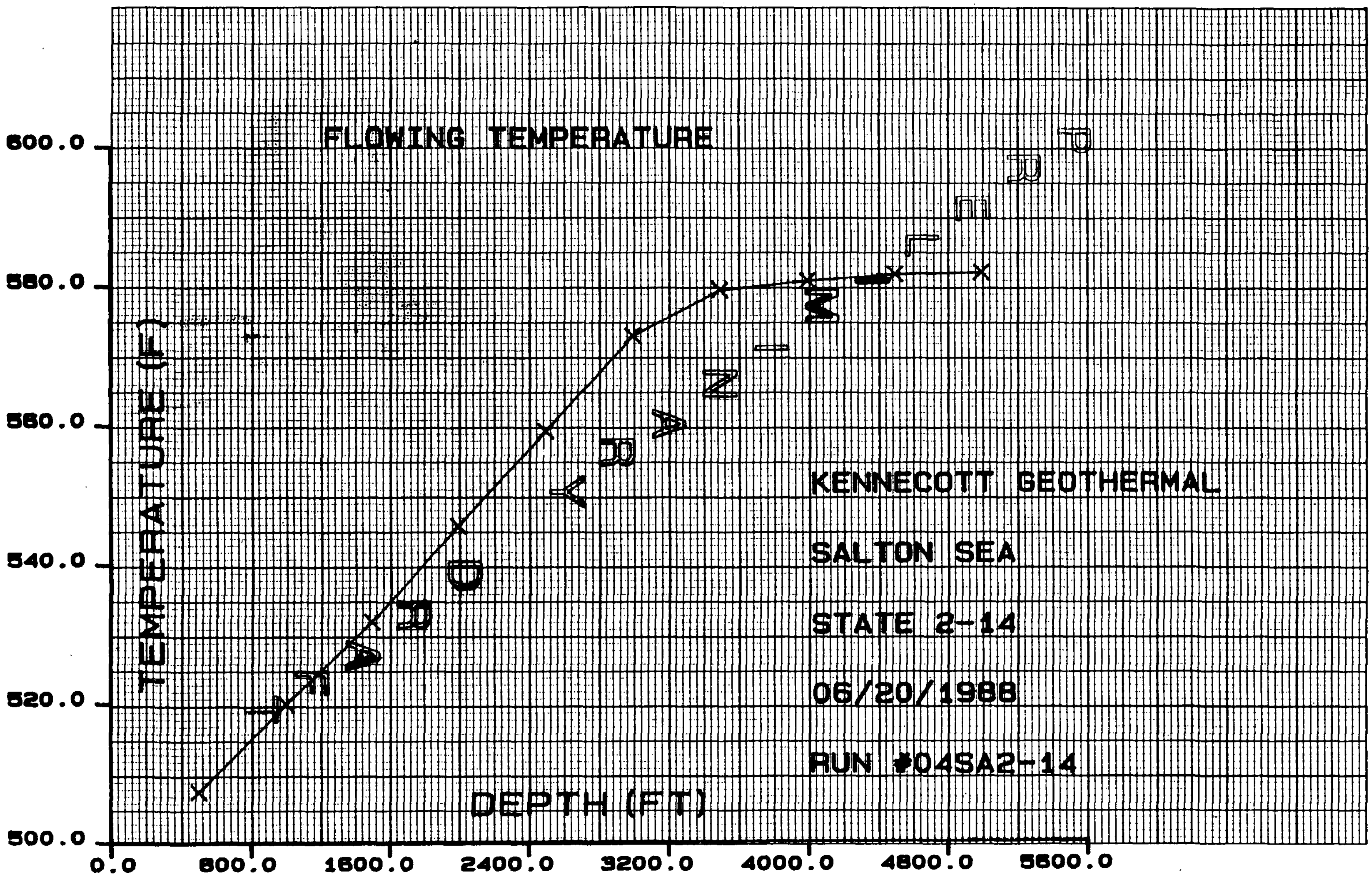
SURVEY DATA

CO. KENNECOTT GEOTHERMAL RUN 04 FIELD SALTON SEA WELL 2-14 STATE

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	500	507.4	0.000	1:00	3000	573.0	.027
1:00	1000	520.0	.025	1:00	3500	579.5	.013
1:00	1500	531.8	.024	1:00	4000	580.9	.003
1:00	2000	545.7	.028	1:00	4500	581.8	.002
1:00	2500	559.2	.027	1:00	5000	582.0	.000

BY C. WEAVER

BAKERSFIELD, CA (805) 589-2768 — 10 × 10 TO ½ INCH 6 × 9 INCHES



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SUB-SURFACE PRESSURE SURVEY

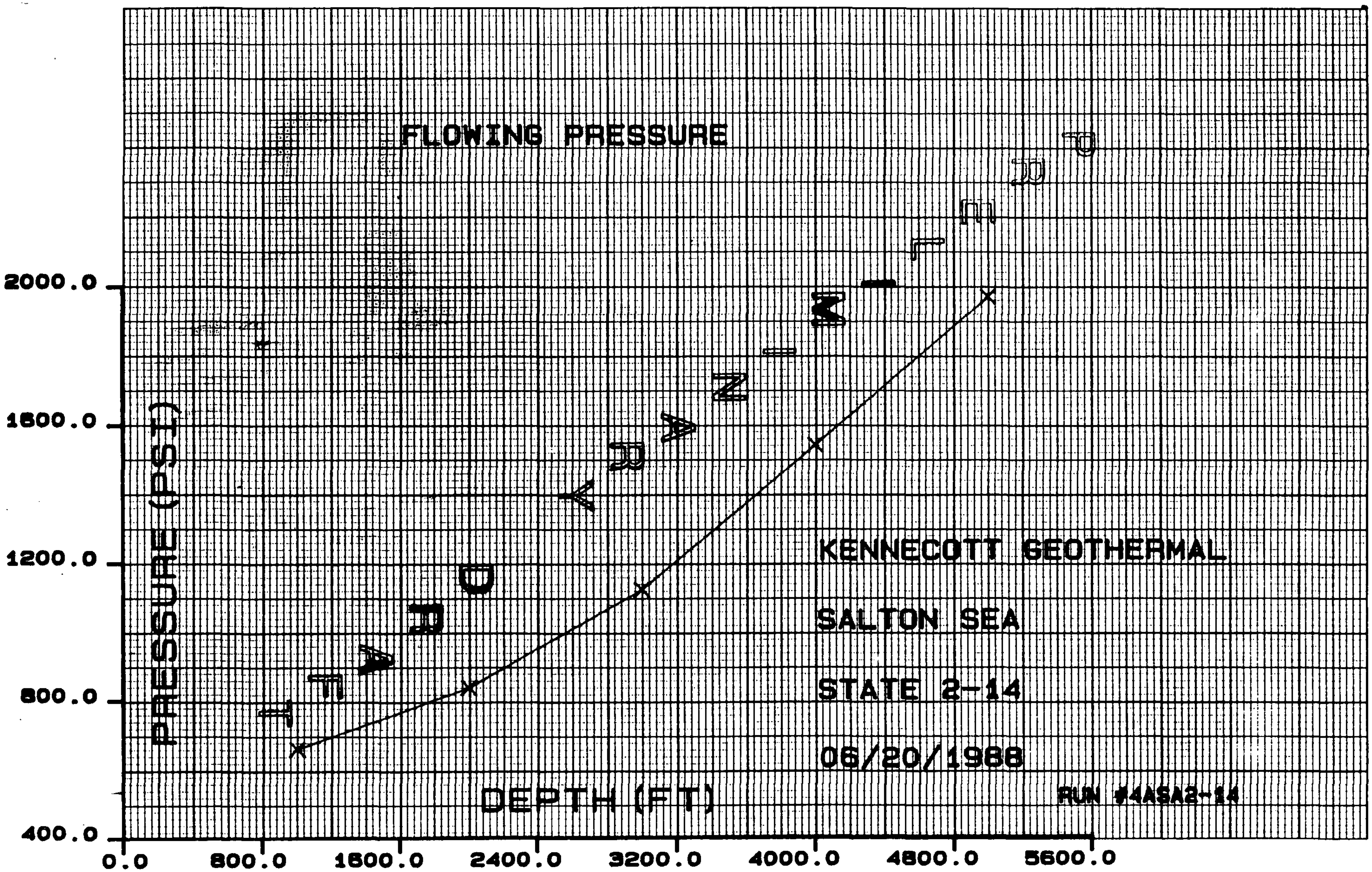
CO.	KENNECOTT GEOTHERMAL	RUN 4A FIELD	SALTON SEA	WELL 2-14 STATE	
EFF DEPTH		WELL STAT	FLOWING	TOOL HUNG	
CASING	-	CASING PRESS		ON BOTTOM	
LINER	-	TUBING PRESS		OFF BOTTOM	
DATE	0620[illegible]	ELEMENT RANGE	0 - 5001	ZERO POINT	29'
ELEVATION		ZONE		SHUT-IN	
MAX TEMP		PICK-UP	N/A	ON-PROD	
PERF	-	CAL SER NO.	P1234	MPP	
TUBING	-				
UNITS	ENGLISH	PURPOSE	FLOWING PRESSURE		

SURVEY DATA

CO. KENNECOTT GEOTHERMAL RUN 4A FIELD SALTON SEA WELL 2-14 STATE

TIME	DEPTH	P/T	GRAD	TIME	DEPTH	P/T	GRAD
1:00	1000	659.4	0.000	1:00	4000	1540.3	.418
1:00	2000	837.0	.178	1:00	5000	1968.6	.428
1:00	3000	1121.9	.285	0:00	0	0.0	0.000

BY C. WEAVER


FLOWING PRESSURE
PRESSURE (PSI)
DEPTH (FT)
2000.0
1600.0
1200.0
800.0
400.0
0.0
800.0
1600.0
2400.0
3200.0
4000.0
4800.0
5600.0
KENNECOTT GEOTHERMAL
SALTON SEA
STATE 2-14
06/20/1988
RUN #4ASA2-14

PRUETT INDUSTRIES INC.
8915 ROSEDALE HWY. BAKERSFIELD, CA. 93312
(805) 589-2768

COMPANY : KENNECOTT GEOTHERMAL
FIELD : SALTON SEA
WELL NUMBER : 2-14
RUN NUMBER : 01
NUMBER OF READINGS : 522
PRESSURE READINGS ARE TAKEN IN PSIA
TIME IS MEASURED IN HOURS

START : 06/12/1988 12:40:00
END : 06/13/1988 02:42:31
FILENAME : 01SA2-14.SUR

SURVEY DATA

COMPANY KENNECOTT RUN 01 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
06-12-1988				13:07:30	2053.49	1.01	-.0861
12:40:00	2053.91	1.43	-.5444	13:07:35	2054.05	1.57	-.0847
12:41:00	2053.94	1.46	-.5277	13:07:40	2054.28	1.80	-.0833
12:42:00	2053.46	.98	-.5111	13:07:45	2054.43	1.95	-.0819
12:43:00	2053.35	.87	-.4944	13:07:50	2054.06	1.58	-.0805
12:44:00	2053.46	.98	-.4777	13:07:55	2053.53	1.05	-.0791
12:45:00	2053.67	1.19	-.4611	13:08:00	2053.44	.96	-.0777
12:46:00	2053.27	.79	-.4444	13:08:05	2054.09	1.61	-.0763
12:47:00	2053.67	1.19	-.4277	13:08:10	2054.32	1.84	-.0750
12:48:00	2054.43	1.95	-.4111	13:08:15	2054.53	2.05	-.0736
12:49:00	2054.35	1.87	-.3944	13:08:20	2054.25	1.77	-.0722
12:50:00	2053.77	1.29	-.3777	13:08:25	2053.86	1.38	-.0708
12:51:00	2053.51	1.03	-.3611	13:08:30	2053.84	1.36	-.0694
12:52:00	2053.39	.91	-.3444	13:08:35	2054.23	1.75	-.0680
12:53:00	2053.52	1.04	-.3277	13:08:40	2054.34	1.86	-.0666
12:54:00	2053.86	1.38	-.3111	13:08:45	2054.44	1.96	-.0652
12:55:00	2054.08	1.60	-.2944	13:08:50	2054.11	1.63	-.0638
12:56:00	2053.74	1.26	-.2777	13:08:55	2053.75	1.27	-.0625
12:57:00	2053.76	1.28	-.2611	13:09:00	2053.66	1.18	-.0611
12:58:00	2054.23	1.75	-.2444	13:09:05	2054.00	1.52	-.0597
12:59:00	2054.05	1.57	-.2277	13:09:10	2054.16	1.68	-.0583
13:00:00	2053.96	1.48	-.2111	13:09:15	2054.33	1.85	-.0569
13:01:00	2053.65	1.17	-.1944	13:09:20	2053.91	1.43	-.0555
13:02:00	2053.88	1.40	-.1777	13:09:25	2053.52	1.04	-.0541
13:03:00	2053.68	1.20	-.1611	13:09:30	2053.39	.91	-.0527
13:04:00	2053.57	1.09	-.1444	13:09:35	2053.86	1.38	-.0513
13:05:00	2053.32	.84	-.1277	13:09:40	2054.02	1.54	-.0500
13:06:00	2053.65	1.17	-.1111	13:09:45	2053.84	1.36	-.0486
13:06:30	2053.61	1.13	-.1027	13:09:50	2053.36	.88	-.0472
13:06:35	2054.12	1.64	-.1013	13:09:55	2053.19	.71	-.0458
13:06:40	2054.18	1.70	-.1000	13:10:00	2053.24	.76	-.0444
13:06:45	2054.20	1.72	-.0986	13:10:05	2053.75	1.27	-.0430
13:06:50	2053.85	1.37	-.0972	13:10:10	2053.87	1.39	-.0416
13:06:55	2053.64	1.16	-.0958	13:10:15	2053.81	1.33	-.0402
13:07:00	2053.72	1.24	-.0944	13:10:20	2053.41	.93	-.0388
13:07:05	2054.20	1.72	-.0930	13:10:25	2052.95	.47	-.0375
13:07:10	2054.24	1.76	-.0916	13:10:30	2053.04	.56	-.0361
13:07:15	2054.21	1.73	-.0902	13:10:35	2053.60	1.12	-.0347
13:07:20	2053.75	1.27	-.0888	13:10:40	2053.47	.99	-.0333
13:07:25	2053.44	.96	-.0875	13:10:45	2053.52	1.04	-.0319

SURVEY DATA

COMPANY KENNECOTT RUN 01 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
13:10:50	2053.19	.71	-.0305	13:15:10	2023.96	-28.52	.0417
13:10:55	2052.80	.32	-.0291	13:15:15	2022.39	-30.09	.0431
13:11:00	2053.07	.59	-.0277	13:15:20	2021.15	-31.33	.0445
13:11:05	2053.34	.86	-.0263	13:15:25	2019.51	-32.97	.0459
13:11:10	2053.57	1.09	-.0250	13:15:30	2018.20	-34.28	.0473
13:11:15	2053.43	.95	-.0236	13:15:35	2016.60	-35.88	.0487
13:11:20	2053.26	.78	-.0222	13:15:40	2015.29	-37.19	.0500
13:11:25	2053.25	.77	-.0208	13:15:45	2013.92	-38.56	.0514
13:11:30	2053.21	.73	-.0194	13:15:50	2012.67	-39.81	.0528
13:11:35	2053.43	.95	-.0180	13:15:55	2011.31	-41.17	.0542
13:11:40	2053.42	.94	-.0166	13:16:00	2009.98	-42.50	.0556
13:11:45	2053.40	.92	-.0152	13:16:05	2008.72	-43.76	.0570
13:11:50	2053.13	.65	-.0138	13:16:10	2007.39	-45.09	.0584
13:11:55	2053.17	.69	-.0125	13:16:15	2006.13	-46.35	.0598
13:12:00	2053.22	.74	-.0111	13:16:20	2004.84	-47.64	.0612
13:12:05	2053.41	.93	-.0097	13:16:25	2003.56	-48.92	.0625
13:12:10	2053.13	.65	-.0083	13:16:30	2002.27	-50.21	.0639
13:12:15	2052.90	.42	-.0069	13:16:35	2001.18	-51.30	.0653
13:12:20	2052.53	.05	-.0055	13:16:40	2000.04	-52.44	.0667
13:12:25	2052.58	.10	-.0041	13:16:45	1998.89	-53.59	.0681
13:12:30	2052.67	.19	-.0027	13:16:50	1997.62	-54.86	.0695
13:12:35	2052.67	.19	-.0013	13:16:55	1995.19	-55.29	.0709
13:12:40	2052.48	.00	.0000	13:17:00	1995.33	-57.15	.0723
13:12:45	2052.11	-.37	.0014	13:17:05	1994.02	-58.46	.0737
13:12:50	2051.74	-.74	.0028	13:17:10	1993.13	-59.35	.0750
13:12:55	2051.60	-.88	.0042	13:17:15	1991.95	-60.53	.0764
13:13:00	2051.56	-.92	.0056	13:17:20	1990.48	-62.00	.0778
13:13:05	2051.10	-1.38	.0070	13:17:25	1990.00	-62.48	.0792
13:13:10	2050.67	-1.81	.0084	13:17:30	1988.78	-63.70	.0806
13:13:15	2050.26	-2.22	.0098	13:17:35	1987.99	-64.49	.0820
13:13:20	2049.70	-2.78	.0112	13:17:40	1986.77	-65.71	.0834
13:13:25	2049.40	-3.08	.0125	13:17:45	1985.73	-66.75	.0848
13:13:30	2048.64	-3.84	.0139	13:17:50	1984.74	-67.74	.0862
13:13:35	2047.74	-4.74	.0153	13:17:55	1983.83	-68.65	.0875
13:13:40	2046.97	-5.51	.0167	13:18:00	1982.71	-69.77	.0889
13:13:45	2046.33	-6.15	.0181	13:18:05	1981.99	-70.49	.0903
13:13:50	2045.49	-6.99	.0195	13:18:10	1980.89	-71.59	.0917
13:13:55	2044.29	-8.19	.0209	13:18:15	1979.94	-72.54	.0931
13:14:00	2042.90	-9.58	.0223	13:18:20	1979.11	-73.37	.0945
13:14:05	2041.92	-10.56	.0237	13:18:25	1978.30	-74.18	.0959
13:14:10	2040.94	-11.54	.0250	13:18:30	1977.49	-74.99	.0973
13:14:15	2039.63	-12.85	.0264	13:18:35	1976.65	-75.83	.0987
13:14:20	2038.57	-13.91	.0278	13:18:40	1975.89	-76.59	.1000
13:14:25	2037.31	-15.17	.0292	13:18:45	1975.07	-77.41	.1014
13:14:30	2035.63	-16.85	.0306	13:18:50	1974.30	-78.18	.1028
13:14:35	2034.20	-18.28	.0320	13:18:55	1973.55	-78.93	.1042
13:14:40	2032.72	-19.76	.0334	13:19:00	1972.71	-79.77	.1056
13:14:45	2031.41	-21.07	.0348	13:19:05	1972.05	-80.43	.1070
13:14:50	2029.93	-22.55	.0362	13:19:10	1971.22	-81.26	.1084
13:14:55	2028.23	-24.25	.0375	13:19:15	1970.56	-81.92	.1098
13:15:00	2027.00	-25.48	.0389	13:19:20	1969.79	-82.69	.1112
13:15:05	2025.40	-27.08	.0403	13:19:25	1969.19	-83.29	.1125

PRELIMINARY DRAFT

SURVEY DATA

COMPANY KENNECOTT RUN 01 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
13:19:30	1968.58	-83.90	.1139	13:24:09	1950.87	-101.61	.1914
13:19:35	1967.94	-84.54	.1153	13:24:19	1950.72	-101.76	.1942
13:19:40	1967.27	-85.21	.1167	13:24:29	1950.47	-102.01	.1970
13:19:45	1966.60	-85.88	.1181	13:24:39	1950.33	-102.15	.1998
13:19:50	196[illegible].05	-86.43	.1195	13:24:49	1950.02	-102.46	.2025
13:19:55	1965.58	-86.90	.1209	13:24:59	1949.95	-102.53	.2053
13:20:00	1965.[illegible]	-87.47	.1223	13:25:09	1949.68	-102.80	.2081
13:20:05	1964.4[illegible]	-87.99	.1237	13:25:19	1949.57	-102.91	.2109
13:20:10	1963.84	-88.64	.1250	13:25:29	1949.49	-102.99	.2137
13:20:15	1963.44	-89.04	.1264	13:25:39	1949.18	-103.30	.2164
13:20:20	1962.91	-89.57	.1278	13:25:49	1949.10	-103.38	.2192
13:20:25	1962.53	-89.95	.1292	13:25:59	1948.95	-103.53	.2220
13:20:30	1961.95	-90.53	.1306	13:26:09	1948.80	-103.68	.2248
13:20:35	1961.62	-90.[illegible]	.1320	13:26:19	1948.79	-103.69	.2275
13:20:40	1961.08	-91.40	.1334	13:26:29	1948.70	-103.78	.2303
13:20:45	1960.81	-91.[illegible]	.1348	13:26:39	1948.60	-103.88	.2331
13:20:50	1960.25	-92.[illegible]	.1362	13:26:49	1948.65	-103.83	.2359
13:20:55	1959.99	-92.49	.1375	13:26:59	1948.46	-104.02	.2387
13:21:00	1959.64	-92.84	.1389	13:27:09	1948.57	-103.91	.2414
13:21:05	1959.21	-93.27	.1403	13:27:19	1948.42	-104.06	.2442
13:21:10	1958.73	-93.75	.1417	13:27:29	1948.53	-103.95	.2470
13:21:15	1958.47	-94.01	.1431	13:27:39	1948.60	-103.88	.2498
13:21:20	1958.20	-94.28	.1445	13:27:49	1948.43	-104.05	.2525
13:21:25	1957.88	-94.60	.1459	13:27:59	1948.36	-104.12	.2553
13:21:30	1957.47	-95.01	.14[illegible]	13:28:09	1948.33	-104.15	.2581
13:21:35	1957.12	-95.36	.1487	13:28:19	1948.42	-104.06	.2609
13:21:40	1956.81	-95.67	.1500	13:28:29	1948.62	-103.86	.2637
13:21:45	1956.58	-95.90	.1514	13:28:44	1948.84	-103.64	.2678
13:21:50	1956.27	-96.21	.1528	13:29:14	1949.26	-103.22	.2762
13:21:55	1956.08	-96.40	.1542	13:29:44	1949.61	-102.87	.2845
13:22:00	1955.78	-96.70	.1556	13:30:[illegible]4	1950.26	-102.22	.2928
13:22:05	1955.57	-96.91	.1570	13:30:[illegible]4	1950.90	-101.58	.3012
13:22:10	1955.36	-97.12	.1584	13:31:14	1951.26	-101.22	.3095
13:22:15	1955.00	-97.48	.1598	13:31:44	1951.54	-100.94	.3178
13:22:20	1954.84	-97.64	.1612	13:32:14	1951.65	-100.83	.3262
13:22:25	1954.51	-97.97	.1625	13:32:44	19[illegible].89	-100.59	.3345
13:22:30	1954.26	-98.22	.1639	13:33:14	1952.14	-100.34	.3428
13:22:35	1953.98	-98.50	.1653	13:33:44	195[illegible].35	-100.13	.3512
13:22:40	1953.75	-98.73	.1667	13:34:14	1952.39	-100.09	.3595
13:22:45	1953.55	-98.93	.1681	13:34:44	1952.3[illegible]	-100.11	.3678
13:22:50	1953.43	-99.05	.1695	13:35:14	1952.4[illegible]	-100.05	.3762
13:22:55	1953.16	-99.32	.1709	13:35:44	1952.56	-99.92	.3845
13:23:00	1953.12	-99.36	.1723	13:36:14	1952.62	-99.86	.3928
13:23:05	1952.77	-99.71	.1737	13:36:44	1952.61	-99.87	.4012
13:23:10	1952.69	-99.79	.1750	13:37:14	1952.79	-99.69	.4095
13:23:15	1952.42	-100.06	.1764	13:37:44	1952.49	-99.99	.4178
13:23:20	1952.36	-100.12	.1778	13:38:14	1952.40	-100.08	.4262
13:23:25	1952.08	-100.40	.1792	13:38:44	1952.50	-99.98	.4345
13:23:30	1952.11	-100.37	.1806	13:39:14	1952.89	-99.59	.4428
13:23:35	1951.79	-100.69	.1820	13:39:44	1953.10	-99.38	.4512
13:23:49	1951.46	-101.02	.1859	13:40:14	1953.01	-99.47	.4595
13:23:59	1951.17	-101.31	.1887	13:40:44	1953.05	-99.43	.4678

PRELIMINARY DRAFT

SURVEY DATA

COMPANY KENNECOTT RUN 01 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
13:41:14	1952.95	-99.53	.4762	17:32:31	1944.70	-107.78	4.3309
13:41:45	1953.16	-99.32	.4848	17:37:31	1944.65	-107.83	4.4142
13:42:45	1953.58	-98.90	.5014	17:42:31	1944.59	-107.89	4.4975
13:43:45	1953.45	-99.03	.5181	17:47:31	1944.75	-107.73	4.5809
13:44:45	1953.70	-98.78	.5348	17:52:31	1945.28	-107.20	4.6642
13:45:45	1954.18	-98.30	.5514	17:57:31	1945.10	-107.38	4.7475
13:46:45	1954.04	-98.44	.5681	18:02:31	1945.38	-107.10	4.8309
13:47:31	1954.19	-98.29	.5809	18:07:31	1945.51	-106.97	4.9142
13:52:31	1954.40	-98.08	.6642	18:12:31	1945.51	-106.97	4.9975
13:57:31	1955.20	-97.28	.7475	18:17:31	1945.55	-106.93	5.0809
14:02:31	1955.29	-97.19	.8309	18:22:31	1945.88	-106.60	5.1642
14:07:31	1941.76	-110.72	.9142	18:27:31	1945.82	-106.66	5.2475
14:12:31	1937.86	-114.62	.9975	18:32:31	1946.32	-106.16	5.3309
14:17:31	1938.03	-114.45	1.0309	18:37:31	1945.31	-107.17	5.4142
14:22:31	1938.38	-114.10	1.1642	18:42:31	1945.32	-107.16	5.4975
14:27:31	1938.53	-113.95	1.2475	18:47:31	1945.66	-106.82	5.5809
14:32:31	1938.15	-114.33	1.3309	18:52:31	1945.83	-106.65	5.6642
14:37:31	1938.36	-114.12	1.4142	18:57:31	1945.96	-106.52	5.7475
14:42:31	1938.51	-113.97	1.4975	19:02:31	1945.86	-106.62	5.8309
14:47:31	1938.86	-113.62	1.5809	19:07:31	1945.55	-106.93	5.9142
14:52:31	1939.23	-113.25	1.6642	19:12:31	1946.03	-106.45	5.9975
14:57:31	1939.43	-113.05	1.7475	19:17:31	1945.71	-106.77	6.0809
15:02:31	1939.63	-112.85	1.8309	19:22:31	1945.67	-106.81	6.1642
15:07:31	1939.64	-112.84	1.9142	19:27:31	1946.07	-106.41	6.2475
15:12:31	1939.61	-112.87	1.9975	19:32:31	1946.11	-106.37	6.3309
15:17:31	1939.80	-112.68	2.0809	19:37:31	1946.42	-106.06	6.4142
15:22:31	1940.04	-112.44	2.1642	19:42:31	1946.29	-106.19	6.4975
15:27:31	1940.30	-112.18	2.2475	19:47:31	1946.60	-105.88	6.5809
15:32:31	1940.33	-112.15	2.3309	19:52:31	1946.66	-105.82	6.6642
15:37:31	1940.62	-111.86	2.4142	19:57:31	1946.66	-105.82	6.7475
15:42:31	1940.55	-111.93	2.4975	20:02:31	1946.06	-106.42	6.8309
15:47:31	1940.65	-111.83	2.5809	20:07:31	1945.73	-106.75	6.9142
15:52:31	1941.33	-111.15	2.6642	20:12:31	1945.65	-106.83	6.9975
15:57:31	1941.45	-111.03	2.7475	20:17:31	1945.54	-106.94	7.0809
16:02:31	1941.59	-110.89	2.8309	20:22:31	1946.83	-105.65	7.1642
16:07:31	1942.12	-110.36	2.9142	20:27:31	1946.66	-105.82	7.2475
16:12:31	1942.12	-110.36	2.9975	20:32:31	1946.10	-106.38	7.3309
16:17:31	1942.19	-110.29	3.0809	20:37:31	1947.31	-105.17	7.4142
16:22:31	1942.64	-109.84	3.1642	20:42:31	1946.00	-106.48	7.4975
16:27:31	1942.99	-109.49	3.2475	20:47:31	1946.22	-106.26	7.5809
16:32:31	1942.88	-109.60	3.3309	20:52:31	1946.49	-105.99	7.6642
16:37:31	1943.13	-109.35	3.4142	20:57:31	1946.04	-106.44	7.7475
16:42:31	1943.16	-109.32	3.4975	21:02:31	1946.38	-106.10	7.8309
16:47:31	1943.04	-109.44	3.5809	21:07:31	1945.94	-106.54	7.9142
16:52:31	1943.70	-108.78	3.6642	21:12:31	1946.57	-105.91	7.9975
16:57:31	1944.01	-108.47	3.7475	21:17:31	1946.80	-105.68	8.0809
17:02:31	1944.26	-108.22	3.8309	21:22:31	1946.53	-105.95	8.1642
17:07:31	1944.60	-107.88	3.9142	21:27:31	1947.12	-105.36	8.2475
17:12:31	1944.33	-108.15	3.9975	21:32:31	1947.06	-105.42	8.3309
17:17:31	1944.37	-108.11	4.0809	21:37:31	1946.52	-105.96	8.4142
17:22:31	1944.44	-108.04	4.1642	21:42:31	1946.14	-106.34	8.4975
17:27:31	1944.22	-108.26	4.2475	21:47:31	1946.12	-106.36	8.5809

SURVEY DATA

COMPANY KENNECOTT   RUN 01 FIELD SALTON SEA   WELL NAME 2-14

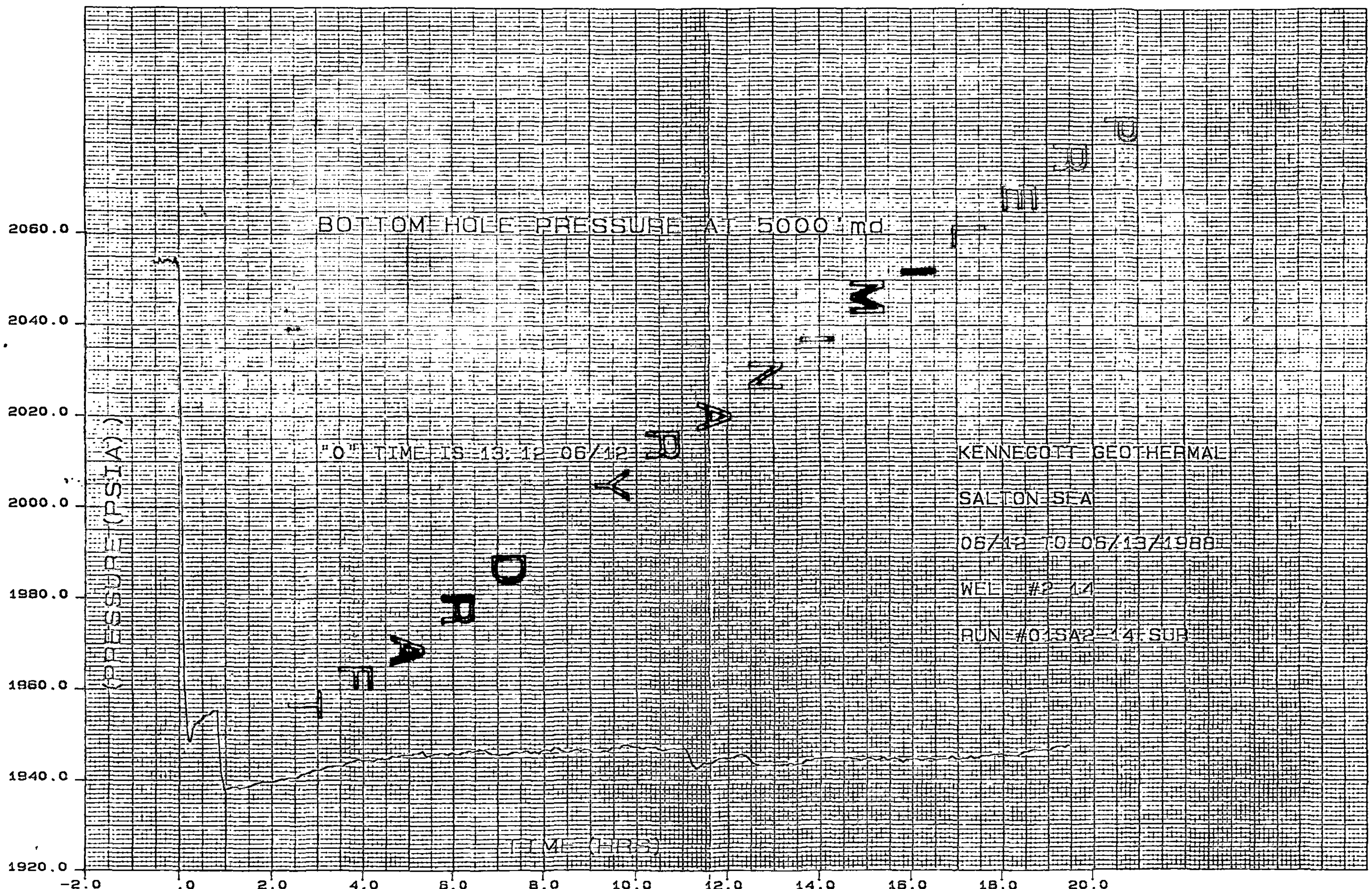
TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
21:52:31	1946.47	-106.01	8.6642	02:07:31	1943.17	-109.31	12.9142
21:57:31	1946.68	-105.80	8.7475	02:12:31	1943.24	-109.24	12.9975
22:02:31	1946.35	-106.13	8.8309	02:17:31	1943.33	-109.15	13.0809
22:07:31	1946.72	-105.76	8.9142	02:22:31	1943.37	-109.11	13.1642
22:12:31	1946.60	-105.88	8.9975	02:27:31	1943.45	-109.03	13.2475
22:17:31	1946.17	-106.31	9.0809	02:32:31	1943.44	-109.04	13.3309
22:22:31	1946.14	-106.34	9.1642	02:37:31	1943.73	-108.75	13.4142
22:27:31	1946.07	-106.41	9.2475	02:42:31	1943.38	-109.10	13.4975
22:32:31	1946.41	-106.07	9.3309	02:47:31	1943.63	-108.85	13.5809
22:37:31	1946.32	-106.16	9.4142	02:52:31	1943.60	-108.88	13.6642
22:42:31	1947.08	-105.40	9.4975	02:57:31	1944.44	-108.04	13.7475
22:47:31	1947.02	-105.46	9.5809	03:02:31	1944.16	-108.32	13.8309
22:52:31	1946.99	-105.49	9.6642	03:07:31	1944.65	-107.83	13.9142
22:57:31	1947.61	-104.87	9.7475	03:12:31	1944.70	-107.78	13.9975
23:02:31	1947.70	-104.78	9.8309	03:17:31	1944.68	-107.80	14.0809
23:07:31	1947.40	-105.08	9.9142	03:22:31	1944.83	-107.65	14.1642
23:12:31	1947.24	-105.24	9.9975	03:27:31	1944.87	-107.61	14.2475
23:17:31	1947.14	-105.34	10.0809	03:32:31	1945.00	-107.48	14.3309
23:22:31	1946.84	-105.64	10.1642	03:37:31	1945.01	-107.47	14.4142
23:27:31	1947.12	-105.36	10.2475	03:42:31	1945.02	-107.46	14.4975
23:32:31	1947.11	-105.37	10.3309	03:47:31	1944.75	-107.73	14.5809
23:37:31	1947.30	-105.18	10.4142	03:52:31	1945.06	-107.42	14.6642
23:42:31	1946.93	-105.55	10.4975	03:57:31	1944.65	-107.83	14.7475
23:47:31	1946.57	-105.91	10.5809	04:02:31	1944.60	-107.88	14.8309
23:52:31	1946.66	-105.82	10.6642	04:07:31	1944.28	-108.20	14.9142
23:57:31	1946.92	-105.56	10.7475	04:12:31	1944.57	-107.91	14.9975
06-13-1988				04:17:31	1944.85	-107.63	15.0809
00:02:31	1947.04	-105.44	10.8309	04:22:31	1944.59	-107.89	15.1642
00:07:31	1946.90	-105.58	10.9142	04:27:31	1944.38	-108.10	15.2475
00:12:31	1947.02	-105.46	10.9975	04:32:31	1944.56	-107.92	15.3309
00:17:31	1947.06	-105.42	11.0809	04:37:31	1944.94	-107.54	15.4142
00:22:31	1945.87	-106.61	11.1642	04:42:31	1944.25	-108.23	15.4975
00:27:31	1943.28	-109.20	11.2475	04:47:31	1944.65	-107.83	15.5809
00:32:31	1942.55	-109.93	11.3309	04:52:31	1944.83	-107.65	15.6642
00:37:31	1943.12	-109.36	11.4142	04:57:31	1944.52	-107.96	15.7475
00:42:31	1943.93	-108.55	11.4975	05:02:31	1944.05	-108.43	15.8309
00:47:31	1943.71	-108.77	11.5809	05:07:31	1944.48	-108.00	15.9142
00:52:31	1943.95	-108.53	11.6642	05:12:31	1944.59	-107.89	15.9975
00:57:31	1944.34	-108.14	11.7475	05:17:31	1944.69	-107.79	16.0809
01:02:31	1944.73	-107.75	11.8309	05:22:31	1944.59	-107.89	16.1642
01:07:31	1944.96	-107.52	11.9142	05:27:31	1944.35	-108.13	16.2475
01:12:31	1944.71	-107.77	11.9975	05:32:31	1944.60	-107.88	16.3309
01:17:31	1944.85	-107.63	12.0809	05:37:31	1944.75	-107.73	16.4142
01:22:31	1944.96	-107.52	12.1642	05:42:31	1944.59	-107.89	16.4975
01:27:31	1945.44	-107.04	12.2475	05:47:31	1944.41	-108.07	16.5809
01:32:31	1945.67	-106.81	12.3309	05:52:31	1944.62	-107.86	16.6642
01:37:31	1945.39	-107.09	12.4142	05:57:31	1944.65	-107.83	16.7475
01:42:31	1944.79	-107.69	12.4975	06:02:31	1944.70	-107.78	16.8309
01:47:31	1943.73	-108.75	12.5809	06:07:31	1945.23	-107.25	16.9142
01:52:31	1943.38	-109.10	12.6642	06:12:31	1944.78	-107.70	16.9975
01:57:31	1943.17	-109.31	12.7475	06:17:31	1944.58	-107.90	17.0809
02:02:31	1943.12	-109.36	12.8309	06:22:31	1944.87	-107.61	17.1642

SURVEY DATA

COMPANY KENNECOTT RUN 01 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
06:27:31	1944.81	-107.67	17.2475	07:37:31	1945.70	-106.78	18.4142
06:32:31	1945.33	-107.15	17.3309	07:42:31	1946.23	-106.25	18.4975
06:37:31	1944.81	-107.67	17.4142	07:47:31	1946.33	-106.15	18.5809
06:42:31	1944.93	-107.55	17.4975	07:52:31	1946.54	-105.94	18.6642
06:47:31	194[illegible].47	-107.01	17.5809	07:57:31	1946.77	-105.71	18.7475
06:52:31	1945.41	-107.07	17.6642	08:02:31	1946.57	-105.91	18.8309
06:57:31	1945.[illegible]	-107.00	17.7475	08:07:31	1946.69	-105.79	18.9142
07:02:31	1945.71	-106.77	17.8309	08:12:31	1946.68	-105.80	18.9975
07:07:31	1945.72	-106.76	17.9142	08:17:31	1946.51	-105.97	19.0809
07:12:31	1945.81	-106.67	17.9975	08:22:31	1947.11	-105.37	19.1642
07:17:31	1945.55	-106.93	18.0809	08:27:31	1947.29	-105.19	19.2475
07:22:31	1945.36	-107.12	18.1642	08:32:31	1947.44	-105.04	19.3309
07:27:31	1945.59	-106.89	18.2475	08:37:31	1947.14	-105.34	19.4142
07:32:31	1945.37	-107.[illegible]1	18.3309	08:42:31	1947.51	-104.87	19.4975

PRELIMINARY DRAFT


BOTTOM HOLE PRESSURE AT 5000'md
"0" TIME IS 13:12 06/12
KENNECOTT GEOTHERMAL
SALTON SEA
06/12 TO 06/13/1988
WELL #2-14
RUN #01SA2-14.SUR
(PRESSURE (PSIA))
TIME (HRS)
2060.0
2040.0
2020.0
2000.0
1980.0
1960.0
1940.0
1920.0
-2.0
.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0

PRUETT INDUSTRIES INC.
8915 ROSEDALE HWY. BAKERSFIELD, CA. 93312
(805) 589-2768

COMPANY : KENNECOTT GEOTHERMAL
FIELD : SALTON SEA
WELL NUMBER : 2-14
RUN NUMBER : 02
NUMBER OF READINGS : 442
PRESSURE READINGS ARE TAKEN IN PSIA
TIME IS MEASURED IN HOURS

START : 06/14/1988 18:18:00
END : 06/15/1988 10:01:30
FILENAME : 02SA2-14.SUR

SURVEY DATA

COMPANY KENNECOTT RUN 02 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
06-14-1988				19:23:13	1948.59	.56	-.3164
18:18:00	1950.07	2.04	-1.4034	19:24:13	1948.77	.74	-.2998
18:20:00	1950.02	1.99	-1.3700	19:25:13	1948.80	.77	-.2831
18:22:00	1949.90	1.87	-1.3367	19:26:13	1948.69	.66	-.2664
18:24:00	1949.83	1.80	-1.3034	19:27:13	1948.77	.74	-.2498
18:26:00	1949.72	1.69	-1.2700	19:28:13	1948.77	.74	-.2331
18:28:00	1949.86	1.83	-1.2367	19:29:13	1948.81	.78	-.2164
18:30:00	1949.66	1.63	-1.2034	19:30:13	1948.88	.85	-.1998
18:32:00	1949.59	1.56	-1.1700	19:31:13	1948.74	.71	-.1831
18:34:00	1949.44	1.41	-1.1367	19:32:13	1948.89	.86	-.1664
18:36:00	1949.24	1.21	-1.1034	19:33:13	1948.95	.92	-.1498
18:38:00	1949.29	1.26	-1.0700	19:34:13	1948.83	.80	-.1331
18:40:00	1949.29	1.26	-1.0367	19:35:13	1948.91	.88	-.1164
18:42:00	1949.11	1.08	-1.0034	19:36:13	1948.74	.71	-.0998
18:44:00	1948.95	.92	-.9700	19:37:13	1948.63	.60	-.0831
18:46:00	1948.71	.68	-.9367	19:38:13	1948.51	.48	-.0664
18:48:00	1948.85	.82	-.9034	19:39:13	1948.58	.55	-.0498
18:50:00	1948.74	.71	-.8700	19:40:13	1948.67	.64	-.0331
18:52:00	1948.81	.78	-.8367	19:40:42	1948.72	.69	-.0250
18:54:00	1948.87	.84	-.8034	19:40:47	1948.65	.62	-.0236
18:56:00	1948.85	.82	-.7700	19:40:52	1948.63	.60	-.0223
18:58:00	1948.67	.64	-.7367	19:40:57	1948.58	.55	-.0209
19:00:00	1948.63	.60	-.7034	19:41:02	1948.53	.50	-.0195
19:02:00	1948.68	.65	-.6700	19:41:07	1948.61	.58	-.0181
19:04:00	1948.44	.41	-.6367	19:41:12	1948.65	.62	-.0167
19:06:00	1948.49	.46	-.6034	19:41:17	1948.52	.49	-.0153
19:08:00	1948.54	.51	-.5700	19:41:22	1948.54	.51	-.0139
19:10:00	1948.47	.44	-.5367	19:41:27	1948.59	.56	-.0125
19:12:00	1948.55	.52	-.5034	19:41:32	1948.57	.54	-.0111
19:14:00	1948.66	.63	-.4700	19:41:37	1948.54	.51	-.0098
19:16:00	1948.46	.43	-.4367	19:41:42	1948.61	.58	-.0084
19:18:00	1948.51	.48	-.4034	19:41:47	1948.54	.51	-.0070
19:20:00	1948.73	.70	-.3700	19:41:52	1948.47	.44	-.0056
19:21:31	1948.66	.63	-.3448	19:41:57	1948.43	.40	-.0042
19:21:36	1948.62	.59	-.3434	19:42:02	1948.27	.24	-.0028
19:21:41	1948.65	.62	-.3420	19:42:07	1948.19	.16	-.0014
19:21:46	1948.66	.63	-.3406	19:42:12	1948.03	.00	.0000
19:21:51	1948.62	.59	-.3392	19:42:17	1947.70	-.33	.0014
19:21:56	1948.66	.63	-.3378	19:42:22	1947.39	-.64	.0027
19:22:13	1948.63	.60	-.3331	19:42:27	1946.90	-1.13	.0041

SURVEY DATA

COMPANY KENNECOTT RUN 02 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
19:42:32	1946.17	-1.86	.0055	19:46:52	1869.72	-78.31	.0777
19:42:37	1945.29	-2.74	.0069	19:46:57	1869.22	-78.81	.0791
19:42:42	1944.29	-3.74	.0083	19:47:02	1868.77	-79.26	.0805
19:42:47	1943.06	-4.97	.0097	19:47:07	1868.41	-79.62	.0819
19:42:52	1941.66	-6.37	.0111	19:47:12	1868.00	-80.03	.0833
19:42:57	1940.03	-8.00	.0125	19:47:17	1867.59	-80.44	.0847
19:43:02	1938.26	-9.77	.0139	19:47:22	1867.27	-80.76	.0861
19:43:07	1936.32	-11.71	.0152	19:47:27	1866.92	-81.11	.0875
19:43:12	1934.33	-13.70	.0166	19:47:32	1866.57	-81.46	.0889
19:43:17	1932.08	-15.95	.0180	19:47:37	1866.24	-81.79	.0902
19:43:22	1929.83	-18.20	.0194	19:47:42	1865.86	-82.17	.0916
19:43:27	1927.53	-20.50	.0208	19:47:47	1865.53	-82.50	.0930
19:43:32	1925.13	-22.90	.0222	19:47:52	1865.17	-82.86	.0944
19:43:37	1922.75	-25.28	.0236	19:47:57	1864.88	-83.15	.0958
19:43:42	1920.37	-27.66	.0250	19:48:02	1864.59	-83.44	.0972
19:43:47	1917.99	-30.04	.0264	19:48:07	1864.32	-83.71	.0986
19:43:52	1915.63	-32.40	.0277	19:48:12	1864.09	-83.94	.1000
19:43:57	1913.35	-34.68	.0291	19:48:17	1863.88	-84.15	.1014
19:44:02	1911.11	-36.92	.0305	19:48:22	1863.64	-84.39	.1027
19:44:07	1908.90	-39.13	.0319	19:48:27	1863.43	-84.60	.1041
19:44:12	1906.75	-41.28	.0333	19:48:32	1863.23	-84.80	.1055
19:44:17	1904.64	-43.39	.0347	19:48:37	1863.03	-85.00	.1069
19:44:22	1902.66	-45.37	.0361	19:48:42	1862.86	-85.17	.1083
19:44:27	1900.73	-47.30	.0375	19:48:47	1862.68	-85.35	.1097
19:44:32	1898.89	-49.14	.0389	19:48:52	1862.50	-85.53	.1111
19:44:37	1896.97	-51.06	.0402	19:48:57	1862.35	-85.68	.1125
19:44:42	1895.27	-52.76	.0416	19:49:02	1862.18	-85.85	.1139
19:44:47	1893.60	-54.43	.0430	19:49:07	1861.94	-86.09	.1152
19:44:52	1892.00	-56.03	.0444	19:49:12	1861.77	-86.26	.1166
19:44:57	1890.48	-57.55	.0458	19:49:17	1861.56	-86.47	.1180
19:45:02	1889.02	-59.01	.0472	19:49:22	1861.34	-86.69	.1194
19:45:07	1887.60	-60.43	.0486	19:49:27	1861.05	-86.98	.1208
19:45:12	1886.22	-61.81	.0500	19:49:32	1860.78	-87.25	.1222
19:45:17	1884.92	-63.11	.0514	19:49:37	1860.54	-87.49	.1236
19:45:22	1883.68	-64.35	.0527	19:49:42	1860.25	-87.76	.1250
19:45:27	1882.47	-65.56	.0541	19:49:47	1859.95	-88.08	.1264
19:45:32	1881.33	-66.70	.0555	19:49:52	1859.58	-88.45	.1277
19:45:37	1880.24	-67.79	.0569	19:49:57	1859.23	-88.80	.1291
19:45:42	1879.21	-68.82	.0583	19:50:02	1858.76	-89.27	.1305
19:45:47	1878.23	-69.80	.0597	19:50:07	1858.28	-89.75	.1319
19:45:52	1877.39	-70.64	.0611	19:50:12	1857.84	-90.19	.1333
19:45:57	1876.68	-71.35	.0625	19:50:17	1857.29	-90.74	.1347
19:46:02	1875.86	-72.17	.0639	19:50:22	1856.73	-91.30	.1361
19:46:07	1875.03	-73.00	.0652	19:50:27	1856.19	-91.84	.1375
19:46:12	1874.27	-73.76	.0666	19:50:32	1855.58	-92.45	.1389
19:46:17	1873.60	-74.43	.0680	19:50:37	1854.95	-93.08	.1402
19:46:22	1873.01	-75.02	.0694	19:50:42	1854.40	-93.63	.1416
19:46:27	1872.30	-75.73	.0708	19:50:47	1853.78	-94.25	.1430
19:46:32	1871.75	-76.28	.0722	19:50:52	1853.16	-94.87	.1444
19:46:37	1871.20	-76.83	.0736	19:50:57	1852.59	-95.44	.1458
19:46:42	1870.68	-77.35	.0750	19:51:02	1851.96	-96.07	.1472
19:46:47	1870.21	-77.82	.0764	19:51:07	1851.35	-96.68	.1486

PRELIMINARY DRAFT

SURVEY DATA

COMPANY KENNECOTT RUN 02 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
19:51:12	1850.79	-97.24	.1500	19:58:40	1835.49	-112.54	.2744
19:51:17	1850.17	-97.86	.1514	19:58:50	1835.32	-112.71	.2772
19:51:22	1849.57	-98.46	.1527	19:59:00	1835.17	-112.86	.2800
19:51:27	1849.08	-98.95	.1541	19:59:10	1834.99	-113.04	.2827
19:51:32	1848.51	-99.52	.1555	19:59:20	1834.82	-113.21	.2855
19:51:37	1847.96	-100.07	.1569	19:59:30	1834.63	-113.40	.2883
19:51:42	1847.49	-100.54	.1583	19:59:40	1834.46	-113.57	.2911
19:51:47	1846.97	-101.06	.1597	19:59:50	1834.31	-113.72	.2939
19:51:52	1846.48	-101.55	.1611	20:00:00	1834.16	-113.87	.2966
19:51:57	1846.00	-102.03	.1625	20:00:10	1834.02	-114.01	.2994
19:52:02	1845.48	-102.55	.1639	20:00:20	1833.88	-114.15	.3022
19:52:07	1844.96	-103.07	.1652	20:00:30	1833.72	-114.31	.3050
19:52:12	1844.50	-103.53	.1666	20:00:40	1833.54	-114.49	.3077
19:52:17	1844.05	-103.98	.1680	20:00:50	1833.40	-114.63	.3105
19:52:22	1843.60	-104.43	.1694	20:01:00	1833.26	-114.77	.3133
19:52:27	1843.20	-104.83	.1708	20:01:10	1833.14	-114.89	.3161
19:52:32	1842.81	-105.22	.1722	20:01:20	1833.00	-115.03	.3189
19:52:50	1841.98	-106.05	.1772	20:01:30	1832.87	-115.16	.3216
19:53:00	1841.53	-106.50	.1800	20:01:40	1832.75	-115.28	.3244
19:53:10	1841.06	-106.97	.1827	20:01:58	1832.53	-115.50	.3294
19:53:20	1840.68	-107.35	.1855	20:02:28	1832.58	-115.45	.3377
19:53:30	1840.27	-107.76	.1883	20:02:58	1833.77	-114.26	.3461
19:53:40	1839.91	-108.12	.1911	20:03:28	1835.18	-112.85	.3544
19:53:50	1839.64	-108.39	.1939	20:03:58	1836.65	-111.38	.3627
19:54:00	1839.36	-108.67	.196[illegible]	20:04:28	1838.11	-109.92	.3711
19:54:10	1839.13	-108.90	.1994	20:04:58	1839.45	-108.58	.3794
19:54:20	1838.87	-109.16	.2022	20:05:28	1840.67	-107.36	.3877
19:54:30	1838.64	-109.39	.2050	20:05:58	1841.80	-106.23	.3961
19:54:40	1838.40	-109.63	.2077	20:06:28	1842.71	-105.32	.4044
19:54:50	1838.23	-109.80	.2105	20:06:58	1843.51	-104.52	.4127
19:55:00	1838.02	-110.01	.2133	20:07:28	1844.15	-103.88	.4211
19:55:10	1837.86	-110.17	.2161	20:07:58	1844.76	-103.27	.4294
19:55:20	1837.77	-110.26	.2189	20:08:28	1845.19	-102.84	.4377
19:55:30	1837.62	-110.41	.2216	20:08:58	1845.54	-102.49	.4461
19:55:40	1837.54	-110.49	.2244	20:09:28	1845.91	-102.12	.4544
19:55:50	1837.41	-110.62	.2272	20:09:58	1846.22	-101.81	.4627
19:56:00	1837.28	-110.75	.2300	20:10:28	1846.44	-101.59	.4711
19:56:10	1837.18	-110.85	.2327	20:10:58	1846.62	-101.41	.4794
19:56:20	1837.06	-110.97	.2355	20:11:28	1846.72	-101.31	.4877
19:56:30	1836.95	-111.08	.2383	20:11:58	1846.57	-101.46	.4961
19:56:40	1836.83	-111.20	.2411	20:12:24	1846.73	-101.30	.5033
19:56:50	1836.68	-111.35	.2439	20:17:24	1849.20	-98.83	.5866
19:57:00	1836.59	-111.44	.2466	20:22:24	1848.59	-99.44	.6700
19:57:10	1836.49	-111.54	.2494	20:27:24	1847.66	-100.37	.7533
19:57:20	1836.36	-111.67	.2522	20:32:24	1850.07	-97.96	.8366
19:57:30	1836.27	-111.76	.2550	20:37:24	1848.06	-99.97	.9200
19:57:40	1836.20	-111.83	.2577	20:42:24	1850.40	-97.63	1.0033
19:57:50	1836.10	-111.93	.2605	20:47:24	1853.16	-94.87	1.0866
19:58:00	1836.01	-112.02	.2633	20:52:24	1859.33	-88.70	1.1700
19:58:10	1835.89	-112.14	.2661	20:57:24	1860.40	-87.63	1.2533
19:58:20	1835.77	-112.26	.2689	21:02:24	1862.88	-85.15	1.3366
19:58:30	1835.64	-112.39	.2716	21:07:24	1863.59	-84.44	1.4200

PRELIMINARY DRAFT

SURVEY DATA

COMPANY KENNECOTT RUN 02 FIELD SALTON SEA WELL NAME 2-14

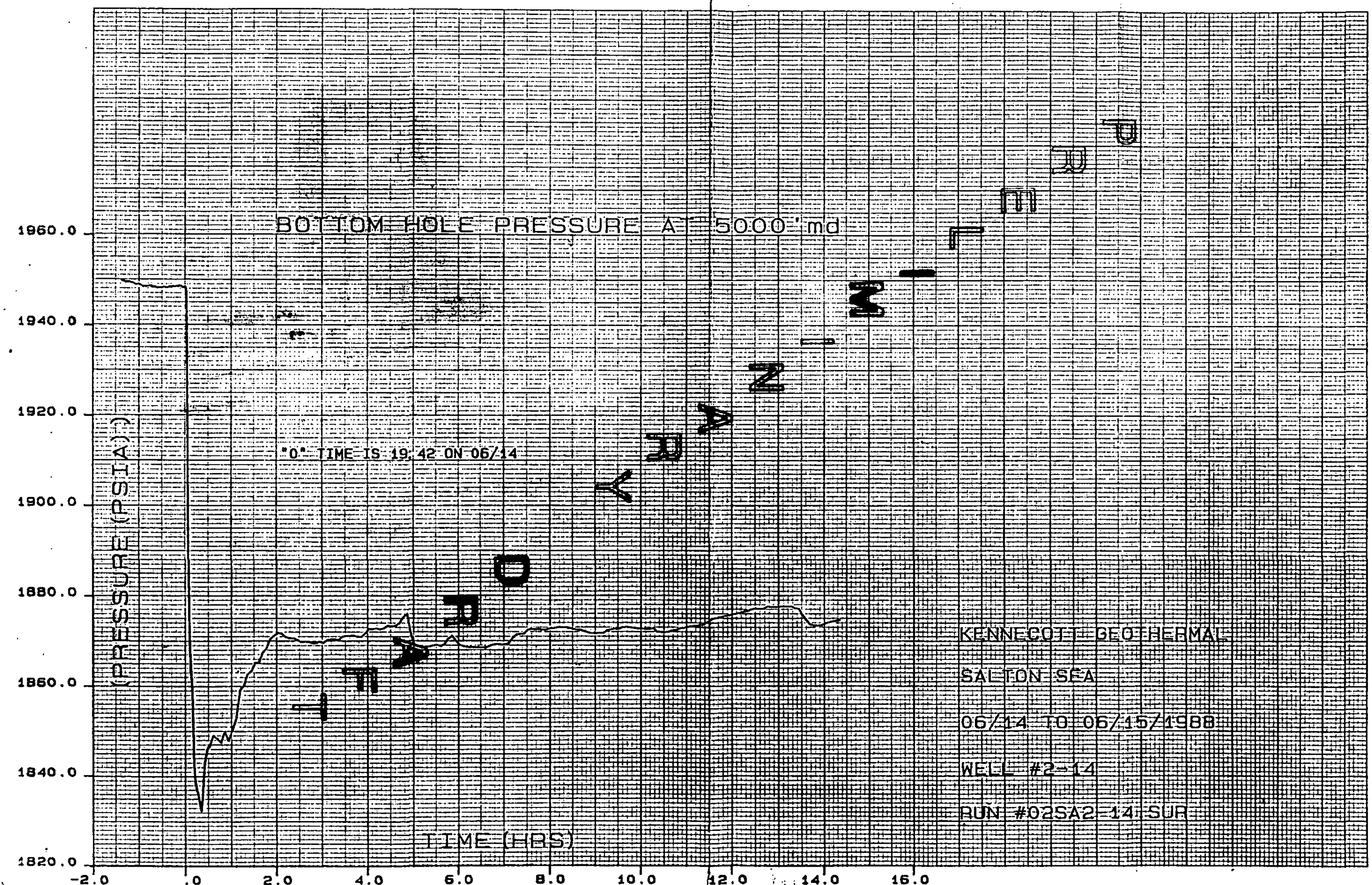
TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
21:12:24	1865.39	-82.64	1.5033	01:27:24	1870.70	-77.33	5.7533
21:17:24	1865.49	-82.54	1.5866	01:32:24	1871.32	-76.71	5.8366
21:22:24	1867.61	-80.42	1.6700	01:37:24	1870.32	-77.71	5.9200
21:27:24	1868.65	-79.38	1.7533	01:42:24	1869.33	-78.70	6.0033
21:32:24	1870.69	-77.34	1.8366	01:47:24	1869.02	-79.01	6.0866
21:37:24	1871.42	-76.61	1.9200	01:52:24	1868.80	-79.23	6.1700
21:42:24	1872.03	-76.00	2.0033	01:57:24	1868.76	-79.27	6.2533
21:47:24	1871.91	-76.12	2.0866	02:02:24	1868.78	-79.25	6.3366
21:52:24	1871.17	-76.86	2.1700	02:07:24	1868.70	-79.33	6.4200
21:57:24	1870.85	-77.18	2.2533	02:12:24	1868.68	-79.35	6.5033
22:02:24	1870.85	-77.18	2.3366	02:17:24	1868.66	-79.37	6.5866
22:07:24	1870.51	-77.52	2.4200	02:22:24	1869.04	-78.99	6.6700
22:12:24	1870.02	-78.01	2.5033	02:27:24	1869.36	-78.67	6.7533
22:17:24	1870.10	-77.93	2.5866	02:32:24	1869.49	-78.54	6.8366
22:22:24	1870.13	-77.90	2.6700	02:37:24	1869.39	-78.64	6.9200
22:27:24	1869.77	-78.26	2.7533	02:42:24	1869.40	-78.63	7.0033
22:32:24	1869.73	-78.30	2.8366	02:47:24	1869.60	-78.43	7.0866
22:37:24	1870.09	-77.94	2.9200	02:52:24	1870.83	-77.20	7.1700
22:42:24	1869.80	-78.23	3.0033	02:57:24	1871.59	-76.44	7.2533
22:47:24	1870.48	-77.55	3.0866	03:02:24	1871.74	-76.29	7.3366
22:52:24	1870.59	-77.44	3.1700	03:07:24	1871.77	-76.26	7.4200
22:57:24	1870.58	-77.45	3.2533	03:12:24	1872.68	-75.35	7.5033
23:02:24	1870.42	-77.61	3.3366	03:17:24	1872.83	-75.20	7.5866
23:07:24	1871.20	-76.83	3.4200	03:22:24	1872.73	-75.30	7.6700
23:12:24	1871.41	-76.62	3.5033	03:27:24	1872.75	-75.28	7.7533
23:17:24	1871.36	-76.57	3.5866	03:32:24	1872.62	-75.41	7.8366
23:22:24	1871.46	-76.57	3.6700	03:37:24	1872.74	-75.29	7.9200
23:27:24	1871.16	-76.87	3.7533	03:42:24	1873.04	-74.99	8.0033
23:32:24	1871.18	-76.85	3.8366	03:47:24	1873.09	-74.94	8.0866
23:37:24	1871.90	-76.13	3.9200	03:52:24	1873.24	-74.79	8.1700
23:42:24	1872.92	-75.11	4.0033	03:57:24	1873.27	-74.76	8.2533
23:47:24	1872.86	-75.17	4.0866	04:02:24	1873.20	-74.83	8.3366
23:52:24	1873.02	-75.01	4.1700	04:07:24	1873.00	-75.03	8.4200
23:57:24	1872.83	-75.20	4.2533	04:12:24	1872.79	-75.24	8.5033
06-15-1988				04:17:24	1872.64	-75.39	8.5866
00:02:24	1873.03	-75.00	4.3366	04:22:24	1872.56	-75.47	8.6700
00:07:24	1873.69	-74.34	4.4200	04:27:24	1872.31	-75.72	8.7533
00:12:24	1873.53	-74.50	4.5033	04:32:24	1872.00	-76.03	8.8366
00:17:24	1873.64	-74.39	4.5866	04:37:24	1871.86	-76.17	8.9200
00:22:24	1874.22	-73.81	4.6700	04:42:24	1871.85	-76.18	9.0033
00:27:24	1875.53	-72.50	4.7533	04:47:24	1871.95	-76.08	9.0866
00:32:24	1876.28	-71.75	4.8366	04:52:24	1871.91	-76.12	9.1700
00:37:24	1872.05	-75.98	4.9200	04:57:24	1872.55	-75.48	9.2533
00:42:24	1869.19	-78.84	5.0033	05:02:24	1872.71	-75.32	9.3366
00:47:24	1869.09	-78.94	5.0866	05:07:24	1872.89	-75.14	9.4200
00:52:24	1868.66	-79.37	5.1700	05:12:24	1872.86	-75.17	9.5033
00:57:24	1868.92	-79.11	5.2533	05:17:24	1873.20	-74.83	9.5866
01:02:24	1868.99	-79.04	5.3366	05:22:24	1873.30	-74.73	9.6700
01:07:24	1869.21	-78.82	5.4200	05:27:24	1873.16	-74.87	9.7533
01:12:24	1869.34	-78.69	5.5033	05:32:24	1873.03	-75.00	9.8366
01:17:24	1869.07	-78.96	5.5866	05:37:24	1872.92	-75.11	9.9200
01:22:24	1869.48	-78.55	5.6700	05:42:24	1872.92	-75.11	10.0033

PRELIMINARY DRAFT

SURVEY DATA

COMPANY KENNECOTT RUN 02 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
05:47:24	1872.75	-75.28	10.0866	07:57:24	1876.72	-71.31	12.2533
05:52:24	1872.82	-75.21	10.1700	08:02:24	1876.88	-71.15	12.3366
05:57:24	1873.00	-75.03	10.2533	08:07:24	1877.30	-70.73	12.4200
06:02:24	1872.23	-75.80	10.3366	08:12:24	1877.37	-70.65	12.5033
06:07:24	1872.12	-75.91	10.4200	08:17:24	1877.36	-70.67	12.5866
06:12:24	1872.07	-75.96	10.5033	08:22:24	1877.36	-70.67	12.6700
06:17:24	1872.22	-75.81	10.5866	08:27:24	1877.89	-70.14	12.7533
06:22:24	1872.48	-75.55	10.6700	08:32:24	1877.71	-70.32	12.8366
06:27:24	1872.66	-75.37	10.7533	08:37:24	1877.73	-70.30	12.9200
06:32:24	1872.95	-75.08	10.8366	08:42:24	1877.80	-70.23	13.0033
06:37:24	1873.09	-74.94	10.9200	08:47:24	1877.93	-70.10	13.0866
06:42:24	1873.28	-74.73	11.0033	08:52:24	1877.88	-70.15	13.1700
06:47:24	1873.50	-74.53	11.0866	08:57:24	1877.88	-70.15	13.2533
06:52:24	1873.55	-74.48	11.1700	09:02:24	1877.46	-70.57	13.3366
06:57:24	1873.67	-74.36	11.2533	09:07:24	1877.35	-70.68	13.4200
07:02:24	1873.82	-74.21	11.3366	09:12:24	1876.02	-72.01	13.5033
07:07:24	1874.27	-73.76	11.4200	09:17:24	1874.88	-73.15	13.5866
07:12:24	1874.76	-73.27	11.5033	09:22:24	1873.91	-74.12	13.6700
07:17:24	1875.17	-72.86	11.5866	09:27:24	1873.61	-74.42	13.7533
07:22:24	1875.30	-72.73	11.6700	09:32:24	1873.63	-74.40	13.8366
07:27:24	1875.50	-72.53	11.7533	09:37:24	1873.69	-74.34	13.9200
07:32:24	1875.76	-72.27	11.8366	09:42:24	1874.07	-73.96	14.0033
07:37:24	1875.86	-72.17	11.9200	09:47:24	1874.36	-73.67	14.0866
07:42:24	1876.17	-71.86	12.0033	09:52:24	1874.56	-73.47	14.1700
07:47:24	1876.27	-71.76	12.0866	09:57:24	1874.74	-73.29	14.2533
07:52:24	1876.44	-71.59	12.1700	10:01:30	1874.84	-73.19	14.3216


BOTTOM HOLE PRESSURE AT 5000'md
PRELIMINARY DRAFT
"0" TIME IS 19:42 ON 06/14
(PRESSURE (PSIA))
TIME (HRS)
1960.0
1940.0
1920.0
1900.0
1880.0
1860.0
1840.0
1820.0
-2.0
.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
KENNECOTT GEOTHERMAL
SALTON SEA
06/14 TO 06/15/1988
WELL #2-14
RUN #02SA2-14-SUR

PRUETT INDUSTRIES INC.
8915 ROSEDALE HWY. BAKERSFIELD. CA. 93312
(805) 589-2768

COMPANY : KENNECOTT GEOTHERMAL
FIELD : SALTON SEA
WELL NUMBER : 2-14
RUN NUMBER : ~~34~~ 03
NUMBER OF READINGS : 602
PRESSURE READINGS ARE TAKEN IN PSIA
TIME IS MEASURED IN HOURS

START : 06/20/1988 17:06:37
END : 06/22/1988 14:28:57
FILENAME : 34SA2-14.DAT

PRELIMINARY DRAFT

SURVEY DATA

COMPANY KENNECOTT RUN 34 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
06-20-1988				17:44:46	1965.35	-.57	-.2794
17:06:37	1965.77	-.15	-.9153	17:45:53	1965.41	-.51	-.2608
17:08:37	1965.52	-.40	-.8819	17:46:03	1965.41	-.51	-.2580
17:10:37	1965.42	-.50	-.8486	17:46:46	1965.56	-.36	-.2461
17:12:37	1965.66	-.26	-.8153	17:46:56	1965.60	-.32	-.2433
17:14:37	1965.45	-.47	-.7819	17:47:01	1965.74	-.18	-.2419
17:16:37	1965.49	-.43	-.7486	17:47:06	1965.80	-.12	-.2405
17:18:37	1965.91	-.01	-.7153	17:47:23	1965.81	-.11	-.2358
17:20:37	1965.65	-.27	-.6819	17:47:52	1965.77	-.15	-.2278
17:22:37	1965.47	-.45	-.6486	17:48:01	1965.68	-.24	-.2253
17:24:37	1965.29	-.63	-.6153	17:48:10	1965.71	-.21	-.2228
17:26:37	1965.46	-.46	-.5819	17:48:20	1965.63	-.29	-.2200
17:28:37	1965.40	-.52	-.5486	17:48:30	1965.61	-.31	-.2172
17:30:37	1965.55	-.37	-.5153	17:48:40	1965.55	-.37	-.2144
17:32:37	1965.54	-.38	-.4819	17:48:50	1965.58	-.34	-.2117
17:34:37	1965.29	-.63	-.4486	17:49:00	1965.58	-.34	-.2089
17:36:37	1965.38	-.54	-.4153	17:49:10	1965.59	-.33	-.2061
17:38:37	1965.46	-.46	-.3819	17:49:20	1965.60	-.32	-.2033
17:40:37	1966.11	.19	-.3486	17:49:30	1965.57	-.35	-.2005
17:42:37	1965.44	-.48	-.3153	17:49:40	1965.62	-.30	-.1978
17:43:01	1965.46	-.46	-.3086	17:49:50	1965.57	-.35	-.1950
17:43:06	1965.48	-.44	-.3072	17:50:00	1965.55	-.37	-.1922
17:43:11	1965.50	-.42	-.3058	17:50:10	1965.49	-.43	-.1894
17:43:16	1965.48	-.44	-.3044	17:50:20	1965.48	-.44	-.1867
17:43:21	1965.42	-.50	-.3030	17:50:30	1965.57	-.35	-.1839
17:43:26	1965.42	-.50	-.3017	17:50:40	1965.52	-.40	-.1811
17:43:31	1965.47	-.45	-.3003	17:50:50	1965.61	-.31	-.1783
17:43:36	1965.43	-.49	-.2989	17:51:00	1965.60	-.32	-.1755
17:43:41	1965.49	-.43	-.2975	17:51:10	1965.66	-.26	-.1728
17:43:46	1965.54	-.38	-.2961	17:51:20	1965.63	-.29	-.1700
17:43:51	1965.53	-.39	-.2947	17:51:30	1965.64	-.28	-.1672
17:43:56	1965.56	-.36	-.2933	17:51:40	1965.67	-.25	-.1644
17:44:01	1965.65	-.27	-.2919	17:51:51	1965.69	-.23	-.1614
17:44:06	1965.63	-.29	-.2905	17:52:01	1965.66	-.26	-.1586
17:44:11	1965.58	-.34	-.2892	17:52:11	1965.54	-.38	-.1558
17:44:16	1965.51	-.41	-.2878	17:52:21	1965.44	-.48	-.1530
17:44:21	1965.42	-.50	-.2864	17:52:31	1965.43	-.49	-.1503
17:44:26	1965.39	-.53	-.2850	17:52:41	1965.42	-.50	-.1475
17:44:31	1965.39	-.53	-.2836	17:52:51	1965.44	-.48	-.1447
17:44:36	1965.36	-.56	-.2822	17:53:01	1965.38	-.54	-.1419

SURVEY DATA

COMPANY KENNECOTT RUN 34 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
17:53:11	1965.52	-.40	-.1392	18:01:52	1966.11	.19	.0056
17:53:21	1965.50	-.42	-.1364	18:02:02	1966.29	.37	.0083
17:53:31	1965.46	-.46	-.1336	18:02:12	1966.67	.75	.0111
17:53:41	1965.43	-.49	-.1308	18:02:22	1967.16	1.24	.0139
17:53:51	1965.45	-.47	-.1280	18:02:32	1967.77	1.85	.0167
17:54:01	1965.47	-.45	-.1253	18:02:44	1968.56	2.64	.0200
17:54:11	1965.45	-.47	-.1225	18:02:55	1970.04	4.12	.0231
17:54:21	1965.46	-.46	-.1197	18:03:04	1971.75	5.83	.0256
17:54:31	1965.42	-.50	-.1169	18:03:14	1974.15	8.23	.0283
17:54:41	1965.46	-.46	-.1142	18:03:23	1977.42	11.50	.0308
17:54:51	1965.51	-.41	-.1114	18:03:32	1981.30	15.38	.0333
17:55:01	1965.56	-.36	-.1086	18:03:41	1985.73	19.81	.0358
17:55:11	1965.60	-.32	-.1058	18:03:51	1990.88	24.96	.0386
17:55:21	1965.60	-.32	-.1030	18:04:00	1996.33	30.41	.0411
17:55:31	1965.55	-.37	-.1003	18:04:09	2002.39	36.47	.0436
17:55:41	1965.45	-.47	-.0975	18:04:19	2008.61	42.69	.0464
17:55:51	1965.49	-.43	-.0947	18:04:28	2015.10	49.18	.0489
17:56:01	1965.44	-.48	-.0919	18:04:37	2021.61	55.69	.0514
17:56:11	1965.45	-.47	-.0892	18:04:47	2028.51	62.59	.0542
17:56:22	1965.45	-.47	-.0861	18:04:56	2035.26	69.34	.0567
17:56:32	1965.52	-.40	-.0833	18:05:05	2041.75	75.83	.0592
17:56:42	1965.54	-.38	-.0805	18:05:15	2047.96	82.04	.0620
17:56:52	1965.50	-.42	-.0778	18:05:24	2053.87	87.95	.0642
17:57:02	1965.45	-.47	-.0750	18:05:33	2059.59	93.67	.0670
17:57:12	1965.40	-.52	-.0722	18:05:43	2065.05	99.13	.0697
17:57:22	1965.35	-.57	-.0694	18:05:52	2070.25	104.33	.0722
17:57:32	1965.39	-.53	-.0667	18:06:01	2075.09	109.17	.0747
17:57:42	1965.47	-.45	-.0639	18:06:10	2079.68	113.76	.0772
17:57:52	1965.56	-.36	-.0611	18:06:20	2083.95	118.03	.0800
17:58:02	1965.48	-.44	-.0583	18:06:29	2087.84	121.92	.0825
17:58:12	1965.48	-.44	-.0555	18:06:38	2091.31	125.39	.0850
17:58:22	1965.43	-.49	-.0528	18:06:48	2094.55	128.63	.0878
17:58:32	1965.49	-.43	-.0500	18:06:57	2097.47	131.55	.0903
17:58:42	1965.48	-.44	-.0472	18:07:06	2100.16	134.24	.0928
17:58:52	1965.54	-.38	-.0444	18:07:16	2102.77	136.85	.0956
17:59:02	1965.56	-.36	-.0417	18:07:25	2104.99	139.07	.0981
17:59:12	1965.58	-.34	-.0389	18:07:34	2107.03	141.11	.1006
17:59:22	1965.47	-.45	-.0361	18:07:44	2108.93	143.01	.1033
17:59:32	1965.46	-.46	-.0333	18:07:53	2110.61	144.69	.1058
17:59:42	1965.40	-.52	-.0305	18:08:02	2112.09	146.17	.1083
17:59:52	1965.44	-.48	-.0278	18:08:11	2113.46	147.54	.1108
18:00:02	1965.49	-.43	-.0250	18:08:21	2114.68	148.76	.1136
18:00:12	1965.49	-.43	-.0222	18:08:30	2115.77	149.85	.1161
18:00:22	1965.50	-.42	-.0194	18:08:39	2116.71	150.79	.1186
18:00:32	1965.63	-.29	-.0167	18:08:48	2117.53	151.61	.1211
18:00:42	1965.65	-.27	-.0139	18:08:58	2118.19	152.27	.1239
18:00:52	1965.71	-.21	-.0111	18:09:07	2118.74	152.82	.1264
18:01:02	1965.72	-.20	-.0083	18:09:16	2119.32	153.40	.1289
18:01:12	1965.76	-.16	-.0055	18:09:25	2119.85	153.93	.1314
18:01:22	1965.76	-.16	-.0028	18:09:35	2120.37	154.45	.1342
18:01:32	1965.92	.00	.0000	18:09:44	2120.79	154.87	.1367
18:01:42	1966.04	.12	.0028	18:09:54	2121.14	155.22	.1395

SURVEY DATA

COMPANY KENNECOTT RUN 34 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
18:10:03	2121.50	155.58	.1420	18:18:06	2126.74	160.82	.2757
18:10:12	2121.65	155.93	.1445	18:18:17	2126.75	160.83	.2792
18:10:21	2122.15	156.23	.1470	18:18:26	2126.76	160.84	.2817
18:10:31	2122.43	156.51	.1497	18:18:48	2126.64	160.72	.2878
18:10:40	2122.72	156.80	.1522	18:19:48	2126.91	160.99	.3045
18:10:49	2122.99	157.07	.1547	18:20:48	2127.25	161.33	.3211
18:10:58	2123.21	157.29	.1572	18:21:48	2127.36	161.44	.3378
18:11:08	2123.[illegible]	157.42	.1600	18:22:48	2127.36	161.45	.3545
18:11:17	2123.46	157.54	.1625	18:23:48	2127.57	161.65	.3711
18:11:26	2123.63	157.71	.1650	18:24:48	2127.63	161.71	.3878
18:11:36	2123.80	157.88	.1678	18:25:48	2127.60	161.68	.4045
18:11:45	2123.93	158.01	.1703	18:26:48	2127.76	161.84	.4211
18:11:54	2124.07	158.15	.1728	18:27:48	2127.75	161.83	.4378
18:12:04	2124.19	158.[illegible]7	.1755	18:28:48	2127.88	161.93	.4545
18:12:13	2124.36	158.[illegible]4	.1781	18:29:48	2128.07	162.15	.4711
18:12:22	2124.53	158.[illegible]	.1806	18:30:48	2128.16	162.24	.4878
18:12:31	2124.65	158.7[illegible]	.1831	18:31:48	2128.20	162.28	.5045
18:12:41	2124.79	158.87	.1858	18:32:48	2128.17	162.25	.5211
18:12:50	2124.92	159.00	.1883	18:33:48	2128.33	162.41	.5378
18:12:59	2125.07	159.15	.1908	18:34:48	2128.29	162.37	.5545
18:13:08	2125.14	159.22	.1933	18:35:48	2128.47	162.55	.5711
18:13:18	2125.17	159.25	.1961	18:36:48	2128.50	162.58	.5878
18:13:27	2125.19	159.27	.1[illegible]6	18:37:48	2128.59	162.67	.6045
18:13:36	2125.21	159.29	.2011	18:38:48	2128.54	162.62	.6211
18:13:46	2125.24	159.32	.203[illegible]	18:39:48	2128.77	162.85	.6378
18:13:55	2125.32	159.40	.20[illegible]	18:40:48	2128.77	162.85	.6545
18:14:04	2125.38	159.46	.2089	18:41:48	2128.73	162.81	.6711
18:14:13	2125.47	159.55	.2114	18:42:48	2128.71	162.79	.6878
18:14:23	2125.55	159.63	.2142	18:43:48	2128.58	162.66	.7045
18:14:32	2125.59	159.67	.2167	18:44:48	2128.42	162.50	.7211
18:14:42	2125.70	159.78	.2195	18:45:48	2128.32	162.40	.7378
18:14:51	2125.74	159.82	.2220	18:46:48	2128.34	162.42	.7545
18:15:00	2125.82	159.90	.2245	18:47:48	2128.28	162.36	.7711
18:15:09	2125.90	159.98	.2270	18:48:48	2128.25	162.33	.7878
18:15:20	2125.98	160.06	.2300	18:49:48	2128.29	162.37	.8045
18:15:29	2126.06	160.14	.2325	18:50:48	2128.36	162.44	.8211
18:15:38	2126.17	160.25	.2350	18:51:48	2128.45	162.53	.8378
18:15:47	2126.28	160.36	.2375	18:52:48	2128.[illegible]8	162.56	.8545
18:15:57	2126.36	160.44	.2403	18:53:48	2128.48	162.56	.8711
18:16:06	2126.39	160.47	.2428	18:54:48	2128.5[illegible]	162.59	.8878
18:16:15	2126.35	160.43	.2453	18:55:48	2128.54	162.62	.9045
18:16:24	2126.33	160.41	.2478	18:56:48	2128.58	162.66	.9211
18:16:34	2126.28	160.36	.2506	18:57:48	2128.58	162.66	.9378
18:16:43	2126.27	160.35	.2531	18:58:48	2128.63	162.71	.9545
18:16:52	2126.29	160.37	.2556	18:59:48	2128.68	162.76	.9711
18:17:02	2126.35	160.43	.2583	19:00:48	2128.75	162.83	.9878
18:17:11	2126.34	160.42	.2608	19:01:48	2128.72	162.80	1.0045
18:17:20	2126.40	160.48	.2633	19:02:48	2128.75	162.83	1.0211
18:17:30	2126.49	160.57	.2661	19:03:48	2128.82	162.90	1.0378
18:17:39	2126.58	160.66	.2686	19:04:48	2128.89	162.97	1.0545
18:17:48	2126.65	160.73	.2711	19:05:48	2128.89	162.97	1.0711
18:17:57	2126.70	160.78	.2736	19:06:48	2129.03	163.11	1.0878

SURVEY DATA

COMPANY KENNECOTT RUN 34 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
19:07:48	2128.89	162.97	1.1045	21:59:16	2127.43	161.51	3.9622
19:08:48	2128.87	162.95	1.1211	22:04:16	2127.51	161.59	4.0456
19:09:48	2128.88	162.96	1.1378	22:09:16	2127.41	161.49	4.1289
19:10:48	2128.82	162.90	1.1545	22:14:16	2127.33	161.41	4.2122
19:11:48	2128.88	162.96	1.1711	22:19:16	2127.32	161.40	4.2956
19:12:48	2128.90	162.98	1.1878	22:24:16	2127.19	161.27	4.3789
19:13:48	2128.90	162.98	1.2045	22:29:16	2127.12	161.20	4.4622
19:14:48	2128.87	162.95	1.2211	22:34:16	2127.24	161.32	4.5456
19:15:48	2128.87	162.95	1.2378	22:39:16	2127.21	161.29	4.6289
19:16:48	2128.79	162.87	1.2545	22:44:16	2127.09	161.17	4.7122
19:17:48	2128.79	162.87	1.2711	22:49:16	2127.01	161.09	4.7956
19:18:48	2128.83	162.91	1.2878	22:54:16	2126.94	161.02	4.8789
19:19:48	2128.80	162.88	1.3045	22:59:16	2126.94	161.02	4.9622
19:20:48	2128.86	162.94	1.3211	23:04:16	2126.97	161.05	5.0456
19:21:48	2128.96	163.04	1.3378	23:09:16	2127.01	161.09	5.1289
19:22:48	2128.93	163.01	1.3545	23:14:16	2127.02	161.10	5.2122
19:23:48	2128.94	163.02	1.3711	23:19:16	2127.07	161.15	5.2956
19:24:48	2128.96	163.04	1.3878	23:24:16	2126.87	160.95	5.3789
19:25:48	2128.96	163.04	1.4045	23:29:16	2127.00	161.08	5.4622
19:26:48	2128.95	163.03	1.4211	23:34:16	2126.98	161.06	5.5456
19:27:48	2129.01	163.09	1.4378	23:39:16	2126.92	161.00	5.6289
19:28:48	2128.91	162.99	1.4545	23:44:16	2126.88	160.96	5.7122
19:29:16	2128.91	162.99	1.4622	23:49:16	2126.84	160.92	5.7956
19:34:16	2128.88	162.96	1.5456	23:54:16	2126.79	160.87	5.8789
19:39:16	2128.85	162.93	1.6289	23:59:16	2126.76	160.84	5.9622
19:44:16	2128.83	162.91	1.7122	06-21-1988			
19:49:16	2128.61	162.89	1.7956	00:04:16	2126.71	160.79	6.0456
19:54:16	2128.58	162.66	1.8789	00:09:16	2126.68	160.76	6.1289
19:59:16	2128.70	162.78	1.9622	00:14:16	2126.65	160.73	6.2122
20:04:16	2128.57	162.65	2.0456	00:19:16	2126.61	160.69	6.2956
20:09:16	2128.55	162.63	2.1289	00:24:16	2126.55	160.63	6.3789
20:14:16	2128.52	162.60	2.2122	00:29:16	2126.50	160.58	6.4622
20:19:16	2128.43	162.51	2.2956	00:34:16	2126.46	160.55	6.5456
20:24:16	2128.42	162.50	2.3789	00:39:16	2126.45	160.53	6.6289
20:29:16	2128.34	162.42	2.4622	00:44:16	2126.45	160.53	6.7122
20:34:16	2128.28	162.36	2.5456	00:49:16	2126.42	160.50	6.7956
20:39:16	2128.30	162.38	2.6289	00:54:16	2126.42	160.50	6.8789
20:44:16	2128.18	162.26	2.7122	00:59:16	2126.40	160.48	6.9622
20:49:16	2128.15	162.23	2.7956	01:04:16	2126.39	160.47	7.0456
20:54:16	2128.04	162.12	2.8789	01:09:16	2126.37	160.45	7.1289
20:59:16	2128.08	162.16	2.9622	01:14:16	2126.35	160.43	7.2122
21:04:16	2128.01	162.09	3.0456	01:19:16	2126.35	160.43	7.2956
21:09:16	2127.97	162.05	3.1289	01:24:16	2126.32	160.40	7.3789
21:14:16	2127.91	161.99	3.2122	01:29:16	2126.30	160.38	7.4622
21:19:16	2127.88	161.96	3.2956	01:34:16	2126.28	160.36	7.5456
21:24:16	2127.79	161.87	3.3789	01:39:16	2126.26	160.34	7.6289
21:29:16	2127.80	161.88	3.4622	01:44:16	2126.25	160.33	7.7122
21:34:16	2127.78	161.86	3.5456	01:49:16	2126.23	160.31	7.7956
21:39:16	2127.80	161.88	3.6289	01:54:16	2126.20	160.28	7.8789
21:44:16	2127.68	161.76	3.7122	01:59:16	2126.18	160.26	7.9622
21:49:16	2127.55	161.63	3.7956	02:04:16	2126.15	160.23	8.0456
21:54:16	2127.50	161.58	3.8789	02:09:16	2126.13	160.21	8.1289

SURVEY DATA

COMPANY KENNECOTT RUN 34 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
02:14:16	2126.11	160.19	8.2122	06:34:16	2125.03	159.11	12.5456
02:19:16	2126.09	160.17	8.2956	06:39:16	2125.00	159.08	12.6289
02:24:16	2126.07	160.15	8.3789	06:44:16	2124.99	159.07	12.7122
02:29:16	2126.06	160.14	8.4622	06:49:16	2125.07	159.15	12.7956
02:34:16	2126.03	160.11	8.5456	06:54:16	2125.07	159.15	12.8789
02:39:16	2126.01	160.09	8.6289	06:59:16	2125.13	159.21	12.9622
02:44:16	2125.99	160.07	8.7122	07:04:16	2125.15	159.23	13.0456
02:49:16	2125.96	160.04	8.7956	07:09:16	2125.12	159.20	13.1289
02:54:16	2125.93	160.01	8.8789	07:14:16	2125.14	159.22	13.2122
02:59:16	2125.93	160.01	8.9622	07:19:16	2125.14	159.22	13.2956
03:04:16	2125.88	159.96	9.0456	07:24:16	2125.17	159.25	13.3789
03:09:16	2125.87	159.95	9.1289	07:29:16	2125.17	159.25	13.4622
03:14:16	2125.85	159.93	9.2122	07:34:16	2125.18	159.26	13.5456
03:19:16	2125.83	159.91	9.2956	07:39:16	2125.17	159.25	13.6289
03:24:16	2125.80	159.88	9.3789	07:44:16	2125.20	159.28	13.7122
03:29:16	2125.81	159.89	9.4622	07:49:16	2125.17	159.25	13.7956
03:34:16	2125.78	159.86	9.5456	07:54:16	2125.30	159.38	13.8789
03:39:16	2125.77	159.85	9.6289	07:59:16	2125.17	159.25	13.9622
03:44:16	2125.74	159.82	9.7122	08:04:16	2125.17	159.25	14.0456
03:49:16	2125.72	159.80	9.7956	08:09:16	2125.18	159.26	14.1289
03:54:16	2125.64	159.72	9.8789	08:14:16	2125.00	159.08	14.2122
03:59:16	2125.68	159.76	9.9622	08:19:16	2125.23	159.31	14.2956
04:04:16	2125.65	159.73	10.0456	08:24:16	2125.17	159.25	14.3789
04:09:16	2125.62	159.70	10.1289	08:29:16	2125.16	159.24	14.4622
04:14:16	2125.61	159.69	10.2122	08:34:16	2125.06	159.14	14.5456
04:19:16	2125.15	159.23	10.2956	08:39:16	2125.22	159.30	14.6289
04:24:16	2125.63	159.71	10.3789	08:44:16	2125.12	159.20	14.7122
04:29:16	2125.40	159.48	10.4622	08:49:16	2125.08	159.16	14.7956
04:34:16	2125.36	159.44	10.5456	08:54:16	2125.00	159.08	14.8789
04:39:16	2125.38	159.46	10.6289	08:59:16	2125.10	159.18	14.9622
04:44:16	2125.37	159.45	10.7122	09:04:16	2125.06	159.14	15.0456
04:49:16	2125.35	159.43	10.7956	09:09:16	2125.09	159.17	15.1289
04:54:16	2125.32	159.40	10.8789	09:14:16	2125.09	159.17	15.2122
04:59:16	2125.33	159.41	10.9622	09:19:16	2125.08	159.16	15.2956
05:04:16	2125.29	159.37	11.0456	09:24:16	2124.97	159.05	15.3789
05:09:16	2125.27	159.35	11.1289	09:29:16	2124.86	158.94	15.4622
05:14:16	2125.29	159.37	11.2122	09:34:16	2124.91	158.99	15.5456
05:19:16	2125.23	159.31	11.2956	09:47:00	2125.77	159.85	15.7578
05:24:16	2125.21	159.29	11.3789	09:47:43	2125.72	159.80	15.7697
05:29:16	2125.27	159.35	11.4622	10:02:43	2125.96	160.04	16.0197
05:34:16	2125.27	159.35	11.5456	10:17:43	2125.59	159.67	16.2697
05:39:16	2125.26	159.34	11.6289	10:32:43	2125.50	159.58	16.5197
05:44:16	2125.23	159.31	11.7122	10:47:43	2125.45	159.53	16.7697
05:49:16	2125.25	159.33	11.7956	10:57:11	2125.79	159.87	16.9275
05:54:16	2125.27	159.35	11.8789	10:57:16	2125.75	159.83	16.9289
05:59:16	2125.25	159.33	11.9622	10:57:21	2125.75	159.83	16.9303
06:04:16	2125.18	159.26	12.0456	10:57:26	2125.76	159.84	16.9317
06:09:16	2125.23	159.31	12.1289	10:57:42	2125.85	159.93	16.9361
06:14:16	2125.17	159.25	12.2122	11:12:42	2125.68	159.76	17.1861
06:19:16	2125.18	159.26	12.2956	11:27:42	2125.62	159.70	17.4361
06:24:16	2125.14	159.22	12.3789	11:42:42	2125.66	159.74	17.6861
06:29:16	2125.01	159.09	12.4622	11:57:42	2125.75	159.83	17.9361

SURVEY DATA

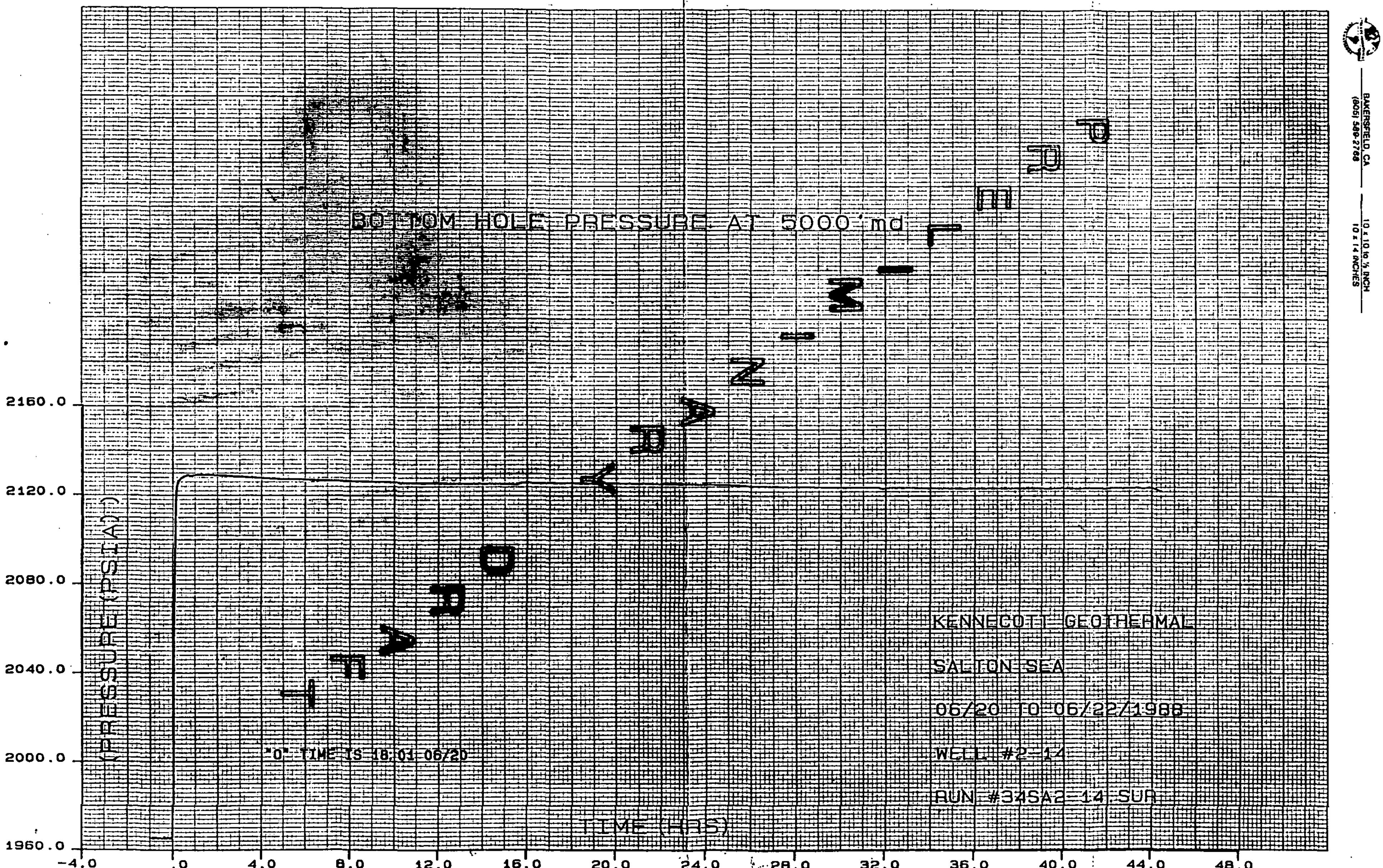
COMPANY KENNECOTT RUN 34 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
12:12:42	2125.61	159.69	18.1861	00:57:42	2123.78	157.86	30.9361
12:27:42	2125.34	159.42	18.4361	01:12:42	2123.76	157.84	31.1861
12:42:42	2125.47	159.55	18.6861	01:27:42	2123.79	157.87	31.4361
12:57:42	2125.45	159.53	18.9361	01:42:42	2123.74	157.82	31.6861
13:12:42	2125.46	159.54	19.1861	01:57:42	2123.21	157.29	31.9361
13:27:42	2125.66	159.74	19.4361	02:12:42	2123.77	157.85	32.1861
13:42:42	2125.67	159.75	19.6861	02:27:42	2123.75	157.83	32.4361
13:57:42	2125.50	159.58	19.9361	02:42:42	2123.70	157.78	32.6861
14:12:42	2125.48	159.56	20.1861	02:57:42	2123.67	157.75	32.9361
14:27:42	2125.47	159.55	20.4361	03:12:42	2123.69	157.77	33.1861
14:42:42	2125.43	159.51	20.6861	03:27:42	2123.62	157.70	33.4361
14:57:42	2125.23	159.31	20.9361	03:42:42	2123.56	157.64	33.6861
15:12:42	2125.46	159.54	21.1861	03:57:42	2123.53	157.61	33.9361
15:27:42	2125.36	159.44	21.4361	04:12:42	2123.52	157.60	34.1861
15:42:42	2125.19	159.27	21.6861	04:27:42	2123.46	157.54	34.4361
15:57:42	2125.12	159.20	21.9361	04:42:42	2123.46	157.54	34.6861
16:12:42	2125.23	159.31	22.1861	04:57:42	2123.45	157.53	34.9361
16:27:42	2125.10	159.18	22.4361	05:12:42	2123.44	157.52	35.1861
16:42:42	2125.12	159.20	22.6861	05:27:42	2123.41	157.49	35.4361
16:57:42	2124.91	158.99	22.9361	05:42:42	2123.41	157.49	35.6861
17:12:42	2125.04	159.12	23.1861	05:57:42	2123.43	157.51	35.9361
17:27:42	2125.00	159.08	23.4361	06:12:42	2123.43	157.51	36.1861
17:42:42	2124.90	158.98	23.6861	06:27:42	2123.44	157.52	36.4361
17:57:42	2125.08	159.16	23.9361	06:42:42	2123.49	157.57	36.6861
18:12:42	2124.99	159.07	24.1861	06:57:42	2123.49	157.57	36.9361
18:27:42	2124.84	158.92	24.4361	07:12:42	2123.45	157.53	37.1861
18:42:42	2124.77	158.85	24.6861	07:27:42	2123.41	157.49	37.4361
18:57:42	2124.82	158.90	24.9361	07:42:42	2123.43	157.51	37.6861
19:12:42	2124.62	158.70	25.1861	07:57:42	2123.44	157.52	37.9361
19:27:42	2124.66	158.74	25.4361	08:12:42	2123.46	157.54	38.1861
19:42:42	2124.39	158.47	25.6861	08:27:42	2123.43	157.51	38.4361
19:57:42	2124.31	158.39	25.9361	08:42:42	2123.44	157.52	38.6861
20:12:42	2124.28	158.36	26.1861	08:57:42	2123.47	157.55	38.9361
20:27:42	2124.27	158.35	26.4361	09:12:42	2123.45	157.53	39.1861
20:42:42	2124.22	158.30	26.6861	09:27:42	2123.32	157.40	39.4361
20:57:42	2124.12	158.20	26.9361	09:42:42	2123.50	157.58	39.6861
21:12:42	2124.06	158.14	27.1861	09:57:42	2123.70	157.78	39.9361
21:27:42	2124.00	158.08	27.4361	10:12:42	2123.41	157.49	40.1861
21:42:42	2124.00	158.08	27.6861	10:27:42	2123.44	157.52	40.4361
21:57:42	2123.95	158.03	27.9361	10:42:42	2123.42	157.50	40.6861
22:12:42	2123.98	158.06	28.1861	10:57:42	2123.65	157.73	40.9361
22:27:42	2124.08	158.16	28.4361	11:12:42	2123.74	157.82	41.1861
22:42:42	2123.94	158.02	28.6861	11:27:42	2123.65	157.73	41.4361
22:57:42	2123.90	157.98	28.9361	11:42:42	2123.59	157.67	41.6861
23:12:42	2123.88	157.96	29.1861	11:57:42	2123.33	157.41	41.9361
23:27:42	2123.86	157.94	29.4361	12:12:42	2123.75	157.83	42.1861
23:42:42	2123.83	157.91	29.6861	12:27:42	2123.72	157.80	42.4361
23:57:42	2123.78	157.86	29.9361	12:42:42	2123.69	157.77	42.6861
06-22-1988				12:57:42	2123.78	157.86	42.9361
00:12:42	2123.77	157.85	30.1861	13:12:42	2123.73	157.81	43.1861
00:27:42	2123.74	157.82	30.4361	13:27:42	2123.99	158.07	43.4361
00:42:42	2123.78	157.86	30.6861	13:42:42	2123.53	157.61	43.6861

SURVEY DATA

COMPANY KENNECOTT RUN 34 FIELD SALTON SEA WELL NAME 2-14

TIME	PRES	DP	DTIME	TIME	PRES	DP	DTIME
13:57:42	2123.95	158.03	43.9361	14:28:28	2122.37	156.45	44.4489
14:12:42	2123.47	157.55	44.1861	14:28:57	2122.33	156.41	44.4570
14:27:42	2122.40	156.48	44.4361				



BOTTOM HOLE PRESSURE AT 5000' md
PRELIMINARY DRAFT
(PRESSURE (PSIA))
TIME (HRS)
"0" TIME IS 18:01 06/20
KENNECOTT GEOTHERMAL
SALTON SEA
06/20 TO 06/22/1988
WELL #2-14
RUN #34SA2-14 SUR
2160.0
2120.0
2080.0
2040.0
2000.0
1960.0
-4.0
.0
4.0
8.0
12.0
16.0
20.0
24.0
28.0
32.0
36.0
40.0
44.0
48.0
BAKERSFIELD, CA
(805) 589-2768
10 x 10 to ½ INCH
10 x 14 INCHES

ADDENDUM H

SUMMARY OF ATTEMPTS TO RUN A CALIPER LOG IN THE STATE 2-14 WELL

Glen E. Tinsley & Associates

Geothermal
Well Testing
Production
Operations

To: Mr. Jake Rudisill
Geysers Geothermal Co.
1160 N. Dutton, Ste.200
Santa Rosa,
CA 95406-1279

August 16, 1988

Sir:

Below is a summary of the attempts to run a caliper log on State 2-14 well on August 8, 1988:

All tools were zeroed at 48 inches above ground level as determined by the cement edge of the cellar. Wellhead pressure = 50 PSIG.

0950 RIH 64 Arm Caliper Arm Tool (7 1/4" OD) stuck at 5 feet below 0, approximately 26" into the 9 5/8" casing.
POOH with 2600# plus tool weight (240#) to unstick.
1350 RIH 3 1/2" Minimum ID Tool (OD 3 1/2") stuck at approximately 5 feet below 0, approximately 26" into the 9 5/8" casing.
POOH with 2400# plus tool weight (100#) to unstick

On August 15 a short TV camera run was made on the well to visually inspect the obstruction. An attempt was made to hydroblast the obstruction, however the equipment failed and it is unknown if this was effective. A copy of the log is enclosed. It is on VCR format. Following is an account of the effort :

The tool was zeroed at 48" above the cement edge of the cellar. Wellhead pressure = 50 PSIG.

0900 RIH with 2 1/8" TV camera (well flowing approximately 50 GPM). Observed a whitish scale beginning at about 6.1 feet in the 9 5/8" casing. Ran to 10.9 feet then POOH (fluid temperature is the limiting factor and had risen to 120 degrees F.).
0945 RIH with 11,000 PSI hydrobalster to approximately the center of MCV 1. Downhole rod failed (bent). POOH.
1110 RIH with 2 1/8" TV camera (well dead, PSI = 00). Fluid too turbid for visibility. POOH. Shut in and secured well.

Careful inspection of the log tape shows that scale buildup at around 6 feet with a well defined buildup around 8 feet.
Enclosed are a copy of Figure 3.4 of the Salton Sea Deep Well Scientific Drilling Program, (State 2-14) Test Report showing the configuration of the wellhead stack and Table 3-2 (pg 3-10), describing the stack.

P.O. Box 1928 • Carlsbad, CA 92008 • (619) 726-1990

There appears to be a discrepancy between the depth of the 9 5/8" casing in all of the logging runs and the as-builts as indicated by Figure 3-4. I talked to Joel Barbour of Bourber Well Surveys, the owner of the camera equipment and found that during the zeroing process the operator had not punched in "negative" and therefore zero on the tape is eight feet above ground level. This coincides with the as-builts and the Dialog runs

Below is a table indicating significant depths in the log:

Log Depth	Actual Depth	Event
1.7 feet:	6.3 feet above GL	Top of MCV-1 gate
6 feet	2 feet above GL	Top of scale
10.9 feet	2.9 feet below GL	End of run

The second TV run begins at 5.40 on the counter and has no significant information in it.

If I can be of any assistance to you please call me at (619) 726-1990.

Repectfully submitted,

Glen E. Tinsley

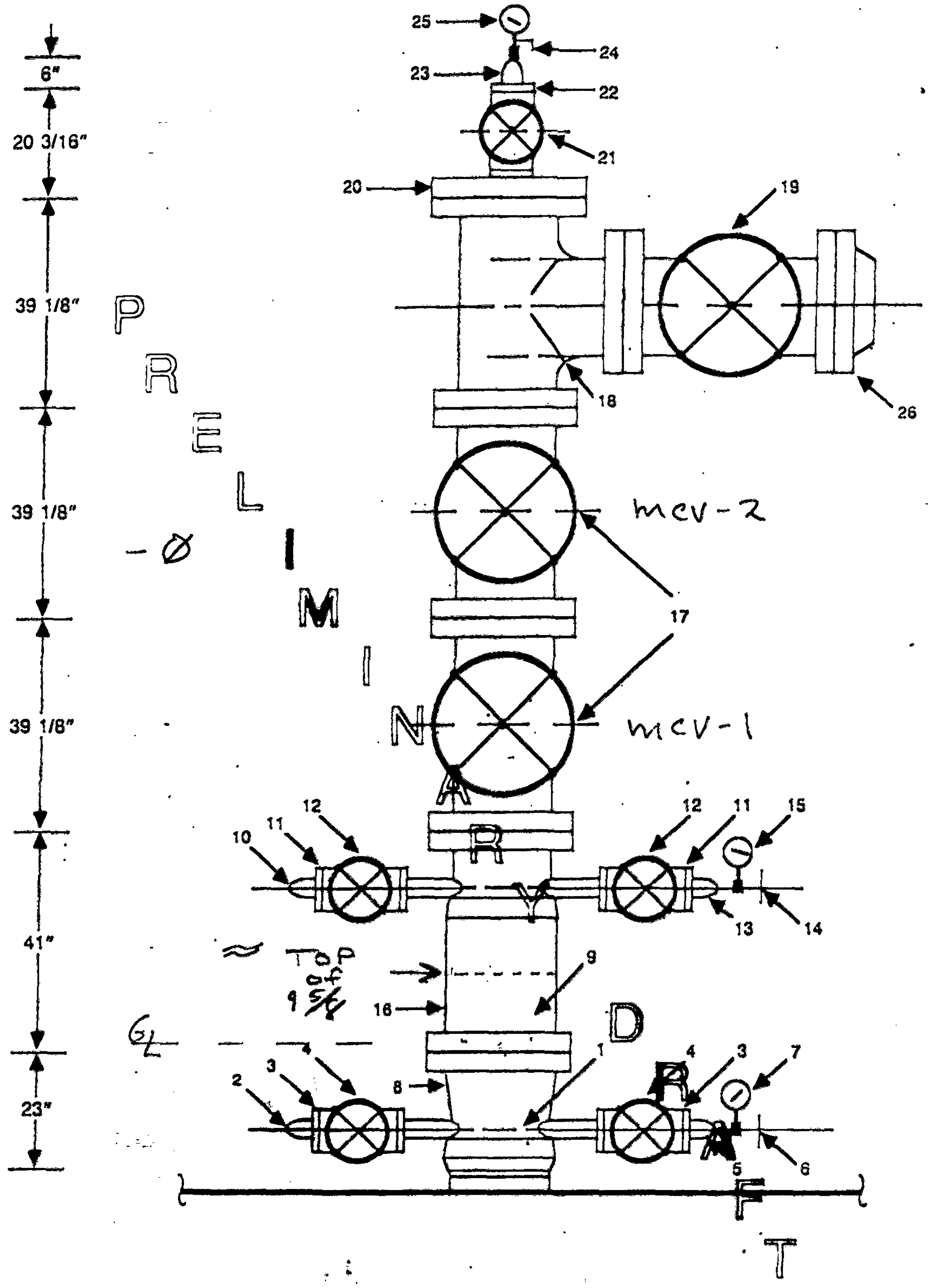


Figure 3-4 Wellhead Design
see Table 3-2 for Wellhead Equipment List

Table 3-2

WELLHEAD EQUIPMENT LIST

Item Number (Fig. 3-4)	Quantity	Description
1	1	Casing head 13-5/8 in. API 3000 x 13-3/8 in. SOW with two 3-1/8 in. API 3000 flange outlets
2	1	Bull plug 3 in. LP threads, plain
3	2	Companion flange 3-1/8 in. API 3000 with 3 in. LP threads
4	2	Gate valve 3-1/8 in. API 3000
5	1	Bull plug 3 in. LP threads with 1/2 in. NPT
6	1	Needle valve 1/2 in. NPT, angle
7	0	Not installed, see item 15
*	4	Ring gasket R-31 (3-1/8 in. API 3000)
*	32	Studs 7/8 in. x 6 in. ASTM A193 Grade B7, HRC22 maximum hardness, with two nuts per stud
*	1	Ring gasket R-57 (13-5/8 in. API 3000)
*	20	Studs 1-3/8 in. x 10-1/4 in. ASTM A193 Grade B7, HRC22 maximum hardness, with two nuts per stud
8	1	Annular seal and centralizer, nominal 13-5/8 in. x 9-5/8 in. casing
9	1	Expansion spool 13-5/8 in. API 3000 x 11 in. API 5000 with two 3-1/8 in. API 5000 flange outlets, 41 in. overall length with 18 in. of expansion on 9-5/8 in. production casing. Top of spool bored to accommodate a 7 in. hang down liner donut assembly
10	1	Bull plug 3 in. LP threads, extra heavy plain
11	2	Companion flange 3-1/8 in. API 5000 with 3 in. LP threads

* Not shown in Figure 3-4

DIALOG minimum
ID Tool
8/10/88

PRELIMINARY DRAFT

3-5'
going in hole

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