REPORT EE

WELL TEST PLAN
Bechtel National, Inc.
12 p.

Addendum DETAILED FLOW TEST PROCEDURE
Mesquite Group, Inc.
24 p.

Appendix E

WELL TEST PLAN

FLOW TEST PLAN
Salton Sea Scientific Drilling Project

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FLOW TEST PLAN
Salton Sea Scientific Drilling Project

Section 1

OBJECTIVES

The primary objective of the flow test is to develop important additional information concerning the Salton Sea geothermal resource by conducting a long-term production flow test of the State 2–14 well. The flow test is planned for 30 days duration. Wellhead pressure (and consequently, brine flow rate) is to be adjusted in three steps to obtain information on resource characteristics such as productivity, permeability, and brine chemistry.

A secondary objective of the flow test is to provide opportunities to conduct scientific research projects concerning other geothermal activities such as seismicity during well production and injection, brine measurements, and brine sampling techniques.

Section 2

INTRODUCTION

The State 2–14 well was drilled for the Department of Energy by Bechtel National, Inc. on a lease held by Kennecott. It is the first major well in the Continental Scientific Drilling Program. Drilling was begun in October 1985 and was completed in March 1986 at a depth of 10,564 ft (3,220 m).

Two short-term flow tests (54 and 37 hours duration) were conducted, one from an upper zone at 6,120 ft (1,865 m) , and the second, a mixed-zone flow test from probable intervals at 6,100, 6,600, 8,600 and 10,475 ft (1,859, 2,012, 2,621 and 3,193 m). In August 1987, the State 2–14 well was reworked below 6,100 ft (1,860 m). Following the rework, another short-term (12 hours) flow test was conducted.

None of these short-term flow tests were conducted over long enough time for the well to reach thermal equilibrium and establish typical production flows. Furthermore, they may not have thoroughly flushed spurious materials such as drilling mud to produce representative brine samples. Therefore, this longer-duration flow test is needed to achieve thermal equilibrium, flush spurious materials, and thereby allow measurement of resource characteristics such as productivity, permeability, and brine chemistry.

Section 3

FLOW TEST

3.1 TECHNICAL

During normal operations for the flow test, geothermal fluid flows from the State 2–14 well to the high pressure separator, V–1, where vapor containing flashed steam and noncondensible gases is separated from the brine as shown in Figure 3–1. The flow rates of the liquid and vapor streams are continuously measured and recorded as are the process conditions in the separator. These measurements are the primary basis for determining the productivity and energy level of the well.

With the well flowing, physical-chemical testing and well temperature-pressure logging are conducted to determine properties such as noncondensible gas content, dissolved solids, chemical analysis, pH, and reservoir characteristics.

The separated vapors from V–1 are discharged to the atmosphere through a vent silencer, V–4, and the liquid pressure is reduced to atmospheric in the atmospheric flash tank, V–3, releasing additional steam. The remaining liquid flows to a brine pond to provide residence time for solids precipitation before the spent brine is injected into the Imperial 1–13 well.

The scaling and corrosive tendencies of the flashed brine pose the greatest potential for operating difficulties. Therefore, redundant level controls and level control valves for V–1 are provided. Since there is a tendency for the brine line and the brine flow meter to foul, redundant flow meters for the flashed brine are provided to allow cleaning during the test while still maintaining normal test flow rates.

Appendix A presents a detailed procedure for the 30–day flow test.

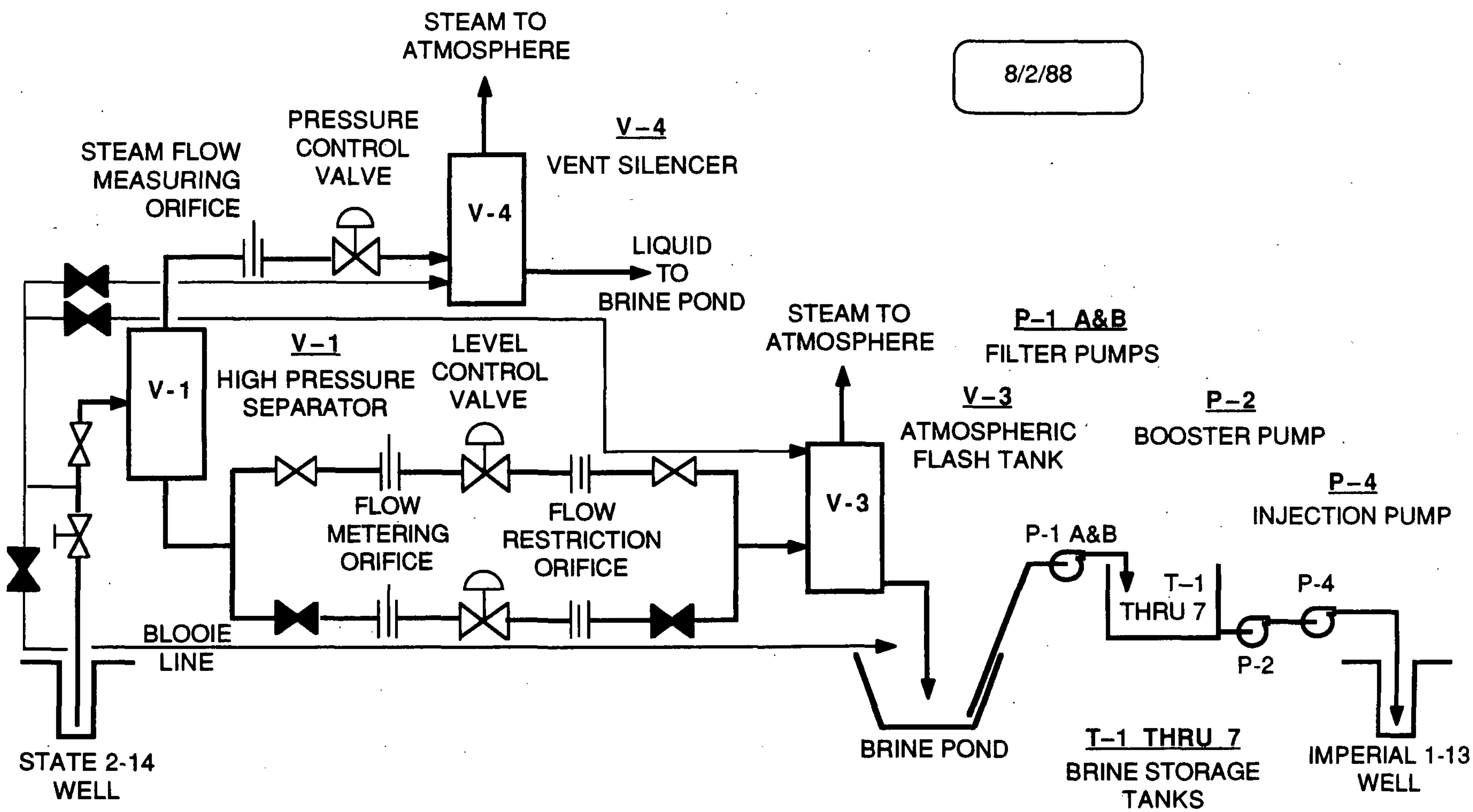


Figure 3–1 Simplified Flow Diagram of Test Facility

3.2 ORGANIZATION

Figure 3–2 presents the flow test operations organization to define the normal communications channels.

The Site Manager is John Contos of Bechtel. John is responsible for all aspects of the site operation including:

- Site safety and emergency situations
- Security
- Environmental compliance and all other permits or contractual obligations
- Provision and maintenance of office space, facilities, and utilities including water, power, and communications
- Coordinating the flow test and the ancillary experiments
- Chairing on-site safety and well-test meetings
- Coordinating site visitors

When John is on the site, he will be the Shift Supervisor who is responsible for all matters relating to operation of the flow test. When John is away from the site, he will designate someone else to perform the duties of Shift Supervisor. This will usually be the Site Engineer, Frank Lemmon.

The Well Test Engineering subcontractor is Mesquite Group, Inc. Mesquite is to provide on-site technical supervision of the flow test including the following:

- Monitor well performance and recommend timely changes of operating conditions to provide safe well operation
- Supervise data acquisition
- Supervise downhole well surveys
- Issue a daily report summarizing test data and providing preliminary interpretation

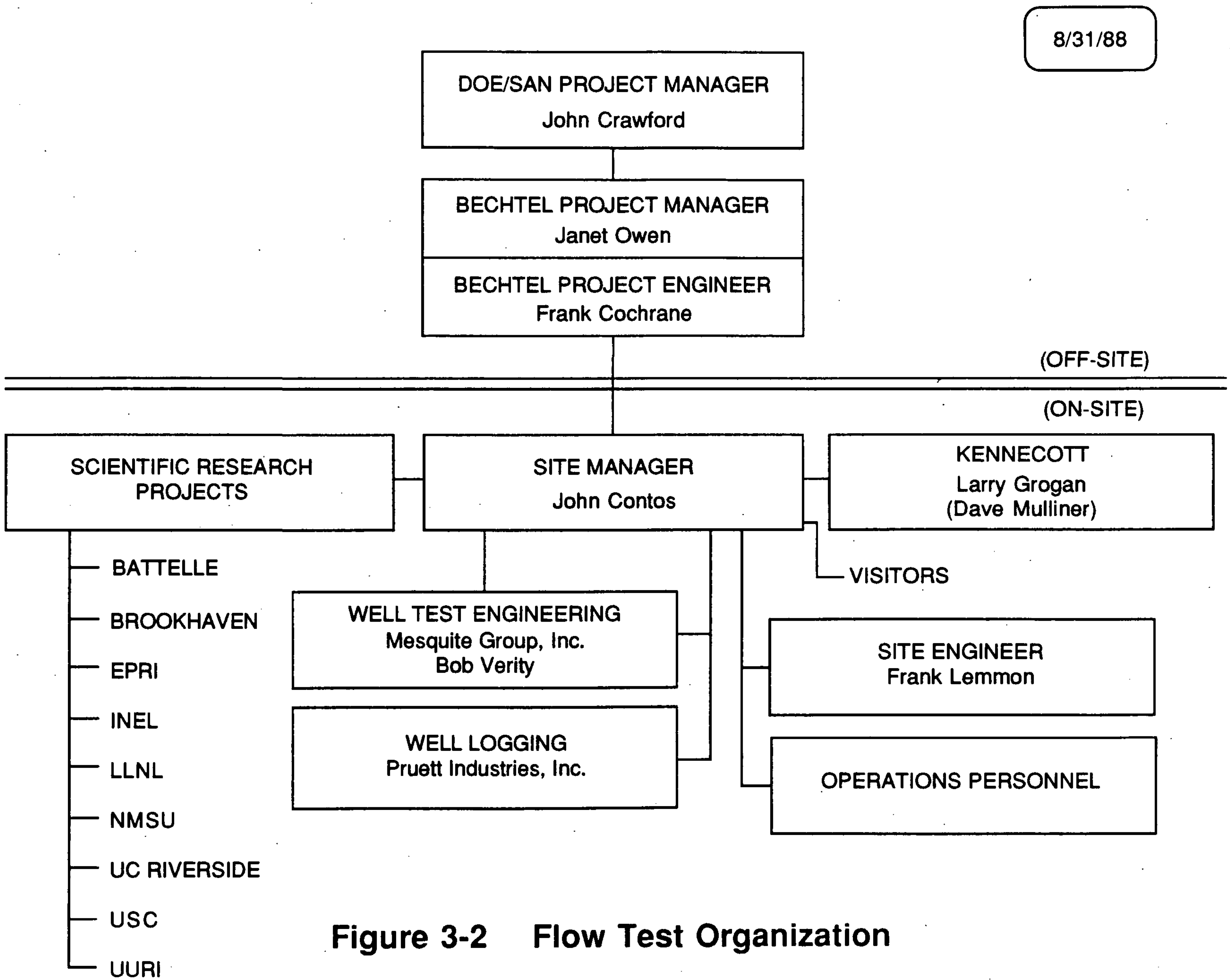


Figure 3-2 Flow Test Organization

The well logging subcontractor, Pruett Industries, Inc., is to perform the downhole well surveys under the technical supervision of the Well Test Engineering subcontractor.

Kennecott is the lease holder for the State 2-14 well location. In addition, Kennecott is to perform chemical sampling as needed during the flow test.

Experimenters concerned with the scientific research projects are to coordinate their activities with the Site Manager. Access to the trailers and facilities involved in a scientific research project is to be coordinated with the experimenter in charge of the project.

Section 4

SCIENTIFIC RESEARCH PROJECTS

A test plan for each scientific research project is to be prepared by each individual scientist. This section contains a synopsis of each test plans from the material submitted by each scientist.

Scheduling and support for the scientific research projects is to be coordinated with the Bechtel site manager, John Contos, phone 619-348-5230.

4.1 PARTICLE METER TESTING

Organization: Battelle Pacific Northwest Laboratories

Principal Investigator: Don Shannon

Purposes:

- Establish the suspended solids content of the brine from the bottom of the separator immediately after flashing and after a two-hour hold time
- Characterize the chemical and size characteristics of the suspended solids
- Evaluate an on-line computerized ultrasonic particle counter in a high-solids brine
- Evaluate the effects of scale deposits on the optical window of a laser particle counter

Approach: Brine from the bottom of the separator is to run through a1/2-in. line about 125 ft (38 m) to a test stand where it flows through the laser optical window, an ultrasonic detector, and a weighed filter for measurement samples are collected for analysis off–site.

4.2 CHEMICAL SAMPLING AND ANALYSIS TO CHARACTERIZE THE BRINE

Organization: Electric Power Research Institute

Principal Investigator: Evan Hughes

Purpose: To collect samples of the produced fluids from the State 2–14 well during a 30–day flow test and perform extensive chemical analyses to characterize the brine.

Approach: Samples will be taken from both the steam and liquid phases at intervals during the flow test. Brine signature analyses will be performed on the samples by the EPRI CHEMLAB.

4.3 SEISMIC MONITORING

Organization: Lawrence Livermore National Laboratory

Principal Investigator: Steve Jarpe

Purpose: To continue a case study of microseismicity related to a well-characterized production-injection test in a geothermal field.

Approach: LLNL has installed and will operate a 36 channel digital event-detecting, full-wave recording seismic network around the injection well from September 1987 through July 1988. The network consists of nine 3–component stations covering to distances of three miles (5 km) from the injection well, including a station on Mullet Island. In addition, a nine sensor array is deployed approximately 1/2 mile (0.8 km) from the injection sited. Digital data from each station are telemetered to a central site at the State 2–14 well where they are recorded. If induced seismicity is observed, its relationship to the production and injection activities will be analyzed. The implications of the natural seismicity for flow within the geothermal field will also be analyzed.

4.4 METAL ION CONCENTRATIONS

Organization: New Mexico State University

Principal Investigator: Dennis Darnall

Purpose: To measure metal ion concentrations in the geothrmal brine

Approach: Brine samples will be collected from the two-phase flowline. Analysis will be done off-site.

4.5 TRANSPORT OF PLATINUM GROUP ELEMENTS, GOLD, AND SULFUR IN THE SALTON SEA GEOTHERMAL BRINES

Organization: University of California at Riverside

Principal Investigator: Michael A. McKibben

Purpose: To study the transport of the platinum group elements, gold, and sulfur in the Salton Sea geothermal brines

Approach: Fluid and solid samples will be collected. Analysis will be done off-site.

4.6 URANIUM SERIES ISOTOPE MEASUREMENTS

Organization: University of Southern California

Principal Investigator: Bret Leslie

Purpose: To provide information to further constrain models of radioisotope exchange mechanisms and develop new methods of estimating hydrogeologic parameters

Approach: Brine and gas samples will be collected. Analysis will be done off-site.

4.7 LIQUID AND GAS SAMPLING

Organization: University of Utah Research Institute

Principal Investigator: Michael C. Adams

Purpose: To determine if differences in the chemistry of the fluid occur as a result of changing flow rates and to determine whether silica precipitates when a cooling coil is used during sample collection.

Approach: Liquid and gas samples will be collected. Analysis will be done off-site.

Addendum

DETAILED FLOW TEST PROCEDURE (Mesquite)

SALTON SEA SCIENTIFIC DRILLING PROJECT
30-DAY TEST PLAN
KENNECOTT STATE 2-14
May 26, 1988

Objectives

A 30-day flow test of the State 2-14 well is planned to fulfill the following objectives:

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

2. 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.

3. 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.

4. Measure the preflash temperature of the brine, and obtain other data necessary to calculate the produced fluid enthalpy and the rate of energy production (approximate MWe).

5. Provide an opportunity for other experimenters to acquire data and perform studies in conjunction with the test in a manner that does not interfere with or unduly jeopardize the other test objectives.

Test Plan Summary (Refer to test schedule, Figure 1.)

The test of State 2-14 is planned to include the operations and data acquisition activities listed below. Activities of other experimenters are not included in the list.

In the conduct of the test, safety and environmental considerations are top priority. Subject to those concerns, the test should be conducted in such a manner as to avoid damage to the wells (production and injection) and to maintain a steady, uninterrupted flow throughout each rate period. The test facility has a number of features which provide redundancy and flexibility of operations. Minor mechanical failures are likely to occur, and in many cases can be handled with minimal disruption of the test. In the event of a failure, or imminent failure, which poses a threat to safety or the environment, the production well will be shut in unless there is a clear and expedient way to bypass the problem area and continue the test.

1. The test is planned for thirty days of continuous flow at three distinct rate steps. The flow rate and duration of each step are planned as listed below, but are subject to revision during the test on the basis of a number of factors including well deliverability, the time required

for the well to stabilize after each rate change, test facility performance, and injection well performance.

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 order and magnitudes of the rate steps are chosen to provide a broad range of rates for reservoir engineering analyses and to allow for facility shakedown and a preliminary evaluation of the well at a moderately low rate. The planned duration of each step is estimated to be adequate for the well to reach essentially stable flow conditions. If the well fails to stabilize during any period, a recommendation may be made to extend the time.

2. A total of five downhole pressure and temperature surveys are 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 are not planned because the mechanical condition of the well is such that logging tools should not be run deeper than 5,500 feet.

3. The test plan calls for 24 brine samples and 8 steam and noncondensible gas samples to be collected and analyzed during the test. The timing of the samples is planned to identify compositional changes which might occur at flow rate changes and to recognize trends.

4. As shown in the test facility flow schematic, the State 2-14 well will flow directly to a separator with orifice flow meters on the steam and brine discharges. The brine will take a second flash into an atmospheric flash tank and will be discharged into the pond where it is intended that polymerization and partial settling of silica and other solids will occur. Brine will be skimmed from the pond, pumped through tanks and then injected into the Imperial 1-13 well.

5. Other qualified experimenters may participate in the test with the approval of the U.S. Department of Energy. Activities which pose a risk of jeopardizing the test will be scheduled near the end.

<u>Operating Limitations</u>

Maximum production rate: Based on experience of the 8/31/87 flow test, the maximum production rate will probably be constrained by the test facility, not the production well. The nominal capacity of the facility is determined by the maximum design rate for the separator, which is 750,000 lbm/hr total mass flow. If there is excessive brine carry-over in the steam from either the vent silencer or the atmospheric flash tank, the flow rate will have to be reduced.

Other factors such as injection capacity or residence time in the pond and tanks for settling may ultimately constrain the rate.

Maximum separator pressure: The maximum operating pressure for the separator and high pressure piping is 500 psi. The separator rupture disk is rated for 590 psi at 400°F.

Maximum injection pressure: The maximum allowable brine injection pressure at the injection wellhead is 300 psi.

General Procedures For Test Operations

The following routine procedures are presented as guidelines to begin the test and may be modified as the test proceeds.

The test startup procedure is attached.

Once per day (on day shift)

1. Zero all recorders.

2. Measure levels in all fuel tanks.

Once per shift

1. Cycle the Strahman valves on all separator level sensing ports.

2. Check oil and water levels in all stationary engines and mobile equipment.

3. Clear fresh water pump suction in the canal, when pump is in operation.

4. Walk the entire perimeter of the brine pond and inspect for signs of dike deterioration (leakage, cracking, etc.).

Once every 2 hours (even hours)

1. Record well test parameters (pressures, temperatures, orifice meter chart readings, weir level reading etc.) on Data Form No. 1.

2. Record liquid levels in the brine tanks and the brine pond.

3. Record the injection wellhead pressure and temperature at Imperial 1-13. While going to and from the well, check for visible leaks in the pipeline.

Once every 2 hours (odd hours)

1. Record oil pressure, water temperature and RPM on all stationary engines.

2. Start the fresh water flush pump and flush the level sensing system on the separator.

3. Check operation of fresh water supply system and chemical metering pump(s), if used.

General Procedures for Test Monitoring and Data Acquisition

The following procedures are presented as guidelines to begin the test and may be modified as the test proceeds if it is determined to be necessary to meet the test objectives.

1. All well test parameters listed in Table 1 are to be recorded on Data Sheet No. 1 every two hours (on the even hours), or more often when conditions are changing rapidly. Record the actual times of readings, regardless of whether the readings are taken at the even hour. Gauges and recorders will be tagged with their identification numbers.

2. Once per shift, the metered brine rate will be verified by the measured flow at the weir box and calculations of the secondary flash and brine density change.

4. Mesquite personnel will verify data quality by spot checks of the readings and by calculational checks for consistency. Whenever operating personnel are occupied with urgent facility maintenance or operations, the Mesquite engineer will do the routine data recording. Consistency checks will focus especially on verifying brine flow rates indicated by the orifice meters because the orifice plates and sensing ports are subject to scale buildup.

5. Mesquite will prepare a written daily test report by 0800 hours each day. The report will summarize the key operating parameters, present preliminary interpretations, and document events pertinent to data acquisition, analysis and reporting. The report will cover the 24 hours from midnight to midnight.

Schedule of Testing Activities

Day No.	Planned Flow Rate (10^3 lbm/hr)	Planned No. of: Brine Sample Sets	Steam & N.C. Gas Samples	Other Activities
0	200-250	0	0	Begin flow test. (Refer to separate startup procedure.) Maintain flow rate as near constant as possible until change on Day 7.
1	200-250	4	2	After about 24 hours of flow, run P & T survey from surface to 5,000 feet. (Refer to separate survey procedure.)
2	200-250	1	0	
3	200-250	1	0	
4	200-250	0	0	
5	200-250	1	0	
6	200-250	0	0	
7	200-250 incr. to 400-500	1*,3**	1*,1**	Assuming flow conditions have been relatively stable for the preceding 2+ days, Run P & T survey from surface to 5,000 feet, increase flow rate to 400,000-500,000 lbm/hr and monitor falloff (Refer to separate survey procedure.)
8	400-500	1	0	Maintain flow rate as near constant as possible until rate change on day 14
9	400-500	1	0	
10	400-500	0	0	
11	400-500	1	0	
12	400-500	0	0	
13	400-500	0	0	

Day No.	Planned Flow Rate (10^3 lbm/hr)	Planned No. of: Brine Sample Sets	Steam & N.C. Gas Samples	Other Activities
14	400-500	1*,3**	1*,1**	Assuming flow conditions have been relatively stable for the preceding 2+ days, Run P & T survey from surface to 5,000 feet. increase flow rate to 600,000-750,000 lbm/hr and monitor falloff. (Refer to separate survey procedure.)
15	600-750	1	0	Maintain flow rate as near constant as possible through end of test.
16	600-750	1	0	
17	600-750	0	0	
18	600-750	1	1	
19	600-750	0	0	
20	600-750	0	0	
21	600-750	1	0	
22	600-750	0	0	
23	600-750	0	0	
24	600-750	0	0	
25	600-750	1	0	
26	600-750	0	0	
27	600-750	0	0	
28	600-750	0	0	
29	600-750	1	1	
30	600-750	0	0	Run P & T survey from surface to 5,000 feet, POH and check temperature chart. RIH with chamber and hang at 5,000 feet. After 1 hour, shut in well and record pressure buildup. (Refer to separate survey procedure.)

* Before rate change
** After rate change

TABLE 1

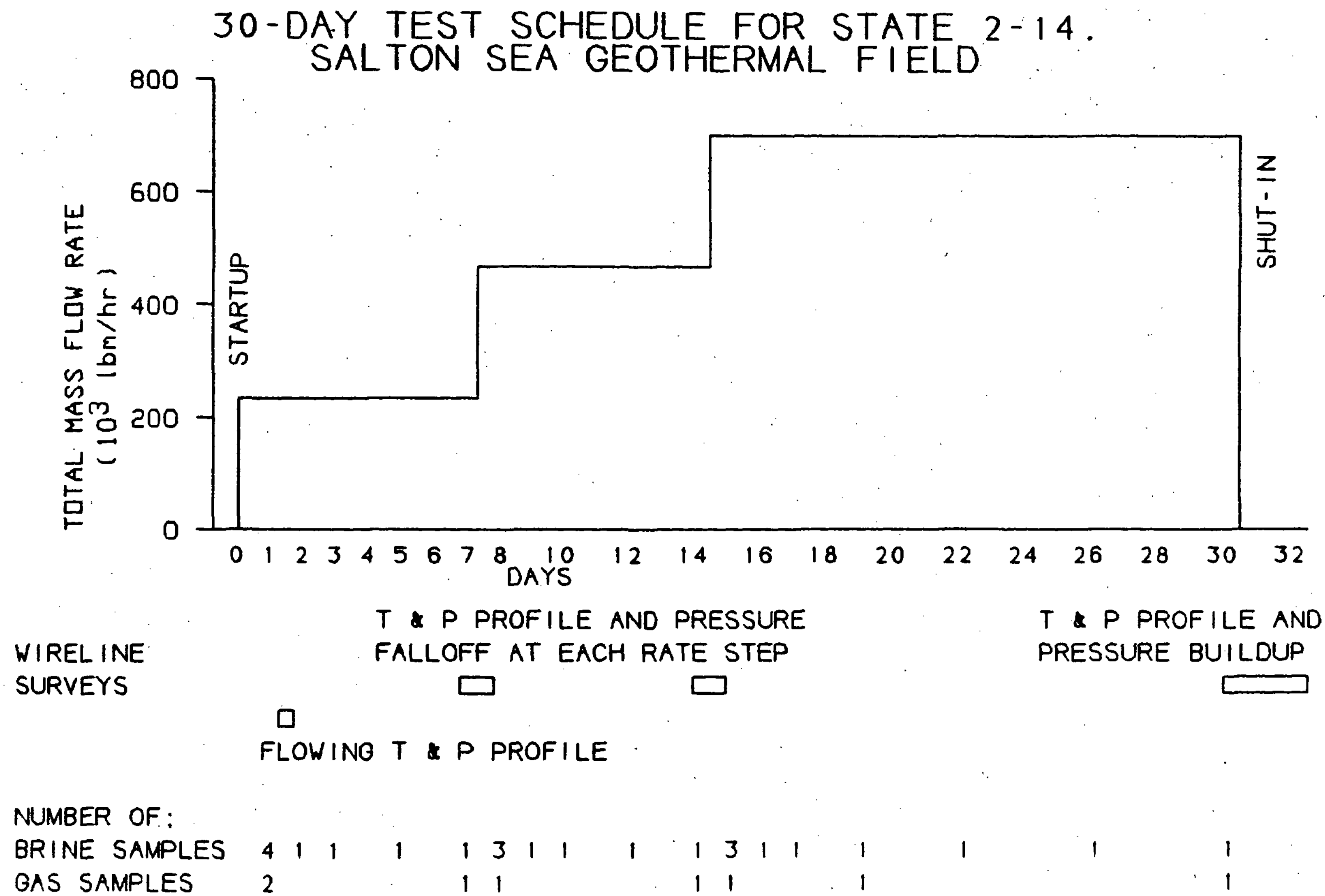
INSTRUMENTATION FOR 30-DAY TEST OF KENNECOTT STATE 2-14

Location	Instrument No. on P & ID	Instrument No. for This Test	Description
Wellhead expansion spool	-	PI-0	0-1000 psi pressure gauge, liquid-filled
Flowline downstream of wellhead	PR-1	PR-1	Pressure recorder 0-600 psi
	PI-1	PI-1	0-600 psi pressure gauge, liquid-filled
	TI-1	TI-1	150°-750°F dial thermometer
Throttling valve on east side of road			
Upstream	-	PI-12	0-600 psi press. gauge, liquid-filled
	-	TW-12	Thermowell w/o gauge
Downstream	-	PI-13	0-600 psi press. gauge, liquid-filled
	-	TI-13	50°-550°F dial thermometer
Separator level	LCR-107	LCR-107	Circular chart recorder
Separator, top of sight glass	PI-105	PI-105	0-600 psi press. gauge
Separator, brine outlet	PI-4	PI-4	0-600 psi press. gauge
	TI-109A	TI-109A	50-500°F dial thermometer
Brine orifice run			
Brine leg A	FR,PR-108A	FR,PR-108A	Circular chart recorder, 0-100" differential (red pen) and 0-500 psi static range (blue pen)
Brine leg B	FR,PR-108B	FR,PR-108B	Circular chart recorder, 0-100" differential (red pen) and 0-500 psi static range (blue pen)
Downstream of L.C.V.			
Brine leg A	PI-143A	PI-143A	0-400 psi press. gauge, liquid-filled
Brine leg B	PI-143B	PI-143B	0-400 psi press. gauge, liquid-filled

TABLE 1

Location	Instrument No. on P & ID	Instrument No. for This Test	Description
Downstream of fixed orifice			
Brine leg A	-	PI-144A	0-100 psi press. gauge
Brine leg B	-	PI-144B	0-100 psi press. gauge
Steam outlet from separator		PI-103	0-600 psi press. gauge
	PCR-103	PCR-103	Circular chart recorder/controller 0-xxx psi
		TI-103	50-500°F dial thermometer
	FR-102	FR-102	Circular chart recorder, 0-200" differential range
Weir box at outlet of atmospheric flash tank	-	Weir Level	Sight gauge
Brine pond	-	Pond Level	Sight gauge
Pond transfer pump discharge	PI-127	PI-127	0-60 psi press. gauge
Fresh water supply	-	F.W. meter	Totalizing water meter
Brine tank No. 1	-	Brine Tank Level	Sight gauge
Brine booster pump discharge	PI-129	PI-129	0-300 psi press. gauge
Injection pump discharge	PI-10	PI-10	0-400 psi press. gauge
Upstream of injection orifice run	-	TI-10	0-250°F dial thermometer
Injection orifice run	DPR-1	DPR-1	Circular chart recorder, 0-100" differential
Injection wellhead	PI-141	PI-141	0-600 psi press. gauge
	TI-140	TI-140	0-250°F dial thermometer

FIGURE 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
T & P PROFILE AND PRESSURE
FALLOFF AT EACH RATE STEP
T & P PROFILE AND
PRESSURE BUILDUP
WIRELINE
SURVEYS
FLOWING T & P PROFILE
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

STARTUP PROCEDURE

1. Install charts on all the recorders, wind clocks, fill all isolation pots and sensing lines with isolation fluid, zero the pens and leave the isolation valves at the orifice flanges shut.

2. Hold a meeting of supervisors and operators to review assignments and procedures for the startup.

3. Check all valves on wellhead and main flowline. Check and adjust to achieve status shown below in this sequence.

Valve No.	Description	Position
WH4	Swab Gate	Closed
WH3	Wing	Closed
WH1	Lower Master	Open
WH2	Upper Master	Open
2	Blooie Line to drilling pit	Closed
3	10" Valve by drilling pit Blooie Line	Open
	10" Valve to experimental loop	Closed
15	10" Valve to experimental loop	Closed
13	10" Valve around experimental loop	Open
	10" Throttle valve near HP Separator	Closed
1	10" Valve to HP Separator	Closed
20	10" Valve to Blooie Line to pit	Open
6	10" Valve to AFT	Closed
5	6" Valve to VS	Closed

- Open WH3 (wing) slowly until pressure in flowline equalizes with well pressure. Well now shut in on throttle valve - ready to start test.

4. Open throttle valve and start well flowing through blooie line directly to main pond and keep throttled to maintain a moderately low rate (estimate 200,000-300,000 lbm/hr). Record wellhead pressure and temperature every 5 to 15 minutes until the wellhead pressure more-or-less stabilizes.

   If flow from the blooie line is likely to damage the partition in the pond, divert flow through one or both of the atmospheric vessels.

5. While well is flowing to pond check valves on separator and adjust as follows:

Valve No.	Description	Position
9	12" Inlet valve to North metering run	Open
11	12" Inlet valve to South metering run	Closed
-	12" Outlet from North metering run	Open
-	12" Outlet from South metering run	Closed
23	6" Bypass - North control valve	Closed
22	6" Bypass - South control valve	Closed
-	6" Gate - on steam line near control valve	Open

- In addition to these valves, the valves to the sight gauge, steam pressure sensing, liquid level controller, instrument air valves from the supply source, and to the steam pressure controller and brine pneumatic level controller must be open.

6. As soon as possible after well cleans up and achieves reasonably stable flow, begin to divert flow through separator. Keep the north brine level control valve open on manual to allow steam and brine to flow through the vessel and warm it up. Gradually close off flow to the pond while opening the valve to the separator (Valve #1). Then switch the brine level control valve to automatic operation and let the brine level rise slowly to the control point. Finish closing the bypass to the pond. Begin metering the flow through the brine and steam orifice runs.

7. Control the well with the flowline throttle valve and the separator pressure to maintain a total mass flow rate of about 200,000 lbm/hr. Operate the separator initially at about 200 psig. The separator pressure may be adjusted to improve operation as the test proceeds.

8. Begin routine data acquisition. Frequency of readings may be reduced to one every 2 hours when well becomes reasonably stable.

9. Check valves on tanks and injection system and adjust as follows:

Description	Position
All bottom valves on tanks	Closed
Inlet valves on all tanks	Open
Outlet valves (manifolded to booster pump suction) on all tanks	Open
Suction and discharge valves on booster and injection pumps	Closed
Bypass valves around booster and injection pumps	Open
8" valves downstream of injection meter run	Open
8" valve on injection water bypass to pond	Open
Injection wellhead wing valve	Closed
Injection wellhead master valve	Open
Injection flowline valve near injection well	Open
8" valves at 3-way junction on injection line branch to Imperial 1-13:	
South valve	Open
East valve (to Imperial well)	Open
North valve (to Wilson well)	Closed

10. Open suction and discharge valves on brine transfer pump at pond. Start brine transfer pump at pond and begin pumping into brine tanks. Allow tanks to fill and bypass back to pond to flush out lines.

11. Open suction and discharge valves on booster pump. Start booster pump and close booster pump bypass. Open injection wellhead valve and simultaneously close 8" bypass to pond.

12. Adjust injection rate to maintain tank and pond levels relatively constant. Use butterfly throttling valve downstream of injection orifice meter run, if necessary, to maintain positive backpressure on meter run.

PROCEDURE FOR TEMPERATURE AND PRESSURE SURVEY ON DAY 1

May 12, 1988

(All depths are referenced to KB. Refer to attached well diagram.)

Summary

A survey will be run after the well has been flowing for about 24 hours to measure the temperature and pressure profiles and to determine the flash depth.

Required Equipment

The wireline service company that performs this work must be equipped as follows:

- Wireline unit with at least 5,000 usable feet of stainless steel or Incoloy capillary tubing
- One Amerada-type temperature instrument with 12-hour clock and a temperature range up to at least 650°F.
- One complete backup temperature instrument.
- Capillary tube chamber
- Sinker bars
- Helium purge system
- High-precision pressure transducer and computer for capillary tube pressure data. Time and pressure data are to be printed out and recorded on floppy disk.
- Wireline lubricator (A companion flange and 3" LPT bushing are on top of the swab gate.)

Procedure

1. Rig up wireline BOP on swab gate. Make up chamber, temperature tool and sinker bars on capillary tubing. (Use sinker bars as required for the flow rate.) Pick up tools and lubricator, make up lubricator.
2. Open master valve and swab gate. Purge capillary tube and get stable pressure reading in lubricator.
3. RIH to 5,000', making stops to purge capillary tube whenever necessary.
4. Hang at 5,000', purge the capillary tube and obtain a stable pressure reading. Record times at this stop and all succeeding stops.
5. Pull up and make stops at 500' intervals up to a depth of 500'. Wait at least 15 minutes at each stop and allow

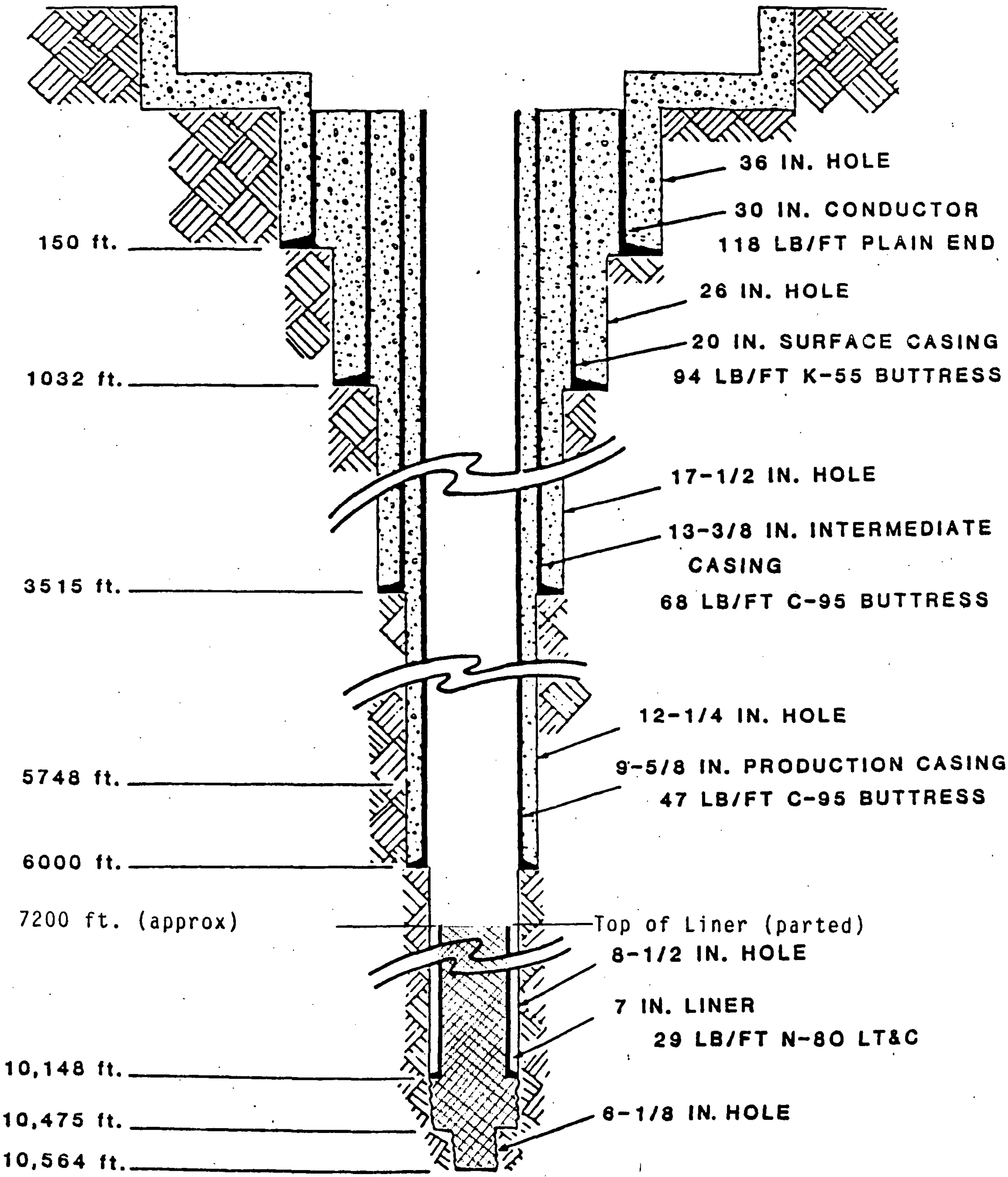
pressure to stabilize. Wash capillary tubing as it comes out of the hole to minimize corrosion.

6. POH and rig down wireline equipment.

KENNECOTT STATE 2-14

WELL DIAGRAM

(All depths are referenced to KB, 29' A.G.L.)



PROCEDURE FOR TEMPERATURE AND PRESSURE SURVEY AT FLOW RATE CHANGES AND FINAL SHUT-IN

May 12, 1988

(All depths are referenced to KB. Refer to attached well diagram.)

Summary

A survey will be run with the well flowing to measure the temperature and pressure profiles before each scheduled rate change and the final shut-in. Then the pressure falloff (after each rate increase) or the pressure buildup (after the final shut-in) will be monitored to obtain data for conventional reservoir analyses.

Required Equipment

The wireline service company that performs this work must be equipped as follows:

- Wireline unit with at least 5,000 usable feet of stainless steel or Incoloy capillary tubing
- One Amerada-type temperature instrument with 12-hour clock and a temperature range up to at least 650°F.
- One complete backup temperature instrument.
- Capillary tube chamber
- Sinker bars
- Helium purge system
- High-precision pressure transducer and computer for capillary tube pressure data. Time and pressure data are to be printed out and recorded on floppy disk.
- Wireline lubricator (A companion flange and 3" LPT bushing are on top of the swab gate).

Procedure

(Begin survey about 5 hours before scheduled rate change or shut-in.)

1. Rig up wireline BOP on swab gate. Make up chamber, temperature tool and sinker bars on capillary tubing. (Use sinker bars as required for the flow rate.) Pick up tools and lubricator, make up lubricator.
2. Open master valve and swab gate. Purge capillary tube and get stable pressure reading in lubricator. Use
3. RIH to 5,000', making stops to purge capillary tube whenever necessary.

4. Hang at 5,000', purge the capillary tube and obtain a stable pressure reading. Record times at this stop and all succeeding stops.

5. Pull up and make stops at 500' intervals up to a depth of 500'. Wait at least 15 minutes at each stop and allow pressure to stabilize. Wash capillary tubing as it comes out of the hole to minimize corrosion.

   a. On the final survey before shut-in, POH and check temperature chart. If temperature chart is good, lay down temperature tool and run back in hole with chamber and sinker bars only.

6. Run back in hole to 5,000', repurge capillary tube and hang for 1 hour before rate change or shut-in.

7. Increase flow rate or shut in well with flowline valve and monitor the pressure falloff or buildup. The Mesquite engineer should plot the pressure falloff to determine when to end the survey and POH. It is estimated that 8 hours will be sufficient time to monitor the falloff. The final buildup may require 1 or 2 days.

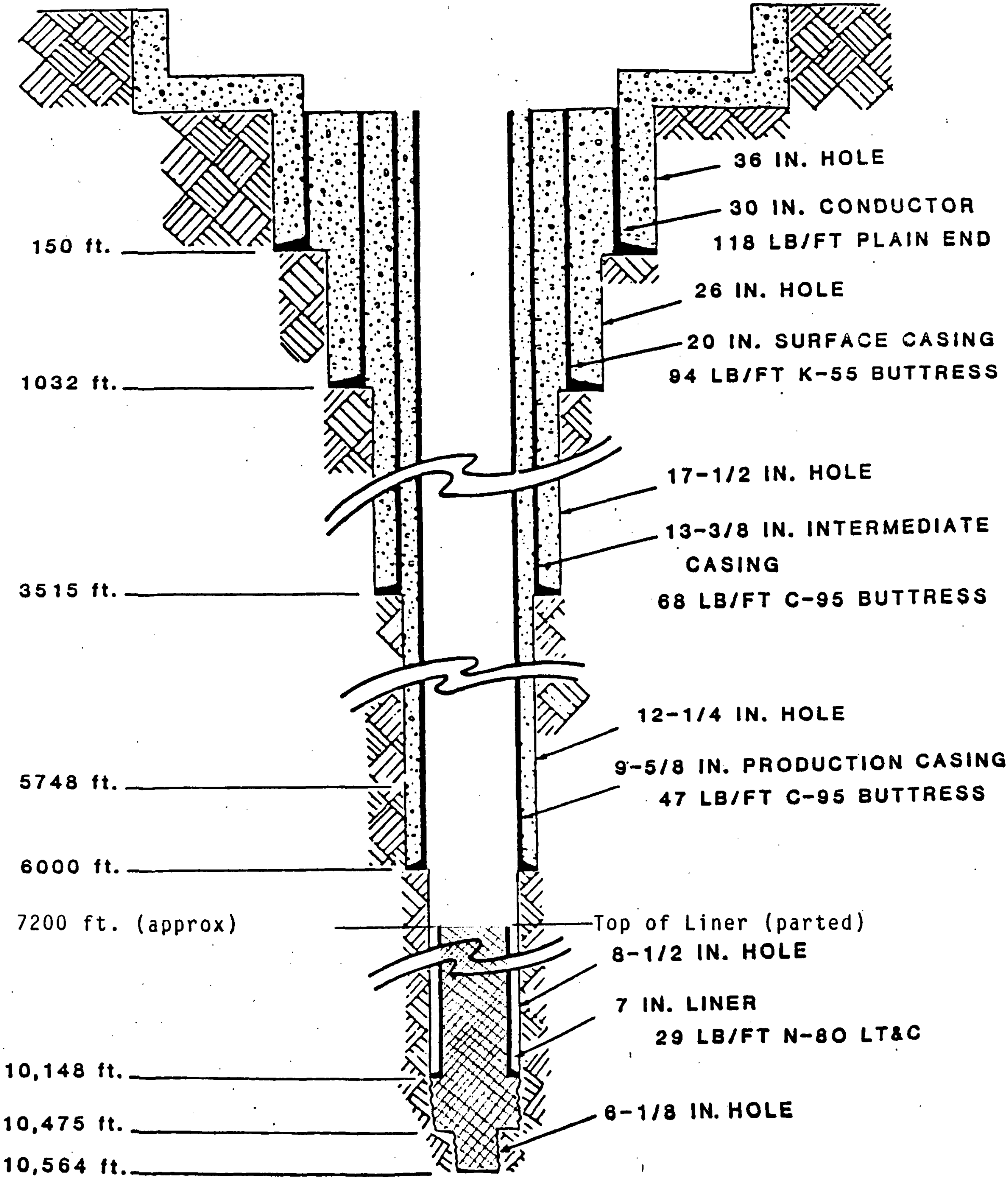
   Until such time as it may be determined to be unnecessary, move the capillary tubing every 1 or 2 hours, if the well is flowing, to be sure it does not become stuck by scale in the packoff. To do this, flag the line, pull up about 100', run back to 5,000' and repurge the capillary tube.

8. When falloff or buildup survey is complete, POH and rig down wireline equipment.

KENNECOTT STATE 2-14

WELL DIAGRAM

(All depths are referenced to KB, 29' A.G.L.)



DATA SUBMITTAL CHECKLIST

CHARTS:

WELLHEAD	PRESSURE	____________
SEPARATOR	STEAM PRESSURE	____________
	LIQUID LEVEL	____________
PRODUCTION FLOWS	STEAM FLOW	____________
	BRINE FLOW, A	____________
	BRINE FLOW, B	____________
INJECTION FLOW/PRESSURE		____________

DATA SHEETS:

NO.1A	____________
NO.1B	____________

DATE: ____________

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

DATE: ______________

PAGE: ____/____

		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
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1400																	
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1800																	
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DATA SHEET NO. 1B
FLOW TEST DATA
KENNECOTT STATE 2-14

DATE: ______________

PAGE: ____/____

		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
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DATA SHEET NO. 2

DATE: ____________

OPERATING DATA ON STATIONARY ENGINES

PAGE: ____/____

		Pond Transfer Pump (P-1)				Booster Pump (P-2)				Injection Pump (P-4)				Generator				
Nominal Time	Actual Time	RPM	Oil Press	Water Temp	Oil & Water Checked	RPM	Oil Press	Water Temp	Oil & Water Checked	RPM	Oil Press	Water Temp	Oil & Water Checked	Volts	Oil Press	Water Temp	Oil & Water Checked	Comments
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0300																		
0500																		
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