(GL00997

OFR 1-22-78

1a

THERMAL POWER
COMPANY

Utah State 14-2 ML-27536

Location: 2310' south and 350' east from the northwest corner Section 2, T 27S, R 9W, Beaver County, Utah.
Elevation:

Take all measurements from top KB.
Keep hole full at all times.
Check operation of BOE each round trip or daily, whichever first occurs.

Drilling Program

1. Drill 26" or 27½" hole to 40'+ to fit 20" casing. Cement with Class B cement treated with 2% $CaCl_2$ to fill annulus to cellar floor. Use 2 centralizers. Drill rat hole.
2. Drill 17½" hole to 650' to fit 13-3/8" casing.
3. Cement 13-3/8", 54.5#, K-55, buttress casing at 650' with 400 sacks Class B cement premixed with 1.0 cf/sack perlite, 2% gel and 40% silica flour. (100% excess). Run guide shoe with insert fillup. Tack weld and Bakerlok bottom 4 collars, weld shoe solid. Use top rubber plug only, plug holding head. Bump plug on shoe. Use 3 centralizers.
4. After 4 hours (or cement is firm), land 13-3/8" casing. Weld on 12" Series 900 WKM geothermal wellhead. Test weld with 1000 psig. Install 12" Series 900 Shaffer double hydraulic control gate and Hydril GK. All blowout preventers on this well to have high temperature packing elements. Test each preventer, casing, kelly cock, valves and check valve in kill line and blow down line valves to 1000 psig. for five minutes. Notify Utah Division of Water Rights to witness preventer tests 3 days in advance of testing (801-586-4231, Cedar City, Gerald Stoker). Enter test results on tour sheet.
5. Drill 12¼" hole to 1820' to fit 9-5/8" casing. One or more cores may be taken. Run Schlumberger Induction, FDC/CNL and Sonic logs at 1820'.
6. Cement 9-5/8", 40#, K-55, buttress casing at 1820' with 350 sacks Class B cement premixed with 1.0 cf/sack perlite, 2% gel, 40% silica flour and 0.3-0.4% HLX-C214 retarder (% retarder to be determined by maximum thermometers). (40% excess). Run fillup shoe and fillup collar on shoe joint. Tack weld top and bottom, bottom 4 collars, weld shoe solid. Use top and bottom rubber plug and plug holding head. Centralize 40' above shoe and every 5th joint above shoe. Have WKM (505-327-3359, Farmington, Sug Roberts) install centralizing elements in 12" head prior to cementing.

601 California Street San Francisco California 94108 415-981-5700 Telex: 34387 NATOMAS SFO

Utah State 14-2 ML-27536
Drilling Program

7. Land 9-5/8" casing. WKM install 12" Series 900 by 10" Series 600 14" stroke casing spool. Test pack off with 1000 psig. Install 10" gate valve, two double hydraulic Shaffer control gates, Hydril GK and Grant rotating head. All equipment to have high temperature packing elements. Test all blowout preventers, casing and valving as before with 1000 psig. for 5 minutes each. Notify Utah DWR to witness preventer tests. Enter test results on tour sheets.

8. Drill $8\frac{1}{2}$" hole to total depth, estimated at 6000'. One or more cores may be taken. Run Schlumberger logs as ordered. Complete or abandon. 7" casing may be run as protection or production casing if required.

9. Survey hole angle every 2-300', on dull bits. Drillable wing stabilizers are to be run in $12\frac{1}{4}$" and $8\frac{1}{2}$" holes, and $17\frac{1}{2}$" hole if required. A multi-shot or wireline angle survey may be run if hole angle exceeds 5^{o} over several thousand feet. Run drill pipe float valve in $8\frac{1}{2}$" hole and have "wet plug" with valve in open position on floor at all times.

10. Install ABC mud logging service at shoe of 20" conductor. Record continuous mud in and out temperature, H_2S, CH_4, lithology, drilling rate. Have pit level indicator and intercom to drillers station. Take two sets W&D samples every 10' above 1800' and every 5' below 1800'. Mail daily copies of the mud log to:

    Thermal Power Co. (3 copies)
    601 California Street
    San Francisco, CA 94108
    W. L. D'Olier

    Hathaway Engineering (1 copy)
    3382 El Camino, Suite 37
    Sacramento, Ca 95821

    Keep 3 copies up to date and spliced in trailer

11. Mud Program. American Mud Company 505-327-2525

    Surface-650'. Water and gel, 8.3-9.0 ppg.
    650'- TD Milford city water, add sodium chloride if req.

    Have lost circulation material on location.

12. Run and record maximum recording thermometers on each Totco run.

13. Telephone numbers:

Thermal Power Company	415-981-5700
W. L. D'Olier	415-982-5630 Nites
	805-833-8313 Weekends
W. N. Hathaway	916-489-1206 Office
	916-944-3884 Home
H. E. Wheeler	916-485-2715

September 9, 1976

WELL SUMMARY REPORT

Operator THERMAL POWER COMPANY Well No. Utah State 14-2, ML-27536

Sec. 2, T. 27S, R. 9W, SL B. & M. Roosevelt KGRA Field Beaver County.

Location 2310' south and 350' east from the northwest corner Section 2
(Give location from property or section corner, or street center lines)

Elevation of ground above sea level 6240 feet USGS.

All depth measurements taken from top of kelly bushing which is 21 feet above ground.
(Derrick Floor, Rotary Table or Kelly Bushing)

The information given herewith is a complete and correct record of the presen condition of the well and all work done thereon, so far as can be determined from all available records.

Date October 26, 1976

Signed W. L. D'Olier

Hathaway Engineering
Engineer

(Superintendent)

Title Vice-President
(President, Secretary or Agent)

Commenced drilling September 11, 1976

Completed drilling October 14, 1976

Total depth 6100' Plugged depth None

Junk OFR 1/22/78

16

Comme

Flowing/gas lift/pumping
(Cross out unnecessary words)

GEOLOGICAL MARKERS	DEPTH
Alluvium	0'-200'
Granite	200'-6100'
See attached lithology log	

Geologic age at total depth: Est. 9-15 mybp

Name of producing zone Granite

	Clean Oil bbl. per day	Gravity Clean Oil	Per Cent Water including emulsion	Gas Mcf. per day	Tubing Pressure	Casin Pressu
Initial production						
Production after 30 days						

CASING RECORD (Present Hole)

Size of Casing (A. P. I.)	Depth of Shoe	Top of Casing	Weight of Casing	New or Second Hand	Seamless or Lapweld	Grade of Casing	Size of Hole Drilled	Number of Sacks of Cement	Depth of Ce if through pe
20"	79'	Surface	94#	N	S	H-40	26"	200	
13-5/8"	645'	Surface	54#	N	S	K-55	17½"	400	
9-5/8"	1805'	Surface	40#	N	S	K-55	12¼"	400	

PERFORATED CASING
(Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

None. Well completed barefoot.

Was the well directionally drilled? No Electrical Log Depths 645'-6100' (Attach Copy of Log)

Δ osp

HISTORY OF GEOTHERMAL WELL

Operator THERMAL POWER COMPANY Field or County Beaver County Roosevelt KGRA
Well name and No. Utah State 14-2, ML-27536, Sec. 2, T 27S, R 9W, SL B. & M.
A.P.I. well No. Name W. L. D'Olier (Person submitting report) Title V-President (President, Secretary or Agent)
Date October 26, 1976

Signature W. L. D'Olier

601 California Street
San Francisco, CA 94108 (Address)

415-981-5700 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date 1976	
)-11	Moved in Loffland Brothers Company, Rig No. 5. Drilled 12¼" hole and opened to 26" to 79'. Cemented 20" OD, 94#, H-40 conductor casing @ 79' with 200 sacks neat cement treated with 2% CaCl2.
)-12	Landed 20" casing. Installed 20" Hydril GK. Drilled 17½" hole to 290'. Installed Alpha-Beta-Gamma mud logging service @ 79'.
)-13	Depth 552'. Mud 8.7 ppg.
)-14	Depth 650'. Mud 8.8 ppg.
	13-3/8" casing @ 645'. Ran 16 joints 13-3/8" OD, 54#, K-55, buttress, new, smls. USS casing including float shoe and 1 centralizer on each of bottom 3 joints and second joint from top. Cemented shoe @ 645' with 400 sacks Class B cement premixed with 1:1 expanded perlite, 2% gel and 40% silica flour. Had good cement returns to surface.
)-15	Landed 13-3/8" casing. Installed 12" Series 900 Shaffer double hydraulic control head and Hydril GK. Installed Grant rotating head. Tested CSO and pipe rams, kill line, blowdown line with 1000 psig. Tested Hydril with 600 psig.
)-16	Drilled 12¼" hole to 1285'. Mud-water.
)-17	Depth 1557'. Mud-water.
)-18	Depth 1625'. Mud 9.2 ppg + LCM. Well kicked while drilling @ 1625'.
)-19	Depth 1805'. Mud 9.5 ppg.
)-20	Ran Schlumberger Induction-Electrical, Compensated Neutron-Formation Density, Borehole Compensated Sonic-Gamma Ray and Temperature logs.
)-21	9-5/8" casing @ 1805'. Ran 44 joints of 9-5/8" OD, 40#, K-55, buttress, new, smls. USS casing including float shoe and float collar @ 1762'. Placed centralizers @ 1785' and over collars of second and every fifth joint to 77'. Cemented shoe @ 1805' with 400 sacks Class B cement premixed with 1:1 expanded perlite, 2% gel and 40% silica flour with 0.3% HR-5 & 0.5% CFR-2. Had good returns to surface during job but no cement returns. Tested casing with 2000 psig.
	Ran Wilson temperature survey. Located top cement @ 150'.
)-22	Landed 9-5/8" casing. Installed WKM thermal expansion head. Installed 2-10" Series 900 Shaffer double hydraulic control gates, Hydril GK and Grant rotating head.
)-23	Tested CSO rams, 3 sets pipe rams, kill line, blowdown manifold and Hydril with 1000 psig.
	Drilled 8½" hole to 1863'. Mud-water.

HISTORY OF GEOTHERMAL WELL

Operator THERMAL POWER COMPANY Field or County Beaver County Roosevelt KGRA

Well name and No. Utah State 14-2, ML-27536, Sec. 2, T 27S, R 9W, SL B. & M.

A.P.I. well No. ..... Name W. L. D'Olier (Person submitting report) Title V-President (President, Secretary or Agent)

Date October 26, 1976

Signature W. L. D'Olier

601 California Street
San Francisco, CA 94108 (Address)

415-981-5700 (Telephone Number)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Date 1976	
9-24	Depth 2233'. Mud-water.
9-25	Depth 2558'. Mud-water.
9-26	Depth 2612'. Mud-water. Cut core 2600'-2612'. Recovered 10'6".
9-27	Depth 2890'. Mud-water.
9-28	Depth 3255'. Mud-water.
9-29	Depth 3653'. Mud 8.7 ppg. with LCM.
9-30	Depth 3696'. Mud 8.8 with LCM.
10- 1	Depth 3701'. Mud 8.6 ppg. with LCM. Ran Eastman single shots: 3200' 3-3/4° N10W. 3696' 5-1/4° N 15W.
10- 2	Depth 3929'. Mud-salt water with LCM.
10- 3	Depth 4184'. Mud-salt water.
10- 4	Depth 4358'. Mud-salt water with LCM.
10- 5	Depth 4535'. Mud 8.6 ppg. with LCM.
10- 6	Depth 4675'. Mud-salt water.
10- 7	Depth 4891'. Mud-salt water.
10- 8	Depth 5138'. Mud-salt water.
10- 9	Depth 5294'. Mud-salt water.
10-10	Depth 5519'. Mud-salt water.
10-11	Depth 5678'. Mud-salt water.
10-12	Depth 5803'. Displaced hole with cold water. Ran Eastman Multi-shot 1805'-5800'. At 5800' MD, 5774.59' TVD, 395.38'N, 120.19'W. Well attempted to flow. Killed well.
10-13	Depth 5980'. Mud-salt water.
10-14	Total depth 6100'. Mud-salt water.
10-15	Ran Schlumberger Induction-Electrical, Borehole Compensated Sonic, Compensated Neutron-Formation Density and Temperature logs.
10-16	Ran Agnew & Sweet temperature survey. Attempted to test well but volume exceeded capacity of 4" flow line.
10-17	Laid down drill pipe. Tore out BOE. Installed 10" wellhead. Released rig to Utah State 72-16.

BIT RECORD

COMPANY	CONTRACTOR	COUNTY	STATE
hermal Power Company	Loffland Rig No. 5	Beaver	Utah

LEASE	WELL NO	SEC	TOWNSHIP	RANGE	BLOCK	FIELD
Utah State	14-2	2	27S	9W	SLB&M	Roosevelt K[illegible]A

TOOL PUSHER	DRILL PIPE	DRAW WORKS	
Buddy Bowden	4½"	Ideco Hydrair H-1000	Spud 9-11-76
DAY DRILLER	TOOL JOINT MAKE / SIZE / TYPE	POWER 2-GMC 12V-71N H.P 868	UNDER SURF
EVENING DRILLER	DRILL COLLAR NO / O.D / I.D / LENGTH	PUMP NO 1 MAKE / MODEL / STROKE: Emsco D-500	INT DATE
MORNING DRILLER	DRILL COLLAR NO / O.D / I.D / LENGTH	PUMP NO. 2 MAKE / MODEL / STROKE: Emsco D-500	T.D. DATE 10-14-76

BIT NO	BIT SIZE	BIT MFGR.	BIT TYPE	SERIAL NO. OF BIT	JET SIZE 1	2	3	DEPTH OUT	FTGE.	HOURS RUN	ACC. HOURS	FT/HR	WEIGHT 1000 LBS.	ROTARY R.P.M.	VERT. DEV.	PUMP PRESS	PUMPS No.	Liner	SPM	MUD Wt	Vis	DULL. CODE T	B	G	REMARKS FORMATION, CIRC. FLUID, ETC.	DATE
[illegible]	12¼	HTC	OSC1	RR	12	12	–	79	79	1½		53														
[illegible]	17½	HTC	OSC3	RR	12	12	–	206	127	7½		17	20	50	½	700										
[illegible]	17½	SM	3JS	RR	16	16	16	650	444	38		12	35	60	½	600										
[illegible]	12¼	RD	S62	RR	20	20	20	1304	654	25½		26	40	50	½	600										
[illegible]	12¼	HTC	X44	RR	20	20	20	1805	501	34½		15	35	60		500										
[illegible]	8½	HTC	OWV	BP 172	12	12	12	1895	90	4½		20	30	55		1000										
[illegible]	8½	HTC	J55	XE 022	12	12	12	2600	705	44½		16	20	60	4½	1000										
8	8½	HTC	J55	XC 302	15	15	15	3696	1096	70¾		15	30	60	5¾	600										
9	8½	RD	FP63	22-1079	15	15	15	4270	574	53¾		11	20	60	6½	600										
10	8½	SM	F5	AC-304	14	14	16	4675	405	57		7	18	60	7½	650										
11	8½	HTC	J44	RA-987	15	15	15	5170	495	51		10	20	60	10½	650										
12	8½	HTC	J44	EB463	15	15	15	5678	508	55		9	22	60	11¾	650										
13	8½	SM	F4	201DD	16	16	14	5983	305	36½		8	20	60	11½	650										
14	8½	SM	F5	445ES	16	16	14	6100	117	13	493	9	20	60	–	650										
–	6½	CNR	C.H.	65-39754				2612	12'	1½																

Compliments of SMITH TOOL

P.O. BOX C19511 • IRVINE, CALIF. 92713
DIVISION OF SMITH INTERNATIONAL, INC

ITH REPRESENTATIVE _____ PHONE _____

Utah State Well 14-2 ML-27536
Roosevelt KGRA, Utah
Core #1

Interval 2600'-12' cut 12' Rec 10' (83%). Core in summary is granodiorite with about 5 thin (1") zones of quartz filled fractures cutting core at high angles. Near top of core a 1.5' zone of predominate quartz is noted.

Fractures are not open. Core is not in reservoir. Local green alteration zones of chlorite after biotite, also a tan material after hornblende. Some red staining. Trace pyrite.

Cut 12' in 5 hours with new 6½" Christensen diamond core head. Core head wornout at end of run.

THERMAL POWER COMPANY
UTAH STATE 14-2 - ROOSEVELT HOT SPRINGS, UTAH
Flow Test 11/16-18/76 (48-hrs.)

(Sample 1 through 6)

Constituent (ppm)	1 1630* 11/16	2 2230* 11/16	3 0630* 11/17	4 1430* 11/17	5 0030* 11/18	6 0630* 11/18	Avg.	Std. Dev.
Sodium	2100.	2100.	2200.	2100.	2100.	2100.	2116	40.8
Potassium	410.	410.	420.	410.	410.	400.	410	6.3
Calcium	8.1	7.6	8.5	7.2	48.	7.1	7.7	.6
Magnesium	0.06	0.06	0.07	0.05	0.13	0.05	0.07	.03
Chloride	3600.	3500.	3500.	3600.	3500.	3600.	3550	55
Bicarbonate	385.	384.	403.	394.	612.	379.	426	91
Carbonate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
Sulfate	75.	74.	76.	75.	73.	74.	74.5	1
Boron	26.	26.	26.	25.	25.	25.	25.5	.6
Nitrate (NO_3)	<.02	<.02	<.02	<.02	<.02	<.02	<0.02	
Ammonium (NH_4)	6.	5.	5.	5.	4.	5.	5	.63
Arsenic	3.2	2.6	2.2	3.6	0.79	3.1	2.6	1
pH	6.1	6.1	6.2	6.2	6.4	6.2	6.2	0.11
TDS (ppm)	6500.	6400.	6700.	6300.	6600.	6700.	6533	163
Conductivity $[\frac{mho}{cm} \times 10^{-3}]$	9.18	9.18	9.18	9.18	9.10	9.38	9.2	.09

*Time

CWM/JRM/tti 12/14/76

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Geologic Division
Branch of Experimental Geochemistry and Mineralogy
345 Middlefield Road, Menlo Park, California 94025

14-2
FILE

March 21, 1977

RECEIVED
MAR 22 1977
TPC

Jake Rudisill
Thermal Power Co.
601 California Street
San Francisco, CA 94108

Dear Jake,

Here are the chemical analyses of the Utah State 14-2 well fluids. The tritium, deuterium, H_2S, and SO_4 sulfur isotopes and SO_4 oxygen isotopes will be a few months more. The small cyclone separator worked well - only 1-2 ppm Cl in the steam condensate and a liquid-vapor ^{18}O fractionation of 2.5‰ vs. 2.6‰ from experiments. Earlier collections with a large separator showed steam in the water and water in the steam. The special port for the calorimeter collected a fluid with $\delta^{18}O = -13.5$ indicating that it contained almost all water ($\delta^{18}O = -13.27, -13.46$) and little steam ($\delta^{18}O = -15.82, -15.87$).

It appears now that Emanuel Mazor and John Bowman will come along for the collection on March 30. We will drive down from SLC on the 29th and connect our separator before you open up on the 30th. If we can sample upstream and downstream of your orifice plate we would like to do so. This would allow us to make an independent estimate of the total fluid enthalpy. For this we would need valves on both sampling points with ½" (or some other agreed upon size) female NPT connections.

Keep me informed of your plans as they develop.

Best wishes,

ALFRED H. TRUESDELL

Enclosure

cc: Stan Ward

OFR 1/22/75

1C

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Branch of Experimental Geochemistry and Mineralogy
345 Middlefield Road, Menlo Park, California 94025

August 15,1977

Jake Rudisill
Thermal Power Company
601 California St
San Francisco, CA 94108

Dear Jake:

The following tritium analyses have been completed on the Utah State 14-2 well at Roosevelt Hot Springs, Utah.

Sample #	Type	Date Collected	TU±1σ
ROT-76-18	Brine	16 Nov 76	0.2±0.2
ROT-76-20	Brine	17 Nov 76	0.4±0.2
ROT-76-21	Steam Condensate	17 Nov 76	7.6±0.4

Analyses were done by F.J. Pearson, Jr. of the USGS in Reston, VA.

Sincerely,

Nancy Nehring

Nancy Nehring

RECEIVED
AUG 17 1977
TPC

U.S. Geological Survey, Water Resources Division
Quality of Water Branch, Menlo Park, California

$\delta^{18}O = -13.46$

ANALYTICAL STATEMENT

Source: Thermal Power Company Well ROT-76-18 Roosevelt, Utah

Lab. No. GT293AT76

Location:

____¼ Sec.____, T.____, R.____

Point of coll: Water separate after 2 1/2 hours; 374°F.

WHP 177 psia, Collection Temp. 14°C

Date of coll.: November 1976

Collected by: A. Truesdell

Analyst: Barnes group

Date completed: 3/77

Checked by:

Field Filter: None.

Lab Filter: 0.1 µm.

1:10 silica field dilution

F denotes field determination.

	mg/l	me/l		mg/l	me/l
SiO_2	640		HCO_3		
Al			CO_3		
Fe			OH		
Mn					
As	3.0		SO_4	78	
			Cl	3650	
			F	5.2	
			Br		
			I		
Ca	9.2		NO_2		
Mg	0.6		NO_3		
Sr			PO_4		
Ba			B	29	
Na	2150				
K	390				
Li					
NH_4					
Cation totals:			Anion totals:		

Dissolved solids:
- Calculated (mg/l) ____
- Residue (180°C) (mg/l) ____

Hardness as $CaCO_3$ (mg/l) ____

N. C. Hardness as $CaCO_3$ (mg/l) ____

Specific conductance (micromhos at 25°C) 9900

F pH 5.9 (paper); Density at 20°C (g/ml) ____

Sulfides as H_2S (mg/l) ____

(Unpublished records, subject to revision. Copied from original record.)

☆ GPO 690-240

U.S. Geological Survey, Water Resources Division
Quality of Water Branch, Menlo Park, California

$\delta^{18}O = -13.27$

ANALYTICAL STATEMENT

Source: Utah State Well #14-2
ROT-76-20

Lab. No. GT295AT76

Location: Roosevelt, Utah
_____ ¼ Sec. _____, T. _____, R. _____

Point of coll: Water separate.

Collection
WHP 177 psia, Temp. 9°C
Date of coll.: November, 1976
Collected by: A. Truesdell

Analyst: Barnes group
Date completed: 3/77
Checked by:
Field Filter: None.
Acid: HCl, HNO_3.
1:10 silica field dilution.
F denotes field determination.
Lab Filter: 0.1 µm.

	mg/l	me/l		mg/l	me/l
SiO_2	820		HCO_3		
Al			CO_3		
Fe			OH		
Mn					
As	2.2		SO_4	60	
			Cl	3650	
			F	4.8	
			Br		
			I		
Ca	6.9		NO_2		
Mg	0.08		NO_3		
Sr			PO_4		
Ba			B	28	
Na	2200				
K	410				
Li					
NH_4					
Cation totals:			Anion totals:		

Dissolved solids:
Calculated (mg/l) _____
Residue (180°C) (mg/l) _____
Hardness as $CaCO_3$ (mg/l) _____
N. C. Hardness as $CaCO_3$ (mg/l) _____

Specific conductance (micromhos at 25°C) 10,000
F_{pH} 6.2 (paper); Density at 20°C (g/ml) _____
Sulfides as H_2S (mg/l) _____
(Unpublished records, subject to revision. Copied from original record.)

☆ GPO 650-240

U.S. Geological Survey, Water Resources Division
Quality of Water Branch, Menlo Park, California

$\delta^{18}O = -15.87$

ANALYTICAL STATEMENT

Source: Utah State Well #14-2
ROT-76-21
Location: Roosevelt, Utah
____ ¼ Sec. ____, T. ____, R. ____

Point of coll: Steam condensate

Collection
____, Temp. 9°C
Date of coll.: November, 1976
Collected by: A. Truesdell

Analyst: Barnes group
Date completed: 3/77
Checked by:
Field Filter: None.
Acid: HCl, HNO_3.
Lab Filter: 0.1 µm.
F denotes field determination.

Lab. No. GT296AT76

	mg/l	me/l		mg/l	me/l
SiO_2	<1	---	HCO_3		
Al			CO_3		
Fe			OH		
Mn					
As	<0.01		SO_4	3	
			Cl	2	
			F	<0.1	
			Br		
			I		
Ca	6.6		NO_2		
Mg	<0.05		NO_3		
Sr			PO_4		
Ba			B	0.55	---
Na	<0.5				
K	<0.1				
Li					
NH_4					
Cation totals:			Anion totals:		

Dissolved solids:
Calculated (mg/l) ____
Residue (180°C) (mg/l) ____
Hardness as $CaCO_3$ (mg/l) ____
N. C. Hardness as $CaCO_3$ (mg/l) ____

Specific conductance (micromhos at 25°C) 185
F pH 4.5 (paper); Density at 20°C (g/ml) ____
Sulfides as H_2S (mg/l) ____
(Unpublished records, subject to revision. Copied from original record.)

☆ GPO 830-240

U.S. Geological Survey, Water Resources Division
Quality of Water Branch, Menlo Park, California

$\delta^{18}O = -15.82$ ‰

ANALYTICAL STATEMENT

Source: Thermal Power Company Well
ROT-76-19 Roosevelt, Utah

Lab. No. GT294AT76

Location:
_____ ¼ Sec. _____, T. _____, R. _____

Point of coll: Steam condensate.

Collection
_____, Temp. 15°C
Date of coll.: November, 1976
Collected by: A. Truesdell

Analyst: Barnes group
Date completed: 3/77
Checked by: _____
Field Filter. None. Acid: HCl, HNO_3.
Lab Filter: 0.1 µm.
F denotes field determination.

	mg/l	me/l		mg/l	me/l
SiO_2	<1	---	HCO_3		
Al			CO_3		
Fe			OH		
Mn					
As	0.02		SO_4	2	
			Cl	1	
			F	<0.1	
			Br		
			I		
Ca	52		NO_2		
Mg	<0.05		NO_3		
Sr			PO_4		
Ba			B	0.6	---
Na	<1				
K	<0.1				
Li					
NH_4					
Cation totals:			Anion totals:		

Dissolved solids:
Calculated (mg/l) _____
Residue (180°C) (mg/l) _____
Hardness as $CaCO_3$ (mg/l) _____
N. C. Hardness as $CaCO_3$ (mg/l) _____

Specific conductance (micromhos at 25°C) 220
F pH 4.9 (paper); Density at 20°C (g/ml) _____
Sulfides as H_2S (mg/l) _____
(Unpublished records, subject to revision. Copied from original record.)

☆ GPO 830-240

THERMAL POWER COMPANY

Geothermal Well: Utah State 14-2 ML-27536
Roosevelt Field, Beaver County, Utah

48-Hour Flow Test, November 16, 1976 to November 18, 1976

CONTENTS

Jacob M. Rudisill
November 24th, 1976

SUMMARY

The well surveys for Pressure and Temperature as well as the 48-hour flow test proceeded without major incident to successful conclusions. A rock throttled flow during the last nine (9) hours of the test, but managed only to change some specific values of enthalpy, and not the overall test results.

The average mass flow $\dot{m}p$ during the stabilized time of flow (1400 hrs. 11/16 to 0100 hrs. 11/18) was 495,000 lbm./hr. as calculated according to P.P. Co.'s methods. (Correcting for a misplaced pressure tap might bring that figure down to $\dot{m}_T$ = 483,000.) Average enthalpy during that time was 444.5 BTU/lbm. which would produce at 70 psig about 17.8% flash, or 88,300 lbm./hr. of 70 psig steam. This would be roughly enough steam to generate 4.5MW of electricity at a heat rate of 19,620 lbm./hr.MW.

DESCRIPTION OF TEST

Agnew and Sweet arrived on site at 2330 hrs. 11/15/76. They were rigged up and ready to run Pressure-Temperature survey at 0130 hr. 11/16. Pressure tool used was for 4000 psi maximum (normal pressured conditions): temperature tool was for 60°F to 600°F service. 12 hr. clocks for the 20 ft./min. survey were pre-zeroed and calibrated. Survey was completed at ∿ 0730 hrs. as scheduled without incident. Pressure clock stopped at 4900', 1796 psig. Temperature survey was completed (see Appendix for data).

Phillips personnel (Cecil Clements and Lee Peiffer) arrived at ∿ 0830 hrs. and began setting up pressure regulator air supply and miscellaneous. Clark Howard arrived at 0930 hrs. and began building up southwest side of sump to provide enough volume for 48-hour test. Roustabouts placed tarp on west side of sump opposite pipe mouth to prevent bank erosion. Tarp was held by dirt and stakes. Barbed wire fence was moved behind tarp.

Well opened at 1120 hrs. 11/16 to ∿ 15% open. Pressure regulator was about ∿ 50% open at 1144 hrs. when seals on pressure regulator began to leak. Well shut-in, regulator flanges tightend, well re-opened at 1155 hrs. Well fully opened at 1245 hrs., without incident. Tarp uprooted from stakes on inner side of sump, blown over barb wire behind it, and torn.

At 1400 hrs. 11/16 the #2 WKM 10" valve's pop-off pressure relief valve's port began to make water through relief hole (1/8" diameter). Flow diminished during test (only a few drops/minute at most) due to lower wellhead pressures and chemical deposits plugging the hole.*

Al Truesdale of the USGS and Dr. Stan Ward took water and steam samples for oxygen isotopes, radon, CH_4, H_2S, CO_2, etc. starting at 1430 hrs., ending at 1700 hrs., 11/16/76.

Upon my arrival at site at 0830 hrs., 11/17/76, streams of condensate were running down sump bank and across Section 2 into Section 3. Howard Construction was called and on the scene at 1230 hrs. Dirt moving started at 1300 hrs. to (1) share up the WNW side of sump, which was eroded badly, and (2) form a drainage ditch to divert most of the condensate to the road leading to Well 54-3's sump, and thus minimize erosion of Federal land. Dirt moving completed at 1700 hrs., and successful.

*Sug Roberts said this phenomenon is entirely normal.

Thermometer was broken at ∿ 0900 hrs., 11/17/76, replaced for 1300 hrs. reading. Temperature data from 0700-1200 hrs. consequently unrecorded.

I personally remained on site from 2000 hrs. to the test's end at 1130 hrs., 11/18/76 to (1) insure sump did not overfill, causing spillage onto Section 3, and (2) periodically inspect backside of sump to shut-off test should erosion be too great. Test was completed with almost one (1) foot of sump depth margin.

Agnew and Sweet began rigging up for a repeat P-T survey, 20 ft./min. at 1020 hrs., 11/18/76. Rigging up was completed at 1130 hrs., well was shut-in, and survey commenced. Obstruction was encountered at 130 feet, preventing entry into wellbore. Obstruction was overcome; consequently, the decision was made to survey from bottom to top. Obstruction encountered at 4387' - not overcome. Surveyed out of hole. P&T surveys both good from 4387'. Ran back in hole with sinker bar and knocked out obstructions at 4400' and on to T.D.

Ran back in hole with P-T instruments and one (1) section sinker bar, surveying going down. Obstruction encountered at 4870'. Survey stopped; tool worked. Obstruction overcome, tool lowered to T.D. (6084'). Surveyed out of hole to 4800', tripped back to surface. Wellhead restored to original 3/32" bleed line at 0400 hrs. Surveys read from 0430 hrs. to 0800 hrs., 11/19/76. Agnew and Sweet released at 0830 hrs.

The afternoon of 11/19/76 was spent (1-hr.) with Charles Marris of Phillips doing one (1) example of data reduction.

SPECIAL COMMENTS ON ROCK-THROTTLING AND SURGING

During the preliminary 2-hour clean-out flow test (10/29/76) of Well 14-2, quite a bit of surging of the flow at the pipe's end was noted, even when the Fisher globe-valve pressure regulator was 90% open. I conjectured then that this surging appeared to be caused by flashing occurring upstream of the lip of the pipe (where the flow reverts from flow pressure to atmospheric). The 48-hour flow test has confirmed this conjecture by two means:

1. 14-2 surged until the Fisher pressure regulator was opened >90% to 100% open. That little bit of reduction in the pressure drop prevented the pre-lip flashing from becoming large enough to surge, and 14-2 flowed fairly uniformly until 0145 hrs. at 11/18/76.

2. At 0145 hrs., 11/18/76 14-2 made a large rock which became lodged in the pressure regulator. This obstruction throttled the flow, causing increases in wellhead pressure and temperature and a decrease in measured enthalpy (and thus ↓ in flow rate). Additionally, the well began to surge again due to the pressure loss caused by the throttling. (See time graphs.)

From these two (2) occurrences I feel confident that the well surges when flow obstructions cause major in-pipe flashing.

Flow Rate

$G_T = \frac{10{,}450}{y0.063\ h\ 1.102} \cdot \frac{p0.96}{}$ if $y \leq 0.3$ or $G_p = 11{,}400 \cdot \frac{p0.96}{h\ 1.102}$ if $y = 0.25$

since G = lbm./ft.^{2} sec, $\dot{m} = \frac{\pi}{4}\left(\frac{dc}{12}\right)^2 \cdot 3600 \cdot G$ lbm./hr.

here, $d_c = 8.0$"

(1a.) $\dot{m}_T = 13{,}968{,}899.23 \cdot \frac{p0.96}{h\ 1.102}$ (1b.) $\dot{m}_p = 14{,}325{,}662.50 \frac{p0.96}{h\ 1.102}$

$\dot{m}_T \times 1.0255 = \dot{m}_p$

Enthalpy Determination

From James' "Metering of Steam-Water Two-Phase Flow by Sharp-Edged Orifices", Institute of M. E. Proceedings 1965-1966, Volume 180 Part 1, p. 563

$$\text{Eq (15)}\quad h_o\ 1.102 = 1450\ \frac{P_c\ 0.96}{Y_{TP}}\ \left(\frac{dc}{dm}\right)^2\ \sqrt{1-B^4}\ \times\ \frac{\sqrt{\left(\frac{h_o-h_p}{L}\right)^{1.5}(\nu_g-\nu_f)+(\nu_f)}}{\sqrt{\phi_{TP}}} \qquad (2)$$

P_c = critical lip pressure (psia)

Y_{TP} = Expansion factor for two-phase flow, from Fig. 14, p. 565

D = diameter of pipe in orifice

d_c = diameter (in) where critical flow occurs

d_m = diameter (in) of metering orifice

B = dm/O

h_o = specific stagnation enthalpy (Btu/lbm.)

h_p = specific enthalpy of saturated liquid (Btu/lbm.)

L = specific latent heat (Btu/lbm.) defined by State

νg = specific volume of dry saturated vapor (ft.^{3}/lbm.)

νf = specific volume of saturated liquid (ft.^{3}/lbm.)

ϕ_{TP} = Meter differential, mmH_g under water.

Constants and Conversion Factors

$D = 10.02"$

$d_c = 8.00"$

$d_m = 7.5"$

$\therefore B = \frac{dn}{D} = \frac{7.5}{10.02} = 0.7485 \Rightarrow B^2 = 0.5603,\ B^4 = 0.3139$

Reduction of Meter Data

There are two readings on the meter: Downstream pressure R_D
Differential pressure R_Δ

Downstream Pressure $= P_D = R_D^2 \times 10$ in psig (3)

Differential Pressure $= P_\Delta = R_\Delta^2 \times 6.966$ in inches of H_2O (4)

since 13.61" H_2O = 1" of H_g = 25.4 mmH_g
1 psi = 51.71 mmH_g

then P_Δ (in H_2O) $\times \frac{25.4\ mmHg}{13.61\ in\ H_2O} = \emptyset_{TP}$ (mmH_g)

Substituting Eq(4) $R_\Delta^2 \times \frac{6.966}{13.61} \times 2.54 = \emptyset_{TP}$

$$\boxed{\emptyset_{TP} = 13.0005 \cdot R_\Delta^2\ mmH_g} \quad (5)$$

To determine Y_{TP}, P_1 is needed

Upstream Pressure $= P_1 = R_D^2 \times 10 + \emptyset_{TP} + Patm$ (6)

$$P_1 = R_D^2 \times 10 + \frac{13.005}{51.71} \times R_\Delta^2 + Patm$$

$$P_1 = R_D^2 \times 10 + 0.25141 \times R_\Delta^2 + Patm$$

Patm = (Barometric Pressure - elevation correction) conversion.

Airport is located at 5040 ft. (within 30').

Wellsite is located at 6240 ft.

Correction 0.875" H_g per 1000' ft. elevation at 5000-6000' range.

$$\text{Patm} = (\text{Barometric Pressure} - (6240\text{-}5040') \cdot \frac{0.875 \text{ in.}}{1000 \text{ ft.}} \times \frac{1 \text{ psi}}{2.036 \text{ in } H_g}$$

$$\text{Patm} = (\text{BP} - 1.05") \frac{1}{2.036} \text{ psia} \qquad (7)$$

Thus one has

$$\boxed{P_1 = R_D^2 \times 10 + 0.25141 R_\Delta^2 + \text{Patm} \quad \text{psia}} \qquad (8)$$

where Patm is defined by E_q (7)

Similarly

$$\boxed{P_\ell = P_L + \text{Patm}} \qquad (9)$$

The remaining variables in E_q (2) are determined by the State properties of water at P_1, and calculations on Figure 14, p. 565.

For Y_{TP}, $\frac{\phi_{TP}}{55.8 \times P_1} \times 100 = \text{abs.}$

$$B = 0.56$$

To get % flash at 82 psia (70 psig), E_q (10) is employed.

$$\% \text{ flash} = \frac{h_o - h_f \text{ @ 82 psia}}{h_{fg} \text{ @ 82 psia}} \times 100 = \frac{h_o - 283.98}{900.1} \times 100 \qquad (10)$$

Example Calculation @ 0100 hrs., 11/17/76

Data: $R_\Delta = 4.95$ $\quad T = 362$ $\quad BP = 25.34$

$R_D = 3.8$ $\quad P_L = 20.25$ psig

Reduction

From E_q (7)

$$Patm = (.25.34" - 1.05") \frac{1}{2.036} = 11.930 \text{ psia}$$

$$\emptyset_{TP} = 318.55" \text{ Hg}$$

From Eq (8)

$$P_i = \frac{(3.8)^2}{144.4} \times 10 + 0.25141 \times (4.95)^2 + 11.930 + 6.1602$$

$P_i = 162.49$ psia ←←←← this sets the State for h_o calculation.

On Fig. 14, $\frac{\emptyset_{TP}}{55.8} \cdot 162.49 \times 100 = \text{absica} = 3.513$, $B^2 = 0.56$ $Y_{TP} = 0.97$

From Eq (9)

$P = P_L + Pam = 20.5 + 11.93 = 32.43$ psia = P

From E_q (2)

$$h_o^{1.102} = \frac{1450\ (32.43)}{0.97\ \sqrt{318.55}}^{0.96} \frac{(8.0)^2}{7.5} \sqrt{1-0.3139} \sqrt{\quad}$$

$$h_o^{1.102} = 2227.24 \sqrt{f(h_o)}$$

From $P_i = 162.5$ psia, and K&K tables

$\nu g = 2.794$ ft.^{3}/lbm.
$\nu f = 0.018168$ ft.^{3}/lbm.
$h_p = 337.48$ Btu/lbm.
$L = 858.7$ Btu/lbm.

Now perform converging - approximation - solution for h_o

Guess $h_o = 475$ Btu/lbm.

$$(475)^{1.102} \stackrel{?}{=} 2227.24 \sqrt{\frac{(475-337.48)^{1.5}}{858.7}\ (2.794-0.01868)+.018168}$$

$$890.7 \stackrel{?}{=} 986.225 \quad \text{NO}$$

Guess h_o = 442, seeking $\Delta \sim 0$, ($|\Delta| \leq 0.1$ is convergence criteria)

$$\Delta = 2227.24 \sqrt{f(442)} - (442)^{1.102}$$

$$\Delta = 1.2167$$

h_o = 442.4, = 0.005

So h_o = 442.4 Btu/lbm.

Substituting into Eqs (1)

$\dot{m}_p$ = 490,800 lbm./hr.

$\dot{m}_T$ = 479,000 lbm./hr.

@ 0100 hrs., 11/17/76

h_o = 442.4 Btu/lbm.
corresponding to saturated fluids @

To get % flash at 82 psia (70 psig), E_q (10) is employed

$$\% = \frac{442.4-283.98}{900.1} \times 100 = \underline{17.6\%}$$

JMR/tti-11/24/76

CALCULATION TABLES

Day	Time Hrs.	P_L psig	R_D	R_Δ	BP "Hg	Patm psia	ØTP mmHg R_7	P_1 psia	Ab	Yrp R_O	P psia R_2	hf Btu/lbm. R_3	L Btu/lbm. R_4	vg lbm./ft.^{2} R_5	vf lbm./ft.^{3} R_6
11/16	1205	13.2	5.6	2.3	25.270	11.90	68.77	326.83	.377	.997	25.1	414.9	790.3	1.2667	0.019198
	1215	20.2	5.4	3.0	"		117.00	305.76	.686	.990	32.1	396.0	808.07	1.5160	0.018923
	1230	24.5	4.6	4.25	"		234.82	228.04	1.85	.985	36.4	367.6	833.4	2.0169	0.018539
	1245	25.75	4.1	5.4	"		379.09	187.33	3.63	.965	37.65	349.79	848.6	2.4384	0.018315
	1300	23.3	4.0	5.2	"		351.53	178.70	3.53	.970	35.2	345.65	852.02	2.5512	0.018265
	1315	22.4	3.9	5.05	"		331.55	170.41	3.49	.970	34.3	341.54	855.42	2.6699	0.018216
	1330	22.2	3.9	"	"		"	170.41	3.49	.970	34.1	"	"	"	"
	1345	22.05	3.9	"	"		"	170.41	3.49	.970	33.95	"	"	"	"
	1400	21.80	3.9	"	"		"	170.41	3.49	.970	33.70	"	"	"	"
	1500	21.53	3.9	5.0	"		325.01	170.29	3.42	.971	33.43	"	"	"	"
	1600	21.42	3.9	"	"		"	170.29	3.42	.971	33.32	"	"	"	"
	1700	21.28	3.85	"	"		"	166.41	3.50	.970	33.18	339.50	857.04	2.7316	0.018191
	1800	21.13	3.85	"	"		"	166.41	3.50	.970	33.03	"	"	"	"
	1900	20.82	3.85	4.95	25.30	11.91	318.54	166.30	3.43	.971	32.73	"	"	"	"
	2000	20.7	3.83	"	"		"	164.76	3.46	.970	32.61	338.59	857.81	2.7598	0.018181
	2100	20.45	3.81	4.90	"		312.14	163.92	3.41	.971	32.36	339.29	857.2	2.770	0.018177
	2200	20.65	3.83	"	"		"	164.64	3.40	.971	32.56	338.49	857.78	2.7598	0.018181
	2300	20.8	3.82	4.95	25.34	11.93	318.54	164.01	3.48	.970	32.73	339.29	857.2	2.770	0.018177
	2400	20.5	3.82	4.9	"		312.14	163.89	3.41	.971	32.43	"	"	"	"
11/17	0100	20.5	3.80	4.95	"		318.54	162.49	3.51	.97	32.43	337.47	858.7	2.7942	0.018168
	0200	20.45	3.80	4.95	"		318.54	162.49	3.51	.97	32.38	"	"	"	"
	0300	20.55	3.80	4.95	"		318.54	162.49	3.51	.97	32.48	"	"	"	"
	0400	20.6	3.80	4.95	"		318.54	162.49	3.51	.97	32.53	"	"	"	"
	0500	20.6	3.80	4.90	"		312.14	162.37	3.51	.97	32.53	337.41	858.75	2.7961	0.018167
	0600	20.58	3.80	4.90	"		312.14	162.37	3.51	.97	32.51	"	"	"	"
	0700	20.60	3.75	4.95	"		318.54	158.72	3.60	.969	32.53	335.48	860.38	2.8578	0.018144
	0900	21.10	3.80	4.95	25.33	11.93	318.54	162.49	3.51	.97	33.03	337.47	858.7	2.7942	0.018168
	1100	21.54	3.90	5.04	25.28	11.90	330.23	170.39	3.47	.97	33.44	341.54	855.42	2.6699	0.018216

CALCULATION TABLES

Day	Time Hr.	P_L psig	R_D	R_Δ	BP "Hg	Patm psia	ϕ_{TP} mmHg R_7	P_1 psia	Ytp R_o	P psia R_2	hf Btu/lbm. R_3	L Btu/lbm. R_4	ν_g lbm./ft.^{3} R_5	ν_f lbm./ft.^{3} R_6
11/17	1300	21.65	3.9	5.05	25.28	11.89	331.55	170.40	.97 3.49	33.54	341.54	855.42	2.6699	0.018216
	1500	21.35	3.85	5.05	25.23	11.88	331.55	166.52	.968 3.57	33.23	339.50	857.04	2.7316	0.018191
	1700	21.42	3.85	5.05	25.21	11.87	331.55	166.51	.968 3.56	33.29	"	"	"	"
	1900	21.2	3.85	5.05	25.21	11.87	331.55	166.51	.968 3.56	33.07	"	"	"	"
	2100	21.3	3.85	5.0	25.20	11.86	325.01	166.39	.968 3.57	33.16	"	"	"	"
	2300	20.96	3.85	5.0	25.18	11.85	325.01	166.38	.968 3.57	32.81	"	"	"	"
11/18 →	0100 rock	21.2	3.85	5.0	25.17	11.85	325.01	166.38	.968 3.57	33.05	"	"	"	"
	0300	20.75	4.05	4.35	25.15	11.84	246	180.62	.976 2.44	32.59	346.59	851.25	2.5249	0.018277
	0500	20.15	4.05	4.3	25.14	11.83	240.38	180.50	.977 2.39	31.98	345.53	851.30	2.5265	0.018276
	0700	20.45	4.05	4.25	25.13	11.83	234.82	180.40	.977 2.33	32.28	346.48	851.34	2.5278	0.018275
	0900	20.40	4.0	4.2	25.15	11.84	229.33	176.27	.977 2.33	32.24	344.46	852.99	2.5852	0.018251
	1100	20.30	3.9	4.3	25.11	11.82	240.38	168.57	.975 2.56	32.12	340.61	856.17	2.6982	0.018205

VALUE TABLE

ROUNDED TO NEAREST 100

Day	Time (hrs.)	h_o (Btu/ lbm.)	lip press. P (psia)	% flash @82 psia	$\dot{m}_p$ (lbm./hr.)	$\dot{m}_T$ (lbm./hr.)	Steam @70 psig based on $\dot{m}_p$
11/16	1205	507.1	25.1	24.8	330,200	322,000	81.9
	1215	471.0	32.1	20.8	453,600	442,300	94.3
	1230	457.9	36.4	19.3	528,000	514,800	101.9
	1245	460.2	37.65	19.6	542,400	528,800	106.3
	1300	457.6	35.2	19.3	511,600	498,900	98.7
	1315	444.7	34.3	17.9	515,000	502,200	92.2
	1330	446.2	34.1	18.0	510,200	497,500	91.8
	1345	447.3	33.95	18.1	506,700	494,100	91.7
	1400	449.3	33.70	18.4	500,700	488,200	92.1
	1500	449.0	33.43	18.3	497,200	484,800	91.0
	1600	449.8	33.32	18.4	494,600	482,300	91.0
	1700	444.9	33.18	17.9	498,600	486,200	89.3
	1800	446.05	33.03	18.0	495,000	482,700	89.1
	1900	446.0	32.73	18.0	490,800	478,600	88.3
	2000	444.1	32.61	17.8	491,400	479,100	87.5
	2100	444.2	32.36	17.8	487,600	475,500	86.8
	2200	441.85	32.56	17.5	493,400	481,100	86.4
	2300	443.75	32.73	17.8	493,500	481,200	87.8
	2400	443.65	32.43	17.7	489,300	477,100	86.6
11/17	0100	442.4	32.43	17.6	490,800	478,600	86.4
	0200	442.8	32.38	17.6	489,600	477,500	86.2
	0300	442.0	32.48	17.6	492,000	479,800	86.6

VALUE TABLES

ROUNDED TO NEAREST 100

Day	Time	h_o (Btu/lbm.)	lip press. P (psia)	% flash @82 psia	$\dot{m}p$ (lbm./hr.)	$\dot{m}_T$ (lbm./hr.)	Steam @ 70 psig based on $\dot{m}p$
11/17	0400	441.6	32.53	17.5	493,300	481,000	86.3
	0500	438.75	32.53	17.2	496,800	484,400	85.5
	0600	438.9	32.51	17.2	496,300	484,000	85.4
	0700	435.8	32.53	16.9	500,500	488,000	84.6
	0900	437.75	33.03	17.1	505,400	492,800	86.4
	1100	450.8	33.44	18.5	495,100	482,800	91.6
	1300	450.6	33.54	18.5	496,800	484,400	91.9
	1500	446.6	33.23	18.1	497,200	484,900	90.0
	1700	446.15	33.29	18.0	498,700	486,200	89.8
	1900	447.9	33.07	18.2	493,400	481,100	89.8
	2100	444.45	33.16	17.8	498,900	486,500	88.8
	2300	447.25	32.81	18.1	490,500	478,200	88.8
11/18 →	0100 rock	445.3	33.05	17.9	496,300	483,900	88.8
	0300	434.85	32.59	16.8	502,600	490,100	84.4
	0500	436.4	31.98	16.9	491,600	479,400	83.1
	0700	431.7	32.28	16.4	502,000	489,500	82.3
	0900	424.7	32.24	15.6	510,500	497,800	79.6
40 days pts	1100	420.85	32.12	15.2	513,800	501,000	78.1

Average Values

During the stabilized period (from 1400 hrs., 11/16/76 to 0100 hrs., 11/18/76)

$\bar{\dot{m}}_p$ = 495,000 lbm./hr. [s = 4,100, n = 27]

$\bar{\dot{s}team}_p$ = 88,300 lbm./hr. (weighted average) at 70 psig flash [s = 2,150, n = 27]

$\bar{h}_o$ = 444.5 Btu/lbm. [s = 3.9, n = 27]

$\bar{\%}$ flash = 17.8% at 70 psig

During the period of rock-throttled flow (0100 hrs., 11/18/76 to 1130 hrs., 11/18/76)

$\bar{\dot{m}}_p$ = 504,100 lbm./hr. [s = 8,600, n = 5]

$\bar{\dot{s}team}_p$ = 81,500 lbm./hr. [s = 2,600, n = 5]

$\bar{h}_o$ = 429.7 Btu/lbm. [s = 6.68, n = 5]

% flash at 70 psig = 16.2%

POST-FLOW

Temp. Profile 20'/min., Element: 90-660, Serial #10008, 12hr. clock, 15 turn

Depth	Temp.	Depth	Temp.
0	90°	3100	496°
100	280°	3200	495°
200	302°	3300	496°
300	310°	3400	496°
400	282°	3500	496°
500	237°	3600	496°
600	354°	3700	496°
700	364°	3800	496°
800	372°	3900	496°
900	384°	4000	496°
1000	393° 378-370	4100	496°
1100	404°	4200	496°
1200	421°	4300	496°
1300	437°	4400	496°
1400	443°	4500	496°
1500	447°	4600	496°
1600	450°	4700	496°
1700	451°	4800	496°
1800	456° 446,443	4900	496°
1900	459°	5000	496°
2000	463°	5100	497°
2100	468°	5200	498°
2200	472°	5300	498°
2300	475°	5400	499°
2400	480° 471-467	5500	501°
2500	486°	5600	502°
2600	500° 478-5	5700	504°
2700	500°	5800	505°
2800	499°	5900	513°
2900	497°	6000	
3000	496°	6084	519.4°

Depth	Press. (Psi)
0	85
500	204
1000	423
1500	629
2000	885
2500	1174
3000	1390
3500	1531
4000	1695
4500	1829
4800	1851
5000	1963 → 2083.3
5500	2143
6000	2386
6084	2401

THERMAL POWER COMPANY
UTAH STATE 14-2 - ROOSEVELT HOT SPRINGS, UTAH
Flow Test 11/16-18/76 (48-hrs.)

(Sample 1 through 6)

Constituent (ppm)	1 1630* 11/16	2 2230* 11/16	3 0630* 11/17	4 1430* 11/17	5 0030* 11/18	6 0630* 11/18	Avg.	Std. Dev.
Sodium	2100.	2100.	2200.	2100.	2100.	2100.	2116	40.8
Potassium	410.	410.	420.	410.	410.	400.	410	6.3
Calcium	8.1	7.6	8.5	7.2	48.	7.1	7.7	.6
Magnesium	0.06	0.06	0.07	0.05	0.13	0.05	0.07	.03
Chloride	3600.	3500.	3500.	3600.	3500.	3600.	3550	55
Bicarbonate	385.	384.	403.	394.	612.	379.	426	91
Carbonate	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
Sulfate	75.	74.	76.	75.	73.	74.	74.5	1
Boron	26.	26.	26.	25.	25.	25.	25.5	.6
Nitrate (NO_3)	<.02	<.02	<.02	<.02	<.02	<.02	<0.02	
Ammonium (NH_4)	6.	5.	5.	5.	4.	5.	5	.63
Arsenic	3.2	2.6	2.2	3.6	0.79	3.1	2.6	1
pH	6.1	6.1	6.2	6.2	6.4	6.2	6.2	0.11
TDS (ppm)	6500.	6400.	6700.	6300.	6600.	6700.	6533	163
Conductivity $\left[\frac{mho}{cm} \times 10^{-3}\right]$	9.18	9.18	9.18	9.18	9.10	9.38	9.2	.09

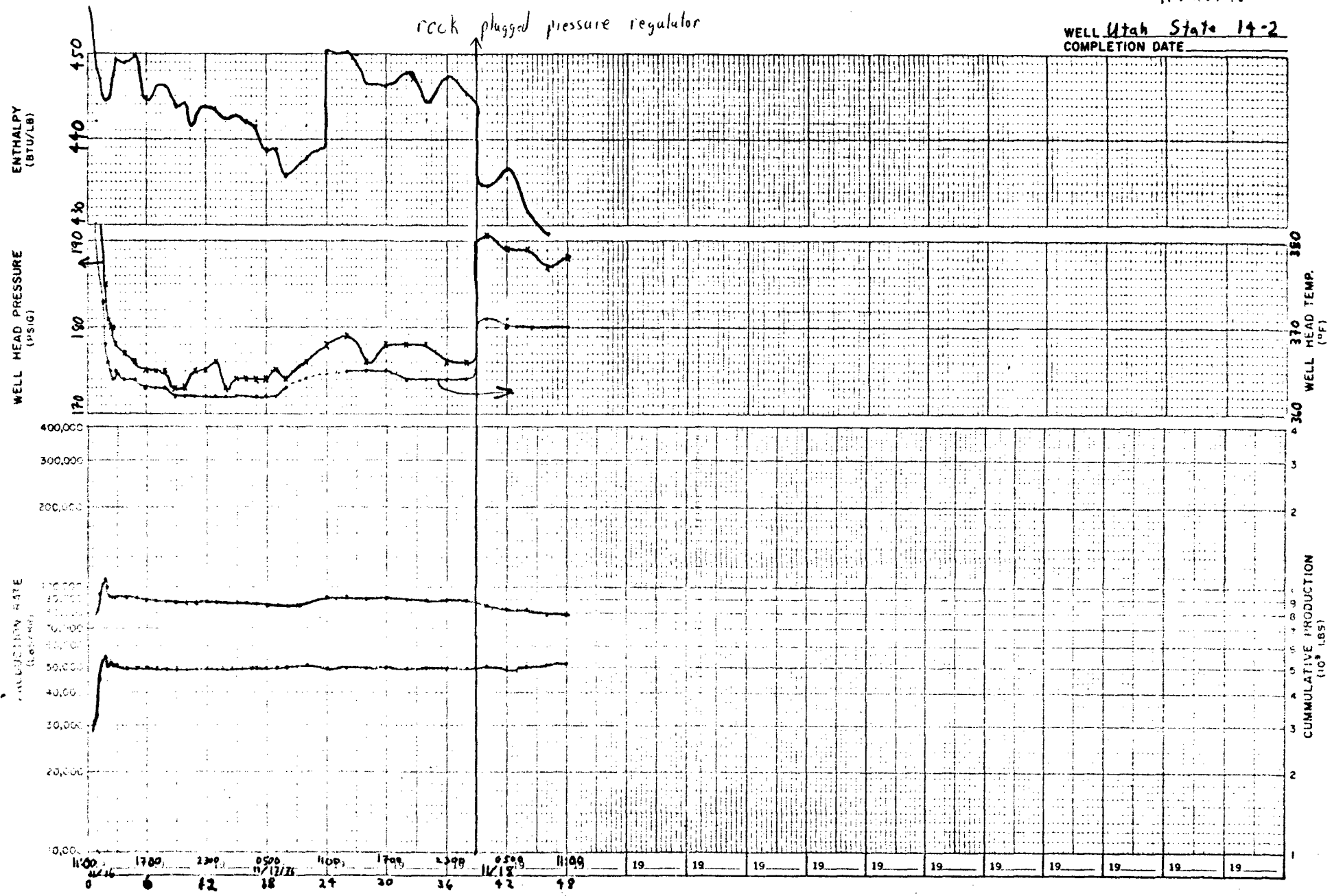
*Time

CWM/JRM/tti 12/14/76

JACOB (JAKE) M. RUBESIN
11/23/76

rock plugged pressure regulator

WELL Utah State 14-2
COMPLETION DATE



HP-25 Program Form

JACOB (JAKE) M. RUDISILL

Title Enthalpy determination from orifice measurements Page 23 of 23

Switch to PRGM mode, press [f] [PRGM], then key in the program.

DISPLAY LINE	DISPLAY CODE	KEY ENTRY	X	Y	Z	T	COMMENTS
00			h0	h0			
01		STO	STO 1				
02		1	1				
03		.	.				
04		3	3				
05		6	6				
06		6	6				
07		5	5				
08		f	f231				
09		EEX	EEX 3				
10		3	R2				
11		8	8				
12		9	9				
13		6	6				
14		y^x	y^x				
15		×	Times				
16		RO	RO				
17		=	=				
18		R/S	R7				
19		√	√				
20		÷	÷				
21		R↓	R1				
22		R↓	R2				
23		=	=				
24		R↓	R4				
25		÷	÷				
26		1.5	1.5				
27		y^x	y^x				
28		CHS	CHS				
29		R↓	R5				
30		−	−				
31		X	X				
32		R↓	R6				
33		+	+				
34		√	√				
35		×	Times				
36		R↓	R1				
37		1	1				
38		.	.				
39		1	1				
40		0	0				
41		2	2				
42		y^x	y^x				
43		−	−				
44		GO TO	GO TO				
45							
46							
47							
48							
49							

REGISTERS	
R0	Trp
R1	h0
R2	P (lip)
R3	hf
R4	L
R5	Vg
R6	Vf
R7	Ø Trp

} at P1

HEWLETT PACKARD

if h_0 is too high, $\Delta \geq 0$
too low, $\Delta < 0$

$|\Delta| \leq 0.1$ is convergence criteria.

Company: ERMAL POWER Lease: UTAH STATE Well No. 1-2

25# BELLOWS 1000 PSI SPRING

DATE Time of Reading	ELAP. TIME Hrs.	WORKING PRESSURE W.H Psig	WORKING PRESSURE L.P Psig	WORKING PRESSURE Temp. F	METER Pressure Psig	METER Diff.	METER Temp. F	METER Orifice	METER Pressure Psig	METER Diff.	METER Temp. F	METER Orifice	REMARKS (Include liquid production data: Type – API Gravity – Amount)
11-16-76									Bar. Pressure				
11:20	POP				()²x10	()²x6.966							Start Flow
12:40													Shut in to repair leak
11:55													Start Flow
12:05		320	13.2	414	5.6	2.3			25.270				
12:15		308	20.2	412	5.4	3							Increase flow
12:30		248	24.5	391	4.6	4.25							" "
12:45		200	25.75	373	4.1	5.4							" " Wide Open
1:00		185	23.3	368	4.0	5.2							
1:15		181	22.4	366	3.9	5.05							
1:30		180	22.2	365	3.9	5.05							
1:45		180	22.05	364	3.9	5.05							
2:00		178	21.80	365	3.9	5.05							
3:00		177	21.55	364	3.9	5.0							PINHOLE IN POP BODY 2ND VANE
4:00		176	21.42	364	3.9	5.0							
5:00		175	21.28	363	3.85	5.0							
6:00		175	21.13	363	3.85	5.0							

17/20

PAGE NO. 2

Company Formal Power Lease Hitch Ott 2 Well No. 1 & 2

2.5# Bolloms \ 1000# = PRING

DATE Time of Reading	ELAP. TIME Hrs.	WORKING PRESSURE WH Psig	WORKING PRESSURE DP Psig	WORKING PRESSURE Temp. F	METER Pressure Psig	METER Diff.	METER Temp. F	METER Orifice	METER Pressure Psig	METER Diff.	METER Temp. F	METER Orifice	REMARKS (Include liquid production data: Type – API Gravity – Amount)
11-16-76									Bar. Pressure (Airport)				
6:00	PM	175	21.13	363	3.85	5.0							
7:00		175	20.82	363	3.85	4.95							
8:00		173	20.7	362	3.83	4.95							
9:00		173	20.45	362	3.81	4.9							
10:00		175	20.65	362	3.83	4.9							
11:00		175	20.8	362	3.82	4.95			25.34				
12:00		176	20.5	362	3.82	4.9			25.34				
1:00		173	20.5	362	3.8	4.95			25.34				
2:00		174	20.45	362	3.8	4.95			25.34				
3:00		174	20.55	362	3.8	4.95			25.34				
4		174	20.6	362	3.8	4.95			25.34				
5:00		174	20.6	362	3.8	4.9			25.34				
6:00		175	20.58	362	3.8	4.9			25.34				
7:00		174	20.60	363	3.75	4.95			25.34				
9:00		176	21.10	—	3.8	4.95							THERMOMETER BROKEN

1/8/13

Company CIBOLA POWER Lease UTAH STATE Well No. 1

25# BELLOWS 1000# SPRING

DATE Time of Reading	ELAP. TIME Hrs.	WORKING PRESSURE WH Psig	WORKING PRESSURE LIP Psig	WORKING PRESSURE Temp. F	METER Pressure Psig	METER Diff.	METER Temp. F	METER Orifice	METER Pressure Psig	METER Diff.	METER Temp. F	METER Orifice	REMARKS (Include liquid production data: Type – API Gravity – Amount)
11-17-76									Barometric				
									Pressure Airport				
9:00AM		176	21.10	—	3.8	4.95							THERMOMETER BROKEN
11:00AM		178	21.54	—	3.9	5.04			25.33				
1:00 P		179	21.65	365	3.9	5.05			25.28				
3:00		176	21.35	365	3.85	5.05			25.23				
5:00		178	21.42	365	3.85	5.05			25.21				
7:00		178	21.2	364	3.85	5.05			25.21				
9:00		178	21.3	364	3.85	5.0			25.20				
11:00		176	20.96	364	3.85	5.0			25.18				
1:00		176	21.2	364	3.85	5.0			25.17				
3:00		191	20.75	371	4.05	4.35							
5:00		189	20.15	370	4.05	4.3			25.14				
7:00		189	20.45	370	4.05	4.25			25.13				
9:00		187	20.40	370	4.0	4.2			25.15				
11:00		188	20.30	370	3.9	4.3			25.11				SHUT IN AT 11:30 AM