GW - 38

GENERAL CORRESPONDENCE

YEAR(S):

2004 - 1986

Martin, Ed

To: Richard Lobato
Subject: RE: Emergency Request for surface re-injection @ NMSU GW-38

Your request, as stated below, is hereby approved. If any circumstances surrounding this one-time discharge change, please advise me.

Ed Martin
New Mexico Oil Conservation Division
Environmental Bureau
1220 S. St. Francis
Santa Fe, NM 87505
Phone: 505-476-3492
Fax: 505-476-3471

-----Original Message-----
From: Richard Lobato [mailto:rilobato@nmsu.edu]
Sent: Thursday, June 24, 2004 10:08 AM
To: emartin@state.nm.us
Subject: Emergency Request for surface re-injection @ NMSU

Ed
Due to the failure of our geo thermal re-injection well (located at the NMSU Golf course) I would like your permission for the surface disposal of approximately 500,000 Gallons of geo thermal water. We plan to use the sand bed located between the NMSU Golf course and the water storage tank. This will be a one time occurrence for three days starting late the 27th of June and ending on the June 30th. As stated before we will dispose of approximately 500,000 gallons during this period. Your assistance in this matter will be greatly appreciated.
Thank you

NEW MEXICO ENVIRONMENT DEPARTMENT
REVENUE TRANSMITTAL FORM

	Description	FUND	CES	DFA ORG	DFA ACCT	ED ORG	ED ACCT	AMOUNT	
1	CY Reimbursement Project _____ Tax ___	064	01						
5	Gross Receipt Tax	064	01		2329	900000	2329134		
3	Air Quality Title V	092	13	1300	1696	900000	4169134		
4	PRP Prepayments	248	14	1400	9696	900000	4989014		
2	Climax Chemical Co.	248	14	1400	9696	900000	4989015		
6	Circle K Reimbursements	248	14	1400	9696	900000	4969248		
7	Hazardous Waste Permits	339	27	2700	1696	900000	4169027		
8	Hazardous Waste Annual Generator Fees	339	27	2700	1696	900000	4169339		
10	Water Quality - Oil Conservation Division	341	29		2329	900000	2329029		1
11	Water Quality - GW Discharge Permit	341	29	2900	1696	900000	4169029	50.00	1
12	Air Quality Permits	631	31	2500	1696	900000	4169031		1
13	Payments under Protest	851	33		2919	900000	2919033		1
*14	Xerox Copies	652	34		2349	900000	2349001		**
15	Ground Water Penalties	652	34		2349	900000	2349002		1
16	Witness Fees	652	34		2349	900000	2349003		1
17	Air Quality Penalties	652	34		2349	900000	2349004		1
18	OSHA Penalties	652	34		2349	900000	2349005		1
19	Prior Year Reimbursement	652	34		2349	900000	2349006		1
20	Surface Water Quality Certification	652	34		2349	900000	2349009		2
21	Jury Duty	652	34		2349	900000	2349012		2
22	CY Reimbursements (i.e. telephone)	652	34		2349	900000	2349014		2
*23	UST Owner's List	783	24	2500	9696	900000	4969201		*2
*24	Hazardous Waste Notifiers List	783	24	2500	9696	900000	4969202		*2
*25	UST Maps	783	24	2500	9696	900000	4989203		*2
*26	UST Owner's Update	783	24	2500	9696	900000	4969205		*2
*28	Hazardous Waste Regulations	783	24	2500	9696	900000	4969207		*2
*29	Radiologic Tech. Regulations	783	24	2500	9696	900000	4969208		*2
*30	Superfund CERLIS List	783	24	2500	9696	900000	4969211		*3
31	Solid Waste Permit Fees	783	24	2500	9696	900000	4969213		3
32	Smoking School	783	24	2500	9696	900000	4969214		3
*33	SWQB - NPS Publications	783	24	2500	9696	900000	4969222		*3
*34	Radiation Licensing Regulation	783	24	2500	9696	900000	4969228		*3
*35	Sale of Equipment	783	24	2500	9696	900000	4969301		*3
*36	Sale of Automobile	783	24	2500	9696	900000	4969302		*3
*37	Lust Recoveries	783	24	2500	9696	900000	4969614		**3
*38	Lust Repayments	783	24	2500	9696	900000	4969615		**3
39	Surface Water Publication	783	24	2500	9696	900000	4969801		3
40	Exxon Reese Drive Ruidoso - CAF	783	24	2500	9696	900000	4969242		4
41	Emerg. Hazardous Waste Penalties NOV	957	32	9600	1696	900000	4164032		4
42	Radiologic Tech. Certification	987	05	0500	1696	900000	4169005		4
44	Ust Permit Fees	989	20	3100	1696	900000	4169020		4
45	UST Tank Installers Fees	989	20	3100	1696	900000	4169021		4
46	Food Permit Fees	991	26	2600	1696	900000	4169026		4
43	Other								4

* Gross Receipt Tax Required ** Site Name & Project Code Required TOTAL 50.00

Contact Person: LC Martin Phone: 476-3472 Date: 2/21/01

Received in ASD By: _____ Date: _____ RT #: ____ ST # : _____

FSB025
Revised 07/07/00

Martin, Ed

To: Anaya, Mary
Subject: Las Cruces Sun-News

RE: Their advertisement #203351
Amount: $725.42

Roger talked to the person in charge of their billing department who has agreed to adjust this bill downward to an amount which would have been charged had the legal notice for GW-038 been placed in the legal notices section of the paper instead of the more expensive section.

I don't know what the adjusted price will be, but they will do one of two things:

1. Issue an adjusted invoice
2. Cancel the above invoice, and give us a credit, and then issue a new invoice.

I will keep you posted if I hear anything else.

LAS CRUCES SUN-NEWS

256 W. Las Cruces Ave
P.O. Box 1749
Las Cruces, NM 88004
(505) 541-5400

ADVERTISING
INVOICE and STATEMENT

1 BILLING PERIOD	2 ADVERTISER/CLIENT NAME
01/01/01 01/31/01	NM STATE OIL CON

23 TOTAL AMOUNT DUE	*UNAPPLIED AMOUNT	3 TERMS OF PAYMENT
$725.42		NET 30 DAYS

21 CURRENT NET AMOUNT DUE	22 30 DAYS	60 DAYS	OVER 90 DAYS
$0.00	$0.00	$0.00	$725.42

4 PAGE #	5 BILLING DATE
1	01/31/01

6 BILLED ACCOUNT NUMBER: 203351

7 ADVERTISER/CLIENT NUMBER: 203351

8 BILLED ACCOUNT NAME AND ADDRESS:
NM STATE OIL CONSERVATION DIV.
2040 SOUTH PACHECO STREET
SANTA FE NM 87505

*** Please Return Stub with Payment ***

9 REMITTANCE ADDRESS:
LAS CRUCES SUN-NEWS
256 W. LAS CRUCES AVENUE
PO BOX 1749
LAS CRUCES NM 88004

You may pay for your advertising with your credit card. Just complete the following.

Circle one: MASTER VISA DISCOVER AMERICAN EXPRESS

Card Number _____

Expiration Date _____

PLEASE DETACH AND RETURN UPPER PORTION WITH YOUR REMITTANCE

10 DATE	11 NEWSPAPER REFERENCE	12 13 14 DESCRIPTION - OTHER COMMENTS/CHARGES	15 16 SAU SIZE BILLED UNITS	17 18 TIMES RUN RATE	19 GROSS AMOUNT	20 NET AMOUNT
		BALANCE FORWARD			714.84	
		FINANCE CHARGE			10.58	
				TOTAL DUE		725.42

RECEIVED
FEB 15 2001
OIL CONSERVATION DIVISION

PAST DUE
REMIT PAYMENT IMMEDIATELY

STATEMENT OF ACCOUNT

AGING OF PAST DUE AMOUNTS

21 CURRENT NET AMOUNT DUE	22 30 DAYS	60 DAYS	OVER 90 DAYS	*UNAPPLIED AMOUNT	23 TOTAL AMOUNT DUE
$0.00	$0.00	$0.00	$725.42	.00	$725.42

LAS CRUCES SUN-NEWS
P.O. Box 1749
Las Cruces, NM 88004
(505) 541-5400

*UNAPPLIED AMOUNTS ARE INCLUDED IN TOTAL AMOUNT DUE

24	25 ADVERTISER INFORMATION			
	1 BILLING PERIOD	6 BILLED ACCOUNT NUMBER	7 ADVERTISER/CLIENT NUMBER	2 ADVERTISER/CLIENT NAME
00177161	01/01/0101/31/01	203351	203351	NM STATE OIL CON

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to New Mexico Water Quality Control Commission Regulations, the following discharge plan application has been submitted to the Director of the Oil Conservation Division, 2040 South Pacheco, Santa Fe, New Mexico 87505, Telephone (505) 827-7131:

(GW-038) New Mexico State University, Benjamin E. Woods, Vice President for Facilities, P.O. Box 30001, Las Cruces, New Mexico 88003-8001, has submitted a renewal application for its previously approved discharge plan to discharge cooled geothermal water to an unlined pit at its greenhouse facility located in Section 23, Township 23 South, Range 2 East, NMPM, Doña Ana County, New Mexico. Approximately 54,720 gallons per day of cooled geothermal water with a total dissolved solids concentration of 1,775 mg/l will be discharged. The discharged geothermal water will percolate into the ground and will reenter the geothermal reservoir. Uppermost ground water is geothermal and is found at 365 feet with a total dissolved solids concentration of 1,636 mg/l. The discharge plan addresses how spills, leaks and other accidental discharges to the surface will be managed.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. The discharge plan application may be viewed at the above address between 8:00 a.m. and 4:00 p.m., Monday through Friday. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and a public hearing may be requested by any interested person. Requests for a public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant public interest.

If no public hearing is held, the Director will approve or disapprove the proposed plan based on information available. If a public hearing is held, the director will approve or disapprove the proposed plan based on information in the plan and information submitted at the hearing.

GIVEN under the Seal of New Mexico Oil Conservation commission at Santa Fe, New Mexico, on this *29th day of September 2000.*

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

for LORI WROTENBERY, Director

SEAL

NEW MEXICO ENERGY, MINERALS and
NATURAL RESOURCES DEPARTMENT

GARY E. JOHNSON
Governor
Jennifer A. Salisbury
Cabinet Secretary

Lori Wrotenbery
Director
Oil Conservation Division

Las Cruces Sun
Attention: Legal Ads
256 W. Las Cruces
Las Cruces, New Mexico 88001

Re: Legal Notice

Dear Sir/Madam:

Please publish the attached notice in the legal notice section one time immediately on receipt of this request. Please proofread carefully, as any error in a land description or in a key word of phrase can invalidate the entire notice.

Immediately upon completion of publication, please send the following to this office.

1. Publisher's affidavit in duplicate.
2. Statement of cost (also in duplicate).
3. Certified invoices for prompt payment.

We should have these immediately after publication in order that the legal notice will be available for the hearing which it advertises, and also so that there will be no delay in your receiving payment.

Please publish the notice no later than_____.

Sincerely,

Donna Dominguez
Clerk Specialist

Attachment

LAS CRUCES SUN-NEWS

256 W. Las Cruces Ave
P.O. Box 1749
Las Cruces, NM 88004
(505) 541-5400

ADVERTISING
INVOICE and STATEMENT

1 BILLING PERIOD	2 ADVERTISER/CLIENT NAME
10/01/00 10/31/00	NM STATE OIL CON

23 TOTAL AMOUNT DUE	*UNAPPLIED AMOUNT	3 TERMS OF PAYMENT
$714.84		NET 30 DAYS

21 CURRENT NET AMOUNT DUE	22 30 DAYS	60 DAYS	OVER 90 DAYS
$714.84	$0.00	$0.00	$0.00

4 PAGE #	5 BILLING DATE
1	10/31/00

6 BILLED ACCOUNT NUMBER
203351

7 ADVERTISER/CLIENT NUMBER
203351

8 BILLED ACCOUNT NAME AND ADDRESS
NM STATE OIL CONSERVATION DIV.
2040 SOUTH PACHECO STREET
SANTA FE NM 87505

*** Please Return Stub with Payment ***

9 REMITTANCE ADDRESS
LAS CRUCES SUN-NEWS
256 W. LAS CRUCES AVENUE
PO BOX 1749
LAS CRUCES NM 88004

You may pay for your advertising with your credit card. Just complete the following.
Circle one: MASTER VISA DISCOVER AMERICAN EXPRESS
Card Number _____
Expiration Date _____

PLEASE DETACH AND RETURN UPPER PORTION WITH YOUR REMITTANCE

10 DATE	11 NEWSPAPER REFERENCE	12 13 14 DESCRIPTION - OTHER COMMENTS/CHARGES	15 16 SAU SIZE BILLED UNITS	17 18 TIMES RUN RATE	19 GROSS AMOUNT	20 NET AMOUNT
		BALANCE FORWARD			.00	
10/08	08973901	NOTICE	3X 8.0		672.00	
LC	RDP		24.00IN			
		TAX			42.84	
				TOTAL DUE		714.84

STATEMENT OF ACCOUNT

AGING OF PAST DUE AMOUNTS

21 CURRENT NET AMOUNT DUE	22 30 DAYS	60 DAYS	OVER 90 DAYS	*UNAPPLIED AMOUNT	23 TOTAL AMOUNT DUE
$714.84	$0.00	$0.00	$0.00	.00	$714.84

LAS CRUCES SUN-NEWS
P.O. Box 1749
Las Cruces, NM 88004
(505) 541-5400

*UNAPPLIED AMOUNTS ARE INCLUDED IN TOTAL AMOUNT DUE

24	25 ADVERTISER INFORMATION			
	1 BILLING PERIOD	6 BILLED ACCOUNT NUMBER	7 ADVERTISER/CLIENT NUMBER	2 ADVERTISER/CLIENT NAME
00170578	10/01/0010/31/00	203351	203351	NM STATE OIL CON

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

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GIVEN under the Seal of New Mexico Oil Conservation commission at Santa Fe, New Mexico, on this *29th day of September 2000.*

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

SEAL

for LORI WROTENBERY, Director

PROOF OF PUBLICATION

David E. McCollum, being duly sworn, deposes and says that he is the Publisher of the Las Cruces Sun-News, a newspaper published daily in the county of Dona Ana, State of New Mexico; that the notice Oil Cons. Div per clipping attached was published once a week/day in regular and entire issue of said newspaper and not in any supplement thereof for 1 consecutive days, the first publication was in the issue dated Sun. Oct. 10, 2000 and the last publication was

_____.

Deponent further states this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Sec. Chapter 167, Laws of 1937.

Signed David E. McCollum

Publisher
Official Position

STATE OF NEW MEXICO
ss.
County of Dona Ana

Subscribed and sworn before me this 11th day of Oct. 00.

Robyn Quille

Notary Public in and for
Dona Ana County, NM

LAS CRUCES SUN-NEWS
256 W. Las Cruces Ave
P.O. Box 1749
Las Cruces, NM 88004
(505) 541-5400

ADVERTISING
INVOICE and STATEMENT

1 BILLING PERIOD	2 ADVERTISER/CLIENT NAME
11/01/00 11/30/00	NM STATE OIL CON

23 TOTAL AMOUNT DUE	*UNAPPLIED AMOUNT	3 TERMS OF PAYMENT
$714.84		NET 30 DAYS

21 CURRENT NET AMOUNT DUE	22 30 DAYS	60 DAYS	OVER 90 DAYS
$0.00	$714.84	$0.00	$0.00

4 PAGE #	5 BILLING DATE
1	11/30/00

6 BILLED ACCOUNT NUMBER
203351

7 ADVERTISER/CLIENT NUMBER
203351

8 BILLED ACCOUNT NAME AND ADDRESS
NM STATE OIL CONSERVATION DIV.
2040 SOUTH PACHECO STREET
SANTA FE NM 87505

*** Please Return Stub with Payment ***

9 REMITTANCE ADDRESS
LAS CRUCES SUN-NEWS
256 W. LAS CRUCES AVENUE
PO BOX 1749
LAS CRUCES NM 88004

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Circle one: MASTER VISA DISCOVER AMERICAN EXPRESS
Card Number _____
Expiration Date _____

PLEASE DETACH AND RETURN UPPER PORTION WITH YOUR REMITTANCE

10 DATE	11 NEWSPAPER REFERENCE	12 13 14 DESCRIPTION - OTHER COMMENTS/CHARGES	15 16 SAU SIZE BILLED UNITS	17 18 TIMES RUN RATE	19 GROSS AMOUNT	20 NET AMOUNT
		BALANCE FORWARD			714.84	
				TOTAL DUE		714.84

RECEIVED
DEC 11 2000
OIL CONSERVATION DIVISION

STATEMENT OF ACCOUNT AGING OF PAST DUE AMOUNTS

21 CURRENT NET AMOUNT DUE	22 30 DAYS	60 DAYS	OVER 90 DAYS	*UNAPPLIED AMOUNT	23 TOTAL AMOUNT DUE
$0.00	$714.84	$0.00	$0.00	.00	$714.84

LAS CRUCES SUN-NEWS
P.O. Box 1749
Las Cruces, NM 88004
(505) 541-5400

***UNAPPLIED AMOUNTS ARE INCLUDED IN TOTAL AMOUNT DUE**

24	25 ADVERTISER INFORMATION			
	1 BILLING PERIOD	6 BILLED ACCOUNT NUMBER	7 ADVERTISER/CLIENT NUMBER	2 ADVERTISER/CLIENT NAME
00172663	11/01/0011/30/00	203351	203351	NM STATE OIL CON

_____

Las Cruces Sun
Attention: Advertising Manager
256 W. Las Cruces
Las Cruces, New Mexico 88001

Re: Notice of Publication

_____
_____
_____

Dear Sir/Madam:

Please publish the attached notice one time immediately on receipt of this request. Please proofread carefully, as any error in a land description or in a key word of phrase can invalidate the entire notice .

Immediately upon completion of publication, please send the following to this office.

1. **Publisher's affidavit in duplicate.**
2. **Statement of cost (also in duplicate).**
3. **Certified invoices for prompt payment.**

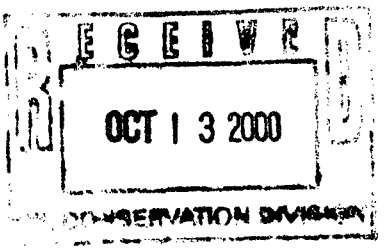
We should have these immediately after publication in order that the legal notice will be available for the hearing which it advertises, and also so that there will be no delay in your receiving payment.

Please publish the notice no later than _____.

Sincerely,

Donna Dominguez
Administrative Secretary

Las Cruces
Sun-News
Great Town • Great Paper
256 W. Las Cruces Ave. Las Cruces, NM 88005 (505) 541-5499 fax (505) 541-5499



INVOICE

NM State Oil Conservation
2040 South Pacheco St.
Santa Fe, NM 87505

Billing Period Oct. 1, 2000 – Oct. 31, 2000

Run date	Section	Ad Size	Amount
Oct. 10, 2000	Main	3 x 8	$672.00

Sub-Total	**$672.00**
NM Tax	**$ 42.84**
Amount Due	**$714.84**

If you have any questions regarding this invoice please call 505/541-5427

THANK YOU, THANK YOU
FOR YOUR BUSINESS

OK to pay
Ed Martin
10/30/00

LAS CRUCES SUN-NEWS

256 W. Las Cruces Ave
P.O. Box 1749
Las Cruces, NM 88004
(505) 541-5400

ADVERTISING
INVOICE and STATEMENT

1 BILLING PERIOD	2 ADVERTISER/CLIENT NAME
12/01/00 12/31/00	NM STATE OIL CON

23 TOTAL AMOUNT DUE	*UNAPPLIED AMOUNT	3 TERMS OF PAYMENT
$714.84		NET 30 DAYS

21 CURRENT NET AMOUNT DUE	22 30 DAYS	60 DAYS	OVER 90 DAYS
$0.00	$0.00	$714.84	$0.00

4 PAGE #	5 BILLING DATE
1	12/31/00

6 BILLED ACCOUNT NUMBER: 203351

7 ADVERTISER/CLIENT NUMBER: 203351

8 BILLED ACCOUNT NAME AND ADDRESS:
NM STATE OIL CONSERVATION DIV.
2040 SOUTH PACHECO STREET
SANTA FE NM 87505

*** Please Return Stub with Payment ***

9 REMITTANCE ADDRESS:
LAS CRUCES SUN-NEWS
256 W. LAS CRUCES AVENUE
PO BOX 1749
LAS CRUCES NM 88004

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10 DATE	11 NEWSPAPER REFERENCE	12 13 14 DESCRIPTION - OTHER COMMENTS/CHARGES	15 16 SAU SIZE BILLED UNITS	17 18 TIMES RUN RATE	19 GROSS AMOUNT	20 NET AMOUNT
		BALANCE FORWARD			714.84	
				TOTAL DUE		714.84

RECEIVED
JAN 1
CONSERVATION DIVISION

PAST DUE

STATEMENT OF ACCOUNT

AGING OF PAST DUE AMOUNTS

21 CURRENT NET AMOUNT DUE	22 30 DAYS	60 DAYS	OVER 90 DAYS	*UNAPPLIED AMOUNT	23 TOTAL AMOUNT DUE
$0.00	$0.00	$714.84	$0.00	.00	$714.84

LAS CRUCES SUN-NEWS
P.O. Box 1749
Las Cruces, NM 88004
(505) 541-5400

*UNAPPLIED AMOUNTS ARE INCLUDED IN TOTAL AMOUNT DUE

24	25 ADVERTISER INFORMATION			
	1 BILLING PERIOD	6 BILLED ACCOUNT NUMBER	7 ADVERTISER/CLIENT NUMBER	2 ADVERTISER/CLIENT NAME
00174864	12/01/0012/31/00	203351	203351	NM STATE OIL CON

1220 South St. Francis
Santa Fe, New Mexico 87505

New Mexico Oil Conservation Division

Fax

To:	Stella Altamirano	**From:**	Ed Martin
Fax:	505-646-6432	**Pages:**	3
Phone:	505-646-1480	**Date:**	02/06/01
Re:	Vendor Questionnaire	**CC:**	

☐ **Urgent** ☐ **For Review** ☐ **Please Comment** ☐ **Please Reply** ☐ **Please Recycle**

Attached is the completed questionnaire. Pleas call me at 505-476-3492 if you have any questions. Thank you for your help.

OFFICE OF FACILITIES & SERVICES

MSC 3545
New Mexico State University
P.O. Box 30001
Las Cruces, NM 88003-8001
(505) 646-3021
FAX: (505) 646-6432

DATE: January 31, 2001

TO: Roger C. Anderson, Chief, Environmental Bureau

FROM: Stella Altamirano, Office of Facilities & Services

SUBJECT: Vendor Questionnaire

We received the renewal application for the New Mexico State University Geothermal Facility. We need to submit a $690.00 renewal fee within 10 days.

At this time, I cannot process a purchase order to cut a check for this amount because your company is not in our purchasing system. Could you please fill out the attached vendor questionnaire and return to me via fax at (505) 646-6432. As soon as I receive this information, it will be entered into our computer system and I will be able to issue a purchase order for the renewal application.

I can be reached at (505) 646-1480 if you have any questions. Thank you for your prompt response.

NEW MEXICO STATE UNIVERSITY VENDOR QUESTIONNAIRE

COMPANIES SHOULD COMPLETE SECTIONS: (A) AND (C) | INDIVIDUALS SHOULD COMPLETE SECTIONS: (A) AND (B)

MAILING ADDRESS FOR PURCHASE ORDERS(please type or clearly print)

(A)

VENDOR NAME ADDRESS CITY, STATE, ZIP CODE COUNTRY	WATER QUALITY MANAGEMENT FUND OIL CONSERVATION DIVISION 1220 ST FRANCIS DR SANTA FE, NM 87505
TELEPHONE NUMBER	505-476-3490
TOLL FREE NUMBER	
FAX NUMBER	505-476-3771
INTERNET ADDRESS	EMARTIN@STATE.NM.US
REMIT TO ADDRESS(if different from mailing address)	
FEDERAL ID #	85-6000565
NM TAX ID #	
SOCIAL SECURITY #	

(B)

INDIVIDUAL CLASSIFICATION

Are you an employee of NMSU? ☐ Yes ☐ No

Have you ever been employed by NMSU? ☐ Yes ☐ No

Is your spouse an employee of NMSU? ☐ Yes ☐ No

Are you a citizen of the United States? ☐ Yes ☐ No

IF NO: What Country? _____

Indicate Visa type and attach the following completed forms and documents: (see A OR B)

A.
1. Federal Form 8233 Exemption from withholding on Compensation for Independent Personal Services of a Non resident Alien Individual;
2. Copy of Nonresident Aliens' Visa; and
3. Federal Form W-8 Certificate of Foreign Status or Form W-9

B. Permanent Resident Alien-Attach Copy of Green Card

STANDARD PAYMENT TERMS ☐ Net 30 ☐ 2 % Net 10 ☐ Other (identify)_____

BUSINESS CLASSIFICATION(check as many as are applicable)

☐ **Minority-Owned** 51 percent of business or stock is owned, and management of daily business operations is controlled by one or more members of the following groups: Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, or Asian Indian Americans.

☐ **Women-Owned** A business that is at least 51 percent owned, controlled, and operated by a woman or women.

Is your company certified as minority owned? ☐ Yes ☐ No Name of Certifying Agency: _____

(C)

BUSINESS SIZE (check one)

☐ Large ☐ Small

BUSINESS STATUS (check one)

☐ Corporation ☒ Government(Local or (State)) ☐ Not for Profit Organization (501) (c)

☐ Sole Proprietor - Name of Owner _____ ☐ Partnership - Name of One of the Owners _____

BUSINESS TYPE (check one)

☐ Manufacturer ☐ Distributor ☐ Service Medical or Health Care ☐YES ☐NO ☐ Retailer ☐ Contractor

☐ Wholesaler ☐ Manufacturer's Agent ☐ Dealer ☐ Other (identify) _____

Please Return Form To:
Physical Plant Dept.
Las Cruces, NM 88003
Fax Number 646-6432

NMSU Department Contact Name: _____
Phone No. _____
Fax No. _____

CPO INTERNAL USE
VENDOR TYPE: _____ 1099 _____
DATA ENTRY DATE/INITIAL _____

THE SANTA FE
NEW MEXICAN
Founded 1849

NM OIL CONSERVATION DIVISION
ATTN: DONNA DOMINGUEZ
2040 S. PACHECO ST.
SANTA FE, NM 87505

AD NUMBER: 174457 ACCOUNT: 56689
LEGAL NO: 68172 P.O.#: 00199000278
185 LINES 1 time(s) at $ 81.55
AFFIDAVITS: 5.25
TAX: 5.43
TOTAL: 92.23

NOTICE OF PUBLICATION

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to New Mexico Water Quality Control Commission Regulations, the following discharge plan application has been submitted to the Director of the Oil Conservation Division, 2040 South Pacheco, Santa Fe, New Mexico 87505, Telephone (505) 827-7131:

(GW-038) New Mexico State University, Benjamin E. Woods, Vice President for Facilities, P.O. Box 30001, Las Cruces, New Mexico 88003-8001, has submitted a renewal application for its previously approved discharge plan to discharge cooled geothermal water to an unlined pit at its greenhouse facility located in Section 23, Township 23 South, Range 2 East, NMPM, Dona Ana County, New Mexico. Approximately 54,720 gallons per day of cooled geothermal water with a total dissolved solids concentration of 1,775 mg/l will be discharged. The discharged geothermal water will percolate into the ground and will reenter the geothermal reservoir. Uppermost groundwater is geothermal and is found at 365 feet with a total dissolved solids concentration of 1,636 mg/l. The discharge plan addresses how spills, leaks and other accidental discharges to the surface will be managed.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. The discharge plan application may be viewed at the above address between 8:00 a.m. and 4:00 p.m., Monday through Friday. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and public hearing may be requested by any interested person. Requests for a public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines that there is significant public interest.

If no hearing is held, the Director will approve or disapprove the proposed plan based on the information available. If a public hearing is held, the director will approval or disapprove the proposed plan based on the information in the plan and information submitted at the hearing.

GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, this ***29th day of September 2000.***

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION
LORI WROTENBERY,
Director

Legal #68172
Pub. October 5, 2000

AFFIDAVIT OF PUBLICATION

STATE OF NEW MEXICO
COUNTY OF SANTA FE
I, B Penney being first duly sworn declare and say that I am Legal Advertising Representative of THE SANTA FE NEW MEXICAN, a daily newspaper published in the English language, and having a general circulation in the Counties of Santa Fe and Los Alamos, State of New Mexico and being a Newspaper duly qualified to publish legal notices and advertisements under the provisions of Chapter 167 on Session Laws of 1937; that the publication #68172 a copy of which is hereto attached was published in said newspaper 1 day(s) between 10/05/2000 and 10/05/2000 and that the notice was published in the newspaper proper and not in any supplement; the first publication being on the 5 day of October, 2000 and that the undersigned has personal knowledge of the matter and things set forth in this affidavit.

/S/ Betsy Penney
LEGAL ADVERTISEMENT REPRESENTATIVE

Subscribed and sworn to before me on this 5 day of October A.D., 2000

Notary Laura E. Harding

Commission Expires 11/23/03

THE SANTA FE
NEW MEXICAN
Founded 1849

OCT 1 0 2000

NM OIL CONSERVATION DIVISION
ATTN: DONNA DOMINGUEZ
2040 S. PACHECO ST.
SANTA FE, NM 87505

AD NUMBER: 174457 ACCOUNT: 56689
LEGAL NO: 68172 P.O.#: 00199000278
185 LINES 1 time(s) at $ 81.55
AFFIDAVITS: 5.25
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STATE OF NEW MEXICO
COUNTY OF SANTA FE
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/S/ Betty Penner
LEGAL ADVERTISEMENT REPRESENTATIVE

Subscribed and sworn to before me on this 5 day of October A.D., 2000

Notary Irene E. Martinez

Commission Expires 11/23/03

NOTICE OF PUBLICATION

STATE OF NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to New Mexico Water Quality Control Commission Regulations, the following discharge plan application has been submitted to the Director of the Oil Conservation Division, 2040 South Pacheco, Santa Fe, New Mexico 87505, Telephone (505) 827-7131:

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STATE OF NEW MEXICO
OIL CONSERVATION DIVISION
LORI WROTENBERY,
Director

Legal #68172
Pub. October 5, 2000

2040 South Pacheco
Santa Fe, NM 87505
Phone: 505-827-7151
Fax: 505-827-8177

New Mexico Oil Conservation Division

Fax

To:	Rick Lovato	**From:**	Ed Martin
Fax:	505-646-6432	**Pages:**	5
Phone:	505-642-4228	**Date:**	10/10/00
Re:	Groundwater Discharge Plan	**CC:**	

☐ **Urgent** ☐ **For Review** ☐ **Please Comment** ☐ **Please Reply** ☐ **Please Recycle**

Attached are the following:

1. My original letter following our inspection of your geothermal facilities. This contains an excerpt of the regulations requiring the renewal and the $50.00 filing fee.

2. Your letter signed by Benjamin E. Woods for renewal of the Discharge Plan. It mentions a $50.00 money order enclosed, but none was.

3. A copy of NMSU's renewal application signed by Benjamin E. Woods.

Let me know if this is not sufficient.

NEW MEXICO ENERGY, MINERALS and
NATURAL RESOURCES DEPARTMENT

GARY E. JOHNSON
Governor
Jennifer A. Salisbury
Cabinet Secretary

Lori Wrotenbery
Director
Oil Conservation Division

May 17, 2000

Mr. David Bollschweiler
Physical Plant Department
New Mexico State University
Box 3001, Department 3545
Las Cruces, New Mexico 88003

Re: Discharge Plan GW-038
NMSU Geothermal Facility
Dona Ana County, New Mexico

Dear Mr. Bollschweiler:

Enclosed is our Site Inspection Sheet for the above facility along with copies of the photographs Wayne Price took during our visit. Thank you very much for the hospitality. We enjoyed our visit.

Per WQCC 3106.F, "If the holder of an approved discharge plan submits an application for discharge plan renewal at least 120 days before the discharge plan expires, and the discharger is not in violation of the approved discharge plan on the date of its expiration, then the existing approved discharge plan for the same activity shall not expire until the application for renewal has bee approved or disapproved. A discharge plan continued under this provision remains fully effective and enforceable. An application for discharge plan renewal must include, and adequately address all of the information necessary for evaluation of a new discharge plan. Previously submitted materials may be included by reference provided they are current, readily available to the secretary and sufficiently identified to be retrieved. [12-1-95]"

Your discharge plan expires on December 22, 2000. You may benefit from the above if your renewal application is submitted at least 120 days prior to this date along with the required $50.00 filing fee.

Discharge plan applications are available on our web site:
http://www.emnrd.state.nm.us/ocd/ocdforms.

If you have any questions, please do not hesitate to contact us.

Sincerely,

Ed Martin

Ed Martin
New Mexico Oil Conservation Division
Environmental Bureau

VICE PRESIDENT FOR FACILITIES

MSC 3545
New Mexico State University
P.O. Box 30001
Las Cruces, NM 88003-8001
(505) 646-2101
Fax: (505) 646-1460

NEW MEXICO STATE UNIVERSITY

Certified Mail
Return Receipt No. Z 777 776 451

September 18, 2000

Mr. Ed Martin
Environmental Bureau
Energy, Minerals and Natural Resources Dept.
PO Box 2088
Santa Fe, NM 87504

RE: Discharge Plan GW-38
NMSU Geothermal Facility
Dona Ana County, New Mexico

Dear Mr. Ed Martin,

In response to your May 17, 2000 letter, New Mexico State University wishes to apply for renewal of the groundwater discharge plan GW-38 for NMSU Geothermal Wells PG-1 (LRG-520-S) and PG-4 (LRG 520-S-3). New Mexico State University is submitting herewith the application form, figures and attachments as required for renewal. All of the previous information submitted as the basis of approval for Plan GW-38 is included by reference.

A money order for $50 is enclosed for the filing fee.

If further information is needed, please feel free to contact me.

Sincerely,

Benjamin E. Woods
Vice President for Facilities

/kmt
Enclosures

cc: Mr. Rich MacRorie, Director, Facilities Operations & Utilities, OFS
Mr. David Bollschweiler, Staff Engineer, OFS

District I
1625 N. French Dr., Hobbs, NM 88240
District II
611 South First, Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resour
Oil Conservation Division
2040 South Pacheco
Santa Fe, NM 87505

Revised March 17, 1999

Submit Original
Plus 1 Copy
to Santa Fe
1 Copy to Appropriate
District Office

DISCHARGE PLAN APPLICATION FOR SERVICE COMPANIES, GAS PLANTS. REFINERIES, COMPRESSOR, AND CRUDE OIL PUMP STATIONS

(Refer to the OCD Guidelines for assistance in completing the application)

☐ New ☒ Renewal ☐ Modification

1. Type: Geothermal Hot Water Heating Project
2. Operator: New Mexico State University
   Address: MSC 3545, Box 30001, Las Cruces, NM 88003
   Contact Person: David Bollschweiler Phone: 505-646-7844
3. Location: NW 1/4 /4 NW 1/4 /4 Section 26 Township 26 South Range 2 East (PG-1)
   SW 1 /4 SW 1 /4 Section 23 Township 23 South Range 2 East (PG-4)
   Submit large scale topographic map showing exact location. (See Figure 1)
4. Attach the name, telephone number and address of the landowner of the facility site.
   See Attachment 1
5. Attach the description of the facility with a diagram indicating location of fences, pits, dikes and tanks on the facility.
   See Attachment 2
6. Attach a description of all materials stored or used at the facility.
   See Attachment 1
7. Attach a description of present sources of effluent and waste solids. Average quality and daily volume of waste water must be included.
   See Attachment 1
8. Attach a description of current liquid and solid waste collection/treatment/disposal procedures.
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10. Attach a routine inspection and maintenance plan to ensure permit compliance.
    See Attachment 1
11. Attach a contingency plan for reporting and clean-up of spills or releases.
    See Attachment 1
12. Attach geological/hydrological information for the facility. Depth to and quality of ground water must be included.
    See Attachment 3
13. Attach a facility closure plan, and other information as is necessary to demonstrate compliance with any other OCD rules, regulations and/or orders.
    See Attachment 1
14. CERTIFICATION

I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

Name: B. E. Woods Title: VP for Facilities

Signature: Benjamin E. Woods Date: 20 Sept 2000

two great-grandchildren, Jonathan Cole and Elizabeth Parker Vermont. Also [redacted]ving Kate are her nephews Stephen Cole and his wife Donna of Georgia and Richard Cole and his wife Clare of the United Kingdom. Predeceasing Kate was her daughter Beth Vermont of Pawleys Island, SC, her husband, Willie G. Jones of Spartanburg, SC, and brothers Joseph and Donald Cole.

Those who knew Kate were always impressed with her sense of adventure. This trait emerged early in life; she was always happier working in the farm fields with her father instead of in the house home on the Summit in Cuba, NY in 1945 after their discharges from the Army.

The adventuresome spirit served her well when she moved South in 1953. She avoided the label "damnyankee" that she wore there for more than 40 years with her final adventure of moving to New Mexico at age 88. A surprise birthday party for her 90th saw her spirits soar by the fulfillment of a long-held fantasy. She flew into the morning sky in a hot air balloon soaring over the Mesilla Valley.

She was ever one to enjoy a good party and fine feasts; She loved her extended family of friends 1:30 p.m. on Sunday, October 8th at Hill Baptist Church. Inurnment of her final remains will be at 11:00 am on November 11, 2000, in Greenlawn Memorial Gardens Cemetery, Spartanburg, South Carolina.

Kate requested that in lieu of flowers, anyone who so wishes could make a contribution to the Georgia B. Jameson Memorial Hall Building Fund at Hill Baptist Church, 7974 Doña Ana Road, Las Cruces, NM 88005.

Arrangements have been entrusted to the care of Baca's Funeral Chapels and Baca's Mimbres Crematory.

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

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GIVEN under the Seal of New Mexico Oil Conservation commission at Santa Fe, New Mexico, on this *29th day of September 2000.*

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

SEAL

LORI WROTENBERY, Director

PROOF OF PUBLICATION

David E. McCollum, being duly sworn, deposes and says that he is the Publisher of the Las Cruces Sun-News, a newspaper published daily in the county of Dona Ana, State of New Mexico; that the notice Oil Cons. Div per clipping attached was published once a week/day in regular and entire issue of said newspaper and not in any supplement thereof for 1 consecutive days, the first publication was in the issue dated Sun. Oct. 10, 2000 and the last publication was

_____.

Deponent further states this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Sec. Chapter 167, Laws of 1937.

Signed David McCollum

Publisher
Official Position

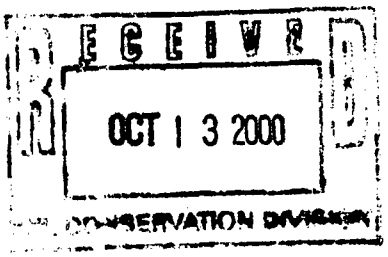
STATE OF NEW MEXICO
ss.
County of Dona Ana

Subscribed and sworn before me this
11th day of Oct. 00.

Robyn Quille

Notary Public in and for
Dona Ana County, NM

Las Cruces
Sun-News
Great Town • Great Paper
256 W. Las Cruces Ave. Las Cruces, NM 88005 (505) 541-5499 fax (505) 541-5499



INVOICE

NM State Oil Conservation
2040 South Pacheco St.
Santa Fe, NM 87505

Billing Period Oct. 1, 2000 – Oct. 31, 2000

Run date	Section	Ad Size	Amount
Oct. 10, 2000	Main	3 x 8	$672.00

Sub-Total	**$672.00**
NM Tax	**$ 42.84**
Amount Due	**$714.84**

If you have any questions regarding this invoice please call 505/541-5427

THANK YOU, THANK YOU
FOR YOUR BUSINESS

Ok to pay
Ed Martin
10/30/00

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

GARY E. JOHNSON
Governor
Jennifer A. Salisbury
Cabinet Secretary

Lori Wrotenbery
Director
Oil Conservation Division

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STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

S E A L

LORI WROTENBERY, Director

VICE PRESIDENT FOR FACILITIES

MSC 3545
New Mexico State University
P.O. Box 30001
Las Cruces, NM 88003-8001
(505) 646-2101
Fax: (505) 646-1460

NEW MEXICO STATE UNIVERSITY

Certified Mail
Return Receipt No. Z 777 776 451

September 18, 2000

Mr. Ed Martin
Environmental Bureau
Energy, Minerals and Natural Resources Dept.
PO Box 2088
Santa Fe, NM 87504

RE: Discharge Plan GW-38
NMSU Geothermal Facility
Dona Ana County, New Mexico

Dear Mr. Ed Martin,

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A money order for $50 is enclosed for the filing fee.

If further information is needed, please feel free to contact me.

Sincerely,

Benjamin E. Woods
Vice President for Facilities

/kmt
Enclosures

cc: Mr. Rich MacRorie, Director, Facilities Operations & Utilities, OFS
Mr. David Bollschweiler, Staff Engineer, OFS

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District IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
2040 South Pacheco
Santa Fe, NM 87505

Revised March 17, 1999

Submit Original
Plus 1 Copy
to Santa Fe
1 Copy to Appropriate
District Office

DISCHARGE PLAN APPLICATION FOR SERVICE COMPANIES, GAS PLANTS. REFINERIES, COMPRESSOR, AND CRUDE OIL PUMP STATIONS

(Refer to the OCD Guidelines for assistance in completing the application)

☐ New ☒ Renewal ☐ Modification

1. Type: Geothermal Hot Water Heating Project
2. Operator: New Mexico State University

   Address: MSC 3545, Box 30001, Las Cruces, NM 88003

   Contact Person: David Bollschweiler Phone: 505-646-7844
3. Location: NW 1/4 /4 NW 1/4 /4 Section 26 Township 26 South Range 2 East (PG-1)
   SW 1 /4 SW 1 /4 Section 23 Township 23 South Range 2 East (PG-4)

   Submit large scale topographic map showing exact location. (See Figure 1)
4. Attach the name, telephone number and address of the landowner of the facility site.

   See Attachment 1
5. Attach the description of the facility with a diagram indicating location of fences, pits, dikes and tanks on the facility.

   See Attachment 2
6. Attach a description of all materials stored or used at the facility.

   See Attachment 1
7. Attach a description of present sources of effluent and waste solids. Average quality and daily volume of waste water must be included.

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    See Attachment 3
13. Attach a facility closure plan, and other information as is necessary to demonstrate compliance with any other OCD rules, regulations and/or orders.

    See Attachment 1
14. CERTIFICATION

I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

Name: B. E. Woods Title: VP for Facilities

Signature: Benjamin E. Woods Date: 20 Sept 2000

Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1972. Field checked 1974. Map edited 1978

Projection and 10,000-foot grid ticks: New Mexico coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid ticks, zone 13, shown in blue. 1927 North American datum

Red tint indicates area in which only landmark buildings are shown

Fine red dashed lines indicate selected fence lines

Where omitted, land lines have not been established

Areas covered by dashed light-blue pattern are subject to controlled inundation

UTM GRID AND 1978 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION

Primary highway, hard surface — Light-duty road, hard or improved surface

Secondary highway, hard surface — Unimproved road

Interstate Route ☐ U. S. Route ○ State Route

QUADRANGLE LOCATION

LAS CRUCES, N. MEX.
1954
AMS 4648 IV SE—SERIES V881

Plotted by the Army Map Service
Published for civil use by the Geological Survey

Control by USGS, USC&GS, and USCE

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1954. Photography field annotated 1955

Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 13, shown in blue

Dashed land lines indicate approximate locations

APPROXIMATE MEAN DECLINATION, 1955

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 5 AND 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER 25, COLORADO OR WASHINGTON 25, D.C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION

Heavy-duty — Light-duty

Medium-duty — Unimproved dirt

U.S. Route ○ State Route

QUADRANGLE LOCATION

TORTUGAS MOUNTAIN, N. MEX.
SW/4 ORGAN PEAK 15' QUADRANGLE
N3215—W10637.5/7.5
1955

FIGURE 1

Attachment 1

4. Name, Telephone number and address of landowner of facility site:

New Mexico State University
505-646-2101
PO Box 30001, MSC 3545
Las Cruces, NM 88003

6. Description of all materials stored or used at the facility:

None

7. Description of current sources of effluent and waste solids:

Waste solids: None
Effluent: Quality - See Attachment 2

Average daily volume:

1996 2,620,641 Gallon/365 days = 7,180 GPD
1997 4,067,321 Gallon/365 days = 11,143 GPD
1998 7,790,241 Gallon/365 days = 21,343 GPD
1999 7,758,873 Gallon/365 days = 20,435 GPD
2000 8,142,462 Gallon/244 days = 33,371 GPD

Effluent is discharged into a retention pond after the geothermal water has been used in greenhouse and fish farm operations. This effluent represents a consumptive use and is the difference between water produced and water re-injected into the geothermal aquifer.

8. Description of current liquid and solid waste collection/treatment/disposal procedures

Solid waste: None

Liquid waste: Collection - See Paragraph 7 above
Treatment - None
Disposal - See Paragraph 7 above

9. Description of proposed modifications to existing collection/treatment/disposal systems.

None

10. Routine inspection and maintenance plan.

The staff at NMSU Office for Facilities and Services (OFS) conducts daily inspections of the production and injection well systems as well as the piping and valve systems. The disposal of effluent at the pond is overseen by both OFS staff and the greenhouse/fish farm research/operations staff.

11. Contingency plan for reporting and clean-up of spills or releases.

All spills or releases will be reported to OCD pursuant to OCD Rule 116 and WQCC 1203.

13. Facility closure plan in compliance with OCD Rules, Regulations and/or Orders.

At this time, and for the foreseeable future, NMSU has no intention of closing or ceasing operations of it geothermal facilities. If closure should be considered in the future, the wells will be abandoned, equipment removed and the well bores will be plugged with concrete in full compliance with OCD and State Engineer's Office Rules and Regulations.

OLD INJECTION WELL CAPPED & ABANDONED

ABANDONED PIPELINE

NEW INJECTION WELL OPERATIONAL

ABANDONED PIPELINE

PG-2 OUT OF OPERATION

DISPOSAL PIT

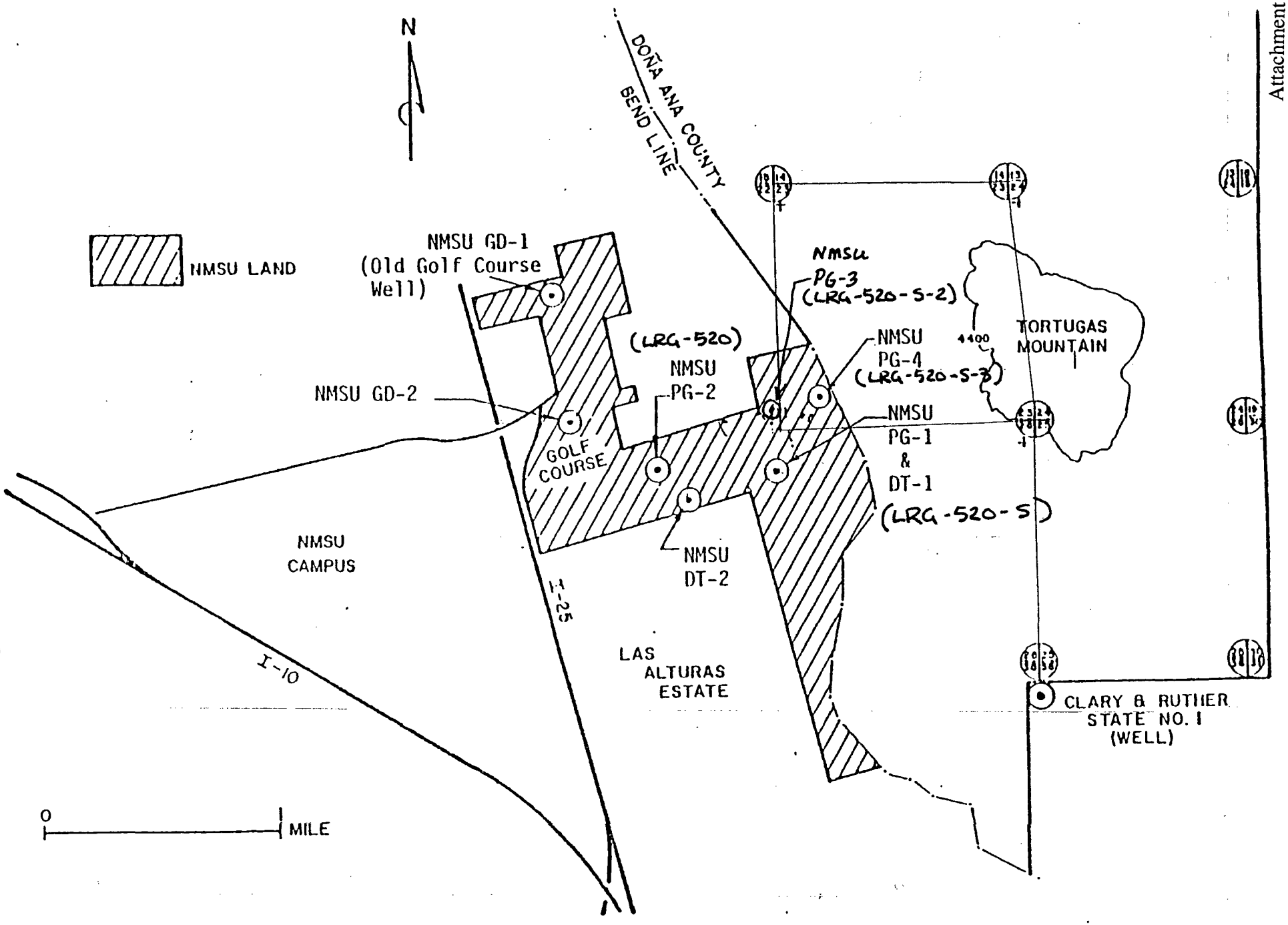
PG-4 OPERATIONAL

ABANDONED PIPELINE

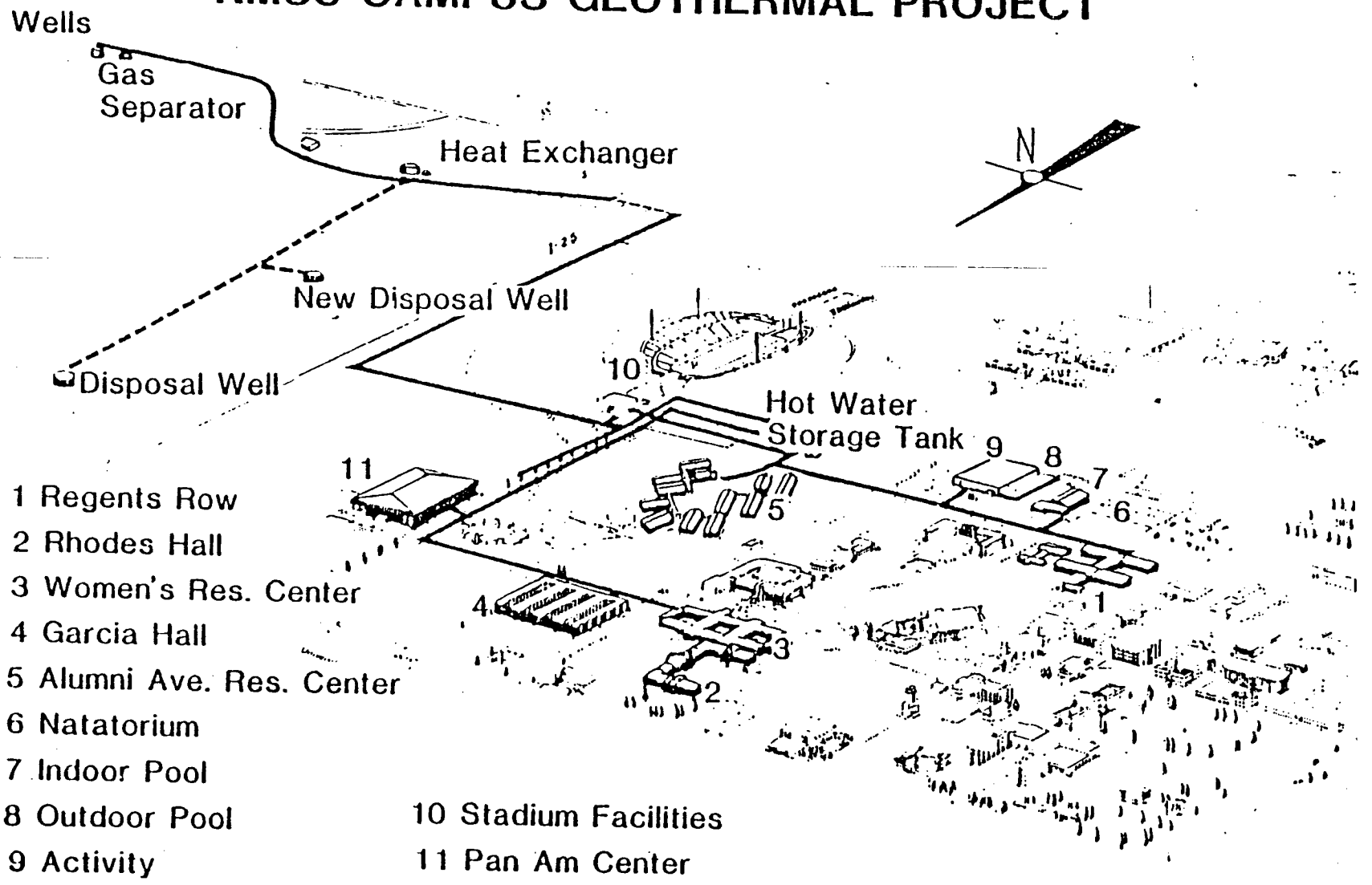
PG-3 OUT OF OPERATION

PG-1 OPERATIONAL

ATTACHMENT 2
SHEET 1 OF 5

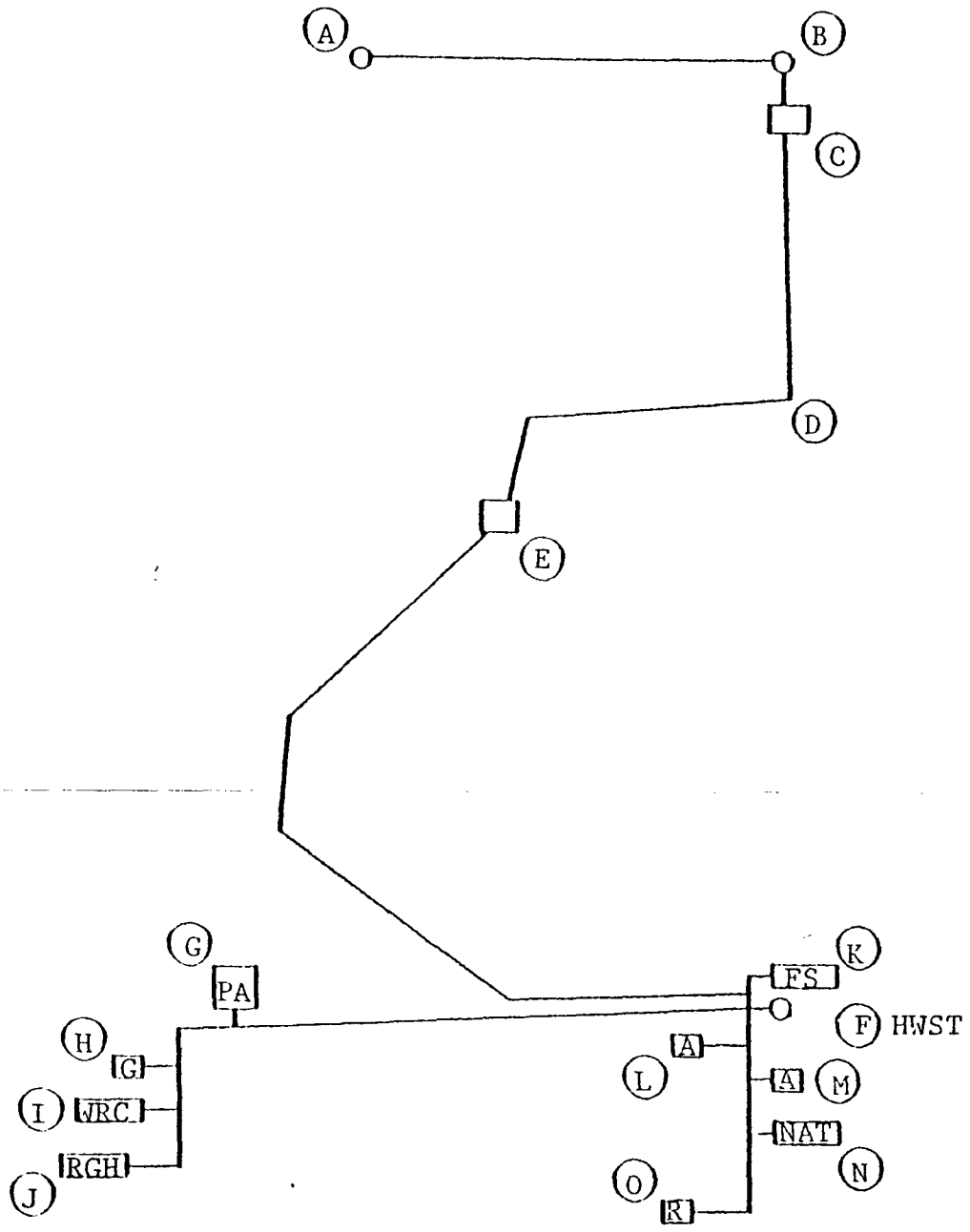

N
DOÑA ANA COUNTY
BEND LINE
NMSU LAND
NMSU GD-1
(Old Golf Course
Well)
NMSU
PG-3
(LRG-520-S-2)
(LRG-520)
NMSU
PG-2
NMSU
PG-4
(LRG-520-S-3)
4400
TORTUGAS
MOUNTAIN
NMSU GD-2
GOLF
COURSE
NMSU
PG-1
&
DT-1
(LRG-520-S)
NMSU
CAMPUS
NMSU
DT-2
I-25
I-10
LAS
ALTURAS
ESTATE
CLARY & RUTHER
STATE NO. 1
(WELL)
0
MILE

NMSU CAMPUS GEOTHERMAL PROJECT



1 Regents Row
2 Rhodes Hall
3 Women's Res. Center
4 Garcia Hall
5 Alumni Ave. Res. Center
6 Natatorium
7 Indoor Pool
8 Outdoor Pool
9 Activity
10 Stadium Facilities
11 Pan Am Center

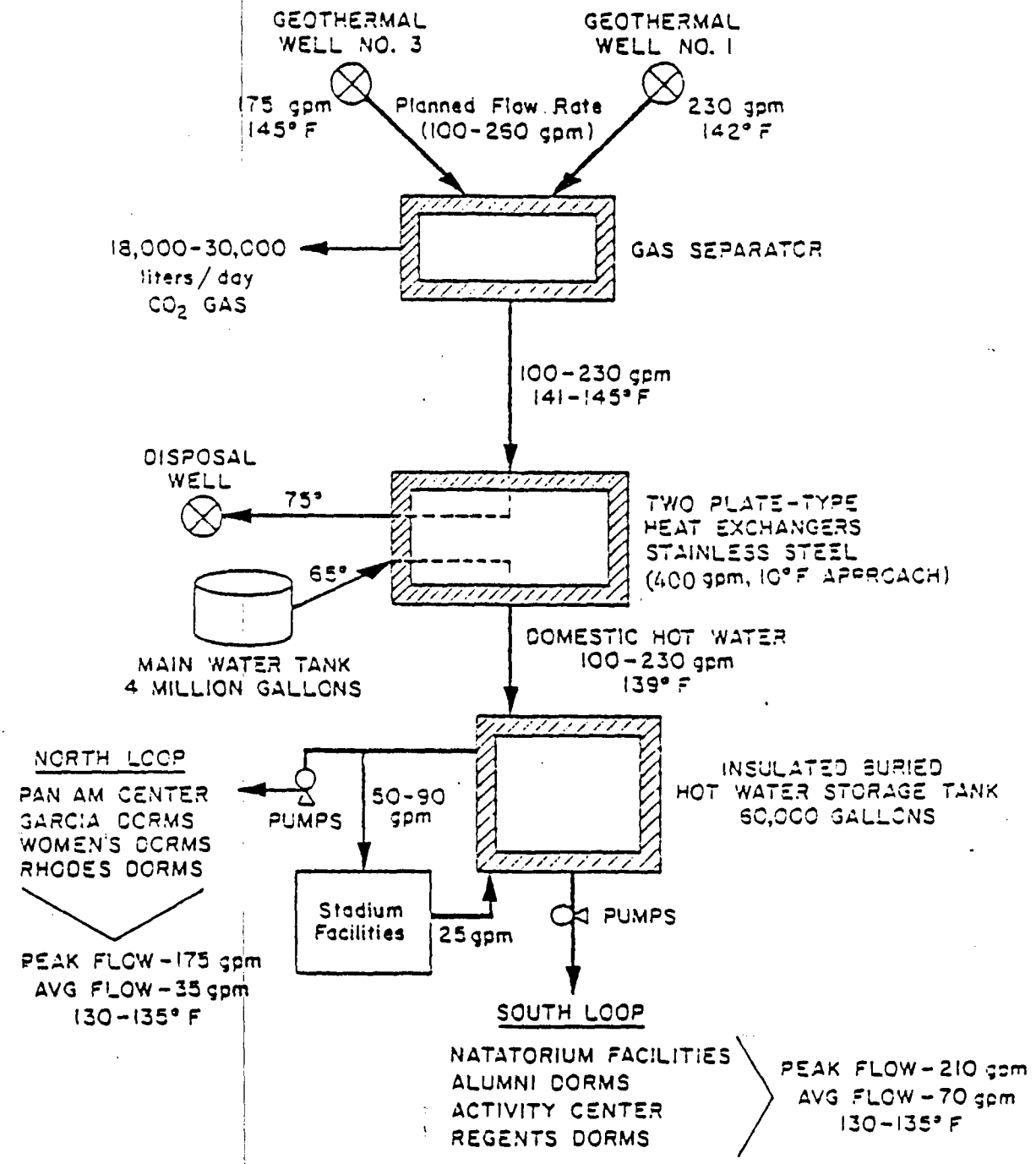
SKETCH OF HOT WATER DISTRIBUTION SYSTEM

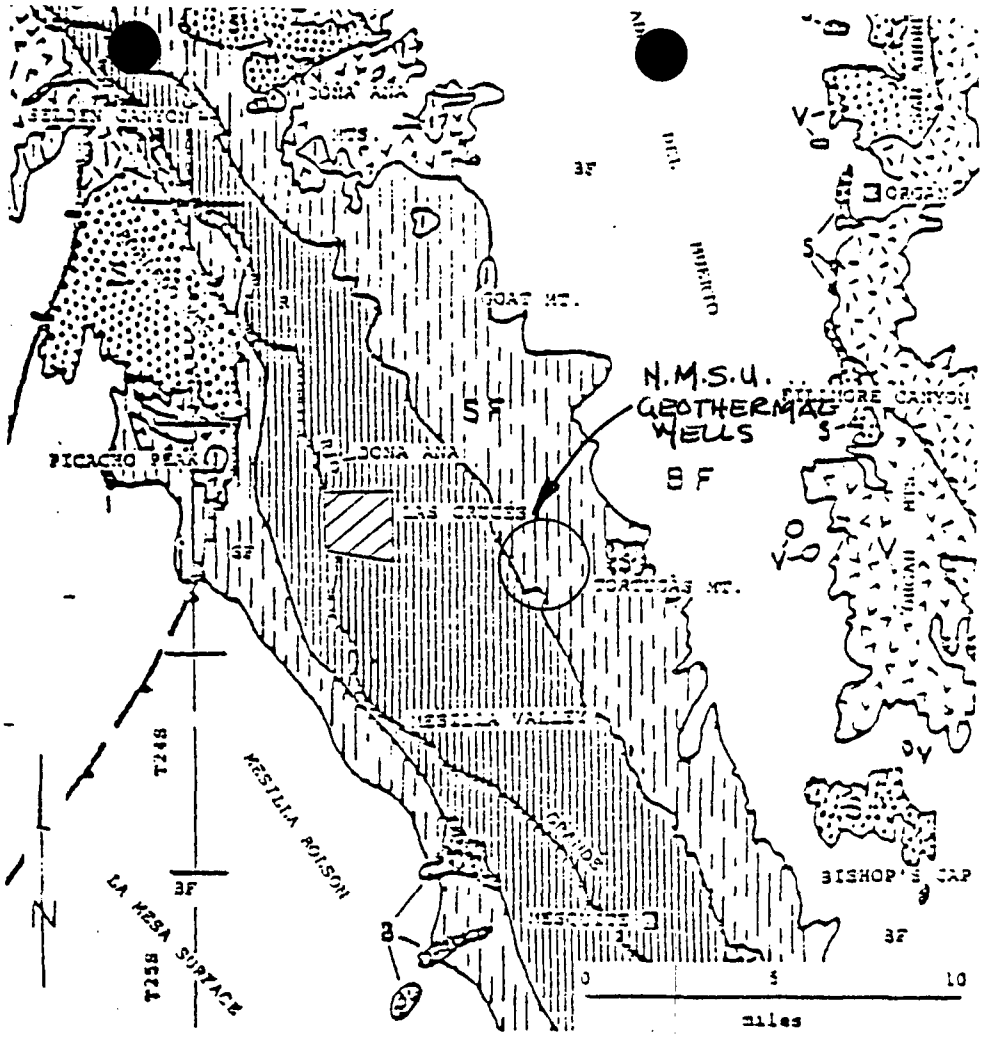


Key

- (A) PG-3
- (B) PG-1
- (C) Gas Separator
- (E) Heat Exchanger
- (F) HWST (Hot Water Storage Tank)
- (G) PA (Pan Am Center)
- (H) G (Garcia)
- (I) WRC (Womens Residence Center)
- (J) RGH (Rhodes, Garnett, Hammil)
- (K) FS (Football Stadium)
- (L) A (Alumni Dorm)
- (M) A (Activity Center)
- (N) NAT (Natatorium)
- (O) R (Regents Dorm)

SYSTEM OVER-VIEW





EXPLANATION

R — Valley-fill alluvium, late Quaternary; clay to gravel, less than 80 ft thick.

B? — Olivine basalt flows and volcanic cones; Quaternary, generally post date the Santa Fe Group.

BF — Basin-fill surface. Santa Fe Group, with discontinuous overlay (generally less than 25 ft thick) of younger alluvial, eolian and minor lacustrine deposits.

SF — Santa Fe Group Basin fill; Miocene to middle Pleistocene; clay to gravel; locally as much as 4,000 ft thick. Also discontinuous overlay (generally less than 100 ft thick) of younger valley slope deposits.

V — Volcanic rocks, and associated clastic sedimentary rocks, undifferentiated; early and middle Tertiary.

S — Sedimentary rocks, undifferentiated; Paleozoic, Cretaceous and early Tertiary.

I — Intrusive rocks, undifferentiated, and associated metamorphics; Precambrian and Tertiary.

Faults involving significant displacements of basin fill.

Geologic map of Las Cruces area.
(From King and Hawley, 1975)

Attachment 3
Sheet 1 of 4

ANALYTICAL REPORT

300339

for

NMSU

Project Manager: *David Bollschweiler*

Project Name: *NMSU Geo #1*

Friday, September 15, 2000

InterLab

4200 South Research Drive, Genesis B * Las Cruces, NM 88003

Phone (505) 646-6611 Fax (505) 646-6613

Interlab

Certificate of Analyses
No. 300339

Project Information

Client: NMSU
Project Name: NMSU Geo #1
Project Location: Las Cruces, NM
Field Sample ID: Geo Well #1
Lab ID No.: 300339
Date Sampled: Sep-6-00
Sample Matrix: Water

Project Manager: David Bollschweiler
Project ID: N/A
Preservative: Ice
Date/Time Received: Sep-6-00 4:00 PM
Analyst: G.V.

Test Description or Parameter	*Test Method*	*Date Analyzed*	*LOQ*	*Final Results*	*Units **
Bicarbonate (as $CaCO_3$)	2320B 18th Ed.	Sep-8-00	2.0	**518.0**	mg/L
Carbonate (as $CaCO_3$)	2320B 18th Ed.	Sep-8-00	2.0	**<2.0**	mg/L
Calcium	EPA 215.1	Sep-8-00	0.5	**158.1**	mg/L
Chloride (as Cl)	EPA 325.3	Sep-8-00	5.0	**576.0**	mg/L
Conductance	EPA 120.1	Sep-7-00	---	**3070**	µ mhos/cm
Fluoride (as F)	EPA 340.1	Sep-13-00	0.1	**1.1**	mg/L
Magnesium	EPA 242.1	Sep-8-00	0.005	**28.4**	mg/L
pH	EPA 9045	Sep-6-00	0-14	**7.26**	---
Potassium	EPA 258.1	Sep-8-00	0.01	**106.11**	mg/L
Sodium	EPA 273.1	Sep-8-00	0.01	**123.5**	mg/L
Sulfate (as SO_4)	EPA 375.3	Sep-12-00	5.0	**230.0**	mg/L
TDS	EPA 160.1	Sep-7-00	10.0	**1996.0**	mg/L

LOQ = Limit of Quantitation.

* Units = Units for Measurement of Results and LOQ

ND = Not Detected = BQL = Below Quantitation Limit

Gracy K Varughese

Gracy K. Varughese
Chief Analyst

TABLE 1. DATA COMPILATIONS FOR NMSU WELLS (5/95 DRAFT)

Well No.	SEO File No.	Location	Use	Status	Date Drilled	Total Depth, ft.	Casing Diameter in.	Production Interval, ft.	Yield, gpm	Drawdown, ft.	Specific Capicity, gpm/ft.	Duration of test hrs.	Date	Static Water Level, ft.	Date
GEOTHERMAL															
PG-2	LRG-520 (LRG-522)	23S.2E.27.124			1979	507	6		17 17				3/82 7/79	282	3/82
PG-1	LRG-520-S (LRG-521)	23S.2E.27.224			1979	860	10 3/4		365 225	203 146	1.8 1.5		3/82 11/79	322	3/82
PG-3	LRG-520-S-2 (LRG-521-S)	23S.2E.22.444			1980	870	10 3/4	750-860	200		19.5	15	1/81	390 390	1/81 1/80
PG-4	LRG-520-S-3 (LRG-4905)	23S.2E.23.331			1986	1015	14								
INJ.	LRG-520 inj (LRG-3648)	23S.2E.27.111	Inj.		1982	477	8	370-380 390-470	250				12/82	188	12/82
	LRG-523	23S.2E.27.224	Obs.		1980	860	4	700-860	750				12/80	327	12/80

PHYSICAL PLANT

Dept. 3545, P.O. Box 30001
Las Cruces, New Mexico 88003-8001
(505) 646-2101
FAX: (505) 646-1460

NEW MEXICO STATE UNIVERSITY

October 10, 1996

Mr. Mark Ashley
Environmental Bureau Chief
Energy, Minerals and Natural Resources Dept.
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

Re: Discharge Plan GW-38 Renewal
NMSU Geothermal Facility
Doña Ana County, New Mexico

Dear Mr. Ashley:

Enclosed is a copy of the annual chemical analysis for the New Mexico State University PG-4 well as required under Discharge Plan GW-38.

Please call Ron Thompson at (505)646-7844 if you have any questions or comments.

Sincerely,

Benjamin E. Woods
Assistant Vice President/Director

/gu
Enclosure
cc: Mr. Owen Lockwood, Assistant Director for Operations & Utilities, PPD
Mr. Ron Thompson, Staff Engineer, PPD

SWAT Laboratory
New Mexico State University
Agronomy & Horticulture Department
Box 30003, Department 3Q
Las Cruces, NM 88003-8003

October 4, 1996

Ron Thompson
Dept 3545
Las Cruces, NM 88003
646-7844

Dear Ron Thompson:

Below are the results of analysis of 1 sample received for examination on August 8, 1996:

Sample I.D. AA72945 Client Code: UTHOMSON
Purchase order number: 01350025 User Code No.: 91-46*
Sample Description: PG 4 Geothermal Well
Sample collector: RON THOMPSON Sample collection date: 08/08/96
Lab submittal date: 08/08/96 Time: 12:44

TEST PARAMETER	UNITS	TEST RESULT	DETECTION LIMIT
Calcium by ICP-	mg/L	169.5	0.1
Magnesium by ICP-	mg/L	31.5	0.1
Potassium by ICP-	mg/L	53.5	0.1
Sodium by ICP-	mg/L	450	0.1
Carbonate	meq/L	0.00	0.01
Bicarbonate	meq/L	9.76	0.01
Chloride by Autoanalyzer	mg/L	618.4	1
Fluoride by electrode	mg/L	2.3	0.1
Sulfate	mg/L	244.2	2.5
Electrical Conductivity	micromhos/cm	2650	1
pH of water		6.60	
Total Dissolved Solids	mg/L	1764	1
Bromide by Ion Chrom-	mg/L	0.4	0.1

Please advise should you have questions concerning these data.

Respectfully submitted,

Andrew Lee Bristol

Andrew Lee Bristol
Laboratory Manager
(505)646-4422

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION
2040 S. PACHECO
SANTA FE, NEW MEXICO 87505
(505) 827-7131

February 7, 1996

Mr. Benjamin E. Woods, Director
Physical Plant Department
New Mexico State University
Box 3001 Department 3545
Las Cruces, New Mexico 88003-0001

RE: Sampling Requirements
Discharge Plan GW-038 Renewal
NMSU Geothermal Facility
Dona Ana County, New Mexico

Dear Mr. Woods:

Under the groundwater discharge plan renewal, GW-038, NMSU Geothermal Facility is required to sample the discharge water for major cations and anions on an annual basis and submit the results to the New Mexico Oil Conservation Division. The discharge water is to sampled for the following constituents using EPA approved methods:

Flouride, Bromide, Calcium, Potassium, Magnesium, Sodium, Bicarbonate, Carbonate, Chloride, Sulfate, Total Dissolved Solids, Cation/Anion Balance, Ph, and Conductivity.

If you have any questions, please call me at (505) 827-7155.

Sincerely,

Mark Ashley
Geologist

PHYSICAL PLANT

Dept. 3545, P.O. Box 30001
Las Cruces, New Mexico 88003-8001
(505) 646-2101
FAX: (505) 646-1460

January 10, 1995

Mr. Roy Johnson
Energy and Minerals Department
State Land Office Building
P. O. Box 2088
Santa Fe, New Mexico 87501

Dear Mr. Johnson:

Enclosed are the reports required by Rule 208 and Rule 210 of the "State of New Mexico Energy and Minerals Department Rules and Regulations: Form G-108 (Monthly Geothermal Production Report) and Form G-110 (Monthly Geothermal Injection Report)."

Sincerely,

Benjamin E. Woods
Director

/gu
Enclosures
cc: Mr. Owen Lockwood, Assistant Director for Operations & Maintenance, PPD
Mr. Ron Thompson, Staff Engineer, PPD

NEW MEXICO OIL CONSERVATION COMMISSION P. O. Box 2088 Santa Fe 87501

FORM G-110
MONTHLY GEOTHERMAL INJECTION REPORT

Month of: DEC 1995

Operator: NEW MEXICO STATE UNIVERSITY					Address: BOX 30001 DEPT 3545 LAS CRUCES NM 88003					
Lease Name: NOT APPLICABLE					Field: LOWER RIO GRANDE			County: DONA ANA		
Well No.	Location UL	S	T	R	P.M. or D.	Acre Feet Water Inj.	Ave.Surf. inj . Press.	Ave. Temp. Inj. Water	Cumulative Water Inj.	Name of Inj. Zone	Source of Water
LRG 3648	D	21	23S	2E	D	14.50	0	99° F	333.21	Santa Fe	PG-4
TOTALS						14.50			333.21		

P.M. is injection into a producing zone for the purpose of building up or maintaining pressure.
D. is injection into a zone other than a producing zone for disposal purposes.
I hereby certify that the above is true and complete to the best of my knowledge and belief.

Remarks: _____

Name: B. Ewell

Company: New Mexico State University

Title: Director of Physical Plant Date: _____

NEW MEXICO OIL CONSERVATION COMMISSION P. O. Box 2088 Santa Fe 87501

FORM G-110
MONTHLY GEOTHERMAL INJECTION REPORT

Month of: DEC 1995

Operator: NEW MEXICO STATE UNIVERSITY					Address: BOX 30001 DEPT 3545 LAS CRUCES NM 88003					
Lease Name: NOT APPLICABLE					Field: LOWER RIO GRANDE			County: DONA ANA		
Well No.	Location UL	S	T	R	P.M. or D.	Acre Feet Water Inj.	Ave.Surf. inj . Press.	Ave. Temp. Inj. Water	Cumulative Water Inj.	Name of Inj. Zone	Source of Water
LRG 3648	D	21	23S	2E	D	14.50	0	99° F	333.21	Santa Fe	PG-4
TOTALS						14.50			333.21		

P.M. is injection into a producing zone for the purpose of building up or maintaining pressure.
D. is injection into a zone other than a producing zone for disposal purposes.
I hereby certify that the above is true and complete to the best of my knowledge and belief.

Remarks: _____

Name: _____

Company: New Mexico State University

Title: Director of Physical Plant Date: _____

NEW MEXICO OIL CONSERVATION COMMISSION

P. O. Box 2088, Santa Fe 87501

FORM G-108

MONTHLY GEOTHERMAL PRODUCTION REPORT

SUBMIT IN DUPLICATE

Month of: DEC 1995

Operator: NEW MEXICO STATE UNIVERSITY					Address: BOX 30001 DEPT 3545 LAS CRUCES NM 88003								
Lease Name: NOT APPLICABLE					Reservoir: LOWER RIO GRANDE						County: DONA ANA		
NOTE: Report actual production (NOT SALES). Use Form G-109 for water injection wells.													
Well Num	Unit Lett	Sec	Twp	Rge	Total mass prod lbs x10^6	Dry stm prod lbs x10^6	Flow temp ° F	Flow pres psig	Water prod ac–ft	Min'ls prod (type and tons)	Method of Prod (F or P)	No Days Well Prod	If well not in production state reason
LRG 520	P	22	23S	2E	0	0	-	-	0	0	P	0	Out of Service
LRG 521	A	27	27S	2E	0	0	-	-	0	0	P	0	Out of Service
LRG 522		27	27S	2E	0	0	-	-	0	0	P	0	Out of Service
PG-4	M	23	23S	2E	48.63	0	146	26	17.92	0	P	31	
TOTALS					48.63	0			17.92	0			

I hereby certify that the information above is true and complete to best of my knowledge and belief.

Benjamin E. Woods
Director of NMSU Physical Plant Department
Date: 1-11-96

NEW MEXICO OIL CONSERVATION COMMISSION

P. O. Box 2088, Santa Fe 87501

FORM G-108

MONTHLY GEOTHERMAL PRODUCTION REPORT

SUBMIT IN DUPLICATE

Month of: DEC 1995

Operator: NEW MEXICO STATE UNIVERSITY					Address: BOX 30001 DEPT 3545 LAS CRUCES NM 88003								
Lease Name: NOT APPLICABLE					Reservoir: LOWER RIO GRANDE					County: DONA ANA			
NOTE: Report actual production (NOT SALES). Use Form G-109 for water injection wells.													
Well Num	Unit Lett	Sec	Twp	Rge	Total mass prod lbs x10^6	Dry stm prod lbs x10^6	Flow temp ^{o} F	Flow pres psig	Water prod ac–ft	Min'ls prod (type and tons)	Method of Prod (F or P)	No Days Well Prod	If well not in production state reason
LRG 520	P	22	23S	2E	0	0	-	-	0	0	P	0	Out of Service
LRG 521	A	27	27S	2E	0	0	-	-	0	0	P	0	Out of Service
LRG 522		27	27S	2E	0	0	-	-	0	0	P	0	Out of Service
PG-4	M	23	23S	2E	48.63	0	146	26	17.92	0	P	31	
TOTALS					48.63	0			17.92	0			

I hereby certify that the information above is true and complete to best of my knowledge and belief.

Benjamin E. Woods
Director of NMSU Physical Plant Department
Date: 1-11-96

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 761-4525 Fax: (505) 761-4542

JAN 1 1 1996

January 9, 1996

Mr. William J. Lemay
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

Dear Mr. Lemay:

This responds to the Energy, Minerals, and Natural Resources Department Oil Conservation Division's public notices dated October 11, and December 4, 1995, regarding the State of New Mexico's proposal to approve the discharge plan for the applicants listed below. We regret any inconvenience that may be caused by the late submission of these comments. Due to the federal budget impasse and subsequent furlough of employees, we were unable to submit these comments prior to the close of the 30-day comment period.

(GW-38) - New Mexico State University. The director of the physical plant has submitted an application renewal to discharge cooled geothermal water to an unlined pit in Section 23, Township 23 South, Range 2 East, Doña Ana County, New Mexico. Approximately 54,720 gallons per day of cooled geothermal water will be stored in an above ground, unlined pit.

(GW-60) - Williams Field Service. The environmental specialist has submitted an application renewal to discharge process water from the Milagro Gas Plant located in Section 12, Township 29 North, Range 11 West, San Juan County, New Mexico. Approximately 1500 gallons per day of process water will be stored in an above ground, double-lined evaporation pond equipped with a leak detection system.

During flight, migratory birds may not distinguish between an evaporation pond or lagoon from a natural waterbody. Therefore, rather than allow migratory birds access to a waterbody that may act as an attractive nuisance, the U.S. Fish and Wildlife Service (Service) recommends that the applicant demonstrate that the pond or lagoon is "bird-safe" (e.g., can meet New Mexico general water quality standards 1102B, 1102F, and 3101K or 3101L), or that the ponds and lagoons be constructed in a manner that prevents bird access (e.g., netted, fenced, enclosed in tanks, etc.).

Migratory birds that land on waterbodies with an oil sheen have the potential to contaminate their eggs during nesting season. Birkhead et al. (1973) reported that

petroleum pollutants carried to the nest on breast feathers, feet, or nesting materials caused reduced hatchability of contaminated eggs. Albers (1977) and Hoffman (1978) showed that as little as 1 to 10 microliters of crude or refined oil topically applied to eggs of various bird species was embryotoxic or teratogenic. We recommend that the Oil Conservation Division or the applicant demonstrate that the pond will have no oil sheen and continue periodic testing to characterize the water quality and determine if any bioaccumulation or ecological risks seem imminent.

Our intent is to inform and intercede before any migratory bird deaths occur as migratory birds are beneficial (e.g., they hold pest populations in check) and are protected by law. The Migratory Bird Treaty Act (MBTA) makes it unlawful for anyone at anytime or in any manner to take (i.e., pursue, hunt, take, capture, kill, transport, or possess) any migratory bird unless authorized by a permit issued by the Department of the Interior. The courts have interpreted "illegal take" to include accidental poisoning or accumulation of harmful concentrations of contaminants by migratory birds, even if the contamination event was accidental or the perpetrator was unaware of the fact that his/her actions (or failure to take action) could ultimately prove harmful to migratory birds. The liability provisions of the MBTA preclude the necessity of proving intent and permits criminal prosecution of persons, associations, partnerships, or corporations that inadvertently or intentionally kill or illegally take one or more migratory birds. Therefore, if the creation and operation of a pond or lagoon results in migratory bird deaths and the problem is not addressed, the operators may be held liable under the enforcement provisions of the MBTA. If migratory birds or other wildlife are dying around a lagoon or pond, please contact either the Service or the New Mexico Department of Game and Fish.

If you have any questions, please contact Joel D. Lusk at (505) 761-4525.

Sincerely,

Jennifer Fowler-Propst
Field Supervisor

cc:
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Chief, New Mexico Environment Department, Surface Water Quality Bureau, Santa Fe, New Mexico

References Cited

Albers, P.H. 1977. *Effects of external application of fuel oil on hatchability of mallard eggs*. Pages 158-173 in Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms, D.A. Wolfe, Ed., Pergamon Press, New York, New York, USA.

Birkhead, T.R., C. Lloyd, and P. Corkhill. 1973. *Oiled seabirds successfully cleaning their plumage*. Br Birds 66:535-543.

Hoffman, D.J. 1978. *Embryotoxic effects of crude oil in mallard ducks and chicks*. Toxicology and Applied Pharmacology 46:183-191.

PROOF OF PUBLICATION

George S. Smith, being duly sworn, deposes and says that he is the Publisher of the Las Cruces Sun-News, a newspaper published daily in the County of Dona Ana, State of New Mexico; that the notice 14406-NOTICE OF PUBLICATION as per clipping attached was published once a week/day in regular and entire issue of said newspaper and not in any supplement thereof, for 1 consecutive weeks/days; that the first publication was in the issue dated 12/22/95 and the last publication was in the issue dated 12/22/95.

Deponent further states this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Sec. 3, Chapter 167, Laws of 1937.

Signed _____

Publisher
Official Position

STATE OF NEW MEXICO

ss.

COUNTY OF DONA ANA

Subscribed and sworn before me this 22nd day of December 1995.

Mary Lucyan Silva

Notary Public in and for Dona Ana County, NM

10-28-97

NOTICE OF PUBLICATION

STATE OF NEW MEXICO
ENERGY, MINERALS AND
NATURAL RESOURCES
DEPARTMENT OIL
CONSERVATION DIVISION

Notice is hereby given that pursuant to New Mexico Water Quality Control Commission Regulations, the following discharge plan renewal application has been submitted to the Director of the Oil Conservation Division, 2040 South Pacheco, Santa Fe, New Mexico 87505, Telephone (505) 827-7131:

(GW-38) - New Mexico State University, Benjamin E. Woods, Director, Physical Plant Department, P.O. Box 30001, Department 3545, Las Cruces, New Mexico, 88003-8001 has submitted an application for renewal of is previously approved discharge plan to discharge cooled geothermal water to an unlined pit at its greenhouse facility located in Section 23, Township 23 South, Range 2 East, NMPM, Dona Ana County, New Mexico. Approximately 54,720 gallons per day of cooled geothermal water with a total dissolved solids concentration of 1,775 mg/l will be discharged. The disposed geothermal water will percolate into the ground and will reenter the geothermal reservoir. Uppermost ground water is geothermal and is found at 365 feet with at total dissolved solids concentration of 1,636 mg/l. The discharge plan addresses how spills, leaks, and other accidental discharges to the surface will be managed.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. The discharge plan application may be viewed at the above address between 8:00 a.m. and 4:00 p.m., Monday through Friday. Prior to ruling on any proposed discharge plan and its modification, the Director of the Oil Conservation of Division shall allow at least thirty (30) days after the date of publication of notice during which comments may be submitted to him and a public hearing may be requested by any interested person. Request for a public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant public interest.

If no public hearing is held, the Director will approve or disapprove the proposed plan based on information available. If a public hearing is held, the director will approve or disapprove the proposed plan based on information in the plan and information in the plan and information submitted at the hearing.

GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 4th day of December 1995.

STATE OF NEW MEXICO
OIL CONSERVATION
DIVISION
/s/William J. Lemay,
Director

Pub. No.: 14406
Publish: December 22, 1995

OK
MA
1-8-96

The Santa Fe New Mexican
Since 1849. We Read You.

NEW MEXICO ENERGY, MINERALS & NATURAL RESOURCES
ATTN: SALLY MARTINEZ
2040 S. PACHECO
SANTA FE, N.M. 87505

AD NUMBER: 447154
LEGAL NO: 58696
ACCOUNT: 56689
P.O. #: 96199002997

160 LINES once at $ 64.00

Affidavits: 5.25

Tax: 4.33

Total: $ 73.58

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

Notice is hereby glen that pursuant to New Mexico Water Quality Control Commission Regulations, the following discharge plan renewal appliation has been submitted to the Director of Oil Conservation Division, 2040 South Pacheco, Santa Fe, New Mexico 87505, Telephone (505) 827-7131:

(GW-38) - New Mexico State University, Benjamin E. Woods, Director, Physical Plant Department, P.O. Box 30001, Department 3545, Las Cruces, New Mexico, 88003-8001 has submitted an application for renewal of its previously approved discharge plan to discharge cooled geothermal water to an unlined pit at its greenhouse facility located in Section 23, Township 23 South, Range 2 East, NMPM, Dona Ana County, New Mexico. Approximately 54,720 gallons per day of cooled geothermal water with a total dissolved solids concentration of 1,775 mg/l will be discharged. The disposed geothermal water will percolate into the ground and will reenter the geothermal reservoir. Uppermost ground water is geothermal and is found at 365 feet with a total dissolved solids concentration of 1,636 mg/l. The discharge plan addresses how spills, leaks, and other accidental discharges to the surface will be managed.

Any interested person may obtain further information from the Oil Conversation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. The discharge plan application may be viewed at the above address between 8:00 a.m. and 4:00 p.m., Monday through Friday. Prior to ruling on any proposed discharge plan or its modifiation, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and a public hearing may be requested by any interested person. Requests for a public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant public interest.

If no public hearing is held, the Director will approve or disapprove the proposed plan based on information available. If a public hearing is held, the director will approve or disapprove the proposed plan based on information in the plan and information submitted at the hearing.

GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 4th day of December 1995.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION
WILLIAM J. LEMAY, Director
Legal #58696

AFFIDAVIT OF PUBLICATION

STATE OF NEW MEXICO
COUNTY OF SANTA FE

I, BETSY PERNER being first duly sworn declare and say that I am Legal Advertising Representative of THE SANTA FE NEW MEXICAN, a daily news paper published in the English language, and having a general circulation in the Counties of Santa Fe and Los Alamos, State of New Mexico and being a Newspaper duly qualified to publish legal notices and advertisements under the provisions of Chapter 167 on Session Laws of 1937; that the publication # 58696 a copy of which is hereto attached was published in said newspaper once each WEEK for ONE consecutive week(s) and that the notice was published in the newspaper proper and not in any supplement; the first publication being on the 14th day of DECEMBER 1995 and that the undersigned has personal knowledge of the matter and things set forth in this affidavit.

/S/ Betsy Perner
LEGAL ADVERTISEMENT REPRESENTATIVE

Subscribed and sworn to before me on this 14th day of DECEMBER A.D., 1995.

OFFICIAL SEAL
Candace C. Ruiz
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 9/29/97

Candace C. Ruiz

OK
12-19-95

The Santa Fe New Mexican
Since 1849. We Read You.

NEW MEXICO ENERGY, MINERALS & NATURAL RESOURCES
ATTN: SALLY MARTINEZ
2040 S. PACHECO
SANTA FE, N.M. 87505

AD NUMBER: 447154 ACCOUNT: 56689
LEGAL NO: 58696 P.O. #: 96199002997

160 LINES once at $ 64.00

Affidavits: 5.25

Tax: 4.33

Total: $ 73.58

DEC 18 1995

OIL CONSERVATION DIVISION

AFFIDAVIT OF PUBLICATION

STATE OF NEW MEXICO
COUNTY OF SANTA FE

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OFFICIAL SEAL
Candace C. Ruiz
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires 9/29/97

Candace C. Ruiz

OK MM 12-19-95

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

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GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 4th day of December 1995.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION
WILLIAM J. LEMAY, Director

Legal # 58696

December 5, 1995

THE NEW MEXICAN
202 E. Marcy
Santa Fe, New Mexico 87501

RE: NOTICE OF PUBLICATION

PO #96-199-002997

ATTN: Betsy Perner

Dear Sir/Madam:

Please publish the attached notice one time immediately on receipt of this request. Please proofread carefully, as any error in a land description or in a key word or phrase can invalidate the entire notice.

Immediately upon completion of publication, please send the following to this office:

1. Publisher's affidavit.
2. Invoices for prompt payment.

We should have these immediately after publication in order that the legal notice will be available for the hearing which it advertises, and also so that there will be no delay in your receiving payment.

Please publish the notice on Thursday, December 14, 1995.

Sincerely,

Sally Martinez

Sally E. Martinez
Administrative Secretary

Attachment

State of New Mexico
ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT
Santa Fe, New Mexico 87505

New Mexico DRUG FREE It's a State of Mind!

December 8, 1995

LAS CRUCES SUN
256 W. Las Cruces
Las Cruces, New Mexico 88001

ATTN: ADVERTISING MANAGER

RE: NOTICE OF PUBLICATION

Dear Sir/Madam:

Please publish the attached notice one time immediately on receipt of this request. Please proofread carefully, as any error in a land description or in a key word or phrase can invalidate the entire notice.

Immediately upon completion of publication, please send the following to this office:

1. Publisher's affidavit in duplicate.
2. Statement of cost (also in duplicate.)
2. CERTIFIED invoices for prompt payment.

We should have these immediately after publication in order that the legal notice will be available for the hearing which it advertises, and also so that there will be no delay in your receiving payment.

Please publish the notice no later than December 15, , 1995.

Sincerely,

Sally Martinez
Sally E. Martinez
Administrative Secretary

Attachment

P 624 835 431

US Postal Service
Receipt for Certified Mail
No Insurance Coverage Provided.
Do not use for International Mail *(See reverse)*

Sent to Las Cruces Sun	
Street & Number	
Post Office, State, & ZIP Code	
Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, & Addressee's Address	
TOTAL Postage & Fees	$
Postmark or Date	

PS Form **3800**, April 1995

VILLAGRA BUILDING - 408 Galisteo
Forestry and Resources Conservation Division
P.O. Box 1948 87504-1948
827-5830
Park and Recreation Division
P.O. Box 1147 87504-1147
827-7465

2040 South Pacheco
Office of the Secretary
827-5950
Administrative Services
827-5925
Energy Conservation & Management
827-5900
Mining and Minerals
827-5970
Oil Conservation
827-7131

NOTICE OF PUBLICATION

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to New Mexico Water Quality Control Commission Regulations, the following discharge plan renewal application has been submitted to the Director of the Oil Conservation Division, 2040 South Pacheco, Santa Fe, New Mexico 87505, Telephone (505) 827-7131:

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GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 4th day of December 1995.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

by _____ Deputy Director

WILLIAM J. LEMAY, Director

SEAL

NOTICE OF PUBLICATION

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

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GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 4th day of December 1995.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

by _____ Deputy Director

WILLIAM J. LEMAY, Director

SEAL

PHYSICAL PLANT

Dept. 3545, P.O. Box 30001
Las Cruces, New Mexico 88003-8001
(505) 646-2101
FAX: (505) 646-1460

November 10, 1995

Certified Mail
Return Receipt No. Z 777 774 489

Mr. Roger C. Anderson
Environmental Bureau Chief
Energy, Minerals and Natural Resources Dept.
P.O. Box 2088
Santa Fe, New Mexico 87504

Re: Discharge Plan GW-38
NMSU Geothermal Facility
Dona Ana County, New Mexico

Dear Mr. Anderson:

In response to your July 21, 1995 letter, New Mexico State University wishes to apply for renewal of the groundwater discharge plan GW-38 for NMSU Geothermal Wells PG-1 (LRG-521) and PG-4. All of the previous information submitted as the basis of approval for Plan GW-38 is included by reference. The only exceptions to that are specifically noted herein.

A check for $740 in enclosed ($50 filing fee plus $690 for geothermal facilities).

If further information is needed, please feel free to contact me.

Sincerely,

Benjamin E. Woods
Assistant Vice President/Director

/gu
Enclosures
cc: Mr. Owen Lockwood, Assistant Director for Operations & Utilities, PPD
Mr. Ron Thompson, Staff Engineer, PPD

Discharge Plan for Geothermal Facilities

I. General Information

A. Name, Address and Telephone Number for Discharger or Legally Responsible Party:

New Mexico State University
P.O. Box 30001/Dept. 3545
Las Cruces, N.M. 88003
Attn: Ben Woods, Director of Physical Plant Department

B. Location of Discharge: Section 23, Township 23 (North) (South), Range 2, (East) (West)

C. Type of Operation:
Surface Disposal of Geothermal fluids from wells PG-1 and PG-4. This operation is identical with that operation previously submitted and approved in Discharge plan GW-38.

D. Affirmation:

"I hereby certify that I am familiar with the information contained in and submitted with this application and that such information is true, accurate and complete to the best of my knowledge and belief."

B. Ewell
(Signature)

13 Nov 95
(Date)

(Signature)

(Date)

II. Plant Processes

A. Describe storage and uses of geothermal waters and any surface disposal impoundments.

Geothermal waters from either PG-1 or PG-4, geothermal wells on the NMSU campus, will be used to heat two research greenhouses. These geothermal waters will be placed in an unlined disposal pit. This pit is 46 feet by 46 feet by 7 feet deep and is located 110 feet north of PG-4. A minimum freeboard of 5 feet will be maintained during disposal. This is as was previously submitted for plan GW-38

B. Estimated quantities used in gallons per day (gpd).
The estimated daily use is 54,720 gallons.

C. Any additives or commingling. There will be no additions or commingling with any other waste stream before disposal into the disposal pit. No fluids or solids other than geothermal waters will be disposed of into this pit.

III. Site Characteristics

A. Provide the name, description, and location of any ground water discharge sites (water wells, seeps, springs, watercourses) within one mile of the outside perimeter of the facility. For water wells, specify use of water (e.g., irrigation, domestic, etc.)
See the attached topographical map
There are no ground water discharge sites within one mile radius. See attached map.

B. If known, provide the flow direction of the ground water most likely to be affected by the discharge. Include the source of the information and how was it determined.
Subsurface flow direction of geothermal waters at PG-4 is southwest toward geothermal wells PG-1 and PG-3 (LRG - 520). Electric logs and static water table measurements show that PG-4 water table elevations are 16 to 23 feet higher than in PG-1 and PG-3. This data is from the interim completion report on DT-3 (PG-4) Geothermal Exploratory well.

C. Provide depth to water of geothermal water, and if possible, any fresh water wells that could be affected by any discharge.
The depth to water PG-4 is at 365 feet. Elevated temperatures, and uniformly low resistivety of E-log of PG-4, by El Paso Water Utilities, indicates saline geothermal fluid from the water table to the total geothermal fluid from the water table to the total depth in PG-4. No fresh water underlies this well. The E-log is on file with discharge plan GW-38.

D. Depth to and lithologic description of rock at base of alluvium. Provide drillers logs and geologic information and maps as available.
See the Geologist's report on file with Discharge Plan GW-38.

E. Describe flooding potential of the discharge site.
The discharge site is located on a hill slope out of any drainage paths. Flooding is not a problem for the site. The local runoff is directed away from the site. See also the attached topographic map.

F. Any additional information that may be necessary to demonstrate that approval of the discharge plan will not result in concentrations in excess of the standards of WQCC Regulations, Section 3-103, or the presence of any toxic pollutant at any place of withdrawal of water for present or reasonably foreseeable future use. Detailed information on site geologic and hydrologic conditions may be required for a technical evaluation of the applicant's proposed discharge plan.

The following information which is already on file with Discharge Plan GW-38:

1. Geologist's Report for PG-4.

2. Flow Test Report (Drill Stem Test).

3. Water Quality Analysis.

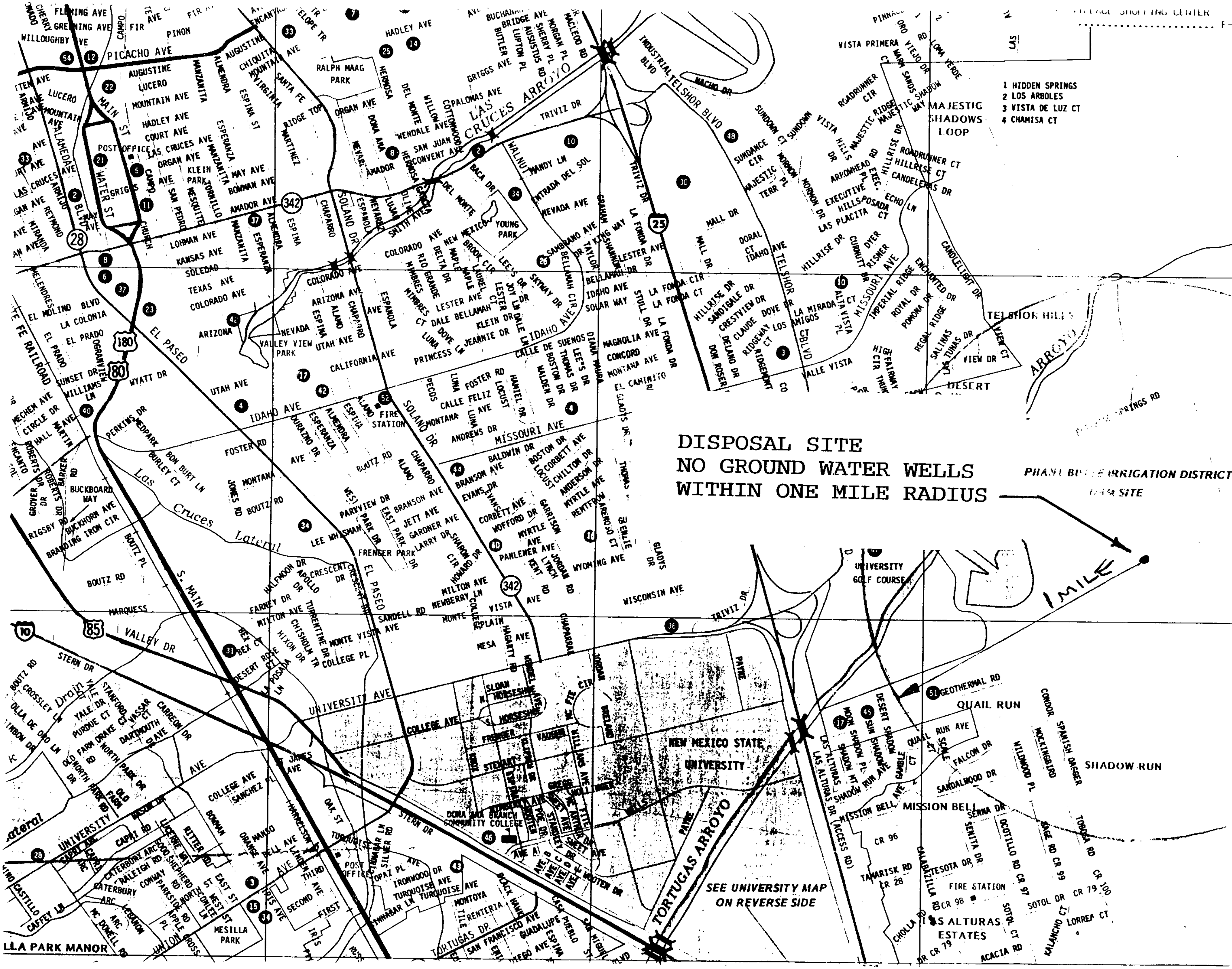
4. Comparison of water quality for PG-1, PG-4, chaffee 35-25, chaffee 12-24, and chaffee 55-25.

5. 24 Hour pump test report.

6. PG-4 E-log

7. Topographical map of discharge site.

8. Engineering estimate of percolation rates.


DISPOSAL SITE
NO GROUND WATER WELLS
WITHIN ONE MILE RADIUS
1 MILE
PHANT BUTTE IRRIGATION DISTRICT
SITE
NEW MEXICO STATE
UNIVERSITY
TORTUGAS ARROYO
LAS CRUCES ARROYO
SEE UNIVERSITY MAP
ON REVERSE SIDE
UNIVERSITY GOLF COURSE
DOÑA ANA BRANCH COMMUNITY COLLEGE
YOUNG PARK
RALPH MAAG PARK
VALLEY VIEW PARK
MESILLA PARK
LAS ALTURAS ESTATES
MAJESTIC SHADOWS LOOP
1 HIDDEN SPRINGS
2 LOS ARBOLES
3 VISTA DE LUZ CT
4 CHAMISA CT
QUAIL RUN
SHADOW RUN
MISSION BELL
F-7

PHYSICAL PLANT

Box 30001, Dept. 3545
Las Cruces, New Mexico 88003-8001
(505) 646-2101
FAX: (505) 646-6432

July 21, 1995

Mr. Mark Ashley
NM Oil Conservation Division
Environmental Bureau
2040 South Pacheco
Santa Fe, New Mexico 87505

Dear Mr. Ashley:

Attached is a copy of a letter dated 9 November 1990 which approved the groundwater discharge plan for the New Mexico State University (NMSU) geothermal facility. I can only assume that this document was inadvertently forwarded to the Artesia Office by the State Office when they signed and sent it to us. I thought you would like to have this for your files. We look forward to receiving your letter and beginning the process of applying for our renewal for the next five (5) year period.

If you have any questions, please do not hesitate to call

Sincerely,

Benjamin E. Woods
Director

/gu
Attachment
cc: Mr. Owen Lockwood, Assistant Director for Operations & Utilities, PPD
Mr. Ron Thompson, Staff Engineer (Civil), PPD

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

ANITA LOCKWOOD
CABINET SECRETARY

May 27, 1993

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

CERTIFIED MAIL
RETURN RECEIPT NO.P-111-334-207

Mr. Benjamin E. Woods
Physical Plant Department
New Mexico State University
Box 3001 Department 3545
Las Cruces, New Mexico 88003-0001

RE: Discharge Plan GW-38
NMSU Geothermal Facility
Dona Ana County, New Mexico

Dear Mr. Woods:

Attached are copies of the analytical results of the water samples taken from the above referenced facility, February 2, 1993, during the inspection conducted by myself and Kathy Brown.

We appreciate your cooperation and courtesy.

If you have any questions or comments, feel free to contact me at 827-5824.

SIncerely,

Chris Eustice

Chris Eustice
Environmental Geologist

Westech Laboratories Inc.
The Quality People
Since 1955

3737 East Broadway Road
Phoenix, Arizona 85040
(602) 437-1080 • fax 437-8706

CLIENT N.M. OIL CONSERVATION DIVISION
ATTN: KATHY BROWN
P.O. BOX 2088
SANTA FE, NM 87504

SAMPLE NO. : 9303063
INVOICE NO.: 22130408
REPORT DATE: 02-19-93
REVIEWED BY: AGN
PAGE : 1 OF 1

CLIENT SAMPLE ID : 9302011600
SAMPLE TYPE .....: WATER
SAMPLED BY .....: K. BROWN/C. EUSTICE
SUBMITTED BY ....: K. BROWN
SAMPLE SOURCE ...: NMSU PRODUCED WATER

AUTHORIZED BY : K. BROWN
CLIENT P.O. : --
SAMPLE DATE ...: 02-01-93
SUBMITTAL DATE : 02-08-93
EXTRACTION DATE: --

Inorganic Chemistry - Total Metals

D A T A T A B L E

Parameter	Result	Unit	Detection Limit	Analysis Date
Total Arsenic .....:	<0.05	mg/L	0.05	02-15-93
Total Barium .....:	0.09	mg/L	0.05	02-15-93
Total Cadmium .....:	<0.05	mg/L	0.05	02-15-93
Total Chromium .....:	<0.05	mg/L	0.05	02-15-93
Total Lead .....:	<0.05	mg/L	0.05	02-15-93
Total Mercury .....:	<0.001	mg/L	0.001	02-17-93
Total Selenium .....:	<0.05	mg/L	0.05	02-15-93
Total Silver .....:	<0.05	mg/L	0.05	02-15-93

(1) Copy to Client

M. Englund
Managing Director

Westech Laboratories Inc.
The Quality People
Since 1955

3737 East Broadway Road
Phoenix, Arizona 85040
(602) 437-1080 • fax 437-8706

CLIENT N.M. OIL CONSERVATION DIVISION
ATTN: KATHY BROWN
P.O. BOX 2088
SANTA FE, NM 87504

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REVIEWED BY: AGN
PAGE : 1 OF 1

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SAMPLE TYPE .....: WATER
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SUBMITTED BY ....: K. BROWN
SAMPLE SOURCE ...: NMSU PRODUCED WATER

AUTHORIZED BY : K. BROWN
CLIENT P.O. : --
SAMPLE DATE ...: 02-01-93
SUBMITTAL DATE : 02-08-93
EXTRACTION DATE: --

Cation / Anion Balance

D A T A T A B L E

Parameter	Result	Unit	Detection Limit	Analysis Date
Total Calcium .....:	140.	mg/L	0.05	02-18-93
Total Magnesium .....:	29.	mg/L	0.10	02-18-93
Total Potassium .....:	51.	mg/L	1.0	02-17-93
Total Sodium .....:	360.	mg/L	0.05	02-18-93
Carbonate .....:	<2.0	mg/L	2.0	02-11-93
Bicarbonate .....:	480.	mg/L	2.0	02-11-93

(1) Copy to Client

M. Gustil
Managing Director

Westech Laboratories Inc.
The Quality People
Since 1955

3737 East Broadway Road
Phoenix, Arizona 85040
(602) 437-1080 • fax 437-8706

CLIENT N.M. OIL CONSERVATION DIVISION
ATTN: KATHY BROWN
P.O. BOX 2088
SANTA FE, NM 87504

SAMPLE NO. : 9303064
INVOICE NO.: 22130408
REPORT DATE: 02-19-93
REVIEWED BY: AGM
PAGE : 1 OF 1

CLIENT SAMPLE ID : 9302011615
SAMPLE TYPE .....: WATER
SAMPLED BY .....: K. BROWN/C. EUSTICE
SUBMITTED BY ....: K. BROWN
SAMPLE SOURCE ...: NMSU DISCHARGED WATER

AUTHORIZED BY : K. BROWN
CLIENT P.O. : --
SAMPLE DATE ...: 02-01-93
SUBMITTAL DATE : 02-08-93
EXTRACTION DATE: --

Inorganic Chemistry - Total Metals

D A T A T A B L E

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Total Lead .....:	<0.05	mg/L	0.05	02-15-93
Total Mercury .....:	<0.001	mg/L	0.001	02-17-93
Total Selenium .....:	<0.05	mg/L	0.05	02-15-93
Total Silver .....:	<0.05	mg/L	0.05	02-15-93

(1) Copy to Client

M. Gruchil
Managing Director

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The Quality People
Since 1955

3737 East Broadway Road
Phoenix, Arizona 85040
(602) 437-1080 • fax 437-8706

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SUBMITTED BY ....: K. BROWN
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SAMPLE DATE ...: 02-01-93
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EXTRACTION DATE: --

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Carbonate .....:	<2.0	mg/L	2.0	02-11-93
Bicarbonate .....:	480.	mg/L	2.0	02-11-93

(1) Copy to Client

M. Engel
Managing Director

STATE OF NEW MEXICO DEPARTMENT OF HEALTH
SCIENTIFIC LABORATORY DIVISION
P.O. Box 4700 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 [505]-841-2500
WATER CHEMISTRY SECTION [505]-841-2555

March 30, 1993

Request
ID No. 022245

ANALYTICAL REPORT
SLD Accession No. WC-93-0270

Distribution
(__) User 70320
(■) Submitter 260
(※) SLD Files

To: Kathy Brown
NM Oil Consv. Div.
State Land Office Bldg.
P.O. Box 2088
Santa Fe, NM 87504-2088

From: Water Chemistry Section
Scientific Laboratory Div.
700 Camino de Salud, NE
Albuquerque, NM 87106

Re: **A water,Nonpres/No sample submitted to this laboratory on February 4, 1993**

DEMOGRAPHIC DATA

COLLECTION
On: 1-Feb-93 *By:* Bro . . .
At: 16:00 hrs. *In/Near:* Las Cruces

LOCATION
Produced Water
NMSU Geothermal

ANALYTICAL RESULTS

Analysis	Value	D. Lmt.	Units
calcium	140.00		mG/L
magnesium	32.00		mG/L
potassium	54.00		mG/L
sodium	445.00		mG/L
bicarbonate	476.00		mG/L
carbonate	0.00		mG/L
chloride	550.00		mG/L
fluoride	2.15		mG/L
sulfate	236.00		mG/L
total diss resid	1808.00		mG/L

Reviewed By: B.P.
Bryan S. Patterson 03/29/93
Analyst, Water Chemistry Section

STATE OF NEW MEXICO DEPARTMENT OF HEALTH
SCIENTIFIC LABORATORY DIVISION
P.O. Box 4700 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 [505]-841-2500
AIR & HEAVY METALS SECTION [505]-841-2553

May 3, 1993

Request ID No. 022246

ANALYTICAL REPORT
SLD Accession No. IC-93-0138

Distribution
(__) User 70320
(■) Submitter 260
(※) SLD Files

To: Kathy Brown
NM Oil Consv. Div.
State Land Office Bldg.
P.O. Box 2088
Santa Fe, NM 87504-2088

From: Air & Heavy Metals Section
Scientific Laboratory Div.
700 Camino de Salud, NE
Albuquerque, NM 87106

Re: **A water,Nonpres/No sample submitted to this laboratory on February 4, 1993**

DEMOGRAPHIC DATA

COLLECTION
On: 1-Feb-93 *By:* Bro . . .
At: 16:00 hrs. *In/Near:* Las Cruces

LOCATION
Produced Water
NMSU Geothermal

ANALYTICAL RESULTS in mG/L

Analysis		Value	Analysis		Value	Analysis		Value
Aluminum	<	0.10	Cobalt	<	0.05	Nickel	<	0.10
Barium	<	0.10	Copper	<	0.10	Silicon		0.50
Beryllium	<	0.10	Iron		7.70	Silver	<	0.10
Boron		0.30	Lead	<	0.10	Strontium		4.00
Cadmium	<	0.10	Magnesium		31.00	Tin	<	0.10
Calcium		160.00	Manganese		0.18	Vanadium	<	0.10
Chromium	<	0.10	Molybdenum	<	0.10	Zinc	<	0.10

Laboratory Remarks: Digested. Acidified at SLD.

Reviewed By: _____
Jim F. Ashby 05/04/93
Supervisor, Air & Heavy Metals Section

STATE OF NEW MEXICO DEPARTMENT OF HEALTH
SCIENTIFIC LABORATORY DIVISION
P.O. Box 4700 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 [505]-841-2500
WATER CHEMISTRY SECTION [505]-841-2555

March 24, 1993

Request
ID No. 022247

ANALYTICAL REPORT
SLD Accession No. WC-93-0273

Distribution
(_) User 70320
(■) Submitter 260
(▩) SLD Files

To: Kathy Brown
NM Oil Consv. Div.
State Land Office Bldg.
P.O. Box 2088
Santa Fe, NM 87504-2088

From: Water Chemistry Section
Scientific Laboratory Div.
700 Camino de Salud, NE
Albuquerque, NM 87106

Re: **A water sample submitted to this laboratory on February 4, 1993**

DEMOGRAPHIC DATA

COLLECTION
On: 1-Feb-93 *By:* Bro . . .
At: 16:15 hrs. *In/Near:* Las Cruces

LOCATION
Discharged Water
NMSU Geothermal

ANALYTICAL RESULTS

Analysis	Value	D. Lmt.	Units
calcium	160.00		mG/L
magnesium	32.00		mG/L
potassium	52.00		mG/L
sodium	426.00		mG/L
bicarbonate	593.00		mG/L
carbonate	0.00		mG/L
chloride	564.00		mG/L
fluoride	2.23		mG/L
sulfate	244.00		mG/L
total diss resid	1807.00		mG/L

Reviewed By: Mary M. Perkins 3/25/93
Mary M Perkins 03/22/93
Analyst, Water Chemistry Section

STATE OF NEW MEXICO DEPARTMENT OF HEALTH
SCIENTIFIC LABORATORY DIVISION
P.O. Box 4700 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 [505]-841-2500
AIR & HEAVY METALS SECTION [505]-841-2553

May 3, 1993

Request ID No. 022248

ANALYTICAL REPORT
SLD Accession No. IC-93-0137

Distribution
(_) User 70320
(■) Submitter 260
(※) SLD Files

To: Kathy Brown
NM Oil Consv. Div.
State Land Office Bldg.
P.O. Box 2088
Santa Fe, NM 87504-2088

From: Air & Heavy Metals Section
Scientific Laboratory Div.
700 Camino de Salud, NE
Albuquerque, NM 87106

Re: **A water,Nonpres/No sample submitted to this laboratory on February 4, 1993**

DEMOGRAPHIC DATA

COLLECTION
On: 1-Feb-93 *By:* Bro . . .
At: 16:15 hrs. *In/Near:* Las Cruces

LOCATION
Discharged Water
NMSU Geothermal

ANALYTICAL RESULTS in mG/L

Analysis		Value	Analysis		Value	Analysis		Value
Aluminum	<	0.10	Cobalt	<	0.05	Nickel	<	0.10
Barium	<	0.10	Copper	<	0.10	Silicon		0.50
Beryllium	<	0.10	Iron		0.20	Silver	<	0.10
Boron		0.40	Lead	<	0.10	Strontium		4.10
Cadmium	<	0.10	Magnesium		32.00	Tin	<	0.10
Calcium		160.00	Manganese	<	0.05	Vanadium	<	0.10
Chromium	<	0.10	Molybdenum	<	0.10	Zinc	<	0.10

Laboratory Remarks: Digested. Acidified at SLD.

Reviewed By: _____
Jim F. Ashby 05/04/93
Supervisor, Air & Heavy Metals Section

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Ecological Services
Suite D, 3530 Pan American Highway, NE
Albuquerque, New Mexico 87107

November 21, 1990

Mr. William J. Lemay, Director
New Mexico Energy, Minerals and
Natural Resources Department
Oil Conservation Division
P.O. Box 2088
Santa Fe, New Mexico 87504-2088

Dear Mr. Lemay:

This responds to the Oil Conservation Division Public Notice dated October 2, 1990, in which several proposed groundwater discharge plans were described. We have reviewed all of the plans and have not identified any resource issues of concern to our agency in the following.

(GW-38) - New Mexico State University, Benjamin E. Woods, Director, Physical Plant Department, Box 30001, Department 3545, Las Cruces, New Mexico, 88003-0001.

(GW-52) - Enron Gas Pipeline Operating Company, P.O. Box 1188, Houston, Texas 77251-1188.

(GW-53) - Enron Gas Pipeline Operating Company, P.O. Box 1188, Houston, Texas 77251-1188.

Our data indicate no listed species would be affected by the proposed actions. There are no wetlands or other environmentally sensitive habitats that would be adversely affected by the discharges.

These comments represent the views of the U.S. Fish and Wildlife Service. If you have any questions concerning our comments, please contact Tom O'Brien at (505) 883-7877.

Sincerely,

John C. Peterson
Field Supervisor

cc:
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Regional Administrator, Environmental Protection Agency, Dallas, Texas
Regional Director, U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement, Albuquerque, New Mexico

Affidavit of Publication

No. 13287

STATE OF NEW MEXICO,

County of Eddy:

Gary D. Scott being duly sworn, says: That he is the Publisher of The Artesia Daily Press, a daily newspaper of general circulation, published in English at Artesia, said county and state, and that the hereto attached Legal Notice

was published in a regular and entire issue of the said Artesia Daily Press, a daily newspaper duly qualified for that purpose within the meaning of Chapter 167 of the 1937 Session Laws of the state of New Mexico for 1 consecutive days weeks on the same day as follows:

First Publication October 9, 1990

Second Publication

Third Publication

Fourth Publication

Gary D. Scott

Subscribed and sworn to before me this 9th day of October 19 90

Barbara Ann Bears
Notary Public, Eddy County, New Mexico

My Commission expires September 23, 1991

Copy of

LEGAL NOTICE

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to New Mexico Water Quality Control Commission Regulations, the following discharge plan application and a renewal application have been submitted to the Director of the Oil Conservation Division, State Land Office Building, P.O. Box 2088, Santa Fe, New Mexico 87504-2088, Telephone (505) 827-5800:

(GW-38) - New Mexico State University, Benjamin E. Woods, Director, Physical Plant Department, Box 30001, Department 3545, Las Cruces, New Mexico, 88003-001, has submitted an application for renewal of its previously approved discharge plan to discharge cooled geothermal water to an unlined pit at its greenhouse facility located in Section 23, Township 23 South, Range 2 East, NMPM, Dona Ana County, New Mexico. Approximately 54,720 gallons per day of cooled geothermal water with a total dissolved solids concentration of 1775 mg/l will be discharged. The disposed geothermal water will percolate into the ground and will reenter the geothermal reservoir. Uppermost ground water is geothermal and is found at 365 feet with a total dissolved solids concentration of 1636 mg/l. The discharge plan address how spills, leaks and other discharges to the surface will be managed.

(GW-52) - Enron Gas Pipeline Operating Company, W. Alan Bowman, Project Environmentalist, P.O. Box 1188, Houston, Texas 7251-1188, has submitted a discharge plan application for its Roswell Compressor station located in the SW/4SW/4, Section 21, Township 9 South, Range 24 East, NMPM, Chaves County, New Mexico. Approximately 1000 gallons per day of wastewater will be transferred to an offsite livestock watering tank. The wastewater has a total dissolved solids concentration of 1250 mg/l. Ground water most likely to be affected by an discharge to the surface at the facility or the location of the stock tank is at a depth of 240 feet with a total dissolved solids concentration of 1551 mg.l The discharge plan addresses how spills, leaks and other discharges to the surface will be managed.

(GW-53) - Enron Gas Pipeline Operating Company, W. Alan Bowman, Project Environmentalist, P.O. Box 1188, Houston, Texas 77251-1188, has submitted a discharge plan application for its Yates Plant located in the SW/4, Section 25, Township 18 South, Range 25 East, NMPM, Eddy County, New Mexico. Approximately 1000 gallons per day of produced water is disposed of in a concrete surface impoundment for evaporation. The wastewater has a total dissolved solids concentration of approximately 1250 mg/l. Ground water most likely to be affected by any discharge to the surface is at a depth of approximately 120 feet with a total dissolved solids concentration from 794 to 875 mg/l. The discharge plan addresses how spills, leaks and other discharges to the surface will be managed.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thrity (30) days after the date of publication of this notice during which comments may be submitted to him and public hearing may be requested by any interested person. Requests for public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant public interest. If no public hearing is held, the Director will approve or disapprove the proposed plan based on information available. If a public hearing is held, the Director will approve or disapprove the proposed plan based on information in the plan and information submitted at the hearing.

GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 2nd day of October, 1990. To be published on or before October 10, 1990.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION
s-William J. LeMay
WILLIAM J. LEMAY
Director

SEAL

Published in the Artesia Daily Press, Artesia, N.M. October 9, 1990.

Legal 13287

Affidavit of Publication

No. 13287

STATE OF NEW MEXICO,

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First Publication October 9, 1990

Second Publication

Third Publication

Fourth Publication

Gary D. Scott

Subscribed and sworn to before me this 9th day of October 19 90

Notary Public, Eddy County, New Mexico

My Commission expires September 23, 1991

Copy of

LEGAL NOTICE

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ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

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(GW-53) - Enron Gas Pipeline Operating Company, W. Alan Bowman, Project Environmentalist, P.O. Box 1188, Houston, Texas 77251-1188, has submitted a discharge plan application for its Yates Plant located in the SW/4, Section 25, Township 18 South, Range 25 East, NMPM, Eddy County, New Mexico. Approximately 1000 gallons per day of produced water is disposed of in a concrete surface impoundment for evaporation. The wastewater has a total dissolved solids concentration of approximately 1250 mg/l. Ground water most likely to be affected by any discharge to the surface is at a depth of approximately 420 feet with a total dissolved solids concentration from 794 to 875 mg/l. The discharge plan addresses how spills, leaks and other discharges to the surface will be managed.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thrity (30) days after the date of publication of this notice during which comments may be submitted to him and public hearing may be requested by any interested person. Requests for public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant public interest.

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GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 2nd day of October, 1990. To be published on or before October 10, 1990.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION
s-William J. LeMay
WILLIAM J. LEMAY
Director

SEAL

Published in the Artesia Daily Press, Artesia, N.M. October 9, 1990.

Legal 13287

AFFIDAVIT OF PUBLICATION

County of Chaves }
State of New Mexico, }

I, Jean M. Pettit

Manager,

Of the Roswell Daily Record, a daily newspaper published at Roswell, New Mexico, do solemnly swear that the clipping hereto attached was published once a week in the regular and entire issue of said paper and not in a supplement thereof for a period

of one time

..... weeks

beginning with the issue dated 8th

October, 1990

and ending with the issue dated 8th

October, 1990

Jean M. Pettit
Manager

Sworn and subscribed to before me

this 8th day of

October, 1990

Marylon S Hughes
Notary Public

My commission expires

July 21, 1994

(Seal)

Publish October 8, 1990

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY, MINERAL AND
NATURAL RESOURCES
DEPARTMENT
OIL CONSERVATION DIVISION

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(GW-53) - Enron Gas Pipeline Operating Company, W. Alan Bowman, Project Environmentalist, P. O. Box 1188, Houston, Texas 77251-1188, has submitted a discharge plan application for its Yates Plant located in the SW/4, Section 25, Township 18 South, Range 25 East, NMPM, Eddy County, New Mexico. Approximately 1000 gallons per day of produced water is disposed of in a concrete surface impoundment for evaporation. The wastewater has a total dissolved solids concentration of approximately 1250 mg/l. Ground water most likely to be affected by any discharge to the surface is at a depth of approximately 120 feet with a total dissolved solids concentration from 794 to 875 mg/l. The discharge plan addresses how spills, leaks and other discharges to the surface will be managed.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and public hearing may be requested by any interested person. Requests for public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant pubic interest.

If no public hearing is held, the Director will approve or disapprove the proposed plan based on information available. If a public hearing is held, the Director will approve or disapprove the proposed plan based on information in the plan and information submitted at the hearing.

GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 2nd day of October, 1990. To be published on or before October 10, 1990.

STATE OF NEW MEXICO OIL
CONSERVATION DIVISON
William J. Lemay
WILLIAM J. LEMAY,
Director

SEAL

AFFIDAVIT OF PUBLICATION

County of Chaves }
State of New Mexico, }

I, Jean M. Pettit

Manager,

Of the Roswell Daily Record, a daily newspaper published at Roswell, New Mexico, do solemnly swear that the clipping hereto attached was published once a week in the regular and entire issue of said paper and not in a supplement thereof for a period

of one time

..... weeks

beginning with the issue dated 8th

October, 1990

and ending with the issue dated 8th

October, 1990

Jean M. Pettit
Manager

Sworn and subscribed to before me

this 8th day of

October, 1990

Notary Public

My commission expires

July 21, 1994

(Seal)

Publish October 8, 1990

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY, MINERAL AND
NATURAL RESOURCES
DEPARTMENT
OIL CONSERVATION DIVISION

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STATE OF NEW MEXICO OIL
CONSERVATION DIVISON
William J. Lemay
WILLIAM J. LEMAY,
Director

SEAL

PROOF OF PUBLICATION

Ray Ayers, being duly sworn, deposes and says that he is the Advertising Manager of the Las Cruces Sun-News, a newspaper published daily except Saturday in the County of Dona Ana, State of New Mexico; that the notice

GW-38, etc.

as per clipping attached, was published once a week in the regular and entire issue of said newspaper and not in any supplement thereof, for one consecutive weeks (day): that the first publication was in the issue dated October 10, 19 90 and the last publication was in the issue dated October 10, 19 90

Deponent further states that this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Sec. 3. Chapter 167, Laws of 1937. And payment of fees for said publication has been made.

(Signed) Ray Ayers

Advertising Manager
Official Position

STATE OF NEW MEXICO
COUNTY OF DONA ANA ss.

Subscribed and sworn to before me this 10th day of October 19 90

Notary Public in and for Dona Ana County, N.M.

OFFICIAL SEAL
HEIDI L. MARTINEZ
NOTARY PUBLIC — NEW MEXICO
NOTARY BOND FILED WITH SECRETARY OF STATE

Signature Heidi L. Martinez

MY COMMISSION EXPIRES 9/4/94

ABC Printing Co., Las Cruces, N.M.

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

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(GW-53) - Enron Gas Pipeline Operating Company, W. Alan Bowman, Project Environmentalist, P.O. Box 1188, Houston, Texas 77251-1188, has submitted a discharge plan application for its Yates Plant located in the SW/4, Section 25, Township 18 South, Range 25 East, NMPM, Eddy County, New Mexico. Approximately 1000 gallons per day of produced water is disposed of in a concrete surface impoundment for evaporation. The wastewater has a total dissolved solids concentration of approximately 1250 mg/l. Ground water most likely to be affected by any discharge to the surface is at a depth of approximately 120 feet with a total dissolved solids concentration from 794 to 875 mg/l. The discharge plan addresses how spills, leaks and other discharges to the surface will be managed.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and public hearing may be requested by any interested person. Requests for public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant public interest.

If no public hearing is held, the Director will approve or disapprove the proposed plan based on information available. If a public hearing is held, the Director will approve or disapprove the proposed plan based on information in the plan and information submitted at the hearing.

GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 2nd day of October, 1990. To be published on or before October 10, 1990.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

/S/WILLIAM J. LEMAY,
Director

SEAL

Pub. No. 90-1568
Publish: October 10, 1990

PHYSICAL PLANT

Box 30001, Dept. 3545
Las Cruces, New Mexico 88003-0001
(505) 646-2101

NEW MEXICO STATE UNIVERSITY

September 21, 1990

Mr. David G. Boyer, Hydrogeologist
Environmental Bureau Chief
Energy, Minerals and Natural Resources Dept.
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Re: Discharge Plan GW-38
NMSU Geothermal Facility
Dona Ana County, New Mexico

Dear Mr. Boyer:

In response of your July 26, 1990 letter, New Mexico State University wishes to apply for renewal of the ground water discharge plan GW-38 for NMSU geothermal wells PG-1 (LRG-521) and PG-4. All of the previous information submitted as the basis of approval for plan GW-38 is hereby included by reference. The only exceptions to that are specifically noted herein.

Mr. C. D. Black is no longer with New Mexico State University. I have assumed the position of Director, Physical Plant Department, New Mexico State University. You may want to change your records accordingly.

If further information is needed, please feel free to contact me.

Sincerely,

Benjamin E. Woods
Director

/gu
Enclosures

Discharge Plan for Geothermal Facilities

I. General Information

A. Name, Address and Telephone Number for Discharger or Legally Responsible Party:

New Mexico State University
P.O. Box 30001/Dept. 3545
Las Cruces, N.M. 88001
Attn: Ben Woods, Director Physical Plant Department

B. Location of Discharge: Section 23, Township 23 (~~North~~) (South), Range 2, (East) (~~West~~)

C. Type of Operation: Surface Disposal of Geothermal fluids from wells PG-1 and PG-4. This operation is identical with that operation previously submitted and approved in Discharge plan GW-38.

D. Affirmation:

"I hereby certify that I am familiar with the information contained in and submitted with this application and that such information is true, accurate and complete to the best of my knowledge and belief."

B. E. Woods — (Signature)
26 Sept 90 — (Date)
Benjamin E. Woods

_____ (Signature)
_____ (Date)

II. Plant Processes

A. Describe storage and uses of geothermal waters and any surface disposal impoundments.

Geothermal waters from either PG-1 or PG-4, geothermal wells on the NMSU campus, will be used to heat two research greenhouses. These geothermal waters will be placed in an unlined disposal pit. This pit is 46 feet by 46 feet by 7 feet deep and is located 110 feet north of PG-4. A minimum freeboard of 5 feet will be maintained during disposal. This is as was previously submitted for plan GW-38.

B. Estimated quantities used in gallons per day (gpd).

The estimated daily use is 54,720 gallons.

C. Any additives or commingling. There will be no additions or commingling with any other waste stream before disposal into the disposal pit. No fluids or solids other than geothermal waters will be disposed of into this pit.

III. Site Characteristics

A. Provide the name, description, and location of any ground water discharge sites (water wells, seeps, springs, watercourses) within one mile of the outside perimeter of the facility. For water wells, specify use of water (e.g., irrigation, domestic, etc.)

See the attached topographic map of the discharge '79 clc map site.

B. If known, provide the flow direction of the ground water most likely to be affected by the discharge. Include the source of the information and how was it determined. Subsurface flow direction of geothermal waters at PG-4 is southwest toward geothermal wells PG-1 and PG-3 (LRG-520). Electric logs and static water table measurements show that PG-4 water table elevations are 16 to 23 feet higher than in PG-1 and PG-3. This data is from the interim completion report on DT-3 (PG-4) Geothermal Exploratory well.

C. Provide depth to water of geothermal water, and if possible, any fresh water wells that could be affected by any discharge. The depth to water PG-4 is at 365 feet. Elevated temperatures, and uniformly low resistivety of E-log of PG-4, by El Paso Water Utilities, indicates saline geothermal fluid from the water table to the total depth in PG-4. No fresh water underlies this well. The E-log is on file with discharge plan GW-38.

D. Depth to and lithologic description of rock at base of alluvium. Provide drillers logs and geologic information and maps as available.

See the Geologist's report on file with Discharge Plan GW-38.

E. Describe flooding potential of the discharge site.

The discharge site is located on a hill slope out of any drainage paths. Flooding is not a problem for the site. The local runoff is directed away from the site. See also the attached topographic map.

F. Any additional information that may be necessary to demonstrate that approval of the discharge plan will not result in concentrations in excess of the standards of WQCC Regulations, Section 3-103, or the presence of any toxic pollutant at any place of withdrawal of water for present or reasonably foreseeable future use. Detailed information on site geologic and hydrologic conditions may be required for a technical evaluation of the applicant's proposed discharge plan.

The following information which is already on file with Discharge Plan GW-38:

1. Geologist's Report for PG-4.
2. Flow Test Report (Drill Stem Test).
3. Water Quality Analysis.
4. Comparison of water quality for PG-1, PG-4, chaffee 35-25, chaffee 12-24, and chaffee 55-25.
5. 24 Hour pump test report.
6. PG-4 E-log
7. Topographic map of discharge site.
8. Engineering estimate of percolation rates.

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

July 26, 1990

CERTIFIED MAIL
RETURN RECEIPT NO. P-918-402-303

Mr. C. D. Black
Physical Plant Department
New Mexico State University
Box 3545
Las Cruces, New Mexico 88003-3545

RE: Discharge Plan GW-38
NMSU Geothermal Facility
Dona Ana County, New Mexico

Dear Mr. Black:

On August 22, 1988, the renewal of ground water discharge plan, GW-38 for the NMSU Geothermal Facility located in Section 23, Township 23 South, Range 2 East, NMPM, Dona Ana County, New Mexico, was approved by the Director of the Oil Conservation Division (OCD). This discharge plan renewal was required and submitted pursuant to Water Quality Control Commission (WQCC) regulations and was approved for a period of two years. The approval will expire on December 22, 1990.

If your facility continues to have effluent or leachate discharges and you wish to continue discharging, please submit your application for renewal of plan approval as quickly as possible. The OCD is reviewing discharge plan submittals and renewals carefully and the review time can often extend for several months. Please indicate whether you have made, or intend to make, any changes in your discharge system, and if so, include an application for plan amendment with your application for renewal. To assist you in preparation of your renewal application, I have enclosed a copy of the OCD's guidelines for preparation of ground water discharge plans at geothermal facilities. Please include these items in your renewal application.

If you no longer have such discharges and discharge plan renewal is not needed, please notify this office.

If you have any questions, please do not hesitate to contact Roger Anderson at (505) 827-5884.

Sincerely,

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

DGB/sl

Enclosure

cc: OCD Santa Fe Office

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Suite D, 3530 Pan American Highway NE
Albuquerque, New Mexico 87107

October 6, 1988

Mr. William J. Lemay, Director
Oil Conservation Division
State Land Office Building
P. O. Box 2088
Santa Fe, New Mexico 87504-2088

Dear Mr. Lemay:

This responds to your public notice dated September 12, 1988, in which several proposed groundwater discharge plans were described. We have reviewed all of the plans and have not identified any resource issues of concern to our agency in the following:

GW-38, New Mexico State University, Dona Ana County, Las Cruces, NM.
GW-17, ACID Engineering, Lea County, NM.
GW-40, Giant Bloomfield Refinery, San Juan County, Bloomfield, NM.

These comments represent the views of the Fish and Wildlife Service. If you have any questions concerning our comments, please contact Tom O'Brien at (505) 883-7877 or FTS 474-7877.

Sincerely yours,

Michael J. Donahoo

Michael J. Donahoo
Acting Field Supervisor

cc:
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Regional Administrator, Environmental Protection Agency, Attn: Kathy Hollar, Office of Ground Water, Dallas, Texas
Regional Director, U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement, Albuquerque, New Mexico

NOTICE OF PUBLICATION

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to New Mexico Water Quality Control Commission Regulations, the following discharge plan application and a renewal application have been submitted to the Director of the Oil Conservation Division, State Land Office Building, P. O. Box 2088, Santa Fe, New Mexico 87504-2088, Telephone (505) 827-5800:

(GW-38) - New Mexico State University, Benjamin E. Woods, Director, Physical Plant Department, Box 30001, Department 3545, Las Cruces, New Mexico, 88003-001, has submitted an application for renewal of its previously approved discharge plan to discharge cooled geothermal water to an unlined pit at its greenhouse facility located in Section 23, Township 23 South, Range 2 East, NMPM, Dona Ana County, New Mexico. Approximately 54,720 gallons per day of cooled geothermal water with a total dissolved solids concentration of 1775 mg/l will be discharged. The disposed geothermal water will percolate into the ground and will reenter the geothermal reservoir. Uppermost ground water is geothermal and is found at 365 feet with a total dissolved solids concentration of 1636 mg/l. The discharge plan address how spills, leaks and other discharges to the surface will be managed.

(GW-52) - Enron Gas Pipeline Operating Company, W. Alan Bowman, Project Environmentalist, P. O. Box 1188, Houston, Texas 7251-1188, has submitted a discharge plan application for its Roswell Compressor station located in the SW/4 SW/4, Section 21, Township 9 South, Range 24 East, NMPM, Chaves County, New Mexico. Approximately 1000 gallons per day of wastewater will be transferred to an offsite livestock watering tank. The wastewater has a total dissolved solids concentration of 1250 mg/l. Ground water most likely to be affected by an discharge to the surface at the facility or the location of the stock tank is at a depth of 240 feet with a total dissolved solids concentration of 1551 mg.l The discharge plan addresses how spills, leaks and other discharges to the surface will be managed.

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Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and public hearing may be requested by any interested person. Requests for public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant pubic interest.

If no public hearing is held, the Director will approve or disapprove the proposed plan based on information available. If a public hearing is held, the Director will approve or disapprove the proposed plan based on information in the plan and information submitted at the hearing.

GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 2nd day of October, 1990. To be published on or before October 10, 1990.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

WILLIAM J. LEMAY, Director

S E A L

AFFIDAVIT OF PUBLICATION

State of New Mexico,
County of Lea.

I,_____

_____

of the Hobbs Daily News-Sun, a daily newspaper published at Hobbs, New Mexico, do solemnly swear that the clipping attached hereto was published once a week in the regular and entire issue of said paper, and not a supplement thereof for a period

of_____

One _____ weeks.
Beginning with the issue dated

August 29 _____, 19 88
and ending with the issue dated

August 29 _____, 19 88

_____
Publisher.

Sworn and subscribed to before

me this 29 _____ day of

August _____, 19 88

_____
Notary Public.

My Commission expires_____

November 14 _____, 19 88
(Seal)

This newspaper is duly qualified to publish legal notices or advertisements within the meaning of Section 3, Chapter 167, Laws of 1937, and payment of fees for said publication has been made.

LEGAL NOTICE
August 29, 1988

NOTICE OF PUBLICATION

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to the New Mexico Water Quality Control Commission Regulations, the following discharge plan renewals have been submitted for approval to the Director of the Oil Conservation Division, State Land Office Building, P.O. Box 2088, Santa Fe, New Mexico 87504-2088, Telephone (505) 827-5800.

(GW-38) New Mexico State University, C.D. Black, Director of Physical Plant Department, Box 30001, Department 3545, Las Cruces, New Mexico 88003, has submitted an application for renewal of its previously approved discharge plan to discharge cooled geothermal water to an unlined pit at its greenhouse facility located in Section 23, Township 23 South, Range 2 East NMPM, Dona Ana County, New Mexico. Approximately 54,720 gallons per day of cooled geothermal water with a total dissolved solids content of 1775 mg/l will be discharged. The disposed geothermal water will percolate into the ground and will re-enter the geothermal reservoir. Uppermost ground water is geothermal and is found with a TDS of 1636 at a depth of 365 feet.

(GW-17) Acid Engineering, Lloyd Bolding, owner, P.O. Box 753, Kilgore, Texas 75662, has submitted an application for renewal of its previously approved discharge plan for its Hobbs service facility located in Section 36, Township 18, South, Range 37 East, (NMPM) Lea County, New Mexico. Approximately 300 gallons per day of waste water containing 0.1% hydrochloric acid by weight will be discharged to a fiberglass tank. The waste water will be recycled as makeup water in the oil well treatment process. Ground water most likely to be affected by a discharge at the surface is at a depth of approximately 46 feet with a total dissolved content of approximately 1400 mg/l.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and a public hearing may be requested by any interested person. Requests for public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant public interest.

If no public hearing is held, the Director will approve or disapprove the proposed plan based on information available. If a public hearing is held, the Director will approve or disapprove the proposed plan based on information in the plan and information submitted at the hearing.

GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 17th day of August. To be published on or before September 2, 1988.

STATE OF
NEW MEXICO

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to the New Mexico Water Quality Control Commission Regulations, the following discharge plan renewals have been submitted for approval to the Director of the Oil Conservation Division, State Land Office Building, P.O. Box 2088, Santa Fe, New Mexico 87504-2088, Telephone (505) 827-5800:

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GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 17th day of August. To be published on or before September 2, 1988.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION
s/WILLIAM J. LEMAY, Director.
Journal, August 27, 1988

RECEIVED
SEP 1 1988
OIL CONSERVATION DIVISION
SANTA FE

STATE OF NEW MEXICO } ss
County of Bernalillo

J. SMITHSON .... being duly sworn declares and says that he is NAT'L ADV. MGR. .... of the **Albuquerque Journal**, and that this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Section 3, Chapter 167, Session Laws of 1937, and that payment therefore has been made or assessed as court costs; that the notice, a copy of which is hereto attached, was published in said paper in the regular daily edition,

for ....1.... times, the first publication being on the ..27.... day of ....August...., 1988......, and the subsequent consecutive publications on ...., 198.....

[signature]

OFFICIAL SEAL
Signature: [signature]
ANGELA M. ARCHIBEQUE
NOTARY PUBLIC NEW MEXICO
Filed with Secretary of State
Expires 10/30/92

Sworn and subscribed to before me, a Notary Public in and for the County of Bernalillo and State of New Mexico, this ..27... day of ...August......, 1988.

PRICE $26.43

Statement to come at end of month.

EDJ-15 (R-2/86)

ACCOUNT NUMBER ...C80932.......

PROOF OF PUBLICATION

Wayne Barnes, being duly sworn, deposes and says that he is the Advertising Director of the Las Cruces Sun-News, a newspaper published daily except Saturday in the County of Dona Ana, State of New Mexico; that the notice

notice of discharge plan renewals

as per clipping attached, was published once a week in the regular and entire issue of said newspaper and not in any supplement thereof, for one consecutive weeks (day): that the first publication was in the issue dated August 26, 19 88 and the last publication was in the issue dated August 26, 19 88

Deponent further states that this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Sec. 3. Chapter 167, Laws of 1937. And payment of fees for said publication has been made.

(Signed) Wayne Barnes

Advertising Director

Official Position

STATE OF NEW MEXICO
COUNTY OF DONA ANA ss.

Subscribed and sworn to before me this 26th day of August 19 88

OFFICIAL SEAL
JUDY M. LUNA
NOTARY PUBLIC - STATE OF NEW MEXICO
My Commission Expires: 3-27-91

Notary Public in and for Dona Ana County, N.M.

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to the New Mexico Water Quality Control Commission Regulations, the following discharge plan renewals have been submitted for approval to the Director of the Oil Conservation Division, State Land Office Building, P.O. Box 2088, Santa Fe, New Mexico 87504-2088, Telephone (505) 827-5800:

(GW-38) New Mexico State University, C.D. Black, Director of Physical Plant Department, Box 30001, Department 3545, Las Cruces, New Mexico 88003, has submitted an application for renewal of its previously approved discharge plan to discharge cooled geothermal water to an unlined pit at its greenhouse facility located in Section 23, Township 23 South, Range 2 East, NMPM, Dona Ana County, New Mexico. Approximately 54,720 gallons per day of cooled geothermal water with a total dissolved solids content of 1775 mg/l will be discharged. The disposed geothermal water will percolate into the ground and will re-enter the geothermal reservoir. Uppermost ground water is geothermal and is found with a TDS of 1636 at a depth of 365 feet.

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GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 17th day of August. To be published on or before September 2, 1988.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

August 22, 1988

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. C. D. Black
Physical Plant Department
New Mexico State University
Box 3545
Las Cruces, New Mexico 88003-3545

RE: Discharge Plan GW-38
New Mexico State University
NMSU Geothermal Wells PG-1 and PG-4
~~Lea County~~, Dona Ana Conty

Dear Mr. Black:

The Oil Conservation Division (OCD) has received and reviewed your application, dated August 5, 1988, for the renewal of the above referenced discharge plan. The renewal application contains the updated information required for approval.

Public notice of your renewal application will be published on or before September 2, 1988. Prior to ruling on any proposed discharge plan renewal, the Director of the OCD shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and a public hearing may be requested by any interested person.

An inspection of the facility by Environmental Bureau personnel will be scheduled for the fall of 1988. If there are no deficiencies found during this inspection, the renewal will be approvable. The trip will be scheduled in conjunction with other inspections in the Southeast part of the state and you will be notified of the dates in advance.

If you have any questions, please do not hesitate to call me at (505) 827-5884.

Sincerely,

Jami Bailey
Geologist

JB:sl

cc: OCD - Santa Fe

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

August 22, 1988

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

RE: NOTICE OF PUBLICATION

_____

_____

_____

County Commissioner
Dona Ana County Courthouse
Las Cruces, New Mexico 88001

Dear Sir:

Please publish the attached notice one time immediately on receipt of this request. Please proofread carefully, as any error in a land description or in a key word or phrase can invalidate the entire notice.

Immediately upon completion of publication, please send the following to this office:

1. Publisher's affidavit in duplicate.
2. Statement of cost (also in duplicate).
3. CERTIFIED invoices for prompt payment.

We should have these immediately after publication in order that the legal notice will be available for the hearing which it advertises, and also so that there will be no delay in your receiving proper payment.

Please publish the notice not later than 9-2-88.

Sincerely,

William J. LeMay
Director

WJL:sl

Attachment

P 612 458 944

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL

(See Reverse)

Sent to	County Comm.	
Street and No.	Doña Ana Courthouse	
P.O., State and ZIP Code	Las Cruces, NM	
Postage		$
Certified Fee		
Special Delivery Fee		
Restricted Delivery Fee		
Return Receipt Showing to whom and Date Delivered		
Return receipt showing to whom, Date, and Address of Delivery		
TOTAL Postage and Fees		$
Postmark or Date		

★ U.S.G.P.O. 1983-403-517

PS Form 3800, Feb. 1982

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

August 22, 1988

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

RE: NOTICE OF PUBLICATION

Las Cruces Sun News
256 West Las Cruces
Las Cruces, New Mexico 88001

Dear Sir:

Please publish the attached notice one time immediately on receipt of this request. Please proofread carefully, as any error in a land description or in a key word or phrase can invalidate the entire notice.

Immediately upon completion of publication, please send the following to this office:

1. Publisher's affidavit in duplicate.
2. Statement of cost (also in duplicate).
3. CERTIFIED invoices for prompt payment.

We should have these immediately after publication in order that the legal notice will be available for the hearing which it advertises, and also so that there will be no delay in your receiving proper payment.

Please publish the notice not later than 9-2-88.

Sincerely,

William J. LeMay
Director

WJL:sl

Attachment

P 612 458 932

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL

(See Reverse)

Sent to	Las Cruces Sun News	
Street and No.	256 W. Las Cruces	
P.O., State and ZIP Code	Las Cruces NM 88001	
Postage		$
Certified Fee		
Special Delivery Fee		
Restricted Delivery Fee		
Return Receipt Showing to whom and Date Delivered		
Return receipt showing to whom, Date, and Address of Delivery		
TOTAL Postage and Fees		$
Postmark or Date		

PS Form 3800, Feb. 1982

★ U.S.G.P.O. 1983-403-517

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to the New Mexico Water Quality Control Commission Regulations, the following discharge plan renewals have been submitted for approval to the Director of the Oil Conservation Division, State Land Office Building, P.O. Box 2088, Santa Fe, New Mexico 87504-2088, Telephone (505) 827-5800:

(GW-38) New Mexico State University, C. D. Black, Director of Physical Plant Department, Box 30001, Department 3545, Las Cruces, New Mexico 88003, has submitted an application for renewal of its previously approved discharge plan to discharge cooled geothermal water to an unlined pit at its greenhouse facility located in Section 23, Township 23 South, Range 2 East, NMPM, Dona Ana County, New Mexico. Approximately 54,720 gallons per day of cooled geothermal water with a total dissolved solids content of 1775 mg/l will be discharged. The disposed geothermal water will percolate into the ground and will re-enter the geothermal reservoir. Uppermost ground water is geothermal and is found with a TDS of 1636 at a depth of 365 feet.

(GW-17) Acid Engineering, Lloyd Bolding, owner, P. O. Box 753, Kilgore, Texas 75662, has submitted an application for renewal of its previously approved discharge plan for its Hobbs service facility located in Section 36, Township 18 South, Range 37 East, (NMPM) Lea County, New Mexico. Approximately 300 gallons per day of waste water containing 0.1% hydrochloric acid by weight will be discharged to a fiberglass tank. The waste water will be recycled as makeup water in the oil well treatment process. Ground water most likely to be affected by a discharge at the surface is at a depth of approximately 46 feet with a total dissolved content of approximately 1400 mg/l.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and a public hearing may be requested by any interested person. Requests for public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant public interest.

If no public hearing is held, the Director will approve or disapprove the proposed plan based on information available. If a public hearing is held, the Director will approve or disapprove the proposed plan based on information in the plan and information submitted at the hearing.

GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 17th day of August. To be published on or before September 2, 1988.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

WILLIAM J. LEMAY, Director

S E A L

PHYSICAL PLANT DEPARTMENT

Box 3545/Las Cruces, New Mexico 88003-3545
Telephone (505) 646-2101

August 5, 1988

David G. Boyer, Chief
Environmental Bureau
P.O. Box 2088
State Land Office Bldg.
Santa Fe, NM 87504

Dear Mr. Boyer:

New Mexico State University wishes to renew its ground water discharge plan GW-38, for NMSU geothermal wells PG-1 (LRG-521) and PG-4. All information previously submitted as the basis of approval for plan GW-38 is hereby included by reference. Any exceptions to that enclosure are specifically noted herein.

Thank you for your assistance in this matter.

Sincerely,

C. D. Black, P.E.
Director, Physical Plant Department

/pah

Discharge Plan for Geothermal Facilities

I. General Information

A. Name, Address and Telephone Number for Discharger or Legally Responsible Party:

New Mexico State University
C. D. Black, Director
Physical Plant Department
Box 30001, Dept 3545
Las Cruces, NM 88003
(505) 646-2101

B. Location of Discharge: Section 23, Township 23 (South), Range 2, (East) (West), Projected.

C. Type of Operation: Surface disposal of geothermal fluids from wells PG-1 and PG-4. This operation is as previously submitted and approved in plan GW-38.

D. Affirmation:

"I hereby certify that I am familiar with the information contained in and submitted with this application and that such information is true, accurate and complete to the best of my knowledge and belief."

(Signature) August 5, 1988
C. D. Black (Date)

(Signature) (Date)

II. Plant Processes

A. Describe storage and uses of geothermal waters and any surface disposal impoundments.
Geothermal waters from either PG-1 or PG-4; geothermal wells on the NMSU campus will be used to heat two research greenhouses. These geothermal waters will be placed in an unlined disposal pit. This pit is 46 feet by 46 feet by 7 feet deep, located 110 feet north of PG-4. A minimum freeboard of 5 feet will be maintained during disposal. This is as previously submitted for plan GW-38.

B. Estimated quantities used in gallons per day (gpd).
The estimated daily use is 54,720 gallons. This is based on an average flow of 38gpm which is slightly above that estimated in GW-38.

C. Any additives or commingling.
There will be no additives or commingling with any other waste stream before disposal into the disposal pit. No fluids or solids other than geothermal waters will be disposed of into this pit. This is as previously submitted in GW-38.

III. Site Characteristics

A. Provide the name, description, and location of any ground water discharge sites (water wells, seeps, springs, watercourses) within one mile of the outside perimeter of the facility. For water wells, specify use of water (e.g., irrigation, domestic, etc.)

See the attached topographical map of the discharge site. This is as previously submitted in GW-38.

B. If known, provide the flow direction of the ground water most likely to be affected by the discharge. Include the source of the information and how was it determined.
Subsurface flow direction of geothermal waters at the PG-4 well site is southwest toward geothermal wells PG-1 and PG-3 (LRG-520). Electric logs and static water table measurements show that PG-4 water table elevations are 16 to 23 feet higher than in PG-1 and PG-3. This data is from the interim completion report on DT-3 (PG-4) Geothermal Exploratory Well.

C. Provide depth to water of geothermal water, and if possible, any fresh water wells that could be affected by any discharge.
The depth to water in PG-4 is at 365 feet. Elevated temperature and uniformly low resistivity of the E-log of PG-4, by El Paso Water Utilities, indicates saline geothermal fluid from the water table to the total depth in PG-4. No fresh water underlies this well. The E-log is on file with discharge plan GW-38.

D. Depth to and lithologic description of rock at base of alluvium. Provide drillers logs and geologic information and maps as available.

See the geologist's report on file with discharge plan GW-38.

E. Describe flooding potential of the discharge site.

The discharge site is located on a hill slope out of the arroyo bottom drainage path. Flooding is not a potential problem for the site. The local runoff is not directed to the discharge site. See the attached topographic map.

F. Any additional information that may be necessary to demonstrate that approval of the discharge plan will not result in concentrations in excess of the standards of WQCC Regulations, Section 3-103, or the presence of any toxic pollutant at any place of withdrawal of water for present or reasonably foreseeable future use. Detailed information on site geologic and hydrologic conditions may be required for a technical evaluation of the applicant's proposed discharge plan.

The following information is already on file with discharge plan GW-38:

1) Geologist Report for PG-4

2) Flow Test Report (Drill Stem Test)

3) Water Quality Analysis

4) Comparison of Water Quality for PG-1, PG-4, Chaffee 35-25, Chaffee 12-24, and Chaffee 55-25.

5) 24-Hour Pump Test Report

6) PG-4 E-Log

7) Topographic Map of Proposed Discharge Site (duplicate attached)

8) Engineering Estimate of Percolation Rates

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87504
(505) 827-5800

July 11, 1988

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. C. D. Black
Physical Plant Department
New Mexico State University|Box 3545
Las Cruces, New Mexico 88003-3545

RE: Discharge Plan GW-38
New Mexico State University
NMSU Geothermal Wells PG-1 and PG-4
Las Cruces, Dona Ana County

Dear Mr. Black:

On December 22, 1986, the ground water discharge plan, GW-38, for NMSU Geothermal wells PG-1 and PG-4 located in Dona Ana County, was approved by the Director of the Oil Conservation Division (OCD). This discharge plan was required and submitted pursuant to Water Quality Control Commission Regulations and it was approved for a period of two years. The approval will expire on December 22, 1988.

If your facility continues to have effluent and leachate discharges and you wish to continue discharging to the unlined pit, please submit your application for renewal of plan approval as quickly as possible. The OCD is reviewing discharge plan submittals and renewals carefully and the review time can often extend for several months. Please indicate whether you have made, or intend to make, any changes in your discharge system, and if so, include an application for plan amendment with your application for renewal. To assist you in preparation of your renewal application, I have enclosed a copy of the OCD's guidelines for preparation of ground water discharge plans at geothermal installations. These guidelines will be used in review of your renewal application.

If you no longer have such discharges and discharge plan renewal is not needed, please notify this office.

If you have any questions, please do not hesitate to contact Jami Bailey at (505) 827-5884

Sincerely,

David G. Boyer, Chief
Environmental Bureau

DGB:JB:sl

Enclosure

cc: OCD - District IV

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

[X] Telephone [ ] Personal	Time 11:30	Date 3/9/87

Originating Party	Other Parties
Jamie Bailey	Dean Leggett 646-2529 Chief Plant Operator

Subject: NMSU pump test of lower flow rates

Discussion: Leggett advised me that they would not allow the holding pond to overflow during the test. Pump test scheduled to begin 3/10/87.

Conclusions or Agreements:

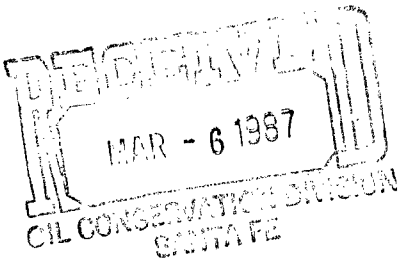
Distribution: File, Johnson, Boyer

Signed: Jamie Bailey

PHYSICAL PLANT DEPARTMENT

Box 3545/Las Cruces, New Mexico 88003-3545
Telephone: (505) 646-2101

NEW MEXICO STATE UNIVERSITY



March 5, 1987

Energy and Minerals Department
Oil Conservation Division
P O Box 2088
Santa Fe, New Mexico 87501

Attention: Roy Johnson

Dear Mr. Johnson:

New Mexico State University is in the process of purchasing new pumping equipment for our well #PG-3 (LRG-520). In an attempt to establish more reliability in our geothermal system, we would like to size this equipment at less capacity than the previous equipment.

The geothermal system is currently in operation using well #PG-1 (LRG-521). This well is producing at approximately 200 g.p.m. NMSU would like to test its geothermal system at lower flow rates in order to more firmly establish the minimum flow required during peak demand times.

This proposed test would entail diverting a portion of the flow from PG-1 to surface ponding located at that well site. We anticipate this to be done during a three-day period for two six-hour intervals on each day. The diverted flows are proposed to be 50 g.p.m. (first day), 75 g.p.m. (second day), and 100 g.p.m. (third day). The total quantity to be diverted would not exceed 81,000 gallons.

NMSU
1888 *Centennial Celebration* 1988

We would like to proceed with this test as soon as possible and therefore request a verbal response relative to this proposed diversion. Please direct your verbal response to Dean Leggett at 646-2529.

We understand that your department has on file the pertinent data concerning the ponding site at PG-1.

Sincerely,

C. D. Black
Director

/pfp

cc: Owen Lockwood, Staff Engineer
George Huff, Assistant Director for Utilities
Dean Leggett, Chief Plant Operator

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501
(505) 827-5800

February 16, 1987

CERTIFIED MAIL

RETURN RECEIPT REQUESTED

Mr. C. D. Black
Physical Plant Department
New Mexico State University
Box 3545
Las Cruces, NM 88003-3545

RE: Discharge Plan (GW-38)
New Mexico State University
Las Cruces, Dona Ana County

Dear Mr. Black:

The request for modification to Ground Water Discharge Plan GW-38 for the alternate use of NMSU geothermal well PG-1 located in Section 23, Township 23 South, Range 2 East, Dona Ana County, is approved with the following provisions:

a) NMSU may use either well PG-1 or PG-4 for servicing the greenhouses.

b) The volume and location of discharge are unchanged. Because there will not be significant changes in discharge water quality or volume, no public notice or comment period is required.

This modification to Discharge Plan GW-38 is approved pursuant to Section 3-109.F of the New Mexico Water Quality Control Commission Regulations. Please be advised that the approval of this modification does not relieve you of liability should your operation result in actual pollution of surface or ground waters which may be actionable under other laws and/or regulations.

Sincerely,

William J. LeMay
Director

WJL/JB/bok

cc: Roy Johnson, OCD

P 612 458 461

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL

(See Reverse)

Sent to Mr. C.D. Black	
Street and No. New Mexico State University	
P.O., State and ZIP Code Box 3545 Las Cruces, NM	
Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to whom and Date Delivered	
Return receipt showing to whom, Date, and Address of Delivery	
TOTAL Postage and Fees	$
Postmark or Date	

★ U.S.G.P.O. 1983-403-517

PS Form 3800, Feb. 1982

TABLE II-14

CHEMICAL ANALYSIS OF DISSOLVED SOLIDS (mg/ℓ)
NMSU Geothermal Wells

	PG-1	PG-3	GD-2 (468[1])	GD-2 (840[1])	DT-3 (Group I)	DT-3 (Group II)
PH	6.30	6.25	7.65	7.80	6.72	8.47
μmhos	3110	3120	3120	2680	2800	2450
TDS	2010	1981	1948	1787	1818	1636
NA	488	488	428	386	428	389
K	54	52	44	35	74	35
Ca	143	141	130	115	132	107
Mg	18.6	18.8	36.0	36.6	32.1	25.1
Cl	584	546	574	440	570	341
CO_3	0	0	0	0	0	31.2
HCO_3	620	610	422	494	487	593
SO_3	250	240	315	280	251	250
Fe	2.8	5.0	1.28	6.00	0.22	0.83
Mn	0.11	0.11	0.09	0.13	1.22	0.45
Hardness	NA	NA	NA	NA	460	369
Alkalinity	NA	NA	NA	NA	399	538
As	<0.004	<0.004	<0.001	0.001	<0.001	<0.001
Ba	0.04	0.04	0.08	0.09	0.07	0.06
Cd	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cr	<0.05	<0.05	<0.02	<0.02	<0.05	<0.05
Pb	<0.005	<0.005	0.005	0.005	<0.005	<0.005
Hg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Se	<0.002	<0.002	<0.001	0.001	<0.001	<0.001
Ag	<0.05	<0.05	0.05	0.05	<0.05	<0.05
NO_3-N	0.03	0.02	0.01	0.02	<0.01	0.54
F	1.27	NA	1.29	0.55	1.78	1.57

PHYSICAL PLANT DEPARTMENT

Box 3545/Las Cruces, New Mexico 88003-3545
Telephone: (505) 646-2101

NEW MEXICO STATE UNIVERSITY

February 13, 1987

Mr. Bill LeMay, Director
Oil Conservation Division
Energy and Minerals Department
State of New Mexico
Box 2088
State Land Office Building
Santa Fe, New Mexico 87501-2088

Dear Mr. LeMay:

New Mexico State University received your approval for a ground water discharge plan (GW-38) for our geothermal well PG-4.

New Mexico State University hereby requests that you allow us to modify that plan in the following manner: add an alternate source of geothermal water--that source is PG-1 (LRG-521). We understand that your department has all the pertinent data concerning this well on file.

The alternate source of geothermal water is the only aspect of the discharge plan for which we are requesting modification. The volume, process, and all other physical aspects of the approved plan would remain the same.

This action is being requested so that we may service the greenhouses with water from either PG-1 or PG-4 thereby controlling pumping costs.

Sincerely,

C. D. Black
Director

/pfp

cc: Owen Lockwood, Staff Engineer

NMSU
1888 *Centennial Celebration* 1988

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501-2088
(505) 827-5800

December 22, 1986

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. C. D. Black
Physical Plant Department
New Mexico State University
Box 3545
Las Cruces, N.M. 88003-3545

Re: Discharge Plan (GW-38)
New Mexico State University
NMSU Geothermal Well PG-4
Las Cruces, Dona Ana County

Dear Mr. Black:

The ground water discharge plan (GW-38) for the NMSU Geothermal Well PG-4 located in Section 23, Township 23 South, Range 2 East, Dona Ana County, New Mexico, is hereby approved. The approved discharge plan consists of materials dated January, 1985; June, 1986; October 16, 1986; and November 18, 1986. Public notice was first published on November 20, 1986.

The discharge plan was submitted pursuant to Section 3-106 of the N.M. Water Quality Control Commission Regulations. It is approved pursuant to Section 3-109.F., which provides for the possible future amendments of the plan. Please be advised that the approval of this plan does not relieve you of liability should your operation result in actual pollution of surface or ground waters which may be actionable under other laws and/or regulations.

There will be no routine monitoring or reporting requirements.

Please note that Section 3-104 of the regulations requires that "when a plan has been approved, discharges must be consistent with the terms and conditions of the plan." Pursuant to Section 3-107.C., you are required to notify the Director of any facility expansion, production increase, or process modification that would result in any significant change in discharge water quality or volume.

Pursuant to Section 3-109.G.4., this plan approval is for a period of two (2) years. This approval will expire December 22, 1988, with renewal dependent on field development research and on feasibility of disposal by injection.

On behalf of the staff of the Oil Conservation Division, I wish to thank you and your staff for your cooperation during this discharge plan review.

Sincerely,

R. L. STAMETS
Director

RLS:JB:dp

cc: Roy Johnson, OCD

PROOF OF PUBLICATION

Wayne Barnes, being duly sworn, deposes and says that he is the Advertising Director of the Las Cruces Sun-News, a newspaper published daily except Saturday in the County of Dona Ana, State of New Mexico; that the notice

Public Notice

as per clipping attached, was published once a week in the regular and entire issue of said newspaper and not in any supplement thereof, for One consecutive weeks (day): that the first publication was in the issue dated November 17 19 86 and the last publication was in the issue dated November 17 19 86

Deponent further states that this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Sec. 3. Chapter 167, Laws of 1937. And payment of fees for said publication has been made.

(Signed) Wayne Barnes

Advertising Director
Official Position

STATE OF NEW MEXICO
COUNTY OF DONA ANA ss.

Subscribed and sworn to before me this 21st day of November 19 86

Notary Public in and for
Dona Ana County, N.M.

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY AND MINERALS
DEPARTMENT
OIL CONSERVATION
DIVISION

Notice is hereby given that pursuant to New Mexico Water Quality Control Commission regulations, the following discharge plans have been submitted for approval to the Director of the Oil Conservation Division, P.O. Box 2088, State Land Office Building, Santa Fe, New Mexico 87504-2088 (505) 827-5800.

(GW-38) New Mexico State University, C. D. Black, Director of Physical Plant Department, Box 3545, Las Cruces, New Mexico 88002, proposes to discharge cooled geothermal water to an unlined pit at its greenhouse facility located in Section 23, Township 23 South, Range 2 East, NMPM, Dona Ana County, New Mexico. Approximately 49,000 gallons per day of cooled geothermal water with a total dissolved solids content of 1775 mg/l will be discharged. The disposed geothermal water will percolate into the ground and will re-enter the geothermal reservoir. Uppermost ground water is geothermal and is found with a TDS of 1636 at a depth of 284 feet.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and a public hearing may be requested by an interested person. Requests for public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant public interest.

If no public hearing is held, the Director will approve or disapprove the proposed plan based on information available. If a public hearing is held, the Director will approve or disapprove the proposed plan based on information in the plan and information submitted at the hearing.

GIVEN Under the Seal of the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 12th day of November, 1986. To be published on or before November 21, 1986.

STATE OF NEW MEXICO
OIL CONSERVATION
DIVISION
/s/R. L. STAMETS
Director

SEAL

Pub. No. 86-1561
Publish: November 17, 1986

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to New Mexico Water Quality Control Commission regulations, the following discharge plans have been submitted for approval to the Director of the Oil Conservation Division, P.O. Box 2088, State Land Office Building, Santa Fe, New Mexico 87504-2088 (505)827-5800.

(GW-33) El Paso Natural Gas Company, San Juan Gas Processing Plant, John Craig, Vice President, P.O.Box 4990, Farmington, New Mexico 87499, has submitted for approval a ground water discharge plan for its facility located in Section 1, Township 29 North, Range 15 West, NMPM, San Juan County, New Mexico. Approximately 4000 gallons per day of contact process wastewater with a total dissolved solids content of approximately 2700 mg/1 will be discharged to a lined wastewater evaporation pond equipped with a leak detection system. Discharges of non-contact wastewater effluent will be addressed in a different ground water discharge plan. The present discharge plan addresses how spills, leaks, and other discharges to ground water at the plant site will be managed. The ground water most likely to be affected by any discharge to the surface is at a depth ranging from 15 feet to 110 feet, with a total dissolved solids concentration averaging 17500 mg/1.

(GW-34) El Paso Natural Gas Company, Kutz Gas Plant, John Craig, Vice President, P.O. Box 4990, Farmington, New Mexico 87499, has submitted for approval a ground water discharge plan for its facity located in Section 15, Township 29 North, Range 12 West, NMPM, San Juan County, New Mexico. Approximately 2,178 gallons per day of process and cooling tower water with a total dissolved solids content of approximately 1060 mg/1 will be discharged to a line wastewater evaporation pond equipped with a leak detection system. The discharge plan addresses how spills, leaks and other discharges to ground water at the plant site will be managed. Protectable ground water most likely to be affected by any discharge to the surface is at a depth ranging from 33 feet to 50 feet, with total dissolved solids concentrations ranging from 774 to 3270 mg/1.

(GW-38) New Mexico State University, C.D. Black, Director of Physical Plant Department, Box 3545, Las Cruces, New Mexico 88002, proposes to discharge cooled geothermal water to an unlined pit at its greenhouse facility located in Section 23, Township 23 South, Range 2 East, NMPM, Dona Ana County, New Mexico. Approximately 49,000 gallons per day of cooled geothermal water with a total dissolved solids content of 1775 mg/1 will be discharged. The disposed geothermal water will percolate into the ground and will re-enter the geothermal reservoir. Uppermost ground water is geothermal and is found with a TDS of 1636 at a depth of 284 feet.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and a public hearing may be requested by an interested person. Requests for public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant public interest.

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GIVEN Under the Seal of the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 12th day of November, 1986. To be

STATE OF NEW MEXICO } ss
County of Bernalillo

THOMAS J. SMITHSON

..... being duly sworn declares and says that he is **NAT'L ADV. MGR.** of the **Albuquerque Journal**, and that this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Section 3, Chapter 167, Session Laws of 1937, and that payment therefore has been made or assessed as court costs; that the notice, a copy of which is hereto attached, was published in said paper in the regular daily edition,

for 1 times, the first publication being on the 20 day of November, 198 6, and the subsequent consecutive publications on .....

Thomas J. Smithson

ICIAL SEAL
NNIE MONTOYA
ARY PUBLIC - STATE OF NEW MEXICO
y Public Filed with Secretary of State
ommission Expires 4-18-90

Sworn and subscribed to before me, a Notary Public in and for the County of Bernalillo and State of New Mexico, this 20 day of November, 198 6

Anne Montoya

PRICE 35.11

Statement to come at end of month.

EDJ-15 (R-2/86)

ACCOUNT NUMBER C 80932

NOTICE OF PUBLICATION
STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

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The discharge p[redacted] addresses how spills, leaks [redacted] other discharges to ground water at the plant site will be managed. Protectable ground water most likely to be affected by any discharge to the surface is at a depth ranging from 33 feet to 50 feet, with total dissolved solids concentrations ranging from 774 to 3270 mg/l.

(GW-38) New Mexico State University, C. D. Black, Director of Physical Plant Department, Box 3545, Las Cruces, New Mexico 88002, proposes to discharge cooled geothermal water to an unlined pit at its greenhouse facility located in Section 23, Township 23 South, Range 2 East, NMPM, Dona Ana County, New Mexico. Approximately 49,000 gallons per day of cooled geothermal water with a total dissolved solids content of 1775 mg/l will be discharged. The disposed geothermal water will percolate into the ground and will re-enter the geothermal reservoir. Uppermost ground water is geothermal and is found with a TDS of 1636 at a depth of 284 feet.

Any interested person may obtain further information from the Oil Conservation Division and may submit written comments to the Director of the Oil Conservation Division at the address given above. Prior to ruling on any proposed discharge plan or its modification, the Director of the Oil Conservation Division shall allow at least thirty (30) days after the date of publication of this notice during which comments may be submitted to him and a public hearing may be requested by an interested person. Requests for public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines there is significant public interest.

If no public hearing is held, the Director will approve or disapprove the proposed plan based on information available. If a public hearing is held, the Director will approve or disapprove the proposed plan based on information in the plan and information submitted at the hearing.

GIVEN Under the Seal of the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 12th day of November, 1986. To be published on or before November 21, 1986.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

R. L. STAMETS
Director

S E A L

PHYSICAL PLANT DEPARTMENT

Box 3545/Las Cruces, New Mexico 88003-3545
Telephone (505) 646-2101

NEW MEXICO STATE UNIVERSITY

November 18, 1986

Mr. R. L. Stamets, Director
Oil Conservation Division
Energy and Minerals Department
Box 2088
Santa Fe, New Mexico 87501

Dear Mr. Stamets:

In reply to your request of November 10, 1986, for additional information regarding the disposal plan for New Mexico State University Geothermal Well PG-4, we are submitting the following information:

Plant Processes

A. There will be no additions or co-mingling with any other waste stream before disposal in the unlined pit.

B. No additives will be introduced to the geothermal water prior to disposal.

C. No fluids or solids other than geothermal waters will be disposed of in the unlined pit.

D. Sanitary sewerage will be the only other liquid waste generated from the greenhouse operation. This will be disposed of in a septic tank/leech field system.

Site Characteristics

A. The reserve pit is the intended disposal pit. No modifications to the reserve pit are intended prior to its use. The minimum freeboard maintained during disposal will be five feet.

Certification

"I hereby certify that I am familiar with the information contained in and submitted with the discharge plan application and that such information is true, accurate, and complete to the best of my knowledge and belief."

(Signature) — (Date) Nov 18, 1986

C. D. BLACK, (Printed Name of Person Signing) — Director, Physical Plant Department (Title)

/pfp
cc: Owen Lockwood

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION

TONEY ANAYA
GOVERNOR

POST OFFICE BOX 2088
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO 87501-2088
(505) 827-5800

November 10, 1986

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. C. D. Black, Director
Physical Plant Department
New Mexico State University
Box 3545
Las Cruces, New Mexico 88003

Re: Discharge Plan (GW-38)
New Mexico State University
NMSU Geothermal Well PG-4
Las Cruces, Dona Ana County

Dear Mr. Black:

Under the provisions of the Water Quality Control Commission (WQCC), the filing of a discharge plan is required for surface disposal of geothermal water produced from the NMSU Geothermal Well PG-4, located in Section 23, Township 23 South, Range 2 East, Dona Ana County, New Mexico. This well is also referred to as DT3 in your submittal. The discharge plan, defined in Section 1-101.P of the WQCC Regulations, should cover all discharges of effluent or leachate at the plant site or adjacent to the plant site. A copy of the regulations is enclosed for your convenience.

We are currently reviewing the submitted discharge plan for the referenced well. The plan submittal, dated October 16, 1986, was received by the OCD on October 20, 1986. The following comments and requests for additional information are based on our review of the data provided in the plan:

I. General Information

A. With your response to our request for information, please include the following affirmation and signature in the format below to complete the application:

"I hereby certify that I am familiar with the information contained in and submitted with the discharge plan application and that such information is true, accurate, and complete to the best of my knowledge and belief."

_____ _____
(Signature) (Date)

_____ _____
(Printed Name of Person Signing) (Title)

II. Plant Processes

A. Will any additions or commingling with any other waste stream occur before disposal in the unlined pit?

B. Provide analyses of any additives to the geothermal water which will be used prior to disposal.

C. List all fluids and solids that will be disposed of in the unlined pit.

D. Will any other liquid waste be generated from the greenhouse operations? What will be the disposition of this waste effluent?

III. Site Characteristics

A. Is the reserve pit the intended disposal pit? If so, are any modifications to the reserve pit planned before its use as the disposal pit? What will be the minimum freeboard maintained during disposal?

Please be advised that any discharge from this facility without prior approval from OCD would be in violation of the regulations. Before discharging, you must have either a discharge plan approved by the OCD or temporary permission to discharge without an approved discharge plan pursuant to Section 3-106.B. Temporary permission can only be granted for good cause shown by you and can only be for a non-renewable period of not more than 120 days. Public notice will be issued the week of November 10 and the following 30 days are required for public comment.

If there are any questions on this matter, please feel free to call Dave Boyer or Jami Bailey at (505) 827-5884, as they have the assigned responsibility for review of this discharge plan.

Sincerely,

R. L. STAMETS
Director

RLS:JB:dp

cc: Roy Johnson, OCD

PHYSICAL PLANT DEPARTMENT

Box 3545/Las Cruces, New Mexico 88003
Telephone (505) 646-3021

NEW MEXICO STATE UNIVERSITY

Dave -
Please Comment
Will be OK w/me For a
two year period - i.e.
until Field development
researches this area -
then injectio -
RY

October 16, 1986

Mr. Roy Johnson
Oil Conservation Division
Geothermal Section
District IV
P. O. Box 2088
Santa Fe, NM 87501

Dear Mr. Johnson:

Subject: Request for Surface Disposal of Geothermal Water

This letter is to request permission for the surface disposal of geothermal water produced from the NMSU geothermal well PG-4 (also referenced as LRG 4905) following the extraction of useful heat from the water. The surface disposal permission is requested on a temporary basis for a duration of five years.

The geothermal water will be produced to heat two experimental NMSU greenhouses. The production requirement is 34 gallons per minute for the greenhouse heating season of 3,200 hours per year, or a total annual production of 6.5 million gallons.

The geothermal water will be disposed into a 46 feet by 46 feet pit that is 7 feet deep. The disposal containment pit is located approximately 110 feet from well PG-4. The estimated ration of percolation to total flow into the disposal pit is 90%. The disposed geothermal water that percolates into the ground will reenter the geothermal reservoir. There is no indication of any fresh water underlying or in the vicinity of the disposal site.

Attached is the E-Log of PG-4 taken by the El Paso Water Utilities. The uniformly low resistivity at all depth, together with the elevated temperature show saline/geothermal fluid from the 284 feet water table to total depth of PG-4. There are several other geothermal wells in the vicinity of the disposal site as indicated on the attached topographical map.

The following additional information is attached to this request:

(1) Geologist Report for PG-4
(2) Flow Test Report (Drill Stem Test).
(3) Water Quality Analysis.
(4) Comparison of Water Quality for PG-1, PG-4, Chaffee 35-25 Chaffee 12-24 and Chaffee 55-25.
(5) 24-hour Pump Test Report.
(6) PG-4 E-Log.
(7) Topographical Map of Proposed Disposal Site.
(8) Engineering Estimate of Percolation Rates.

Please feel free to call if you have any questions.

Thank you for your consideration of this request.

Sincerely,

C. D. Black, Director
Physical Plant Department
New Mexico State Univeristy

mmd

Enclosures

Physical Science Laboratory

memorandum

September 30, 1986

TO: Owen Lockwood
FROM: Roy A. Cunniff RAC
SUBJECT: Percolation Rates, PG-4

1. As you requested, I have made an analysis of surface percolation rates for the reserve pit adjacent to PG-4. These calculations are attached, and are summarized as follows.

2. At flow rates of 750 gpm, the observed and calculated percolation and evaporation rates are as follows:

   A. Evaporation rate: 130 gpm

   B. Percolation rate: 620 gpm

   C. Ratio of percolation to total flow: 0.83

3. Based on these observations, an engineering estimate can be made for PG-4 as a production well to s ply a 30 gpm heating load in the Research Greenhouses, with the cooled effluent to be discharged into the reserve pit.

   A. Evaporation rate: 3 gpm

   B. Percolation rate: 27 gpm

   C. Ratio of percolation to total flow: 0.90

4. If the calculations are representative of long term conditions, the greenhouse heating load would represent less than 2 acre feet per year of consumptive use.

I. OBSERVED PERCOLATION RATE

1. TEST CONDITIONS

INFLOW: 750 gpm @ 145°F (PUMP TEST 28 Aug 86)

AIR FLOW: 6.8 mph ≅ 10 fps

AIR TEMP: 75°F

2. DISPOSAL POND CONDITIONS (SEE PAGE 5/6)

WATER DEPTH: 3 FEET

BOTTOM PIT AREA: 2,025

SURFACE AREA: 2600 FT²

SIDE SLOPE: 45°

II. CALCULATED VALUES

1. TOTAL INFLOW = PERCOLATION LOSS + EVAP. LOSS
(FOR CONSTANT WATER LEVEL)

2. EVAPORATION LOSS: (Chemical Engineers Handbook, pg 545)

$K_G b' = 0.68 (b'V)^{0.65}$; b' = diameter of pond
V = Air velocity, fps

$K_G = \frac{\text{Lb·mole } H_2O}{\text{HR - FT}^2 \text{ - MOL FRAC}}$

For $b' = 51$ FT, $V = 10$ fps

$K_G = 0.68 V^{0.65} \frac{(51 \times 12)^{0.65}}{(51 \times 12)}$

$K_G = 0.32$

3. Evaporation loss as flow.

$$= 0.32 \frac{\text{Lb-mole}}{\text{HR-FT}^2\text{-MOL FRAC}} \times A\ \text{FT}^2 \times \frac{\text{HR}}{60\ \text{min}} \times \frac{1}{\text{mol frac}}$$

For Water at 140°F (average temp)

$$pp = 2.892$$

$$\text{mol frac.} = \frac{2.892}{12.68} = 0.228$$

$$\frac{\text{lb-mole}}{\text{min}} = 60.8$$

$$gpm = 60.8 \frac{\text{LB-mole}}{\text{min}} \times \frac{18\ \text{LB}}{\text{LB-mole}} \times \frac{\text{GAL}}{8.33\ \text{LB}}$$

$gpm \cong 130$ GPM Evaporation loss

4. PERCOLATION RATE:

$$\text{RATE}_P = \text{RATE}_I - \text{RATE}_E$$

$$= 750\ gpm - 130$$

$$= 620\ gpm$$

$$\text{PERCOLATION FRACTION} = \frac{620}{750} = 0.83$$

III. Probable Effects at 30 GPM

1. Assumptions:

Air Flow: 10 fps
Air Temp: 75 °F
Pond Size: 5 feet diameter

2. Calculations for Evaporation Losses

$$K_G = 0.68\ 10^{0.65}\ \frac{(5\times12)}{5\times12}^{0.65}$$

$$= 0.724$$

$$\text{Flow Rate} = 0.724 \times \frac{25H^2}{60} \times \frac{1}{0.228} \times 18 \times \frac{1}{8.33}$$

$$= 2.85 \doteq 3 \text{ gpm}$$

3. Percolation Rate

a. 27 gpm

b. Fraction: $\frac{27}{30} = 0.9$

This is reasonable; total flow is only 4% of tested flow. At high flow rates, the pond builds a wetted surface which allows very rapid percolation. At very low flow rates, it is possible that the wetted surface would be too small to allow 100 percent percolation. Accordingly, evaporation loss is likely to be not more than 10% of total inflow, or 3 gpm

IV. Consumptive Water Use

1. Assumptions

a. Total flow is 20 gpm

b. Evaporation loss is 3 gpm

c. Duration of heating season: 3200 hours per year

2. Calculations

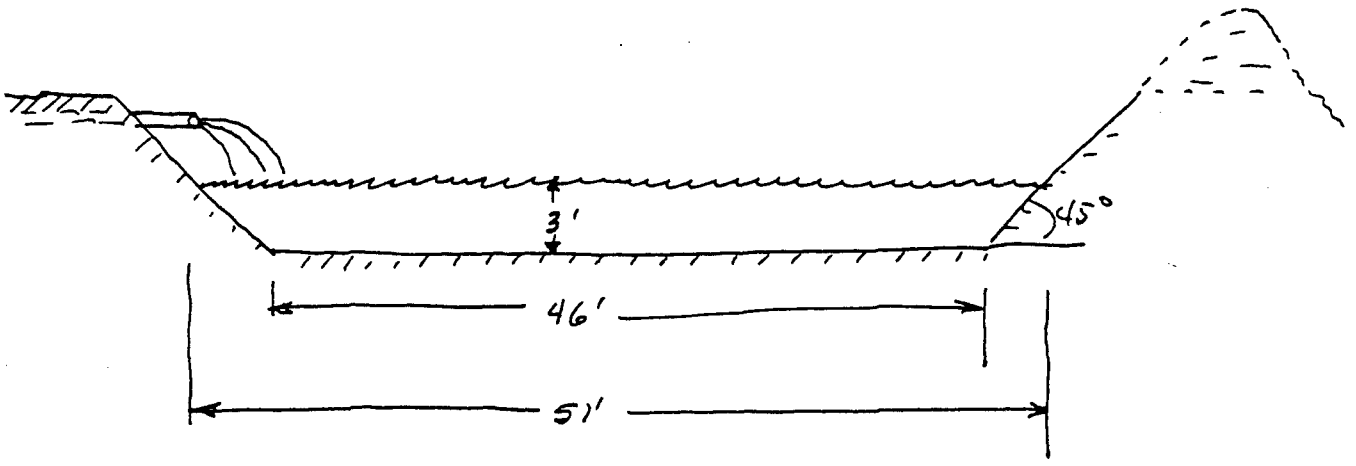
Consumptive Use = Evap loss × Duration

$= 3 \text{ gpm} \times \frac{60 \text{ min}}{\text{Hr}} \times 3200 \text{ hr/yr}$

= 576,000 gallons per year

= 1.77 acre feet / year

Reserve Pit During Flow Test



Test Conditions (During Pump Test 28 August 1986)

1. Flow rate was 4,000 gallons in 30 minutes in partially-full pit
   Decreased to 250 gpm for 3 hours
   Increased to 750 gpm for 6 hours
2. Pit bottom had no standing water 6 hours later

Test Conditions (During Test 27 August 1986)

1. Flow rate was 700 gpm for 7 hours (294,000 gallons)
   Decreased to 300 gpm for 6.5 hours
   Increased to 1,450 gpm for 1.0 hours
2. Reserve pit filled To 3-feet horizon in 3-hour period, remained constant until flow was reduced. Water level dropped to 1.5 feet after 6.5 hours; increased to 3 feet after one hour at 1,450 gpm. Pump was shut down for maintenance for 3 hours; water level dropped to 0.5 feet.

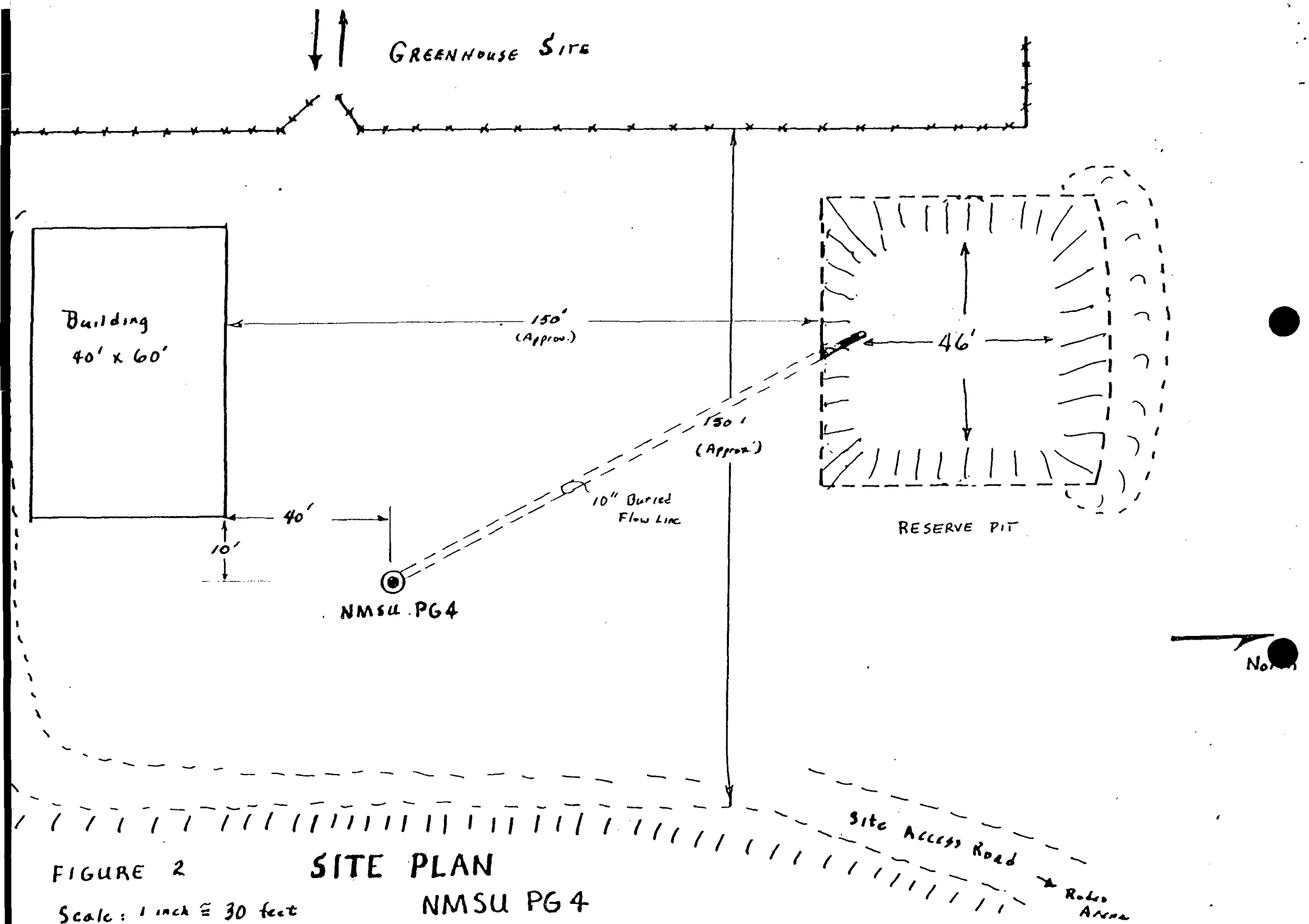


FIGURE 2 SITE PLAN

Scale: 1 inch ≡ 30 feet NMSU PG 4

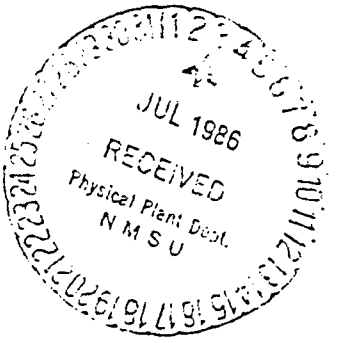
R. CUNNIFF

6/6

GEOLOGISTS REPORT

NSMU DT-3

Sec 23, T-23-S, R-2-#



LITHOLOGY AS DETERMINED FROM EXAMINATIONS OF DRILL CUTTINGS

As marked on original sample bags, depth is referenced to the kelly on the Stewart rig. For continuation drilling, the depths are referenced to the kelly on the L&M rig; hence 960 feet for the Stewart drilling is 965 feet on the new reference.

The interval from 900-960 feet is essentially a gravel composed of 70% to 75% volcanic rock fragments of dark gray, brown, and red colors; dense, very finely crystalline to amorphous in texture; and appears to be chiefly basalt, rhyolite, chert and possible obsidian. The remainder is limestone; light gray, light tan and gray in color; dense to finely crystalline, some of which appears to be finely oolitic. Destructive solution of this carbonate leaves a residue of very fine rounded quartz sand grains, clear to white in color, and minor amounts of gray silt.

It is quite likely that the calcium carbonate formed as a void-filler and cement, since mild hydrocloric acid will cause a brief period of effervescence when applied to most of the volcanic particles. However, the limestone particles in well cuttings are distinctly separate from the volcanics so it is also possible that sandy limestone fragments were deposited simultaneously with the volcanic gravel. Consequently there can be little effective interstitial porosity, or--in the latter case--a good gravel-type porosity and permeability. Sample examinations did not reveal which condition exists.

There were no sample cuttings available from 965-982 feet (L&M kelly reference depth), due to lost circulation problems in the original drilling. Bottom of original casing was reported at 982 feet, although measurements made during L&M operations suggest the true depth could be 984-985 feet.

At 982-985 feet there is an unconsolidated or poorly cemented sand conglomerate of 85% clear to white quartz grains, 65% of which are approximately 0.9 to 1.2 mm in size, 20% are approximately 0.5 mm in diameter, and 15% would pass through a 0.3 mm sieve. Remainder of sample is 5% light brown to tan sandy limestone, 5% light gray to dark gray limey-silty-shale, and 5% assorted volcanic fragments. Because of the brief period of circulation and high rate of penetration while drilling through this interval, it was considered possible that the sample is not representative of the indicated lithology.

Drilling from 987 feet to total depth of 1012 feet had no drilling resistance or was in a void which yielded no samples to the surface. The insertion of 5 9/16-inch liner into a drilled, unsampled interval from 1012-1015 feet (by rotation and downward pressure of the drill-stem) suggests that the open bore hole had been filled by loose material (possible drill cuttings) which sloughed into the hole during the 8-hour drill stem test.

After reviewing the lithologic descriptions of other NMSU geothermal wells and of Chaffee geothermal wells on Tortugas Mountain (NMERDI 2-67-2238 (2), it was further apparent that the samples from 982-985 feet were highly anomalous, as no other bore-hole in the area has encountered a similar lithologic interval during drilling. However, NMSU production wells reportedly yield sand in large amounts, so examination of a sample from the PG-1 sand separator, which represents formation sand at 750 feet, revealed the following:

> NMSU PG-1: Very fine quartz sand, primarily clear to white in color, lessor amounts buff, tan and red, sub-rounded to rounded and frosted, and almost all grains 0.3 mm or less in size comprise 90% of the washed sample. The balance (10%) of the specimen is made up of fine volcanic particles and a light blue-green limey shale which completely dissolves into silt with mild (10%) HCl application. The unwashed sample is very heavy in fine silt which washes out readily. Estimated silt content is 35% or greater.

Examination of the 982-985 foot sample from DT-3 reveals no more than 15% of the very fine sand grains and little silt. It therefore seems improbable that this interval might be correlative with the producing zone in PG-1 (700-750 feet of depth).

In reviewing the 1984 drilling history of DT-3 it is apparent that large volumes of fluid were introduced into the bore-hole while circulation was lost. Also, at this time it appears that drilling fluids in the mud pit were being agitated. Consequently, another possibility is that surface sands and gravels could have been pumped into the well along with the drilling fluids. Therefore, samples of material from the newly excavated reserve pit and from the nearby surface were examined. These samples compare favorably with those from DT-3 at 980-985 feet. The only major difference is that there are more and larger volcanic fragments in the surface and pit specimens. Of course, being larger and heavier, these could not be as susceptible to recycling as the smaller granules.

From the foregoing, and from a study of the drilling record, it is therefore concluded: DT-3 did not encount.r a naturally deposited sandstone layer at approximately 982-985 feet, but merely found surface material which either settled out or was washed back into the hole from the previous drilling operation. Because of the slow drilling rate immediately below this 'detrital' material, from 985-987 feet at 4 minutes/foot, it must be assumed that a dense hard formation is present. Cuttings from this zone were dispersed into the presumed void at 987-1012 feet, which interval continued to absorb large amounts of injected air and fluid plus all other formation cuttings drilled. Below the void a formation approximately one-half as hard as that immediately above that lost circulation zone was encountered, from 1012-1015 feet, where drilling advanced at 2 minutes/foot. The carbonaceous deposit lining the return flow lines during penetration of the section from 982 feet to total depth indicates that calcium carbonate rock was present and that carbon dioxide was recovered.

A prognostication to satisfy known factors can be advanced for DT-3 as follows: the stratigraphy from surface down to at least 960 feet is essentially the volcanic gravels of the Santa Fe formation. At that depth large fractures

occur, which explains the lost circulation problems that led to termination of drilling in 1984.

At 982 feet, a three-foot deposit of detrital material, carried into the well by drilling fluids, rested upon a thin, two-foot thick wedge or block of andesite. Immediately below this andesite, at 987 feet, the bore-hole intersected a high-angle fault with an exceedingly porous and permeable gouge or breccia zone. At 1012 feet the drill bit encountered firm unbroken Hueco carbonate. The extraordinarily high flow rate measured by Schlumberger (Flopetrol-Johnston) testing is an indication of this fault zone's excellent reservoir characteristics.

A further observation is made relative to the zone from 967-982 feet. (Depths referenced to kelly bushing on L&M rig.) This zone was the original lost circulation zone, which Stewart encountered. From records of that drilling, the borehole accepted 10,000 pounds of bentonite, paper, polymer and cotton seed hulls without regaining circulation. However, when the 8 5/8-inch casing was inserted, it landed at 982-984 feet of depth. Of significance, the bore-hole overflowed mud into the reserve pit when the casing landed. These facts suggest that the unknown zone was "filled" with the LCM, and the fluid level rose to within 200 feet of ground surface before the casing was inserted; the casing then displaced a calculated volume of 165 cubic feet of mud, which caused the borehole to overflow. Feom these facts, together with the analysis of the sampled residue from 982-985 feet, it is possible the original lost circulation zone was a solution cavern at the base of the Santa Fe group, which became filled by casing and LCM. Such solution caverns reportedly were encountered in the Chaffee wells 12-24 and 35-25 at or beneath bedrock contact.

PART II, SECTION 6
DRILL STEM TEST OF OPEN ZONE AT 987 FEET

6.1 Introduction

A flow test of Well DT-3 at New Mexico State University, New Mexico was conducted from April 27 to April 28, 1986. The test was designed to obtain physical and chemical data to be used for standard reservoir calculations and for determination of fluid characteristics. Physical Science Laboratory, New Mexico State University, designed the test, provided monitoring equipment and personnel for the test, and evaluated the data.

6.2 Methods of Data Acquisition

FLOW RATES: Determined by timed fill tests into a 500-barrel (21,000 gallons) tank. Flow was directed to the reserve pit while the tank was gauged for an initial reading, then flow was redirected to the tank. After a specific period of time, flow would be directed again to the pits, the tank gauged for a final reading, and the difference found to determine volume as per posted tank straps. The volume was divided by time to determine rate in gallons per minutes. To estimate flow rates during drilling, and as a check against timed fill tests, an alternative system was used.

TEMPERATURE, SURFACE: Water temperature was measured by use of two electronic probes connected to an electronic meter. Probes were covered by insulation and taped to the exterior surface of the 8 5/8-inch wellhead. Temperatures from these probe units were accurate to within ± 0.1 °F. The electronic meter was used to the conclusion of the test.

TEMPERATURE, BOTTOM HOLE: A continuous record of flowing temperature at 730 feet was acquired by the FLOPETROL tool, which also was used to acquire a two-hour temperature at 960 feet of depth. The final temperature survey was run by New Mexico State University on 28 April, 1986 using a Spafford probe.

PRESSURE, INJECTION: Pressure at the compressors was recorded on a 24-hr circular chart recorder. Accuracy of this gauge was nominal and was utilized

only for gross changes in injection pressure. A more precise measurement was obtained using the FLOPETROL tool, which permitted an accurate determination of injection pressure using a Johnston-Macco SPRO gauge rigged up on the well-head and the lubricator pressurized while flowing. This pressure stabilized at 230 psia with three compressors operating, and was 202 increasing to 205 psia at test end using two compressors.

PRESSURE, BUILDUP TEST: Pressure was measured by a Johnston-Macco SPRO strain gauge with 0.01-psi readability, 0.01-psi accuracy, plus a temperature sensor accurate to 0.01 °F. The gauge was rigged up inside a lubricator on the well-head and pressurized to check for leaks. The gauge was then lowered to 730.5 ft KB and injection started. Since the pressure port is 6 inches from the bottom of the tool, precise depth of measurement during the buildup test was 730 ft KB.

AIR SUPPLY: Temperature and pressure were recorded for the air inlet to the compressors, and to the inlet and discharge from the booster.

WATER ANALYSIS: Water samples were taken from a valve located on the bottom of the main 8 5/8-inch flow line and were collected in plastic containers. Water samples taken during the test were analyzed by Andrew Bristol, Soil and Water Testing Laboratory, New Mexico State University.

6.3 Summary of Events

6.3.1 Pre-Test Operations

The drilling crew rigged for the test by inserting open-end, 6-inch drill stem to 745 feet of depth. This depth was chosen to place the drill stem opening at the top of the screen section. Operations were completed by 1:00 pm, April 27. The rig then was placed on standby.

FLOPETROL Johnston was notified at 8:00 am, April 27, and the equipment arrived at 5:00 pm. For the next several hours, the equipment was rigged and tested. The probe was set at 742 feet KB, with the pressure port located exactly at 730 feet KB.

6.3.2 Test Operations

The flow test was begun at 9:00 pm on April 27, 1986. Initially, all of the on-site air equipment was used, which included three 850 cfm compressors, and the 1500 psi booster. Flow was estimated to be 1,050 gpm. Because such a high flow rate extended over an 8-hour period might have caused the reserve pits to overflow, at the end of the first 30 minutes, one of the compressors was stopped. Resultant flow rate was measured and estimated to be 700 gpm, and this flow rate was maintained for the remainder of the test.

Four timed fill tests were made, using the ~~5,000~~ 500 barrel tank. Water samples were acquired for each fill test. Flow line valve to the pit was closed, and the 8-inch valve was opened to the tank. For the first timed fill test, the main flow line valve could be closed only partially, because of calcium carbonate build-up on the valve seat and disk. This condition steadily worsened during the remainder of the test. As a consequence, precise flow measurements were obtained only for that portion of the flow directed into the tank. Flow rates into the reserve pit were measured by other methods.

Airlift was terminated at 5:00 am, April 28, 1986, and pressure buildup was recorded.

6.3.3 Post-Test Operations

Following completion of the pressure buildup test, the FLOPETROL tool was lowered to 960 feet of depth to attempt a temperature survey. Intent was to obtain a temperature log from the bottom up. The temperature sensor is located on the top of the tool, with a total tool length of some 15 feet. To protect this tool, it was deliberately kept inside the original well casing. As a result, the deepest penetration for the temperature sensor was 960 feet. After two hours, the tool still had not reached thermal equilibrium, and the indicated temperature was 146.3 °F, with warming still occuring. Accordingly, the temperature log effort was abandoned because of exessive rig standby costs. A temperature survey was made on the well at 9:00 pm on April 28, using a NMSU-owned Spafford probe. This survey was conducted from the water table at 345 ft (±) to 960 feet of depth.

6.4 Analysis of Pressure Buildup Test

6.4.1 Background

For this section, the calculations are based on work defined by Earlaugher (1977),[30] which have been adapted for water well terminology. These methods are used extensively for evaluating petroleum wells, and have gained significant use in evaluating geothermal wells.

Parameters used in the calculations are based on a combination of observed and estimated values, as follows:

Casing ID: 7.875 in. = 0.65625 feet

r_w = ½ of casing ID = 0.328 feet

Production Rate = 700 gpm = 26,331 barrels per day

Elapsed Time = t = 8 hrs = 0.33 days

Reservoir Thickness = 150 feet (assumed)

Viscosity = μ = 0.455 at 115 °F

Formation Volume Factor = β = 1.04 (Typical value)

Slope of equilibrium recovery curve = m = 1.0 (From Horner plot)

Porosity = ϕ = 0.15 (Typical value)

Compressibility = Ct = 1×10^{-5} (Typical value)

Pressure Measurements:

$P_{1\text{ - hr}}$ = 159.01 psi (Pressure at the end of 1 hour)

Pwf = 155.71 psi (Pressure while flowing)

P* = 159.01 psi (Pressure at infinite time; when

$$\log \frac{tP + \Delta T}{\Delta T} = 0.)$$

(This occurred for this test at one minute elapsed shut in time.)

6.4.2 Analysis of data provided by the pressure buildup test was performed using a Horner plot. Calculated values are listed as follows:

Transmissibility = Kh = 2,025,968 md-ft

Permeability = K = 13.5 Darcys

Skin Factor = S = negligible

ΔP Skin = negligible
Radius of Influence = ri = 2,625 feet
Reservoir Volume = 83.4 million barrels = 10,774 acre feet
Productivity = PI = 7979 BBL/Day/psi = 100 gpm/foot of drawdown

Several important facts are highlighted by this analysis. The formation has excellent permeability (roughly to five three times higher than another geothermal well tested by the same methodology in the Las Cruces area.) The productivity of 234 gpm per psi represents a value five to ten times higher than good geothermal wells at Beowave, Navada. High permeability is a fracture-induced value. Skin damage, normally caused by poor drilling practices, was negligible, which helps explain the high permeability.

Based on the high permeability, the reservoir safely can produce flow rates higher than 2,000 gpm.

Since no reservoir boundaries were detected during the pressure buildup, it can be assumed the radius of influence is larger than 2,625 feet, and the Reservoir Volume is larger than the calculated 10,774 acre feet. Although no boundary was observed, it is likely the fault F-6 deduced by Reynolds acts as a boundary on the north for shallower ground waters; hence extraction of water was from the east and up the fault.

It is noted that bottom hole pressure increased by a modest amount (0.58 psia) during the eight-hour flow test. This increase can only mean the reservoir was recharging at a rate faster than the extraction rate of 700 gpm. Moreover, the production temperature increased from a value of 145 °F to 146.1 °F during the flow period. From thermal balance calculations (Appendix A-8) the true production temperature would be at least 147.6 °F. The temperature increase from 145 °F to 146 °F is a positive sign that the geothermal reservoir is separated from cooler regimes which otherwise might have been drawn into the production zone, at the high rates of water extraction produced during the drilling and test. From thermal balance calculations, the likely well head temperature produced by mechanical pumping is expected to be at least 147 °F.

6.4.3 Calculations of Reservoir Hydrology Factors

Transmissibility

$$kh = 162.6 \frac{q\mu}{m}$$

where k = Permeability (md)

h = Aquifer formation thickness (ft) (= 150 feet)

q = Flowrate (bbl/day) (= 26.331 bbl/day)

μ = Viscosity (cp) (= 0.455 CP @ 145 °F)

B = Formation volume factor (= 1.04)

m = Slope (= 1.0, see Horner plot)

From (1), $kh = \frac{162.6\ (26.331)\ (0.455)\ (1.04)}{1.0}$ md-ft

or, kh = 2,025,968 md-ft

$$K = \frac{kh}{h} = \frac{2,025,9\ 3}{150} - 13,506 \text{ md} = 13.5 \text{ Darcys}$$

Skin Damage

$$\Delta P_{skin} = 0.87 \text{ ms}$$

where s = skin factor = $1.151 \left[\left(\frac{P_{1hr} - P_{wf}}{m} \right) - \log \left(\frac{k}{\phi \mu c r_w^2} \right) + 3.23 \right]$

where P_{1hr} = Pressure after shutdown for 1 hr. (= 159.02 psi)

P_{wf} = Pressure during flowing (155.71 psi)

ϕ = Porosity (= 0.15 as a typical value)

r_w = Casing radius (= $\frac{7.875}{24}$ ft = 0.328 ft)

h = Formation thickness (assume 150 ft as a typical value)

m = Slope (= 1.0)

c = Compressibility (= 1.0×10^{-5} PSI^{-1} as a typical value)

Thus $s = 1.151\ (3.3 - 12.65 + 3.23)$

$= \text{negative; negligible}$

$\Delta P_{skin} = 0.87\ (1.0)\ (\text{negligible})\ \text{psi}$

$= \text{negligible}$

Productivity

$$PI = q/(P^* - P_{wf} - \Delta)_{skin})$$

where P^* = Pressure at infinite time after shutdown (= 159.01 psi)

Thus,

$$\text{Productivity} = \frac{26{,}331\ \text{bbl/day}}{(159.01 - 155.71 - 0)\ \text{psi}} = \frac{3{,}979\ \text{bbl}}{\text{day psi}} = \frac{234\ \text{gpm}}{\text{psi}}$$

In terms of gpm per foot of drawdown:

Productivity = 100 gpm/ft

NOTE:

The pressure increase during the flow test was measured while the well was producing 700 gpm. This increase meant the reservoir was recharging at a rate faster than the extraction rate. The flow test started ten hours after cessation of the drilling operations in which water was extracted at a rate estimated to be more than 1,000 gpm. Hence, it is possible the pressure gained during the flow test is a recharge from the higher extraction rate during drilling. Even so, the effective results of this phenomenon is that an extraction rate of 700-1000 gallons per minute results in effectively no drawdown. Since the reservoir recovered initial pressure within 30 seconds after the air lift stopped, the conclusion reached is that productivity of the reservoir is higher than calculated. For this well, the productivity is a function of the diameter of the drill hole which intersected the fault. An analogy to flow in pipes, the friction loss caused by flow of water through a 7 7/8-inch nozzle and then 300 feet of 8-inch steel pipe would cause 1 to 3 psi friction loss. Thus, the pressure sensor at 730 feet of depth is recording a pressure drop caused by friction loss during flow conditions.

When flow is reduced, so is friction loss, and a smaller pressure head loss is recorded. A slightly larger well bore (for example 10-inch) would decrease the friction loss, and result in productivity of 250 to 300 gpm per foot of drawdown.

Radius of Influence

$$r_i = \left(\frac{KT}{948\ \phi\mu C_t}\right)^{\frac{1}{2}}$$

$$= \left(\frac{13.506 \times 0.33}{948 \times 0.15 \times 0.455 \times 1 \times 10^{-5}}\right)^{\frac{1}{2}}$$

$$= 2{,}625 \text{ feet}$$

NOTE:
The calculated radius is based on Darcy's Laws. In this fault-dominated system it is unreasonable to believe that a symmetrical reservoir system exists. Instead, the influence of water extraction will be propagated along fault conduits. Using this as a model, NMSU PG-1 well, which is located 2,000 feet away, would be expected to be influenced only if a direct fracture link existed. The mapped fault system tends to eliminate this possiblity. The influence of high water extraction rates from the reservoir likely will be significant at much greater distances than calculated, along fault conduits.

Reservoir Volume

$$v = \frac{\phi\pi r i^2 h}{\beta}$$

$$= 1.15 \times \pi \times \frac{2{,}625^2}{1.04} \times 150 \times 0.1781$$

$$= 83.4 \text{ million barrels}$$

$$= 10{,}774 \text{ acre feet}$$

PART II, SECTION 5

EVALUATION OF WATER QUALITY

Formation water was sampled during each of the four timed fill tests. A complete analysis was performed only for samples #1 and #4. Results of this analysis are tabulated in Table II-8 which follows. This table also provides comparative data for the other NMSU geothermal wells.

Significant variances exist between DT-3 water and other NMSU wells. Relative to the pH values obtained under pressurized flow for the other wells, the reported value for DT-3 of 7.65 undoubtedly represents the effects of carbon dioxide release. A mechanically pumped sample more probably would have a pH of 6.25 to 6.3 (PG-1 and PG-3 values), which represents a slightly acidic water containing dissolved carbon dioxide. Carbon dioxide leaves the fluid stream as pressure is reduced; consequently, the pH increases. At equilibrium, the pH has been measured to be 8.35. Accordingly, the reported pH represents a stage in CO_2 evolution roughly 40 percent between the in situ conditions and final equilibrium.

As the CO_2 escapes, the pH increase causes a decrease in the solubility of calcium carbonate, which then precipitates. Because this was an airlift test, it was not possible to obtain a direct measure of dissolved gases. Instead, only subjective measures are available. During the twelve hours of drilling operations, and the eight hours of flow testing, a thick residue of calcium carbonate deposited on surface piping and valves. At the end of the test, the coating was 1/16-inch in thickness. This is a very rapid build-up, and suggests that the fluid is very enriched in carbon dioxide. Further, this build-up suggests that the formation fluid had a higher concentration of calcium (and perhaps magnesium) then the water analysis indicates.

As a crude, and probably imprecise measurement of the likely in situ calcium levels, and of the likely carbon dioxide level of the formation water, a comparison can be made with PG-1 and PG-3. From earlier analytical work performed by NMSU researchers, PG-1 and PG-3 had a pressurized fluid pH of 6.25 to 6.3. At that pH, the calcium level was 141 to 143 mg/liter. At a pH

of 7.95, the analysis was 82 mg/liter. For these samples, the reported CO_2 content was 210 to 220 cc per liter for these two wells. Using these values as a proxy, the rate of change of calcium per unit change in pH is roughly 37 to 1. (For each unit increase in pH level, the dissolved calcium decreases by 37 mg per liter.)

For fill test number 1, the calcium content was 103 mg per liter at a pH of 7.7. Using the proxy ratio, the possible calcium level at a pH of 6.3 can be estimated to be 155 mg per liter. Similarly, for fill test number 3, the calcium level is estimated to be 154 mg per liter at a pH of 6.3. If there is a linear correlation between calcium level and carbon dioxide content, the DT-3 well would have a CO_2 level some 8 percent higher than PG-1 and PG-3. This estimated value for DT-3 thus would be 240 cc of carbon dioxide per liter of fluid.

It is also instructive to review water hardness. PG-1 and PG-3 had a value of 248 to 249 mg per liter of hardness (as $CaCO_3$). The DT-3 water had 55 to 60 percent greater hardness. This factor suggests the in situ calcium level was even higher than estimated. It also is indirect evidence that the well intersected a carbonate stucture.

Although not conclusive, the above calculations are consistent with the high degree of carbonation exhibited by the fluid, and by the extremely rapid build-up of calcium carbonate.

An implicit assumption used in the preceeding analysis is that the geothermal waters originate in the same formations, and little or no shallower water mixing occurs. This assumption can be very much in error. Silicon dioxide levels should be a good indicator of possible mixing. PG-1 and PG-3 have SiO_2 levels of 68 to 70 mg per liter, and the significantly cooler PG-2 has a level of 71 mg per liter. The somewhat hotter DT-3 water had a silica level of 46.3 to 49.0 mg per liter. If anything, silica levels suggest a higher degree of mixing (at some point in the recharge cycle) for DT-3 water than for the other geothermal wells.

Fluoride, chloride and boron levels quite frequently are used to estimate mixing ratios. DT-3 levels for fluoride are higher than PG-1, but lower than PG-3. Similarly, the boron level of DT-3 is almost three times higher than PG-1. On the converse, the chloride level of DT-3 is some ten percent lower than PG-1. These analyses suggest that the waters from these NMSU wells might have a common origin, but the circulation patterns for recharge and reheating have exposed the DT-3 water to different strata than the other NMSU wells.

If the DT-3 well intersected a limestone strata, it would be expected that water chemistry would be similar to the first two Chaffee geothermal wells (12-24 and 35-25) both of which bottomed in Paleozic limestone below alluvial fill, and Chaffee well 55-25 which intersected a massive andesite strata before bottoming in limestone. Table II-9 is a tabular comparison of the DT-3 mean values with PG-1 and the three Chaffee wells. In turn, Table II-10 is a tabular comparison of the DT-3 mean value with the mean values from the first two Chaffee wells. As can be seen, this latter comparison indicates the DT-3 water is very comparable with Chaffee wells. This is indirect confirmation that DT-3 intersected a limestone formation.

With the exception of arsenic and boron, the values for the group of wells in Table II-10 fall within a ten percent variance. Since the analytical techniques are generally only 95 percent precise, the comparative analyses suggest a common origin for DT-3 and Chaffee waters. Two minerals are outside the 10 percent variance. Boron levels in DT-3 are almost double the values reported for the Chaffee wells. On the converse, arsenic levels reported for the Chaffee wells are more than ten-fold higher than DT-3.

Another significant water value is pizeometric head. If the DT-3 formation is hydraulically connected with the other NMSU wells, or with the Chaffee wells, it would be expected that the wells would have a common pizeometric head. As shown in Table II-11 the water level in DT-3 was at 347 feet below ground surface, or 3,865 feet above Mean Sea Level. In Table II-12 this level is compared with the measured values for NMSU wells PG-1 and PG-3, and with reported values for the Chaffee wells.

NMSU DT-3 has a pizeometric surface almost 20 feet higher than the other NMSU geothermal wells. This level is higher than Chaffee wells 35-25 and 55-25, and almost identical to Chaffee 12-24. These facts strongly suggest that DT-3 would share a hydraulic connection with the Chaffee wells, but would be separated from the other NMSU geothermal wells.

A detailed and comprehensive flow test would be required to document any direct or indirect hydraulic connections. Lacking such a test, reliance must be placed on other indirect observations. NMSU PG-1 was continuously in production at 185 gpm during the drilling and testing operation on DT-3. The wells are separated by a lateral distance of approximately 2,000 feet.

Production temperature and flow rate for PG-1 were monitored continuously for 60 days after the DT-3 test, and well head pressure was checked daily. No evidence could be seen for unexpected deviations in well production. This survey was not conclusive. Influence from DT-3 on PG-1 would be expected to show up in variations in water level, or temperature. Considering a fully-instrumented test of the PG-1 a d PG-3 interconnection in 1981, the influence of PG-3 production on PG-1 water levels represented a change in water level of only six inches, at a separation distance of 1,200 feet. This influence took 16 hours to show up in the observation well. Because the extraction rate from DT-3 was 4 to 6 times higher than the PG-3 production rate of 185 gpm during the referenced test, any effects on PG-1 would be expected to be more pronounced than observed from the PG-3 test. However, increased separation distance would tend to diminish these effects. Accordingly, it can be deduced only that if there is a connection between PG-1 and DT-3, the degree of influence would be expected to be minimal. Considering that several mapped faults lie between DT-3 and the other NMSU geothermal wells, it is unlikely that a hydraulic connection can exist. On a long-term basis, however, it is possible that continued high volume production from DT-3 would have an apprecible effect on the temperatures of PG-1, since this latter well is in direct communication with shallower and cooler ground water, and a high rate of extraction from DT-3 might represent diversion of heated water away from the fracture system feeding PG-1.

Of significance, no hydrogen sulfide odor was detected during the drilling and testing of DT-3. Trace odor of H_2S was detected during all previous NMSU geothermal drilling and significant levels of H_2S have been detected in PG-1, PG-2, PG-3, and the original disposal well. Hydrogen sulfide corrosion disabled the PG-1 pump in 1984; in June 1986 the new pump was removed for insection and the pump column again displayed severe H_2S corrosion. This H_2S is a shallow ground water problem not in evidence in the Chaffee wells. The apparent absence of H_2S from DT-3 water is additional indirect evidence that the DT-3 well has intersected water more similar to Chaffee wells than the other NMSU wells. Table II-13 provides data on H_2S levels for other NMSU wells, and Figure II-13 shows the relative location of NMSU and Chaffee geothermal wells.

TABLE II-8

CHEMICAL ANALYSIS OF DISSOLVED SOLIDS (mg/ℓ)

NMSU Geothermal Wells

	PG-1	PG-3	GD-2 (468[1])	GD-2 (840[1])	DT-3 (Group I) (During Drilling)	DT-3 (Group II-1) (During Flow Test)	DT-3 (Group II-4) (During Flow Test)
pH	6.30	6.25	7.65	7.80	6.72	7.70	7.56
µmhos	3110	3120	3120	2680	2800	2720	2,790
TDS	2010	1981	1948	1787	1818	1695	1,854
NA	488	488	428	386	428	430.9	449.1
K	54	52	44	35	74	59.0	48.8
Ca	143	141	130	15	132	102.9	107.4
Mg	18.6	18.8	36.0	36.6	32.1	31.4	32.6
Cl	584	546	574	40	570	528.3	528.3
CO_3	0	0	0	0	0	0	0
HCO_3	620	610	422	94	487	462.5	489.4
SO_3	250	240	315	80	251	232.4	289.2
Fe	2.8	5.0	1.28	00	0.22	0.05	<0.05
Mn	0.11	0.11	0.09	13	1.22	<0.02	<0.02
Hardness	NA	NA	NA	NA	460	386	402
Alkalinity	NA	NA	NA	NA	399	379	401
As	<0.004	<0.004	<0.001	0.001	<0.001	0.007	0.006
Ba	0.04	0.04	0.08	0.09	0.07	0.07	0.08
Cd	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cr	<0.05	<0.05	<0.02	<0.02	<0.05	<0.02	<0.002
Pb	<0.005	<0.005	0.005	0.005	<0.005	<0.005	<0.005
Hg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Se	<0.002	<0.002	<0.001	0.001	<0.001	<0.001	<0.001
Ag	<0.05	<0.05	0.05	0.05	<0.05	0.02	<0.02
NO_3-N	0.03	0.02	0.01	0.02	<0.01	0.05	0.03
F	1.27	NA	1.29	0.55	1.78	2.00	2.08

TABLE II-9

COMPARISON OF DT-3 MEAN VALUES WITH NMSU PG-1 AND CHAFFEE WELLS
(VALUE IN mg/ℓ)

	DT-3 Avg.	PG-1	35-25	12-24	55-25	
Conductivity	2,755	3,110	2,580	3,000	2,300	
TDS	1,775	2,010	1,626	1,968	1,480	
pH	7.63	6.56	8.05	7.57	7.46	
Hardness ($CaCO_3$)	383	NR	NR	383	377	
Alkalinity ($CaCO_3$)	401	NR	NR	356	306	
Na	440	488	397.5	392.4	350.8	
K	53.9	54	54.7	58.3	53.2	
Ca	105.1	143	129.2	107.4	96.9	
Mg	32.0	18.6	31.2	28.0	33.0	
Cℓ	528.3	584	496.3	499.2	482.2	
HCO_3	476.0	620	394.2	448.7	373.4	
SO_4	236	250	300	220.8	198.0	
As	0.007	<0.004	0.014	0.003	0.001	
Ba	0.07	0.08	<0.4	<0.4	0.08	
Fe	0.05	2.8	0.22	0.13	0.10	
B	0.48	NR	0.36	0.18	0.58	Tap Water 0.04
F	2.04	1.27	2.16	2.20	2.41	
SiO_2	47.7	NR	56.5	50.9	51.5	

TABLE II-10

COMPARISON OF MEAN VALUES FOR DT-3 WITH CHAFFEE WELLS
(VALUES IN mg/ℓ)

	DT-3 Mean	Chaffee Mean
TDS	1,775	1,797
pH	7.63	7.81
Hardness ($CaCO_3$)	383	383
Alkalinity ($CaCO_3$)	401	356
Na	440	395
K	53.9	56.5
Ca	105.1	118.3
Mg	32.0	29.6
Cℓ	528.3	497.8
HCO_3	476.0	421.5
SO_4	236	260.4
As	0.007	0.085
Ba	0.07	<0.4
Fe	0.05	0.17
B	0.48	0.27
F	2.04	2.18
SiO_2	47.7	53.7

TABLE II-11
WATER DEPTH AT TEST START

Initial Conditions

1. Tool set at 730 feet below KB.
2. Recorded pressure 159 psia, or 146.4 psig.
3. KB is 9.3 feet above ground level.
4. Ground level is 4212 feet above Mean Sea Level.
5. Density of water at 145 °F is equivalent to 2.3476 feet per psi.

Calculations

1. Feet of water above pressure tool:
   146.4 psig x 2.3476, or 343.7 feet.

2. Depth below KB to water level:
   730-343.7, or 356.3 feet.

3. Depth below ground level to water level:
   356.3-9.3, or 347 feet.

4. Water level, feet above MSL:
   4,212-347, or 3,865 feet.

TABLE II-12

WATER LEVEL -- NMSU AND OTHER GEOTHERMAL WELLS

Well	Water Level, Feet above MSL	
NMSU PG-1	3,838	
NMSU PG-3	3,837	
Chaffee 35-25	3,855	Note 1
Chaffee 12-24	3,866	Note 2
Chaffee 55-25	3,847	Note 3
NMSU DT-3	3,865	

NOTES

1. Reported in Table C-1 and Figure C-1, Reference 21. This level has been adjusted to conform with the true surface elevation, which is much lower than reported.

2. Reported in Table C-3 and Figure C-2, Reference 21. This level has been adjusted to conform with the true surface elevation, which is much lower than the author reported.

3. Reported in Reference 29. This was the surface of water in the well bore two years after the well was completed.

TABLE II-13

H_2S Content of NMSU Geothermal Wells

(mg/ℓ)

Date	PG-1	PG-2	PG-3	GCW
1981	<0.038	<0.038	<0.038	0.51[3]
1982	0.06	0.15		
15 Mar 83	0.21	---	---	
14 Apr 83	---	---	0.07	
22 Jun 83	---	2.50[1]	---	
26 Aug 83	0.30			
26 Sep 83			<0.10	
7 Oct 83			<0.10	
1 Nov 83		0.15[2]	0.07	
15 Dec 83	0.13[2]			
12 Jan 84		0.24	0.16	

1. Value is abnormally high, and suggests possibly either a sampling or a measurement error occurred. However, elevated H_2S levels in this well contributed to failure of original shell-and-tube heat exchanger for this service, in less than two years of operation.
2. Indicates analysis after well had been treated with sodium hypochlorite to determine if H_2S concentration was the result of anerobic bacterial action. Reduction in H_2S level is strong corroberation that much, if not all, of the H_2S does result from bacterial decomposition of organic matter. When the results of the well treatment were discussed with Dr. John Zack of the NMSU Biology Department, and Dr. Edward Lasherly, Department of Biology, University of Calgary, consensus was that the H_2S almost surely was the result of anerobic, sulfate-reducing bacteria. Source presumably from the shallower ground water. (Personal Communications)
3. Sample acquired in November 1980, and data reported in May 1981, before geothermal wells had been in service. This Golf Course well was drilled in 1960; taken out of service in 1970. Water sample was taken incident to installation of a small pump (20 gpm) which was being used to attempt to extract water to see if stable conditions could be measured. H_2S odor was very pronounced in well house.

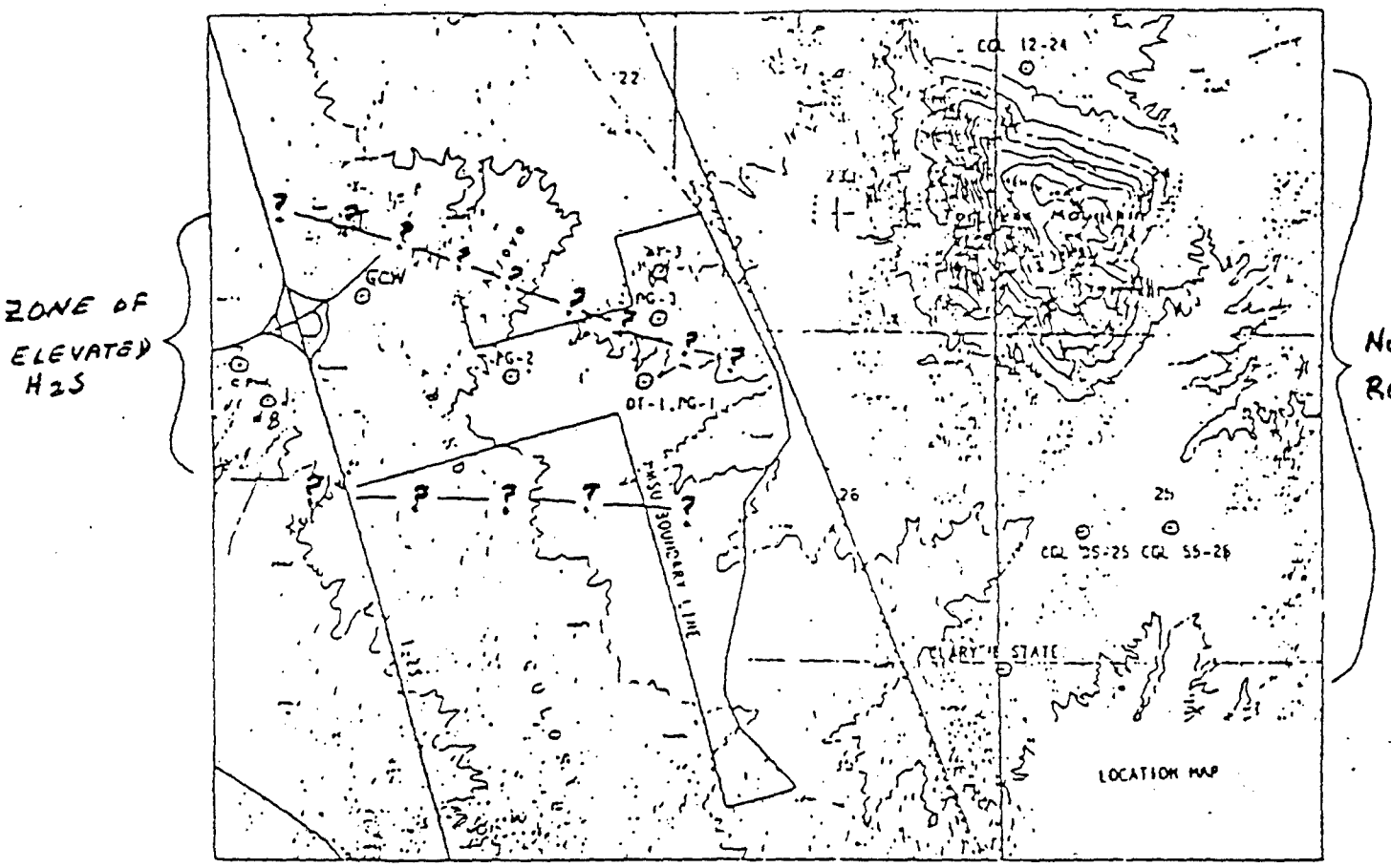


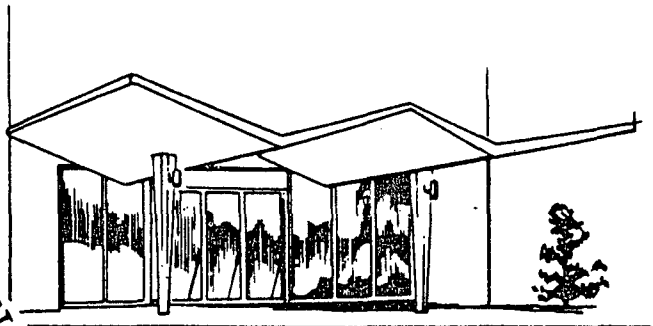
Figure II-13 Location map for New Mexico State University (NMSU) and private industry wells in the vicinity of Tortugas Mountain

NMSU GEOTHERMAL WELL PG-4
24-hour Pump Test

by

Roy A. Cunniff

September 1986



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1. BACKGROUND

A 24-hour pump test was conducted on NMSU Geothermal Well PG-4 from 0800 hours August 21, 1986 to 1100 hours August 22, 1986. The well is 1,015 feet deep with slotted liner from 735 feet to 1,012 feet of depth. The casing is 14-inch (OD) to 680 feet, with 8-inch ID from 660 to 985 feet, and 5 1/2-inch OD from 974 to 1,015 feet. Slotted interval extends from 735 feet to total depth. Lowest 25 feet interval is 7 7/8-inch open hole completion in a bedrock fault zone into which was placed the 5 1/2-inch slotted liner. Static water level is at 366.5 feet of depth, referenced to the top of the existing 14-inch casing.

An 8-hour drill stem test was conducted at the conclusion of drilling activities on 28 April 1986. This test indicated the open hole well could produce geothermal water at a productivity of 100 gallons per minute per foot of drawdown, at a produced temperature of 146 °F. Formation permeability was calculated to be 13.5 Darcys, with a radius of influence of 2,625 feet and a reservoir volume of 10,774 acre feet. From the carbonate buildup on surface flow lines, it was suspected that the formation water contains elevated levels of dissolved carbon dioxide.

2. TEST OUTLINE

The pump test was planned so as to provide quantitative data on the hydrological behavior of the well at sustained high flow rates, and to measure quantitatively the constituent dissolved minerals and gases. The latter factor required setting and maintaining an equilibrium flow rate of 250-300 gpm. To acquire accurate measurements, the flow rate of 250-300 gpm would be passed through a newly installed gas separator. This low rate of flow would not have provided a significant stress for the aquifer; hence a multi-phased test was planned.

- The flow rate initially would be set at or near 600 gpm, and would be maintained at that rate for 8 hours.

- A lower flow rate (250 to 300 gpm) would be established and maintained for 4 hours to assure equilibrium conditions were established in the gas separator.

- A final 12-hour steady state flow rate of 600 to 700 gpm would be maintained to test conclusion.

- Water samples would be acquired hourly for follow-on analysis. Gas samples would be acquired at frequent intervals up to a maximum of 10 samples, to include wellhead sampling of gas where pressure was flashed to atmospheric, as well as tests using a newly-installed gas separator with pressure flashed from 100 psig to 55 psig. Assistance would be obtained from contractual support provided by Dr. Otto Vetter, of Vetter Research.

- Surface and down-hole conditions would be monitored continuously during the test.

- The observation well OW-1, located 1,750 feet southwest of PG-4, would be monitored continuously for water level and for the temperature of the water at the 500-feet horizon. If possible, monitoring operations also would be conducted for PG-3, located 850 feet southeast of PG-4.

3. SUMMARY OF TEST RESULTS

Although the tests and resulting analyses were hampered by equipment malfunctions, the tests results confirmed an excellent geothermal resource. Key observations and conclusions are summarized as follows:

- Because of pump problems, a series of step-flow tests were completed. Although not as conclusive as a long-term test, Summers has shown that step-flow tests can correlate very closely with longer flow tests. (Reference 1)

- The completed well displays a productivity of at least 100 gallons per minute per foot of drawdown. An average flow rate of 675 gpm was

maintained for 24 hours of pumping. At the tested peak flow rate of 1,450 gpm, the instantaneous drawdown was 16 feet, of which 12 feet represented well bore and pump column friction losses. In the first half of the test period, sustained flow rates of 700 to 800 gpm resulted in a drawdown of 6.5 feet. In the latter half of the test period, sustained flow rates of 700 to 800 gpm resulted in a drawdown of 6.3 feet. (See Hydrology analysis at Appendix A.) For all flow rates, the well reached a recharge boundary within a few minutes after the flow rate was changed.

- Interference between PG-4 and OW-1 was minimal. Measured deviation of water level in the observation well was 1.2 inches. From calculations at Appendix B, the low rate of interference between the wells indicates the fault-fracture system is likely the source of geothermal water at PG-4.

- Produced temperature was constant at 146 ± 0.25 °F at all flow rates between 500 and 1450 gpm. A temperature rise to 148 °F was noted during a 3-hour dissolved gas test at 250 gpm. This increase in temperature was caused in part by friction generated by pump mechanical action at low flow rates (temperature rise of 0.6 °F). (See Appendix C). The adjusted well head temperature of 147.4 ± 0.25 °F represents a true measure of increased temperature at low flow rates. This temperature variation between high and low flow rates suggests two different aquifers were being pumped, with probable mixing and cross-flow occuring.

- Mineral content of the water is 1,760 milligrams of dissolved minerals per liter of fluid. Analysis of fluid samples indicate no variance exists between the dissolved mineral content at low or high flow rates. With the exception of silica and fluoride values there is not a significant variance detected between PG-4 and other NMSU geothermal wells. (See Appendix D and Special Report by Vetter Research.)

- Dissolved gases consist mainly of nitrogen and carbon dioxide. Dr. Otto Vetter has concluded that two different flow regimes are intermixing. At higher flow rates, (700 - 750 gpm) PG-4 produces 15 percent less CO_2 than PG-1, but slightly higher levels of N_2.

- At higher flow rates, PG-4 produces 16% less gas per gallon of fluid than PG-1 when flashed to atmospheric pressure. At lower flow rates, PG-4 produces only one-third as much gas when flashed from reservoir pressure to a controlled pressure of 54 psig.

- Gas analyses tend to confirm existence of a mixed reservoir, with probable cross-flow occuring. Gas generation at lower flow rates tends to confirm that this reservoir has a somewhat higher pressure, which also is confirmed by the slightly higher temperature produced at lower flow rates.

- Hydrogen sulfide, if present at all, is below detection limits. However, air drilling operations might have resulted in excess air injected into the reservoir, which would tend to oxidize the H_2S. Moreover, because the open screen section of PG-4 has the potential to communicate to a limited extent with other NMSU geothermal wells, it is possible that full scale usage of this well could eventually cause migration of slight amounts of H_2S to PG-4.

- The possible presence of entrapped air causes computational difficulties in establishing a bubble point pressure. From data presented in Appendix D, it is likely that the bubble point pressure is 105 psia for PG-4 and 120 psia or higher for PG-1 and PG-3. Above this level, we would expect to see shortened pump life and accelerated corrosion of the pump column. This factor could account for previous pump problems. If this bubble point pressure is 105 psia, for a production rate of 600 gpm, the pump setting depth should be at least 585 feet in PG-4.

4. TEST PROCEDURES

4.1 Downhole Equipment

The pump was installed and operated by Western Pump and Supply Company of Deming, NM. A Simmons turbine pump was installed with a 6-stage Simmons SJ12H pump bowls. The unit consisted of a 1½-inch shaft, 2½-inch oil tube, and 8-inch pump column. A 200 horse power Randolph gear drive with

2:3 gear ratio was set on top of the pump. The pump was driven by a 350 horse power Cummins diesel engine. Pump suction was set at 518 feet of depth. This pump and motor combination was designed to produce 600 gpm at not less than 600 feet total dynamic head.

Downhole instrumentation consisted of a tandum unit supplied by FLOPETROL- Johnston. Two separate but identical SSDP units were supplied. Each tool consisted of a strain gauge pressure sensor accurate to within ± 5 psi with a resolution of 0.02 psi. The temperature channel was accurate to within ± 1 °F with a resolution of 0.12 °F. Both units also contained a clock-operated EPROM data storage unit. Data sampling rate was set at a 30 second interval; however the length of the test and limited data storage caused a further limitation. Pressure and temperature values were recorded only when the value was 0.0046 psi higher or lower than the last recorded value. Tools were set in the well using a fixture threaded to the pump suction, with one tool at 545 feet and the second tool at 553.85 feet. (Both depths are referenced to the top of the 14-inch casing.) Based on water level measurements made just before the pump was set, the shallow tool sensed pressure 2.5 percent lower than the true pressure. The deeper setting tool sensed pressure to be 3.0 percent higher than true pressure. In a dynamic environment, the tools measured and recorded pressure changes which were almost identical for both tools. Because the battery-operated clocks were started automatically, the starting times are different for the two tools. In addition, the 30-second sampling intervals are slightly off-set, so that the aggregate data set contains samples somewhat more frequently than once each 30-seconds.

A surface flow line consisting of 8-inch steel pipe was connected to the pump head. This flow line was equipped with pressure and temperature ports, and was regulated by an 8-inch gate valve at the point of discharge into the 10-inch disposal line which empties into the reserve pit 100 feet from the well.

A gas separator fixture was installed adjacent to the well head. This consisted of a cylindrical steel tank some 10 feet high, and 2 feet in diameter. Geothermal water from a 2-inch steel pipeline connected with the flow line, was introduced into the side of the separator. A top vent was used for gas sampling, and the bottom drain emptied into a 2-inch steel line connected with the disposal line. The vessel was equipped with sight glasses, pressure and temperature ports, control valves, and sampling ports. The unit was designed to handle steady state flow rates of 250 to 300 gpm, with a useable gas collection volume of 12 cubic feet. Water and gas collection and analysis was contracted to Vetter Research and field operations were conducted by Dr. Otto Vetter.

See Appendix E for a description and inventory of other test and measuring equipment used in the test.

4.2 Conduct of Test

The test was started at 0800 hours, 21 August 1986. Initially the pump rate was set at 1600 RPM. A shut-in test was conducted at 0806 hours to compare pump performance with the manufacturer's curve. Back pressure was then set at 50 psig. Initially, flow was only estimated because the primary flow measuring equipment failed to work properly. The backup flow recorder, which is a Polysonic single-position doppler unit, was installed and used for the balance of the test. Well head pressure was allowed to fluctuate for the initial two hours to acquire various gas measurements. The pressure was set at 44-48 psig and maintained at that level until 1500 hours. During this total of 7 hours of production, the flow rate ranged from 550-700 gpm through the surface flow line, with an additional 100-150 gpm routed through the gas separator at various times. (Total flow rate was 700 - 800 gpm.) These tests indicated that the well head pressure would have to be set at or near 100 psig in order to provide a controlled pressure environment of at least 55 psig in the gas separator. This pressure was selected as the most likely bubble point pressure for CO_2 based on a review of earlier gas measurements for PG-1.

At 1500 hours, the well head pressure was increased to 100 psig. Within a few minutes, the combination of thermal expansion and the high pressure caused the Dressor coupling between the well head and the flow line to fail. Pressure was immediately reduced but the coupling continued to leak. The pump was shut down for ten minutes to repair the coupling. Flow was resumed at 1545, and pressure was gradually increased to 94 psig. The gas separator flow would not stabilize, so the pressure was increased to 110 psig at 2000 hours. At this point the flow rate was reduced to approximately 240 gpm, and routed entirely through the separator. Flow was to be allowed to stabilize for two hours. At 2120 hours, the main O-ring seal on the pump base failed. Wellhead pressure was reduced to zero, but major leakage still occured. Several hours were spent attempting to make adjustments. Because of concern that the leaking water would wash away the sand underneath the pump base, which could cause the pump to shift and break the shaft, the pump was shut down at 2242 hours. A replacement O-ring seal was provided by the vendor, and was reinstalled.

Pumping resumed at 0130 hours 22 August 1986. Effectively this was a step-test from a reservoir at initial conditions, as indicated by the SSDP tools.

Initially, the flow was maintained in a full discharge mode, with zero back pressure. The flow rate was allowed to go to pump maximum (1450 gpm) in order to accelerate ground water movement. This rate was maintained until 0200 hours. A recharge boundary was reached at $\Delta t = 7$ minutes. Flow was then reduced to 250 gpm, and was routed through the gas separator. Well head pressure was set at 105 psig with the gas separator pressure set at 54-58 psig. Flow was continued at this setting until 0500 hours. At 0500 hours the flow was set at 700 to 800 gpm with a surface pressure of 65-66 psig, and this flow rate was maintained to test conclusion at 1100 hours, 22 August 1986. A final shut-in test of the pump was conducted just before the pump was turned off.

A shut-in pressure recovery test was then conducted from 1100 to 1300 hours. Surface measurements indicated the water level had reached original levels; accordingly the test was concluded and the pump was removed. Downhole instrumentation was recovered at 1730 hours, and the data were retrived from the EPROM by 1900 hours. One significant factor was noted during pump removal. The bottom of the lower pressure tool had impacted the top of the 1-inch cementing line left in the well at the conclusion of drilling activities. As a result the fixture hanger was badly mangled. The top of the 1-inch pipe is located at a depth of 566 feet. This pipe should be removed before a permanent pump is installed.

APPENDIX A
CALCULATIONS OF RESERVOIR HYDROLOGY FACTORS

1. Background

For this section, the calculations are based on work defined by Earlaugher (Reference 7), which have been adapted for water well terminology. These methods are used extensively for evaluating petroleum wells, and have gained significant use in evaluating geothermal wells in the past ten years.

2. Assumptions

a. The flowing fluid is single phase, with small and constant compressibility.

b. The medium is homogeneous and isotropic, and the porosity is constant.

c. The radial-cylindrical flow model is applicable, and the reservoir is infinite acting.

d. Fluid and rock properties are independent of pressure; gravity effects are negligible.

3. Transmissibility

$$\text{Transmissibility} = kh = 162.6 \frac{q\mu\beta}{m}$$

where k = Permeability (md)

h = Aquifer formation thickness (ft)

q = Flowrate (bbl/day) (= 23,143 bbl/day @ 675 gpm)

μ = Viscosity (cp) (= 0.455 CP @ 145 °F)

B = Formation volume factor (≈ 1.04)

m = Slope (= 0.259, see Attachment)

From (1), $kh = \frac{162.6\ (23,143)\ (0.455)\ (1.04)}{0.259}$ md-ft

or, kh = 6,875,200 md-ft

Assume h = saturated thickness = 600 feet (water table to bedrock)

$$K = \frac{kh}{h} = \frac{6,875,200}{600} = 11,308 \text{ md} = 11.3 \text{ Darcys (Completed well)}$$

K = 13.0 Darcys (Openhole Completion for m = 0.26 and h = 600)

4. Skin Damage

$$\Delta P_{skin} = 0.87\ ms$$

where s = skin factor $= 1.151 \left[\left(\frac{P_{1hr} - P_{wf}}{m} \right) - \log \left(\frac{k}{\phi \mu c r_w^2} \right) + 3.23 \right]$

where P_{1hr} = Pressure after shutdown for 1 hr. (= 97.16 psi)

P_{wf} = Pressure during flowing (94.49 psi)

ϕ = Porosity (= 0.10 as a typical value)

r_w = Casing radius (= 0.311 feet for completed well)

h = Formation thickness (assume 600 ft)

m = Slope = 0.259

c = Compressibility (= 6.0×10^{-6} $PS1^{-1}$ as a typical value)

Thus s = 1.151 (10.3 - 11.66 + 3.23)

= 1.85 psi

ΔP_{skin} = 0.87 (0.259) (1.85) psi

= 0.42 psi

5. Productivity

$$PI = q/(P^* - P_{wf} - \Delta P_{skin})$$

where P^* = Pressure at infinite time after shutdown (= 97.22 psi)

Thus,

$$\text{Productivity} = \frac{23{,}143 \text{ bbl/day}}{(97.22 - 94.49 - 0.42) \text{ psi}} = \frac{10{,}018 \text{ bbl}}{\text{day psi}} = \frac{292 \text{ gpm}}{\text{psi}}$$

In terms of gpm per foot of drawdown:

Productivity = 124 gpm/ft

6. Radius of Influence

$$r_i = \left(\frac{KT}{948\ \phi\mu C_t}\right)^{\frac{1}{2}}$$

$$= \left(\frac{11{,}308 \times 1.0}{948 \times 0.10 \times 0.455 \times 6 \times 10^{-6}}\right)^{\frac{1}{2}}$$

= 6,610 feet

NOTE: The calculated radius is based on Darcy's Laws. In this fault-dominated system it is unreasonable to believe that a symmetrical reservoir system exists. Instead, the influence of water extraction will be propagated along fault conduits. Using this as a model, NMSU OW-1 well, which is located 1,750 feet away, would be expected to be influenced only if a direct fracture link existed. The mapped fault system tends to eliminate this possiblity. The influence of high water extraction rates from the reservoir likely will be significant at much greater distances than calculated, along fault conduits.

7. Reservoir Volume

$$V = \frac{\phi \pi r_i^2 h}{\beta}$$

$$= 0.10 \times \pi \times \frac{6{,}610^2 \times 600 \times 0.1781}{1.04}$$

= 1,410 million barrels

= 181,600 acre feet

NOTE: This reservoir volume assumes a uniform reservoir, acting uniformly radially around the well bore. This is not reasonable. Accordingly, the true reservoir volume will be only the saturated pore space, solution channels, and fault intersections within the reservoir. If the assumed value for porosity (ϕ = 0.10) is valid, the reservoir can produce without recharge only 18,600 acre feet. Since a recharge boundary was reached very quickly (See Figure A-1) with no temperature decline, the conclusion is reached that the calculated volume is a valid approximation of the rock-water structure. Since the rock mass will reheat the recharge water, the inference is that the reservoir to all intents and purposes is without limit.

Figure A-2 is representative of the pumped flow rate vs time for the duration of the test. Figure A-3 contains data extracted from the FLOPETROL-Johnston report as to drawdown vs time for the duration of the test.

Figure A-1. Drawdown vs Log Time for PG-4 (Second Step Test)

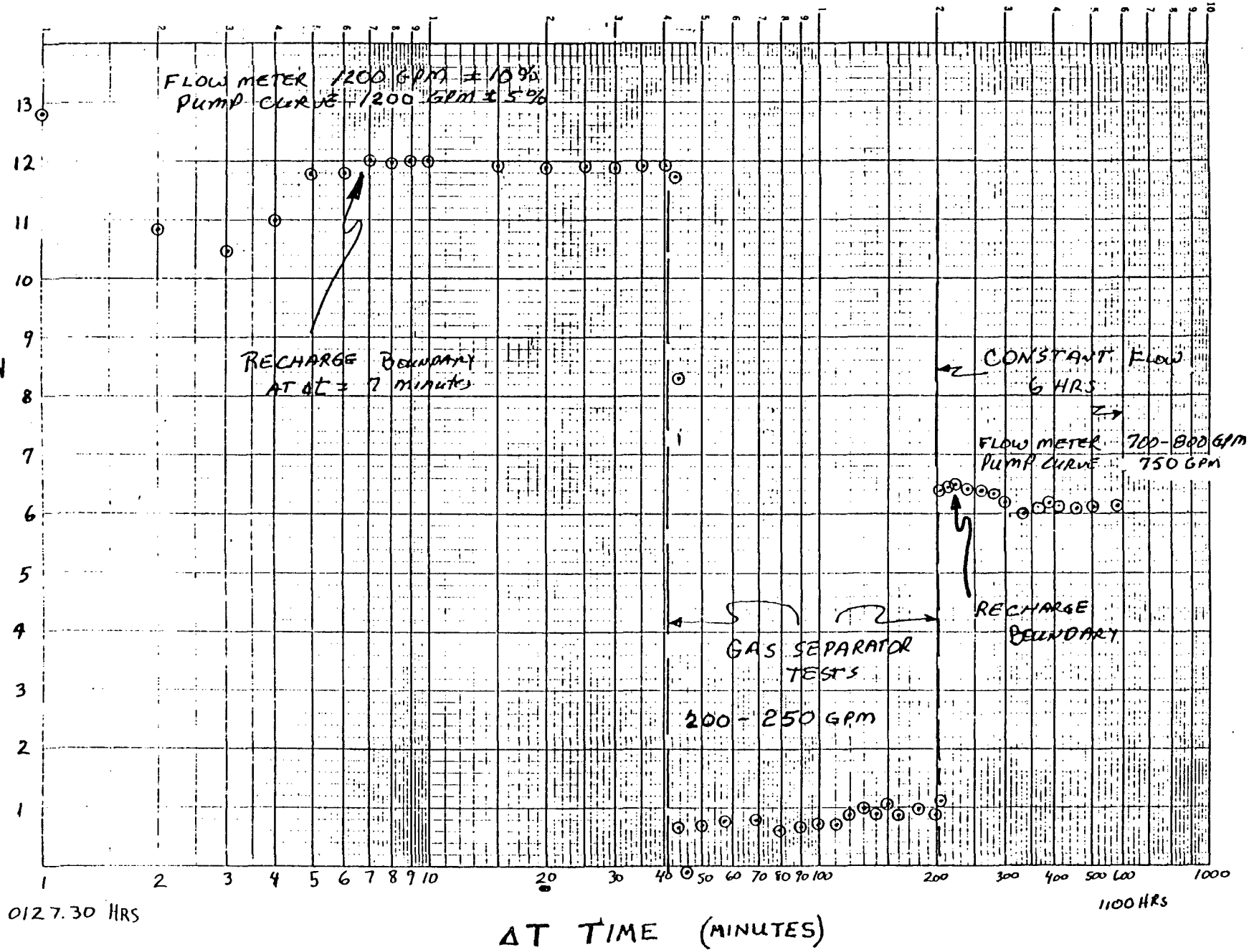
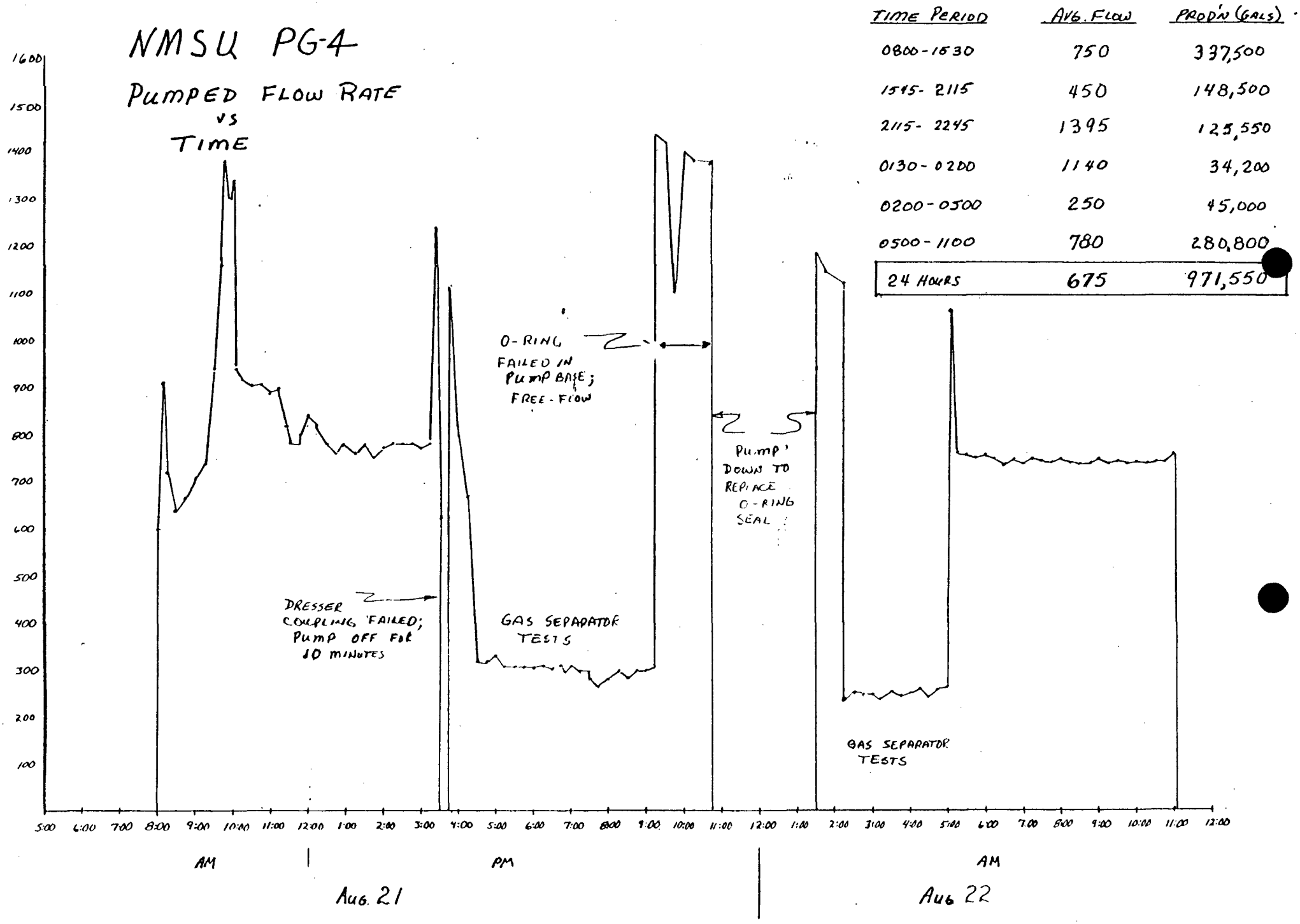


Figure A-2. NMSU PG-4 Pumped Flow Rate vs Time.



TIME PERIOD	AVG. FLOW	PRODN (GALS)
0800-1530	750	337,500
1545-2115	450	148,500
2115-2245	1395	125,550
0130-0200	1140	34,200
0200-0500	250	45,000
0500-1100	780	280,800
24 HOURS	675	971,550

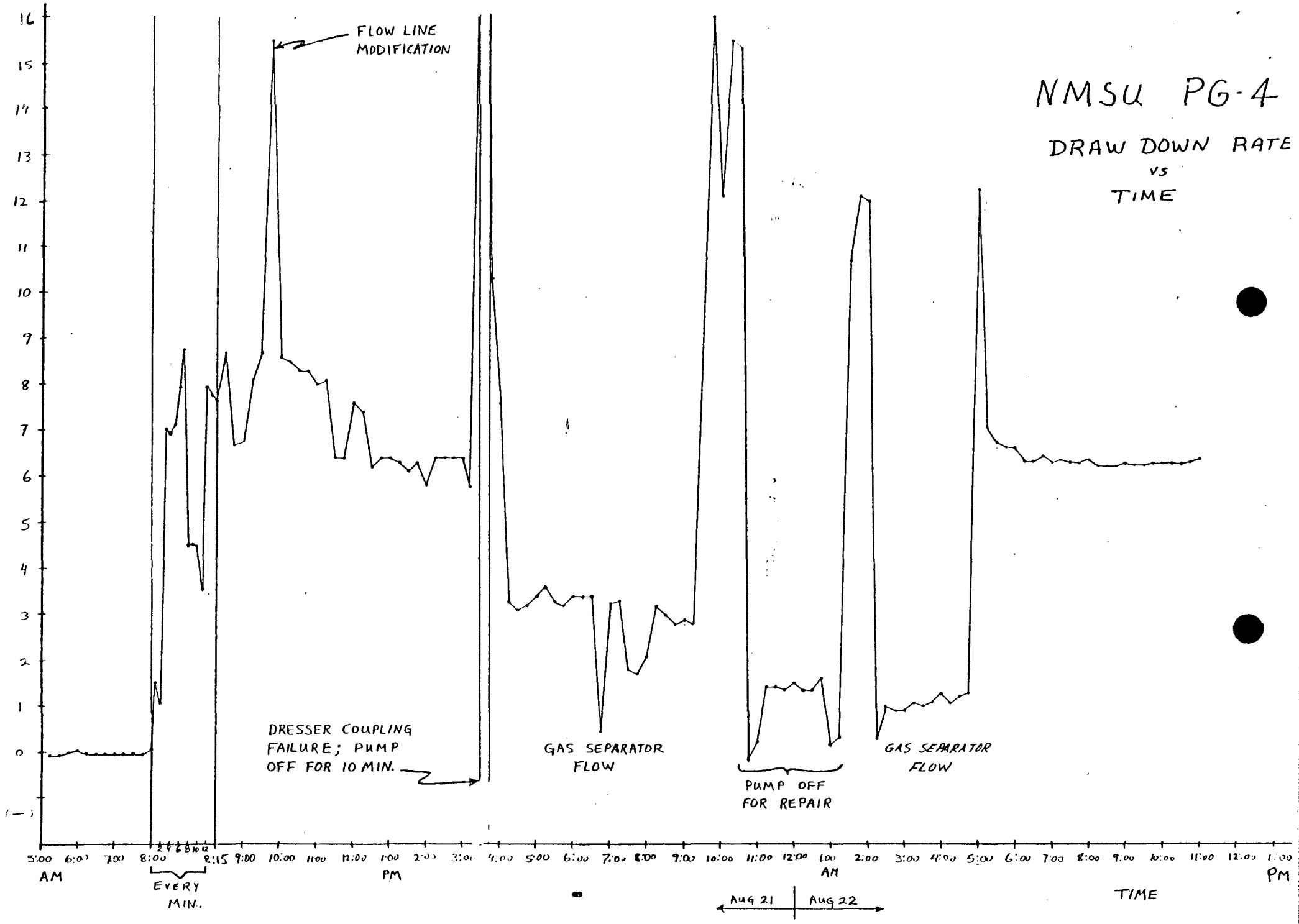


Figure A-3. NMSU PG-4 Drawdown Rate vs Time.

ATTACHMENT 1 TO APPENDIX A
COMPUTING HORNER SLOPE, m

1. The slope of the pressure-recovery curve for the values of ΔP vs Log $\frac{tp + \Delta t}{\Delta T}$. This slope is defined as m, and the shape of the curve together with the slope have proved to be useful indicators for computing well and formation losses, reservoir life, radius of influence, and reservoir parameters such as permeability and transmissibility. It is noted that the reservoir engineers have defined transmissibility as the product of permeability (measured in millidarcies) and reservoir thickness. As a consequence, this transmissibility term has dimensions of millidarcy-feet, or length cubed. Hydrologists for water wells also have a term for transmissibility, which has units of gallons per day per feet of aquifer thickness. Using dimensional analysis, the hydrologist value of 4,000 GPD/ft is equal to approximately 78,000 md-feet. For this reservoir, where h is assumed to be 600 feet, the permeability would be 130 md.

2. For well PG-4, the Horner plot is at Figure A-4, attached. The value of m must be obtained at a large value of ΔT, when the rate of change of pressure with respect to time (DPDT) $\approx$ 0. This Horner plot shows almost instantaneous recovery to original pressure at Δt = 1 minute; thereafter, the DPDT value oscillates slightly above and below original pressure. At the end of the shut-in period (ΔT = 60 minutes) observed reservoir pressure was higher then original pressure. For these reasons, the Horner plot cannot be used for a graphical solution to find slope, m.

3. The instantaneous value for slope m = f (DPDT) also can be computed from the data acquired by the pressure tool, which sampled at 5-second intervals. Representative values were calculated. For example, at ΔT = 13 minutes, m = 0.335; at Δt = 45 seconds, m = 0.2896; and at Δt = 53.5 minutes, m = 0.245. Those positive values for m are matched by negative values of similar magnitude. A weighted average value is m = 0.318.

4. Earlaugher (Reference 7) also developed expressions for a phenomenon termed "infinite reservoirs". These reservoirs are characterized by very high values of permeability and transmissibility, high productivity, and very rapid equilibrium after shut-in. To use the expressions for "infinite reservoirs", Earlaugher developed these new terms.

$$\text{"Dimensionless Time"} = T_D = \frac{2.637 \times 10^{-3}\ kT}{\phi\mu\ C_T\ r_w^{\,2}} \qquad (1)$$

$$\text{"Dimensionless Pressure"} = P_D = -\frac{1}{2}\left[E_i\ (-x)\right] \qquad (2)$$

$$\text{where } (-x) = \frac{R_D^{\,2}}{4T_D}$$

$$\text{"Dimensionless Radius"} = R_D = \frac{r_i}{r_w} \qquad (3)$$

where r_i = radius to observation well

r_w = radius of test well

R_D = 1.0 for well-bore test

Using these expressions, if the ratio $\Delta T \div r_i^{\,2} > 100$

then (2) becomes

$$P_D = \frac{1}{2}\ \text{In}\ \frac{TD}{R_D^{\,2}} + 0.80906 \qquad (4)$$

and also

$$P_D = \left(P_{avg} - P_{wf}\right) \frac{1}{141.2\left(\frac{\phi\mu}{KT}\right)}$$

5. Substituting the appropriate values in the above equations produces a calculated value of permeability = k = 15,662 md for t = 5 seconds. This value for k, together with an assumed value of reservoir thickness of 600 feet (saturated depth from water level to bedrock for PG-4) produces a value of m = 0.20.

6. The tested configuration of the well PG-4 is different from the well tested in the drill stem test. Largest difference is the fact that the open hole used for the drill stem test has been partially blocked by inserting a slotted liner so that the effective cross-sectional open area is equivalent to a radius of 0.311 feet compared with the value used for drill stem test of $r_w = 0.328$. Since P_D increases with decreasing r_w, the perceived transmissibility will decrease, as will perceived permeability. For this reason, the value of m used to estimate transmissibility was chosen to be m = 0.26, which is midway within the range of values m ≈ 0.318 to m ≈ 0.20 which the alternative calculations would indicate are representative values.

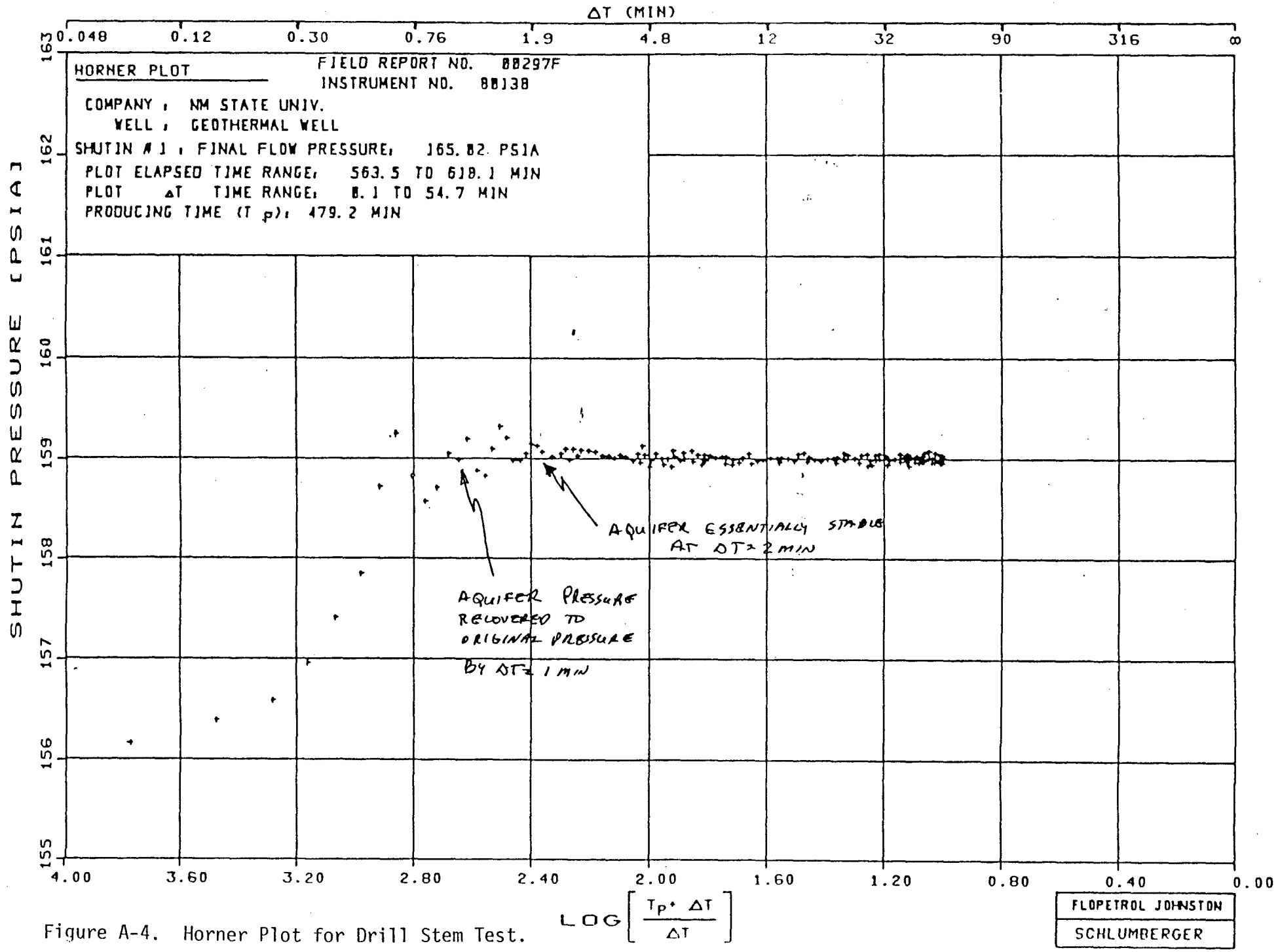


Figure A-4. Horner Plot for Drill Stem Test.

ATTACHMENT 2 TO APPENDIX A
SHUT-IN PUMP PRESSURE TESTS

Test #1 (0805 - 0809 Hours, 26 August)

Indicated RPM: 1500 - 1600
Pressure: 78 psig
Total Head (Feet)
Pressure: 183
Static: 366.5
Drawdown: 5.5
555 ; Equals 92.5 Ft Hd/Stage

From pump affinity laws, this head is developed at 1,650 RPM. (RPM gage was incorrectly read as low, or was low.)

Test #2 (1100 - 1105 Hours, 27 August)

Indicated RPM: 1800
Pressure: 122 psig
Total Head (Feet)
Pressure: 286.7
Static: 366.5
Drawdown: 6.3
660 ; Equals 109 Ft Hd/Stage

From pump affinity laws, this head is developed at 1,803 RPM. (RPM gage is essentially correct.)

APPENDIX B
INTERFERENCE TESTING

1. In the following discussion, the same first four assumptions have been made about the reservoir and its fluids as earlier in Appendix A. Additionally, the following assumptions have been made about the behavior of the reservoir prior to and during the interference test:

   a. Initially, the pressure throughout the reservoir is uniform.

   b. A long-duration, constant flowrate modification is started at the active well, and the pressure change is monitored at a shut-in observation well.

   c. The reservoir is infinite acting, and wellbore storage and skin effects are minimal.

2. With these assumptions, the basic equation relating the pressure change at the observation well to reservoir and fluid parameter is:

$$P_i - P(r,t) = \Delta P = -70.6 \frac{q\mu B}{kh} \cdot \left[Ei \left(- \frac{r^2 \phi \mu c_t}{0.001055\ kt} \right) \right]$$

where

P_i = initial reservoir pressure, psi

$P(r,t)$ = pressure at observation well, psi

Δ = pressure change at observation well, psi

q = flowrate at active well, STB/D

μ = viscosity, cp

B = formation volume factor, RB/STB

k = permeability, md

h = thickness ft

r = distance between active and observation wells ft

ϕ = porosity, fraction

c_t = system total compressibility, psi^{-1}

t = time, hours

Ei = exponential integral function, defined by

$$Ei(-x) = -\int_x^{\infty} \frac{e^{-\gamma}}{\gamma}\, d\gamma$$ (See Figure B-1.)

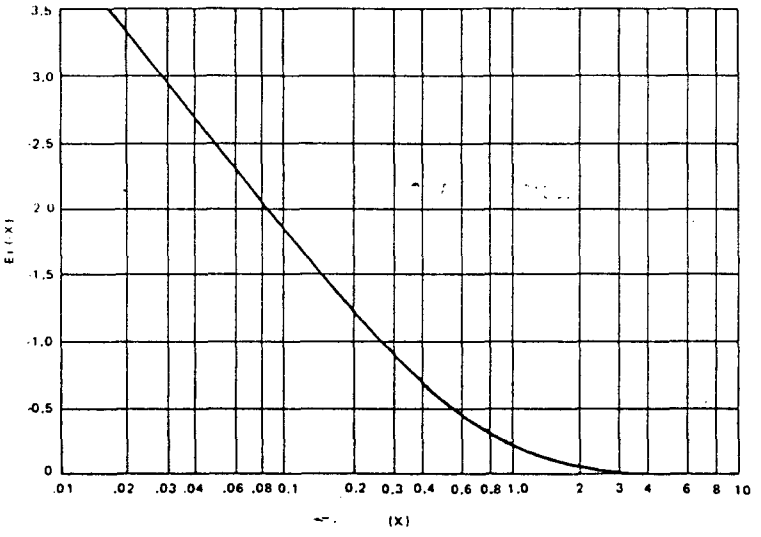


Figure B-1. Exponential Integral Function

3. With an observed change of 1.2 inches in the water level at time equals 3 hours, the preceding equation can be solved for the requisite values.

Since $\Delta P = (1.2)\ \frac{FT}{12in}\ (2.35)\ \frac{psi}{FT} = 0.064$ psi

Therefore,

$$[Ei(-x)] = (\Delta P) \div \left(\frac{70.6\ q\mu\beta}{kh}\right)$$

$$[Ei(-x)] = 0.582$$

from Figure B-1, for $[Ei(-x)] = 0.167$,

$$(-x) = 0.55.$$

Similarly,

$$(-x) = \frac{r^2\ \phi\ \mu\ c_t}{0.001055\ Kt}$$

or

$$Kt = \frac{1}{(-x)} \times \frac{r^2 \phi \mu c_t}{0.001055\ Kt}$$

$$Kt = 1593$$

For t = 3 hours

$$K = 530 \text{ md}$$

NOTE: For initial interference testing of PG-1 with OW-1, the reported transmissibilty was 6,000 gpd/ft, or roughly 200 md.

4. If the sharp fluctuation at t = 1 hour was caused by the pump test on PG-4, a similar calculation can be made, if we assume that the sharp rise in water level occured just after an equal (but not measured) drop in water level of the same magnitude.

$$\Delta P = (4.8 \text{ in})\left(\frac{1}{12}\right)\left(\frac{1}{2.35}\right) = 0.17 \text{ psi}$$

for this value of ΔP, [Ei(-x)] = 2.33 from Figure B-1, (-x) = 0.07 and Kt = 12,514. Hence, K = 12,514 md or 12.5 Darcys.

5. A direct fault conduit would have to link PG-4 and OW-1 in order for the observed phenomenon at time equals one hour to have been caused by PG-4. Note that the observed phenomenon was a rise in water level, which is exactly opposite a theoretical drawdown. From the reflection seismic survey completed as part of the well siting decision for PG-4, the mapped faults lie at considerable distance from OW-1. This factor tends to rule out a fault conduit.

As an additional, but indirect observation that the sharp fluctuation is not connected to the PG-4 pump test, the pumped water samples from PG-4 contain no measureable H_2S. If a very high permeability existed as a direct link between the wells OW-1 and PG-4, H_2S would have migrated to PG-4 during the process of extracting almost 1.8 million gallons of water from PG-4 in April and August 1986. The absence of H_2S from PG-4 does not mean the well will be forevermore free of H_2S, nor does it imply no

direct communication exists. Since the wells PG-1, PG-3, OW-1, and PG-4 have a slotted liner in the range of 3,150 to 3,475 feet elevation above Mean Sea Level, some communicaion will exist. The lower value of permability (530 md computed earlier) is somewhat larger than the permeability value (200 md) computed from interference tests between PG-1 and OW-1 in 1980 and 1981. (References 2, 3, and 4.) This low value of permeability in an E-W direction is consistent with the structural theory as to the location of the boundary fault controlling PG-4. This fault was mapped as lying 1,550 feet to the east of OW-3. Presumably, the permeability would be the same order-of-magnitude as an extension of the data between PG-1 and OW-1, or 200 md.

It is noted that the permeability of 530 md is smaller than the value derived from interference tests between PG-3 and OW-1 in January 1981 and repeated in July 1981. Those tests provided indications of a permeability of 1,500 to 1,600 md in a N-S direction. The new tests of PG-4 interference with OW-1 suggest that the apparent permeability between PG-4 and OW-1 has a magnitude only 30 percent of the apparent permeability between PG-3 and OW-1. This factor supports the conclusion that the mapped faults adjacent to PG-4 are the primary source of extracted water, and only a very minor component of flow is withdrawn from the saturated alluvial fill in which the earlier NMSU geothermal wells were completed.

The sharp rise in water depth at time equals one hour could be the result of the initial hydraulic shock wave moving through the aquifer. If this were true, a similar phenomenon should have been detected at 3:30 and 4:30 p.m., again between 10:42 and 11:42 p.m., and finally 11:00 and 12:00 a.m. (22 August). These latter intervals were time periods in which the pump was started or stopped. No such perturbations were noted. Accordingly, the perturbation at t = 1 hour cannot be explained. Possibly, a simple measurement error was made.

6. The data and observations at PG-4 can be used to compute the theoretical drawdown at OW-1, if the acquifer performance were consistent with all the stated assumptions. Using equation (1) and Figure B-1, the following table is calculated:

TABLE B-1. THEORETICAL DRAWDOWN, OW-1

Time (Hr)	(-x)	[Ei(x)]	ΔP (psi)	ΔP (inch)
1	0.062	2.6	0.292	-8.2
3	0.02	3.3	0.3706	-10.45
14	0.0045	4.4	0.444	-13.9
24	0.0026	5.25	0.5896	-16.6

Since none of the observed drawdown measurements are similar to the theoretical values, two conclusions are possible.

- The aquifer is non-uniform, and has fault-fractures induced values which render invalid the theoretical calculations.

- Little or no interference will exist between PG-4 and OW-1, or PG-4 and PG-1.

7. Table B-2 which follows is a tabular summary of the tested interference between OW-1 and each of the three NMSU geothermal wells. Figure B-2 is a sketch which depicts the bedrock faults mapped from the reflection seismic survey. Figure B-3 is data reflecting the drawdown and temperature data for observations in OW-1. Note that the temperature data are suspect. It is unfortunate that the temperature fluctuations occurred coincident with the water table fluctuations at t = one hour. These temperature measurements are not reliable, because the temperature probe was erratic. It is not reasonable to expect that a rock-water equilibrium at 140 °F with the likely open pore volume of only 10 percent of the rock volume would change from equilibrium conditions as quickly as indicated. Some minor temperature fluctuations might have occurred, but magnitude and timing cannot be determined.

TABLE B-2. COMPARISON OF OW-1 INTERFERENCE

Date	Pumped Well	Rate GPM	Pumped Times (Hrs)	Distance From OW-1 (ft)	Total Drawdown (ft)
12/17/80	PG-1	149	44	240	13.75
1/25/81	PG-3	200	14	1,031	1.08
1/26/81	PG-1 &	200	16.5	240 &	18.25
	PG-3	200		1,031	
		400			
8/27/86	PG-4	675	24	1,750	0.1

NOTES:

1. At extraction rate 2.8 times larger than for the PG-3 test, PG-4 influence on OW-1 was only 30 percent of the PG-3 test. This factor strongly suggests that PG-4 will have negligible effects on PG-1.

2. Since influence varies directly as the rate of extraction and as the square of the radius between the pumped well and the observation well, the implications are that PG-4 at flow rates up to 1,450 gpm, will have little or no measureable effect on PG-1.

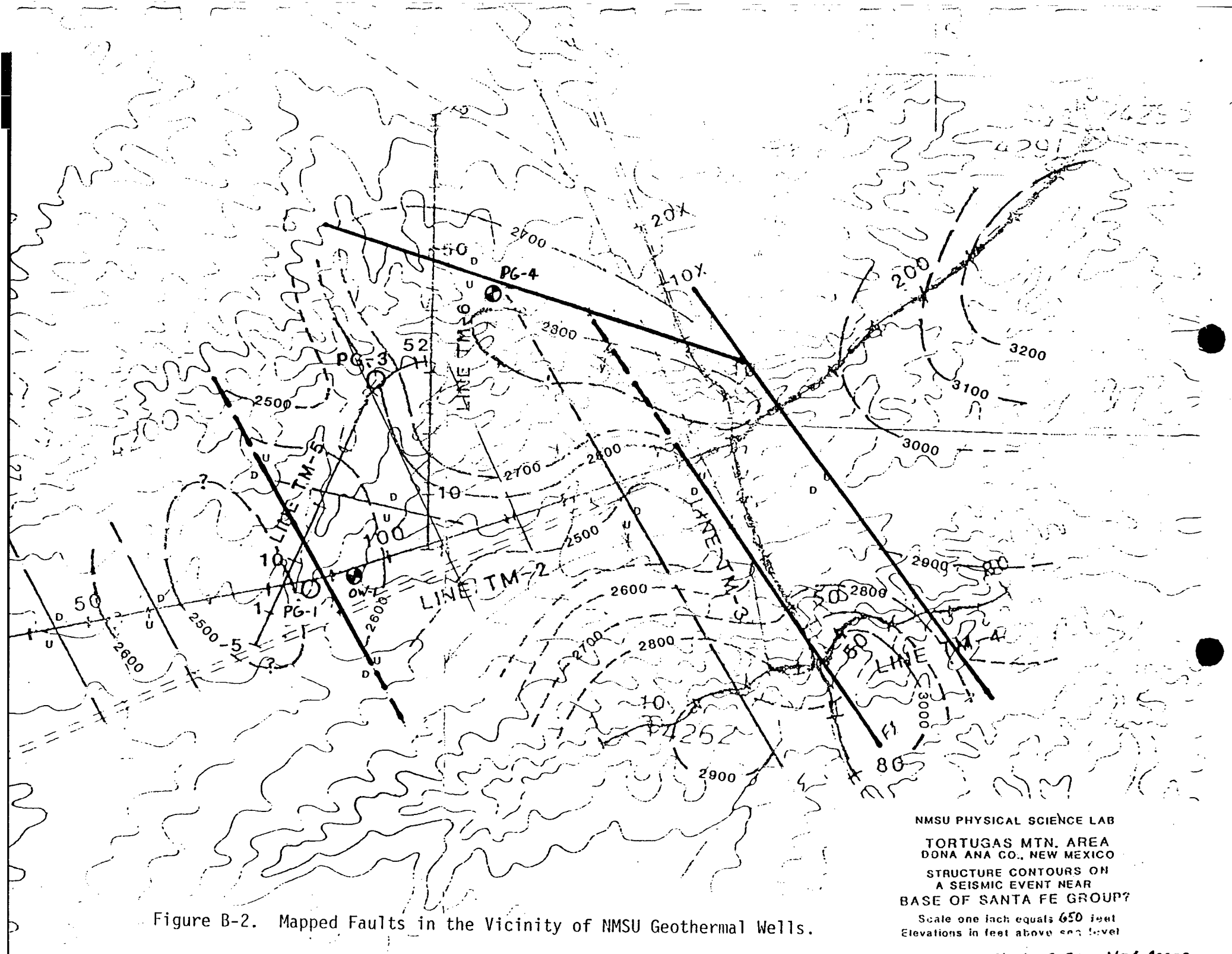


Figure B-2. Mapped Faults in the Vicinity of NMSU Geothermal Wells.

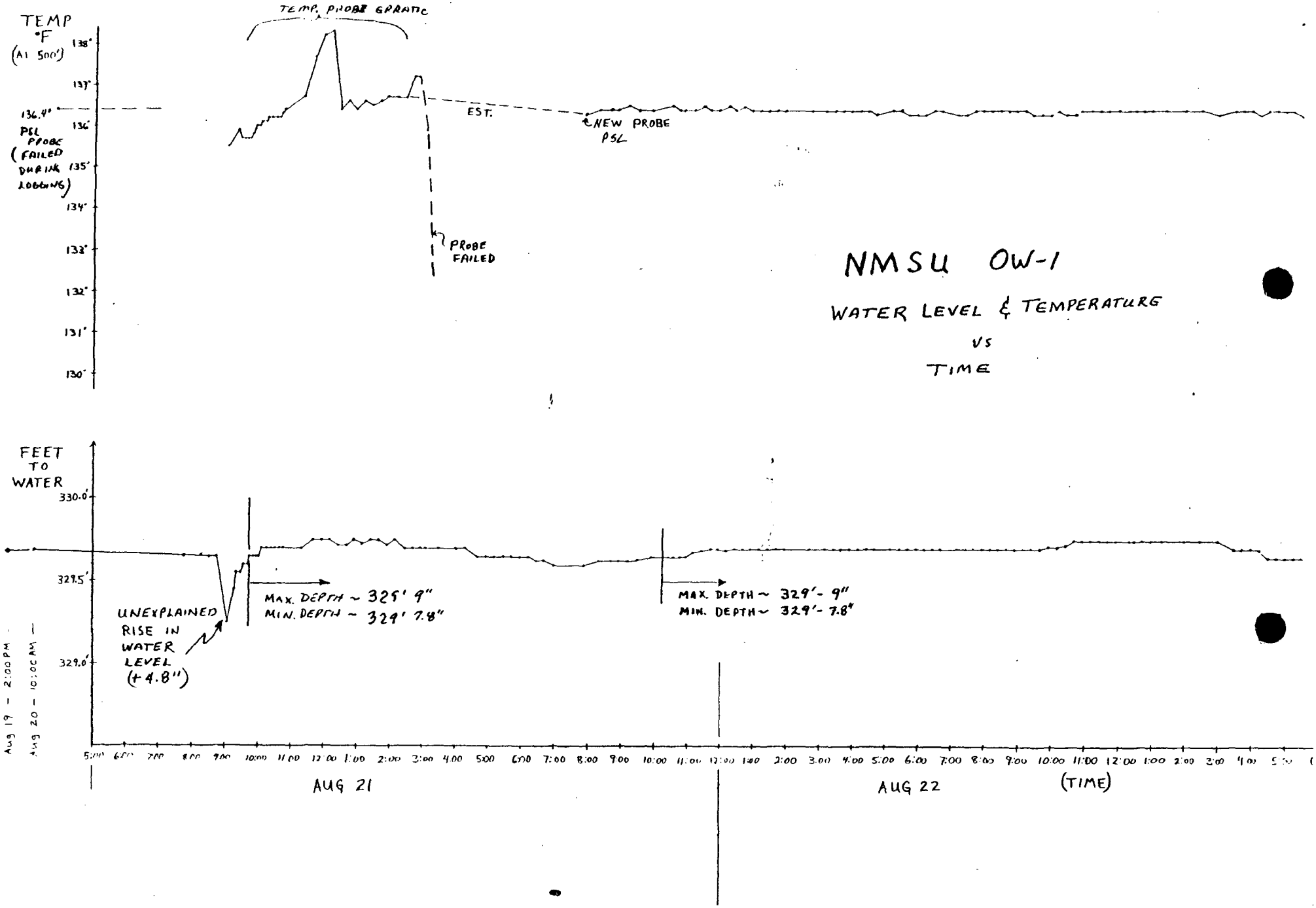

TEMP °F (At 500')
138°
137°
136.4°
136°
PSL
(PROBE FAILED DURING LOGGING)
135°
134°
133°
132°
131°
130°
TEMP. PROBE ERRATIC
EST.
NEW PROBE PSL
PROBE FAILED
NMSU OW-1
WATER LEVEL & TEMPERATURE
VS
TIME
FEET TO WATER
330.0'
329.5'
329.0'
UNEXPLAINED RISE IN WATER LEVEL (+4.8")
MAX. DEPTH ~ 329' 9"
MIN. DEPTH ~ 329' 7.8"
MAX. DEPTH ~ 329'- 9"
MIN. DEPTH ~ 329'- 7.8"
Aug 19 - 2:00 PM
Aug 20 - 10:00 AM
AUG 21
AUG 22
(TIME)

Figure B-3.

APPENDIX C
TEMPERATURE EFFECTS OF PUMP FRICTION

1. Background:

At high rates of flow (700 - 1,450 gpm) the well head temperature was recorded as 146 ± 0.25 °F. At low flow rates, temperature increased to 148 °F. Some part of this increase could be the result of pump and shaft friction, which is transferred as heat to the fluid.

2. Pump Friction Effects:

a. $TR = \frac{H\ (1.0 - Eff)}{788\ Eff}$;

TR = Temperature Rise °F
H = Total Head, Feet
Eff = Pump Eff

b. The pump curve displays efficiency values at a range of flows from 860 gpm to 200 gpm. To calculate the efficiency at lower flow rates, use is made of the pump affinity laws. Since efficiency is equal to Brake Horsepower divided by hydraulic horsepower, the efficiency will vary directly as Brake Horsepower. Accordingly, the pump efficiency at 240 gpm is calculated to be 57 percent; similarly, efficiency at 740 gpm is 60 percent.

c. For 240 gpm, total head is 600 feet

$$TR = \frac{600\ (1 - 0.57)}{778\ (0.57)} \cong 0.6\ °F$$

d. For 740 gpm, total head is 558 feet

$$TR = \frac{558\ (1 - 0.68)}{778\ (0.68)} \cong 0.3\ °F$$

3. Adjusted Well Head Temperature

Flow Rate (GPM)	Adjusted Temperature (°F)	Subsurface Temperature (°F) While Flowing	Variance Subsurface (°F)	Subsurface Temperature (°F) After-Flow
240	147.4 ± 0.25	145.8	- 1.6 ± 0.25	146.1
740	145.7 ± 0.25	145.8	+ 0.2 ± 0.25	146.6

NOTES:

1. This analysis suggests that the FLOPETROL SSDP temperature probe is reasonably accurate at high rates of flow; for whatever reason, the tool failed to respond properly at low flow rates.

2. It is possible that the tool response to low flow rates is the reason that both tools indicated a temperature rise each of the three times the pumping was stopped. This increase occurred 8 to 10 minutes after flow was stopped, and the indicated rise ranged from 0.3 to 0.8 °F. This temperature rise also suggests that a component of after-flow is occuring, from a higher temperature source, and a convective thermal cell has started to form in the well bore. Source of this after-flow cannot be determined; possibly, the flow is coming from the point of least flow resistance, which could be the lowest segment of the well, or the top of the slotted liner at 735 feet. Since this low flow condition also appears to be enriched in dissolved gases relative to higher flow rates, hence a higher pressure regime, the after-flow very likely is originating in the deeper substructure.

3. From the FLOPETROL-Johnston tool used for the drill stem test, the flowing temperature at 745 feet of depth was 146.5 °F. This temperature was confirmed using the Spafford temperature probe. These measurements tend to confirm a higher temperature flow regime, with the temperature at 970 feet of depth measured to be 147.6 °F.

Attached Figure C-1 is a graphical portrayal of the time vs temperature, along with time vs wellhead pressure and pump RPM. Figure C-2 and C-3 are down-hole temperature measurement recordings from the two SSDP tools.

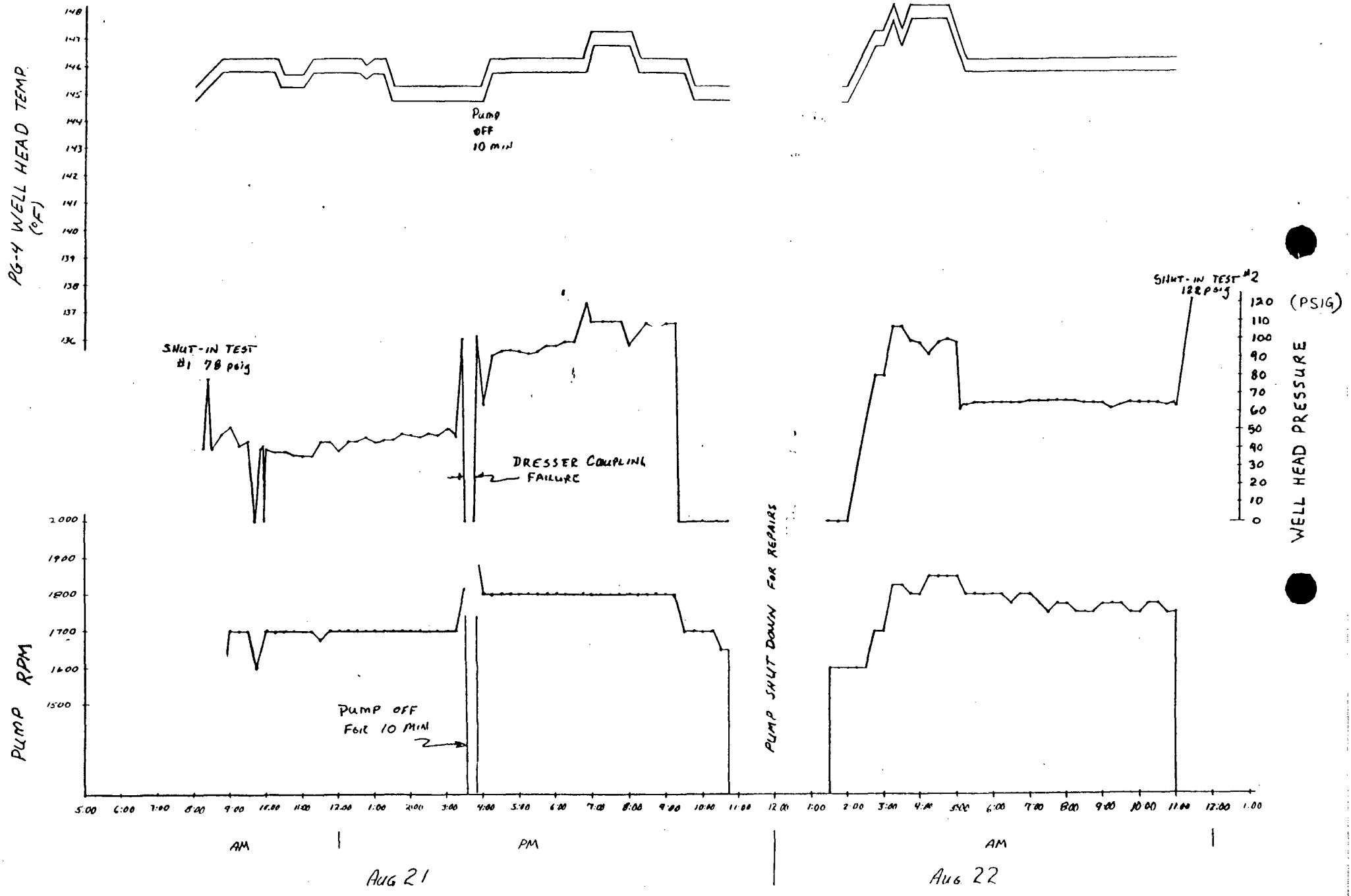

PG-4 WELL HEAD TEMP (°F)
148
147
146
145
144
143
142
141
140
139
138
137
136
Pump OFF 10 min
SHUT-IN TEST #1 78 psig
DRESSER COUPLING FAILURE
SHUT-IN TEST #2 122 psig
120
110
100
90
80
70
60
50
40
30
20
10
0
(PSIG)
WELL HEAD PRESSURE
PUMP RPM
2000
1900
1800
1700
1600
1500
Pump OFF For 10 Min
PUMP SHUT DOWN FOR REPAIRS
5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 1:00
AM
PM
AM
Aug 21
Aug 22

Figure C-1.

BOTTOMHOLE TEMPERATURE LOG

FIELD REPORT NO. 04978F
INSTRUMENT NO. 85499
DEPTH : 549 FT

COMPANY : NEW MEXICO STATE UNIVERSITY
WELL : NMSU PG4

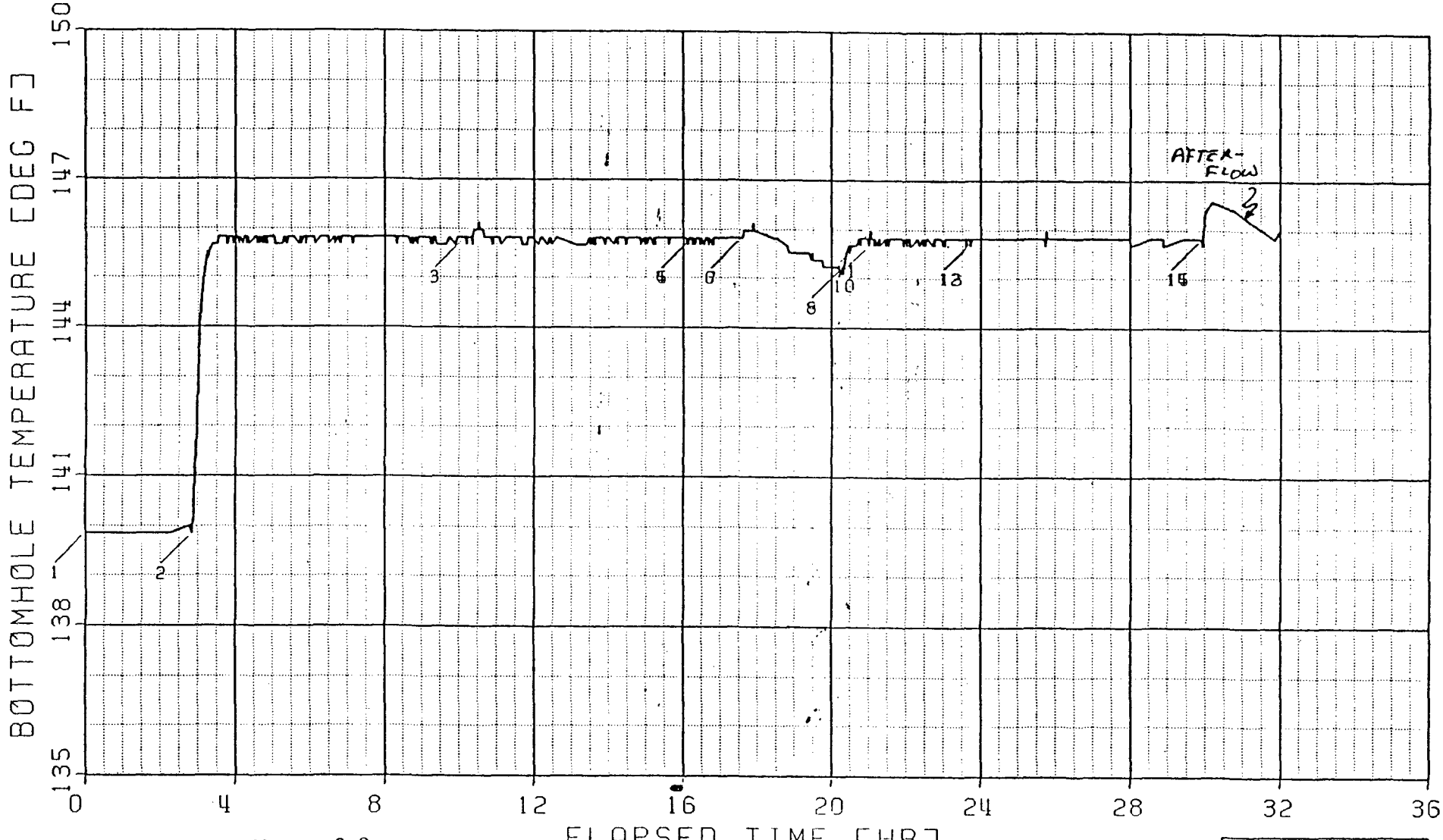


Figure C-2.

FLOPETROL JOHNSTON

BØTTØMHØLE TEMPERATURE LØG

FIELD REPORT NO. 04978F
INSTRUMENT NO. 85433
DEPTH : 541 FT

COMPANY : NEW MEXICO STATE UNIVERSITY
WELL : NMSU PG4

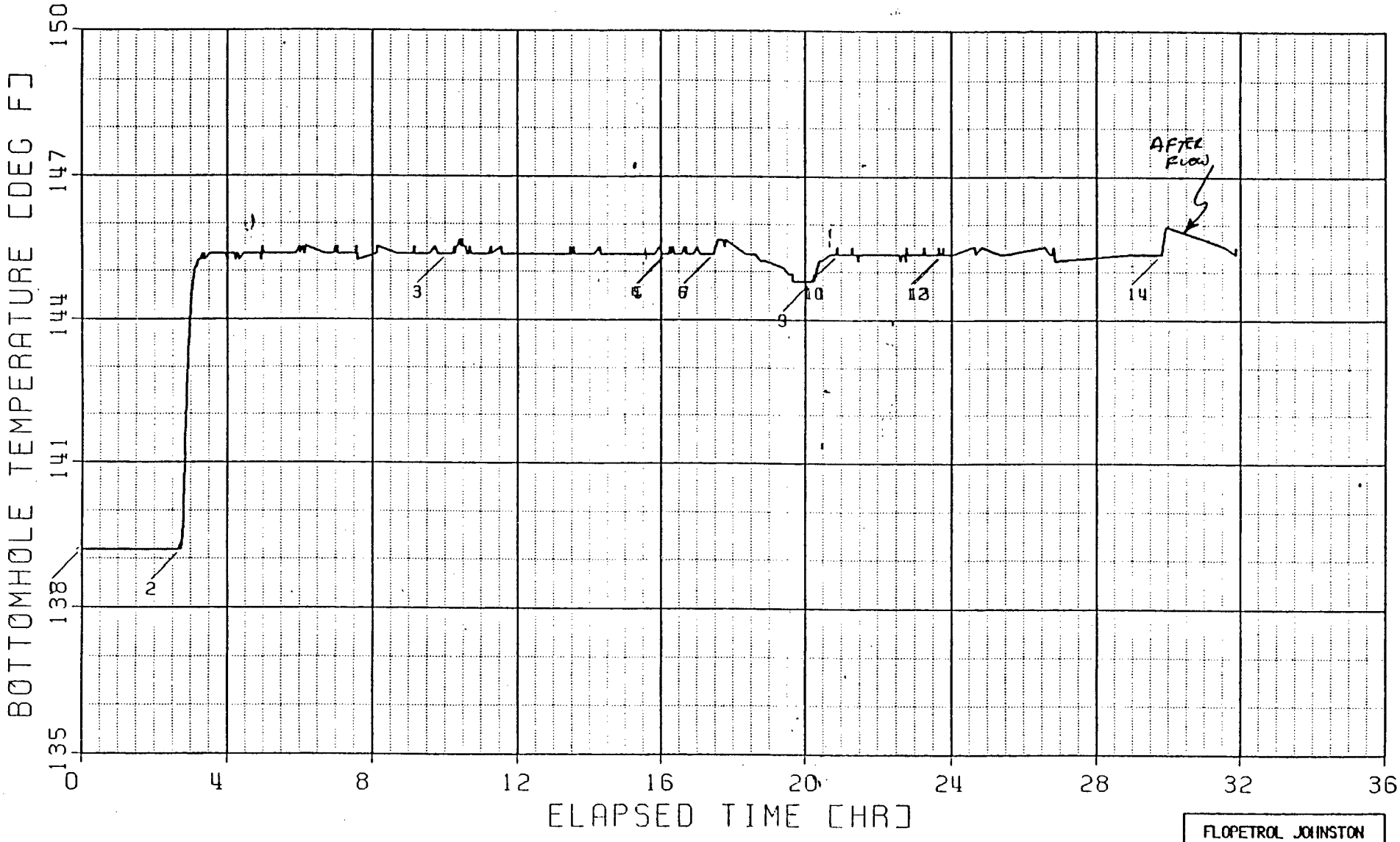


Figure C-3.

FLOPETROL JOHNSTON
Schlumberger

APPENDIX D
ANALYSIS OF DISSOLVED MINERALS AND GASES

1. Fourteen water samples were collected during this well test. All samples were collected with pressure flashed to atmospheric conditions.

   a. Composition of the flashed water samples did not vary within analytical detection limits and accuracy. Relatively constant composition of the produced liquid indicates that there were no detectable changes in the reservoir water composition during the duration of this test. (See Table D-1.) Also, the reservoir fluid from PG-4 is similar to other geothermal wells in this area. (See Table D-2.)

   b. Total dissolved mineral content of the water is an average of 1,770 mg per liter. This is a calculated value, which takes into account the conversion of bicarbonate into CO_3 during analysis. Good ionic balance is exhibited accross the analyses.

2. Eight gas samples were collected. This quantity of samples was chosen based on preliminary gas/liquid ratio measurements performed at the site. Six of the gas samples were collected at the wellhead from the two-phase production line. The remaining two gas samples were collected from the separator.

   a. Large concentrations of air were found in all gas samples. The most likely source for this air is air drilling operations completed in April, 1986.

   b. Because of the excess oxygen measured by the analyses, the resulting composition was adjusted to delete the oxygen, and adjust the nitrogen levels. This computation is consistent with Henry's Law for perfect gases, and is valid within measurement uncertainties. Table D-3 provides the results of the analysis. In turn, Table D-4 is a comparison of the dissolved gas content with NMSU well PG-1.

3. The separator gas was also examined for its H_2S content. For this reason, an additional gas sample was collected and analyzed.

   a. Gas samples collected at the wellhead were not examined for H_2S content. The small sampling apparatus collected too little gas; and accordingly too small a quantity of H_2S (if any at all) in these gases to obtain sufficiently large sample volumes for a precise H_2S analysis.

   b. If any H_2S exists at all in the produced gases, it will be below 0.065 mg per liter of gas. At this concentration, the H_2S level would be less than one-tenth of the lowest measured level in other NMSU wells. Possibly the low H_2S concentration is an artificial condition caused by previous air injections into the reservoir.

   c. Table D-5 is a comparison of dissolved H_2S levels reported in NMSU wells.

4. For a complete report of the dissolved mineral and gas analysis, see Special Report from Vetter Research at Appendix G.

5. Evaluation of the dissolved gas content is hampered by the likely presence of air injected into the reservoir during the air drilling process. Although the effects of this air have been computationally removed, the resulting values are still anomalously high in nitrogen contents relative to the other NMSU geothermal wells.

   The analytical values for CO_2, with excess air removed, depict an decrease in CO_2 content with an increase in back pressure. Since this increase was measured at a back pressure of 54 psig, one implication is that the bubble point pressure of CO_2 in the reservoir is higher than 54 psig.

   If the bubble point pressure is higher than 54 psig (66.64 psia) the question arises as to how high it is. The pump suction was set at a level which would produce a pressure head of 73 psia above the pump

suction at the drawdown level measured with a flow rate of 250 gpm. When the pump was producing maximum output of 1,450 gpm, the pressure head on the pump suction was only 62.4 psia. When the pump was removed, the pump column showed evidence of calcite accumulation inside the pump column, which implies that two-phase flow had occurred with CO_2 release. Hence, the carbonation could have occurred at any time during the pump test.

From a review of Figure D-1, which follows, the bubble point pressure could be as high as 105-120 psia. At that pressure, the pump would have to be set at a depth below drawdown level of 220-255 feet to prevent two-phase flow. For PG-4, at a flow rate of 600 gpm, this would entail a setting depth of 590 feet below ground level. Assuming that the bubble point pressure for PG-1 and PG-3 are at or above 120 psia, the pump setting depths for PG-1 and PG-3 would be order of magnitude of 725 feet for PG-1 and 775 feet for PG-3 at the flow rates now produced.

A bubble pressure higher than 120 psia, or a flow rate for PG-1 higher than 200 gpm or PG-3 higher than 175 gpm would mean two-phase flow was being experienced. Under those conditions, a greatly reduced pump life would be experienced, and accelerated corrosion would be noted on pump columns. In fact, these problems have arisen. The problems would be magnified for the high turbine speed, light weight impellors in the PG-3 submersible pump. It is highly probable that pump problems experienced for these two wells are in part attributable to an elevated CO_2 bubble point pressure.

FIGURE D-1

CO_2 BUBBLE-POINT PRESSURES
NMSU GEOTHERMAL WELLS

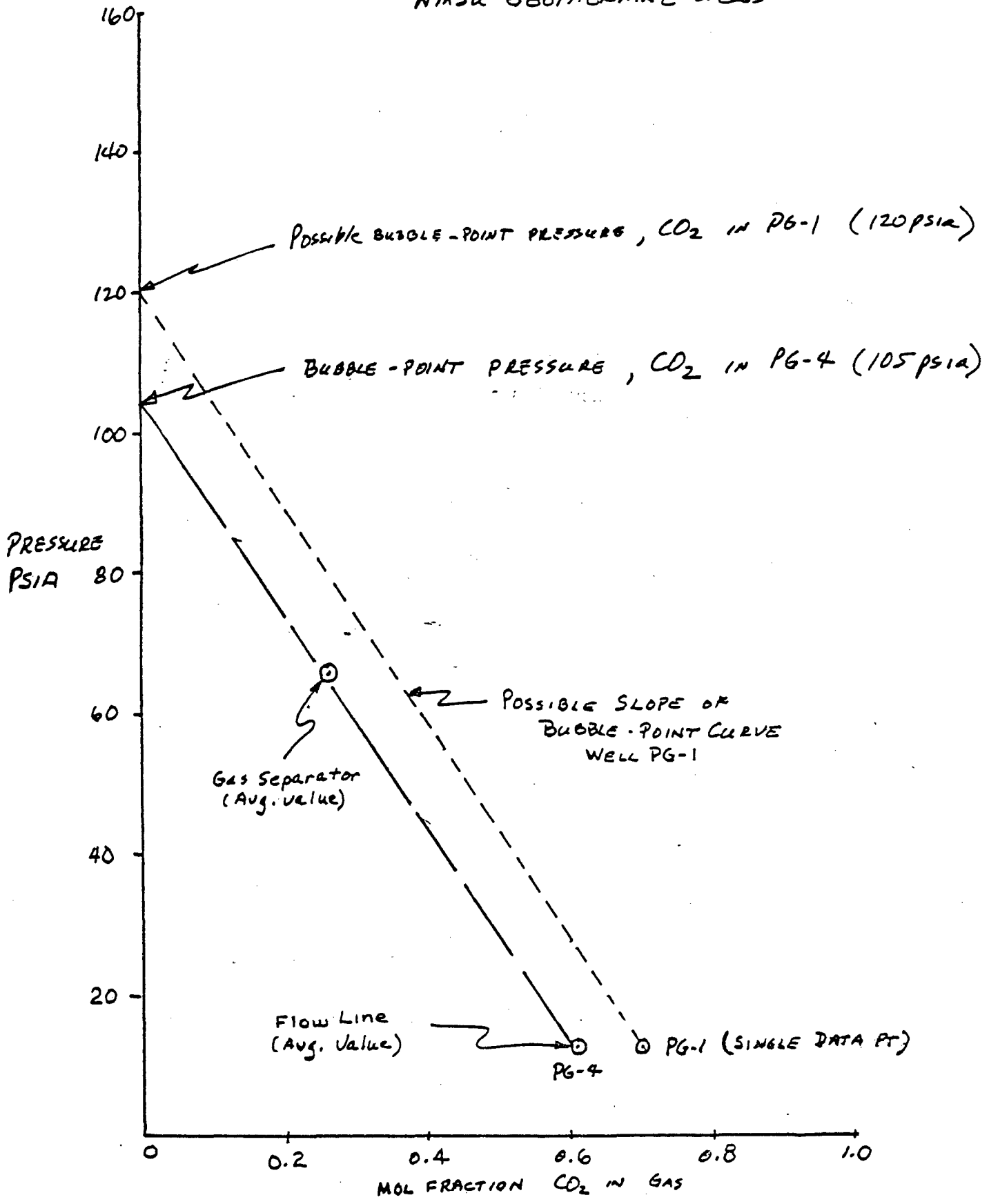


TABLE D-1

CHEMICAL ANALYSIS OF DISSOLVED SOLIDS (mg/ℓ)

NMSU Geothermal Wells

	PG-1	PG-3	GD-2 (468[1])	GD-2 (840[1])	PG-4 (Group I) (During Pump Test)	PG-4 (Group II-1) (During Drill Stem Test)	PG-4 (Group II-4) (During Drill Stem Test)
pH	6.30	6.25	7.65	7.80	6.64	7.70	7.56
µmhos	3110	3120	3120	2680		2720	2,790
TDS	2010	1981	1948	1787	1770	1695	1,854
NA	488	488	428	386	428	430.9	449.1
K	54	52	44	35	49.2	59.0	48.8
Ca	143	141	130	115	158.7	102.9	107.4
Mg	18.6	18.8	36.0	36.6	31.2	31.4	32.6
Cl	584	546	574	540	541	528.3	528.3
CO_3	0	0	0	0	0	0	0
HCO_3	620	610	422	594	603	462.5	489.4
SO_4	250	240	315	280	248	232.4	289.2
Fe	2.8	5.0	1.28	2.00	1.17	0.05	0.05
Mn	0.11	0.11	0.09	0.13	0.109	0.02	0.02
Hardness	NA	NA	NA	NA		386	402
Alkalinity	NA	NA	NA	NA		379	401
As	<0.004	<0.004	<0.001	0.001		0.007	0.006
Ba	0.04	0.04	0.08	0.09	0.29	0.07	0.08
Cd	<0.005	<0.005	<0.005	<0.005		<0.005	<0.005
Cr	<0.05	<0.05	<0.02	<0.02		<0.02	<0.002
Pb	<0.005	<0.005	0.005	0.005		<0.005	<0.005
Hg	<0.0002	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Se	<0.002	<0.002	<0.001	0.001		<0.001	<0.001
Ag	<0.05	<0.05	0.05	0.05		0.02	<0.02
NO_3-N	0.03	0.02	0.01	0.02		0.05	0.03
F	1.27	NA	1.29	0.55	2.16	2.00	2.08

TABLE D-2

COMPARISON OF PG-4 VALUES WITH NMSU PG-1 AND CHAFFEE WELLS
(VALUE in mg/ℓ)

	PG-4 Flow Avg.	PG-1	35-25	12-24	55-25
Conductivity		3,110	2,580	3,000	2,300
TDS	1770	2,010	1,626	1,968	1,480
pH	6.64	6.56	8.05	7.57	7.46
Hardness ($CaCO_3$)	NR	NR	NR	383	377
Alkalinity ($CaCO_3$)	NR	NR	NR	356	306
Na	428	488	397.5	392.4	350.8
K	49.2	54	54.7	58.3	53.2
Ca	158.7	143	129.2	107.4	96.9
Mg	31.2	18.6	31.2	28.0	33.0
Cℓ	541	584	496.3	499.2	482.2
HCO_3	603	620	394.2	448.7	373.4
SO_4	249	250	300	220.8	198.0
As		<0.004	0.014	0.003	0.001
Ba	0.29	0.08	<0.4	<0.4	0.08
Fe	1.17	2.8	0.22	0.13	0.10
B	NR	NR	0.36	0.18	0.58
F	2.16	1.27	2.16	2.20	2.41
SiO_2	44.9	73	56.5	50.9	51.5
Temperature °F					
Subsurface	150	143	154?	150	158?
Surface Flow Line	148	142	N.D.	N.D.	N.D.
TOTAL DEPTH (FT)	1,015	1,000	950	1,078	2,645

NOTE: Chaffee well samples were acquired during drilling with aerated foam, or are samples only from the well bore at the water table. These samples cannot be considered to be fully representative of in situ reservoir conditions.

TABLE D-3
DISSOLVED GAS ANALYSIS

Lab Sample: 1156 (Flow line)

Conditions: Flow Rate: 700 gpm liquid rate
Temperature: 146 °F liquid temperature, flashed to 144 °F
Pressure: Flashed to atmospheric from 44 psig

Sample: Gas Rate: 1.08×10^{-3} liter/sec
Liquid Rate: 6×10^{-3} liter/sec
Gas/Liquid Ratio: 0.178 ml gas/ml liquid

Composition:	Gas Sample Vol. %	Calculated Analysis
CO_2:	82	368 mg/liter of liquid
N_2:	18	1.5 mg/liter of liquid

Lab Sample: 1163

Conditions: Flow Rate: 750 gpm liquid rate
Temperature: 146 °F liquid temperature, flashed to 144 °F
Pressure: Flashed to atmospheric from 63 psig

Sample: Gas Rate: 1.25×10^{-3} liter/sec
Liquid Rate: 6.9×10^{-3} liter/sec
Gas/Liquid Ratio: 0.181 ml gas/ml liquid

Composition:	Gas Sample Vol. %	Calculated Analysis
CO_2:	86.7	385 mg/liter of liquid
N_2:	13.3	1.1 mg/liter of liquid

Lab Sample: 1160 and 1161, Average Values (Gas Separator)

Conditions: Flow Rate: 250 gpm liquid rate
Temperature: 142 °F at gas separator
Pressure: 54 psig at gas separator

Sample: Gas Rate: 2.26 liter/sec
Liquid Rate: 15.8 liter/sec
Gas/Liquid Ratio: 0.144 ml gas/ml liquid

Composition:	Gas Sample Vol. %	Calculated Analysis
CO_2:	24.4	110 mg/liter of liquid
N_2:	75.6	6.3 mg/liter of liquid

TABLE D-4

COMPARISON OF DISSOLVED GAS ANALYSES

(Based on Table 4 of Vetter Research Report)

	CO_2		N_2		Gas Flow Rate
	Vol. %	mg/l	Vol. %	mg/l	Ft^3/gal per min
PG-4 (Average of six flow-line samples) T = 144 °F P = Atmospheric P_{whd} = 44 psig Rate: 700 gpm	83.7	368	16.3	1.3	2.5×10^{-2}
PG-1 Sample T = 142 °F P = Atmospheric Rate: 200 gpm	94	133	5.5	0.5	3.0×10^{-2}
PG-4 Sample (Average of two gas separator samples) T = 142 °F P = 54 psig Rate: 250 gpm	24.4	110	75.6	5.3	1.1×10^{-2}

NOTES:

1. At higher flow rates, PG-4 produces 15 percent less CO_2 than PG-1, and three times as much N_2.

2. At higher flow rates, PG-4 produces 16 percent less gas per gallon of fluid than PG-1 when flashed to atmospheric pressure. At lower flow rates, PG-4 produces one-third the amount of gas when flashed from reservoir pressure to a controlled pressure of 54 psig.

3. Gas analyses tend to confirm existence of a mixed reservoir, with probable cross-flow occuring. Gas generation at lower flow rates tends to confirm that this reservoir has a somewhat higher pressure, which also is confirmed by the slightly higher temperature produced at lower flow rates.

TABLE D-5

H_2S CONTENT OF NMSU GEOTHERMAL WELLS

(mg per liter of liquid except as noted)

Date	PG-1	PG-2	PG-3	GCW	PG-4
1981	0.038	0.038	0.038	0.51[3]	
1982	0.06	0.15			
15 Mar 83	0.21	---	---		
14 Apr 83	---	---	0.07		
22 Jun 83	---	2.50[1]	---		
26 Aug 83	0.30				
26 Sep 83			0.10		
7 Oct 83			0.10		
1 Nov 83		0.15[2]	0.07		
15 Dec 83	0.13[2]				
12 Jan 84		0.24	0.16		
22 Aug 86					<0.0625 (mg H_2S per liter of gas)

1. Value is abnormally high, and suggests possibly either a sampling or a measurement error occurred. However, elevated H_2S levels in this well contributed to failure of original shell-and-tube heat exchanger for this service, in less than two years of operation.
2. Indicates analysis after well had been treated with sodium hypochlorite to determine if H_2S concentration was the result of anerobic bacterial action. Reduction in H_2S level is strong corroberation that much, if not all, of the H_2S does result from bacterial decomposition of organic matter. When the results of the well treatment were discussed with Dr. John Zack of the NMSU Biology Department, and Dr. Edward Lasherly, Department of Biology, University of Calgary, consensus was that the H_2S almost surely was the result of anerobic, sulfate-reducing bacteria. Source presumably from the shallower ground water. (Personal Communications)
3. Sample acquired in November 1980, and data reported in May 1981, before geothermal wells had been in service. This Golf Course well was drilled in 1960; taken out of service in 1970. Water sample was taken incident to installation of a small pump (20 gpm) which was being used to attempt to extract water to see if stable conditions could be measured. H_2S odor was very pronounced in well house.

APPENDIX E
TEST EQUPMENT INVENTORY

1. Water Level Indicators. Four different probes were used, as follows:

   a. Solinst Sounder conductivity probe (used for observation well)

   b. Powers Well Sounder conductivity probe (used for PG-4)

   c. Fisher Water Finder conductivity probe (used for PG-4)

   d. Acoustic probe (used for all wells)

2. Well Temperature Probes.

   a. The primary probe is a PSL manufactured probe calibrated to ± 0.1 °F. NOTE: This probe was used for initial temperature measurements in PG-3 and OW-1. On 25 August, a break occured in the insulation jacket and the probe had to be repaired. Repair and recalibration action were finished by 1630 hours 26 August.

   b. The backup probe is a Gisco-Keck Temperature probe borrowed from the NMSU Energy Institute. This probe was limited to 500 feet of depth, and has not been recently calibrated. This probe was used for initial measurements in OW-1 on August 26, and the measurements were erratic. The probe batteries subsequently failed. Subsequent measurements during the remainder of the flow test were made using the newly repaired and recalibrated PSL probe, starting at 1900 hours 26 August.

   c. The precision Spafford temperature probe owned by NMSU was requested for use in logging PG-4 to give a comparision with earlier logs acquired by this same tool. However, the probe was reported to be inoperative so it was not used.

3. Flow Line Temperatures

a. The flow line temperature was measured using an electronic probe connected to a digital readout. The probe and readout combination are calibrated to ± 0.25 °F.

b. Similar equipment with the same accuracy was used to monitor entering and exiting water temperatures from the gas separator.

4. Well Head Flow Rates

a. The primary flow rate meter was scheduled to be the CONTROLATRON, a two position Doppler type acoustic flow meter. This is a highly accurate instrument, but is sensitive and did not work properly.

b. A portable POLYSONICS Doppler type flow meter was used for the flow line measurements, and was relocated to the gas separator during the dissolved gas test.

c. A well head flow rate was estimated from the pump curves for varying RPM rates ranging from 1650 to 1850 RPM. The pump curve was checked against measured values by the use of two shut-in tests conducted at the beginning and the end of the pump test (See Attachment). These shut-in tests established that the pump was performing in agreement with the manufacturer's curve, as long as the RPM meter was working properly and could be accurately read. With this latter condition of uncertainty, good correlation existed between flow rates as measured by the POLYSONICS, and as estimated from the pump curves. In turn, these flow rates were consistent with the estimated rates based on a specific capacity of 100 gpm per foot of drawdown, and the measured drawdown rates.

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APPENDIX F
REPORT FROM FLOPETROL-JOHNSTON

REPORT NO. 04978F

PAGE NO. 1

TEST DATE: 21-Aug-1986

WELL PERFORMANCE TESTING™ REPORT

A Production System Analysis (NODAL™)
Based On Model Verified™ Interpretation

FLOPETROL JOHNSTON

Schlumberger

Company: NEW MEXICO STATE UNIVERSITY	Well: NMSU PG4
TEST IDENTIFICATION	**WELL LOCATION**
Test Type ..... P/M SSDP	Field ..... --
Test No. ..... --	County ..... Dona Ana
Formation	State ..... New Mexico
Test Interval (ft)	Sec/Twn/Rng 23/ 23s/ 2e
COMPLETION CONFIGURATION	**TEST STRING CONFIGURATION**
Total Depth (MD/TUD) (ft) .... n/a	Tubing Length (ft)/I.D. (in)..
Casing/Liner I.D. (in)	Tubing Length (ft)/I.D. (in)..
Hole Size (in)	Packer Depth (ft) .....
Perforated Interval (ft)	Gauge Depth (ft)/Type ..... 549 / SSDP
Shot Density (shots/ft)	Downhole Valve (Y/N)/Type .... None
Perforation Diameter (in)	**TEST CONDITION**
Net Pay (ft)	Tbg/Wellhead Pressure (psi) ..
	Separator Pressure (psi) .....
INTERPRETATION RESULTS	**ROCK/FLUID/WELLBORE PROPERTIES**
Model of Behavior	Oil Density (deg. API) .....
Fluid Type Used For Analysis .	Basic Solids (%) .....
Reservoir Pressure (psi)	Gas Gravity .....
Transmissibility (md.ft/cp) ..	GOR (scf/STB) .....
Effective Permeability (md) ..	Water Cut (%) .....
Skin Factor	Viscosity (cp) .....
Storativity Ratio	Total Compressibility (1/psi).
Interporosity Flow Coeff.	Porosity (%) .....
Distance to an Anomaly (ft) ..	Reservoir Temperature (F) ....
Radius of Investigation (ft)..	Form.Vol.Factor (bbl/STB) ....

MAXIMUM PRODUCTION RATE DURING TEST: --

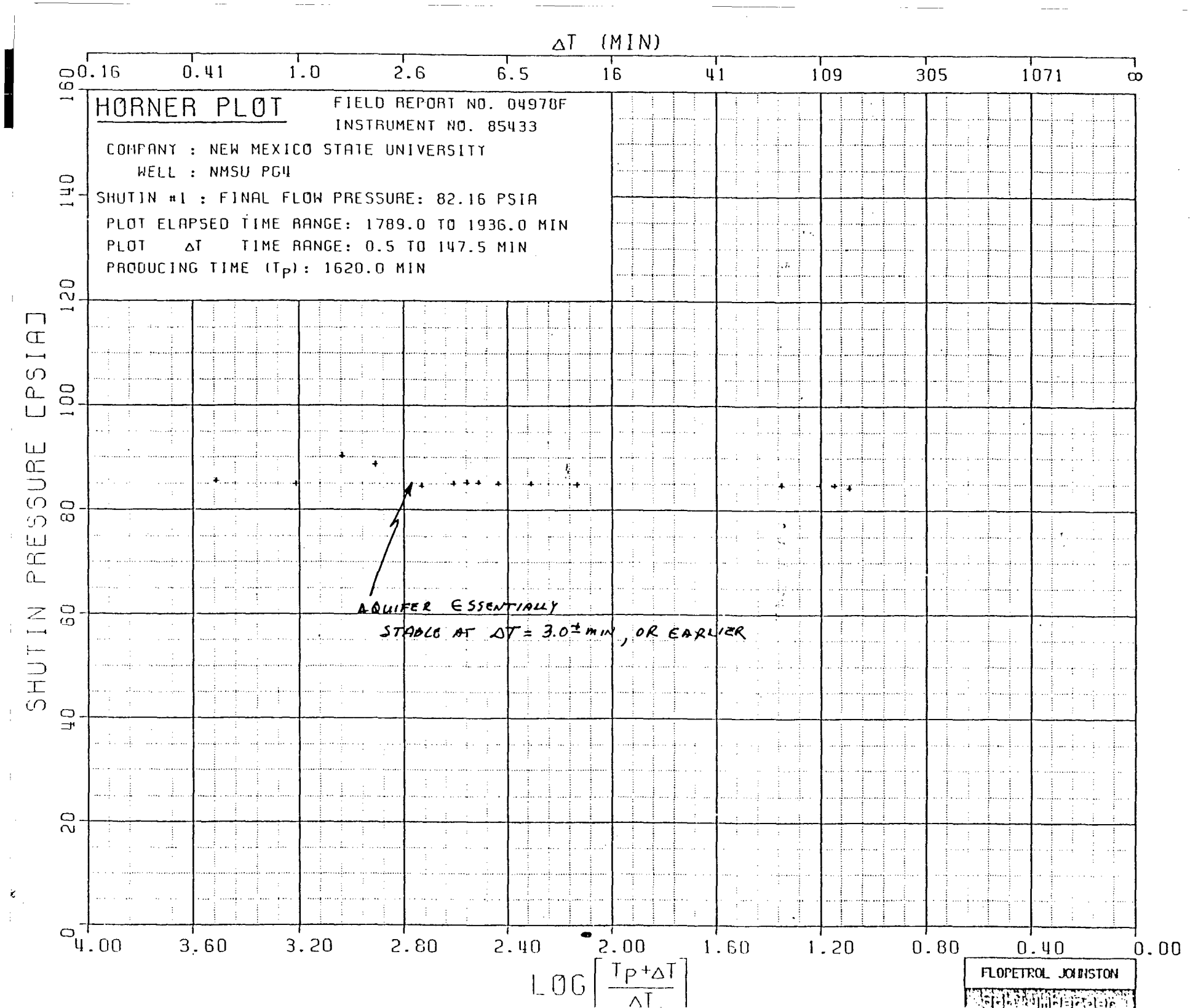
COMMENTS:

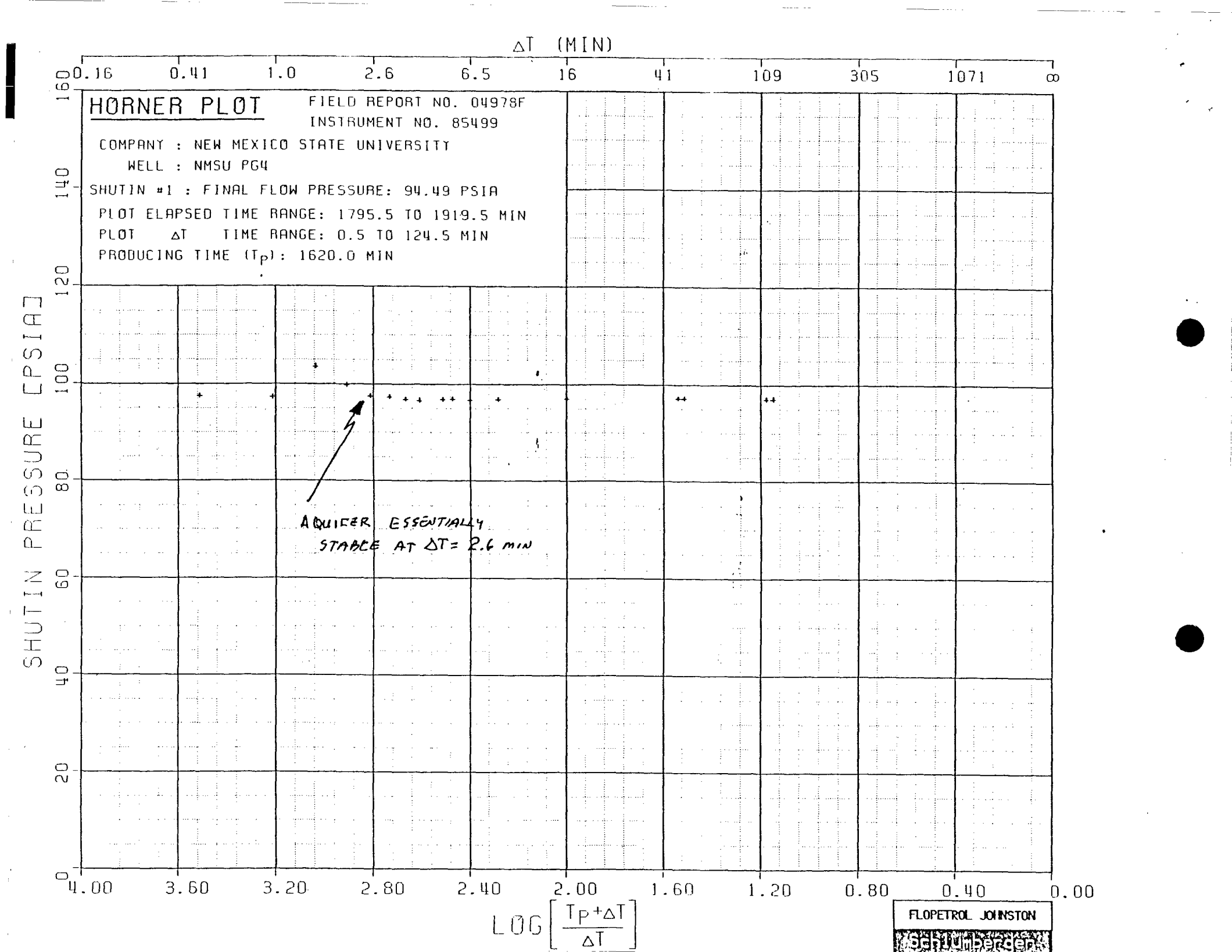
Enclosed is the data collected during the pump test of the above captioned well. It includes a pressure log, temperature log and listing of all the points recorded during the test, from both instruments. Also included is a Horner plot of the test period after the pump was shut down, this plot is not considered to be a reliable plot for interpretation due to the rapid pressure stabilization and then slight pressure decrease.

The pressure difference noted between the two gauges is believed to be due in part to the depth difference between the instruments (85433 at 541 ft., 85499 at 549 ft., this accounts for about 3 psi); the rest of the difference is probably a summation of the instrument accuracy and the result of running the instruments into a joint of pipe during the trip in the hole. A comparsion of the pressure change noted on each instrument shows a much closer comparsion.

There is an elapsed time difference of about 6 minutes between the instruments due to different initial power up times but the responses are essentially the same.

Questions concerning this report or requests for additional plots should be directed to Dick Simper at (915) 694-1986.

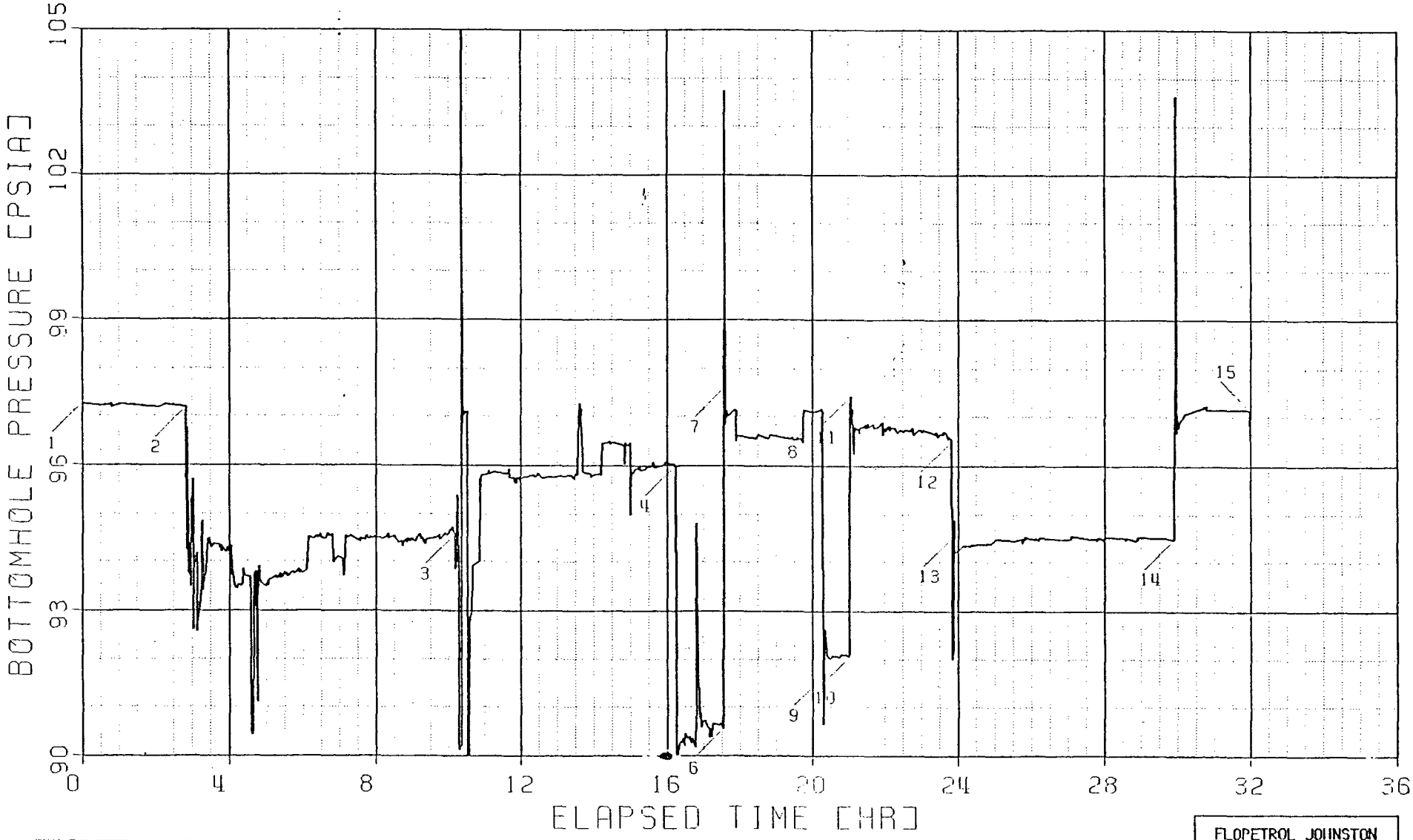

ΔT (MIN)
0.16
0.41
1.0
2.6
6.5
16
41
109
305
1071
∞
HORNER PLOT
FIELD REPORT NO. 04970F
INSTRUMENT NO. 85433
COMPANY : NEW MEXICO STATE UNIVERSITY
WELL : NMSU PG4
SHUTIN #1 : FINAL FLOW PRESSURE: 82.16 PSIA
PLOT ELAPSED TIME RANGE: 1789.0 TO 1936.0 MIN
PLOT ΔT TIME RANGE: 0.5 TO 147.5 MIN
PRODUCING TIME (T_P): 1620.0 MIN
SHUTIN PRESSURE [PSIA]
160
140
120
100
80
60
40
20
0
AQUIFER ESSENTIALLY
STABLE AT ΔT = 3.0± MIN, OR EARLIER
4.00
3.60
3.20
2.80
2.40
2.00
1.60
1.20
0.80
0.40
0.00
LOG [(Tp+ΔT)/ΔT]
FLOPETROL JOHNSTON


ΔT (MIN)
0.16
0.41
1.0
2.6
6.5
16
41
109
305
1071
∞
HORNER PLOT
FIELD REPORT NO. 04978F
INSTRUMENT NO. 85499
COMPANY : NEW MEXICO STATE UNIVERSITY
WELL : NMSU PG4
SHUTIN #1 : FINAL FLOW PRESSURE: 94.49 PSIA
PLOT ELAPSED TIME RANGE: 1795.5 TO 1919.5 MIN
PLOT ΔT TIME RANGE: 0.5 TO 124.5 MIN
PRODUCING TIME (T_p): 1620.0 MIN
AQUIFER ESSENTIALLY
STABLE AT ΔT = 2.6 MIN
SHUTIN PRESSURE [PSIA]
160
140
120
100
80
60
40
20
0
4.00
3.60
3.20
2.80
2.40
2.00
1.60
1.20
0.80
0.40
0.00
LOG $\left[\frac{T_p+\Delta T}{\Delta T}\right]$
FLOPETROL JOHNSTON
Schlumberger

BØTTØMHØLE PRESSURE LØG

FIELD REPORT NO. 04978F
INSTRUMENT NO. 85499
DEPTH : 549 FT
CAPACITY : 10000 PSI
PORT OPENING : OUTSIDE

COMPANY : NEW MEXICO STATE UNIVERSITY
WELL : NMSU PG4

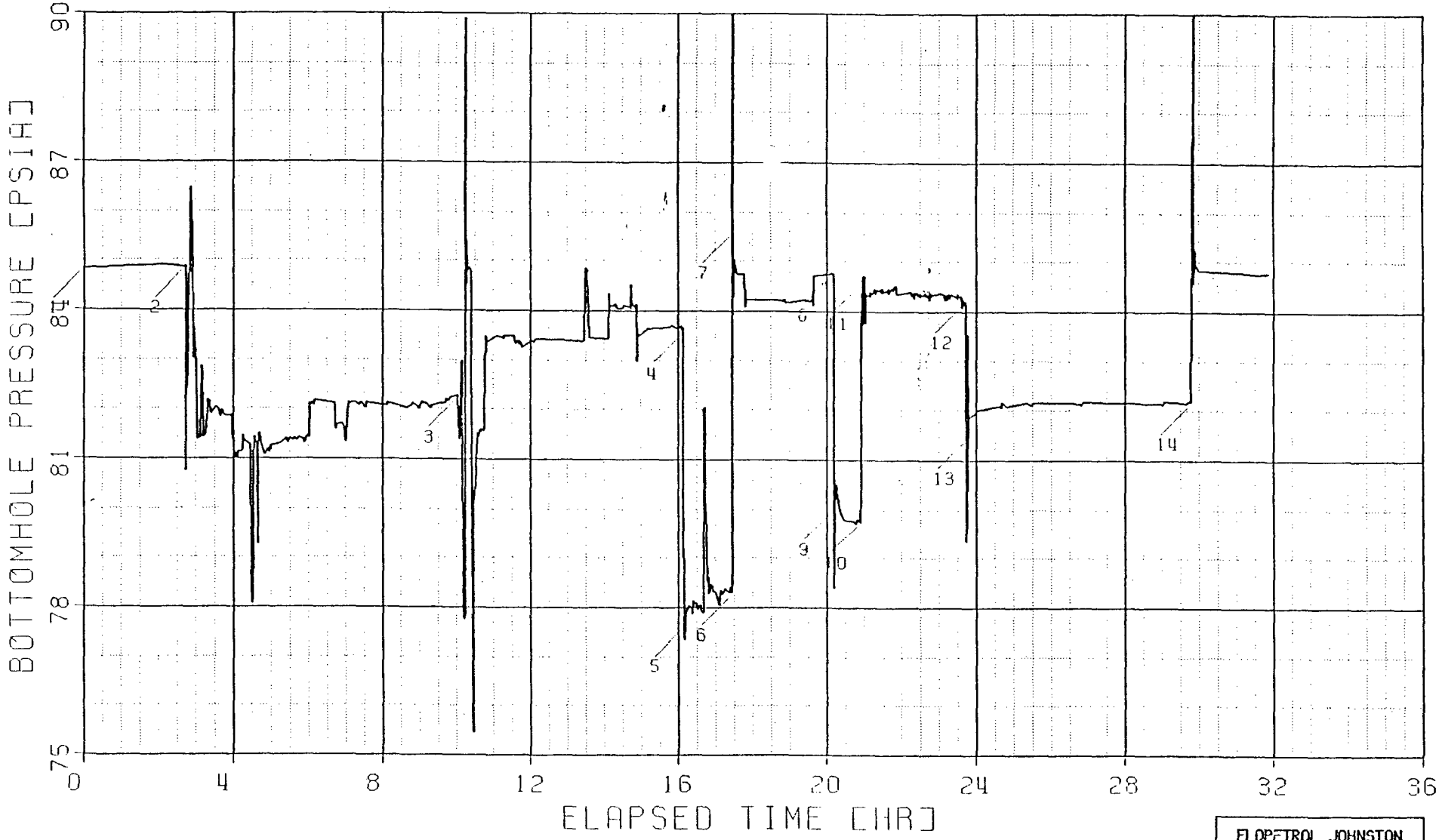


FLOPETROL JOHNSTON

BOTTOMHOLE PRESSURE LOG

FIELD REPORT NO. 04978F
INSTRUMENT NO. 85433
DEPTH : 541 FT
CAPACITY : 10000 PSI
PORT OPENING : OUTSIDE

COMPANY : NEW MEXICO STATE UNIVERSITY
WELL : NMSU PG4

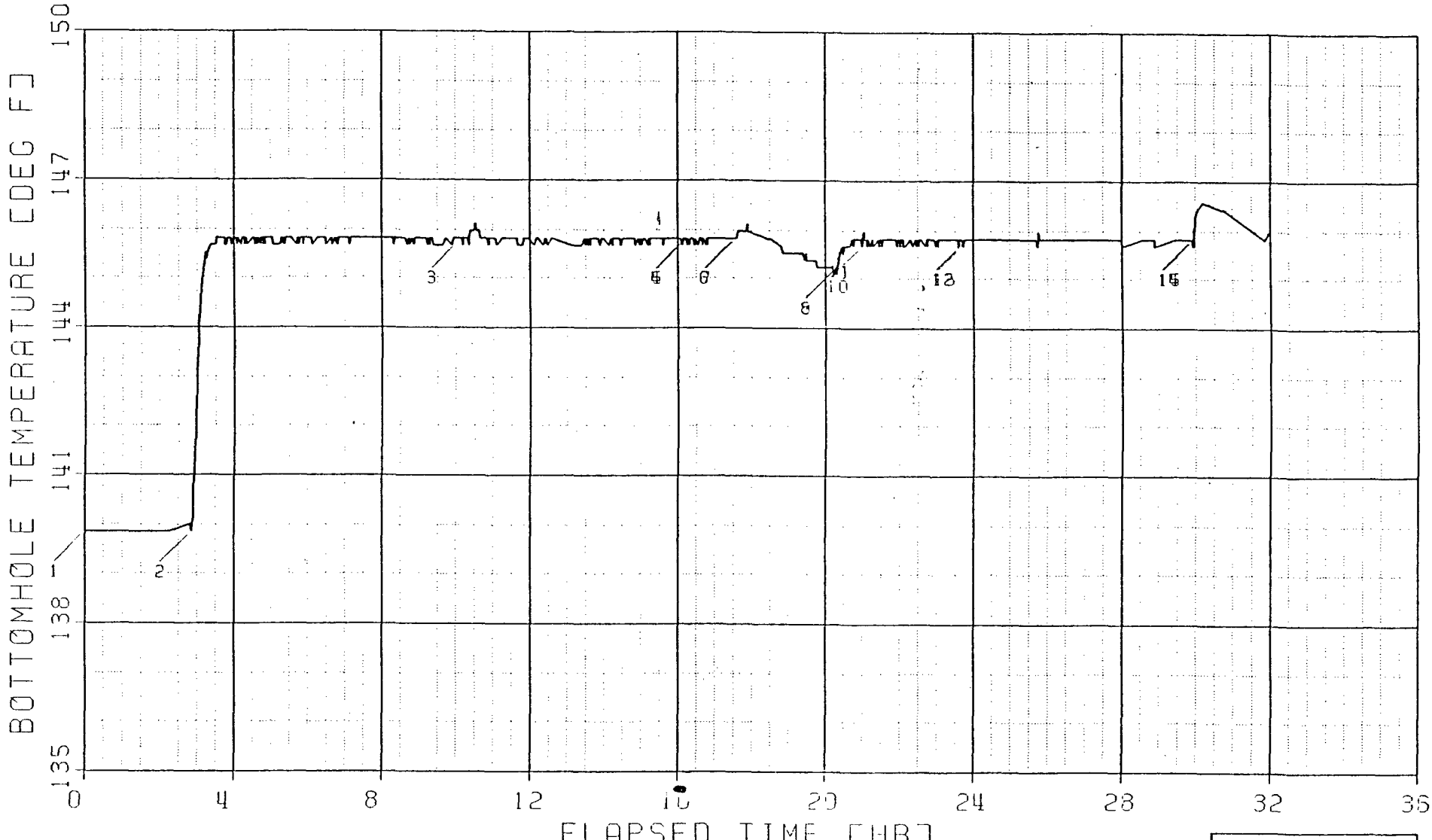


FLOPETROL JOHNSTON

BOTTOMHOLE TEMPERATURE LOG

FIELD REPORT NO. 04978F
INSTRUMENT NO. 85499
DEPTH : 549 FT

COMPANY : NEW MEXICO STATE UNIVERSITY
WELL : NMSU PG4

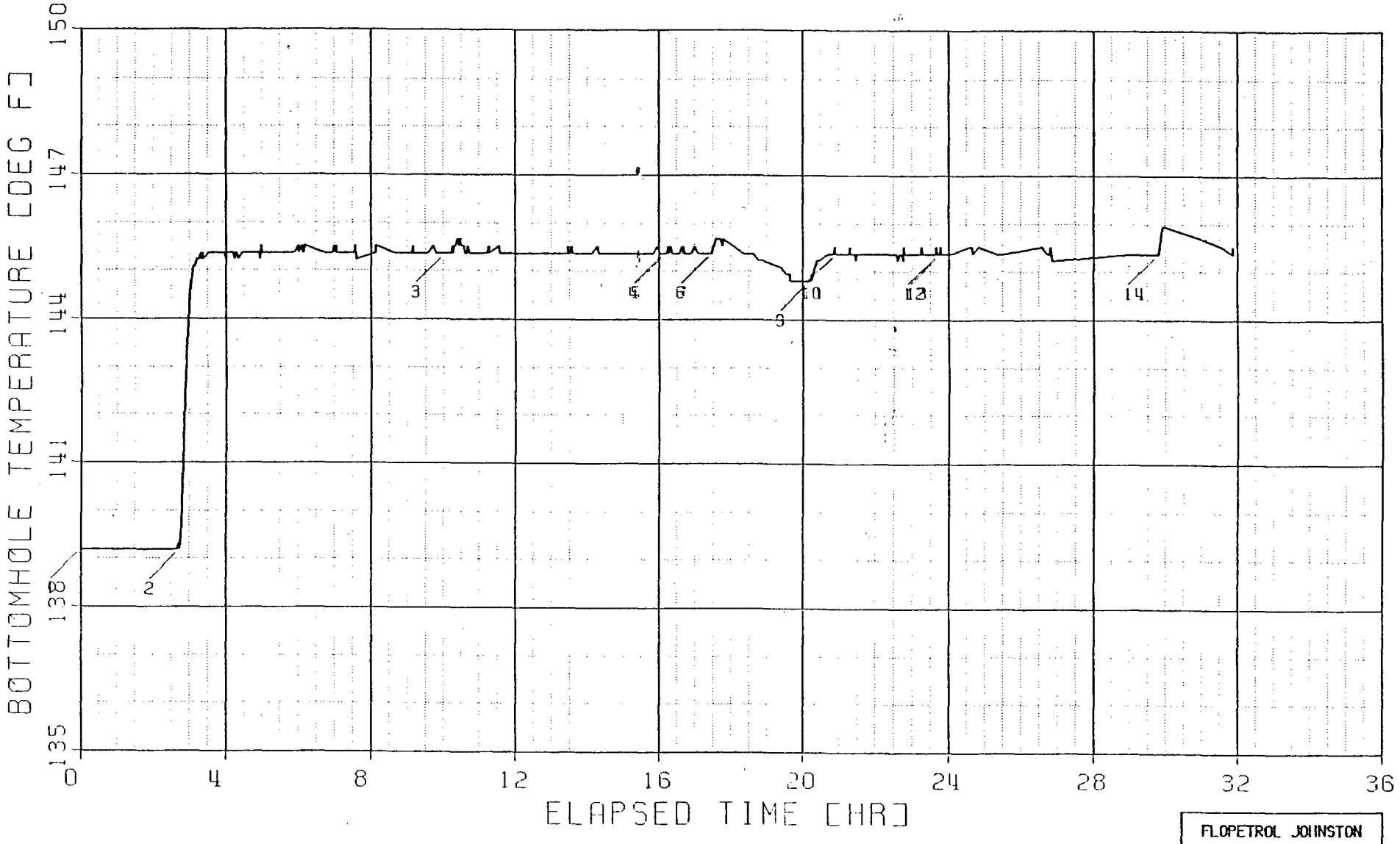


FLOPETROL JOHNSTON

BOTTOMHOLE TEMPERATURE LOG

FIELD REPORT NO. 04978F
INSTRUMENT NO. 85433
DEPTH : 541 FT

COMPANY : NEW MEXICO STATE UNIVERSITY
WELL : NMSU PG4



FLOPETROL JOHNSTON
Schlumberger

****
* WELL TEST DATA PRINTOUT *
****

FIELD REPORT # : 04978F

COMPANY : NEW MEXICO STATE UNIVERSITY
WELL : NMSU PG4

INSTRUMENT # : 85433
CAPACITY [PSI] : 10000.
DEPTH [FT] : 541.0
PORT OPENING : OUTSIDE

LABEL POINT INFORMATION

#	TIME OF DAY HH:MM:SS	DATE DD-MM	EXPLANATION	ELAPSED TIME, HR	BOT HOLE PRESSURE PSIA	BOT HOLE TEMP. DEG F
1	5:15: 0	21-AU	START FLOW	0.000	84.83	139.2
2	7:59:30	21-AU	FLOW POINT	2.742	84.86	139.2
3	15:19: 0	21-AU	FLOW POINT	10.067	82.26	145.4
4	21:23:30	21-AU	FLOW POINT	16.142	83.55	145.4
5	21:26:30	21-AU	FLOW POINT	16.192	77.63	145.4
6	22:42: 0	21-AU	FLOW POINT	17.450	78.27	145.4
7	22:44: 0	21-AU	FLOW POINT	17.483	85.59	145.4
8	1:26:30	22-AU	FLOW POINT	20.192	84.75	144.8
9	1:28: 0	22-AU	FLOW POINT	20.217	80.01	144.8
10	2: 9:30	22-AU	FLOW POINT	20.908	79.74	145.4
11	2:12:30	22-AU	FLOW POINT	20.958	84.58	145.4
12	4:58:30	22-AU	FLOW POINT	23.725	84.20	145.4
13	5: 2:30	22-AU	FLOW POINT	23.792	81.46	145.4
14	11: 3:30	22-AU	FLOW POINT	29.808	82.16	145.4
15	11: 7:30	22-AU	FLOW POINT	29.875	85.02	145.7
16	13:31: 0	22-AU	PULLED LOOSE	32.267	84.25	145.4
17	13:57: 0	22-AU	END FLOW	32.700	58.88	144.9

SUMMARY OF FLOW PERIODS

PERIOD	START ELAPSED TIME, HR	END ELAPSED TIME, HR	DURATION HR	START PRESSURE PSIA	END PRESSURE PSIA
1	0.000	32.700	32.700	84.83	58.88

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
9: 9:30	21-AU	3.908	3.908	145.4	81.85
9:11:30	21-AU	3.942	3.942	145.4	81.85
9:12:30	21-AU	3.958	3.958	145.4	81.87
9:13: 0	21-AU	3.967	3.967	145.4	81.46
9:14: 0	21-AU	3.983	3.983	145.4	81.42
9:14:30	21-AU	3.992	3.992	145.2	81.33
9:15:30	21-AU	4.008	4.008	145.4	81.37
9:16: 0	21-AU	4.017	4.017	145.2	81.33
9:16:30	21-AU	4.025	4.025	145.4	81.04
9:17: 0	21-AU	4.033	4.033	145.4	81.11
9:19: 0	21-AU	4.067	4.067	145.4	81.03
9:20: 0	21-AU	4.083	4.083	145.4	80.99
9:21: 0	21-AU	4.100	4.100	145.4	81.10
9:22: 0	21-AU	4.117	4.117	145.4	81.06
9:22:30	21-AU	4.125	4.125	145.4	81.01
9:23: 0	21-AU	4.133	4.133	145.4	81.13
9:27: 0	21-AU	4.200	4.200	145.4	81.13
9:29: 0	21-AU	4.233	4.233	145.4	81.13
9:30: 0	21-AU	4.250	4.250	145.2	81.14
9:30:30	21-AU	4.258	4.258	145.4	81.18
9:31: 0	21-AU	4.267	4.267	145.4	81.47
9:31:30	21-AU	4.275	4.275	145.4	81.34
9:33:30	21-AU	4.308	4.308	145.4	81.35
9:34:30	21-AU	4.325	4.325	145.4	81.34
9:35: 0	21-AU	4.333	4.333	145.2	81.36
9:43: 0	21-AU	4.467	4.467	145.4	81.27
9:43:30	21-AU	4.475	4.475	145.4	78.78
9:44: 0	21-AU	4.483	4.483	145.4	78.37
9:45: 0	21-AU	4.500	4.500	145.4	78.15
9:45:30	21-AU	4.508	4.508	145.4	78.06
9:46:30	21-AU	4.525	4.525	145.4	78.17
9:47: 0	21-AU	4.533	4.533	145.4	78.20
9:47:30	21-AU	4.542	4.542	145.4	79.31
9:48: 0	21-AU	4.550	4.550	145.4	80.89
9:48:30	21-AU	4.558	4.558	145.4	81.44
9:49: 0	21-AU	4.567	4.567	145.4	81.32
9:53: 0	21-AU	4.633	4.633	145.4	81.32
9:53:30	21-AU	4.642	4.642	145.4	81.34
9:54: 0	21-AU	4.650	4.650	145.4	79.26
9:54:30	21-AU	4.658	4.658	145.4	79.91
9:55: 0	21-AU	4.667	4.667	145.4	81.20
9:56: 0	21-AU	4.683	4.683	145.4	81.47
9:57: 0	21-AU	4.700	4.700	145.4	81.51
9:58: 0	21-AU	4.717	4.717	145.4	81.34
10: 6: 0	21-AU	4.850	4.850	145.4	81.06
10:10: 0	21-AU	4.917	4.917	145.4	81.18
10:12: 0	21-AU	4.950	4.950	145.2	81.19
10:13: 0	21-AU	4.967	4.967	145.4	81.11
10:14: 0	21-AU	4.983	4.983	145.5	81.21

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
12:40: 0	21-AU	7.417	7.417	145.4	82.14
12:48: 0	21-AU	7.550	7.550	145.4	82.02
12:50: 0	21-AU	7.583	7.583	145.5	82.12
12:51: 0	21-AU	7.600	7.600	145.2	82.13
13:23: 0	21-AU	8.133	8.133	145.4	82.07
13:23:30	21-AU	8.142	8.142	145.5	82.13
13:55:30	21-AU	8.675	8.675	145.4	82.02
14: 3:30	21-AU	8.808	8.808	145.4	82.07
14: 5:30	21-AU	8.842	8.842	145.4	82.12
14:13:30	21-AU	8.975	8.975	145.4	82.04
14:15:30	21-AU	9.008	9.008	145.4	81.99
14:19:30	21-AU	9.075	9.075	145.4	82.16
14:23:30	21-AU	9.142	9.142	145.4	82.09
14:24:30	21-AU	9.158	9.158	145.5	82.10
14:25: 0	21-AU	9.167	9.167	145.4	82.14
14:33: 0	21-AU	9.300	9.300	145.4	82.00
14:34: 0	21-AU	9.317	9.317	145.4	82.07
14:50: 0	21-AU	9.583	9.583	145.4	82.11
14:58: 0	21-AU	9.717	9.717	145.5	82.13
14:59: 0	21-AU	9.733	9.733	145.5	82.22
15: 3: 0	21-AU	9.800	9.800	145.4	82.16
15: 5: 0	21-AU	9.833	9.833	145.4	82.16
15: 5:30	21-AU	9.842	9.842	145.4	82.23
15:13:30	21-AU	9.975	9.975	145.4	82.26
15:17:30	21-AU	10.042	10.042	145.4	82.28
15:18:30	21-AU	10.058	10.058	145.4	82.28
15:19: 0	21-AU	10.067	10.067	145.4	82.26
15:19:30	21-AU	10.075	10.075	145.4	81.39
15:20:30	21-AU	10.092	10.092	145.4	81.51
15:21: 0	21-AU	10.100	10.100	145.4	81.58
15:21:30	21-AU	10.108	10.108	145.4	81.51
15:22: 0	21-AU	10.117	10.117	145.4	82.35
15:22:30	21-AU	10.125	10.125	145.4	82.36
15:23: 0	21-AU	10.133	10.133	145.4	82.69
15:24: 0	21-AU	10.150	10.150	145.4	82.93
15:24:30	21-AU	10.158	10.158	145.4	82.98
15:25: 0	21-AU	10.167	10.167	145.4	82.35
15:25:30	21-AU	10.175	10.175	145.4	77.89
15:27:30	21-AU	10.208	10.208	145.4	77.82
15:28:30	21-AU	10.225	10.225	145.4	77.75
15:29: 0	21-AU	10.233	10.233	145.4	77.86
15:29:30	21-AU	10.242	10.242	145.4	77.82
15:30: 0	21-AU	10.250	10.250	145.4	89.19
15:30:30	21-AU	10.258	10.258	145.4	89.89
15:31: 0	21-AU	10.267	10.267	145.5	86.31
15:31:30	21-AU	10.275	10.275	145.5	84.51
15:32: 0	21-AU	10.283	10.283	145.4	85.04
15:32:30	21-AU	10.292	10.292	145.5	85.10
15:33:30	21-AU	10.308	10.308	145.5	84.77

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA	
18:35:30	21-AU	13.342	13.342	145.4	83.39	
18:39:30	21-AU	13.408	13.408	145.4	83.36	
18:41:30	21-AU	13.442	13.442	145.4	83.39	
18:42: 0	21-AU	13.450	13.450	145.4	83.38	
18:43: 0	21-AU	13.467	13.467	145.5	83.76	
18:43:30	21-AU	13.475	13.475	145.4	84.10	
18:44: 0	21-AU	13.483	13.483	145.4	84.66	
18:44:30	21-AU	13.492	13.492	145.4	84.58	
18:45: 0	21-AU	13.500	13.500	145.4	84.64	
18:45:30	21-AU	13.508	13.508	145.4	84.85	
18:46:30	21-AU	13.525	13.525	145.4	84.75	
18:47: 0	21-AU	13.533	13.533	145.4	84.82	
18:47:30	21-AU	13.542	13.542	145.4	84.76	
18:48: 0	21-AU	13.550	13.550	145.4	84.25	
18:49: 0	21-AU	13.567	13.567	145.5	84.38	
18:50: 0	21-AU	13.583	13.583	145.4	84.35	
18:50:30	21-AU	13.592	13.592	145.4	83.44	
19:22:30	21-AU	14.125	14.125	145.4	83.41	
19:23: 0	21-AU	14.133	14.133	145.4	84.34	
19:24: 0	21-AU	14.150	14.150	145.4	84.08	
19:32: 0	21-AU	14.283	14.283	145.5	84.10	
19:34: 0	21-AU	14.317	14.317	145.4	84.06	
19:34:30	21-AU	14.325	14.325	145.4	84.15	
19:36:30	21-AU	14.358	14.358	145.4	84.04	
19:44:30	21-AU	14.492	14.492	145.4	84.04	
19:46:30	21-AU	14.525	14.525	145.4	84.03	
19:47:30	21-AU	14.542	14.542	145.4	84.10	
19:55:30	21-AU	14.675	14.675	145.4	84.08	
19:57:30	21-AU	14.708	14.708	145.4	84.06	
19:58:30	21-AU	14.725	14.725	145.4	84.04	
19:59: 0	21-AU	14.733	14.733	145.4	84.52	
19:59:30	21-AU	14.742	14.742	145.4	84.25	1.43
20: 0:30	21-AU	14.758	14.758	145.4	84.10	
20: 4:30	21-AU	14.825	14.825	145.4	84.10	
20: 6:30	21-AU	14.858	14.858	145.4	84.03	
20: 7:30	21-AU	14.875	14.875	145.4	84.13	
20: 8: 0	21-AU	14.883	14.883	145.4	84.10	
20: 8:30	21-AU	14.892	14.892	145.4	83.17	
20: 9: 0	21-AU	14.900	14.900	145.4	82.96	
20: 9:30	21-AU	14.908	14.908	145.4	83.60	
20:10: 0	21-AU	14.917	14.917	145.4	83.46	3.29
20:26: 0	21-AU	15.183	15.183	145.4	83.62	2.91
20:58: 0	21-AU	15.717	15.717	145.4	83.65	2.84
21: 2: 0	21-AU	15.783	15.783	145.4	83.65	
21: 4: 0	21-AU	15.817	15.817	145.4	83.62	
21: 5: 0	21-AU	15.833	15.833	145.4	83.70	
21:13: 0	21-AU	15.967	15.967	145.5	83.64	2.87
21:17: 0	21-AU	16.033	16.033	145.4	83.65	
21:19: 0	21-AU	16.067	16.067	145.4	83.63	

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
22:21:30	21-AU	17.108	17.108	145.4	78.05
22:23:30	21-AU	17.142	17.142	145.4	78.34
22:25:30	21-AU	17.175	17.175	145.4	78.30
22:26: 0	21-AU	17.183	17.183	145.4	78.25
22:30: 0	21-AU	17.250	17.250	145.4	78.37
22:38: 0	21-AU	17.383	17.383	145.4	78.29
22:39: 0	21-AU	17.400	17.400	145.4	78.34
22:39:30	21-AU	17.408	17.408	145.4	78.41
22:41:30	21-AU	17.442	17.442	145.4	78.29
22:42: 0	21-AU	17.450	17.450	145.4	78.27
22:42:30	21-AU	17.458	17.458	145.4	78.54
22:43: 0	21-AU	17.467	17.467	145.4	93.51
22:43:30	21-AU	17.475	17.475	145.4	88.55
22:44: 0	21-AU	17.483	17.483	145.4	85.59
22:44:30	21-AU	17.492	17.492	145.5	84.27
22:45:30	21-AU	17.508	17.508	145.5	84.84
22:46: 0	21-AU	17.517	17.517	145.5	85.03
22:47: 0	21-AU	17.533	17.533	145.5	84.82
22:48: 0	21-AU	17.550	17.550	145.5	84.75
22:49: 0	21-AU	17.567	17.567	145.5	84.86
22:50: 0	21-AU	17.583	17.583	145.7	84.74
22:58: 0	21-AU	17.717	17.717	145.7	84.74
23: 2: 0	21-AU	17.783	17.783	145.5	84.74
23: 2:30	21-AU	17.792	17.792	145.5	84.75
23: 3: 0	21-AU	17.800	17.800	145.5	84.15
23: 3:30	21-AU	17.808	17.808	145.7	84.08
23: 4:30	21-AU	17.825	17.825	145.7	84.23
23:36:30	21-AU	18.358	18.358	145.4	84.22
23:52:30	21-AU	18.625	18.625	145.4	84.23
0: 0:30	22-AU	18.758	18.758	145.2	84.21
0: 4:30	22-AU	18.825	18.825	145.2	84.19
0: 6:30	22-AU	18.858	18.858	145.2	84.24
0: 7:30	22-AU	18.875	18.875	145.2	84.17
0:39:30	22-AU	19.408	19.408	145.1	84.22
0:47:30	22-AU	19.542	19.542	144.9	84.19
0:51:30	22-AU	19.608	19.608	144.9	84.21
0:52:30	22-AU	19.625	19.625	144.9	84.19
0:53: 0	22-AU	19.633	19.633	144.9	84.25
0:53:30	22-AU	19.642	19.642	144.9	84.11
0:54: 0	22-AU	19.650	19.650	144.9	84.14
0:54:30	22-AU	19.658	19.658	144.8	84.70
1:26:30	22-AU	20.192	20.192	144.8	84.75
1:27: 0	22-AU	20.200	20.200	144.8	79.41
1:27:30	22-AU	20.208	20.208	144.8	78.39
1:28: 0	22-AU	20.217	20.217	144.8	80.01
1:29: 0	22-AU	20.233	20.233	144.8	80.37
1:30: 0	22-AU	20.250	20.250	144.9	80.51
1:31: 0	22-AU	20.267	20.267	144.8	80.50
1:35: 0	22-AU	20.333	20.333	145.1	80.04

APPENDIX G.
REPORT FROM VETTER RESEARCH

REPORT

GEOTHERMAL WELL TEST

WELL PG-4

AUGUST 1986

PREPARED BY

VECTOR RESEARCH

3189C AIRWAY AVE. – COSTA MESA – CALIFORNIA 92626

SUBMITTED TO

NEW MEXICO STATE UNIVERSITY

LAS CRUCES, NM

DISTRIBUTION LIST:

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3.	VR Files	3 Copies

DATE OF ISSUANCE: Sept. 10, 1986
VR REPORT NO: PSL
SIGNATURE(S): Otto Vetter

September 11, 1986

PSL

PREAMBLE

The Physical Science Laboratory (PSL) of the New Mexico State University in Las Cruces, New Mexico, contracted Vetter Research (VR) to assist PSL personnel in a geothermal well test. This contract was documented in PSL Purchase Order No. 4-71354 PR dated 8/15/86 (copy attached).

The contract required Dr. O.J. Vetter (VR) to assist PSL personnel in a one day flow test of well No. PG-4 located close to the Las Cruces campus of the New Mexico State University. Vetter was supposed to:

1. Collect ten or more water samples.
2. Collect ten or more gas samples.
3. Analyze these samples.
4. Report the analytical data to PSL.
5. Submit a copy of the analytical data and all comments related to these data and observations during the well test.

During the initial discussions at the well-site, it was also decided to perform some H2S analyses which could become pertinent for the entire future development of this resource. Additional equipment was sent from Costa Mesa, California, to the well-site in Las Cruces, New Mexico, by express mail in order to perform this additional work which came as something of an "after-thought".

This present document represents our final report and is VR's final delivery under this contract.

September 8, 1986
Costa Mesa, California

Otto Vetter

(Dr. O.J. Vetter)

1.0 OBJECTIVES

The objectives for our work described in this report are as follows:

1. Assist PSL personnel through on-site advise and participation to conduct a 24-hour geothermal well test at PG-4.

2. Collect a sufficient number of water and gas samples and analyze these samples for their pertinent composition. The number of water and gas samples should be sufficient in order to see if there are major trends in the composition of the produced fluids during this well test.

3. Document all field and laboratory efforts as well as pertinent observations in a final report.

Specifically excluded from these mutually agreed upon objectives was any subsequent work related to the thermodynamic behavior of the produced fluids. This means, no calculations related to either the flash behavior or the scale forming tendency of the produced fluids were requested from VR under this contract.

2.0 CONCLUSIONS

In this section of the report we summarize some of our conclusions based on the limited work we performed during and after this well test:

1. A total of 14 water samples (instead of 10) were collected during this well test. All samples were flashed to atmospheric conditions and analyzed.

2. The composition of the flashed water samples did not vary within our analytical detection limits and accuracy. The almost constant composition of the produced liquid phase indicates that there are no noticeable changes in the reservoir water composition during the duration of this test. Also, it was noted that the water composition is rather similar to that found in other geothermal wells in this area.

3. The water analysis data seem to be accurate enough for most purposes related to the future development of this geothermal project. In particular, the ion balance calculations show excellent internal consistency. However, there seems to exist a discrepancy between the measured and calculated TDS values. We used the analytical data from the other PSL wells and calculated both the ion and TDS balances. The same situation exists in those cases: Good ion balances but the same discrepencies between the calculated and measured TDS! These discrepancies seem to be caused by CO_2 escaping from the

sample during the actual TDS determination. This means, the calculated TDS values are more accurate than the measured TDS values.

4. A total of eight (8) gas samples instead of ten (10) were collected. This number of gas samples seem to be efficient based on some preliminary gas/liquid ratio measurements performed at the site.

5. Six (6) of the gas samples were collected at the wellhead from the two-phase production line. The remaining two (2) gas samples were collected from the separator.

6. The gas composition varied throughout the test as opposed to the liquid composition.

7. Large concentrations of air were found in all gas samples. The most likely source for this air-contamination must be seen in the air-contamination of the reservoir that was caused during a previous well test (using an airlift method instead of a downhole pump. Air must have contaminated the reservoir during these previous well tests.

8. When the separator was used, extremely small well head production rates were selected in order to stay within the separator operating limits. For this reason, the downhole pump was drastically slowed down. During this time, (this means while all the fluids were produced through the existing separator), the gas composition of the produced fluids changed drastically. The nitrogen content went from approximately 37 volume percent (wellhead samples) to approximately 75 volume percent (wellhead separator samples). This could mean that one of the existing production zones contains large amounts of nitrogen and that this zone is produced preferentially at low total mass flow rates.

9. The separator gas was also examined for its H2S content. For this reason, an additional gas sample was collected and analyzed.

10. None of the gas samples collected at the wellhead were examined for the H2S content. There was too little gas separated from our sampling equipment and too little H2S (if any at all) in these gases to obtain sufficiently large sample volumes for a precise H2S analysis.

11. If any H2S exists at all in the produced gases, it will be below 0.065 mg per liter gas. This means, there should not be any environmental problems related to H2S in this geothermal development unless the low H2S concentration is an artifact caused by previous air injections into the reservoir.

12. The produced waters seem to contain sufficiently large concentrations of barium and sulfate ions to generate a $BaSO_4$ scale problem. There also seems to exist a possibility of $CaCO_3$ scale formation. Only correct calculations can determine whether or not any of these scale problems truly exist in the field (downhole).

13. The data given in this report are sufficient to perform some calculations related to the potentially existing $CaCO_3$ and $BaSO_4$ scale problems.

3.0 RECOMMENDATIONS

In this section of the report we outline some of our recommendations related to this well test of PG-4:

1. We strongly recommend to perform some complete model calculations using the gas and liquid data given in this report. These calculations should be concerned with the flash behavior and the scale forming tendency of the reservoir fluids and all produced fluids under all conceivable production conditions.

2. All computer calculations related to any scale formation and to the pertinent flash requirements must start with some flash calculations. The bubble point pressures and the pertinent flash behavior of the reservoir fluids and the produced fluids should be calculated by using a reliable computer model and the data given in this report.

3. $BaSO_4$ and $CaCO_3$ scale tendency calculations should follow these bubble point pressure and flash calculations.

4.0 SHORT HISTORY OF PG-4 WELL TEST

A downhole pump was installed in the well. A fairly small, upright (cylindrical) test separator was also installed at the well site. However, this test separator was used only for a relative short period of time. This separator was simply too small to be operated efficiently and reliably under the rather large maximum flow rate conditions. This means, the well is able to produce at least 10 times the amount of fluids that this separator could reliably handle.

The well test (i.e. the downhole pump) was started in the morning of August 21, 1986. The sampling equipment was started at 11:20 (all times given in this report are in "military time").

The separator was started in the evening of August 21, 1986. During the early morning of August 22, 1986 (at 03:00 hours), the separator was shut down and the well flow rate was drastically increased again. The test was concluded on August 22, 1986 at 11:00 hours.

4.1 WELL HEAD SAMPLING

Initally, the sampling equipment was "hooked" into the two-phase production line close to the well head. Most of our gas and liquid sampling as well as our gas/liquid ratio determinations were performed with the fluids flowing in this two-phase flow line.

4.1.1 WATER SAMPLING

The sampling method used at this location was fairly simple:

A 500 ml glass separator was used to separate the liquid phase from the gas phase at atmospheric pressure. The inlet to this glass separator was connected through a needle valve to the two-phase flow line close to the wellhead. The glass separator was operated at a liquid flow rate of a maximum of 300 ml per minute. The water was continuously drained through the bottom outlet of the glass separator.

Two types of water samples were collected:

1. Non-acidified, raw water samples:

   The water from the glass separator was filled directly into a 1000 ml polyethylene sample bottle. Care was taken to avoid air contamination of the collected samples.

2. Acidified water samples.

   Five (5) ml of concentrated HNO3 (nitric acid) were filled into a calibrated 200 ml polyethylene sample container. The sample was filled into this sample container from the bottom outlet of the glass separator. Sample water was filled into these calibrated sample containers until the red mark at 200 ml fill volume was reached.

The constituents of the non-acidified, raw water samples may still chemically react during sample transport and treating prior to the actual analysis. If these reactions lead to precipitations, the actual analysis may become invalid. To avoid many of these potentially occuring precipitation reactions, the nitric acid was used in some of the samples.

As it turned out later, the nitric acid prevented some of the iron ions to precipitate prior to analysis. This means, the acidified samples show the correct iron content of the produced water and not the raw samples.

4.1.2 GAS SAMPLING

Glass bulbs having a volume of 250 ml were used for the sampling of the gas. These sampling bulbs were connected to the gas line of the glass separator.

The cylindrical gas sample bulbs have a glass/teflon valve at each end. Another opening near the center of each bulb was closed with a silicon rubber septum to allow a convenient aliquoting of the gas sample for a later analysis by gas chromotography (GC).

After filling all gas lines and the sample bulb with produced water, the sampling process was started. The glass separator was operated as described above (see Water Sampling) and below (Gas/Liquid Ratio Measurements During Sampling). The gas from the glass separator displaced the water in all gas lines and the gas sample bulb. After flowing approximately 10 liter of gas through the entire system, the outlet valve of the gas sample bulb was closed. Some pressure was allowed to build up within the gas sample bulb and, then, the inlet valve of the gas sample bulb was closed and the sample bulb was disconnected from the system. This concluded the gas sampling process.

4.2 GAS/LIQUID RATIO MEASUREMENTS DURING SAMPLING

A considerable time was spent to determine the ratio of "gas to liquid" in a slip stream taken from the two-phase line. The gas/liquid separation was performed at atmospheric pressure. The needle valve (inlet line to glass separator) was adjusted to give a rather steady total mass flow rate into the glass separator. Then, the water outlet valve of the glass separator was adjusted so that a rather constant level of liquid was observed within this separator.

At a given start time and a certain fluid level within the separator, the water flow rate out of the separator was monitored by flowing the water into a 1000 ml volumetric cylinder. After a measured period of time and after the water level within the separator was precisely located at the start mark, the monitoring was stopped. This method gave rather accurate numbers about the water flow rate out of the glass separator.

Then, the same method of operating the glass separator over a given time was used to monitor the gas flow rate out of the separator. The same volumetric cylinder was filled with water and was mounted in an inverted position in a water bath. At the start of the monitoring period, the gas was flowing into the cylinder to replace the water. When the water level was at the 1000 ml mark within the cylinder and, at the same time, the water levels inside and outside of the cylinder were equal, the time for this monitoring process was stopped. This test tells us how

many ml of gas were produced per minute at a given, previously measured water production rate. In other words, this method allows us a rather quick and simple but still accurate gas/liquid ratio determination.

Table 1 of this report shows the actual measured and the calculated numbers.

The major problem with this method is the fact that the slip stream of fluids from the two-phase line may contain various amounts of gases and liquids that were flashed within the wellbore prior to reaching the sample point.

In other words, the fluids entering the glass separator may contain two types of gas:

1. The gas flashed from the liquid phase as the high-pressure water is exposed to a pressure drop between the two-phase flow line and the glass separator.

2. The free gas that already existed at the pressure within the two-phase flow line. This free gas was formed through flashing of the reservoir fluids on their way up the wellbore into this two-phase line. We know of only two accurate and reliable means to avoid these problems:

   a. The pressure at the point of sampling (i.e. within the two-phase line) must be kept above the bubble point pressure, thus assuring the flow of a single-phase liquid in this two-phase line.

   b. A wellhead separator has to be used at the test site and all flow measurements have to be performed with single-phase fluids, i.e., using the gas line and the liquid line out of the separator.

Both methods have been used at the test site.

The wellbore separator was operated during the night of August 2 to 22, 1986 under the following conditions:

1. Sep. Press: ~~58~~ 54 psig
2. Sep. Temp: ~~143~~ 142°F 'F
3. Liquid Rate: ~~200~~ 250 gpm or ~~757~~ 946 lpm
4. Gas Discharge Rate: 136 lpm

Corrections by RAC 9/15/86

The gas/liquid ratio based on these numbers is ~~0.180~~ 0.144 (ml/ml) or ~~180~~ 144 ml of gas per 1000 ml of liquid.

The agreement between the gas/liquid ratios in the two-phase flow line and that measured in the separator seems to be excellent. However, we believe that this agreement is rather superficial for the following reasons:

The pressure drop by measuring the gas/liquid rate in the two-phase flow line is actually equivalent to the actual pressure within this two-phase flow line because the fluids are flashed down to atmospheric pressure within the glass separator. For example, if the line pressure is 44 psig, then the measured gas/liquid ratio of 0.187 (see Table 1) is due to a flash of the reservoir fluids from reservoir pressure to atmospheric pressure.

The situation is quite different when it comes to the gas/liquid ratio measurement in the wellhead separator. here, only the flash from reservoir pressure to 58 psig is considered. To make things even more difficult the gas/liquid ratio (GLR) of 0.180 has to be interpreted somewhat differently than the GLR determined at the wellhead. The wellhead pressure GLR is expressed in "ml of gas (measured at atmospheric pressure) that is liberated from one liter reservoir fluid if this reservoir fluid is flashed by decreasing the reservoir pressure down to 58 psig".

4.3 SEPARATOR SAMPLING

In order to perform some measurements and sampling by using the wellhead separator, the total wellhead flow had to be drastically reduced. This was accomplished through reducing the RPM of the downhole pump and pinching of the inlet valve of the wellhead separator.

A constant liquid level was established within the wellhead separator by regulating the water outlet valve. The pressure within the separator was adjusted by regulating the gas outlet valve. using this method (all valves were manually operated) resulted in fairly constant gas and liquid flow rates out of the separator and a constant liquid level and pressure within the separator.

The liquid flow rate out of the separator was measured with an ultra-sonic flow meter. The small gas flow rate was measured by using the calibrated cylinder (see above under Wellhead Sampling).

Samples of gases and liquids were collected by using the methods also described earlier in this report.

5.0 ANALYTICAL REPORT (WATER ANALYSES)

Table 2 shows the analytical data related to the water samples collected both at the wellhead and at the separator. Ion balances performed on these data indicate that there is a good

agreement between the cations and the anions. Obviously, this means that all major constituents of these water samples are accounted for.

There are major differences between the measured and calculated TDS of each sample. The calculated TDS is much higher than the actually measured TDS. There is a fairly simple explanation for this "phenomenon". The pH of the samples is below 7 and the HCO3 content of each sample is high. for an actual TDS determination, the sample is heated close to its boiling point to vaporize the water. However, not only the water but also some of the CO2 escaped from the sample during these TDS determination. In other words, the HCO3 content of the sample was converted into an equivalent CO3 content. Naturally, this conversion is accompanied by a weight loss. Therefore, the calculated and not the actually measured TDS values should be used for any future utilization of these analytical data.

6.0 ANALYTICAL REPORT (GAS ANALYSES)

Table 3 shows the results of the gas analyses. Some of the pertinent details of the gas samples are given in Table 1.

There seems to exist a major problem regarding the gas analysis data as shown in Table 3. The oxygen content is much too high in order to represent a "normal" geothermal non-condensable gas. All the samples appeared to be contaminated with air. At first, we thought of the possibility of having caused an air contamination during the sampling or the analytical work. However, this possibility was discarded for two reasons:

1. The air contamination is not only too high but also seems to be rather constant throughout the entire set of samples. None of our equipment or sampling procedures would cause such a uniform "picture".

2. After discussing the problem with PSL personnel it became apparent that the gas samples should contain certain concentrations of air due to the fact that rather large quantities of air were injected into the well during a previous attempt to flow the well (air-lifting).

It was decided that the data given in Table 3 represent correct analytical values. Furthermore, all samples were analyzed in triplicate to shed some light on the obvious air problem. The data listed in Table 3 represent average values of the individual three analyses of each sample.

Naturally, the high air contamination decreased the concentrations of the other constituents in the remainder of each gas sample. This means that portion of each gas sample that is truly

due to the true reservoir fluids has actually a higher concentration than that indicated in Table 3. Therefore, only the major constituents in these gas samples can be used for all further work regarding these data.

An attempt was made to back-calculate the nitrogen and CO2 contents of the gas that is truly due to native reservoir fluids. In order to perform these calculations, it was assumed that the entire oxygen content of the samples (see Table 3) is due to air contamination. The results of these computations are given in Table 4.

Even a casual glance at these data in Table 4 would show extremely high nitrogen concentrations in the two separator samples. This high nitrogen content does not fall in line with the nitrogen values of all the other samples collected at the wellhead. (IF THE SEPARATOR PRESSURE WAS ABOVE CO_2 BUBBLE PT, BUT BELOW N_2 BUBBLE PT., THE SEPARATOR GAS WOULD BE ENRICHED IN N_2 RELATIVE TO GAS SAMPLES ACQUIRED BY FLASHING TO ATMOSPHERIC PRESSURE. JRC, 9-15-86.

7.0 SULFIDE ANALYSES OF GASES

There was no smell of H2S at the well site at any time during the well test. Still, an attempt was made to trap any H2S that may potentially exist in the exhausted separator gas. In order to determine extremely small concentrations of H2S in a gas, an easy and accurate method is to bubble large volumes of this gas through a trap that contains a solution of CaSO4 or any other H2S "scavenger" in water. This means, large and correctly measured volumes of the gas have to b bubbled through this trap. The H2S will react with the Cd ions and will form CdS that can then be accurately determined. These large volumes of gas were available only from the separator that was installed at the test site.

80,000 ml of separator gas at ambient pressure and temperature were bubbled through the trap. The detection limits for H2S in this particular set-up would have been approximately 5 mg of H2S in these 80,000 ml. However, no detectable sulfide ions were found. This means, the separator gas contained less than 0.063 mg H2S per liter of separator gas.

Considering these extremely low H2S concentrations and the absence of any H2S smell at the test site, no further attempts were made to determine the H2S in the produced fluids.

These extremely low H2S values could mean either one of two initial factors for this entire geothermal project:

1. There is no, or only an extremely small, H2S concentration in the reservoir fluids.

2. Any measurable amount of H2S was oxidized during previous attempts of flowing the well through air-lifting.

TABLE 4

WELL TEST OF GEOTHERMAL WELL PG-4
(NEW MEXICO STATE UNIVERSITY)
CHEMICAL ANALYSES OF PRODUCED GASES
(AUGUST 1986)

AVERAGE ANALYTICAL VALUES (IN VOLUME PERCENT)
AFTER COMPUTATIONAL EXCLUSION OF AIR

VR CODE	N2	CO2	AR/O2	TOTAL
1156	18.1	82.4	**	100.5
1157	16.6	81.6	**	98.2
1158	17.5	80.1	**	97.6
1159	12.7	84.6	**	97.3
1160	73.4	25.8	**	99.2
1161	76.7	22.5	**	99.2
1162	18.9	82.5	**	101.4
1163	13.2	85.7	**	98.9

NORMALIZED COMPOSITION (IN VOLUME PERCENT)
AFTER COMPUTATIONAL EXCLUSION OF AIR

VR CODE	N2	CO2	AR/O2	TOTAL
1156	18.0	82.0	**	100.0
1157	16.9	83.1	**	100.0
1158	17.9	82.1	**	100.0
1159	13.1	86.9	**	100.0
1160	74.0	26.0	**	100.0
1161	77.3	22.7	**	100.0
1162	18.6	81.4	**	100.0
1163	13.3	86.7	**	100.0

SAMPLE IDENTIFICATION

VR CODE	SAMPLE ID	DATE	TIME
1156	PG-4 WH	8/21/86	11:50
1157	PG-4 WH	8/21/86	14:00
1158	PG-4 WH	8/21/86	15:00
1159	PG-4 WH	8/21/86	18:25
1160	PG-4 SEPARATOR	8/22/86	03:00
1161	PG-4 SEPARATOR	8/22/86	03:10
1162	PG-4 WH	8/22/86	09:00
1163	PG-4 WH	8/22/86	11:01

** Note: Oxygen was removed by computation.

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
4: 9: 0	22-AU	23.000	23.000	145.7	96.73
4:11: 0	22-AU	23.033	23.033	145.8	96.71
4:11:30	22-AU	23.042	23.042	145.7	96.67
4:12:30	22-AU	23.058	23.058	145.8	96.73
4:28:30	22-AU	23.325	23.325	145.8	96.67
4:32:30	22-AU	23.392	23.392	145.8	96.64
4:34:30	22-AU	23.425	23.425	145.8	96.71
4:36:30	22-AU	23.458	23.458	145.8	96.60
4:44:30	22-AU	23.592	23.592	145.8	96.69
4:45: 0	22-AU	23.600	23.600	145.7	96.63
4:47: 0	22-AU	23.633	23.633	145.8	96.64
4:47:30	22-AU	23.642	23.642	145.8	96.71
4:51:30	22-AU	23.708	23.708	145.8	96.66
4:52: 0	22-AU	23.717	23.717	145.8	96.66
4:53: 0	22-AU	23.733	23.733	145.7	96.54
4:54: 0	22-AU	23.750	23.750	145.8	96.60
4:58: 0	22-AU	23.817	23.817	145.8	96.55
4:58:30	22-AU	23.825	23.825	145.8	96.51
4:59: 0	22-AU	23.833	23.833	145.8	93.77
4:59:30	22-AU	23.842	23.842	145.8	92.00
5: 0: 0	22-AU	23.850	23.850	145.8	91.98
5: 0:30	22-AU	23.858	23.858	145.8	92.20
5: 1: 0	22-AU	23.867	23.867	145.8	92.14
5: 1:30	22-AU	23.875	23.875	145.8	92.20
5: 2: 0	22-AU	23.883	23.883	145.8	94.55
5: 2:30	22-AU	23.892	23.892	145.8	94.89
5: 3: 0	22-AU	23.900	23.900	145.8	94.18
5:19: 0	22-AU	24.167	24.167	145.8	94.36
5:20: 0	22-AU	24.183	24.183	145.8	94.37
5:20:30	22-AU	24.192	24.192	145.8	94.32
5:21: 0	22-AU	24.200	24.200	145.8	94.37
5:29: 0	22-AU	24.333	24.333	145.8	94.33
5:31: 0	22-AU	24.367	24.367	145.8	94.37
6: 3: 0	22-AU	24.900	24.900	145.8	94.40
6:11: 0	22-AU	25.033	25.033	145.8	94.49
6:43: 0	22-AU	25.567	25.567	145.8	94.46
6:51: 0	22-AU	25.700	25.700	145.8	94.48
6:53: 0	22-AU	25.733	25.733	145.7	94.50
6:54: 0	22-AU	25.750	25.750	145.8	94.48
6:54:30	22-AU	25.758	25.758	146.0	94.40
6:56:30	22-AU	25.792	25.792	145.8	94.49
6:57:30	22-AU	25.808	25.808	145.8	94.46
6:58: 0	22-AU	25.817	25.817	145.8	94.55
6:58:30	22-AU	25.825	25.825	145.8	94.45
6:59: 0	22-AU	25.833	25.833	145.8	94.51
7:15: 0	22-AU	26.100	26.100	145.8	94.48
7:19: 0	22-AU	26.167	26.167	145.8	94.49
7:21: 0	22-AU	26.200	26.200	145.8	94.51
7:21:30	22-AU	26.208	26.208	145.8	94.45

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
13: 9: 0	22-AU	32.000	32.000	145.8	96.52
13: 9:30	22-AU	32.008	32.008	145.8	96.66
13:13:30	22-AU	32.075	32.075	145.8	96.58
13:29:30	22-AU	32.342	32.342	145.7	96.63
13:31:30	22-AU	32.375	32.375	145.8	96.57
13:32: 0	22-AU	32.383	32.383	145.7	94.27
13:32:30	22-AU	32.392	32.392	145.7	88.40
13:33: 0	22-AU	32.400	32.400	145.8	88.01
13:35: 0	22-AU	32.433	32.433	145.8	88.17
13:36: 0	22-AU	32.450	32.450	145.7	88.08
13:38: 0	22-AU	32.483	32.483	145.7	88.14
13:38:30	22-AU	32.492	32.492	145.7	88.10
13:39: 0	22-AU	32.500	32.500	145.7	86.56
13:39:30	22-AU	32.508	32.508	145.7	81.61
13:40: 0	22-AU	32.517	32.517	145.8	79.46
13:40:30	22-AU	32.525	32.525	145.7	79.66
13:41: 0	22-AU	32.533	32.533	145.7	79.69
13:42: 0	22-AU	32.550	32.550	145.7	79.51
13:43: 0	22-AU	32.567	32.567	145.8	79.45
13:43:30	22-AU	32.575	32.575	145.7	79.55
13:45:30	22-AU	32.608	32.608	145.8	79.48
13:49:30	22-AU	32.675	32.675	145.8	79.55
13:51:30	22-AU	32.708	32.708	145.8	79.56
13:52:30	22-AU	32.725	32.725	146.0	79.56
13:53: 0	22-AU	32.733	32.733	145.8	77.79
13:53:30	22-AU	32.742	32.742	145.8	71.12
13:54:30	22-AU	32.758	32.758	145.8	71.05
13:55:30	22-AU	32.775	32.775	145.7	71.30
13:56: 0	22-AU	32.783	32.783	145.7	71.39
13:57: 0	22-AU	32.800	32.800	145.7	71.33
13:57:30	22-AU	32.808	32.808	145.7	71.29
13:58: 0	22-AU	32.817	32.817	145.7	68.92
13:58:30	22-AU	32.825	32.825	145.7	63.16
13:59: 0	22-AU	32.833	32.833	145.5	62.75
13:59:30	22-AU	32.842	32.842	145.5	62.73
14: 0:30	22-AU	32.858	32.858	145.4	62.99
14: 2:30	22-AU	32.892	32.892	145.2	62.89
14: 3: 0	22-AU	32.900	32.900	145.2	57.51
14: 3:30	22-AU	32.908	32.908	145.2	54.08
14: 4:30	22-AU	32.925	32.925	145.2	54.42
14: 5: 0	22-AU	32.933	32.933	145.2	54.43
14: 5:30	22-AU	32.942	32.942	145.1	54.29
14: 6:30	22-AU	32.958	32.958	145.1	54.23
14: 7:30	22-AU	32.975	32.975	145.1	54.35
14: 8: 0	22-AU	32.983	32.983	145.1	50.56
14: 8:30	22-AU	32.992	32.992	145.1	45.81
14: 9: 0	22-AU	33.000	33.000	144.9	45.94
14: 9:30	22-AU	33.008	33.008	144.9	45.90
14:10:30	22-AU	33.025	33.025	144.8	45.70

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
16:30:30	22-AU	35.358	35.358	108.3	19.65
16:31: 0	22-AU	35.367	35.367	108.1	19.54
16:31:30	22-AU	35.375	35.375	108.0	19.59
16:32:30	22-AU	35.392	35.392	107.8	19.21
16:33:30	22-AU	35.408	35.408	107.8	18.91
16:34: 0	22-AU	35.417	35.417	107.8	18.79
16:36: 0	22-AU	35.450	35.450	108.4	17.85
16:36:30	22-AU	35.458	35.458	108.6	17.77
16:37: 0	22-AU	35.467	35.467	108.7	17.35

due to the true reservoir fluids has actually a higher concentration than that indicated in Table 3. Therefore, only the major constituents in these gas samples can be used for all further work regarding these data.

An attempt was made to back-calculate the nitrogen and CO2 contents of the gas that is truly due to native reservoir fluids. In order to perform these calculations, it was assumed that the entire oxygen content of the samples (see Table 3) is due to air contamination. The results of these computations are given in Table 4.

Even a casual glance at these data in Table 4 would show extremely high nitrogen concentrations in the two separator samples. This high nitrogen content does not fall in line with the nitrogen values of all the other samples collected at the wellhead. (IF THE SEPARATOR PRESSURE WAS ABOVE CO_2 BUBBLE PT, BUT BELOW N_2 BUBBLE PT., THE SEPARATOR GAS WOULD BE ENRICHED IN N_2 RELATIVE TO GAS SAMPLES ACQUIRED BY FLASHING TO ATMOSPHERIC PRESSURE.) RBC, 9-15-86.

7.0 SULFIDE ANALYSES OF GASES

There was no smell of H2S at the well site at any time during the well test. Still, an attempt was made to trap any H2S that may potentially exist in the exhausted separator gas. In order to determine extremely small concentrations of H2S in a gas, an easy and accurate method is to bubble large volumes of this gas through a trap that contains a solution of CaSO4 or any other H2S "scavenger" in water. This means, large and correctly measured volumes of the gas have to be bubbled through this trap. The H2S will react with the Cd ions and will form CdS that can then be accurately determined. These large volumes of gas were available only from the separator that was installed at the test site.

80,000 ml of separator gas at ambient pressure and temperature were bubbled through the trap. The detection limits for H2S in this particular set-up would have been approximately 5 mg of H2S in these 80,000 ml. However, no detectable sulfide ions were found. This means, the separator gas contained less than 0.063 mg H2S per liter of separator gas.

Considering these extremely low H2S concentrations and the absence of any H2S smell at the test site, no further attempts were made to determine the H2S in the produced fluids.

These extremely low H2S values could mean either one of two initial factors for this entire geothermal project:

1. There is no, or only an extremely small, H2S concentration in the reservoir fluids.

2. Any measurable amount of H2S was oxidized during previous attempts of flowing the well through air-lifting.

Presently, there does not seem to exist sufficient data to determine which one of the two factors is the true cause for our findings that there was barely any (if any) H_2S in the produced fluids during this geothermal well test.

TABLE 1

GAS/LIQUID LIQUID RATIO DETERMINATIONS

AT WELLHEAD TWO-PHASE LINE
(August 1986)

DATE	TIME	TOTAL (GPM)	PRESS. (psig)	FLOW RATES FROM SAMPLING DEVICE WATER (min/ltr)	GAS (min/ltr)	GAS/LIQUID RATIO (ml/ml)
8/21	11:44	~~518~~	44	2:46	-	-
8/21	12:00	~~507~~	44	2:47	-	-
8/21	12:30	~~508~~ 700	44	-	15:30	0.178
8/21	12:50	~~519~~	44	2:46	-	-
8/21	13:00	~~518~~	44	1:55	-	-
8/21	13:03	~~520~~ 700	44	1:54	-	-
8/21	13:37	~~520~~	44	-	10:15	0.187
8/21	13:50	~~519~~	44	1:56	-	-
8/21	17:00	~~610~~	95	2:35	-	-
8/21	17:05	~~608~~ 350	95	2:37	-	-
8/21	17:10	~~610~~	95	-	13:50	0.187
8/21	17:25	~~610~~	95	2:38	-	-
8/22	09:05	~~709~~	63	2:24	-	-
8/22	09:10	~~710~~	64	2:25	-	-
8/22	09:13	~~709~~ 750	63	-	13:19	0.186
8/22	09:30	~~710~~	63	2:27	-	-

TABLE 2

WELL TEST OF GEOTHERMAL WELL PG-4
(NEW MEXICO STATE UNIVERSITY)
CHEMICAL ANALYSES OF PRODUCED WATERS
(AUGUST 1986)

VR CODE	SAMPLE ID	DATE	TIME	NA	CA	MG
1142	-WH	8/21/86	12:25:00	427.	158.	31.1
1143	-WH	8/21/86	13:10:00	427.	158.	31.0
1144	-WH	8/21/86	14:00:00	427.	159.	30.9
1145	-WH	8/21/86	17:00:00	427.	157.	31.0
1146	-WH	8/21/86	18:20:00	427.	154.	30.6
1147	-SEPARATOR	8/22/86	03:00:00	436.	155.	30.9
1148	-WH	8/22/86	09:00:00	436.	155.	31.3
1149	-WH	8/22/86	10:00:00	436.	162.	31.5
1150	-WH	8/22/86	10:30:00	427.	155.	31.2
1151	-WH (ACID)	8/21/86	15:00:00	422.	163.	31.1
1152	-WH (ACID)	8/21/86	17:01:00	422.	162.	31.5
1153	-WH (ACID)	8/21/86	18:20:00	429.	164.	31.3
1154	-SEP. (ACID)	8/22/86	03:05:00	424.	161.	31.9
1155	-WH (ACID)	8/22/86	09:00:00	426.	159.	31.8

VR CODE	SAMPLE ID	DATE	TIME	K	CL	SO4
1142	-WH	8/21/86	12:25:00	49.3	541.	247.
1143	-WH	8/21/86	13:10:00	49.8	541.	247.
1144	-WH	8/21/86	14:00:00	49.5	541.	244.
1145	-WH	8/21/86	17:00:00	49.3	543.	242.
1146	-WH	8/21/86	18:20:00	51.1	539.	239.
1147	-SEPARATOR	8/22/86	03:00:00	49.8	538.	252.
1148	-WH	8/22/86	09:00:00	49.0	545.	249.
1149	-WH	8/22/86	10:00:00	49.0	545.	244.
1150	-WH	8/22/86	10:30:00	48.5	539.	249.
1151	-WH (ACID)	8/21/86	15:00:00	48.6	N/R	N/R
1152	-WH (ACID)	8/21/86	17:01:00	48.5	N/R	N/R
1153	-WH (ACID)	8/21/86	18:20:00	49.8	N/R	N/R
1154	-SEP. (ACID)	8/22/86	03:05:00	48.2	N/R	N/R
1155	-WH (ACID)	8/22/86	09:00:00	48.7	N/R	N/R

VR CODE	SAMPLE ID	DATE	TIME	HCO3	PH	TDS
1142	-WH	8/21/86	12:25:00	605.	6.56	1780
1143	-WH	8/21/86	13:10:00	610.	6.86	1770
1144	-WH	8/21/86	14:00:00	602.	6.60	1750
1145	-WH	8/21/86	17:00:00	597.	6.67	1770
1146	-WH	8/21/86	18:20:00	605.	6.69	1760
1147	-SEPARATOR	8/22/86	03:00:00	605.	6.58	1770
1148	-WH	8/22/86	09:00:00	600.	6.59	1740
1149	-WH	8/22/86	10:00:00	607.	6.57	1780
1150	-WH	8/22/86	10:30:00	600.	6.63	1790
1151	-WH (ACID)	8/21/86	15:00:00	N/R	N/R	N/R
1152	-WH (ACID)	8/21/86	17:01:00	N/R	N/R	N/R
1153	-WH (ACID)	8/21/86	18:20:00	N/R	N/R	N/R
1154	-SEP. (ACID)	8/22/86	03:05:00	N/R	N/R	N/R
1155	-WH (ACID)	8/22/86	09:00:00	N/R	N/R	N/R

VR CODE	SAMPLE ID	DATE	TIME	F	MN	BA
1142	-WH	8/21/86	12:25:00	2.17	0.091	0.32
1143	-WH	8/21/86	13:10:00	2.17	0.088	0.28
1144	-WH	8/21/86	14:00:00	2.15	0.087	0.21
1145	-WH	8/21/86	17:00:00	2.15	0.088	0.27
1146	-WH	8/21/86	18:20:00	2.17	0.090	0.33
1147	-SEPARATOR	8/22/86	03:00:00	2.17	0.086	0.23
1148	-WH	8/22/86	09:00:00	2.17	0.145	0.46
1149	-WH	8/22/86	10:00:00	2.15	0.155	0.30
1150	-WH	8/22/86	10:30:00	2.11	0.149	0.24
1151	-WH (ACID)	8/21/86	15:00:00	N/R	0.101	0.27
1152	-WH (ACID)	8/21/86	17:01:00	N/R	0.098	0.29
1153	-WH (ACID)	8/21/86	18:20:00	N/R	0.097	0.25
1154	-SEP. (ACID)	8/22/86	03:05:00	N/R	0.101	0.32
1155	-WH (ACID)	8/22/86	09:00:00	N/R	0.156	0.29

VR CODE	SAMPLE ID	DATE	TIME	FE	SIO2	TOC
1142	-WH	8/21/86	12:25:00	<0.05	43.6	8.40
1143	-WH	8/21/86	13:10:00	<0.05	45.5	6.50
1144	-WH	8/21/86	14:00:00	<0.05	46.0	7.00
1145	-WH	8/21/86	17:00:00	<0.05	43.6	9.30
1146	-WH	8/21/86	18:20:00	<0.05	44.2	6.00
1147	-SEPARATOR	8/22/86	03:00:00	<0.05	44.2	2.10
1148	-WH	8/22/86	09:00:00	<0.05	45.7	6.20
1149	-WH	8/22/86	10:00:00	<0.05	46.7	3.80
1150	-WH	8/22/86	10:30:00	<0.05	43.8	5.80
1151	-WH (ACID)	8/21/86	15:00:00	1.19	44.6	N/R
1152	-WH (ACID)	8/21/86	17:01:00	1.29	44.7	N/R
1153	-WH (ACID)	8/21/86	18:20:00	0.940	45.6	N/R
1154	-SEP. (ACID)	8/22/86	03:05:00	1.45	44.7	N/R
1155	-WH (ACID)	8/22/86	09:00:00	0.970	45.0	N/R

N/R = Not requested for acidified samples

TABLE 3

WELL TEST OF GEOTHERMAL WELL PG-4
(NEW MEXICO STATE UNIVERSITY)
CHEMICAL ANALYSES OF PRODUCED GASES
(AUGUST 1986)

AVERAGE ANALYTICAL VALUES (IN VOLUME PERCENT)
BEFORE COMPUTATIONAL EXCLUSION OF AIR

VR CODE	N2	CO2	AR/O2	TOTAL
1156	40.9	51.3	8.3	100.5
1157	39.8	50.1	8.3	98.2
1158	38.4	51.6	7.6	97.6
1159	36.8	52.4	8.1	97.3
1160	75.1	15.1	9.0	99.2
1161	77.0	14.2	8.0	99.2
1162	35.7	59.5	6.2	101.4
1163	35.4	56.0	7.5	98.9

NORMALIZED COMPOSITION (IN VOLUME PERCENT)
BEFORE COMPUTATIONAL EXCLUSION OF AIR

VR CODE	N2	CO2	AR/O2	TOTAL
1156	40.7	51.0	8.3	100.0
1157	40.6	51.0	8.4	100.0
1158	39.3	52.9	7.8	100.0
1159	37.8	53.9	8.3	100.0
1160	75.7	15.2	9.1	100.0
1161	77.6	14.3	8.1	100.0
1162	35.2	58.7	6.1	100.0
1163	35.8	56.7	7.5	100.0

SAMPLE IDENTIFICATION

VR CODE	SAMPLE ID	DATE	TIME
1156	PG-4 WH	8/21/86	11:50
1157	PG-4 WH	8/21/86	14:00
1158	PG-4 WH	8/21/86	15:00
1159	PG-4 WH	8/21/86	18:25
1160	PG-4 SEPARATOR	8/22/86	03:00
1161	PG-4 SEPARATOR	8/22/86	03:10
1162	PG-4 WH	8/22/86	09:00
1163	PG-4 WH	8/22/86	11:01

** Note: Oxygen was removed by computation.

TABLE 4

WELL TEST OF GEOTHERMAL WELL PG-4
(NEW MEXICO STATE UNIVERSITY)
CHEMICAL ANALYSES OF PRODUCED GASES
(AUGUST 1986)

AVERAGE ANALYTICAL VALUES (IN VOLUME PERCENT)
AFTER COMPUTATIONAL EXCLUSION OF AIR

VR CODE	N2	CO2	AR/O2	TOTAL
1156	18.1	82.4	**	100.5
1157	16.6	81.6	**	98.2
1158	17.5	80.1	**	97.6
1159	12.7	84.6	**	97.3
1160	73.4	25.8	**	99.2
1161	76.7	22.5	**	99.2
1162	18.9	82.5	**	101.4
1163	13.2	85.7	**	98.9

NORMALIZED COMPOSITION (IN VOLUME PERCENT)
AFTER COMPUTATIONAL EXCLUSION OF AIR

VR CODE	N2	CO2	AR/O2	TOTAL
1156	18.0	82.0	**	100.0
1157	16.9	83.1	**	100.0
1158	17.9	82.1	**	100.0
1159	13.1	86.9	**	100.0
1160	74.0	26.0	**	100.0
1161	77.3	22.7	**	100.0
1162	18.6	81.4	**	100.0
1163	13.3	86.7	**	100.0

SAMPLE IDENTIFICATION

VR CODE	SAMPLE ID	DATE	TIME
1156	PG-4 WH	8/21/86	11:50
1157	PG-4 WH	8/21/86	14:00
1158	PG-4 WH	8/21/86	15:00
1159	PG-4 WH	8/21/86	18:25
1160	PG-4 SEPARATOR	8/22/86	03:00
1161	PG-4 SEPARATOR	8/22/86	03:10
1162	PG-4 WH	8/22/86	09:00
1163	PG-4 WH	8/22/86	11:01

** Note: Oxygen was removed by computation.

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
3: 4:30	22-AU	21.825	21.825	145.4	84.47
3: 5:30	22-AU	21.842	21.842	145.4	84.52
3: 6:30	22-AU	21.858	21.858	145.4	84.46
3: 7: 0	22-AU	21.867	21.867	145.4	84.34
3:23: 0	22-AU	22.133	22.133	145.4	84.37
3:31: 0	22-AU	22.267	22.267	145.4	84.39
3:32: 0	22-AU	22.283	22.283	145.4	84.30
3:34: 0	22-AU	22.317	22.317	145.4	84.34
3:35: 0	22-AU	22.333	22.333	145.4	84.25
3:35:30	22-AU	22.342	22.342	145.4	84.37
3:37:30	22-AU	22.375	22.375	145.4	84.34
3:38:30	22-AU	22.392	22.392	145.4	84.39
3:42:30	22-AU	22.458	22.458	145.4	84.30
3:43:30	22-AU	22.475	22.475	145.4	84.37
3:45:30	22-AU	22.508	22.508	145.4	84.28
3:46: 0	22-AU	22.517	22.517	145.4	84.35
3:50: 0	22-AU	22.583	22.583	145.4	84.32
3:52: 0	22-AU	22.617	22.617	145.2	84.38
3:54: 0	22-AU	22.650	22.650	145.4	84.30
3:56: 0	22-AU	22.683	22.683	145.4	84.35
3:57: 0	22-AU	22.700	22.700	145.4	84.28
3:59: 0	22-AU	22.733	22.733	145.4	84.34
3:59:30	22-AU	22.742	22.742	145.4	84.23
4: 0:30	22-AU	22.758	22.758	145.4	84.37
4: 1: 0	22-AU	22.767	22.767	145.2	84.38
4: 1:30	22-AU	22.775	22.775	145.5	84.29
4: 3:30	22-AU	22.808	22.808	145.4	84.28
4: 4: 0	22-AU	22.817	22.817	145.4	84.35
4:12: 0	22-AU	22.950	22.950	145.4	84.34
4:14: 0	22-AU	22.983	22.983	145.4	84.32
4:15: 0	22-AU	23.000	23.000	145.4	84.37
4:23: 0	22-AU	23.133	23.133	145.4	84.34
4:24: 0	22-AU	23.150	23.150	145.4	84.23
4:26: 0	22-AU	23.183	23.183	145.4	84.34
4:28: 0	22-AU	23.217	23.217	145.4	84.23
4:29: 0	22-AU	23.233	23.233	145.4	84.35
4:30: 0	22-AU	23.250	23.250	145.4	84.32
4:30:30	22-AU	23.258	23.258	145.4	84.25
4:31: 0	22-AU	23.267	23.267	145.5	84.36
4:32: 0	22-AU	23.283	23.283	145.4	84.25
4:34: 0	22-AU	23.317	23.317	145.4	84.35
4:42: 0	22-AU	23.450	23.450	145.4	84.30
4:44: 0	22-AU	23.483	23.483	145.4	84.30
4:45: 0	22-AU	23.500	23.500	145.4	84.27
4:45:30	22-AU	23.508	23.508	145.4	84.34
4:49:30	22-AU	23.575	23.575	145.4	84.28
4:51:30	22-AU	23.608	23.608	145.4	84.32
4:52: 0	22-AU	23.617	23.617	145.4	84.08
4:53: 0	22-AU	23.633	23.633	145.4	84.25

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
13: 7:30	22-AU	31.875	31.875	145.4	84.78
13: 8: 0	22-AU	31.883	31.883	145.5	84.75
13: 8:30	22-AU	31.892	31.892	145.5	84.24
13: 9:30	22-AU	31.908	31.908	145.4	84.18
13:10:30	22-AU	31.925	31.925	145.4	84.27
13:26:30	22-AU	32.192	32.192	145.4	84.27
13:28:30	22-AU	32.225	32.225	145.4	84.20
13:30:30	22-AU	32.258	32.258	145.4	84.27
13:31: 0	22-AU	32.267	32.267	145.4	84.25
13:31:30	22-AU	32.275	32.275	145.4	83.74
13:32: 0	22-AU	32.283	32.283	145.2	78.30
13:32:30	22-AU	32.292	32.292	145.2	75.81
13:33:30	22-AU	32.308	32.308	145.4	75.99
13:34:30	22-AU	32.325	32.325	145.4	75.87
13:36:30	22-AU	32.358	32.358	145.4	75.99
13:38:30	22-AU	32.392	32.392	145.4	75.92
13:39: 0	22-AU	32.400	32.400	145.4	71.34
13:39:30	22-AU	32.408	32.408	145.2	67.52
13:40: 0	22-AU	32.417	32.417	145.4	67.59
13:41: 0	22-AU	32.433	32.433	145.4	67.35
13:43: 0	22-AU	32.467	32.467	145.4	67.44
13:44: 0	22-AU	32.483	32.483	145.2	67.31
13:52: 0	22-AU	32.617	32.617	145.2	67.41
13:52:30	22-AU	32.625	32.625	145.2	67.41
13:53: 0	22-AU	32.633	32.633	145.2	61.41
13:53:30	22-AU	32.642	32.642	145.2	58.86
13:54:30	22-AU	32.658	32.658	145.2	59.05
13:56:30	22-AU	32.692	32.692	144.9	58.81
13:57: 0	22-AU	32.700	32.700	144.9	58.88

WELL TEST DATA PRINTOUT

FIELD REPORT # : 04978F

COMPANY : NEW MEXICO STATE UNIVERSITY
WELL : NMSU PG4

INSTRUMENT # : 85499
CAPACITY [PSI] : 10000.
DEPTH [FT] : 549.0
PORT OPENING : OUTSIDE

LABEL POINT INFORMATION

#	TIME OF DAY HH:MM:SS	DATE DD-MM	EXPLANATION	ELAPSED TIME, HR	BOT HOLE PRESSURE PSIA	BOT HOLE TEMP. DEG F
1	5: 9: 0	21-AU	START FLOW	0.000	97.26	139.9
2	8: 0: 0	21-AU	FLOW POINT	2.850	97.19	139.9
3	15:19:30	21-AU	FLOW POINT	10.175	94.57	145.8
4	21:23:30	21-AU	FLOW POINT	16.242	96.00	145.8
5	21:25:30	21-AU	FLOW POINT	16.275	89.71	145.8
6	22:42:30	21-AU	FLOW POINT	17.558	90.57	145.8
7	22:44:30	21-AU	FLOW POINT	17.592	97.62	145.8
8	1:27: 0	22-AU	FLOW POINT	20.300	97.11	145.2
9	1:28: 0	22-AU	FLOW POINT	20.317	91.66	145.2
10	2: 9:30	22-AU	FLOW POINT	21.008	92.04	145.7
11	2:12:30	22-AU	FLOW POINT	21.058	97.42	146.0
12	4:58:30	22-AU	FLOW POINT	23.825	96.51	145.8
13	5: 2: 0	22-AU	FLOW POINT	23.883	94.55	145.8
14	11: 4: 0	22-AU	FLOW POINT	29.917	94.49	145.8
15	11: 6:30	22-AU	FLOW POINT	29.958	97.57	145.8
16	13:31:30	22-AU	PULLED LOOSE	32.375	96.57	145.8
17	16:37: 0	22-AU	END FLOW	35.467	17.35	108.7

SUMMARY OF FLOW PERIODS

PERIOD	START ELAPSED TIME, HR	END ELAPSED TIME, HR	DURATION HR	START PRESSURE PSIA	END PRESSURE PSIA
1	0.000	35.467	35.467	97.26	17.35

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
8:33:30	21-AU	3.408	3.408	145.7	94.13
8:34:30	21-AU	3.425	3.425	145.7	94.29
8:35: 0	21-AU	3.433	3.433	145.7	94.47
8:37: 0	21-AU	3.467	3.467	145.7	94.45
8:38: 0	21-AU	3.483	3.483	145.7	94.47
8:40: 0	21-AU	3.517	3.517	145.7	94.29
8:42: 0	21-AU	3.550	3.550	145.8	94.30
8:43: 0	21-AU	3.567	3.567	145.8	94.30
8:43:30	21-AU	3.575	3.575	145.8	94.37
8:51:30	21-AU	3.708	3.708	145.8	94.36
8:53:30	21-AU	3.742	3.742	145.8	94.34
8:54:30	21-AU	3.758	3.758	145.8	94.34
8:55: 0	21-AU	3.767	3.767	145.7	94.27
8:57: 0	21-AU	3.800	3.800	145.7	94.35
8:57:30	21-AU	3.808	3.808	145.7	94.20
8:58: 0	21-AU	3.817	3.817	145.7	94.30
9: 0: 0	21-AU	3.850	3.850	145.8	94.33
9: 4: 0	21-AU	3.917	3.917	145.8	94.18
9: 6: 0	21-AU	3.950	3.950	145.7	94.25
9: 6:30	21-AU	3.958	3.958	145.7	94.30
9: 8:30	21-AU	3.992	3.992	145.8	94.20
9:12:30	21-AU	4.058	4.058	145.8	94.29
9:13: 0	21-AU	4.067	4.067	145.8	94.33
9:13:30	21-AU	4.075	4.075	145.8	93.71
9:14: 0	21-AU	4.083	4.083	145.8	93.84
9:14:30	21-AU	4.092	4.092	145.7	93.76
9:15:30	21-AU	4.108	4.108	145.7	93.76
9:16: 0	21-AU	4.117	4.117	145.8	93.75
9:17: 0	21-AU	4.133	4.133	145.8	93.50
9:21: 0	21-AU	4.200	4.200	145.7	93.43
9:23: 0	21-AU	4.233	4.233	145.7	93.45
9:24: 0	21-AU	4.250	4.250	145.8	93.53
9:26: 0	21-AU	4.283	4.283	145.8	93.56
9:27: 0	21-AU	4.300	4.300	145.8	93.53
9:27:30	21-AU	4.308	4.308	145.7	93.49
9:29:30	21-AU	4.342	4.342	145.8	93.52
9:30:30	21-AU	4.358	4.358	145.7	93.52
9:31:30	21-AU	4.375	4.375	145.7	93.85
9:32:30	21-AU	4.392	4.392	145.7	93.70
9:40:30	21-AU	4.525	4.525	145.8	93.69
9:42:30	21-AU	4.558	4.558	145.8	93.72
9:43: 0	21-AU	4.567	4.567	145.8	93.69
9:43:30	21-AU	4.575	4.575	145.8	93.20
9:44: 0	21-AU	4.583	4.583	145.7	91.02
9:44:30	21-AU	4.592	4.592	145.8	90.64
9:45:30	21-AU	4.608	4.608	145.7	90.50
9:46: 0	21-AU	4.617	4.617	145.7	90.42
9:46:30	21-AU	4.625	4.625	145.8	90.54
9:47: 0	21-AU	4.633	4.633	145.8	90.48

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
11: 7:30	21-AU	5.975	5.975	145.8	93.77
11:15:30	21-AU	6.108	6.108	145.8	93.83
11:16:30	21-AU	6.125	6.125	145.8	93.81
11:17: 0	21-AU	6.133	6.133	145.8	93.81
11:17:30	21-AU	6.142	6.142	145.7	94.32
11:18: 0	21-AU	6.150	6.150	145.7	94.51
11:26: 0	21-AU	6.283	6.283	145.8	94.48
11:30: 0	21-AU	6.350	6.350	145.8	94.48
11:32: 0	21-AU	6.383	6.383	145.8	94.55
11:34: 0	21-AU	6.417	6.417	145.8	94.48
11:38: 0	21-AU	6.483	6.483	145.8	94.57
11:39: 0	21-AU	6.500	6.500	145.7	94.50
11:47: 0	21-AU	6.633	6.633	145.8	94.49
11:49: 0	21-AU	6.667	6.667	145.7	94.51
11:50: 0	21-AU	6.683	6.683	145.7	94.59
11:54: 0	21-AU	6.750	6.750	145.8	94.51
11:56: 0	21-AU	6.783	6.783	145.8	94.51
11:57: 0	21-AU	6.800	6.800	145.7	94.57
11:58: 0	21-AU	6.817	6.817	145.8	94.49
11:58:30	21-AU	6.825	6.825	145.7	94.53
11:59: 0	21-AU	6.833	6.833	145.8	93.97
12: 7: 0	21-AU	6.967	6.967	145.8	94.11
12:15: 0	21-AU	7.100	7.100	145.8	94.05
12:15:30	21-AU	7.108	7.108	145.8	94.03
12:16: 0	21-AU	7.117	7.117	145.8	93.71
12:17: 0	21-AU	7.133	7.133	145.7	93.86
12:19: 0	21-AU	7.167	7.167	145.7	93.86
12:19:30	21-AU	7.175	7.175	145.8	94.55
12:23:30	21-AU	7.242	7.242	145.8	94.49
12:27:30	21-AU	7.308	7.308	145.8	94.55
12:43:30	21-AU	7.575	7.575	145.8	94.43
12:44: 0	21-AU	7.583	7.583	145.8	94.49
12:52: 0	21-AU	7.717	7.717	145.8	94.46
12:53: 0	21-AU	7.733	7.733	145.8	94.54
12:57: 0	21-AU	7.800	7.800	145.8	94.49
12:59: 0	21-AU	7.833	7.833	145.8	94.52
13: 0: 0	21-AU	7.850	7.850	145.8	94.48
13: 0:30	21-AU	7.858	7.858	145.8	94.52
13: 4:30	21-AU	7.925	7.925	145.8	94.48
13: 6:30	21-AU	7.958	7.958	145.8	94.52
13:22:30	21-AU	8.225	8.225	145.8	94.48
13:26:30	21-AU	8.292	8.292	145.8	94.52
13:28:30	21-AU	8.325	8.325	145.8	94.49
13:29: 0	21-AU	8.333	8.333	145.7	94.59
13:31: 0	21-AU	8.367	8.367	145.8	94.48
13:39: 0	21-AU	8.500	8.500	145.8	94.54
13:47: 0	21-AU	8.633	8.633	145.8	94.39
13:51: 0	21-AU	8.700	8.700	145.7	94.44
13:53: 0	21-AU	8.733	8.733	145.7	94.39

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
15:30:30	21-AU	10.358	10.358	145.7	105.09
15:31: 0	21-AU	10.367	10.367	145.8	101.07
15:31:30	21-AU	10.375	10.375	145.8	98.09
15:32: 0	21-AU	10.383	10.383	145.8	96.63
15:33: 0	21-AU	10.400	10.400	146.0	97.07
15:33:30	21-AU	10.408	10.408	146.0	97.20
15:34:30	21-AU	10.425	10.425	146.0	97.01
15:35:30	21-AU	10.442	10.442	146.0	96.99
15:36:30	21-AU	10.458	10.458	146.0	97.11
15:38:30	21-AU	10.492	10.492	146.0	97.07
15:39:30	21-AU	10.508	10.508	146.0	97.08
15:40: 0	21-AU	10.517	10.517	146.0	97.11
15:40:30	21-AU	10.525	10.525	146.0	88.48
15:41: 0	21-AU	10.533	10.533	146.1	92.12
15:41:30	21-AU	10.542	10.542	146.1	91.80
15:42: 0	21-AU	10.550	10.550	146.0	88.46
15:42:30	21-AU	10.558	10.558	146.0	87.93
15:43: 0	21-AU	10.567	10.567	146.0	88.45
15:43:30	21-AU	10.575	10.575	146.0	92.80
15:44: 0	21-AU	10.583	10.583	146.0	92.67
15:45: 0	21-AU	10.600	10.600	146.0	92.86
15:47: 0	21-AU	10.633	10.633	146.0	92.87
15:48: 0	21-AU	10.650	10.650	146.0	92.98
15:48:30	21-AU	10.658	10.658	145.8	93.81
15:49: 0	21-AU	10.667	10.667	145.8	93.92
15:57: 0	21-AU	10.800	10.800	145.8	93.99
16: 1: 0	21-AU	10.867	10.867	145.8	94.00
16: 1:30	21-AU	10.875	10.875	145.7	94.02
16: 2: 0	21-AU	10.883	10.883	145.8	95.71
16: 3: 0	21-AU	10.900	10.900	145.7	95.53
16: 3:30	21-AU	10.908	10.908	145.8	95.72
16: 4: 0	21-AU	10.917	10.917	145.8	95.81
16:12: 0	21-AU	11.050	11.050	145.8	95.80
16:16: 0	21-AU	11.117	11.117	145.7	95.83
16:16:30	21-AU	11.125	11.125	145.7	95.89
16:17: 0	21-AU	11.133	11.133	145.7	95.82
16:25: 0	21-AU	11.267	11.267	145.8	95.87
16:41: 0	21-AU	11.533	11.533	145.8	95.84
16:49: 0	21-AU	11.667	11.667	145.8	95.83
16:49:30	21-AU	11.675	11.675	145.7	95.92
16:50:30	21-AU	11.692	11.692	145.7	95.74
16:58:30	21-AU	11.825	11.825	145.7	95.74
16:59:30	21-AU	11.842	11.842	145.8	95.74
17: 0: 0	21-AU	11.850	11.850	145.8	95.75
17: 0:30	21-AU	11.858	11.858	145.8	95.63
17: 1: 0	21-AU	11.867	11.867	145.8	95.71
17: 3: 0	21-AU	11.900	11.900	145.8	95.63
17: 3:30	21-AU	11.908	11.908	145.8	95.75
17: 7:30	21-AU	11.975	11.975	145.8	95.74

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
20: 7: 0	21-AU	14.967	14.967	145.8	96.43
20: 8: 0	21-AU	14.983	14.983	145.7	96.44
20: 8:30	21-AU	14.992	14.992	145.8	96.48
20: 9: 0	21-AU	15.000	15.000	145.8	94.98
20: 9:30	21-AU	15.008	15.008	145.8	95.23
20:10: 0	21-AU	15.017	15.017	145.7	95.87
20:14: 0	21-AU	15.083	15.083	145.8	95.84
20:16: 0	21-AU	15.117	15.117	145.8	95.84
20:16:30	21-AU	15.125	15.125	145.8	95.91
20:20:30	21-AU	15.192	15.192	145.7	95.92
20:22:30	21-AU	15.225	15.225	145.8	95.91
20:23: 0	21-AU	15.233	15.233	145.8	95.99
20:24: 0	21-AU	15.250	15.250	145.8	95.93
20:24:30	21-AU	15.258	15.258	145.7	95.99
20:25: 0	21-AU	15.267	15.267	145.8	95.90
20:33: 0	21-AU	15.400	15.400	145.8	95.91
20:35: 0	21-AU	15.433	15.433	145.8	95.97
20:43: 0	21-AU	15.567	15.567	145.8	95.97
20:45: 0	21-AU	15.600	15.600	145.8	96.00
20:46: 0	21-AU	15.617	15.617	145.8	96.00
20:46:30	21-AU	15.625	15.625	145.7	96.07
20:48:30	21-AU	15.658	15.658	145.8	95.96
21: 4:30	21-AU	15.925	15.925	145.8	96.00
21: 5:30	21-AU	15.942	15.942	145.8	96.02
21: 6: 0	21-AU	15.950	15.950	145.8	96.06
21:14: 0	21-AU	16.083	16.083	145.8	96.03
21:18: 0	21-AU	16.150	16.150	145.7	96.01
21:19: 0	21-AU	16.167	16.167	145.8	96.05
21:23: 0	21-AU	16.233	16.233	145.8	95.97
21:23:30	21-AU	16.242	16.242	145.8	96.00
21:24:30	21-AU	16.258	16.258	145.8	92.48
21:25: 0	21-AU	16.267	16.267	145.7	90.01
21:25:30	21-AU	16.275	16.275	145.8	89.71
21:27:30	21-AU	16.308	16.308	145.8	89.98
21:28: 0	21-AU	16.317	16.317	145.7	90.17
21:30: 0	21-AU	16.350	16.350	145.8	90.27
21:34: 0	21-AU	16.417	16.417	145.8	90.27
21:35: 0	21-AU	16.433	16.433	145.8	90.36
21:36: 0	21-AU	16.450	16.450	145.8	90.24
21:36:30	21-AU	16.458	16.458	145.7	90.31
21:37:30	21-AU	16.475	16.475	145.8	90.20
21:38: 0	21-AU	16.483	16.483	145.8	90.18
21:38:30	21-AU	16.492	16.492	145.8	90.45
21:42:30	21-AU	16.558	16.558	145.7	90.35
21:44:30	21-AU	16.592	16.592	145.8	90.39
21:48:30	21-AU	16.658	16.658	145.8	90.24
21:49:30	21-AU	16.675	16.675	145.7	90.36
21:51:30	21-AU	16.708	16.708	145.8	90.33
21:55:30	21-AU	16.775	16.775	145.7	90.17

TEST PHASE : FLOW PERIOD # 1

TIME OF DAY HH:MM:SS	DATE DD-MM	ELAPSED TIME, HR	DELTA TIME, HR	BOT HOLE TEMP. DEG F	BOT HOLE PRESSURE PSIA
0:32:30	22-AU	19.392	19.392	145.5	96.56
0:36:30	22-AU	19.458	19.458	145.4	96.58
0:38:30	22-AU	19.492	19.492	145.5	96.57
0:39:30	22-AU	19.508	19.508	145.4	96.53
0:47:30	22-AU	19.642	19.642	145.4	96.56
0:51:30	22-AU	19.708	19.708	145.4	96.55
0:53:30	22-AU	19.742	19.742	145.4	96.53
0:54: 0	22-AU	19.750	19.750	145.4	96.46
0:55: 0	22-AU	19.767	19.767	145.4	97.01
0:56: 0	22-AU	19.783	19.783	145.2	97.14
1:12: 0	22-AU	20.050	20.050	145.2	97.10
1:20: 0	22-AU	20.183	20.183	145.2	97.13
1:24: 0	22-AU	20.250	20.250	145.1	97.15
1:26: 0	22-AU	20.283	20.283	145.1	97.10
1:27: 0	22-AU	20.300	20.300	145.2	97.11
1:27:30	22-AU	20.308	20.308	145.1	90.65
1:28: 0	22-AU	20.317	20.317	145.2	91.66
1:28:30	22-AU	20.325	20.325	145.1	92.29
1:29: 0	22-AU	20.333	20.333	145.2	92.52
1:29:30	22-AU	20.342	20.342	145.2	92.63
1:31:30	22-AU	20.375	20.375	145.4	92.42
1:33:30	22-AU	20.408	20.408	145.5	92.07
1:37:30	22-AU	20.475	20.475	145.7	91.99
1:38:30	22-AU	20.492	20.492	145.7	92.02
1:39:30	22-AU	20.508	20.508	145.5	91.97
1:41:30	22-AU	20.542	20.542	145.7	92.05
1:49:30	22-AU	20.675	20.675	145.7	92.05
1:53:30	22-AU	20.742	20.742	145.8	92.03
1:55:30	22-AU	20.775	20.775	145.7	92.02
1:56: 0	22-AU	20.783	20.783	145.8	92.08
2: 4: 0	22-AU	20.917	20.917	145.8	92.09
2: 8: 0	22-AU	20.983	20.983	145.8	92.06
2: 9: 0	22-AU	21.000	21.000	145.7	92.08
2: 9:30	22-AU	21.008	21.008	145.7	92.04
2:10: 0	22-AU	21.017	21.017	145.8	92.12
2:10:30	22-AU	21.025	21.025	145.8	93.59
2:11: 0	22-AU	21.033	21.033	145.8	97.29
2:11:30	22-AU	21.042	21.042	145.8	96.82
2:12: 0	22-AU	21.050	21.050	145.8	96.70
2:12:30	22-AU	21.058	21.058	146.0	97.42
2:13: 0	22-AU	21.067	21.067	145.8	97.11
2:13:30	22-AU	21.075	21.075	145.8	97.01
2:14:30	22-AU	21.092	21.092	145.8	97.17
2:15: 0	22-AU	21.100	21.100	145.8	97.08
2:17: 0	22-AU	21.133	21.133	145.8	97.10
2:17:30	22-AU	21.142	21.142	145.7	96.24
2:18: 0	22-AU	21.150	21.150	145.8	96.58
2:20: 0	22-AU	21.183	21.183	145.8	96.80
2:22: 0	22-AU	21.217	21.217	145.7	96.75