2R - 22

GENERAL CORRESPONDENCE

YEAR(S):

2001 - 1991

Southern Business Unit
Domestic Production

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

February 28, 2001

RECEIVED
MAR 01 2001
ENVIRONMENTAL BUREAU
OIL CONSERVATION DIVISION

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87504

RE: Annual Groundwater Monitoring Report, January - December 2000
Indian Basin Remediation Project

Dear Mr. Olson:

Marathon Oil Company (Marathon) submits the Annual Groundwater Monitoring Report, January - December 2000, to the New Mexico Oil Conservation Division (OCD). The annual report, which was prepared by ARCADIS Geraghty & Miller, Inc., summarizes the investigation, groundwater monitoring and remediation activities associated with the Indian Basin Remediation Project during the 2000 calendar year.

The laboratory analytical reports are included in an electronic format on a compact disk located in the report binder. Also, the investigation activities included borehole video logging of select monitoring wells. Two video tapes are included as an attachment to this cover letter.

If you have any questions or need any additional information, then please call me at (915) 687-8118.

Sincerely,

M. Paul Peacock

M. Paul Peacock
Advanced Environmental & Safety Engineer

enclosures
MPP\OCD 2000 Annual Report.wpd

File 540-16

cc: T. C. Lowry w/o enclosures
C. M. Schweser w/o enclosures
F. D. Searle w/o enclosures
K. W. Tatarzyn w/oenclosures
Chris Biagi of Kerr-McGee Corporation w/enclosures

NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

GARY E. JOHNSON
Governor
Jennifer A. Salisbury
Cabinet Secretary

Lori Wrotenbery
Director
Oil Conservation Division

December 11, 2000

CERTIFIED MAIL
RETURN RECEIPT NO. 5051-3969

Mr. Paul Peacock
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702-0552

RE: 1999 ANNUAL GROUND WATER MONITORING REPORT
MARATHON INDIAN BASIN GAS PLANT

Dear Mr. Peacock:

The New Mexico Oil Conservation Division (OCD) has reviewed Marathon Oil Company's (MOC) February 29, 2000 "ANNUAL GROUNDWATER MONITORING REPORT, JANUARY – DECEMBER 1999, INDIAN BASIN REMEDIATION PROJECT". This document contains the results of MOC's ground water remediation and monitoring of hydrocarbon contaminated ground water at MOC's Indian Basin Gas Plant. The plan requests approval of completion of investigation of the extent of ground water contamination at the site.

The above-referenced request is approved. Please be advised that OCD approval does not relieve MOC of responsibility if the current monitor well network fails to adequately monitor contamination related to MOC's activities, or if contamination exists which is outside the scope of the monitoring plan. In addition, OCD approval does not relieve MOC of responsibility for compliance with any other federal, state or local laws and regulations.

If you have any questions, please contact me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrologist
Environmental Bureau

xc: Tim Gum, OCD Artesia District Supervisor

Olson, William

From: M P Peacock [SMTP:MPPeacock@MarathonOil.com]
Sent: Friday, September 22, 2000 9:53 AM
To: Olson, William
Cc: CMSchweser@MarathonOil.com; FDSearle@MarathonOil.com; RVColeman@MarathonOil.com
Subject: IBRP Semi-Annual Sampling Schedule -Forwarded

Bill,

The semi-annual groundwater sampling event for the Indian Basin Remediation Project is scheduled to begin on September 28, 2000 as outlined in the attached e-mail from Alan Reed of ARCADIS Geraghty & Miller. If you wish to collect duplicate samples, then please advise.

Sincerely,

M. Paul Peacock

Advanced Environmental & Safety Engineer

Marathon Oil Company
P. O. Box 552
Midland, TX 79702

Ph: 915/687-8312
Fax: 915/687-8305

E-mail: mppeacock@marathonoil.com

IBRP Semi-Annual Sampling Schedule

Olson, William

From: Reed, Alan J. [SMTP:AReed2@arcadis-us.com]
Sent: Wednesday, September 13, 2000 10:19 AM
To: mppeacock@marathonoil.com
Subject: IBRP Semi-Annual Sampling Schedule

Paul -

We were able to schedule the groundwater gauging portion of the October sampling event at IBRP for Thursday and Friday, September 28-29, 2000. We will return to IBRP on Monday, October 2nd to collect groundwater samples. All sampling will be completed by Friday, October 6th. Please contact me if you have any concerns regarding the schedule. Thanks.

Alan J. Reed, Jr.
ARCADIS Geraghty & Miller, Inc.
areed2@arcadis-us.com
(915) 699-1381

Olson, William

From: M P Peacock [SMTP:MPPeacock@MarathonOil.com]
Sent: Wednesday, March 29, 2000 6:33 AM
To: Olson, William
Cc: mhansen@gmgw.com; CMSchweser@MarathonOil.com; FDSearle@MarathonOil.com; TADeines@MarathonOil.com
Subject: IBRP April Groundwater Sampling Event

Bill,

The semi-annual groundwater sampling event for the Indian Basin Remediation Project is scheduled for the week of April 24, 2000. If you have any questions, then please advise.

Sincerely,

M. Paul Peacock

Advanced Environmental & Safety Engineer

Marathon Oil Company
P. O. Box 552
Midland, TX 79702

Ph: 915/687-8312
Fax: 915/687-8305
E-mail: mppeacock@marathonoil.com

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

February 29, 2000

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

RECEIVED
MAR 03 2000
ENVIRONMENTAL BUREAU
OIL CONSERVATION DIVISION

RE: Annual Groundwater Monitoring Report, January - December 1999
Indian Basin Remediation Project

Dear Mr. Olson:

Marathon Oil Company (Marathon) submits the Annual Groundwater Monitoring Report, January - December 1999 (Volume 1 and 2), to the New Mexico Oil Conservation Division (OCD). The annual report, which was prepared by ARCADIS Geraghty & Miller, Inc., summarizes the investigation, groundwater monitoring and remediation activities associated with the Indian Basin Remediation Project during the 1999 calendar year. During our meeting at your office in Santa Fe, New Mexico on February 16, 2000, the OCD verbally agreed to the following format changes for the annual report.

1. Eliminate the Monitoring Well Hydrographs
2. Eliminate the BTEX Concentration Trend Plots
3. Only, submit the historical analytical data for the compounds that was laboratory analyzed in the reporting year.
4. Submit the laboratory analytical reports in an electronic format. The electronic format was not available for the 1999 annual report but will be submitted for the future annual reports. The electronic format would have replaced Volume 2 of the 1999 annual report, which was submitted in a three inch binder.

The investigation activities included borehole video logging of select monitoring wells. Four video tapes are included as an attachment to this cover letter. The investigation activities also included remediation and monitoring at well MW-98. This work was completed in response to the OCD letter dated March 4, 1999, which requested that Marathon complete the delineation of groundwater impacts south of the Lower Queen upgradient well MW-98. As described in the report, Marathon initiated condensate recovery in March 1999. To date, no condensate is present in the well and the laboratory analysis of a groundwater sample did not detect any BTEX compounds at concentrations above their respective regulatory standards. Therefore, Marathon has completed the delineation of the groundwater impacts near well MW-98 and requests approval of the Comprehensive Site Characterization Report dated December 1998 that was prepared by IT Corporation.

If you have any questions or need any additional information, then please call me at (915) 687-8312.

Sincerely,

M. Paul Peacock
Advanced Environmental & Safety Engineer

enclosures
MPP\ocd99rep.wpd

File 552-03

cc: T. C. Lowry w/o enclosures F. D. Searle w/o enclosures K. W. Tatarzyn w/enclosures

Olson, William

From: M P Peacock[SMTP:MPPeacock@MarathonOil.com]
Sent: Tuesday, April 13, 1999 12:09 PM
To: Olson, William
Cc: mhansen@gmgw.com; CMSchweser@MarathonOil.com; FDSearle@MarathonOil.com
Subject: Revised: IBRP Semi-Annual Sampling Event

Revision: The semiannual groundwater sampling event for the Indian Basin Remediation Project is scheduled for the week of April 19, 1999 not March 19, 1999.

Bill,

As required by condition 6 of your letter dated March 4, 1999, this e-mail is notification that the semiannual groundwater sampling event for the Indian Basin Remediation Project is scheduled for the week of March 19, 1999. The groundwater sampling event will be completed by ARCADIS Geraghty & Miller, Inc. If you have any questions, then please advise.

M. Paul Peacock
Ph: 915/687-8312
Fax: 915/687-8305
E-mail: mppeacock@marathonoil.com

Olson, William

From: M P Peacock[SMTP:MPPeacock@MarathonOil.com]
Sent: Tuesday, April 13, 1999 9:33 AM
To: Olson, William
Cc: mhansen@gmgw.com; CMSchweser@MarathonOil.com; FDSearle@MarathonOil.com
Subject: IBRP Semi-Annual Sampling Event

Bill,

As required by condition 6 of your letter dated March 4, 1999, this e-mail is notification that the semiannual groundwater sampling event for the Indian Basin Remediation Project is scheduled for the week of March 19, 1999. The groundwater sampling event will be completed by ARCADIS Geraghty & Miller, Inc. If you have any questions, then please advise.

M. Paul Peacock
Ph: 915/687-8312
Fax: 915/687-8305
E-mail: mppeacock@marathonoil.com

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

March 30, 1999

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

RECEIVED
APR 05 1999
ENVIRONMENTAL BUREAU
OIL CONSERVATION DIVISION

RE: Remediation Workplan
Indian Basin Remediation Project
Marathon Oil Company

Dear Mr. Olson:

Marathon Oil Company (Marathon) is requesting approval of this workplan to conduct remediation activities for the Indian Basin Remediation Project. The remediation activities include the installation and testing of additional Lower Queen aquifer monitoring wells within the hydrocarbon plume as described in detail below.

Lower Queen Aquifer Remediation Activities
Drill and complete approximately five Lower Queen aquifer monitoring wells (MW-112, 113, 114, 115 and 116) within the hydrocarbon plume as shown on the attached Figure 1-3. The wells will be constructed as shown on the attached typical well completion diagram. The wells will be developed as detailed in the Monitoring Well Development section of the work plan. If hydrocarbons are present in the well, then groundwater samples will not be collected. Otherwise, each well will be sampled as detailed in the Groundwater Sampling and Analysis section of the workplan. Upon completion of the sampling activities, a video camera survey, a Natural Gamma Ray log, a short term vapor extraction test and a short term pumping rate test will be performed on the open borehole section of each well. Based on the data collected during the testing activities, well screen may be installed in each well.

Monitoring Well Development
The monitoring wells will be developed by purging until the groundwater is clear and field measurements of pH, conductivity, temperature and turbidity have stabilized. The extracted fluids will be pumped or bailed into a trailer-mounted fiberglass tank and transported to the Indian Basin Gas Plant for disposal in one of the double-lined sumps of the plant's wastewater collection system.

Groundwater Sampling and Analysis
Upon completion of the development and purging activities, groundwater samples will be collected using a disposable bailer. The groundwater samples will be placed in appropriate containers, stored on ice, and shipped to Core Laboratories in Valpariso, Indiana for analysis. The groundwater samples will be analyzed for benzene, toluene, ethyl benzene and xylenes by USEPA Method 8020.

The proposed investigations activities are scheduled to begin on or about April 26, 1999. The remediation activities will be reported in the Annual Monitoring Report and submitted to your office by March 1, 2000. If you have any questions or comments, then please call me at (915) 687-8312.

Sincerely,

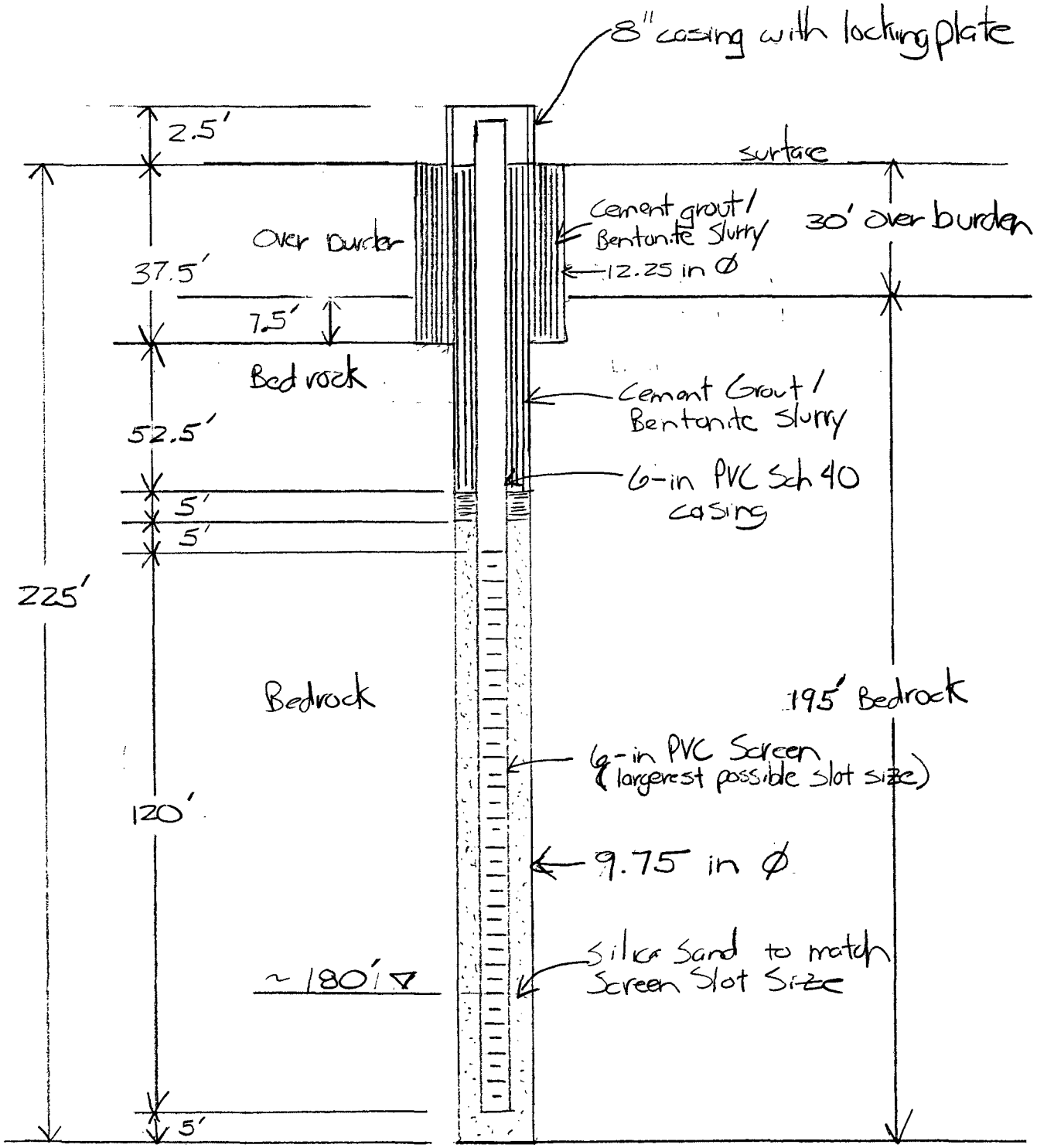
M. Paul Peacock

M. Paul Peacock
Advanced Environmental & Safety Engineer

attachments
MPP\wellwkpl.wpd

pc: Michael Hansen of ARCADIS Geraghty & Miller w/attachments
T. C. Lowry w/o attachments
F. D. Searle w/o attachments
K. W. Tatarzyn w/o attachments

Subject Proposed Infill Well Completion MW-(112-116)	Page No. 1	Of 1
File Indian Basin Remediation Project	By M.P. Peacock	Date 4/1/98



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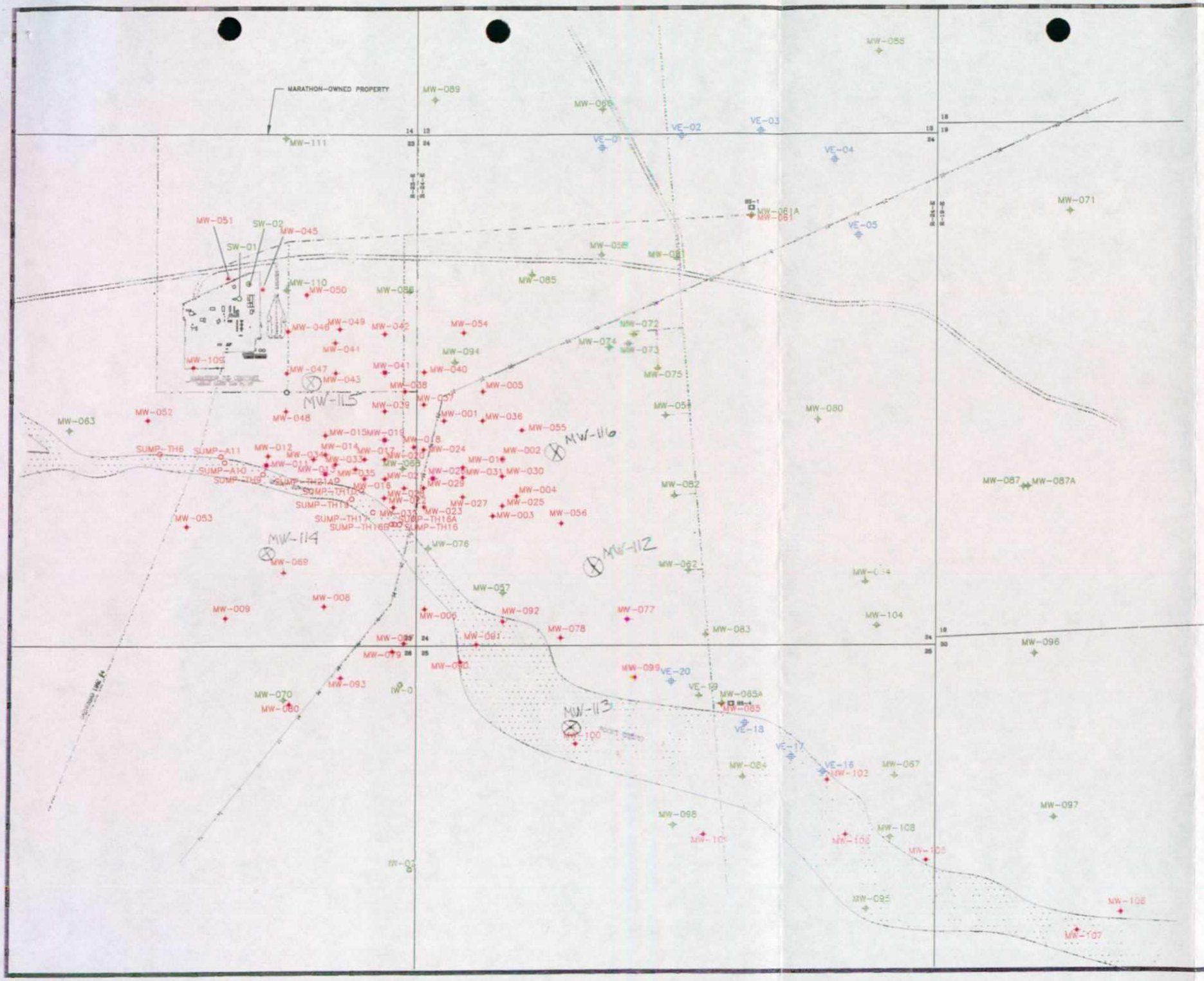

LEGEND

- MONITORING WELL (SHALLOW ZONE)
- INFILTRATION WELL (SHALLOW ZONE)
- RECOVERY SUMP (SHALLOW ZONE)
- RECOVERY WELL (SHALLOW ZONE)
- VAPOR EXTRACTION WELL (SHALLOW GROUNDWATER)
- MONITORING WELL (LOWER QUEEN)
- INFILTRATION WELL (LOWER QUEEN)
- INDUSTRIAL SUPPLY WELL (LOWER QUEEN)
- RECOVERY WELL (LOWER QUEEN)
- VAPOR EXTRACTION WELL (LOWER QUEEN)
- BLOWER STATION
- FENCING
- POWER LINE

FLUOR DANIEL GTI

0 FEET 1000
SCALE

WELL LOCATION MAP

CLIENT: MARATHON OIL COMPANY

LOCATION: INDIAN BASIN REMEDIATION PROJECT
EDDY COUNTY, NEW MEXICO

FILE:	PROJECT NO.:
5469-SP (1:1000)	105469

REV.:

DES.:	DET.:	DATE:	FIGURE:
CL	DH	11/17/98	1-3
PM:		PE/RG:	

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

March 30, 1999

RECEIVED
APR 05 1999
ENVIRONMENTAL BUREAU
OIL CONSERVATION DIVISION

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

RE: Annual Groundwater Monitoring Report, January - December 1998
Indian Basin Remediation Project
Marathon Oil Company

Dear Mr. Olson:

I have enclosed the Annual Groundwater Monitoring Report, January - December 1998, Indian Basin Remediation Project that was prepared by ARCADIS Geraghty & Miller, Inc. The report, that was prepared in accordance with your approval letter dated March 12, 1997, summarizes the groundwater monitoring and remediation activities associated with the Indian Basin Remediation Project during the 1998 calendar year. Marathon Oil Company requests approval of the proposed modifications of the Groundwater Monitoring Plan in Section 7 of the report.

If you have any questions or need any additional information, then please call me at (915) 687-8312.

Sincerely,

M. Paul Peacock

M. Paul Peacock
Advanced Environmental & Safety Engineer

enclosures
MPP\ocd98rep.wpd

File 552-03

cc: T. C. Lowry w/o enclosures
F. D. Searle w/o enclosures
K. W. Tatarzyn w/o enclosures

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

March 8, 1999

RECEIVED
MAR 10 1999

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

RE: Groundwater Discharge Plan (GW-21) Notification
Indian Basin Remediation Project
Marathon Oil Company

Dear Mr. Olson:

As required by the Groundwater Discharge Plan (GW-21) dated October 31, 1994, Marathon Oil Company (Marathon) verbally notified your office on February 24, 1999 that the benzene concentration in the treated water effluent from both air strippers exceeded the New Mexico Water Quality Commission (WQCC) standard. This water is currently infiltrated into Lower Queen infiltration well IW-1 and IW-2. The water samples were collected on January 28, 1999 and analyzed by Pinnacle Laboratories, Inc. of Albuquerque, NM. The Laboratory Report Number 901082 dated February 18, 1999 is attached.

The air strippers are cleaned quarterly to ensure that dissolved hydrocarbons can be removed from the groundwater to the WQCC standards. The air strippers were cleaned on January 19, 1999. The water flowrate into the air strippers was reduced in order to increase the efficiency of the air strippers. Marathon collected confirmation samples on February 25, 1999. The laboratory analysis of the water samples did not detect a benzene concentration (< 5 ug/l) in the treated water effluent from both air strippers. Therefore, the treated water effluent from both air strippers are in compliance with the Groundwater Discharge Plan. The water samples were analyzed by Core Laboratories. The Laboratory Report Number 902015 dated March 3, 1999 is attached. If you have any questions or comments, then please call me at (915) 687-8312.

Sincerely,

M. Paul Peacock

M. Paul Peacock
Advanced Environmental & Safety Engineer

pc: F. D. Searle w/o attachments
C. M. Schweser w/attachments

Attachments
MPP\ocdexced.wpd
File 556-01/524-03

CORE LABORATORIES

ANALYTICAL REPORT

JOB NUMBER: 902015

Prepared For:

Marathon Oil Company
125 West Missouri Street
P.O. Box 552
Midland, TX 79702-0552

Attention: Mr. Paul Peacock

Date: 03/01/99

Les Arnold
Signature

3/1/99
Date

Name: Les Arnold

Title: Laboratory Manager

2400 Cumberland Drive
Valparaiso, IN 46383

PHONE: 219-464-2389
FAX..: 219-462-2953

MCR

MAR 05 1999

Environmental & Safety

The analytical results, opinions or interpretations contained in this report are based upon information and material supplied by the client for whose exclusive and confidential use this report has been made. The analytical results, opinions or interpreta tions expressed represent the best judgment of Core Laboratories. Core Laboratories, however, makes no warranty or representation, express or implied, of any type, and expressly disclaims same as to the productivity, proper operations or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced, in whole or in part, without the written approval of Core Laboratories.

CORE LABORATORIES

SAMPLE INFORMATION
Date: 03/01/99

Job Number.: 902015
Customer...: Marathon Oil Company
Attn.....: Mr. Paul Peacock

Project Number.....: 96000651
Customer Project ID....: INDIAN BASIN REM
Project Description....: Marathon Oil Co., Midland, Tx

Laboratory Sample ID	Customer Sample ID	Sample Matrix	Date Sampled	Time Sampled	Date Received	Time Received
902015-1	WEST AIR STRIPPER INFLUENT	Water	02/25/1999	00:00	02/26/1999	10:55
902015-2	WEST AIR STRIPPER EFFLUENT	Water	02/25/1999	00:00	02/26/1999	10:55
902015-3	EAST AIR STRIPPER INFLUENT	Water	02/25/1999	00:00	02/26/1999	10:55
902015-4	EAST AIR STRIPPER EFFLUENT	Water	02/25/1999	00:00	02/26/1999	10:55

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CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 902015 Date: 03/01/99

CUSTOMER: Marathon Oil Company PROJECT: INDIAN BASIN REM ATTN: Mr. Paul Peacock

Customer Sample ID: WEST AIR STRIPPER INFLUENT
Date Sampled.....: 02/25/1999
Time Sampled.....: 00:00
Sample Matrix.....: Water

Laboratory Sample ID: 902015-1
Date Received.....: 02/26/1999
Time Received.....: 10:55

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 8015B	Nonhalogenated Organics using GC/FID					
	Diesel Range Organics	1.2	0.60	mg/L	03/01/99	jdb
EPA 8015B	Nonhalogenated Organics using GC/FID					
	Gasoline Range Organics	0.80	0.50	mg/L	02/26/99	weh
EPA 8260	Volatile Organic Compounds					
	Benzene	68	5	ug/L	02/28/99	weh
	Ethylbenzene	100	5	ug/L	02/28/99	weh
	Toluene	ND	5	ug/L	02/28/99	weh
	Xylenes (total)	170	20	ug/L	02/28/99	weh

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CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 902015

Date: 03/01/99

CUSTOMER: Marathon Oil Company PROJECT: INDIAN BASIN REM ATTN: Mr. Paul Peacock

Customer Sample ID: WEST AIR STRIPPER EFFLUENT
Date Sampled.....: 02/25/1999
Time Sampled.....: 00:00
Sample Matrix.....: Water

Laboratory Sample ID: 902015-2
Date Received.....: 02/26/1999
Time Received.....: 10:55

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 8015B	Nonhalogenated Organics using GC/FID					
	Diesel Range Organics	<0.60	0.60	mg/L	03/01/99	jdb
EPA 8015B	Nonhalogenated Organics using GC/FID					
	Gasoline Range Organics	0.51	0.50	mg/L	02/26/99	weh
EPA 8260	Volatile Organic Compounds					
	Benzene	ND	5	ug/L	02/28/99	weh
	Ethylbenzene	ND	5	ug/L	02/28/99	weh
	Toluene	ND	5	ug/L	02/28/99	weh
	Xylenes (total)	<20	20	ug/L	02/28/99	weh

The analytical results, opinions or interpretations contained in this report are based upon information and material supplied by the client for whose exclusive and confidential use this report has been made. The analytical results, opinions or interpretations expressed represent the best judgment of Core Laboratories. Core Laboratories, however, makes no warranty or representation, express or implied, of any type, and expressly disclaims same as to the productivity, proper operations or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced, in whole or in part, without the written approval of Core Laboratories.

CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 902015 Date: 03/01/99

CUSTOMER: Marathon Oil Company PROJECT: INDIAN BASIN REM ATTN: Mr. Paul Peacock

Customer Sample ID: EAST AIR STRIPPER INFLUENT
Date Sampled.....: 02/25/1999
Time Sampled.....: 00:00
Sample Matrix.....: Water

Laboratory Sample ID: 902015-3
Date Received.....: 02/26/1999
Time Received.....: 10:55

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 8015B	Nonhalogenated Organics using GC/FID					
	Diesel Range Organics	1.9	0.60	mg/L	03/01/99	jdb
EPA 8015B	Nonhalogenated Organics using GC/FID					
	Gasoline Range Organics	0.68	0.50	mg/L	02/26/99	weh
EPA 8260	Volatile Organic Compounds					
	Benzene	69	5	ug/L	02/28/99	weh
	Ethylbenzene	91	5	ug/L	02/28/99	weh
	Toluene	ND	5	ug/L	02/28/99	weh
	Xylenes (total)	150	20	ug/L	02/28/99	weh

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CORE LABORATORIES

LABORATORY TEST RESULTS

Job Number: 902015

Date: 03/01/99

CUSTOMER: Marathon Oil Company PROJECT: INDIAN BASIN REM ATTN: Mr. Paul Peacock

Customer Sample ID: EAST AIR STRIPPER EFFLUENT
Date Sampled.....: 02/25/1999
Time Sampled.....: 00:00
Sample Matrix.....: Water

Laboratory Sample ID: 902015-4
Date Received.....: 02/26/1999
Time Received.....: 10:55

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	REPORTING LIMIT	UNITS	DATE	TECH
EPA 8015B	Nonhalogenated Organics using GC/FID					
	Diesel Range Organics	0.78	0.60	mg/L	03/01/99	jdb
EPA 8015B	Nonhalogenated Organics using GC/FID					
	Gasoline Range Organics	<0.50	0.50	mg/L	02/26/99	weh
EPA 8260	Volatile Organic Compounds					
	Benzene	ND	5	ug/L	02/28/99	weh
	Ethylbenzene	ND	5	ug/L	02/28/99	weh
	Toluene	ND	5	ug/L	02/28/99	weh
	Xylenes (total)	<20	20	ug/L	02/28/99	weh

The analytical results, opinions or interpretations contained in this report are based upon information and material supplied by the client for whose exclusive and confidential use this report has been made. The analytical results, opinions or interpretations expressed represent the best judgment of Core Laboratories. Core Laboratories, however, makes no warranty or representation, express or implied, of any type, and expressly disclaims same as to the productivity, proper operations or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced, in whole or in part, without the written approval of Core Laboratories.

CORE LABORATORIES

QUALITY CONTROL RESULTS

Job Number.: 902015 | Report Date.: 03/01/99

CUSTOMER: Marathon Oil Company | PROJECT: Marathon Oil Co., Midland, Tx | ATTN: Mr. Paul Peacock

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time

Test Method.....: EPA 8015B
Method Description.: Nonhalogenated Organics using GC/FID
Batch.....: 36070
Units.....: mg/L
Analyst...: jdb

MB	Method Blank				03/01/1999	1219

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Diesel Range Organics	ND						

LCS	Laboratory Control Sample	V16878B			03/01/1999	1239

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Diesel Range Organics	414		500.000000		82.8	%	70-130

MS	Matrix Spike	V16878B	902015-4		03/01/1999	1417

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Diesel Range Organics	421		500.000000	ND	84.2	%	70-130

MSD	Matrix Spike Duplicate	V16878B	902015-4		03/01/1999	1437

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Diesel Range Organics	486	421	500.000000	ND	97.2	%	70-130
					14.3	R	20

Test Method.....: EPA 8015B
Method Description.: Nonhalogenated Organics using GC/FID
Batch.....: 36030
Units.....: mg/L
Analyst...: weh

LCS	Laboratory Control Sample	GROSTD			02/26/1999	1445

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Gasoline Range Organics	9.550		10		95.5	%	70-130

MB	Method Blank				02/26/1999	1518

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Gasoline Range Organics	0.050						

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

The analytical results, opinions or interpretations contained in this report are based upon information and material supplied by the client for whose exclusive and confidential use this report has been made. The analytical results, opinions or interpretations expressed represent the best judgment of Core Laboratories. Core Laboratories, however, makes no warranty or representation, express or implied, of any type, and expressly disclaims same as to the productivity, proper operations or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced, in whole or in part, without the written approval of Core Laboratories.

CORE LABORATORIES

QUALITY CONTROL RESULTS

Job Number.: 902015 | Report Date.: 03/01/99

CUSTOMER: Marathon Oil Company | PROJECT: Marathon Oil Co., Midland, Tx | ATTN: Mr. Paul Peacock

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
MS	Matrix Spike	GROSTD	902014-1		02/26/1999	1622

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Gasoline Range Organics	10.424		10	0.066	103.6	%	70-130

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
MSD	Matrix Spike Duplicate	GROSTD	902014-1		02/26/1999	1653

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Gasoline Range Organics	10.430	10.424	10	0.066	103.6	%	70-130
					0.1	R	20

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
LCS	Laboratory Control Sample	GROSTD			02/26/1999	1932

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Gasoline Range Organics	10.266		10		102.7	%	70-130

Test Method.....: EPA 8260 | Batch.....: 36042 | Analyst...: weh
Method Description.: Volatile Organic Compounds | Units.....: ug/L

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
MB	Method Blank				02/28/1999	1236

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
o-Xylene	ND						
Acrolein	ND						
1,2,4-Trimethylbenzene	ND						
m&p-Xylenes	ND						
Isopropylbenzene	ND						
Trichlorofluoromethane	ND						
2-Chloroethylvinyl ether	ND						
Dichlorodifluoromethane	ND						
Dibromomethane	ND						
Bromobenzene	ND						
1,2,3-Trichloropropane	ND						
1,1,1,2-Tetrachloroethane	ND						
tert-Butyl methyl ether (MTBE)	ND						
1,2-Dichlorobenzene	ND						
1,3-Dichlorobenzene	ND						
1,4-Dichlorobenzene	ND						
Acrylonitrile	ND						
Acetone	ND						
Benzene	ND						
Bromodichloromethane	ND						
Bromoform	ND						
Bromomethane	ND						
2-Butanone	ND						
Carbon disulfide	ND						
Carbon tetrachloride	ND						
Dibromochloromethane	ND						
Chlorobenzene	ND						
Chloroethane	ND						

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

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CORE LABORATORIES

QUALITY CONTROL RESULTS

Job Number.: 902015

Report Date.: 03/01/99

CUSTOMER: Marathon Oil Company PROJECT: Marathon Oil Co., Midland, Tx ATTN: Mr. Paul Peacock

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
MB	Method Blank				02/28/1999	1236

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Chloroform	ND						
Chloromethane	ND						
1,1-Dichloroethane	ND						
1,2-Dichloroethane	ND						
1,1-Dichloroethene	ND						
trans-1,2-Dichloroethene	ND						
cis-1,2-Dichloroethene	ND						
1,2-Dichloropropane	ND						
cis-1,3-Dichloropropene	ND						
trans-1,3-Dichloropropene	ND						
Ethylbenzene	ND						
2-Hexanone	ND						
Methylene chloride	ND						
4-Methyl-2-pentanone (MIBK)	ND						
Styrene	ND						
1,1,2,2-Tetrachloroethane	ND						
Tetrachloroethene	ND						
Toluene	ND						
1,1,1-Trichloroethane	ND						
1,1,2-Trichloroethane	ND						
Trichloroethene	ND						
Vinyl acetate	ND						
Vinyl chloride	ND						
Xylenes (total)	ND						

LCS	Laboratory Control Sample	CLPVOAMS2			02/28/1999	1308

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Benzene	51.14		50		102.3	%	67-127
Chlorobenzene	53.38		50		106.8	%	68-128
1,1-Dichloroethene	52.65		50		105.3	%	66-126
Toluene	46.90		50		93.8	%	72-132
Trichloroethene	52.24		50		104.5	%	74-134

MS	Matrix Spike	CLPVOAMS2	902043-1		02/28/1999	1945

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Benzene	51.37		50	ND	102.7	%	74-127
Chlorobenzene	50.42		50	ND	100.8	%	75-130
1,1-Dichloroethene	49.88		50	ND	99.8	%	59-172
Toluene	46.78		50	ND	93.6	%	76-125
Trichloroethene	50.00		50	ND	100.0	%	71-140

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

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CORE LABORATORIES

QUALITY CONTROL RESULTS

Job Number.: 902015

Report Date.: 03/01/99

CUSTOMER: Marathon Oil Company PROJECT: Marathon Oil Co., Midland, Tx ATTN: Mr. Paul Peacock

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
MSD	Matrix Spike Duplicate	CLPVOAMS2	902043-1		02/28/1999	2017

Parameter/Test Description	QC Result	QC Result	True Value	Orig. Value	Calc. Result	*	Limits
Benzene	52.44	51.37	50	ND	104.9	%	74-127
					2.1	R	30
Chlorobenzene	51.52	50.42	50	ND	103.0	%	75-130
					2.2	R	30
1,1-Dichloroethene	51.16	49.88	50	ND	102.3	%	59-172
					2.5	R	30
Toluene	46.43	46.78	50	ND	92.9	%	76-125
					0.8	R	30
Trichloroethene	50.96	50.00	50	ND	101.9	%	71-140
					1.9	R	30

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

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CORE LABORATORIES

SURROGATE RECOVERIES REPORT

Job Number.: 902015

Report Date.: 03/01/99

CUSTOMER: Marathon Oil Company PROJECT: Marathon Oil Co., Midland, Tx ATTN: Mr. Paul Peacock

Method.....: Volatile Organic Compounds
Method Code.....: 826TCL

Batch.....: 36042
Analyst.....: weh

Surrogate	Units
1,2-Dichloroethane-d4 (surrogate)	ug/L

Lab ID	Matrix	QC Type	Dilution	Result	True Value	Percent Recovery	Limits	Flag	Date	Time
		MB		41.25	50.00	82.5	76-120		02/28/1999	1236
		LCS		41.56	50.00	83.1	76-120		02/28/1999	1308
902015-1			5	42.33	50.00	84.7	76-120		02/28/1999	1339
902015-2			5	42.07	50.00	84.1	76-120		02/28/1999	1411
902015-3			5	42.15	50.00	84.3	76-120		02/28/1999	1443
902015-4			5	42.39	50.00	84.8	76-120		02/28/1999	1514
902023-1			200	46.10	50.00	92.2	76-120		02/28/1999	1603
902043-1				45.92	50.00	91.8	76-120		02/28/1999	1634
902043-1		MS		48.18	50.00	96.4	76-120		02/28/1999	1945
902043-1		MSD		49.98	50.00	100.0	76-120		02/28/1999	2017

Surrogate	Units
BFB (Surrogate)	ug/L

Lab ID	Matrix	QC Type	Dilution	Result	True Value	Percent Recovery	Limits	Flag	Date	Time
		MB		47.79	50.00	95.6	86-115		02/28/1999	1236
		LCS		48.00	50.00	96.0	86-115		02/28/1999	1308
902015-1			5	48.76	50.00	97.5	86-115		02/28/1999	1339
902015-2			5	48.88	50.00	97.8	86-115		02/28/1999	1411
902015-3			5	49.16	50.00	98.3	86-115		02/28/1999	1443
902015-4			5	48.67	50.00	97.3	86-115		02/28/1999	1514
902023-1			200	46.41	50.00	92.8	86-115		02/28/1999	1603
902043-1				49.18	50.00	98.4	86-115		02/28/1999	1634
902043-1		MS		46.66	50.00	93.3	86-115		02/28/1999	1945
902043-1		MSD		47.99	50.00	96.0	86-115		02/28/1999	2017

Surrogate	Units
Toluene-d8	ug/L

Lab ID	Matrix	QC Type	Dilution	Result	True Value	Percent Recovery	Limits	Flag	Date	Time
		MB		44.80	50.00	89.6	88-110		02/28/1999	1236
		LCS		44.20	50.00	88.4	88-110		02/28/1999	1308
902015-1			5	46.16	50.00	92.3	88-110		02/28/1999	1339
902015-2			5	46.11	50.00	92.2	88-110		02/28/1999	1411
902015-3			5	45.23	50.00	90.5	88-110		02/28/1999	1443
902015-4			5	45.65	50.00	91.3	88-110		02/28/1999	1514
902023-1			200	45.69	50.00	91.4	88-110		02/28/1999	1603
902043-1				45.63	50.00	91.3	88-110		02/28/1999	1634
902043-1		MS		45.70	50.00	91.4	88-110		02/28/1999	1945
902043-1		MSD		45.49	50.00	91.0	88-110		02/28/1999	2017

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CORE LABORATORIES

QUALITY ASSURANCE FOOTER

METHOD REFERENCES

(1) EPA SW-846, Test Methods for Evaluating Solid Waste, Third Edition, September 1986, July 1992, and September 1994 updates
(2) Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992
(3) EPA 600/4-79-020, Methods of Chemical Analysis for Waters and Wastes, March 1983
(4) Federal Register, Friday, October 26, 1984 (40 CFR Part 136)
(5) American Society for Testing and Materials, Volumes 5.01, 5.02, 5.03, 1992
(6) EPA 600/4-89-001, Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Fresh Water Organisms
(7) EPA 600/4-90-027, Methods for Measuring the Acute Toxicity of Effluent and Receiving Waters to Fresh Water and Marine Organisms, Fourth Edition

COMMENTS

All methods of chemical analysis have a statistical uncertainty associated with the results. Unless otherwise indicated, the data in this report are within the limits of uncertainty as specified in the referenced method. Quality control acceptance criteria are based either on actual laboratory performance or on limits specified in the referenced method. The date and time of analysis indicated on the QA report may not reflect the actual time of analysis for QC samples. All data reported on an "as received" basis unless otherwise indicated. Data reported in the QA report may be lower than sample data due to dilution of samples into the calibration range of the analysis. Sample concentrations for solid samples are calculated on an as received (wet) basis. Unless otherwise indicated, volatiles by gas chromatography (GC) are reported from a single column. Volatiles analyses by GC on low level soil extractions are conducted at room temperature.

FLAGS, FOOTNOTES, AND ABBREVIATIONS (as needed)

NA = Not analyzed
N/A = Not applicable
ug/L = Micrograms per liter
mg/L = Milligrams per liter
N.I. = Not Ignitable
S.I. = Sustains Ignition
I(NS) = Ignites, but does not Sustain Ignition
RPD = Relative Percent Difference
ND = Not detected at a value greater than the reporting limit
NC = Not calculable due to values lower than the detection limit
(a) = Surrogate recoveries were outside acceptable ranges due to matrix effects.
(b) = Surrogate recoveries were not calculated due to dilution of the sample below the detectable range for the surrogate.
(c) = Matrix spike recoveries were outside acceptable ranges due to matrix effects.
(d) = Relative Percent Difference (RPD) for duplicate analysis outside acceptance limits due to actual differences in the sample matrix.
(e) = The limit listed for flammability indicates the upper limit for the test. Samples are not tested at temperatures above 140 Fahrenheit since only samples which will sustain ignition at temperatures below 140 are considered flammable.
(f) = Results for this hydrocarbon range did not match a typical hydrocarbon pattern. Results were quantified using a diesel standard, however, the hydrocarbon pattern did not match a diesel pattern.
(g) = Results for this hydrocarbon range did not match a typical hydrocarbon pattern. Results were quantified using a gasoline standard, however, the hydrocarbon pattern did not match a gasoline pattern.
(h) = High dilution due to matrix effects

QC SAMPLE IDENTIFICATIONS

MB = Method Blank
RB = Reagent Blank
ICB = Initial Calibration Blank
CCB = Continuing Calibration Blank
CS = Calibration Standard
ICB = Initial Calibration Verification
CCV = Continuing Calibration Verification
SB = Storage Blank
MS = Matrix Spike
MSD = Matrix Spike Duplicate
MD = Matrix Duplicate
BS = Blank Spike
SS = Surrogate Spike
LCS = Laboratory Control Standard
RS = Reference Standard

SUBCONTRACTED LABORATORY LOCATIONS

Core Laboratories:	Aurora, Colorado	*AU
	Casper, Wyoming	*CA
	Corpus Christi, Texas	*CC
	Edison, New Jersey	*ED
	Houston, Texas (Env)	*HE
	Houston, Texas (Pet)	*HP
	Indianapolis, Indiana	*IN
	Lake Charles, Louisiana	*LC
	Long Beach, California	*LB
	Tampa, Florida	*TP
	Valparaiso, Indiana	*VP
Aquatic Testing Laboratories:	Ventura, California	*AT

2400 Cumberland Drive
Valparaiso, IN 46383

rpjsckl | Job Sample Receipt Checklist Report 02/26/99 | V2

Job Number.....: 902015 Location.: 57211 Customer Job ID.....: Job Check List Date.: 02/26/99
Project Number.: 96000651 Project Description.: Marathon Oil Co., Midland, Tx Project Manager.....: lpa
Customer.....: Marathon Oil Company Contact.: Mr. Paul Peacock

Questions ?	(Y/N)	Comments
Chain-of-Custody Present?.....	Y	
Custody seal on shipping container?.....		
...If "yes", custody seal intact?.....		
Custody seals on sample containers?.....		
...If "yes", custody seal intact?.....		
Samples chilled?.....	Y	
Temperature of cooler acceptable? (4 deg C +/- 2).		
Samples received intact (good condition)?.....	N	WEST AIR STRIPPER EFFLUENT BOTTLE BROKEN IN TRANSIT
Volatile samples acceptable? (no headspace).....	Y	
Correct containers used?.....	Y	
Adequate sample volume provided?.....	Y	
Samples preserved correctly?.....	Y	
Samples received within holding-time?.....	Y	
Agreement between COC and sample labels?.....	Y	
Additional.....		
Comments.....		
Sample Custodian Signature.....JH.....		

CORE LAB

CORE LABORATORIES, INC.

2400 Cumberland Drive
Valparaiso, IN 46383

CHAIN OF CUSTODY RECORD

02/24/99 15:35 FAX 219 462 2953 CORE LAB

219/464-2389

CUSTOMER INFORMATION	PROJECT INFORMATION
COMPANY: Marathon Oil Company	PROJECT NAME/NUMBER: Indian Basin Remediation Project
SEND REPORT TO: Paul Peacock	BILLING INFORMATION
ADDRESS: P.O. Box 552	BILL TO: Same
Midland, TX 79702	ADDRESS:
PHONE: 915/687-8312	PHONE:
FAX: 915/687-8305	FAX: PO NO.:

LAB JOB NO. 902615

	SAMPLE DESCRIPTION	SAMPLE DATE	SAMPLE TIME	SAMPLE MATRIX	CONTAINER	PRESERV.	NUMBER OF CONTAINERS	BTEX Method 8021	TPH GRO Method 8015	TPH DRO Method 8015						REMARKS/PRECAUTIONS
	~~West Air Stripper~~															
1	West Air Stripper Influent	2/25/99		Water	4ml	HCL		X	X							
2	West Air Stripper Effluent	2/25/99			4ml	HCL		X	X							
3	East Air Stripper Influent	2/25/99			4ml	HCL		X	X							
4	East Air Stripper Effluent	2/25/99			4ml	HCL		X	X							
1	West Air Stripper Influent	2/25/99			16 oz	None				X						
2	West Air Stripper Effluent	2/25/99			16 oz	None				X						
3	East Air Stripper Influent	2/25/99			16 oz	None				X						
4	East Air Stripper Effluent	2/25/99			16 oz	None				X						

SAMPLER: SHIPMENT METHOD: AIRBILL NO.:

REQUIRED TURNAROUND:* ☐ SAME DAY ☐ 24 HOURS ☐ 48 HOURS ☐ 72 HOURS ☐ 5 DAYS ☐ 10 DAYS ☑ ROUTINE OTHER

1. RELINQUISHED BY:	DATE	2. RELINQUISHED BY:	DATE	3. RELINQUISHED BY:	DATE
SIGNATURE: Rigo Aguilera	2-25-99	SIGNATURE:		SIGNATURE:	
PRINTED NAME/COMPANY: Rigo Aguilera MOC	TIME 11:55 AM	PRINTED NAME/COMPANY:	TIME	PRINTED NAME/COMPANY:	TIME
1. RECEIVED BY:	DATE	2. RECEIVED BY:	DATE	3. RECEIVED BY:	DATE
SIGNATURE: Jan Bobo	2/26/99	SIGNATURE:		SIGNATURE:	
PRINTED NAME/COMPANY: JBJ Corp	TIME 1100	PRINTED NAME/COMPANY:	TIME	PRINTED NAME/COMPANY:	TIME

* RUSH TURNAROUND MAY REQUIRE SURCHARGE

☐ Anaheim, CA
1250 E. Gene Autry Way
Anaheim, CA 92805
(714) 937-1094 Fax (714) 937-1170

☐ Aurora, CO
10700 E. Bethany Drive
Aurora, CO 80014
(303) 751-1780 Fax (303) 751-4784

☐ Carson, CA
21730 S. Wilmington Ave. - Suite 201
Carson, CA 90810-1640
(310) 513-2031 Fax (310) 513-2039

☐ Casper, WY
430 W. First Street
Casper, WY 82601
(307) 235-5744 Fax (307) 266-1676

☐ Corpus Christi, TX
1733 N. Padre Island Drive
Corpus Christi, TX 78408
(512) 289-2673 Fax (512) 289-2474

☐ [illegible]
[illegible]
[illegible] Fax [illegible]

☐ Houston, TX (EAW)
6316 Rothway Drive
Houston, TX 77040
(713) 690-4444 Fax (713) 690-5646

☐ Houston, TX (SW)
8210 Mosley Road
Houston, TX 77075
(713) 943-9776 Fax (713) 943-3846

☐ Indianapolis, IN
7728 Moller Road
Indianapolis, IN 46268
(317) 875-4954 Fax (317) 872-6189

☐ Lake Charles, LA
3645 Beglis Parkway
Sulphur, LA 70663
(318) 583-4926 Fax (318) 583-4929

☐ Valparaiso, IN
2400 Cumberland Drive
Valparaiso, IN 46383
(219) 464-2389 Fax (219) 462-2953

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque. New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

Pinnacle Lab ID number **901082**
February 18, 1999

MARATHON OIL COMPANY
P.O. BOX 552
MIDLAND, TX 79702-0552

Project Name IB REMEDIATION
Project Number (none)

Attention: PAUL PEACOCK

On 1/29/99 Pinnacle Laboratories, Inc. Inc., (ADHS License No. AZ0592), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

EPA method 8021 was performed by Pinnacle Laboratories, Inc., Albuquerque, NM.

All other parameters were performed by ESL (OR) Inc., Durham, OR.

If you have any questions or comments, please do not hesitate to contact us at (505)344-3777.

Kimberly D. McNeill
Project Manager

H. Mitchell Rubenstein, Ph. D.
General Manager

MR: mt

Enclosure

MCR

EB 2 1999

...ronmental & Safety

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

CLIENT	: MARATHON OIL COMPANY	PINNACLE ID	: 901082
PROJECT #	: (none)	DATE RECEIVED	: 1/29/99
PROJECT NAME	: IB REMEDIATION	REPORT DATE	: 2/18/99

FIN ID. #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
C1	W. STRIPPER INLET	AQUEOUS	1/28/99
C2	W. STRIPPER OUTLET	AQUEOUS	1/28/99
C3	E. STRIPPER INLET	AQUEOUS	1/28/99
C4	E. STRIPPER OUTLET	AQUEOUS	1/28/99
C5	LYMAN	AQUEOUS	1/28/99

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

GAS CHROMATOGRAPHY RESULTS

TEST : EPA 8021 MODIFIED
CLIENT : MARATHON OIL COMPANY
PROJECT # : (none)
PROJECT NAME : IB REMEDIATION

PINNACLE I.D.: 901082

SAMPLE I.D. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	W. STRIPPER INLET	AQUEOUS	1/28/99	NA	1/29/99	50
02	W. STRIPPER OUTLET	AQUEOUS	1/28/99	NA	2/1/99	10
03	E. STRIPPER INLET	AQUEOUS	1/28/99	NA	1/29/99	50

PARAMETER	DET. LIMIT	UNITS	W. STRIPPER INLET	W. STRIPPER OUTLET	E. STRIPPER INLET
BENZENE	0.5	**UG/L**	**160**	**19**	**160**
TOLUENE	0.5	**UG/L**	**53**	**77**	**75**
ETHYLBENZENE	0.5	**UG/L**	**270**	**11**	**270**
TOTAL XYLENES	0.5	**UG/L**	**440**	**22**	**500**

SURROGATE:					
BROMOFLUOROBENZENE (%)			108	120	103
SURROGATE LIMITS	(80 - 120)				

CHEMIST NOTES:
N/A

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

GAS CHROMATOGRAPHY RESULTS

TEST : EPA 8021 MODIFIED
CLIENT : MARATHON OIL COMPANY
PROJECT # : (none)
PROJECT NAME : IB REMEDIATION

PINNACLE I.D.: 901082

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	E. STRIPPER OUTLET	AQUEOUS	1/28/99	NA	2/1/99	20
05	LYMAN	AQUEOUS	1/28/99	NA	1/29/99	1

PARAMETER	DET. LIMIT	UNITS	E. STRIPPER OUTLET	LYMAN
BENZENE	0.5	**UG/L**	**24**	< 0.5
TOLUENE	0.5	**UG/L**	**120**	< 0.5
ETHYLBENZENE	0.5	**UG/L**	**29**	< 0.5
TOTAL XYLENES	0.5	**UG/L**	**470**	< 0.5

SURROGATE:

BROMOFLUOROBENZENE (%)		100	102
SURROGATE LIMITS	(80 - 120)		

CHEMIST NOTES:
N/A

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

GAS CHROMATOGRAPHY RESULTS
REAGENT BLANK

TEST	: EPA 8021 MODIFIED	PINNACLE I.D.	:	901082
BLANK I. D.	: 012899	DATE EXTRACTED	:	NA
CLIENT	: MARATHON OIL COMPANY	DATE ANALYZED	:	1/28/99
PROJECT #	: (none)	SAMPLE MATRIX	:	AQUEOUS
PROJECT NAME	: IB REMEDIATION			

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5

SURROGATE:
BROMOFLUOROBENZENE (%) 103
SURROGATE LIMITS: (80 - 120)
CHEMIST NOTES:
N/A

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

GAS CHROMATOGRAPHY RESULTS
REAGENT BLANK

TEST	: EPA 8021 MODIFIED	PINNACLE I.D.	: 901082
BLANK I. D.	: 012999	DATE EXTRACTED	: NA
CLIENT	: MARATHON OIL COMPANY	DATE ANALYZED	: 1/29/99
PROJECT #	: (none)	SAMPLE MATRIX	: AQUEOUS
PROJECT NAME	: IB REMEDIATION		

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5

SURROGATE:
BROMOFLUOROBENZENE (%) 113
SURROGATE LIMITS: (80 - 120)
CHEMIST NOTES:
N/A

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque. New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

GAS CHROMATOGRAPHY RESULTS
REAGENT BLANK

TEST	: EPA 8021 MODIFIED	PINNACLE I.D.	:	901082
BLANK I. D.	: 020199	DATE EXTRACTED	:	NA
CLIENT	: MARATHON OIL COMPANY	DATE ANALYZED	:	2/1/99
PROJECT #	: (none)	SAMPLE MATRIX	:	AQUEOUS
PROJECT NAME	: IB REMEDIATION			

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5

SURROGATE:
BROMOFLUOROBENZENE (%) 108
SURROGATE LIMITS: (80 - 120)
CHEMIST NOTES:
N/A

PINNACLE LABORATORIES

2709-D Pan American Freeway NE
Albuquerque, New Mexico 87107
Phone (505) 344-3777
Fax (505) 344-4413

GAS CHROMATOGRAPHY QUALITY CONTROL
MSMSD

TEST	: EPA 8021 MODIFIED			
MSMSD #	: 901073-01	PINNACLE I.D.	:	901082
CLIENT	: MARATHON OIL COMPANY	DATE EXTRACTED	:	NA
PROJECT #	: (none)	DATE ANALYZED	:	1/28/99
PROJECT NAME	: IB REMEDIATION	SAMPLE MATRIX	:	AQUEOUS
		UNITS	:	UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD	REC LIMITS	RPD LIMITS
BENZENE	<0.5	10.0	10.5	105	10.3	103	2	(80 - 120)	20
TOLUENE	0.53	10.0	10.6	101	10.4	99	2	(80 - 120)	20
ETHYLBENZENE	<0.5	10.0	11.4	114	10.9	109	4	(80 - 120)	20
TOTAL XYLENES	<0.5	30.0	31.5	105	30.5	102	3	(80 - 120)	20

CHEMIST NOTES:
N/A

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Environmental Services Laboratory, Inc. E S L

17400 SW Upper Boones Ferry Road • Suite 270 • Portland, OR 97224 • (503) 670-8520

February 11, 1999

Kim McNeill
Pinnacle Laboratories

2709-D Pan American Fwy NE

Albuquerque, NM 87107

TEL: 505-344-3777

FAX (505) 344-4413

RE: 901082 / MOC

Order No.: 9902014

Dear Kim McNeill,

Environmental Services Laboratory received 1 sample on 2/1/99 for the analyses presented in the following report.

The Samples were analyzed for the following tests:
CHLORIDE (Chloride)

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except where noted in the Case Narrative. Results apply only to the samples analyzed. Reproduction of this report is permitted only in its entirety, without the written approval from the Laboratory.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Kimberly Hill
Project Manager

Technical Review

Environmental Services Laboratory

Date: *11-Feb-99*

CLIENT:	Pinnacle Laboratories	**Client Sample ID:**	901082-01
Lab Order:	9902014	**Tag Number:**	
Project:	901082 / MOC	**Collection Date:**	1/28/99
Lab ID:	9902014-01A	**Matrix:**	AQUEOUS

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
CHLORIDE		CHLORIDE				Analyst: sld
Chloride	ND	0.5		mg/L	1	2/9/99

Qualifiers:

ND - Not Detected at the Reporting Limit

J - Analyte detected below quantitation limits

B - Analyte detected in the associated Method Blank

* - Value exceeds Maximum Contaminant Level

S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits

E - Value above quantitation range

Environmental Services Laboratory

Date: *11-Feb-99*

CLIENT: Pinnacle Laboratories
Work Order: 9902014
Project: 901082 / MOC

QC SUMMARY REPORT

Method Blank

Sample ID: **MBLK** Batch ID: **NO INST_990** Test Code: **Chloride** Units: **mg/L** Analysis Date **2/9/99** Prep Date:

Client ID: **9902014** Run ID: **NO INST_990209A** SeqNo: **3327**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	ND	0.5									

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank

Environmental Services Laboratory

Date: *11-Feb-99*

CLIENT: Pinnacle Laboratories
Work Order: 9902014
Project: 901082 / MOC

QC SUMMARY REPORT

Sample Duplicate

Sample ID: **9902037-03A DUP** Batch ID: **NO INST_990** Test Code: **Chloride** Units: **mg/L** Analysis Date **2/9/99** Prep Date:

Client ID: **9902014** Run ID: **NO INST_990209A** SeqNo: **3331**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	3.8	0.5	0	0	0.0%	0	0	4.3	12.3%	20	

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank

Environmental Services Laboratory

Date: *11-Feb-99*

CLIENT: Pinnacle Laboratories
Work Order: 9902014
Project: 901082 / MOC

QC SUMMARY REPORT

Sample Matrix Spike

Sample ID: **9902037-03A MS** Batch ID: **NO INST_990** Test Code: **Chloride** Units: **mg/L** Analysis Date **2/9/99** Prep Date:

Client ID: **9902014** Run ID: **NO INST_990209A** SeqNo: **3332**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	9	0.5	5	4.3	94.0%	75	125	0			

Sample ID: **9902037-03A MSD** Batch ID: **NO INST_990** Test Code: **Chloride** Units: **mg/L** Analysis Date **2/9/99** Prep Date:

Client ID: **9902014** Run ID: **NO INST_990209A** SeqNo: **3333**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	9.25	0.5	5	4.3	99.0%	75	125	9	2.7%	20	

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank

Environmental Services Laboratory

Date: *11-Feb-99*

CLIENT: Pinnacle Laboratories
Work Order: 9902014
Project: 901082 / MOC

QC SUMMARY REPORT

Initial Calibration Verification Standard

Sample ID: **ICV** Batch ID: **NO INST_990** Test Code: **Chloride** Units: **mg/L** Analysis Date **2/9/99** Prep Date:

Client ID: **9902014** Run ID: **NO INST_990209A** SeqNo: **3328**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Chloride	10	0.5	10	0	100.0%	85	115	0			

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank

Pinnacle Laboratories, Inc. **Interlab Chain of Custody** Date: 1/29 Page: 1 of 1 9902014

Network Project Manager: Kimberly D. McNeill

Pinnacle Laboratories, Inc.
2709-D Pan American Freeway, NE
Albuquerque, New Mexico 87107
(505) 344-3777 Fax (505) 344-4413

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Metals (8) RCRA	RCRA TCLP METALS	Metals-13 PP List	Metals-TAL		TOX	TOC	Gen Chemistry: Chloride		Oil and Grease	Volatile Organics GC/MS (8260)	BOD	COD	PESTICIDES/PCB (608/8080)	8270 BY GC/MS	PNA (8310)	8240 (TCLP 1311) ZHE	Herbicides (615/8150)	Base/Neutral Acid Compounds GC/MS (625/8270)	URANIUM	RADIUM 226+228	Gross Alpha/Beta	TO-14	NUMBER OF CONTAINERS
901082-01	1/28	0820	AQ	01								X																

PROJECT INFORMATION	SAMPLE RECEIPT	SAMPLES SENT TO:	RELINQUISHED BY: 1.	RELINQUISHED BY: 2.
PROJECT #: 901082	Total Number of Containers	PENSACOLA - STL-FL	Signature: Time: 1700	Signature: Time:
PROJ. NAME: MOC	Chain of Custody Seals	PORTLAND - ESL-OR X	Francine Torino	
QC LEVEL: STD. IV	Received Intact?	STL - CT	Printed Name: Date: Francine Torino 2/1/99	Printed Name: Date:
QC REQUIRED: MS MSD BLANK	Received Good Cond./Cold	STL- NEW JERSEY		
TAT: STANDARD RUSH!!	LAB NUMBER:	N. CREEK	Pinnacle Laboratories, Inc.	Company
		BARRINGER	RECEIVED BY: 1.	RECEIVED BY: 2
DUE DATE: 2/12	COMMENTS	SEQUOIA	Signature Time	Signature: Time:
RUSH SURCHARGE: —				
CLIENT DISCOUNT: —			Printed Name Date	Printed Name: Date:
SPECIAL CERTIFICATION REQUIRED: YES NO			Company	Company

Pinnacle Laboratories Inc.

CHAIN OF CUSTODY

DATE: 1-28-99 PAGE: 1 OF 1

PLI Accession #: 901082

SHADED AREAS ARE FOR LAB USE ONLY.

PLEASE FILL THIS FORM IN COMPLETELY.

PROJECT MANAGER: PAUL PEACOCK

COMPANY: MARATHON OIL CO
ADDRESS: P.O. BOX 552
MIDLAND TX
PHONE: 915 687-8312
FAX: 915 687-8305

BILL TO:
COMPANY: SAME AS ABOVE
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	Petroleum Hydrocarbons (418.1) TRPH	(MOD.8015) Diesel/Direct Inject	BTEX (8020)	(M8015) Gas/Purge & Trap	8021 (BTEX)/8015 (Gasoline) MTBE	8021 (BTEX) ☐ MTBE ☐ TMB ☐ PCE	8021 (TCL)	8021 (EDX)	8021 (HALO)	8021 (CUST)	504.1 EDB ☐ / DBCP ☐	Chloride	8260 (TCL) Volatile Organics	8260 (Full) Volatile Organics	8260 (CUST) Volatile Organics	8260 (Landfill) Volatile Organics	Pesticides /PCB (608/8081/8082)	Herbicides (615/8151)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Polynuclear Aromatics (610/8310/8270-SIMS)	General Chemistry:		Priority Pollutant Metals (13)	Target Analyte List Metals (23)	RCRA Metals (8)	RCRA Metals by TCLP (Method 1311)	Metals:		NUMBER OF CONTAINERS
W. STRIPPER inlet	1-28-99	8:50 AM	water	01			✓																										2
W. STRIPPER outlet	"	8:55 AM	"	02			✓																										2
E. STRIPPER inlet	"	8:59 AM	"	03			✓																										2
E. STRIPPER outlet	"	9:04 AM	"	04			✓																										2
LYMAN	"	8:22 AM	"	05			✓																										2
LYMAN	"	8:20 AM	"	05												✓																	1

PROJECT INFORMATION	
PROJ. NO.	
PROJ. NAME: FB Remediation	
P.O. NO.	
SHIPPED VIA:	
SAMPLE RECEIPT	
NO. CONTAINERS	10
CUSTODY SEALS	Y / N / NA
RECEIVED INTACT	Yes
BLUE ICE/ICE	5°C

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) [ ] 24hr [ ] 48hr [ ] 72hr [ ] 1 WEEK (NORMAL) ✓

CERTIFICATION REQUIRED: [ ] NM [ ] SDWA [ ] OTHER

METHANOL PRESERVATION [ ]

COMMENTS: FIXED FEE [ ]

-02 Rec'd 1 VOA Broken

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.
Signature: Bigo Aguilar Time: 9:15	Signature: Time:
Printed Name: Bigo Aguilar Date: 1-28-99	Printed Name: Date:
Company: MARATHON OIL CO. See reverse side (Force Majeure)	Company:
RECEIVED BY: 1.	**RECEIVED BY: (LAB) 2.**
Signature: Time:	Signature: Francine Torino Time: 1035
Printed Name: Date:	Printed Name: Francine Torino Date: 1/29/99
Company:	Pinnacle Laboratories Inc.

Olson, William

From: M P Peacock[SMTP:MPPeacock@MarathonOil.com]
Sent: Wednesday, March 03, 1999 10:52 AM
To: Olson, William
Cc: FDSearle@MarathonOil.com
Subject: IBRP Air Stripper Results

Bill,

I received the lab results of the confirmation water samples that were collected on February 24, 1999 from the air strippers at the Indian Basin Remediation Project. The lab analysis did not detect a benzene concentration above the WQCC Standard of 10 ppb in the effluent water sample from the air strippers. Therefore, the air strippers are now in compliance. Upon receipt of the lab report, I will send both lab reports and a cover letter to your office for the elevated benzene concentration in the water sample that was collected on January 28, 1999.

Please advise if you have any questions.

M. Paul Peacock
Ph: 915/687-8312
Fax: 915/687-8305
E-mail: mppeacock@marathonoil.com

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

December 31, 1998

RECEIVED
JAN 05 1999
ENVIRONMENTAL BUREAU
OIL CONSERVATION DIVISION

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

RE: Comprehensive Site Characterization Report
Indian Basin Remediation Project
Marathon Oil Company

Dear Mr. Olson:

I have enclosed the Comprehensive Site Characterization Report dated December 1998 that was prepared by IT Corporation, formerly Fluor Daniel GTI, Inc. The report, that was prepared in accordance with your letter dated December 11, 1997; Marathon Oil Company's Work Plan dated April 17, 1998; and your approval letter dated May 20, 1998; summarizes the additional investigation activities completed during the 1998 calendar year for the Indian Basin Remediation Project. The borehole video tapes of monitoring wells MW-73, MW-74, MW-75 and MW-76 are also enclosed.

If you have any questions or need any additional information, then please call me at (915) 687-8398.

Sincerely,

M. Paul Peacock

M. Paul Peacock
Advanced Environmental & Safety Engineer

enclosures
MPP\ocdcscr.wpd

File 576-14

cc: T. C. Lowry w/enclosures
F. D. Searle
K. W. Tatarzyn

NEW MEXICO ENERGY, MINERALS
& NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
2040 South Pacheco Street
Santa Fe, New Mexico 87505
(505) 827-7131

November 17, 1998

Mr. Paul Peacock
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702-0552

RE: GROUND WATER ANALYSES
MARATHON INDIAN BASIN GAS

Dear Mr. Peacock:

Enclosed you find copies of the New Mexico Oil Conservation Division's (OCD) laboratory analyses of ground water samples from monitor wells at the Indian Basin Gas Plant that the OCD split with Marathon on June 23 and June 24, 1998.

If you have any questions, please contact me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrologist
Environmental Bureau

enclosure

xc: Tim Gum, OCD Artesia District Supervisor

PINNACLE LABORATORIES

RECEIVED
JUL 04 1998
ENVIRONMENTAL BUREAU
OIL CONSERVATION DIVISION

PL I.D. **806378**

September 3, 1998

NMOCD
2040 S. Pacheco
Santa Fe, NM 87505

Project Name/Number: INDIAN BASIN MARATHON

Attention: Bill Olson

On **06/25/98**, Pinnacle Laborataories Inc., (ADHS License No. AZ0592), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

All analyses were performed by STAR Analytical, Fort Worth, TX.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Kimberly D. McNeill
Project Manager

H. Mitchell Rubenstein, Ph.D.
General Manager

MR:jt

Enclosure

2709-D Pan American Freeway, NE, Albuquerque, New Mexico 87107 Phone: 505-344-3777, Fax: 505-344-4413

PINNACLE LABORATORIES

CLIENT	:NMOCD	DATE RECEIVED	:06/25/98
PROJECT #	:MARATHON		
PROJECT NAME	:INDIAN BASIN	REPORT DATE	:09/03/98

PL ID: 806378

	PINNACLE ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	806378-01	9806230900 (MW-85)	AQUEOUS	06/23/98
02	806378-02	9806231300 (MW-84)	AQUEOUS	06/23/98
03	806378-03	9806231430 (MW-64)	AQUEOUS	06/23/98
04	806378-04	9806240915 (MW-59)	AQUEOUS	06/24/98
05	806378-05	9806241130 (MW-74)	AQUEOUS	06/24/98
06	806378-06	TB	AQUEOUS	06/22/98

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	6

2709-D Pan American Freeway, NE, Albuquerque, New Mexico 87107 Phone: 505-344-3777, Fax: 505-344-4413

STAR ANALYTICAL

14500 Trinity Boulevard, Suite 106 • Fort Worth, Texas 76155
Tarrant County • (817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431

ACCREDITED

American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

ANALYTICAL REPORT FOR SAMPLES:

Sample Description	Laboratory Sample Number	Sample Matrix	Date Sampled
806378-01	8060345-00	Water	6/23/98
806378-02	8060345-01	Water	6/23/98
806378-03	8060345-02	Water	6/23/98
806378-04	8060345-03	Water	6/24/98
806378-05	8060345-04	Water	6/24/98
Trip Blank	8060345-05	Water	6/22/98

Star Analytical, Inc.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

L Hall

Lari Hall, Project Manager

STAR ANALYTICAL
14500 Trinity Boulevard, Suite 106 • Fort Worth, Texas 76155
Tarrant County • (817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431

ACCREDITED

American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-01			**8060345-00**				**Water**	
Acetone	06V8484	6/29/98	6/29/98		500	ND	ug/l	D
Benzene	"	"	"		100	**188**	"	D
Bromobenzene	"	"	"		100	ND	"	D
Bromochloromethane	"	"	"		100	ND	"	D
Bromodichloromethane	"	"	"		100	ND	"	D
Bromoform	"	"	"		100	ND	"	D
Bromomethane	"	"	"		100	ND	"	D
2-Butanone	"	"	"		500	ND	"	D
n-Butylbenzene	"	"	"		100	ND	"	D
sec-Butylbenzene	"	"	"		100	ND	"	D
tert-Butylbenzene	"	"	"		100	ND	"	D
Carbon disulfide	"	"	"		100	ND	"	D
Carbon tetrachloride	"	"	"		100	ND	"	D
Chlorobenzene	"	"	"		100	ND	"	D
Chloroethane	"	"	"		100	ND	"	D
Chloroform	"	"	"		100	ND	"	D
Chloromethane	"	"	"		100	ND	"	D
2-Chlorotoluene	"	"	"		100	ND	"	D
4-Chlorotoluene	"	"	"		100	ND	"	D
Dibromochloromethane	"	"	"		100	ND	"	D
1,2-Dibromo-3-chloropropane	"	"	"		100	ND	"	D
1,2-Dibromoethane	"	"	"		100	ND	"	D
Dibromomethane	"	"	"		100	ND	"	D
1,2-Dichlorobenzene	"	"	"		100	ND	"	D
1,3-Dichlorobenzene	"	"	"		100	ND	"	D
1,4-Dichlorobenzene	"	"	"		100	ND	"	D
Dichlorodifluoromethane	"	"	"		100	ND	"	D
1,1-Dichloroethane	"	"	"		100	ND	"	D
1,2-Dichloroethane	"	"	"		100	ND	"	D
1,1-Dichloroethene	"	"	"		100	ND	"	D
cis-1,2-Dichloroethene	"	"	"		100	ND	"	D
trans-1,2-Dichloroethene	"	"	"		100	ND	"	D
1,2-Dichloropropane	"	"	"		100	ND	"	D
1,3-Dichloropropane	"	"	"		100	ND	"	D
2,2-Dichloropropane	"	"	"		100	ND	"	D
1,1-Dichloropropene	"	"	"		100	ND	"	D
cis-1,3-Dichloropropene	"	"	"		100	ND	"	D
trans-1,3-Dichloropropene	"	"	"		100	ND	"	D
Ethylbenzene	"	"	"		100	ND	"	D
Hexachlorobutadiene	"	"	"		100	**130**	"	D
2-Hexanone	"	"	"		500	ND	"	D

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L Hall

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-01 (continued)			**8060345-00**				**Water**	
Isopropylbenzene	06V8484	6/29/98	6/29/98		100	ND	ug/l	D
p-Isopropyltoluene	"	"	"		100	ND	"	D
Methylene chloride	"	"	"		500	ND	"	D
Methyl tert-butyl ether	"	"	"		100	ND	"	D
4-Methyl-2-pentanone	"	"	"		500	ND	"	D
Naphthalene	"	"	"		100	ND	"	D
n-Propylbenzene	"	"	"		100	ND	"	D
Styrene	"	"	"		100	ND	"	D
1,1,1,2-Tetrachloroethane	"	"	"		100	ND	"	D
1,1,2,2-Tetrachloroethane	"	"	"		100	ND	"	D
Tetrachloroethene	"	"	"		100	ND	"	D
Toluene	"	"	"		100	ND	"	D
1,2,3-Trichlorobenzene	"	"	"		100	ND	"	D
1,2,4-Trichlorobenzene	"	"	"		100	ND	"	D
1,1,1-Trichloroethane	"	"	"		100	ND	"	D
1,1,2-Trichloroethane	"	"	"		100	ND	"	D
Trichloroethene	"	"	"		100	ND	"	D
Trichlorofluoromethane	"	"	"		100	ND	"	D
1,2,3-Trichloropropane	"	"	"		100	ND	"	D
1,2,4-Trimethylbenzene	"	"	"		100	**125**	"	D
1,3,5-Trimethylbenzene	"	"	"		100	ND	"	D
Vinyl acetate	"	"	"		100	ND	"	D
Vinyl chloride	"	"	"		100	ND	"	D
m,p-Xylene	"	"	"		100	ND	"	D
o-Xylene	"	"	"		100	ND	"	D
Surrogate: DBFM	"	"	"	*86.0-118*		*96.0*	*%*	
Surrogate: Toluene-d8	"	"	"	*88.0-110*		*98.6*	"	
Surrogate: 4-BFB	"	"	"	*86.0-115*		*98.0*	"	

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American Enviro. Network	Project:	NMOCD		Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378		Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil		Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-02			**8060345-01**				**Water**	
Acetone	06V8484	6/29/98	6/29/98		10.0	ND	ug/l	
Benzene	"	"	"		2.00	**82.7**	"	
Bromobenzene	"	"	"		2.00	ND	"	
Bromochloromethane	"	"	"		2.00	ND	"	
Bromodichloromethane	"	"	"		2.00	ND	"	
Bromoform	"	"	"		2.00	ND	"	
Bromomethane	"	"	"		2.00	ND	"	
2-Butanone	"	"	"		10.0	ND	"	
n-Butylbenzene	"	"	"		2.00	ND	"	
sec-Butylbenzene	"	"	"		2.00	ND	"	
tert-Butylbenzene	"	"	"		2.00	ND	"	
Carbon disulfide	"	"	"		2.00	ND	"	
Carbon tetrachloride	"	"	"		2.00	ND	"	
Chlorobenzene	"	"	"		2.00	ND	"	
Chloroethane	"	"	"		2.00	ND	"	
Chloroform	"	"	"		2.00	ND	"	
Chloromethane	"	"	"		2.00	ND	"	
2-Chlorotoluene	"	"	"		2.00	ND	"	
4-Chlorotoluene	"	"	"		2.00	ND	"	
Dibromochloromethane	"	"	"		2.00	ND	"	
1,2-Dibromo-3-chloropropane	"	"	"		2.00	ND	"	
1,2-Dibromoethane	"	"	"		2.00	ND	"	
Dibromomethane	"	"	"		2.00	ND	"	
1,2-Dichlorobenzene	"	"	"		2.00	ND	"	
1,3-Dichlorobenzene	"	"	"		2.00	ND	"	
1,4-Dichlorobenzene	"	"	"		2.00	ND	"	
Dichlorodifluoromethane	"	"	"		2.00	ND	"	
1,1-Dichloroethane	"	"	"		2.00	ND	"	
1,2-Dichloroethane	"	"	"		2.00	ND	"	
1,1-Dichloroethene	"	"	"		2.00	ND	"	
cis-1,2-Dichloroethene	"	"	"		2.00	ND	"	
trans-1,2-Dichloroethene	"	"	"		2.00	ND	"	
1,2-Dichloropropane	"	"	"		2.00	ND	"	
1,3-Dichloropropane	"	"	"		2.00	ND	"	
2,2-Dichloropropane	"	"	"		2.00	ND	"	
1,1-Dichloropropene	"	"	"		2.00	ND	"	
cis-1,3-Dichloropropene	"	"	"		2.00	ND	"	
trans-1,3-Dichloropropene	"	"	"		2.00	ND	"	
Ethylbenzene	"	"	"		2.00	**55.7**	"	
Hexachlorobutadiene	"	"	"		2.00	ND	"	
2-Hexanone	"	"	"		10.0	ND	"	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-02 (continued)			**8060345-01**				**Water**	
Isopropylbenzene	06V8484	6/29/98	6/29/98		2.00	**8.63**	ug/l	
p-Isopropyltoluene	"	"	"		2.00	ND	"	
Methylene chloride	"	"	"		10.0	ND	"	
Methyl tert-butyl ether	"	"	"		2.00	ND	"	
4-Methyl-2-pentanone	"	"	"		10.0	ND	"	
Naphthalene	"	"	"		2.00	ND	"	
n-Propylbenzene	"	"	"		2.00	**10.6**	"	
Styrene	"	"	"		2.00	ND	"	
1,1,1,2-Tetrachloroethane	"	"	"		2.00	ND	"	
1,1,2,2-Tetrachloroethane	"	"	"		2.00	ND	"	
Tetrachloroethene	"	"	"		2.00	ND	"	
Toluene	"	"	"		2.00	**11.9**	"	
1,2,3-Trichlorobenzene	"	"	"		2.00	ND	"	
1,2,4-Trichlorobenzene	"	"	"		2.00	ND	"	
1,1,1-Trichloroethane	"	"	"		2.00	ND	"	
1,1,2-Trichloroethane	"	"	"		2.00	ND	"	
Trichloroethene	"	"	"		2.00	ND	"	
Trichlorofluoromethane	"	"	"		2.00	ND	"	
1,2,3-Trichloropropane	"	"	"		2.00	ND	"	
1,2,4-Trimethylbenzene	"	"	"		2.00	**94.1**	"	
1,3,5-Trimethylbenzene	"	"	"		2.00	ND	"	
Vinyl acetate	"	"	"		2.00	ND	"	
Vinyl chloride	"	"	"		2.00	ND	"	
m,p-Xylene	"	"	"		2.00	**418**	"	
o-Xylene	"	"	"		2.00	**38.7**	"	
Surrogate: DBFM	"	"	"	*86.0-118*		*100*	*%*	
Surrogate: Toluene-d8	"	"	"	*88.0-110*		*99.2*	"	
Surrogate: 4-BFB	"	"	"	*86.0-115*		*97.0*	"	

Star Analytical, Inc.

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-03			**8060345-02**				**Water**	
Acetone	06V8484	6/29/98	6/29/98		10.0	ND	ug/l	
Benzene	"	"	"		2.00	ND	"	
Bromobenzene	"	"	"		2.00	ND	"	
Bromochloromethane	"	"	"		2.00	ND	"	
Bromodichloromethane	"	"	"		2.00	ND	"	
Bromoform	"	"	"		2.00	ND	"	
Bromomethane	"	"	"		2.00	ND	"	
2-Butanone	"	"	"		10.0	ND	"	
n-Butylbenzene	"	"	"		2.00	ND	"	
sec-Butylbenzene	"	"	"		2.00	ND	"	
tert-Butylbenzene	"	"	"		2.00	ND	"	
Carbon disulfide	"	"	"		2.00	ND	"	
Carbon tetrachloride	"	"	"		2.00	ND	"	
Chlorobenzene	"	"	"		2.00	ND	"	
Chloroethane	"	"	"		2.00	ND	"	
Chloroform	"	"	"		2.00	ND	"	
Chloromethane	"	"	"		2.00	ND	"	
2-Chlorotoluene	"	"	"		2.00	ND	"	
4-Chlorotoluene	"	"	"		2.00	ND	"	
Dibromochloromethane	"	"	"		2.00	ND	"	
1,2-Dibromo-3-chloropropane	"	"	"		2.00	ND	"	
1,2-Dibromoethane	"	"	"		2.00	ND	"	
Dibromomethane	"	"	"		2.00	ND	"	
1,2-Dichlorobenzene	"	"	"		2.00	ND	"	
1,3-Dichlorobenzene	"	"	"		2.00	ND	"	
1,4-Dichlorobenzene	"	"	"		2.00	ND	"	
Dichlorodifluoromethane	"	"	"		2.00	ND	"	
1,1-Dichloroethane	"	"	"		2.00	ND	"	
1,2-Dichloroethane	"	"	"		2.00	ND	"	
1,1-Dichloroethene	"	"	"		2.00	ND	"	
cis-1,2-Dichloroethene	"	"	"		2.00	ND	"	
trans-1,2-Dichloroethene	"	"	"		2.00	ND	"	
1,2-Dichloropropane	"	"	"		2.00	ND	"	
1,3-Dichloropropane	"	"	"		2.00	ND	"	
2,2-Dichloropropane	"	"	"		2.00	ND	"	
1,1-Dichloropropene	"	"	"		2.00	ND	"	
cis-1,3-Dichloropropene	"	"	"		2.00	ND	"	
trans-1,3-Dichloropropene	"	"	"		2.00	ND	"	
Ethylbenzene	"	"	"		2.00	ND	"	
Hexachlorobutadiene	"	"	"		2.00	ND	"	
2-Hexanone	"	"	"		10.0	ND	"	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-03 (continued)			**8060345-02**				**Water**	
Isopropylbenzene	06V8484	6/29/98	6/29/98		2.00	ND	ug/l	
p-Isopropyltoluene	"	"	"		2.00	ND	"	
Methylene chloride	"	"	"		10.0	ND	"	
Methyl tert-butyl ether	"	"	"		2.00	ND	"	
4-Methyl-2-pentanone	"	"	"		10.0	ND	"	
Naphthalene	"	"	"		2.00	ND	"	
n-Propylbenzene	"	"	"		2.00	ND	"	
Styrene	"	"	"		2.00	ND	"	
1,1,1,2-Tetrachloroethane	"	"	"		2.00	ND	"	
1,1,2,2-Tetrachloroethane	"	"	"		2.00	ND	"	
Tetrachloroethene	"	"	"		2.00	ND	"	
Toluene	"	"	"		2.00	ND	"	
1,2,3-Trichlorobenzene	"	"	"		2.00	ND	"	
1,2,4-Trichlorobenzene	"	"	"		2.00	ND	"	
1,1,1-Trichloroethane	"	"	"		2.00	ND	"	
1,1,2-Trichloroethane	"	"	"		2.00	ND	"	
Trichloroethene	"	"	"		2.00	ND	"	
Trichlorofluoromethane	"	"	"		2.00	ND	"	
1,2,3-Trichloropropane	"	"	"		2.00	ND	"	
1,2,4-Trimethylbenzene	"	"	"		2.00	ND	"	
1,3,5-Trimethylbenzene	"	"	"		2.00	ND	"	
Vinyl acetate	"	"	"		2.00	ND	"	
Vinyl chloride	"	"	"		2.00	ND	"	
m,p-Xylene	"	"	"		2.00	ND	"	
o-Xylene	"	"	"		2.00	ND	"	
Surrogate: DBFM	"	"	"	*86.0-118*		*99.4*	*%*	
Surrogate: Toluene-d8	"	"	"	*88.0-110*		*98.2*	"	
Surrogate: 4-BFB	"	"	"	*86.0-115*		*94.6*	"	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-04			**8060345-03**				**Water**	
Acetone	06V8484	6/29/98	6/29/98		10.0	ND	ug/l	
Benzene	"	"	"		2.00	ND	"	
Bromobenzene	"	"	"		2.00	ND	"	
Bromochloromethane	"	"	"		2.00	ND	"	
Bromodichloromethane	"	"	"		2.00	ND	"	
Bromoform	"	"	"		2.00	ND	"	
Bromomethane	"	"	"		2.00	ND	"	
2-Butanone	"	"	"		10.0	ND	"	
n-Butylbenzene	"	"	"		2.00	ND	"	
sec-Butylbenzene	"	"	"		2.00	ND	"	
tert-Butylbenzene	"	"	"		2.00	ND	"	
Carbon disulfide	"	"	"		2.00	ND	"	
Carbon tetrachloride	"	"	"		2.00	ND	"	
Chlorobenzene	"	"	"		2.00	ND	"	
Chloroethane	"	"	"		2.00	ND	"	
Chloroform	"	"	"		2.00	ND	"	
Chloromethane	"	"	"		2.00	ND	"	
2-Chlorotoluene	"	"	"		2.00	ND	"	
4-Chlorotoluene	"	"	"		2.00	ND	"	
Dibromochloromethane	"	"	"		2.00	ND	"	
1,2-Dibromo-3-chloropropane	"	"	"		2.00	ND	"	
1,2-Dibromoethane	"	"	"		2.00	ND	"	
Dibromomethane	"	"	"		2.00	ND	"	
1,2-Dichlorobenzene	"	"	"		2.00	ND	"	
1,3-Dichlorobenzene	"	"	"		2.00	ND	"	
1,4-Dichlorobenzene	"	"	"		2.00	ND	"	
Dichlorodifluoromethane	"	"	"		2.00	ND	"	
1,1-Dichloroethane	"	"	"		2.00	ND	"	
1,2-Dichloroethane	"	"	"		2.00	ND	"	
1,1-Dichloroethene	"	"	"		2.00	ND	"	
cis-1,2-Dichloroethene	"	"	"		2.00	ND	"	
trans-1,2-Dichloroethene	"	"	"		2.00	ND	"	
1,2-Dichloropropane	"	"	"		2.00	ND	"	
1,3-Dichloropropane	"	"	"		2.00	ND	"	
2,2-Dichloropropane	"	"	"		2.00	ND	"	
1,1-Dichloropropene	"	"	"		2.00	ND	"	
cis-1,3-Dichloropropene	"	"	"		2.00	ND	"	
trans-1,3-Dichloropropene	"	"	"		2.00	ND	"	
Ethylbenzene	"	"	"		2.00	**99.4**	"	
Hexachlorobutadiene	"	"	"		2.00	ND	"	
2-Hexanone	"	"	"		10.0	ND	"	

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2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-04 (continued)			**8060345-03**				**Water**	
Isopropylbenzene	06V8484	6/29/98	6/29/98		2.00	ND	ug/l	
p-Isopropyltoluene	"	"	"		2.00	ND	"	
Methylene chloride	"	"	"		10.0	ND	"	
Methyl tert-butyl ether	"	"	"		2.00	ND	"	
4-Methyl-2-pentanone	"	"	"		10.0	ND	"	
Naphthalene	"	"	"		2.00	**7.25**	"	
n-Propylbenzene	"	"	"		2.00	**50.8**	"	
Styrene	"	"	"		2.00	ND	"	
1,1,1,2-Tetrachloroethane	"	"	"		2.00	ND	"	
1,1,2,2-Tetrachloroethane	"	"	"		2.00	ND	"	
Tetrachloroethene	"	"	"		2.00	ND	"	
Toluene	"	"	"		2.00	ND	"	
1,2,3-Trichlorobenzene	"	"	"		2.00	ND	"	
1,2,4-Trichlorobenzene	"	"	"		2.00	ND	"	
1,1,1-Trichloroethane	"	"	"		2.00	ND	"	
1,1,2-Trichloroethane	"	"	"		2.00	ND	"	
Trichloroethene	"	"	"		2.00	ND	"	
Trichlorofluoromethane	"	"	"		2.00	ND	"	
1,2,3-Trichloropropane	"	"	"		2.00	ND	"	
1,2,4-Trimethylbenzene	"	"	"		100	**348**	"	D
1,3,5-Trimethylbenzene	"	"	"		2.00	**66.1**	"	
Vinyl acetate	"	"	"		2.00	ND	"	
Vinyl chloride	"	"	"		2.00	ND	"	
m,p-Xylene	"	"	"		2.00	**49.7**	"	
o-Xylene	"	"	"		2.00	ND	"	
Surrogate: DBFM	"	"	"	*86.0-118*		*96.4*	*%*	
Surrogate: Toluene-d8	"	"	"	*88.0-110*		*97.6*	"	
Surrogate: 4-BFB	"	"	"	*86.0-115*		*95.4*	"	

Star Analytical, Inc.

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-05			**8060345-04**				**Water**	
Acetone	06V8484	6/29/98	6/29/98		500	ND	ug/l	D
Benzene	"	"	"		100	**213**	"	D
Bromobenzene	"	"	"		100	ND	"	D
Bromochloromethane	"	"	"		100	ND	"	D
Bromodichloromethane	"	"	"		100	ND	"	D
Bromoform	"	"	"		100	ND	"	D
Bromomethane	"	"	"		100	ND	"	D
2-Butanone	"	"	"		500	ND	"	D
n-Butylbenzene	"	"	"		100	ND	"	D
sec-Butylbenzene	"	"	"		100	ND	"	D
tert-Butylbenzene	"	"	"		100	ND	"	D
Carbon disulfide	"	"	"		100	ND	"	D
Carbon tetrachloride	"	"	"		100	ND	"	D
Chlorobenzene	"	"	"		100	ND	"	D
Chloroethane	"	"	"		100	ND	"	D
Chloroform	"	"	"		100	ND	"	D
Chloromethane	"	"	"		100	ND	"	D
2-Chlorotoluene	"	"	"		100	ND	"	D
4-Chlorotoluene	"	"	"		100	ND	"	D
Dibromochloromethane	"	"	"		100	ND	"	D
1,2-Dibromo-3-chloropropane	"	"	"		100	ND	"	D
1,2-Dibromoethane	"	"	"		100	ND	"	D
Dibromomethane	"	"	"		100	ND	"	D
1,2-Dichlorobenzene	"	"	"		100	ND	"	D
1,3-Dichlorobenzene	"	"	"		100	ND	"	D
1,4-Dichlorobenzene	"	"	"		100	ND	"	D
Dichlorodifluoromethane	"	"	"		100	ND	"	D
1,1-Dichloroethane	"	"	"		100	ND	"	D
1,2-Dichloroethane	"	"	"		100	ND	"	D
1,1-Dichloroethene	"	"	"		100	ND	"	D
cis-1,2-Dichloroethene	"	"	"		100	ND	"	D
trans-1,2-Dichloroethene	"	"	"		100	ND	"	D
1,2-Dichloropropane	"	"	"		100	ND	"	D
1,3-Dichloropropane	"	"	"		100	ND	"	D
2,2-Dichloropropane	"	"	"		100	ND	"	D
1,1-Dichloropropene	"	"	"		100	ND	"	D
cis-1,3-Dichloropropene	"	"	"		100	ND	"	D
trans-1,3-Dichloropropene	"	"	"		100	ND	"	D
Ethylbenzene	"	"	"		100	ND	"	D
Hexachlorobutadiene	"	"	"		100	ND	"	D
2-Hexanone	"	"	"		500	ND	"	D

Star Analytical, Inc.

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L Hall

Lari Hall, Project Manager

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-05 (continued)			**8060345-04**				**Water**	
Isopropylbenzene	06V8484	6/29/98	6/29/98		100	ND	ug/l	D
p-Isopropyltoluene	"	"	"		100	ND	"	D
Methylene chloride	"	"	"		500	ND	"	D
Methyl tert-butyl ether	"	"	"		100	ND	"	D
4-Methyl-2-pentanone	"	"	"		500	ND	"	D
Naphthalene	"	"	"		100	ND	"	D
n-Propylbenzene	"	"	"		100	ND	"	D
Styrene	"	"	"		100	ND	"	D
1,1,1,2-Tetrachloroethane	"	"	"		100	ND	"	D
1,1,2,2-Tetrachloroethane	"	"	"		100	ND	"	D
Tetrachloroethene	"	"	"		100	ND	"	D
Toluene	"	"	"		100	ND	"	D
1,2,3-Trichlorobenzene	"	"	"		100	ND	"	D
1,2,4-Trichlorobenzene	"	"	"		100	ND	"	D
1,1,1-Trichloroethane	"	"	"		100	ND	"	D
1,1,2-Trichloroethane	"	"	"		100	ND	"	D
Trichloroethene	"	"	"		100	ND	"	D
Trichlorofluoromethane	"	"	"		100	ND	"	D
1,2,3-Trichloropropane	"	"	"		100	ND	"	D
1,2,4-Trimethylbenzene	"	"	"		100	ND	"	D
1,3,5-Trimethylbenzene	"	"	"		100	ND	"	D
Vinyl acetate	"	"	"		100	ND	"	D
Vinyl chloride	"	"	"		100	ND	"	D
m,p-Xylene	"	"	"		100	ND	"	D
o-Xylene	"	"	"		100	ND	"	D
Surrogate: DBFM	"	"	"	*86.0-118*		*98.0*	*%*	
Surrogate: Toluene-d8	"	"	"	*88.0-110*		*99.0*	"	
Surrogate: 4-BFB	"	"	"	*86.0-115*		*98.0*	"	

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American Enviro. Network	Project:	NMOCD		Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378		Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil		Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
Trip Blank			**8060345-05**				**Water**	
Acetone	06V8484	6/29/98	6/29/98		10.0	ND	ug/l	
Benzene	"	"	"		2.00	ND	"	
Bromobenzene	"	"	"		2.00	ND	"	
Bromochloromethane	"	"	"		2.00	ND	"	
Bromodichloromethane	"	"	"		2.00	ND	"	
Bromoform	"	"	"		2.00	ND	"	
Bromomethane	"	"	"		2.00	ND	"	
2-Butanone	"	"	"		10.0	ND	"	
n-Butylbenzene	"	"	"		2.00	ND	"	
sec-Butylbenzene	"	"	"		2.00	ND	"	
tert-Butylbenzene	"	"	"		2.00	ND	"	
Carbon disulfide	"	"	"		2.00	ND	"	
Carbon tetrachloride	"	"	"		2.00	ND	"	
Chlorobenzene	"	"	"		2.00	ND	"	
Chloroethane	"	"	"		2.00	ND	"	
Chloroform	"	"	"		2.00	ND	"	
Chloromethane	"	"	"		2.00	ND	"	
2-Chlorotoluene	"	"	"		2.00	ND	"	
4-Chlorotoluene	"	"	"		2.00	ND	"	
Dibromochloromethane	"	"	"		2.00	ND	"	
1,2-Dibromo-3-chloropropane	"	"	"		2.00	ND	"	
1,2-Dibromoethane	"	"	"		2.00	ND	"	
Dibromomethane	"	"	"		2.00	ND	"	
1,2-Dichlorobenzene	"	"	"		2.00	ND	"	
1,3-Dichlorobenzene	"	"	"		2.00	ND	"	
1,4-Dichlorobenzene	"	"	"		2.00	ND	"	
Dichlorodifluoromethane	"	"	"		2.00	ND	"	
1,1-Dichloroethane	"	"	"		2.00	ND	"	
1,2-Dichloroethane	"	"	"		2.00	ND	"	
1,1-Dichloroethene	"	"	"		2.00	ND	"	
cis-1,2-Dichloroethene	"	"	"		2.00	ND	"	
trans-1,2-Dichloroethene	"	"	"		2.00	ND	"	
1,2-Dichloropropane	"	"	"		2.00	ND	"	
1,3-Dichloropropane	"	"	"		2.00	ND	"	
2,2-Dichloropropane	"	"	"		2.00	ND	"	
1,1-Dichloropropene	"	"	"		2.00	ND	"	
cis-1,3-Dichloropropene	"	"	"		2.00	ND	"	
trans-1,3-Dichloropropene	"	"	"		2.00	ND	"	
Ethylbenzene	"	"	"		2.00	ND	"	
Hexachlorobutadiene	"	"	"		2.00	ND	"	
2-Hexanone	"	"	"		10.0	ND	"	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
Trip Blank (continued)			**8060345-05**				**Water**	
Isopropylbenzene	06V8484	6/29/98	6/29/98		2.00	ND	ug/l	
p-Isopropyltoluene	"	"	"		2.00	ND	"	
Methylene chloride	"	"	"		10.0	ND	"	
Methyl tert-butyl ether	"	"	"		2.00	ND	"	
4-Methyl-2-pentanone	"	"	"		10.0	ND	"	
Naphthalene	"	"	"		2.00	ND	"	
n-Propylbenzene	"	"	"		2.00	ND	"	
Styrene	"	"	"		2.00	ND	"	
1,1,1,2-Tetrachloroethane	"	"	"		2.00	ND	"	
1,1,2,2-Tetrachloroethane	"	"	"		2.00	ND	"	
Tetrachloroethene	"	"	"		2.00	ND	"	
Toluene	"	"	"		2.00	ND	"	
1,2,3-Trichlorobenzene	"	"	"		2.00	ND	"	
1,2,4-Trichlorobenzene	"	"	"		2.00	ND	"	
1,1,1-Trichloroethane	"	"	"		2.00	ND	"	
1,1,2-Trichloroethane	"	"	"		2.00	ND	"	
Trichloroethene	"	"	"		2.00	ND	"	
Trichlorofluoromethane	"	"	"		2.00	ND	"	
1,2,3-Trichloropropane	"	"	"		2.00	ND	"	
1,2,4-Trimethylbenzene	"	"	"		2.00	ND	"	
1,3,5-Trimethylbenzene	"	"	"		2.00	ND	"	
Vinyl acetate	"	"	"		2.00	ND	"	
Vinyl chloride	"	"	"		2.00	ND	"	
m,p-Xylene	"	"	"		2.00	ND	"	
o-Xylene	"	"	"		2.00	ND	"	
Surrogate: DBFM	"	"	"	*86.0-118*		*101*	*%*	
Surrogate: Toluene-d8	"	"	"	*88.0-110*		*96.8*	"	
Surrogate: 4-BFB	"	"	"	*86.0-115*		*96.0*	"	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-01			**8060345-00**				**Water**	
Acenaphthene	07V8172	6/30/98	7/16/98		20	ND	ug/l	D
Acenaphthylene	"	"	"		20	ND	"	D
Aniline	"	"	"		20	ND	"	D
Anthracene	"	"	"		20	ND	"	D
Benzoic Acid	"	"	"		100	ND	"	D
Benzo (a) anthracene	"	"	"		20	ND	"	D
Benzo (b) fluoranthene	"	"	"		20	ND	"	D
Benzo (k) fluoranthene	"	"	"		20	ND	"	D
Benzo (ghi) perylene	"	"	"		20	ND	"	D
Benzo (a) pyrene	"	"	"		20	ND	"	D
Benzyl alcohol	"	"	"		20	ND	"	D
Bis(2-chloroethoxy)methane	"	"	"		20	ND	"	D
Bis(2-chloroethyl)ether	"	"	"		20	ND	"	D
Bis(2-chloroisopropyl)ether	"	"	"		20	ND	"	D
Bis(2-ethylhexyl)phthalate	"	"	"		20	ND	"	D
4-Bromophenyl phenyl ether	"	"	"		20	ND	"	D
Butyl benzyl phthalate	"	"	"		20	ND	"	D
Carbazole	"	"	"		20	ND	"	D
4-Chloroaniline	"	"	"		20	ND	"	D
2-Chloronaphthalene	"	"	"		20	ND	"	D
4-Chloro-3-methylphenol	"	"	"		20	ND	"	D
2-Chlorophenol	"	"	"		20	ND	"	D
4-Chlorophenyl phenyl ether	"	"	"		20	ND	"	D
Chrysene	"	"	"		20	ND	"	D
Dibenz (a,h) anthracene	"	"	"		20	ND	"	D
Dibenzofuran	"	"	"		20	ND	"	D
Di-n-butyl phthalate	"	"	"		100	ND	"	D
1,3-Dichlorobenzene	"	"	"		20	ND	"	D
1,4-Dichlorobenzene	"	"	"		20	ND	"	D
1,2-Dichlorobenzene	"	"	"		20	ND	"	D
3,3'-Dichlorobenzidine	"	"	"		100	ND	"	D
2,4-Dichlorophenol	"	"	"		20	ND	"	D
Diethyl phthalate	"	"	"		20	ND	"	D
2,4-Dimethylphenol	"	"	"		20	ND	"	D
Dimethyl phthalate	"	"	"		20	ND	"	D
4,6-Dinitro-2-methylphenol	"	"	"		100	ND	"	D
2,4-Dinitrophenol	"	"	"		100	ND	"	D
2,4-Dinitrotoluene	"	"	"		20	ND	"	D
2,6-Dinitrotoluene	"	"	"		20	ND	"	D
Di-n-octyl phthalate	"	"	"		20	ND	"	D
Fluoranthene	"	"	"		20	ND	"	D

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-01 (continued)			**8060345-00**				**Water**	
Fluorene	07V8172	6/30/98	7/16/98		20	ND	ug/l	D
Hexachlorobenzene	"	"	"		20	ND	"	D
Hexachlorobutadiene	"	"	"		20	ND	"	D
Hexachlorocyclopentadiene	"	"	"		20	ND	"	D
Hexachloroethane	"	"	"		20	ND	"	D
Indeno (1,2,3-cd) pyrene	"	"	"		20	ND	"	D
Isophorone	"	"	"		20	ND	"	D
2-Methylnaphthalene	"	"	"		20	ND	"	D
2-Methylphenol	"	"	"		20	ND	"	D
3 & 4-Methylphenol	"	"	"		20	ND	"	D
Naphthalene	"	"	"		20	ND	"	D
2-Nitroaniline	"	"	"		100	ND	"	D
3-Nitroaniline	"	"	"		100	ND	"	D
4-Nitroaniline	"	"	"		100	ND	"	D
Nitrobenzene	"	"	"		20	ND	"	D
2-Nitrophenol	"	"	"		20	ND	"	D
4-Nitrophenol	"	"	"		100	ND	"	D
N-Nitrosodiphenylamine	"	"	"		20	ND	"	D
N-Nitrosodi-n-propylamine	"	"	"		20	ND	"	D
Pentachlorophenol	"	"	"		100	ND	"	D
Phenanthrene	"	"	"		20	ND	"	D
Phenol	"	"	"		20	ND	"	D
Pyrene	"	"	"		20	ND	"	D
1 2,4-Trichlorobenzene	"	"	"		20	ND	"	D
2 4,5-Trichlorophenol	"	"	"		100	ND	"	D
2 4,6-Trichlorophenol	"	"	"		20	ND	"	D
Surrogate: 2-FP	"	"	"	*43-120*		*31*	*%*	*1,D*
Surrogate: Phenol-d6	"	"	"	*10-94*		*60*	"	*D*
Surrogate: 2,4,6-TBP	"	"	"	*10-120*		*47*	"	*D*
Surrogate: Nitrobenzene-d5	"	"	"	*35-110*		*99*	"	*D*
Surrogate: 2-FBP	"	"	"	*43-120*		*51*	"	*D*
Surrogate: p-Terphenyl-d14	"	"	"	*33-140*		*59*	"	*D*

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-02			**8060345-01**				**Water**	
Acenaphthene	07V8172	6/30/98	7/16/98		20	ND	ug/l	D
Acenaphthylene	"	"	"		20	ND	"	D
Aniline	"	"	"		20	ND	"	D
Anthracene	"	"	"		20	ND	"	D
Benzoic Acid	"	"	"		100	ND	"	D
Benzo (a) anthracene	"	"	"		20	ND	"	D
Benzo (b) fluoranthene	"	"	"		20	ND	"	D
Benzo (k) fluoranthene	"	"	"		20	ND	"	D
Benzo (ghi) perylene	"	"	"		20	ND	"	D
Benzo (a) pyrene	"	"	"		20	ND	"	D
Benzyl alcohol	"	"	"		20	ND	"	D
Bis(2-chloroethoxy)methane	"	"	"		20	ND	"	D
Bis(2-chloroethyl)ether	"	"	"		20	ND	"	D
Bis(2-chloroisopropyl)ether	"	"	"		20	ND	"	D
Bis(2-ethylhexyl)phthalate	"	"	"		20	ND	"	D
4-Bromophenyl phenyl ether	"	"	"		20	ND	"	D
Butyl benzyl phthalate	"	"	"		20	ND	"	D
Carbazole	"	"	"		20	ND	"	D
4-Chloroaniline	"	"	"		20	ND	"	D
2-Chloronaphthalene	"	"	"		20	ND	"	D
4-Chloro-3-methylphenol	"	"	"		20	ND	"	D
2-Chlorophenol	"	"	"		20	ND	"	D
4-Chlorophenyl phenyl ether	"	"	"		20	ND	"	D
Chrysene	"	"	"		20	ND	"	D
Dibenz (a,h) anthracene	"	"	"		20	ND	"	D
Dibenzofuran	"	"	"		20	ND	"	D
Di-n-butyl phthalate	"	"	"		100	ND	"	D
1,3-Dichlorobenzene	"	"	"		20	ND	"	D
1,4-Dichlorobenzene	"	"	"		20	ND	"	D
1,2-Dichlorobenzene	"	"	"		20	ND	"	D
3,3'-Dichlorobenzidine	"	"	"		100	ND	"	D
2,4-Dichlorophenol	"	"	"		20	ND	"	D
Diethyl phthalate	"	"	"		20	ND	"	D
2,4-Dimethylphenol	"	"	"		20	ND	"	D
Dimethyl phthalate	"	"	"		20	ND	"	D
4,6-Dinitro-2-methylphenol	"	"	"		100	ND	"	D
2,4-Dinitrophenol	"	"	"		100	ND	"	D
2,4-Dinitrotoluene	"	"	"		20	ND	"	D
2,6-Dinitrotoluene	"	"	"		20	ND	"	D
Di-n-octyl phthalate	"	"	"		20	ND	"	D
Fluoranthene	"	"	"		20	ND	"	D

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-02 (continued)			**8060345-01**				**Water**	
Fluorene	07V8172	6/30/98	7/16/98		20	ND	ug/l	D
Hexachlorobenzene	"	"	"		20	ND	"	D
Hexachlorobutadiene	"	"	"		20	ND	"	D
Hexachlorocyclopentadiene	"	"	"		20	ND	"	D
Hexachloroethane	"	"	"		20	ND	"	D
Indeno (1,2,3-cd) pyrene	"	"	"		20	ND	"	D
Isophorone	"	"	"		20	ND	"	D
2-Methylnaphthalene	"	"	"		20	ND	"	D
2-Methylphenol	"	"	"		20	ND	"	D
3 & 4-Methylphenol	"	"	"		20	ND	"	D
Naphthalene	"	"	"		20	ND	"	D
2-Nitroaniline	"	"	"		100	ND	"	D
3-Nitroaniline	"	"	"		100	ND	"	D
4-Nitroaniline	"	"	"		100	ND	"	D
Nitrobenzene	"	"	"		20	ND	"	D
2-Nitrophenol	"	"	"		20	ND	"	D
4-Nitrophenol	"	"	"		100	ND	"	D
N-Nitrosodiphenylamine	"	"	"		20	ND	"	D
N-Nitrosodi-n-propylamine	"	"	"		20	ND	"	D
Pentachlorophenol	"	"	"		100	ND	"	D
Phenanthrene	"	"	"		20	ND	"	D
Phenol	"	"	"		20	ND	"	D
Pyrene	"	"	"		20	ND	"	D
1,2,4-Trichlorobenzene	"	"	"		20	ND	"	D
2,4,5-Trichlorophenol	"	"	"		100	ND	"	D
2,4,6-Trichlorophenol	"	"	"		20	ND	"	D
Surrogate: 2-FP	"	"	"	*43-120*		*38*	*%*	*1,D*
Surrogate: Phenol-d6	"	"	"	*10-94*		*35*	"	*D*
Surrogate: 2,4,6-TBP	"	"	"	*10-120*		*60*	"	*D*
Surrogate: Nitrobenzene-d5	"	"	"	*35-110*		*55*	"	*D*
Surrogate: 2-FBP	"	"	"	*43-120*		*75*	"	*D*
Surrogate: p-Terphenyl-d14	"	"	"	*33-140*		*74*	"	*D*

Star Analytical, Inc.

**Refer to end of report for text of notes and definitions.*

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-03			**8060345-02**				**Water**	
Acenaphthene	07V8172	6/30/98	7/16/98		2.0	ND	ug/l	
Acenaphthylene	"	"	"		2.0	ND	"	
Aniline	"	"	"		2.0	ND	"	
Anthracene	"	"	"		2.0	ND	"	
Benzoic Acid	"	"	"		10	ND	"	
Benzo (a) anthracene	"	"	"		2.0	ND	"	
Benzo (b) fluoranthene	"	"	"		2.0	ND	"	
Benzo (k) fluoranthene	"	"	"		2.0	ND	"	
Benzo (ghi) perylene	"	"	"		2.0	ND	"	
Benzo (a) pyrene	"	"	"		2.0	ND	"	
Benzyl alcohol	"	"	"		2.0	ND	"	
Bis(2-chloroethoxy)methane	"	"	"		2.0	ND	"	
Bis(2-chloroethyl)ether	"	"	"		2.0	ND	"	
Bis(2-chloroisopropyl)ether	"	"	"		2.0	ND	"	
Bis(2-ethylhexyl)phthalate	"	"	"		2.0	ND	"	
4-Bromophenyl phenyl ether	"	"	"		2.0	ND	"	
Butyl benzyl phthalate	"	"	"		2.0	ND	"	
Carbazole	"	"	"		2.0	ND	"	
4-Chloroaniline	"	"	"		2.0	ND	"	
2-Chloronaphthalene	"	"	"		2.0	ND	"	
4-Chloro-3-methylphenol	"	"	"		2.0	ND	"	
2-Chlorophenol	"	"	"		2.0	ND	"	
4-Chlorophenyl phenyl ether	"	"	"		2.0	ND	"	
Chrysene	"	"	"		2.0	ND	"	
Dibenz (a,h) anthracene	"	"	"		2.0	ND	"	
Dibenzofuran	"	"	"		2.0	ND	"	
Di-n-butyl phthalate	"	"	"		10	ND	"	
1,3-Dichlorobenzene	"	"	"		2.0	ND	"	
1,4-Dichlorobenzene	"	"	"		2.0	ND	"	
1,2-Dichlorobenzene	"	"	"		2.0	ND	"	
3,3'-Dichlorobenzidine	"	"	"		10	ND	"	
2,4-Dichlorophenol	"	"	"		2.0	ND	"	
Diethyl phthalate	"	"	"		2.0	ND	"	
2,4-Dimethylphenol	"	"	"		2.0	ND	"	
Dimethyl phthalate	"	"	"		2.0	ND	"	
4,6-Dinitro-2-methylphenol	"	"	"		10	ND	"	
2,4-Dinitrophenol	"	"	"		10	ND	"	
2,4-Dinitrotoluene	"	"	"		2.0	ND	"	
2,6-Dinitrotoluene	"	"	"		2.0	ND	"	
Di-n-octyl phthalate	"	"	"		2.0	ND	"	
Fluoranthene	"	"	"		2.0	ND	"	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-03 (continued)			**8060345-02**				**Water**	
Fluorene	07V8172	6/30/98	7/16/98		2.0	ND	ug/l	
Hexachlorobenzene	"	"	"		2.0	ND	"	
Hexachlorobutadiene	"	"	"		2.0	ND	"	
Hexachlorocyclopentadiene	"	"	"		2.0	ND	"	
Hexachloroethane	"	"	"		2.0	ND	"	
Indeno (1,2,3-cd) pyrene	"	"	"		2.0	ND	"	
Isophorone	"	"	"		2.0	ND	"	
2-Methylnaphthalene	"	"	"		2.0	ND	"	
2-Methylphenol	"	"	"		2.0	ND	"	
3 & 4-Methylphenol	"	"	"		2.0	ND	"	
Naphthalene	"	"	"		2.0	ND	"	
2-Nitroaniline	"	"	"		10	ND	"	
3-Nitroaniline	"	"	"		10	ND	"	
4-Nitroaniline	"	"	"		10	ND	"	
Nitrobenzene	"	"	"		2.0	ND	"	
2-Nitrophenol	"	"	"		2.0	ND	"	
4-Nitrophenol	"	"	"		10	ND	"	
N-Nitrosodiphenylamine	"	"	"		2.0	ND	"	
N-Nitrosodi-n-propylamine	"	"	"		2.0	ND	"	
Pentachlorophenol	"	"	"		10	ND	"	
Phenanthrene	"	"	"		2.0	ND	"	
Phenol	"	"	"		2.0	ND	"	
Pyrene	"	"	"		2.0	ND	"	
1,2,4-Trichlorobenzene	"	"	"		2.0	ND	"	
2,4,5-Trichlorophenol	"	"	"		10	ND	"	
2,4,6-Trichlorophenol	"	"	"		2.0	ND	"	
Surrogate: 2-FP	"	"	"	*43-120*		*39*	*%*	*1*
Surrogate: Phenol-d6	"	"	"	*10-94*		*29*	"	
Surrogate: 2,4,6-TBP	"	"	"	*10-120*		*46*	"	
Surrogate: Nitrobenzene-d5	"	"	"	*35-110*		*46*	"	
Surrogate: 2-FBP	"	"	"	*43-120*		*42*	"	*1*
Surrogate: p-Terphenyl-d14	"	"	"	*33-140*		*53*	"	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-04			**8060345-03**				**Water**	
Acenaphthene	07V8172	6/30/98	7/16/98		20	ND	ug/l	D
Acenaphthylene	"	"	"		20	ND	"	D
Aniline	"	"	"		20	ND	"	D
Anthracene	"	"	"		20	ND	"	D
Benzoic Acid	"	"	"		100	ND	"	D
Benzo (a) anthracene	"	"	"		20	ND	"	D
Benzo (b) fluoranthene	"	"	"		20	ND	"	D
Benzo (k) fluoranthene	"	"	"		20	ND	"	D
Benzo (ghi) perylene	"	"	"		20	ND	"	D
Benzo (a) pyrene	"	"	"		20	ND	"	D
Benzyl alcohol	"	"	"		20	ND	"	D
Bis(2-chloroethoxy)methane	"	"	"		20	ND	"	D
Bis(2-chloroethyl)ether	"	"	"		20	ND	"	D
Bis(2-chloroisopropyl)ether	"	"	"		20	ND	"	D
Bis(2-ethylhexyl)phthalate	"	"	"		20	ND	"	D
4-Bromophenyl phenyl ether	"	"	"		20	ND	"	D
Butyl benzyl phthalate	"	"	"		20	ND	"	D
Carbazole	"	"	"		20	ND	"	D
4-Chloroaniline	"	"	"		20	ND	"	D
2-Chloronaphthalene	"	"	"		20	ND	"	D
4-Chloro-3-methylphenol	"	"	"		20	ND	"	D
2-Chlorophenol	"	"	"		20	ND	"	D
4-Chlorophenyl phenyl ether	"	"	"		20	ND	"	D
Chrysene	"	"	"		20	ND	"	D
Dibenz (a,h) anthracene	"	"	"		20	ND	"	D
Dibenzofuran	"	"	"		20	ND	"	D
Di-n-butyl phthalate	"	"	"		100	ND	"	D
1,3-Dichlorobenzene	"	"	"		20	ND	"	D
1,4-Dichlorobenzene	"	"	"		20	ND	"	D
1,2-Dichlorobenzene	"	"	"		20	ND	"	D
3,3'-Dichlorobenzidine	"	"	"		100	ND	"	D
2,4-Dichlorophenol	"	"	"		20	ND	"	D
Diethyl phthalate	"	"	"		20	ND	"	D
2,4-Dimethylphenol	"	"	"		20	ND	"	D
Dimethyl phthalate	"	"	"		20	ND	"	D
4,6-Dinitro-2-methylphenol	"	"	"		100	ND	"	D
2,4-Dinitrophenol	"	"	"		100	ND	"	D
2,4-Dinitrotoluene	"	"	"		20	ND	"	D
2,6-Dinitrotoluene	"	"	"		20	ND	"	D
Di-n-octyl phthalate	"	"	"		20	ND	"	D
Fluoranthene	"	"	"		20	ND	"	D

Star Analytical, Inc.

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-04 (continued)			**8060345-03**				**Water**	
Fluorene	07V8172	6/30/98	7/16/98		20	ND	ug/l	D
Hexachlorobenzene	"	"	"		20	ND	"	D
Hexachlorobutadiene	"	"	"		20	ND	"	D
Hexachlorocyclopentadiene	"	"	"		20	ND	"	D
Hexachloroethane	"	"	"		20	ND	"	D
Indeno (1,2,3-cd) pyrene	"	"	"		20	ND	"	D
Isophorone	"	"	"		20	ND	"	D
2-Methylnaphthalene	"	"	"		20	ND	"	D
2-Methylphenol	"	"	"		20	ND	"	D
3 & 4-Methylphenol	"	"	"		20	ND	"	D
Naphthalene	"	"	"		20	ND	"	D
2-Nitroaniline	"	"	"		100	ND	"	D
3-Nitroaniline	"	"	"		100	ND	"	D
4-Nitroaniline	"	"	"		100	ND	"	D
Nitrobenzene	"	"	"		20	ND	"	D
2-Nitrophenol	"	"	"		20	ND	"	D
4-Nitrophenol	"	"	"		100	ND	"	D
N-Nitrosodiphenylamine	"	"	"		20	ND	"	D
N-Nitrosodi-n-propylamine	"	"	"		20	ND	"	D
Pentachlorophenol	"	"	"		100	ND	"	D
Phenanthrene	"	"	"		20	ND	"	D
Phenol	"	"	"		20	ND	"	D
Pyrene	"	"	"		20	ND	"	D
1,2,4-Trichlorobenzene	"	"	"		20	ND	"	D
2,4,5-Trichlorophenol	"	"	"		100	ND	"	D
2,4,6-Trichlorophenol	"	"	"		20	ND	"	D
Surrogate: 2-FP	"	"	"	*43-120*		*18*	*%*	*1,D*
Surrogate: Phenol-d6	"	"	"	*10-94*		*50*	"	*D*
Surrogate: 2,4,6-TBP	"	"	"	*10-120*		*50*	"	*D*
Surrogate: Nitrobenzene-d5	"	"	"	*35-110*		*92*	"	*D*
Surrogate: 2-FBP	"	"	"	*43-120*		*45*	"	*D*
Surrogate: p-Terphenyl-d14	"	"	"	*33-140*		*60*	"	*D*

Star Analytical, Inc.

**Refer to end of report for text of notes and definitions.*

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-05			**8060345-04**				**Water**	
Acenaphthene	07V8172	6/30/98	7/16/98		20	ND	ug/l	D
Acenaphthylene	"	"	"		20	ND	"	D
Aniline	"	"	"		20	ND	"	D
Anthracene	"	"	"		20	ND	"	D
Benzoic Acid	"	"	"		100	ND	"	D
Benzo (a) anthracene	"	"	"		20	ND	"	D
Benzo (b) fluoranthene	"	"	"		20	ND	"	D
Benzo (k) fluoranthene	"	"	"		20	ND	"	D
Benzo (ghi) perylene	"	"	"		20	ND	"	D
Benzo (a) pyrene	"	"	"		20	ND	"	D
Benzyl alcohol	"	"	"		20	ND	"	D
Bis(2-chloroethoxy)methane	"	"	"		20	ND	"	D
Bis(2-chloroethyl)ether	"	"	"		20	ND	"	D
Bis(2-chloroisopropyl)ether	"	"	"		20	ND	"	D
Bis(2-ethylhexyl)phthalate	"	"	"		20	ND	"	D
4-Bromophenyl phenyl ether	"	"	"		20	ND	"	D
Butyl benzyl phthalate	"	"	"		20	ND	"	D
Carbazole	"	"	"		20	ND	"	D
4-Chloroaniline	"	"	"		20	ND	"	D
2-Chloronaphthalene	"	"	"		20	ND	"	D
4-Chloro-3-methylphenol	"	"	"		20	ND	"	D
2-Chlorophenol	"	"	"		20	ND	"	D
4-Chlorophenyl phenyl ether	"	"	"		20	ND	"	D
Chrysene	"	"	"		20	ND	"	D
Dibenz (a,h) anthracene	"	"	"		20	ND	"	D
Dibenzofuran	"	"	"		20	ND	"	D
Di-n-butyl phthalate	"	"	"		100	ND	"	D
1 3-Dichlorobenzene	"	"	"		20	ND	"	D
1 4-Dichlorobenzene	"	"	"		20	ND	"	D
1 2-Dichlorobenzene	"	"	"		20	ND	"	D
3 3'-Dichlorobenzidine	"	"	"		100	ND	"	D
2 4-Dichlorophenol	"	"	"		20	ND	"	D
Diethyl phthalate	"	"	"		20	ND	"	D
2 4-Dimethylphenol	"	"	"		20	ND	"	D
Dimethyl phthalate	"	"	"		20	ND	"	D
4 6-Dinitro-2-methylphenol	"	"	"		100	ND	"	D
2 4-Dinitrophenol	"	"	"		100	ND	"	D
2 4-Dinitrotoluene	"	"	"		20	ND	"	D
2 6-Dinitrotoluene	"	"	"		20	ND	"	D
Di-n-octyl phthalate	"	"	"		20	ND	"	D
Fluoranthene	"	"	"		20	ND	"	D

Star Analytical, Inc.

**Refer to end of report for text of notes and definitions.*

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2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Surrogate Limits	Reporting Limit	Result	Units	Notes*
806378-05 (continued)			**8060345-04**				**Water**	
Fluorene	07V8172	6/30/98	7/16/98		20	ND	ug/l	D
Hexachlorobenzene	"	"	"		20	ND	"	D
Hexachlorobutadiene	"	"	"		20	ND	"	D
Hexachlorocyclopentadiene	"	"	"		20	ND	"	D
Hexachloroethane	"	"	"		20	ND	"	D
Indeno (1,2,3-cd) pyrene	"	"	"		20	ND	"	D
Isophorone	"	"	"		20	ND	"	D
2-Methylnaphthalene	"	"	"		20	ND	"	D
2-Methylphenol	"	"	"		20	ND	"	D
3 & 4-Methylphenol	"	"	"		20	ND	"	D
Naphthalene	"	"	"		20	ND	"	D
2-Nitroaniline	"	"	"		100	ND	"	D
3-Nitroaniline	"	"	"		100	ND	"	D
4-Nitroaniline	"	"	"		100	ND	"	D
Nitrobenzene	"	"	"		20	ND	"	D
2-Nitrophenol	"	"	"		20	ND	"	D
4-Nitrophenol	"	"	"		100	ND	"	D
N-Nitrosodiphenylamine	"	"	"		20	ND	"	D
N-Nitrosodi-n-propylamine	"	"	"		20	ND	"	D
Pentachlorophenol	"	"	"		100	ND	"	D
Phenanthrene	"	"	"		20	ND	"	D
Phenol	"	"	"		20	ND	"	D
Pyrene	"	"	"		20	ND	"	D
1,2,4-Trichlorobenzene	"	"	"		20	ND	"	D
2,4,5-Trichlorophenol	"	"	"		100	ND	"	D
2,4,6-Trichlorophenol	"	"	"		20	ND	"	D
Surrogate: 2-FP	"	"	"	*43-120*		*70*	*%*	*D*
Surrogate: Phenol-d6	"	"	"	*10-94*		*46*	"	*D*
Surrogate: 2,4,6-TBP	"	"	"	*10-120*		*55*	"	*D*
Surrogate: Nitrobenzene-d5	"	"	"	*35-110*		*71*	"	*D*
Surrogate: 2-FBP	"	"	"	*43-120*		*65*	"	*D*
Surrogate: p-Terphenyl-d14	"	"	"	*33-140*		*73*	"	*D*

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**Refer to end of report for text of notes and definitions.*

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Lari Hall, Project Manager

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Tarrant County • (817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Total Metals by EPA 200 Series Methods
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	Reporting Limit	Result	Units	Notes*
806378-01			**8060345-00**				**Water**	
Aluminum	07V8283	7/9/98	7/14/98	EPA 200.7	0.200	**0.985**	mg/l	
Arsenic	06V8477	6/29/98	6/30/98	EPA 200.7	0.200	ND	"	
Barium	"	"	"	EPA 200.7	0.100	**0.221**	"	
Boron	07V8284	6/30/98	7/13/98	EPA 200.7	0.100	**0.513**	"	
Cadmium	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Calcium	07V8304	6/30/98	7/19/98	EPA 200.7	10.0	**153**	"	D
Chromium	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Cobalt	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Copper	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	ND	"	
Iron	07V8226	"	7/15/98	EPA 200.7	0.0500	**0.773**	"	
Lead	06V8477	7/7/98	7/7/98	EPA 200.7	0.00050	**0.0019**	"	
Magnesium	07V8304	6/30/98	7/19/98	EPA 200.7	5.00	**142**	"	D
Manganese	07V8226	6/29/98	7/15/98	EPA 200.7	0.0500	**0.175**	"	
Molybdenum	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Nickel	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	**0.0720**	"	
Potassium	07V8132	6/30/98	7/9/98	EPA 200.7	0.500	ND	"	
Selenium	06V8477	6/29/98	6/30/98	EPA 200.7	0.200	ND	"	
Silicon	07V8305	6/30/98	7/17/98	EPA 200.7	10.0	**20.1**	"	D
Silver	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Sodium	07V8315	7/7/98	7/7/98	EPA 200.7	0.0150	**68.0**	"	
Vanadium	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Zinc	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	**0.113**	"	
Mercury	07V8010	6/30/98	7/1/98	EPA 245.1	0.00020	ND	"	
806378-02			**8060345-01**				**Water**	
Aluminum	07V8283	7/9/98	7/14/98	EPA 200.7	0.200	**0.680**	mg/l	
Arsenic	06V8477	6/29/98	6/30/98	EPA 200.7	0.200	ND	"	
Barium	"	"	"	EPA 200.7	0.100	**0.226**	"	
Boron	07V8284	6/30/98	7/13/98	EPA 200.7	0.100	**0.366**	"	
Cadmium	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Calcium	07V8304	6/30/98	7/19/98	EPA 200.7	10.0	**95.5**	"	D
Chromium	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Cobalt	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Copper	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	ND	"	
Iron	07V8226	"	7/15/98	EPA 200.7	0.0500	**1.02**	"	
Lead	06V8477	7/7/98	7/7/98	EPA 200.7	0.00050	ND	"	
Magnesium	07V8304	6/30/98	7/19/98	EPA 200.7	5.00	**39.3**	"	D
Manganese	07V8226	6/29/98	7/15/98	EPA 200.7	0.0500	**0.252**	"	
Molybdenum	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Nickel	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	**0.0660**	"	
Potassium	07V8132	6/30/98	7/9/98	EPA 200.7	0.500	ND	"	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Total Metals by EPA 200 Series Methods
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	Reporting Limit	Result	Units	Notes*
806378-02 (continued)			**8060345-01**				**Water**	
Selenium	06V8477	6/29/98	6/30/98	EPA 200.7	0.200	ND	mg/l	
Silicon	07V8305	6/30/98	7/17/98	EPA 200.7	10.0	**16.1**	"	D
Silver	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Sodium	07V8315	7/7/98	7/7/98	EPA 200.7	0.0150	**6.00**	"	
Vanadium	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Zinc	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	**0.0620**	"	
Mercury	07V8010	6/30/98	7/1/98	EPA 245.1	0.00020	ND	"	
806378-03			**8060345-02**				**Water**	
Aluminum	07V8283	7/9/98	7/14/98	EPA 200.7	0.200	**0.811**	mg/l	
Arsenic	06V8477	6/29/98	6/30/98	EPA 200.7	0.200	ND	"	
Barium	"	"	"	EPA 200.7	0.100	ND	"	
Boron	07V8284	6/30/98	7/13/98	EPA 200.7	0.100	**0.319**	"	
Cadmium	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Calcium	07V8304	6/30/98	7/19/98	EPA 200.7	10.0	**132**	"	D
Chromium	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Cobalt	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Copper	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	ND	"	
Iron	07V8226	"	7/15/98	EPA 200.7	0.0500	**0.0690**	"	
Lead	06V8477	7/7/98	7/7/98	EPA 200.7	0.00050	ND	"	
Magnesium	07V8304	6/30/98	7/19/98	EPA 200.7	5.00	**54.6**	"	D
Manganese	07V8226	6/29/98	7/15/98	EPA 200.7	0.0500	ND	"	
Molybdenum	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Nickel	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	**0.0880**	"	
Potassium	07V8132	6/30/98	7/9/98	EPA 200.7	0.500	ND	"	
Selenium	06V8477	6/29/98	6/30/98	EPA 200.7	0.200	ND	"	
Silicon	07V8305	6/30/98	7/17/98	EPA 200.7	10.0	**15.4**	"	D
Silver	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Sodium	07V8315	7/7/98	7/7/98	EPA 200.7	0.0150	**9.90**	"	
Vanadium	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Zinc	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	**0.0680**	"	
Mercury	07V8010	6/30/98	7/1/98	EPA 245.1	0.00020	ND	"	
806378-04			**8060345-03**				**Water**	
Aluminum	07V8283	7/9/98	7/14/98	EPA 200.7	0.200	**0.840**	mg/l	
Arsenic	06V8477	6/29/98	6/30/98	EPA 200.7	0.200	ND	"	
Barium	"	"	"	EPA 200.7	0.100	**0.331**	"	
Boron	07V8284	6/30/98	7/13/98	EPA 200.7	0.100	**0.544**	"	
Cadmium	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Calcium	07V8304	6/30/98	7/19/98	EPA 200.7	20.0	**265**	"	D
Chromium	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	**0.571**	"	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Total Metals by EPA 200 Series Methods
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	Reporting Limit	Result	Units	Notes*
806378-04 (continued)			**8060345-03**				**Water**	
Cobalt	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	mg/l	
Copper	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	**0.135**	"	
Iron	07V8226	"	7/15/98	EPA 200.7	0.100	**9.08**	"	D
Lead	06V8477	7/7/98	7/7/98	EPA 200.7	0.00050	**0.032**	"	
Magnesium	07V8304	6/30/98	7/19/98	EPA 200.7	10.0	**426**	"	D
Manganese	07V8226	6/29/98	7/15/98	EPA 200.7	0.0500	**1.58**	"	
Molybdenum	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Nickel	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	**1.73**	"	
Potassium	07V8132	6/30/98	7/9/98	EPA 200.7	0.500	**9.73**	"	
Selenium	06V8477	6/29/98	6/30/98	EPA 200.7	0.200	ND	"	
Silicon	07V8305	6/30/98	7/17/98	EPA 200.7	10.0	**40.4**	"	D
Silver	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Sodium	07V8315	7/7/98	7/10/98	EPA 200.7	5.00	**650**	"	
Vanadium	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Zinc	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	**0.727**	"	
Mercury	07V8010	6/30/98	7/1/98	EPA 245.1	0.00020	ND	"	
806378-05			**8060345-04**				**Water**	
Aluminum	07V8283	7/9/98	7/14/98	EPA 200.7	0.200	**0.789**	mg/l	
Arsenic	06V8477	6/29/98	6/30/98	EPA 200.7	0.200	ND	"	
Barium	"	"	"	EPA 200.7	0.100	**0.582**	"	
Boron	07V8284	6/30/98	7/13/98	EPA 200.7	0.100	**0.603**	"	
Cadmium	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Calcium	07V8304	6/30/98	7/19/98	EPA 200.7	10.0	**150**	"	D
Chromium	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Cobalt	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Copper	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	ND	"	
Iron	07V8226	"	7/15/98	EPA 200.7	0.0500	**1.62**	"	
Lead	06V8477	7/7/98	7/7/98	EPA 200.7	0.00050	**0.0065**	"	
Magnesium	07V8304	6/30/98	7/19/98	EPA 200.7	5.00	**200**	"	D
Manganese	07V8226	6/29/98	7/15/98	EPA 200.7	0.0500	**0.330**	"	
Molybdenum	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Nickel	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	ND	"	
Potassium	07V8132	6/30/98	7/9/98	EPA 200.7	0.500	ND	"	
Selenium	06V8477	6/29/98	6/30/98	EPA 200.7	0.200	ND	"	
Silicon	07V8305	6/30/98	7/17/98	EPA 200.7	10.0	**25.9**	"	D
Silver	06V8477	6/29/98	6/30/98	EPA 200.7	0.0300	ND	"	
Sodium	07V8315	7/7/98	7/10/98	EPA 200.7	0.500	**190**	"	
Vanadium	07V8284	6/30/98	7/13/98	EPA 200.7	0.0500	ND	"	
Zinc	06V8477	6/29/98	6/30/98	EPA 200.7	0.0500	**0.210**	"	
Mercury	07V8010	6/30/98	7/1/98	EPA 245.1	0.00020	ND	"	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Total Metals by EPA 6000/7000 Series Methods
Star Analytical, Inc.

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method	Reporting Limit	Result	Units	Notes*
806378-01			**8060345-00**				**Water**	
Antimony	07V8314	6/30/98	7/20/98	EPA 7041	0.0050	ND	mg/l	
Beryllium	07V8307	"	7/13/98	EPA 7091	0.0010	ND	"	
Selenium	07V8133	"	7/9/98	EPA 7740	0.0050	ND	"	
Thallium	07V8313	"	7/20/98	EPA 7841	0.0050	ND	"	
806378-02			**8060345-01**				**Water**	
Antimony	07V8314	6/30/98	7/20/98	EPA 7041	0.0050	ND	mg/l	
Beryllium	07V8307	"	7/13/98	EPA 7091	0.0010	ND	"	
Selenium	07V8133	"	7/9/98	EPA 7740	0.0050	ND	"	
Thallium	07V8313	"	7/20/98	EPA 7841	0.0050	ND	"	
806378-03			**8060345-02**				**Water**	
Antimony	07V8314	6/30/98	7/20/98	EPA 7041	0.0050	ND	mg/l	
Beryllium	07V8307	"	7/13/98	EPA 7091	0.0010	ND	"	
Selenium	07V8133	"	7/9/98	EPA 7740	0.0050	ND	"	
Thallium	07V8313	"	7/20/98	EPA 7841	0.0050	ND	"	
806378-04			**8060345-03**				**Water**	
Antimony	07V8314	6/30/98	7/20/98	EPA 7041	0.0050	ND	mg/l	
Beryllium	07V8307	"	7/13/98	EPA 7091	0.0010	ND	"	
Selenium	07V8133	"	7/9/98	EPA 7740	0.0050	ND	"	
Thallium	07V8313	"	7/20/98	EPA 7841	0.0050	ND	"	
806378-05			**8060345-04**				**Water**	
Antimony	07V8314	6/30/98	7/20/98	EPA 7041	0.0050	ND	mg/l	
Beryllium	07V8307	"	7/13/98	EPA 7091	0.0010	ND	"	
Selenium	07V8133	"	7/9/98	EPA 7740	0.0050	ND	"	
Thallium	07V8313	"	7/20/98	EPA 7841	0.0050	ND	"	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 06V8484	**Date Prepared: 6/29/98**				**Extraction Method: EPA 5030**					
Blank	**06V8484-BLK1**									
Acetone	6/29/98			ND	ug/l	10.0				
Benzene	"			ND	"	2.00				
Bromobenzene	"			ND	"	2.00				
Bromochloromethane	"			ND	"	2.00				
Bromodichloromethane	"			ND	"	2.00				
Bromoform	"			ND	"	2.00				
Bromomethane	"			ND	"	2.00				
2-Butanone	"			ND	"	10.0				
n-Butylbenzene	"			ND	"	2.00				
sec-Butylbenzene	"			ND	"	2.00				
tert-Butylbenzene	"			ND	"	2.00				
Carbon disulfide	"			ND	"	2.00				
Carbon tetrachloride	"			ND	"	2.00				
Chlorobenzene	"			ND	"	2.00				
Chloroethane	"			ND	"	2.00				
Chloroform	"			ND	"	2.00				
Chloromethane	"			ND	"	2.00				
2-Chlorotoluene	"			ND	"	2.00				
4-Chlorotoluene	"			ND	"	2.00				
Dibromochloromethane	"			ND	"	2.00				
1,2-Dibromo-3-chloropropane	"			ND	"	2.00				
1,2-Dibromoethane	"			ND	"	2.00				
Dibromomethane	"			ND	"	2.00				
1,2-Dichlorobenzene	"			ND	"	2.00				
1,3-Dichlorobenzene	"			ND	"	2.00				
1,4-Dichlorobenzene	"			ND	"	2.00				
Dichlorodifluoromethane	"			ND	"	2.00				
1,1-Dichloroethane	"			ND	"	2.00				
1,2-Dichloroethane	"			ND	"	2.00				
1,1-Dichloroethene	"			ND	"	2.00				
cis-1,2-Dichloroethene	"			ND	"	2.00				
trans-1,2-Dichloroethene	"			ND	"	2.00				
1,2-Dichloropropane	"			ND	"	2.00				
1,3-Dichloropropane	"			ND	"	2.00				
2,2-Dichloropropane	"			ND	"	2.00				
1,1-Dichloropropene	"			ND	"	2.00				
cis-1,3-Dichloropropene	"			ND	"	2.00				
trans-1,3-Dichloropropene	"			ND	"	2.00				
Ethylbenzene	"			ND	"	2.00				
Hexachlorobutadiene	"			ND	"	2.00				

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Blank (continued)	**06V8484-BLK1**									
2-Hexanone	6/29/98			**ND**	ug/l	**10.0**				
Isopropylbenzene	"			**ND**	"	**2.00**				
p-Isopropyltoluene	"			**ND**	"	**2.00**				
Methylene chloride	"			**ND**	"	**10.0**				
Methyl tert-butyl ether	"			**ND**	"	**2.00**				
4-Methyl-2-pentanone	"			**ND**	"	**10.0**				
Naphthalene	"			**ND**	"	**2.00**				
n-Propylbenzene	"			**ND**	"	**2.00**				
Styrene	"			**ND**	"	**2.00**				
1,1,2-Tetrachloroethane	"			**ND**	"	**2.00**				
1,2,2-Tetrachloroethane	"			**ND**	"	**2.00**				
Tetrachloroethene	"			**ND**	"	**2.00**				
Toluene	"			**ND**	"	**2.00**				
1,2,3-Trichlorobenzene	"			**ND**	"	**2.00**				
1,2,4-Trichlorobenzene	"			**ND**	"	**2.00**				
1,1,1-Trichloroethane	"			**ND**	"	**2.00**				
1,1,2-Trichloroethane	"			**ND**	"	**2.00**				
Trichloroethene	"			**ND**	"	**2.00**				
Trichlorofluoromethane	"			**ND**	"	**2.00**				
1,2,3-Trichloropropane	"			**ND**	"	**2.00**				
1,2,4-Trimethylbenzene	"			**ND**	"	**2.00**				
1,3,5-Trimethylbenzene	"			**ND**	"	**2.00**				
Vinyl acetate	"			**ND**	"	**2.00**				
Vinyl chloride	"			**ND**	"	**2.00**				
m,p-Xylene	"			**ND**	"	**2.00**				
o-Xylene	"			**ND**	"	**2.00**				
Surrogate: DBFM	"	*50.0*		*47.0*	"	*86.0-118*	*94.0*			
Surrogate: Toluene-d8	"	*50.0*		*47.0*	"	*88.0-110*	*94.0*			
Surrogate: 4-BFB	"	*50.0*		*51.7*	"	*86.0-115*	*103*			
LCS	**06V8484-BS1**									
Benzene	6/29/98	50.0		49.1	ug/l	76.0-127	98.2			
Chlorobenzene	"	50.0		63.0	"	75.0-130	126			
1,1-Dichloroethene	"	50.0		35.5	"	58.0-145	71.0			
Toluene	"	50.0		57.3	"	76.0-127	115			
Trichloroethene	"	50.0		53.5	"	71.0-140	107			
Surrogate: DBFM	"	*50.0*		*49.9*	"	*86.0-118*	*99.8*			
Surrogate: Toluene-d8	"	*50.0*		*49.9*	"	*88.0-110*	*99.8*			
Surrogate: 4-BFB	"	*50.0*		*50.1*	"	*86.0-115*	*100*			

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Volatile Organic Compounds by EPA Method 8260/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
LCS Dup	**06V8484-BSD1**									
Benzene	6/29/98	50.0		49.3	ug/l	76.0-127	98.6	21.0	0.407	
Chlorobenzene	"	50.0		62.4	"	75.0-130	125	21.0	0.797	
1,1-Dichloroethene	"	50.0		35.3	"	58.0-145	70.6	22.0	0.565	
Toluene	"	50.0		57.6	"	76.0-127	115	21.0	0	
Trichloroethene	"	50.0		54.2	"	71.0-140	108	24.0	0.930	
Surrogate: DBFM	*"*	*50.0*		*46.8*	*"*	*86.0-118*	*93.6*			
Surrogate: Toluene-d8	*"*	*50.0*		*48.8*	*"*	*88.0-110*	*97.6*			
Surrogate: 4-BFB	*"*	*50.0*		*52.0*	*"*	*86.0-115*	*104*			

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 07V8172	**Date Prepared: 6/30/98**				**Extraction Method: EPA 1311/3510**					
Blank	**07V8172-BLK1**									
Acenaphthene	7/16/98			ND	ug/l	2.0				
Acenaphthylene	"			ND	"	2.0				
Aniline	"			ND	"	2.0				
Anthracene	"			ND	"	2.0				
Benzoic Acid	"			ND	"	10				
Benzo (a) anthracene	"			ND	"	2.0				
Benzo (b) fluoranthene	"			ND	"	2.0				
Benzo (k) fluoranthene	"			ND	"	2.0				
Benzo (ghi) perylene	"			ND	"	2.0				
Benzo (a) pyrene	"			ND	"	2.0				
Benzyl alcohol	"			ND	"	2.0				
Bis(2-chloroethoxy)methane	"			ND	"	2.0				
Bis(2-chloroethyl)ether	"			ND	"	2.0				
Bis(2-chloroisopropyl)ether	"			ND	"	2.0				
Bis(2-ethylhexyl)phthalate	"			ND	"	2.0				
4-Bromophenyl phenyl ether	"			ND	"	2.0				
Butyl benzyl phthalate	"			ND	"	2.0				
Carbazole	"			ND	"	2.0				
4-Chloroaniline	"			ND	"	2.0				
2-Chloronaphthalene	"			ND	"	2.0				
4-Chloro-3-methylphenol	"			ND	"	2.0				
2-Chlorophenol	"			ND	"	2.0				
4-Chlorophenyl phenyl ether	"			ND	"	2.0				
Chrysene	"			ND	"	2.0				
Dibenz (a,h) anthracene	"			ND	"	2.0				
Dibenzofuran	"			ND	"	2.0				
Di-n-butyl phthalate	"			ND	"	10				
1,3-Dichlorobenzene	"			ND	"	2.0				
1,4-Dichlorobenzene	"			ND	"	2.0				
1,2-Dichlorobenzene	"			ND	"	2.0				
3,3'-Dichlorobenzidine	"			ND	"	10				
2,4-Dichlorophenol	"			ND	"	2.0				
Diethyl phthalate	"			ND	"	2.0				
2,4-Dimethylphenol	"			ND	"	2.0				
Dimethyl phthalate	"			ND	"	2.0				
4,6-Dinitro-2-methylphenol	"			ND	"	10				
2,4-Dinitrophenol	"			ND	"	10				
2,4-Dinitrotoluene	"			ND	"	2.0				
2,6-Dinitrotoluene	"			ND	"	2.0				
Di-n-octyl phthalate	"			ND	"	2.0				

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Blank (continued)	**07V8172-BLK1**									
Fluoranthene	7/16/98			**ND**	ug/l	**2.0**				
Fluorene	"			**ND**	"	**2.0**				
Hexachlorobenzene	"			**ND**	"	**2.0**				
Hexachlorobutadiene	"			**ND**	"	**2.0**				
Hexachlorocyclopentadiene	"			**ND**	"	**2.0**				
Hexachloroethane	"			**ND**	"	**2.0**				
Indeno (1,2,3-cd) pyrene	"			**ND**	"	**2.0**				
Isophorone	"			**ND**	"	**2.0**				
2-Methylnaphthalene	"			**ND**	"	**2.0**				
2-Methylphenol	"			**ND**	"	**2.0**				
3 & 4-Methylphenol	"			**ND**	"	**2.0**				
Naphthalene	"			**ND**	"	**2.0**				
2-Nitroaniline	"			**ND**	"	**10**				
3-Nitroaniline	"			**ND**	"	**10**				
4-Nitroaniline	"			**ND**	"	**10**				
Nitrobenzene	"			**ND**	"	**2.0**				
2-Nitrophenol	"			**ND**	"	**2.0**				
4-Nitrophenol	"			**ND**	"	**10**				
N-Nitrosodiphenylamine	"			**ND**	"	**2.0**				
N-Nitrosodi-n-propylamine	"			**ND**	"	**2.0**				
Pentachlorophenol	"			**ND**	"	**10**				
Phenanthrene	"			**ND**	"	**2.0**				
Phenol	"			**ND**	"	**2.0**				
Pyrene	"			**ND**	"	**2.0**				
1,2,4-Trichlorobenzene	"			**ND**	"	**2.0**				
2,4,5-Trichlorophenol	"			**ND**	"	**10**				
2,4,6-Trichlorophenol	"			**ND**	"	**2.0**				
Surrogate: 2-FP	"	*200*		*110*	"	*43-120*	*55*			
Surrogate: Phenol-d6	"	*200*		*85*	"	*10-94*	*43*			
Surrogate: 2,4,6-TBP	"	*200*		*70*	"	*10-120*	*35*			
Surrogate: Nitrobenzene-d5	"	*100*		*67*	"	*35-110*	*67*			
Surrogate: 2-FBP	"	*100*		*68*	"	*43-120*	*68*			
Surrogate: p-Terphenyl-d14	"	*100*		*120*	"	*33-140*	*120*			
LCS	**07V8172-BS1**									
Acenaphthene	7/16/98	100		61	ug/l	46-120	61			
4-Chloro-3-methylphenol	"	200		140	"	23-97	70			
2-Chlorophenol	"	200		110	"	27-120	55			
1,4-Dichlorobenzene	"	100		55	"	36-97	55			
2,4-Dinitrotoluene	"	100		48	"	24-96	48			
4-Nitrophenol	"	200		39	"	10-80	20			

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Semivolatile Organic Compounds by EPA Method 8270C/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
LCS (continued)	**07V8172-BS1**									
N-Nitrosodi-n-propylamine	7/16/98	100		65	ug/l	41-120	65			
Pentachlorophenol	"	200		37	"	9.0-100	19			
Phenol	"	200		110	"	12-89	55			
Pyrene	"	100		96	"	26-130	96			
1,2,4-Trichlorobenzene	"	100		69	"	39-98	69			
LCS Dup	**07V8172-BSD1**									
Acenaphthene	7/16/98	100		65	ug/l	46-120	65	31	6.3	
4-Chloro-3-methylphenol	"	200		160	"	23-97	80	42	13	
2-Chlorophenol	"	200		130	"	27-120	65	40	17	
1,4-Dichlorobenzene	"	100		61	"	36-97	61	28	10	
2,4-Dinitrotoluene	"	100		52	"	24-96	52	38	8.0	
4-Nitrophenol	"	200		43	"	10-80	22	50	9.5	
N-Nitrosodi-n-propylamine	"	100		73	"	41-120	73	38	12	
Pentachlorophenol	"	200		43	"	9.0-100	22	50	15	
Phenol	"	200		120	"	12-89	60	42	8.7	
Pyrene	"	100		110	"	26-130	110	31	14	
1,2,4-Trichlorobenzene	"	100		77	"	39-98	77	28	11	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Total Metals by EPA 200 Series Methods/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 06V8477	**Date Prepared: 6/29/98**				**Extraction Method: EPA 3010**					
Blank	**06V8477-BLK1**									
Arsenic	6/30/98			**ND**	mg/l	**0.200**				
Barium	"			**ND**	"	**0.100**				
Cadmium	"			**ND**	"	**0.0300**				
Chromium	"			**ND**	"	**0.0300**				
Copper	"			**ND**	"	**0.0500**				
Nickel	"			**ND**	"	**0.0500**				
Selenium	"			**ND**	"	**0.200**				
Silver	"			**ND**	"	**0.0300**				
Zinc	"			**ND**	"	**0.0500**				
LCS	**06V8477-BS1**									
Arsenic	6/30/98	1.00		0.909	mg/l	80.0-120	90.9			
Barium	"	1.00		0.966	"	80.0-120	96.6			
Cadmium	"	1.00		0.962	"	80.0-120	96.2			
Chromium	"	1.00		0.949	"	80.0-120	94.9			
Copper	"	1.00		0.935	"	80.0-120	93.5			
Nickel	"	1.00		0.972	"	80.0-120	97.2			
Selenium	"	1.00		0.944	"	80.0-120	94.4			
Silver	"	1.00		0.917	"	80.0-120	91.7			
Zinc	"	1.00		0.980	"	80.0-120	98.0			
Matrix Spike	**06V8477-MS1**		**8060344-00**							
Arsenic	6/30/98	1.00	ND	0.838	mg/l	80.0-120	**83.8**			
Barium	"	1.00	ND	0.953	"	80.0-120	**95.3**			
Cadmium	"	1.00	0.0740	0.969	"	80.0-120	**89.5**			
Chromium	"	1.00	0.456	1.29	"	80.0-120	**83.4**			
Copper	"	1.00	ND	1.07	"	80.0-120	**107**			
Nickel	"	1.00	0.189	1.09	"	80.0-120	**90.1**			
Selenium	"	1.00	ND	0.913	"	80.0-120	**91.3**			
Silver	"	1.00	ND	0.895	"	80.0-120	**89.5**			
Zinc	"	1.00	0.0980	1.04	"	80.0-120	**94.2**			
Matrix Spike Dup	**06V8477-MSD1**		**8060344-00**							
Arsenic	6/30/98	1.00	ND	0.716	mg/l	80.0-120	**71.6**	20.0	**15.7**	
Barium	"	1.00	ND	0.981	"	80.0-120	**98.1**	20.0	**2.90**	
Cadmium	"	1.00	0.0740	1.02	"	80.0-120	**94.6**	30.0	**5.54**	
Chromium	"	1.00	0.456	1.25	"	80.0-120	**79.4**	20.0	**4.91**	

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American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Total Metals by EPA 200 Series Methods/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Matrix Spike Dup (continued)	**06V8477-MSD1**		**8060344-00**							
Copper	6/30/98	1.00	ND	1.03	mg/l	80.0-120	**103**	20.0	**3.81**	
Nickel	"	1.00	0.189	1.13	"	80.0-120	**94.1**	20.0	**4.34**	
Selenium	"	1.00	ND	1.16	"	80.0-120	**116**	20.0	**23.8**	
Silver	"	1.00	ND	0.928	"	80.0-120	**92.8**	20.0	**3.62**	
Zinc	"	1.00	0.0980	1.06	"	80.0-120	**96.2**	20.0	**2.10**	
Batch: 07V8010	**Date Prepared: 6/30/98**				**Extraction Method: EPA 7470**					
Blank	**07V8010-BLK1**									
Mercury	7/1/98			**ND**	mg/l	**0.00020**				
LCS	**07V8010-BS1**									
Mercury	7/1/98	0.0050		0.0045	mg/l	70-130	90			
Matrix Spike	**07V8010-MS1**		**8060345-01**							
Mercury	7/1/98	0.0050	ND	0.0028	mg/l	75-130	**56**			
Matrix Spike Dup	**07V8010-MSD1**		**8060345-01**							
Mercury	7/1/98	0.0050	ND	0.0028	mg/l	75-130	**56**	20	**0**	
Batch: 07V8132	**Date Prepared: 6/30/98**				**Extraction Method: EPA 3010**					
Blank	**07V8132-BLK1**									
Potassium	7/9/98			**ND**	mg/l	**0.500**				
LCS	**07V8132-BS1**									
Potassium	7/9/98	10.0		9.77	mg/l	80.0-120	97.7			
Matrix Spike	**07V8132-MS1**		**8060344-00**							
Potassium	7/9/98	10.0	42.2	35.1	mg/l	80.0-120	**NR**			
Matrix Spike Dup	**07V8132-MSD1**		**8060344-00**							
Potassium	7/9/98	10.0	42.2	37.4	mg/l	80.0-120	**NR**	20.0		
Batch: 07V8226	**Date Prepared: 7/9/98**				**Extraction Method: EPA 3010**					
Blank	**07V8226-BLK1**									
Iron	7/15/98			**ND**	mg/l	**0.0500**				
Manganese	"			**ND**	"	**0.0500**				
Blank	**07V8226-BLK2**									
Iron	7/15/98			**ND**	mg/l	**0.0500**				
Manganese	"			**ND**	"	**0.0500**				

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2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Total Metals by EPA 200 Series Methods/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
LCS	**07V8226-BS1**									
Iron	7/15/98	1.00		1.11	mg/l	80.0-120	111			
Manganese	"	1.00		1.00	"	80.0-120	100			
LCS	**07V8226-BS2**									
Iron	7/15/98	1.00		0.924	mg/l	80.0-120	92.4			
Manganese	"	1.00		0.983	"	80.0-120	98.3			
Matrix Spike	**07V8226-MS1**		**8070075-01**							
Iron	7/15/98	1.00		2.18	mg/l	80.0-120				
Manganese	"	1.00		0.989	"	80.0-120				
Matrix Spike	**07V8226-MS2**		**8060344-00**							
Iron	7/15/98	1.00	3.99	4.97	mg/l	80.0-120	**98.0**			
Manganese	"	1.00	ND	0.980	"	80.0-120	**98.0**			
Matrix Spike Dup	**07V8226-MSD1**		**8070075-01**							
Iron	7/15/98	1.00		2.16	mg/l	80.0-120		20.0		
Manganese	"	1.00		0.996	"	80.0-120		20.0		
Matrix Spike Dup	**07V8226-MSD2**		**8060344-00**							
Iron	7/15/98	1.00	3.99	5.01	mg/l	80.0-120	**102**	20.0	**4.00**	
Manganese	"	1.00	ND	1.02	"	80.0-120	**102**	20.0	**4.00**	
Batch: 07V8283	**Date Prepared: 7/9/98**				**Extraction Method: EPA 3010**					
Blank	**07V8283-BLK1**									
Aluminum	7/17/98			**ND**	mg/l	**0.200**				
LCS	**07V8283-BS1**									
Aluminum	7/17/98	1.00		1.09	mg/l	80.0-120	109			
Matrix Spike	**07V8283-MS1**		**8060344-00**							
Aluminum	7/17/98	1.00	0.759	1.28	mg/l	80.0-120	**52.1**			
Matrix Spike Dup	**07V8283-MSD1**		**8060344-00**							
Aluminum	7/17/98	1.00	0.759	1.80	mg/l	80.0-120	**104**	20.0	**66.5**	
Batch: 07V8284	**Date Prepared: 6/30/98**				**Extraction Method: EPA 3010**					
Blank	**07V8284-BLK1**									
Boron	7/13/98			**ND**	mg/l	**0.100**				
Cobalt	"			**ND**	"	**0.0500**				
Molybdenum	"			**ND**	"	**0.0500**				

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Lari Hall, Project Manager

STAR ANALYTICAL
14500 Trinity Boulevard, Suite 106 • Fort Worth, Texas 76155
Tarrant County • (817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431

ACCREDITED

American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Total Metals by EPA 200 Series Methods/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit / Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Blank (continued)	**07V8284-BLK1**									
Vanadium	7/13/98			**ND**	mg/l	**0.0500**				
LCS	**07V8284-BS1**									
Boron	7/13/98	1.00		1.11	mg/l	80.0-120	111			
Cobalt	"	1.00		0.980	"	80.0-120	98.0			
Molybdenum	"	1.00		0.910	"	80.0-120	91.0			
Vanadium	"	1.00		0.978	"	80.0-120	97.8			
Matrix Spike	**07V8284-MS1**		**8060344-00**							
Boron	7/13/98	1.00	1.51	1.97	mg/l	80.0-120	**46.0**			
Cobalt	"	1.00	0.0930	1.05	"	80.0-120	**95.7**			
Molybdenum	"	1.00	ND	1.05	"	80.0-120	**105**			
Vanadium	"	1.00	ND	1.08	"	80.0-120	**108**			
Matrix Spike Dup	**07V8284-MSD1**		**8060344-00**							
Boron	7/13/98	1.00	1.51	3.19	mg/l	80.0-120	**168**	20.0	**114**	
Cobalt	"	1.00	0.0930	1.03	"	80.0-120	**93.7**	20.0	**2.11**	
Molybdenum	"	1.00	ND	1.14	"	80.0-120	**114**	20.0	**8.22**	
Vanadium	"	1.00	ND	1.05	"	80.0-120	**105**	20.0	**2.82**	
Batch: 07V8304	**Date Prepared: 6/30/98**				**Extraction Method: EPA 3010**					
Blank	**07V8304-BLK1**									
Calcium	7/19/98			**ND**	mg/l	**0.200**				
Magnesium	"			**ND**	"	**0.100**				
LCS	**07V8304-BS1**									
Calcium	7/19/98	1.00		0.880	mg/l	80.0-120	88.0			
Magnesium	"	1.00		0.828	"	80.0-120	82.8			
Matrix Spike	**07V8304-MS1**		**8060294-00**							
Calcium	7/19/98	1.00	1.80	2.51	mg/l	80.0-120	**71.0**			
Magnesium	"	1.00	0.775	1.58	"	80.0-120	**80.5**			
Matrix Spike Dup	**07V8304-MSD1**		**8060294-00**							
Calcium	7/19/98	1.00	1.80	2.49	mg/l	80.0-120	**69.0**	20.0	**2.86**	
Magnesium	"	1.00	0.775	1.65	"	80.0-120	**87.5**	20.0	**8.33**	
Batch: 07V8305	**Date Prepared: 6/30/98**				**Extraction Method: EPA 3010**					
Blank	**07V8305-BLK1**									
Silicon	7/17/98			**ND**	mg/l	**0.500**				

**Refer to end of report for text of notes and definitions.*

L Hall

Lari Hall, Project Manager

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Tarrant County • (817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431

ACCREDITED

American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Total Metals by EPA 200 Series Methods/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
LCS	**07V8305-BS1**									
Silicon	7/17/98	0.500		0.525	mg/l	80.0-120	105			
Matrix Spike	**07V8305-MS1**		**8060294-00**							
Silicon	7/17/98	0.500		7.80	mg/l	80.0-120				
Matrix Spike Dup	**07V8305-MSD1**		**8060294-00**							
Silicon	7/17/98	0.500		32.5	mg/l	80.0-120		20.0		

Star Analytical, Inc.

**Refer to end of report for text of notes and definitions.*

L Hall

Lari Hall, Project Manager

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Tarrant County • (817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431

ACCREDITED

American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Total Metals by EPA 6000/7000 Series Methods/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 07V8133	**Date Prepared: 6/30/98**				**Extraction Method: EPA 1311/3020**					
Blank	**07V8133-BLK1**									
Selenium	7/9/98			**ND**	mg/l	**0.0050**				
LCS	**07V8133-BS1**									
Selenium	7/9/98	0.010		0.010	mg/l	80-120	100			
LCS Dup	**07V8133-BSD1**									
Selenium	7/9/98	0.010		0.0098	mg/l	80-120	98	30	2.0	
Matrix Spike	**07V8133-MS1**		**8060294-00**							
Selenium	7/9/98	0.010	ND	0.0088	mg/l	80-120	**88**			
Matrix Spike Dup	**07V8133-MSD1**		**8060294-00**							
Selenium	7/9/98	0.010	ND	0.012	mg/l	80-120	**120**	30	**31**	
Batch: 07V8307	**Date Prepared: 6/30/98**				**Extraction Method: EPA 3010**					
Blank	**07V8307-BLK1**									
Beryllium	7/13/98			**ND**	mg/l	**0.0010**				
LCS	**07V8307-BS1**									
Beryllium	7/13/98	0.010		0.0095	mg/l	80-120	95			
Matrix Spike	**07V8307-MS1**		**8060294-00**							
Beryllium	7/13/98	0.010		0.017	mg/l	80-120				
Matrix Spike Dup	**07V8307-MSD1**		**8060294-00**							
Beryllium	7/13/98	0.010		0.017	mg/l	80-120		30		
Batch: 07V8313	**Date Prepared: 6/30/98**				**Extraction Method: EPA 3010**					
Blank	**07V8313-BLK1**									
Thallium	7/20/98			**ND**	mg/l	**0.0050**				
LCS	**07V8313-BS1**									
Thallium	7/20/98	0.010		0.012	mg/l	80-120	120			
Matrix Spike	**07V8313-MS1**		**8060294-00**							
Thallium	7/20/98	0.010	ND	0.013	mg/l	80-120	**130**			
Matrix Spike Dup	**07V8313-MSD1**		**8060294-00**							
Thallium	7/20/98	0.010	ND	0.013	mg/l	80-120	**130**	30	**0**	

Star Analytical, Inc.

**Refer to end of report for text of notes and definitions.*

L Hall

Lari Hall, Project Manager

STAR ANALYTICAL
14500 Trinity Boulevard, Suite 106 • Fort Worth, Texas 76155
Tarrant County • (817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431

ACCREDITED

American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Total Metals by EPA 6000/7000 Series Methods/Quality Control
Star Analytical, Inc.

Analyte	Date Analyzed	Spike Level	Sample Result	QC Result	Units	Reporting Limit Recov. Limits	Recov. %	RPD Limit	RPD %	Notes*
Batch: 07V8314	**Date Prepared: 6/30/98**				**Extraction Method: EPA 3010**					
Blank	**07V8314-BLK1**									
Antimony	7/20/98			**ND**	mg/l	**0.0050**				
LCS	**07V8314-BS1**									
Antimony	7/20/98	0.010		0.010	mg/l	80-120	100			
Matrix Spike	**07V8314-MS1**		**8060294-00**							
Antimony	7/20/98	0.010	ND	0.0088	mg/l	80-120	**88**			
Matrix Spike Dup	**07V8314-MSD1**		**8060294-00**							
Antimony	7/20/98	0.010	ND	0.011	mg/l	80-120	**110**	30	**22**	

Star Analytical, Inc.

**Refer to end of report for text of notes and definitions.*

L Hall

Lari Hall, Project Manager

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Tarrant County • (817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431

American Enviro. Network	Project:	NMOCD	Sampled:	6/22/98 to 6/24/98
2709-D Pan American Freeway, NE	Project Number:	806378	Received:	6/26/98
Albuquerque, NM 87107	Project Manager:	Kim McNeil	Reported:	7/21/98 07:56

Notes and Definitions

#	Note
D	Data reported from a dilution.
1	Spike recovery outside control limits due to sample matrix interference.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
Recov.	Recovery
RPD	Relative Percent Difference

Star Analytical, Inc.

L Hall

Lari Hall, Project Manager

44/47

AMERICAN ENVIRONMENTAL NETWORK
Albuquerque, New Mexico

Interlab Chain of Custody

DATE: _____ PAGE: ___ OF ___

NETWORK PROJECT MANAGER: KIMBERLY D. McNEILL

COMPANY: AMERICAN ENVIRONMENTAL NETWORK
ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER: Kim McNeill

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Metals - TAL	Metals - PP List	Metals - RCRA	RCRA Metals by TCLP (1311)	8260 -		TOC	Gen Chemistry	Hg & Se by AA		Oil and Grease	BOD	COD	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	Polynuclear Aromatics (610/8310)	8240 (TCLP 1311) ZHE	8270 (TCLP 1311)		Na, Tl, V, Zn	TO-14	Gross Alpha/Beta	metals: Al, Sb, As, Ba, Be,	B, Cd, Ca, Cr, Co, Cu, Fe,	Pb, Mg, Mn, Mo, Ni, K, Se, Si, Ag	NUMBER OF CONTAINERS
806378-01	6/23/98	0900	AQ	806034	5	-00			X				X							X						X			X	X	X	
-02		1300		806034	5	-01			X				X							X						X			X	X	X	
-03		1430		806034	5	-02			X				X							X						X			X	X	X	
-04	6/24/98	0915		806034	5	-03			X				X							X						X			X	X	X	
-05		1130		806034	5	-04			X				X							X						X			X	X	X	
Trip Blank	6/22/98	1147		806034	5	-05			X																							

PROJECT INFORMATION	
PROJECT NUMBER:	806378
PROJECT NAME:	NMOCD
QC LEVEL:	(STD) IV
QC REQUIRED:	MS MSD BLANK
TAT:	(STANDARD) RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
INTACT?	
RECEIVED GOOD COND./COLD	
LAB NUMBER	

DUE DATE: _____
RUSH SURCHARGE: _____
CLIENT DISCOUNT: _____
SPECIAL CERTIFICATION REQUIRED: ☐YES ☐NO

SAMPLES SENT TO:
CONNECTICUT
ILLINOIS
MASSACHUSETTS
PENSACOLA
PORTLAND
PHOENIX
N.CAROLINA

RELINQUISHED BY: 1.
Signature: KDMcNeill Time: 3:45
Printed Name: Kim McNeill Date: 6/25/98
Albuquerque

RECEIVED BY: 1.
Signature: Time:
Printed Name: Date:
Company:

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: (LAB) 2.
Signature: Luis Hall Time: 9:00
Printed Name: Luis Hall Date: 6/26/98
Company: Star Analytical

5/47

American Environmental Network (NM), Inc.

CHAIN OF CUSTODY

DATE: 6/25/98 PAGE: 1 OF 1

AEN(NM) Accession #: 806318

SHADED AREAS ARE FOR LAB USE ONLY

PLEASE FILL THIS FORM IN COMPLETELY.

PROJECT MANAGER: Bill Olson

COMPANY: NM Oil Conservation Division
ADDRESS: 2040 S. Pacheco
Santa Fe, NM 87505
PHONE: (505) 827-7154
FAX: (505) 827-8177

BILL TO: Same
COMPANY:
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	Petroleum Hydrocarbons (418.1) TRPH	(MOD.8015) Diesel/Direct Inject	(M8015) Gas/Purge & Trap	8021 (BTEX)/8015 (Gasoline)	8021 (BTEX) ☐ MTBE ☐ TMB ☐ PCE	8021 (TCL)	8021 (EDX)	8021 (HALO)	8021 (CUST)	504.1 EDB ☐ / DBCP ☐		8260 (TCL) Volatile Organics	8260 (Full) Volatile Organics	8260 (CUST) Volatile Organics	8260 (Landfill) Volatile Organics	Pesticides /PCB (608/8081)	Herbicides (615/8151)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Polynuclear Aromatics (610/8310)	General Chemistry:			Priority Pollutant Metals (13)	Target Analyte List Metals (23)	RCRA Metals (8)	RCRA Metals by TCLP (Method 1311)	Metals: 6010 and Item 24	Hg + Se by AA	NUMBER OF CONTAINERS
9806230900 (MW-85)	6/23/98	0900	water	01													2					2									1	6	5
9806231300 (MW-84)	6/23/98	1300	water	02													2					2									1		5
9806231430 (MW-64)	6/23/98	1430	water	03													2					2									1		5
9806240915 (MW-59)	6/24/98	0915	water	04													2					2									1		5
9806241130 (MW-74)	6/24/98	1130	water	05													2					2									1		5
TB	6/22/98	1147	water	06													1																1

PROJECT INFORMATION

PROJ. NO.: Marathon
PROJ. NAME: Indian Basin
P.O. NO.:
SHIPPED VIA:

SAMPLE RECEIPT

NO. CONTAINERS	26
CUSTODY SEALS	Y N/NA
RECEIVED INTACT	YES
BLUE ICE/ICE	5C

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒

CERTIFICATION REQUIRED: ☐ NM ☐ SDWA ☐ OTHER

METHANOL PRESERVATION ☐

COMMENTS: FIXED FEE ☐

Send to separate lab from Marathon

RELINQUISHED BY: 1.
Signature: Bill Olson Time: 0836
Printed Name: William Olson Date: 6/25/98
Company: NMOCD

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: 1.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY (LAB): 2.
Signature: Francine Lopez Time: 0838
Printed Name: Francine Lopez Date: 6/26/98
American Environmental Network (NM), Inc.

STAR ANALYTICAL
14500 Trinity Boulevard, Suite 106 • Fort Worth, Texas 76155
Tarrant County • (817) 571-6800 • Metro (817) 540-6982 • FAX (817) 267-5431

ACCREDITED

Cooler/Sample Receipt Form

Date Received: 6/26/98
No. of Coolers: 2
Date Logged In: 6/26/98

Client: American Enviro. Network
Contact: Kim McNeill
Project: NMOCD
By (sign): John Hall

Sample Numbers: 8060345-00-05

Shipping Method:	STAR	CLIENT	AIRBORNE	UPS	FEDEX	OTHER: _____
Custody Seals on cooler:			YES	NO	N/A	
Chain of Custody in plastic:			YES	NO	N/A	
Temperature of cooler < 4C			YES	NO	N/A	
If not, actual temperature:			_____			
Ice and packing:			YES	NO	N/A	
Chain of Custody filled out properly:			YES	NO		
Sample containers intact:			YES	NO		
Labels agree with Chain of Custody:			YES	NO		
Correct containers used:			YES	NO		
Preserved properly:			YES	NO	N/A	
Sufficient sample:			YES	NO		
Bubbles absent from VOA's:			YES	NO	N/A	
Client called:			YES	NO		

Details: LH 7/1/98

Comments:

American Environmental Network (NM), Inc.

CHAIN OF CUSTODY

DATE: 6/25/98 PAGE: 1 OF 1

AEN(NM) Accession #: 806378

SHADED AREAS ARE FOR LAB USE ONLY.

PLEASE FILL THIS FORM IN COMPLETELY.

PROJECT MANAGER: Bill Olson

COMPANY: NM Oil Conservation Division

ADDRESS: 2040 S. Pacheco
Santa Fe, NM 87505

PHONE: (505) 827-7154

FAX: (505) 827-8177

BILL TO: Same

COMPANY:

ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	Petroleum Hydrocarbons (418.1) TRPH	(MOD.8015) Diesel/Direct Inject	(M8015) Gas/Purge & Trap	8021 (BTEX)/8015 (Gasoline)	8021 (BTEX) ☐ MTBE ☐ TMB ☐ PCE	8021 (TCL)	8021 (EDX)	8021 (HALO)	8021 (CUST)	504.1 EDB ☐ / DBCP ☐		8260 (TCL) Volatile Organics	8260 (Full) Volatile Organics	8260 (CUST) Volatile Organics	8260 (Landfill) Volatile Organics	Pesticides /PCB (608/8081)	Herbicides (615/8151)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Polynuclear Aromatics (610/8310)	General Chemistry:			Priority Pollutant Metals (13)	Target Analyte List Metals (23)	RCRA Metals (8)	RCRA Metals by TCLP (Method 1311)	Metals: 6010 and Item 24 Hg + Se by AA		NUMBER OF CONTAINERS
9806230900 (MW-85)	6/23/98	0900	water	01													2					2									1	6	5
9806231300 (MW-84)	6/23/98	1300	water	02													2					2									1		5
9806231430 (MW-64)	6/23/98	1430	water	03													2					2									1		5
9806240915 (MW-59)	6/24/98	0915	water	04													2					2									1		5
9806241130 (MW-74)	6/24/98	1130	water	05													2					2									1		5
TB	6/22/98	1147	water	06													1																1

PROJECT INFORMATION	
PROJ. NO.:	Marathon
PROJ. NAME:	Indian Basin
P.O. NO.:	
SHIPPED VIA:	

SAMPLE RECEIPT	
NO. CONTAINERS	26
CUSTODY SEALS	Y / N / NA
RECEIVED INTACT	Yes
BLUE ICE/ICE	5°C

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒

CERTIFICATION REQUIRED: ☐ NM ☐ SDWA ☐ OTHER

METHANOL PRESERVATION ☐

COMMENTS: FIXED FEE ☐

Send to separate lab from Marathon

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.
Signature: Bill Olson Time: 0836	Signature: Time:
Printed Name: William Olson Date: 6/25/98	Printed Name: Date:
Company: NMOCD	Company:

RECEIVED BY: 1.	RECEIVED BY: (LAB) 2.
Signature: Time:	Signature: Francine Turrio Time: 0838
Printed Name: Date:	Printed Name: Francine Turrio Date: 6/25/98
Company:	American Enviromental Network (NM), Inc.

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

October 23, 1998

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

RE: Comprehensive Site Characterization Report
Indian Basin Remediation Project
Marathon Oil Company

Dear Mr. Olson:

The purpose of this letter is to confirm our meeting on September 28, 1998, concerning an extension of the October 30, 1998 deadline for the comprehensive site characterization report for the Indian Basin Remediation Project. The deadline is necessary to collect additional groundwater samples from select monitoring wells during the 3rd quarter monitoring event. Marathon Oil Company will submit the report to your office by December 31, 1998.

If you have any questions or comments, then please call me at (915) 687-8398.

Sincerely,

M. Paul Peacock

M. Paul Peacock
Advanced Environmental & Safety Engineer

MPP\ocdextn2.wpd

File 576-14

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

June 10, 1998

RECEIVED
JUN 15 1998

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

RE: Site Investigation Notification
Indian Basin Remediation Project
Marathon Oil Company

Dear Mr. Olson:

As you requested in your approval letter dated May 20, 1998, Marathon Oil Company (Marathon) is notifying the Oil Conservation Division (OCD) of the New Mexico Energy, Minerals and Natural Resources Department in advance of the comprehensive water quality sampling event for the Indian Basin Remediation Project. The sampling event is scheduled to begin on June 15, 1998 and be completed by July 3, 1998. As we discussed in our telephone conversation on June 9, 1998, Marathon will collect split samples with the OCD from MW-46, MW-59, MW-74, MW-84 and MW-85 on June 23 - 24, 1998. Also, the comprehensive water quality sampling event will replace the 3rd quarter sampling event that was scheduled for July 1998.

If you have any questions or comments, then please call me at (915) 687-8398.

Sincerely,

M. Paul Peacock

M. Paul Peacock
Advanced Environmental & Safety Engineer

MPP\ocdnotf.wpd

cc: Cymantha Liakos of Fluor Daniel GTI
C. M. Schweser
F. D. Searle

File 576-14

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

May 20, 1998

CERTIFIED MAIL
RETURN RECEIPT NO. Z-235-437-270

Mr. Paul Peacock
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702-0552

RE: SITE INVESTIGATION WORK PLAN
MARATHON INDIAN BASIN GAS PLANT

Dear Mr. Peacock:

The New Mexico Oil Conservation Division (OCD) has reviewed Marathon Oil Company's (MOC) April 17, 1998 "SITE INVESTIGATION WORKPLAN, INDIAN BASIN REMEDIATION PROJECT, MARATHON OIL COMPANY". This document contains MOC's plan for installation of additional monitoring wells and comprehensive water quality sampling related to ground water remedial actions at MOC's Indian Basin Gas Plant.

The above referenced work plan is approved with the following conditions:

1. Soil sampling from line #1 borehole will include analysis for concentrations of total petroleum hydrocarbons (TPH) in soil.

2. MOC will notify the OCD at least 1 week in advance of the comprehensive water quality sampling event such that the OCD has the opportunity to witness the events and split samples.

Please be advised that OCD approval does not relieve MOC of liability if the investigations fail to define the extent of contamination related to MOC's activities. In addition, OCD approval does not relieve MOC of responsibility for compliance with any other federal, state or local laws and regulations.

If you have any questions, please contact me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: Tim Gum, OCD Artesia District Supervisor

Z 235 437 270

US Postal Service

Receipt for Certified Mail

No Insurance Coverage Provided.

Do not use for International Mail *(See reverse)*

Sent to	
Street & Number	
Post Office, State, & ZIP Code	
Postage	$
Certified Fee	
Special Delivery Fee	
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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

May 19, 1998

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

RECEIVED
MAY 26 1998
ENVIRONMENTAL BUREAU
OIL CONSERVATION DIVISION

RE: Annual Monitoring Report, January - December 1997
Indian Basin Remediation Project
Marathon Oil Company

Dear Mr. Olson:

I have enclosed the Annual Monitoring Report, January - December 1997, Indian Basin Remediation Project that was prepared by Fluor Daniel GTI, Inc. The report, that was prepared in accordance with your approval letter dated March 12, 1997, summarizes the groundwater monitoring and remediation activities associated with the Indian Basin Remediation Project during the 1997 calendar year.

If you have any questions or comments, then please call me at (915) 687-8398.

Sincerely,

M. Paul Peacock

M. Paul Peacock
Advanced Environmental & Safety Engineer

attachments
MPP\ocdanrpt.wpd

File 552-03

cc: OCD Artesia District Office w/attachments
F. D. Searle w/o attachments
A. B. Schoffmann w/o attachments

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

April 29, 1998

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

RE: Annual Groundwater Remediation Monitoring Report
Indian Basin Remediation Project
Marathon Oil Company

Dear Mr. Olson:

The purpose of this letter is to confirm our telephone conversation on April 28, 1998, concerning an extension of the May 1, 1998 deadline for the annual groundwater remediation monitoring report for the Indian Basin Remediation Project. Marathon Oil Company will submit the annual report to your office by May 22, 1998.

If you have any questions or comments, then please call me at (915) 687-8398.

Sincerely,

M. Paul Peacock

M. Paul Peacock
Advanced Environmental & Safety Engineer

MPP\ocdextn1.wpd

File 552-03

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

April 29, 1998

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

RE: Annual Groundwater Remediation Monitoring Report
Indian Basin Remediation Project
Marathon Oil Company

Dear Mr. Olson:

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If you have any questions or comments, then please call me at (915) 687-8398.

Sincerely,

M. Paul Peacock

M. Paul Peacock
Advanced Environmental & Safety Engineer

MPP\ocdextn1.wpd

File 552-03

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

April 17, 1998

RECEIVED
APR 20 1998
OIL CONSERVATION DIVISION

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

RE: Site Investigation Workplan
Indian Basin Remediation Project
Marathon Oil Company

Dear Mr. Olson:

Marathon Oil Company (Marathon) is requesting approval of this workplan to conduct additional site investigation activities for the Indian Basin Remediation Project. The additional site investigation activities were requested in your letter dated December 11, 1997. Three workplan tasks are proposed: 1) install one Shallow zone monitoring well on the gas plant property southeast of the Line #1 spill; 2) install one Lower Queen aquifer monitoring well on the gas plant property east of the loading dock; and 3) conduct a one time comprehensive groundwater sampling event. The proposed locations of the Lower Queen aquifer and Shallow zone monitoring wells are shown on Figure 1. The proposed well completion diagrams for each well are included in Appendix A. The site investigation activities are described in detail below.

Shallow Zone Investigation of the Line #1 Spill

1) Drill one soil boring to delineate the vertical extent of soil contamination resulting from the pipeline #1 spill that occurred on July 10, 1994. If the vertical extent of contamination is defined, then the soil boring will be abandoned using cement grout and will not be completed as a monitoring well. Due to the presence of cobbles in the area, the soil boring will be completed using a dual casing air hammer method. If possible, soil samples will be collected at one-foot intervals from the soil boring and field screened for volatile organic compounds (VOCs) using a photoionization detector. The soil sample with the highest concentration of VOCs and the soil sample collected from the bottom of the soil boring will be placed in appropriate containers, stored on ice, and shipped to AEN Laboratories for analysis. The soil samples will be analyzed for VOCs using Environmental Protection Agency (EPA) method 8260. If the extent of soil contamination cannot be delineated prior to encountering the saturated zone or bedrock, then the soil boring will be completed as a monitoring well (MW-109) in the Shallow zone. The well will be developed and sampled as detailed in the Monitoring Well Development section and the Groundwater Sampling and Analysis section, respectively, of the workplan.

Lower Queen Aquifer Investigation of the Loading Dock Area

2) Drill, complete, and develop one Lower Queen aquifer monitoring well (MW-110) between Shallow zone monitoring wells MW-45 and MW-50 to delineate the extent of Shallow Zone contamination migrating to the Lower Queen aquifer. The well will be developed and sampled as detailed in the Monitoring Well Development section and the Groundwater Sampling and Analysis section, respectively, of the work plan. If laboratory analysis detects groundwater contamination above the water standards listed in 20 NMAC 6.2.3103, then one additional downgradient Lower Queen aquifer monitoring well (MW-111) will be drilled and completed north of proposed monitoring well MW-110. The well will be developed and sampled as detailed in the Monitoring Well Development section and the Groundwater Sampling and Analysis section, respectively, of the workplan.

One-Time Comprehensive Groundwater Sampling Event

3) Sample all Shallow zone wells, Lower Queen aquifer wells, water supply wells (SW-1, SW-2, SW-3, and the Lyman well) and the Rocky Arroyo spring after the completion of the proposed monitoring wells in this workplan. The infiltration wells MW-51, IW-1, and IW-2 are excluded from this sampling event. Prior to collecting the groundwater samples, all Shallow zone and Lower Queen aquifer wells that do not have pumps or do not contain free-phase product will be purged by removing three well volumes. Groundwater samples will be collected from the discharge piping of the pump from the water supply wells (SW-1, SW-3 and Lyman well). Water supply well SW-2 will be sampled using a disposable bailer without purging. The pumps in the recovery wells will be removed, and groundwater samples will be collected without purging. As we agreed in our meeting on February 27, 1998, groundwater samples will also be collected from wells that contain free-phase product using a disposable bailer for the purpose of determining the highest concentration of the constituents present. However, sampling of the wells that contain free-phase product will be completed without purging to eliminate the potential of cross-contamination of other wells by the purging equipment. Additionally, the laboratory may be required to dilute the groundwater samples that are collected from wells with free-phase product, which would increase the practical quantitation limit and potentially mask low level concentration of constituents present. The wells will be sampled and analyzed as detailed in the Groundwater Sampling And Analysis section of the workplan. Groundwater samples collected from Shallow zone wells that do not contain sufficient water for all analyses listed on Table 1 will be analyzed in the order that the laboratory method number is listed on Table 1.

Monitoring Well Development

The monitoring wells will be developed by purging until the groundwater is clear and field measurements of pH, conductivity, temperature and turbidity have stabilized. The extracted fluids will be pumped or bailed into a trailer-mounted fiberglass tank and transported to the Indian Basin Gas Plant for disposal in one of the double-lined sumps of the plant's wastewater collection system.

Groundwater Sampling and Analysis

Upon completion of the development and purging activities, groundwater samples will be collected using a disposable bailer. The groundwater samples will be placed in appropriate containers, stored on ice, and shipped to AEN Laboratories for analysis. The groundwater samples will be analyzed for the water standards listed in 20 NMAC 6.2.3103 and for the toxic pollutants listed in 20 NMAC 6.2.1101 using approved methods as listed on Table 1. The samples collected for dissolved metals analysis will be field screened. A duplicate sample will be collected once every 20 samples for quality assurance/quality control.

The proposed investigations activities are scheduled to begin on or about June 1, 1998. The final report of the investigation activities described in this workplan will be submitted to your office by October 30, 1998. The report will also include the additional information requested in your letter dated December 11, 1997. If you have any questions or comments, then please call me at (915) 687-8398.

Sincerely,

M. Paul Peacock

M. Paul Peacock
Advanced Environmental & Safety Engineer

attachments
MPP\ocdwkpl.wpd

cc: Cymantha Liakos of Fluor Daniel GTI w/attachments
T. C. Lowry w/p attachments
A. B. Schoffmann w/o attachments
F. D. Searle w/o attachments

File 552-03

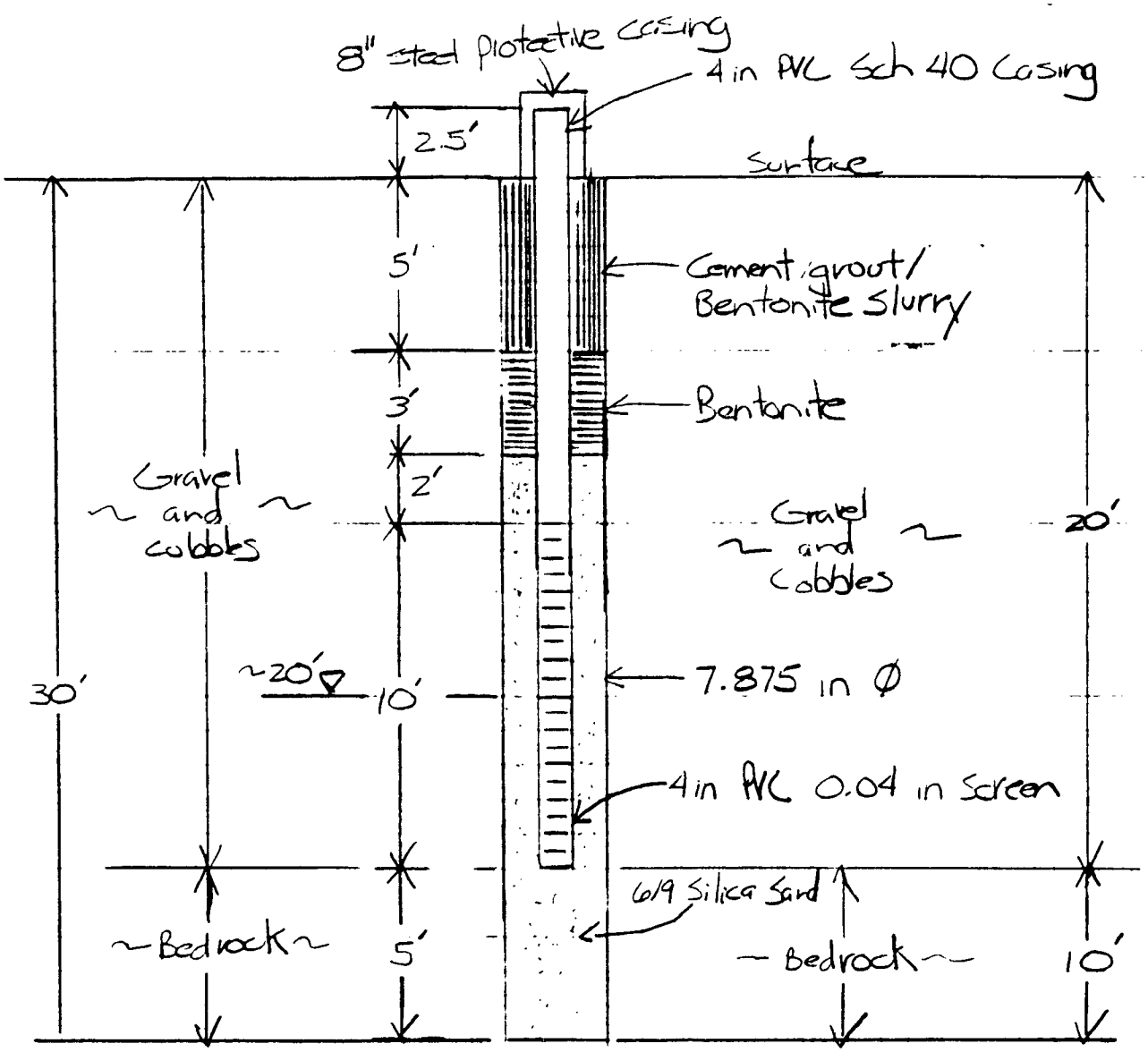
Table 1. Comprehensive Groundwater Sampling Event
Indian Basin Remediation Project

Constituent	Method	Detection Limit mg/l	Groundwater Standards mg/l
Volatile Organic Compounds			
Acrylonitrile	8260	0.1000	
Acrolein	8260	0.0050	
Benzene	8260	0.0010	0.0100
Bis (chloromethyl ether)	8260	0.0250	
Bromodichloromethane	8260	0.0050	
Tribromomethane or Bromoform	8260	0.0150	
Bromomethane or Methyl Bromide	8260	0.0200	
Carbon Tetrachloride	8260	0.0020	0.0100
Monochlorobenzene or Chlorobenzene	8260	0.0050	
Chloroform	8260	0.0050	0.1000
Chloromethane or Methyl Chloride	8260	0.0010	
Dichlorodifluoromethane	8260	0.0050	
1,1-Dichloroethane	8260	0.0050	0.0250
1,2-Dichloroethane	8260	0.0010	0.0100
1,1-Dichloroethylene	8260	0.0010	0.0050
cis-1,2-Dichloroethylene	8260	0.0050	
trans-1,2-Dichloroethylene	8260	0.0050	
Ethyl Benzene	8260	0.0050	0.7500
Hexachlorobutadiene	8260	0.0100	
Hexachloroethane	8260	0.0100	
Dichloromethane or Methylene Chloride	8260	0.0010	0.1000
1,1,2,2-Tetrachloroethane	8260	0.0050	0.0100
1,1,2,2-Tetrachloroethylene or Tetrachloroethylene	8260	0.0010	0.0200
Toluene	8260	0.0050	0.7500
1,1,1-Trichloroethane	8260	0.0050	0.0600
1,1,2-Trichloroethane	8260	0.0020	0.0100
Trichloroethylene	8260	0.0010	0.1000
Trichlorofluoromethane	8260	0.0100	
Vinyl Chloride	8260	0.0010	0.0010
Total Xylenes (o, m & p-xylene)	8260	0.0050	0.6200
Total Dichlorobenzenes (o, m & p-dichlorobenzene)	8260	0.0350	
Total Dichloropropenes (cis & trans-1,3-dichloropropene)	8260	0.0300	
Ethylene Dibromide	504.1	0.000025	0.0001
Semi-Volatile Organic Compounds			
Benzidine	8270		
Hexachlorobenzene	8270	0.0010	
Pentachlorobenzene	8270	0.0100	
1,2,4,5-Tetrachlorobenzene	8270	0.0100	
2,4-Diclorophenol	8270	0.0100	
2,4,5-Trichlorophenol	8270	0.0100	
2,4,6-Trichlorophenol	8270	0.0100	
Bis(2-chloroethyl)ether	8270	0.0100	
Bis (2-chloroisopropyl) ether or Bis(2-chloro-1-methylethyl)ether	8270	0.0100	
Dichlorobenzidine or 3,3'Dichlorobenzidine	8270	0.0100	
2,4-Dinitrotoluene	8270	0.0100	
Diphenylhydrazine	8270		
Hexachlorocyclopentadiene	8270	0.0100	
Isophorone	8270	0.0100	
Nitrobenzene	8270	0.0100	
2,4-dinitro-o-cresol or 4,6-Dinitro-o-cresol	8270	0.0500	
Pentachlorophenol	8270	0.0500	
Phenol	8270	0.0010	0.0050
Di-n-buthyl phthalate	8270	0.0100	
Diethyl Phthalate	8270	0.0100	
Dimethyl Phthalate	8270	0.0100	
Bis(2-ethylhexyl)phthalate	8270	0.0200	
N-Nitrosodi-n-buthylamine	8270	0.0100	
N-Nitrosodiethylamine	8270	0.0200	
N-Nitrosodimethylamine	8270	0.0020	
N-Nitrosodiphenylamine	8270	0.0050	
N-Nitrosopyrrolidine	8270	0.0400	
Total Dinitrophenols (o-Nitrophenol, p-Nitrophenol)	8270	0.0600	

Table 1. Comprehensive Groundwater Sampling Event
Indian Basin Remediation Project

Constituent	Method	Detection Limit mg/l	Groundwater Standards mg/l
Polynuclear Aromatic Hydrocarbons (PAHs)			
Anthracene	8310	0.0100	
Benzo(a)pyrene	8310	0.0007	0.0007
3,4-benzofluoranthene (Benzo(b)fluoranthene)	8310	0.0200	
Benzo(k)fluoranthene	8310	0.0200	
Fluoranthene	8310	0.0100	
Fluorene	8310	0.0100	
1-Methylnaphthalene	8310	0.0100	
2-Methylnaphthalene	8310	0.0100	
Naphthalene	8310	0.0100	
Phenanthrene	8310	0.0100	
Pyrene	8310	0.0100	
PAHs:total naphthalene plus monomethylnaphthalenes	8310	0.0300	0.0300
Dissolved Metals except Mercury			
Aluminum	6010	3.0000	5.0000
Barium	6010	0.0200	1.0000
Boron	6010	0.5000	0.7500
Chromium	6010	0.0100	0.0500
Cobalt	6010	0.0300	0.0500
Copper	6010	0.0600	1.0000
Iron	6010	0.1000	1.0000
Manganese	6010	0.0300	0.2000
Molybdenum	6010	0.7500	1.0000
Nickel	6010	0.0500	0.2000
Silver	6010	0.0100	0.0500
Zinc	6010	0.0500	10.0000
Arsenic	6010	0.0100	0.1000
Cadmium	6010	0.0020	0.0100
Lead	6010	0.0100	0.0500
Selenium	6010	0.0200	0.0500
Uranium	200.8	0.0050	5.0000
Mercury	7471	0.0010	0.0020
General Chemistry			
Chloride	325.2	5.0000	250.0000
Fluoride	340.2	0.4000	1.6000
Phenols	420.1	0.0050	0.0050
Sulfate	375.2	5.0000	600.0000
Nitrate	353.2 & 354.1	1.0000	10.0000
Cyanide	335.2	0.1000	0.2000
TDS	160.1	10.0000	1000.0000
Pesticides			
Aldrin	8081	0.0100	
alpha-BHC	8081	0.0001	
beta-BHC	8081	0.0001	
delta-BHC	8081	0.0001	
gamma-BHC	8081	0.0001	
Technical BHC (alpha, beta, delta, gamma-BHC)	8081	0.0004	
Chlordane	8081	0.0050	
DDT or 4,4'-DDT	8081	0.0010	
Dieldrin	8081	0.0010	
Endosulfan I	8081	0.0010	
Endosulfan II	8081	0.0010	
Endosulfan Sulfate	8081	0.0010	
Endrin	8081	0.0010	
Heptachlor	8081	0.0010	
Toxaphene	8081	0.0010	
Polychlorinated biphenyls (PCB's)	8081		0.001
Radioactivity			
Total Ra226 & Ra228	EPA-EMSL-LV-0539 & 903.1	2.5 pCi/L	30 pCi/L

Subject Proposed Well Completion MW-109	Page No. 1 Of 1
File Indian Basin Remediation Project	By M.P. Peacock Date 4/1/98



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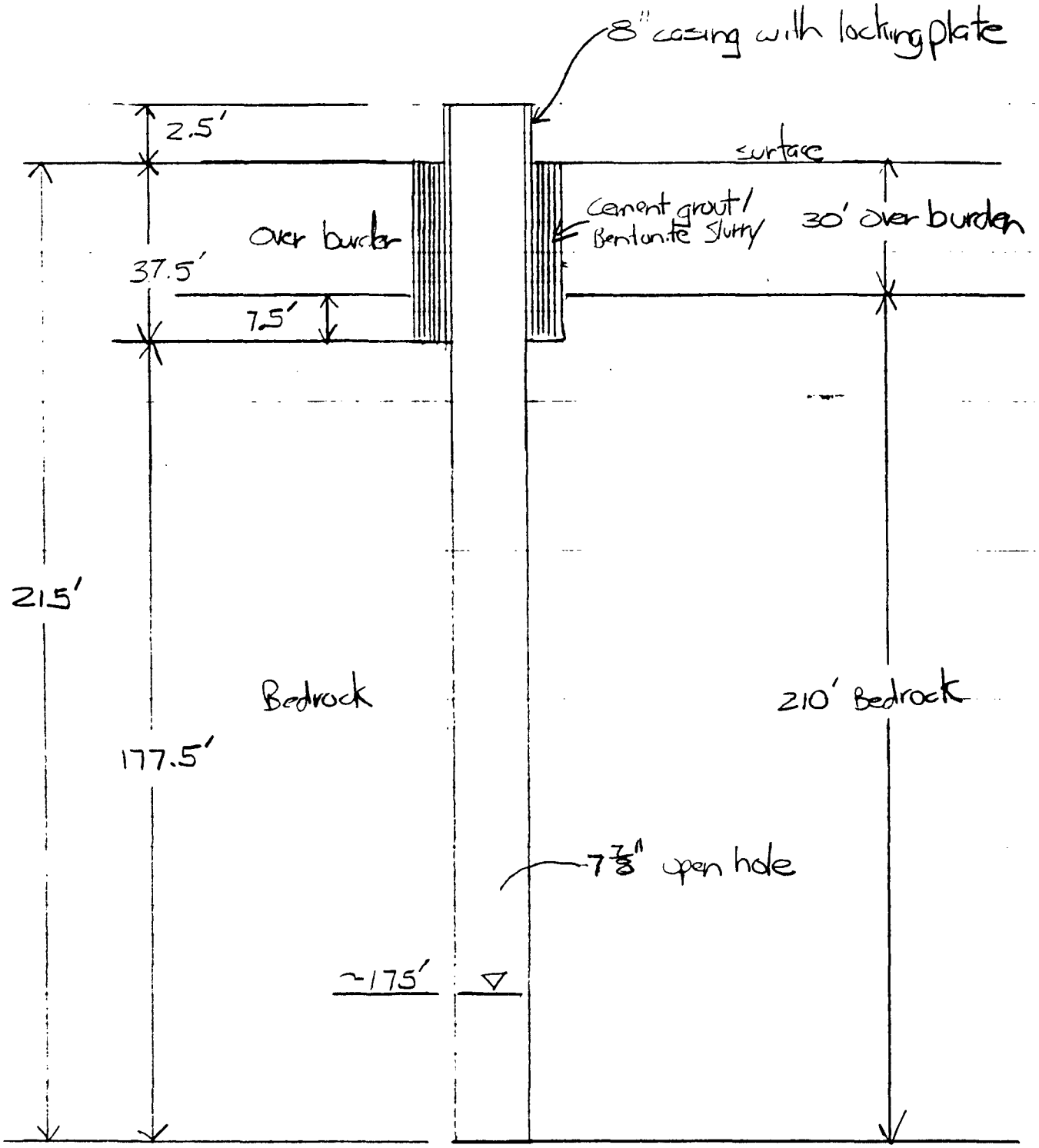
Subject Proposed Well Completion – MW-110	Page No. 1 Of 1
File Indian Basin Remediation Project	By M.P. Peacock Date 4/1/98



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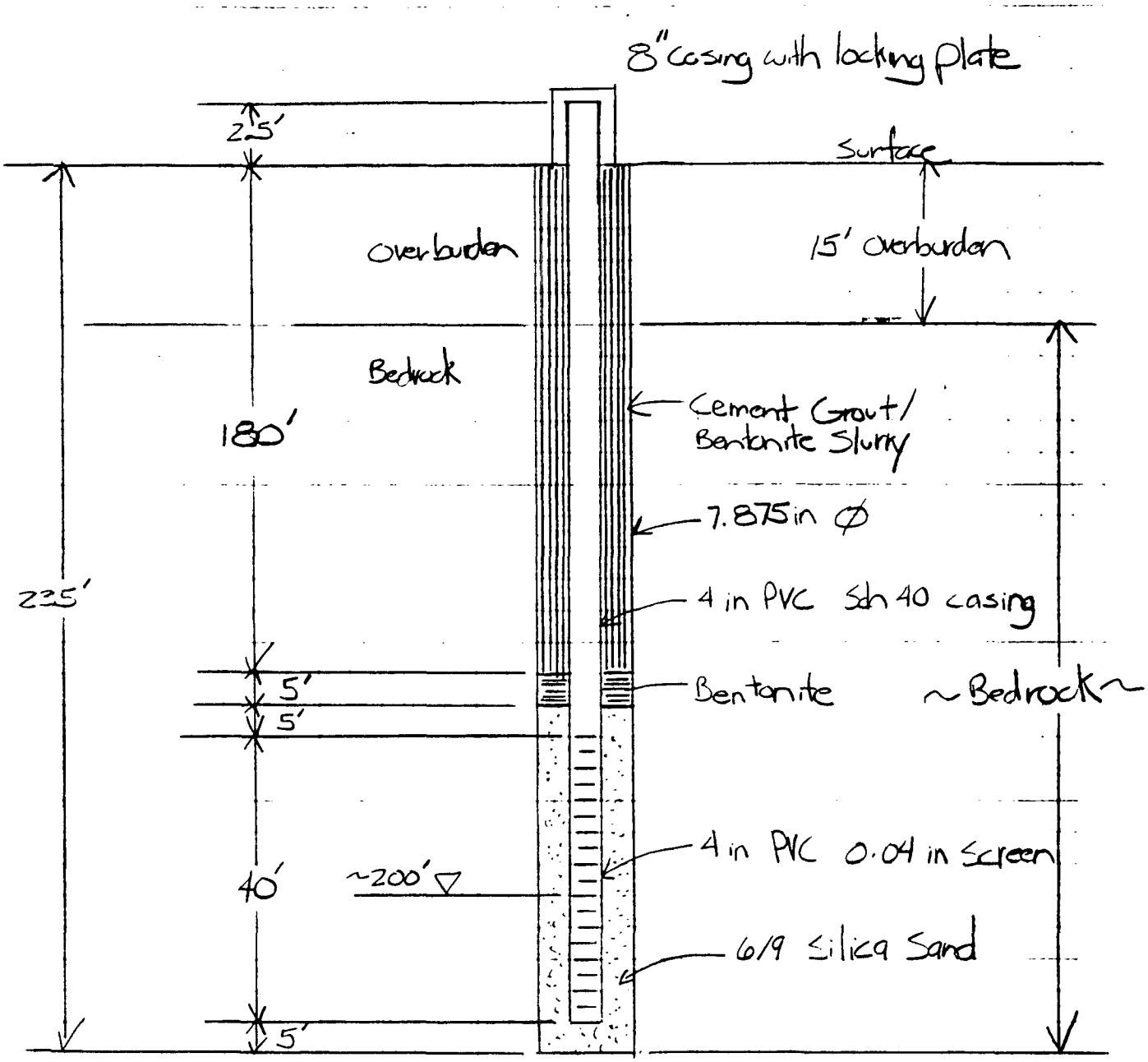
Subject	Proposed Well Completion MW-111	Page No. 1	Of 1
File	Indian Basin Remediation Project	By M.P. Peacock	Date 4/1/98



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OCD/Marathon Indian Basin Meeting 2/27/98 9:00am

participants - Bill Olson - OCD Envir. Bureau
Roger Anderson - "
Mark Ashley - "
Paul Peacock - Marathon
Ben Schoffmann - "

Review OCD 12/11/97 letter

OCD concerned that Marathon going forward with RA when Marathon doesn't own land with contaminated GW.
OCD believes it will be difficult to recommend approval of alternate stds. without land ownership.

Referred Marathon to WQ Act provision on contaminating own property

Marathon to reevaluate move to alternate stds. May or may not wish to continue

Commended Marathon for quality of comprehensive report

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

RECEIVED
FEB 23 1998

February 18, 1998

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

RE: Annual Groundwater Remediation Monitoring Report
Indian Basin Remediation Project
Marathon Oil Company

Dear Mr. Olson:

In reference to our telephone conversation on February 17, 1998, Marathon Oil Company (Marathon) requests an extension of the March 1, 1998 deadline for the annual groundwater remediation monitoring report for the Indian Basin Remediation Project. Marathon is currently developing a database and 3-D model to analyze and display the monitoring data. In order to incorporate the database and 3-D model in the annual report, Marathon requests a two month extension for submittal of the annual report on May 1, 1998.

If you have any questions or comments, then please call me at (915) 687-8398.

Sincerely,

M. Paul Peacock
Advanced Environmental & Safety Engineer

MPP\ocdexten.wpd

File 552-03

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

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To Bill Olson	From Paul Peacock	
Co./Dept.	Co.	
Phone #	Phone # 915/687-8398	
Fax # 505/827-8177	Fax # 915/687-8305	

February 18, 1998

Mr. William C. Olson
Hydrogeologist
Environment Bureau
Oil Conservation Division
2040 S. Pacheco
Santa Fe, New Mexico 87505

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Indian Basin Remediation Project
Marathon Oil Company

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Sincerely,

M. Paul Peacock

M. Paul Peacock
Advanced Environmental & Safety Engineer

MPP\ocdexten.wpd

File 552-03

1/19/98
Verbal approval to
Paul Peacock
Will Olson

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

December 11, 1997

CERTIFIED MAIL
RETURN RECEIPT NO. 410-431-233

Mr. Robert J. Menzie
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702-0552

RE: COMPREHENSIVE SITE CHARACTERIZATION REPORT
MARATHON INDIAN BASIN GAS

Dear Mr. Menzie:

The New Mexico Oil Conservation Division's (OCD) has reviewed the following Marathon Oil Company (MOC) documents which were submitted to the OCD on August 28, 1997:

- August 25, 1997 "COMPREHENSIVE SITE CHARACTERIZATION REPORT, INDIAN BASIN REMEDIATION PROJECT, NEW MEXICO".
- August 12, 1997 "COMPREHENSIVE SITE CHARACTERIZATION REPORT, INDIAN BASIN REMEDIATION PROJECT, NEW MEXICO 1991-1997".
- December 6, 1996 "PHASE II SITE ASSESSMENT OF THE INDIAN BASIN GAS PLANT".

The OCD has the following comments, requests for information and requirements regarding the above referenced comprehensive site characterization report:

1. Section 2.3, Page 8

   This section should include a discussion of areas with anomalous water table elevations which are depicted on Figure 2-6.

2. Section 3.2.1.1., Page 11

This section concludes that "the extent of BTEX and condensate in the Shallow Zone are adequately defined". However, the report does not address the extent of Shallow Zone contamination in the vicinity of the Line 1 pipeline spill. The extent of Shallow Zone contamination can not be considered complete until the extent of contamination in the Line 1 pipeline spill area has been investigated. In prior correspondence (September 18, 1995), MOC committed to conducting additional investigations in this area. The OCD requires that MOC submit a work plan for investigation of the extent of contamination resulting from the Line 1 spill. The results of these investigations will need to be included in the comprehensive site investigation report.

3. Section 3.2.1.2., Page 11

This section concludes that "the extent of BTEX and condensate in the Lower Queen are adequately defined". The shallow zone investigations have shown that the loading dock east of the plant appears to be a source of high levels of BTEX contaminants in the shallow zone. However, there is no Lower Queen monitor well in this area to show if these Shallow Zone contaminants are migrating into the Lower Queen. The OCD requires that MOC submit a work plan for installation of an additional Lower Queen monitor well in this area. The results of these investigations will need to be included in the comprehensive site investigation report.

4. Section 3.2.2., Page 11

Only 6 monitor wells were sampled and analyzed for phenols and 2 monitor wells which previously contained phenols in excess of New Mexico Water Quality Control Commission (WQCC) standards were not resampled. In addition, only a limited number of monitoring wells were sampled and analyzed for the presence of other semi-volatile organics (SVOC). Therefore, the OCD reserves comment of the presence of SVOC's in ground water until more extensive ground water sampling is conducted as outlined in item #9 below.

5. Section 3.2.3.2., Pages 14-16 and Section 5.0, Page 22

The OCD defers comment on modifications of the ground water monitoring requirements until more extensive ground water sampling is conducted as outlined in item #9 below.

6. Figure 1-3

This figure needs to include the locations of the sumps which were used for recovery of condensate and water in and along Rocky Arroyo.

7. Figure 2-6

This figure lists some of the monitor wells as "Dry". However, a review of the well logs shows that several of these "Dry" wells appear to be completed above the elevation where saturation should occur in the Shallow Zone. The wells with dry designations should be reviewed and those that are completed above the zone of saturation should be redesignated as not deep enough ("NDE").

8. Figure 2-6 and Figure 3-1

MW-93 is designated as "NDE" on figure 2-6 but is designated as "DRY" on figure 3-1. The appropriate designation needs to be determined and consistently used on each figure.

9. Figure 3-1, Figure 3-2 and Tables 3-1 thru 3-2

a. A large number of monitoring wells are listed as not sampled ("NS"). The OCD's May 7, 1996 approval of the investigation work plan required that water quality samples be obtained from **all** Shallow Zone and Lower Queen wells. A review of the data shows that MOC has not complied with this approval condition. Therefore, the OCD requires that MOC conduct another site characterization water quality sampling event. During this sampling event, water quality samples will be obtained from **all** Shallow Zone and Lower Queen monitoring wells and water supply wells (including **all** upgradient and downgradient water supply wells and springs). Ground water obtained from **all** sampling points will be sampled and analyzed for **all** water standards listed in 20 NMAC 6.2.3103 and for **all** toxic pollutants listed in 20 NMAC 6.2.1101 using EPA approved methods and quality assurance/quality control. The OCD suggests that this sampling event be coordinated with a quarterly sampling event.

b. It appears that free phase product was not measured in **all** Shallow Zone and Lower Queen wells. The OCD requires that MOC measure the thickness of free phase product in **all** Shallow Zone and Lower Queen wells during the above required sampling event.

(NOTE: If MOC is confused about the definition of the word all, please contact the OCD for clarification.)

10. Figure 3-2 and Table 3-2

Figure 3-2 lists monitor wells MW-104 and MW-108 as "NI" (not installed). However, Table 3-2 lists the results of semi-volatile organic water analyses for these wells. The status of these wells needs to be clarified and these discrepancies need to be corrected.

11. Appendix A

The "COMPREHENSIVE SITE CHARACTERIZATION REPORT" needs to include the geologic logs and well completion logs for all of the monitor wells.

12. Borehole Video

In prior OCD correspondence (May 8, 1996 and January 18, 1996) the OCD has required submission of a copy of the video tape from the open borehole video survey. The borehole video was performed for the purposes of determining predominant fracture trace patterns to be able to predict contaminant migration in the subsurface. Since this was investigation derived data, the OCD requires that the comprehensive site investigation report include a discussion of the results of the borehole video survey and a copy of the video tape.

Once the above required investigation actions are completed, the OCD requires that MOC submit a new draft site characterization report which contains the information requested above and the results of all investigation activities.

If you have any questions, please contact me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: Tim Gum, OCD Artesia District Supervisor

P 410 431 233

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PS Form 3800, April 1995

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

August 25, 1997

Mr. William C. Olson
Hydrogeologist, Environmental Bureau
New Mexico - Oil Conservation Division
2040 South Pacheco
Santa Fe, New Mexico 87505

RECEIVED
AUG 28 1997
Environmental Bureau
Oil Conservation Division

RE: ***Comprehensive Site Characterization Report***
Indian Basin Remediation Project, New Mexico

Dear Mr. Olson:

Marathon Oil Company (Marathon) hereby submits two copies of the *Comprehensive Site Characterization Report* for the Indian Basin Remediation Project in response to your letter dated May 7, 1997 approving work plans for additional groundwater investigation activities. The report summarizes all characterization activities performed at the site since 1991. Reports and analytical data that have not been previously submitted to the New Mexico Oil Conservation Division (OCD) are provided as attachments and appendices, respectively.

Based on the information provided in this report, Marathon has concluded characterization of the site. Delineation of contaminants of concern in the soil and both the Shallow Zone and Lower Queen groundwater is complete. As you are aware and as detailed in Section 4.0 of this report, remediation activities are underway. Development of a comprehensive site remediation program will follow completion of ongoing vapor extraction testing. Modifications to the Groundwater Monitoring Plan are provided in Section 5.0 of the report. Marathon intends to implement these modifications during the October 1997 sampling event.

Please be advised that effective August 18, 1997, Marathon's new project manager will be Paul Peacock. We would like to schedule a meeting later this year to introduce the new project manager and review the project status.

Should you have any questions concerning the contents of this report or the planned activities at the site, please do not hesitate to contact me at (915) 687-8312 or Paul at (915) 687-8398.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Advanced Health, Environmental, and Safety Professional

ENCLOSURE and ATTACHMENTS

c: Tim Gum, District Supervisor - OCD District Office, Artesia, NM (with enclosures)

NEW MEXICO ENERGY, MINERALS
& NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
2040 South Pacheco Street
Santa Fe, New Mexico 87505
(505) 827-7131

July 16, 1997

Mr. Robert J. Menzie
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702-0552

RE: GROUND WATER ANALYSES
MARATHON INDIAN BASIN GAS

Dear Mr. Menzie:

Enclosed you find copies of the New Mexico Oil Conservation Division's (OCD) laboratory analyses of ground water samples from monitor wells at the Indian Basin Gas Plant that the OCD split with Marathon on April 30, 1997.

If you have any questions, please contact me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

enclosure

xc: Tim Gum, OCD 010Artesia District Supervisor

Mid-Continent Region
Production United States

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

RECEIVED
JUN - 6 1997

Marathon Oil Company

June 4, 1997

Mr. William C. Olson
Hydrogeologist
Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Remediation Project
Notification of Report Submittal Date Change

Dear Mr. Olson:

Subsequent to our telephone conversation today in which your verbal approval for a two-month extension was received, Marathon will submit the Comprehensive Site Characterization Report for the Indian Basin Remediation Project by September 1, 1997.

Also, during our conversation I notified you that Marathon and Fluor Daniel GTI plan to conduct vapor extraction testing at the second vapor extraction blower station connected to newly drilled vapor extraction wells (VE-16, VE-17, VE-18, VE-19, and VE-20). This testing will require approximately three days to complete. If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental & Safety Specialist

c: T. C. Lowry
F. D. Searle

File: 568-00

Mid-Continent Region
Production United States

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

RECEIVED
MAY 19 1997
CONSERVATION DIVISION

Marathon Oil Company

May 16, 1997

Mr. Roger Anderson
Environmental Bureau Chief
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Gas Plant/ Remediation Project
Groundwater Discharge Plan (GW-21)-Notification of Discharge

Dear Mr. Anderson:

As required by Marathon's Groundwater Discharge Plan (GW-21) January 11 and April 18, 1996 modifications approved by the OCD in a letter dated May 9, 1996, Marathon is notifying your office that the benzene concentration in the treated water effluent from both air strippers exceeded the Water Quality Control Commission (WQCC) standard. This water is currently infiltrated (discharged) into Lower Queen infiltration well IW-2 and Shallow infiltration wells MW-45 and MW-51 consistent with permit conditions. The water sample was collected on May 12, 1997. Attached is the laboratory report. If you have any questions, please contact me at (915) 687-8312 or menzie@hou.moc.com.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental & Safety Specialist

c: C. M. Schweser

File: 556-01

GAS CHROMOTOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL COMPANY
PROJECT # : 97002
PROJECT NAME : IB REMED

AEN I.D.: 705338

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	WEST INLET #1	AQUEOUS	5/12/97	NA	5/13/97	50
02	WEST OUTLET #1	AQUEOUS	5/12/97	NA	5/13/97	20
03	EAST INLET #1	AQUEOUS	5/12/97	NA	5/13/97	50

PARAMETER	DET. LIMIT	UNITS	01	02	03
BENZENE	0.5	UG/L	130	12	130
TOLUENE	0.5	UG/L	< 25	16	< 25
ETHYLBENZENE	0.5	UG/L	140	13	140
TOTAL XYLENES	0.5	UG/L	510	65	500
SURROGATE:					
BROMOFLUOROBENZENE (%)			101	116	101
SURROGATE LIMITS	(80 - 120)				

CHEMIST NOTES:
N/A

GAS CHROMOTOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL COMPANY AEN I.D.: 705338
PROJECT # : 97002
PROJECT NAME : IB REMED

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	EAST OUTLET #1	AQUEOUS	5/12/97	NA	5/13/97	20
05	TRIP BLANK (TB)	AQUEOUS	5/8/97	NA	5/13/97	1

PARAMETER	DET. LIMIT	UNITS	04	05
BENZENE	0.5	UG/L	14	< 0.5
TOLUENE	0.5	UG/L	16	< 0.5
ETHYLBENZENE	0.5	UG/L	15	< 0.5
TOTAL XYLENES	0.5	UG/L	68	< 0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)			110	102
SURROGATE LIMITS	(80 - 120)			

CHEMIST NOTES:
N/A

American Environmental Network, Inc.

AEN I.D. **705314**

RECEIVED
MAY 15 1997
Environmental Bureau
Oil Conservation Division

May 14, 1997

N.M. Oil Conservation Division
2040 S. Pacheco
Santa Fe, NM 87505

Project Name/Number: MARATHON INDIAN BASIN (NONE)

Attention: Bill Olson

On **05/02/97**, American Environmental Network (NM), Inc., (ADHS License No. AZ0015) received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

All analyses were performed by American Environmental Network (FL) Inc., 11 East Olive Road, Pensacola, FL.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Kimberly D. McNeill
Project Manager

H. Mitchell Rubenstein, Ph.D.
General Manager

MR:ft

Enclosure

2709-D Pan American Freeway, NE • Albuquerque, NM 87107 • (505) 344-3777 • Fax (602) 344-4413

American Environmental Network, Inc.

CLIENT	: N.M. OIL CONSERVATION	DATE RECEIVED	: 05/02/97
PROJECT #	: (NONE)		
PROJECT NAME	: MARATHON INDIAN BASIN	REPORT DATE	: 05/14/97

AEN ID: 705314

	AEN ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	705314-01	MW-89	AQUEOUS	04/30/97
02	705314-02	MW-88	AQUEOUS	04/30/97
03	705314-03	MW-96	AQUEOUS	04/30/97
04	705314-04	MW-97	AQUEOUS	04/30/97
05	705314-05	MW-95	AQUEOUS	04/30/97
06	705314-06	MW-98	AQUEOUS	04/30/97
07	705314-07	TB	AQUEOUS	04/29/97

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	7

AEN STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

American Environmental Network, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	705044
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	705314
Project Name:	N.M. OIL CONS. DIV.
Project Location:	MARATHON INDIAN BASIN
Test:	BETX (8020)
Analysis Method:	8020/Test Methods for Evaluating Solid Waste. SW-846, 3rd ed.
Extraction Method:	N/A
Matrix:	WATER
QC Level:	II

Lab Id:	001	Sample Date/Time:	30-APR-97 0955
Client Sample Id:	705314-01	Received Date:	06-MAY-97
Batch: KIW070		Extraction Date:	N/A
Blank: A	Dry Weight %: N/A	Analysis Date:	07-MAY-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	UG/L	ND	1	
TOLUENE	UG/L	ND	5	
ETHYLBENZENE	UG/L	ND	1	
XYLENES (TOTAL)	UG/L	ND	2	
TRIFLUOROTOLUENE (PID)	%REC/SURR	99	84-115	
ANALYST	INITIALS	KKS		

Comments:

American Environmental Network, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	705044
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	705314
Project Name:	N.M. OIL CONS. DIV.
Project Location:	MARATHON INDIAN BASIN
Test:	BETX (8020)
Analysis Method:	8020/Test Methods for Evaluating Solid Waste. SW-846, 3rd ed.
Extraction Method:	N/A
Matrix:	WATER
QC Level:	II

Lab Id:	002	Sample Date/Time:	30-APR-97 1120
Client Sample Id:	705314-02	Received Date:	06-MAY-97
Batch: KIW070		Extraction Date:	N/A
Blank: A	Dry Weight %: N/A	Analysis Date:	07-MAY-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	UG/L	ND	1	
TOLUENE	UG/L	ND	5	
ETHYLBENZENE	UG/L	ND	1	
XYLENES (TOTAL)	UG/L	ND	2	
TRIFLUOROTOLUENE (PID)	%REC/SURR	104	84-115	
ANALYST	INITIALS	KKS		

Comments:

American Environmental Network, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	705044
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	705314
Project Name:	N.M. OIL CONS. DIV.
Project Location:	MARATHON INDIAN BASIN
Test:	BETX (8020)
Analysis Method:	8020/Test Methods for Evaluating Solid Waste. SW-846, 3rd ed.
Extraction Method:	N/A
Matrix:	WATER
QC Level:	II

Lab Id:	003	Sample Date/Time:	30-APR-97 1255
Client Sample Id:	705314-03	Received Date:	06-MAY-97
Batch: KIW070		Extraction Date:	N/A
Blank: A	Dry Weight %: N/A	Analysis Date:	07-MAY-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	UG/L	ND	1	
TOLUENE	UG/L	ND	5	
ETHYLBENZENE	UG/L	ND	1	
XYLENES (TOTAL)	UG/L	ND	2	
TRIFLUOROTOLUENE (PID)	%REC/SURR	101	84-115	
ANALYST	INITIALS	KKS		

Comments:

American Environmental Network, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	705044
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	705314
Project Name:	N.M. OIL CONS. DIV.
Project Location:	MARATHON INDIAN BASIN
Test:	BETX (8020)
Analysis Method:	8020/Test Methods for Evaluating Solid Waste. SW-846, 3rd ed.
Extraction Method:	N/A
Matrix:	WATER
QC Level:	II

Lab Id:	004	Sample Date/Time:	30-APR-97 1445
Client Sample Id:	705314-04	Received Date:	06-MAY-97
Batch: KIW070		Extraction Date:	N/A
Blank: A	Dry Weight %: N/A	Analysis Date:	08-MAY-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	UG/L	ND	1	
TOLUENE	UG/L	ND	5	
ETHYLBENZENE	UG/L	ND	1	
XYLENES (TOTAL)	UG/L	ND	2	
TRIFLUOROTOLUENE (PID)	%REC/SURR	106	84-115	
ANALYST	INITIALS	KKS		

Comments:

American Environmental Network, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	705044
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	705314
Project Name:	N.M. OIL CONS. DIV.
Project Location:	MARATHON INDIAN BASIN
Test:	BETX (8020)
Analysis Method:	8020/Test Methods for Evaluating Solid Waste. SW-846, 3rd ed.
Extraction Method:	N/A
Matrix:	WATER
QC Level:	II

Lab Id:	005	Sample Date/Time:	30-APR-97 1635
Client Sample Id:	705314-05	Received Date:	06-MAY-97
Batch: KIW070		Extraction Date:	N/A
Blank: A	Dry Weight %: N/A	Analysis Date:	08-MAY-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	UG/L	ND	1	
TOLUENE	UG/L	ND	5	
ETHYLBENZENE	UG/L	ND	1	
XYLENES (TOTAL)	UG/L	ND	2	
TRIFLUOROTOLUENE (PID)	%REC/SURR	102	84-115	
ANALYST	INITIALS	KKS		

Comments:

American Environmental Network, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	705044
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	705314
Project Name:	N.M. OIL CONS. DIV.
Project Location:	MARATHON INDIAN BASIN
Test:	BETX (8020)
Analysis Method:	8020/Test Methods for Evaluating Solid Waste. SW-846, 3rd ed.
Extraction Method:	N/A
Matrix:	WATER
QC Level:	II

Lab Id:	006	Sample Date/Time:	30-APR-97 1800
Client Sample Id:	705314-06	Received Date:	06-MAY-97
Batch: KIW070		Extraction Date:	N/A
Blank: A	Dry Weight %: N/A	Analysis Date:	08-MAY-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	UG/L	8	1	
TOLUENE	UG/L	ND	5	
ETHYLBENZENE	UG/L	2	1	
XYLENES (TOTAL)	UG/L	30	2	
TRIFLUOROTOLUENE (PID)	%REC/SURR	284*	84-115	
ANALYST	INITIALS	KKS		

Comments:

* SURROGATE IS ~~OUTSIDE ACC~~EPTABLE LIMITS DUE TO MATRIX INTERFERENCE, VERIFIED.

American Environmental Network, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	705044
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	705314
Project Name:	N.M. OIL CONS. DIV.
Project Location:	MARATHON INDIAN BASIN
Test:	BETX (8020)
Analysis Method:	8020/Test Methods for Evaluating Solid Waste. SW-846, 3rd ed.
Extraction Method:	N/A
Matrix:	WATER
QC Level:	II

Lab Id:	007	Sample Date/Time:	29-APR-97 1010
Client Sample Id:	705314-07	Received Date:	06-MAY-97
Batch: KIW070		Extraction Date:	N/A
Blank: A	Dry Weight %: N/A	Analysis Date:	07-MAY-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
BENZENE	UG/L	ND	1	
TOLUENE	UG/L	ND	5	
ETHYLBENZENE	UG/L	ND	1	
XYLENES (TOTAL)	UG/L	ND	2	
TRIFLUOROTOLUENE (PID)	%REC/SURR	104	84-115	
ANALYST	INITIALS	KKS		

Comments:

American Environmental Network, Inc.

"Method Report Summary"

Accession Number: 705044
Client: AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number: 705314
Project Name: N.M. OIL CONS. DIV.
Project Location: MARATHON INDIAN BASIN
Test: BETX (8020)

Client Sample Id:	Parameter:	Unit:	Result:
705314-06	BENZENE	UG/L	8
	ETHYLBENZENE	UG/L	2
	XYLENES (TOTAL)	UG/L	30

American Environmental Network, Inc.

"QC Report"

Title: Water Blank
Batch: KIW070
Analysis Method: 8020/Test Methods for Evaluating Solid Waste. SW-846, 3rd ed.
Extraction Method: N/A

Blank Id: A Date Analyzed: 07-MAY-97 Date Extracted: N/A

Parameters:	Units:	Results:	Reporting Limits:
BENZENE	UG/L	ND	1
CHLOROBENZENE	UG/L	ND	1
1,2-DICHLOROBENZENE	UG/L	ND	2
1,3-DICHLOROBENZENE	UG/L	ND	2
1,4-DICHLOROBENZENE	UG/L	ND	2
ETHYLBENZENE	UG/L	ND	1
TOLUENE	UG/L	ND	5
XYLENES (TOTAL)	UG/L	ND	2
METHYL T-BUTYL ETHER	UG/L	ND	5
TRIFLUOROTOLUENE (PID)	%REC/SURR	105	84-115
ANALYST	INITIALS	SB	

Comments:

American Environmental Network, Inc.

"QC Report"

Title: Water Reagent
Batch: KIW070
Analysis Method: 8020/Test Methods for Evaluating Solid Waste. SW-846, 3rd ed.
Extraction Method: N/A

RS Date Analyzed: 07-MAY-97
RSD Date Analyzed: 07-MAY-97

RS Date Extracted: N/A
RSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
BENZENE	50	<1	65	130	61	122	6	16	72-132
TOLUENE	50	<5	61	122	58	116	5	16	69-132
Surrogates:									
TRIFLUOROTOLUENE (PID)				102		101			84-115

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

American Environmental Network, Inc.

"QC Report"

Title: Water Matrix
Batch: KIW070
Analysis Method: 8020/Test Methods for Evaluating Solid Waste. SW-846, 3rd ed.
Extraction Method: N/A

Dry Weight %: N/A
Sample Spiked: 705044-1

MS Date Analyzed: 08-MAY-97
MSD Date Analyzed: 08-MAY-97

MS Date Extracted: N/A
MSD Date Extracted: N/A

Parameters:	Spike Added	Sample Conc	MS Conc	MS %Rec	MSD Conc	MSD %Rec	RPD	RPD Lmts	Rec Lmts
BENZENE	50	<1	59	118	63	126	7	14	73-130
TOLUENE	50	<5	56	112	60	120	7	15	71-129
Surrogates:									
TRIFLUOROTOLUENE (PID)				99		100			84-115

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

American Environmental Network, Inc.

Common notation for Organic reporting

N/S = NOT SUBMITTED
N/A = NOT APPLICABLE
D = DILUTED OUT
UG/L = PARTS PER BILLION.
UG/KG = PARTS PER BILLION.
MG/KG = PARTS PER MILLION.
MG/L = PARTS PER MILLION.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.
ORGANIC SOILS ARE REPORTED ON A DRY WEIGHT BASIS.
** COMPOUNDS FLAGGED IN METHOD ARE NOT WITHIN THE FIVE POINT CURVE. THEY ARE SEARCHED FOR QUALITATIVELY.
ND = NOT DETECTED ABOVE REPORTING LIMIT.

RECOGNIZED INITIALS:

SK-SHELLEY KEARLEY

DC-DAVID CELESTIAL

BB-BETSY BRADNER

KKS-KIMBERLY SMITH

SB-SHARON BRADDOCK

MLP-MELISSA L. PATRICK

TSD-PATRICIA DENT

American Environmental Network of Florida
PROJECT SAMPLE INSPECTION FORM

Lab Accession #: 705044 Date Received: 06-May-97

1. Was there a Chain of Custody? (Yes) No*
2. Was Chain of Custody properly filled out and relinquished? (Yes) No*
3. Were samples received cold? (Criteria: 1° - 4°C: AEN-SOP 1055) (Yes) No* N/A
4. Were all samples properly labeled and identified? (Yes) No*
5. Did samples require splitting? Yes* (No) Req By: PM Client Other*
6. Were samples received in proper containers for analysis requested? (Yes) No*
7. Were all sample containers received intact? (Yes) No*
8. Were samples checked for preservative? *(Check pH of all H_2O requiring preservative except VOA vials that require zero headspace)*+ (Yes) No* N/A
9. Is there sufficient volume for analysis requested? (Yes) No*
10. Were samples received within Holding Time? (REFER TO AEN-SOP 1040) (Yes) No*
11. Is Headspace visible > ¼" in diameter in VOA vials?* If any headspace is evident, comment in out-of-control section. Yes* No (N/A)
12. If sent, were matrix spike bottles returned? Yes No* (N/A)
13. Was Project Manager notified of problems? (initials:_____) Yes No* (N/A)

Airbill Number(s): 1856689064 Shipped By: FEDEX

Cooler Number(s): N/S Shipping Charges: N/A

Cooler Weight(s): N/A Cooler Temp(s) (°C): 1°C - CCK3

(LIST THERMOMETER NUMBER(S) FOR VERIFICATION)

Out of Control Events and Inspection Comments:

(USE BACK OF PSIF FOR ADDITIONAL NOTES AND COMMENTS)

Inspected By: PHE Date: 5/6/97 Logged By: PHE Date: 5/6/97

* *Note all Out-of-Control and/or questionable events on Comment Section of this form.*

* *Note who requested the splitting of samples on the Comment Section of this form.*

\+ *All preservatives for the State of North Carolina, the State of New York, and other requested samples are to be recorded on the sheet provided to record pH results (AEN-SOP 938, section 2.2.9).*

* *According to EPA, ¼" of headspace is allowed in 40 ml vials requiring volatile analysis, however, AEN makes it policy to record any headspace as out-of-control (AEN-SOP 938, section 2.2.12).*

American Environmental Network
Albuquerque, New Mexico

Interlab Chain of Custody

DATE: ..... PAGE 1 OF 1

NETWORK PROJECT MANAGER: KIMBERLY D. McNEILL

COMPANY: American Environmental Network
ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

705044

CLIENT PROJECT MANAGER: Kim McNeill

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Metals - TAL	Metals - PP List	Metals - RCRA	RCRA Metals by TCLP (1311)	8020		TOX	TOC	Gen Chemistry			Oil and Grease	BOD	COD	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	Polynuclear Aromatics (610/8310)	8240 (TCLP 1311) ZHE	8270 (TCLP 1311)			TC-14	Gross Alpha/Beta				NUMBER OF CONTAINERS
705314 - 01	4/30/97	9:55	AQ	1					X																								
- 02		1120		2					X																								
- 03		1255		3					X																								
- 04		1445		4					X																								
- 05		1635		5					X																								
- 06		1800		6					X																								
- 07	4/29/97	10:10		7					X																								

PROJECT INFORMATION

PROJECT NUMBER: 705314
PROJECT NAME: NM OIL CONS DIV
QC LEVEL: ~~STD~~ IV
QC REQUIRED: MS MSD BLANK
TAT: STANDARD RUSH!

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
INTACT?	
RECEIVED GOOD COND./COLD	
LAB NUMBER	

SAMPLES SENT TO:

SAN DIEGO	
Paragon	
RENTON	
PENSACOLA	X
PORTLAND	
PHOENIX	

RELINQUISHED BY: 1.
Signature: Time: 1700
Printed Name: Brian Price Date: 05-05-97
Albuquerque NM

RELINQUISHED BY: 2.
Signature: Time: 5/6/97
Printed Name: Date:
Company: AEN

RECEIVED BY: 1.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: (LAB) 2.
Signature: Time: 0830
Printed Name: R. ELSPER MAN Date: 5/6/97
Company: AENEL

DUE DATE: 05-09-97
RUSH SURCHARGE:
CLIENT DISCOUNT:
SPECIAL CERTIFICATION REQUIRED: ☐ YES ☐ NO

Labs: San Diego (619) 458-9141 • Phoenix (602) 496-4400 • Seattle (206) 228-8335 • Pensacola (904) 474-1001 • Portland (503) 684-0447 • Albuquerque (505) 344-3777

American Environmental Network (NM), Inc.
Albuquerque • Phoenix • Pensacola • Portland • Pleasant Hills • Columbia

CHAIN OF CUSTODY

DATE: 05-02-97 PAGE: 1 OF 1

AEN LAB I.D. [redacted]

SHADED AREAS: FOR LAB USE ONLY

PLEASE FILL THIS FORM IN COMPLETELY.

PROJECT MANAGER: Bill Olson
COMPANY: NM Oil Conservation Div.
ADDRESS: 2040 S. Pacheco
Santa Fe, NM 87505
PHONE: (505) 827-7154
FAX: (505) 827-8177
BILL TO: Same
COMPANY:
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	Petroleum Hydrocarbons (418.1) TRPH	(MOD.8015) Diesel/Direct/Inject		(M8015) Gas/Purge & Trap	Gasoline/BTEX & MTBE (M8015/8020)	BTXE/MTBE (8020)	BTEX & Chlorinated Aromatics (602/8020)	BTEX/MTBE/EDC & EDB (8020/8010/Short)	Chlorinated Hydrocarbons (601/8010)		504 EDB ☐ / DBCP ☐	Polynuclear Aromatics (610/8310)	Volatile Organics (624/8240) GC/MS	Volatile Organics (8260) GC/MS		Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)		General Chemistry:			Priority Pollutant Metals (13)	Target Analyte List Metals (23)	RCRA Metals (8)	RCRA Metals by TCLP (Method 1311)	Metals:		NUMBER OF CONTAINERS
MW-89	4/30/97	0955	AQ	01							3																						3
MW-88	4/30/97	1120		02							3																						3
MW-96	4/30/97	1255		03							3																						3
MW-97	4/30/97	1445		04							3																						3
MW-95	4/30/97	1635		05							3																						3
MW-98	4/30/97	1800		06							3																						3
TB	4/29/97	10:10	AQ	07							1																						1

PROJECT INFORMATION
PROJ. NO.:
PROJ. NAME: Marathon Indian Basin
P.O. NO.:
SHIPPED VIA:

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS
(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) X
CERTIFICATION REQUIRED: ☐ NM ☐ SDWA ☐ OTHER
METHANOL PRESERVATION ☐
COMMENTS: FIXED FEE ☐
Please subcontract to alternate AEN lab

Flare Field

RELINQUISHED BY: 1.
Signature: Bill Olson Time: 1820
Printed Name: Bill Olson Date: 5/2/97
Company: NMOCD

RECEIVED BY:
Signature: Time:
Printed Name: Date:
Company:

RELINQUISHED BY: 2.
Signature Time
Printed Name Date
Company:

RECEIVED BY (LAB)

DISTRIBUTION: White, Canary - AEN Pink - ORIGINATOR

American Environmental Network (NM), Inc.
Albuquerque • Phoenix • Pensacola • Portland • Pleasant Hills • Columbia

CHAIN OF CUSTODY

DATE: 05-02-97 PAGE: 1 OF 1

AEN LAB I.D. [redacted]

SHADED AREAS ARE FOR LAB USE ONLY

PLEASE FILL THIS FORM IN COMPLETELY.

PROJECT MANAGER: Bill Olson
COMPANY: NM Oil Conservation Div.
ADDRESS: 2040 S. Pacheco
Santa Fe, NM 87505
PHONE: (505) 827-7154
FAX: (505) 827-8177
BILL TO: Same
COMPANY:
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	Petroleum Hydrocarbons (418.1) TRPH	(MOD.8015) Diesel/Direct/Inject		(M8015) Gas/Purge & Trap	Gasoline/BTEX & MTBE (M8015/8020)	BTXE/MTBE (8020)	BTEX & Chlorinated Aromatics (602/8020)	BTEX/MTBE/EDC & EDB (8020/8010/Short)	Chlorinated Hydrocarbons (601/8010)		504 EDB ☐ / DBCP ☐	Polynuclear Aromatics (610/8310)	Volatile Organics (624/8240) GC/MS	Volatile Organics (8260) GC/MS		Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)		General Chemistry:			Priority Pollutant Metals (13)	Target Analyte List Metals (23)	RCRA Metals (8)	RCRA Metals by TCLP (Method 1311)	Metals:		NUMBER OF CONTAINERS
MW-89	4/30/97	0955	AQ	-01							3																						
MW-88	4/30/97	1120		-02							3																						
MW-96	4/30/97	1255		-03							3																						
MW-97	4/30/97	1445		-04							3																						
MW-95	4/30/97	1635		-05							3																						
MW-98	4/30/97	1800		-06							3																						
TB	4/29/97	10:10	AQ	-07							1																						

PROJECT INFORMATION	PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS	RELINQUISHED BY: 1.	RELINQUISHED BY: 2.
PROJ. NO.:	(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) X	Signature: Bill Olson Time: 1820	Signature: Time:
PROJ. NAME: Marathon Indian Basin	CERTIFICATION REQUIRED: ☐ NM ☐ SDWA ☐ OTHER	Printed Name: Bill Olson Date: 5/2/97	Printed Name: Date:
P.O. NO.:	METHANOL PRESERVATION ☐	Company: NMOCD	Company:
SHIPPED VIA:	COMMENTS: FIXED FEE ☐	RECEIVED BY: 1.	RECEIVED BY (LAB): 2.
SAMPLE RECEIPT	Please subcontract to alternate AEN lab	Signature: Time:	[redacted]
[redacted]		Printed Name: Date:	[redacted]
	From Field	Company:	[redacted]

DISTRIBUTION: White, Canary - AEN Pink - ORIGINATOR

American Environmental Network (NM), Inc.
Albuquerque • Phoenix • Pensacola • Portland • Pleasant Hills • Columbia

CHAIN OF CUSTODY

DATE: _____ PAGE: ___ OF ___

AEN LAB I.D. 7 [illegible] 314

SHADED AREAS ARE FOR LAB USE ONLY.

PLEASE FILL THIS FORM IN COMPLETELY.

PROJECT MANAGER: Bill Olson

COMPANY: NM Oil Conservation Div.
ADDRESS: 2040 S. Pacheco
Santa Fe, NM 87505
PHONE: 505 827-7154
FAX: 505 827-8177

BILL TO: Same
COMPANY:
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	Petroleum Hydrocarbons (418.1) TRPH	(MOD.8015) Diesel/Direct/Inject		(M8015) Gas/Purge & Trap	Gasoline/BTEX & MTBE (M8015/8020)	BTXE/MTBE (8020)	BTEX & Chlorinated Aromatics (602/8020)	BTEX/MTBE/EDC & EDB (8020/8010/Short)	Chlorinated Hydrocarbons (601/8010)		504 EDB ☐ / DBCP ☐	Polynuclear Aromatics (610/8310)	Volatile Organics (624/8240) GC/MS	Volatile Organics (8260) GC/MS		Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)		General Chemistry:			Priority Pollutant Metals (13)	Target Analyte List Metals (23)	RCRA Metals (8)	RCRA Metals by TCLP (Method 1311)	Metals:		NUMBER OF CONTAINERS
MW-89	4/24/97	0950		-01							3																						3
MW-88	4/24/97	1120		-02							3																						3
MW-96	4/24/97	[illegible]		-03							[illegible]																						3
MW-97	[illegible]	[illegible]		[illegible]																													3
MW-95	4/24/97	[illegible]		[illegible]							3																						3
MW-98	4/24/97	1300		[illegible]							3																						3
[illegible]				-02							1																						1

PROJECT INFORMATION	
PROJ. NO.:	
PROJ. NAME:	Marathon Indian
P.O. NO.:	Basin
SHIPPED VIA:	

SAMPLE RECEIPT	
NO. CONTAINERS	19
CUSTODY SEALS	Y/N/NA
RECEIVED INTACT	Y-S
BLUE ICE/ICE	[illegible]

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒

CERTIFICATION REQUIRED: ☐ NM ☐ SDWA ☐ OTHER

METHANOL PRESERVATION ☐

COMMENTS: FIXED FEE ☐

Please subcontract [illegible] AEN lab

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.
Signature: [signature] Time: 1820	Signature: Time:
Printed Name: Bill Olson Date: 5/2/97	Printed Name: Date:
Company: NM OCD	Company:

RECEIVED BY: 1.	RECEIVED BY: (LAB) 2.
Signature: Time:	Signature: [signature] Time: 1821
Printed Name: Date:	Printed Name: [illegible] Date: 05-02-97
Company:	American Enviromental Network (NM), Inc.

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

May 8, 1997

CERTIFIED MAIL
RETURN RECEIPT NO. P-410-431-171

Mr. Robert J. Menzie, Jr.
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702-0552

RE: RISK ASSESSMENT WORK PLAN
MARATHON INDIAN BASIN GAS PLANT
EDDY COUNTY, NEW MEXICO

Dear Mr. Menzie:

The New Mexico Oil Conservation Division (OCD) has reviewed the following Marathon Oil Company (MOC) documents:

- March 13, 1997 "INDIAN BASIN REMEDIATION PROJECT; RESPONSE TO OCD COMMENTS ON WORKPLAN FOR RISK ASSESSMENT TO ESTABLISH ALTERNATE ABATEMENT STANDARDS, MARATHON OIL COMPANY, INDIAN BASIN REMEDIATION PROJECT".

- April 25, 1997 "INDIAN BASIN REMEDIATION PROJECT, MARCH 1997 GROUNDWATER SAMPLING"

The OCD has the following comments and requests for information regarding the above referenced documents:

1. The OCD disagrees with MOC's proposal to only include benzene, toluene, ethylbenzene and xylene (BTEX) in Section 2.2 of the work plan as chemicals of potential concern (COPC). All chemical constituents for which there is a New Mexico Water Quality Control Commission ground water standard and which are present in the discharged fluids or in the highly contaminated ground water areas are COPC's. This is important since the risk assessment must consider cumulative health effects from all COPC's. Please redraft this section to include a discussion of all site COPC's.

2. As stated in the OCD's February 28, 1996 correspondence, Section 2.4 of the work plan disregards significant exposure pathways. The future off-site uses presented do not consider potential use of ground water as a source of drinking water, industrial use, agricultural uses or stock watering within the

contaminated ground water plume. Since MOC does not own the surface lands overlying a large portion of the contaminant plume, MOC cannot control future uses in what is considered the "Off-Site" areas. Unless MOC can provide the OCD with a legal document showing that ground water within the plume area is restricted from use as a source of drinking water, this section needs to be redrafted to include potential future residential, industrial, agricultural and stock watering uses of ground water within the plume area.

3. Consistent with OCD's above comments above, Table 7 of the work plan needs to be redrafted to reflect potential future off-site uses as discussed below:

   a. The ground water exposure pathway only considers that a future off-site resident would be potentially impacted if contaminated ground water migrated to a downgradient residential well. As discussed above, the future off-site ground water pathway must consider the potential for future residential, industrial, agricultural and stock watering uses of ground water within the plume area.

   b. In addition to stock watering, agricultural use in the risk assessment will need to consider the potential for contaminant impacts from use of ground water and surface water on offsite crops.

4. Due to the lack of sufficient analytical data in the highly contaminated areas of the plume and the presence of non-BTEX ground water contaminants, the OCD believes that additional data will be needed for determining the site COPC's and for risk assessment modeling. Therefore, the OCD requires that MOC submit a source characterization work plan to fully identify the type and magnitude of ground water contaminants in all contaminated ground water areas.

Submission of the above requested information will allow the OCD to continue a review of this work plan. If there are any questions, please feel free to contact me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: OCD Artesia District Office

P 410 431 171

US Postal Service

Receipt for Certified Mail

No Insurance Coverage Provided.

Do not use for International Mail *(See reverse)*

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Street & Number	
Post Office, State, & ZIP Code	
Postage	$
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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 1985

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

May 7, 1997

RECEIVED
MAY - 9 1997
OIL CONSERVATION DIVISION

Mr. Roger Anderson
Environmental Bureau Chief
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Gas Plant/ Remediation Project
Groundwater Discharge Plan (GW-21)-Notification of Discharge

Dear Mr. Anderson:

As required by Marathon's Groundwater Discharge Plan (GW-21) January 11 and April 18, 1996 modifications approved by the OCD in a letter dated May 9, 1996, Marathon is notifying your office that the benzene concentration in the treated water effluent from one of the two air strippers exceeded the Water Quality Control Commission (WQCC) standard. This water is currently infiltrated (discharged) into Lower Queen infiltration well IW-2 and Shallow infiltration wells MW-45 and MW-51 consistent with permit conditions. The water sample was collected on April 28, 1997. Attached is the laboratory report. If you have any questions, please contact me at (915) 687-8312 or menzie@hou.moc.com.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Advanced Environmental & Safety Specialist

c: C. M. Schweser

File: *556-01*

American Environmental Network, Inc.

AEN I.D. 704393

May 5, 1997

MARATHON OIL CO.
125 WEST MISSOURI STREET
MIDLAND, TEXAS 79701

Project Name IB REMED
Project Number 97002

Attention: BOB MENZIE

On 4/29/97 American Environmental Network (NM), Inc. (ADHS License No. AZ0015), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (505)344-3777.

Kimberly D. McNeill
Project Manager

H. Mitchell Rubenstein, Ph. D.
General Manager

MR: mt

Enclosure

2709-D Pan American Freeway, NE • Albuquerque, NM 87107 • (505) 344-3777 • Fax (602) 344-4413

CLIENT	: MARATHON OIL CO.	AEN I.D.	: 704393
PROJECT #	: 97002	DATE RECEIVED	: 4/29/97
PROJECT NAME	: IB REMED	REPORT DATE	: 5/5/97

AEN ID. #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	WEST INLET #1	AQ	4/28/97
02	WEST OUTLET #1	AQ	4/28/97
03	EAST INLET #1	AQ	4/28/97
04	EAST OUTLET #1	AQ	4/28/97
05	TRIP BLANK	AQ	4/21/97

American Environmental Network Inc

GAS CHROMOTOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL CO. AEN I.D.: 704393
PROJECT # : 97002
PROJECT NAME : IB REMED

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	WEST INLET #1	AQUEOUS	4/28/97	NA	4/30/97	20
02	WEST OUTLET #1	AQUEOUS	4/28/97	NA	4/29/97	10
03	EAST INLET #1	AQUEOUS	4/28/97	NA	4/30/97	20

PARAMETER	DET. LIMIT	UNITS	01	02	03
BENZENE	0.5	UG/L	**91**	**7.6**	**98**
TOLUENE	0.5	UG/L	**16 ***	**9.8 ***	**17 ***
ETHYLBENZENE	0.5	UG/L	**69**	**7.3**	**58**
TOTAL XYLENES	0.5	UG/L	**290**	**47**	**260**
SURROGATE:					
BROMOFLUOROBENZENE (%)			98	109	99
SURROGATE LIMITS	(80 - 120)				

CHEMIST NOTES:
*** WHEN -02 WAS EXAMINED BY MASS SPECTROSCOPY, TOLUENE WAS DETERMINED TO BE A FALSE POSITIVE BY PHOTOIONIZATION.**

GAS CHROMOTOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL CO. AEN I.D.: 704393
PROJECT # : 97002
PROJECT NAME : IB REMED

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	EAST OUTLET #1	AQUEOUS	4/28/97	NA	4/29/97	10
05	TRIP BLANK	AQUEOUS	4/21/97	NA	4/29/97	1

PARAMETER	DET. LIMIT	UNITS	04	05
BENZENE	0.5	**UG/L**	**12**	< 0.5
TOLUENE	0.5	**UG/L**	**12 ***	< 0.5
ETHYLBENZENE	0.5	**UG/L**	**10**	< 0.5
TOTAL XYLENES	0.5	**UG/L**	**60**	< 0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)			114	111
SURROGATE LIMITS	(80 - 120)			

CHEMIST NOTES:
*** WHEN -02 WAS EXAMINED BY MASS SPECTROSCOPY, TOLUENE WAS DETERMINED TO BE A FALSE POSITIVE BY PHOTOIONIZATION.**

GAS CHROMOTOGRAPHY RESULTS
REAGENT BLANK

TEST	: BTEX (EPA 8020)	AEN I.D.	: 704393
BLANK I. D.	: 043097	DATE EXRACTED	: N/A
CLIENT	: MARATHON OIL CO.	DATE ANALYZED	: 4/30/97
PROJECT #	: 97002	SAMPLE MATRIX	: AQUEOUS
PROJECT NAME	: IB REMED		

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5

SURROGATE:
BROMOFLUOROBENZENE (%) 105
SURROGATE LIMITS: (80 - 120)
CHEMIST NOTES:
N/A

GAS CHROMOTOGRAPHY RESULTS
REAGENT BLANK

TEST	: BTEX (EPA 8020)	AEN I.D.	: 704393
BLANK I. D.	: 042997	DATE EXRACTED	: N/A
CLIENT	: MARATHON OIL CO.	DATE ANALYZED	: 4/29/97
PROJECT #	: 97002	SAMPLE MATRIX	: AQUEOUS
PROJECT NAME	: IB REMED		

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5

SURROGATE:
BROMOFLUOROBENZENE (%) 115
SURROGATE LIMITS: (80 - 120)
CHEMIST NOTES:
N/A

GAS CHROMOTOGRAPHY QUALITY CONTROL
MSMSD

TEST	: BTEX (EPA 8020)			
MSMSD #	: 042997	AEN I.D.	:	704393
CLIENT	: MARATHON OIL CO.	DATE EXRACTED	:	N/A
PROJECT #	: 97002	DATE ANALYZED	:	4/29/97
PROJECT NAME	: IB REMED	SAMPLE MATRIX	:	AQUEOUS
		UNITS	:	UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD	REC LIMITS	RPD LIMITS
BENZENE	<0.5	10.0	9.6	96	9.5	95	1	(80 - 120)	20
TOLUENE	<0.5	10.0	9.3	93	9.2	92	1	(80 - 120)	20
ETHYLBENZENE	<0.5	10.0	10.1	101	10.0	100	1	(80 - 120)	20
TOTAL XYLENES	<0.5	30.0	30.3	101	30.0	100	1	(80 - 120)	20

CHEMIST NOTES:
N/A

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

American Environmental Network (NM), Inc.
Albuquerque • Phoenix • Pensacola • Portland • Pleasant Hills • Columbia

CHAIN OF CUSTODY

DATE: 4/28/97 PAGE: 1 OF 1

AEN LAB I.D. ~~704398~~ 704393

SHADED AREAS ARE FOR LAB USE ONLY.

PLEASE FILL THIS FORM IN COMPLETELY.

PROJECT MANAGER:

COMPANY: MARATHON OIL CO
ADDRESS: 125 WEST MISSOURI STREET
MIDLAND, TX. 79701
PHONE: 915-687-8312
FAX: 915-687-8305

BILL TO: BOB MENZIE
COMPANY: MARATHON OIL CO.
ADDRESS: P.O. BOX 552
MIDLAND, TX. 79702

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	BTXE/~~MTBE~~ (8020)	NUMBER OF CONTAINERS
WEST INLET #1	4/28/97	1115	WATER	-01	X	2
WEST OUTLET #1	4/28/97	1125	↓	-02	X	2
EAST INLET #1	4/28/97	1210	↓	-03	X	2
EAST OUTLET #1	4/28/97	1230	↓	-04	X	2
TRIP BLANK (TB)	4/21/97	1345	WATER	-05	X	1

Petroleum Hydrocarbons (418.1) TRPH
(MOD.8015) Diesel/Direct/Inject
(M8015) Gas/Purge & Trap
Gasoline/BTEX & MTBE (M8015/8020)
BTEX & Chlorinated Aromatics (602/8020)
BTEX/MTBE/EDC & EDB (8020/8010/Short)
Chlorinated Hydrocarbons (601/8010)
504 EDB ☐ / DBCP ☐
Polynuclear Aromatics (610/8310)
Volatile Organics (624/8240) GC/MS
Volatile Organics (8260) GC/MS
Pesticides/PCB (608/8080)
Herbicides (615/8150)
Base/Neutral/Acid Compounds GC/MS (625/8270)
General Chemistry:
Priority Pollutant Metals (13)
Target Analyte List Metals (23)
RCRA Metals (8)
RCRA Metals by TCLP (Method 1311)
Metals:

PROJECT INFORMATION

PROJ. NO.: 97002
PROJ. NAME: I B REMED
P.O. NO.:
SHIPPED VIA:

SAMPLE RECEIPT

NO. CONTAINERS	8 9
CUSTODY SEALS	Y/N/NA
RECEIVED INTACT	yes
BLUE ICE/ICE	13°

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) [ ]24hr [ ]48hr [ ]72hr [ ]1 WEEK (NORMAL) X

CERTIFICATION REQUIRED: [ ]NM [ ]SDWA [ ]OTHER

METHANOL PRESERVATION [ ]

COMMENTS: FIXED FEE [ ]

BP 04-29-97

(-03) East inlet time = 11:55, 12:10
(-04) East outlet time = 12:20, 12:30

RELINQUISHED BY: 1.
Signature: Norm Thomas Time: 1300
Printed Name: NORM THOMAS Date: 1300
Company: INDIAN ENVIRONMENTAL

RECEIVED BY: 1.
Signature: Time:
Printed Name: Date:
Company:

RELINQUISHED BY: 2.
Signature Time
Printed Name Date
Company

RECEIVED BY: (LAB) 2.
Signature: Time: 10:30
Printed Name: Brian Price Date: 04-29-97
American Enviromental Network (NM), Inc.

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

RECEIVED
MAY - 9 1997
OIL CONSERVATION DIVISION

May 5, 1997

Mr. William C. Olson
Hydrogeologist
Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Remediation Project
Notification of drilling of Vapor Extraction, Infiltration and Recovery wells

Dear Mr. Olson:

Marathon is notifying your office that drilling of five vapor extraction, one Lower Queen infiltration, and two Lower Queen groundwater recovery wells will commence on Tuesday morning, May 13, 1997. The vapor extraction wells are designated VE-16, VE-17, VE-18, VE-19, and VE-20 and will be located near MW-65 just north of Rocky Arroyo, spaced approximately 600 feet apart. The recovery and infiltration wells will be designated MW-104, MW-108, and IW-3, respectively. If you have any questions, please contact me at (915) 687-8312 or menzie@hou.moc.com.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental & Safety Specialist

File: 568-00

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

April 25, 1997

Mr. William C. Olson
Hydrogeologist
Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

Re: Indian Basin Remediation Project
March 1997 Groundwater Sampling

Dear Mr. Olson:

In March 1997, Marathon sampled and tested six Indian Basin Remediation Project wells for seven constituents not analyzed for since early in the Project. Constituents found in the testing to be above WQCC standards in some wells are iron, manganese, sulfate, and TDS. A summary table of the March 1997 sampling results and a copy of the laboratory report is attached. Marathon is evaluating the presence of these inorganic compounds with respect to background concentrations and to determine if they may be related to naturally occurring biodegradation of hydrocarbon. If you have any questions, please contact me at (915) 687-8312 or menzie@hou.moc.com.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Advanced Environmental & Safety Specialist

Marathon Oil Company

Indian Basin Remediation Project

Laboratory Results, March 1997 Sampling Event

Analyte	WQCC Standard mg/l	AEN PQL mg/l	Shallow monitoring wells					Lower Queen monitoring well
			MW-13	MW-41	MW-49	MW-50	MW-56	MW-60
Phenol	0.005	0.003	<0.006	<0.003	<0.003	<0.003	<0.003	<0.004
Barium	1.0	0.02	0.37	0.37	0.07	0.03	0.66	0.03
Manganese	0.2	0.05	0.48	0.11	0.33	0.64	0.24	0.03
Iron	1.0	0.1	29	0.69	6.8	6.5	28	0.67
TDS	1000	10	770	1500	3100	5900	1200	760
Sulfate	600	10	<10	98	1000	3600	<10	280
Fluoride	1.6	0.4	0.4	1.5	1.4	1.2	1.5	0.8

First Quarter 1997

American Environmental Network, Inc.

AEN I.D. **703361**

April 9, 1997

Marathon Oil Company
P.O. Box 552
Midland, TX 79702

Project Name/Number: MOC/IBGP 023350224.64

Attention: Bob Menzie

On **03/24/97**, American Environmental Network (NM), Inc., (ADHS License No. AZ0015) received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

All analyses were performed by American Environmental Network (FL) Inc., 11 East Olive Road, Pensacola, FL.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Kimberly D. McNeill
Project Manager

H. Mitchell Rubenstein, Ph.D.
General Manager

MR:ft

Enclosure

2709-D Pan American Freeway, NE • Albuquerque, NM 87107 • (505) 344-3777 • Fax (602) 344-4413

American Environmental Network, Inc.

CLIENT	: MARATHON OIL COMPANY	DATE RECEIVED	: 03/24/97
PROJECT #	: 023350224.64		
PROJECT NAME	: MOC/IBGP	REPORT DATE	: 04/09/97

AEN ID: 703361

	AEN ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	703361-01	MW-60	AQUEOUS	03/19/97
02	703361-02	MW-41	AQUEOUS	03/20/97
03	703361-03	MW-49	AQUEOUS	03/20/97
04	703361-04	MW-50	AQUEOUS	03/20/97
05	703361-05	MW-56	AQUEOUS	03/21/97
06	703361-06	MW-13	AQUEOUS	03/21/97

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	6

AEN STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

American Environmental Network, Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 703418
Client: AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number: 703361
Project Name: MARATHON OIL CO.
Project Location: MOC/IBGP
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 703361-01			Lab ID: 001		
FLUORIDE (340.2/4500-F C)	MG/L	0.8	0.2	FLW011	
SULFATE (375.4)	MG/L	280	250	SEW023	+
TOTAL DISSOLVED SOLIDS (160.1)	MG/L	760	5	TDW016	
Comments:					
Client ID: 703361-02			Lab ID: 002		
FLUORIDE (340.2/4500-F C)	MG/L	1.5	0.2	FLW011	
SULFATE (375.4)	MG/L	98	50	SEW023	+
TOTAL DISSOLVED SOLIDS (160.1)	MG/L	1500	5	TDW016	
Comments:					
Client ID: 703361-03			Lab ID: 003		
FLUORIDE (340.2/4500-F C)	MG/L	1.4	0.2	FLW011	
SULFATE (375.4)	MG/L	1000	500	SEW023	+
TOTAL DISSOLVED SOLIDS (160.1)	MG/L	3100	5	TDW016	
Comments:					
Client ID: 703361-04			Lab ID: 004		
FLUORIDE (340.2/4500-F C)	MG/L	1.2	0.2	FLW011	
SULFATE (375.4)	MG/L	3600	1000	SEW023	+
TOTAL DISSOLVED SOLIDS (160.1)	MG/L	5900	5	TDW016	
Comments:					
Client ID: 703361-05			Lab ID: 005		
FLUORIDE (340.2/4500-F C)	MG/L	1.5	0.2	FLW011	
SULFATE (375.4)	MG/L	ND	10	SEW023	
TOTAL DISSOLVED SOLIDS (160.1)	MG/L	1200	5	TDW016	
Comments:					

American Environmental Network, Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 703418
Client: AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number: 703361
Project Name: MARATHON OIL CO.
Project Location: MOC/IBGP
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 703361-06			Lab ID: 006		
FLUORIDE (340.2/4500-F C)	MG/L	0.4	0.2	FLW011	
SULFATE (375.4)	MG/L	ND	10	SEW023	
TOTAL DISSOLVED SOLIDS (160.1)	MG/L	770	5	TDW016	

Comments:

American Environmental Network, Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 703418
Client: AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number: 703361
Project Name: MARATHON OIL CO.
Project Location: MOC/IBGP
Test: Group of Single Wetchem

Client ID:	Lab ID:	Matrix:	Date/Time Sampled:	Date Received:
703361-01	001	WATER	19-MAR-97 1730	25-MAR-97
703361-02	002	WATER	20-MAR-97 1530	25-MAR-97
703361-03	003	WATER	20-MAR-97 1610	25-MAR-97
703361-04	004	WATER	20-MAR-97 1710	25-MAR-97
703361-05	005	WATER	20-MAR-97 0830	25-MAR-97
703361-06	006	WATER	20-MAR-97 0930	25-MAR-97

American Environmental Network, Inc.

"Method Report Summary"

Accession Number: 703418
Client: AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number: 703361
Project Name: MARATHON OIL CO.
Project Location: MOC/IBGP
Test: Group of Single Wetchem

Client Sample Id:	Parameter:	Unit:	Result:
703361-01	FLUORIDE (340.2/4500-F C)	MG/L	0.8
	SULFATE (375.4)	MG/L	280
	TOTAL DISSOLVED SOLIDS (160.1)	MG/L	760
703361-02	FLUORIDE (340.2/4500-F C)	MG/L	1.5
	SULFATE (375.4)	MG/L	98
	TOTAL DISSOLVED SOLIDS (160.1)	MG/L	1500
703361-03	FLUORIDE (340.2/4500-F C)	MG/L	1.4
	SULFATE (375.4)	MG/L	1000
	TOTAL DISSOLVED SOLIDS (160.1)	MG/L	3100
703361-04	FLUORIDE (340.2/4500-F C)	MG/L	1.2
	SULFATE (375.4)	MG/L	3600
	TOTAL DISSOLVED SOLIDS (160.1)	MG/L	5900
703361-05	FLUORIDE (340.2/4500-F C)	MG/L	1.5
	TOTAL DISSOLVED SOLIDS (160.1)	MG/L	1200
703361-06	FLUORIDE (340.2/4500-F C)	MG/L	0.4
	TOTAL DISSOLVED SOLIDS (160.1)	MG/L	770

American Environmental Network, Inc.

"WetChem Quality Control Report"

Parameter:	FLUORIDE	SULFATE	TDS
Batch Id:	FLW011	SEW023	TDW016
Blank Result:	<0.2	<10	<5
Anal. Method:	340.2	375.4	160.1
Prep. Method:	N/A	N/A	N/A
Analysis Date:	31-MAR-97	01-APR-97	27-MAR-97
Prep. Date:	31-MAR-97	01-APR-97	26-MAR-97
Sample Duplication			
Sample Dup:	703291-1	703290-1	703361-1
Rept Limit:	<0.2	<50+	<5
Sample Result:	0.48	134	280
Dup Result:	0.46	135	244
Sample RPD:	0.02G	1G	14
Max RPD:	0.2	50+	16
Dry Weight%	N/A	N/A	N/A
Matrix Spike			
Sample Spiked:	703291-1	703290-1	N/A
Rept Limit:	<0.2	<100+	N/A
Sample Result:	0.48	134	
Spiked Result:	1.32	328	
Spike Added:	0.8	200	
% Recovery:	105	97	
% Rec Limits:	81-127	64-150	
Dry Weight%	N/A	N/A	
ICV			
ICV Result:	1.12	19.6	354
True Result:	1.20	20	293
% Recovery:	93	98	121
% Rec Limits:	90-110	90-110	90-110
LCS			
LCS Result:			354
True Result:			294
% Recovery:			120
% Rec Limits:			66-122

American Environmental Network, Inc.

"Quality Control Comments"

Batch Id:	Comments:
FLW011	703172-1; WAS ADDED TO BATCH ON 02-APR-97
TDW016	703361-1; 26-MAR-97; PREP DATE: 26-MAR-97; ANALYSIS DATE: 27-MAR-97
TDW016	703432-1 WAS ADDED TO BATCH ON 27-MAR-97

----- Common Footnotes WetChem -----

N/A = NOT APPLICABLE.
N/S = NOT SUBMITTED.
N/C = SAMPLE AND DUPLICATE RESULTS ARE AT OR BELOW AEN REPORTING LIMIT; THEREFORE, THE RPD IS "NOT CALCULABLE" AND NO CONTROL LIMITS APPLY.
N/D = NOT DETECTED.
R = REACTIVE
T = TOTAL
G = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X AEN REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE RESULT IS AT OR BELOW AEN REPORTING LIMIT; THEREFORE, THE RESULTS ARE "IN CONTROL".
Q = THE ANALYTICAL (POST-DISTILLATION) SPIKE IS REPORTED DUE TO PERCENT RECOVERY BEING OUTSIDE ACCEPTANCE LIMITS ON THE MATRIX (PRE-DISTILLATION) SPIKE.
# = ELEVATED REPORTING LIMIT DUE TO INSUFFICIENT SAMPLE.
+ = ELEVATED REPORTING LIMIT DUE TO DILUTION INTO CALIBRATION RANGE.
* = ELEVATED REPORTING LIMIT DUE TO MATRIX INTERFERENCE. (DILUTION PRIOR TO ANALYSIS)
@ = ADJUSTED REPORTING LIMIT DUE TO SAMPLE MATRIX. (DILUTION PRIOR TO DIGESTION)
P = ANALYTICAL (POST DIGESTION) SPIKE.
I = DUPLICATE INJECTION.
& = AUTOMATED
F = SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
N/C+ = NOT CALCULABLE
H = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X AEN REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE AEN REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL".
A = SAMPLE AND DUPLICATE RESULTS ARE "OUT OF CONTROL".
Z = THE SAMPLE RESULT FOR THE SPIKE IS BELOW THE REPORTING LIMIT. HOWEVER, THIS RESULT IS REPORTED FOR ACCURATE QC CALCULATIONS.
NH= SAMPLE AND / OR DUPLICATE RESULT IS BELOW 5 X AEN REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE AEN REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL". SAMPLE IS NON-HOMOGENEOUS.
(*) = DETECTION LIMITS RAISED DUE TO CLP METHOD NOT REQUIRING A CONCENTRATION STEP FOR CN.
(CA) = SEE CORRECTIVE ACTIONS FORM.
**= MATRIX INTERFERENCE
SW-846, 3rd Edition, latest EPA-approved edition.
EPA 600/4-79-020, Revised March 1983.
STANDARD METHODS, For the Examination of Water and Wastewater, latest EPA-approved edition.
NIOSH Manual of Analytical Methods, 4th Edition.
ANNUAL BOOK OF ASTM STANDARDS, VOLUMES 11.01 and 11.02, latest EPA-approved edition.
METHODS FOR THE DETERMINATION OF INORGANIC SUBSTANCES IN ENVIRONMENTAL SAMPLES, EPA600/R-93/100, AUGUST 1993
AEN-PN USES THE MOST CURRENT PROMULGATED METHODS FROM THE REFERENCES LISTED ABOVE.
METHOD FOR SOIL ANALYSIS, PART 2, CHEMICAL AND MICROBILOGICAL PROPERTIES, 2ND EDITION.
1. COLIFORM. COLIFORM PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE LOGARITHM OF COLONIES PER 100 MLS OF SAMPLE ON DUPLICATE PLATES.
2. PH. PH PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE ANALYSIS.
3. FLASHPOINT. FLASHPOINT PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE ANALYSIS.
RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION).
RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

DPH = DOLLY P. HWANG	RB = REBECCA BROWN	AB = ANDY BROTHERTON
JL = JAN LECLEAR	NSB = NANCY S. BUTLER	MM = MIKE MCKENZIE
MB = MICHELLE BOTTS	ED = ESTHER DANTIN	
PLD = PAULA L. DOUGHTY	RH = RICKY HAGENDORFER	

American Environmental Network, Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 703418
Client: AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number: 703361
Project Name: MARATHON OIL CO.
Project Location: MOC/IBGP
Test: Group of Single Metals
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 703361-01			Lab ID:001		
BARIUM (200.7)	MG/L	0.03	0.01	B0W068	
IRON (200.7)	MG/L	0.67	0.02	N0W068	
MANGANESE (200.7)	MG/L	0.03	0.01	G0W068	
Comments:					
Client ID: 703361-02			Lab ID:002		
BARIUM (200.7)	MG/L	0.37	0.01	B0W068	
IRON (200.7)	MG/L	0.69	0.02	N0W068	
MANGANESE (200.7)	MG/L	0.11	0.01	G0W068	
Comments:					
Client ID: 703361-03			Lab ID:003		
BARIUM (200.7)	MG/L	0.07	0.01	B0W068	
IRON (200.7)	MG/L	6.8	0.02	N0W068	
MANGANESE (200.7)	MG/L	0.33	0.01	G0W068	
Comments:					
Client ID: 703361-04			Lab ID:004		
BARIUM (200.7)	MG/L	0.03	0.01	B0W068	
IRON (200.7)	MG/L	6.5	0.02	N0W068	
MANGANESE (200.7)	MG/L	0.64	0.01	G0W068	
Comments:					
Client ID: 703361-05			Lab ID:005		
BARIUM (200.7)	MG/L	0.66	0.01	B0W068	
IRON (200.7)	MG/L	28	0.02	N0W068	
MANGANESE (200.7)	MG/L	0.24	0.01	G0W068	
Comments:					
Client ID: 703361-06			Lab ID:006		
BARIUM (200.7)	MG/L	0.37	0.01	B0W068	
IRON (200.7)	MG/L	29	0.02	N0W068	
MANGANESE (200.7)	MG/L	0.48	0.01	G0W068	
Comments:					

American Environmental Network, Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 703418
Client: AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number: 703361
Project Name: MARATHON OIL CO.
Project Location: MOC/IBGP
Test: Group of Single Metals

Client Id:	Lab Id:	Matrix:	Date/Time Sampled:	Date Received:
703361-01	001	WATER	19-MAR-97 1730	25-MAR-97
703361-02	002	WATER	20-MAR-97 1530	25-MAR-97
703361-03	003	WATER	20-MAR-97 1610	25-MAR-97
703361-04	004	WATER	20-MAR-97 1710	25-MAR-97
703361-05	005	WATER	20-MAR-97 0830	25-MAR-97
703361-06	006	WATER	20-MAR-97 0930	25-MAR-97

American Environmental Network, Inc.

"Method Report Summary"

Accession Number: 703418
Client: AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number: 703361
Project Name: MARATHON OIL CO.
Project Location: MOC/IBGP
Test: Group of Single Metals

Client Sample Id:	Parameter:	Unit:	Result:
703361-01	BARIUM (200.7)	MG/L	0.03
	IRON (200.7)	MG/L	0.67
	MANGANESE (200.7)	MG/L	0.03
703361-02	BARIUM (200.7)	MG/L	0.37
	IRON (200.7)	MG/L	0.69
	MANGANESE (200.7)	MG/L	0.11
703361-03	BARIUM (200.7)	MG/L	0.07
	IRON (200.7)	MG/L	6.8
	MANGANESE (200.7)	MG/L	0.33
703361-04	BARIUM (200.7)	MG/L	0.03
	IRON (200.7)	MG/L	6.5
	MANGANESE (200.7)	MG/L	0.64
703361-05	BARIUM (200.7)	MG/L	0.66
	IRON (200.7)	MG/L	28
	MANGANESE (200.7)	MG/L	0.24
703361-06	BARIUM (200.7)	MG/L	0.37
	IRON (200.7)	MG/L	29
	MANGANESE (200.7)	MG/L	0.48

American Environmental Network, Inc.

"Metals Quality Control Report"

Parameter:	BARIUM	IRON	MANGANESE
Batch Id:	B0W068	N0W068	G0W068
Blank Result:	<0.01	<0.02	<0.01
Anal. Method:	200.7	200.7	200.7
Prep. Method:	EPA 600	EPA 600	EPA 600
Analysis Date:	02-APR-97	02-APR-97	02-APR-97
Prep. Date:	02-APR-97	02-APR-97	02-APR-97
Sample Duplication			
Sample Dup:	703418-1	703418-1	703418-1
Rept Limit:	<0.01	<0.02	<0.01
Sample Result:	2.0	2.7	2.0
Dup Result:	2.1	2.7	2.0
Sample RPD:	5	0	0
Max RPD:	20	20	20
Dry Weight%	N/A	N/A	N/A
Matrix Spike			
Sample Spiked:	703418-1	703418-1	703418-1
Rept Limit:	<0.01	<0.02	<0.01
Sample Result:	0.03	0.67	0.03
Spiked Result:	2.0	2.7	2.0
Spike Added:	2.0	2.0	2.0
% Recovery:	99	102	99
% Rec Limits:	75-125	75-125	75-125
Dry Weight%	N/A	N/A	N/A
ICV			
ICV Result:	5.0	5.1	5.0
True Result:	5.0	5.0	5.0
% Recovery:	100	102	100
% Rec Limits:	90-110	90-110	90-110
LCS			
LCS Result:	2.0	2.1	2.0
True Result:	2.0	2.0	2.0
% Recovery:	100	105	100
% Rec Limits:	80-120	80-120	80-120

American Environmental Network, Inc.

"Quality Control Comments"

Batch Id:	Comments:
B0W068	ANALYST: JR
B0W068	The results reported under "Sample Duplication" are the MS/MSD.
N0W068	ANALYST: JR
N0W068	The results reported under "Sample Duplication" are the MS/MSD.
G0W068	ANALYST: JR
G0W068	The results reported under "Sample Duplication" are the MS/MSD.

American Environmental Network, Inc.

----- Common Footnotes Metals -----

N/A = NOT APPLICABLE.
N/S = NOT SUBMITTED.
N/C = SAMPLE AND DUPLICATE RESULTS ARE AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RPD IS "NOT CALCULABLE" AND NO CONTROL LIMITS APPLY.
N/D = NOT DETECTED.
DISS. OR D = DISSOLVED
T & D = TOTAL AND DISSOLVED
R = REACTIVE
T = TOTAL
G = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE RESULT IS AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "IN CONTROL".
Q = THE ANALYTICAL (POST-DIGESTION) SPIKE IS REPORTED DUE TO PERCENT RECOVERY BEING OUTSIDE ACCEPTANCE LIMITS ON THE MATRIX (PRE-DIGESTION) SPIKE.
# = ELEVATED REPORTING LIMIT DUE TO INSUFFICIENT SAMPLE.
+ = ELEVATED REPORTING LIMIT DUE TO DILUTION INTO CALIBRATION RANGE.
* = ELEVATED REPORTING LIMIT DUE TO MATRIX INTERFERENCE. (DILUTION PRIOR TO ANALYSIS)
@ = ADJUSTED REPORTING LIMIT DUE TO SAMPLE MATRIX. (DILUTION PRIOR TO DIGESTION)
P = ANALYTICAL (POST DIGESTION) SPIKE.
I = DUPLICATE INJECTION.
& = AUTOMATED
F = SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
N/C+ = NOT CALCULABLE
N/C* = NOT CALCULABLE; SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
H = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL".
A = SAMPLE AND DUPLICATE RESULTS ARE "OUT OF CONTROL".
Z = THE SAMPLE RESULT FOR THE SPIKE IS BELOW THE REPORTING LIMIT. HOWEVER, THIS RESULT IS REPORTED FOR ACCURATE QC CALCULATIONS.
NH= SAMPLE AND / OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL". SAMPLE IS NON-HOMOGENEOUS.
J = (FLORIDA DEP 'J' FLAG) - MATRIX SPIKE AND POST SPIKE RECOVERY IS OUT OF THE ACCEPTABLE RANGE. SEE OUT OF CONTROL EVENTS FORM.
U = (FLORIDA DEP 'U' FLAG) - THE COMPOUND WAS ANALYZED FOR, BUT NOT DETECTED.
S = METHOD OF STANDARD ADDITIONS (MSA) WAS PERFORMED ON THIS SAMPLE.

FROM ANALYSIS REPORT:
RL= REPORTING LIMIT BASED ON METHOD DETECTION LIMIT STUDIES.
Q= QUALIFIER (FOOTNOTE)

FROM QUALITY CONTROL REPORT:
RPD= RELATIVE PERCENT DEVIATION.
RPT LIMIT= REPORTING LIMIT BASED ON METHOD DETECTION LIMIT STUDIES.

NOTE: THE UNITS REPORTED ON THE QUALITY CONTROL REPORT ARE REPORTED ON AN AS RUN BASIS.

SW-846, 3rd Edition, latest revision.
EPA 600/4-79-020, Revised March 1983.
NIOSH Manual of Analytical Methods, 4th Edition.
Standard Methods For the Examination of Water and Wastewater, 18th Edition, 1992.
Methods For the Determination of Metals in Environmental Samples - Supplement I, EPA 600/R-94-111, May 1994.

GJ = GARY JACOBS
JLH = JAMES L. HERED
CD = CHRISTY DRAPER
JR = JOHN REED
LV = LASSANDRA VON APPEN

American Environmental Network, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	703418
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	703361
Project Name:	MARATHON OIL CO.
Project Location:	MOC/IBGP
Test:	ACID EXTRACTABLES (8270)
Analysis Method:	8270/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Extraction Method:	3520/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Matrix:	WATER
QC Level:	II

Lab Id:	001	Sample Date/Time:	19-MAR-97 1730
Client Sample Id:	703361-01	Received Date:	25-MAR-97
Batch: ALW062		Extraction Date:	26-MAR-97
Blank: A	Dry Weight %: N/A	Analysis Date:	04-APR-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
PHENOL	MG/L	ND	0.004	
2-FLUOROPHENOL	%REC/SURR	76	21-100	
PHENOL-D6	%REC/SURR	72	10-100	
2,4,6-TRIBROMOPHENOL	%REC/SURR	75	10-123	
ANALYST	INITIALS	RW		

Comments:

American Environmental Network, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	703418
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	703361
Project Name:	MARATHON OIL CO.
Project Location:	MOC/IBGP
Test:	ACID EXTRACTABLES (8270)
Analysis Method:	8270/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Extraction Method:	3520/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Matrix:	WATER
QC Level:	II

Lab Id:	002	Sample Date/Time:	20-MAR-97 1530
Client Sample Id:	703361-02	Received Date:	25-MAR-97
Batch: ALW062		Extraction Date:	26-MAR-97
Blank: A	Dry Weight %: N/A	Analysis Date:	04-APR-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
PHENOL	MG/L	ND	0.003	
2-FLUOROPHENOL	%REC/SURR	89	21-100	
PHENOL-D6	%REC/SURR	76	10-100	
2,4,6-TRIBROMOPHENOL	%REC/SURR	100	10-123	
ANALYST	INITIALS	RW		

Comments:

American Environmental Network, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	703418
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	703361
Project Name:	MARATHON OIL CO.
Project Location:	MOC/IBGP
Test:	ACID EXTRACTABLES (8270)
Analysis Method:	8270/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Extraction Method:	3520/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Matrix:	WATER
QC Level:	II

Lab Id:	003	Sample Date/Time:	20-MAR-97 1610
Client Sample Id:	703361-03	Received Date:	25-MAR-97
Batch: ALW062		Extraction Date:	26-MAR-97
Blank: A	Dry Weight %: N/A	Analysis Date:	04-APR-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
PHENOL	MG/L	ND	0.003	
2-FLUOROPHENOL	%REC/SURR	92	21-100	
PHENOL-D6	%REC/SURR	81	10-100	
2,4,6-TRIBROMOPHENOL	%REC/SURR	101	10-123	
ANALYST	INITIALS	RW		

Comments:

American Environmental Network, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	703418
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	703361
Project Name:	MARATHON OIL CO.
Project Location:	MOC/IBGP
Test:	ACID EXTRACTABLES (8270)
Analysis Method:	8270/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Extraction Method:	3520/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Matrix:	WATER
QC Level:	II

Lab Id:	004	Sample Date/Time:	20-MAR-97 1710
Client Sample Id:	703361-04	Received Date:	25-MAR-97
Batch: ALW062		Extraction Date:	26-MAR-97
Blank: A	Dry Weight %: N/A	Analysis Date:	04-APR-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
PHENOL	MG/L	ND	0.003	
2-FLUOROPHENOL	%REC/SURR	75	21-100	
PHENOL-D6	%REC/SURR	52	10-100	
2,4,6-TRIBROMOPHENOL	%REC/SURR	96	10-123	
ANALYST	INITIALS	RW		

Comments:

American Environmental Network, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	703418
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	703361
Project Name:	MARATHON OIL CO.
Project Location:	MOC/IBGP
Test:	ACID EXTRACTABLES (8270)
Analysis Method:	8270/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Extraction Method:	3520/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Matrix:	WATER
QC Level:	II

Lab Id:	005	Sample Date/Time:	20-MAR-97 0830
Client Sample Id:	703361-05	Received Date:	25-MAR-97
Batch: ALW062		Extraction Date:	26-MAR-97
Blank: A	Dry Weight %: N/A	Analysis Date:	04-APR-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
PHENOL	MG/L	ND	0.003	
2-FLUOROPHENOL	%REC/SURR	76	21-100	
PHENOL-D6	%REC/SURR	60	10-100	
2,4,6-TRIBROMOPHENOL	%REC/SURR	111	10-123	
ANALYST	INITIALS	RW		

Comments:

American Environmental Network Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession:	703418
Client:	AMERICAN ENVIRONMENTAL NETWORK (NEW MEXICO) INC.
Project Number:	703361
Project Name:	MARATHON OIL CO.
Project Location:	MOC/IBGP
Test:	ACID EXTRACTABLES (8270)
Analysis Method:	8270/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Extraction Method:	3520/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Matrix:	WATER
QC Level:	II

Lab Id:	006	Sample Date/Time:	20-MAR-97 0930
Client Sample Id:	703361-06	Received Date:	25-MAR-97
Batch: ALW062		Extraction Date:	26-MAR-97
Blank: A	Dry Weight %: N/A	Analysis Date:	04-APR-97

Parameter:	Units:	Results:	Rpt Lmts:	Q:
PHENOL	MG/L	ND	0.006	
2-FLUOROPHENOL	%REC/SURR	83	21-100	
PHENOL-D6	%REC/SURR	72	10-100	
2,4,6-TRIBROMOPHENOL	%REC/SURR	87	10-123	
ANALYST	INITIALS	RW		

Comments:

American Environmental Network, Inc.

"QC Report"

Title: Water Blank
Batch: ALW062
Analysis Method: 8270/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Extraction Method: 3520/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.

Blank Id: A Date Analyzed: 03-APR-97 Date Extracted: 26-MAR-97

Parameters:	Units:	Results:	Reporting Limits:
P-CHLORO-M-CRESOL	UG/L	ND	10
2-CHLOROPHENOL	UG/L	ND	10
O-CRESOL	UG/L	ND	10
M,P CRESOL	UG/L	ND	10
2,4-DICHLOROPHENOL	UG/L	ND	10
2,6-DICHLOROPHENOL	UG/L	ND	10
2,4-DIMETHYLPHENOL	UG/L	ND	10
4,6-DINITRO-O-CRESOL	UG/L	ND	50
2,4-DINITROPHENOL	UG/L	ND	10
2-NITROPHENOL	UG/L	ND	10
4-NITROPHENOL	UG/L	ND	50
PENTACHLOROPHENOL	UG/L	ND	50
PHENOL	UG/L	ND	10
2,3,4,6-TETRACHLOROPHENOL	UG/L	ND	10
2,4,5-TRICHLOROPHENOL	UG/L	ND	50
2,4,6-TRICHLOROPHENOL	UG/L	ND	10
ACENAPHTHENE	UG/L	ND	10
ACENAPHTHYLENE	UG/L	ND	10
ACETOPHENONE	UG/L	ND	10
2-ACETYLAMINOFLUORENE	UG/L	ND	10
4-AMINOBIPHENYL	UG/L	ND	10
ANILINE	UG/L	ND	10
ANTHRACENE	UG/L	ND	10
ARAMITE	UG/L	ND	10
BENZO (A) ANTHRACENE	UG/L	ND	10
BENZO (A) PYRENE	UG/L	ND	10
BENZO (B) FLUORANTHENE	UG/L	ND	10
BENZO (G,H,I) PERYLENE	UG/L	ND	10
BENZO (K) FLUORANTHENE	UG/L	ND	10
BENZYL ALCOHOL	UG/L	ND	10
BIS(2-CHLORO-1-METHYLETHYL)ETHER	UG/L	ND	10
BIS(2-CHLOROETHOXY)METHANE	UG/L	ND	10
BIS(2-CHLOROETHYL)ETHER	UG/L	ND	10
BIS(2-ETHYLHEXYL)PHTHALATE	UG/L	ND	10
4-BROMOPHENYL PHENYL ETHER	UG/L	ND	10
BUTYLBENZYL PHTHALATE	UG/L	ND	10
P-CHLOROANILINE	UG/L	ND	10
CHLOROBENZILATE	UG/L	ND	10
2-CHLORONAPHTHALENE	UG/L	ND	10
4-CHLOROPHENYL PHENYL ETHER	UG/L	ND	10
CHRYSENE	UG/L	ND	10
DIALLATE	UG/L	ND	10
DIBENZO (A,H) ANTHRACENE	UG/L	ND	10
DIBENZOFURAN	UG/L	ND	10
1,2-DICHLOROBENZENE	UG/L	ND	10
1,3-DICHLOROBENZENE	UG/L	ND	10

American Environmental Network, Inc.

"QC Report"

Title: Water Blank
Batch: ALW062
Analysis Method: 8270/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Extraction Method: 3520/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.

Parameters:	Units:	Results:	Reporting Limits:
1,4-DICHLOROBENZENE	UG/L	ND	10
3,3'-DICHLOROBENZIDINE	UG/L	ND	50
DIETHYLPHTHALATE	UG/L	ND	10
DIMETHOATE	UG/L	ND	10
P-DIMETHYLAMINOAZOBENZENE	UG/L	ND	10
7,12-DIMETHYLBENZ(A)ANTHRACENE	UG/L	ND	10
3,3'-DIMETHYLBENZIDINE	UG/L	ND	10
A,A-DIMETHYLPHENETHYLAMINE	UG/L	ND	10
DIMETHYLPHTHALATE	UG/L	ND	10
DI-N-BUTYLPHTHALATE	UG/L	ND	10
M-DINITROBENZENE	UG/L	ND	10
2,4-DINITROTOLUENE	UG/L	ND	10
2,6-DINITROTOLUENE	UG/L	ND	10
DI-N-OCTYLPHTHALATE	UG/L	ND	10
DIPHENYLAMINE	UG/L	ND	10
ETHYL METHANESULFONATE	UG/L	ND	10
FAMPHUR	UG/L	ND	10
FLUORANTHENE	UG/L	ND	10
FLUORENE	UG/L	ND	10
HEXACHLOROBENZENE	UG/L	ND	10
HEXACHLOROBUTADIENE	UG/L	ND	10
HEXACHLOROCYCLOPENTADIENE	UG/L	ND	10
HEXACHLOROETHANE	UG/L	ND	10
HEXACHLOROPHENE	UG/L	ND	10
HEXACHLOROPROPENE	UG/L	ND	10
INDENO (1,2,3-CD) PYRENE	UG/L	ND	10
ISODRIN	UG/L	ND	10
ISOPHORONE	UG/L	ND	10
ISOSAFROLE	UG/L	ND	10
KEPONE	UG/L	ND	10
METHAPYRILENE	UG/L	ND	10
3-METHYLCHOLANTHRENE	UG/L	ND	10
METHYL METHANESULFONATE	UG/L	ND	10
1-METHYLNAPHTHALENE	UG/L	ND	10
2-METHYLNAPHTHALENE	UG/L	ND	10
NAPHTHALENE	UG/L	ND	10
1,4-NAPHTHOQUINONE	UG/L	ND	10
1-NAPHTHYLAMINE	UG/L	ND	10
2-NAPHTHYLAMINE	UG/L	ND	10
2-NITROANILINE	UG/L	ND	50
3-NITROANILINE	UG/L	ND	50
4-NITROANILINE	UG/L	ND	50
NITROBENZENE	UG/L	ND	10
5-NITRO-O-TOLUIDINE	UG/L	ND	10
4-NITROQUINOLINE-1-OXIDE	UG/L	ND	10
N-NITROSODIETHYLAMINE	UG/L	ND	10
N-NITROSODIMETHYLAMINE	UG/L	ND	10

American Environmental Network, Inc.

"QC Report"

Title: Water Blank
Batch: ALW062
Analysis Method: 8270/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Extraction Method: 3520/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.

Parameters:	Units:	Results:	Reporting Limits:
N-NITROSODI-N-BUTYLAMINE	UG/L	ND	10
N-NITROSODIPHENYLAMINE	UG/L	ND	10
N-NITROSOMETHYLETHYLAMINE	UG/L	ND	10
N-NITROSOMORPHOLINE	UG/L	ND	10
N-NITROSOPIPERIDINE	UG/L	ND	10
N-NITROSOPYRROLIDINE	UG/L	ND	10
PARATHION	UG/L	ND	10
PENTACHLOROBENZENE	UG/L	ND	10
PENTACHLOROETHANE	UG/L	ND	10
PENTACHLORONITROBENZENE	UG/L	ND	10
PHENACETIN	UG/L	ND	10
PHENANTHRENE	UG/L	ND	10
2-PICOLINE	UG/L	ND	10
P-PHENYLENEDIAMINE	UG/L	ND	10
PRONAMIDE	UG/L	ND	10
PYRENE	UG/L	ND	10
PYRIDINE	UG/L	ND	10
SAFROLE	UG/L	ND	10
SULFOTEPP	UG/L	ND	10
1,2,4,5-TETRACHLOROBENZENE	UG/L	ND	10
THIONAZIN	UG/L	ND	10
O-TOLUIDINE	UG/L	ND	10
1,2,4 TRICHLOROBENZENE	UG/L	ND	10
SYM-TRINITROBENZENE	UG/L	ND	10
O,O,O-TRIETHYL PHOSPHOROTHIATE	UG/L	ND	10
BENZIDINE	UG/L	ND	10
BIS(2-CHLOROISOPROPYL)ETHER	UG/L	ND	10
2-(SEC BUTYL)4,6-DINITRO-PHENOL(DINOSEB)	UG/L	ND	10
N-NITROSO-DI-N-PROPYLAMINE	UG/L	ND	10
6-METHYL CHRYSENE	UG/L	ND	20
INDENE	UG/L	ND	20
QUINOLINE	UG/L	ND	50
BENZENETHIOL	UG/L	ND	20
2-FLUOROBIPHENYL	%REC/SURR	88	43-116
TERPHENYL-D14	%REC/SURR	90	33-124
NITROBENZENE-D5	%REC/SURR	74	35-114
2-FLUOROPHENOL	%REC/SURR	65	21-100
PHENOL-D6	%REC/SURR	65	10-100
2,4,6-TRIBROMOPHENOL	%REC/SURR	65	10-123
ANALYST	INITIALS	RW	

Comments:

American Environmental Network, Inc.

"QC Report"

Title: Water Reagent
Batch: ALW062
Analysis Method: 8270/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Extraction Method: 3520/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.

RS Date Analyzed: 03-APR-97
RSD Date Analyzed: 03-APR-97

RS Date Extracted: 26-MAR-97
RSD Date Extracted: 26-MAR-97

Parameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
PHENOL	150	<10	128	85	102	68	22	32	5-112
2-CHLOROPHENOL	150	<10	142	95	112	75	24	27	40-120
1,4-DICHLOROBENZENE	100	<10	74	74	86	86	15	29	32-119
N-NITRO-DI-N-PROPYLAMINE	100	<10	76	76	82	82	8	30	26-128
1,2,4 TRICHLOROBENZENE	100	<10	70	70	80	80	13	28	44-142
4-CHLORO-3-METHYLPHENOL	150	<10	126	84	112	75	11	28	30-128
ACENAPHTHENE	100	<10	98	98	104	104	6	26	47-145
4-NITROPHENOL	150	<50	102	68	91	61	11	50	1-132
2,4-DINITROTOLUENE	100	<10	98	98	100	100	2	29	39-138
PENTACHLOROPHENOL	150	<50	112	75	102	68	10	24	15-157
PYRENE	100	<10	94	94	100	100	6	25	52-115
Surrogates:									
NITROBENZENE-D5				77		82			35-114
2-FLUOROBIPHENYL				88		88			43-116
TERPHENYL-D14				91		96			33-124
PHENOL-D6				76		58			10-100
2-FLUOROPHENOL				78		59			21-100
2,4,6-TRIBROMOPHENOL				77		67			10-123

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

American Environmental Network, Inc.

"QC Report"

Title: Water Matrix
Batch: ALW062
Analysis Method: 8270/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.
Extraction Method: 3520/Test Methods for Evaluating Solid and Haz Waste, SW-846, 3rd Ed.

Dry Weight %: N/A
Sample Spiked: 703304-2

MS Date Analyzed: 03-APR-97
MSD Date Analyzed: 03-APR-97

MS Date Extracted: 28-MAR-97
MSD Date Extracted: 28-MAR-96

Parameters:	Spike Added	Sample Conc	MS Conc	MS %Rec	MSD Conc	MSD %Rec	RPD	RPD Lmts	Rec Lmts
PHENOL	300	<10	216	72	260	87	19	38	5-112
2-CHLOROPHENOL	300	<10	232	77	284	95	21	25	38-120
1,4-DICHLOROBENZENE	200	<10	148	74	156	78	5	27	39-112
N-NITRO-DI-N-PROPYLAMINE	200	<10	164	82	180	90	9	30	32-125
1,2,4 TRICHLOROBENZENE	200	<10	160	80	172	86	7	30	44-118
4-CHLORO-3-METHYLPHENOL	300	<10	208	69	248	83	18	23	42-131
ACENAPHTHENE	200	<10	188	94	192	96	2	21	47-131
4-NITROPHENOL	300	<50	136	45	160	53	16	36	1-116
2,4-DINITROTOLUENE	200	<10	160	80	172	86	7	22	39-138
PENTACHLOROPHENOL	300	<50	204	68	248	83	20	36	14-164
PYRENE	200	<10	180	90	192	96	6	21	52-115
Surrogates:									
NITROBENZENE-D5				81		86			35-114
2-FLUOROBIPHENYL				84		89			43-116
TERPHENYL-D14				85		90			33-124
PHENOL-D6				70		81			10-100
2-FLUOROPHENOL				68		78			21-100
2,4,6-TRIBROMOPHENOL				76		87			10-123

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

American Environmental Network, Inc.

Common notation for Organic reporting

N/S = NOT SUBMITTED
N/A = NOT APPLICABLE
D = DILUTED OUT
UG/L = PARTS PER BILLION.
UG/KG = PARTS PER BILLION.
MG/KG = PARTS PER MILLION.
MG/L = PARTS PER MILLION.
MG/M3 = MILLIGRAMS PER CUBIC METER.
NG = NANOGRAMS.
UG = MICROGRAMS.
PPBV = PARTS PER BILLION/VOLUME.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS
J = THE REPORTED VALUE IS EITHER LESS THAN THE REPORTING LIMIT BUT GREATER THAN ZERO, OR QUANTITATED AS A TIC; THEREFORE, IT IS ESTIMATED.
JJ = REPORTED VALUE IS ESTIMATED DUE TO MATRIX INTERFERENCE.
ND = NOT DETECTED ABOVE REPORT LIMIT.
RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.
RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

ORGANIC SOILS ARE REPORTED ON A DRY WEIGHT BASIS.

DUE TO THE NATURE OF THE SAMPLE MATRIX, MATRIX SPIKE/MATRIX SPIKE DUPLICATE ANALYSIS CANNOT BE PERFORMED FOR AIR ANALYSIS.

CLP SOW 1991, USEPA CONTRACT LABORATORY PROGRAM, STATEMENT OF WORK FOR ORGANICS ANALYSIS, DOCUMENT NUMBER OLM01.8, AUGUST 1991.

AEN-PN USES THE MOST CURRENT PROMULGATED METHODS CONTAINED IN THE REFERENCE MANUALS.

LP = LEVERNE PETERSON	RW = RITA WINGO
LD = LARRY DILMORE	LL = LANCE LARSON
PL = PAUL LESCHENSKY	BV = BEN VAUGHN
DWB = DAVID BOWERS	

American Environmental Network
Albuquerque, New Mexico

Interlab Chain of Custody

DATE: 3/24 PAGE: 1 OF 1

NETWORK PROJECT MANAGER: KIMBERLY D. McNEILL

COMPANY: American Environmental Network
ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER: Kim McNeill

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Metals - TAL	Metals - PP List	Metals - RCRA	RCRA Metals by TCLP (1311)	Barium, Manganese, Fe	TDS, SO4, F	~~TOX~~ ~~Total~~ Phenolics by 8270	TOC	Gen Chemistry			Oil and Grease	BOD	COD	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	Polynuclear Aromatics (610/8310)	8240 (TCLP 1311) ZHE	8270 (TCLP 1311)			TC-14	Gross Alpha/Beta				NUMBER OF CONTAINERS
703361-01	3/19/97	1730	AQ	1					X	X	X																						
-02	3/20	1530		2					X	X	X																						
-03	3/20	1610		3					X	X	X																						
-04	3/20	1710		4					X	X	X																						
-05	3/21	0830		5					X	X	X																						
-06	3/21	0930		6					X	X	X																						

PROJECT INFORMATION

PROJECT NUMBER: 703361
PROJECT NAME: Marathon Oil Co.
QC LEVEL: STD IV
QC REQUIRED: MS MSD BLANK
TAT STANDARD RUSH!

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS
CHAIN OF CUSTODY SEALS
INTACT?
RECEIVED GOOD COND./COLD
LAB NUMBER 703418

DUE DATE: 4/5
RUSH SURCHARGE:
CLIENT DISCOUNT:
SPECIAL CERTIFICATION REQUIRED: ☐YES ☐NO

Phenol by 8270
0.003 Mg/L

SAMPLES SENT TO:

SAN DIEGO	
Paragon	
RENTON	
PENSACOLA	X
PORTLAND	
PHOENIX	

RELINQUISHED BY: 1.
Signature: John Caldwell Time: 1700
Printed Name: John Caldwell Date: 3/24/97
Albuquerque

RELINQUISHED BY: 2.
Signature Time
Printed Name: 3/25/97 Date:
Company: pwc

RECEIVED BY: 1.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: (LAB) 2.
Signature: Bob Elsperman Time: 0832
Printed Name: R. ELSPERMAN Date: 3/25/97
Company: BENFL

American Environmental Network of Florida
PROJECT SAMPLE INSPECTION FORM

Lab Accession #: 703418 Date Received: 25-Mar-97

1. Was there a Chain of Custody? Yes No♣
2. Was Chain of Custody properly filled out and relinquished? Yes No♣
3. Were samples received cold? (Criteria: 1° - 4°C: AEN-SOP 1055) Yes No♣ N/A
4. Were all samples properly labeled and identified? Yes No♣
5. Did samples require splitting? Yes♣ No
   Req By: PM Client Other♦
6. Were samples received in proper containers for analysis requested? Yes No♣
7. Were all sample containers received intact? Yes No♣
8. Were samples checked for preservative? *(Check pH of all H_2O requiring preservative except VOA vials that require zero headspace)*+ Yes No♣ N/A
9. Is there sufficient volume for analysis requested? Yes No♣
10. Were samples received within Holding Time? (REFER TO AEN-SOP 1040) Yes No♣
11. Is Headspace visible > ¼" in diameter in VOA vials?* If any headspace is evident, comment in out-of-control section. Yes♣ No N/A
12. If sent, were matrix spike bottles returned? Yes No♣ N/A
13. Was Project Manager notified of problems? (initials:_____) Yes No♣ N/A

Airbill Number(s): _____

Shipped By: FEDEX

Cooler Number(s): N/S

Shipping Charges: N/A

Cooler Weight(s): N/A

Cooler Temp(s) (°C): 2°C - CCK4

(LIST THERMOMETER NUMBER(S) FOR VERIFICATION)

Out of Control Events and Inspection Comments:

Client Cooler

(USE BACK OF PSIF FOR ADDITIONAL NOTES AND COMMENTS)

Inspected By: PJE Date: 3/25/97 Logged By: PJE Date: 3/25/97

♣ *Note all Out-of-Control and/or questionable events on Comment Section of this form.*

♦ *Note who requested the splitting of samples on the Comment Section of this form.*

\+ *All preservatives for the State of North Carolina, the State of New York, and other requested samples are to be recorded on the sheet provided to record pH results (AEN-SOP 938, section 2.2.9).*

* *According to EPA, ¼" of headspace is allowed in 40 ml vials requiring volatile analysis, however, AEN makes it policy to record any headspace as out-of-control (AEN-SOP 938, section 2.2.12).*

American Environmental Network (NM), Inc.
Albuquerque • Phoenix • Pensacola • Portland • Pleasant Hills • Columbia

CHAIN OF CUSTODY

DATE: 3/19/97 PAGE: 1 OF 1

AEN LAB I.D. 70336/

SHADED AREAS ARE FOR LAB USE ONLY.

PLEASE FILL THIS FORM IN COMPLETELY.

PROJECT MANAGER: Susan Fields

COMPANY: Fluor Daniel GTI
ADDRESS: 2501 Yale Blvd SE #204
Albuquerque New Mexico 87106
PHONE: 505-242-3113
FAX: 505-242-1103
BILL TO: Marathon Oil Company (Bob Menzie)
COMPANY:
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB I.D.	Petroleum Hydrocarbons (418.1) TRPH	(MOD.8015) Diesel/Direct/Inject	(M8015) Gas/Purge & Trap	Gasoline/BTEX & MTBE (M8015/8020)	BTXE/MTBE (8020)	BTEX & Chlorinated Aromatics (602/8020)	BTEX/MTBE/EDC & EDB (8020/8010/Short)	Chlorinated Hydrocarbons (601/8010)	504 EDB ☐ / DBCP ☐	Polynuclear Aromatics (610/8310)	Volatile Organics (624/8240) GC/MS	Volatile Organics (8260) GC/MS	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Phenol	General Chemistry:	Barium, Manganese, Iron	TDS, SO4, F	Priority Pollutant Metals (13)	Target Analyte List Metals (23)	RCRA Metals (8)	RCRA Metals by TCLP (Method 1311)	Metals:	NUMBER OF CONTAINERS
MW-60	3/19/97	17:30	AQ	-01																X		X	X						3
MW-41	3/20/97	15:30	↓	-02																X		X	X						3
MW-49	3/20/97	16:10	↓	-03																X		X	X						3
MW-50	3/20/97	17:10	↓	-04																X		X	X						3
MW-56	3/21/97	08:30	↓	-05																X		X	X						3
MW-13	3/21/97	09:30	↓	-06																X		X	X						3

PROJECT INFORMATION

PROJ. NO.: 023350224.64
PROJ. NAME: MOC/IBGP
P.O. NO.:
SHIPPED VIA:

SAMPLE RECEIPT

NO. CONTAINERS	18
CUSTODY SEALS	Y N/NA
RECEIVED INTACT	Yes
BLUE ICE/ICE	2°C

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) [ ] 24hr [ ] 48hr [ ] 72hr [ ] 1 WEEK (NORMAL) [X] JC
CERTIFICATION REQUIRED: [ ] NM [ ] SDWA [ ] OTHER
METHANOL PRESERVATION [ ]
COMMENTS: FIXED FEE [ ]

RELINQUISHED BY: 1.
Signature: [signature] Time: 08:10
Printed Name: Charles T. Briscoe Date: 3/24/97
Company: Fluor Daniel GTI

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: 1.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: (LAB) 2.
Signature: [signature] Time: 08:20
Printed Name: John [signature] Date: 3/24/97
American Enviromental Network (NM), Inc.

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

April 10, 1997

Mr. William C. Olson
Hydrogeologist
Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Remediation Project
Notification of Second Quarter 1997 monitoring well sampling

Dear Mr. Olson:

Marathon is notifying your office that the Second Quarter groundwater sampling episode will commence on Sunday, April 27, 1997. Fluor Daniel GTI, Inc. will be conducting the gauging on Sunday afternoon, Monday, and Tuesday of that week. Purging and sampling of the Lower Queen and Shallow wells will begin on Wednesday morning.

Per our telephone conversation on April 4, I understand that you would like to split samples collected from the newly installed monitoring wells with us during this quarterly event. If you let me know the wells you would like to sample, I will organize the order of sampling so that these wells will be sampled on Wednesday and Thursday. Please use the attached base maps of the Shallow zone and Lower Queen wells to select the wells for split sampling. Note that the Shallow zone map shows only those wells that may contain enough water to sample. The Lower Queen base map shows all wells. Please call me or email me to let me know which wells you choose. If you have any questions, please contact me at (915) 687-8312 or menzie@hou.moc.com.

Sincerely,

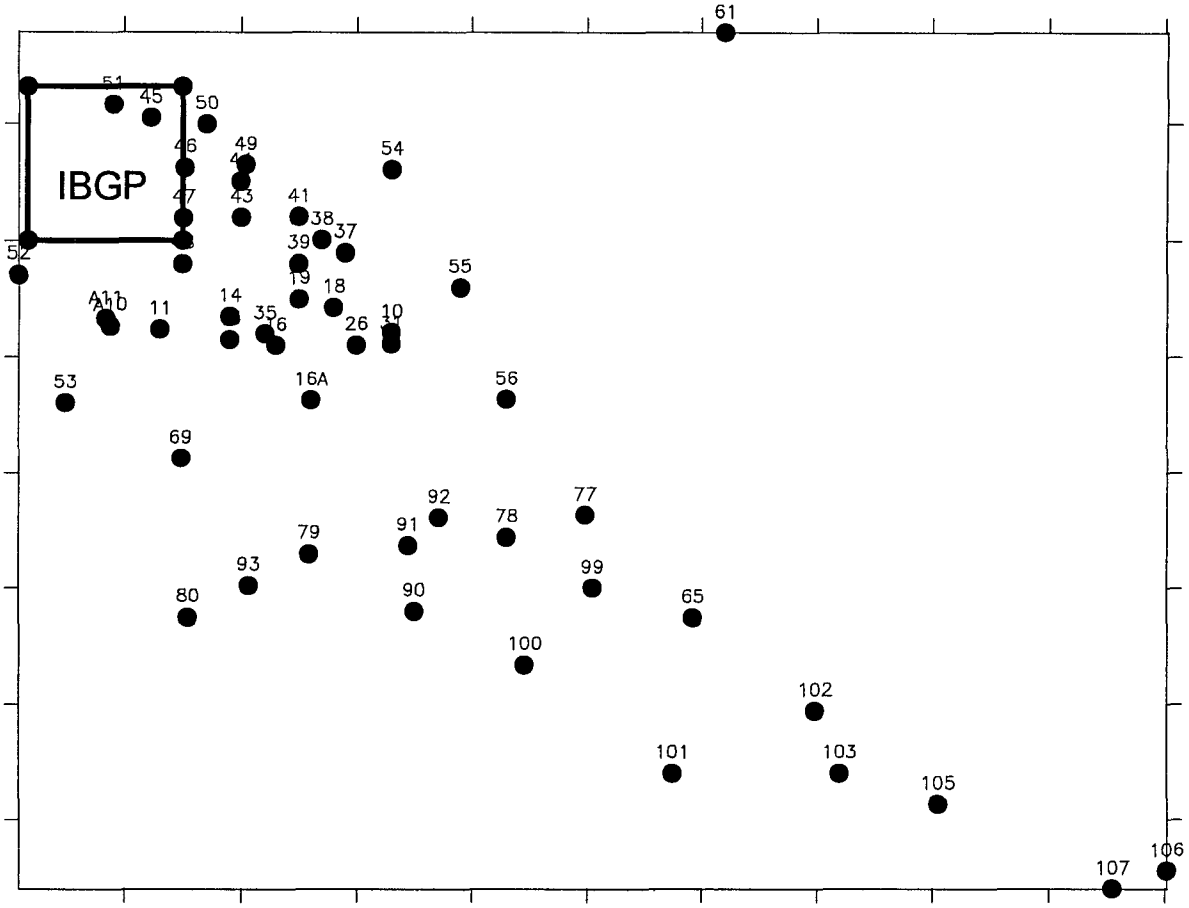
Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Advanced Environmental & Safety Specialist

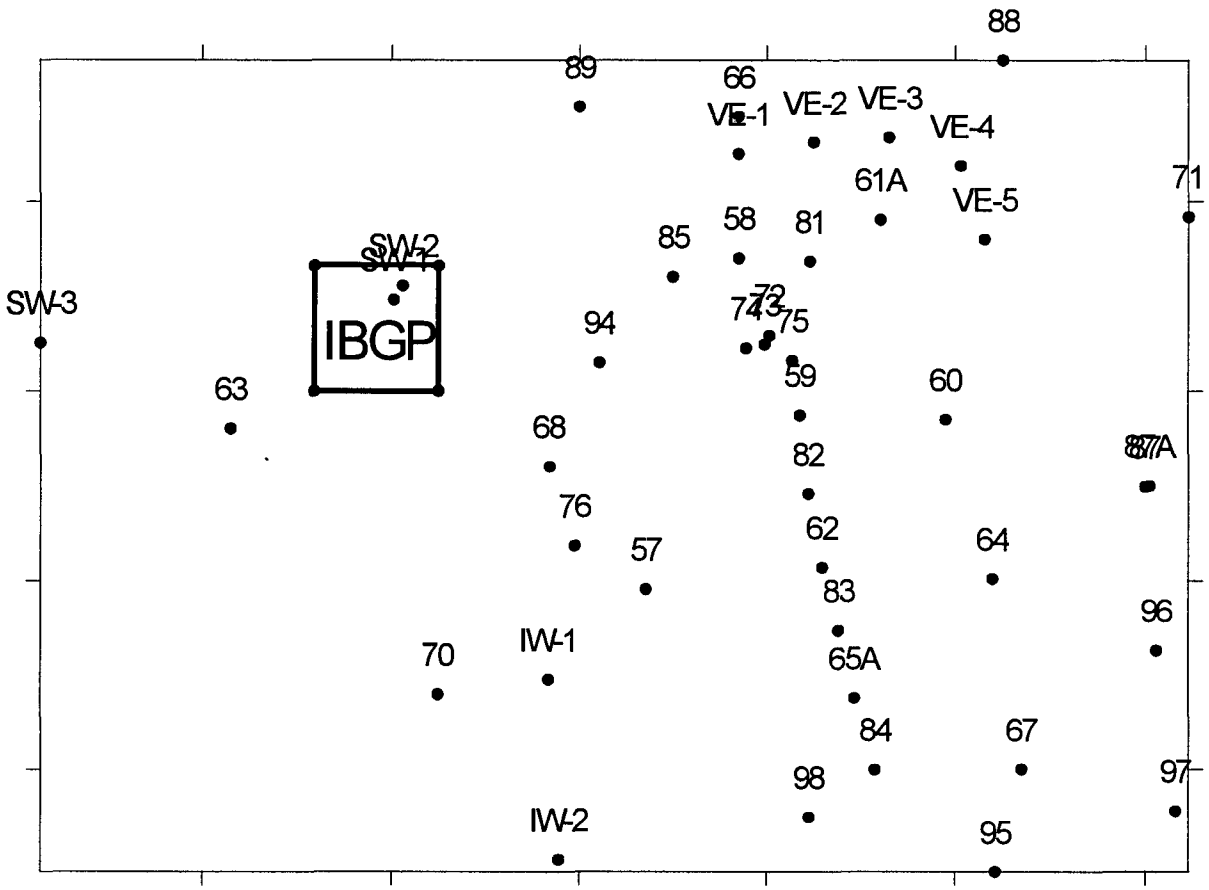
c: S. Fields, Fluor Daniel GTI, Albuquerque
C. M. Schweser, Marathon, IBGP
F. D. Searle, Marathon, Midland

File: 568-00

Shallow Zone Base Map



Lower Queen Base Map



OCD/Marathon Indian Basin Meeting 4/9/97 9:30 am

OCD considers remediation under 19(21)
Majority of contamination from 19(21) activities
MOC can work under prior regs (grandfathered)

Review MOC 3/13/97 letter

MOC has not discussed this issue with BLM

OCD will respond to 3/13 correspondence by next week

OCD + MOC will meet again to discuss after MOC meets with BLM, and GTI

OCD concerned about RA including cummulative effects of contaminants

Attendees - Bill Olson - OCD
Roger Anderson - "
Mark Ashley - "
Hamid Carroll - "
Bob Menzie - Marathon
Lou Soldano - Marathon legal
David Searle - Marathon
Louis Rose - Montgomery & Andrews

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

March 13, 1997

RECEIVED
MAR 17 1997
Environmental Bureau
Oil Conservation Division

Mr. William C. Olson
Hydrogeologist
Environmental Bureau
Oil Conservation Division
2040 Pacheco Street
Santa Fe, New Mexico 87501

Re: Indian Basin Remediation Project; Response to OCD Comments on *Workplan for Risk Assessment to Establish Alternative Abatement Standards, Marathon Oil Company, Indian Basin Remediation Project*

Dear Mr. Olson:

Marathon has reviewed your letter of February 28, 1996, regarding Marathon's *Workplan for Risk Assessment to Establish Alternative Abatement Standards, Marathon Oil Company, Indian Basin Remediation* Project, and, taking into consideration our discussions of October 29, 1996, at the OCD offices in Santa Fe, submits the following response.

OCD Comment 1: ***Section 2.2 lists only benzene, toluene, ethyl benzene and xylene (BTEX) as chemicals of potential concern (COPC). Chloride and total dissolved solids in ground water at the site exceed New Mexico Water Quality Control Commission ground water standards and must be considered as COPC's. Please redraft this section to include a discussion of why metals, chloride and total dissolved solids are not COPC's. The discussion also needs to include relevant data in support of MOC's determination of COPC's such as summary tables of ground water analyses for polynuclear aromatic hydrocarbons, metals and TDS similar to those presented for BTEX and chloride.***

For purposes of the proposed risk assessment, contaminants other than BTEX are not COPC's, because Marathon does not contemplate seeking alternative abatement standards for any contaminants except BTEX. For this reason, Marathon proposes that no contaminants other than BTEX be designated as COPC's in the workplan.

OCD Comment 2.a: ***Section 2.4 disregards significant exposure pathways. The future off-site uses presented do not consider potential use of ground water as a source of drinking water, industrial use or stock watering within the contaminated ground water plume. Since MOC does not own the surface lands overlying a large***

portion of the contaminant plume, MOC cannot control future uses in what is considered the "Off-Site" areas. Therefore, this section needs to be redrafted to include potential future residential, industrial and stock watering uses of ground water within the plume area.

Marathon believes there is no reasonable expectation that groundwater in which the COPCs exceed standards will be used as a human drinking water supply. All of the offsite surface which lies over the plume is owned by the United States and is managed by the BLM. Some surface near the plume is owned by the State of New Mexico and managed by the State Land Office. The BLM-managed lands are classified as not for sale or trade and BLM indicates no change is likely to that classification or in current allowed surface uses, which do not include residential use. The risk assessment will consider use of ground water from within the plume for stock watering, oil and gas production operations and Off-Site Gas Plant operations. It will also consider exposure to those working on the IBRP pump, treat and infiltrate system. The feasibility of non-oil and gas mining operations which might reasonably be expected to encounter ground water will be examined. SLO policies toward the surface will be similarly documented and the risk assessment adjusted if necessary.

<u>OCD Comment 2.b</u>: ***The text in Section 2.4 states that "the exposure pathways from COPC's in soil to the prey is incomplete." However, Table 7 shows that the soil pathway for ecological receptors is complete. This discrepancy needs to be corrected.***

Table 7 has been modified to show all routes to ecological receptors from soil sources as being potentially complete. All routes to hunters from soil have also been changed to potentially complete.

<u>OCD Comment 3</u>: ***Table 7 needs to be redrafted to reflect potential future off-site uses as discussed above and below.***

<u>OCD Comment 3.a:</u> ***The ingestion exposure route for the future off-site resident is not an "incidental ingestion" exposure route. The future off-site resident exposure scenario needs to include "ingestion" of ground water as a sole source drinking water supply in the exposure routes.***

Table 7 has been modified to include ingestion of groundwater (as opposed to incidental ingestion) as a potentially complete pathway.

<u>OCD Comment 3.b</u>: ***The ground water exposure pathway only considers that a future off-site resident would be potentially impacted if contaminated ground water migrated to a down gradient residential well. As discussed above, the future off-site ground water pathway must consider the potential for future residential, industrial and stock watering uses of ground water within the plume area.***

Table 7 has been modified as follows to be consistent with the response to comment 2.a., and to reflect OCD's definition of "on-site" as being the lands overlying the plume which are actually owned by Marathon:

Off-Site Resident - For the reasons stated in the response to comment 2.a., no change has been made to Table 7 regarding exposure to the Off-Site Resident from soil or groundwater. Those routes are still shown as being incomplete except in the event of migration of COPC's to existing ranch wells. For surface water, changes have been made to consider potential future migration of COPC's to off-site surface water.

Off-Site Worker - Because of OCD's definition of "on-site", the new receptor category, "Off-Site Worker" has been added. As indicated in the response to comment 2.a., these workers are anticipated to be limited to workers engaged in oil and gas production operations, Plant workers and those working to repair the pump, treat and infiltrate system. A review of other mining operations which might conceivably have workers present in the area in the future will be made, and if warranted, the potential exposure to such workers will be analyzed.

Stock watering - This potential pathway is now reflected in the changes made to the groundwater and surface water portions of the Table 7 matrix for ecological receptors. While all pathways are shown as currently incomplete, all are shown as potentially complete in the future.

<u>OCD Comment 3.c</u>: ***If "incidental ingestion" and dermal contact with soils are considered as potential soil exposure pathways for ecological receptors, inhalation also needs to be included as a potential pathway.***

As indicated in the response to comment 2.b., Table 7 has been modified to include inhalation of volatiles/dust emissions by ecological receptors as a potentially complete pathway.

<u>OCD Comment 3.d</u>: ***Since a person could potentially drink surface water during hunting, the surface water pathway needs to include the hunter as a potential receptor for the "incidental ingestion" exposure route.***

Table 7 has been modified to show all future surface water exposure routes as potentially complete pathways for hunters. Note that these pathways will only be considered potentially complete in the risk assessment if the fate and transport modeling predicts an impact to the spring.

OCD Comments 3.e: ***This table does not consider agriculture as a potential use of ground water or surface water. The risk assessment will need to consider the potential for contaminant impacts on future agricultural uses.***

As indicated in the response to comment 3.b., Table 7 has been modified to include stock watering (the likely agricultural use of groundwater) as a potentially complete pathway. Please see the response to comment 2.a. for additional discussion of this pathway.

Table 7, revised according to the responses contained in this letter, is attached. Once you have had the opportunity to consider the contents of this letter, I would like to meet with you to further discuss the workplan.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Advanced Environmental & Safety Specialist

Table 7
Preliminary Exposure Pathway Matrix
Indian Basin Remediation Project
Carlsbad, New Mexico
REVISED MARCH 12, 1997

Exposure Medium	Exposure Route	RECEPTORS: On-Site Worker		Off-Site Worker		On-Site Resident[a]		Off-Site Resident		Hunter		Ecological Receptors	
		Current	Future	Current	Future	Current	Future	Current	Future	Current	Future	Current	Future
SOIL	Incidental ingestion	•	•	•	•	INC	INC	INC[b]	INC[b]	•	•	•	•
	Inhalation of volatiles/dust	•	•	•	•	INC	INC	INC[b]	INC[b]	•	•	•	•
	Dermal contact	•	•	•	•	INC	INC	INC[b]	INC[b]	•	•	•	•
GROUNDWATER	Ingestion	•[e]	•[e]	•[h]	•	INC	INC	INC[c]	•[d]	INC	INC	INC	•[l]
	Inhalation of volatiles	•[e]	•[e]	•[h]	•	INC	INC	INC[c]	•[d]	INC	INC	INC	•[l]
	Dermal contact	•[e]	•[e]	•[h]	•	INC	INC	INC[c]	•[d]	INC	INC	INC	•[l]
SURFACE WATER	Incidental ingestion	NA	NA	INC[g]	•[f]	NA	NA	INC[g]	•[f]	INC[g]	•[f]	INC[g]	•[f]
	Inhalation	NA	NA	INC[g]	•[f]	NA	NA	INC[g]	•[f]	INC[g]	•[f]	INC[g]	•[f]
	Dermal contact	NA	NA	INC[g]	•[f]	NA	NA	INC[g]	•[f]	INC[g]	•[f]	INC[g]	•[f]

Remarks

a Site will remain industrial

b Off-site soils above plume will remain non-residential. Off-site soils outside plume area are not impacted

c No detectable COPC in off-site wells on residential property

d Based on potential migration of COPCs to off-site ranch wells for domestic water supply or use of groundwater within current plume

e Untreated groundwater is presently On-Site only within the IBRP pump, treat and infiltration system. Treated groundwater is on-site both in the pump, treat and infiltration system and in the water supply system for the acid-gas injection well. Potential exposure is only through work repairing leaks in the various pipelines. Treated groundwater is no longer used for process water in the Gas Plant.

f Based on potential migration of COPCs to off-site surface water.

g No detectable COPCs in off-site surface water.

h The only current Off-Site worker exposure is the same as is described for On-Site workers in remark e.

l Cattle only based on future use of groundwater for stock watering.

• = Potentially complete NA = Not Applicable INC = Incomplete

Bill Olson

From: Robert J. Menzie[SMTP:menzie@hou.moc.com]
Sent: Tuesday, January 28, 1997 9:16 AM
To: William Olson
Cc: Susan Fields
Subject: Notification of First QUarter sampling episode

This is your 48 hr notification of Marathon's planned sampling of Indian Basin Remediaiton Project wells beginning Feb. 3. The first couple of days will consist of gauging 35 Lower QUeen and 36 SHallow zone wells. The latter part of the week will consist of purging and sampling of project wells.

The new SHallow and Lower QUeen monitoring wells will undergo additional testing per your letter dated May 7, 1996. In addition to BTEX and Cl-, TDS, major cation and anion, and PAH analysis will be conducted. Let me know if you want to split samples during this round. 915-687-8312

Call if you have questions.

BOb Menzie

RECEIVED
FEB - 3 1997

Marathon Oil Company

Mid-Continent Region
Production United States

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

January 24, 1997

Mr. William Olson
Hydrogeologist
Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Remediation Project
Proposed Groundwater Monitoring Plan Modification

Dear Mr. Olson:

Marathon Oil Company is requesting review and approval of modifications to the Groundwater Monitoring Plan for the Indian Basin Remediation Project which was set forth in Appendix H of the Marathon Indian Basin Treatment Plan document dated March 5, 1992 and approved April 2, 1992 by the Oil Conservation Division. The revised plan consists of two tables that have been updated to include all groundwater monitoring wells drilled and completed since 1992. In addition, these two tables describe the revised sampling frequency for both Shallow and Lower Queen wells.

Analytes for laboratory analysis will be limited to benzene, toluene, ethylbenzene, and xylenes by EPA Method 8020 or 8240 and chloride by EPA Method 325.3. Per our verbal discussion, annual reporting of gauging and sampling results will commence after submittal of the Fourth Quarter 1996 Monitoring Report due February 10, 1997. An annual report summarizing data from the previous calendar year will be submitted each year by March 1 beginning in 1998. If you have any questions please call me.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Advanced Environmental & Safety Specialist

Attachments: Table 1, Lower Queen Monitoring Wells
Table 2, Shallow Zone Monitoring Wells

c: T. C. Lowry
F. D. Searle

File 552-03

TABLE 1. LOWER QUEEN MONITORING WELLS

Well	Sample Order	Sampling Frequency	Gauge Frequency	TOC Elev. (ft AMSL)	Top of Galvanized Collar Elev. (ft AMSL)	Total Depth (ft FTOC)	Well Casing ID (in) / Type	Well Screen Interval Top (ft FTOC)	Well Screen Interval Bottom (ft FTOC)	Aquifer Thickness Exposed in well (ft)
MW-57	22	semiannual	quarterly	3787.70	-	179.30	4 PVC	157.10	179.30	22.20
MW-58	gauge only through piezometer	-	quarterly	3824.07	-	234.10	8 steel; OH	?	234.10	#VALUE!
MW-59	10	semiannual	quarterly	3819.59	-	211.29	4 PVC	185.51	211.29	25.78
MW-60	11	quarterly	quarterly	3815.28	-	226.08	4 PVC	172.86	226.08	53.22
MW-61A	8	quarterly	quarterly	3815.97	-	216.37	4 PVC	175.87	216.37	40.50
MW-62	14	semiannual	quarterly	3819.90	-	224.69	4 PVC	179.90	224.69	44.79
MW-63	4	annually	quarterly	3626.16	-	221.68	4 PVC	175.39	221.88	46.49
MW-64	15	semiannual	quarterly	3798.57	-	204.36	4 PVC	156.68	204.38	47.70
MW-65A	19	annually	quarterly	3763.26	-	168.56	4 PVC	117.90	168.56	50.66
MW-66	6	quarterly	quarterly	3828.98	-	237.86	4 PVC	184.81	237.66	52.85
MW-67	16	semiannual	quarterly	3765.87	-	168.54	4 PVC	114.78	168.54	53.76
MW-68	23	annually	quarterly	3797.83	-		4 PVC	151.81	203.43	51.62
MW-70	1	annually	quarterly	3822.57	-	228.14	4 PVC	175.32	228.14	52.82
MW-71	9	quarterly	quarterly	3778.05	-	232.55	4 PVC	?	232.55	#VALUE!
MW-72**	gauge only through piezometer	-	quarterly	-	3821.14	?	8 PVC	?	?	#VALUE!
MW-73**	gauge only	-	quarterly	3820.09	-	222.50	8 steel; OH	7	222.50	215.50
MW-74**	gauge only	-	quarterly	3820.82	-	220.00	8 steel; OH	7	220.00	213.00
MW-75**	gauge only through piezometer	-	quarterly	-	3816.71	220.00	8 steel; OH	10	220.00	210.00
MW-76**	gauge only through piezometer	-	quarterly	-	3796.35	220.00	8 steel; OH	6	220.00	214.00
MW-81	gauge only through piezometer	-	quarterly	-	3817.03	228.45	8 steel; OH	77	228.45	151.45
MW-82**	gauge only through piezometer	-	quarterly	-	3825.07	229.50	8 steel; OH	70	229.50	159.50
MW-83	gauge only through piezometer	-	quarterly	-	3794.12	205.80	8 steel; OH	40.5	205.80	165.30
MW-84	gauge only through piezometer	-	quarterly	-	3759.60	170.90	8 steel; OH	65	170.90	105.90
MW-85	gauge only through piezometer	-	quarterly	-	3824.93	239.80	8 steel; OH	75	239.80	164.80
MW-86	gauge only through piezometer	-	quarterly	3823.99	-	223.49	8 steel; OH	75	223.49	148.49
MW-87	12	quarterly	quarterly	3740.50	Top of cap	168.35	4 PVC	145	168.35	23.35
MW-87A	13	quarterly	quarterly	3739.53	-	132.90	8 steel; OH	10	132.90	122.90
MW-88	7	quarterly	quarterly	3789.70	-	177.65	4 PVC	140	177.65	37.65
MW-89	5	quarterly	quarterly	3827.68	Top of cap	232.53	4 PVC	187	232.53	45.53
MW-94	gauge only through piezometer	-	quarterly	-	3821.48	230.10	8 steel; OH	65	230.10	165.10
MW-95*	21	annually	quarterly	-	-	-	4 PVC	-	-	-
MW-96*	17	quarterly	quarterly	-	-	-	4 PVC	-	-	-
MW-97*	18	quarterly	quarterly	-	-	-	4 PVC	-	-	-
MW-98*	20	annually	quarterly	-	-	-	4 PVC	-	-	-
IW-1**	gauge only through piezometer	-	quarterly	3808.55	-	232.50	11 steel; OH	73	232.50	159.50
IW-2	gauge only	-	quarterly	3835.86	-	299.89	11 steel; OH	159	299.89	140.89
IW-3*	gauge only	-	quarterly	-	-	-	11 steel; OH	-	-	-
SW-1	sample through installed pump	annually		3808.19	-	255	7 steel; OH	165	255	90
SW-2	3	annually	quarterly	3808.79	-	292	10 steel; OH	163	292	129
SW-3	2	annually	quarterly	3842.29	-	232.70	8 steel; OH	81.5	232.70	151.20

*Proposed wells

**Need TD gauged

AMSL = above mean sea level

FTOC = from top of casing

TABLE 2. SHALLOW ZONE MONITORING WELLS

Well	TOC Elev. (ft AMSL)	Sampling Frequency	Gauge Frequency	Total Depth (ft FTOC)	Well Casing ID (in) / Type	Well Screen Interval Top (ft FTOC)	Aquifer Thickness Exposed in well (ft)
MW-10	3790.78	semiannual	quarterly	19.08	4 PVC	8.97	10.11
MW-11	3806.96	semiannual	quarterly	24.85	4 PVC	14.68	10.17
MW-13	3801.58	semiannual	quarterly	22.07	2 PVC	11.64	10.43
MW-19	3797.21	semiannual	quarterly	19.11	4 PVC	8.96	10.15
MW-38	3797.32	semiannual	quarterly	20.57	4 PVC	10.4	10.17
MW-39	3796.20	semiannual	quarterly	20.54	4 PVC	10.17	10.37
MW-41	3799.04	semiannual	quarterly	24.04	4 PVC	13.87	10.17
MW-43	3802.05	semiannual	quarterly	24.55	4 PVC	14.40	10.15
MW-44	3804.14	semiannual	quarterly	25.24	4 PVC	15.09	10.15
MW-46	3805.54	semiannual	quarterly	20.24	4 PVC	9.69	10.55
MW-47	3805.09	semiannual	quarterly	21.79	2 PVC	11.75	10.04
MW-48	3806.18	semiannual	quarterly	19.98	2 PVC	9.94	10.04
MW-49	3805.61	semiannual	quarterly	25.91	2 PVC	15.82	10.09
MW-50	3813.35	semiannual	quarterly	37.15	2 PVC	22.11	15.04
MW-52	3817.49	semiannual	quarterly	21.44	2 PVC	11.4	10.04
MW-54	3823.86	semiannual	quarterly	78.15	4 PVC	42.92	35.23
MW-55	3794.40	semiannual	quarterly	66.32	4 PVC	21.43	44.89
MW-56	3782.45	semiannual	quarterly	43.76	4 PVC	28.79	14.97
MW-69	3805.11	semiannual	quarterly	51.27	4 PVC	16.56	34.71
MW-61	3816.20	semiannual	quarterly	57.97	4 PVC	47.83	10.14
MW-65	3763.31	quarterly	quarterly	57.69	4 PVC	37.58	20.11
MW-77	3775.48	quarterly	quarterly	80	8 steel; OH	15	65.00
MW-78	3785.82	quarterly	quarterly	85	8 steel; OH	11	74.00
MW-79	3788.39	quarterly	quarterly	80	8 steel; OH	5.5	74.50
MW-80	3821.64	quarterly	quarterly	90	8 steel; OH	16.75	73.25
MW-90	*	quarterly	quarterly	70	4 PVC	10.0	60.00
MW-91	*	quarterly	quarterly	70	4 PVC	10.0	60.00
MW-92	*	quarterly	quarterly	70	4 PVC	10.0	60.00
MW-93	*	quarterly	quarterly	70	4 PVC	10.0	60.00
MW-99	*	quarterly	quarterly	70	4 PVC	10.0	60.00
MW-100	*	quarterly	quarterly	70	4 PVC	10.0	60.00
MW-101	*	quarterly	quarterly	70	4 PVC	10.0	60.00
MW-102	*	quarterly	quarterly	70	4 PVC	10.0	60.00
MW-103	*	quarterly	quarterly	70	4 PVC	10.0	60.00
MW-104	*	quarterly	quarterly	70	4 PVC	10.0	60.00
MW-105	*	quarterly	quarterly	70	4 PVC	10.0	60.00
MW-106	*	quarterly	quarterly	90	4 PVC	10.0	80.00
MW-107	*	quarterly	quarterly	80	4 PVC	10.0	70.00

* Elevation survey pending

AMSL = above mean sea level

FTOC = from top of casing

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 27, 1996

Mr. William Olson
Hydrogeologist
Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, NM 87501

11/27/96
Verbal approval
Will follow

RE: Shallow zone Assessment Work Plan
Indian Basin Remediation Project

Dear Mr. Olson:

P.S. correspondence is follow up to conversation

Marathon Oil Company is providing you with this work plan to delineate the extent of impacts to the Shallow aquifer southeast of the Indian Basin Gas Plant. As we discussed in our telephone conversation today, Marathon is continuing to investigate the extent of impact from a liquid gas condensate and brine production pipeline spill discovered in April 1991 near the Indian Basin Gas Plant.

Background and Purpose

The delineation assessment consists of installation, development, and sampling of 13 monitoring wells generally located along the axis of Rocky Arroyo, downgradient of MW-69. The well locations will determine the extent of impacts to the Shallow zone. The well locations were selected based on groundwater monitoring data and a soil gas survey conducted along Rocky Arroyo in October 1996.

The soil gas survey identified hydrocarbon in soil vapor southeast and downgradient from previously proposed Shallow zone monitoring wells MW-90, MW-91, MW-92, and MW-93. Therefore, the locations of MW-90 and MW-92, approved in your May 7, 1996 letter responding to both Marathon's December 18, 1995 and February 26, 1996 work plans, have been changed. The locations of MW-91 and MW-93 were not modified. In addition, based on the lateral extent indicated by the soil gas survey, nine additional wells were needed to complete the delineation.

The locations of the 13 monitoring wells are shown on the attached Benzene in Shallow Groundwater Map based on the July 1996 quarterly monitoring episode (Figure 1). Wells MW-90 through MW-93 retain their previous designation. The nine additional wells are denoted as MW-99 through MW-107.

Monitoring Well Installation

Boreholes will be a minimum of two inches larger than the outside diameter of the well casing. The depth of each boring will be variable, depending on the location of the water table, but the wells are expected to be no greater than 70 feet in depth. Each borehole will extend a minimum of 10 feet into the groundwater. Wells will be completed with 4-inch, Schedule 40 PVC, flush threaded casing and 0.040-inch slot, prefabricated screen. The wells will be completed with 10 feet of blank casing and the remaining depth will be screened. This will allow use of the wells for vapor extraction at a later date if determined appropriate. Each well will be installed with a 2.5-foot stickup and locking, metal protective cover. A typical well completion diagram is attached as Figure 2.

Monitoring Well Development & Sampling

Well development will be accomplished using a submersible pump that is capable of a 20 gallon-per-minute pump rate. Each well will be pumped at a sustained rate for 6 to 8 hours or until the extracted water is free of sediments. Development water will be contained in a portable tank and transported to the Indian Basin Gas Plant for disposal in the facility wastewater collection system.

The well water will be sampled at the time the wells are developed. Initial groundwater samples from the new wells will be analyzed for total dissolved solids, chloride, benzene, toluene, ethylbenzene, and xylenes (BTEX), and polyaromatic hydrocarbons. Reduction of the analytical parameters to BTEX and chloride only for subsequent samples may be requested depending on whether the additional analytes are detected by the initial results.

Reporting & Schedule

The groundwater monitoring results will be submitted with the April 1997 Quarterly Monitoring Report for this project. The results of the assessment, along with lithologic and well completion diagrams will be submitted with the Final Site Investigation Report due to the OCD on July 1, 1996. Installation of the wells will commence on January 6, 1997 and be complete by early February. Marathon will notify you at least 48 hours in advance of the commencement of drilling.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental & Safety Representative

c: S. Fields, Fluor Daniel GTI, Albuquerque, NM

File: 576-17

Figure 1
July 1996 Benzene in Shallow Groundwater (ug/l)

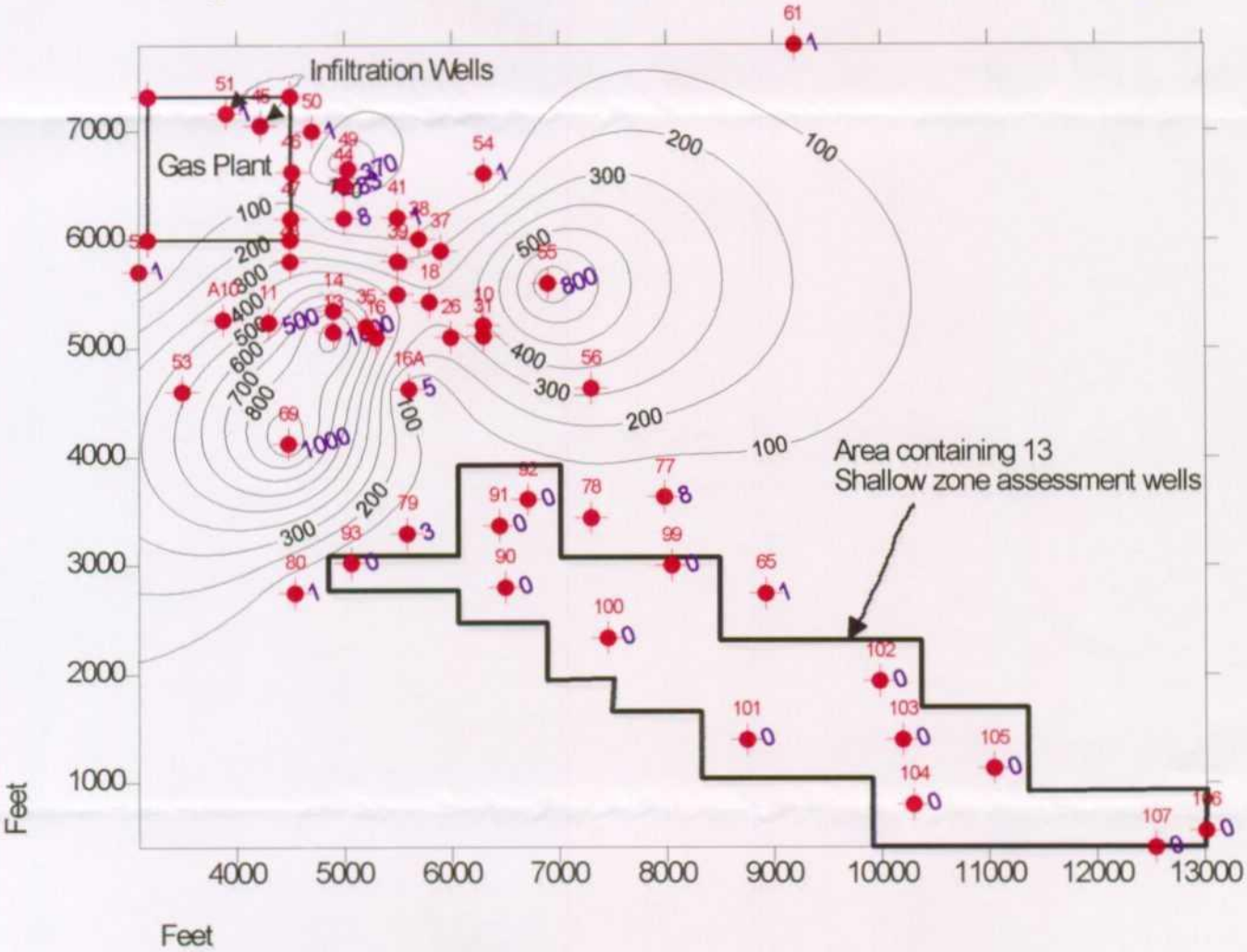
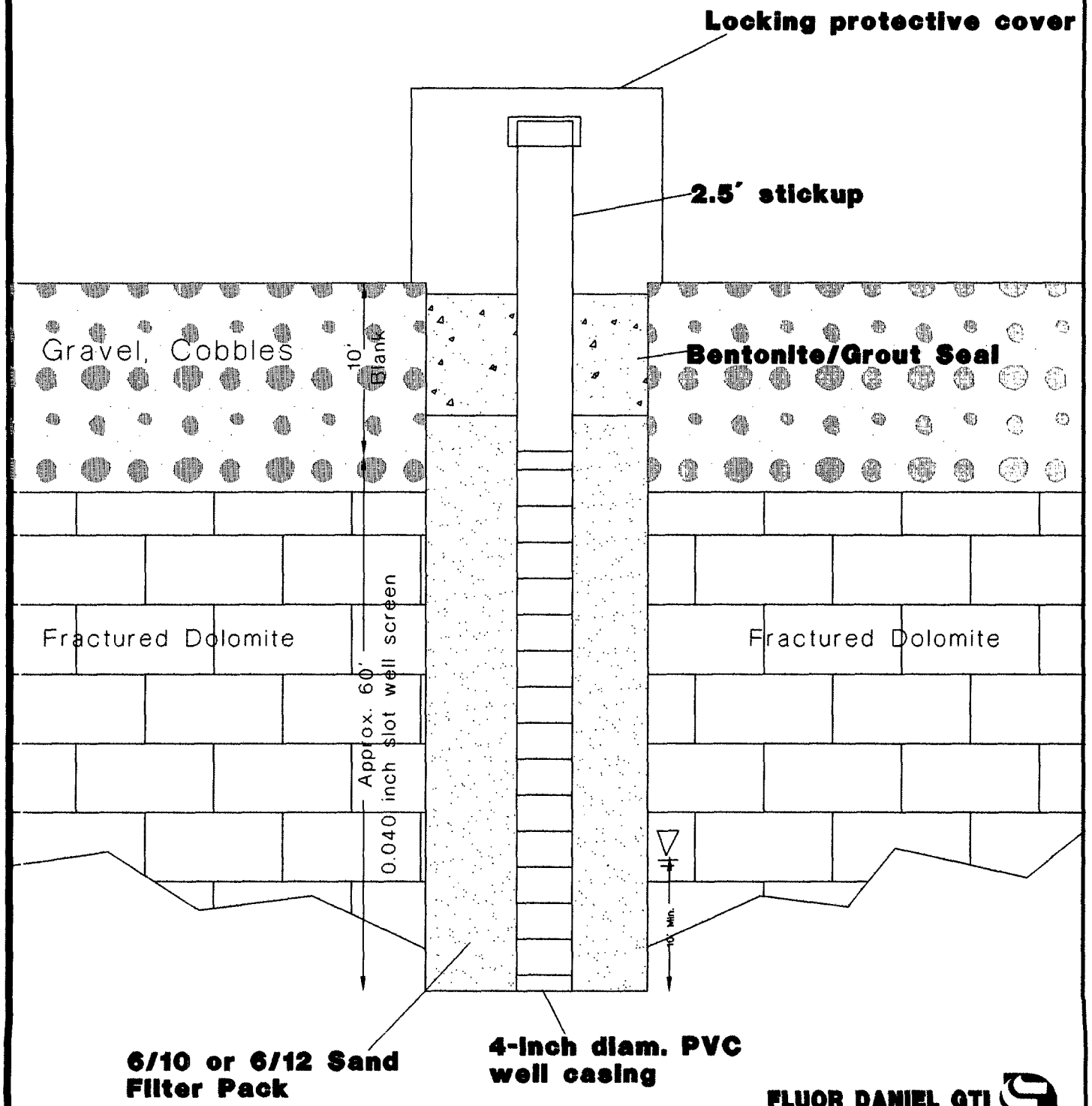


FIGURE 2
TYPICAL SHALLOW ZONE MONITORING WELL
(Monitoring Wells 90-93, 99-107)



FLUOR DANIEL GTI

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

RECEIVED
AUG 21 1996
CONSERVATION DIVISION

August 19, 1996

Mr. William C. Olson
Hydrogeologist
Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Remediation Project
Notification of new monitoring well sampling

Dear Mr. Olson:

Marathon is notifying your office that groundwater sampling of newly installed monitoring wells (i.e., MW-87, MW-87A, MW-88, and MW-89) is scheduled for Thursday, August 22, 1996. Fluor Daniel GTI, Inc. will be conducting the gauging, purging, and sampling activities. If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental & Safety Representative

File: 568-00

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

Post-it™ Fax Note 7671	Date 8-19-96	# of pages ▶ 1
To Bill Olson	From Bob Menzie	
Co./Dept. OCD	Co. Marathon	
Phone #	Phone # 915-687-8312	
Fax # 505-827-8177	Fax #	

August 19, 1996

Mr. William C. Olson
Hydrogeologist
Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Remediation Project
Notification of new monitoring well sampling

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Marathon is notifying your office that groundwater sampling of newly installed monitoring wells (i.e., MW-87, MW-87A, MW-88, and MW-89) is scheduled for Thursday, August 22, 1996. Fluor Daniel GTI, Inc. will be conducting the gauging, purging, and sampling activities. If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental & Safety Representative

File: 568-00

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

August 9, 1996

Mr. William Olson
Hydrogeologist, Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Remediation Project
Notification of Late Submittal of Second Quarter 1996 Quarterly Report

Dear Mr. Olson:

Per our telephone conversation today, Marathon is notifying your office that the process of data compilation and summary reporting of Second Quarter (April 1 through June 30, 1996) Indian Basin remediation project activities is not complete. Marathon will be submitting this report by Friday, August 23, 1996. If you have any questions please call me.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental & Safety Representative

c: Roger C. Anderson, OCD Bureau Chief, Santa Fe

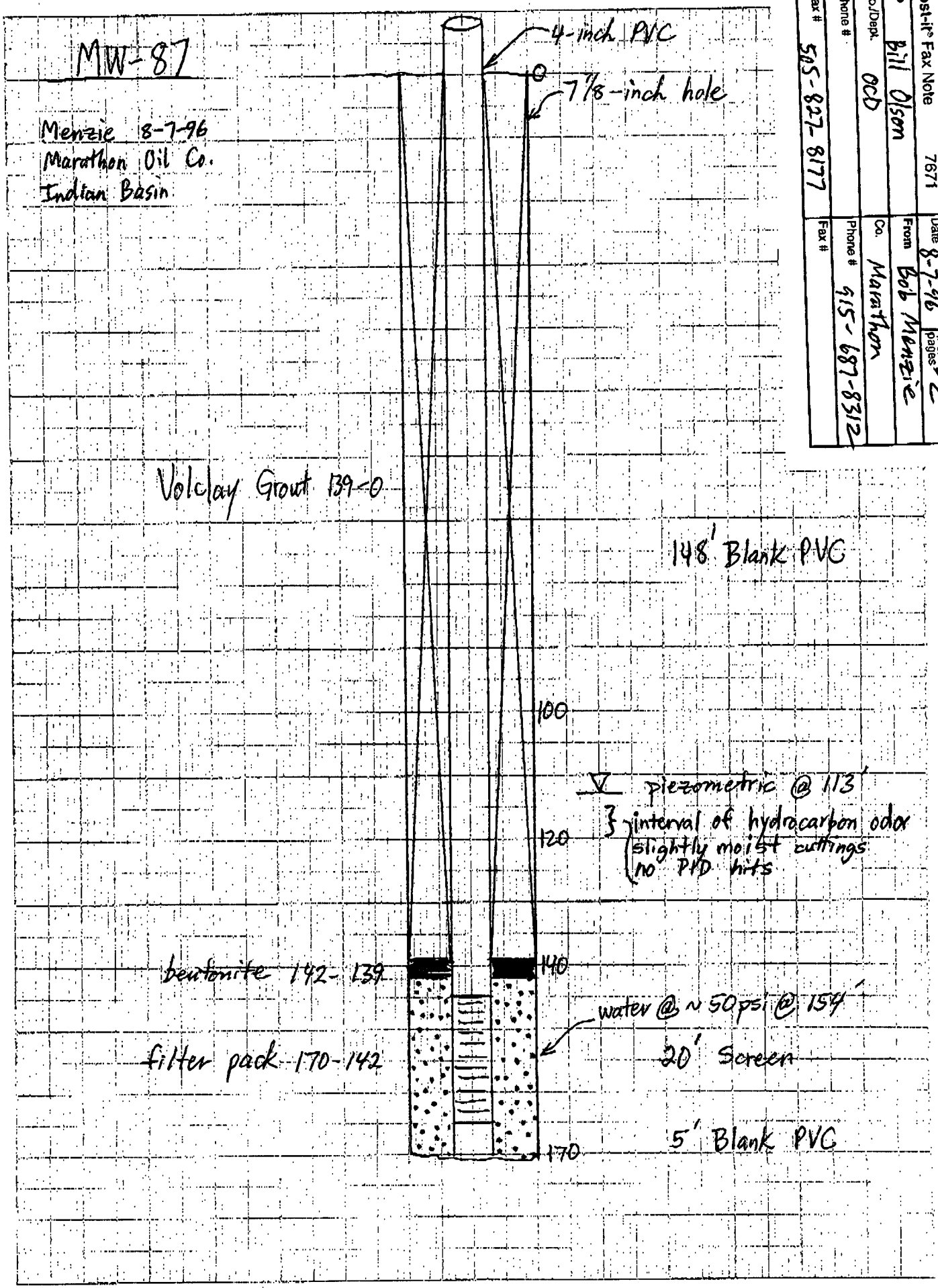
File 572-00

Post-it® Fax Note 7671

To Bill Olson		Date 8-7-96	# of pages ▶ 2
Co./Dept. OCD		From Bob Menzie	
Phone #		Co. Marathon	
Fax # 505-827-8177		Phone # 915-687-8312	
		Fax #	

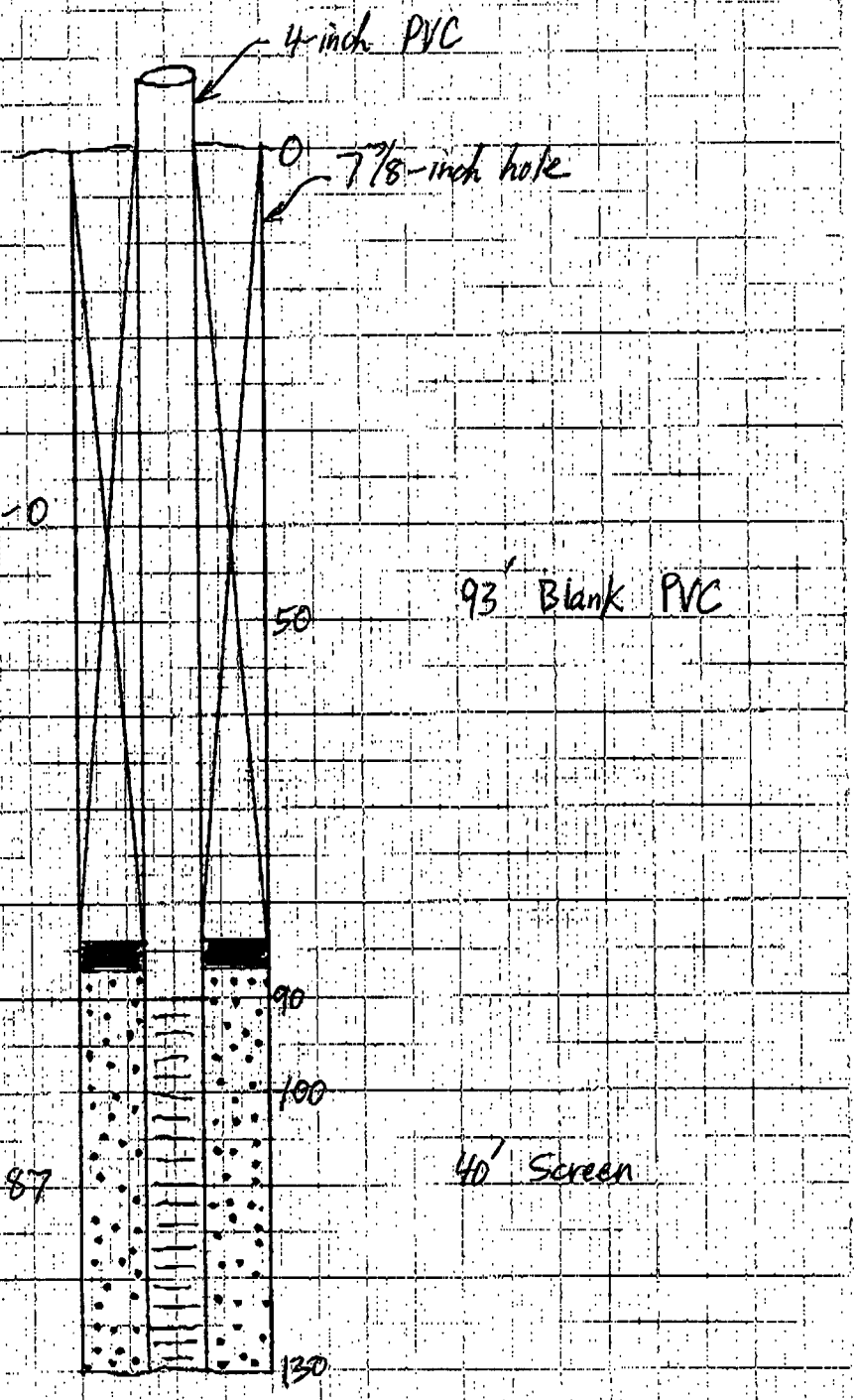
MW-87

Menzie 8-7-96
Marathon Oil Co.
Indian Basin



MW-87A

Menzie 8-7-96
Marathon Oil Co.
Indian Basin



20 X 20 TO THE INCH 46 1240
KEUFFEL & ESSER CO.

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

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☑ Telephone ☐ Personal	Time 1400	Date 7/22/96

Originating Party	Other Parties
Bob Menzie - Marathon	Bill Olson - Envir. Bureau

Subject

Marathon - Indian Basin

Discussion

Called to report that most of the new wells drilled to SE of plant contain free product.
Also - injection well Fw-1 located south of the plant also contains free product
~~The~~ - MW 64 now contains approx. 1/3' of free product
Drilling program still ongoing - ie - eastern wells
Informed him that IW-2 cannot be used as injection well if contaminated and requested following report under 1-203

Conclusions or Agreements

He will file written notice of findings

Distribution
file
OCD - Artesia Office

Signed Bill Olson

NEW MEXICO ENERGY, MINERALS
& NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
2040 South Pacheco Street
Santa Fe, New Mexico 87505
(505) 827-7131

May 8, 1996

CERTIFIED MAIL
RETURN RECEIPT NO. P-269-269-143

Mr. David Searle
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702-0552

RE: BOREHOLE VIDEO LOGS
MARATHON INDIAN BASIN GAS PLANT
EDDY COUNTY, NEW MEXICO

Dear Mr. Searle:

The New Mexico Oil Conservation Division (OCD) has completed a review of Marathon Oil Company's (MOC) March 4, 1996 "INDIAN BASIN REMEDIATION PROJECT, EDDY COUNTY, NEW MEXICO". This document contains Marathon's request that the open borehole video logs of monitor wells MW-73, 74, 75 and 76 be retained by MOC as confidential information.

As discussed at OCD's May 6, 1996 meeting with you, these well logs are investigation data generated for the purposes of determining predominant fracture patterns in the Lower Queen. Since these logs are important data for establishing fracture trends and for predicting potential fluid and vapor migration pathways, copies of these logs must be filed with the OCD prior to the OCD considering alternate abatement standards for this site.

If you have any questions, please contact me at (505) 827-7152.

Sincerely,

Roger C. Anderson
Environmental Bureau Chief

xc: OCD Artesia District Office

P 269 269 143

US Postal Service

Receipt for Certified Mail

No Insurance Coverage Provided.

Do not use for International Mail *(See reverse)*

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Restricted Delivery Fee	
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Return Receipt Showing to Whom, Date, & Addressee's Address	
TOTAL Postage & Fees	$
Postmark or Date	

PS Form **3800**, April 1995

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

April 18, 1996

Mr. Mark Ashley
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RECEIVED
APR 22 1996
Environmental
Oil Conservation

RE: Indian Basin Gas Plant
Groundwater Discharge Plan (GW-21) Amended Modification

Dear Mr. Ashley:

Attached are three copies of an amended modification to the Indian Basin Gas Plant Groundwater Discharge Plan (GW-21) submitted by Marathon Oil Company on behalf of the Indian Basin Gas Plant owners for your review and approval. The discharge plan modification is necessary to permit the addition of a treated groundwater infiltration system. This document includes the following changes to the original modification document dated January 15, 1996:

1) the locations of two infiltration wells (IW-1 and IW-2);
2) the location of the underground discharge (infiltration) pipeline to Lower Queen infiltration wells, IW-1 and IW-2;
3) the addition of third aboveground tank at the treatment compound;
4) the addition of a second air stripper at the treatment compound; and,
5) installation of the carbon filtration system will be dependent on whether air stripping is effective in treating the discharge (infiltration) water to less than New Mexico Water Quality Control Commission Groundwater Quality Standards (Section 3-103).

If you have any questions concerning the discharge plan, please call me.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental & Safety Representative

c: T. L. Guillory
F. D. Searle
R. F. Unger

File: 556-01

MARATHON OIL COMPANY
INDIAN BASIN GAS PLANT
GROUNDWATER DISCHARGE PLAN (GW-21) MODIFICATION

Submitted on behalf of the working interest owners to
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division

April 18, 1996

INTRODUCTION

This Groundwater Discharge Plan modification is to address the addition of a treated groundwater infiltration system at the Indian Basin Gas Plant which includes up to two Lower Queen infiltration wells (IW-1 and IW-2), up to two Shallow zone infiltration wells (MW-45 and MW-51), an underground groundwater collection pipeline to the water treatment compound, an underground treated groundwater discharge pipeline to the two Lower Queen infiltration wells, an aboveground treated water discharge pipeline to MW-45, and an underground pipeline conveying treated water to MW-51. This document is an amendment to the existing Groundwater Discharge Plan document dated November 26, 1994, as approved.

TYPE OF OPERATION

A discharge system to collect and treat hydrocarbon-contaminated groundwater and infiltrate (discharge) the treated water into wells completed within the Shallow alluvial and Lower Queen aquifers.

OPERATOR/LEGALLY RESPONSIBLE PARTY & LOCAL REPRESENTATIVE

No change from approved Groundwater Discharge Plan dated November 26, 1994.

LOCATION OF FACILITY

Figures 1 and 2 show the locations of the various components of the infiltration system. The two Lower Queen infiltration wells (IW-1 and IW-2) are located on Bureau of Land Management (BLM) property in the northeast 1/4 of Section 26, Township 21S, Range 23E, in Eddy County, New Mexico. Shallow zone infiltration wells MW-45 and MW-51, the aboveground treated water discharge pipeline to MW-45, and the underground pipeline conveying treated water to MW-51 are located on Marathon's Indian Basin Gas Plant property in the northeast 1/4 of Section 23, Township 21S, Range 23E. The underground gathering pipeline conveying hydrocarbon-contaminated groundwater to the water treatment compound is located on both BLM and the Indian Basin Gas Plant property in Sections 23, 24, and 25, Township 21S, Range 23E. The treated groundwater underground discharge pipeline to the two Lower Queen infiltration wells is located on both BLM and Indian Basin Gas Plant property in Section 23 and 26, Township 21S, Range 23E.

LANDOWNER

The landowner of the Indian Basin Gas Plant property has not changed from approved Groundwater Discharge Plan dated November 26, 1994; however, two underground pipelines and the two Lower Queen infiltration wells are located on BLM property.

FACILITY DESCRIPTION

Figures 1 and 2 show the specific facilities associated with the treatment of hydrocarbon-contaminated groundwater and infiltration into the Shallow alluvial and Lower Queen aquifers. The treatment compound facilities include an underground gathering pipeline, two air strippers, and carbon vessels, if needed. The infiltration system consists of two underground discharge pipelines (one to MW-51; one to IW-1 and IW-2), an aboveground discharge pipeline (to MW-45), two Shallow alluvial infiltration wells, and up to two Lower Queen infiltration wells.

SOURCES AND QUANTITIES OF EFFLUENTS & WASTE SOLIDS

Effluents

The two effluents of the infiltration system are: 1) hydrocarbon-contaminated groundwater; and, 2) treated water cleaned to less than New Mexico Water Quality Control Commission (WQCC) groundwater quality standards described in the WQCC Regulations in Section 3-103. The quantity of hydrocarbon-contaminated groundwater gathered in the underground pipeline is approximately 6857 barrels per day (bbl/day) or 200 gallons per minute (gpm). The quantity of treated water infiltrated into the Lower Queen aquifer via the two infiltration wells will range from 0 to 150 gpm. The quantity of treated water infiltrated into the Shallow alluvial aquifer via the two infiltration wells will range from 0 to 50 gpm. The water that is not infiltrated into either aquifer will be used as plant process water or diverted to one of the Class II disposal wells as described in the approved Groundwater Discharge Plan dated November 26, 1994.

Waste Solid

The waste solid generated from the infiltration system is spent carbon contained within the vessels. This waste will be recycled by a carbon regeneration service company. Regenerated carbon will be used to replace the spent carbon. If disposal of spent carbon is required, appropriate analytical tests will be performed to properly characterize the waste for disposal.

EFFLUENT AND SOLID WASTE QUALITY CHARACTERISTICS

Effluent

Appendix A is an October 1995 laboratory analysis report of the two effluents: 1) hydrocarbon-contaminated groundwater in the underground gathering pipeline which was sampled from the air stripper inlet (stripper inlet); and, 2) treated groundwater sampled at the outlet of the air stripper (stripper outlet). Appendix B contains an April 1995 laboratory analysis report of the treated groundwater from a sample collected at the outlet of the air stripper and provides full-suite analyses of WQCC groundwater quality standards.

Waste
No laboratory analysis is available for spent carbon because the system has not been constructed yet. Under current plans, spent carbon will be recycled via a regeneration service. Analysis of spent carbon will be performed if waste characterization is required for disposal. The laboratory report will be kept on file at the gas plant.

TRANSFER AND STORAGE OF PROCESS FLUIDS AND EFFLUENTS

Transfer of hydrocarbon-contaminated groundwater is by an underground gathering pipeline. Transfer of treated water is by both aboveground and underground pipelines. Storage of hydrocarbon-contaminated groundwater prior to treatment by air stripping and carbon was previously in two aboveground steel tanks that are described in the approved Groundwater Discharge Plan dated November 26, 1994. A third aboveground tank and a second air stripper will be installed at the treatment compound. Figure 2 is a generalized flow schematic of the gathering, storage, treatment, and discharge (infiltration) system.

Discharges of effluents can occur throughout the system. Spills from the two air strippers, three storage tanks, or carbon vessels at the treatment compound are within an unlined secondary containment. Containment is afforded by an earthen berm that is capable of containing 133% of the storage tank volume.

Underground Pipelines
The infiltration system includes two underground pipelines. The pipelines will be hydrostatically integrity tested after initial construction to maintain 5 pounds per square inch (psi) above normal operating pressure for a duration of 4 hours. For polyethylene lines, integrity will be verified by visual inspection of pressured line. Results of the pressure tests will be kept on file at the gas plant.

EFFLUENT DISPOSAL

Infiltration Wells
Hydrocarbon-contaminated groundwater will be treated water to less than WQCC groundwater quality standards at the treatment compound by air stripping. If air stripping does not reduce the concentration of contaminants in the treated water to less than WQCC groundwater quality standards, a carbon system will be installed to remove the residual contamination in the treated water stream. Following treatment, the treated water will be infiltrated into the Shallow alluvial and/or Lower Queen aquifers as previously described. Up to 200 gpm of treated water will be infiltrated into the Lower Queen aquifer through wells IW-1 and IW-2. Up to 50 gpm of treated water will be infiltrated into the Shallow alluvial aquifer via wells MW-45 and MW-51. The proposed well construction diagrams for IW-1 and IW-2 and the well completion diagrams for wells MW-45 and MW-51 are included in Appendix C. Construction of these

wells will confine the infiltration (recharge) of treated water to the zone of completion.

Overflow of treated water from infiltration wells will be prevented by installation of a high level shut-off mechanism. This will prevent treated water from flowing out of the casing and onto the ground.

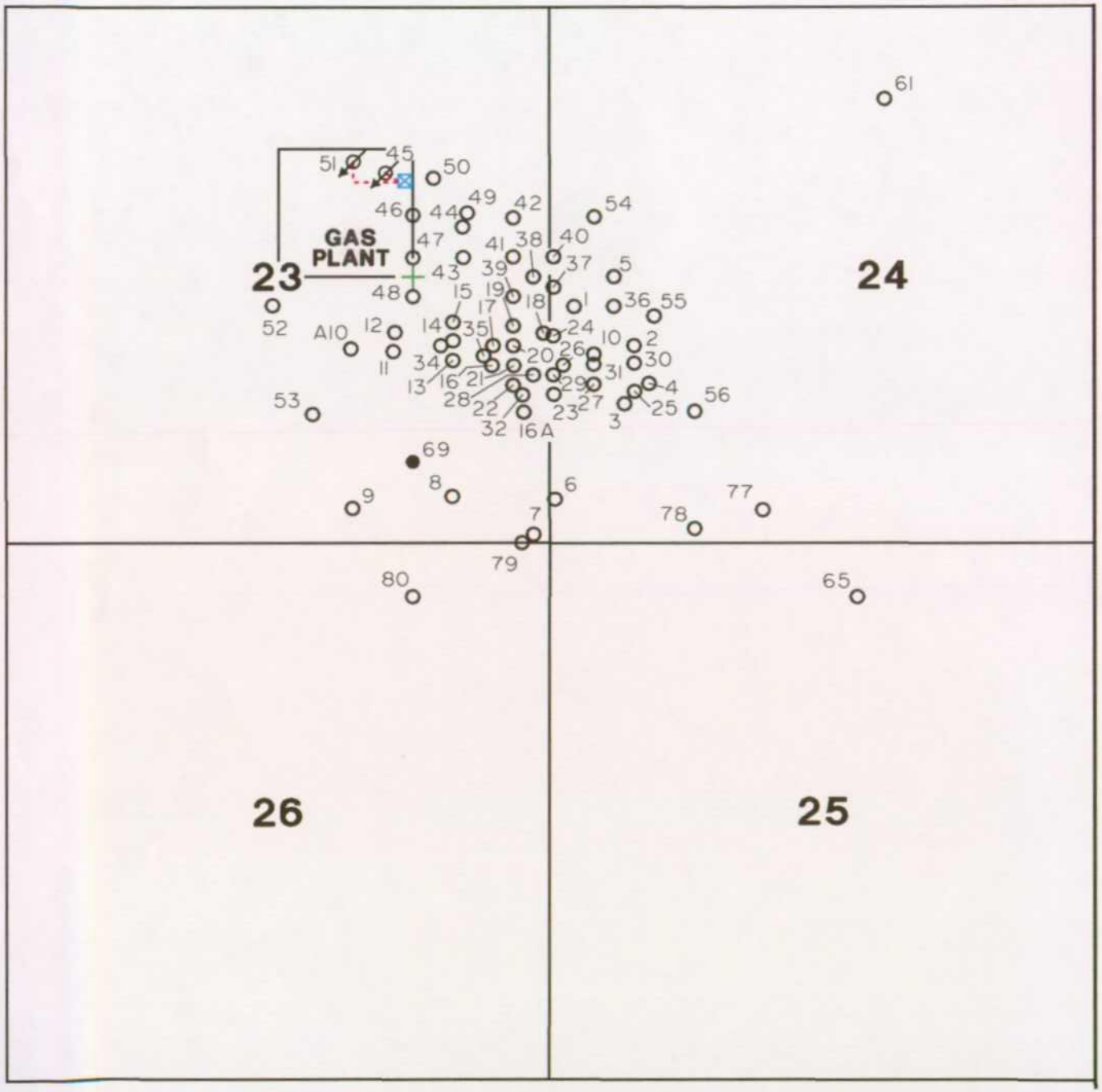
Monitoring of the treated water effluent will be conducted on a monthly basis to ensure that water treatment to less than WQCC groundwater quality standards is accomplished by air stripping (and carbon filtration if required). Water samples will be collected at the outlet of both air strippers (or after carbon vessels if required) prior to the treated water entering the discharge pipelines that convey the treated water to the infiltration wells. The water samples will be analyzed for benzene, ethylbenzene, toluene, and total xylenes by Environmental Protection Agency Method 8020. Monthly laboratory reports of treated water samples will be kept on file at the gas plant. If the laboratory report indicates that WQCC groundwater standards have been exceeded, the OCD will be notified.

INSPECTION, MAINTENANCE AND REPORTING

Inspections of the underground pipeline right-of-way will be conducted to search for moist soils or staining that may indicate a potential pipeline leak. In addition, flow meters will be placed on both ends of the pipeline for daily comparison purposes to detect potential pipeline leaks. An apparent leak will be investigated immediately. A confirmed leak will be reported to the OCD according to WQCC Regulations.

R 23 E

T 21 S



- RECOVERY WELL
- MONITOR WELL
- TREATMENT COMPOUND
- PROPOSED DISCHARGE LINE
- 0,0 REFERENCE POINT
- PROPOSED INFILTRATION WELL

0 1/4 1/2
MILE

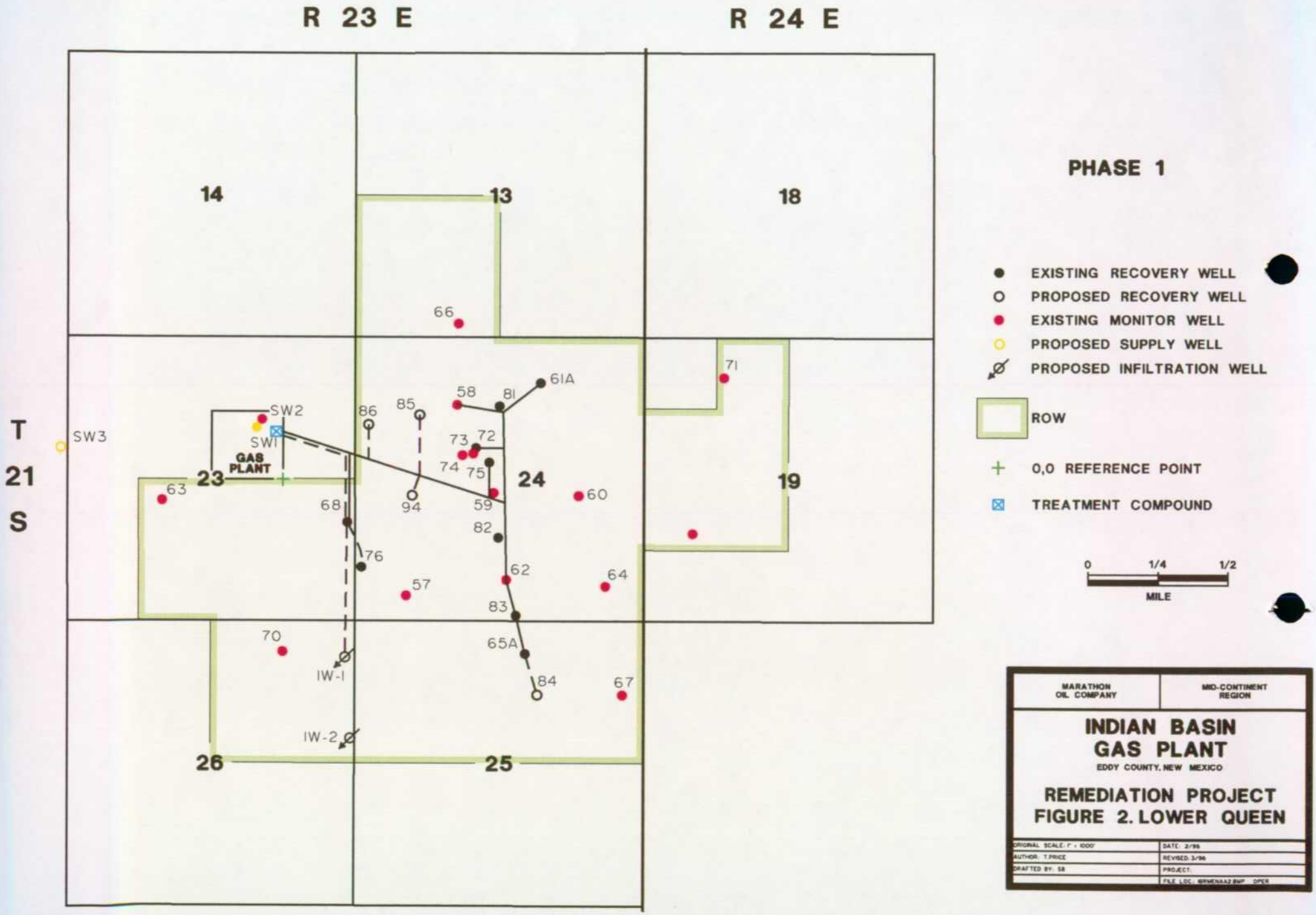
MARATHON OIL COMPANY	MID-CONTINENT REGION

INDIAN BASIN GAS PLANT

EDDY COUNTY, NEW MEXICO

REMEDIATION PROJECT
FIGURE 1. SHALLOW ZONE

ORIGINAL SCALE: 1" = 750'	DATE: 4/96
AUTHOR: T.PRICE	REVISED:
DRAFTED BY: SB	PROJECT:
	FILE LOC: BRMENA44.BMP OPER


R 23 E
R 24 E
T 21 S
14
13
18
23
24
19
26
25
GAS PLANT
SW1
SW2
SW3
IW-1
IW-2
66
58
81
61A
71
86
85
73
72
74
75
63
68
94
59
60
82
76
62
64
57
83
70
65A
84
67
PHASE 1
EXISTING RECOVERY WELL
PROPOSED RECOVERY WELL
EXISTING MONITOR WELL
PROPOSED SUPPLY WELL
PROPOSED INFILTRATION WELL
ROW
0,0 REFERENCE POINT
TREATMENT COMPOUND
0
1/4
1/2
MILE
MARATHON OIL COMPANY
MID-CONTINENT REGION
INDIAN BASIN GAS PLANT
EDDY COUNTY, NEW MEXICO
REMEDIATION PROJECT
FIGURE 2. LOWER QUEEN
ORIGINAL SCALE: 1" = 1000'
AUTHOR: T.PRICE
DRAFTED BY: SB
DATE: 2/95
REVISED: 3/96
PROJECT:

APPENDIX A

LABORATORY ANALYSIS OF HYDROCARBON-CONTAMINATED GROUNDWATER EFFLUENT

(previously submitted in original modification document dated 1-15-96)

APPENDIX B

LABORATORY ANALYSIS OF TREATED WATER EFFLUENT

(previously submitted in original modification document dated 1-15-96)

APPENDIX C

WELL COMPLETION DIAGRAMS

(previously submitted in original modification document dated 1-15-96)

Mid-Continent Region
Production United States

CONSERVATION DIVISION
RECEIVED
96 MAR 8 AM 8 52

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

March 4, 1996

Mr. William Olson
New Mexico Oil Conservation Division
Environmental Bureau
2040 Pacheco Street
Santa Fe, New Mexico 87501

RE: Indian Basin Remediation Project
Eddy County, New Mexico

Dear Mr. Olson:

This letter is written in response to the request contained in your letter dated January 18, 1996 for copies of the videos taken of wells MW-73, 74, 75, and 76. Copies of the videos have not been submitted because Marathon believes they are distinctly different from the logging information normally submitted to OCD on wells of this type.

As I mentioned during our recent telephone conversation, I believe it is in the best interests of all parties, OCD included, to have Marathon retain the videos. The videos have been of some limited use to us in testing our theories of aquifer characteristics and plume migration. However, they require studious interpretation done in conjunction with other contemporaneous quantitative data. The important quantitative information regarding the Lower Queen aquifer has already been submitted to OCD in the form of well completion reports and quarterly project reports. A casual viewer of the videos could easily misinterpret what is shown, particularly since actual testing of wellbore fluids would be required for definitive analysis. My concern is that someone unfamiliar with the project would view the footage and jump to conclusions about Marathon's remediation efforts because of a gross misunderstanding of what has been viewed. Marathon's intent is to clean up the contamination rather than spend its energies straightening out a misinterpretation. As I indicated previously, Marathon is willing to make the videos available for your viewing at any time. However, Marathon asks that it not be required to provide OCD a copy at this juncture in the project.

Marathon appreciates OCD's consideration of this request. If you have any questions or would like to discuss this matter further, please contact Tom Lowry or me at this office.

Sincerely,

CK Curlee

C. K. Curlee
Environmental & Safety Supervisor

File 568-00

xc: T. C. Lowry
A. R. Kukla
R. J. Menzie
R. F. Unger

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 28, 1996

CERTIFIED MAIL
RETURN RECEIPT NO. Z-765-962-547

Mr. Robert J. Menzie, Jr.
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702-0552

RE: RISK ASSESSMENT WORK PLAN
MARATHON INDIAN BASIN GAS PLANT
EDDY COUNTY, NEW MEXICO

Dear Mr. Menzie:

The New Mexico Oil Conservation Division (OCD) is in the process of reviewing Marathon Oil Company's (MOC) September 25, 1995 "WORKPLAN FOR RISK ASSESSMENT TO ESTABLISH ALTERNATE ABATEMENT STANDARDS, MARATHON OIL COMPANY, INDIAN BASIN REMEDIATION PROJECT, 18 MILES NORTHWEST OF CARLSBAD, NEW MEXICO" which was received by the OCD on December 12, 1995.

The OCD has the following comments and requests for information regarding the above referenced document:

1. Section 2.2 lists only benzene, toluene, ethylbenzene and xylene (BTEX) as chemicals of potential concern (COPC). Chloride and total dissolved solids in ground water at the site exceed New Mexico Water Quality Control Commission ground water standards and must be considered as COPC's. Please redraft this section to include a discussion of why metals, chloride and total dissolved solids are not COPC's. The discussion also needs to include relevant data in support of MOC's determination of COPC's such as summary tables of ground water analyses for polynuclear aromatic hydrocarbons, metals and TDS similar to those presented for BTEX and chloride.

2. a. Section 2.4 disregards significant exposure pathways. The future off-site uses presented do not consider potential use of ground water as a source of drinking water, industrial use or stock watering within the contaminated ground water plume. Since MOC does not own the surface lands overlying a large portion of the contaminant plume, MOC cannot control future uses in what is considered the "Off-Site" areas. Therefore, this section needs to be redrafted to include potential future residential, industrial and stock watering uses of ground water within the plume area.

b. The text in Section 2.4 states that "the exposure pathway from COPC's in soil to the prey is incomplete". However, Table 7 shows that the soil pathway for ecological receptors is complete. This discrepancy needs to be corrected.

3. Table 7 needs to be redrafted to reflect potential future off-site uses as discussed above and below.

a. The ingestion exposure route for the future off-site resident is not an "incidental ingestion" exposure route. The future off-site resident exposure scenario needs to include "ingestion" of ground water as a sole source drinking water supply in the exposure routes.

b. The ground water exposure pathway only considers that a future off-site resident would be potentially impacted if contaminated ground water migrated to a downgradient residential well. As discussed above, the future off-site ground water pathway must consider the potential for future residential, industrial and stock watering uses of ground water within the plume area.

c. If "incidental ingestion" and dermal contact with soils are considered as potential soil exposure pathways for ecological receptors, inhalation also needs to be included as a potential pathway.

d. Since a person could potentially drink surface water during hunting, the surface water pathway needs to include the hunter as a potential receptor for the "incidental ingestion" exposure route.

e. This table does not consider agriculture as a potential use of ground water or surface water. The risk assessment will need to consider the potential for contaminant impacts on future agricultural use.

Submission of the above requested information will allow the OCD to continue a review of this work plan. If there are any questions, please feel free to contact me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: OCD Artesia District

Z 765 962 547

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NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
2040 S. Pacheco
Santa Fe, New Mexico 87505

January 18, 1996

CERTIFIED MAIL
RETURN RECEIPT NO. Z-765-962-540

Mr. Robert J. Menzie, Jr.
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702-0552

RE: ADDITIONAL GROUND WATER INVESTIGATIONS
MARATHON INDIAN BASIN GAS PLANT
EDDY COUNTY, NEW MEXICO

Dear Mr. Menzie:

The New Mexico Oil Conservation Division (OCD) is in the process of reviewing Marathon Oil Company's (MOC) December 18, 1995 "INDIAN BASIN REMEDIATION PROJECT, PROPOSED WELL DRILLING WORKPLAN". This document was submitted as a result of a December 6, 1995 meeting between OCD and MOC at which the OCD requested that MOC perform additional ground water plume delineation prior to OCD's final consideration of MOC's application for alternate abatement standards. The document contains Marathon's proposed work plan for installation of additional monitor wells, two injection wells for reinjection of treated ground water and installation of vapor extraction wells at the Indian Basin Gas Plant.

The OCD has the following comments and requests for information regarding the above referenced document:

1. The proposed shallow zone wells do not address the area directly downgradient of monitor well MW-69. Since MW-69 contains free phase product, the OCD requires that MOC install an additional well downgradient of MW-69 (approximately midway between MW-79 and MW-80).

2. Please provide the OCD all the data and aquifer modelling information which were used to determine the locations of the injection wells. In addition, please provide the OCD copies of the videos of the open hole video logging which was performed last year.

3. Please provide the OCD with specific information on how all monitor wells, injection wells and vapor extraction wells are proposed to be constructed (ie. casing and screen intervals, casing type and size, grout type and grout intervals, etc.).

4. The OCD is concerned that the monitor wells are proposed to be completed with a large section of open hole. This would make the monitor wells potential conduits for migration of contamination to deeper ground water. Please address this concern.

5. Please provide the OCD with MOC's proposed soil and ground water sampling program.

6. Please provide the OCD with a proposed schedule for completion of the work elements and submission of a report on the investigations.

7. The OCD would like to remind MOC that while the OCD can approve construction of the injection wells, MOC cannot inject fluids until a discharge plan for injection has been approved.

Submission of the above requested information will allow the OCD to complete a review of this work plan.

If there are any questions, please feel free to contact me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: OCD Artesia District

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

February 26, 1996

Mr. William Olson
Hydrogeologist, Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Remediation Project
Proposed Well Drilling Workplan

Dear Mr. Olson:

This letter is written in response to your letter dated January 18, 1996 in which you requested additional information regarding Marathon's "Proposed Well Drilling Workplan" dated December 18, 1995. The following responses refer to the numbered requests in your January 18 letter.

1) As required by the OCD, an additional Shallow zone well (MW-93) is proposed downgradient of monitoring well MW-69, approximately midway between MW-79 and MW-80. Table 1 indicates the proposed completion details for this well (MW-93). However, Marathon requests flexibility to modify overall number of Shallow zone monitoring wells and the locations of proposed wells MW-90, 91, 92, and 93 pending results from other drilling activities.

2) Attached is the Lower Queen aquifer test report, prepared by Groundwater Technology, Inc. (GTI) in November 1995 and entitled "Aquifer Testing and Groundwater Flow Modeling Report," which contains the aquifer parameters used for groundwater flow simulations. Initial modeling focused on two pumping and infiltration scenarios, results of which are contained in the GTI report. Additional modeling was conducted in January and February, 1996 to refine the simulations by using updated pumping rate data for recently installed recovery wells MW-81, MW-82, and MW-83 and possible modified locations of proposed recovery wells MW-85, MW-86 and a new proposed recovery well MW-94. Tables 2 and 3 show the aquifer parameters and recovery/infiltration data used for these simulations. Marathon plans to drill four new recovery wells (MW-84, MW-85, MW-86, and MW-94) and one infiltration well (IW-1) as indicated on the attached GTI simulation diagram. Locations of recovery wells MW-84, 85, and 86 remain unchanged; recovery well MW-94 is a new well located in the interior of the plume area and is designed to assist with flow capture. The infiltration well is located south of Rocky Arroyo, upgradient of the contaminant plume. The modeling simulation shows capture of 100% of the infiltrated treated water effluent by the eight existing and four proposed recovery wells.

   Borehole videos are not included with this package and will be addressed in a separate letter.

3) Per your request, Table 1 provides the proposed casing and grouting details for the planned wells.

4) The proposed completions of Lower Queen monitoring wells MW-87, MW-88, and MW-89 have been changed to address the potential of hydrocarbon contamination of the Lower Queen aquifer via the borehole. These changes are detailed in Table 1.

5) Recovered drill cuttings for each well will be logged and field screened at five-foot intervals using a photo ionization detector by a qualified geologist. Well construction diagrams will be completed by the geologist and will include a lithologic column along with the results of field screening of the cuttings.

   Well development by downhole pumping will proceed following the drilling and completing of the wells. After the wells are developed, a disposable bailer will be used to collect groundwater samples for each well. The samples will be placed in appropriate containers, stored on ice, and delivered to Analytical Technologies, Inc. for analysis. Samples will be analyzed for benzene, toluene, ethylbenzene, total xylenes (BTEX), and chloride by Environmental Protection Agency methods 8020 and 325.2, respectively. Strict chain-of-custody procedures will be followed.

6) Marathon proposes to complete the work elements according to the following schedule:

   a) Phase 1: Drill, complete, develop, and sample four Lower Queen groundwater recovery wells (MW-84, MW-85, MW-86, and MW-94) and the upgradient infiltration well (IW-1) by June 1, 1996. This assumes OCD approval of the work plan is not later than March 25, 1996.

   b) Phase 2: Due to application processing time associated with obtaining a New Mexico Air Pollution Control Bureau 702 air permit for the installation of the proposed Lower Queen barrier vapor extraction system, Marathon plans to delay drilling of the Lower Queen vapor extraction wells until the air permit is received. In addition, the wells will be drilled in two stages, with 5 wells proposed initially, then the remaining extraction wells drilled after reviewing results from operating the first stage vapor extraction wells for a period of up to two (2) months. The first stage wells will be completed by December 1, 1996 and the second stage wells will be completed by March 1, 1997. While the number and locations of vapor extraction wells have been tentatively identified, Marathon requires flexibility to change the locations in the field as wells are being drilled. Likewise, results of interwellbore testing of the first stage vapor extraction wells as well as additional sampling results will help confirm locations of second stage wells. However, the exact number and locations of second stage vapor extraction wells may change prior to actual drilling.

   c) Phase 3: Drill, complete, develop, and sample Shallow zone and Lower Queen monitoring wells as needed by May 1, 1997. Information obtained from drilling the above identified recovery, injection, and vapor extraction wells may alter the number and locations of additional monitoring wells.

   d) Submit a report of the investigations described in a) through c) above by July 1, 1997.

7) As you are aware, Marathon has submitted an application for approval to modify the Indian Basin Gas Plant Groundwater Discharge Plan (GW-21) to allow upgradient infiltration of treated water from the remediation project. Adjustment of the proposed drilling schedule as discussed in Item 6 above is, in part, to allow time for OCD review and approval of the discharge plan modification.

If you have any additional information needs or questions please call me.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental & Safety Representative

Attachments

xc: Tim Gum, OCD District Office, Artesia, New Mexico
File 542-04

Table 1. Casing and Grouting Details

Well	Proposed Well Use	Planned Drilling Phase	Cased-Hole Diameter (inches)	Approximate Cased-Hole Depth (feet)	Surface Casing Diameter (inches)	Surface Casing Thickness (inches)	Grout Type	Approximate Grouting Interval (feet)	Completion Hole Diameter (inches)	Completion Type	Approximate Completion Interval (feet)
MW-84	LQ recovery	1	12.25	30	8.625	0.25	bentonite-concrete	30 to surface	7.875	open hole	180 to 30
MW-85	LQ recovery	1	12.25	50	8.625	0.25	bentonite-concrete	50 to surface	7.875	open hole	220 to 50
MW-86	LQ recovery	1	12.25	50	8.625	0.25	bentonite-concrete	50 to surface	7.875	open hole	220 to 50
MW-94	LQ recovery	1	12.25	40	8.625	0.25	bentonite-concrete	40 to surface	7.875	open hole	190 to 40
IW-1	LQ infiltration	1	17.5	70	12	0.188	bentonite-concrete	70 to surface	11	open hole	195 to 70
VE-1	vapor extraction	2a	12.25	78	8.625	0.25	bentonite-concrete	78 to surface	7.875	open hole	217 to 78
VE-2	vapor extraction	2a	12.25	73	8.625	0.25	bentonite-concrete	73 to surface	7.875	open hole	211 to 73
VE-3	vapor extraction	2a	12.25	73	8.625	0.25	bentonite-concrete	73 to surface	7.875	open hole	206 to 73
VE-4	vapor extraction	2a	12.25	58	8.625	0.25	bentonite-concrete	58 to surface	7.875	open hole	193 to 58
VE-5	vapor extraction	2a	12.25	58	8.625	0.25	bentonite-concrete	58 to surface	7.875	open hole	183 to 58
VE-6	vapor extraction	2b	12.25	58	8.625	0.25	bentonite-concrete	58 to surface	7.875	open hole	173 to 58
VE-7	vapor extraction	2b	12.25	78	8.625	0.25	bentonite-concrete	78 to surface	7.875	open hole	233 to 78
VE-8	vapor extraction	2b	12.25	78	8.625	0.25	bentonite-concrete	78 to surface	7.875	open hole	233 to 78
VE-9	vapor extraction	2b	12.25	73	8.625	0.25	bentonite-concrete	73 to surface	7.875	open hole	218 to 73
VE-10	vapor extraction	2b	12.25	73	8.625	0.25	bentonite-concrete	73 to surface	7.875	open hole	238 to 73
VE-11	vapor extraction	2b	12.25	88	8.625	0.25	bentonite-concrete	88 to surface	7.875	open hole	205 to 88
VE-12	vapor extraction	2b	12.25	68	8.625	0.25	bentonite-concrete	68 to surface	7.875	open hole	180 to 68
VE-13	vapor extraction	2b	12.25	58	8.625	0.25	bentonite-concrete	58 to surface	7.875	open hole	170 to 58
VE-14	vapor extraction	2b	12.25	68	8.625	0.25	bentonite-concrete	68 to surface	7.875	open hole	177 to 68
VE-15	vapor extraction	2b	12.25	83	8.625	0.25	bentonite-concrete	83 to surface	7.875	open hole	203 to 83
MW-87	LQ monitor	3	12.25	107	8.625	0.25	bentonite-concrete	107 to surface	6.125	open hole	132 to 107
MW-88	LQ monitor	3	12.25	157	8.625	0.25	bentonite-concrete	157 to surface	6.125	open hole	182 to 157
MW-89	LQ monitor	3	12.25	201	8.625	0.25	bentonite-concrete	201 to surface	6.125	open hole	226 to 201
MW-90	Shallow monitor	3	12.25	30	8.625	0.25	bentonite-concrete	30 to surface	7.875	open hole	60 to 30
MW-91	Shallow monitor	3	12.25	30	8.625	0.25	bentonite-concrete	30 to surface	7.875	open hole	60 to 30
MW-92	Shallow monitor	3	12.25	30	8.625	0.25	bentonite-concrete	30 to surface	7.875	open hole	60 to 30
MW-93	Shallow monitor	3	12.25	30	8.625	0.25	bentonite-concrete	30 to surface	7.875	open hole	60 to 30

Table 2. Aquifer Parameters

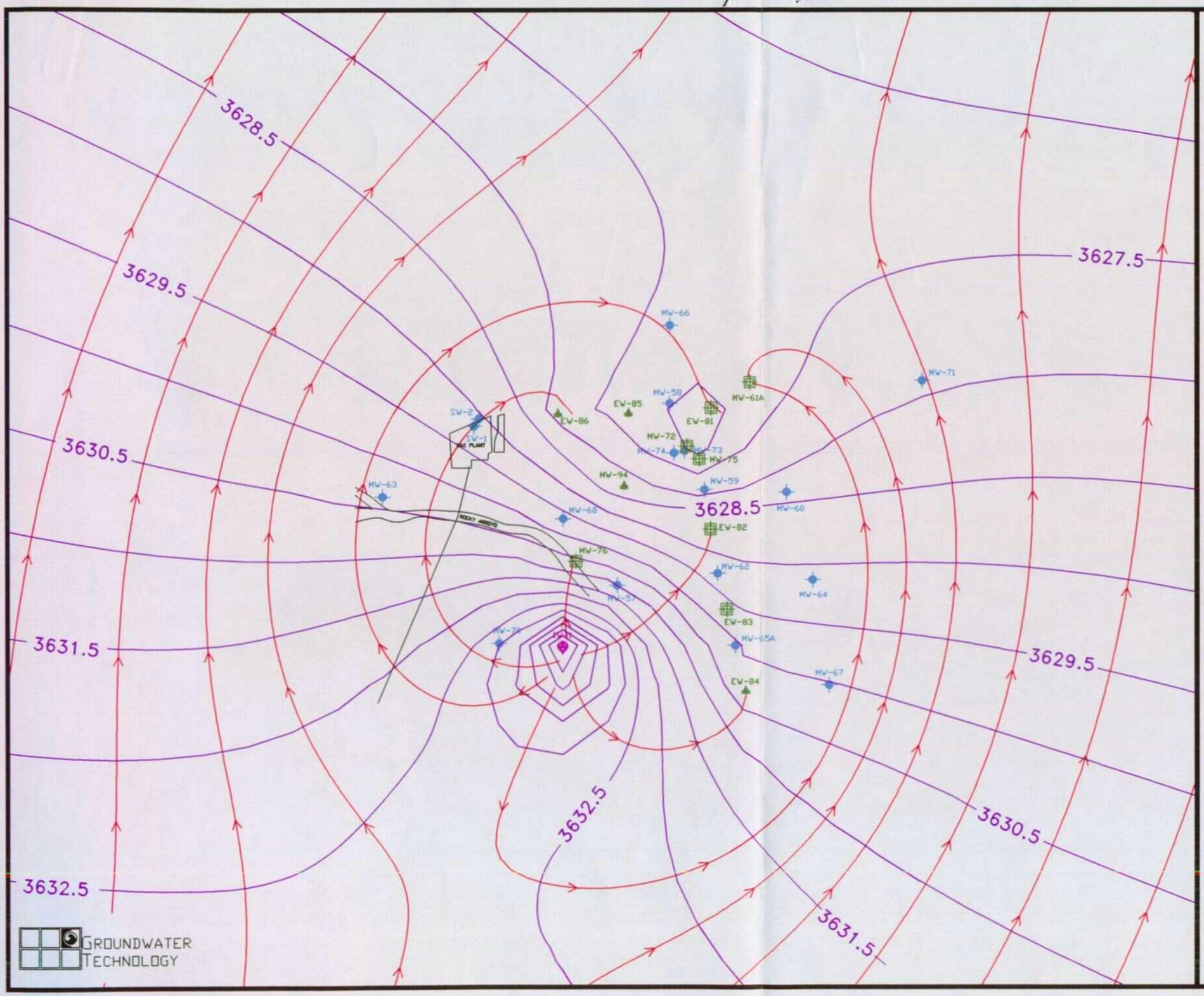
Aquifer Parameter	Value
Hydraulic Conductivity	52 ft/day
Gradient	.0002
Storage Coefficient	.0004
Porosity	.02
Aquifer Top (arbitrary)	3700' AMSL
Aquifer Bottom	3577'AMSL
Recharge	0 ft^3/day

Note: AMSL = Above Mean Sea Level

TABLE 3
RECOVERY AND INFILTRATION RATES
LOWER QUEEN FLOW MODELING SCENARIO

Existing Recovery Well	Proposed Recovery Well	Proposed Infiltration Well	Rate (gpm)
MW-61A			8.5
MW-68			3.5
MW-72			18.4
MW-75			13.7
MW-76			20
MW-81			20
MW-82			8
MW-83			19.1
SW-1			0
	MW-84		20
	MW-85		20
	MW-86		20
	MW-94		20
		IW-1*	-191.2
TOTAL RECOVERY			191.2
TOTAL INFILTRATION*			191.2

Note: Actual infiltration rate will be Total Recovery less plant use and infiltration to Shallow zone wells.



EXPLANATION

- LOWER AQUIFER MONITOR WELL
- CONDENSATE LINE
- 3628.5 — POTENTIOMETRIC SURFACE ELEVATION
- FLOW LINES
- EXISTING EXTRACTION WELL
- PROPOSED EXTRACTION WELL
- PROPOSED INJECTION WELL

N

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APPROX. SCALE IN FEET

MARATHON OIL COMPANY

INDIAN BASIN REMEDIATION PROJECT

INDIAN BASIN, NEW MEXICO

053350108

DRAWN BY: K. SPENCER DATE: 1/29/96
DRAFTED BY: M. RENDA DATE: 2/20/96
CHECKED BY:_____ DATE:_____

FEBRUARY 1996

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

February 7, 1996

Mr. William Olson
Hydrogeologist, Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

Fax recieved on 2/8/96 Will Olson

RE: Indian Basin Remediation Project
Late Submittal of Fourth Quarter 1995 Quarterly Report

Dear Mr. Olson:

Per our telephone conversation today, Marathon is notifying your office that the process of data compilation and summary reporting of Fourth Quarter (October 1 through December 31, 1995) Indian Basin remediation project activities is not complete as of today. Marathon will be submitting this report late, but plans to hand deliver it to you on Friday, February 23, 1996. If you have any additional information needs or questions please call me.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental & Safety Representative

Attachments

c: Roger C. Anderson, OCD Bureau Chief, Santa Fe
C. K. Curlee
T. L. Guillory
T. C. Lowry
R. F. Unger

File 572-00

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

January 15, 1996

Mr. Roger C. Anderson
Environmental Bureau Chief
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Gas Plant
Groundwater Discharge Plan (GW-21) Modification

Dear Mr. Anderson:

Attached are three copies of a modification to the Indian Basin Gas Plant Groundwater Discharge Plan (GW-21) for your review and approval. The discharge plan modification is necessary to permit the addition of a treated groundwater injection system. This document is submitted by Marathon Oil Company on behalf of the Indian Basin Gas Plant owners. In addition, a check for the $50 filing fee is enclosed. If you have any questions concerning the discharge plan, please call me.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental Representative

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JAN 19 1996
Environmental Bureau
Oil Conservation Division

File: 556-01

MARATHON OIL COMPANY
INDIAN BASIN GAS PLANT
GROUNDWATER DISCHARGE PLAN (GW-21) MODIFICATION

Submitted on behalf of the working interest owners to
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division

INTRODUCTION

This Groundwater Discharge Plan modification is to address the addition of a treated groundwater injection system at the Indian Basin Gas Plant which includes up to two Lower Queen injection wells (IW-1 and IW-2), up to two Shallow zone injection wells (MW-45 and MW-51), an underground groundwater collection pipeline to the water treatment compound, an underground treated groundwater discharge pipeline to the two Lower Queen injection wells, an aboveground treated water discharge pipeline to MW-45, and an underground pipeline conveying treated water to MW-51. This document is an amendment to the existing Groundwater Discharge Plan document dated November 26, 1994, as approved.

TYPE OF OPERATION

A discharge system to collect and treat hydrocarbon-contaminated groundwater and inject (discharge) the treated water into wells completed within the Lower Queen and Shallow alluvial aquifers.

OPERATOR/LEGALLY RESPONSIBLE PARTY & LOCAL REPRESENTATIVE

No change from approved Groundwater Discharge Plan dated November 26, 1994.

LOCATION OF FACILITY

Figures 1 & 2 are maps showing the locations of the various components of the injection system. The two Lower Queen injection wells (IW-1 and IW-2) are located on Bureau of Land Management (BLM) property in the southeast 1/4 of Section 23, Township 21S, Range 23E, in Eddy County, New Mexico. Shallow zone injection wells MW-45 and MW-51, the aboveground treated water discharge pipeline to MW-45, and the underground pipeline conveying treated water to MW-51 are located on Marathon's Indian Basin Gas Plant property in the northeast 1/4 of Section 23, Township 21S, Range 23E. The underground gathering pipeline conveying hydrocarbon-contaminated groundwater to the water treatment compound is located on both BLM and the Indian Basin Gas Plant property in Sections 23, 24, and 25, Township 21S, Range 23E. The treated groundwater discharge underground pipeline to the two Lower Queen injection wells is located on both BLM and Indian Basin Gas Plant property in Section 23, Township 21S, Range 23E.

LANDOWNER

The landowner of the Indian Basin Gas Plant property has not changed from the approved Groundwater Discharge Plan dated November 26, 1994; however, two underground pipelines and the two Lower Queen injection wells are located on BLM property.

FACILITY DESCRIPTION

Figures 1 & 2 show the specific facilities associated with the treatment of hydrocarbon-contaminated groundwater and injection into the Shallow zone and Lower Queen aquifers. The treatment compound facilities will include all underground gathering pipeline, up to two air strippers, and activated carbon vessels. The injection system will consists of two underground discharge pipelines, an aboveground discharge pipeline, two Shallow zone injection wells, and two Lower Queen injection wells.

SOURCES AND QUANTITIES OF EFFLUENTS & WASTE SOLIDS

Effluents

The two effluents of the injection system are: 1) hydrocarbon-contaminated groundwater; and, 2) treated water cleaned to New Mexico Water Quality Control Commission (WQCC) standards described in the WQCC Regulations in Section 3-103. The quantity of hydrocarbon-contaminated groundwater gathered in the underground pipeline will be approximately 6857 bbl/day or 200 gpm. The quantity of treated water injected into the Lower Queen aquifer via the two injection wells will range from 0 to 200 gpm. The quantity of treated water injected into the Shallow zone aquifer via the two injection wells will range from 0 to 50 gpm. The water that is not injected into either aquifer will be used as plant process water or diverted to one of the Class II disposal wells as described in the approved Groundwater Discharge Plan.

Waste Solid

The waste solid generated from the injection system is spent activated carbon contained within the vessels. This waste will be recycled by a carbon regeneration service company. Regenerated carbon will be used to replace the spent carbon. If disposal of spent activated carbon is required, appropriate analytical tests will be performed to properly characterize the waste for disposal.

EFFLUENT AND SOLID WASTE QUALITY CHARACTERISTICS

Effluent

Appendix A is an October 1995 laboratory report containing analyses of the hydrocarbon-contaminated groundwater gathered in the underground pipeline going into the air stripper (stripper inlet) and of treated water exiting the air stripper (stripper outlet). Appendix B contains an April 1995 laboratory analysis report of the treated groundwater from a sample collected at the

outlet of the air stripper and provides full suite analysis of parameters contained in the WQCC groundwater standards.

Waste

No laboratory analysis is available for spent activated carbon because the system has not been constructed yet. Under current plans, spent activated carbon will be recycled via a regeneration service. Analysis will be performed when required to characterize for disposal. The laboratory report will be kept on file at the gas plant.

TRANSFER AND STORAGE OF PROCESS FLUIDS AND EFFLUENTS

Transfer of hydrocarbon-contaminated groundwater is by an underground gathering pipeline. Transfer of treated water is by both aboveground and underground pipelines. Storage of hydrocarbon-contaminated groundwater prior to treatment by air stripping and activated carbon is in aboveground steel tanks as described in the approved Groundwater Discharge Plan. Figure 2 is a generalized flow schematic of the gathering, storage, treatment, and discharge (injection) system.

Discharges of effluents can occur throughout the system. Discharges from the air stripper, storage tanks, or carbon vessels at the treatment compound are within an unlined secondary containment. Containment is afforded by an earthen berm that is capable of containing 133% of the storage tank volume.

Underground Pipelines

The injection system includes two underground pipelines. The pipelines will be hydrostatically tested after initial construction; integrity will be demonstrated by maintaining 5 psi above normal operating pressure for a duration of four hours. For polyethylene lines, integrity will be verified by visual inspection of pressured line. Results of the pressure tests will be kept on file at the gas plant.

EFFLUENT DISPOSAL

Hydrocarbon-contaminated groundwater will be treated to WQCC standards at the treatment compound by the air stripper/activated carbon system. Treated water will then be injected into the Lower Queen and/or Shallow zone aquifers as previously described. Up to 200 gpm of treated water will be injected into the Lower Queen aquifer through wells IW-1 and IW-2. Up to 50 gpm of treated water into the Shallow zone aquifer via wells MW-45 and MW-51. The proposed well construction diagrams for IW-1 and IW-2 and the well completion diagrams for wells MW-45 and MW-51 are included in Appendix C. Construction of these wells will confine the injection (recharge) of treated water to the zone of completion.

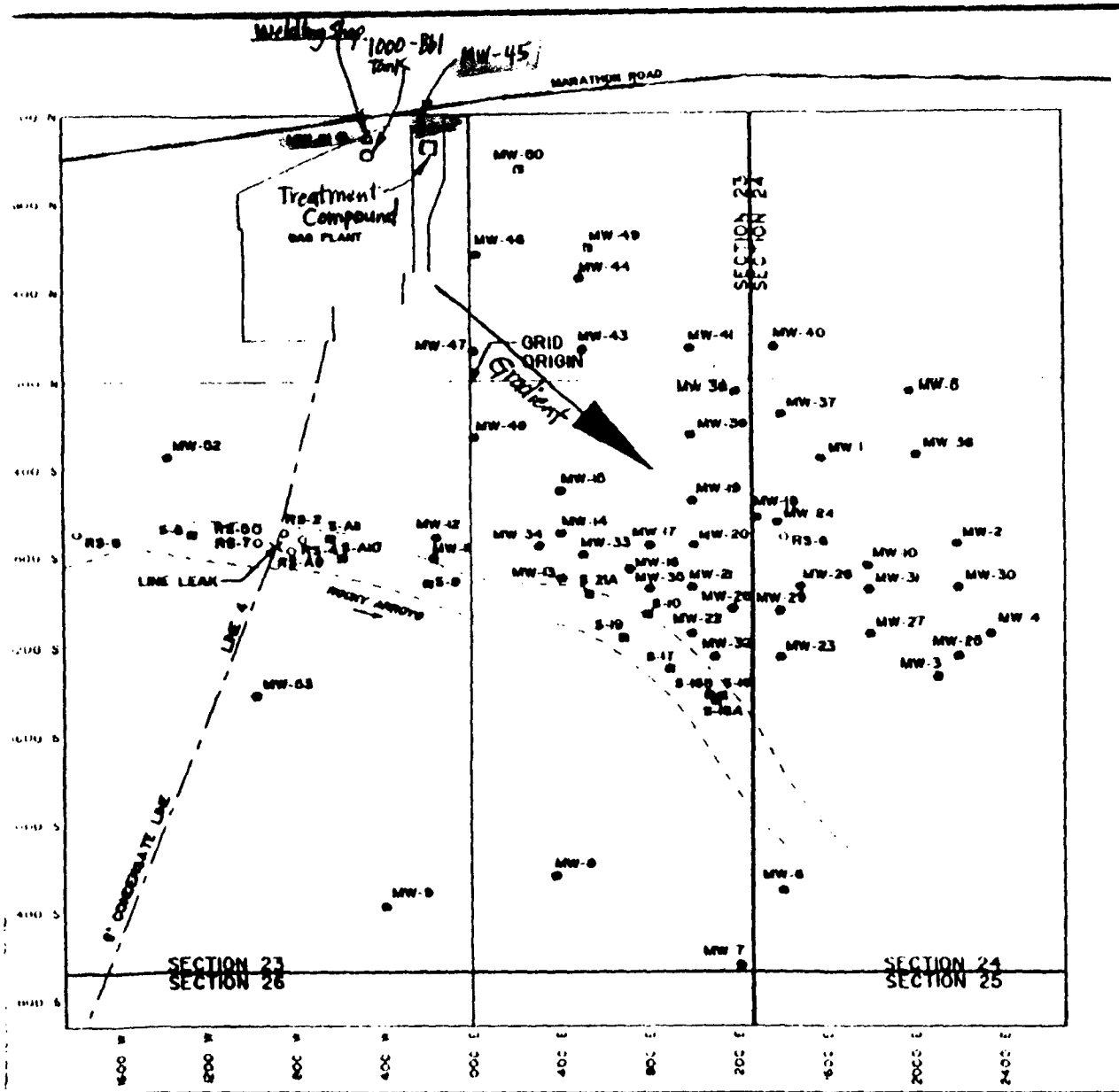
Overflow of treated water from injection wells will be prevented by installation of a high level shut-off mechanism at 10 feet below the top of the wellhead casing. This will prevent treated water from flowing out of the casing and onto the ground.

Monitoring of the treated water effluent will be conducted on a monthly basis to ensure that treatment to WQCC groundwater standards is being accomplished by the air stripper and activated carbon. Water samples will be collected at the outlet of the last treatment equipment (i.e., the air stripper or the activated carbon vessel) prior to the treated water entering the discharge pipelines that convey the treated water to the injection wells. The water samples will be analyzed for benzene, ethylbenzene, toluene, and total xylenes by Environmental Protection Agency Method 8020. Monthly laboratory reports of treated water samples will be kept on file at the gas plant. If the laboratory report indicates that WQCC groundwater standards have been exceeded, the OCD will be notified.

INSPECTION, MAINTENANCE AND REPORTING

Inspections of the underground pipeline right-of-way will be conducted to search for moist soils or staining that may indicate a potential pipeline leak. In addition, flow meters will be placed on either end of the pipeline for daily comparison purposes to detect potential pipeline leaks. An apparent leak will be investigated immediately. A confirmed leak of contaminated water will be reported to the OCD according to WQCC Regulations.

INDIAN BASIN GAS PLANT
ARTESIA, NEW MEXICO



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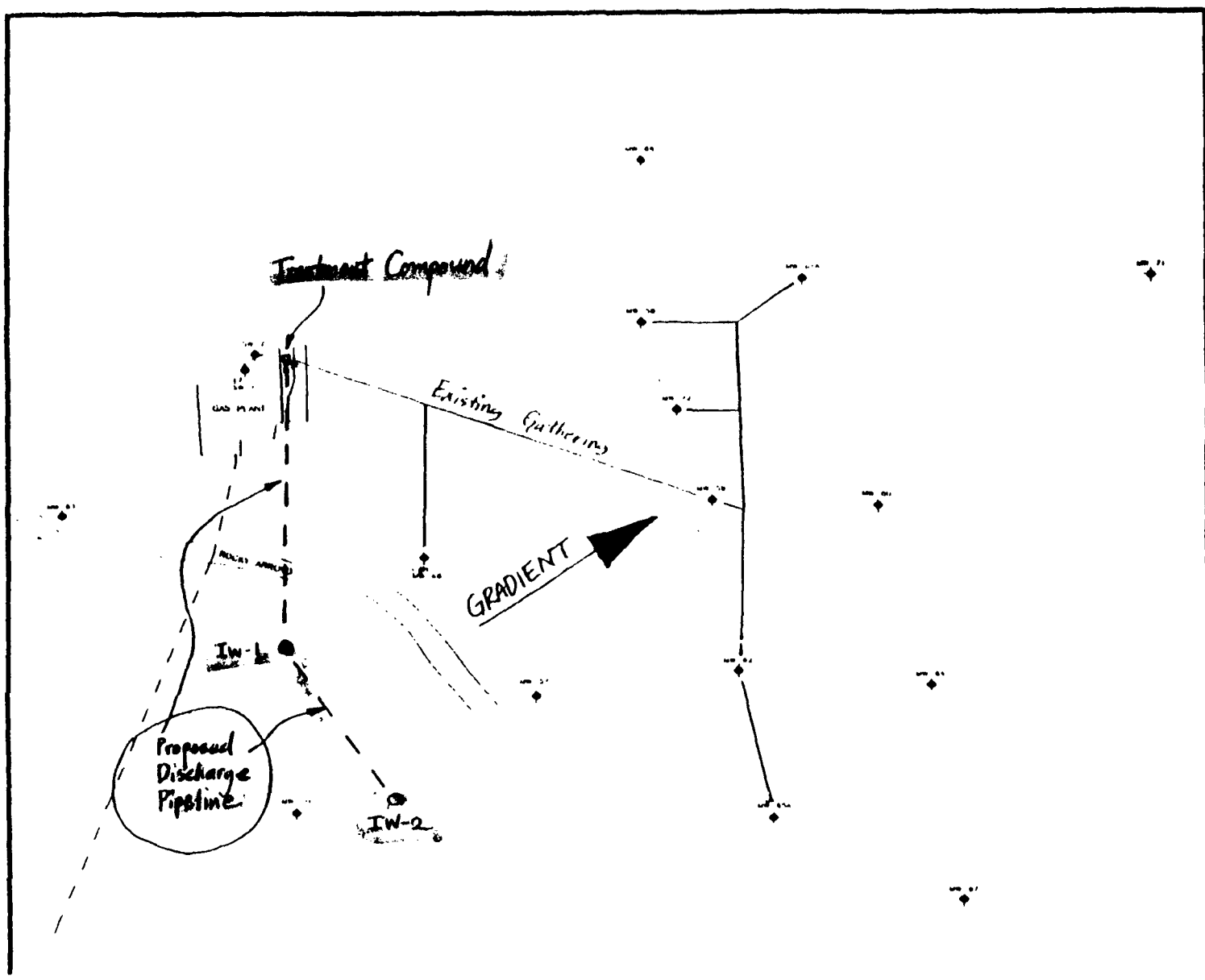
LEGEND

- MW-9 ● SHALLOW ALLUVIAL GROUNDWATER MONITORING WELL
- RS-4 ○ 4 INCH PVC RECOVERY SUMP
- S-19 ■ 24 INCH GALVANIZED RECOVERY SUMP

Figure 1	MARARTHON OIL COMPANY
	INDIAN BASIN GAS PLANT
Shallow zone Base	DATE / SCALE / PROJECT NO. / PREPARED BY / CHECKED BY / DRAFTED BY / PAGE NO.



EXPLANATION

◆ MONITOR WELL

- — - CONDENSATE LINE

N

0 1000 2000

APPROX. SCALE IN FEET

MARATHON OIL COMPANY

INDIAN BASIN GAS PLANT SITE

INDIAN BASIN, NEW MEXICO

02335V112

DRAWN BY: DACRE BUSH DATE: 03-11-94
DRAFTED BY: DEN HOLMES DATE: 03-20-94
CHECKED BY: _____ DATE:

Figure 2

AnalyticalTechnologies,Inc.

2709-D Pan American Freeway, NE Albuquerque, NM 87107
Phone (505) 344-3777 FAX (505) 344-4413

ATI I.D. **510345**

October 26, 1995

Marathon Oil Company
P.O. Box 552
Midland, TX 79702

Project Name/Number: IB REMEDIATION 44999

Attention: Bob Menzie

On **10/13/95**, Analytical Technologies, Inc., (ADHS License No. AZ0015), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

EPA method 325.3 analyses were performed by Analytical Technologies, Inc., 11 East Olive Road, Pensacola, FL.

All other analyses were performed by Analytical Technologies, Inc., Albuquerque, NM.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Kimberly D. McNeill
Project Manager

H. Mitchell Rubenstein, Ph.D.
Laboratory Manager

MR:jt

Enclosure

AnalyticalTechnologies,Inc.

CLIENT	:MARATHON OIL CO.	DATE RECEIVED	:10/13/95
PROJECT #	:44999		
PROJECT NAME	:IB REMEDIATION	REPORT DATE	:10/26/95

ATI ID: 510345

	ATI ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	510345-01	SW-1	AQUEOUS	10/12/95
02	NA	STRIPPER INLET	AQUEOUS	10/12/95
03	NA	STRIPPER OUTLET	AQUEOUS	10/12/95
04	510345-04	LYMAN	AQUEOUS	10/12/95
05	510345-05	ARROYO	AQUEOUS	10/12/95
06	510345-06	BIEBBLE	AQUEOUS	10/12/95
07	NA	TRIP BLANK	AQUEOUS	10/05/95

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	7

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

AnalyticalTechnologies,Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 510280
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 510345
Project Name: MARATHON OIL
Project Location: INDIAN BASIN REMEDIATION-MO
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 510345-01			Lab ID: 001		
CHLORIDE (325.3)	MG/L	24	1	CIW040	
Comments:					
Client ID: 510345-04			Lab ID: 002		
CHLORIDE (325.3)	MG/L	12	2	CIW040	#
Comments:					
Client ID: 510345-05			Lab ID: 003		
CHLORIDE (325.3)	MG/L	14	2	CIW040	#
Comments:					
Client ID: 510345-06			Lab ID: 004		
CHLORIDE (325.3)	MG/L	13	2	CIW040	#
Comments:					

AnalyticalTechnologies, Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 510280
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 510345
Project Name: MARATHON OIL
Project Location: INDIAN BASIN REMEDIATION-MO
Test: Group of Single Wetchem

Client ID:	Lab ID:	Matrix:	Date/Time Sampled:	Date Received:
510345-01	001	WATER	12-OCT-95 0958	14-OCT-95
510345-04	002	WATER	12-OCT-95 1015	14-OCT-95
510345-05	003	WATER	12-OCT-95 1025	14-OCT-95
510345-06	004	WATER	12-OCT-95 1035	14-OCT-95

AnalyticalTechnologies,Inc.

"Method Report Summary"

Accession Number: 510280
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 510345
Project Name: MARATHON OIL
Project Location: INDIAN BASIN REMEDIATION-MO
Test: Group of Single Wetchem

Client Sample Id:	Parameter:	Unit:	Result:
510345-01	CHLORIDE (325.3)	MG/L	24
510345-04	CHLORIDE (325.3)	MG/L	12
510345-05	CHLORIDE (325.3)	MG/L	14
510345-06	CHLORIDE (325.3)	MG/L	13

AnalyticalTechnologies,Inc.

"WetChem Quality Control Report"

Parameter:	CHLORIDE
Batch Id:	CIW040
Blank Result:	<1
Anal. Method:	325.3
Prep. Method:	N/A
Analysis Date:	24-OCT-95
Prep. Date:	24-OCT-95

Sample Duplication

Sample Dup:	510279-13
Rept Limit:	<1
Sample Result:	9.31
Dup Result:	9.41
Sample RPD:	1
Max RPD:	6
Dry Weight%	N/A

Matrix Spike

Sample Spiked:	510279-13
Rept Limit:	<1
Sample Result:	9.31
Spiked Result:	59.5
Spike Added:	55.0
% Recovery:	91
% Rec Limits:	89-110
Dry Weight%	N/A

ICV

ICV Result:	94.9
True Result:	100.0
% Recovery:	95
% Rec Limits:	90-110

LCS

LCS Result:	
True Result:	
% Recovery:	
% Rec Limits:	

AnalyticalTechnologies,Inc.

----- Common Footnotes Wet Chem -----

N/A = NOT APPLICABLE.
N/S = NOT SUBMITTED.
N/C = SAMPLE AND DUPLICATE RESULTS ARE AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RPD IS "NOT CALCULABLE" AND NO CONTROL LIMITS APPLY.
ND = NOT DETECTED ABOVE REPORTING LIMIT.
DISS. OR D = DISSOLVED
T & D = TOTAL AND DISSOLVED
R = REACTIVE
T = TOTAL
G = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE RESULT IS AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "IN CONTROL".
Q = THE ANALYTICAL (POST-DIGESTION) SPIKE IS REPORTED DUE TO THE MATRIX (PRE-DIGESTION) SPIKE BEING OUTSIDE ACCEPTANCE LIMITS.
# = ELEVATED REPORTING LIMIT DUE TO INSUFFICIENT SAMPLE.
+ = ELEVATED REPORTING LIMIT DUE TO DILUTION INTO CALIBRATION RANGE.
* = ELEVATED REPORTING LIMIT DUE TO MATRIX INTERFERENCE.
@ = ADJUSTED REPORTING LIMIT DUE TO SAMPLE MATRIX (DILUTION PRIOR TO PREPARATION).
P = ANALYTICAL (POST-DIGESTION) SPIKE
I = DUPLICATE INJECTION
& = AUTOMATED
F = SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
N/C+ = NOT CALCULABLE
N/C* = NOT CALCULABLE; SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
H = SAMPLE AND/OR DUPLICATE IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL".
A = SAMPLE AND DUPLICATE RESULTS ARE "OUT OF CONTROL".
Z = THE SAMPLE RESULT FOR THE SPIKE IS BELOW REPORTING LIMIT. HOWEVER, THIS RESULT IS REPORTED FOR ACCURATE QC CALCULATIONS.
NH= SAMPLE AND / OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE RESULTS EXCEED THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL" SAMPLE IS NON-HOMOGENOUS.
(*) = DETECTION LIMITS RAISED DUE TO CLP METHOD NOT REQUIRING A CONCENTRATION STEP FOR CN.

(CA) = SEE CORRECTIVE ACTIONS FORM.

SW-846, 3RD EDITION, SEPTEMBER 1986 AND REVISION 1, JULY 1992.
EPA 600/4-79-020, REVISED MARCH 1983.
STANDARD METHODS, 17TH ED., 1989
NIOSH MANUAL OF ANALYTICAL METHODS, 3RD EDITION.
ANNUAL BOOK OF ASTM STANDARDS, VOLUME 11.01, 1991.

1. COLIFORM. COLIFORM PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE LOGARITHM OF COLONIES PER 100 MLS OF SAMPLE ON DUPLICATE PLATES.

2. PH. PH PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND THE DUPLICATE ANALYSIS.

3. FLASHPOINT. FLASHPOINT PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE ANALYSIS. IF FLASHPOINT IS LESS THAN 25 DEGREES CELSIUS, THE DETECTION LIMIT BECOMES THE INITIAL STARTING TEMPERATURE.

RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION).

RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

DPH = DOLLY P. HWANG	SG = SCOTT GRESHAM	RB = REBECCA BROWN
TT = TONY TINEO	NSB = NANCY S. BUTLER	FB = FREDDIE BROWN
MM = MARY MOLONEY	CF = CHRISTINE FOSTER	HN = HONG NGUYEN
GJ = GARY JACOBS		

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 510345

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	10/12/95	NA	10/13/95	1
02	STRIPPER INLET	AQUEOUS	10/12/95	NA	10/13/95	10
03	STRIPPER OUTLET	AQUEOUS	10/12/95	NA	10/13/95	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	92	2.8
TOLUENE	UG/L	<0.5	6.2	7.1
ETHYLBENZENE	UG/L	0.6	110	4.1
TOTAL XYLENES	UG/L	1.2	220	20

SURROGATE:

BROMOFLUOROBENZENE (%)	101	82	79

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 510345

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	LYMAN	AQUEOUS	10/12/95	NA	10/13/95	1
05	ARROYO	AQUEOUS	10/12/95	NA	10/13/95	1
06	BIEBBLE	AQUEOUS	10/12/95	NA	10/13/95	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	1.6	1.2	<0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)		98	99	101

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 510345

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
07	TRIP BLANK	AQUEOUS	10/05/95	NA	10/13/95	1

PARAMETER	UNITS	07
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%) 99

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 510345
BLANK I.D.	: 101395	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 10/13/95
PROJECT NAME	: IB REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	102

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: BTEX (EPA 8020)	ATI I.D.	: 510345
BLANK I.D.	: 101395B	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 10/13/95
PROJECT NAME	: IB REMEDIATION	DILUTION FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
TOLUENE	UG/L	<0.5
ETHYLBENZENE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	98

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: BTEX (EPA 8020)		
MSMSD #	: 51034501	ATI I.D.	: 510345
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: 44999	DATE ANALYZED	: 10/13/95
PROJECT NAME	: IB REMEDIATION	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 51034501	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
BENZENE	<0.5	10	12	120	10	100	18
TOLUENE	<0.5	10	10	100	10	100	0
ETHYLBENZENE	0.6	10	10	94	10	94	0
TOTAL XYLENES	1.2	30	30	96	31	99	3

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc., Albuquerque, NM
San Diego • Phoenix • Seattle • Pensacola • Ft. Collins • Portland • Albuquerque

CHAIN OF CUSTODY

DATE: 10-12-95 PAGE 1 OF 1

ATI LAB I.D. 510345

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: BOB MENZIE

COMPANY: MARATHON Oil Co
ADDRESS: P.O. BOX 552
MIDLAND TX 79702
PHONE: 915 687-8312
FAX: 915 687-8305

BILL TO:
COMPANY: SAME AS Above
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)	BTXE/~~MTBE~~ (8020)	chloride	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	Polynuclear Aromatics (610/8310)	SDWA Primary Standards - Arizona	SDWA Secondary Standards - Arizona	SDWA Primary Standards - Federal	SDWA Secondary Standards - Federal	The 13 Priority Pollutant Metals	RCRA Metals by Total Digestion	RCRA Metals by TCLP (1311)	NUMBER OF CONTAINERS
SW-1	10-12-95	9:58	water	-01				✓	✓																3
STRIPPER inlet		10:05		-02				✓																	2
STRIPPER outlet		10:07		-03				✓																	2
Lyman		10:15		-04				✓	✓																3
ARROYO		10:25		-05				✓	✓																3
Biebble		10:35		-06				✓	✓																3
Trip Blank	10/5	—	AQ	-07				X																	1

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJ. NO.:	44999	NO. CONTAINERS	APPR 17
PROJ. NAME:	IB Remediation	CUSTODY SEALS	Y / N / NA
P.O. NO.:		RECEIVED INTACT	Y
SHIPPED VIA:		RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Rodrigo A Aguilera Time: 11:08	Signature: Kevin Cook Time: 0825	Signature: Time:
Printed Name: Rodrigo A Aguilera Date: 10-12-95	Printed Name: KEVIN Cook Date: 10/13/95	Printed Name: Date:
Company: MARATHON Phone: 915 687-8312	Company: GTI	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Kevin Cook Time: 1108	Signature: Time:	Signature: Andrew Parker Time: 0820
Printed Name: Kevin Cook Date: 10-12-95	Printed Name: Date:	Printed Name: Andrew Parker Date: 10/13
Company: GTI (915) 687-8312	Company:	Analytical Technologies, Inc.

Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody

DATE 10/13 PAGE 1 OF 1

NETWORK PROJECT MANAGER: ~~LETITIA KRAKOWSKI~~ Kim McNeill

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER: Kim McNeill

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)		632/632 MOD	619/619 MOD	610/8310	Chloride		8240 (TCLP 1311) ZHE		Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)		NACE	ASBESTOS		BOD	TOTAL COLIFORM	FECAL COLIFORM		GROSS ALPHA/BETA	RADIUM 226/228		AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
510345-01	10/12	0958	AQ	1										X																			
-04	↓	1015	↓	2										X																			
-05	↓	1025	↓	3										X																			
-06	↓	1035	↓	4										X																			

PROJECT INFORMATION	
PROJECT NUMBER:	510345
PROJECT NAME:	Indian Basin Remediation :MO
QC LEVEL:	STD IV
QC REQUIRED:	MS MSD BLANK
TAT:	STANDARD RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
INTACT?	
RECEIVED GOOD COND./COLD	
LAB NUMBER	510280

DUE DATE: 10/25
RUSH SURCHARGE: no
CLIENT DISCOUNT: Quote %

~~DO NOT ROUTE TO PHOENIX~~

IWOHKM 510345

SAMPLES SENT TO:	
SAN DIEGO	
FT. COLLINS	
RENTON	
PENSACOLA	X
PORTLAND	
PHOENIX	
FIBERQUANT	

RELINQUISHED BY: 1.		RELINQUISHED BY: 2.	
Signature: Andrew Parker	Time: 1700	Signature:	Time:
Printed Name: Andrew Parker	Date 10/13	Printed Name:	Date
Analytical Technologies, Inc. Albuquerque		Company:	
RECEIVED BY: (LAB) 1.		**RECEIVED BY: (LAB) 2.**	
Signature: Robt Elsperman	Time: 0930	Signature:	Time:
Printed Name: R. ELSPERMAN	Date: 10/14/15	Printed Name:	Date:
Company: ATI- FL		Company:	

APPENDIX B

LABORATORY ANALYSIS OF TREATED WATER EFFLUENT

Analytical Technologies, Inc.

2709-D Pan American Freeway, NE Albuquerque, NM 87107
Phone (505) 344-3777 FAX (505) 344-4413

ATI I.D. **503327**

April 18, 1995

Marathon Oil Company
P.O. Box 552
Midland, TX 79702-0552

Project Name/Number: IB INJECTION INDIAN BASIN (44999)

Attention: Bob Menzie

On **03/10/95**, Analytical Technologies, Inc., (ADHS License No. AZ0015), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

This report is being reissued in part to include Radiochemisty/Uranium results. It is now complete.

Please note additional case narrative for Radium 226/228 included in this report.

Due to laboratory error, the EPA recommended hold for Nitrate analyses was missed. Total Nitrate/Nitrite analysis was performed and the results are included in this report. We apologize for any incovenience. There is no charge for this analysis.

Radiochemistry and Uranium analyses were performed by Analytical Technologies, Inc., 225 Commerce Drive, Fort Collins, CO.

EPA Method 8010/8020 and 504.1 analyses were performed by Analytical Technologies, Inc., Albuquerque, NM.

Analytical Technologies, Inc.

All other analyses were performed by Analytical Technologies, Inc., 11 East Olive Road, Pensacola, FL.

This report is being reissued in part to correct typographical error.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Letitia Krakowski, Ph.D.
Project Manager

H. Mitchell Rubenstein, Ph.D.
Laboratory Manager

MR:jt

Enclosure

Analytical Technologies, Inc.

CLIENT	: MARATHON OIL CO.	DATE RECEIVED	: 03/10/95
PROJECT #	: INDIAN BASIN (44999)		
PROJECT NAME	: IB INJECTION	REPORT DATE	: 03/24/95

ATI ID: 503327

	ATI PENSACOLA ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	503327-01	S-OUT	AQUEOUS	03/09/95
02	503327-02	TRIP BLANK	AQUEOUS	02/28/95

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	2

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 503475
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 503327
Project Name: MARATHON OIL
Project Location: IB INJECTION
Test: Group of Single Wetchem
Matrix: WATER
QC Level: II

Lab ID: 001
Client Sample Id: 503327-01

Sample Date/Time: 09-MAR-95 1530
Received Date: 11-MAR-95

Parameters:	Units:	Results:	Rpt Lmts:	Q:	Batch:	Analyst:
CHLORIDE (325.2)	MG/L	40	2		CKW08A	TT
CYANIDE, TOTAL (335.2)	MG/L	ND	0.005		CNW015	MM
FLUORIDE (340.2)	MG/L	0.8	0.2		FLW020	DPH
NITRITE-NITRATE, NITROGEN (353.2)	MG/L	ND	0.1		N3W16A	BF
PHENOLS, TOTAL (420.1)	MG/L	ND	0.006	#	PEW009	MM
SULFATE (375.4)	MG/L	360	100	+	SEW020	DBH
TOTAL DISSOLVED SOLIDS (160.1)	MG/L	730	5		TDW014	NB

Comments:

Analytical Technologies, Inc.

"Method Report Summary"

Accession Number: 503475
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 503327
Project Name: MARATHON OIL
Project Location: IB INJECTION
Test: Group of Single Wetchem

Client Sample Id:	Parameter:	Unit:	Result:
503327-01	CHLORIDE (325.2)	MG/L	40
	FLUORIDE (340.2)	MG/L	0.8
	SULFATE (375.4)	MG/L	360
	TOTAL DISSOLVED SOLIDS (160.1)	MG/L	730

Analytical Technologies, Inc.

"WetChem Quality Control Report"

Parameter:	CHLORIDE	CYANIDE	FLUORIDE	NO2NO3	PHENOL	SULFATE
Batch Id:	CKW08A	CNW015	FLW020	N3W16A	PEW009	SEW020
Blank Result:	<2	<0.005	<0.2	<0.1	<0.005	<10
Anal. Method:	325.2	335.2	340.2	353.2	420.1	375.4
Prep. Method:	N/A	N/A	N/A	N/A	N/A	N/A
Analysis Date:	20-MAR-95	21-MAR-95	17-MAR-95	17-MAR-95	21-MAR-95	20-MAR-95
Prep. Date:	20-MAR-95	21-MAR-95	17-MAR-95	17-MAR-95	16-MAR-95	20-MAR-95
Sample Duplication						
Sample Dup:	503475-1	503475-1	503336-1	503495-6	N/A	503334-1
Rept Limit:	<2	<0.005	<0.2	<0.1	N/A	<10
Sample Result:	40.1	<0.005	<0.2	0.35		26.9
Dup Result:	38.5	<0.005	<0.2	0.36		26.5
Sample RPD:	4	N/C	N/C	0.01G		0.4G
Max RPD:	13	0.005	0.2	0.1		10
Dry Weight%	N/A	N/A	N/A	N/A		N/A
Matrix Spike						
Sample Spiked:	503475-1	503475-1	503336-1	503495-6	503475-1	503335-4
Rept Limit:	<2	<0.005	<0.2	<0.1	<0.006#	<10
Sample Result:	40.1	<0.005	<0.2	0.35	<0.006	10.8
Spiked Result:	58.7	0.082	0.906	1.38	0.026	31.2
Spike Added:	20	0.100	0.800	1.0	0.022	20
% Recovery:	93	82	113	103	118	102
% Rec Limits:	89-110	63-114	70-129	85-118	59-151	51-151
Dry Weight%	N/A	N/A	N/A	N/A	N/A	N/A
ICV						
ICV Result:	56	0.041	1.10	1.94	0.038	20.5
True Result:	55	0.045	1.20	2.00	0.040	20
% Recovery:	102	91	92	97	95	103
% Rec Limits:	90-110	90-110	90-110	90-110	90-110	90-110
LCS						
LCS Result:						
True Result:						
% Recovery:						
% Rec Limits:						

Analytical Technologies, Inc.

"WetChem Quality Control Report"

Parameter:	TDS
Batch Id:	TDW014
Blank Result:	<5
Anal. Method:	160.1
Prep. Method:	N/A
Analysis Date:	16-MAR-95
Prep. Date:	16-MAR-95

Sample Duplication

Sample Dup:	503475-1
Rept Limit:	<5
Sample Result:	733
Dup Result:	728
Sample RPD:	1
Max RPD:	16
Dry Weight%	N/A

Matrix Spike

Sample Spiked:	N/A
Rept Limit:	N/A
Sample Result:	
Spiked Result:	
Spike Added:	
% Recovery:	
% Rec Limits:	
Dry Weight%	

ICV

ICV Result:	
True Result:	
% Recovery:	
% Rec Limits:	

LCS

LCS Result:	265
True Result:	293
% Recovery:	90
% Rec Limits:	66-122

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 503475
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 503327
Project Name: MARATHON OIL
Project Location: IB INJECTION
Test: Group of Single Metals
Matrix: WATER
QC Level: II

Lab Id: 001
Client Sample Id: 503327-01
Sample Date/Time: 09-MAR-95 1530
Received Date: 11-MAR-95

Parameters:	Units:	Results:	Rpt Lmts:	Q:	Batch:	Analyst:
SILVER (200.7)	MG/L	ND	0.01		A0W060	JRR
ALUMINUM (200.7)	MG/L	ND	0.06		L0W060	JRR
ARSENIC (206.2)	MG/L	ND	0.005		R2W087	CD
BORON (200.7)	MG/L	ND	0.09		O0W060	JRR
BARIUM (200.7)	MG/L	0.10	0.01		B0W060	JRR
CADMIUM (213.2)	MG/L	ND	0.0005		C2W087	SL
COBALT (200.7)	MG/L	ND	0.01		T0W060	JRR
CHROMIUM (200.7)	MG/L	ND	0.01		H0W060	JRR
COPPER (200.7)	MG/L	ND	0.01		F0W060	JRR
IRON (200.7)	MG/L	0.61	0.02		N0W060	JRR
MERCURY (245.1)	MG/L	ND	0.0002		M2W037	SL
MANGANESE (200.7)	MG/L	0.27	0.01		G0W060	JRR
MOLYBDENUM (200.7)	MG/L	ND	0.01		D0W060	JRR
NICKEL (200.7)	MG/L	ND	0.02		E0W060	JRR
LEAD (239.2)	MG/L	ND	0.003		P2W087	CD
SELENIUM (270.2)	MG/L	ND	0.005		S2W087	SL
ZINC (200.7)	MG/L	ND	0.02		50W060	JRR

Comments:

Analytical Technologies, Inc.

"Method Report Summary"

Accession Number: 503475
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 503327
Project Name: MARATHON OIL
Project Location: IB INJECTION
Test: Group of Single Metals

Client Sample Id:	Parameter:	Unit:	Result:
503327-01	BARIUM (200.7)	MG/L	0.10
	IRON (200.7)	MG/L	0.61
	MANGANESE (200.7)	MG/L	0.27

Analytical Technologies, Inc.

"Metals Quality Control Report"

Parameter:	SILVER	ALUMINUM	ARSENIC	BORON	BARIUM	CADMIUM
Batch Id:	A0W060	L0W060	R2W087	O0W060	B0W060	C2W087
Blank Result:	<0.01	<0.06	<0.005	<0.09	<0.01	<0.0005
Anal. Method:	200.7	200.7	206.2	200.7	200.7	213.2
Prep. Method:	EPA 600	EPA 600	EPA 600	EPA 600	EPA 600	EPA 600
Analysis Date:	15-MAR-95	15-MAR-95	21-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95
Prep. Date:	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95
Sample Duplication						
Sample Dup:	503514-1	503514-1	503457-22	503514-1	503514-1	503457-22
Rept Limit:	<0.01	<0.06	<0.10+	<0.09	<0.01	<0.0005
Sample Result:	2.0	22	0.76	3.8	2.3	0.0049
Dup Result:	1.9	22	0.77	3.8	2.3	0.0050
Sample RPD:	5	0	1	0	0	2
Max RPD:	20	20	20	20	20	20
Dry Weight%	N/A	N/A	N/A	N/A	N/A	N/A
Matrix Spike						
Sample Spiked:	503514-1	503514-1	503457-22	503514-1	503514-1	503457-22
Rept Limit:	<0.01	<0.06	<0.10+	<0.09	<0.01	<0.0005
Sample Result:	<0.01	20	0.73	1.9	0.43	<0.0005
Spiked Result:	2.0	22	0.76	3.8	2.3	0.0049
Spike Added:	2.0	2.0F	0.040F	2.0	2.0	0.0050
% Recovery:	100	100	75	95	94	98
% Rec Limits:	75-125	75-125	75-125	75-125	75-125	75-125
Dry Weight%	N/A	N/A	N/A	N/A	N/A	N/A
ICV						
ICV Result:	5.0	5.3	0.039	5.1	5.1	0.0020
True Result:	5.0	5.0	0.040	5.0	5.0	0.0020
% Recovery:	100	106	98	102	102	100
% Rec Limits:	90-110	90-110	90-110	90-110	90-110	90-110
LCS						
LCS Result:	2.1	2.1	0.037	2.0	2.0	0.0048
True Result:	2.0	2.0	0.040	2.0	2.0	0.0050
% Recovery:	105	105	93	100	100	96
% Rec Limits:	80-120	80-120	80-120	80-120	80-120	80-120

Analytical Technologies, Inc.

"Metals Quality Control Report"

Parameter:	COBALT	CHROMIUM	COPPER	IRON	MERCURY	MANGANESE
Batch Id:	T0W060	H0W060	F0W060	N0W060	M2W037	G0W060
Blank Result:	<0.01	<0.01	<0.01	<0.02	<0.0002	<0.01
Anal. Method:	200.7	200.7	200.7	200.7	245.1	200.7
Prep. Method:	EPA 600	EPA 600	EPA 600	EPA 600	245.1	EPA 600
Analysis Date:	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95	16-MAR-95	15-MAR-95
Prep. Date:	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95	16-MAR-95	15-MAR-95
Sample Duplication						
Sample Dup:	503514-1	503514-1	503514-1	503514-1	503580-1	503514-1
Rept Limit:	<0.01	<0.01	<0.01	<0.02	<0.0002	<0.01
Sample Result:	1.9	2.0	2.0	48	0.0046	5.6
Dup Result:	1.9	2.0	2.0	47	0.0047	5.5
Sample RPD:	0	0	0	2	2	2
Max RPD:	20	20	20	20	20	20
Dry Weight%	N/A	N/A	N/A	N/A	N/A	N/A
Matrix Spike						
Sample Spiked:	503514-1	503514-1	503514-1	503514-1	503580-1	503514-1
Rept Limit:	<0.01	<0.01	<0.01	<0.02	<0.0002	<0.01
Sample Result:	0.05	0.15	0.07	45	<0.0002	3.6
Spiked Result:	1.9	2.0	2.0	48	0.0046	5.6
Spike Added:	2.0	2.0	2.0	2.0F	0.0050	2.0
% Recovery:	93	93	97	150	92	100
% Rec Limits:	75-125	75-125	75-125	75-125	75-125	75-125
Dry Weight%	N/A	N/A	N/A	N/A	N/A	N/A
ICV						
ICV Result:	5.1	5.2	5.0	5.3	0.0041	5.1
True Result:	5.0	5.0	5.0	5.0	0.0040	5.0
% Recovery:	102	104	100	106	103	102
% Rec Limits:	90-110	90-110	90-110	90-110	80-120	90-110
LCS						
LCS Result:	2.1	2.1	2.0	2.1	0.0046	2.1
True Result:	2.0	2.0	2.0	2.0	0.0050	2.0
% Recovery:	105	105	100	105	92	105
% Rec Limits:	80-120	80-120	80-120	80-120	80-120	80-120

Analytical **Technologies,** Inc.

"Metals Quality Control Report"

Parameter:	MOLYBDENUM	NICKEL	LEAD	SELENIUM	ZINC
Batch Id:	D0W060	E0W060	P2W087	S2W087	50W060
Blank Result:	<0.01	<0.02	<0.003	<0.005	<0.02
Anal. Method:	200.7	200.7	239.2	270.2	200.7
Prep. Method:	EPA 600	EPA 600	EPA 600	EPA 600	EPA 600
Analysis Date:	15-MAR-95	15-MAR-95	20-MAR-95	17-MAR-95	15-MAR-95
Prep. Date:	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95
Sample Duplication					
Sample Dup:	503514-1	503514-1	503457-22	503457-22	503514-1
Rept Limit:	<0.01	<0.02	<0.003	<0.005	<0.02
Sample Result:	1.9	2.1	0.020	0.037	76
Dup Result:	1.9	2.1	0.020	0.036	75
Sample RPD:	0	0	0	3	1
Max RPD:	20	20	20	20	20
Dry Weight%	N/A	N/A	N/A	N/A	N/A
Matrix Spike					
Sample Spiked:	503514-1	503514-1	503457-22	503457-22	503514-1
Rept Limit:	<0.01	<0.02	<0.003	<0.005	<0.02
Sample Result:	0.01	0.28	<0.003	<0.005	72
Spiked Result:	1.9	2.1	0.020	0.037	76
Spike Added:	2.0	2.0	0.020	0.040	2.0F
% Recovery:	95	91	100	93	200
% Rec Limits:	75-125	75-125	75-125	75-125	75-125
Dry Weight%	N/A	N/A	N/A	N/A	N/A
ICV					
ICV Result:	4.9	5.1	0.039	0.021	5.2
True Result:	5.0	5.0	0.040	0.020	5.0
% Recovery:	98	102	98	105	104
% Rec Limits:	90-110	90-110	90-110	90-110	90-110
LCS					
LCS Result:	2.1	2.1	0.020	0.040	2.1
True Result:	2.0	2.0	0.020	0.040	2.0
% Recovery:	105	105	100	100	105
% Rec Limits:	80-120	80-120	80-120	80-120	80-120

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : ETHYLENE DIBROMIDE (EPA METHOD 504.1)

CLIENT : MARATHON OIL CO. ATI I.D.: 503327

PROJECT # : INDIAN BASIN (44999)

PROJECT NAME : IB INJECTION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	S-OUT	AQUEOUS	03/09/95	03/13/95	03/14/95	1

PARAMETER	UNITS	01
ETHYLENE DIBROMIDE	UG/L	<0.01

SURROGATE:

1,4-DICHLOROBENZENE (%)	109

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: ETHYLENE DIBROMIDE (EPA METHOD 504.1)		
BLANK I.D.	: 031395	ATI I.D.	: 503327
CLIENT	: MARATHON OIL CO.	MATRIX	: AQUEOUS
PROJECT #	: INDIAN BASIN (44999)	DATE EXTRACTED	: 03/13/95
PROJECT NAME	: IB INJECTION	DATE ANALYZED	: 03/13/95
		DILUTION FACTOR	: 1

PARAMETER	UNITS	
ETHYLENE DIBROMIDE	UG/L	<0.01

SURROGATE:

1,4-DICHLOROBENZENE (%)	114

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: ETHYLENE DIBROMIDE (EPA METHOD 504.1)		
MSMSD #	: 031395	ATI I.D.	: 503327
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: 03/13/95
PROJECT #	: INDIAN BASIN (44999)	DATE ANALYZED	: 03/13/95
PROJECT NAME	: IB INJECTION	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 031395	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
ETHYLENE DIBROMIDE	<0.01	0.25	0.29	116	0.27	108	7

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

GAS CHROMATOGRAPHY RESULTS

Analytical Technologies, Inc.

TEST : PURGEABLE HALOCARBONS/AROMATICS (EPA 8010/8020)
CLIENT : MARATHON OIL CO. ATI I.D.: 503327
PROJECT # : INDIAN BASIN (44999)
PROJECT NAME : IB INJECTION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	S-OUT	AQUEOUS	03/09/95	NA	03/13/95	1
02	TRIP BLANK	AQUEOUS	02/28/95	NA	03/13/95	1

PARAMETER	UNITS	01	02
BENZENE	UG/L	<0.5	<0.5
BROMODICHLOROMETHANE	UG/L	<0.2	<0.2
BROMOFORM	UG/L	<0.5	<0.5
BROMOMETHANE	UG/L	<1.0	<1.0
CARBON TETRACHLORIDE	UG/L	<0.2	<0.2
CHLOROBENZENE	UG/L	<0.5	<0.5
CHLOROETHANE	UG/L	<0.5	<0.5
CHLOROFORM	UG/L	<0.5	<0.5
CHLOROMETHANE	UG/L	<1.0	<1.0
DIBROMOCHLOROMETHANE	UG/L	<0.2	<0.2
1,2-DIBROMOETHANE (EDB)	UG/L	<0.2	<0.2
1,2-DICHLOROBENZENE	UG/L	<0.5	<0.5
1,3-DICHLOROBENZENE	UG/L	<0.5	<0.5
1,4-DICHLOROBENZENE	UG/L	<0.5	<0.5
1,1-DICHLOROETHANE	UG/L	<0.2	<0.2
1,2-DICHLOROETHANE (EDC)	UG/L	<0.5	<0.5
1,1-DICHLOROETHENE	UG/L	<0.2	<0.2
CIS-1,2-DICHLOROETHENE	UG/L	<0.2	<0.2
TRANS-1,2-DICHLOROETHENE	UG/L	<1.0	<1.0
1,2-DICHLOROPROPANE	UG/L	<0.2	<0.2
CIS-1,3-DICHLOROPROPENE	UG/L	<0.2	<0.2
TRANS-1,3-DICHLOROPROPENE	UG/L	<0.2	<0.2
ETHYLBENZENE	UG/L	<0.5	<0.5
METHYL-t-BUTYL ETHER	UG/L	<2.5	<2.5
METHYLENE CHLORIDE	UG/L	<2.0	<2.0
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.2	<0.2
TETRACHLOROETHENE	UG/L	<0.5	<0.5
TOLUENE	UG/L	0.5	<0.5
1,1,1-TRICHLOROETHANE	UG/L	<1.0	<1.0
1,1,2-TRICHLOROETHANE	UG/L	<0.2	<0.2
TRICHLOROETHENE	UG/L	<0.2	<0.2
TRICHLOROFLUOROMETHANE	UG/L	<0.2	<0.2
VINYL CHLORIDE	UG/L	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5

SURROGATES:

BROMOCHLOROMETHANE (%)	100	102
TRIFLUOROTOLUENE (%)	94	95

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS - QUALITY CONTROL

REAGENT BLANK

TEST	: EPA 8010/8020	ATI I.D.	: 503327
BLANK I.D.	: 031395	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: INDIAN BASIN (44999)	DATE ANALYZED	: 03/13/95
PROJECT NAME	: IB INJECTION	DIL. FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
BROMODICHLOROMETHANE	UG/L	<0.2
BROMOFORM	UG/L	<0.5
BROMOMETHANE	UG/L	<1.0
CARBON TETRACHLORIDE	UG/L	<0.2
CHLOROBENZENE	UG/L	<0.5
CHLOROETHANE	UG/L	<0.5
CHLOROFORM	UG/L	<0.5
CHLOROMETHANE	UG/L	<1.0
DIBROMOCHLOROMETHANE	UG/L	<0.2
1,2-DIBROMOETHANE (EDB)	UG/L	<0.2
1,2-DICHLOROBENZENE	UG/L	<0.5
1,3-DICHLOROBENZENE	UG/L	<0.5
1,4-DICHLOROBENZENE	UG/L	<0.5
1,1-DICHLOROETHANE	UG/L	<0.2
1,2-DICHLOROETHANE (EDC)	UG/L	<0.5
1,1-DICHLOROETHENE	UG/L	<0.2
CIS-1,2-DICHLOROETHENE	UG/L	<0.2
TRANS-1,2-DICHLOROETHENE	UG/L	<1.0
1,2-DICHLOROPROPANE	UG/L	<0.2
CIS-1,3-DICHLOROPROPENE	UG/L	<0.2
TRANS-1,3-DICHLOROPROPENE	UG/L	<0.2
ETHYLBENZENE	UG/L	<0.5
METHYL-t-BUTYL ETHER	UG/L	<2.5
METHYLENE CHLORIDE	UG/L	<2.0
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.2
TETRACHLOROETHENE	UG/L	<0.2
TOLUENE	UG/L	<0.5
1,1,1-TRICHLOROETHANE	UG/L	<1.0
1,1,2-TRICHLOROETHANE	UG/L	<0.2
TRICHLOROETHENE	UG/L	<0.2
TRICHLOROFLUOROMETHANE	UG/L	<0.2
VINYL CHLORIDE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5

SURROGATES:

BROMOCHLOROMETHANE (%)	105
TRIFLUOROTOLUENE (%)	101

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: PURGEABLE HALOCARBONS/AROMATICS (EPA 8010/8020)		
MSMSD #	: 50332701	ATI I.D.	: 503327
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: INDIAN BASIN (44999)	DATE ANALYZED	: 03/13/95
PROJECT NAME	: IB INJECTION	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 50332701	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
BENZENE	<0.5	10	10	100	10	100	0
CHLOROBENZENE	<0.5	10	12	120	11	110	9
1,1-DICHLOROETHENE	<0.2	10	8.4	84	8.9	89	6
TOLUENE	<0.5	10	11	110	11	110	0
TRICHLOROETHENE	<0.2	10	11	110	12	120	9

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 503475
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 503327
Project Name: MARATHON OIL
Project Location: IB INJECTION
Test: POLYNUCLEAR AROMATICS BY 8310
Analysis Method: 8310 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: 3510/SW-846, 3rd Edition, September 1986 and Revision 1, July 1992
Matrix: WATER
QC Level: II

Lab Id: 001
Client Sample Id: 503327-01

Sample Date/Time: 09-MAR-95 1530
Received Date: 11-MAR-95

Batch: PAW081
Blank: A

Dry Weight %: N/A

Extraction Date: 15-MAR-95
Analysis Date: 17-MAR-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
ACENAPHTHENE	UG/L	ND	1	
ACENAPHTHYLENE	UG/L	ND	1	
ANTHRACENE	UG/L	ND	1	
BENZO(a)ANTHRACENE	UG/L	ND	1	
BENZO(a)PYRENE	UG/L	ND	1	
BENZO(b)FLUORANTHENE	UG/L	ND	1	
BENZO(g,h,i)PERYLENE	UG/L	ND	1	
BENZO(k)FLUORANTHENE	UG/L	ND	1	
CHRYSENE	UG/L	ND	1	
DIBENZO(a,h)ANTHRACENE	UG/L	ND	1	
FLUORANTHENE	UG/L	ND	1	
FLUORENE	UG/L	ND	1	
INDENO(1,2,3-cd)PYRENE	UG/L	ND	1	
NAPHTHALENE	UG/L	ND	1	
PHENANTHRENE	UG/L	ND	1	
PYRENE	UG/L	ND	1	
1-METHYLNAPHTHALENE	UG/L	ND	1	
2-METHYLNAPHTHALENE	UG/L	ND	1	
2-CHLOROANTHRACENE	%REC/SURR	67	24-128	
ANALYST	INITIALS	TLH		

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Blank
Batch: PAW081
Analysis Method: 8310 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: 3510/SW-846, 3rd Edition, September 1986 and Revision 1, July 1992

Blank Id: A Date Analyzed: 16-MAR-95 Date Extracted: 15-MAR-95

Parameters:	Units:	Results:	Reporting Limits:
ACENAPHTHENE	UG/L	ND	1
ACENAPHTHYLENE	UG/L	ND	1
ANTHRACENE	UG/L	ND	1
BENZO(a)ANTHRACENE	UG/L	ND	1
BENZO(a)PYRENE	UG/L	ND	1
BENZO(b)FLUORANTHENE	UG/L	ND	1
BENZO(g,h,i)PERYLENE	UG/L	ND	1
BENZO(k)FLUORANTHENE	UG/L	ND	1
CHRYSENE	UG/L	ND	1
DIBENZO(a,h)ANTHRACENE	UG/L	ND	1
FLUORANTHENE	UG/L	ND	1
FLUORENE	UG/L	ND	1
INDENO(1,2,3-cd)PYRENE	UG/L	ND	1
NAPHTHALENE	UG/L	ND	1
PHENANTHRENE	UG/L	ND	1
PYRENE	UG/L	ND	1
1-METHYLNAPHTHALENE	UG/L	ND	1
2-METHYLNAPHTHALENE	UG/L	ND	1
2-CHLOROANTHRACENE	%REC/SURR	47	24-128
ANALYST	INITIALS	TLH	

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Reagent
Batch: PAW081
Analysis Method: 8310 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: 3510/SW-846, 3rd Edition, September 1986 and Revision 1, July 1992

RS Date Analyzed: 16-MAR-95
RSD Date Analyzed: 16-MAR-95

RS Date Extracted: 15-MAR-95
RSD Date Extracted: 15-MAR-95

Parameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
ACENAPHTHYLENE	80.0	<1	64	80	59	74	8	46	52-102
BENZO(k)FLUORANTHENE	4.0	<1	4.2	105	4.0	100	5	30	66-131
CHRYSENE	4.0	<1	4.3	108	4.0	100	8	29	69-122
PHENANTHRENE	4.0	<1	4.0	100	3.6	90	11	28	70-111
PYRENE	4.0	<1	3.5	88	3.1	78	12	26	76-112
Surrogates:									
2-CHLOROANTHRACENE				97		88			24-128

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Analytical Technologies, Inc.

"QC Report"

Title: Water Matrix
Batch: PAW081
Analysis Method: 8310 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: 3510/SW-846, 3rd Edition, September 1986 and Revision 1, July 1992

Dry Weight %: N/A
Sample Spiked: 503475-1

MS Date Analyzed: 17-MAR-95
MSD Date Analyzed: 17-MAR-95

MS Date Extracted: 15-MAR-95
MSD Date Extracted: 15-MAR-95

Parameters:	Spike Added	Sample Conc	MS Conc	MS %Rec	MSD Conc	MSD %Rec	RPD	RPD Lmts	Rec Lmts
ACENAPHTHYLENE	80.0	<1	57	71	58	73	3	45	3-139
BENZO(k)FLUORANTHENE	4.0	<1	3.8	95	3.8	95	0	29	32-150
CHRYSENE	4.0	<1	4.1	103	3.8	95	8	26	26-178
PHENANTHRENE	4.0	<1	3.2	80	3.1	78	3	37	31-154
PYRENE	4.0	<1	3.5	88	2.9	73	19	25	25-140
Surrogates:									
2-CHLOROANTHRACENE				66		61			24-128

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 503475
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 503327
Project Name: MARATHON OIL
Project Location: IB INJECTION
Test: PCB
Analysis Method: 8080 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.
Extraction Method: 3510 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.
Matrix: WATER
QC Level: II

Lab Id: 001
Client Sample Id: 503327-01
Sample Date/Time: 09-MAR-95 1530
Received Date: 11-MAR-95

Batch: PCW055
Blank: A
Dry Weight %: N/A
Extraction Date: 15-MAR-95
Analysis Date: 21-MAR-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
AROCLOR-1016	UG/L	ND	1	
AROCLOR-1221	UG/L	ND	1	
AROCLOR-1232	UG/L	ND	1	
AROCLOR-1242	UG/L	ND	1	
AROCLOR-1248	UG/L	ND	1	
AROCLOR-1254	UG/L	ND	1	
AROCLOR-1260	UG/L	ND	1	
DCB	%REC/SURR	92	22-147	
TCMX	%REC/SURR	78	14-134	
ANALYST	INITIALS	KK		

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Blank
Batch: PCW055
Analysis Method: 8080 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.
Extraction Method: 3510 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.

Blank Id: A Date Analyzed: 20-MAR-95 Date Extracted: 15-MAR-95

Parameters:	Units:	Results:	Reporting Limits:
AROCLOR-1016	UG/L	ND	1
AROCLOR-1221	UG/L	ND	1
AROCLOR-1232	UG/L	ND	1
AROCLOR-1242	UG/L	ND	1
AROCLOR-1248	UG/L	ND	1
AROCLOR-1254	UG/L	ND	1
AROCLOR-1260	UG/L	ND	1
DCB	%REC/SURR	110	22-147
TCMX	%REC/SURR	91	14-134
ANALYST	INITIALS	KK	

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Reagent
Batch: PCW055
Analysis Method: 8080 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.
Extraction Method: 3510 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.

RS Date Analyzed: 20-MAR-95
RSD Date Analyzed: 20-MAR-95

RS Date Extracted: 15-MAR-95
RSD Date Extracted: 15-MAR-95

Parameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
PCB - 1016	10.0	<1	9.6	96	9.5	95	1	30	50-114
PCB - 1260	10.0	<1	10	100	11	110	10	30	8-127
Surrogates:									
DCB				106		108			22-147
TCMX				88		88			14-134

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Analytical Technologies, Inc.

"QC Report"

Title: Water Matrix
Batch: PCW055
Analysis Method: 8080 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.
Extraction Method: 3510 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.

Dry Weight %: N/A
Sample Spiked: 503475-1

MS Date Analyzed: 21-MAR-95
MSD Date Analyzed: 21-MAR-95

MS Date Extracted: 15-MAR-95
MSD Date Extracted: 15-MAR-95

Parameters:	Spike Added	Sample Conc	MS Conc	MS %Rec	MSD Conc	MSD %Rec	RPD	RPD Lmts	Rec Lmts
PCB - 1016	20	<1	17	85	17	85	0	30	50-114
PCB - 1260	20	<1	18	90	18	90	0	30	8-127
Surrogates:									
DCB				85		88			22-147
TCMX				74		75			14-134

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

AnalyticalTechnologies,Inc., Albuquerque, NM
San Diego • Phoenix • Seattle • Pensacola • Ft. Collins • Portland • Albuquerque

CHAIN OF CUSTODY

DATE: 3-9-95 PAGE 1 OF 1

ATI LAB I.D. 503327

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Menzie

COMPANY: Marathon Oil Company
ADDRESS: P.O. Box 552
Midland, TX 79702-0552
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO: SAME
COMPANY:
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)	BTXE/MTBE (8020)	NO_3 as N	SO_4	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.	General Chem. (Cl, SO_4, TDS)	Phenolic	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	Polynuclear Aromatics (610/8310)	Cl	Cadmium 226/228	SDWA Primary Standards - Arizona	SDWA Secondary Standards - Arizona	SDWA Primary Standards - Federal	SDWA Secondary Standards - Federal	As, Cd, Pb, Se, Ba, Hg, Cr, Ag, Cu, Fe, Mn, Zn, Al, B, Co, Mo, Ni	The 13 Priority Pollutant Metals	RCRA Metals by Total Digestion	RCRA Metals by TCLP (1311)	Cl	NUMBER CONTAINERS
Trip Blank	2-28-95	0910	Water	02																											1
5-Out	3-9-95	3:30P		01						✓	✓	✓																			5
5-Out		3:47P		01												✓															2
5-Out		3:55P		01																✓											2
5-Out		4:05P		01											✓																2
5-Out		4:10P		01										✓																	1
5-Out		4:12P		01					✓																						1
5-Out		4:20P		01																	✓	✓				✓	✓				3
5-Out		4:28P		01																										✓	1

PROJECT INFORMATION

PROJ. NO.: Indian Basin (44999)
PROJ. NAME: IB Injection
P.O. NO.:
SHIPPED VIA: Greyhound

SAMPLE RECEIPT

NO. CONTAINERS	15
CUSTODY SEALS	Y (N) NA
RECEIVED INTACT	Y
RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: [signature] Time: 4:45PM	Signature: Time:	Signature: Time:
Printed Name: CT Menzie Jr. Date: 3-9-95	Printed Name: Date:	Printed Name: Date:
Company: Marathon Phone: 915-687-8312	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY:(LAB) 3.
Signature: Time:	Signature: Time:	Signature: [signature] Time: 1010
Printed Name: Date:	Printed Name: Date:	Printed Name: Dianne Sutter Date: 3/10/95
Company:	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619) 458-9141 • Phoenix (602) 496-4400 • Seattle (206) 228-8335 • Pensacola (904) 474-1001 • Portland (503) 684-0447 • Albuquerque (505) 344-3777 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody

503475

DATE 3/10/95 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: Analytical Technologies, Inc.

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

* See original chain of custody for times on each sample bottle.

CLIENT PROJECT MANAGER: QL

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	632/632 MOD	619/619 MOD	610/8310	8240 (TCLP 1311) ZHE	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)	NACE	ASBESTOS	BOD	TOTAL COLIFORM	FECAL COLIFORM	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
503327-01	3/9	3:30	AQ							X		X	X	X		X		X		X					

PROJECT INFORMATION	
PROJECT NUMBER:	503327
PROJECT NAME:	MO
QC LEVEL:	(STD.) IV
QC REQUIRED:	MS MSD BLANK
TAT:	(STANDARD) RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
INTACT?	
RECEIVED GOOD COND./COLD	
LAB NUMBER	

DUE DATE: 3/24

RUSH SURCHARGE: 0

CLIENT DISCOUNT: 10 %

Will 1316

SAMPLES SENT TO:
- SAN DIEGO
- FT. COLLINS
- RENTON
- PENSACOLA X
- PORTLAND
- PHOENIX
- FIBERQUANT

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.
Signature: D Lutt Time: 1730	Signature: Time:
Printed Name: Dave Lutter Date: 3/10/95	Printed Name: Date:
Analytical Technologies, Inc. Albuquerque	Company:
RECEIVED BY: (LAB) 1.	**RECEIVED BY: (LAB) 2.**
Signature: Time:	Signature: Time: 0906
Printed Name: Date:	Printed Name: R. ELSPERMAN Date: 3/11/95
Company:	Company: ATI-PNS

MAR 15 '95 08:32AM ATI ALBUQUERQUE P.2

----- Common Footnotes Wet Chem -----

N/A = NOT APPLICABLE.
N/S = NOT SUBMITTED.
N/C = SAMPLE AND DUPLICATE RESULTS ARE AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RPD IS "NOT CALCULABLE" AND NO CONTROL LIMITS APPLY.
ND = NOT DETECTED ABOVE REPORTING LIMIT.
DISS. OR D = DISSOLVED
T & D = TOTAL AND DISSOLVED
R = REACTIVE
T = TOTAL
G = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE RESULT IS AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "IN CONTROL".
Q = THE ANALYTICAL (POST-DIGESTION) SPIKE IS REPORTED DUE TO THE MATRIX (PRE-DIGESTION) SPIKE BEING OUTSIDE ACCEPTANCE LIMITS.
# = ELEVATED REPORTING LIMIT DUE TO INSUFFICIENT SAMPLE.
+ = ELEVATED REPORTING LIMIT DUE TO DILUTION INTO CALIBRATION RANGE.
* = ELEVATED REPORTING LIMIT DUE TO MATRIX INTERFERENCE.
@ = ADJUSTED REPORTING LIMIT DUE TO SAMPLE MATRIX (DILUTION PRIOR TO PREPARATION).
P = ANALYTICAL (POST-DIGESTION) SPIKE
I = DUPLICATE INJECTION
& = AUTOMATED
F = SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
N/C+ = NOT CALCULABLE
N/C* = NOT CALCULABLE; SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
H = SAMPLE AND/OR DUPLICATE IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL".
A = SAMPLE AND DUPLICATE RESULTS ARE "OUT OF CONTROL".
Z = THE SAMPLE RESULT FOR THE SPIKE IS BELOW REPORTING LIMIT. HOWEVER, THIS RESULT IS REPORTED FOR ACCURATE QC CALCULATIONS.
NH= SAMPLE AND / OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE RESULTS EXCEED THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL" SAMPLE IS NON-HOMOGENOUS.
(*) = DETECTION LIMITS RAISED DUE TO CLP METHOD NOT REQUIRING A CONCENTRATION STEP FOR CN.

(CA) = SEE CORRECTIVE ACTIONS FORM.

SW-846, 3RD EDITION, SEPTEMBER 1986 AND REVISION 1, JULY 1992.
EPA 600/4-79-020, REVISED MARCH 1983.
STANDARD METHODS, 17TH ED., 1989
NIOSH MANUAL OF ANALYTICAL METHODS, 3RD EDITION.
ANNUAL BOOK OF ASTM STANDARDS, VOLUME 11.01, 1991.

1. COLIFORM. COLIFORM PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE LOGARITHM OF COLONIES PER 100 MLS OF SAMPLE ON DUPLICATE PLATES.

2. PH. PH PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND THE DUPLICATE ANALYSIS.

3. FLASHPOINT. FLASHPOINT PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE ANALYSIS. IF FLASHPOINT IS LESS THAN 25 DEGREES CELSIUS, THE DETECTION LIMIT BECOMES THE INITIAL STARTING TEMPERATURE.

RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION).

RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

DPH = DOLLY P. HWANG	RB = REBECCA BROWN
DBH = DONALD B. HAND	BF = BLANCA FACH
TT = TONY TINEO	NB = NANCY L. BRASCH
JHS = JOSEPH SAUNDERS	MM = MARY MOLONEY
NSB = NANCY S. BUTLER	CF = CHRISTINE FOSTER

----- Common Footnotes Metals -----

N/A = NOT APPLICABLE.
N/S = NOT SUBMITTED.
N/C = SAMPLE AND DUPLICATE RESULTS ARE AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RPD IS "NOT CALCULABLE" AND NO CONTROL LIMITS APPLY.
N/D = NOT DETECTED.
DISS. OR D = DISSOLVED
T & D = TOTAL AND DISSOLVED
R = REACTIVE
T = TOTAL
G = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE RESULT IS AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "IN CONTROL".
Q = THE ANALYTICAL (POST-DIGESTION) SPIKE IS REPORTED DUE TO PERCENT RECOVERY BEING OUTSIDE ACCEPTANCE LIMITS ON THE MATRIX (PRE-DIGESTION) SPIKE.
# = ELEVATED REPORTING LIMIT DUE TO INSUFFICIENT SAMPLE.
+ = ELEVATED REPORTING LIMIT DUE TO DILUTION INTO CALIBRATION RANGE.
* = ELEVATED REPORTING LIMIT DUE TO MATRIX INTERFERENCE. (DILUTION PRIOR TO ANALYSIS)
@ = ADJUSTED REPORTING LIMIT DUE TO SAMPLE MATRIX. (DILUTION PRIOR TO DIGESTION)
P = ANALYTICAL (POST DIGESTION) SPIKE.
I = DUPLICATE INJECTION.
& = AUTOMATED
F = SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
N/C+ = NOT CALCULABLE
N/C* = NOT CALCULABLE; SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
H = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL".
A = SAMPLE AND DUPLICATE RESULTS ARE "OUT OF CONTROL".
Z = THE SAMPLE RESULT FOR THE SPIKE IS BELOW THE REPORTING LIMIT. HOWEVER, THIS RESULT IS REPORTED FOR ACCURATE QC CALCULATIONS.
NH= SAMPLE AND / OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL". SAMPLE IS NON-HOMOGENEOUS.
J = (FLORIDA DEP 'J' FLAG) - MATRIX SPIKE AND POST SPIKE RECOVERY IS OUT OF THE ACCEPTABLE RANGE. SEE OUT OF CONTROL EVENTS FORM.
S = METHOD OF STANDARD ADDITIONS (MSA) WAS PERFORMED ON THIS SAMPLE.

FROM ANALYSIS REPORT:
RL= REPORTING LIMIT BASED ON METHOD DETECTION LIMIT STUDIES.
Q= QUALIFIER (FOOTNOTE)

FROM QUALITY CONTROL REPORT:
RPD= RELATIVE PERCENT DEVIATION.
RPT LIMIT= REPORTING LIMIT BASED ON METHOD DETECTION LIMIT STUDIES.

NOTE: THE UNITS REPORTED ON THE QUALITY CONTROL REPORT ARE REPORTED ON AN AS RUN BASIS.

SW-846, 3rd Edition, September 1986 and Revision 1, July 1992.
EPA 600/4-79-020, Revised March 1983.
NIOSH Manual of Analytical Methods, 3rd Edition.

JP = JAY PEREZ
GJ = GARY JACOBS
JLH = JAMES L. HERED
CD = CHRISTY DRAPER
JRR = JOHN R. ROWE
JR = JOHN REED
SL = STEPHANIE LOWRY

Common notation for Organic reporting

N/S = NOT SUBMITTED
N/A = NOT APPLICABLE
D = DILUTED OUT
UG = MICROGRAMS
UG/L = PARTS PER BILLION.
UG/KG = PARTS PER BILLION.
MG/M3 = MILLIGRAM PER CUBIC METER.
PPMV = PART PER MILLION BY VOLUME.
MG/KG = PARTS PER MILLION.
MG/L = PARTS PER MILLION.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS

SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

ORGANIC SOILS ARE REPORTED ON A DRYWEIGHT BASIS.

ND = NOT DETECTED ABOVE REPORTING LIMIT.

RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

ATI/GC/FID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME IONIZATION DETECTOR (FID).

ATI/GC/FIX
ATI GAS CHROMATOGRAPHIC METHOD FOR ANALYSIS OF FIXED GASES EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD) AND FLAME IONIZATION DETECTOR (FID).

ATI/GC/FPD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME PHOTOMETRIC DETECTOR (FPD) IN SULFUR-SPECIFIC MODE.

ATI/GC/PID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH PHOTOIONIZATION DETECTOR (PID).

ATI/GC/TCD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD).

LJT = LISA THOMASON
DGH = DARREL HALSELL
TLH = TARA HELTON
KW = KAREN WADSWORTH
MV = MONIQUE VERHEYDEN
SW = STEVE WILHITE
JMP = JACKIE PRICE
SJF = STEVE FILOROMO
PL = PAUL LESCHENSKY
RW = ROBERT WOLFE
BV = BEN VAUGHN
KS = KENDALL SMITH
NC = NICOLE CALL
LKD = LEIGH DUVALL

Common notation for Organic reporting

N/S = NOT SUBMITTED
N/A = NOT APPLICABLE
D = DILUTED OUT
UG/L = PARTS PER BILLION.
UG/KG = PARTS PER BILLION.
MG/KG = PARTS PER MILLION.
MG/L = PARTS PER MILLION.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
J = THE REPORTED VALUE IS EITHER LESS THAN THE REPORTING LIMIT BUT GREATER THAN ZERO, OR QUANTITATED AS A TIC; THEREFORE, IT IS ESTIMATED.
JJ = THE REPORTED VALUE IS ESTIMATED DUE TO MATRIX INTERFERENCE.
ND = NOT DETECTED ABOVE REPORTING LIMIT.
RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.
RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

ORGANIC SOILS ARE REPORTED ON A DRY WEIGHT BASIS.

RP = ROBERT PEREZ
KK = KERRY KUST
RW = ROBERT WOLFE
FC = FRANKIE COLEMAN

Analytical Technologies, Inc.

2709-D Pan American Freeway, NE Albuquerque, NM 87107
Phone (505) 344-3777 FAX (505) 344-4413

ATI I.D. 503327

April 12, 1995

Marathon Oil Company
P.O. Box 552
Midland, TX 79702-0552

Project Name/Number: IB INJECTION INDIAN BASIN (44999)

Attention: Bob Menzie

On **03/10/95**, Analytical Technologies, Inc., (ADHS License No. AZ0015), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

This report is being reissued in part to include Radiochemisty/Uranium results. It is now complete.

Please note additional case narrative for Radium 226/228 included in this report.

Due to laboratory error, the EPA recommended hold for Nitrate analyses was missed. Total Nitrate/Nitrite analysis was performed and the results are included in this report. We apologize for any incovenience. There is no charge for this analysis.

Radiochemistry and Uranium analyses were performed by Analytical Technologies, Inc., 225 Commerce Drive, Fort Collins, CO.

EPA Method 8010/8010 and 504.1 analyses were performed by Analytical Technologies, Inc., Albuquerque, NM.

All other analyses were performed by Analytical Technologies, Inc., 11 East Olive Road, Pensacola, FL.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Letitia Krakowski, Ph.D.
Project Manager

H. Mitchell Rubenstein, Ph.D.
Laboratory Manager

MR:jt

Enclosure

CLIENT	: MARATHON OIL CO.	DATE RECEIVED	: 03/10/95
PROJECT #	: INDIAN BASIN (44999)		
PROJECT NAME	: IB INJECTION	REPORT DATE	: 03/24/95

ATI ID: 503327

	ATI PENSACOLA ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	503327-01	S-OUT	AQUEOUS	03/09/95
02	503327-02	TRIP BLANK	AQUEOUS	02/28/95

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	2

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

TOTAL URANIUM ANALYSIS RESULTS SUMMARY

By Laser-Induced Kinetic Phosphorimetry

Lab Name: Analytical Technologies, Inc. Date Collected: 03/09/95

Client Name: ATI-NM Date Analyzed : 03/15/95

Client Project ID: MO -- 503327 Sample Matrix : Water

Lab Sample ID Series: 95-03-083

Client Sample ID	Lab Sample ID	Total Uranium (ug/L)
S-Out	03-083-01	0.61 ± 0.08
Duplicate	03-083-D1	0.65 ± 0.09

Reported Uncertainties are the Estimated Total Propagated Uncertainties (2σ). See ATI SOP 743FC for details of TPU determinations.

Remarks:

Sample 95-03-083-D1 is a duplicate of 95-03-083-01.

Analytical Technologies, Inc.

TOTAL URANIUM ANALYSIS RESULTS SUMMARY

By Laser-Induced Kinetic Phosphorimetry

Lab Name: Analytical Technologies, Inc. Date Collected: 03/15/95

Client Name: ATI-NM Date Analyzed : 03/15/95

Client Project ID: MO -- 503327 Sample Matrix : Water

Lab Sample ID Series: 95-03-020

Client Sample ID	Lab Sample ID	Total Uranium (ug/L)
Blank	03-020-B1	0.00 ± 0.05

Reported Uncertainties are the Estimated Total Propagated Uncertainties (2σ). See ATI SOP 743FC for details of TPU determinations.

Remarks:

Blank for work orders 95-03-020 and 95-03-083.

Analytical Technologies, Inc.

TOTAL URANIUM BLANK SPIKE RESULTS SUMMARY

By Laser-Induced Kinetic Phosphorimetry

Lab Name: Analytical Technologies, Inc. Date Collected: 03/15/95

Client Name: ATI-NM Date Analyzed : 03/15/95

Client Project ID: MO -- 503327 Sample Matrix : Water

Lab Sample ID Series: 95-03-020

Lab Sample ID	Spike Conc. (ug/L)	Rep't Conc. (ug/L)
95-03-020-S1	12.5 ± 1.9	12.6 ± 2.4

Reported Uncertainties are the Estimated Total Propagated Uncertainties (2σ). See ATI SOP 743FC for details of TPU determinations.

ATI sets control limits for KPA Uranium measurements as follows:
Blank Spike Control Limits = Known (μ) ± 0.15 * μ.

Matrix Spike Control Limits = Known (μ) + Native Concentration ± 0.25 * (μ + Native Concentration).

ATI uses these control limits for all KPA Uranium measurements

Acceptance Range for spike samples is the known value ± the control limits stated above. The reported value, without the uncertainty, should be compared to that range.

Remarks:

Blank spike for work orders 95-03-020 and 95-03-083.

Analytical Technologies, Inc.

TOTAL URANIUM MATRIX SPIKE RESULTS SUMMARY

By Laser-Induced Kinetic Phosphorimetry

Lab Name: Analytical Technologies, Inc. Date Collected: 03/09/95

Client Name: ATI-NM Date Analyzed : 03/15/95

Client Project ID: MO -- 503327 Sample Matrix : Water

Lab Sample ID Series: 95-03-083

Lab Sample ID	Known Conc. (ug/L)	Rep't Conc. (ug/L)
95-03-083-M1	0.81 ± 0.20	0.79 ± 0.19

Reported Uncertainties are the Estimated Total Propagated Uncertainties (2σ). See ATI SOP 743FC for details of TPU determinations.

ATI sets control limits for KPA Uranium measurements as follows:
Blank Spike Control Limits = Known (μ) ± 0.15 * μ.

Matrix Spike Control Limits = Known (μ) + Native Concentration ± 0.25 * (μ + Native Concentration).

ATI uses these control limits for all KPA Uranium measurements

Acceptance Range for spike samples is the known value ± the control limits stated above. The reported value, without the uncertainty, should be compared to that range.

Remarks:

Sample 95-03-083-M1 is a matrix spike of 95-03-083-01.

Analytical **Technologies,** Inc.

Narrative Comments for Work Order 95-03-083
$^{226/228}$Ra by Gamma Spectroscopy in Water
04/10/95

Work Order 95-03-083 was received on 03/11/95 and scheduled for gamma spectroscopy. The gamma analysis was completed on 04/01/95.

Sample 95-03-088-S1 failed ATI control limits slightly high due to an unusually low chemical yield. All other quality control requirements passed including another blank spike and a blank.

Reported results are believed not to be affected by the low blank spike recovery. Sufficient sample is not available for re-extraction, however; if additional sample is provided, it will be re-analyzed at no extra charge.

John Mitchell
Radiochemistry Instrument Technician

Analytical Technologies, Inc.

GAMMA SPECTROMETRY RESULTS SUMMARY

Method 901.1 (Modified)

Lab Name: Analytical Technologies, Inc.

Date Collected: 03/09/95 12:00

Client Name: ATI-NM

Date Analyzed: 03/31/95 00:58

Lab Sample ID: 95-03-083-01

Sample Matrix: Water

Client Sample ID: S-OUT

Radium Recovery: 0.930

Bi/Pb-214 ingrowth for Ra-226 determination: 15.8 days

Nuclide	Activity (pCi/Liter)	% Uncertainty
Pb-214	0.460 ± 0.682	148
Ra-226	0.460 ± 0.682	148
Bi-214	< 0.730	BDL
Ra-228	< 1.00	BDL

Reported Uncertainties are the Estimated Total Propagated Uncertainty (2σ).
See ATI SOP 743FC for details of the TPU determination.

BDL = Below Detection Limit; see method for DL determination

Analytical Technologies, Inc.

GAMMA SPECTROMETRY RESULTS SUMMARY

Method 901.1 (Modified)

Lab Name: Analytical Technologies, Inc. Date Collected: 03/15/95 12:00

Client Name: ATI-NM Date Analyzed: 03/31/95 02:18

Lab Sample ID: 95-03-088-B1 Sample Matrix: Water

Client Sample ID: Blank Radium Recovery: 0.894

Bi/Pb-214 ingrowth for Ra-226 determination: 15.9 days

Nuclide	Activity (pCi/Liter)	% Uncertainty
Ra-226	0.840 ± 0.546	65.1
Pb-214	0.840 ± 0.546	65.1
Bi-214	< 0.620	BDL
Ra-228	< 0.890	BDL

Reported Uncertainties are the Estimated Total Propagated Uncertainty (2σ).
See ATI SOP 743FC for details of the TPU determination.

BDL = Below Detection Limit; see method for DL determination

Remarks: Blank for work orders 95-03-088 and 95-03-083.

Analytical Technologies, Inc.

RADIUM 226 and RADIUM 228 BLANK SPIKE RESULTS

Method 901.1 (Modified)/KAHN et al (1990)

Lab Name: Analytical Technologies, Inc. Date Collected: 03-15-95

Client Name: ATI-NM Date Analyzed : 03-31-95

Client Project ID : MO -- 503327 Sample Matrix : Water

Lab Workorder Number : 95-03-088 Units : liter

Lab Sample ID	Radium 226 Known Value	Radium 226 Rep't Value	Radium 228 Known Value	Radium 228 Rep't Value
95-03-088-S1	14.8 ± 3.85	19.5 ± 2.33	14.9 ± 6.41	21.0 ± 2.42

Reported Uncertainties are the Estimated Total Propagated Uncertainties (2σ). See ATI SOP 743FC for details of TPU determinations.

The U.S. EPA sets control limits for Ra-226 measurements as follows :
Control Limits = Known (μ) ± 0.26 * μ, for μ > 0.1 pCi/l

The U.S. EPA sets control limits for Ra-228 measurements as follows :
Control Limits = Known (μ) ± 0.43 * μ, for μ > 0.1 pCi/l

ATI uses these control limits for all Ra-226/228 measurements.

Acceptance Range for blank spike samples is the known value ± the control limits stated above. The reported value, without the uncertainty, should be compared to that range.

Remarks:

Blank spike for work orders 95-03-088 and 95-03-083.

Analytical Technologies, Inc.

RADIUM 226 and RADIUM 228 BLANK SPIKE RESULTS

Method 901.1 (Modified)/KAHN et al (1990)

Lab Name: Analytical Technologies, Inc. Date Collected: 03-15-95

Client Name: ATI-NM Date Analyzed : 04-01-95

Client Project ID : MO -- 503327 Sample Matrix : Water

Lab Workorder Number : 95-03-088 Units : liter

Lab Sample ID	Radium 226 Known Value	Radium 226 Rep't Value	Radium 228 Known Value	Radium 228 Rep't Value
95-03-088-S2	14.8 ± 3.85	16.6 ± 2.11	14.9 ± 6.41	19.4 ± 2.40

Reported Uncertainties are the Estimated Total Propagated Uncertainties (2σ). See ATI SOP 743FC for details of TPU determinations.

The U.S. EPA sets control limits for Ra-226 measurements as follows :
Control Limits = Known (μ) ± 0.26 * μ, for μ > 0.1 pCi/l

The U.S. EPA sets control limits for Ra-228 measurements as follows :
Control Limits = Known (μ) ± 0.43 * μ, for μ > 0.1 pCi/l

ATI uses these control limits for all Ra-226/228 measurements.

Acceptance Range for blank spike samples is the known value ± the control limits stated above. The reported value, without the uncertainty, should be compared to that range.

Remarks:

Blank spike for work orders 95-03-088 and 95-03-083.
Sample 95-03-088-S2 is a blank spike duplicate.

Analytical Technologies, Inc., Albuquerque, NM
San Diego • Phoenix • Seattle • Pensacola • Ft. Collins • Portland • Albuquerque

CHAIN OF CUSTODY

DATE: 3-9-95 PAGE 1 OF 1

ATI LAB I.D. 503327

ALL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Menzie

COMPANY: Marathon Oil Company
ADDRESS: P.O. Box 552
Midland TX 79702-0552
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO: SAME
COMPANY:
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)	BTXE/MTBE (8020)	NO3 as N	SO4	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.	General Chem. (F, Cl, SO4, TDS)	Phenolic	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	Polynuclear Aromatics (610/8310)	U	Radium 226/228	SDWA Primary Standards - Arizona	SDWA Secondary Standards - Arizona	SDWA Primary Standards - Federal	SDWA Secondary Standards - Federal	As, Cd, Pb, Se, Ba, Hg, Cr, Ag, Cu, Fe, Mn, Zn, Al, B, Co, Mo, Ni	The 13 Priority Pollutant Metals	RCRA Metals by Total Digestion	RCRA Metals by TCLP (1311)	CN	NUMBER OF CONTAINERS
Trip Blank	3-28-95	0910	Water	02																											1
5-Out	3-9-95	3:30P		01						✓	✓	✓																			5
5-Out		3:47P		01												✓															2
5-Out		3:55P		01																✓											2
5-Out		4:05P		01											✓																2
5-Out		4:10P		01										✓																	1
5-Out		4:12P		01					✓																						1
5-Out		4:20P		01																	✓	✓				✓	✓				3
5-Out		4:28P		01																										✓	1

PROJECT INFORMATION

PROJ. NO.: Indian Basin (44499)
PROJ. NAME: IB Injection
P.O. NO.:
SHIPPED VIA: Greyhound

SAMPLE RECEIPT

NO. CONTAINERS	15
CUSTODY SEALS	Y N NA
RECEIVED INTACT	Y
RECEIVED COLD	Y

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: RJ Menzie Time: 4:45PM	Signature: Time:	Signature: Time:
Printed Name: RJ Menzie Jr. Date: 3-9-95	Printed Name: Date:	Printed Name: Date:
Company: Marathon Phone: 915-687-8312	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: Time: 1010
Printed Name: Date:	Printed Name: Date:	Printed Name: Dianne Butler Date: 3/10/95
Company:	Company:	Analytical Technologies, Inc.

Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody 95-03-083

DATE 3/10/95 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: Analytical Technologies, Inc.

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)		632/632 MOD	619/619 MOD	610/8310			8240 (TCLP 1311) ZHE		Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)		NACE	ASBESTOS		BOD	TOTAL COLIFORM	FECAL COLIFORM		GROSS ALPHA/BETA	RADIUM 226/228	Uranium KPA	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
503327-01	3/9	1620	AQ	01																										X	X			2 FAE

PROJECT INFORMATION	
PROJECT NUMBER:	503327
PROJECT NAME:	MD
QC LEVEL:	STD IV
QC REQUIRED:	MS MSD BLANK
TAT:	STANDARD RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	2
CHAIN OF CUSTODY SEALS	NP
INTACT?	NP
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	

DUE DATE: 3/24, 4/7 24hrs

RUSH SURCHARGE: 0

CLIENT DISCOUNT: 10 %

WO# 1317

SAMPLES SENT TO:	
SAN DIEGO	
FT. COLLINS	X
RENTON	
PENSACOLA	
PORTLAND	
PHOENIX	
FIBERQUANT	

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.
Signature: D Butler Time: 1730	Signature: Time:
Printed Name: Dan Butler Date 3/10/95	Printed Name: Date
Analytical Technologies, Inc. Albuquerque	Company: Fed-X
RECEIVED BY: (LAB) 1.	**RECEIVED BY: (LAB) 2.**
Signature: Time:	Signature: Time: 9:30
Printed Name: Date:	Printed Name: J. Reilly Date: 3-11-95
Company: Fed-X	Company: ATI

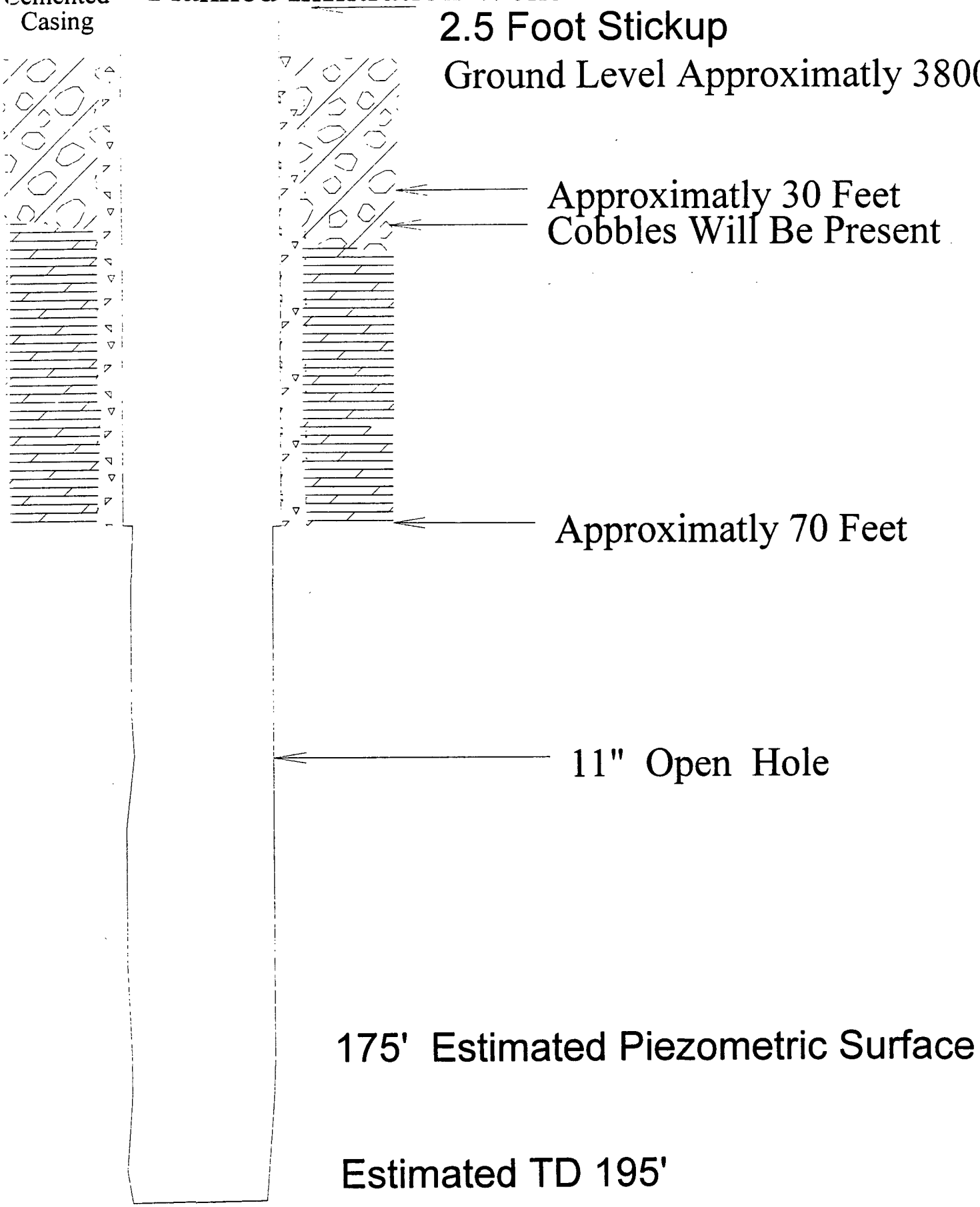
ATI Labs: San Diego (619) 458-9141 • Phoenix (602) 496-4400 • Seattle (206) 228-8335 • Pensacola (904) 474-1001 • Portland (503) 684-0447 • Albuquerque (505) 344-3777 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

APPENDIX C

WELL COMPLETION DIAGRAMS

Marathon Oil Company

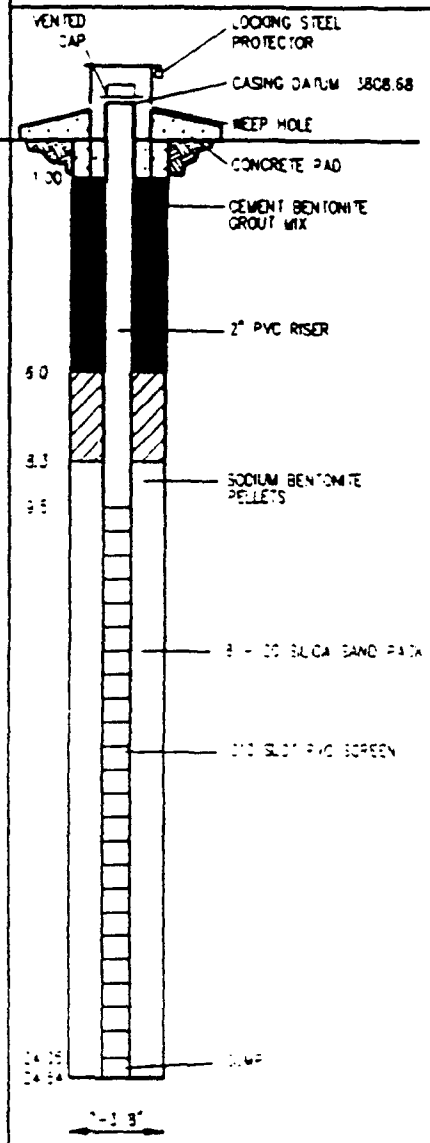
Planned Infiltration Wells IW-1 and IW-2



WELL COMPLETION RECORD

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3806.6				
	0	SILT 7.5 YR 6/4, LIGHT BROWN, LOOSE, SOFT, DRY	ML		1 GC; NS	
	2.7	CLAYEY SILT 7.5 YR 5/4, BROWN, NON-PLASTIC, DRY, FRIABLE, CALICHE NODULES, 15% CLAY, 10% CALICHE, 75% SILT	ML		2 1.5; 3 1.5; NS; 4 .5	
	9.3	SANDSTONE 2.5 YR 8/4, PALE YELLOW, MODERATELY HARD, SLIGHTLY CEMENTED, FINE GRAINED, SILTY. COLOR CHANGES TO 2.5 Y 5/6 LIGHT OLIVE BROWN WITH INCREASED MOISTURE. 2.5 Y 4/4 OLIVE BROWN AND 2.5 Y 5/6 LIGHT OLIVE BROWN AT 17.5 CEMENTED, HARD AT 18.0, WET AT 18.5	DM		5 0.9; NR; NS; NS; 6 0.2; NR; NS; 7 0.5; NR; NS; 8 0.6; NR; NS; 9 0.4; NR; NS	
	24.5	AUGER REFUSAL AT 24.5				

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ FT)
NR NO RECOVERY
NS NOT SAMPLED
GC GRAB COMPOSITE

JOB NAME/NUMBER **MW-45 (BH-68)**

BORING NUMBER **MARATHON/91029**

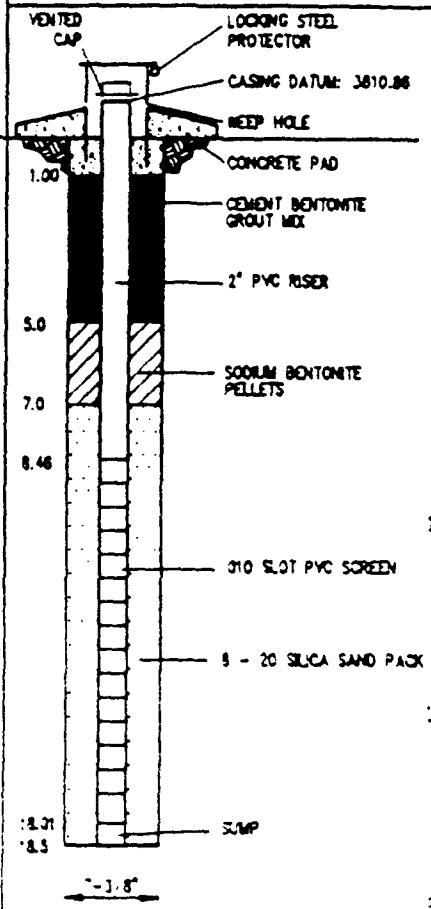
DATE DRILLED 6/2/91
DRILLING METHOD HSA
DRILLED BY [illegible]
LOGGED BY JMB
CHECKED BY [illegible]

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
(ENVIRONMENTAL CONSULTANTS)

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	'N' VALUE
		GROUND SURFACE: 3809.3				
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, LOOSE, DRY, SOFT	ML		1 GC; NS	
	2.8	CLAYEY SILT: 7.5 YR 5/4, BROWN, FIRM, FRIABLE, DRY, 15% CLAY, 10% CALICHE	ML		2 NR; 3 NR; NS; 4 NR	1.0; 0.1; 1.0
	8.5	SILT, GRAVEL, COBBLES: SILT IS 10 YR 6/4 TO 5/4, LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY, GRAVEL & COBBLES ARE 2.5 YR 5/0 TO 4/0, GRAY TO DARK GRAY AND ARE DOLOMITIC LIMESTONE, VUGGY POROSITY, LIMESTONE IS ALSO 2.5 Y 6/2 LIGHT BROWNISH GRAY	GM		5 NR; NS; 6 NR; 7 NR; NS	0.6; 0.6; 0.7
	16.5					
	18.9 / 18.5	SANDSTONE: 2.5 Y 6/6, OLIVE YELLOW HARD, FINE GRAINED, SILTY	SS		8 NR	0.5
	20	AUGER REFUSAL AT 18.5' BOREHOLE OVM READING: 0.0 PPM				
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR NO RECOVERY
NS NOT SAMPLED

JOB NAME/NUMBER **MW-51 (BH-74)**

BORING NUMBER **MARATHON/91029**

DATE DRILLED 6/6/91
DRILLING METHOD HSA/SS
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY SAR PAGE 1 OF 1

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3708 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-2873

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

January 10, 1996

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Enclosed are analytical results of water samples obtained on December 27, 1995 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File: 574-04

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 512408

PROJECT # : (NONE)

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	12/27/95	NA	01/02/96	1
02	LYMAN	AQUEOUS	12/27/95	NA	01/02/96	1
03	ARROYO	AQUEOUS	12/27/95	NA	01/02/96	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	114	94	91

AnalyticalTechnologies,Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 512971

CLIENT : ANALYTICAL TECHNOLOGIES OF NM, INC.
PROJECT # : 512408
PROJECT NAME : REMEDIATION

DATE RECEIVED : 12/29/95
REPORT DATE : 01/08/96

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	27	10.8	10.3

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

January 10, 1996

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Ms. Lyman:

Enclosed are analytical results from a water sample obtained on December 27, 1995 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File 574-04

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 512408

PROJECT # : (NONE)

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	12/27/95	NA	01/02/96	1
02	LYMAN	AQUEOUS	12/27/95	NA	01/02/96	1
03	ARROYO	AQUEOUS	12/27/95	NA	01/02/96	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	114	94	91

AnalyticalTechnologies,Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 512971

CLIENT : ANALYTICAL TECHNOLOGIES OF NM, INC.
PROJECT # : 512408
PROJECT NAME : REMEDIATION

DATE RECEIVED : 12/29/95
REPORT DATE : 01/08/96

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	27	10.8	10.3

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

January 10, 1996

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from a water sample obtained on December 27, 1995 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed using EPA-approved methods by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File 574-04

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 512408

PROJECT # : (NONE)

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	12/27/95	NA	01/02/96	1
02	LYMAN	AQUEOUS	12/27/95	NA	01/02/96	1
03	ARROYO	AQUEOUS	12/27/95	NA	01/02/96	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	114	94	91

AnalyticalTechnologies,Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 512971

CLIENT : ANALYTICAL TECHNOLOGIES OF NM, INC.
PROJECT # : 512408
PROJECT NAME : REMEDIATION

DATE RECEIVED : 12/29/95
REPORT DATE : 01/08/96

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	27	10.8	10.3

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

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

[X] Telephone [ ] Personal	Time	Date 1/5/96

Originating Party	Other Parties
Bill Olson - Envir. Bureau	Bob Menzie - Marathon

Subject

Dec 1995 Well Drilling Workplan

Discussion

OCD needs following info prior to approval
- additional well between 79 and 80 (Shallow well)
- sampling plan
- more detailed MW completion info (casing size, casing intervals, cement, type, etc)
- more detailed VE completion info (grouting of wells)

Conclusions or Agreements

He is on vacation. Will try to get info to me by Mon - Tues (1/8 - 1/9)

Distribution

Signed Bill Olson

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

December 21, 1995

Mr. William C. Olson
Hydrogeologist
Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Remediation Project
Notification of First Quarter Sampling Episode

Dear Mr. Olson:

Marathon is notifying your office that the First Quarter 1996 groundwater monitoring and sampling episode is scheduled for Monday, January 15 through Thursday, January 18. Groundwater Technology, Inc. will be conducting the gauging, purging, and sampling activities. If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental Representative

c: C. K. Curlee
C. M. Schweser
T. L. Guillory

File: 568-00

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

December 18, 1995

DEC 22 1995

Mr. William Olson
Hydrogeologist
Environmental Bureau
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Remediation Project
Proposed Well Drilling Workplan

Dear Mr. Olson:

Marathon Oil Company is requesting your approval of this workplan to drill, complete, and develop 26 wells described as:

1) three groundwater extraction wells to enhance pump-and-treat containment of the Lower Queen hydrocarbon plume (MW-84, MW-85, MW-86);

2) three downgradient monitoring wells to complete the delineation of the Lower Queen hydrocarbon plume (MW-87, MW-88, MW-89);

3) three downgradient monitoring wells for delineation of the Shallow zone hydrocarbon plume (MW-90, MW-91, MW-92);

4) two upgradient injection wells to inject treated groundwater into the Lower Queen aquifer (IW-1, IW-2); and,

5) fifteen downgradient (barrier) vapor extraction wells to contain the Lower Queen vadose zone plume (VE-1 through VE-15);

Figure 1 is a Lower Queen potentiometric surface map showing the proposed locations of the Lower Queen extraction, monitoring, and injection wells. The locations of the Lower Queen groundwater extraction and injection wells were chosen based on data collected from step- and constant-rate pump tests and aquifer modelling conducted to simulate plume containment under a proposed pumping and injection scenario. Figure 2 is a Shallow zone potentiometric surface map showing the proposed locations of the three Shallow monitoring wells. Attached as Appendix A are proposed completion diagrams for each well.

Development of the wells will be accomplished using a submersible pump that is capable of achieving a 20-gallons-per-minute rate at approximately 220 feet below grade. Each well will be pumped at a sustainable rate for 6 to 8 hours. The extracted fluids will be pumped into a trailer-mounted fiberglass tank and transported to the Indian Basin Gas Plant for disposal in one of the double-lined sumps of the plant's wastewater collection (open drain) system.

Drilling is scheduled to commence on or about January 8, 1996 and will require approximately 52 days to complete. If you have any questions please call me.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Advanced Environmental Representative

File: 568-00

Figure 1. Lower Queen October 1995 Potentiometric Surface showing proposed locations of 3 groundwater extraction (84, 85, 86), 3 monitoring (87, 88, 89), 2 injection (IW-1, IW-2), and 15 vapor extraction wells (VE-).

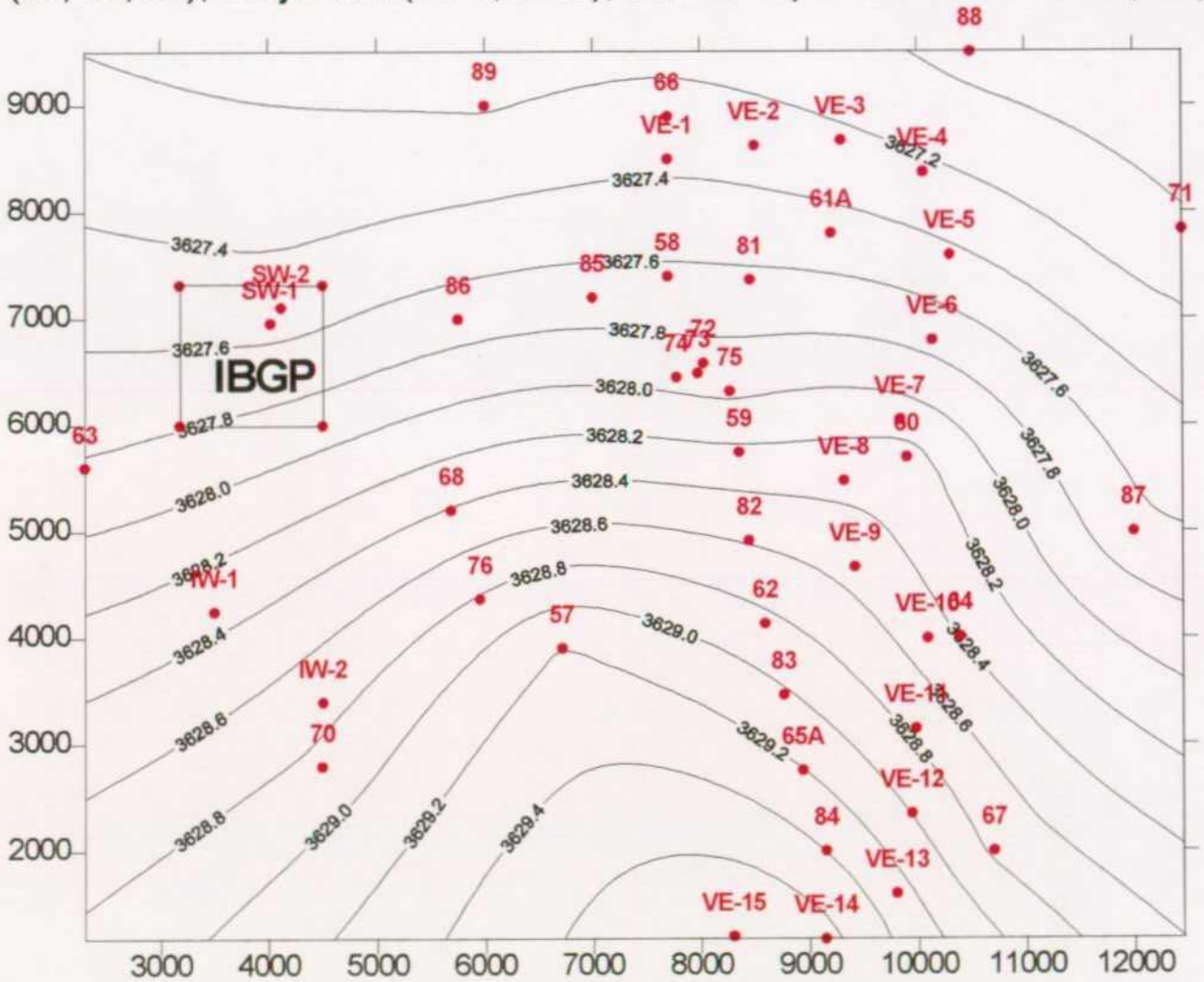
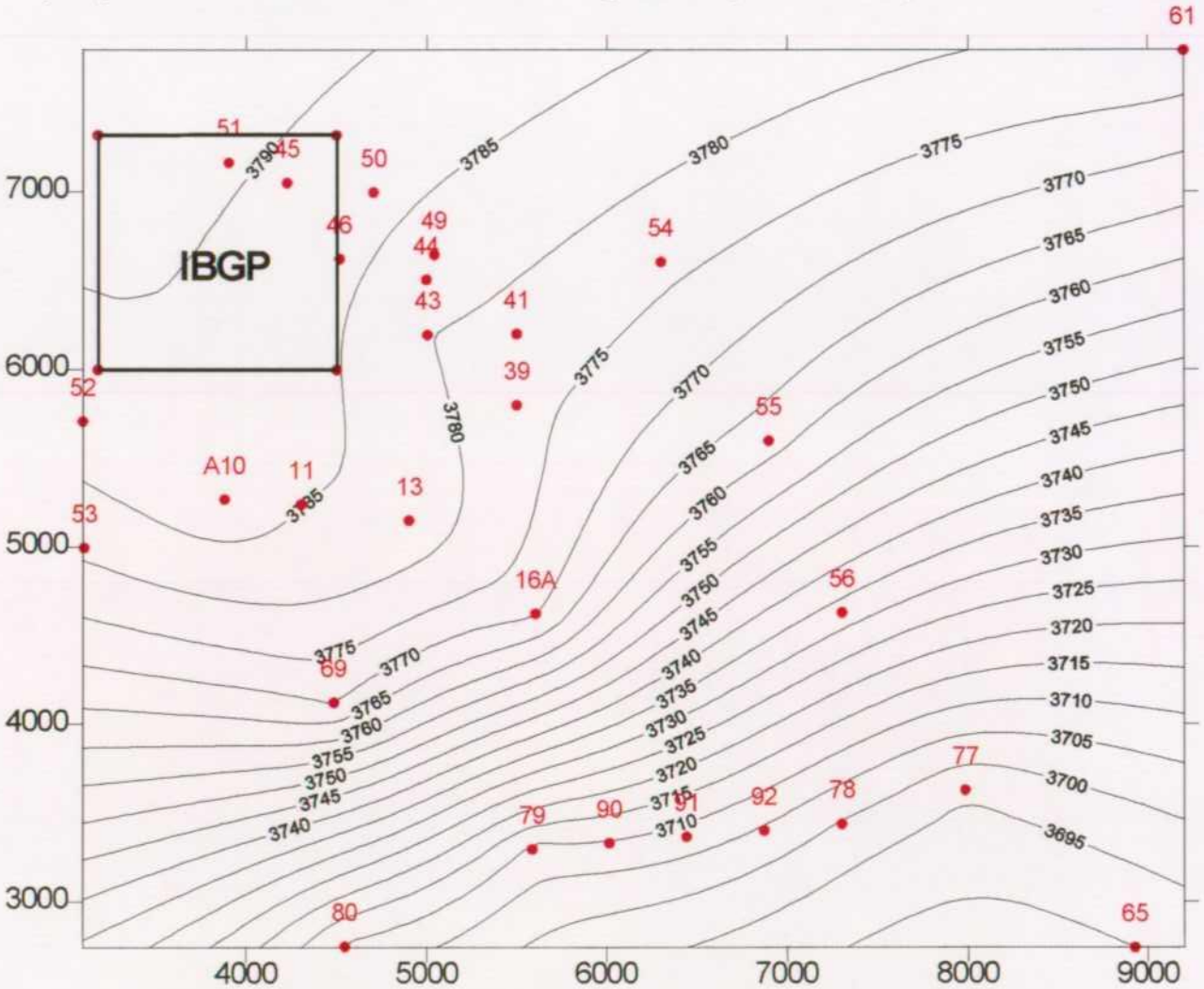


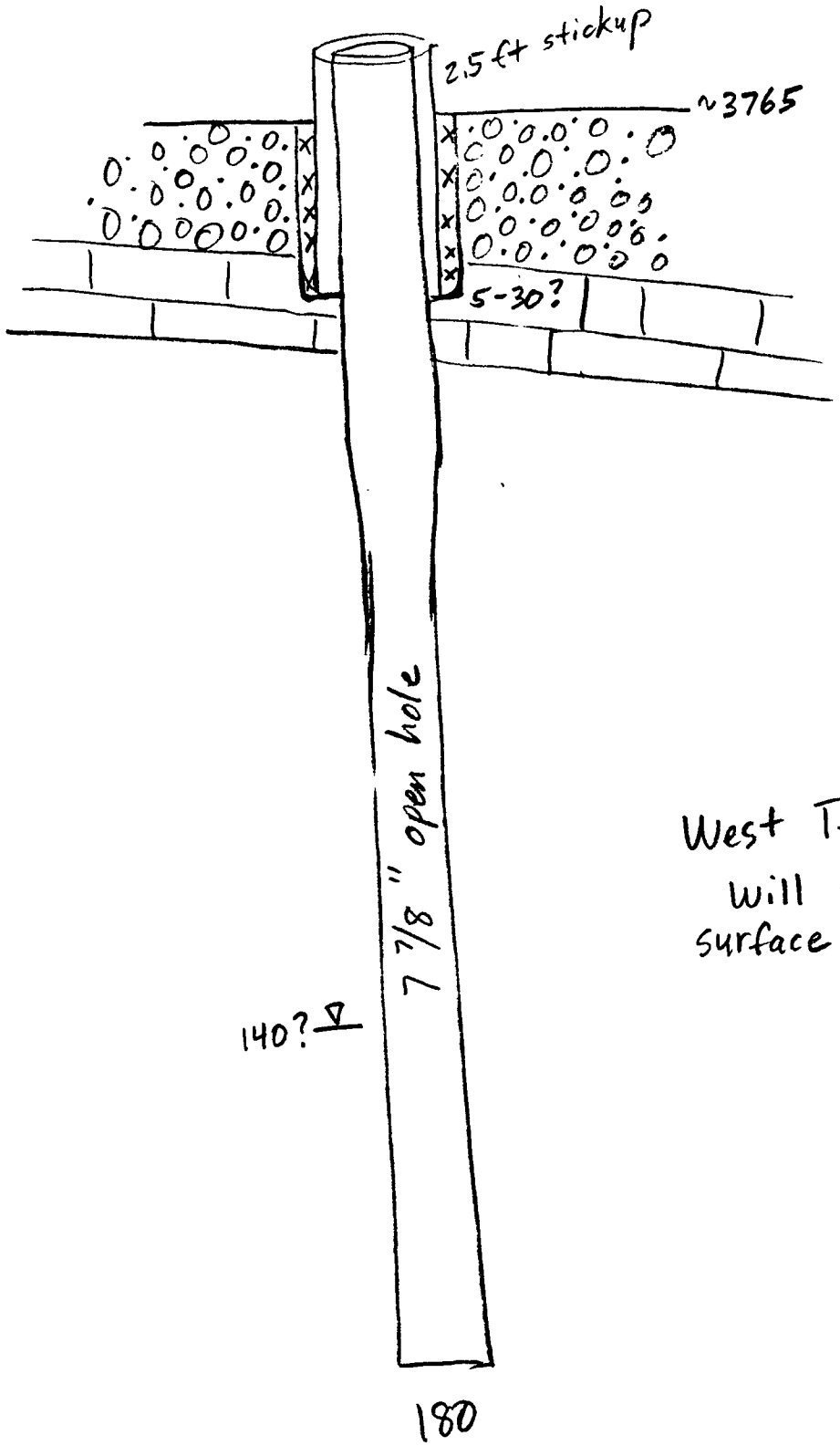
Figure 2. Shallow zone October 1995 Potentiometric Surface showing proposed locations of 3 monitoring wells (90, 91, 92).



APPENDIX A

PROPOSED WELL COMPLETION DIAGRAMS

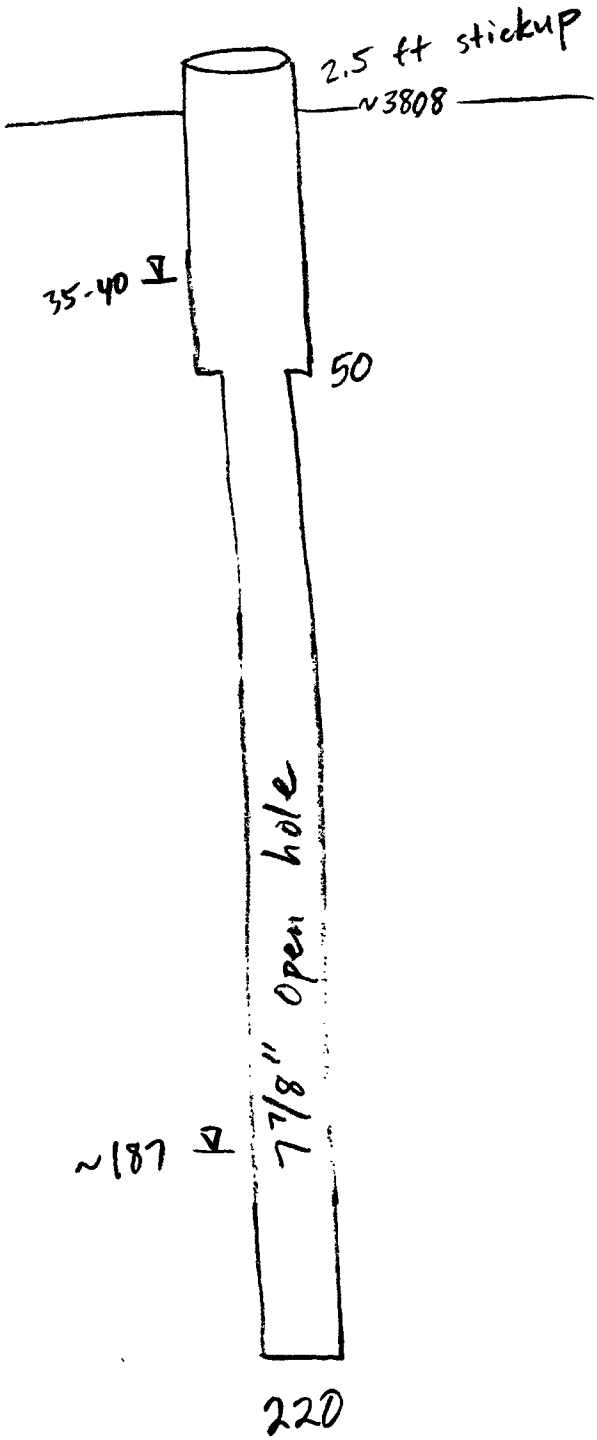
MW-84



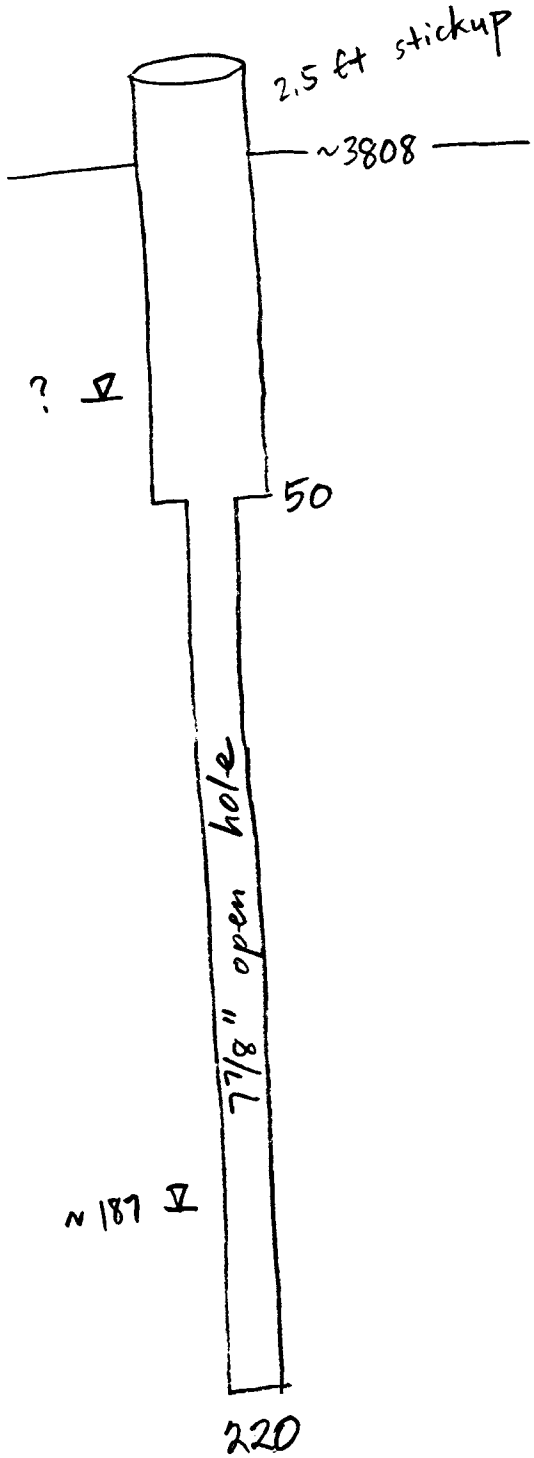
in arroyo; access OK, but thickness of cobble unknown. May need different rig to set surface casing. Hole would not stay open last time we tried this. Will try to drill on bedrock high if possible, but cannot guarantee.

West Texas —
Will we need 2 surface casing strings?

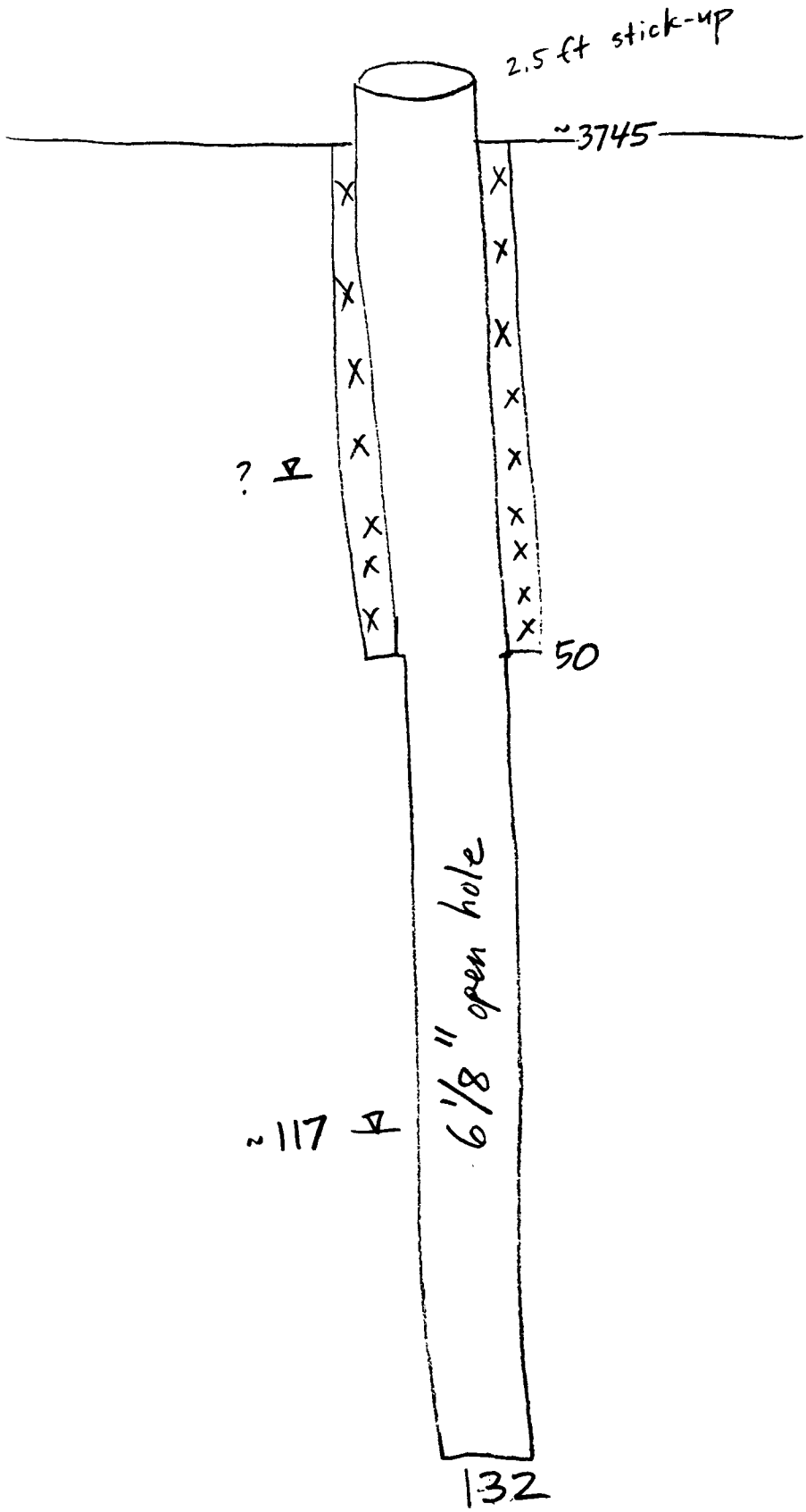
MW-85



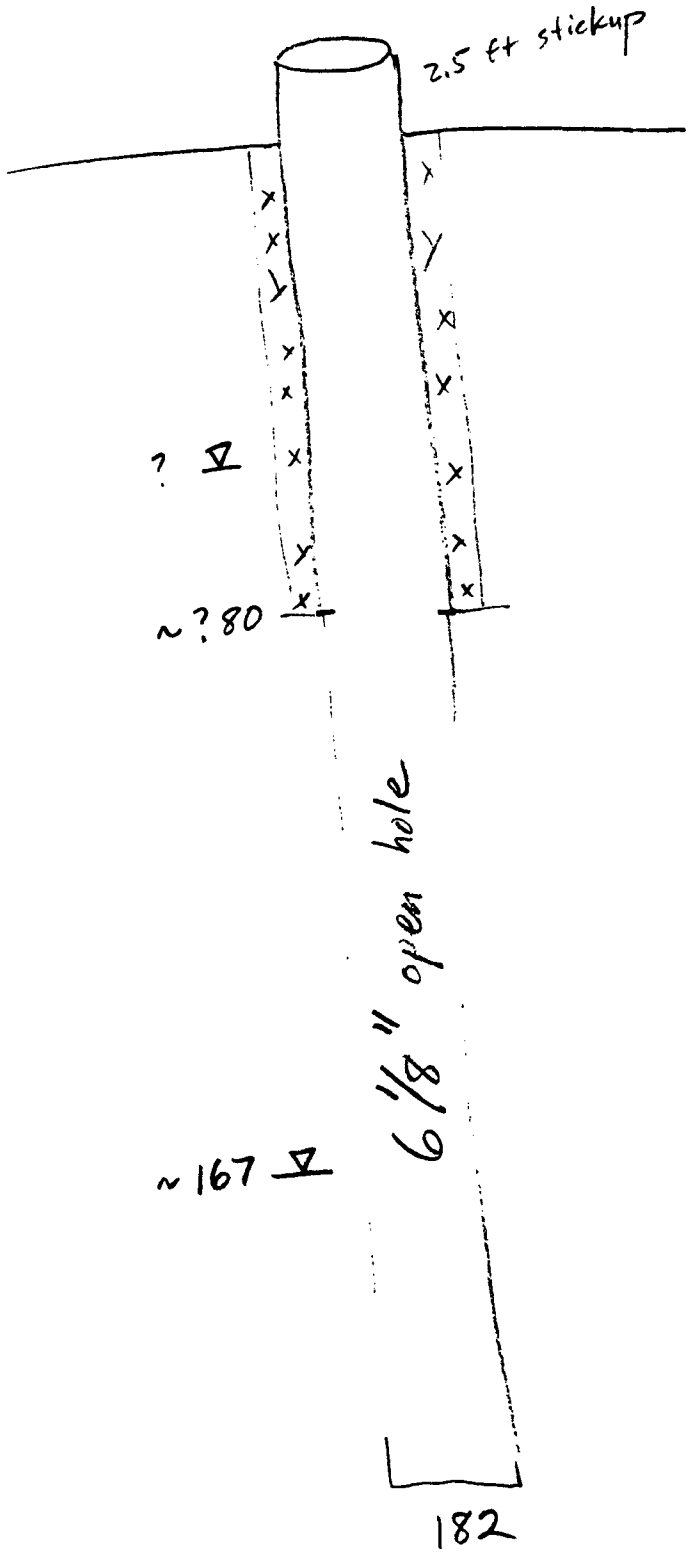
MW-86



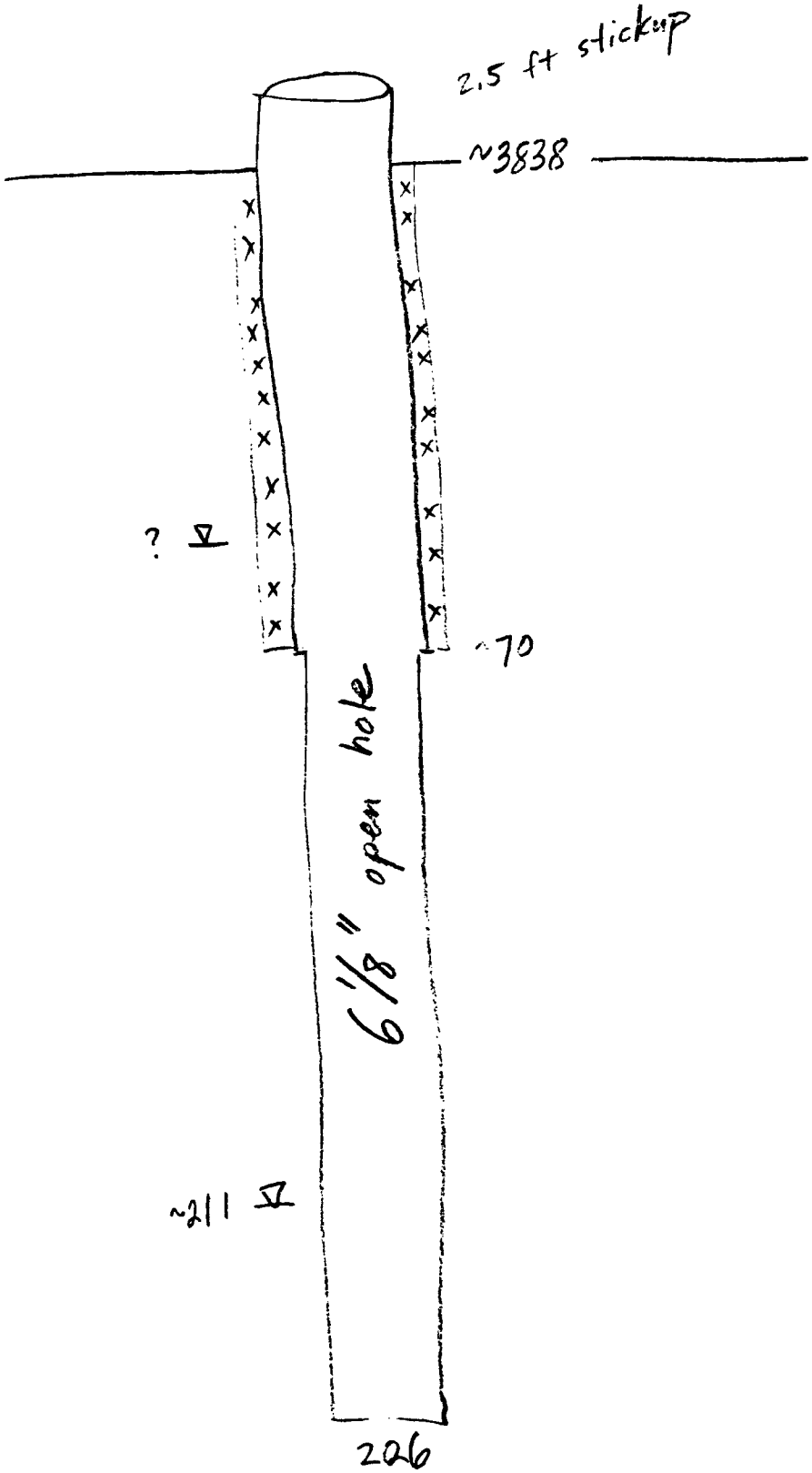
MW-87



MW-88

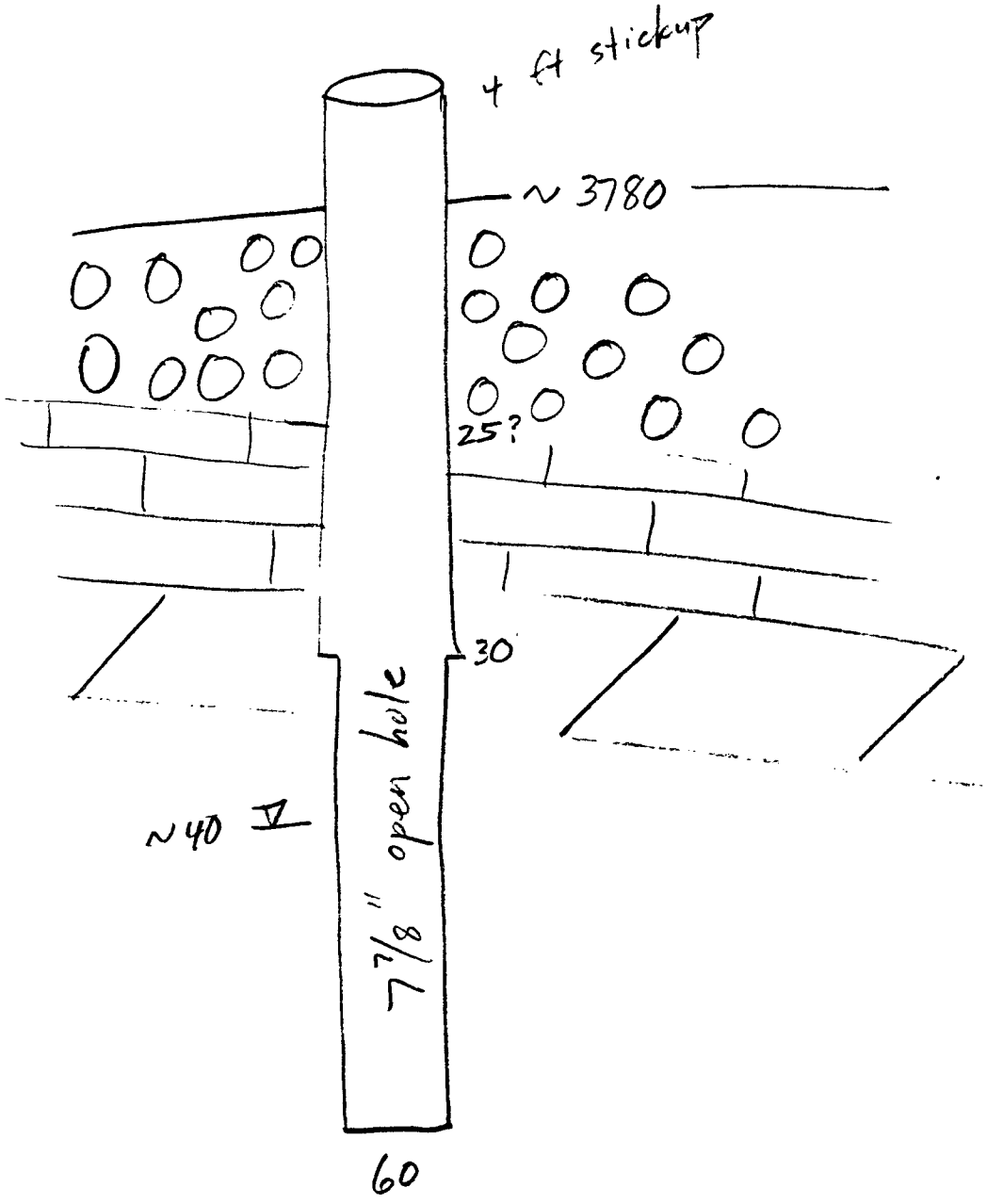


MW-89

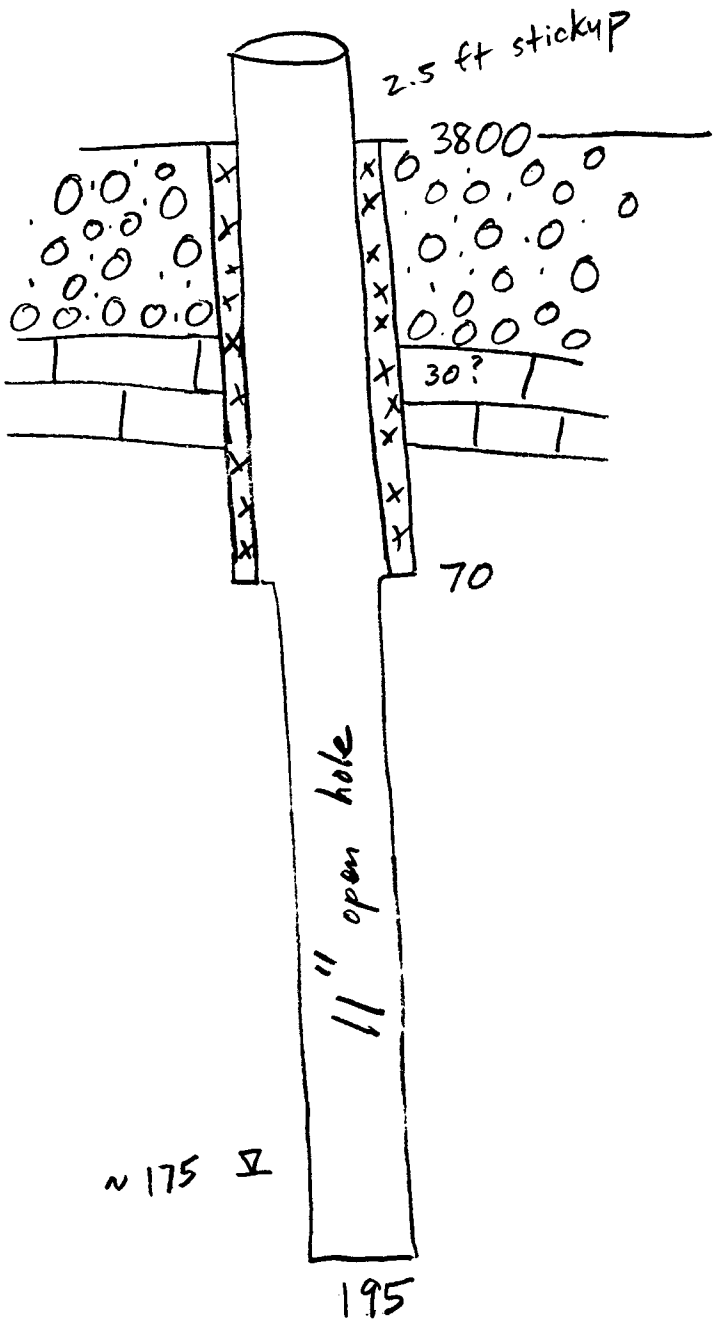


3 wells

MW-90, MW-91, MW-92

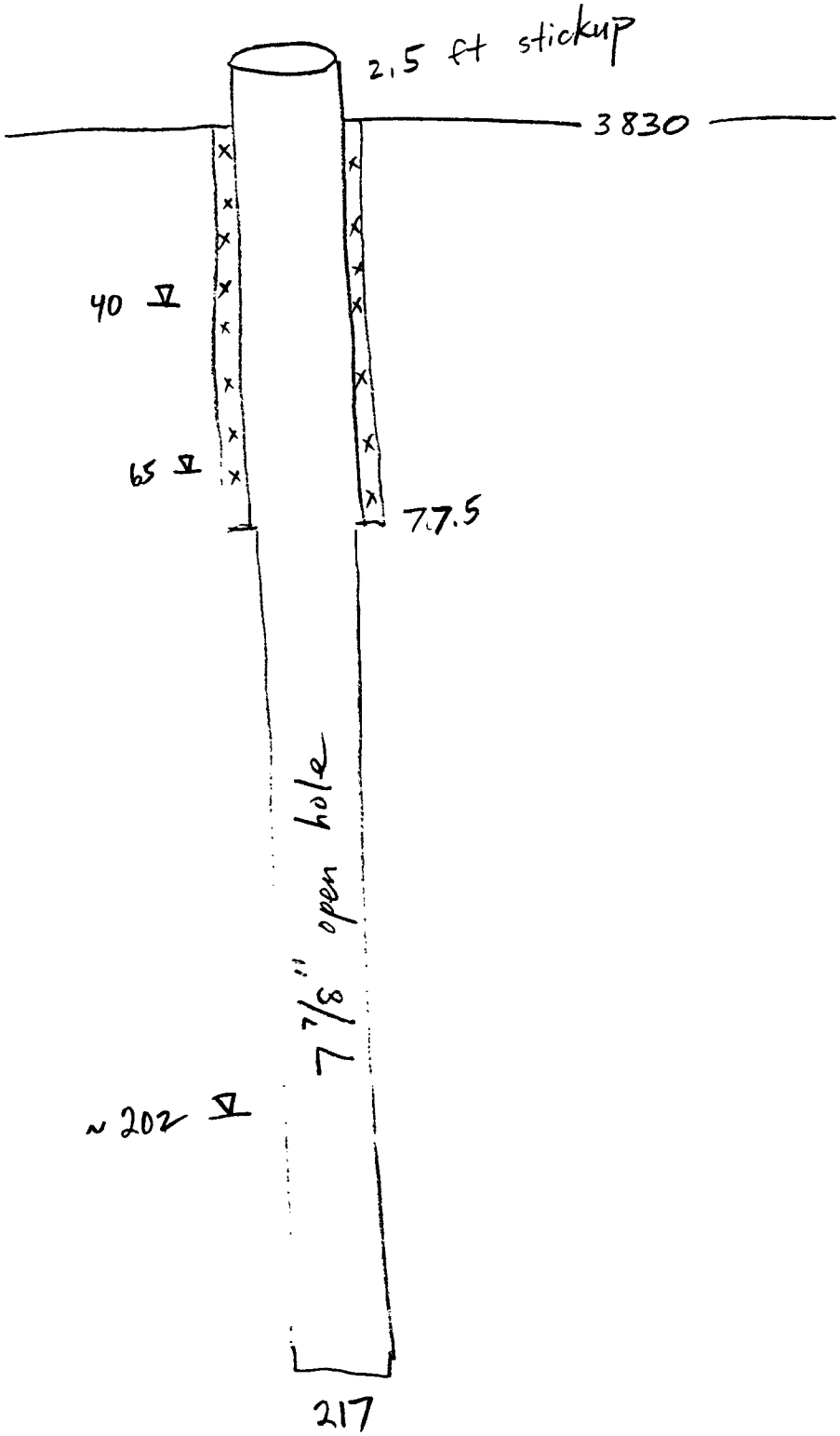


IW-1 (and IW-2)

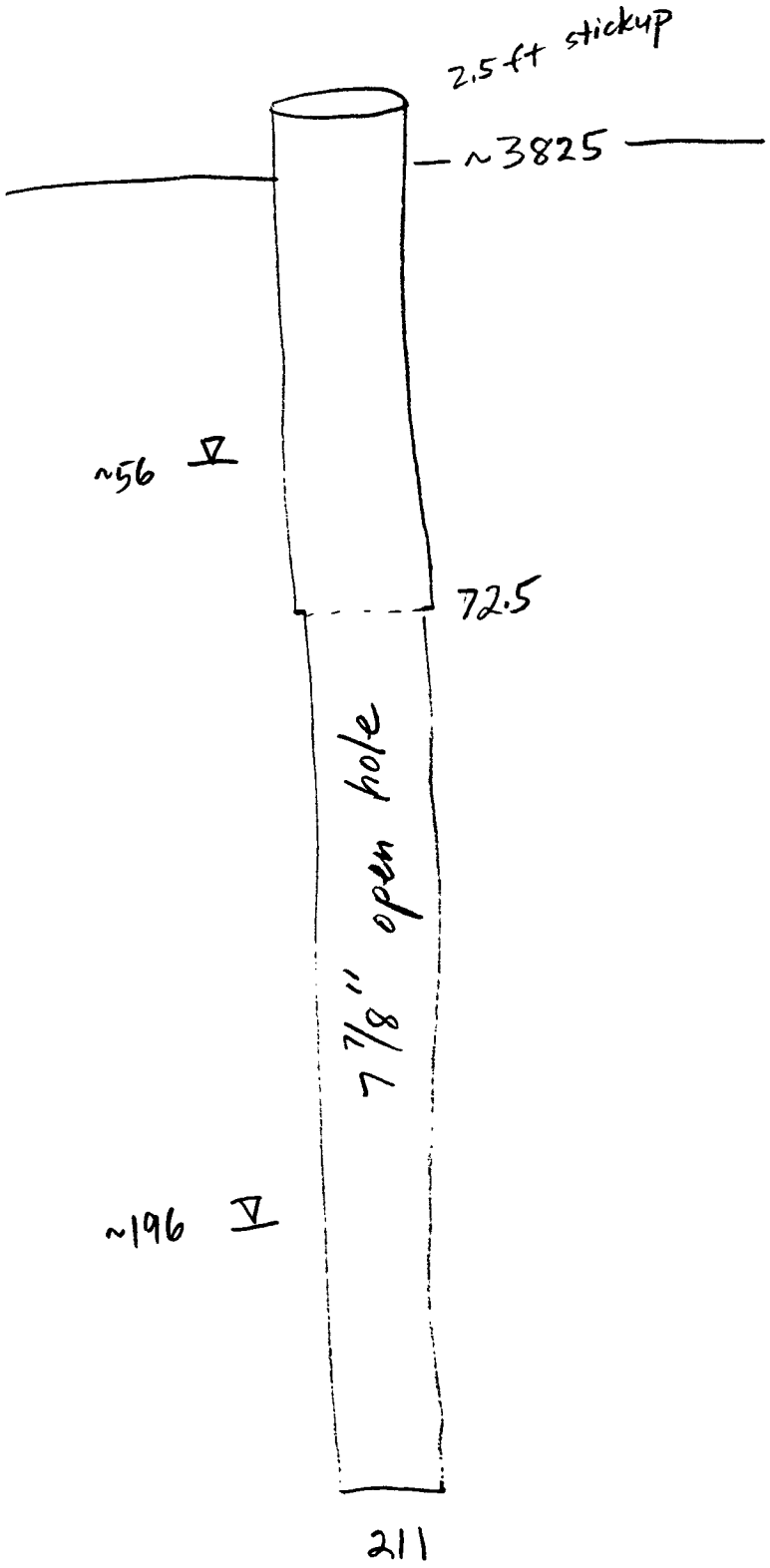


cobbles will be present as described at MW-84

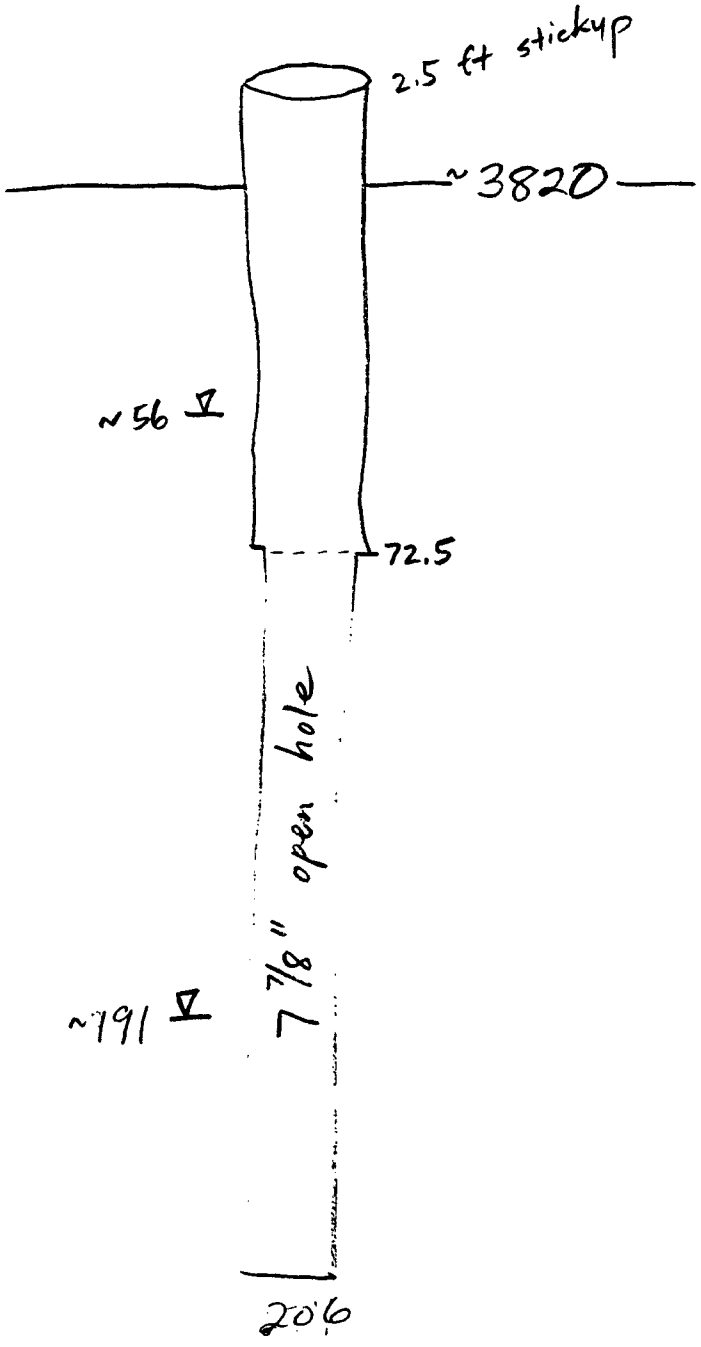
VE-1



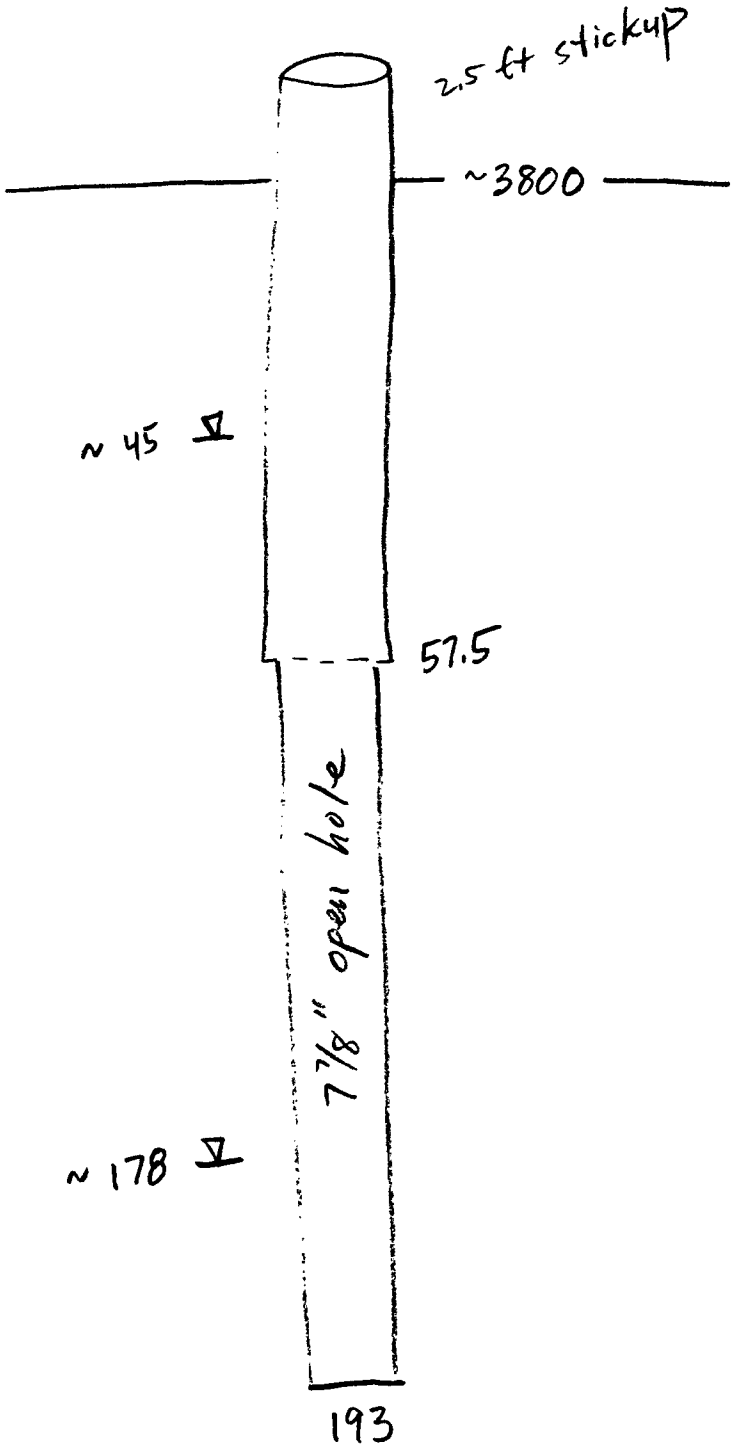
VE-2



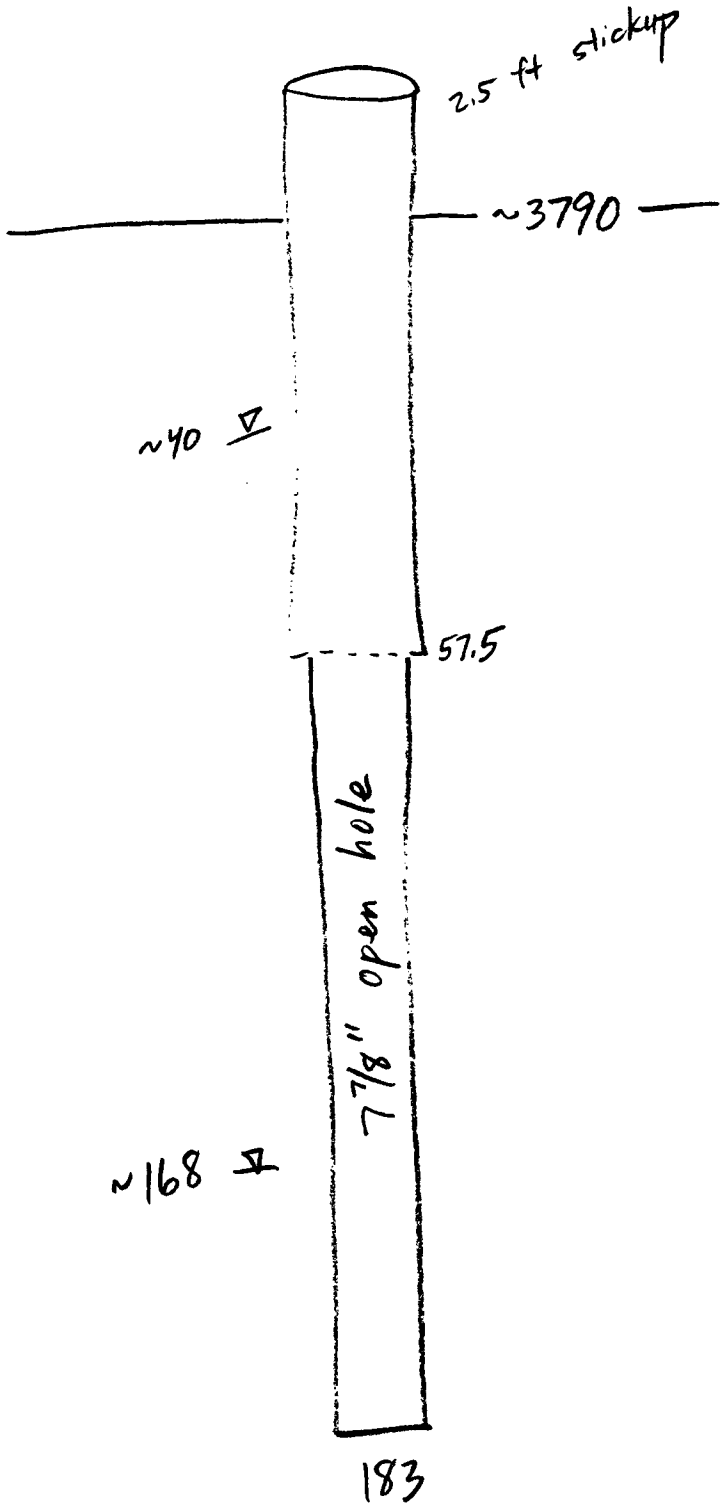
VE-3



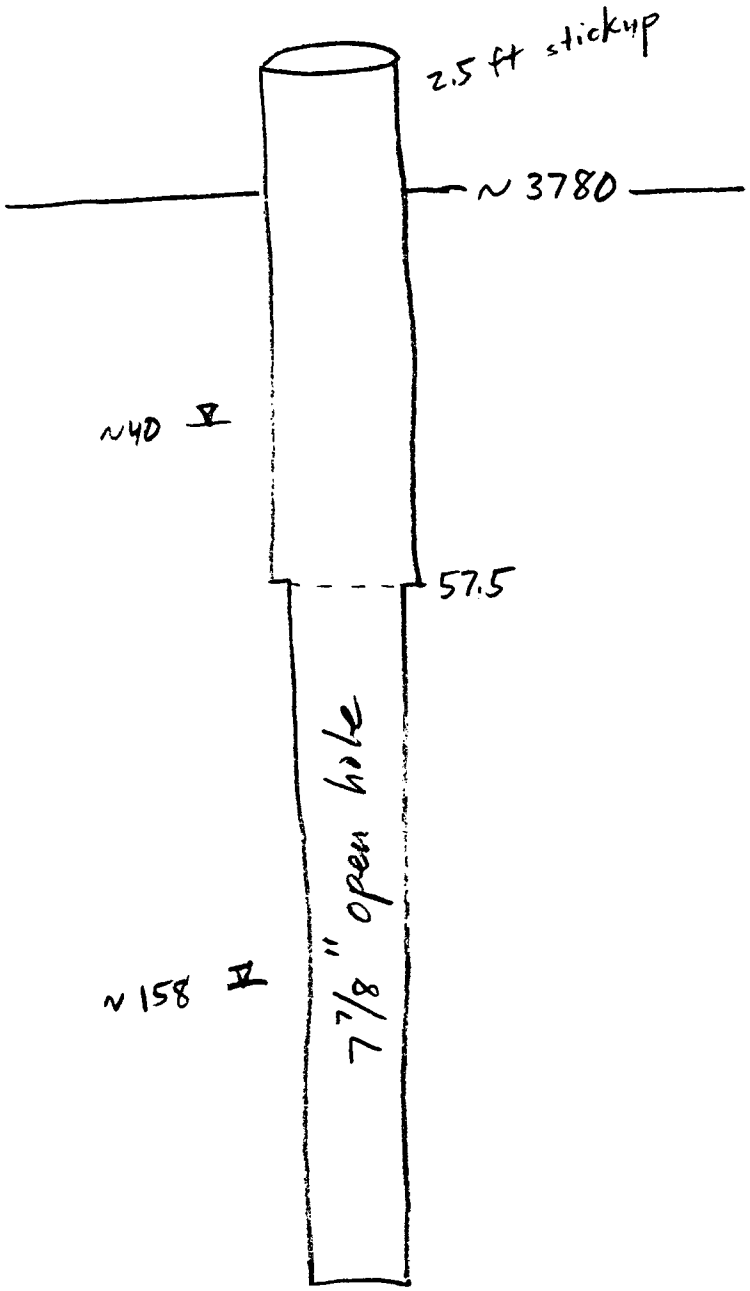
VE-4



VE-5

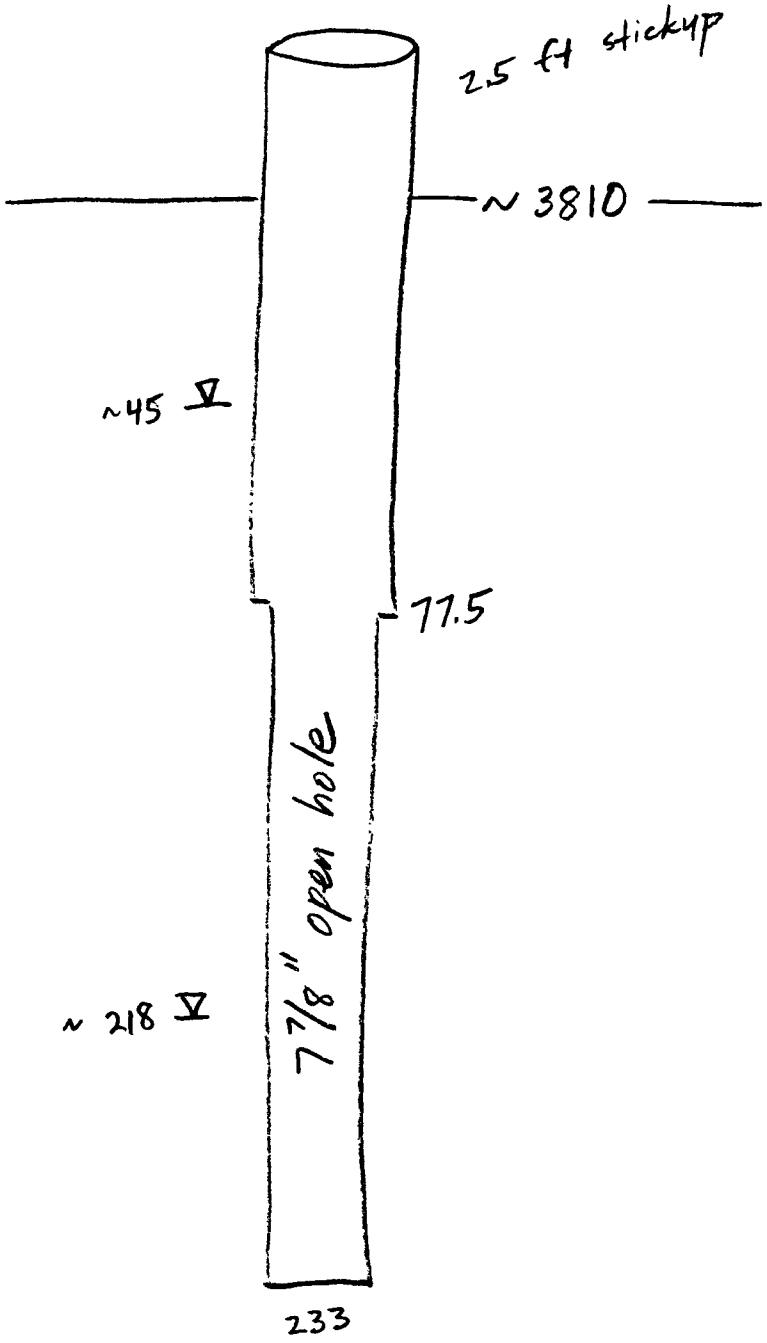


VE-6

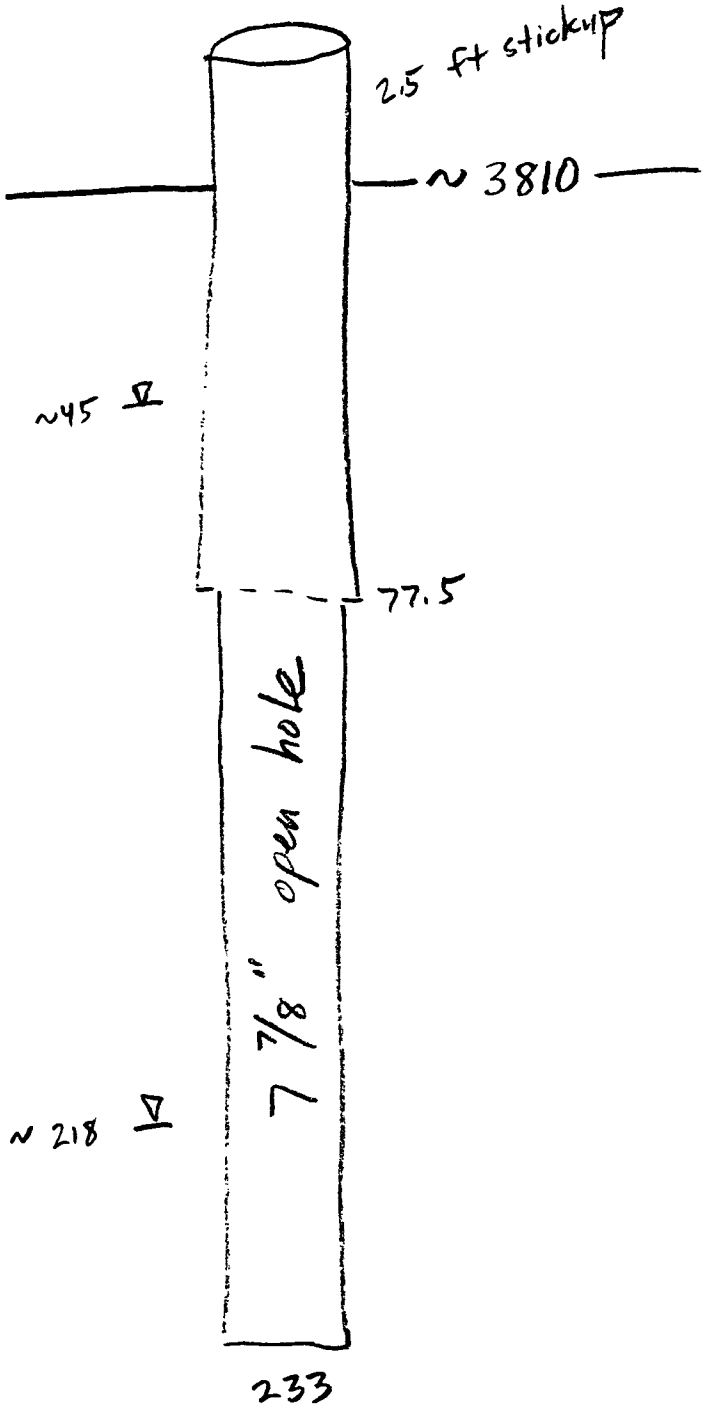


173

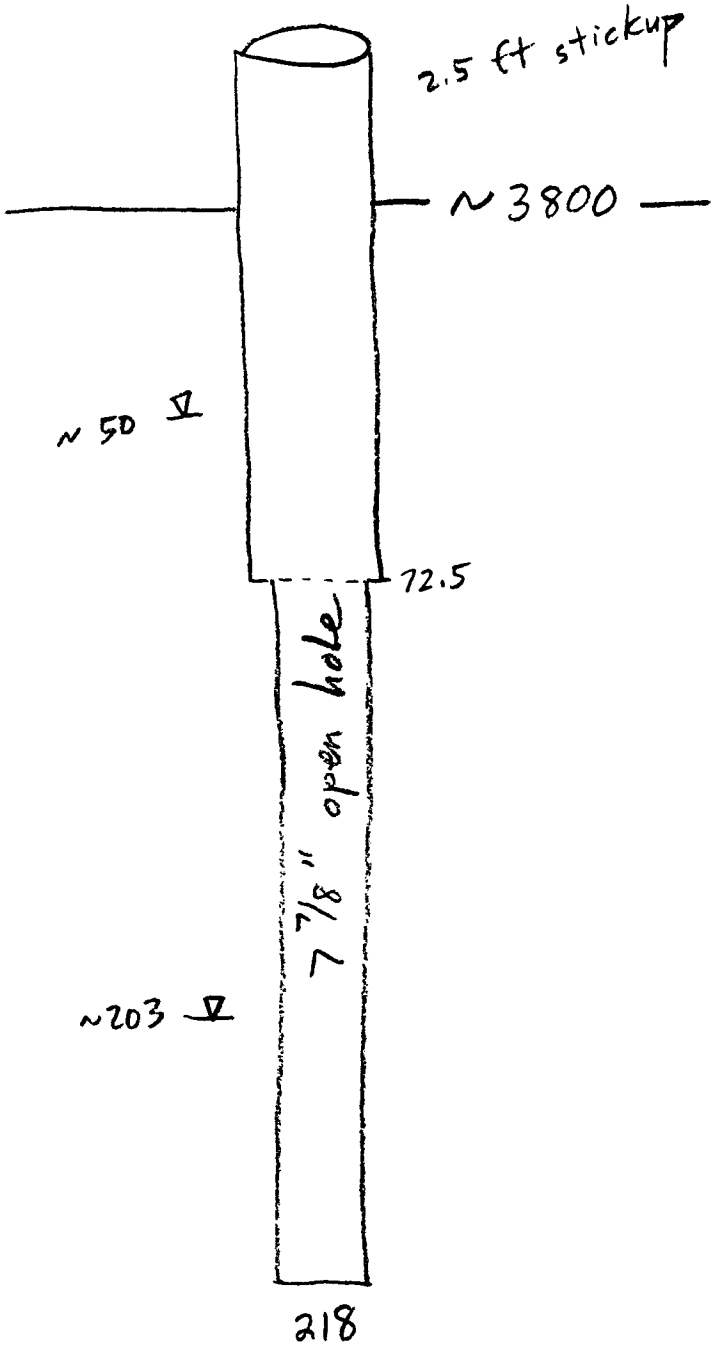
VE-7



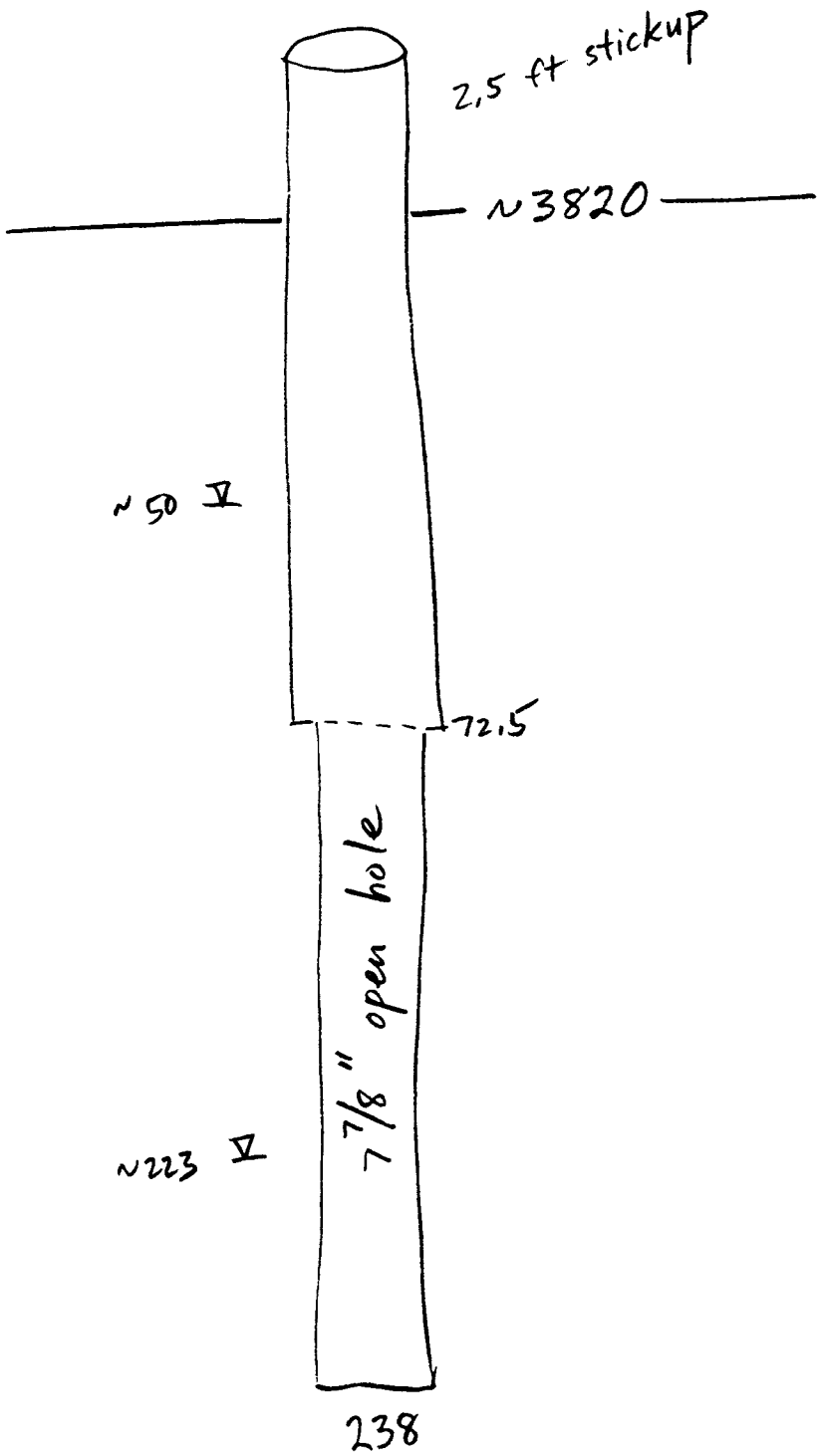
VE-8



VE-9



VE-10



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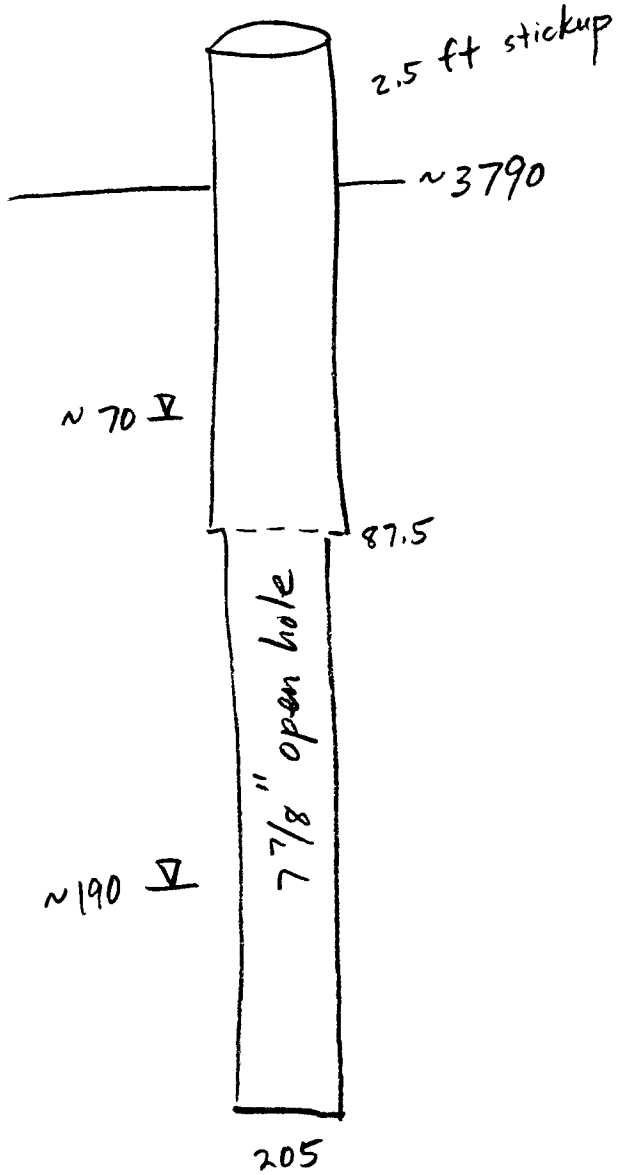
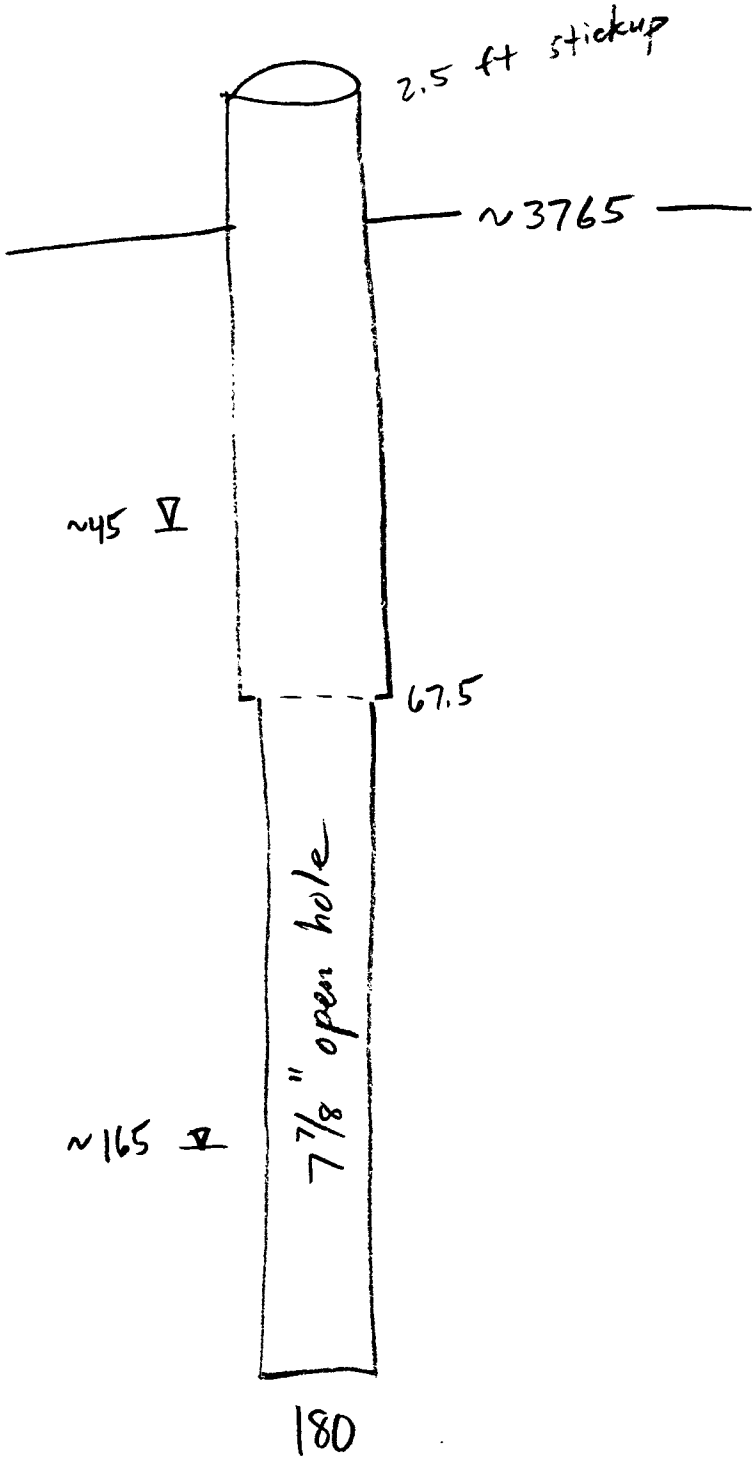


VE-12



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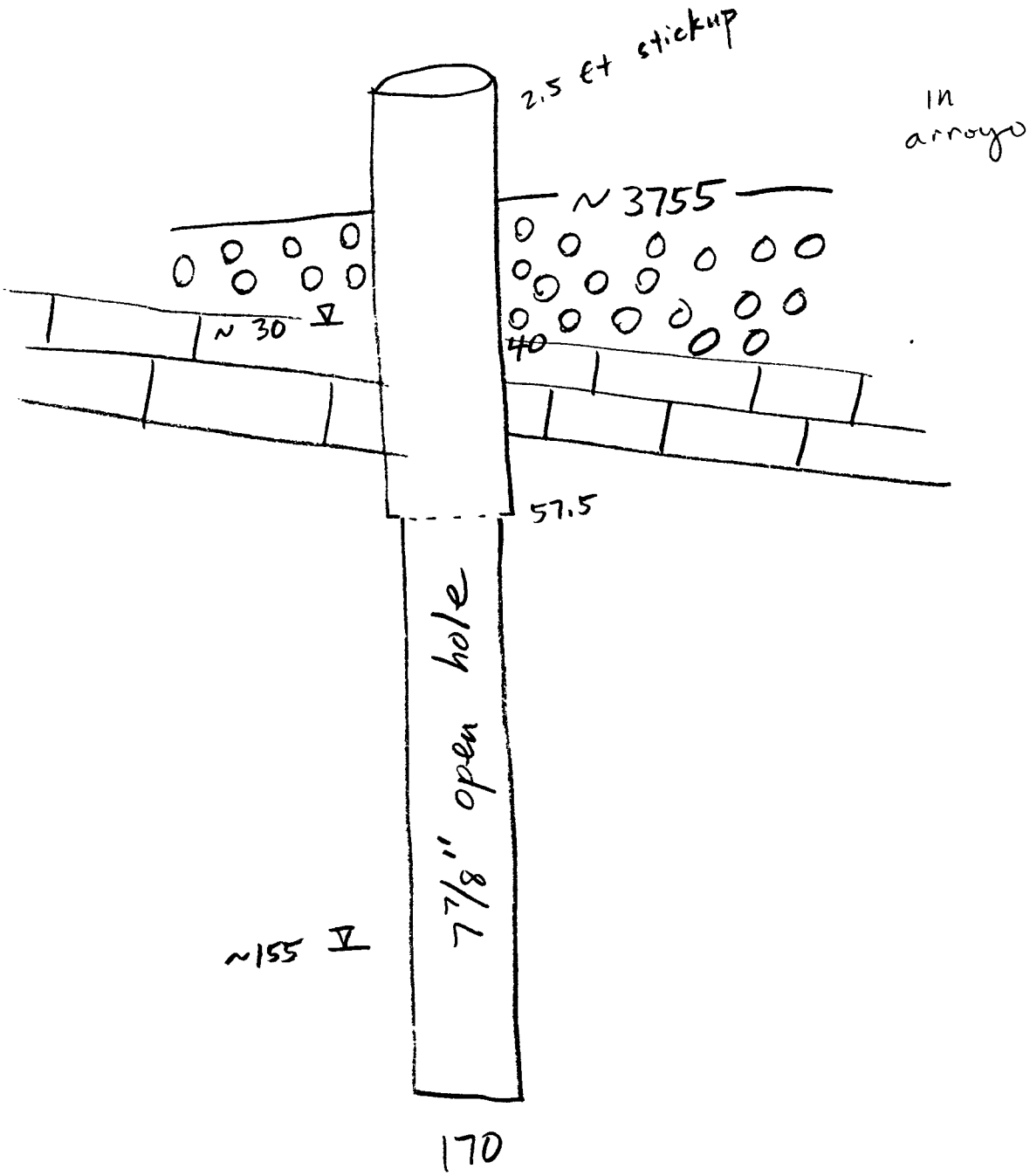
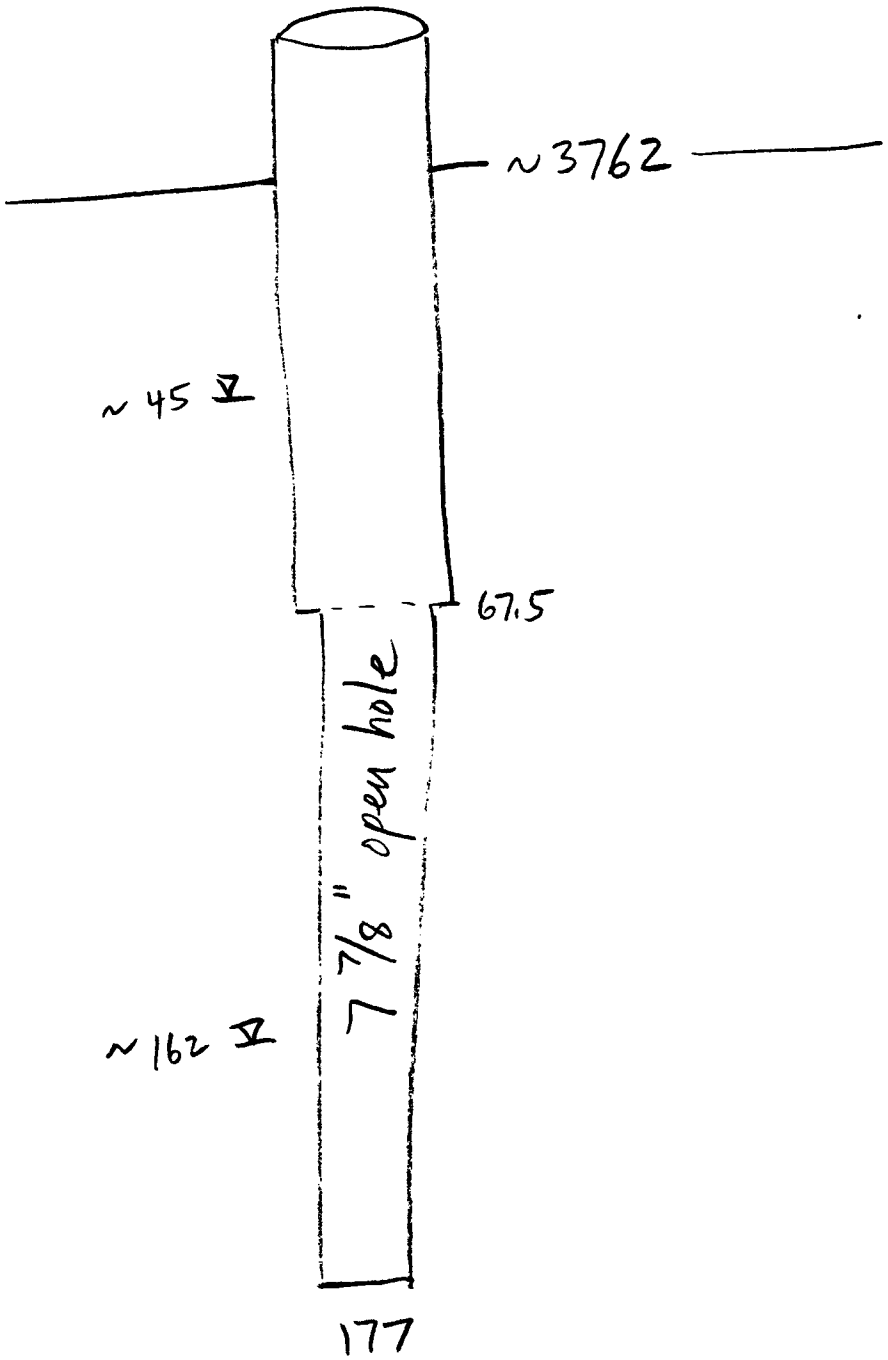
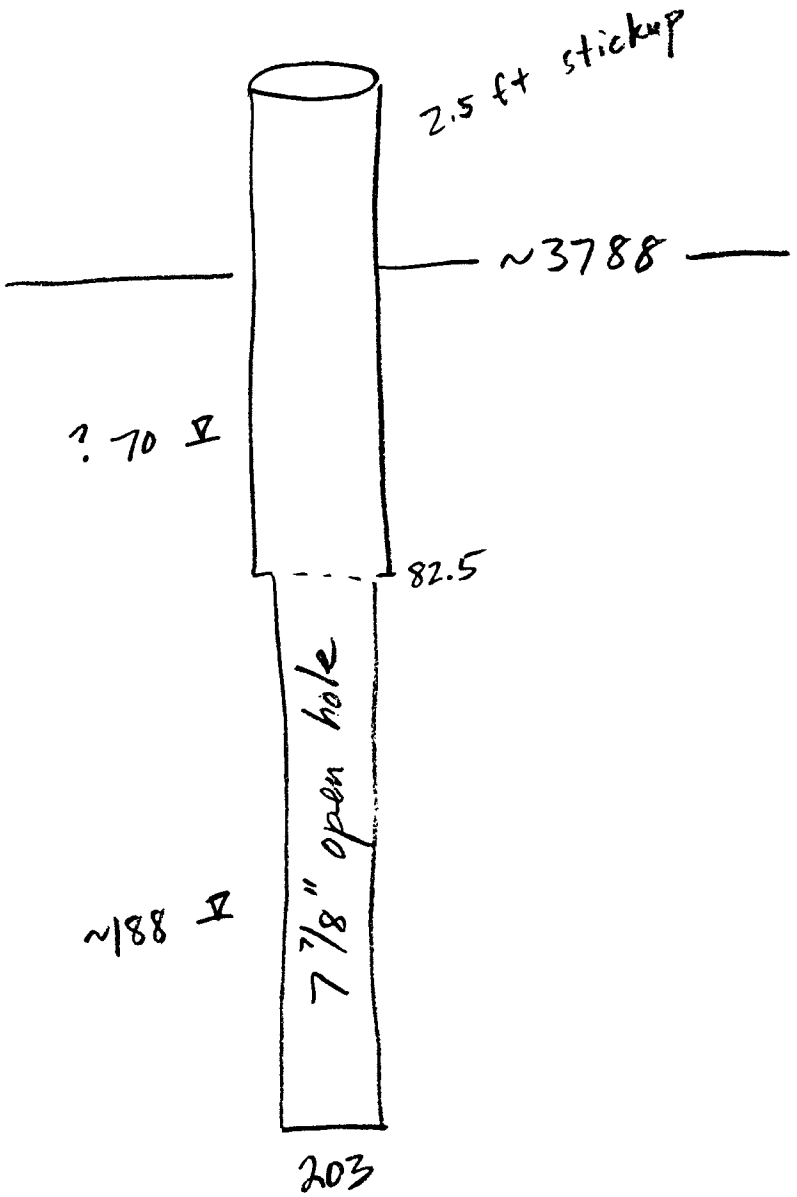


VE-14



VE-15



Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

December 7, 1995

RECEIVED
DEC 1 2 1995
Environmental Bureau
Oil Conservation Division

Mr. Roger C. Anderson
Environmental Bureau Chief
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

Re: Indian Basin Remediation Project
Transmittal of Workplan for Risk Assessment
to Establish Alternative Abatement Standards

Dear Mr. Anderson:

Marathon Oil Company is considering petitioning for regulation of the referenced remediation project under Subpart IV of the New Mexico Water Quality Control Commission regulations, as recently amended. Marathon may seek alternative abatement standards pursuant to Section 4103.F of these regulations.

To assess whether establishing alternative abatement standards is warranted, Marathon proposes to conduct a formal risk assessment. Presented to you during our meeting yesterday were three copies of a document (prepared by Groundwater Technology, Inc. and dated September 25,1995) entitled "Workplan for Risk Assessment to Establish Alternative Abatement Standards." Marathon requests Oil Conservation Division comments on this risk assessment workplan prior to proceeding with the formal risk assessment. To allow sufficient review time following yesterday's presentation and initial discussion, Marathon would appreciate receiving your response by February 1, 1996.

If you have any questions concerning the workplan or the project, please call Robert J. Menzie, Jr. or me at 915-682-1626.

Sincerely,

CK Curlee

Charles K. Curlee
Environmental and Safety Supervisor

File: 574-07

12/6/95 NMOCD/Marathon Meeting on Indian Basin Plant

Attendees

Bill Olson - NMOCD
Roger Anderson -
Rand Carroll -
Mark Ashley -
Charlie Curley - Marathon
Bob Menzie - "
Jon - Marathon attny
Sira Brothers - Ground Water Technology
Paul McCaw

Handout of Work plan (12/6/95) for Risk Assessment for Alternate Abatement stds.

Belief that under O&G Act 70-2-12.22 treatment of natural gas

* Marathon will provide opinion on O&G Act vs. Water Quality Act

Paul - review work plan

look at table 7 ~~other~~ exposure pathways
ie. surface water Human incidental exposure

* Marathon will send new transmittal letter for work plan

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 20, 1995

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Ms. Lyman:

Enclosed are analytical results from a water sample obtained on October 12, 1995 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed using EPA-approved methods by Analytical Technologies, Inc. in Albuquerque, New Mexico and Pensacola, Florida, respectively.

Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Advanced Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Carlsbad)
R. F. Unger
File 574-04

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 510345

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	LYMAN	AQUEOUS	10/12/95	NA	10/13/95	1
05	ARROYO	AQUEOUS	10/12/95	NA	10/13/95	1
06	BIEBBLE	AQUEOUS	10/12/95	NA	10/13/95	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	1.6	1.2	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	98	99	101

AnalyticalTechnologies,Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 510280
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 510345
Project Name: MARATHON OIL
Project Location: INDIAN BASIN REMEDIATION-MO
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 510345-01			Lab ID: 001		
CHLORIDE (325.3)	MG/L	24	1	CIW040	
Comments:					
Client ID: 510345-04			Lab ID: 002		
CHLORIDE (325.3)	MG/L	12	2	CIW040	#
Comments:					
Client ID: 510345-05			Lab ID: 003		
CHLORIDE (325.3)	MG/L	14	2	CIW040	#
Comments:					
Client ID: 510345-06			Lab ID: 004		
CHLORIDE (325.3)	MG/L	13	2	CIW040	#
Comments:					

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 20, 1995

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Enclosed are analytical results of water samples obtained on October 12, 1995 from your well and a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Pensacola, Florida respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Advanced Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File: 574-04

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 510345

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	LYMAN	AQUEOUS	10/12/95	NA	10/13/95	1
05	ARROYO	AQUEOUS	10/12/95	NA	10/13/95	1
06	BIEBBLE	AQUEOUS	10/12/95	NA	10/13/95	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	1.6	1.2	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	98	99	101

AnalyticalTechnologies,Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 510280
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 510345
Project Name: MARATHON OIL
Project Location: INDIAN BASIN REMEDIATION-MO
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 510345-01			Lab ID: 001		
CHLORIDE (325.3)	MG/L	24	1	CIW040	
Comments:					
Client ID: 510345-04			Lab ID: 002		
CHLORIDE (325.3)	MG/L	12	2	CIW040	#
Comments:					
Client ID: 510345-05			Lab ID: 003		
CHLORIDE (325.3)	MG/L	14	2	CIW040	#
Comments:					
Client ID: 510345-06			Lab ID: 004		
CHLORIDE (325.3)	MG/L	13	2	CIW040	#
Comments:					

Mid-Continent Region
Production - United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 20, 1995

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from a water sample obtained on October 12, 1995 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed using EPA-approved methods by Analytical Technologies, Inc. in Albuquerque, New Mexico and Pensacola, Florida, respectively.

Short term plans are to continue monthly sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Advanced Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File 574-04

AnalyticalTechnologies,Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 510345

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	LYMAN	AQUEOUS	10/12/95	NA	10/13/95	1
05	ARROYO	AQUEOUS	10/12/95	NA	10/13/95	1
06	BIEBBLE	AQUEOUS	10/12/95	NA	10/13/95	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	1.6	1.2	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	98	99	101

AnalyticalTechnologies,Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 510280
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 510345
Project Name: MARATHON OIL
Project Location: INDIAN BASIN REMEDIATION-MO
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 510345-01			Lab ID: 001		
CHLORIDE (325.3)	MG/L	24	1	CIW040	
Comments:					
Client ID: 510345-04			Lab ID: 002		
CHLORIDE (325.3)	MG/L	12	2	CIW040	#
Comments:					
Client ID: 510345-05			Lab ID: 003		
CHLORIDE (325.3)	MG/L	14	2	CIW040	#
Comments:					
Client ID: 510345-06			Lab ID: 004		
CHLORIDE (325.3)	MG/L	13	2	CIW040	#
Comments:					

Mid-Continent Region
Production United States

P.O. Box 552,
Midland, TX 79702-0552
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
1995 SEP 18 AM 8 52

Marathon Oil Company

September 18, 1995

Mr. William C. Olson
Hydrogeologist
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Gas Plant
Notification of Line # 1 Pipeline Spill Vertical Assessment Revised Workplan

Dear Mr. Olson:

As a result of C. K. Curlee's telephone conversation with you on September 15 regarding the Indian Basin Gas Plant Line # 1 pipeline spill vertical assessment workscope, Marathon is notifying the Oil Conservation Division of a revised workplan for the project. Marathon now plans to not assess the vertical extent of the pipeline spill impact beyond the 13 feet depth of the original excavation. Impact to shallow groundwater, if any resulted from the Line #1 release, can be monitored using shallow groundwater monitoring wells present downgradient of the pipeline leak site. Furthermore, Marathon's intent is to address historic and potential future gas plant releases together with the remediation of the larger Line #4 pipeline release that was discovered in April 1991. Current plans are to determine alternative standards or alternative cleanup levels for the vadose zone, shallow groundwater, and Lower Queen aquifer beneath the plant. Therefore, any additional assessment or abatement related to the Line #1 pipeline leak that may be necessary will be addressed after a risk determination is made.

If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental Representative

c: C. K. Curlee
N. R. Garza
L. J. Oswald

File: 528-15

Table 7
Preliminary Exposure Pathway Matrix
Indian Basin Remediation Project
Carlsbad, New Mexico

Exposure Medium	Exposure Route	RECEPTORS: On-Site Worker		On-Site Resident[a]		Off-Site Resident		Hunter		Ecological Receptors		Remarks
		Current	Future	Current	Future	Current	Future	Current	Future	Current	Future	
SOIL	Incidental ingestion	●	●	INC	INC	INC[b]	INC[b]	INC[g]	INC[g]	●	●	
	Inhalation of volatiles/dust emissions	●	●	INC	INC	INC[b]	INC[b]	INC[g]	INC[g]	INC[h]	INC[h]	
	Dermal contact	●	●	INC	INC	INC[b]	INC[b]	INC[g]	INC[g]	●	●	
GROUNDWATER	Incidental ingestion	●[e]	●[e]	INC	INC	INC[c]	●[d]	INC[g]	INC[g]	NA	NA	
	Inhalation of volatiles	●[e]	●[e]	INC	INC	INC[c]	●[d]	INC[g]	INC[g]	NA	NA	
	Dermal contact	●[e]	●[e]	INC	INC	INC[c]	●[d]	INC[g]	INC[g]	NA	NA	
SURFACE WATER	Incidental ingestion	NA	NA	NA	NA	NA	NA	NA	NA	●[f]	●[f]	
	Inhalation	NA	NA	NA	NA	NA	NA	NA	NA	INC	INC	
	Dermal contact	NA	NA	NA	NA	NA	NA	NA	NA	INC	INC	

a Site is likely to remain industrial
b Off-site soils are not impacted
c No detectable COPC levels in off-site wells
d Based on potential migration of COPCs to off-site ranch wells for domestic water supply
e Groundwater is used for process water only. This exposure pathway is considered insignificant. Potential exposure only through accidental spills, discharges, and spray from cooling tower
f Based on potential migration of COPCs to off-site natural spring
g On-site surface soils outside of gas plant are not impacted
h Soil COPCs are highly volatile

● = Potentially complete NA = Not Applicable INC = Incomplete

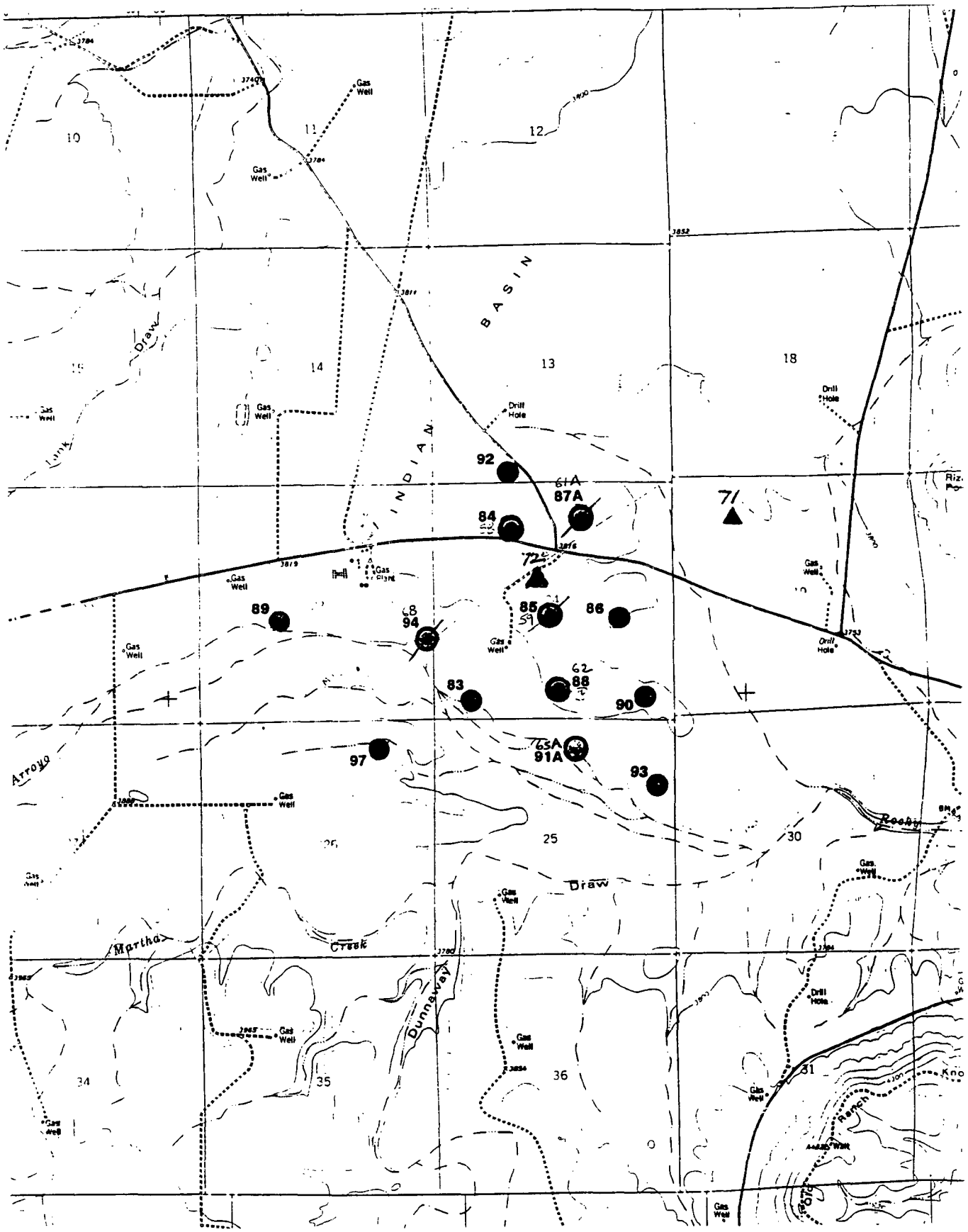
GROUNDWATER TECHNOLOGY

Table 8
Water Supply Wells in the Vicinity of the Indian Basin Remediation Project
Carlsbad, New Mexico

Figure 3 Designation	SEO Location Description	Well Owner	Well Depth (ft)	Use	Formation/Aquifer	Depth-to-water (ft)	Date of Mermnt
1	21.23.2.33434	Forrest Lee	NS	Stock	possible Queen	146.8	10/6/87
2	21.23.14.21221	Forrest Lee	25	Stock	alluvial of Roswell Basin*	14.6	1/12/54
3	21.23.22.241444	Dean Lee	256	Stock	lower Queen	213	11/3/92
4	21.23.24.22221	David Bradley	>31	Stock	alluvial of Carlsbad Basin	13	11/3/92
5	21.24.23.332232	Walter Biebelle	145	Stock/Domestic	alluvial of Carlsbad Basin/Seven Rivers	NS	NS
6	21.24.23.43233	William Shafer	300	Domestic	alluvial of Carlsbad Basin/Yates	50	8/17/65
7	21.24.23.43411	Earnest Shafer, Sr.	60	Domestic	alluvial of Carlsbad Basin	54	10/6/87
8	21.24.26.22230	Gerold Elmore	66	Domestic	alluvial of Carlsbad Basin	38	8/17/65
9	21.24.26.24323	William Shafer	69	NS	alluvial of Carlsbad Basin?	40	11/19/92
10	21.24.28.23232	William Shafer	138	Stock	alluvial of Carlsbad Basin/upper Queen	83	11/4/92
11	21.24.29.221112	Shafer (Biebelle)	70	Commercial OWD/ stock/domestic	alluvial of Carlsbad Basin	37	11/3/92
12	20.24.25.22233	Foster	275	Stock	Queen?**	265	2/11/94
13	20.24.35.11231	Foster	NS	Stock	Unknown	167	1/17/63
14	20.25.32.41	Howell	NS	NS	Unknown	NS	NS

Notes:

Data based on well logs on file at NMSEO, Roswell office (information provided by Marathon).
NS = Not specified
SEO = State Engineer's Office
* = SEO files indicate completion in Grayburg
** = SEO files indicated completion in Artesia Group, but SEO field representative indicates that this formation designation is used when the aquifer is unknown



LQ MONITOR WELL

LQ RECOVERY WELL

PROPOSED LOCATION

35 BOREHOLE NUMBER

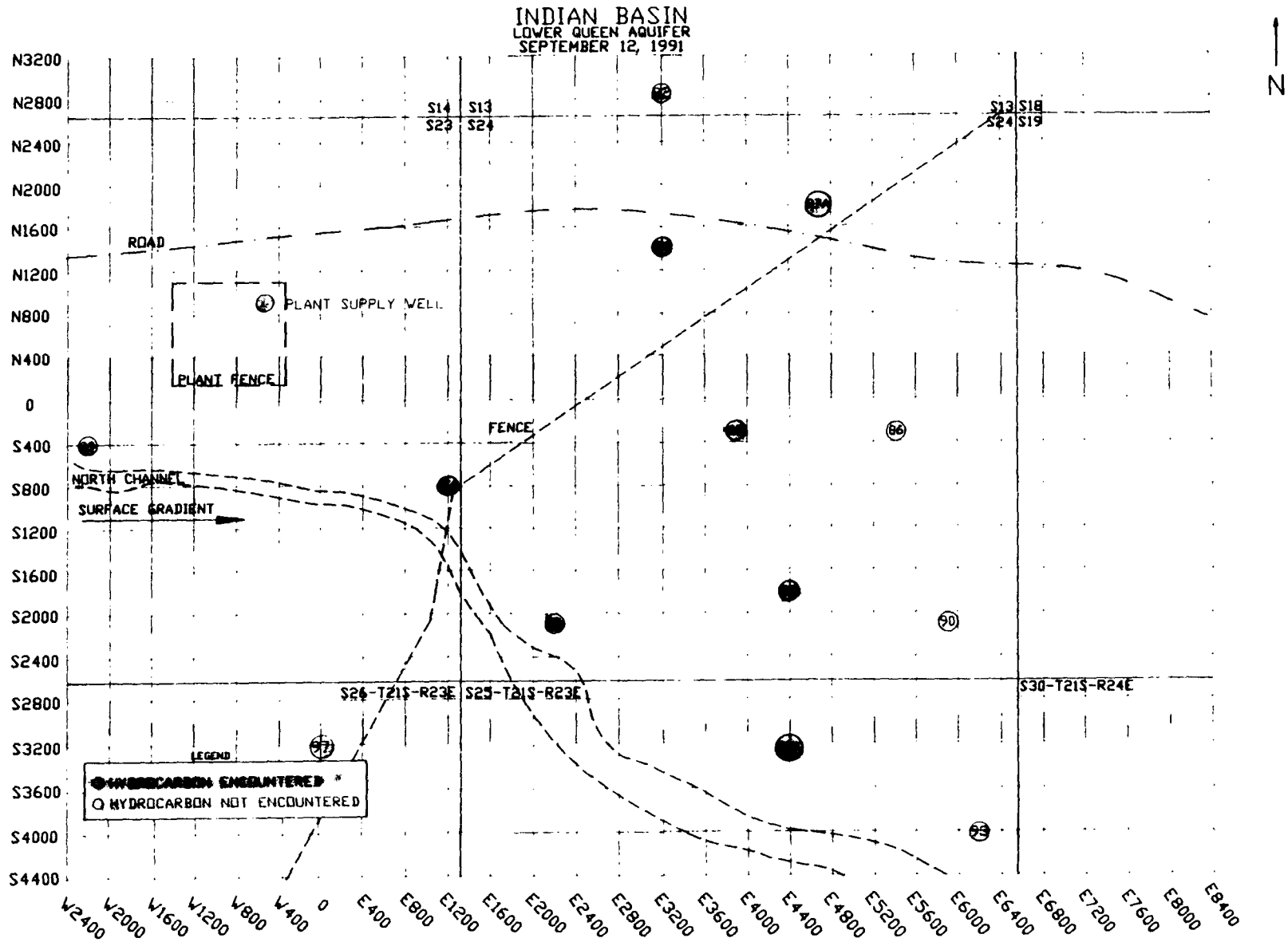
Free product well

MARATHON OIL COMPANY
MID-CONTINENT REGION

MARTHA CREEK

7.5' QUAD

1" = 2000'


INDIAN BASIN
LOWER QUEEN AQUIFER
SEPTEMBER 12, 1991
N
N3200
N2800
N2400
N2000
N1600
N1200
N800
N400
0
S400
S800
S1200
S1600
S2000
S2400
S2800
S3200
S3600
S4000
S4400
W2400
W2000
W1600
W1200
W800
W400
0
E400
E800
E1200
E1600
E2000
E2400
E2800
E3200
E3600
E4000
E4400
E4800
E5200
E5600
E6000
E6400
E6800
E7200
E7600
E8000
E8400
S14 S13
S23 S24
S13 S18
S24 S19
ROAD
PLANT SUPPLY WELL
PLANT FENCE
FENCE
NORTH CHANNEL
SURFACE GRADIENT
S26-T21S-R23E
S25-T21S-R23E
S30-T21S-R24E
LEGEND
HYDROCARBON ENCOUNTERED *
HYDROCARBON NOT ENCOUNTERED

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

August 18, 1995

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from a water sample obtained on July 21, 1995 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed using EPA-approved methods by Analytical Technologies, Inc. in Albuquerque, New Mexico and Pensacola, Florida, respectively.

Short term plans are to continue monthly sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File 574-04

Analytical Technologies, Inc.

CLIENT	: MARATHON OIL CO.	DATE RECEIVED	: 07/24/95
PROJECT #	: 44999		
PROJECT NAME	: IB REMEDIATION	REPORT DATE	: 08/10/95

ATI ID: 507392

	ATI PENSACOLA ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	507392-01	SW-1	AQUEOUS	07/21/95
02	507392-02	STRIP OUTLET	AQUEOUS	07/21/95
03	507392-03	STRIP INLET	AQUEOUS	07/21/95
04	507392-04	BIEBBLE	AQUEOUS	07/21/95
05	507392-05	ARROYO	AQUEOUS	07/21/95
06	507392-06	LYMAN	AQUEOUS	07/21/95
07	507392-07	TRIP BLANK	AQUEOUS	07/14/95

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	7

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507392

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	BIEBBLE	AQUEOUS	07/21/95	NA	07/25/95	1
05	ARROYO	AQUEOUS	07/21/95	NA	07/25/95	1
06	LYMAN	AQUEOUS	07/21/95	NA	07/25/95	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)		97	96	101

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 507486
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 507392
Project Name: MARATHON
Project Location: IB REMEDIATION
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 507392-01			Lab ID: 001		
CHLORIDE (325.2)	MG/L	25	2	CKW21B	
Comments:					
Client ID: 507392-04			Lab ID: 002		
CHLORIDE (325.2)	MG/L	10	2	CKW21B	
Comments:					
Client ID: 507392-05			Lab ID: 003		
CHLORIDE (325.2)	MG/L	12	2	CKW21B	
Comments:					
Client ID: 507392-06			Lab ID: 004		
CHLORIDE (325.2)	MG/L	11	2	CKW21B	
Comments:					

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

August 18, 1995

RECEIVED
AUG 21 1995
Environmental Bureau
Oil Conservation Division

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Ms. Lyman:

Enclosed are analytical results from a water sample obtained on July 21, 1995 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed using EPA-approved methods by Analytical Technologies, Inc. in Albuquerque, New Mexico and Pensacola, Florida, respectively.

Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File: 574-04

Analytical Technologies, Inc.

CLIENT	: MARATHON OIL CO.	DATE RECEIVED	: 07/24/95
PROJECT #	: 44999		
PROJECT NAME	: IB REMEDIATION	REPORT DATE	: 08/10/95

ATI ID: 507392

	ATI PENSACOLA ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
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05	507392-05	ARROYO	AQUEOUS	07/21/95
06	507392-06	LYMAN	AQUEOUS	07/21/95
07	507392-07	TRIP BLANK	AQUEOUS	07/14/95

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	7

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507392

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	BIEBBLE	AQUEOUS	07/21/95	NA	07/25/95	1
05	ARROYO	AQUEOUS	07/21/95	NA	07/25/95	1
06	LYMAN	AQUEOUS	07/21/95	NA	07/25/95	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	97	96	101

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 507486
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 507392
Project Name: MARATHON
Project Location: IB REMEDIATION
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
Client ID: 507392-01			Lab ID: 001		
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CHLORIDE (325.2)	MG/L	10	2	CKW21B	
Comments:					
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Comments:					
Client ID: 507392-06			Lab ID: 004		
CHLORIDE (325.2	MG/L	11	2	CKW21B	
Comments:					

Mid-Continent Region
Production, United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

August 18, 1995

RECEIVED
AUG 21 1995
Environmental Bureau
Oil Conservation Division

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Enclosed are analytical results of water samples obtained on July 21, 1995 from your well and a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Pensacola, Florida respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File: 574-04

Analytical Technologies, Inc.

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PROJECT #	: 44999		
PROJECT NAME	: IB REMEDIATION	REPORT DATE	: 08/10/95

ATI ID: 507392

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---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	7

ATI STANDARD DISPOSAL PRACTICE

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Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 507392

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
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06	LYMAN	AQUEOUS	07/21/95	NA	07/25/95	1

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BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)		97	96	101

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - MULTIPLE"

Accession: 507486
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 507392
Project Name: MARATHON
Project Location: IB REMEDIATION
Test: Group of Single Wetchem
QcLevel: II

Parameter:	Unit:	Result:	R.L:	Batch:	Q:
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CHLORIDE (325.2)	MG/L	25	2	CKW21B	
Comments:					
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CHLORIDE (325.2)	MG/L	10	2	CKW21B	
Comments:					
Client ID: 507392-05			Lab ID: 003		
CHLORIDE (325.2)	MG/L	12	2	CKW21B	
Comments:					
Client ID: 507392-06			Lab ID: 004		
CHLORIDE (325.2)	MG/L	11	2	CKW21B	
Comments:					

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

July 12, 1995

Mr. William C. Olson
Hydrogeologist
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RECEIVED
JUL 17 1995
Environmental Bureau
Oil Conservation Division

RE: Indian Basin Remediation Project
Notification of Third Quarter Sampling Episode

Dear Mr. Olson:

Marathon is notifying your office that the Third Quarter 1995 groundwater monitoring and sampling episode is scheduled for Tuesday, July 18 through Thursday, July 20. Groundwater Technology, Inc. will be conducting the gauging and sampling activities and West Texas Water Well Service will assist with purging of the Lower Queen monitoring wells.

Gauging of the Lower Queen and Shallow zone will commence Tuesday morning at approximately 7:00 am Mountain time. Purging and sampling of Lower Queen wells will proceed following gauging, probably Tuesday afternoon.

If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Production Environmental Representative

c: C. K. Curlee
N. R. Garza
L. J. Oswald

File: 568-00

OIL CONSERVATION DIVISION
RECEIVED
'95 JUL 17 AM 8 52

Marathon Oil Company

Mid-Continent Region
Production United States

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

July 12, 1995

Mr. William C. Olson
Hydrogeologist
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Gas Plant
Notification of Line # 1 Pipeline Spill Vertical Assessment Report Submittal Delay

Dear Mr. Olson:

Your letter dated April 27, 1995 approving Marathon's proposed workplan for supplemental assessment of the vertical extent of contamination from a July 13, 1994 leak of condensate and produced water from gathering line #1 in the Indian Basin Gas Plant requested that a report on the supplemental assessment be submitted by August 1, 1995. Marathon is notifying your office that the report will not be submitted until October 1, 1995.

The reason for the delay in transmitting the report to you is Marathon desires to schedule the drilling for mid-August when other drilling associated with the remediation project is planned. By combining the two drilling workscopes, Marathon can avoid additional drill rig mobilization costs. In addition, our current preferred drilling contractor does not have a rig available to complete the drilling in July.

If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Production Environmental Representative

c: C. K. Curlee
N. R. Garza
L. J. Oswald

File: 528-15

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

June 20, 1995

CERTIFIED MAIL
RETURN RECEIPT NO. P-667-242-278

Mr. Robert J. Menzie, Jr.
Production Environmental Representative
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702-0552

RE: GROUND WATER REMEDIATION PROJECT
MARATHON INDIAN BASIN GAS PLANT
EDDY COUNTY, NEW MEXICO

Dear Mr. Menzie:

The New Mexico Oil Conservation Division (OCD) has completed a review of Marathon Oil Company's (MOC) April 19, 1995 "INDIAN BASIN REMEDIATION PROJECT, INFILTRATION PLAN FOR TREATED GROUNDWATER". This document contains Marathon's work plan for installation of an infiltration system as a modification of the existing ground water remediation system at MOC's Indian Basin Gas Plant.

The concept of infiltration of treated ground water is acceptable. Since treated ground water from this remediation system is currently used as process water at the Indian Basin Plant, the OCD has not required that a separate discharge plan be submitted for the treatment system. However, due to the potential for system upsets, this system, as proposed to be modified to include infiltration of treated water, will need to receive a discharge plan under New Mexico Water Quality Control Commission (WQCC) Regulations.

Therefore, if Marathon wishes to proceed with the infiltration proposal, under the provisions of the WQCC Regulations, you are hearby notified that the filing of a discharge plan is required for the ground water remediation system at the Marathon Indian Basin located in Section 20, Township 14 North, Range 13 East, (NMPM), McKinley County, New Mexico.

This notification of discharge plan requirement is pursuant to Part 3-104 and Part 3-106 of the WQCC Regulations. The discharge plan, defined in Part 1.101.Q. of the WQCC Regulations, should cover all discharges of effluent or leachate at the site or adjacent to the site.

Included in the application should be plans for controlling spills and accidental discharges (including detection of leaks in below grade sumps, buried underground tanks and/or piping).

Three copies of the discharge plan should be submitted for review purposes.

If there are any questions on this matter, please feel free to contact Bill Olson at (505) 827-7154.

Sincerely,

William J. LeMay
Director

xc: Tim Gum, OCD Artesia District Supervisor
Ray Smith, OCD Artesia District

P 667 242 278
Certified Mail Receipt
No Insurance Coverage Provided
Do not use for International Mail
(See Reverse)

Sent to	
Street & No.	
P.O., 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, & Address of Delivery	
TOTAL Postage & Fees	$
Postmark or Date	

PS Form 3800, June 1990

Fold at line over top of envelope to the right of the return address.

Bill Olson

From: Bill Olson
To: Tim Gumm
Cc: Ray Smith
Subject: Marathon Indian Basin Remediation
Date: Thursday, June 15, 1995 9:15AM
Priority: High

Atached is a draft letter requiring a discharge plan for Marathon's Indian Basin remediation system. Please provide me with any comments by 9:00 am on 6/19/95. Thanks!

<<File Attachment: DP.NOT>>

Bill Olson

From: Tim Gumm
Date sent: Thursday, June 15, 1995 9:49AM
To: Bill Olson
Subject: Registered: Tim Gumm

Your message
To: Tim Gumm
Subject: Marathon Indian Basin Remediation
Date: Thursday, June 15, 1995 9:15AM
was accessed on
Date: Thursday, June 15, 1995 9:49AM

Bill Olson

From: Ray Smith
Date sent: Friday, June 16, 1995 10:03AM
To: Bill Olson
Subject: Registered: Ray Smith

Your message
To: Ray Smith
Subject: Marathon Indian Basin Remediation
Date: Thursday, June 15, 1995 9:15AM
was accessed on
Date: Friday, June 16, 1995 10:03AM

Mid-Continent Region
Product United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

RECEIVED
CONSERVATION DIVISION

June 9, 1995

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from a water sample obtained on May 18, 1995 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed using EPA-approved methods by Analytical Technologies, Inc. in Albuquerque, New Mexico and Fort Collins, Colorado, respectively.

Short term plans are to continue monthly sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

Attachment

cc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File 574-04

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 505376

PROJECT # : (NONE)

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	05/18/95	NA	05/22/95	1
02	LYMAN	AQUEOUS	05/18/95	NA	05/22/95	1
03	ARROYO	AQUEOUS	05/18/95	NA	05/22/95	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)		92	101	97

Analytical Technologies, Inc.

INORGANIC ANALYSES
NONMETALS

Sample ID

Arroyo

Lab Name: Analytical Technologies, Inc.

Client Name: Analytical Technologies, Inc. New Mexico

Client Project ID: 505376

Lab Sample ID: 95-05-154-03

Date Collected: 05/18/95

Sample Matrix: Water

Analyte	Method*	Concentration (mg/L)	Detection Limit (mg/L)	Analysis Date
Chloride	4500-Cl B.	9	5	05/25/95

ND = Not Detected

* Methods are from Standard Methods for the Examination of Water and Wastewater, 17th edition 1989

Mid-Continent Region
Product United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

June 9, 1995

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Ms. Lyman:

Enclosed are analytical results from a water sample obtained on May 18, 1995 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed using EPA-approved methods by Analytical Technologies, Inc. in Albuquerque, New Mexico and Fort Collins, Colorado, respectively.

Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File: 574-04

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 505376

PROJECT # : (NONE)

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	05/18/95	NA	05/22/95	1
02	LYMAN	AQUEOUS	05/18/95	NA	05/22/95	1
03	ARROYO	AQUEOUS	05/18/95	NA	05/22/95	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)		92	101	97

Analytical Technologies, Inc.

INORGANIC ANALYSES
NONMETALS

Sample ID

Lyman

Lab Name: Analytical Technologies, Inc.

Client Name: Analytical Technologies, Inc. New Mexico

Client Project ID: 505376

Lab Sample ID: 95-05-154-02

Date Collected: 05/18/95

Sample Matrix: Water

Analyte	Method*	Concentration (mg/L)	Detection Limit (mg/L)	Analysis Date
Chloride	4500-Cl B.	10	5	05/25/95

ND = Not Detected

* Methods are from Standard Methods for the Examination of Water and Wastewater, 17th edition 1989

Mid-Continent Region
Production United States

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

OIL CONSERVATION DIVISION
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95 JUN 8 AM 8 52

Marathon Oil Company

June 6, 1995

Mr. William C. Olson
Hydrogeologist
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

RE: Indian Basin Remediation Project
Notification of Gathering System expansion to connnect MW-75

Dear Mr. Olson:

Marathon is installing a 6-inch polyethylene underground pipeline segment between Lower Queen recovery well MW-75 and the main line of the project contaminated groundwater gathering system. Marathon is providing 48-hour notice of the required pressure integrity test of this line that is scheduled for Friday morning, June 9, 1995. The line will be hydrotested at a pressure of three pounds per square inch greater than operating pressure. A test log or record of the pressure observations will be generated to document the test results.

Per your instruction, only the new segment will be pressure tested. After this segment is tested, the connection to the main line will be completed. To ensure integrity of the connection, a visual examination for leaks at the main line connection will be conducted for one day following the initiation of fluid transfer past this point.

Enclosed is a map of the Indian Basin remediation project area showing the locations of select project recovery and monitoring wells, the groundwater treatment compound at the Indian Basin Gas Plant, and the various segments of the contaminated groundwater gathering system. Please call if you have any questions regarding the project.

Sincerely,

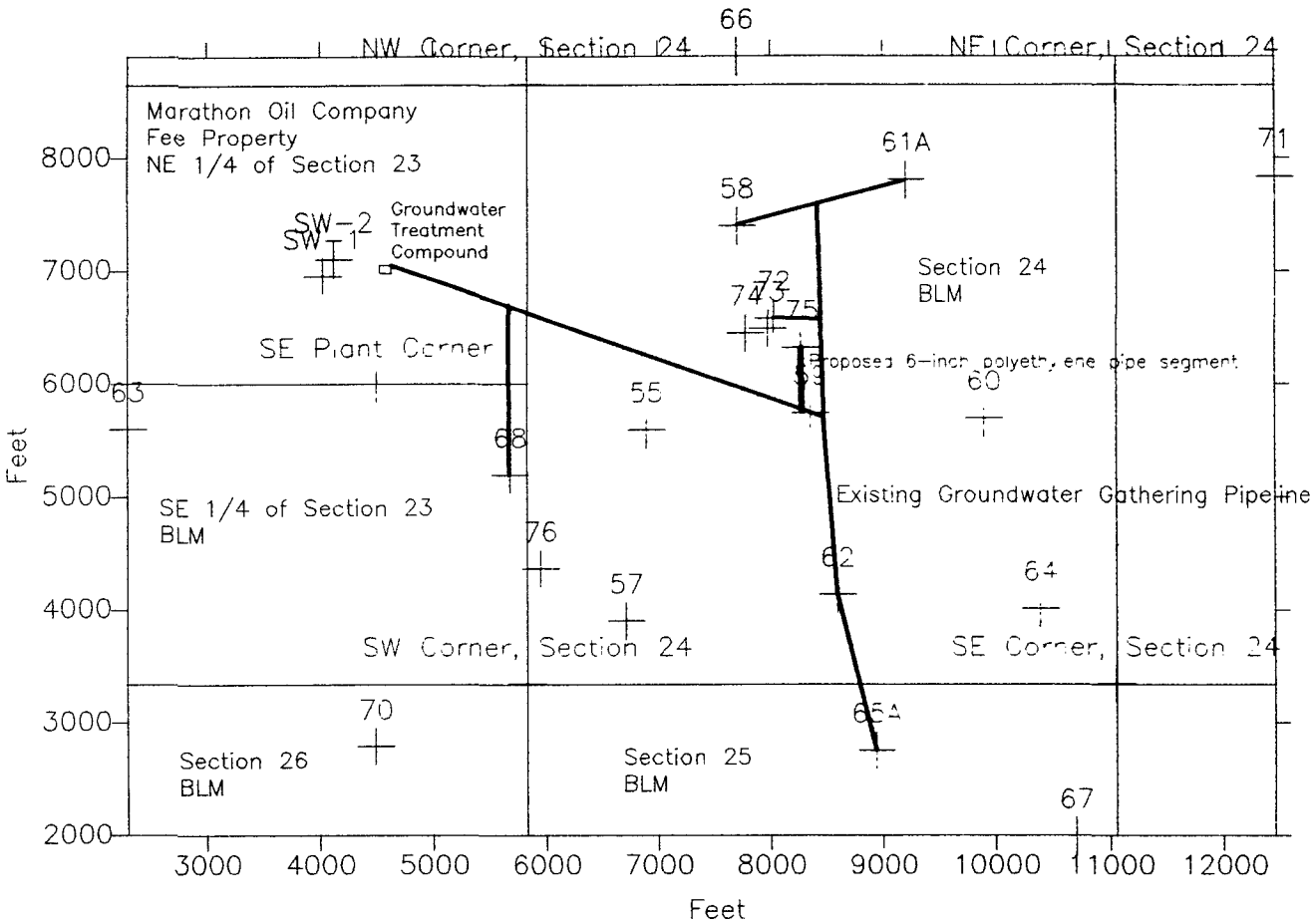
Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Production Environmental Representative

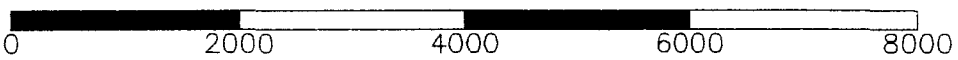
Attachment

c: C. K. Curlee
T. Gum, OCD, Artesia District Supervisor
C. M. Schweser

Marathon Oil Company
Indian Basin Remediation Project
Right-of-Way Map



Well number designations are SEO and OCD monitoring well numbers
(previous maps submitted to BLM used borehole designations)



Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

May 31, 1995d

Mr. & Mrs. Walter Biebelle
Queens Route
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Enclosed are analytical results of water samples obtained on April 7, 1995 from your well and a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and San Diego, California, respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File: 574-04

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 504339

PROJECT # : 44999

PROJECT NAME : I.B. REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
19	SW-1	AQUEOUS	04/07/95	NA	04/14/95	1
20	LYMAN	AQUEOUS	04/07/95	NA	04/14/95	1
21	ARROYO	AQUEOUS	04/07/95	NA	04/14/95	1

PARAMETER	UNITS	19	20	21
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	105	98	95

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 504339

PROJECT # : 44999

PROJECT NAME : I.B. REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
22	BIEBBLE	AQUEOUS	04/07/95	NA	04/14/95	1
23	STRIP INLET	AQUEOUS	04/07/95	NA	04/14/95	50
24	STRIP OUTLET	AQUEOUS	04/07/95	NA	04/14/95	1

PARAMETER	UNITS	22	23	24
BENZENE	UG/L	<0.5	42	<0.5
TOLUENE	UG/L	<0.5	<25	<0.5
ETHYLBENZENE	UG/L	<0.5	46	<0.5
TOTAL XYLENES	UG/L	<0.5	400	2.0
SURROGATE:				
BROMOFLUOROBENZENE (%)		89	84	89

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 504339

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : I.B. REMEDIATION

DATE RECEIVED : 04/10/95
REPORT DATE : 04/28/95

PARAMETER	UNITS	21	22	25	26	27
CHLORIDE (EPA 325.2)	MG/L	13	10.8	13	29	123

Mid-Continent Region
Production United States

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

Marathon Oil Company

May 31, 1995

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from a water sample obtained on April 7, 1995 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed using EPA-approved methods by Analytical Technologies, Inc. in Albuquerque, New Mexico and San Diego, California, respectively.

Short term plans are to continue monthly sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

cc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File 574-04

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 504339

PROJECT # : 44999

PROJECT NAME : I.B. REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
19	SW-1	AQUEOUS	04/07/95	NA	04/14/95	1
20	LYMAN	AQUEOUS	04/07/95	NA	04/14/95	1
21	ARROYO	AQUEOUS	04/07/95	NA	04/14/95	1

PARAMETER	UNITS	19	20	21
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	105	98	95

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 504339

DATE RECEIVED : 04/10/95

REPORT DATE : 04/28/95

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : I.B. REMEDIATION

PARAMETER	UNITS	21	22	25	26	27
CHLORIDE (EPA 325.2)	MG/L	13	10.8	13	29	128

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

May 31, 1995

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Ms. Lyman:

Enclosed are analytical results from a water sample obtained on April 7, 1995 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

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Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File: 574-04

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 504339

PROJECT # : 44999

PROJECT NAME : I.B. REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
19	SW-1	AQUEOUS	04/07/95	NA	04/14/95	1
20	LYMAN	AQUEOUS	04/07/95	NA	04/14/95	1
21	ARROYO	AQUEOUS	04/07/95	NA	04/14/95	1

PARAMETER	UNITS	19	20	21
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	105	98	95

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 504339

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : I.B. REMEDIATION

DATE RECEIVED : 04/10/95
REPORT DATE : 04/28/95

PARAMETER	UNITS	15	17	18	19	20
CHLORIDE (EPA 325.2)	MG/L	12	13	6.9	23	13

Mid-Continent Region
Production
United States

CONSERVATION DIVISION
RECEIVED
95 MAY 8 AM 8 52

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

May 15, 1995

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Ms. Lyman:

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Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A Collar (BLM - Carlsbad)
R. F. Unger
File: 574-04

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 503328

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	03/09/95	NA	03/14/95	1
02	LYMAN	AQUEOUS	03/09/95	NA	03/14/95	1
03	ARROYO	AQUEOUS	03/09/95	NA	03/14/95	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	111	113	111

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 503328

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 03/10/95
REPORT DATE : 03/29/95

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	24	12.0	11.5

Mid-Continent Region
Production, United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

May 15, 1995

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from a water sample obtained on March 9, 1995 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

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Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

cc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Carlsbad)
R. F. Unger
File 574-04

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 503328

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	03/09/95	NA	03/14/95	1
02	LYMAN	AQUEOUS	03/09/95	NA	03/14/95	1
03	ARROYO	AQUEOUS	03/09/95	NA	03/14/95	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	111	113	111

Analytical Technologies, Inc

GENERAL CHEMISTRY RESULTS

ATI I.D. : 503328

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 03/10/95
REPORT DATE : 03/29/95

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	24	12.0	11.5

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

RECEIVED
MAY 10 1995
Environmental Bureau
Oil Conservation Division

May 8, 1995

Mr. Roger C. Anderson
State of New Mexico, Oil Conservation Division
2040 S. Pacheco St.
Santa Fe, New Mexico 87505

Dear Mr. Anderson:

Enclosed is the First Quarter 1995 Treatment Project Report for the Indian Basin Remediation Project. This report is submitted on behalf of the Indian Basin Gas Plant owners in accordance with the Indian Basin Treatment Project Plan prepared by Marathon and approved by the Oil Conservation Division on April 2, 1992. If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Production Environmental & Safety Representative

Attachment

c: William C. Olson, Oil Conservation Division, Santa Fe

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

April 19, 1995

Mr. William C. Olson
Hydrogeologist
Oil Conservation Division
2040 Pacheco St.
Santa Fe, New Mexico 87501

Re: Indian Basin Remediation Project
Infiltration Plan for Treated Groundwater

Dear Mr. Olson:

In compliance with New Mexico Oil Conservation Division (OCD) Condition No. 2 in a letter from Mr. William J. LeMay dated April 2, 1992, Marathon is submitting an Infiltration Plan for OCD approval to infiltrate treated groundwater into wells completed in the Lower Queen aquifer and shallow alluvium referred to as the "shallow zone" or "perched soil water zone." Lower Queen groundwater is recovered and pumped to a treatment compound as part of an ongoing pump-and-treat remediation system under OCD direction. Recovered Lower Queen groundwater is treated by an air stripper at the treatment compound to meet or exceed New Mexico Water Quality Control Commission (WQCC) standards for groundwater in Section 3-103. This plan proposes to infiltrate treated water by gravity drainage into two existing upgradient Shallow zone monitoring wells (MW-45 and MW-51) and two proposed upgradient Lower Queen infiltration wells (IW-1 and IW-2).

Due to increasing groundwater recovery and treatment, infiltration into the Lower Queen aquifer is necessary to ensure continued compliance with Marathon's Lower Queen aquifer water usage permit (RA-5131) issued by the New Mexico State Engineer Office (SEO) in Roswell, New Mexico. Marathon gained approval from the SEO to infiltrate treated water into both zones on March 20, 1995. Although Marathon has approval to infiltrate water, a permit is pending to obtain receipt of a gallon-for-gallon credit for treated groundwater infiltrated into the Lower Queen aquifer. Shallow zone infiltration is required to comply with the SEO directive to replace the groundwater appropriated from this zone on a gallon-per-gallon basis (Condition 1 in Mr. Richard Cibak's SEO letter dated March 18, 1992). Marathon does not possess Shallow zone water rights.

INFILTRATION WELLS

Shallow zone

Figure 1 shows the locations of two existing upgradient Shallow zone monitoring wells (MW-45 and MW-51). Treated groundwater will be conveyed from the air stripper to MW-45 using a fexible hose laid along the ground surface. Transfer of treated groundwater to MW-51 will be accomplished by withdrawing water from the 1000-barrel steel tank used for freshwater supply at the plant. Water in this tank is conveyed from the air stripper at the treatment compound to the tank via an underground pipeline. Another underground pipeline transfers the water from the tank to a spigot on the north side of the welding shop. A flexible hose will be used to convey the water from this spigot to MW-51. Each wellhead will be equipped with a flow meter to measure the volume of gallons infiltrated into the Shallow zone.

Lower Queen

Figure 2 shows the approximate locations of two proposed infiltration wells, which are downgradient of MW-63 and MW-70, the two Lower Queen upgradient monitoring wells used to determine the background concentration of groundwater flowing into the remediation project area. Two boreholes will be drilled to approximately 180 feet below grade or to a depth that is five feet below the groundwater elevation. The well will be completed open hole with surface casing set to a depth approximately 50 feet below the bedrock contact with the overlying alluvium. A 4.5- to 6-inch inside diameter polyethylene pipeline will be installed between the treatment compound and the Lower Queen infiltration wellheads. Upon completion of the pipeline, a pressure test will be conducted at three pounds per square inch greater than operating pressure to ensure integrity. Transfer of treated groundwater will be accomplished by the outlet pump at the treatment compound. Each wellhead will be equipped with a flow meter to measure the volume of gallons infiltrated into the aquifer.

MONITORING OF TREATED WATER

To ensure compliance with the WQCC groundwater standards in Section 3-103, the treated groundwater to be infiltrated will be sampled on a regular schedule and submitted for the appropriate laboratory analyses. Samples will be collected from the effluent port located on the air stripper. On March 9, 1995, samples were collected from the effluent port on the air stripper to determine an appropriate monitoring frequency. The laboratory analysis reports are attached. The proposed schedule for sampling and analysis is provided below.

MONTHLY WATER ANALYSES FOR INFILTRATION STREAM

PARAMETER	TEST METHOD	WQCC Standard	MARCH 1995 Results
Benzene	EPA 8020	10 ug/l	<0.5 ug/l
Toluene	EPA 8020	750 ug/l	**0.5 ug/l**
Ethylbenzene	EPA 8020	750 ug/l	<0.5 ug/l
total Xylenes	EPA 8020	620 ug/l	<0.5 ug/l
PAHs: total naphthalene plus monomethylnaphthalenes	EPA 8310	30 ug/l	<3 ug/l
benzo-a-pyrene	EPA 8310	0.7 ug/l	**<1 ug/l***
chloride	EPA 325.2	250 mg/l	**40 mg/l**
phenols (total)	EPA 420.1	0.005 mg/l	**<0.006 mg/l***
sulfate	EPA 375.4	600.0 mg/l	**360 mg/l**
total dissolved solids (TDS)	EPA 160.1	1000.0 mg/l	**730 mg/l**
pH	field	between 6 and 9	not determined

*Analytical Technologies, Inc. Pensacola, FL laboratory method detection limit above WQCC Section 3-103 Standard

ANNUAL WATER ANALYSES FOR INFILTRATION STREAM (Radionucleides, Metals, Nitrate, and Fluoride)

PARAMETER	TEST METHOD	WQCC Standard (ug/l)	MARCH 1995 Results (ug/l)
Uranium	Laser-induced Kinetic Phosphorimetry	5.0	0.00061
Combined Radium 226 and 228	Method 901.1 (modified)	30 pCi/l	Ra-226 (0.460±0.682 pCi/l) Ra-228 (<1.00 pCi/l)
Aluminum	EPA 200.7	5.0	<0.06
Arsenic	EPA 206.2	0.1	<0.005
Barium	EPA 200.7	1.0	**0.10**
Copper	EPA 200.7	1.0	<0.01
Iron	EPA 200.7	1.0	**0.61**
Molybdenum	EPA 200.7	1.0	<0.01
Boron	EPA 200.7	0.75	<0.09
Cadmium	EPA 213.2	0.01	<0.0005
Chromium	EPA 200.7	0.05	<0.01
Cobalt	EPA 200.7	0.05	<0.01
Cyanide (total)	EPA 335.3	0.2	<0.005
Fluoride	EPA 340.2	1.6	**0.8**
Lead	EPA 239.2	0.05	<0.003
Manganese	EPA 200.7	0.2	**0.27**
Nickel	EPA 200.7	0.2	<0.02
Mercury	EPA 245.1	0.002	<0.0002
Nitrate (total)	EPA 353.2	10.0	<0.1
Selenium	EPA 270.2	0.05	<0.005
Silver	EPA 200.7	0.05	<0.01
Zinc	EPA 200.7	10.0	<0.02

ANNUAL WATER ANALYSES FOR INFILTRATION STREAM
(PCBs and chlorinated organic compounds)

PARAMETER	TEST METHOD	WQCC Standard (ug/l)	MARCH 1995 Results (ug/l)
Polychlorinated biphenyls (PCBs)	EPA 8080	1.0	<1.0
carbon tetrachloride	EPA 8010	10	<0.2
1,2-dichloroethane (EDC)	EPA 8010	10	<0.5
1,1,2-trichloroethane	EPA 8010	10	<0.2
1,1,2,2-tetrachloroethane	EPA 8010	10	<0.2
1,1-dichloroethylene (1,1-DCE)	EPA 8010	5.0	<0.2
1,1,2,2-tetrachloroethylene (PCE)	EPA 8010	20	<0.5
1,1,2-trichloroethylene (TCE)	EPA 8010	100	<0.2
methylene chloride	EPA 8010	100	<2.0
chloroform	EPA 8010	100	<0.5
1,1-dichloroethane	EPA 8010	25	<0.2
ethylene dibromide (EDB)	EPA 504.1	0.1	<0.01
1,1,1-trichloroethane	EPA 8010	60	<1.0
vinyl chloride	EPA 8010	1.0	<0.5

Reporting

Marathon will notify the OCD if monitoring results indicate infiltrated water is above WQCC standards. Monthly and annual laboratory analysis results of the infiltration water stream will be transmitted to the OCD office in Santa Fe as part of the quarterly report.

Please approve this proposed infiltration plan at your earliest convenience. Submittal of the discharge pipeline right-of-way application to the Bureau of Land Management and drilling of Lower Queen infiltration wells are pending until Marathon receives your approval.

Sincerely,

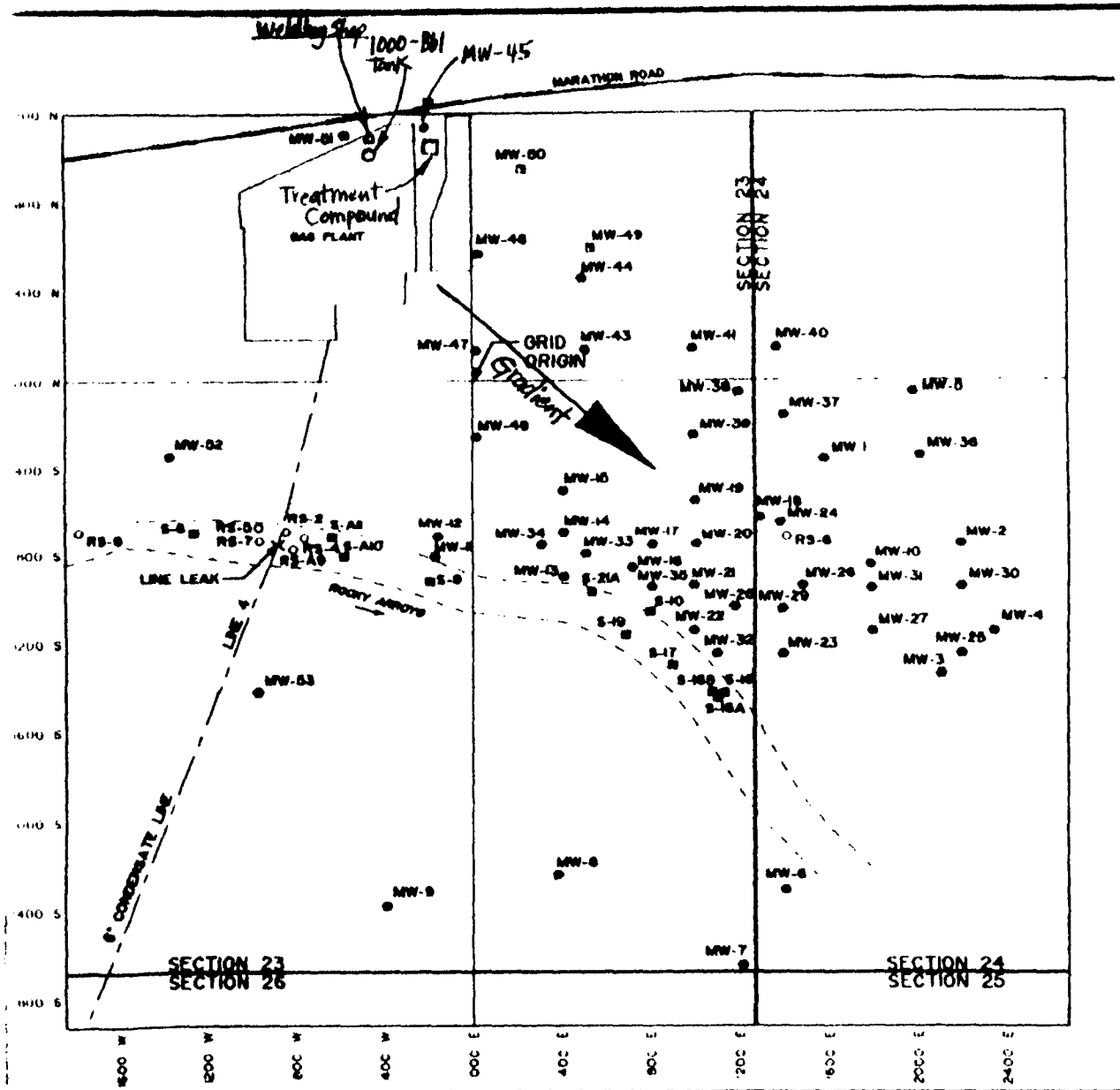
Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Production Environmental Representative

Attachment

c: C. K. Curlee, Marathon, Midland
C. M. Schweser, Marathon, Indian Basin Gas Plant
File No. 556-01

INDIAN BASIN GAS PLANT
ARTESIA, NEW MEXICO



SCALE

0 1000' 2000'

FEET

LEGEND

MW-9 ● SHALLOW ALLUVIAL GROUNDWATER MONITORING WELL

RS-4 ○ 4 INCH PVC RECOVERY SUMP

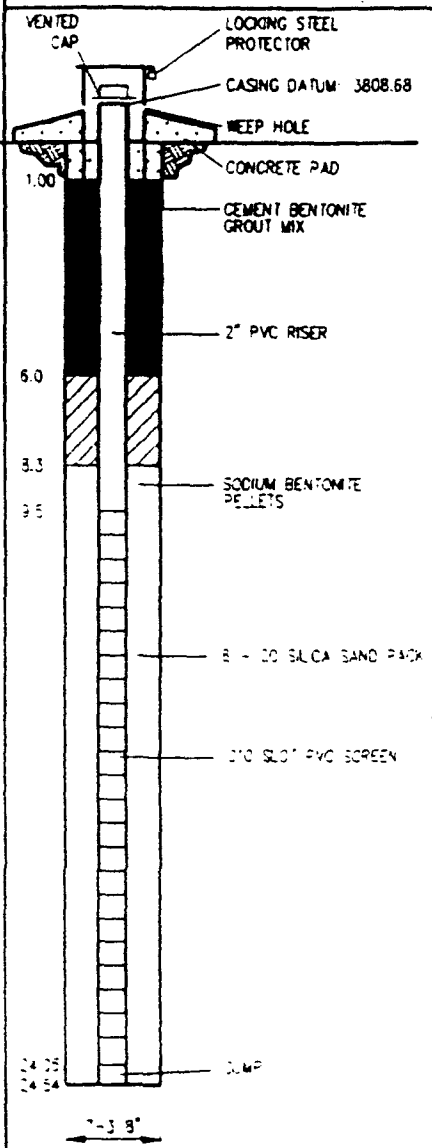
S-19 ■ 24 INCH GALVANIZED RECOVERY SUMP

Figure 1	MARARTHON OIL COMPANY
	INDIAN BASIN GAS PLANT
Shallow zone Base	PREPARED BY / CHECKED BY / DRAFTED BY

WELL COMPLETION RECORD

GEOLOG UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3806.6				
	0	SILT, 7.5 YR 6/4, LIGHT BROWN, LOOSE, SOFT, DRY	ML		1 GC; NS	
	2.7	CLAYEY SILT: 7.5 YR 5/4, BROWN, NON-PLASTIC, DRY, FRIABLE, CALICHE NODULES, 15% CLAY, 10% CALICHE, 75% SILT	ML		2 1.5; 3 1.5; NS; 4 1.5	
	5					
	8.3	SANDSTONE, 2.5 YR 8/4, PALE YELLOW, MODERATELY HARD, SLIGHTLY CEMENTED, FINE GRAINED, SILTY	SM		5 0.9; NR; NS	
	10	COLOR CHANGES TO 2.5 Y 5/6 LIGHT OLIVE BROWN WITH INCREASED MOISTURE			NS	
	15	2.5 Y 4/4 OLIVE BROWN AND 2.5 Y 5/6 LIGHT OLIVE BROWN AT 17.5'; CEMENTED HARD AT 18.0'; WET AT 18.5			15 0.4; NR; NS; 17 0.5; NR; NS; 19 0.6; NR; NS	
18.5						
	20					
	24.5				23 0.4; NR; NS	
	25	AUGER REFUSAL AT 24.5				
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-45 (BH-68)***

BORING NUMBER ***MARATHON/91029***

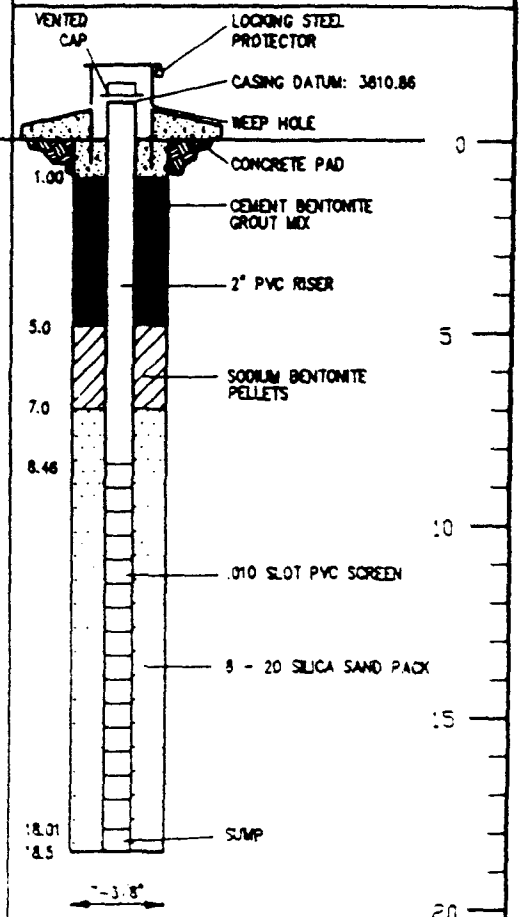
DATE DRILLED 6/2/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY LMB
OPERATED BY BJS

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS

WELL COMPLETION RECOR

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3809.3				
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, LOOSE, DRY, SOFT	ML		1 GC; NS	
	2.8	CLAYEY SILT: 7.5 YR 5/4, BROWN, FIRM, FRIABLE, DRY, 15% CLAY, 10% CALICHE	ML		2 NR 1.0; 3 NR 0.1; NS; 4 NR 1.0	
	8.5	SILT, GRAVEL, COBBLES: SILT IS 10 YR 6/4 TO 5/4, LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY, GRAVEL & COBBLES ARE 2.5 YR 5/0 TO 4/0, GRAY TO DARK GRAY AND ARE DOLOMITIC LIMESTONE, VUGGY POROSITY, LIMESTONE IS ALSO 2.5 Y 6/2 LIGHT BROWNISH GRAY	GM		5 NR 0.6; NS; 6 NR 0.6; 7 NR 0.7; NS	
	17.9 / 18.5	SANDSTONE: 2.5 Y 6/6, OLIVE YELLOW HARD, FINE GRAINED, SILTY	SS		8 NR 0.5	
	20	AUGER REFUSAL AT 18.5' BOREHOLE OVM READING: 0.0 PPM				

WELL COMPLETION DETAIL



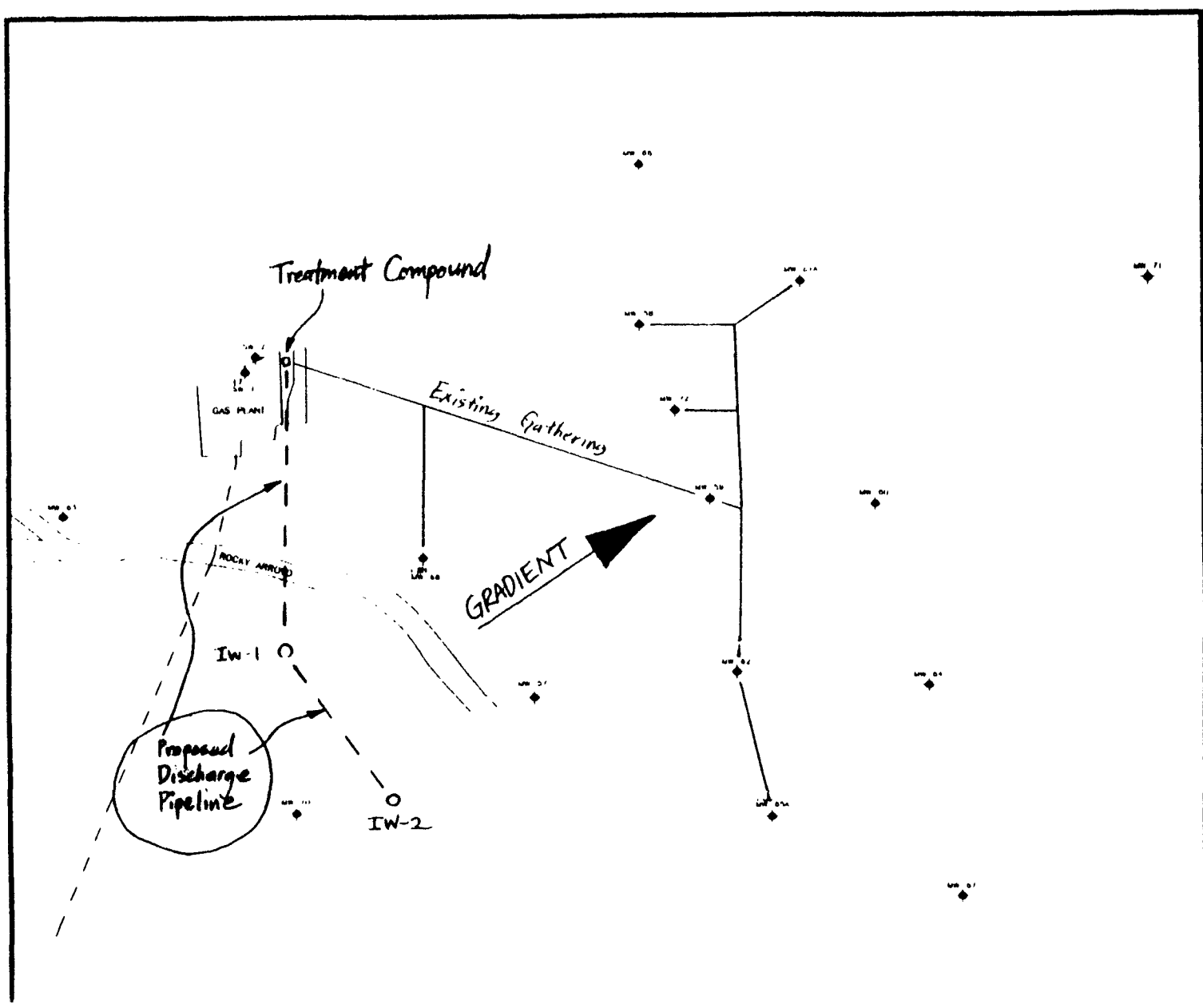
SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR NO RECOVERY
NS NOT SAMPLED

JOB NAME/NUMBER **MW-51 (BH-74)**

BORING NUMBER **MARATHON/91029**

DATE DRILLED 6/6/91
DRILLING METHOD HSA/SS
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR PAGE 1 OF 1

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
2700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3875



EXPLANATION

◆ MONITOR WELL

- — - CONDENSATE LINE

N

0 1000 2000

APPROX. SCALE IN FEET

MARATHON OIL COMPANY

INDIAN BASIN GAS PLANT SITE

INDIAN BASIN, NEW MEXICO

02335V112

DRAWN BY: DACRE BUSH DATE: 05-11-94

DRAFTED BY: DEN HOLMES DATE: 05-20-94

CHECKED BY: _____ DATE: _____

Figure 2

Analytical Technologies, Inc.

2709-D Pan American Freeway, NE Albuquerque, NM 87107
Phone (505) 344-3777 FAX (505) 344-4413

ATI I.D. **503327**

April 18, 1995

Marathon Oil Company
P.O. Box 552
Midland, TX 79702-0552

Project Name/Number: IB INJECTION INDIAN BASIN (44999)

Attention: Bob Menzie

On **03/10/95**, Analytical Technologies, Inc., (ADHS License No. AZ0015), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

This report is being reissued in part to include Radiochemisty/Uranium results. It is now complete.

Please note additional case narrative for Radium 226/228 included in this report.

Due to laboratory error, the EPA recommended hold for Nitrate analyses was missed. Total Nitrate/Nitrite analysis was performed and the results are included in this report. We apologize for any incovenience. There is no charge for this analysis.

Radiochemistry and Uranium analyses were performed by Analytical Technologies, Inc., 225 Commerce Drive, Fort Collins, CO.

EPA Method 8010/8020 and 504.1 analyses were performed by Analytical Technologies, Inc., Albuquerque, NM.

APR 20 1995

Analytical Technologies, Inc.

All other analyses were performed by Analytical Technologies, Inc., 11 East Olive Road, Pensacola, FL.

This report is being reissued in part to correct typographical error.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Letitia Krakowski, Ph.D.
Project Manager

H. Mitchell Rubenstein, Ph.D.
Laboratory Manager

MR:jt

Enclosure

Analytical Technologies, Inc.

CLIENT	: MARATHON OIL CO.	DATE RECEIVED	: 03/10/95
PROJECT #	: INDIAN BASIN (44999)		
PROJECT NAME	: IB INJECTION	REPORT DATE	: 03/24/95

ATI ID: 503327

	ATI PENSACOLA ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	503327-01	S-OUT	AQUEOUS	03/09/95
02	503327-02	TRIP BLANK	AQUEOUS	02/28/95

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	2

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 503475
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 503327
Project Name: MARATHON OIL
Project Location: IB INJECTION
Test: Group of Single Wetchem
Matrix: WATER
QC Level: II

Lab ID: 001
Client Sample Id: 503327-01

Sample Date/Time: 09-MAR-95 1530
Received Date: 11-MAR-95

Parameters:	Units:	Results:	Rpt Lmts:	Q:	Batch:	Analyst:
CHLORIDE (325.2)	MG/L	40	2		CKW08A	TT
CYANIDE, TOTAL (335.2)	MG/L	ND	0.005		CNW015	MM
FLUORIDE (340.2)	MG/L	0.8	0.2		FLW020	DPH
NITRITE-NITRATE, NITROGEN (353.2)	MG/L	ND	0.1		N3W16A	BF
PHENOLS, TOTAL (420.1)	MG/L	ND	0.006	#	PEW009	MM
SULFATE (375.4)	MG/L	360	100	+	SEW020	DBH
TOTAL DISSOLVED SOLIDS (160.1)	MG/L	730	5		TDW014	NB

Comments:

Analytical Technologies, Inc.

"Method Report Summary"

Accession Number: 503475
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 503327
Project Name: MARATHON OIL
Project Location: IB INJECTION
Test: Group of Single Wetchem

Client Sample Id:	Parameter:	Unit:	Result:
503327-01	CHLORIDE (325.2)	MG/L	40
	FLUORIDE (340.2)	MG/L	0.8
	SULFATE (375.4)	MG/L	360
	TOTAL DISSOLVED SOLIDS (160.1)	MG/L	730

Analytical Technologies, Inc.

"WetChem Quality Control Report"

Parameter:	CHLORIDE	CYANIDE	FLUORIDE	NO2NO3	PHENOL	SULFATE
Batch Id:	CKW08A	CNW015	FLW020	N3W16A	PEW009	SEW020
Blank Result:	<2	<0.005	<0.2	<0.1	<0.005	<10
Anal. Method:	325.2	335.2	340.2	353.2	420.1	375.4
Prep. Method:	N/A	N/A	N/A	N/A	N/A	N/A
Analysis Date:	20-MAR-95	21-MAR-95	17-MAR-95	17-MAR-95	21-MAR-95	20-MAR-95
Prep. Date:	20-MAR-95	21-MAR-95	17-MAR-95	17-MAR-95	16-MAR-95	20-MAR-95
Sample Duplication						
Sample Dup:	503475-1	503475-1	503336-1	503495-6	N/A	503334-1
Rept Limit:	<2	<0.005	<0.2	<0.1	N/A	<10
Sample Result:	40.1	<0.005	<0.2	0.35		26.9
Dup Result:	38.5	<0.005	<0.2	0.36		26.5
Sample RPD:	4	N/C	N/C	0.01G		0.4G
Max RPD:	13	0.005	0.2	0.1		10
Dry Weight%	N/A	N/A	N/A	N/A		N/A
Matrix Spike						
Sample Spiked:	503475-1	503475-1	503336-1	503495-6	503475-1	503335-4
Rept Limit:	<2	<0.005	<0.2	<0.1	<0.006#	<10
Sample Result:	40.1	<0.005	<0.2	0.35	<0.006	10.8
Spiked Result:	58.7	0.082	0.906	1.38	0.026	31.2
Spike Added:	20	0.100	0.800	1.0	0.022	20
% Recovery:	93	82	113	103	118	102
% Rec Limits:	89-110	63-114	70-129	85-118	59-151	51-151
Dry Weight%	N/A	N/A	N/A	N/A	N/A	N/A
ICV						
ICV Result:	56	0.041	1.10	1.94	0.038	20.5
True Result:	55	0.045	1.20	2.00	0.040	20
% Recovery:	102	91	92	97	95	103
% Rec Limits:	90-110	90-110	90-110	90-110	90-110	90-110
LCS						
LCS Result:						
True Result:						
% Recovery:						
% Rec Limits:						

Analytical Technologies, Inc.

"WetChem Quality Control Report"

Parameter:	TDS
Batch Id:	TDW014
Blank Result:	<5
Anal. Method:	160.1
Prep. Method:	N/A
Analysis Date:	16-MAR-95
Prep. Date:	16-MAR-95

Sample Duplication

Sample Dup:	503475-1
Rept Limit:	<5
Sample Result:	733
Dup Result:	728
Sample RPD:	1
Max RPD:	16
Dry Weight%	N/A

Matrix Spike

Sample Spiked:	N/A
Rept Limit:	N/A
Sample Result:	
Spiked Result:	
Spike Added:	
% Recovery:	
% Rec Limits:	
Dry Weight%	

ICV

ICV Result:	
True Result:	
% Recovery:	
% Rec Limits:	

LCS

LCS Result:	265
True Result:	293
% Recovery:	90
% Rec Limits:	66-122

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 503475
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 503327
Project Name: MARATHON OIL
Project Location: IB INJECTION
Test: Group of Single Metals
Matrix: WATER
QC Level: II

Lab Id: 001
Client Sample Id: 503327-01

Sample Date/Time: 09-MAR-95 1530
Received Date: 11-MAR-95

Parameters:	Units:	Results:	Rpt Lmts:	Q:	Batch:	Analyst:
SILVER (200.7)	MG/L	ND	0.01		A0W060	JRR
ALUMINUM (200.7)	MG/L	ND	0.06		L0W060	JRR
ARSENIC (206.2)	MG/L	ND	0.005		R2W087	CD
BORON (200.7)	MG/L	ND	0.09		O0W060	JRR
BARIUM (200.7)	MG/L	0.10	0.01		B0W060	JRR
CADMIUM (213.2)	MG/L	ND	0.0005		C2W087	SL
COBALT (200.7)	MG/L	ND	0.01		T0W060	JRR
CHROMIUM (200.7)	MG/L	ND	0.01		H0W060	JRR
COPPER (200.7)	MG/L	ND	0.01		F0W060	JRR
IRON (200.7)	MG/L	0.61	0.02		N0W060	JRR
MERCURY (245.1)	MG/L	ND	0.0002		M2W037	SL
MANGANESE (200.7)	MG/L	0.27	0.01		G0W060	JRR
MOLYBDENUM (200.7)	MG/L	ND	0.01		D0W060	JRR
NICKEL (200.7)	MG/L	ND	0.02		E0W060	JRR
LEAD (239.2)	MG/L	ND	0.003		P2W087	CD
SELENIUM (270.2)	MG/L	ND	0.005		S2W087	SL
ZINC (200.7)	MG/L	ND	0.02		50W060	JRR

Comments:

Analytical Technologies, Inc.

"Method Report Summary"

Accession Number: 503475
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 503327
Project Name: MARATHON OIL
Project Location: IB INJECTION
Test: Group of Single Metals

Client Sample Id:	Parameter:	Unit:	Result:
503327-01	BARIUM (200.7)	MG/L	0.10
	IRON (200.7)	MG/L	0.61
	MANGANESE (200.7)	MG/L	0.27

Analytical Technologies, Inc.

"Metals Quality Control Report"

Parameter:	SILVER	ALUMINUM	ARSENIC	BORON	BARIUM	CADMIUM
Batch Id:	A0W060	L0W060	R2W087	O0W060	B0W060	C2W087
Blank Result:	<0.01	<0.06	<0.005	<0.09	<0.01	<0.0005
Anal. Method:	200.7	200.7	206.2	200.7	200.7	213.2
Prep. Method:	EPA 600	EPA 600	EPA 600	EPA 600	EPA 600	EPA 600
Analysis Date:	15-MAR-95	15-MAR-95	21-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95
Prep. Date:	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95
Sample Duplication						
Sample Dup:	503514-1	503514-1	503457-22	503514-1	503514-1	503457-22
Rept Limit:	<0.01	<0.06	<0.10+	<0.09	<0.01	<0.0005
Sample Result:	2.0	22	0.76	3.8	2.3	0.0049
Dup Result:	1.9	22	0.77	3.8	2.3	0.0050
Sample RPD:	5	0	1	0	0	2
Max RPD:	20	20	20	20	20	20
Dry Weight%	N/A	N/A	N/A	N/A	N/A	N/A
Matrix Spike						
Sample Spiked:	503514-1	503514-1	503457-22	503514-1	503514-1	503457-22
Rept Limit:	<0.01	<0.06	<0.10+	<0.09	<0.01	<0.0005
Sample Result:	<0.01	20	0.73	1.9	0.43	<0.0005
Spiked Result:	2.0	22	0.76	3.8	2.3	0.0049
Spike Added:	2.0	2.0F	0.040F	2.0	2.0	0.0050
% Recovery:	100	100	75	95	94	98
% Rec Limits:	75-125	75-125	75-125	75-125	75-125	75-125
Dry Weight%	N/A	N/A	N/A	N/A	N/A	N/A
ICV						
ICV Result:	5.0	5.3	0.039	5.1	5.1	0.0020
True Result:	5.0	5.0	0.040	5.0	5.0	0.0020
% Recovery:	100	106	98	102	102	100
% Rec Limits:	90-110	90-110	90-110	90-110	90-110	90-110
LCS						
LCS Result:	2.1	2.1	0.037	2.0	2.0	0.0048
True Result:	2.0	2.0	0.040	2.0	2.0	0.0050
% Recovery:	105	105	93	100	100	96
% Rec Limits:	80-120	80-120	80-120	80-120	80-120	80-120

Analytical **Technologies,** Inc.

"Metals Quality Control Report"

Parameter:	COBALT	CHROMIUM	COPPER	IRON	MERCURY	MANGANESE
Batch Id:	T0W060	H0W060	F0W060	N0W060	M2W037	G0W060
Blank Result:	<0.01	<0.01	<0.01	<0.02	<0.0002	<0.01
Anal. Method:	200.7	200.7	200.7	200.7	245.1	200.7
Prep. Method:	EPA 600	EPA 600	EPA 600	EPA 600	245.1	EPA 600
Analysis Date:	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95	16-MAR-95	15-MAR-95
Prep. Date:	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95	16-MAR-95	15-MAR-95
Sample Duplication						
Sample Dup:	503514-1	503514-1	503514-1	503514-1	503580-1	503514-1
Rept Limit:	<0.01	<0.01	<0.01	<0.02	<0.0002	<0.01
Sample Result:	1.9	2.0	2.0	48	0.0046	5.6
Dup Result:	1.9	2.0	2.0	47	0.0047	5.5
Sample RPD:	0	0	0	2	2	2
Max RPD:	20	20	20	20	20	20
Dry Weight%	N/A	N/A	N/A	N/A	N/A	N/A
Matrix Spike						
Sample Spiked:	503514-1	503514-1	503514-1	503514-1	503580-1	503514-1
Rept Limit:	<0.01	<0.01	<0.01	<0.02	<0.0002	<0.01
Sample Result:	0.05	0.15	0.07	45	<0.0002	3.6
Spiked Result:	1.9	2.0	2.0	48	0.0046	5.6
Spike Added:	2.0	2.0	2.0	2.0F	0.0050	2.0
% Recovery:	93	93	97	150	92	100
% Rec Limits:	75-125	75-125	75-125	75-125	75-125	75-125
Dry Weight%	N/A	N/A	N/A	N/A	N/A	N/A
ICV						
ICV Result:	5.1	5.2	5.0	5.3	0.0041	5.1
True Result:	5.0	5.0	5.0	5.0	0.0040	5.0
% Recovery:	102	104	100	106	103	102
% Rec Limits:	90-110	90-110	90-110	90-110	80-120	90-110
LCS						
LCS Result:	2.1	2.1	2.0	2.1	0.0046	2.1
True Result:	2.0	2.0	2.0	2.0	0.0050	2.0
% Recovery:	105	105	100	105	92	105
% Rec Limits:	80-120	80-120	80-120	80-120	80-120	80-120

Analytical Technologies, Inc.

"Metals Quality Control Report"

Parameter:	MOLYBDENUM	NICKEL	LEAD	SELENIUM	ZINC
Batch Id:	D0W060	E0W060	P2W087	S2W087	50W060
Blank Result:	<0.01	<0.02	<0.003	<0.005	<0.02
Anal. Method:	200.7	200.7	239.2	270.2	200.7
Prep. Method:	EPA 600	EPA 600	EPA 600	EPA 600	EPA 600
Analysis Date:	15-MAR-95	15-MAR-95	20-MAR-95	17-MAR-95	15-MAR-95
Prep. Date:	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95	15-MAR-95
Sample Duplication					
Sample Dup:	503514-1	503514-1	503457-22	503457-22	503514-1
Rept Limit:	<0.01	<0.02	<0.003	<0.005	<0.02
Sample Result:	1.9	2.1	0.020	0.037	76
Dup Result:	1.9	2.1	0.020	0.036	75
Sample RPD:	0	0	0	3	1
Max RPD:	20	20	20	20	20
Dry Weight%	N/A	N/A	N/A	N/A	N/A
Matrix Spike					
Sample Spiked:	503514-1	503514-1	503457-22	503457-22	503514-1
Rept Limit:	<0.01	<0.02	<0.003	<0.005	<0.02
Sample Result:	0.01	0.28	<0.003	<0.005	72
Spiked Result:	1.9	2.1	0.020	0.037	76
Spike Added:	2.0	2.0	0.020	0.040	2.0F
% Recovery:	95	91	100	93	200
% Rec Limits:	75-125	75-125	75-125	75-125	75-125
Dry Weight%	N/A	N/A	N/A	N/A	N/A
ICV					
ICV Result:	4.9	5.1	0.039	0.021	5.2
True Result:	5.0	5.0	0.040	0.020	5.0
% Recovery:	98	102	98	105	104
% Rec Limits:	90-110	90-110	90-110	90-110	90-110
LCS					
LCS Result:	2.1	2.1	0.020	0.040	2.1
True Result:	2.0	2.0	0.020	0.040	2.0
% Recovery:	105	105	100	100	105
% Rec Limits:	80-120	80-120	80-120	80-120	80-120

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : ETHYLENE DIBROMIDE (EPA METHOD 504.1)

CLIENT : MARATHON OIL CO. ATI I.D.: 503327

PROJECT # : INDIAN BASIN (44999)

PROJECT NAME : IB INJECTION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	S-OUT	AQUEOUS	03/09/95	03/13/95	03/14/95	1

PARAMETER	UNITS	01
ETHYLENE DIBROMIDE	UG/L	<0.01

SURROGATE:

1,4-DICHLOROBENZENE (%)	109

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

REAGENT BLANK

TEST	: ETHYLENE DIBROMIDE (EPA METHOD 504.1)		
BLANK I.D.	: 031395	ATI I.D.	: 503327
CLIENT	: MARATHON OIL CO.	MATRIX	: AQUEOUS
PROJECT #	: INDIAN BASIN (44999)	DATE EXTRACTED	: 03/13/95
PROJECT NAME	: IB INJECTION	DATE ANALYZED	: 03/13/95
		DILUTION FACTOR	: 1

PARAMETER	UNITS	
ETHYLENE DIBROMIDE	UG/L	<0.01

SURROGATE:

1,4-DICHLOROBENZENE (%)	114

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: ETHYLENE DIBROMIDE (EPA METHOD 504.1)		
MSMSD #	: 031395	ATI I.D.	: 503327
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: 03/13/95
PROJECT #	: INDIAN BASIN (44999)	DATE ANALYZED	: 03/13/95
PROJECT NAME	: IB INJECTION	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 031395	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
ETHYLENE DIBROMIDE	<0.01	0.25	0.29	116	0.27	108	7

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

GAS CHROMATOGRAPHY RESULTS

Analytical Technologies, Inc.

TEST : PURGEABLE HALOCARBONS/AROMATICS (EPA 8010/8020)
CLIENT : MARATHON OIL CO. ATI I.D.: 503327
PROJECT # : INDIAN BASIN (44999)
PROJECT NAME : IB INJECTION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	S-OUT	AQUEOUS	03/09/95	NA	03/13/95	1
02	TRIP BLANK	AQUEOUS	02/28/95	NA	03/13/95	1

PARAMETER	UNITS	01	02
BENZENE	UG/L	<0.5	<0.5
BROMODICHLOROMETHANE	UG/L	<0.2	<0.2
BROMOFORM	UG/L	<0.5	<0.5
BROMOMETHANE	UG/L	<1.0	<1.0
CARBON TETRACHLORIDE	UG/L	<0.2	<0.2
CHLOROBENZENE	UG/L	<0.5	<0.5
CHLOROETHANE	UG/L	<0.5	<0.5
CHLOROFORM	UG/L	<0.5	<0.5
CHLOROMETHANE	UG/L	<1.0	<1.0
DIBROMOCHLOROMETHANE	UG/L	<0.2	<0.2
1,2-DIBROMOETHANE (EDB)	UG/L	<0.2	<0.2
1,2-DICHLOROBENZENE	UG/L	<0.5	<0.5
1,3-DICHLOROBENZENE	UG/L	<0.5	<0.5
1,4-DICHLOROBENZENE	UG/L	<0.5	<0.5
1,1-DICHLOROETHANE	UG/L	<0.2	<0.2
1,2-DICHLOROETHANE (EDC)	UG/L	<0.5	<0.5
1,1-DICHLOROETHENE	UG/L	<0.2	<0.2
CIS-1,2-DICHLOROETHENE	UG/L	<0.2	<0.2
TRANS-1,2-DICHLOROETHENE	UG/L	<1.0	<1.0
1,2-DICHLOROPROPANE	UG/L	<0.2	<0.2
CIS-1,3-DICHLOROPROPENE	UG/L	<0.2	<0.2
TRANS-1,3-DICHLOROPROPENE	UG/L	<0.2	<0.2
ETHYLBENZENE	UG/L	<0.5	<0.5
METHYL-t-BUTYL ETHER	UG/L	<2.5	<2.5
METHYLENE CHLORIDE	UG/L	<2.0	<2.0
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.2	<0.2
TETRACHLOROETHENE	UG/L	<0.5	<0.5
TOLUENE	UG/L	0.5	<0.5
1,1,1-TRICHLOROETHANE	UG/L	<1.0	<1.0
1,1,2-TRICHLOROETHANE	UG/L	<0.2	<0.2
TRICHLOROETHENE	UG/L	<0.2	<0.2
TRICHLOROFLUOROMETHANE	UG/L	<0.2	<0.2
VINYL CHLORIDE	UG/L	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5

SURROGATES:

BROMOCHLOROMETHANE (%)	100	102
TRIFLUOROTOLUENE (%)	94	95

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS - QUALITY CONTROL

REAGENT BLANK

TEST	: EPA 8010/8020	ATI I.D.	: 503327
BLANK I.D.	: 031395	MATRIX	: AQUEOUS
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: INDIAN BASIN (44999)	DATE ANALYZED	: 03/13/95
PROJECT NAME	: IB INJECTION	DIL. FACTOR	: 1

PARAMETER	UNITS	
BENZENE	UG/L	<0.5
BROMODICHLOROMETHANE	UG/L	<0.2
BROMOFORM	UG/L	<0.5
BROMOMETHANE	UG/L	<1.0
CARBON TETRACHLORIDE	UG/L	<0.2
CHLOROBENZENE	UG/L	<0.5
CHLOROETHANE	UG/L	<0.5
CHLOROFORM	UG/L	<0.5
CHLOROMETHANE	UG/L	<1.0
DIBROMOCHLOROMETHANE	UG/L	<0.2
1,2-DIBROMOETHANE (EDB)	UG/L	<0.2
1,2-DICHLOROBENZENE	UG/L	<0.5
1,3-DICHLOROBENZENE	UG/L	<0.5
1,4-DICHLOROBENZENE	UG/L	<0.5
1,1-DICHLOROETHANE	UG/L	<0.2
1,2-DICHLOROETHANE (EDC)	UG/L	<0.5
1,1-DICHLOROETHENE	UG/L	<0.2
CIS-1,2-DICHLOROETHENE	UG/L	<0.2
TRANS-1,2-DICHLOROETHENE	UG/L	<1.0
1,2-DICHLOROPROPANE	UG/L	<0.2
CIS-1,3-DICHLOROPROPENE	UG/L	<0.2
TRANS-1,3-DICHLOROPROPENE	UG/L	<0.2
ETHYLBENZENE	UG/L	<0.5
METHYL-t-BUTYL ETHER	UG/L	<2.5
METHYLENE CHLORIDE	UG/L	<2.0
1,1,2,2-TETRACHLOROETHANE	UG/L	<0.2
TETRACHLOROETHENE	UG/L	<0.2
TOLUENE	UG/L	<0.5
1,1,1-TRICHLOROETHANE	UG/L	<1.0
1,1,2-TRICHLOROETHANE	UG/L	<0.2
TRICHLOROETHENE	UG/L	<0.2
TRICHLOROFLUOROMETHANE	UG/L	<0.2
VINYL CHLORIDE	UG/L	<0.5
TOTAL XYLENES	UG/L	<0.5

SURROGATES:

BROMOCHLOROMETHANE (%)	105
TRIFLUOROTOLUENE (%)	101

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - QUALITY CONTROL

MSMSD

TEST	: PURGEABLE HALOCARBONS/AROMATICS (EPA 8010/8020)		
MSMSD #	: 50332701	ATI I.D.	: 503327
CLIENT	: MARATHON OIL CO.	DATE EXTRACTED	: NA
PROJECT #	: INDIAN BASIN (44999)	DATE ANALYZED	: 03/13/95
PROJECT NAME	: IB INJECTION	SAMPLE MATRIX	: AQUEOUS
REF. I.D.	: 50332701	UNITS	: UG/L

PARAMETER	SAMPLE RESULT	CONC SPIKE	SPIKED SAMPLE	% REC	DUP SPIKE	DUP % REC	RPD
BENZENE	<0.5	10	10	100	10	100	0
CHLOROBENZENE	<0.5	10	12	120	11	110	9
1,1-DICHLOROETHENE	<0.2	10	8.4	84	8.9	89	6
TOLUENE	<0.5	10	11	110	11	110	0
TRICHLOROETHENE	<0.2	10	11	110	12	120	9

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative Percent Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 503475
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 503327
Project Name: MARATHON OIL
Project Location: IB INJECTION
Test: POLYNUCLEAR AROMATICS BY 8310
Analysis Method: 8310 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: 3510/SW-846, 3rd Edition, September 1986 and Revision 1, July 1992
Matrix: WATER
QC Level: II

Lab Id: 001
Client Sample Id: 503327-01

Sample Date/Time: 09-MAR-95 1530
Received Date: 11-MAR-95

Batch: PAW081
Blank: A

Dry Weight %: N/A

Extraction Date: 15-MAR-95
Analysis Date: 17-MAR-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
ACENAPHTHENE	UG/L	ND	1	
ACENAPHTHYLENE	UG/L	ND	1	
ANTHRACENE	UG/L	ND	1	
BENZO(a)ANTHRACENE	UG/L	ND	1	
BENZO(a)PYRENE	UG/L	ND	1	
BENZO(b)FLUORANTHENE	UG/L	ND	1	
BENZO(g,h,i)PERYLENE	UG/L	ND	1	
BENZO(k,FLUORANTHENE	UG/L	ND	1	
CHRYSENE	UG/L	ND	1	
DIBENZO(a,h)ANTHRACENE	UG/L	ND	1	
FLUORANTHENE	UG/L	ND	1	
FLUORENE	UG/L	ND	1	
INDENO(1,2,3-cd)PYRENE	UG/L	ND	1	
NAPHTHALENE	UG/L	ND	1	
PHENANTHRENE	UG/L	ND	1	
PYRENE	UG/L	ND	1	
1-METHYLNAPHTHALENE	UG/L	ND	1	
2-METHYLNAPHTHALENE	UG/L	ND	1	
2-CHLOROANTHRACENE	%REC/SURR	67	24-128	
ANALYST	INITIALS	TLH		

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Blank
Batch: PAW081
Analysis Method: 8310 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: 3510/SW-846, 3rd Edition, September 1986 and Revision 1, July 1992

Blank Id: A Date Analyzed: 16-MAR-95 Date Extracted: 15-MAR-95

Parameters:	Units:	Results:	Reporting Limits:
ACENAPHTHENE	UG/L	ND	1
ACENAPHTHYLENE	UG/L	ND	1
ANTHRACENE	UG/L	ND	1
BENZO(a)ANTHRACENE	UG/L	ND	1
BENZO(a)PYRENE	UG/L	ND	1
BENZO(b)FLUORANTHENE	UG/L	ND	1
BENZO(g,h,i)PERYLENE	UG/L	ND	1
BENZO(k)FLUORANTHENE	UG/L	ND	1
CHRYSENE	UG/L	ND	1
DIBENZO(a,h)ANTHRACENE	UG/L	ND	1
FLUORANTHENE	UG/L	ND	1
FLUORENE	UG/L	ND	1
INDENO(1,2,3-cd)PYRENE	UG/L	ND	1
NAPHTHALENE	UG/L	ND	1
PHENANTHRENE	UG/L	ND	1
PYRENE	UG/L	ND	1
1-METHYLNAPHTHALENE	UG/L	ND	1
2-METHYLNAPHTHALENE	UG/L	ND	1
2-CHLOROANTHRACENE	%REC/SURR	47	24-128
ANALYST	INITIALS	TLH	

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Reagent
Batch: PAW081
Analysis Method: 8310 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: 3510/SW-846, 3rd Edition, September 1986 and Revision 1, July 1992

RS Date Analyzed: 16-MAR-95
RSD Date Analyzed: 16-MAR-95

RS Date Extracted: 15-MAR-95
RSD Date Extracted: 15-MAR-95

Parameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
ACENAPHTHYLENE	80.0	<1	64	80	59	74	8	46	52-102
BENZO(k)FLUORANTHENE	4.0	<1	4.2	105	4.0	100	5	30	66-131
CHRYSENE	4.0	<1	4.3	108	4.0	100	8	29	69-122
PHENANTHRENE	4.0	<1	4.0	100	3.6	90	11	28	70-111
PYRENE	4.0	<1	3.5	88	3.1	78	12	26	76-112
Surrogates:									
2-CHLOROANTHRACENE				97		88			24-128

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Analytical Technologies, Inc.

"QC Report"

Title: Water Matrix
Batch: PAW081
Analysis Method: 8310 / SW 846, 3rd Edition, September 1986 and Revision 1, July 1992
Extraction Method: 3510/SW-846, 3rd Edition, September 1986 and Revision 1, July 1992

Dry Weight %: N/A
Sample Spiked: 503475-1

MS Date Analyzed: 17-MAR-95
MSD Date Analyzed: 17-MAR-95

MS Date Extracted: 15-MAR-95
MSD Date Extracted: 15-MAR-95

Parameters:	Spike Added	Sample Conc	MS Conc	MS %Rec	MSD Conc	MSD %Rec	RPD	RPD Lmts	Rec Lmts
ACENAPHTHYLENE	80.0	<1	57	71	58	73	3	45	3-139
BENZO(k)FLUORANTHENE	4.0	<1	3.8	95	3.8	95	0	29	32-150
CHRYSENE	4.0	<1	4.1	103	3.8	95	8	26	26-178
PHENANTHRENE	4.0	<1	3.2	80	3.1	78	3	37	31-154
PYRENE	4.0	<1	3.5	88	2.9	73	19	25	25-140
Surrogates:									
2-CHLOROANTHRACENE				66		61			24-128

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Analytical Technologies, Inc.

"FINAL REPORT FORMAT - SINGLE"

Accession: 503475
Client: ANALYTICAL TECHNOLOGIES, INC.
Project Number: 503327
Project Name: MARATHON OIL
Project Location: IB INJECTION
Test: PCB
Analysis Method: 8080 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.
Extraction Method: 3510 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.
Matrix: WATER
QC Level: II

Lab Id: 001
Client Sample Id: 503327-01

Sample Date/Time: 09-MAR-95 1530
Received Date: 11-MAR-95

Batch: PCW055
Blank: A

Dry Weight %: N/A

Extraction Date: 15-MAR-95
Analysis Date: 21-MAR-95

Parameter:	Units:	Results:	Rpt Lmts:	Q:
AROCLOR-1016	UG/L	ND	1	
AROCLOR-1221	UG/L	ND	1	
AROCLOR-1232	UG/L	ND	1	
AROCLOR-1242	UG/L	ND	1	
AROCLOR-1248	UG/L	ND	1	
AROCLOR-1254	UG/L	ND	1	
AROCLOR-1260	UG/L	ND	1	
DCB	%REC/SURR	92	22-147	
TCMX	%REC/SURR	78	14-134	
ANALYST	INITIALS	KK		

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Blank
Batch: PCW055
Analysis Method: 8080 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.
Extraction Method: 3510 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.

Blank Id: A Date Analyzed: 20-MAR-95 Date Extracted: 15-MAR-95

Parameters:	Units:	Results:	Reporting Limits:
AROCLOR-1016	UG/L	ND	1
AROCLOR-1221	UG/L	ND	1
AROCLOR-1232	UG/L	ND	1
AROCLOR-1242	UG/L	ND	1
AROCLOR-1248	UG/L	ND	1
AROCLOR-1254	UG/L	ND	1
AROCLOR-1260	UG/L	ND	1
DCB	%REC/SURR	110	22-147
TCMX	%REC/SURR	91	14-134
ANALYST	*INITIALS*	*KK*	

Comments:

Analytical Technologies, Inc.

"QC Report"

Title: Water Reagent
Batch: PCW055
Analysis Method: 8080 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.
Extraction Method: 3510 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.

RS Date Analyzed: 20-MAR-95
RSD Date Analyzed: 20-MAR-95

RS Date Extracted: 15-MAR-95
RSD Date Extracted: 15-MAR-95

Parameters:	Spike Added	Sample Conc	RS Conc	RS %Rec	RSD Conc	RSD %Rec	RPD	RPD Lmts	Rec Lmts
PCB - 1016	10.0	<1	9.6	96	9.5	95	1	30	50-114
PCB - 1260	10.0	<1	10	100	11	110	10	30	8-127
Surrogates:									
DCB				106		108			22-147
TCMX				88		88			14-134

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Analytical Technologies, Inc.

"QC Report"

Title: Water Matrix
Batch: PCW055
Analysis Method: 8080 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.
Extraction Method: 3510 / SW-846, 3rd Edition, September 1986 and Rev. 1, July 1992.

Dry Weight %: N/A
Sample Spiked: 503475-1

MS Date Analyzed: 21-MAR-95
MSD Date Analyzed: 21-MAR-95

MS Date Extracted: 15-MAR-95
MSD Date Extracted: 15-MAR-95

Parameters:	Spike Added	Sample Conc	MS Conc	MS %Rec	MSD Conc	MSD %Rec	RPD	RPD Lmts	Rec Lmts
PCB - 1016	20	<1	17	85	17	85	0	30	50-114
PCB - 1260	20	<1	18	90	18	90	0	30	8-127
Surrogates:									
DCB				85		88			22-147
TCMX				74		75			14-134

Comments:

Notes:
N/S = NOT SUBMITTED N/A = NOT APPLICABLE D = DILUTED OUT
UG/L = PARTS PER BILLION. < = LESS THAN REPORTING LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

Analytical Technologies, Inc., Albuquerque, NM
San Diego • Phoenix • Seattle • Pensacola • Ft. Collins • Portland • Albuquerque

CHAIN OF CUSTODY

DATE: 3-9-95 PAGE 1 OF 1

ATI LAB I.D. 503327

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Menzie

COMPANY: Marathon Oil Company
ADDRESS: P.O. Box 552
Midland, TX 79702-0552
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY: same
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)	BTXE/MTBE (8020)	NO_3 as N	504.1	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.	General Chem. (F, Cl, SO_4, TDS)	Phenolic	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	Polynuclear Aromatics (610/8310)	U	Radium 226/228	SDWA Primary Standards - Arizona	SDWA Secondary Standards - Arizona	SDWA Primary Standards - Federal	SDWA Secondary Standards - Federal	As, Cd, Pb, Se, Ba, Hg, Cr, Ag, Cu,	Fe, Mn, Zn, Al, B, Co, Mo, Ni	The 13 Priority Pollutant Metals	RCRA Metals by Total Digestion	RCRA Metals by TCLP (1311)	CN	NUMBER OF CONTAINERS
Trip Blank	2-28-95	0910	Water	02																													1
S-Out	3-9-95	3:30P		01						✓	✓	✓																					5
S-Out		3:47P		01												✓																	2
S-Out		3:55P		01																✓													2
S-Out		4:05P		01											✓																		2
S-Out		4:10P		01										✓																			1
S-Out		4:12P		01					✓																								1
S-Out		4:20P		01																	✓	✓					✓	✓					3
S-Out		4:28P		01																												✓	1

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJ. NO.:	Indian Basin (44999)	NO. CONTAINERS	18
PROJ. NAME:	IB Injection	CUSTODY SEALS	Y (N) NA
P.O. NO.:		RECEIVED INTACT	✓
SHIPPED VIA:	Greyhound	RECEIVED COLD	✓

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.		RELINQUISHED BY: 2.		RELINQUISHED BY: 3.	
Signature: [signature]	Time: 4:45 PM	Signature:	Time:	Signature:	Time:
Printed Name: BJ Menzie Jr.	Date: 3-9-95	Printed Name:	Date:	Printed Name:	Date:
Company: Marathon	Phone: 915-687-8312	Company:		Company:	

RECEIVED BY: 1.		RECEIVED BY: 2.		RECEIVED BY: (LAB) 3.	
Signature:	Time:	Signature:	Time:	Signature: [signature]	Time: 1010
Printed Name:	Date:	Printed Name:	Date:	Printed Name: Dianne Letter	Date: 3/10/95
Company:		Company:		Analytical Technologies, Inc.	

ATI Labs: San Diego (619) 458-9141 • Phoenix (602) 496-4400 • Seattle (206) 228-8335 • Pensacola (904) 474-1001 • Portland (503) 684-0447 • Albuquerque (505) 344-3777 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

AnalyticalTechnologies,Inc. Albuquerque, NM

Chain of Custody

503475

DATE 3/10/95 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: Analytical Technologies, Inc.

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

* See original chain of custody for times on each sample bottle.

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)	632/632 MOD	619/619 MOD	610/8310	8240 TCLP 1311) ZHE	Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GCMS (624/8240)	NACE	ASBESTOS	BOD	TOTAL COLIFORM	FECAL COLIFORM	GROSS ALPHA/BETA	RADIUM 226/228	AIR - O2, CO2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
503327-01	3/9	3:30	AQ							X		X	X	X		X		X			X				

PROJECT INFORMATION	
PROJECT NUMBER:	503327
PROJECT NAME:	MO
QC LEVEL:	(STD.) IV
QC REQUIRED:	MS MSD BLANK
TAT:	(STANDARD) RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
INTACT?	
RECEIVED GOOD COND./COLD	
LAB NUMBER	

DUE DATE: 3/24

RUSH SURCHARGE: 0

CLIENT DISCOUNT: 10 %

WO# 1316

SAMPLES SENT TO:
- SAN DIEGO
- FT. COLLINS
- RENTON
- PENSACOLA
- PORTLAND
- PHOENIX
- FIBERQUANT

RELINQUISHED BY: 1.
Signature: [illegible] Time: 1730
Printed Name: [illegible] Date: 3/10/95
Analytical Technologies, Inc. Albuquerque

RELINQUISHED BY: 2.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: (LAB) 1.
Signature: Time:
Printed Name: Date:
Company:

RECEIVED BY: (LAB) 2.
Signature: [illegible] Time: 0906
Printed Name: R. ELSPERMAN Date: 3/11/95
Company: ATI-PNS

----- Common Footnotes Wet Chem -----

N/A = NOT APPLICABLE.
N/S = NOT SUBMITTED.
N/C = SAMPLE AND DUPLICATE RESULTS ARE AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RPD IS "NOT CALCULABLE" AND NO CONTROL LIMITS APPLY.
ND = NOT DETECTED ABOVE REPORTING LIMIT.
DISS. OR D = DISSOLVED
T & D = TOTAL AND DISSOLVED
R = REACTIVE
T = TOTAL
G = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE RESULT IS AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "IN CONTROL".
Q = THE ANALYTICAL (POST-DIGESTION) SPIKE IS REPORTED DUE TO THE MATRIX (PRE-DIGESTION) SPIKE BEING OUTSIDE ACCEPTANCE LIMITS.
# = ELEVATED REPORTING LIMIT DUE TO INSUFFICIENT SAMPLE.
+ = ELEVATED REPORTING LIMIT DUE TO DILUTION INTO CALIBRATION RANGE.
* = ELEVATED REPORTING LIMIT DUE TO MATRIX INTERFERENCE.
@ = ADJUSTED REPORTING LIMIT DUE TO SAMPLE MATRIX (DILUTION PRIOR TO PREPARATION).
P = ANALYTICAL (POST-DIGESTION) SPIKE
I = DUPLICATE INJECTION
& = AUTOMATED
F = SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
N/C+ = NOT CALCULABLE
N/C* = NOT CALCULABLE; SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
H = SAMPLE AND/OR DUPLICATE IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL".
A = SAMPLE AND DUPLICATE RESULTS ARE "OUT OF CONTROL".
Z = THE SAMPLE RESULT FOR THE SPIKE IS BELOW REPORTING LIMIT. HOWEVER, THIS RESULT IS REPORTED FOR ACCURATE QC CALCULATIONS.
NH= SAMPLE AND / OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE RESULTS EXCEED THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL" SAMPLE IS NON-HOMOGENOUS.
(*) = DETECTION LIMITS RAISED DUE TO CLP METHOD NOT REQUIRING A CONCENTRATION STEP FOR CN.

(CA) = SEE CORRECTIVE ACTIONS FORM.

SW-846, 3RD EDITION, SEPTEMBER 1986 AND REVISION 1, JULY 1992.
EPA 600/4-79-020, REVISED MARCH 1983.
STANDARD METHODS, 17TH ED., 1989
NIOSH MANUAL OF ANALYTICAL METHODS, 3RD EDITION.
ANNUAL BOOK OF ASTM STANDARDS, VOLUME 11.01, 1991.

1. COLIFORM. COLIFORM PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE LOGARITHM OF COLONIES PER 100 MLS OF SAMPLE ON DUPLICATE PLATES.

2. PH. PH PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND THE DUPLICATE ANALYSIS.

3. FLASHPOINT. FLASHPOINT PRECISION IS MEASURED BY THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE ANALYSIS. IF FLASHPOINT IS LESS THAN 25 DEGREES CELSIUS, THE DETECTION LIMIT BECOMES THE INITIAL STARTING TEMPERATURE.

RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION).

RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

DPH = DOLLY P. HWANG
DBH = DONALD B. HAND
TT = TONY TINEO
JHS = JOSEPH SAUNDERS
NSB = NANCY S. BUTLER
RB = REBECCA BROWN
BF = BLANCA FACH
NB = NANCY L. BRASCH
MM = MARY MOLONEY
CF = CHRISTINE FOSTER

----- Common Footnotes Metals -----

N/A = NOT APPLICABLE.
N/S = NOT SUBMITTED.
N/C = SAMPLE AND DUPLICATE RESULTS ARE AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RPD IS "NOT CALCULABLE" AND NO CONTROL LIMITS APPLY.
N/D = NOT DETECTED.
DISS. OR D = DISSOLVED
T & D = TOTAL AND DISSOLVED
R = REACTIVE
T = TOTAL
G = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE SAMPLE AND DUPLICATE RESULT IS AT OR BELOW ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "IN CONTROL".
Q = THE ANALYTICAL (POST-DIGESTION) SPIKE IS REPORTED DUE TO PERCENT RECOVERY BEING OUTSIDE ACCEPTANCE LIMITS ON THE MATRIX (PRE-DIGESTION) SPIKE.
# = ELEVATED REPORTING LIMIT DUE TO INSUFFICIENT SAMPLE.
+ = ELEVATED REPORTING LIMIT DUE TO DILUTION INTO CALIBRATION RANGE.
* = ELEVATED REPORTING LIMIT DUE TO MATRIX INTERFERENCE. (DILUTION PRIOR TO ANALYSIS)
@ = ADJUSTED REPORTING LIMIT DUE TO SAMPLE MATRIX. (DILUTION PRIOR TO DIGESTION)
P = ANALYTICAL (POST DIGESTION) SPIKE.
I = DUPLICATE INJECTION.
& = AUTOMATED
F = SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
N/C+ = NOT CALCULABLE
N/C* = NOT CALCULABLE; SAMPLE SPIKED > 4 X SPIKE CONCENTRATION.
H = SAMPLE AND/OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL".
A = SAMPLE AND DUPLICATE RESULTS ARE "OUT OF CONTROL".
Z = THE SAMPLE RESULT FOR THE SPIKE IS BELOW THE REPORTING LIMIT. HOWEVER, THIS RESULT IS REPORTED FOR ACCURATE QC CALCULATIONS.
NH= SAMPLE AND / OR DUPLICATE RESULT IS BELOW 5 X ATI REPORTING LIMIT AND THE ABSOLUTE DIFFERENCE BETWEEN THE RESULTS EXCEEDS THE ATI REPORTING LIMIT; THEREFORE, THE RESULTS ARE "OUT OF CONTROL". SAMPLE IS NON-HOMOGENEOUS.
J = (FLORIDA DEP 'J' FLAG) - MATRIX SPIKE AND POST SPIKE RECOVERY IS OUT OF THE ACCEPTABLE RANGE. SEE OUT OF CONTROL EVENTS FORM.
S = METHOD OF STANDARD ADDITIONS (MSA) WAS PERFORMED ON THIS SAMPLE.

FROM ANALYSIS REPORT:
RL= REPORTING LIMIT BASED ON METHOD DETECTION LIMIT STUDIES.
Q= QUALIFIER (FOOTNOTE)

FROM QUALITY CONTROL REPORT:
RPD= RELATIVE PERCENT DEVIATION.
RPT LIMIT= REPORTING LIMIT BASED ON METHOD DETECTION LIMIT STUDIES.

NOTE: THE UNITS REPORTED ON THE QUALITY CONTROL REPORT ARE REPORTED ON AN AS RUN BASIS.

SW-846, 3rd Edition, September 1986 and Revision 1, July 1992.
EPA 600/4-79-020, Revised March 1983.
NIOSH Manual of Analytical Methods, 3rd Edition.

JP = JAY PEREZ
GJ = GARY JACOBS
JLH = JAMES L. HERED
CD = CHRISTY DRAPER
JRR = JOHN R. ROWE
JR = JOHN REED
SL = STEPHANIE LOWRY

Common notation for Organic reporting

N/S = NOT SUBMITTED
N/A = NOT APPLICABLE
D = DILUTED OUT
UG = MICROGRAMS
UG/L = PARTS PER BILLION.
UG/KG = PARTS PER BILLION.
MG/M3 = MILLIGRAM PER CUBIC METER.
PPMV = PART PER MILLION BY VOLUME.
MG/KG = PARTS PER MILLION.
MG/L = PARTS PER MILLION.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS

SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

ORGANIC SOILS ARE REPORTED ON A DRYWEIGHT BASIS.

ND = NOT DETECTED ABOVE REPORTING LIMIT.

RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.

RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

ATI/GC/FID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME IONIZATION DETECTOR (FID).

ATI/GC/FIX
ATI GAS CHROMATOGRAPHIC METHOD FOR ANALYSIS OF FIXED GASES EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD) AND FLAME IONIZATION DETECTOR (FID).

ATI/GC/FPD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH FLAME PHOTOMETRIC DETECTOR (FPD) IN SULFUR-SPECIFIC MODE.

ATI/GC/PID
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH PHOTOIONIZATION DETECTOR (PID).

ATI/GC/TCD
ATI GAS CHROMATOGRAPHIC METHOD EMPLOYING DIRECT INJECTION ON COLUMN WITH THERMAL CONDUCTIVITY DETECTOR (TCD).

LJT = LISA THOMASON
DGH = DARREL HALSELL
TLH = TARA HELTON
KW = KAREN WADSWORTH
MV = MONIQUE VERHEYDEN
SW = STEVE WILHITE
JMP = JACKIE PRICE
SJF = STEVE FILOROMO
PL = PAUL LESCHENSKY
RW = ROBERT WOLFE
BV = BEN VAUGHN
KS = KENDALL SMITH
NC = NICOLE CALL
LKD = LEIGH DUVALL

Common notation for Organic reporting

N/S = NOT SUBMITTED
N/A = NOT APPLICABLE
D = DILUTED OUT
UG/L = PARTS PER BILLION.
UG/KG = PARTS PER BILLION.
MG/KG = PARTS PER MILLION.
MG/L = PARTS PER MILLION.
< = LESS THAN DETECTION LIMIT.
* = VALUES OUTSIDE OF QUALITY CONTROL LIMITS.
J = THE REPORTED VALUE IS EITHER LESS THAN THE REPORTING LIMIT BUT GREATER THAN ZERO, OR QUANTITATED AS A TIC; THEREFORE, IT IS ESTIMATED.
JJ = THE REPORTED VALUE IS ESTIMATED DUE TO MATRIX INTERFERENCE.
ND = NOT DETECTED ABOVE REPORTING LIMIT.
RPT LIMIT = REPORTING LIMITS BASED ON METHOD DETECTION LIMIT STUDIES.
RPD = RELATIVE PERCENT DIFFERENCE (OR DEVIATION)

SOURCES FOR CONTROL LIMITS ARE INTERNAL LABORATORY QUALITY ASSURANCE PROGRAM AND REFERENCED METHOD.

ORGANIC SOILS ARE REPORTED ON A DRY WEIGHT BASIS.

RP = ROBERT PEREZ
KK = KERRY KUST
RW = ROBERT WOLFE
FC = FRANKIE COLEMAN

Analytical Technologies, Inc.

2709-D Pan American Freeway NE Albuquerque, NM 87107
Phone (505) 344-3777 FAX (505) 344-4413

ATI I.D. **503327**

April 12, 1995

Marathon Oil Company
P.O. Box 552
Midland, TX 79702-0552

Project Name/Number: IB INJECTION INDIAN BASIN (44999)

Attention: Bob Menzie

On **03/10/95**, Analytical Technologies, Inc., (ADHS License No. AZ0015), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

This report is being reissued in part to include Radiochemisty/Uranium results. It is now complete.

Please note additional case narrative for Radium 226/228 included in this report.

Due to laboratory error, the EPA recommended hold for Nitrate analyses was missed. Total Nitrate/Nitrite analysis was performed and the results are included in this report. We apologize for any incovenience. There is no charge for this analysis.

Radiochemistry and Uranium analyses were performed by Analytical Technologies, Inc., 225 Commerce Drive, Fort Collins, CO.

EPA Method 8010/8010 and 504.1 analyses were performed by Analytical Technologies, Inc., Albuquerque, NM.

All other analyses were performed by Analytical Technologies, Inc., 11 East Olive Road, Pensacola, FL.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Letitia Krakowski, Ph.D.
Project Manager

H. Mitchell Rubenstein, Ph.D.
Laboratory Manager

MR:jt

Enclosure

CLIENT	:MARATHON OIL CO.	DATE RECEIVED	:03/10/95
PROJECT #	:INDIAN BASIN (44999)		
PROJECT NAME	:IB INJECTION	REPORT DATE	:03/24/95

ATI ID: 503327

	ATI PENSACOLA ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	503327-01	S-OUT	AQUEOUS	03/09/95
02	503327-02	TRIP BLANK	AQUEOUS	02/28/95

---TOTALS---

MATRIX	#SAMPLES
AQUEOUS	2

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

TOTAL URANIUM ANALYSIS RESULTS SUMMARY

By Laser-Induced Kinetic Phosphorimetry

Lab Name: Analytical Technologies, Inc. Date Collected: 03/09/95

Client Name: ATI-NM Date Analyzed : 03/15/95

Client Project ID: MO -- 503327 Sample Matrix : Water

Lab Sample ID Series: 95-03-083

Client Sample ID	Lab Sample ID	Total Uranium (ug/L)
S-Out	03-083-01	0.61 ± 0.08
Duplicate	03-083-D1	0.65 ± 0.09

Reported Uncertainties are the Estimated Total Propagated Uncertainties (2σ). See ATI SOP 743FC for details of TPU determinations.

Remarks:

Sample 95-03-083-D1 is a duplicate of 95-03-083-01.

Analytical Technologies, Inc.

TOTAL URANIUM ANALYSIS RESULTS SUMMARY

By Laser-Induced Kinetic Phosphorimetry

Lab Name: Analytical Technologies, Inc. Date Collected: 03/15/95

Client Name: ATI-NM Date Analyzed : 03/15/95

Client Project ID: MO -- 503327 Sample Matrix : Water

Lab Sample ID Series: 95-03-020

Client Sample ID	Lab Sample ID	Total Uranium (ug/L)
Blank	03-020-B1	0.00 ± 0.05

Reported Uncertainties are the Estimated Total Propagated Uncertainties (2σ). See ATI SOP 743FC for details of TPU determinations.

Remarks:

Blank for work orders 95-03-020 and 95-03-083.

Analytical Technologies, Inc.

TOTAL URANIUM BLANK SPIKE RESULTS SUMMARY

By Laser-Induced Kinetic Phosphorimetry

Lab Name: Analytical Technologies, Inc. Date Collected: 03/15/95

Client Name: ATI-NM Date Analyzed : 03/15/95

Client Project ID: MO -- 503327 Sample Matrix : Water

Lab Sample ID Series: 95-03-020

Lab Sample ID	Spike Conc. (ug/L)	Rep't Conc. (ug/L)
95-03-020-S1	12.5 ± 1.9	12.6 ± 2.4

Reported Uncertainties are the Estimated Total Propagated Uncertainties (2σ). See ATI SOP 743FC for details of TPU determinations.

ATI sets control limits for KPA Uranium measurements as follows:
Blank Spike Control Limits = Known (μ) ± 0.15 * μ.

Matrix Spike Control Limits = Known (μ) + Native Concentration ± 0.25 * (μ + Native Concentration).

ATI uses these control limits for all KPA Uranium measurements

Acceptance Range for spike samples is the known value ± the control limits stated above. The reported value, without the uncertainty, should be compared to that range.

Remarks:

Blank spike for work orders 95-03-020 and 95-03-083.

Analytical Technologies, Inc.

TOTAL URANIUM MATRIX SPIKE RESULTS SUMMARY

By Laser-Induced Kinetic Phosphorimetry

Lab Name: Analytical Technologies, Inc. Date Collected: 03/09/95

Client Name: ATI-NM Date Analyzed : 03/15/95

Client Project ID: MO -- 503327 Sample Matrix : Water

Lab Sample ID Series: 95-03-083

Lab Sample ID	Known Conc. (ug/L)	Rep't Conc. (ug/L)
95-03-083-M1	0.81 ± 0.20	0.79 ± 0.19

Reported Uncertainties are the Estimated Total Propagated Uncertainties (2σ). See ATI SOP 743FC for details of TPU determinations.

ATI sets control limits for KPA Uranium measurements as follows:
Blank Spike Control Limits = Known (μ) ± 0.15 * μ.

Matrix Spike Control Limits = Known (μ) + Native Concentration ± 0.25 * (μ + Native Concentration).

ATI uses these control limits for all KPA Uranium measurements

Acceptance Range for spike samples is the known value ± the control limits stated above. The reported value, without the uncertainty, should be compared to that range.

Remarks:

Sample 95-03-083-M1 is a matrix spike of 95-03-083-01.

Analytical **Technologies,** Inc.

Narrative Comments for Work Order 95-03-083
$^{226/228}$Ra by Gamma Spectroscopy in Water
04/10/95

Work Order 95-03-083 was received on 03/11/95 and scheduled for gamma spectroscopy. The gamma analysis was completed on 04/01/95.

Sample 95-03-088-S1 failed ATI control limits slightly high due to an unusually low chemical yield. All other quality control requirements passed including another blank spike and a blank.

Reported results are believed not to be affected by the low blank spike recovery. Sufficient sample is not available for re-extraction, however; if additional sample is provided, it will be re-analyzed at no extra charge.

John Mitchell
Radiochemistry Instrument Technician

Analytical Technologies, Inc.

GAMMA SPECTROMETRY RESULTS SUMMARY

Method 901.1 (Modified)

Lab Name: Analytical Technologies, Inc. Date Collected: 03/09/95 12:00

Client Name: ATI-NM Date Analyzed: 03/31/95 00:58

Lab Sample ID: 95-03-083-01 Sample Matrix: Water

Client Sample ID: S-OUT Radium Recovery: 0.930

Bi/Pb-214 ingrowth for Ra-226 determination: 15.8 days

Nuclide	Activity (pCi/Liter)	% Uncertainty
Pb-214	0.460 ± 0.682	148
Ra-226	0.460 ± 0.682	148
Bi-214	< 0.730	BDL
Ra-228	< 1.00	BDL

Reported Uncertainties are the Estimated Total Propagated Uncertainty (2σ).
See ATI SOP 743FC for details of the TPU determination.

BDL = Below Detection Limit; see method for DL determination

Analytical Technologies, Inc.

GAMMA SPECTROMETRY RESULTS SUMMARY

Method 901.1 (Modified)

Lab Name: Analytical Technologies, Inc.

Date Collected: 03/15/95 12:00

Client Name: ATI-NM

Date Analyzed: 03/31/95 02:18

Lab Sample ID: 95-03-088-B1

Sample Matrix: Water

Client Sample ID: Blank

Radium Recovery: 0.894

Bi/Pb-214 ingrowth for Ra-226 determination: 15.9 days

Nuclide	Activity (pCi/Liter)	% Uncertainty
Ra-226	0.840 ± 0.546	65.1
Pb-214	0.840 ± 0.546	65.1
Bi-214	< 0.620	BDL
Ra-228	< 0.890	BDL

Reported Uncertainties are the Estimated Total Propagated Uncertainty (2σ).
See ATI SOP 743FC for details of the TPU determination.

BDL = Below Detection Limit; see method for DL determination

Remarks: Blank for work orders 95-03-088 and 95-03-083.

Analytical Technologies, Inc.

RADIUM 226 and RADIUM 228 BLANK SPIKE RESULTS

Method 901.1 (Modified)/KAHN et al (1990)

Lab Name: Analytical Technologies, Inc. Date Collected: 03-15-95

Client Name: ATI-NM Date Analyzed : 03-31-95

Client Project ID : MO -- 503327 Sample Matrix : Water

Lab Workorder Number : 95-03-088 Units : liter

Lab Sample ID	Radium 226 Known Value	Radium 226 Rep't Value	Radium 228 Known Value	Radium 228 Rep't Value
95-03-088-S1	14.8 ± 3.85	19.5 ± 2.33	14.9 ± 6.41	21.0 ± 2.42

Reported Uncertainties are the Estimated Total Propagated Uncertainties (2σ). See ATI SOP 743FC for details of TPU determinations.

The U.S. EPA sets control limits for Ra-226 measurements as follows :
Control Limits = Known (μ) ± 0.26 * μ, for μ > 0.1 pCi/l

The U.S. EPA sets control limits for Ra-228 measurements as follows :
Control Limits = Known (μ) ± 0.43 * μ, for μ > 0.1 pCi/l

ATI uses these control limits for all Ra-226/228 measurements.

Acceptance Range for blank spike samples is the known value ± the control limits stated above. The reported value, without the uncertainty, should be compared to that range.

Remarks:

Blank spike for work orders 95-03-088 and 95-03-083.

Analytical Technologies, Inc.

RADIUM 226 and RADIUM 228 BLANK SPIKE RESULTS

Method 901.1 (Modified)/KAHN et al (1990)

Lab Name: Analytical Technologies, Inc. Date Collected: 03-15-95

Client Name: ATI-NM Date Analyzed : 04-01-95

Client Project ID : MO -- 503327 Sample Matrix : Water

Lab Workorder Number : 95-03-088 Units : liter

Lab Sample ID	Radium 226 Known Value	Radium 226 Rep't Value	Radium 228 Known Value	Radium 228 Rep't Value
95-03-088-S2	14.8 ± 3.85	16.6 ± 2.11	14.9 ± 6.41	19.4 ± 2.40

Reported Uncertainties are the Estimated Total Propagated Uncertainties (2σ). See ATI SOP 743FC for details of TPU determinations.

The U.S. EPA sets control limits for Ra-226 measurements as follows :
Control Limits = Known (μ) ± 0.26 * μ, for μ > 0.1 pCi/l

The U.S. EPA sets control limits for Ra-228 measurements as follows :
Control Limits = Known (μ) ± 0.43 * μ, for μ > 0.1 pCi/l

ATI uses these control limits for all Ra-226/228 measurements.

Acceptance Range for blank spike samples is the known value ± the control limits stated above. The reported value, without the uncertainty, should be compared to that range.

Remarks:

Blank spike for work orders 95-03-088 and 95-03-083.
Sample 95-03-088-S2 is a blank spike duplicate.

Analytical Technologies, Inc., Albuquerque, NM
San Diego • Phoenix • Seattle • Pensacola • Ft. Collins • Portland • Albuquerque

CHAIN OF CUSTODY

DATE: 3-9-95 PAGE 1 OF 1

ATI LAB I.D. 503521.

PROJECT MANAGER: Bob Menzie

COMPANY: Marathon Oil Company
ADDRESS: P.O. Box 552
Midland, TX 79702-0552
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY: same
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020)	BTXE/MTBE (8020)	NO_3 as N	SO_4	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg.	General Chem. (F, Cl, SO_4, TDS)	Phenolic	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	Polynuclear Aromatics (610/8310)	U	Radium 226/228	SDWA Primary Standards - Arizona	SDWA Secondary Standards - Arizona	SDWA Primary Standards - Federal	SDWA Secondary Standards - Federal	As, Cd, Pb, Se, Ba, Hg, Cr, Ag, Cu,	Fe, Mn, Zn, Al, B, Co, Mo, Ni	The 13 Priority Pollutant Metals	RCRA Metals by Total Digestion	RCRA Metals by TCLP (1311)	CN	NUMBER OF CONTAINERS
Trip Blank	2-28-95	0910	Water	02																												1
S-Out	3-9-95	3:30P		01						✓	✓	✓																				5
S-Out		3:47P		01												✓																2
S-Out		3:55P		01																✓												2
S-Out		4:05P		01											✓																	2
S-Out		4:10P		01										✓																		1
S-Out		4:12P		01					✓																							1
S-Out		4:20P		01																	✓	✓					✓	✓				3
S-Out		4:28P		01																											✓	1

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJ. NO.:	Indian Basin 44999	NO. CONTAINERS	18
PROJ. NAME:	IB Injection	CUSTODY SEALS	Y (N) NA
P.O. NO.:		RECEIVED INTACT	✓
SHIPPED VIA:	Greyhound	RECEIVED COLD	✓

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.		RELINQUISHED BY: 2.		RELINQUISHED BY: 3.	
Signature: RJ Menzie Jr.	Time: 4:45PM	Signature:	Time:	Signature:	Time:
Printed Name: RJ Menzie Jr.	Date: 3-9-95	Printed Name:	Date:	Printed Name:	Date:
Company: Marathon	Phone: 915-687-8312	Company:		Company:	

RECEIVED BY: 1.		RECEIVED BY: 2.		RECEIVED BY: (LAB) 3.	
Signature:	Time:	Signature:	Time:	Signature: [signature]	Time: 1010
Printed Name:	Date:	Printed Name:	Date:	Printed Name: Dianne Butler	Date: 3/10/95
Company:		Company:		Analytical Technologies, Inc.	

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Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody 95-03-083

DATE 3/10/95 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: **Analytical Technologies, Inc.**

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)		632/632 MOD	619/619 MOD	610/8310			8240 (TCLP 1311) ZHE		Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)		NACE	ASBESTOS		BOD	TOTAL COLIFORM	FECAL COLIFORM		GROSS ALPHA/BETA	RADIUM 226/228	Uranium KPA	AIR - O_2, CO_2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
503327-01	3/9	1620	AQ	01																									X	X			2 PA

PROJECT INFORMATION	
PROJECT NUMBER:	503327
PROJECT NAME:	MD
QC LEVEL:	STD IV
QC REQUIRED:	MS MSD BLANK
TAT:	STANDARD RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	2
CHAIN OF CUSTODY SEALS	NP
INTACT?	NP
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	

DUE DATE: 3/24, 4/7 24 hrs

RUSH SURCHARGE: 0

CLIENT DISCOUNT: 10 %

WO# 1317

SAMPLES SENT TO:	
SAN DIEGO	
FT. COLLINS	X
RENTON	
PENSACOLA	
PORTLAND	
PHOENIX	
FIBERQUANT	

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.
Signature: Time: 1730	Signature: Time:
Printed Name: Date 3/10/95	Printed Name: Date
Analytical Technologies, Inc. Albuquerque	Company: Fed-X
RECEIVED BY: (LAB) 1.	**RECEIVED BY: (LAB) 2.**
Signature: Time:	Signature: Time: 9:30
Printed Name: Date:	Printed Name: Date: 3-11-95
Company: Fed-X	Company: ATI

Marathon Oil Company

Indian Basin Environmental Treatment Plan

Technological Description and Plans for Implementation

implemented by
Marathon Oil Company
on behalf of the
Indian Basin Gas Plant Owners

submitted March 5, 1992
New Mexico
Oil Conservation Division

01

RESTRICTED

Indian Basin Environmental Treatment Plan

Technological Description
and
Plans for Implementation

---

implemented by
Marathon Oil Company
on behalf of the
Indian Basin Gas Plant Owners

01

March 5, 1992

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Indian Basin Environmental Treatment Plan

Introduction

This plan describes an environmental problem and a proposed treatment plan for the Indian Basin Gas Plant located in Eddy County, New Mexico. The facility processes natural gas and produced liquids consisting of brine and gas condensate. The environmental problem arose from a produced liquid gathering line leak discovered in April, 1991.

This plan discusses the alternative treatment technologies we considered and details the technologies selected as most effective for the removal of volatile hydrocarbons encountered at the site. Benzene is the hydrocarbon component we seek to reduce but other hydrocarbons will be removed as benzene concentration is reduced.

The plan acknowledges the impact of the leak on the chloride content of the shallow zone and Lower Queen waters, but our treatment is not focused on chlorides. Chlorides will be reduced as a byproduct of an integrated plan of shallow and deep water removal, treatment, and ongoing water use to meet requirements of the gas plant operations.

Considerable improvements in the operation of the gas gathering system and in monitoring and checking of system components were made since the discovery of the leak which occurred from November, 1990 to April, 1991. These facility improvements, and the treatments planned for hydrocarbon plume containment and gradual hydrocarbon reduction, make the operation of the production system and gas plant more environmentally secure.

Problem Outlined and Emergency Responses Taken

Gathering Line 4 leaked gas condensate (hereafter called condensate, for brevity) and brine (reservoir water associated with production of gas and condensate) from November,1990 to April,1991. These liquids migrated subsurface in the alluvium, moving eastward generally along the path of the North channel of Rocky Arroyo. Liquids followed the topographic contour lows of the bedrock under the alluvium at a depth of approximately 20 feet.

Soon after the discovery of the leak, shallow pits and shallow recovery wells were installed and liquids were pumped for emergency withdrawals from the impacted area from April,1991 to August,1991 during the early phases of assessment. The plume migrated laterally as it moved eastward. We detected and pumped hydrocarbon from several shallow recovery wells drilled north of the arroyo. Very limited movement of a few hundred feet westward (upgradient) was detected.

In July of 1991 delineation drilling to the aquifer located approximately 200 ft subsurface, revealed water soluble hydrocarbon constituents and occasional floating free condensate upon the Lower Queen aquifer. The chemical nature of the free condensate discovered on the aquifer differs from that which leaked from the Line 4 source and created the shallow impacted area. This treatment plan addresses both shallow zone soil and water and Lower Queen aquifer impacts, since limited data reveal possible localized vertical migration of shallow zone fluids to the Lower Queen in the impacted area. Residual plumes of soluble hydrocarbon exist in the shallow zone soil, the shallow soil water, and in the Lower Queen aquifer. Emergency withdrawal of limited free product from Lower Queen commenced in September, 1991 from well BH-88 and from additional wells in November, 1991.

In September of 1991 a planned maintenance shutdown of the plant was used to conduct inspections and integrity tests of the gas and liquid gathering lines at Indian Basin. These tests were made to minimize or eliminate future leaks and to provide operational longevity. For example, the main pipeline crossing Rocky Arroyo was modified to provide early leak detection and a double-pipe design was used to minimize future leak hazard. Several techniques were used for leak detection and the lines were conventionally pressure tested. Valve replacements and new isolation valves were installed to achieve better line isolation where needed. Dresser sleeves and steel sections in liquid lines were eliminated. These and other improvements are described more fully in a report to Mr. William LeMay, Director, New Mexico Oil Conservation Division, Nov.23, 1991.

Need for Action and a Treatment Plan

Further actions, i.e. field activity beyond the emergency withdrawals already performed, are needed to provide plume containment and hydrocarbon component reduction. These actions, we believe, will eliminate the possibility of adversely affecting water quality of downgradient users of Lower Queen water. The actions proposed address water removal and treatment of the affected portion of the Lower Queen aquifer and surficial waters above the Lower Queen believed to communicate with the Lower Queen in limited locations within the affected areas. The treatment actions proposed arise from a study of chemicals found in the water and assessment of potential health issues associated with these chemicals.

Our assessment of chemicals of concern finds benzene as the only chemical constituent of concern for the treatment plan. A chemical of concern is a site-specific constituent found in the environment that poses critical concern to human receptors. The selection of chemicals of concern begins with the acquisition of site specific analytical data and sorting those data by medium (groundwater, soil, surface water, etc.).

Analytical data for the site were collected from soil, shallow soil water, and deep groundwater during site characterization. These data have previously been forwarded to the New Mexico OCD in the site characterization reports and subsequent field wide point-in-time water analyses.

Benzene is a recognized human carcinogen and is the primary focus of the treatment plan to prevent it representing a threat to any human receptors. The treatment plan, even though based on benzene reduction, also reduces other dissolved volatile hydrocarbon components of the condensate such as ethyl benzene, toluene and xylene.

Sample analyses of monitor wells for heavy metals (i.e., arsenic, barium, cadmium, chromium, lead, mercury, selenium, iron, manganese, aluminum and silver) were made and found to be at or below instrument detection limits or below state discharge standards. Radionuclide analyses of monitoring well waters were also below state discharge standards.

Human receptor exposure of the chemical of concern, benzene, must have four elements to complete the exposure pathway. They are as follows:

Source
Transportation Medium
Exposure Point or Point of Contact
Exposure Route (Inhalation or Ingestion)

If any of these elements is missing, the exposure pathway is broken and eliminates any possibility of human receptor exposure.

The condensate from the Gathering Line 4 and the hydrocarbon found on the Lower Queen aquifer are the contaminant sources. Contaminant migration scenarios were developed to assess continuity of the four exposure pathway elements. The following scenarios describe potential exposure pathways for benzene at the leak site.

Soil-to-Groundwater-to-Humans

A potential exists for percolation of water following rainfall through contaminated soil, and the migrating water may acquire solubilized benzene from the soil. In the immediate area of the Indian Basin Gas Plant the shallow soil water horizon is not now nor has it ever been used as a potable water source. Since this shallow ephemeral soil water is not used as a drinking water source, the immediate exposure pathway to human receptors has been interrupted and there is no measurable risk to human receptors from shallow soil water.

Soil-to-Air-to-Humans

Benzene in the soil has potential to enter the atmosphere through vaporization and migration in soil gas. However, soil boring records from the site characterization commonly exhibit minimal VOC in soil gas near the surface. Thus, it's not possible to inhale benzene from air coming off the soil. Additionally, people seldom have reason to enter the leak-impacted area, which provides additional protection to humans and again interrupts the exposure pathway. Soil gas creates no measurable risk to human receptors.

Groundwater-to-Drinking Water Wells-to-Humans

The Lower Queen aquifer provides plant process and fire protection water at the Indian Basin Plant and is a potable water source for nearby ranches. Plant employees were provided with bottled drinking water prior to this incident and posted warnings are plainly visible cautioning against the consumption of well water.

A potential exists for shallow benzene-contaminated groundwater to migrate to the Lower Queen aquifer. As described above, a condensate of an unknown source or event was discovered on the Lower Queen. A program to treat Lower Queen benzene contamination will be discussed in detail in the remainder of this report. The treatment plan also addresses shallow soil water and soil which may continue to affect the Lower Queen if left untreated.

Our treatment of the affected portion of the Lower Queen and the supplemental Shallow zone actions proposed herein will reduce hydrocarbon sources which may affect the Lower Queen aquifer. The proposed actions in this comprehensive treatment plan interrupt the only potential exposure pathway of the Line 4 release, thus greatly reducing risk to human receptors.

The actions discussed below provide fast and environmentally sound treatment of affected waters. These actions were chosen by a thorough screening of available environmental remediation technologies with the constraint of the depth and areal extent of the impacted areas discovered.

Actions aimed at plume containment and hydrocarbon reduction are ready to commence shortly after approval of this plan.

Treatment Technologies Considered

A variety of published remediation plans initiated in the 1980's were reviewed for applicability to Indian Basin. Most of the plans reviewed used offsite disposal and capping, i.e. remove or cover over the problem. In situations where movement of contaminant to ground water is slow or non-existent, this is a reasonable approach. The gas plant owners consider the cover-over approach inappropriate as the constituents

found impact water. Capping at Indian Basin is inappropriate as the land surface was not adversely affected by the spill and continues to support vegetation as before.

Other published remediation decisions reached in the 1980's led to no action . This is also inappropriate at Indian Basin. Other examples of treatments reviewed and found inapplicable are burning and solidification. Since the focus is water quality and its preservation at Indian Basin we are led to those technologies which deal with water contamination by benzene.

Treatment Leading to Closure

Of the treatment alternatives reviewed for Indian Basin, we consider any plan which seeks to achieve a statutory prescribed level of benzene in drinking water at all locations of the Lower Queen as impractical in light of recent experience at other sites reported in popular press and trade publications. From these reports it is quite likely to be impossible to achieve statutory levels at any cost and time, especially in fractured aquifers such as the Lower Queen. In cases of contamination by floating volatile hydrocarbon, the task of remediation to a prescribed level is now thought to be much more difficult than the perception of just a few years ago. Experience shows this is due to a number of factors such as limited solubility of contaminants in water in comparison to hydrocarbon adsorbed or in immobile phases, and by the unknown distribution of free product pools and contaminated soil or rock layers which continue to leach into the water.

This treatment plan will continue until one of two options set out below occurs. Notice will be given to the New Mexico OCD and upon their concurrence that the conditions of the option are met, treatment will be discontinued. After a period of additional monitoring as set out below, closure for the treatment plan is expected.

OPTION 1:

In the event that the then current statutory level for benzene concentration (as determined by the statutory level for benzene for contaminated water discharge) is achieved at any time on all water sampling points, Option 1 will be reached. As a

subset of this option, as individual withdrawal points reach this same statutory level, treatment of that location may be suspended, provided that sampling for monitoring is continued thereon for the remainder of the treatment plan.

OPTION 2:

Treatment in accordance with the details set forth in this plan will be conducted until an asymptotic leveling of dissolved benzene in the Lower Queen water is reached. Asymptotic leveling is defined as the gradual approach of the logarithm of benzene concentration to a near constant value, smoothed and plotted as a function of time from treatment initiation.

The asymptotic state will be evaluated with methods described in Technical Limits of Groundwater Remediation, API Report No. 4510, June, 1991. The asymptotic behavior of benzene indicates a steady state balance exists between small scale, localized contamination in hard-to-reach areas, and component removal mechanisms, including pump-and-treat and natural decay processes. Simple arithmetic averaging of monitor points is used to define field average benzene concentration. Individual values of asymptotic benzene concentrations may vary from well to well.

Supplemental treatment strategies such as bioventing and shallow zone soil or soil gas treatments are used to accelerate benzene reduction in shallow zone and Lower Queen waters. These strategies may be used at any time during the treatment and are applied as needed by the plant owners, and are not subject to quantitative analyses for asymptotic behavior. Closure conditions address benzene content in Lower Queen water only.

This treatment plan will be conducted for two years, even if an asymptotic level is reached before that time (provided that such level is in excess of the statutory level) to ensure that the steady state conditions have been reached. Monitoring will continue for a period of one year beyond cessation of treatment.

In summary, Marathon developed a comprehensive treatment strategy which is based on the recognized distribution of contaminated water, the direction of water flow, and downgradient receptors. Our plan prevents benzene migration to these receptors and thereby prevents health risks to those receptors. The treatment must acknowledge

the unique size, aquifer properties, and depth of the affected zones. Our ability to curtail fluid migration by pumping water is known from effects of current plant water withdrawals on water levels. Additional knowledge of the remaining in-situ water contamination will only come with experience gained during the treatment effort.

Treatment Strategies

Containment of the water-soluble benzene plume is considered the most important objective of the 1992 action plan. Plume monitoring wells and optional pump locations for soluble benzene product extraction wells were drilled in 1991.

Six pump locations and nine plume monitor wells will be used for Lower Queen plume control. Extracted water will be cleaned of benzene to statutory discharge standards or better, and a portion of the cleaned water will be used, as in the past, for ongoing plant operations. The process selected to extract benzene from the produced water is air stripping at a dedicated water cleaning plant. Air stripping is a proven technology for volatile hydrocarbon removal.

Excess water, i.e. water pumped and cleaned over and above gas plant requirements, may be returned to the Lower Queen. Later in the treatment plan cleaned water may be diverted to the Shallow Impacted zone. Cleaned water returned to the shallow zone restores the volume of water removed during the emergency withdrawals of April, 1991 to August, 1991, and subsequent volumes of water to be removed for soil and shallow water treatment, or both.

Supplemental pumping and water cleaning for removal of volatile hydrocarbon components is needed in the shallow zone. This will reduce and eventually eliminate the possibility of re-exposure of Lower Queen water with impacted shallow zone water. The treatment plan acknowledges that shallow zone soil and water represent a source of hydrocarbon which may be transported by water to the Lower Queen aquifer. The treatment aims to reduce these high concentrations of benzene to a level which is consistent with the above objectives for Lower Queen water quality.

The treatment plan does not seek and we do not believe it is technically feasible or necessary to achieve water quality in the Shallow Impacted Area which is equal to that in the Lower Queen. Natural processes of adsorption, biological degradation, and dispersal reduce hydrocarbon concentrations in water during possible migration to the Lower Queen.

Detailed Treatment Plan

Lower Queen Well Placement and Aquifer Characteristics

Fig. 1 shows the six locations of Lower Queen wells with electric submersible pumps for free product and water removal. These wells (BH-84, BH-85, BH-87A, BH-88, BH-91A, and BH-94) experienced some floating product either at the time of drilling or during well development. Three of these wells (BH-84, BH-85, and BH-88) are located near the center of the hydrocarbon plume. Two of the pumped wells (BH-87A, BH-91A) were initially fringe wells with low BTEX concentrations, but then they developed small levels of floating product sometime after well development. The remaining pumped well (BH-94) was drilled in part to investigate Lower Queen water quality near the area suspected to be a point where leaked fluids left Rocky Arroyo and spread laterally and possibly vertically. The six pump locations are chosen to maximize plume containment and volatile hydrocarbon removal.

Fig. 1 also shows the nine Lower Queen wells used to monitor plume confinement and pumping effectiveness. The Lower Queen groundwater generally flows to the east in the absence of water withdrawal for plant use. The monitor well locations are BH-89, west and upgradient of the site of the release, BH-97 on the south, BH-92 and two plant wells SW-1, SW-2 on the north, and BH-86, BH-90, and BH-93 on the east. The remaining well location BH-83 is an interior well which was drilled and found to be a clean well but which later developed elevated BTEX concentrations due to plume spreading.

Fig. 2 shows the hydrostatic potential for Lower Queen water obtained by fluid level measurements obtained in September, 1991. The potentials are dramatically affected by the rate of pumping of Lower Queen water at SW-1 for plant process water

needs. Plant process water requirements change as the process demands change over time. In 1991 the total plant process water removed from the Lower Queen was about 1500 barrels per day and this volume approximates the future plant requirement during the treatment period.

Process water not evaporated at the plant is injected into the Devonian water disposal well (API 30-015-00037) at a depth of 10,438 feet pursuant to New Mexico Oil Conservation Commission Division Order, permit no. SWD-416.

Water withdrawal at SW-1 provides only partial control of the benzene plume. In the present operations, pumping at SW-1, Lower Queen water is drawn toward the well from locations as far as an imaginary line oriented at N-45-E passing through BH-94. Fluid west of this line is affected by and eventually produced at the plant process water supply well. Fluid east of this imaginary line is able to flow along the general E-NE direction of the regional water flow. A more effective plume control is achieved by pumping plant water from the environmental wells installed in 1991, Fig. 1.

From Fig. 2 the movement of Lower Queen water near the Indian Basin Gas Plant is E-NE, especially in the areas unaffected by the plant process water supply well. Area water wells, including potential downgradient receptor wells, are identified in Fig.3. The Lyman stock tank water well located approximately 2 miles from the eastern ring of monitor wells (BH-86, BH-90, Bh-93) is the downgradient well closest to the plume. Other wells in the vicinity are the Biebelle, Lee and Howell water wells. The results of sampling programs instituted in these wells shows no detected BTEX or elevated chlorides to date (Appendix A).

Lower Queen Plume Containment and Component Reduction

Field water samples were taken on all wells from the early days of the site investigation to the present. The BTEX components and benzene in particular were measured for all samples. Component plume maps were created as often as data permitted meaningful contouring. The benzene plume map of the Lower Queen, Fig. 4, was made from data taken during a two week "point-in-time" intensive sampling

round in September 18-27, 1991. For comparison, Fig. 5 shows the benzene plume map from the December, 1991 quarter point-in-time.

In September, 1991 (Fig. 4), the maximum benzene concentration is 2200 ppb in BH-88 and concentration tails off sharply to the east, with small levels at the plume fringe wells; BH-87A (190 ppb), BH-90 (150 ppb), and well BH-93 (280 ppb). BH-88 exhibited the largest floating product thickness of all wells prior to initiation of emergency fluid withdrawals from it in September, 1991. Trace amount of free product in the sample could have caused an unrealistically high benzene concentration value. Benzene concentration tails off gradually to the west, north and south. Well BH-86 is an eastern fringe well of very low hydrocarbon content as of September, 1991, with BTEX of 37 ppb and benzene of 33 ppb.

In December, 1991 (Fig. 5), the maximum benzene concentration is 1900 ppb in well BH-94 and the southeast feature of high benzene concentration mounding around BH-88 in September (Fig. 4) has diminished. This may be an early indication of the success of the limited withdrawals in the Lower Queen.

The plume containment measure chosen for the Lower Queen is pump-and-treat using the well locations of Fig. 1 to arrest any eastward drift of dissolved benzene in the water. The free product thickness in Lower Queen wells pumped to date was typically only a few inches, and the total free product recovered from the Lower Queen is 42 barrels as of January 31, 1992.

The cumulative volumes of water and condensate pumped from the Lower Queen wells are given in Appendix B. These show well BH-85 has produced the most fluid to date, consistent with its installed pump capacity of 40 gpm. All other wells are rated for 10 gpm continuous duty. The design field capacity of all six pumps is 75 gpm (2500 barrels/day) for the Lower Queen. The large capacity of BH-85 means that it has a large drainage radius in comparison to the remaining wells.

The current withdrawal for the plant process water is approximately 45 gpm (1500 barrels/day) from SW-1. When the air stripper becomes operational, the pumped water drawn from the six new Lower Queen wells will be used for gas plant process water requirements. The plant supply wells SW-1 and SW-2 will be used for standby and monitoring only. The Lower Queen water pumped and cleaned but not required by

the plant, up to 1000 barrels/day (30 gpm), is a maximum design value based on maximum treatment capacity, less any water simultaneously pumped from the shallow zone.

The excess water pumped and cleaned but not used for plant processes will be placed by some combination of injection into the Lower Queen, injection into a shallow ground water infiltration gallery south of the plant, and/or injection into a shallow well. This is discussed more fully in the section on the shallow impacted area below.

Shallow Impacted Area Wells and Soil Characteristics

A total of 79 boreholes were drilled for all of the Shallow Impacted Area (SIA) at Indian Basin. Of these, 49 were completed as monitor wells. Excavations were used in the arroyo for emergency withdrawal, with 17 locations completed as recovery and monitor wells.

Fig. 6 shows a base map of the shallow monitor wells and recovery sumps used in the emergency product recovery operations from April, 1991 to August ,1991.

The shallow alluvium water is an ephemeral soil water and is confined to an area defined by the arroyo on the south, the highway on the north, and by the stock fence on the east. Fig. 7 shows a map of the net water thickness in the shallow alluvium obtained by the field-wide survey in September, 1991.

Alluvial ground water is primarily confined to a porous sand/gravel body lying above the shallow bedrock and oriented in the same general direction, i.e. southeast. Ground water potential in the shallow zone shown in Fig. 8 reveals a consistent flow to the E-SE direction, roughly parallel to the path of the arroyo.

During the emergency fluid withdrawals of the summer of 1991 a total of 3,245 barrels of condensate and 79,754 barrels of water were recovered from a total of 28 wells and pits. The locations and cumulative total fluids pumped are given in Appendix C. The locations with highest cumulative withdrawals are in or near the arroyo and indicate regions of high flow capacity of the shallow zone water.

Using the general direction of groundwater flow indicated by potentials of Fig. 8, water treatment in the shallow alluvium by a pump-and-treat system should use recovery wells which are both downgradient and in bedrock depressions, and with insertion locations as far upgradient as possible, consistent with hydrocarbon plume delineation and ongoing plant operations.

Shallow Impacted Zone and Treatment Plan

Hydrocarbon concentration was detected in the shallow alluvium adjacent to the arroyo and around MW-47, southeast of the plant. The latter area is upgradient for alluvial ground water flow and may not to be associated with the Line 4 release. However, since it may act as a continuing source of hydrocarbon for alluvial water, it is included in the treatment plan objectives.

Based on successful soil venting results described later, the plan for the shallow impacted area is to pump down the shallow zone water level, preferably before annual rainfall peaks. This creates a maximum vadose zone thickness to promote venting effectiveness. The shallow water pumped in this period is combined with pumped Lower Queen water. The combined waters are cleaned and disposed as described above.

Following this period of intense venting and water level reduction, the next phase will concentrate on re-fill of the shallow zone with pump-and-treat water (from both shallow and Lower Queen sources). Repeated applications of pump-down, soil venting, and water re-fill may be needed in some areas of more persistent contamination near Rocky Arroyo.

A water budget and clean water allocation plan is presented in Appendix D. It summarizes the rates expected for each water zone for injection and production phases.

Clean water is re-introduced into the zone in an upgradient infiltration gallery or a well point (i.e. MW-47, 600 feet southeast of the plant) or both. The cleaned water insertion fulfills the obligation to replace shallow zone withdrawals, past and

future. Cleaned water also migrates to the downgradient pump locations and equilibrates with the soil and residual water. When sampled, this migrating water will provide an indicator of progress of surface treatment.

An added benefit of removing shallow water for cleaning is a lowering of average chloride level in shallow zone water. The treated water which is re-inserted into the shallow zone for water replacement will be primarily obtained from the Lower Queen, which is very low in chloride content.

A plot of possible injection and production well locations for shallow alluvium ground water treatment is shown in Fig. 9. This shows a possible infiltration gallery south of the gas plant and west of the plume and an upgradient injection well at MW-47. We also indicate several potential locations for three downgradient production wells for shallow alluvial water control and treatment. The sweep of injected water follows the natural soil water flow direction and gradually removes residual dissolved volatile hydrocarbon. Produced water is processed in the same facility used for treatment of produced Lower Queen water.

Air Stripper Treatment Facility Operation

Pumped Lower Queen and shallow zone waters are mixed in the gathering line which starts at BH-94, Appendix E. The combined flow moves north to join with the trunk line serving the remaining Lower Queen producers to the east.

Fluid is separated at the air stripper treatment facility, Appendix F. An oil/water separator removes any free product before it moves on for soluble hydrocarbon removal. The separator operates at 20 psig with a methane gas blanket to avert combustion potential. The liquid hydrocarbon removed by the oil/water separator moves into a holding tank, which is emptied as necessary into the plant skimmer tanks.

Water from the separator moves into an equalization tank. Any unintended free product carried over into the equalization tank is monitored and if detected, is pumped back into the oil/water separator by operator control.

The water with dissolved hydrocarbon from the equalization tank is pumped into the top of the air stripper. The air stripper is a 3-tray, shallow tray design which reduces BTEX components to <20 ppb and benzene to <5 ppb for 1300 ppb benzene inlet concentration. The cleaned fluid is delivered to a clean water supply tank. Water from the supply tank is used for plant make-up water (45 gpm) and recycle injection described above.

The air stripper is designed to operate in all weather conditions and has safety and control features described in Appendix F. Notable features are the high fluid level shut-down controls on each tank, controls at the air stripper, and the 3-level protection against free product carry-over into the air stripper. All are environmental safeguards to ensure that effluent water quality remains within statutory discharge levels. Stripper effluent will be sampled to establish that the effluent water remains within the statutory discharge regulations and within design specifications.

Upsets in normal stripper operation must be incorporated in system design. An upset is an interruption in the water production from the air stripper. Emergency upsets of short duration are handled by a shut-down of the treatment system and an activation of back-up water supply for the gas plant.

Upsets of longer duration are handled by a shut-down of the water treatment system but with continuation of pumping from the recovery wells. Produced, untreated water will be by-passed to the salt water disposal tanks. Water from these tanks is injected into the Devonian disposal well. Appendix F describes control features of the air stripper plant in detail.

Soil Venting Augmentation for Shallow Zone Treatment

Shallow zone water treatment in the air stripper removes soluble hydrocarbons from the produced water. The vadose zone above the water contains product adsorbed on the rock and possibly as free product in residual phase hydrocarbon in the capillary pores. The vadose zone products will affect water migrating through this zone during periods of shallow water migration and fluid level excursions. If left unchecked, this acts as a continuing source of water degradation which affects the overall treatment schedule and delays completion.

Soil venting was proven successful at Indian Basin in a field pilot. Venting is the application of a suction pressure at the wellbore to remove hydrocarbon vapor contained in the vadose zone. Vent gas is exhausted to the atmosphere. Details of the progress of a soil venting pilot operation conducted from September-November, 1991, are shown in Appendix G. It shows that high vent gas hydrocarbon concentrations persist for approximately 2 months of venting. Vented air showed a concentration peak when the blower was re-started after a two-week shut-down. This may be due to water level depression in the area around the vent well or to vapor-soil diffusion and re-equilibration during shut-down. In either case, the venting produces significant hydrocarbon extraction even when the hydrocarbon concentration is confined to a few feet immediately above the water level.

Soil venting is effective in reducing the impact of water level changes on water degradation in the shallow zone. Soil venting will be used to extract volatile hydrocarbons from zones which are not amenable to treatment by pump-and-treat. An added but unquantified benefit of venting is augmented in-situ biological reduction of volatile hydrocarbon expected in the shallow zone, or bioventing. Appendix G also shows anticipated patterns for soil venting wells and hardware specifications of the blower selected for venting.

The maximum emission of hydrocarbon from venting is limited by New Mexico Air Quality Regulation 703. This emission limit controls the number of simultaneous wells undergoing venting, depending on airflow rates and exhaust concentration achieved. Vented air will be sampled to assure compliance and operation efficacy.

Water Management

Water production from the Lower Queen is the key to hydrocarbon plume containment in the Lower Queen. The design capacity of the air stripper is 2500 barrels/day (75 gpm) and the water pumped from the shallow zone is expected to average 100-300 barrels/day. The existing water rights for the Lower Queen are based on a rolling average of 87 acre-ft/yr in a 5-year period. In the current 5-year period we also have a carry-over credit of 56 acre-ft. This leads to a permitted average net withdrawal of 98 acre-ft/yr, or about 2100 barrels/day (62 gpm).

Monitoring Program

This treatment plan includes significant monitoring activity during the early phases of the project. These activities are aimed at demonstrating effectiveness of plume containment in the Lower Queen and compliance with regulations for water inserted into the shallow zone or Lower Queen. Supplementary water sampling in the shallow zone is needed to ensure that hydrocarbon in the shallow zone is reduced.

The plume containment in the Lower Queen is established by time sequences of concentration maps generated from analyzed water samples. The sampling for monitor wells in the Lower Queen is hampered by the well depth, equipment bulk and weight, and protocols of purge volumes and decontamination between samples.

Future monitor well sampling will use a specially designed, commercially available, Grundfos Redi-Flo2 submersible pump for purging and sampling. The pump is relatively light weight, low capacity, and is variable speed. The EPA recommended flow rate of 100 ml/min for organic compounds in water can be achieved with this unit. A published paper comparing the pump sample results with five control samples showed 96% benzene recovery and 99.5% VOC recovery for high VOC loading.

The water sampling schedule and sampling locations are described in Appendix H.

A lengthy search and in-house laboratory investigation of alternative sample analyses methods was conducted at Marathon's research center. This search led to the identification of high performance liquid chromatography (HPLC) with UV absorption for BTEX components and chlorides analyses. The method is simpler and faster than the purge and trap gas chromatography technique used previously for monitor well analyses. The method can be used for monitor and recovery well BTEX and chloride analyses when it is established as an acceptable substitute for the EPA 8020 method.

The quality assurance protocol is described in Appendix I. It details the sampling methods and detection techniques for both routine monitoring of the monitor

and recovery wells (HPLC method) and of the neighbor water wells and springs (commercial laboratory running EPA 8020).

The monitor wells are completed as described by EPA protocol and representative completion diagrams for Lower Queen and shallow zone wells are shown in Appendix J.

Contingencies For Plume Migration

The success of the treatment plan to achieve benzene plume control is supported by preliminary modeling studies and early field data on fringe well benzene concentrations. However, contingencies for possible plume migration beyond the current set of monitor wells on the eastern plume fringe are needed.

These fringe wells, BH-86, BH-90, and 93, are hydraulic downgradient wells of low benzene concentration. The most recent point-in-time results for samples taken from Dec. 16-18, 1991 for benzene content in these wells can be compared to those taken in September, 1991. The comparison shows that limited withdrawals (200-300 bbl/d) conducted since December 1, 1991 had already reduced benzene content in two of the three wells (BH-86 and BH-90A). After these December samples were obtained, higher withdrawals (600-1500 bbl/d) were initiated. We expect that these higher withdrawals will have an even more beneficial effect on the benzene concentrations.

Assuming these trends correctly reflect changes in these wells over the quarter from September to December, we propose a contingency plan for the Lower Queen monitor wells. We have modified pump rates where possible to create a bigger cone of depression in the area. If this produces favorable results of benzene reduction in BH-93 at the next point-in-time sample round in March, 1992, then we believe all three wells continue to qualify as fringe monitor wells.

If the modified pumping effort is unsuccessful, as inferred from a marked increase in benzene content in BH-93, an additional monitor well east of BH-93 may be needed to determine plume limits and confirm down gradient water quality.

FIGURES

Fig. 1 Recovery and Monitor Wells (Lower Queen)

Fig. 2 Potentiometric Surface (Lower Queen)

Fig. 3 Area Water Wells in Relationship to Indian Basin

Fig. 4 Benzene Plume in September, 1991 (Lower Queen)

Fig. 5 Benzene Plume in December, 1991 (Lower Queen)

Fig. 6 Shallow Zone Base Map

Fig. 7 Net Water Thickness in December, 1991 (Shallow Zone)

Fig. 8 Potentiometric Surface (Shallow Zone)

Fig. 9 Recovery and Insertion Points (Shallow Zone)

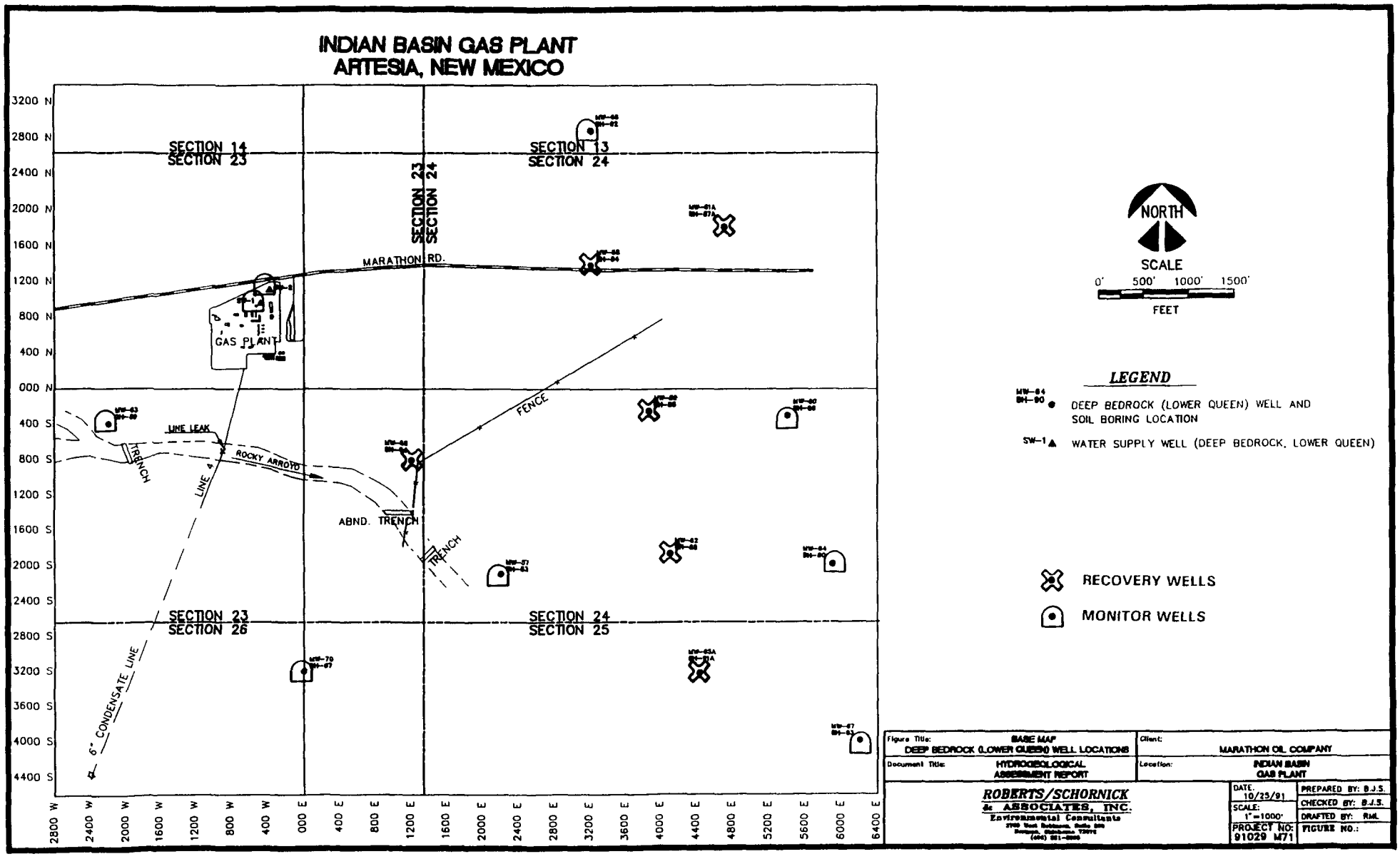


Fig. 1 Recovery and Monitor Wells (Lower Queen)

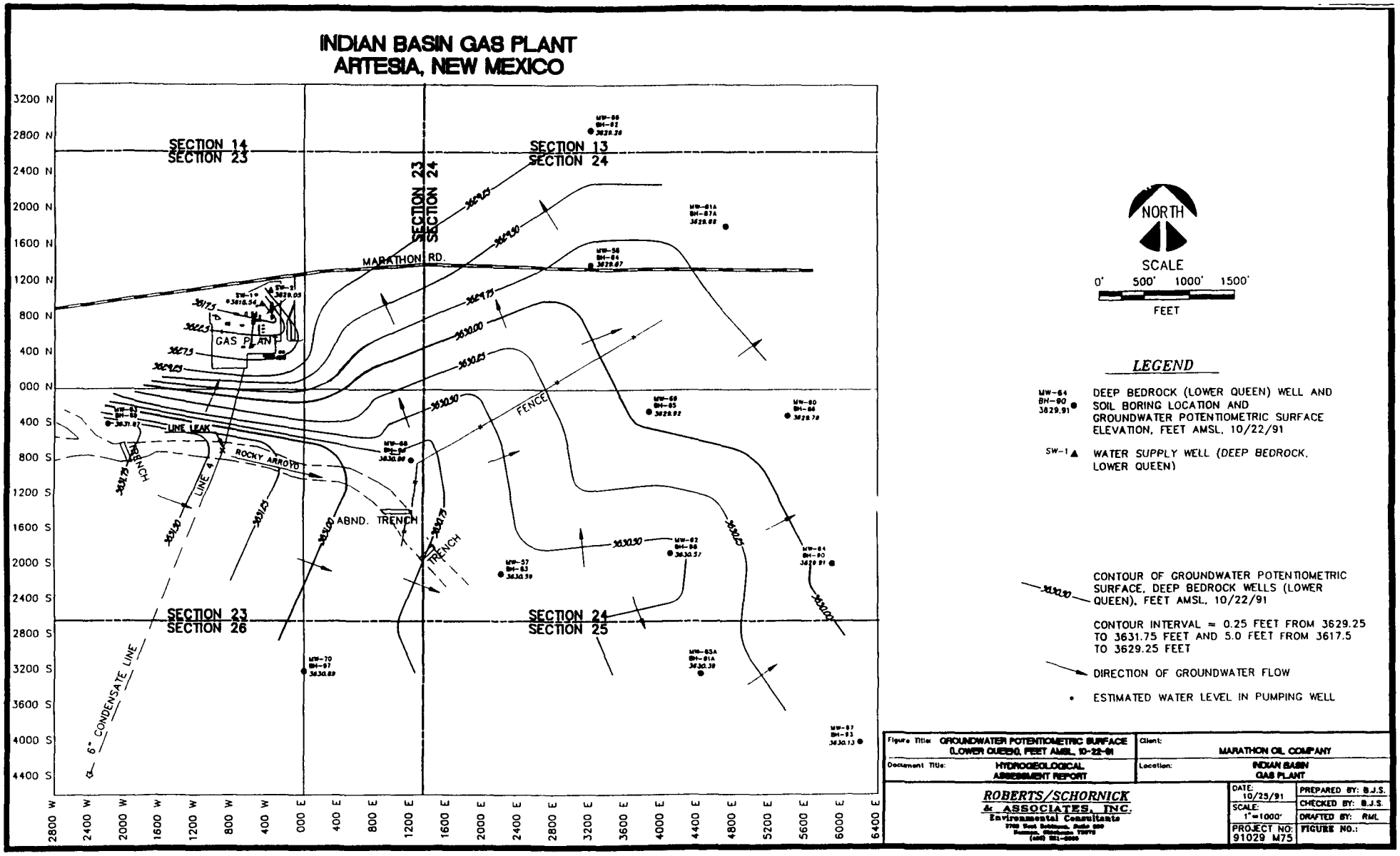


Fig. 2 Potentiometric Surface (Lower Queen)

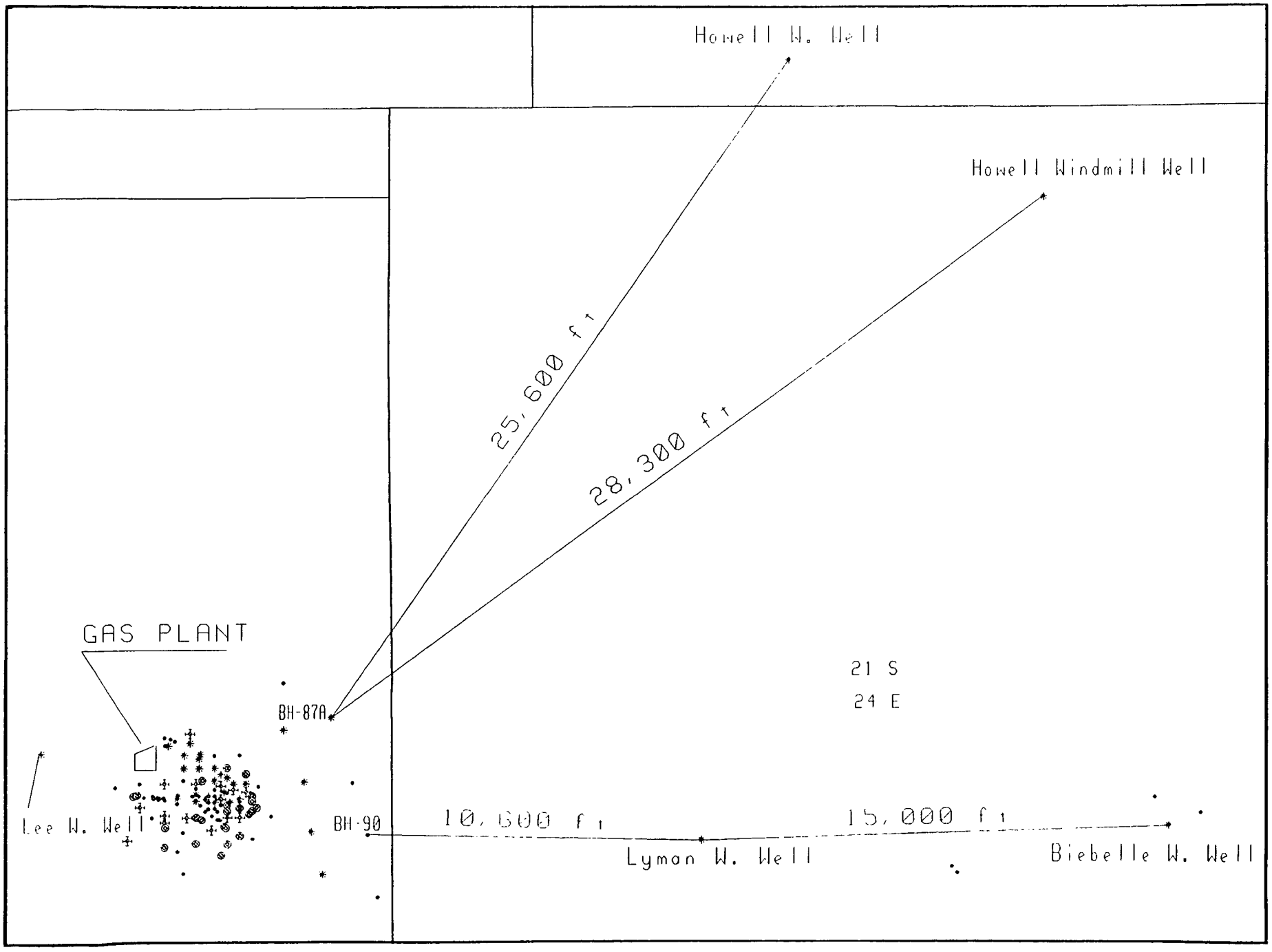


Fig. 3 Area Water Wells in Relationship to Indian Basin

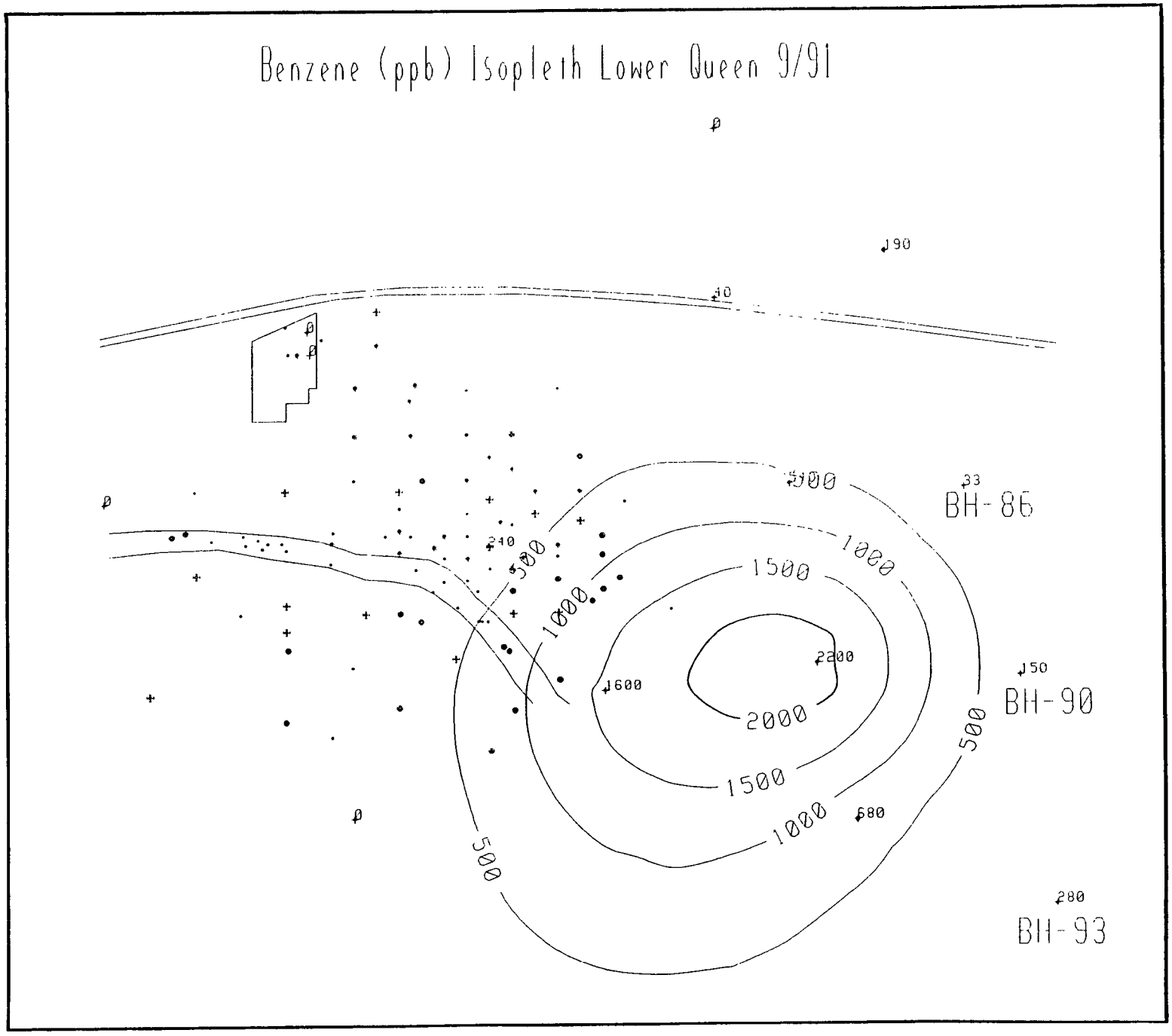


Fig. 4 Benzene Plume in September, 1991 (Lower Queen)

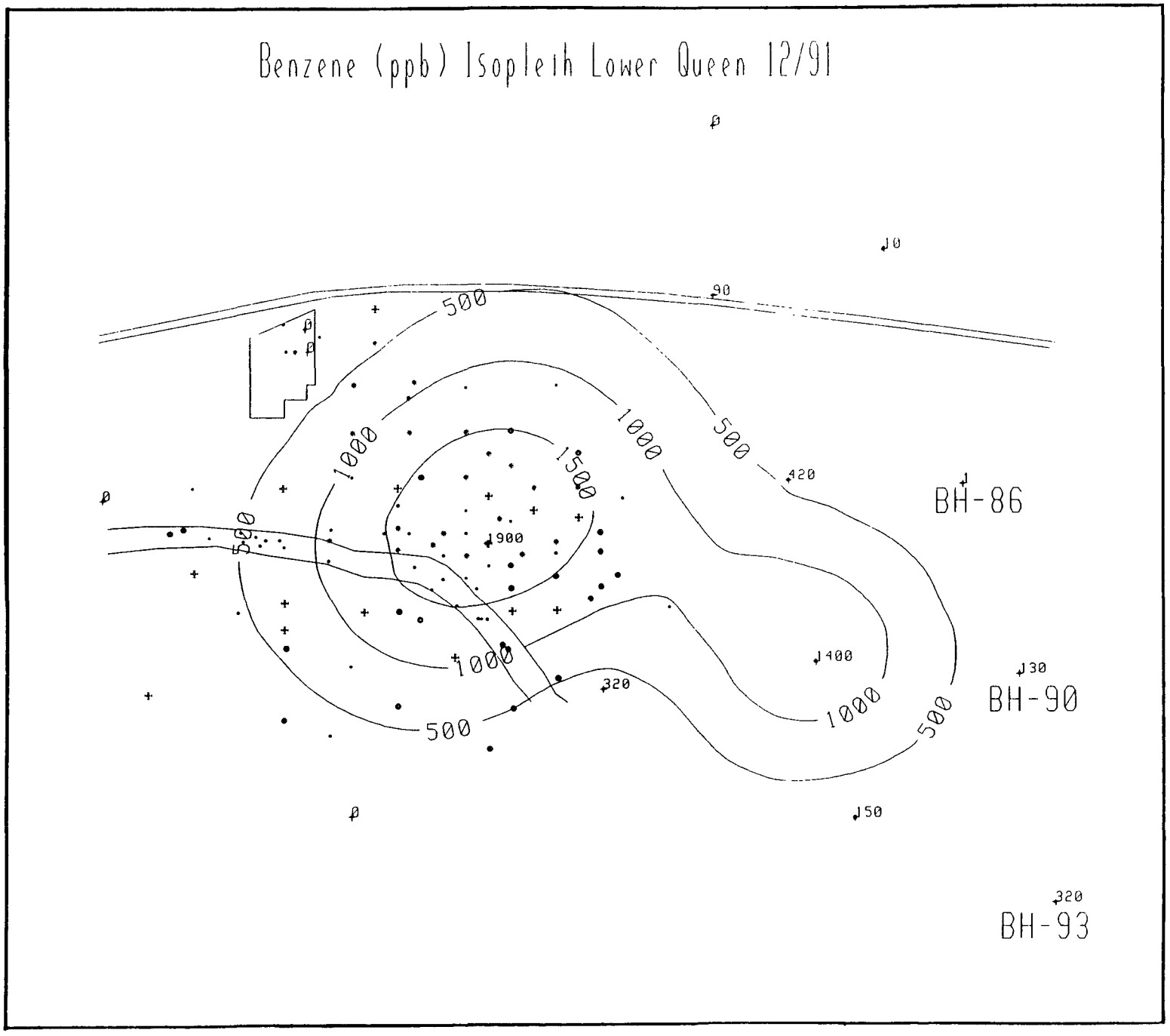


Fig. 5 Benzene Plume in December, 1991 (Lower Queen)

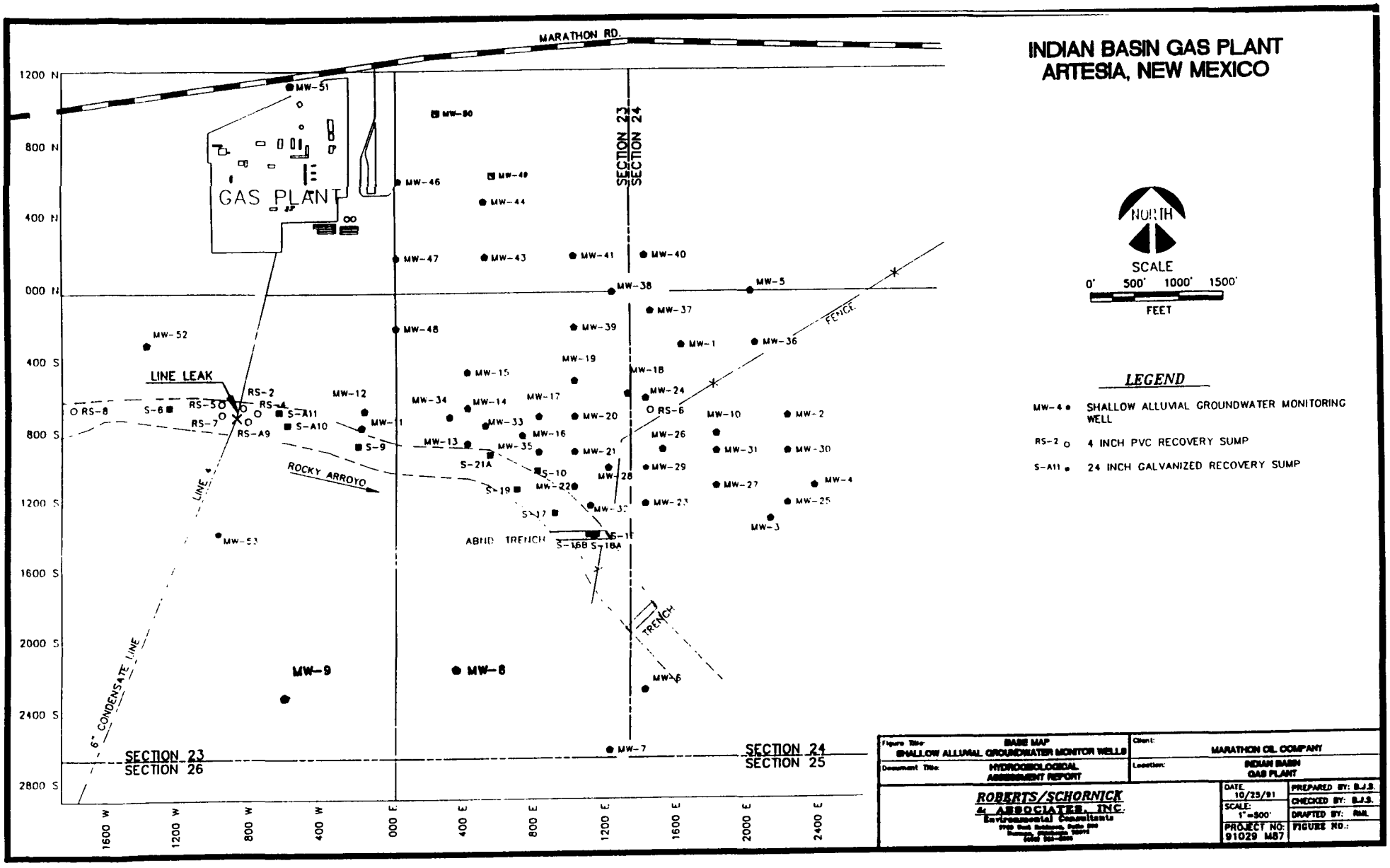


Fig. 6 Shallow Zone Base Map

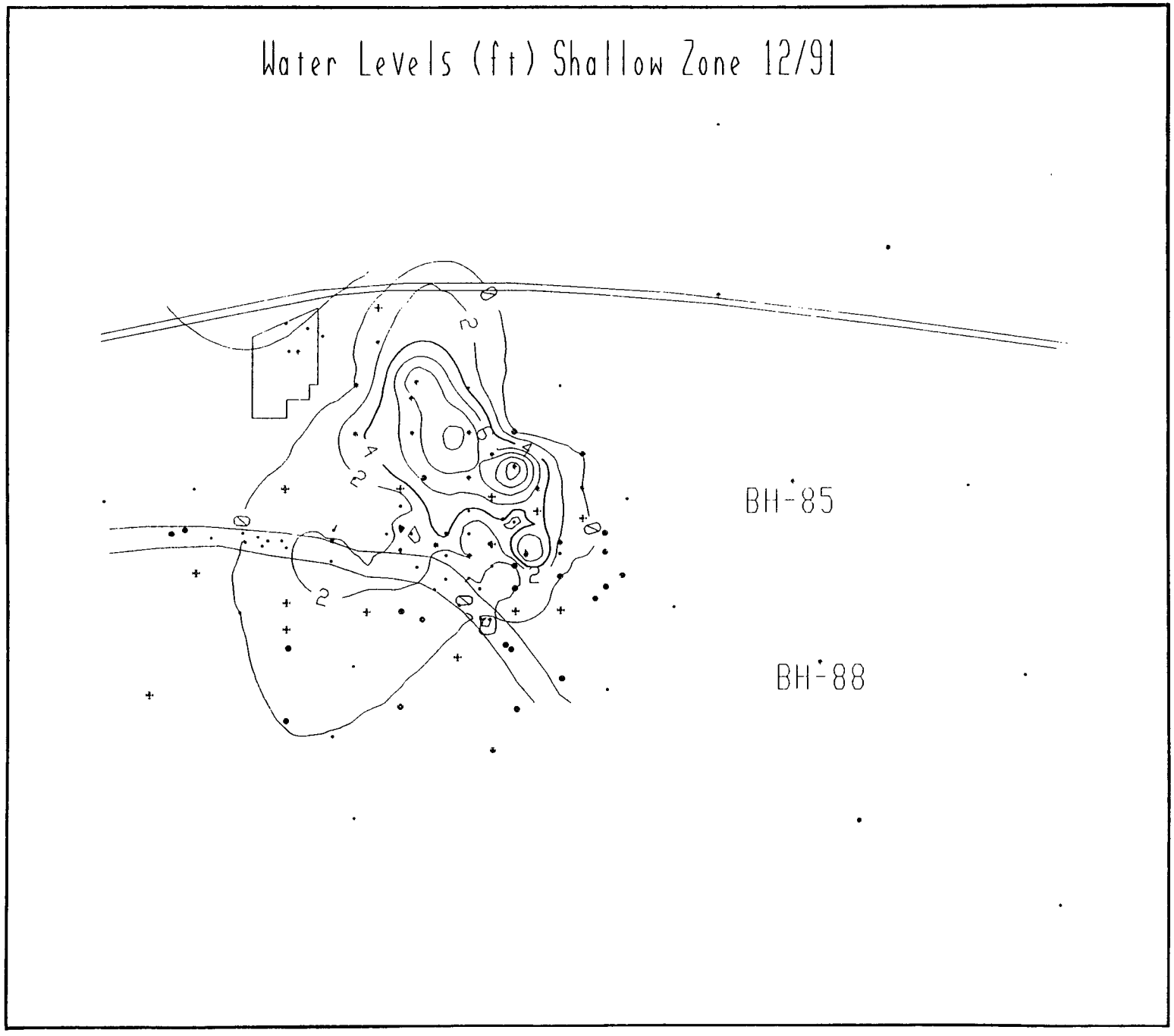


Fig. 7 Net Water Thickness in December, 1991 (Shallow Zone)

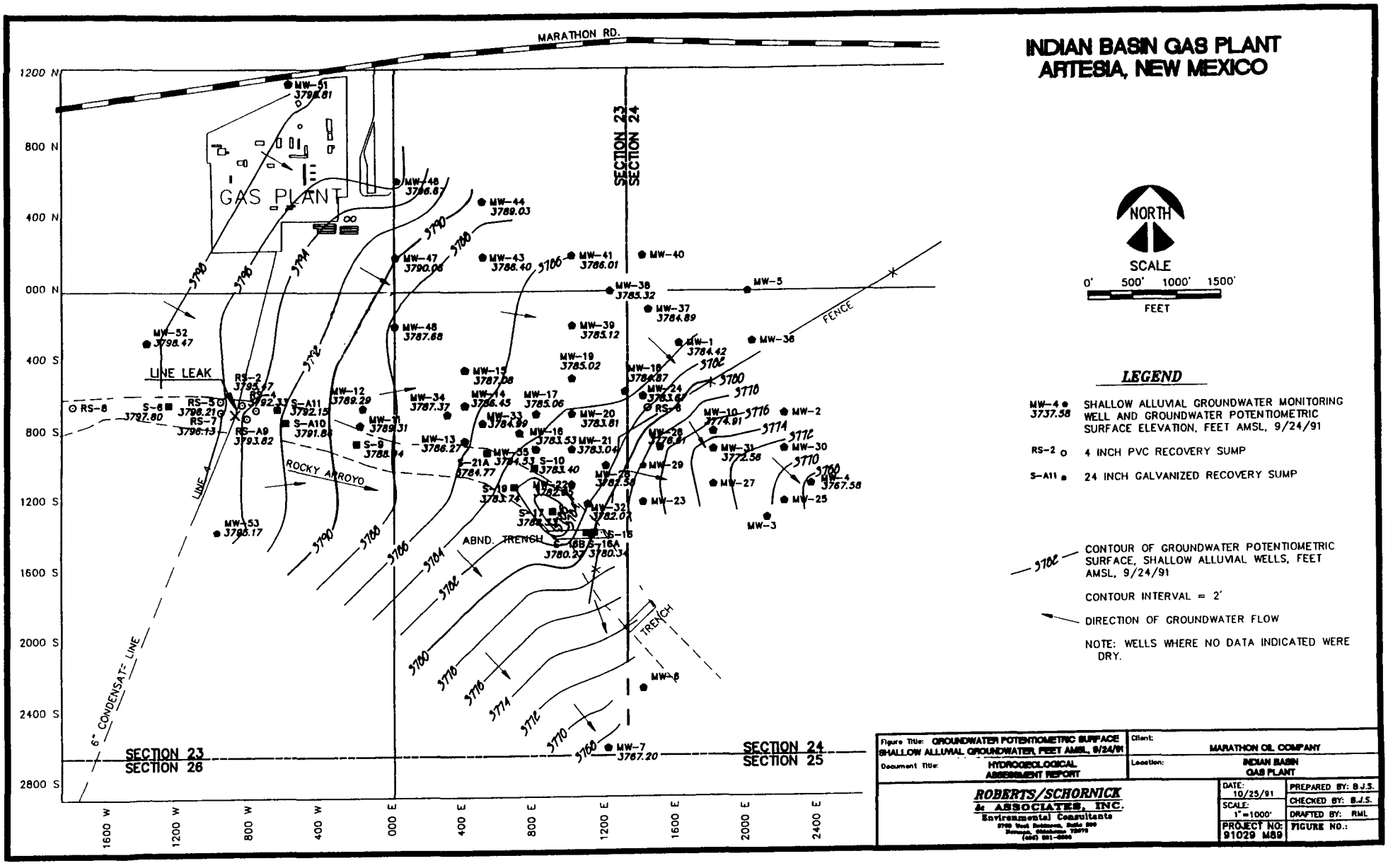


Fig. 8 Potentiometric Surface (Shallow Zone)

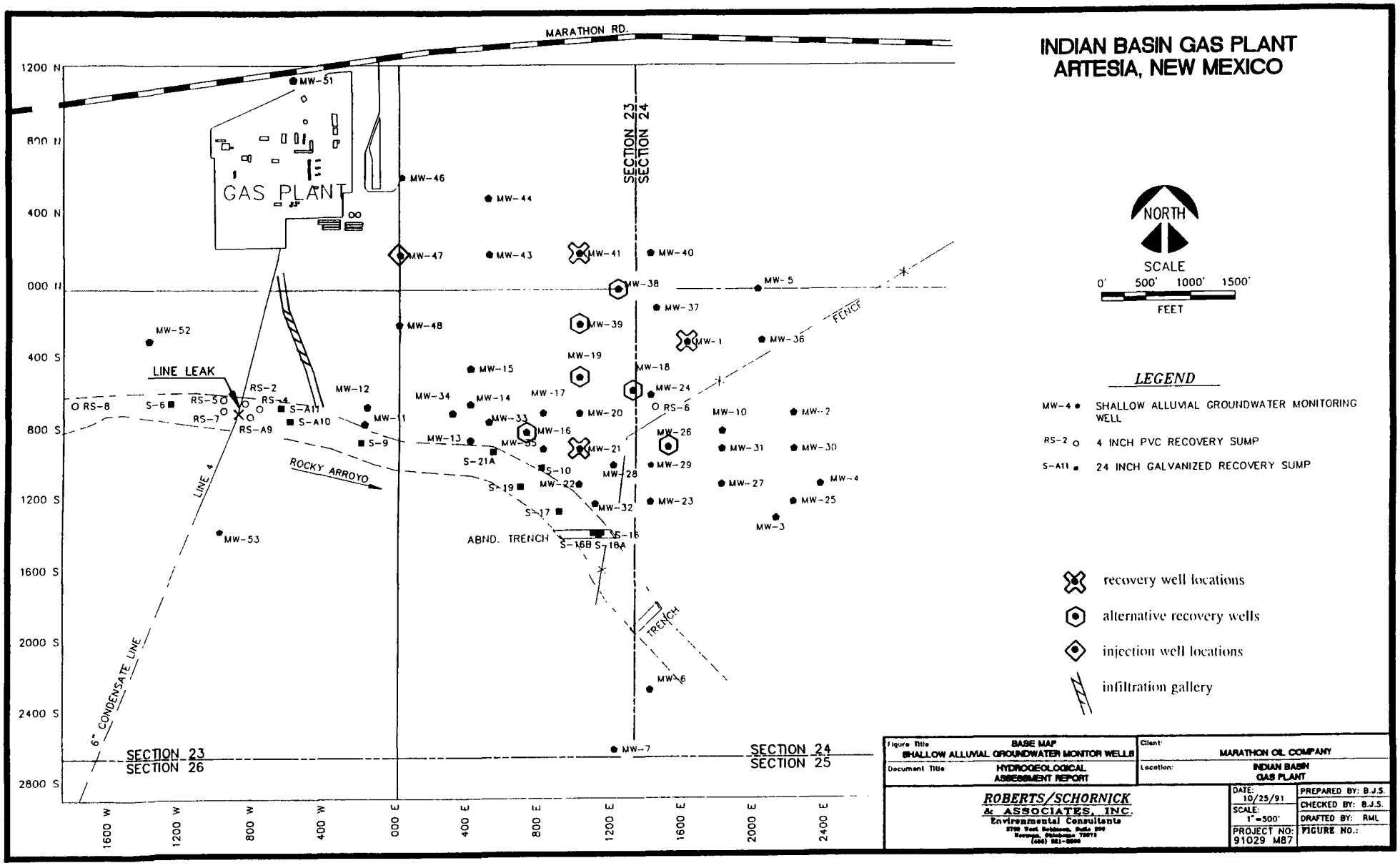


Fig. 9 Recovery and Insertion Points (Shallow Zone)

APPENDICES

Appendix A Area Wells and Springs - BTEX and Chlorides

Appendix B Emergency Fluid Withdrawals per Well (Lower Queen)

Appendix C Emergency Station Withdrawals (Shallow Zone)

Appendix D Water Budget Chart For Pump and Treat Options

Appendix E Flow Lines and Electric Power (Lower Queen)

Appendix F Air Stripper Operation and Control Systems

Appendix G Soil Venting Pilot Performance, Field Layout, Blower Specifications

Appendix H Well Monitoring Schedules Table for Shallow and Lower Queen Wells

Appendix I Quality Assurance Document

Appendix J Typical Well Completion Diagram for Monitor Wells

Appendix A

Appendix A : Area Wells and Surface Waters - BTEX and Chlorides

Number	Location	Date	Benzene (ppb)	Toluene (ppb)	Ethyl Benzene (ppb)	Xylenes (ppb)	Chloride (mg/l)
1	LYMAN	12-May-91	<5	<5	<5	<5	12.9
1		20-May-91	<1	<1	<1	<1	13.2
1		27-May-91	<1	<1	<1	<1	13.3
1		03-Jun-91	<1	<1	<1	<1	13.2
1		11-Jun-91	<1	<1	<1	<1	13.2
1		17-Jun-91	<1	<1	<1	<1	12.8
1		24-Jun-91	<1	<1	<1	<1	18.5
1		29-Jun-91	<1	<1	<1	<1	12.3
1		08-Jul-91	<1	<1	<1	<1	12.4
1		16-Jul-91	<1	<1	<1	<1	12.1
1		20-Jul-91	<1	<1	<1	<1	12.0
1		21-Jul-91	<1	<1	<1	<1	11.9
1		22-Jul-91	<1	<1	<1	<1	11.4
1		23-Jul-91	<1	<1	<1	<1	11.0
1		24-Jul-91	<1	<1	<1	<1	11.0
1		25-Jul-91	<1	<1	<1	<1	12.0
1		26-Jul-91	<1	<1	<1	<1	12.5
1		27-Jul-91	<1	<1	<1	<1	12.2
1		28-Jul-91	<1	<1	<1	<1	12.6
1		29-Jul-91	<1	<1	<1	<1	12.5
1		30-Jul-91	<1	<1	<1	<1	12.8
1		31-Jul-91	<1	<1	<1	<1	12.2
1		01-Aug-91	<1	<1	<1	<1	12.2
1		02-Aug-91	<1	<1	<1	<1	13.0
1		03-Aug-91	<1	<1	<1	<1	13.0
1		04-Aug-91	<1	<1	<1	<1	13.2
1		05-Aug-91	<1	<1	<1	<1	13.1
1		06-Aug-91	<1	<1	<1	<1	13.2
1		07-Aug-91	<1	<1	<1	<1	13.3
1		08-Aug-91	<1	<1	<1	<1	13.2
1		09-Aug-91	<1	<1	<1	<1	13.6
1		10-Aug-91	<1	<1	<1	<1	13.6
1		11-Aug-91	<1	<1	<1	<1	13.7
1		12-Aug-91	<1	<1	<1	<1	12.5
1		13-Aug-91	<1	<1	<1	<1	12.1
1		14-Aug-91	<1	<1	<1	<1	11.8
1		15-Aug-91	<1	<1	<1	<1	12.2

Appendix A : Area Wells and Surface Waters - BTEX and Chlorides

Number	Location	Date	Benzene (ppb)	Toluene (ppb)	Ethyl Benzene (ppb)	Xylenes (ppb)	Chloride (mg/l)
1		16-Aug-91	<1	<1	<1	<1	12.5
1		17-Aug-91	<1	<1	<1	<1	12.0
1		18-Aug-91	<1	<1	<1	<1	12.6
1		19-Aug-91	<1	<1	<1	<1	13.5
1		20-Aug-91	<1	<1	<1	<1	11.5
1		21-Aug-91	<1	<1	<1	<1	17.9
1		22-Aug-91	<1	<1	<1	<1	12.7
1		26-Aug-91	<1	<1	<1	<1	12.4
1		03-Sep-91	<1	<1	<1	<1	12.1
1		09-Sep-91	<1	<1	<1	<1	12.7
1		16-Sep-91	<1	<1	<1	<1	11.1
1		24-Sep-91	<1	<1	<1	<1	10.6
1		30-Sep-91	<1	<1	<1	<1	11.3
1		07-Oct-91	<1	<1	<1	<1	12.6
1		14-Oct-91	<1	<1	<1	<1	12.5
1		21-Oct-91	<1	<1	<1	<1	12.1
1		28-Oct-91	<1	<1	<1	<1	11.7
1		04-Nov-91	<1	<1	<1	<1	12.6
1		11-Nov-91	<1	<1	<1	<1	11.8
1		18-Nov-91	<1	<1	<1	<1	12.9
1		25-Nov-91	<1	<1	<1	<1	11.8
1		02-Dec-91	<1	<1	<1	<1	12.2
1		16-Dec-91	<1	<1	<1	<1	11.8
1		30-Dec-91	<1	<1	<1	<1	12.3
1		06-Jan-92	<1	<1	<1	<1	12.3
1		20-Jan-92	<1	<1	<1	<1	12.1
2	UPPER INDIAN HILL SPRING WEST	12-May-91	<5	<5	<5	<5	11.8
2		20-May-91	<1	<1	<1	<1	11.3
2		27-May-91	<1	<1	<1	<1	11.7
2		03-Jun-91	<1	<1	<1	<1	11.3
2		04-Jun-91	<1	<1	<1	<1	11.4
2		11-Jun-91	<1	<1	<1	<1	11.2
2		17-Jun-91	<1	<1	<1	<1	10.9
2		24-Jun-91	<1	<1	<1	<1	11.3
2		01-Jul-91	<1	<1	<1	<1	10.3
2		08-Jul-91	<1	<1	<1	<1	11.0
2		15-Jul-91	<1	<1	<1	<1	12.9
2		22-Jul-91	<1	<1	<1	<1	3.0
2		29-Jul-91	<1	<1	<1	<1	8.1

Appendix A : Area Wells and Surface Waters - BTEX and Chlorides

Number	Location	Date	Benzene (ppb)	Toluene (ppb)	Ethyl Benzene (ppb)	Xylenes (ppb)	Chloride (mg/l)
2		04-Aug-91	<1	<1	<1	<1	8.7
2		12-Aug-91	<1	<1	<1	<1	9.7
2		19-Aug-91	<1	<1	<1	<1	4.3
2		26-Aug-91	<1	<1	<1	<1	6.6
2		09-Sep-91	<1	<1	<1	<1	8.6
2		24-Sep-91	<1	<1	<1	<1	8.0
2		07-Oct-91	<1	<1	<1	<1	9.1
2		21-Oct-91	<1	<1	<1	<1	8.9
2		04-Nov-91	<1	<1	<1	<1	9.2
2		18-Nov-91	<1	<1	<1	<1	9.6
2		02-Dec-91	<1	<1	<1	<1	9.7
2		06-Jan-92	<1	<1	<1	<1	10.2
3	LOWER INDIAN HILL SPRING	12-May-91	<5	<5	<5	<5	11.9
3		20-May-91	<1	<1	<1	<1	11.6
3		27-May-91	<1	<1	<1	<1	11.2
3		03-Jun-91	<1	<1	<1	<1	11.3
3		04-Jun-91	<1	<1	<1	<1	11.6
3		11-Jun-91	<1	<1	<1	<1	11.2
3		17-Jun-91	<1	<1	<1	<1	11.1
3		24-Jun-91	<1	<1	<1	<1	11.3
3		01-Jul-91	<1	<1	<1	<1	10.5
3		08-Jul-91	<1	<1	<1	<1	10.8
3		15-Jul-91	<1	<1	<1	<1	11.6
3		22-Jul-91	<1	<1	<1	<1	5.2
3		29-Jul-91	<1	<1	<1	<1	7.9
3		04-Aug-91	<1	<1	<1	<1	8.7
3		12-Aug-91	<1	<1	<1	<1	9.6
3		19-Aug-91	<1	<1	<1	<1	5.0
3		26-Aug-91	<1	<1	<1	<1	6.7
3		09-Sep-91	<1	<1	<1	<1	8.6
3		24-Sep-91	<1	<1	<1	<1	8.2
3		07-Oct-91	<1	<1	<1	<1	8.6
3		21-Oct-91	<1	<1	<1	<1	8.8
3		04-Nov-91	<1	<1	<1	<1	9.0
3		18-Nov-91	<1	<1	<1	<1	9.2
3		02-Dec-91	<1	<1	<1	<1	9.5
3		06-Jan-92	<1	<1	<1	<1	10.2
4	BIEBELLE WELL	22-Apr-91	<5	<5	<5	<5	15.0
4		12-May-91	<5	<5	<5	<5	11.2

Appendix A : Area Wells and Surface Waters - BTEX and Chlorides

Number	Location	Date	Benzene (ppb)	Toluene (ppb)	Ethyl Benzene (ppb)	Xylenes (ppb)	Chloride (mg/l)
4		20-May-91	<1	<1	<1	<1	11.4
4		27-May-91	<1	<1	<1	<1	11.1
4		03-Jun-91	<1	<1	<1	<1	11.2
4		11-Jun-91	<1	<1	<1	<1	11.3
4		17-Jun-91	<1	<1	<1	<1	11.1
4		24-Jun-91	<1	<1	<1	<1	11.4
4		01-Jul-91	<1	<1	<1	<1	10.5
4		08-Jul-91	<1	<1	<1	<1	10.9
4		15-Jul-91	<1	<1	<1	<1	11.3
4		22-Jul-91	<1	<1	<1	<1	9.7
4		29-Jul-91	<1	<1	<1	<1	11.2
4		04-Aug-91	<1	<1	<1	<1	10.1
4		12-Aug-91	<1	<1	<1	<1	10.9
4		19-Aug-91	<1	<1	<1	<1	10.4
4		26-Aug-91	<1	<1	<1	<1	8.2
4		09-Sep-91	<1	<1	<1	<1	8.9
4		24-Sep-91	<1	<1	<1	<1	8.5
4		07-Oct-91	<1	<1	<1	<1	9.0
4		21-Oct-91	<1	<1	<1	<1	9.2
4		04-Nov-91	<1	<1	<1	<1	8.9
4		18-Nov-91	<1	<1	<1	<1	9.3
4		02-Dec-91	<1	<1	<1	<1	9.4
4		06-Jan-92	<1	<1	<1	<1	10.1
4	BIEBELLE POND	22-Aug-91	<1	<1	<1	<1	0.9
5	ARROYO SPRING WATER	12-May-91	<5	<5	<5	<5	11.8
5		20-May-91	<1	<1	<1	<1	11.2
5		27-May-91	<1	<1	<1	<1	11.1
5		03-Jun-91	<1	<1	<1	<1	11.0
5		11-Jun-91	<1	<1	<1	<1	11.3
5		17-Jun-91	<1	<1	<1	<1	11.4
5		24-Jun-91	<1	<1	<1	<1	11.7
5		01-Jul-91	<1	<1	<1	<1	10.6
5		08-Jul-91	<1	<1	<1	<1	10.9
5		15-Jul-91	<1	<1	<1	<1	12.1
5		22-Jul-91	<1	<1	<1	<1	4.1
5		29-Jul-91	<1	<1	<1	<1	9.2
5		04-Aug-91	<1	<1	<1	<1	9.4
5		12-Aug-91	<1	<1	<1	<1	9.7
5		19-Aug-91	<1	<1	<1	<1	5.4

Appendix A : Area Wells and Surface Waters - BTEX and Chlorides

Number	Location	Date	Benzene (ppb)	Toluene (ppb)	Ethyl Benzene (ppb)	Xylenes (ppb)	Chloride (mg/l)
5		26-Aug-91	<1	<1	<1	<1	7.6
5		09-Sep-91	<1	<1	<1	<1	8.2
5		24-Sep-91	<1	<1	<1	<1	8.2
5		07-Oct-91	<1	<1	<1	<1	8.7
5		21-Oct-91	<1	<1	<1	<1	8.4
5		04-Nov-91	<1	<1	<1	<1	9.0
5		18-Nov-91	<1	<1	<1	<1	9.2
5		02-Dec-91	<1	<1	<1	<1	9.3
5		06-Jan-92	<1	<1	<1	<1	10.0
6	UPPER INDIAN HILLS SPRING EAST	12-May-91	<5	<5	<5	<5	11.3
6		20-May-91	<1	<1	<1	<1	11.3
6		27-May-91	<1	<1	<1	<1	11.1
6		03-Jun-91	<1	<1	<1	<1	17.1
6		11-Jun-91	<1	<1	<1	<1	11.3
6		17-Jun-91	<1	<1	<1	<1	11.1
6		24-Jun-91	<1	<1	<1	<1	11.3
6		01-Jul-91	<1	<1	<1	<1	10.3
6		08-Jul-91	<1	<1	<1	<1	11.0
6		15-Jul-91	<1	<1	<1	<1	11.8
6		22-Jul-91	<1	<1	<1	<1	3.8
6		29-Jul-91	<1	<1	<1	<1	8.6
6		04-Aug-91	<1	<1	<1	<1	9.4
6		12-Aug-91	<1	<1	<1	<1	10.1
6		19-Aug-91	<1	<1	<1	<1	5.0
6		26-Aug-91	<1	<1	<1	<1	7.7
6		09-Sep-91	<1	<1	<1	<1	8.9
6		24-Sep-91	<1	<1	<1	<1	7.8
6		07-Oct-91	<1	<1	<1	<1	8.9
6		21-Oct-91	<1	<1	<1	<1	8.9
6		04-Nov-91	<1	<1	<1	<1	9.2
6		18-Nov-91	<1	<1	<1	<1	9.7
6		02-Dec-91	<1	<1	<1	<1	9.5
6		06-Jan-92	<1	<1	<1	<1	10.2
7	IBGP PLANT WELL NO. 1	18-Apr-91	<5	<5	<5	<5	16.6
7		18-Apr-91	<5	<5	<5	<5	16.8
7		12-May-91	<5	<5	<5	<5	17.1
7		20-May-91	<1	<1	<1	<1	16.9
7		27-May-91	<1	<1	<1	<1	17.0
7		03-Jun-91	<1	<1	<1	<1	16.6

Appendix A : Area Wells and Surface Waters - BTEX and Chlorides

Number	Location	Date	Benzene (ppb)	Toluene (ppb)	Ethyl Benzene (ppb)	Xylenes (ppb)	Chloride (mg/l)
7		11-Jun-91	<1	<1	<1	<1	17.2
7		17-Jun-91	<1	<1	<1	<1	16.9
7		24-Jun-91	<1	<1	<1	<1	16.7
7		29-Jun-91	<1	<1	<1	<1	16.4
7		08-Jul-91	<1	<1	<1	<1	16.7
7		16-Jul-91	<1	<1	<1	<1	17.2
7		19-Jul-91	<1	<1	<1	<1	17.1
7		23-Jul-91	<1	<1	<1	<1	17.2
7		29-Jul-91	<1	<1	<1	<1	17.6
7		04-Aug-91	<1	<1	<1	<1	17.0
7		12-Aug-91	<1	<1	<1	<1	17.6
7		20-Aug-91	<1	<1	<1	<1	17.2
7		21-Aug-91	<1	<1	<1	<1	17.4
7		23-Aug-91	<1	<1	<1	<1	17.3
7		24-Aug-91	<1	<1	<1	<1	17.4
7		26-Aug-91	<1	<1	<1	<1	17.1
7		28-Aug-91	<1	<5	<5	<5	NA
7		03-Sep-91	<1	<5	<5	<5	NA
7		09-Sep-91	<1	<5	<5	<5	17.3
7		07-Oct-91	<1	<1	<1	<1	17.4
7		21-Oct-91	<1	<1	<1	<1	16.8
7		04-Nov-91	<1	<1	<1	<1	17.0
7		18-Nov-91	<1	<1	<1	<1	17.1
7		02-Dec-91	<1	<1	<1	<1	17.3
7		16-Dec-91	<1	<1	<1	<1	17.0
7		06-Jan-92	<1	<1	<1	<1	17.8
8	IBGP PLANT WELL NO. 1A	18-Apr-91	<5	<5	<5	<5	16.7
8		12-May-91	<5	<5	<5	<5	20.4
8		20-May-91	<1	<1	<1	<1	30.0
8		03-Jun-91	<1	<1	<1	<1	25.0
8		11-Jun-91	<1	<1	<1	<1	25.0
8		17-Jun-91	<1	<1	<1	<1	28.0
8		24-Jun-91	<1	<1	<1	<1	37.0
8		29-Jun-91	<1	<1	<1	<1	28.0
8		08-Jul-91	<1	<1	<1	<1	31.0
8		16-Jul-91	<1	<1	<1	<1	34.0
8		23-Jul-91	<1	<1	<1	<1	21.0
8		29-Jul-91	<1	<1	<1	<1	17.6
8		08-Aug-91	<1	<1	<1	<1	68.0

Appendix A : Area Wells and Surface Waters - BTEX and Chlorides

Number	Location	Date	Benzene (ppb)	Toluene (ppb)	Ethyl Benzene (ppb)	Xylenes (ppb)	Chloride (mg/l)
8		13-Aug-91	<1	<1	<1	<1	68.0
8		18-Aug-91	<1	<1	<1	<1	15.2
8		20-Aug-91	2	<1	<1	<1	36.0
8		21-Aug-91	<1	<1	<1	<1	32.0
8		22-Aug-91	<1	<1	<1	<1	26.0
8		23-Aug-91	<1	<1	<1	<1	24.0
8		24-Aug-91	<1	<1	<1	<1	14.7
8		24-Aug-91	<1	<1	<1	<1	18.1
8		26-Aug-91	<1	<1	<1	<1	13.6
8		27-Aug-91	<1	<5	<5	<5	NA
8	(bottom of well No. 1A)	28-Aug-91	<1	<5	<5	<5	NA
8		03-Sep-91	<1	<5	<5	<5	NA
8		09-Sep-91	<1	<5	<5	<5	17.8
8		23-Sep-91	<1	<1	<1	<1	12.6
8		07-Oct-91	<1	<1	<1	<1	242
8		21-Oct-91	<1	<1	<1	<1	582
8		04-Nov-91	<1	<1	<1	<1	620
8		18-Nov-91	<1	<1	<1	<1	469
8		02-Dec-91	<1	<1	<1	<1	636
8		16-Dec-91	<1	<1	<1	<1	477
8		16-Dec-91	<1	<1	<1	<1	477
8		06-Jan-92	<1	<1	<1	<1	370
9	LEE WATER WELL	12-May-91	<5	<5	<5	<5	7.5
9		20-May-91	<1	<1	<1	<1	7.9
9		27-May-91	<1	<1	<1	<1	14.1
9		03-Jun-91	<1	<1	<1	<1	10.7
9		11-Jun-91	<1	<1	<1	<1	7.5
9		17-Jun-91	<1	<1	<1	<1	12.3
9		24-Jun-91	<1	<1	<1	<1	11.3
9		29-Jun-91	<1	<1	<1	<1	6.7
9		08-Jul-91	<1	<1	<1	<1	15.2
9		15-Jul-91	<1	<1	<1	<1	8.0
9		23-Jul-91	<1	<1	<1	<1	11.8
9		29-Jul-91	<1	<1	<1	<1	15.9
9		04-Aug-91	<1	<1	<1	<1	15.7
9		12-Aug-91	<1	<1	<1	<1	16.2
9		19-Aug-91	<1	<1	<1	<1	11.8
9		26-Aug-91	<1	<1	<1	<1	16.3
9		09-Sep-91	<1	<1	<1	<1	16.6

Appendix A : Area Wells and Surface Waters - BTEX and Chlorides

Number	Location	Date	Benzene (ppb)	Toluene (ppb)	Ethyl Benzene (ppb)	Xylenes (ppb)	Chloride (mg/l)
9		24-Sep-91	<1	<1	<1	<1	7.7
9		07-Oct-91	<1	<1	<1	<1	16.9
9		21-Oct-91	<1	<1	<1	<1	9.0
9		04-Nov-91	<1	<1	<1	<1	9.3
9		18-Nov-91	<1	<1	<1	<1	17.9
9		02-Dec-91	<1	<1	<1	<1	12.0
9		06-Jan-92	<1	<1	<1	<1	17.3
10	HOWELL WATER TANK	19-Aug-91	<1	<1	<1	<1	83.0
10		26-Aug-91	<1	<1	<1	<1	77.0
10		09-Sep-91	<1	<1	<1	<1	80.0
10		23-Sep-91	<1	<1	<1	<1	80.0
10		07-Oct-91	<1	<1	<1	<1	82.0
10		21-Oct-91	<1	<1	<1	<1	83.0
10		04-Nov-91	<1	<1	<1	<1	86.0
10		18-Nov-91	<1	<1	<1	<1	91.0
10		02-Dec-91	<1	<1	<1	<1	82.0
10		06-Jan-92	<1	<1	<1	<1	85.0
11	HOWELL'S WINDMILL WELL	19-Aug-91	<1	<1	<1	<1	20.0
11		26-Aug-91	<1	<1	<1	<1	20.0
11		09-Sep-91	<1	<1	<1	<1	22.0
11		23-Sep-91	<1	<1	<1	<1	21.0
11		07-Oct-91	<1	<1	<1	<1	18.3
11		21-Oct-91	<1	<1	<1	<1	18.3
11		04-Nov-91	<1	<1	<1	<1	19.6
11		18-Nov-91	<1	<1	<1	<1	16.2
11		02-Dec-91	<1	<1	<1	<1	18.5
11		06-Jan-92	<1	<1	<1	<1	19.3
12	PLANT WATER SUPPLY TANK	21-Aug-91	<1	<1	<1	<1	17.6
12	(tank bottom)	28-Aug-91	<1	<5	<5	<5	NA
12		03-Sep-91	<1	<5	<5	<5	NA
12		09-Sep-91	<1	<5	<5	<5	17.6
12		24-Sep-91	<1	<1	<1	<1	17.2
12		07-Oct-91	<1	<1	<1	<1	16.7
12		21-Oct-91	<1	<1	<1	<1	18.4
12		04-Nov-91	<1	<1	<1	<1	16.5
12		18-Nov-91	<1	<1	<1	<1	18.0
12		02-Dec-91	<1	<1	<1	<1	16.9

Appendix B

Appendix B

Lower Queen Emergency Withdrawals Cumulative Fluid Per Well*		
LQ Well No.	Barrels of Condensate	Barrels of Water**
BH-84	0	6,112
BH-85	5	17,070
BH-87A	6	6,842
BH-88	10	6,667
BH-91A	4	9,111
BH-94	4	6,635
subtotal to 12/1/91	29	
condensate since 12/1/91	13	
total	42	52,437

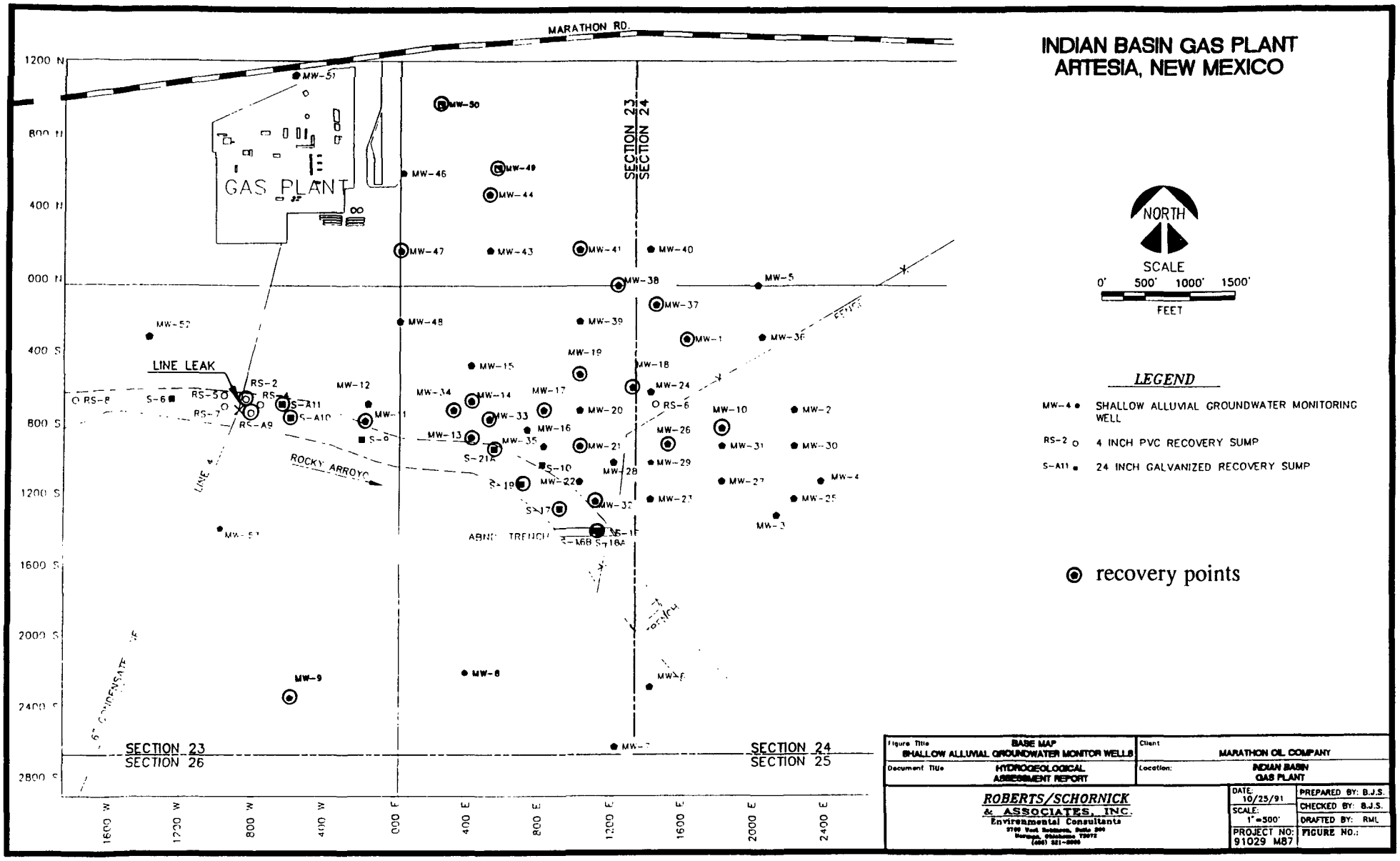
* data from September 1, 1991 to January 31, 1992
** water meters (after 11/2/91) and frac tank levels (before 11/2/91)

Appendix C

Appendix C

Shallow Zone Emergency Withdrawals Cumulative Fluid Per Station*		
Station No.**	Barrels of Condensate	Barrels of Water
1	1,115	3,518
2	117	8,732
3	947	24,477
4	60	57
5	936	17,627
6	70	6,470
7	0	4,339
8	0	14,534
Total	3,245	79,754

* data from April 16, 1991 to August 24, 1991
** pits 1,2,3,4,11A,16A,16B,17,19,21A; boreholes 14,32,33,34,36,37,40,41,42,44,49,59,60,61,61,64,67,70,72,73



Appendix C Shallow Zone Recovery Points (Emergency Withdrawals of 1991)

Appendix D

Appendix D

Water Budget Chart-Pump and Treat Options		
Phase 1	SIA pump and treat & soil vent	300 BWD
(Low Option)	LQ pump and treat	1200 BWD
	total treating volume	1500 BWD
	plant use	1500 BWD
	SIA injection/infiltration	0 BWD
	LQ injection (BH-89)	0 BWD
Phase 1	SIA pump and treat & soil vent	400 BWD
(High Option)	LQ pump and treat	2100 BWD
	total treating volume	2500 BWD
	plant use	1500 BWD
	SIA injection/infiltration	0 BWD
	LQ injection	1000 BWD
Phase 2	SIA pump and treat & soil vent	300 BWD
(Low Option)	LQ pump and treat	1500 BWD
	total treating volume	1800 BWD
	plant use	1500 BWD
	SIA injection/infiltration	300 BWD
	LQ injection	0 BWD
Phase 2	SIA pump and treat & soil vent	400 BWD
(High Option)	LQ pump and treat & soil vent	2100 BWD
	total treating volume	2500 BWD
	plant use	1500 BWD
	SIA injection/infiltration	400 BWD
	LQ injection	600 BWD

Appendix E

Appendix E

Flow Lines and Electric Power (Lower Queen)

Fig. E-1 shows the layout of flow lines and electric power distribution for the Lower Queen pumped wells. Power is provided by a 460v, 3-phase power grid to each pumped well. Local branch lines not yet built and not shown will be used for shallow zone power distribution and water collection. The soil venting system uses portable power generation and is not connected to the power grid.

Control boxes at the wellheads are equipped with Coyote motor protection switches to provide undercurrent, overcurrent, and voltage and phase protection to the pumps, Fig. E-2. The undercurrent condition is used to sense cavitation or air lockup. Pumps are shut down within one second of this condition. Pumps restart automatically at any time setting from one minute to twelve hours.

Pumps are also under control of "Murphy switches" to sense over and under pressure in the wellhead tubing. The over pressure limitation is used to sense flow line blockage or intentional valve closure at the stripper caused by high fluid level, an alarm condition. The pumps will attempt to automatically restart after a programmed delay time, which is set unequal from one pump to another to reduce inrush demand. The under pressure condition is used to sense flow line rupture or pump blockage and must be reset manually after inspection of system components to identify the reason for underpressure.

Flow lines are 4" PVC except in runs serving one well and all lines are buried to a depth of 38" below ground surface. Major branch lines are equipped with shut-off valves for flow line isolation and testing. The lines terminate at the east edge of the plant fence, where the air stripper plant is located.

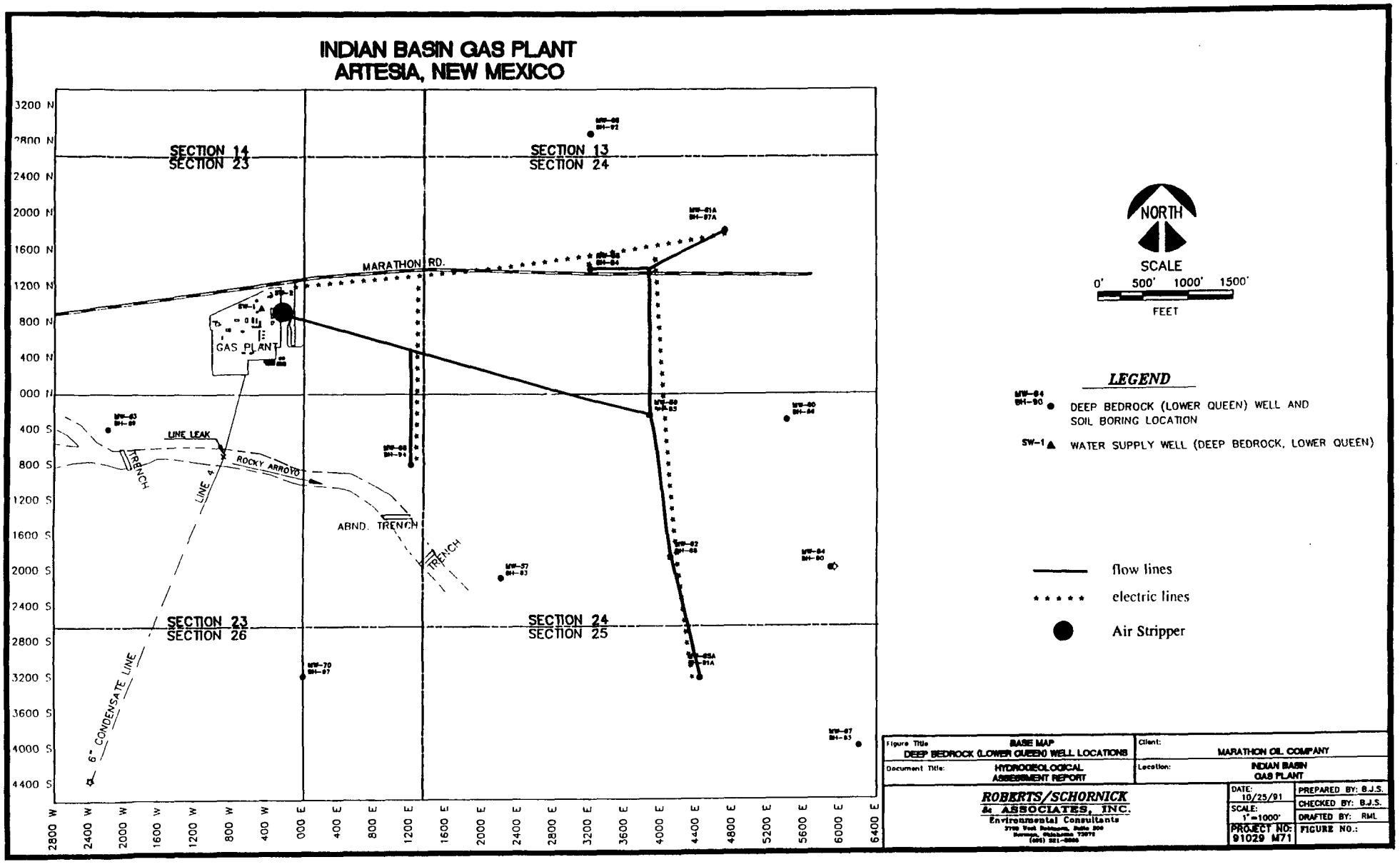


Fig. E-1 Flow Lines and Electric Power (Lower Queen Wells)

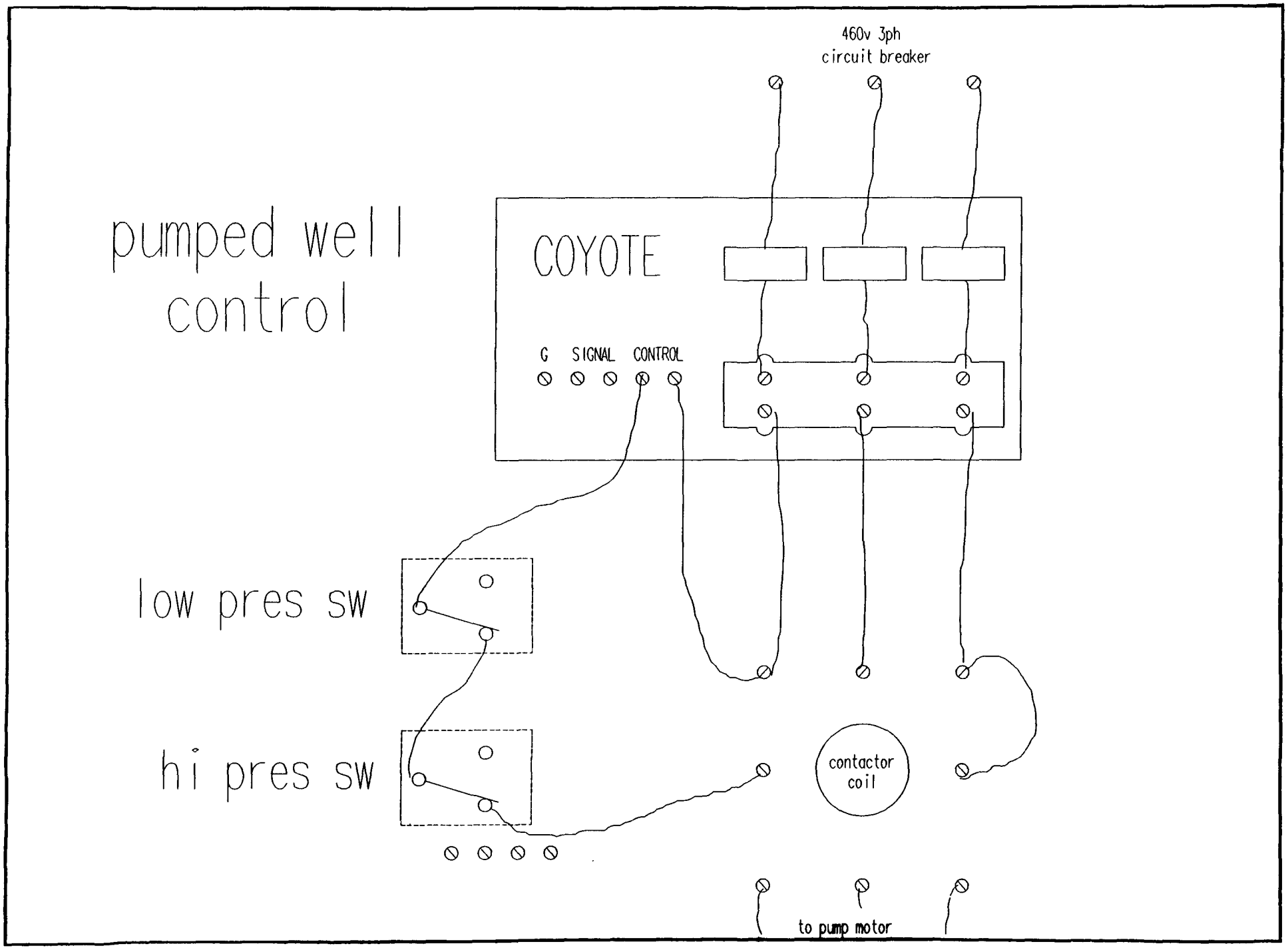


Fig. E-2 Wellhead Control System (Lower Queen Wells)

Appendix F

Appendix F

Air Stripper Operation and Control Systems

Fig. F-1 shows the schematic of the air stripper plant for benzene removal from pumped water. Water and occasional free product slugs are separated in an oil/water separator. The separator is a conventional three-phase production separator modified for this application. It uses a methane blanket operated at 20-30 psi supplied by a fuel gas line from the gas plant. This blanket excludes air for safer and cleaner operation and provides a natural drive to move liquids to their respective collection tanks for further processing. Water and condensate are separated by an adjustable weir gate. Laboratory and field observations to date suggest that water and condensate separate cleanly. Separated liquids accumulate and leave by the combined action of adjustable floats and their respective motor valves for liquid drainage.

An equalization tank for water staging to the air stripper is placed after the oil/water separator. Condensate from the oil/water separator and any condensate which may be carried over to the equalization tank (which is sensed in and removed from the equalization tank) are stored in a condensate storage tank until removed.

Three levels of protection are provided to minimize risk of product carry-over to the stripper, thence to the effluent stream. Level one is the oil/water separator itself. Under normal operation, no free product is expected in the water line from the oil/water separator, but the possibility of product carry-over cannot be excluded.

Level two protection is provided by the design of the discharge line from the equalization tank to the equalization pump. It is joined to a vent pipe to the atmosphere. If the normal pump float control, EPoff, fails and the HCdet sensor fails (to sense either air or hydrocarbon) and the tank continues to empty, the equalization pump (EP) will run dry when the tank liquid level drops below the height of the vent pipe tie-in to the EP suction

line. The free product must have built up to a thickness equal to this vent connection height (4 ft in the schematic) before free product is allowed to enter the suction line of the EP.

Level three protection is provided by a hydrocarbon detector, HCdet, in the equalization tank. It senses free product which may be accumulating in the tank due to faulty oil/water separator operation or incomplete separation. The detector senses capacitance and is placed below the minimum liquid level in the equalization tank established by the pump-off setting (EPoff). In normal conditions of little or no free product, HCdet senses a water environment at all times, even when the fluid is at low level (i.e. at EPoff). If free product accumulates and the low level fluid sensed is condensate, which has a much lower dielectric constant than water, an alarm condition is initiated. Condensate must completely surround the probe before it can detect significant dielectric reduction. The detector will trip out on alarm when the condensate layer is about 1 inch in thickness in the equilization tank.

Actually, both condensate and air have a much lower dielectric than water and the sensor, HCdet, serves as both free product and tank leak detector (air surrounds the detector). If the visual check in response to the alarm condition shows condensate has indeed accumulated, a product pump (PP) is used to skim off some water and the accumulated condensate from the equalization tank and return them to the condensate storage tank. Free product is thereby skimmed off the equalization tank as often as required, which should be very infrequent, if ever. Normal operation is resumed at the end of the product removal cycle.

The equalization tank, air stripper, and water supply tanks are equipped with extreme high fluid level alarm (HLA) switches in addition to the normal high and low level float controls for pumps. Extreme high level indicates a failure in the downstream pumps or a plugged stripper or disposal line upset. Any of these high fluid levels actuates closure of a main shut-off valve. This causes fluid pressure build-up in the flow lines and eventually causes the recovery pumps to trip out on high wellhead pressure control (Murphy

switches). This ensures that the system will shut down if it is unable to process fluid for any reason.

Table F-1 summarizes the main control features of the air stripper and auxiliary equipment.

Figs. F2-F3 show front and side views of the stripper aeration process, illustrating the three-tray cascade with weir gate control and sinuous traverses of water in each tray.

Fig. F4-F5 are control schematics for the equipment supplied with the air stripper.

Table F-1 Control Actions for Indian Basin Air Stripper Plant

	sensor detection					action desired					
	HCdet	HLAcs	HLAeq	HLAas	HLAws	MSV	MV	PP	EP	SP	B
problem	✓	-	-	-	-	close	close	on*	off	-	-
clear	-	-	-	-	-	open	open	off*	-	-	-
problem	-	✓	-	-	-	close	close	-	-	-	-
clear	-	-	-	-	-	open	open	-	-	-	-
problem	-	-	✓	-	-	close	close	-	-	-	-
clear	-	-	-	-	-	open	open	-	-	-	-
problem	-	-	-	✓	-	-	-	-	off	-	-
clear	-	-	-	-	-	-	-	-	-	-	-
problem	-	-	-	-	✓	close	close	-	off	off	-
clear	-	-	-	-	-	open	open	-	-	-	-

* PP is under manual control

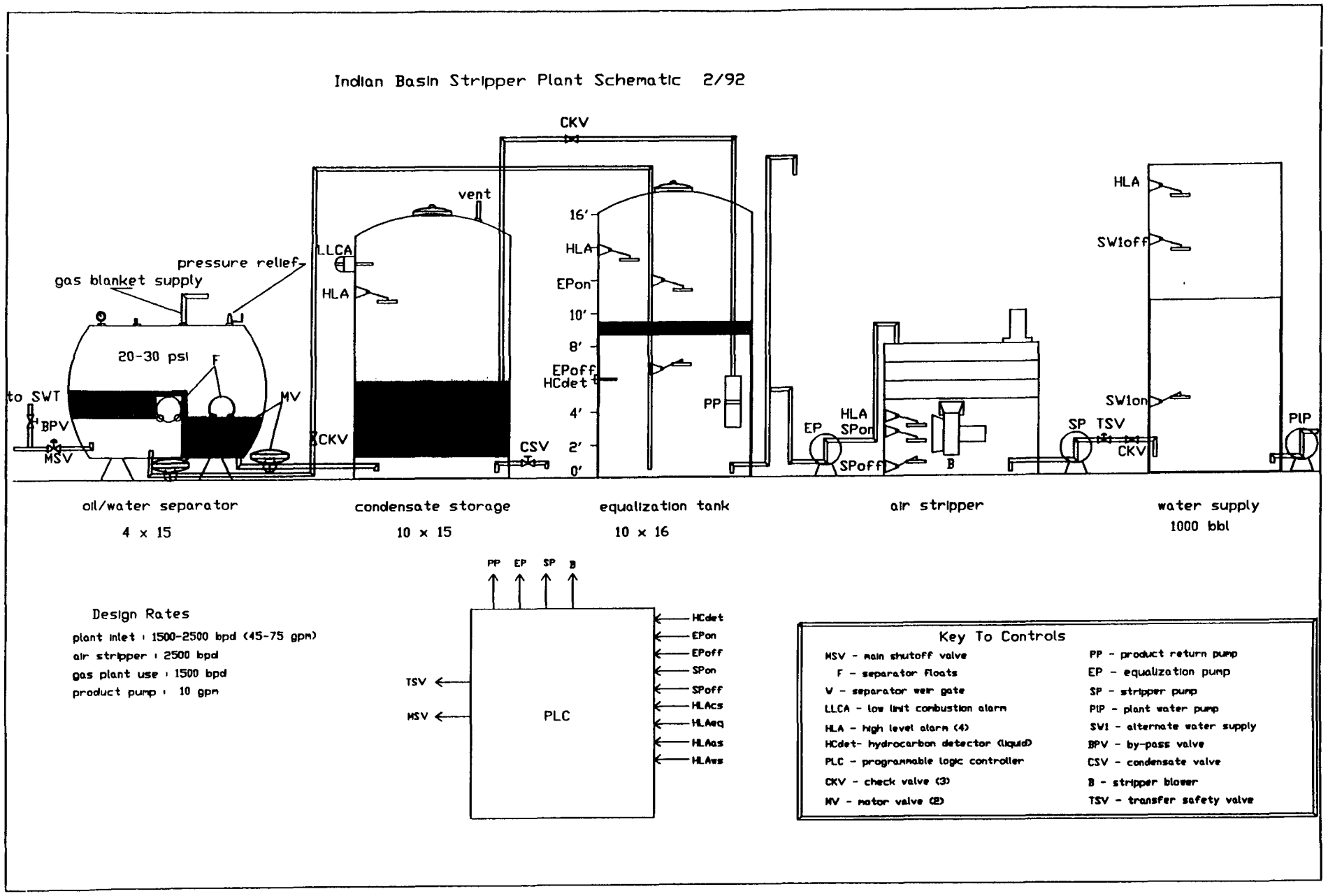
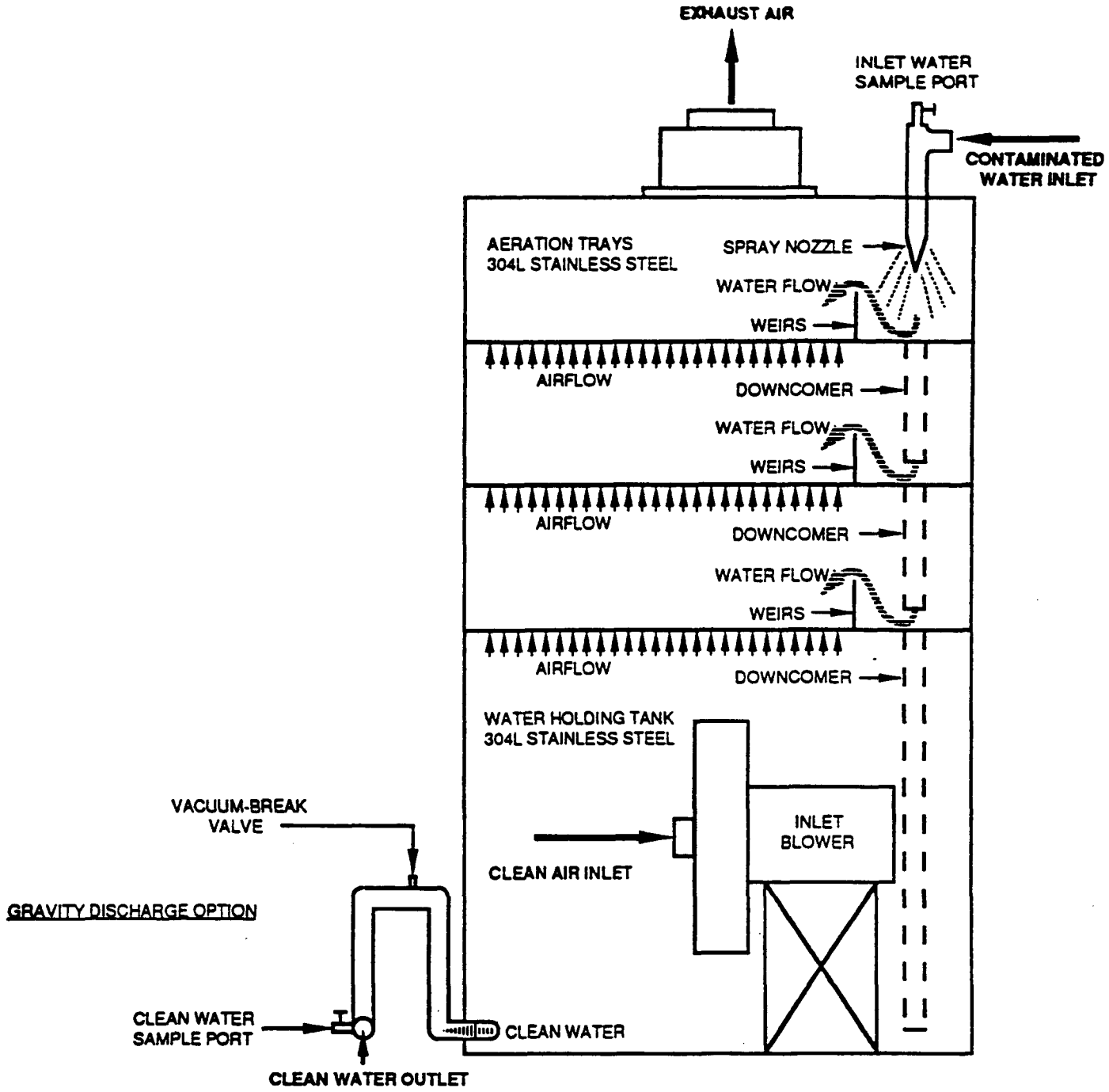


Fig. F-1 Air Stripper Plant Schematic



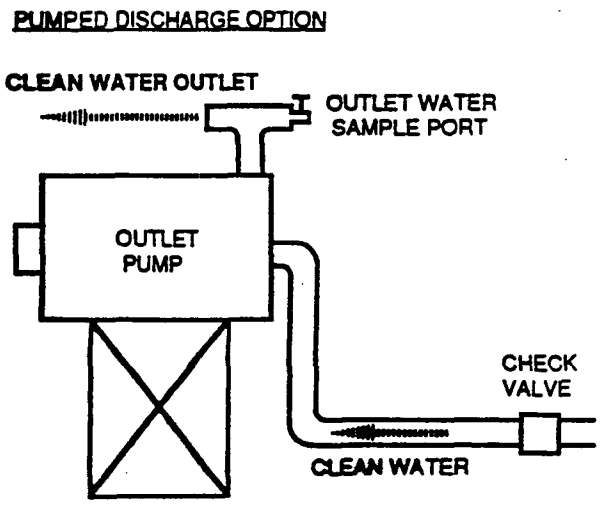


Fig. F-2

NORTH EAST ENVIRONMENTAL PRODUCTS, INC. 17 TECHNOLOGY DRIVE WEST LEBANON, NH 03784 (603) 298-7061		
TOLERANCES UNLESS OTHERWISE SPECIFIED N/A		DRAWING NAME AERATION PROCESS, FRONT VIEW
APPROVALS	DATE	TYPICAL SYSTEM
DRAWN KM	6/21/91	
CHECKED		SCALE: NONE / SIZE: A / SHEET 1 OF 2
		DO NOT SCALE DRAWING

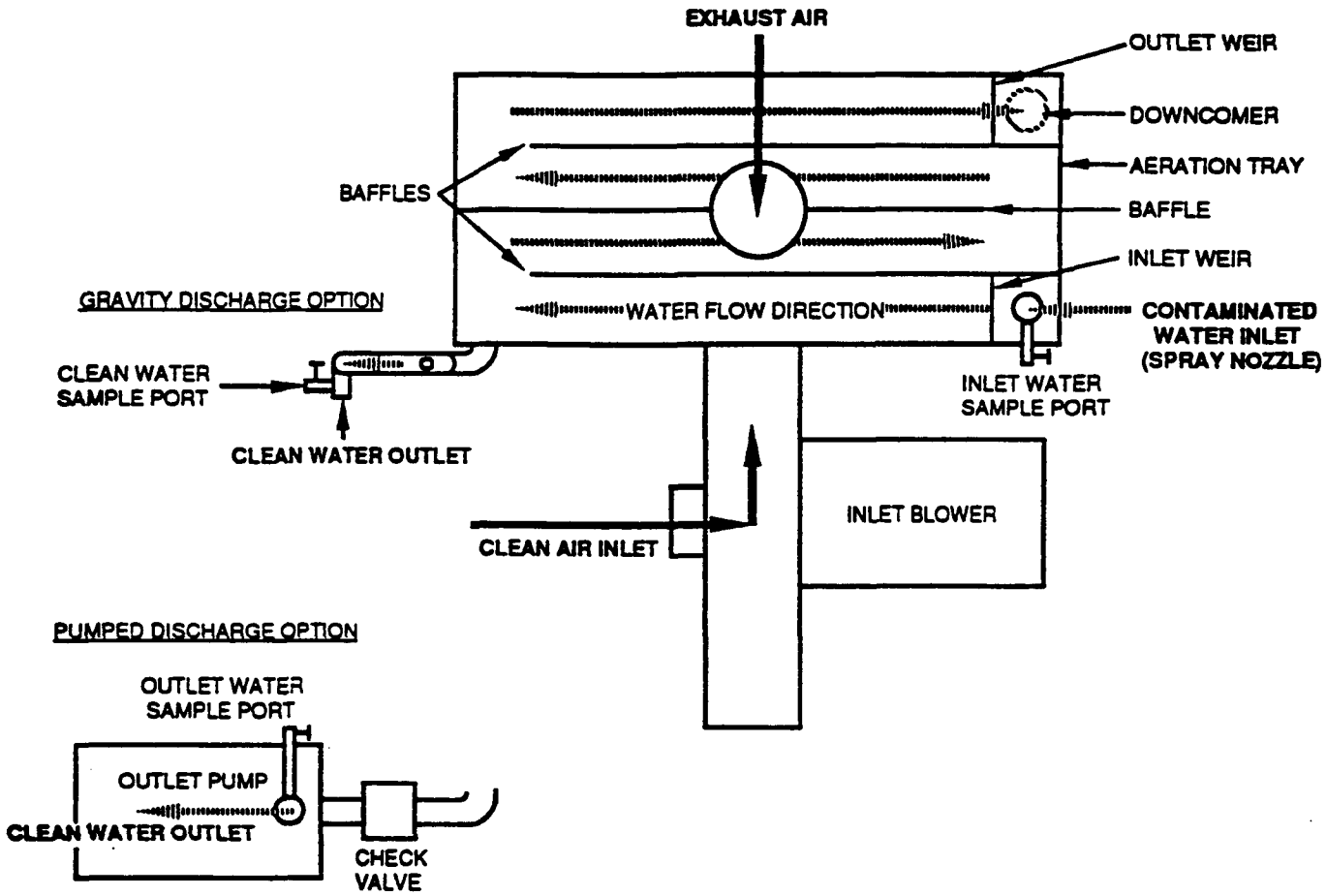


Fig. F-3

NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
(603) 298-7061

TOLERANCES UNLESS OTHERWISE SPECIFIED N/A	DRAWING NAME AERATION PROCESS, TOP VIEW
APPROVALS / DATE	TYPICAL SYSTEM
DRAWN KM / 6/21/91	
	SCALE: NONE / SIZE: A / SHEET 2 OF 2
	DO NOT SCALE DRAWING

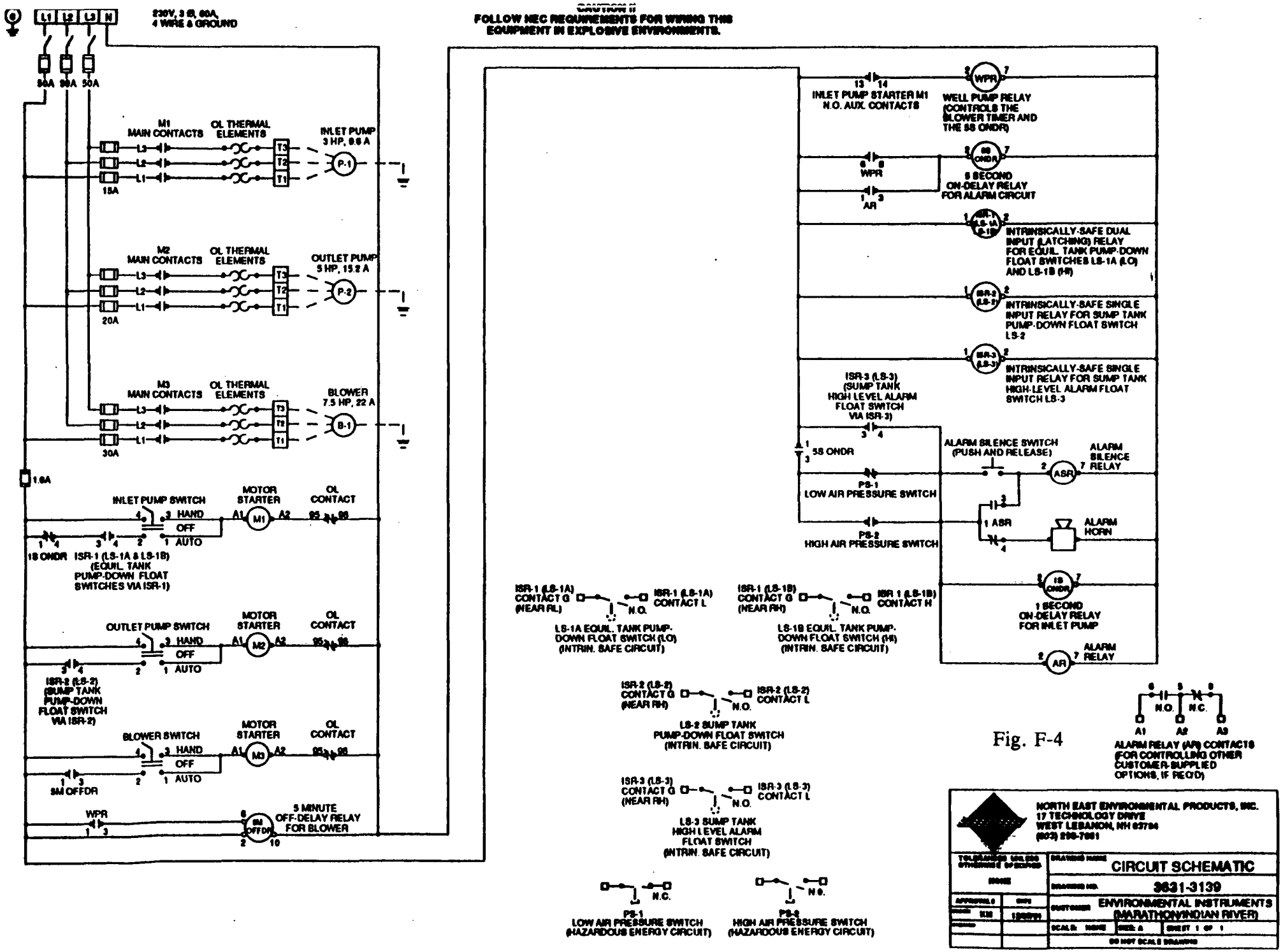

L1 L2 L3 N
230V, 3 Ø, 60A,
4 WIRE & GROUND
50A 50A 50A
CAUTION !!
FOLLOW NEC REQUIREMENTS FOR WIRING THIS
EQUIPMENT IN EXPLOSIVE ENVIRONMENTS.
M1
MAIN CONTACTS
OL THERMAL
ELEMENTS
INLET PUMP
3 HP, 9.6 A
P-1
15A
M2
MAIN CONTACTS
OL THERMAL
ELEMENTS
OUTLET PUMP
5 HP, 15.2 A
P-2
20A
M3
MAIN CONTACTS
OL THERMAL
ELEMENTS
BLOWER
7.5 HP, 22 A
B-1
30A
1.6A
INLET PUMP SWITCH
HAND
OFF
AUTO
MOTOR
STARTER
M1
OL
CONTACT
1S ONDR
ISR-1 (LS-1A & LS-1B)
(EQUIL. TANK
PUMP-DOWN FLOAT
SWITCHES VIA ISR-1)
OUTLET PUMP SWITCH
M2
ISR-2 (LS-2)
(SUMP TANK
PUMP-DOWN
FLOAT SWITCH
VIA ISR-2)
BLOWER SWITCH
M3
5M OFFDR
WPR
5 MINUTE
OFF-DELAY RELAY
FOR BLOWER
INLET PUMP STARTER M1
N.O. AUX. CONTACTS
WELL PUMP RELAY
(CONTROLS THE
BLOWER TIMER AND
THE 5S ONDR)
5S ONDR
5 SECOND
ON-DELAY RELAY
FOR ALARM CIRCUIT
AR
INTRINSICALLY-SAFE DUAL
INPUT (LATCHING) RELAY
FOR EQUIL. TANK PUMP-DOWN
FLOAT SWITCHES LS-1A (LO)
AND LS-1B (HI)
INTRINSICALLY-SAFE SINGLE
INPUT RELAY FOR SUMP TANK
PUMP-DOWN FLOAT SWITCH
LS-2
INTRINSICALLY-SAFE SINGLE
INPUT RELAY FOR SUMP TANK
HIGH-LEVEL ALARM FLOAT
SWITCH LS-3
ISR-3 (LS-3)
(SUMP TANK
HIGH LEVEL ALARM
FLOAT SWITCH
VIA ISR-3)
ALARM SILENCE SWITCH
(PUSH AND RELEASE)
ALARM
SILENCE
RELAY
ASR
PS-1
LOW AIR PRESSURE SWITCH
PS-2
HIGH AIR PRESSURE SWITCH
ALARM
HORN
1S ONDR
1 SECOND
ON-DELAY RELAY
FOR INLET PUMP
ALARM
RELAY
ISR-1 (LS-1A)
CONTACT G
(NEAR RL)
ISR-1 (LS-1A)
CONTACT L
N.O.
LS-1A EQUIL. TANK PUMP-
DOWN FLOAT SWITCH (LO)
(INTRIN. SAFE CIRCUIT)
ISR-1 (LS-1B)
CONTACT G
(NEAR RH)
ISR 1 (LS-1B)
CONTACT H
LS-1B EQUIL. TANK PUMP-
DOWN FLOAT SWITCH (HI)
(INTRIN. SAFE CIRCUIT)
ISR-2 (LS-2)
CONTACT G
(NEAR RH)
ISR-2 (LS-2)
CONTACT L
LS-2 SUMP TANK
PUMP-DOWN FLOAT SWITCH
(INTRIN. SAFE CIRCUIT)
ISR-3 (LS-3)
CONTACT G
(NEAR RH)
ISR-3 (LS-3)
CONTACT L
LS-3 SUMP TANK
HIGH LEVEL ALARM
FLOAT SWITCH
(INTRIN. SAFE CIRCUIT)
N.C.
PS-1
LOW AIR PRESSURE SWITCH
(HAZARDOUS ENERGY CIRCUIT)
N.O.
PS-2
HIGH AIR PRESSURE SWITCH
(HAZARDOUS ENERGY CIRCUIT)
N.O.
N.C.
A1 A2 A3
ALARM RELAY (AR) CONTACTS
(FOR CONTROLLING OTHER
CUSTOMER-SUPPLIED
OPTIONS, IF REQ'D)
NORTH EAST ENVIRONMENTAL PRODUCTS, INC.
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
CIRCUIT SCHEMATIC
3631-3139
ENVIRONMENTAL INSTRUMENTS
(MARATHON/INDIAN RIVER)
SCALE: NONE
SIZE: A
SHEET 1 OF 1
DO NOT SCALE DRAWING

Fig. F-4

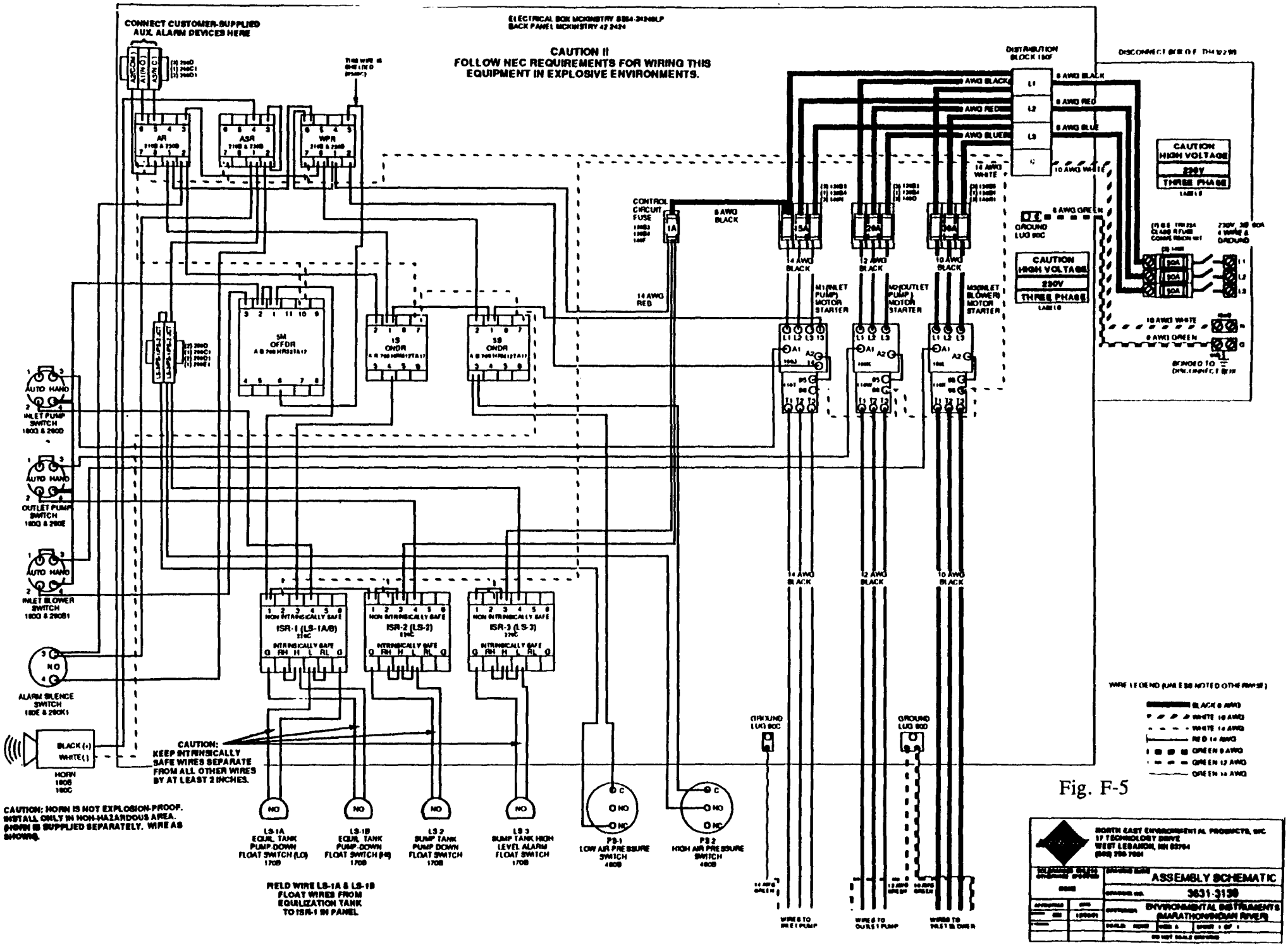

CONNECT CUSTOMER-SUPPLIED AUX. ALARM DEVICES HERE
CAUTION !!
FOLLOW NEC REQUIREMENTS FOR WIRING THIS EQUIPMENT IN EXPLOSIVE ENVIRONMENTS.
DISTRIBUTION BLOCK 180F
CONTROL CIRCUIT FUSE
8 AWG BLACK
14 AWG RED
14 AWG BLACK
12 AWG BLACK
10 AWG BLACK
M1 (INLET PUMP) MOTOR STARTER
M2 (OUTLET PUMP) MOTOR STARTER
M3 (INLET BLOWER) MOTOR STARTER
GROUND LUG 80C
CAUTION HIGH VOLTAGE
230V
THREE PHASE
AR
ASR
WPR
5M OFFDR
1S ONDR
3S ONDR
AUTO HAND
INLET PUMP SWITCH
OUTLET PUMP SWITCH
INLET BLOWER SWITCH
ALARM SILENCE SWITCH
HORN
ISR-1 (LS-1A/B)
ISR-2 (LS-2)
ISR-3 (LS-3)
NON INTRINSICALLY SAFE
INTRINSICALLY SAFE
CAUTION: KEEP INTRINSICALLY SAFE WIRES SEPARATE FROM ALL OTHER WIRES BY AT LEAST 2 INCHES.
CAUTION: HORN IS NOT EXPLOSION-PROOF. INSTALL ONLY IN NON-HAZARDOUS AREA. (HORN IS SUPPLIED SEPARATELY. WIRE AS SHOWN).
LS-1A EQUIL TANK PUMP-DOWN FLOAT SWITCH (LO)
LS-1B EQUIL TANK PUMP-DOWN FLOAT SWITCH (HI)
LS 2 SUMP TANK PUMP DOWN FLOAT SWITCH
LS 3 SUMP TANK HIGH LEVEL ALARM FLOAT SWITCH
PS-1 LOW AIR PRESSURE SWITCH
PS 2 HIGH AIR PRESSURE SWITCH
FIELD WIRE LS-1A & LS-1B FLOAT WIRES FROM EQUILIZATION TANK TO ISR-1 IN PANEL
WIRE TO INLET PUMP
WIRE TO OUTLET PUMP
WIRE TO INLET BLOWER
WIRE LEGEND (UNLESS NOTED OTHERWISE)
BLACK 8 AWG
WHITE 10 AWG
WHITE 14 AWG
RED 14 AWG
GREEN 8 AWG
GREEN 12 AWG
GREEN 14 AWG
NORTH EAST ENVIRONMENTAL PRODUCTS, INC
17 TECHNOLOGY DRIVE
WEST LEBANON, NH 03784
ASSEMBLY SCHEMATIC
3631-3138
ENVIRONMENTAL INSTRUMENTS (MARATHON/INDIAN RIVER)

Fig. F-5

Appendix G

Appendix G

Soil Venting Pilot and Field Layout

Pilot Rationale

In July, 1991, Marathon contracted a soil venting pilot project with Environmental Science and Engineering, Inc. The purpose of the pilot was to obtain basic data on airflow rate, suction pressure, and produced gas composition from a shallow zone test plot.

Soil in the area is generally composed of a silt layer several feet thick overlying the alluvium of sand/gravel above the shallow bedrock. Shallow zone water is found above and occasionally within the fractured bedrock but has a distinctive area of confinement and is not part of any extensive shallow ground water found elsewhere in the Upper Queen. The silt layer of the surface soil is much less permeable than the gravel layer below. As it turns out this fortunate occurrence promotes airflow at depth and extends the radius of influence of any venting operation.

Pilot Location

Vapor headspace readings indicated the presence of strong hydrocarbon vapors in several wells near the arroyo and the final site for the venting pilot was located near such a well. The hydrocarbon contents in monitor well vapors were obtained with both a flame ionization detector (FID) instrument and a photo ionization detector (PID) instrument.

At contractor's recommendation, new wells were drilled for the pilot study. One well was drilled for the venting well and a row of three observation wells was placed to detect vacuum produced by the venting well. The new venting well was completed in a manner similar to existing monitor wells so that the performance of the pilot would indicate potential for venting existing monitor wells.

Fig. G-1 shows the general location of the venting pilot test in the field and Fig. G-2 is an expanded view of the pilot area and shows the well configurations used for the test. The pilot is situated along the line connecting monitor wells MW-14 and MW-33.

Well Configuration

We obtained soil samples and headspace gas vapor contents in the wells drilled for the venting pilot. Fig. G-3 shows the completion diagram for the vented well and Fig. G-4 shows the HNu readings (PID) of drill cuttings' headspace gas as a function of depth. The contamination is clearly not uniform and is concentrated near the water level at the TD of the well. Later measurements of cuttings' headspace gas with the more sensitive OVA (FID) method confirmed this trend with depth. Samples with the highest headspace readings were chosen for cuttings' analyses of total petroleum hydrocarbon (TPH).

The concentration of contamination in the deepest part of the well represents a significant challenge to normal venting operations because the airflow moving into a screened section of the well varies with depth and is least at greatest depth. This means the efficiency of contact of air with the greatest contaminated soil horizon is low in homogeneous soil. At Indian Basin, the soil is not homogeneous and the low permeability silt layer above the gravel, combined with the very great permeability in the gravel, improves airflow at depth and improves contact with contaminated soil, Fig. G-5.

Pilot Operation

Venting was conducted in two phases due to equipment failure. Phase one used a regenerative blower and phase two used a positive displacement blower. In both phases airflow was relatively steady at around 150 cfm with a suction pressure of 28 inches of water.

The produced gas varied widely in volatile organic carbon (VOC) during the test. We expected to see a dramatic decrease in VOC levels after

only a few days of operation based on some preliminary laboratory results in lucite cylinders loaded with field soil from contaminated zones.

Venting Rate and Vapor Concentration

Fig. G-6 shows the venting concentration profile observed in both phases of the study. In the first phase it shows an early period of stabilization of several days, followed by a slow decline in VOC for twelve days, at which point the equipment failure occurred.

The second phase began after a hiatus of 18 days and exhibited an initial concentration much higher than observed during the first phase of venting. Concentration did fall off very quickly, but stabilized at levels still higher than those observed at the end of the first phase. During the latter part of the second phase of venting the concentration leveled off at about 3500-4000 ppm with little decline.

Hydrocarbon Extraction and Fluid Levels

Hydrocarbon removed during both phases of venting averaged 50 lb/day, or about 9 barrels of hydrocarbon over the venting period. This compares to about 42 barrels of hydrocarbon produced by all pumped Lower Queen wells up to January 31, 1992 (Appendix C). This indicates significant upside potential for venting for hydrocarbon removal in the vadose zone.

Marathon is encouraged by the soil venting pilot results and will initiate a field program to use soil venting to augment treatment of the waters. The plan is based on the field observation that vented air concentrations rose from phase one to phase two, and during this period fluid levels in the neighboring monitor wells fell by about 0.7 ft, Table G-1.

Table G-1 Fluid Levels in Monitor Wells During Soil Venting Study		
Date	Level in MW-33 (TOC*)	Level in MW-13 (ft TOC*)
9/25	16.65	15.46
9/26	16.65	15.56
9/27	16.75	15.60
9/28	16.85	15.70
9/29	16.94	15.78
10/1	17.10	15.92
10/3	17.20	16.05
10/4	17.25	16.10
10/9	17.47	16.34
10/26	17.98	17.02
10/27	18.02	17.06
10/28	n.a.	17.10
11/1	n.a.	17.15
11/2	n.a.	17.25
11/4	n.a.	17.24
11/7	18.28	17.36
11/8	18.28	17.30
* TOC = top of casing		

Our assumption is that falling fluid level exposes more contaminated gravel to airflow, and that this increased VOC in the vented air. A similar explanation of VOC concentration of a venting project at a Florida landfill site was given recently (Remediation, Winter 1991/92, p.19-37). Other

explanations, including the possible movement of a small product pool closer to the well during phase two, are possible. However, this is unlikely as the fluid in the vent well was pumped during phase one only. The vent well was not pumped during phase two.

Field Implementation of Soil Venting

The blower selected for field venting is a positive displacement, electric motor-driven unit with an auxiliary diesel generator for power. The blower and air treating components are supplied as a skid mounted system and are illustrated in Fig. G-7. The blower system includes an 80-gallon water knock-out tank, vacuum relief valve, in-line air filter, discharge silencer, sample ports, 2 vacuum gauges, and a sheave set for variable speed options. The 10 hp blower is equiped with an explosion proof starter. Blower specifications (performance data) for suction mode are illustrated in Fig. G-8.

The operating field procedure is to minimize liquid in the shallow zones where venting is planned. This requires a careful selection of areas where shallow zone pumping has a chance to reduce fluid level without excessive rate. These areas are tentatively identified in Fig. G-9.

The venting process uses several wells connected to a single blower by a manifold. The blower chosen is of sufficient capacity to meet but not exceed air emission regulation limitations. The best estimate available today from the venting pilot is that three wells of similar capacity can be vented at the same time. As venting is allowed to mature and VOC level decreases, more wells can be vented up to the limit of the blower capacity. As the concentration approaches a value where venting is no longer effective, a new well group is identified based on headspace readings and water levels.

If patterns with insufficient water level control are encountered, venting will take place with no active control on water level. It may be that an occasional rainfall increases water level temporarily. It is then useful to re-sample such water for indications of soluble product. If necessary, venting could be re-started in such locations, depending on the availability of the unit at that time.

The goal is to complete as many patterns as possible with a single application of venting during extended drawdown conditions. If schedules permit, this can be completed within about one year of venting for the patterns shown in Fig. G-9. At that time the venting can be continued on a trial basis on patterns where fluid level control is impossible or on dry wells with residual headspace readings.

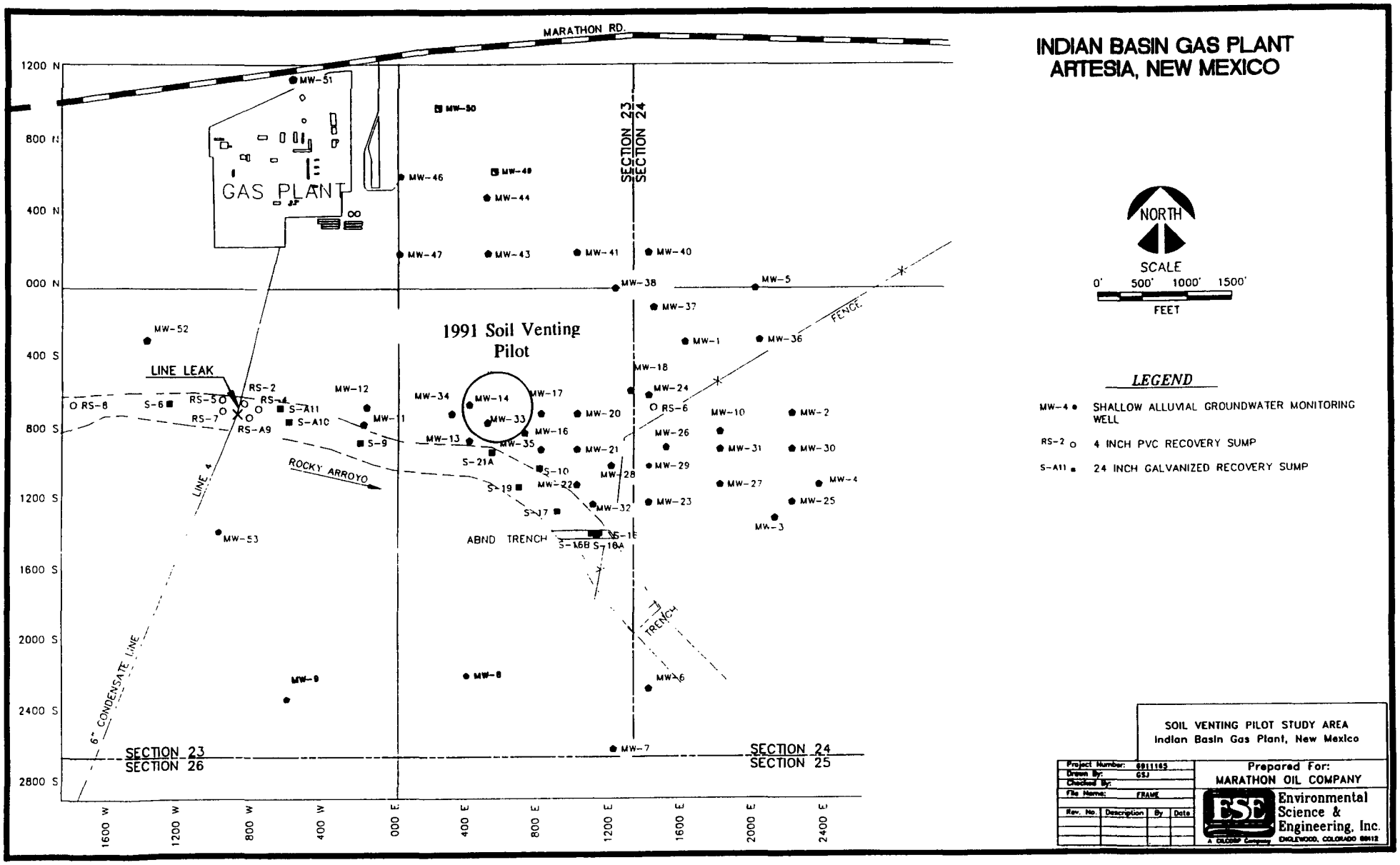


Fig. G-1 Soil Venting Pilot Location (Shallow Zone)

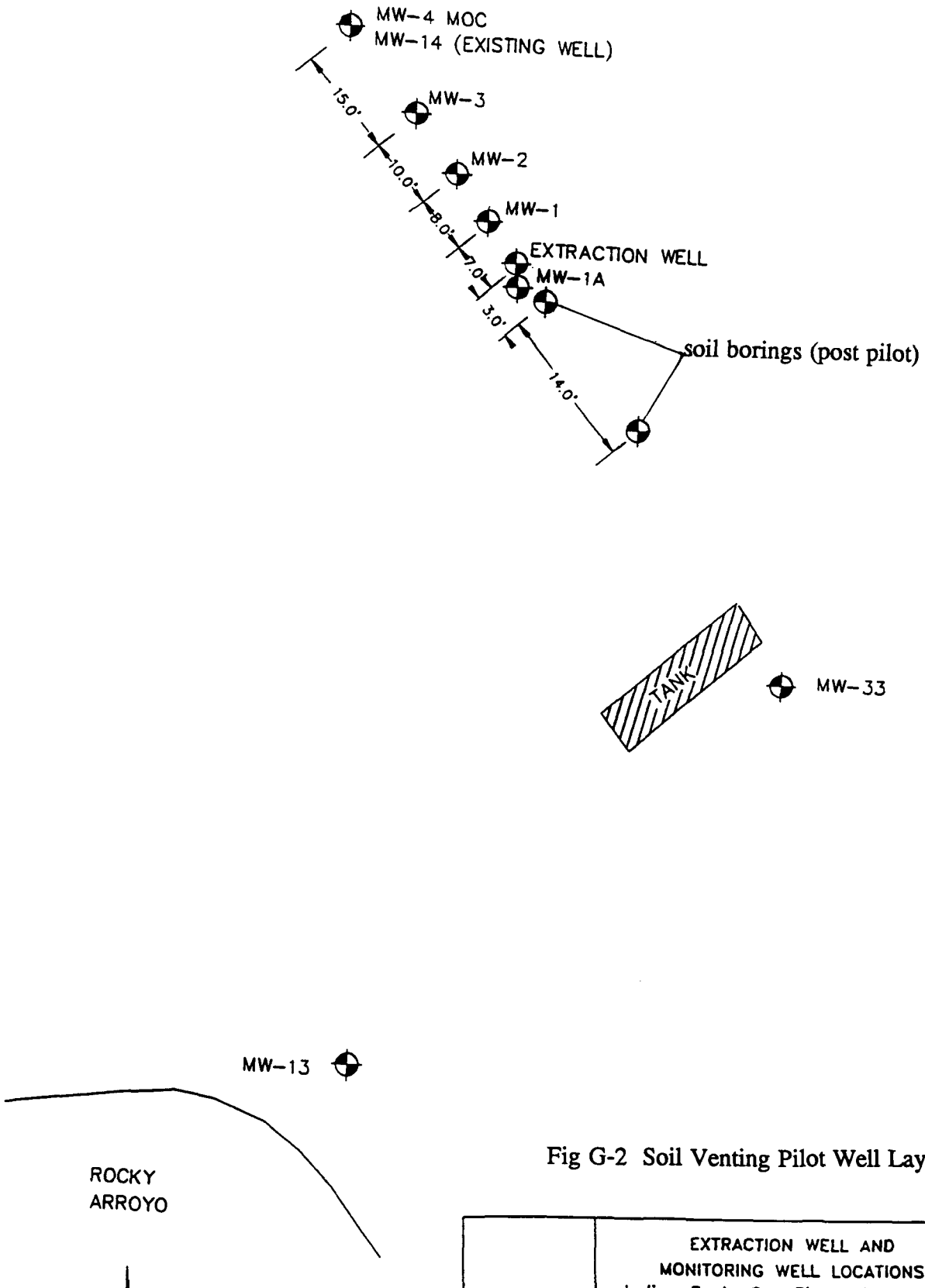


Fig G-2 Soil Venting Pilot Well Layout

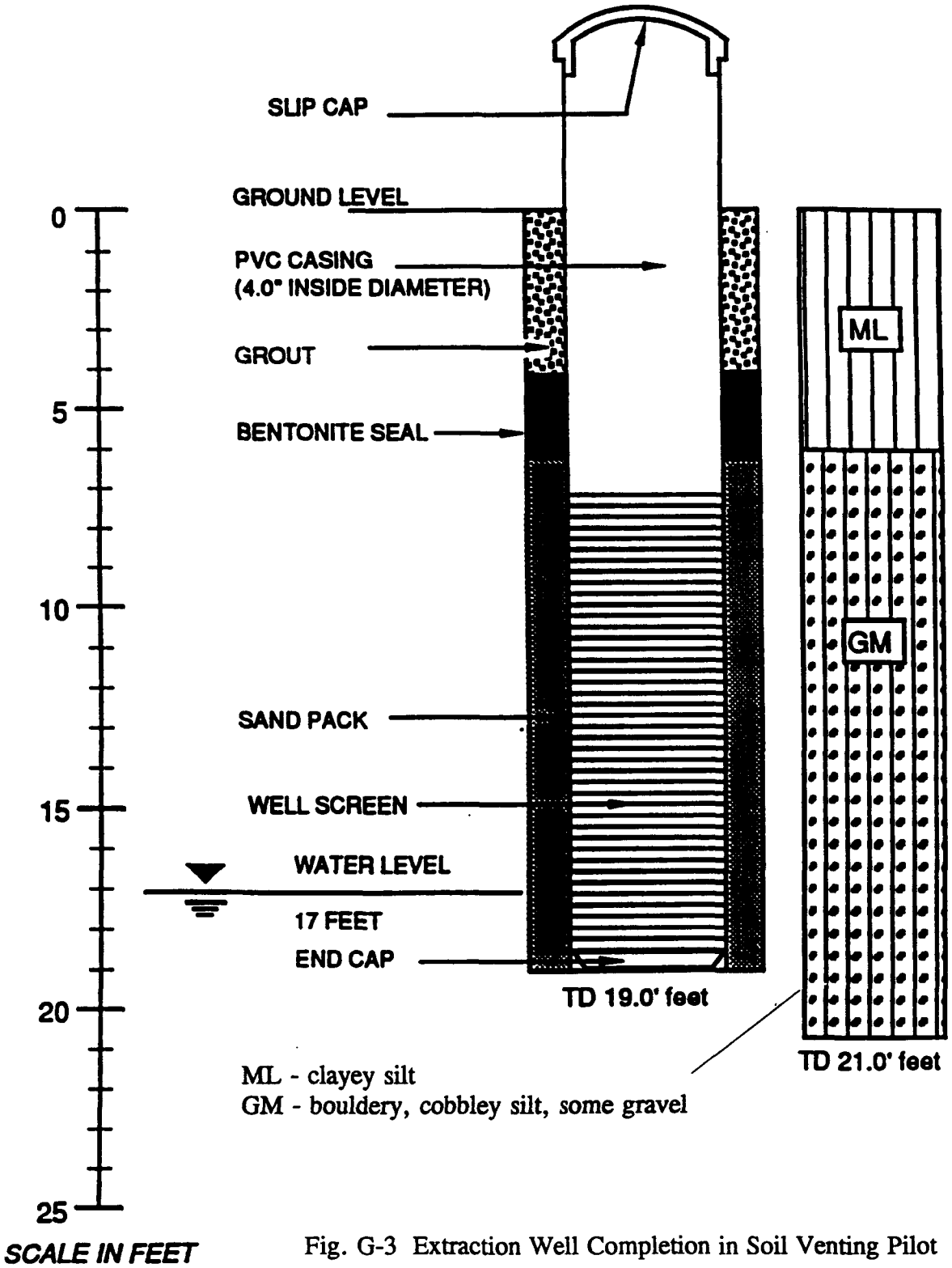
EXTRACTION WELL AND
MONITORING WELL LOCATIONS
Indian Basin Gas Plant, New Mexico

Project Number:	6911165
Drawn By:	GSJ
Checked By:	
File Name:	FRAME

Rev. No.	Description	By	Date

Prepared For:
MARATHON OIL COMPANY

Environmental Science & Engineering, Inc.
A CILCORP Company
ENGLEWOOD, COLORADO 80112



ML - clayey silt
GM - bouldery, cobbley silt, some gravel

Fig. G-3 Extraction Well Completion in Soil Venting Pilot

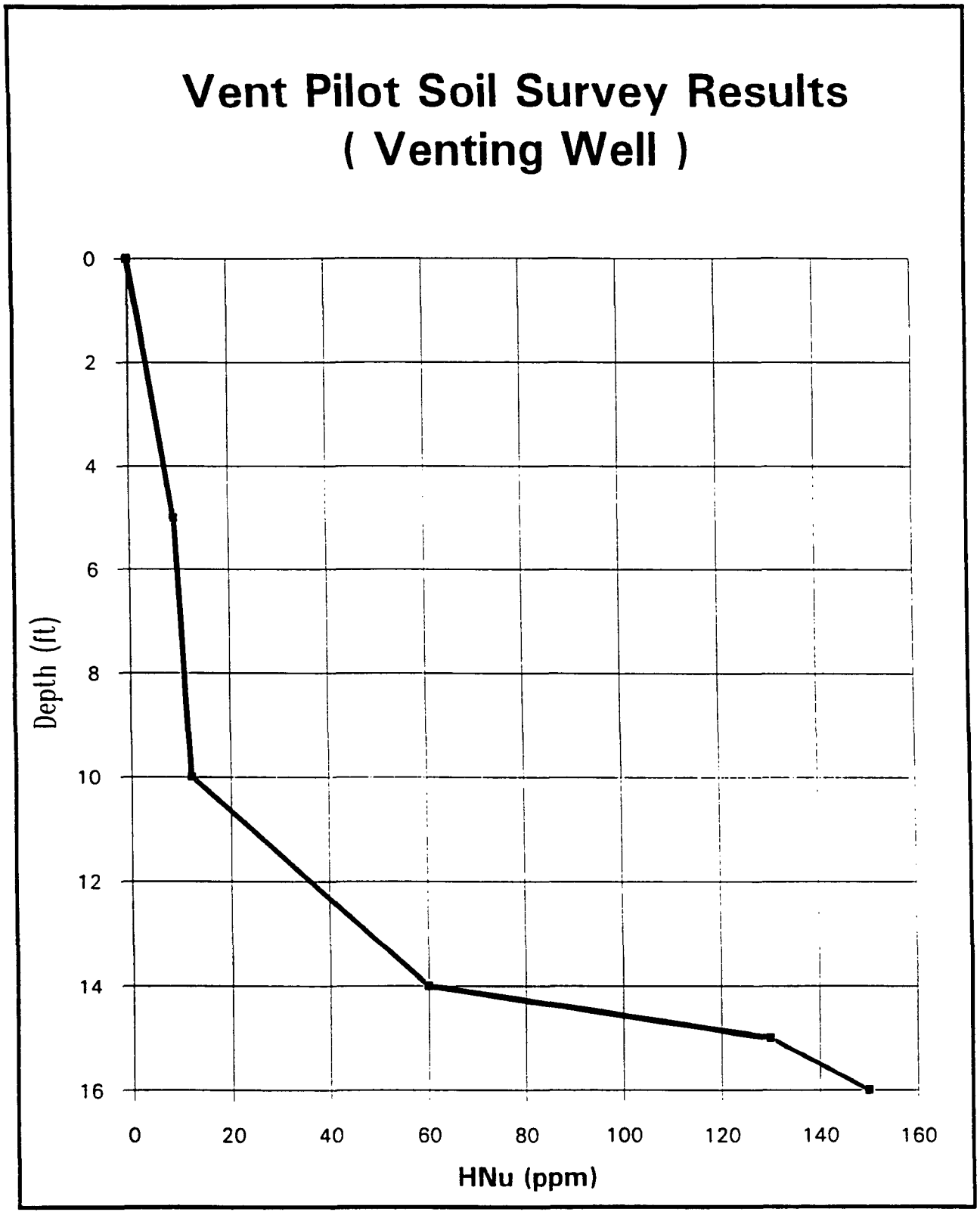


Fig. G-4 Volatile Hydrocarbon Profile as HNu in Venting Pilot

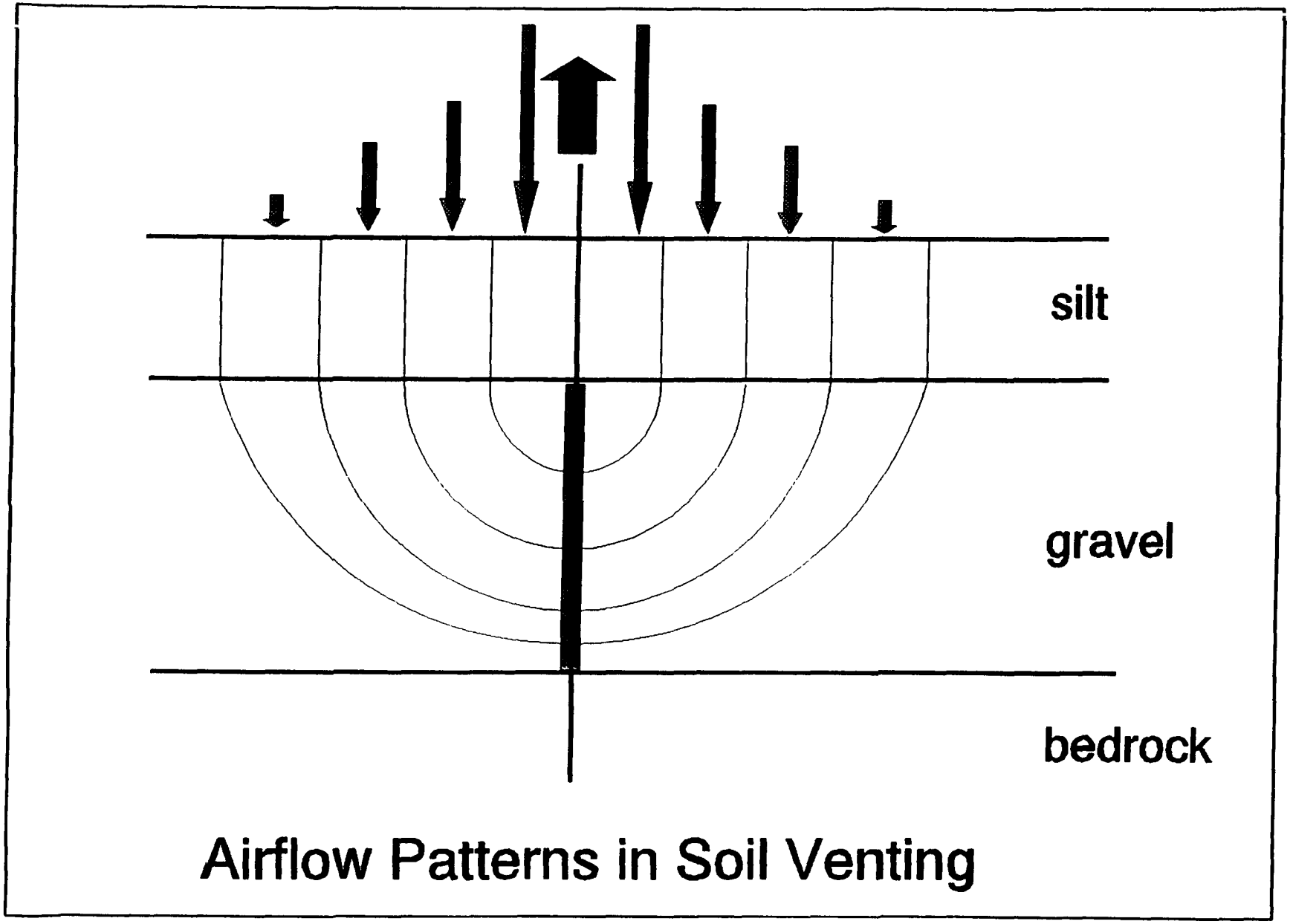


Fig. G-5 Airflow Patterns in Gravel Covered by Silt

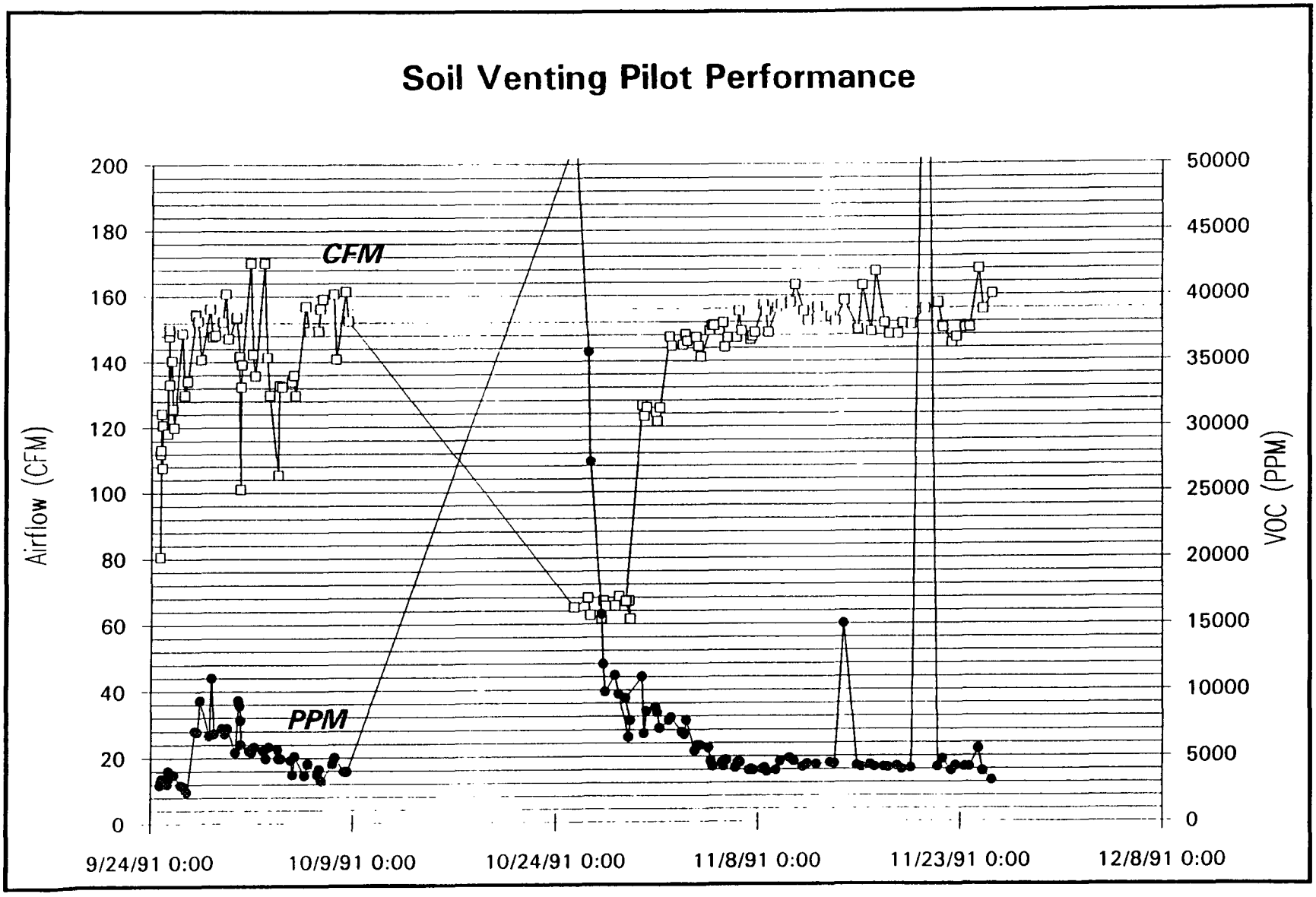


Fig. G-6 Soil Venting Pilot Performance

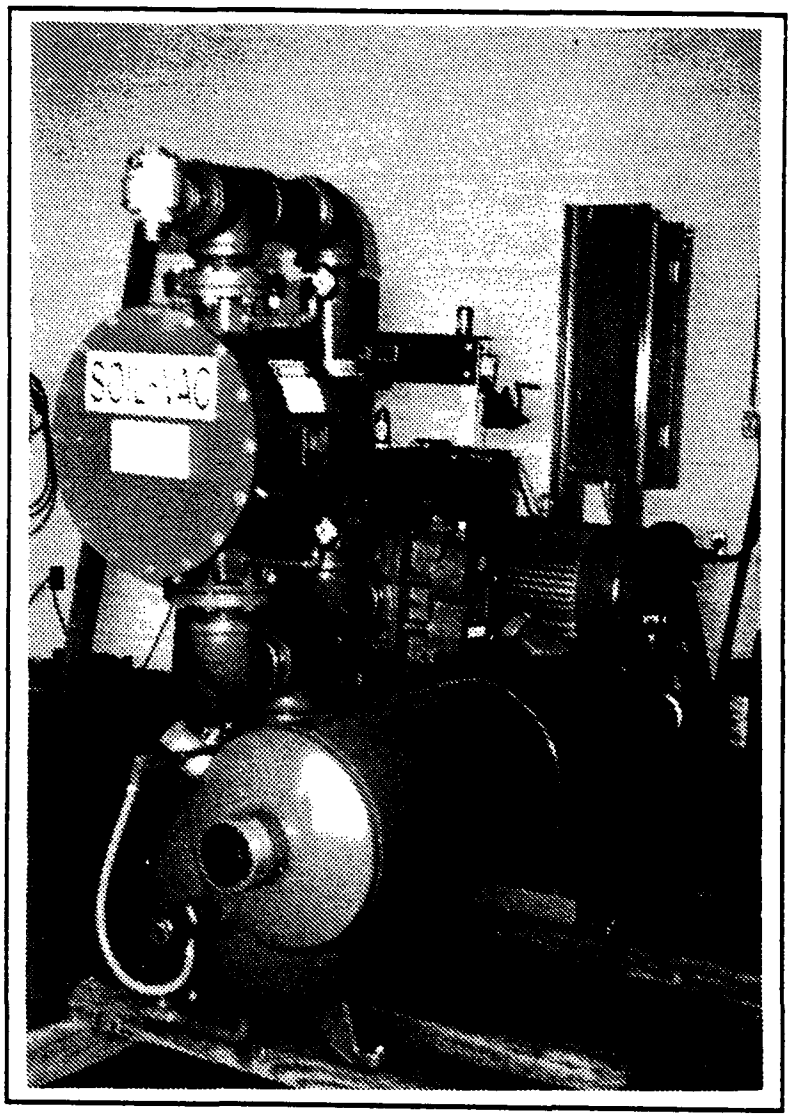


Fig. G-7 Blower System Components

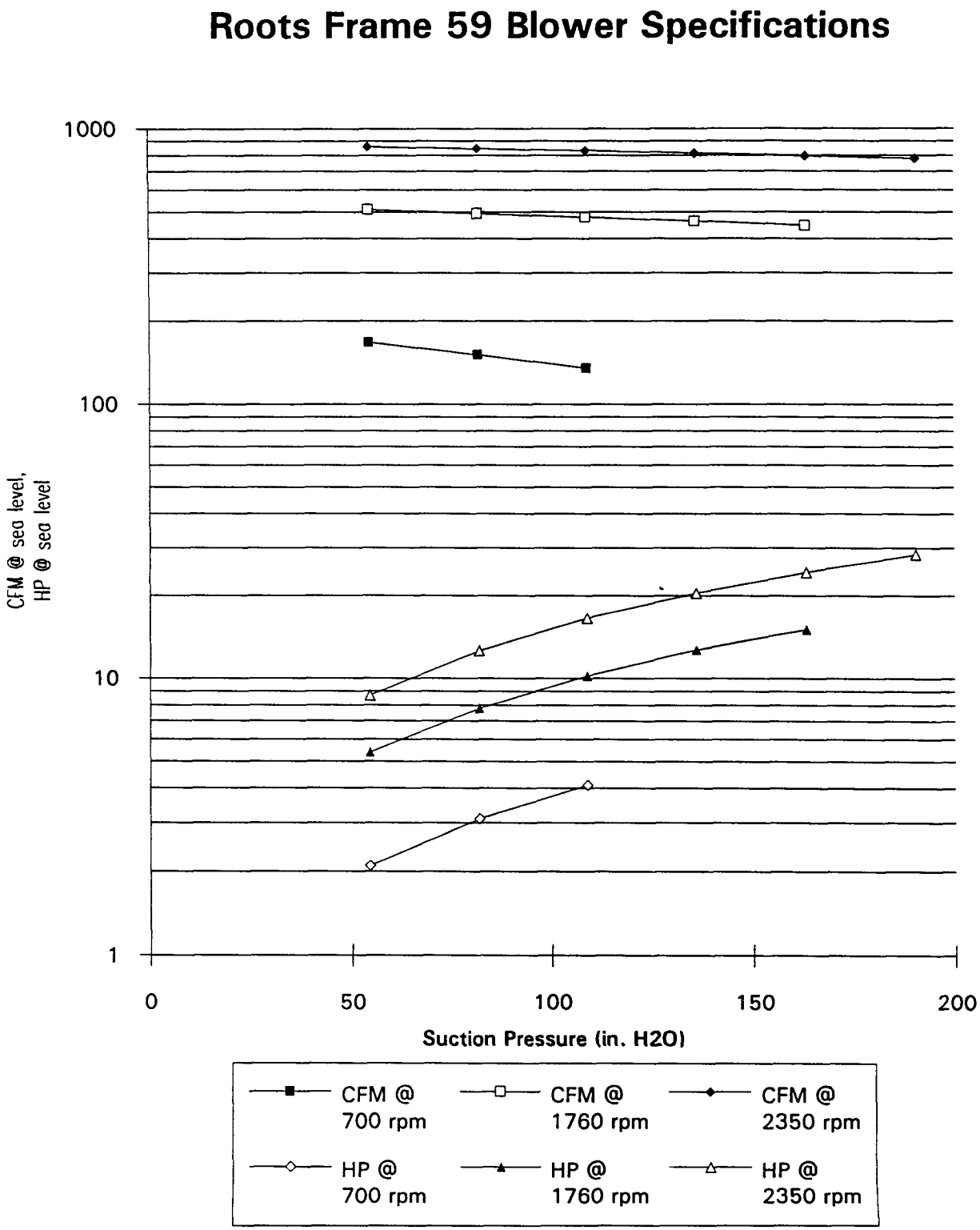


Fig. G-8 Blower Performance Curve for Field Application of Venting

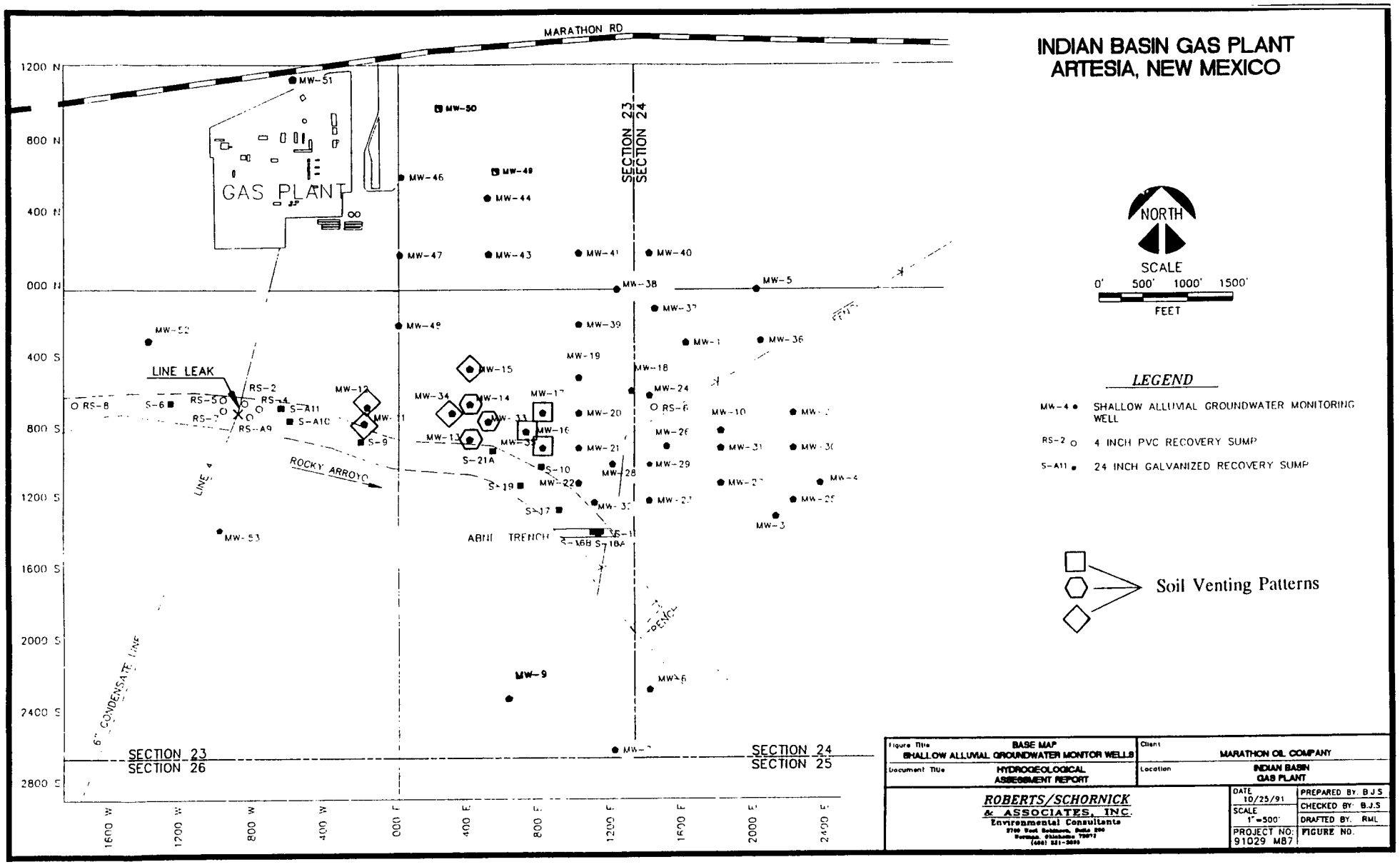


Fig. G-9 Venting Patterns for Field Application of Venting

Appendix H

Appendix H

Sampling Schedule for Shallow and Deep Wells

The schedules for sampling of Shallow zone and Lower Queen water are determined by a need to monitor plume movement in a timely and cost-effective manner. Three kinds of sample strategies are generally recognized to handle the different needs of a large treatment program.

Indicator Samples

This category of sampling represents those which need consistent and systematic repeats but are generally inexpensive, easy to use, and diagnostic but not yet accepted for regulatory decision making. Examples of this kind of sampling are effluent monitoring from the air stripper and the most frequently sampled monitor wells for plume identification. To reduce costs and provide the frequency of sampling needed for rapid identification of potential problems, we choose the HPLC UV absorption method discussed in the section **Monitoring Program** in the report.

Routine Samples

Routine sampling is used to establish reference bench marks of the progress of the treatment plan. In the past we refer to these as point-in-time sample rounds where as many wells as possible are sampled in the shortest time possible. In Indian Basin the well distances and depths combine to make sampling a chore and a very expensive proposition. In order to provide the maximum amount of data for the bench marks of progress we will also use the HPLC method for water analyses, as field comparisons with the purge and trap EPA 8020 were favorable.

Special Samples

Special samples are those used as supplementary information not directly related to the treatment goals but likely to be important for occasional, unique requests. In this category we also fit the special needs of ranchers and other private parties. For these purposes we will continue to rely on independent, certified laboratory analyses with EPA approved analysis techniques.

Sample Locations for Monitoring

Water samples from soil water and Lower Queen water will be analyzed for BTEX constituents and chlorides, with occasional hardness tests. BTEX analyses provide benzene concentration, our chemical of concern. The following tables list the wells to be sampled, frequency of sampling and parameters measured.

The wells listed are considered a maximum number to be sampled during any one quarter. There are times when it is either impossible to obtain all samples indicated, or when it is unnecessary because of the plume dynamics. For example, it is impossible to sample a shallow zone well if it is dry or cannot be adequately purged. For Lower Queen wells, it is unnecessary to forever sample quarterly those upgradient wells and other wells which have always shown non-detectable benzene.

Routine Water Sampling Schedule
Lower Queen Monitor Wells

Well No.	Sampling Parameters	Frequency
BH-83 (MW-57)	BTEX's & chloride	quarterly
R BH-84 (MW-58)	"	"
R BH-85 (MW-59)	"	"
BH-86 (MW-60)	"	"
R BH-87A (MW-61A)	"	"
R BH-88 (MW-62)	"	"
BH-89 (MW-63)	"	"
BH-90 (MW-64)	"	"
R BH-91A (MW-65A)	"	"
BH-92 (MW-66)	"	"
BH-93 (MW-67)	"	"
R BH-94 (MW-68)	"	"
BH-97 (MW-70)	"	"
SW-1 (plant well)	"	"
SW-2 (backup well)	"	"

Routine Water Sampling Schedule
Shallow Zone Wells

Well/Pit ID	Sampling Parameters	Frequency
BH-24 (MW-3)	BTEX's & chloride	quarterly
BH-28 (MW-5)	"	"
BH-29 (MW-6)	"	"
BH-30 (MW-7)	"	"
BH-31 (MW-8)	"	"
BH-32 (MW-9)	"	"
BH-33 (MW-10)	"	"
BH-34 (MW-11)	"	"
BH-36 (MW-13)	"	"
BH-42 (MW-19)	"	"
BH-47 (MW-24)	"	"
BH-53 (MW-29)	"	"
BH-56 (MW-32)	"	"
BH-61 (MW-38)	"	"
BH-67 (MW-44)	"	"
BH-71 (MW-48)	"	"
BH-73 (MW-50)	"	"
BH-75 (MW-52)	"	"
BH-77 (MW-53)	"	"
BH-80 (MW-54)	"	"
BH-81 (MW-55)	"	"
BH-82 (MW-56)	"	"
BH-95 (MW-69)	"	"
Pits A10, 16A	"	"

Appendix I

Appendix I

Quality Assurance Document

Marathon's responsibility as operator of this treatment program is to perform reliable and valid field procedures and obtain analytical laboratory data for groundwater monitoring for the duration of the monitoring period. These responsibilities include providing trained field personnel, using proper sampling techniques, and providing quality assurance for field and laboratory procedures for sample identification, handling and preservation, and sample analysis. Samples will be measured primarily for BTEX and chlorides (Appendix H).

Sample Acquisition Personnel

Monitor and recovery wells in the treatment area will be sampled quarterly (Appendix H) by trained personnel. Past point-in-time sample rounds were supervised by an independent environmental contractor and were conducted by this contractor's personnel with Marathon employee and contract employee participation. Future point-in-time sample rounds will be conducted with a similar mixture of independent environmental contractor personnel and Marathon personnel until the necessary training is completed.

Area wells and springs will continue to be sampled by trained Marathon environmental specialists, as in the past. Samples are taken using established field procedures at each of these sites, chain-of-custody documentation, shipping and handling, and independent laboratory analyses, as in the past.

Sample Acquisition Methods

Monitor wells are purged prior to sampling with portable submersible pumps or compressed air bladder pumps for three casing volumes. In shallow zone wells not equipped with bladder pumps, a portable electric

submersible pump will be used for purging. In low yield wells the purge volume is reduced to the amount which can be pumped to dryness or pump limitation. Recovering wells are tested for pH, temperature, and conductance to check for sample stability. Samples from wells which recovery in more than two hours are rejected.

Purge water and excess sample water are collected in drums for later removal and disposal.

The portable pump is decontaminated between wells with an Alconox wash, rinsed with a hydrocabon-free water, rinsed again with de-ionized water, on both internal surfaces (by pumping) and external surfaces exposed to sample water or contacted by the wellbore.

Sample bottles are filled with minimum contact with air and checked for gas (and refilled, if necessary). Bottles are labelled and iced immediately at the wellhead.

Recovery wells are sampled from pressurized flow lines at the surface as the wellhead construction does not permit sampler insertion into the well.

Quality Assurance (Field)

Sample bottles are glass with fluorocarbon resin-lined caps. Samples are taken directly from field sample bottles without bottle-to-bottle transfer. Contact with air is kept to an absolute minimum throughout the sample recovery, handling, and preparation phases.

Filled sample bottles from the field are brought to the plant chemical laboratory, labels are checked for completeness, and samples are stored on-site in a refrigerator at 4°C until the samples are ready for packing and shipping to the PTC analytical laboratory. Standard custody transfer forms are used for shipment and validation purposes.

A complete sample log of the day's collection is maintained by the sampling crew. The field logbook is the single most important record of sample handling and field observations at the time of sampling.

A field sample trip blank is taken to the field on each day and is treated in the same manner as the samples actually taken from the wellheads. Equipment blanks are obtained from the portable samling pump from the final rinse water used for decontamination, one sample at the beginning of the day and one at end of a day of sampling.

Quality Assurance (Laboratory)

The HPLC technique for BTEX and chlorides analyses of monitor and recovery wells was developed for this project by Marathon's research center personnel and field tested by the equipment manufacturer. In the HPLC method a filtered water sample is injected directly into the separation column. Inorganics and ionic organics are then eluted with water. The organics of interest which remain are then eluted with a mixture of water and acetonitrile. Aromatics are measured by absorption of ultra-violet light at 202 nm. The technique is robust and less prone to operator inexperience than a conventinal purge-and-trap GLC method and has been used in four separate Marathon field operations to monitor tracers in water injection studies. Analyses will be conducted in Denver at Marathon's research center.

Laboratory sample blanks and spiked sample tests will be used in each quater sampling round to provide instrument checks, bottle checks, and environment suitability for sampling at low ppb levels.

Periodic monitoring and performance of the HPLC method in the laboratory will be conducted using auxiliary HPLC and state-of-the-art purge-and-trap equipment at Marathon's PTC.

Appendix J

Appendix J

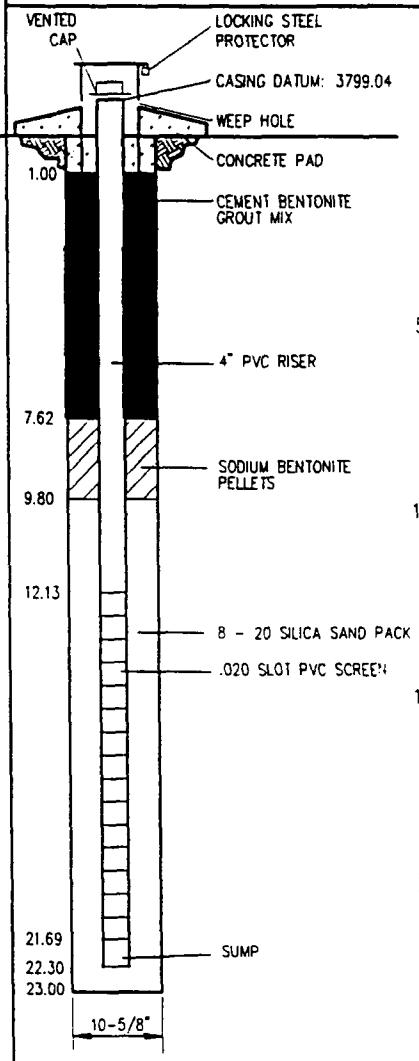
Wellbore Completion Diagrams

Completion diagrams for typical shallow zone and Lower Queen monitor wells are included here. In addition to completion detail, these show depth to water, lithology descriptions, and soil classifications.

Appendix J

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3797.3				
	0	SILT: WEAK RED 2.5 YR 5/2, LOOSE, DRY	ML		1 GC NS	
	2.8	SILTY CLAY: REDDISH BROWN 5 YR 5/3, 25% SILT, 15% CALICHE DEPOSITS, FIRM, FRIABLE, DRY	CL		2 .3 NR	
	4.7 5	SILTY CLAY: PINK 7.5 YR 7/3, 20% SILT, 30% CALICHE DEPOSITS, FIRM, FRIABLE, DRY	CL		3 .2 NR NS 4 .5	
	8.5 10	CLAYEY GRAVEL AND COBBLES: GRAVEL IS DOLOMITIC LIMESTONE, GRAY 5 YR 5/1, DENSE, 60% GRAVEL, 10% COBBLES, 30% CLAY, CLAY IS LIGHT BROWN 9.5 YR 6/3, DRY	GC		5 .0 NR NS 6 .0 NR	
15.03'	14.5 15	CLAYEY GRAVEL AND COBBLES: AS ABOVE BUT SATURATED BELOW 14.5' WITH STRONG HYDROCARBON ODOR	GC		7 0.8 NR NS	
	18.0 20	SILTY SANDSTONE: OLIVE GRAY 5 YR 5/2, VERY SOFT, VERY FINE GRAINED, VERY POORLY CEMENTED, VERY FINELY BEDDED, SATURATED, STRONG HYDRO-CARBON ODOR	SILTY SAND STONE		8 0.8 NR 9 0.5 NS	
	22.5 23.0	POSSIBLY DOLOMITE BELOW 22.8', VERY HARD	DOLOMITE		10 0.3 NS	
	25	AUGER REFUSAL AT 23.0'				
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

JOB NAME/NUMBER ***MW-41 (BH-64)***

BORING NUMBER ***MARATHON/91029***

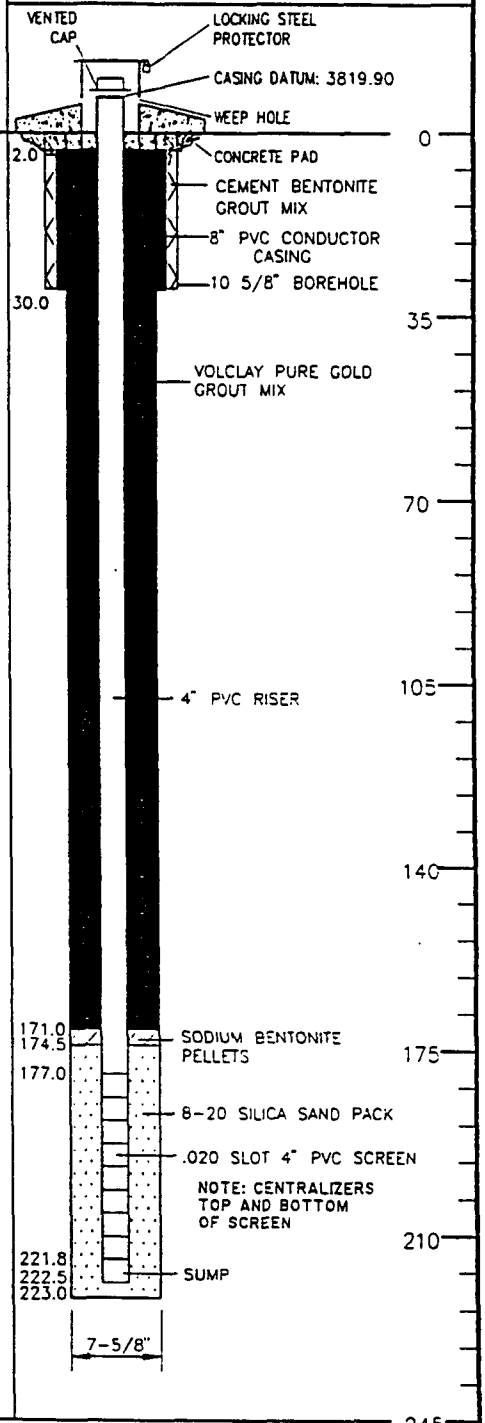
DATE DRILLED 5/30/91
DRILLING METHOD HSA/SS
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY SAR

PAGE 1 OF 1

Typical Shallow Zone Completion

Appendix J

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #88 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3817.00				
	0	0.3 CLAYEY SILT:	ML			
	8.0	CHERTY DOLOMITE:	CRT.DOLO.			
	10.0	SILTSTONE CHERTY DOLOMITE:	CRT.DOLO.			
	12.0	CHERTY DOLOMITE:	CRT.DOLO.			
		DOLOMITIC SILTSTONE:	DOLO. SILTSTONE			
	22.0	SANDSTONE:	SS			
	30.0	SANDSTONE:	SS			
	34.0	SANDSTONE:	SS			
	35					
	40.0	SANDSTONE:	SS			
	42.0	SANDSTONE:	SS			
	50.0	SANDSTONE:	SS			
	52.0	SANDSTONE:	SS			
	54.0	SANDSTONE:	SS			
	66.0	CHERTY DOLOMITE:	CRT.DOLO.			
	70					
	72.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	74.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	77.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	92.0	CHERTY DOLOMITE:	CRT.DOLO.			
	96.0	CHERT:	CHERT			
	100.0	CHERTY DOLOMITE:	CRT.DOLO.			
	102.0	CHERTY DOLOMITE:	CRT.DOLO.			
	105					
	106.0	CHERTY DOLOMITE:	CRT.DOLO.			
	114.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	116.0	CHERTY DOLOMITE:	CRT.DOLO.			
	128.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	134.0					
	136.0	SANDSTONE & CHERTY DOLOMITE:	SS/CT.DOL			
		CHERTY DOLOMITE:	CRT.DOLO.			
	140					
		DOLOMITIC SANDSTONE:	DOLO.SS			
	150.0					
	154.0	DOLOMITIC SANDSTONE:	DOLO.SS			
		CHERTY DOLOMITE:	CRT.DOLO.			
	162.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	164.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	174.0					
	175					
		CHERTY DOLOMITE:	CRT.DOLO.			
▽ 188.36	184.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	190.0	CHERTY DOLOMITE:	CRT.DOLO.			
	198.0					
	200.0	CHERTY DOLOMITE:	CRT.DOLO.			
▽ 205.0	202.0	CHERTY DOLOMITE:	CRT.DOLO.			
	204.0	CHERTY DOLOMITE:	CRT.DOLO.			
		CHERTY DOLOMITE:	CRT.DOLO.			
	210					
	211.0	SANDSTONE:	SS			
	223.0					
		BORING TERMINATED AT 223.0'				
		NOTE: SEE LOG BH-88 FOR MORE IN-DEPTH DESCRIPTION.				
	245					



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-62 (BH-88)*

DATE DRILLED 7/24/91 CONDUCTOR INSTALLED 7/20/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY DHC
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3805

Typical Lower Queen Well Completion

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
'95 MAR 8 AM 8 52

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

March 3, 1995

Mr. William C. Olson
Hydrogeologist
Oil Conservation Division
2040 Pacheco Street
Santa Fe, New Mexico 87505

Re: Line #1 Pipeline Spill Assessment
Marathon Indian Basin Gas Plant
Eddy County, New Mexico

Dear Mr. Olson:

In response to your letter dated January 6, 1995, Marathon is submitting this workplan to address the Oil Conservation Division (OCD) request to define the vertical extent of contamination related to a July 13, 1994 release of condensate and produced water from Line #1, a gathering line associated with the Indian Basin Gas Plant.

Marathon proposes to drill one shallow borehole near the center of the previously excavated area to approximately 30 feet below grade or to the depth that the perched shallow saturated zone is encountered, if it is present. Since the excavation to remove the source showed that alluvial cobble to boulder gravel is present to at least 13 feet below grade (the limit of the excavation), hollow-stem auger drilling will not be effective. Alternatively, Marathon proposes utilizing a drilling rig capable of penetrating the coarse alluvium and the underlying bedrock. Since this type of drilling will result in only small rock chips as cuttings, only field screening with a flame ionization detector (FID) or photoionization detector (PID) will be used to detect the presence of hydrocarbons in the subsurface. A continuous borehole log of the lithologic units encountered will be completed by a geologist. Field screening readings will be recorded every two feet of drill depth and recorded on the borehole log. Marathon will submit a written report of field screening results.

If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental Representative

Attachment

xc: C. K. Curlee
N. R. Garza, Indian Basin Gas Plant
Ray Smith, OCD District Office - Artesia

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

February 8, 1995

RECEIVED
FEB 10 1995
Environmental Bureau
Oil Conservation Division

Mr. Roger C. Anderson
State of New Mexico, Oil Conservation Division
2040 S. Pacheco St.
Santa Fe, New Mexico 87505

Dear Mr. Anderson:

Enclosed is the Fourth Quarter 1994 Treatment Project Report for the Indian Basin Remediation Project. This report is submitted on behalf of the Indian Basin Gas Plant owners in accordance with the Indian Basin Treatment Project Plan prepared by Marathon and approved by the Oil Conservation Division on April 2, 1992. If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental & Safety Representative

Enclosure

xc: William C. Olson, Oil Conservation Division, Santa Fe

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
'95 FEB 14 AM 8 52

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

February 6, 1995

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Ms. Lyman:

Enclosed are analytical results from a water sample obtained on December 16, 1994 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less that the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
R. F. Unger

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 412394

PROJECT # : (NONE)

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	12/16/94	NA	12/28/94	1
02	LYMAN	AQUEOUS	12/16/94	NA	12/28/94	1
03	ARROYO	AQUEOUS	12/16/94	NA	12/28/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	0.7	<0.5	<0.5
TOTAL XYLENES	UG/L	4.8	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	109	100	100

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 412394

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 12/20/94
REPORT DATE : 01/09/95

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	25	11.8	12.2

Mid-Con[illegible]nt Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

February 6, 1995

RECEIVED

FEB 09 1995

Environmental Bureau
Oil Conservation Division

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Ms. Lyman:

Enclosed are analytical results from a water sample obtained on January 11, 1995 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less that the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and San Diego, California, respectively, using EPA-approved methods.

Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
R. F. Unger

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
09	STRIPPER INLET	AQUEOUS	01/11/95	NA	01/14/95	10
10	LYMAN	AQUEOUS	01/11/95	NA	01/13/95	1
11	BIEBBLE	AQUEOUS	01/11/95	NA	01/13/95	1

PARAMETER	UNITS	09	10	11
BENZENE	UG/L	89	<0.5	<0.5
TOLUENE	UG/L	<5.0	<0.5	<0.5
ETHYLBENZENE	UG/L	99	<0.5	<0.5
TOTAL XYLENES	UG/L	140	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	90	95	101

Analytical Technologies, Inc.

CLIENT : MARATHON OIL CO. DATE RECEIVED : 01/12/95
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION REPORT DATE : 01/25/95

ATI ID: 501338

	ATI SAN DIEGO ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	501338-01	MW-58	AQUEOUS	01/11/95
02	501338-02	MW-72	AQUEOUS	01/11/95
03	501338-03	MW-59	AQUEOUS	01/11/95
04	501338-04	MW-62	AQUEOUS	01/11/95
05	501338-05	MW-65A	AQUEOUS	01/11/95
06	501338-06	MW-68	AQUEOUS	01/11/95
07	501338-07	SW-1	AQUEOUS	01/11/95
08	501338-08	STRIPPER OUTLET	AQUEOUS	01/11/95
09	501338-09	STRIPPER INLET	AQUEOUS	01/11/95
10	501338-10	LYMAN	AQUEOUS	01/11/95
11	501338-11	BIEBBLE	AQUEOUS	01/11/95
12	501338-12	ARROYO	AQUEOUS	01/11/95
13	501338-13	MW-70RB	AQUEOUS	01/09/95
14	501338-14	MW-70	AQUEOUS	01/09/95
15	501338-15	MW-63RB	AQUEOUS	01/09/95
16	501338-16	MW-63	AQUEOUS	01/09/95
17	501338-17	MW-66RB	AQUEOUS	01/09/95
18	501338-18	MW-66	AQUEOUS	01/09/95
19	501338-19	TRIP BLANK	AQUEOUS	01/05/95
20	501338-20	MW-71RB	AQUEOUS	01/10/95
21	501338-21	MW-71	AQUEOUS	01/10/95
22	501338-22	MW-61ARB	AQUEOUS	01/10/95
23	501338-23	MW-61A	AQUEOUS	01/10/95
24	501338-24	MW-60RB	AQUEOUS	01/10/95
25	501338-25	MW-60	AQUEOUS	01/10/95
26	501338-26	MW-64RB	AQUEOUS	01/10/95
27	501338-27	MW-64	AQUEOUS	01/10/95
28	501338-28	MW-54	AQUEOUS	01/10/95
29	501338-29	MW-39	AQUEOUS	01/10/95
30	501338-30	MW-50	AQUEOUS	01/11/95

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 501338
Project Name: MARATHON OIL

ATI I.D.: 501115

Sample #	Client ID	Matrix	Date Sampled	Date Received
6	501338-06	WATER	11-JAN-95	13-JAN-95
7	501338-07	WATER	11-JAN-95	13-JAN-95
8	501338-10 Lyman	WATER	11-JAN-95	13-JAN-95
9	501338-11	WATER	11-JAN-95	13-JAN-95
10	501338-12	WATER	11-JAN-95	13-JAN-95

Parameter	Units	6	7	8	9	10
CHLORIDE	MG/L	34.0	33.0	11.0	8.0	10.0

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

February 6, 1995

RECEIVED
FEB 09 1995
Environmental Bureau
Oil Conservation Division

Mr. and Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

RE: Water Analysis

Enclosed are analytical results of water samples obtained on December 16, 1994 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
R. F. Unger

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 412394

PROJECT # : (NONE)

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	12/16/94	NA	12/28/94	1
02	LYMAN	AQUEOUS	12/16/94	NA	12/28/94	1
03	ARROYO	AQUEOUS	12/16/94	NA	12/28/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	0.7	<0.5	<0.5
TOTAL XYLENES	UG/L	4.8	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	109	100	100

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 412394

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 12/20/94
REPORT DATE : 01/09/95

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	25	11.8	12.2

Mid-Cont[illegible]t Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

February 6, 1995

RECEIVED
FEB 09 1995
Environmental Bureau
Oil Conservation Division

Mr. and Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

RE: Water Analysis

Enclosed are analytical results of water samples obtained on January 11, 1995 from a natural spring in Rocky Arroyo and the tank adjacent to your well . These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and San Diego, California, respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
R. F. Unger

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
09	STRIPPER INLET	AQUEOUS	01/11/95	NA	01/14/95	10
10	LYMAN	AQUEOUS	01/11/95	NA	01/13/95	1
11	BIEBBLE	AQUEOUS	01/11/95	NA	01/13/95	1

PARAMETER	UNITS	09	10	11
BENZENE	UG/L	89	<0.5	<0.5
TOLUENE	UG/L	<5.0	<0.5	<0.5
ETHYLBENZENE	UG/L	99	<0.5	<0.5
TOTAL XYLENES	UG/L	140	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	90	95	101

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
12	ARROYO	AQUEOUS	01/11/95	NA	01/13/95	1
13	MW-70RB	AQUEOUS	01/09/95	NA	01/13/95	1
14	MW-70	AQUEOUS	01/09/95	NA	01/13/95	1

PARAMETER	UNITS	12	13	14
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	1.3	2.3
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	2.4

SURROGATE:

BROMOFLUOROBENZENE (%)	106	107	102

Analytical Technologies, Inc.

CLIENT : MARATHON OIL CO.
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 01/12/95
REPORT DATE : 01/25/95

ATI ID: 501338

	ATI SAN DIEGO ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	501338-01	MW-58	AQUEOUS	01/11/95
02	501338-02	MW-72	AQUEOUS	01/11/95
03	501338-03	MW-59	AQUEOUS	01/11/95
04	501338-04	MW-62	AQUEOUS	01/11/95
05	501338-05	MW-65A	AQUEOUS	01/11/95
06	501338-06	MW-68	AQUEOUS	01/11/95
07	501338-07	SW-1	AQUEOUS	01/11/95
08	501338-08	STRIPPER OUTLET	AQUEOUS	01/11/95
09	501338-09	STRIPPER INLET	AQUEOUS	01/11/95
10	501338-10	LYMAN	AQUEOUS	01/11/95
11	501338-11	BIEBBLE	AQUEOUS	01/11/95
12	501338-12	ARROYO	AQUEOUS	01/11/95
13	501338-13	MW-70RB	AQUEOUS	01/09/95
14	501338-14	MW-70	AQUEOUS	01/09/95
15	501338-15	MW-63RB	AQUEOUS	01/09/95
16	501338-16	MW-63	AQUEOUS	01/09/95
17	501338-17	MW-66RB	AQUEOUS	01/09/95
18	501338-18	MW-66	AQUEOUS	01/09/95
19	501338-19	TRIP BLANK	AQUEOUS	01/05/95
20	501338-20	MW-71RB	AQUEOUS	01/10/95
21	501338-21	MW-71	AQUEOUS	01/10/95
22	501338-22	MW-61ARB	AQUEOUS	01/10/95
23	501338-23	MW-61A	AQUEOUS	01/10/95
24	501338-24	MW-60RB	AQUEOUS	01/10/95
25	501338-25	MW-60	AQUEOUS	01/10/95
26	501338-26	MW-64RB	AQUEOUS	01/10/95
27	501338-27	MW-64	AQUEOUS	01/10/95
28	501338-28	MW-54	AQUEOUS	01/10/95
29	501338-29	MW-39	AQUEOUS	01/10/95
30	501338-30	MW-50	AQUEOUS	01/11/95

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 501338 ATI I.D.: 501115
Project Name: MARATHON OIL

Sample #	Client ID	Matrix	Date Sampled	Date Received
6	501338-06	WATER	11-JAN-95	13-JAN-95
7	501338-07	WATER	11-JAN-95	13-JAN-95
8	501338-10	WATER	11-JAN-95	13-JAN-95
9	501338-11 Biebelle	WATER	11-JAN-95	13-JAN-95
10	501338-12 Arroyo	WATER	11-JAN-95	13-JAN-95

Parameter	Units	6	7	8	9	10
CHLORIDE	MG/L	34.0	33.0	11.0	8.0	10.0

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

February 6, 1995

RECEIVED
FEB 09 1995
Environmental Bureau
Oil Conservation Division

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from a water sample obtained on December 16, 1994 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less that the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue monthly sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

cc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
R. F. Unger

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 412394

PROJECT # : (NONE)

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	12/16/94	NA	12/28/94	1
02	LYMAN	AQUEOUS	12/16/94	NA	12/28/94	1
03	ARROYO	AQUEOUS	12/16/94	NA	12/28/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	0.7	<0.5	<0.5
TOTAL XYLENES	UG/L	4.8	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	109	100	100

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 412394

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 12/20/94
REPORT DATE : 01/09/95

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	25	11.8	12.2

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

February 6, 1995

RECEIVED
FEB 09 1995
Environmental Bureau
Oil Conservation Division

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

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Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

cc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
R. F. Unger

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 501338

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
12	ARROYO	AQUEOUS	01/11/95	NA	01/13/95	1
13	MW-70RB	AQUEOUS	01/09/95	NA	01/13/95	1
14	MW-70	AQUEOUS	01/09/95	NA	01/13/95	1

PARAMETER	UNITS	12	13	14
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	1.3	2.3
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	2.4

SURROGATE:

BROMOFLUOROBENZENE (%)	106	107	102

Analytical Technologies, Inc.

CLIENT : MARATHON OIL CO. DATE RECEIVED : 01/12/95
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION REPORT DATE : 01/25/95

ATI ID: 501338

	ATI SAN DIEGO ID #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
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06	501338-06	MW-68	AQUEOUS	01/11/95
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18	501338-18	MW-66	AQUEOUS	01/09/95
19	501338-19	TRIP BLANK	AQUEOUS	01/05/95
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25	501338-25	MW-60	AQUEOUS	01/10/95
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27	501338-27	MW-64	AQUEOUS	01/10/95
28	501338-28	MW-54	AQUEOUS	01/10/95
29	501338-29	MW-39	AQUEOUS	01/10/95
30	501338-30	MW-50	AQUEOUS	01/11/95

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 501338 ATI I.D.: 501115
Project Name: MARATHON OIL

Sample #	Client ID	Matrix	Date Sampled	Date Received
6	501338-06	WATER	11-JAN-95	13-JAN-95
7	501338-07	WATER	11-JAN-95	13-JAN-95
8	501338-10	WATER	11-JAN-95	13-JAN-95
9	501338-11	WATER	11-JAN-95	13-JAN-95
10	501338-12 Arroyo	WATER	11-JAN-95	13-JAN-95

Parameter	Units	6	7	8	9	10
CHLORIDE	MG/L	34.0	33.0	11.0	8.0	10.0

STATE OF
NEW MEXICO

OFFICE OF
THE ATTORNEY
GENERAL

MICHAEL DICKMAN
ASSISTANT ATTORNEY GENERAL

P.O. DRAWER 1508
BATAAN MEMORIAL BLDG.
SANTA FE, NEW MEXICO 87504
PHONE: (505) 827-6020

ALBUQUERQUE JOURNAL

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P.O. DRAWER J
ALBUQUERQUE, NEW MEXICO 87103 (505) 823-3954

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
NEW MEXICO STATE OFFICE

MICHAEL P. VALDEZ
SPECIAL AGENT

POST OFFICE & FEDERAL BLDG.
P.O. BOX 2496 505 988-6478
SANTA FE, NM 87504-2496 FTS 476-6478

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

December 21, 1994

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Ms. Lyman:

Enclosed are analytical results from a water sample obtained on November 30, 1994 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less that the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
R. F. Unger

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX, MTBE (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 412308

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	TRIP BLANK	AQUEOUS	11/17/94	NA	12/08/94	1
02	LYMAN	AQUEOUS	11/30/94	NA	12/08/94	1
03	ARROYO	AQUEOUS	11/30/94	NA	12/09/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	99	100	100

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 412308

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 12/02/94
REPORT DATE : 12/15/94

PARAMETER	UNITS	02	03	04
CHLORIDE (EPA 325.2)	MG/L	12.1	11.1	24

Mid-Continent Region
Product United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

December 21, 1994

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from a water sample obtained on November 30, 1994 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

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Robert J. Menzie, Jr.
Environmental Representative

Attachment

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A. Collar (BLM - Roswell)
R. F. Unger

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX, MTBE (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 412308

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	TRIP BLANK	AQUEOUS	11/17/94	NA	12/08/94	1
02	LYMAN	AQUEOUS	11/30/94	NA	12/08/94	1
03	ARROYO	AQUEOUS	11/30/94	NA	12/09/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	99	100	100

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 412308

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 12/02/94
REPORT DATE : 12/15/94

PARAMETER	UNITS	02	03	04
CHLORIDE (EPA 325.2)	MG/L	12.1	11.1	24

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

December 21, 1994

Mr. and Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

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Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
R. F. Unger

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX, MTBE (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 412308

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	TRIP BLANK	AQUEOUS	11/17/94	NA	12/08/94	1
02	LYMAN	AQUEOUS	11/30/94	NA	12/08/94	1
03	ARROYO	AQUEOUS	11/30/94	NA	12/09/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	99	100	100

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 412308

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 12/02/94
REPORT DATE : 12/15/94

PARAMETER	UNITS	02	03	04
CHLORIDE (EPA 325.2)	MG/L	12.1	11.1	24

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 22, 1994

Fax recieved on 11/22/94 13:10 hrs.

Mr. William Olson
State of New Mexico, Oil Conservation Division
2040 South Pacheco Street
Santa Fe, New Mexico 87505

RE: Indian Basin Remediation Project Workplan

Dear Mr. Olson:

This letter describes workplan activities associated with the Indian Basin Remediation Project near the Indian Basin Gas Plant in Eddy County, New Mexico that will commence on November 28, 1994. Marathon is requesting Oil Conservation Division approval of this workscope consisting of a drilling and well development phase, a borehole video survey phase, and vapor extraction pilot testing phase to be conducted between November 28 and December 23, 1994.

DRILLING AND WELL DEVELOPMENT WORKSCOPES (November 28 - December 9, 1994)

Shallow Zone Plume Delineation
Four monitoring wells (MW-77, MW-78, MW-79, MW-80) will be installed using an air rotary drilling rig to approximately 70 feet below grade or 15 feet below the Shallow zone static depth-to-groundwater elevation. Figure 1 shows the approximate locations of these wells. The purpose of these wells is to delineate the southeastern extent of the Shallow plume.

Lower Queen Enhanced Product Recovery
Figure 1 shows the approximate location of one pumping well (MW-76) which will be installed using an air rotary drilling rig to approximately 200 feet below grade or 20 to 30 feet below the Lower Queen static depth-to-groundwater elevation. The purpose of this well is to test the potential for free product recovery and groundwater drawdown utilizing a dual-pump completion. The well location was selected to maximize the potential for the presence of free product. The two pumps and gathering line to the well will be installed in early 1995 after Bureau of Land Management (BLM) right-of-ways are approved for the gathering line and State Engineer Lower Queen groundwater withdrawal permits are secured.

Vapor Extraction Well and Vapor Monitoring Point
Two monitoring points and one extraction well (MP-1D, MP-2D, VEW-1D) will be installed using an air rotary drilling rig to approximately 220 feet below grade or approximately 20 feet below the Lower Queen static depth-to-groundwater elevation. Figure 1 shows the approximate well locations. The wells will be completed so that they may also be used as monitor or product recovery wells after pilot testing is complete.

Description of Activities Associated with Drilling Operations

Field Screening, Drill Cutting Handling and Disposal
During drilling of all wells, drill cuttings will be collected at approximately 10-foot intervals for lithologic logging and field screening for total ionizable organic vapors using a photoionization detector (PID) or flame ionization detector (FID). No soil or bedrock samples will be collected for laboratory analysis. Drill cuttings will be placed on 6-mil plastic sheeting laid on the ground. Volatile organic compounds in the cuttings will be released to the atmosphere during the drilling and cutting-removal process; therefore, after the well is completed the cuttings will be spread on the ground around the well.

Well Completion Description and Decontamination
All wells will initially be drilled to a depth of approximately zero to twenty (0-20) feet into the Queen dolomite using an air rotary drill rig. Steel conductor casing (10-inch O.D.) will be seated approximately two feet below the alluvium/bedrock contact and grouted into place with a cement/bentonite mixture. The conductor will be allowed to set for 24 hours prior to reentering the casing to drill an eight-inch nominal hole in the consolidated bedrock to total depth. The well completion will be open hole below the conductor. A steel surface monitor with locking cover will be installed to protect the conductor casing and provide well security. All drilling equipment will be decontaminated between boreholes using steam-cleaning techniques.

Well Development, Purged Groundwater Collection/Disposal, and Groundwater Sampling
Each well will be developed by pumping for eight hours using a downhole pump. Purged groundwater will be pumped into a trailer-mounted, 1000-gallon fiberglass tank and transported to the Indian Basin Gas Plant for disposal into a sump of the open drain system. In January 1995, during the First Quarter monitoring episode, groundwater samples will be collected from each well. The samples will be shipped to Analytical Technologies, Inc. in Albuquerque, New Mexico for benzene, toluene, ethylbenzene, and total xylene (BTEX) and chloride analyses by EPA Methods 8020 and 325.2, respectively.

BOREHOLE VIDEO SURVEY PHASE (December 5 - 7, 1994)

Subsequent to drilling, a borehole video survey will be conducted in two to four wells for up to 1000 feet of borehole or 3 days of survey and setup, whichever occurs first.

VAPOR EXTRACTION PILOT TESTS (December 5 - 23, 1994)

The pilot tests will be conducted by attaching a regenerative vacuum blower with an explosion-proof motor to the extraction wells. The blower system shall include a particulate filter, vacuum gauges, and an ambient air intake valve to control flow and vacuum. Extracted vapors shall be direct-discharged to the atmosphere for which a permit is not required. The following parameters shall be monitored during the tests and recorded on a field log at approximate fifteen minute intervals for the first elapsed hour, at approximate thirty minute intervals for the following three hours and hourly for the remainder of each test: 1) Pre- and post-filter vacuum at the blowers; 2) Induced vacuum at surrounding monitor points; 3) Applied vacuum at the vapor extraction wellhead; 4) Pre-and post-blower air stream temperature; 5) Process air stream velocity; and, 6) Air effluent organic vapor concentration and percent LEL.

Shallow Vadose Zone Pilot Tests (December 5 - 9, 1994)
Two short-term (four to eight hour or until induced vacuum in surrounding monitor points and offgas concentrations have stabilized) vapor extraction pilot tests shall be conducted in the Shallow zone at the site to determine radius of influence under present conditions in the shallow vadose zone. The first test shall be conducted on VEW-1S in the vicinity of well MW-14, approximately 1,000 feet southwest of the gas plant and north of Rocky Arroyo (Figure 1). The second test shall be conducted in the area of monitor wells MW-18, MW-19, and MW-20 to provide radius of influence and offgas concentration data.

To aid in specifying the optimal air flow for a full-scale SVES, a pilot venting step-test shall also be conducted on well VEW-1S. During the step-test, varying degrees of vacuum (100%, 75%, 50%, and 25% of blower capacity) shall be applied to VEW-1S and the vacuum and air flow rate at the wellhead shall be measured. During each step, induced vacuum shall also be measured in the surrounding monitor points.

One vapor sample will be collected during each of the two shallow zone pilot tests on wells VEW-1S and MW-18 near the end of each test. The vapor samples will be collected in Tedlar bags from an air sampling port located on the blower exhaust stack. Chain-of-Custody documentation will be completed for each sample collected; samples will be delivered to the laboratory within 24 hours of collection. Vapor samples will be analyzed for total nonmethane hydrocarbons (EPA TO-14), purgeable aromatics and alocarbons (EPA 8010/8020), and methane, carbon dioxide, and oxygen (GC-TCD).

Lower Queen Pilot Tests

Lower Queen Pre-Pilot Test (December 5 - 9, 1994)

Prior to conducting the full-scale pilot tests on the Lower Queen, a pre-pilot test shall be conducted on VEW-1D (Figure 1). The objective of this pre-test shall be to determine the

optimum blower type and size for conducting the full-scale, extended pilot tests on the Lower Queen. The test will be performed for approximately four hours over which time the blower vacuum and the air flow rate will be monitored. Prior to ending the test, induced vacuum shall also be measured in surrounding monitor wells to determine the zone of influence. This data will be used to aid in sizing the blower equipment for the full-scale tests.

Lower Queen Full-Scale Pilot Tests (December 19 - 23, 1994)

Following completion of the pre-pilot test and determination of blower requirements, three pilot tests shall be conducted to determine the feasibility and effective zone of influence while venting on the Lower Queen dolomite. One long-term (72- to 96-hour) pilot test shall be conducted on VEW-1D in the eastern portion of the site near MW-59 and MW-72 (Figure 1). MP-1D, MP-2D, MW-58, MW-59, and MW-72 will be used as monitor points to measure induced vacuum. Using these wells, an array of monitor points shall form a radial pattern around the test well at distances ranging from 100 to greater than 1,000 feet. A step-test will also be conducted on VEW-1D. During the step-test varying degrees of vacuum (100%, 75%, 50%, and 25% blower capacities) will be applied to VEW-1D and vacuum and air-flow rate at the wellhead will be measured. During each step (approximately two to three hours), induced vacuum will also be measured in surrounding monitor wells. Step-tests are necessary to determine the most effective flow rates through the formation.

A second pilot test (approximately eight hours) will be conducted on MW-67. The purpose of this test is to determine air flow and offgas concentrations due to venting in this area of the site. Induced vacuum may not be detectable in surrounding wells, the closest of which (MW-65A) is located 1,900 feet from MW-67; however, the nearest surrounding monitor wells shall be checked at lease once for induced vacuum response during the test.

A third pilot test (approximately eight hours) will be conducted on MW-68 (screened from 148 to 199 feet). The purpose of this test is to determine the effect, if any, on the Shallow zone while venting on the deep zone and the relative degree, if any, of interconnectivity between the two zones. MW-18, MW-20, MW-21, MW-24, MW-26, and MW-8 (screened from approximately 5 to 20 feet) shall be used as monitor points.

Two vapor effluent samples will be collected during the 72- to 96-hour Lower Queen pilot test on VEW-1D; one sample will be collected after approximately 24 hours into the test and the second sample will be collected near the end of the test. One vapor sample will be collected during each of the Lower Queen tests on wells MW-67 and MW-68, near the end of each test. The vapor samples will be collected in Tedlar bags from an air sampling port located on the blower exhaust stack. Chain-of-Custody documentation shall be completed for each sample collected; samples shall be delivered to the laboratory within 24 hours of collection. Vapor samples shall be analyzed for total nonmethane hydrocarbons (EPA TO-14), purgeable aromatics and alocarbons (EPA 8010/8020), and methane, carbon dioxide, and oxygen (GC-TCD).

REPORTING

Drilling Investigation Reporting
A letter report that includes a discussion of field investigation methodologies and results of drilling will be submitted to the OCD by March 1, 1995. The report will include a lithologic/well completion log for each well, volatile organic vapor readings for each well from field screening using a PID or FID, and a well location map.

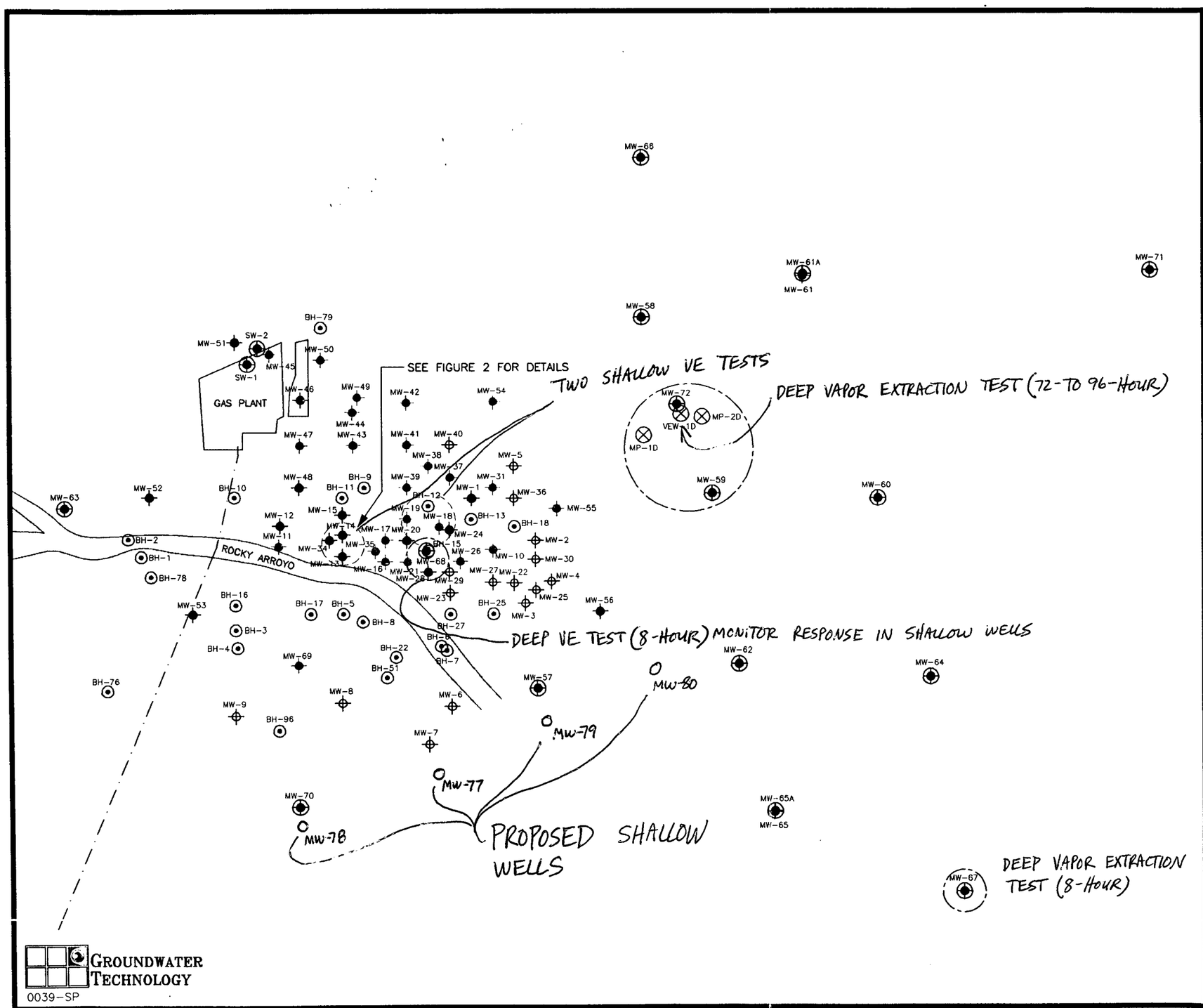
Pilot Test Reporting
A second report which summarizes the findings of the pilot tests will be submitted to the OCD by March 1, 1995. Results of the downhole video survey will be used in conjunction with the information from the lithologic/well construction logs to assess fracture trends, if possible. Laboratory vapor results will be provided in appendices and summarized in tables as appropriate. The final location of the vapor extraction test wells and monitor points and the interpreted areas of influence will be plotted.

Please approve this workplan as soon as possible so that drilling work scheduled for November 28 may commence without delay. Thank you in advance for your expedited review of this workplan.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental Representative

xc: S. Brothers, Groundwater Technology-Albuquerque
C. K. Curlee



GROUNDWATER TECHNOLOGY

0039-SP

EXPLANATION

- UPPER AQUIFER MONITOR WELL
- LOWER AQUIFER MONITOR WELL
- MONITOR WELL (DRY)
- BOREHOLE
- CONDENSATE LINE
- PROPOSED PILOT TEST WELL TO BE INSTALLED
- PROPOSED PILOT TEST AREA FOR UPPER QUEEN (SHALLOW ZONE)
- PROPOSED PILOT TEST AREA FOR LOWER QUEEN (DEEP ZONE)

NOTE: SEE TABLE 1 FOR DISTANCES OF WELLS TO BE USED AS MONITOR POINTS FROM VAPOR EXTRACTION WELLS, AND FOR WELL CONSTRUCTION SPECIFICATIONS.

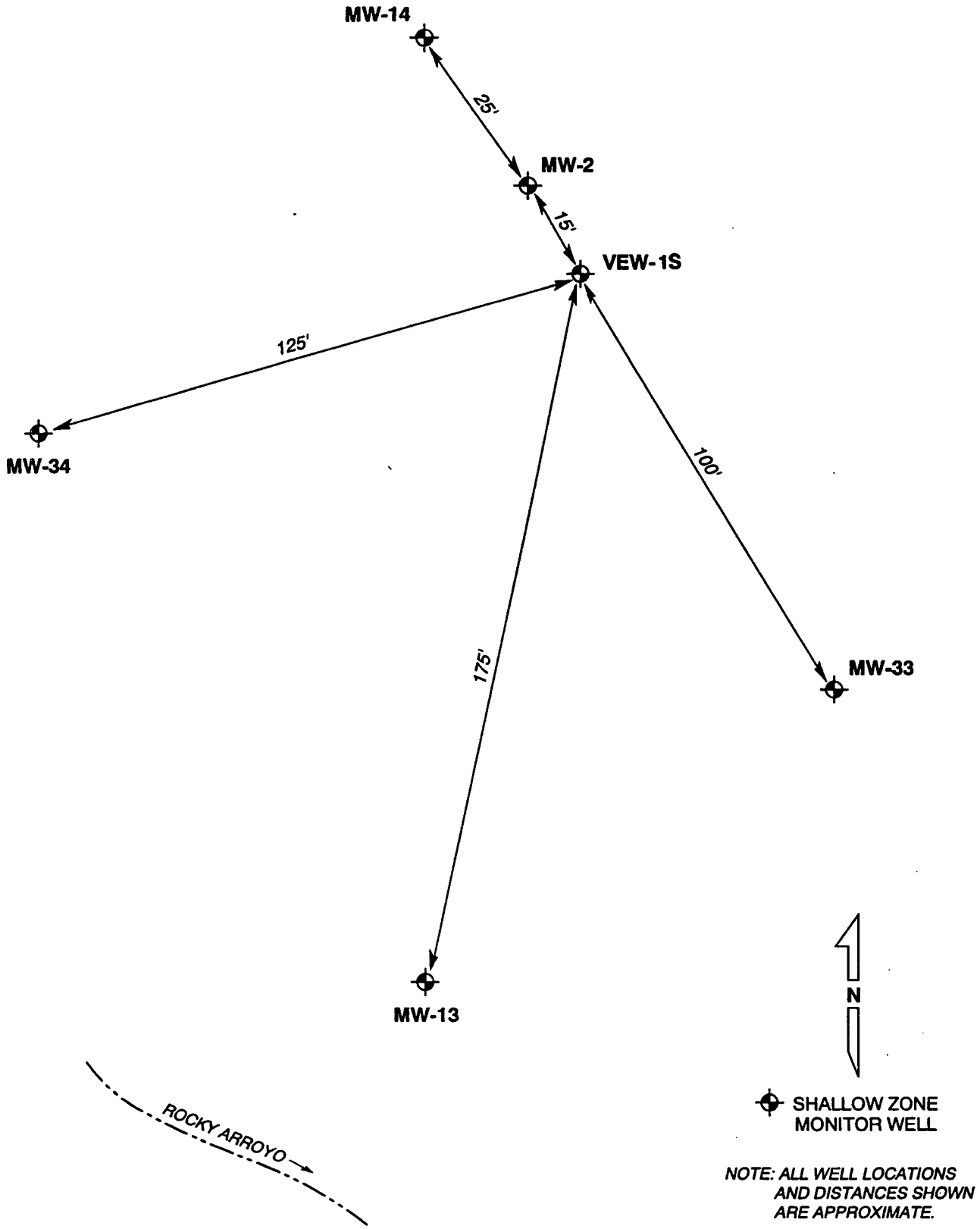
MARATHON OIL COMPANY
INDIAN BASIN GAS PLANT SITE
INDIAN BASIN, NEW MEXICO
023350039

DRAWN BY: T. BENNET DATE: 10-17-94
DRAFTED BY: DEN HOLMES DATE: 10-19-94
CHECKED BY: TB DATE: 10/20/94

SITE PLAN SHOWING PROPOSED SOIL VAPOR EXTRACTION PILOT TEST LOCATIONS

Site plan showing proposed pilot test wells and proposed pilot test areas at Marathon Oil Company's Indian Basin Gas Plant, Indian Basin, New Mexico.

DRAWN BY	FOLDER	FILE	CHECKED BY	APPROVED BY
JU 10/20/94	Marathon Oil Co.	Propst 10/94	TB 10/20/94	TB 10/20/94



NOTE: ALL WELL LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE.

MARATHON OIL COMPANY / INDIAN GAS PLANT

PROPOSED PILOT TEST MONITORING ARRAY FOR SHALLOW ZONE SOIL VAPOR EXTRACTION PILOT TEST ON WELL VEW-1S

FIGURE 2

LOCATION: INDIAN BASIN, NEW MEXICO

PROJECT NO.: 023350039

GROUNDWATER TECHNOLOGY

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 14, 1994

Mr. and Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

RE: Water Analysis

Enclosed are analytical results of water samples obtained on October 6, 1994 from a natural spring in Rocky Arroyo and the tank adjacent to your well. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
R. F. Unger

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 410345

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
44	ARROYO	AQUEOUS	10/06/94	NA	10/10/94	1
45	LYMAN WELL	AQUEOUS	10/06/94	NA	10/10/94	1

PARAMETER	UNITS	44	45
BENZENE	UG/L	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5
TOTAL XYLENES	UG/L	0.6	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	95	105

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 410345

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 10/07/94
REPORT DATE : 10/28/94

PARAMETER	UNITS	41	42	43	44	45
CHLORIDE (EPA 325.2)	MG/L	4.2	360	380	13	14

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 410345

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
33	MW-62	AQUEOUS	10/06/94	NA	10/10/94	10
34	MW-65A	AQUEOUS	10/06/94	NA	10/10/94	1
36	BIEBBLE	AQUEOUS	10/06/94	NA	10/10/94	1

PARAMETER	UNITS	33	34	36
BENZENE	UG/L	13	1.7	<0.5
TOLUENE	UG/L	13	<0.5	<0.5
ETHYLBENZENE	UG/L	11	<0.5	<0.5
TOTAL XYLENES	UG/L	39	<0.5	<0.5
SURROGATE:				
BROMOFLUOROBENZENE (%)		91	97	97

Analytical Technologies, Inc. GENERAL CHEMISTRY RESULTS

ATI I.D. : 410345

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 10/07/94
REPORT DATE : 10/28/94

PARAMETER	UNITS	36	37	38	39	40
CHLORIDE (EPA 325.2)	MG/L	13	300	270	290	130

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 14, 1994

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Ms. Lyman:

Enclosed are analytical results from a water sample obtained on October 6, 1994 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less that the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
R. F. Unger

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 410345

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
44	ARROYO	AQUEOUS	10/06/94	NA	10/10/94	1
45	LYMAN WELL	AQUEOUS	10/06/94	NA	10/10/94	1

PARAMETER	UNITS	44	45
BENZENE	UG/L	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5
TOTAL XYLENES	UG/L	0.6	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	95	105

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 410345

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 10/07/94
REPORT DATE : 10/28/94

PARAMETER	UNITS	41	42	43	44	45
CHLORIDE (EPA 325.2)	MG/L	4.2	360	380	13	14

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 14, 1994

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from a water sample obtained on October 6, 1994 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less that the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue monthly sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

cc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
R. F. Unger

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 410345

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
44	ARROYO	AQUEOUS	10/06/94	NA	10/10/94	1
45	LYMAN WELL	AQUEOUS	10/06/94	NA	10/10/94	1

PARAMETER	UNITS	44	45
BENZENE	UG/L	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5
TOTAL XYLENES	UG/L	0.6	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	95	105

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 410345

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 10/07/94
REPORT DATE : 10/28/94

PARAMETER	UNITS	41	42	43	44	45
CHLORIDE (EPA 325.2)	MG/L	4.2	360	380	13	14

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 11, 1994

RECEIVED
NOV 15 1994
OIL CONSERVATION DIV.
SANTA FE

Mr. William Olson
State of New Mexico, Oil Conservation Division
2040 South Pacheco Street
Santa Fe, New Mexico 87505

RE: Indian Basin Treatment Plan Modification

Dear Mr. Olson:

In early September 1994, Marathon received verbal approval from your office to temporarily cease groundwater withdrawal from Lower Queen pumping well MW-61A pending the results of groundwater sampling and analysis (Figure 1). Marathon proposed to cease pumping of this well because two consecutive quarterly sampling episodes (April and July) suggested the groundwater in this well was below New Mexico Water Quality Control Commission (WQCC) standards in Section 3-103. This well was continuously pumped for plume control between November 1, 1991 and September 13, 1994. The pump and tubing were removed from the well on September 29, 1994.

On October 4, 1994, during the Fourth Quarter monitoring episode this well was sampled through a 2-inch, Grundfos Rediflow pump. Prior to sampling, three well volumes were purged and four groundwater parameters were monitored (temperature, pH, specific conductance, and dissolved oxygen). These parameters stabilized prior to sampling, indicating that three well volumes are adequate to purge the well and obtain a representative sample of the Lower Queen groundwater flowing to this well. Sample results indicate benzene, toluene, ethlybenzene, and total xylenes (BTEX) concentrations in groundwater from this well are below the WQCC standards in Section 3-103. The chloride concentration was 11 mg/L which is within the background range for the Lower Queen aquifer based on quarterly monitoring data. October 4, 1994 laboratory results for MW-61A are attached.

Marathon is requesting OCD approval to designate this well as a downgradient monitoring well and sample the Lower Queen groundwater for BTEX and chloride on a quarterly frequency. The next quarterly monitoring episode is scheduled for January 10 to 12, 1995.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Production Environmental Representative

INDIAN BASIN GAS PLANT
ARTESIA, NEW MEXICO

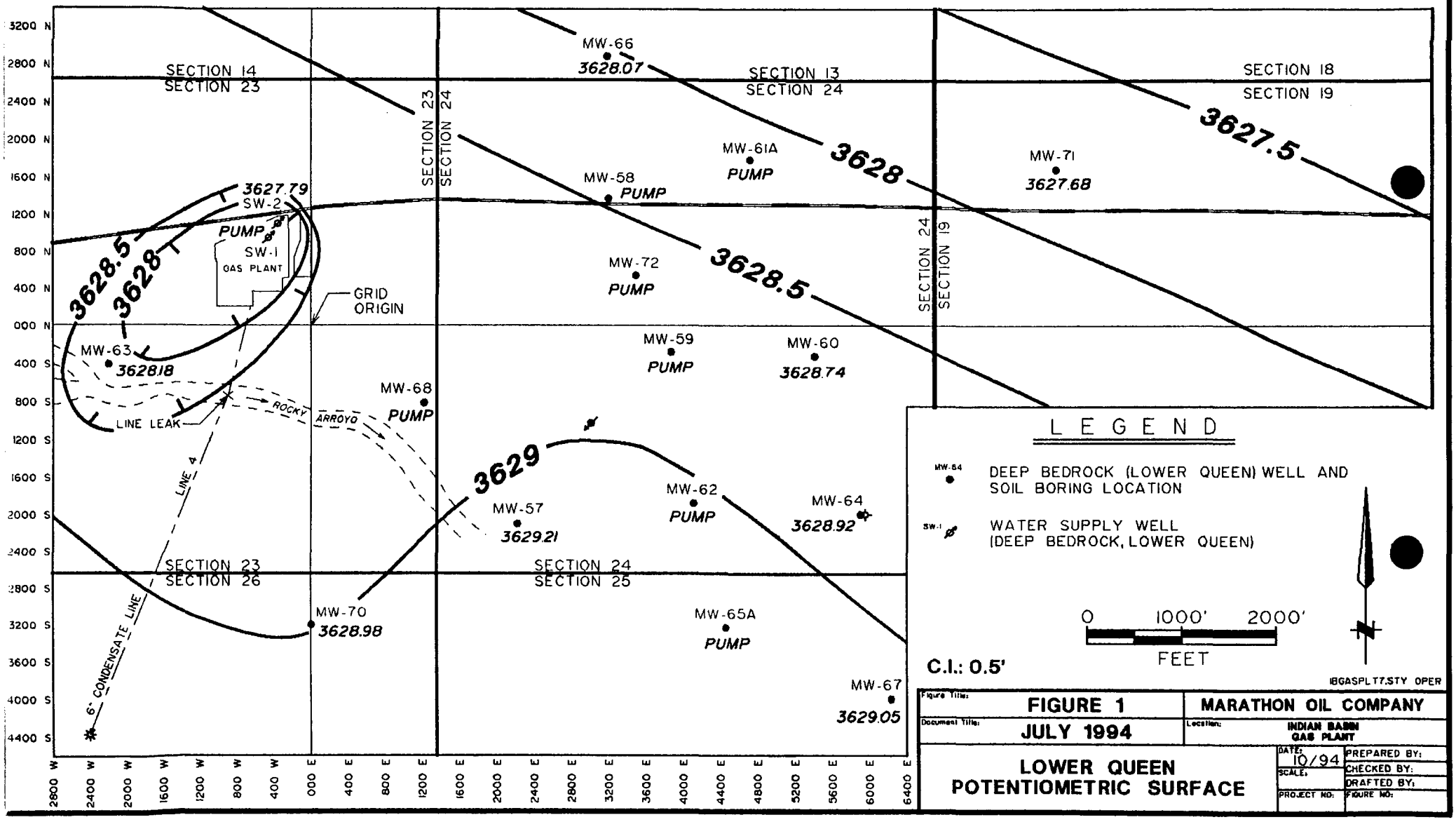


Figure Title: FIGURE 1		MARATHON OIL COMPANY
Document Title: JULY 1994		Location: INDIAN BASIN GAS PLANT
LOWER QUEEN POTENTIOMETRIC SURFACE	DATE: 10/94	PREPARED BY:
	SCALE:	CHECKED BY:
	PROJECT NO:	DRAFTED BY:
		FIGURE NO:

Analytical Technologies, Inc.

2709-D Pan American Freeway, NE Albuquerque, NM 87107
Phone (505) 344-3777 FAX (505) 344-4413

ATI I.D. **410345**

October 28, 1994

Marathon Oil Company
125 W. Missouri St.
Midland, TX 79701

Project Name/Number: IB REMEDIATION 44999

Attention: Bob Menzie

On **10/07/94**, Analytical Technologies, Inc., (ADHS License No. AZ0015), received a request to analyze **aqueous** samples. The samples were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

After a discussion with the client, it appears that the cooler was inadvertly opened by a wrong party. Inspection (of the cooler by the Lab Manager) appears to indicate that the samples were undisturbed. All other aspects appear satisfactory. (Temperature 4°C.)

On 10/28/94 all analyses were cancelled for samples on hold per Bob Menzie.

EPA Method 8020 analyses were performed by Analytical Technologies, Inc., Albuquerque, NM.

Chloride analyses were performed by Analytical Technologies, Inc., 9830 S. 51st Street, Suite B-113, Phoenix, AZ.

If you have any questions or comments, please do not hesitate to contact us at (505) 344-3777.

Letitia Krakowski, Ph.D.
Project Manager

H. Mitchell Rubenstein, Ph.D.
Laboratory Manager

MR:jt

Enclosure

Analytical Technologies, Inc.

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 10/07/94
REPORT DATE : 10/28/94

ATI I.D. : 410345

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	TRIP BLANK	AQUEOUS	09/29/94
02	EB-1	AQUEOUS	10/04/94
03	MW-70	AQUEOUS	10/04/94
04	EB-2	AQUEOUS	10/04/94
05	MW-63	AQUEOUS	10/04/94
06	EB-3	AQUEOUS	10/04/94
07	MW-71	AQUEOUS	10/04/94
08	EB-4	AQUEOUS	10/04/94
09	MW-66	AQUEOUS	10/04/94
10	EB-5	AQUEOUS	10/04/94
11	MW-61	AQUEOUS	10/04/94
12	EB-6	AQUEOUS	10/04/94
13	MW-61A	AQUEOUS	10/04/94
14	EB-7	AQUEOUS	10/05/94
15	MW-60	AQUEOUS	10/05/94
16	EB-8	AQUEOUS	10/05/94
17	MW-65	AQUEOUS	10/05/94
18	SUMP 16A	AQUEOUS	10/05/94
19	MW-64	AQUEOUS	10/05/94
20	EB-9	AQUEOUS	10/05/94
21	MW-67	AQUEOUS	10/05/94
22	EB-10	AQUEOUS	10/05/94
23	MW-57	AQUEOUS	10/05/94
24	EB-11	AQUEOUS	10/05/94
25	MW-55	AQUEOUS	10/05/94
26	EB-12	AQUEOUS	10/05/94
27	MW-54	AQUEOUS	10/05/94
28	STRIPPER INLET	AQUEOUS	10/06/94
29	STRIPPER OUTLET	AQUEOUS	10/06/94
30	SW-1	AQUEOUS	10/06/94
31	MW-58	AQUEOUS	10/06/94
32	MW-59	AQUEOUS	10/06/94
33	MW-62	AQUEOUS	10/06/94
34	MW-65A	AQUEOUS	10/06/94
35	MW-68	AQUEOUS	10/06/94
36	BIEBBLE	AQUEOUS	10/06/94
37	MW-41	AQUEOUS	10/05/94
38	MW-43	AQUEOUS	10/05/94

(CONTINUED NEXT PAGE)

Analytical Technologies, Inc.

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION
ATI I.D. : 410345

DATE RECEIVED : 10/07/94
REPORT DATE : 10/28/94

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
39	MW-50	AQUEOUS	10/05/94
40	MW-11	AQUEOUS	10/05/94
41	SUMP A10	AQUEOUS	10/05/94
42	MW-44	AQUEOUS	10/05/94
43	MW-49	AQUEOUS	10/05/94
44	ARROYO	AQUEOUS	10/06/94
45	LYMAN WELL	AQUEOUS	10/06/94

----- TOTALS -----

MATRIX	# SAMPLES
AQUEOUS	45

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 410345

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : IB REMEDIATION

DATE RECEIVED : 10/07/94
REPORT DATE : 10/28/94

PARAMETER	UNITS	13	15	17	18	19
CHLORIDE (EPA 325.2)	MG/L	11	9.1	5.9	128	10.2

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 410345

PROJECT # : 44999

PROJECT NAME : IB REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
13	MW-61A	AQUEOUS	10/04/94	NA	10/09/94	1
14	EB-7	AQUEOUS	10/05/94	NA	10/09/94	1
15	MW-60	AQUEOUS	10/05/94	NA	10/09/94	1

PARAMETER	UNITS	13	14	15
BENZENE	UG/L	4.8	0.5	<0.5
TOLUENE	UG/L	4.5	1.8	0.6
ETHYLBENZENE	UG/L	3.7	1.3	0.6
TOTAL XYLENES	UG/L	37	16	4.9

SURROGATE:

BROMOFLUOROBENZENE (%)	105	97	101

AnalyticalTechnologies, Inc., Albuquerque, NM
San Diego • Phoenix • Seattle • Pensacola • Ft. Collins • Portland • Albuquerque

CHAIN OF CUSTODY

DATE: 10-4-94 PAGE 2 OF 5

ATI LAB I.D. 410345

PLEASE FILL THIS FORM IN COMPLETELY. SHADED AREAS ARE FOR LAB USE ONLY.

PROJECT MANAGER: Bob Menzie

COMPANY: Marathon Oil Company
ADDRESS: 125 W. Missouri St.
Midland, TX 79701
PHONE: 915-687-8312
FAX: 915-687-8337

BILL TO:
COMPANY: Same
ADDRESS:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE (8020)	Chloride	Hold Marathon approval	NUMBER OF CONTAINERS
EB-5	10-4-94	3:35p	Water	10	✓			2
MW-61	↓	4:39p	↓	11	✓	✓		3
EB-6		4:51p		12	✓			2
MW-61A	↓	6:08p	↓	13	✓	✓		3
EB-7	10-5-94	9:16a	Water	14	✓			2
MW-60	↓	10:02a	↓	15	✓	✓		3
EB-8		10:19a		16			✓	2
MW-65	↓	8:58a	↓	17	✓	✓		3
Sump 16A	↓	9:34a	↓	18	✓	✓		3

Petroleum Hydrocarbons (418.1) | (MOD 8015) Gas/Diesel | Diesel/Gasoline/BTXE/MTBE (MOD 8015/8020) | Chlorinated Hydrocarbons (601/8010) | Aromatic Hydrocarbons (602/8020) | SDWA Volatiles (502.1/503.1), 502.2 Reg. & Unreg. | Pesticides/PCB (608/8080) | Herbicides (615/8150) | Base/Neutral/Acid Compounds GC/MS (625/8270) | Volatile Organics GC/MS (624/8240) | Polynuclear Aromatics (610/8310) | SDWA Primary Standards - Arizona | SDWA Secondary Standards - Arizona | SDWA Primary Standards - Federal | SDWA Secondary Standards - Federal | The 13 Priority Pollutant Metals | RCRA Metals by Total Digestion | RCRA Metals by TCLP (1311)

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJ. NO.:	44999	NO. CONTAINERS	23
PROJ. NAME:	IB Remediation	CUSTODY SEALS	(Y) N / NA
P.O. NO.:		RECEIVED INTACT	✓
SHIPPED VIA:		RECEIVED COLD	✓

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

(RUSH) ☐ 24hr ☐ 48hr ☐ 72hr ☐ 1 WEEK (NORMAL) ☒ 2 WEEK

Comments:

SAMPLED & RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: [signature] Time: 2:00pm	Signature: Time:	Signature: Time:
Printed Name: BJ Menzie Date: 10-6-94	Printed Name: Date:	Printed Name: Date:
Company: Marathon Phone: 915-687-8312	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: [signature] Time: 1530
Printed Name: Date:	Printed Name: Date:	Printed Name: Dianne Cutler Date: 10/7/94
Company:	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619) 458-9141 • Phoenix (602) 496-4400 • Seattle (206) 228-8335 • Pensacola (904) 474-1001 • Portland (503) 684-0447 • Albuquerque (505) 344-3777 DISTRIBUTION: White, Canary - ATI • Pink - ORIGINATOR

Analytical Technologies, Inc. Albuquerque, NM

Chain of Custody

DATE 10/7/94 PAGE 1 OF 1

NETWORK PROJECT MANAGER: LETITIA KRAKOWSKI

COMPANY: Analytical Technologies, Inc.

ADDRESS: 2709-D Pan American Freeway, NE
Albuquerque, NM 87107

CLIENT PROJECT MANAGER:

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	TOX	TOC	ORGANIC LEAD	SULFIDE	SURFACTANTS (MBAS)		632/632 MOD	619/619 MOD	610/8310	Cl-		8240 (TCLP 1311) ZHE		Diesel/Gasoline/BTXE/MTBE/ (MOD 8015/8020)	Volatile Organics GC/MS (624/8240)		NACE	ASBESTOS		BOD	TOTAL COLIFORM	FECAL COLIFORM		GROSS ALPHA/BETA	RADIUM 226/228		AIR - O_2, CO_2, METHANE	AIR/Diesel/Gasoline/BTXE/ (MOD 8015/8020)	NUMBER OF CONTAINERS
410345-03	10-4	0933	MQ	3																														1
-05		1134		5																														
-07		1320		7																														
-09		1458		9																														
-11		1639		11																														
-13		1808		13																														
-15	10-5	1602		15																														
-17		0856		17																														
-18		0934		18																														

PROJECT INFORMATION	
PROJECT NUMBER:	410345
PROJECT NAME:	MO
QC LEVEL:	STD. IV
QC REQUIRED:	MS MSD BLANK
TAT:	STANDARD RUSH!

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	9
CHAIN OF CUSTODY SEALS	NA
INTACT?	Y
RECEIVED GOOD COND./COLD	Y
LAB NUMBER	410345

DUE DATE: 10/21
RUSH SURCHARGE: 0
CLIENT DISCOUNT: 10 %

work LK1036

SAMPLES SENT TO:	
SAN DIEGO	
FT. COLLINS	
RENTON	
PENSACOLA	
PORTLAND	
PHOENIX	X
FIBERQUANT	

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.
Signature: D. Butler Time: 1730	Signature: Time:
Printed Name: Dianne Butler Date 10/7/94	Printed Name: Date
Analytical Technologies, Inc. Albuquerque	Company:
RECEIVED BY: (LAB) 1.	**RECEIVED BY: (LAB) 2.**
Signature: Time:	Signature: Linda Estelman Time: 946
Printed Name: Date:	Printed Name: Linda Estelman Date: 10/8/94
Company:	Company: ATI

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 3, 1994

Mr. Roger C. Anderson
State of New Mexico
Oil Conservation Division
2040 South Pacheco Street
Santa Fe, New Mexico 87505

Dear Mr. Anderson:

Enclosed is the Third Quarter 1994 Treatment Project Report for the Indian Basin Remediation Project. This report is submitted on behalf of the Indian Basin Gas Plant owners in accordance with the Indian Basin Treatment Project Plan prepared by Marathon and approved by the Oil Conservation Division on April 2, 1992.

If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental & Safety Representative

RECEIVED
NOV 09 1994
OIL CONSERVATION DIV.
SANTA FE

Enclosure

xc: William C. Olson, Oil Conservation Division, Santa Fe

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 22, 1994

Mr. William Olson
Hydrogeologist
Environmental Bureau
New Mexico Oil Conservation Division
Land Office Building
Santa Fe, New Mexico 87504-2088

RE: Indian Basin Remediation Project
Underground Pipeline Hydrostatic Test Results

Dear Mr. Olson:

On August 29, 1994, Marathon Oil Company completed a hydrostatic test of an 0.8-mile section of the remediation project underground gathering pipeline that conveys groundwater contaminated with condensate from offsite groundwater recovery wells to the treatment compound at the Indian Basin Gas Plant. The hydrostatic test of the 6-inch polyethylene line was performed to satisfy a condition in your letter dated August 18, 1994 approving the replacement of this line. Mr. Mark Ashley, from the Oil Conservation Division district office in Artesia, witnessed the test.

Condition 3 of your letter requires Marathon to submit the results of the pressure testing upon completion of the project. Attached are five pages of pressure test logs and calibration records for the test. A successful test was performed between approximately 7:15 and 11:15 am. During that period the pressure dropped from 120 to 116 pounds per square inch (lbs/in^2). Normal operating pressure is approximately 50 lbs/in^2. Maximum pressure during shut-in conditions is approximately 80 lbs/in^2.

If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental Representative

xc: C. M. Schweser, IBGP

FERGUSON CONSTRUCTION COMPANY

PRESSURE TEST LOG

Report #_____

Sheet #____ of ____ Sheets

Proj. or Sch. #____ W.O.____

Marathon #2281

LOCATION: Water Line (LINE No) ____ (MILE No.) TO: Marathon Plant (MILE No.) ____ (RECHAIN Sta) ____ (RECHAIN Sta.) ____ (STATE) DATE: 8-29-94

PUMP: Gardner Denver (Mfr.) ____ (MODEL), ____ (Co. No.) 3" (BORE) x 5" (STROKE) 3 (No. Cyl.) 0.458998 GPR (Gal. PER STROKE)

PIPE: ____ (Mfr.), ____ (O.D.) x ____ (W.T.), ____ (SLX), ____ (MILL TEST) P.S.I. ____ (S.M.Y.) P.S.I.

Length Test Section: ____ (MILES), Elevation: ____ (LOW) Ft., ____ (HIGH) Ft., ____ (DEADWEIGHT) Ft., Pressure: ____ (LOW) Max P.S.I. ____ (HIGH) Min P.S.I. ____ (DEADWEIGHT) Max P.S.I.

Gallons This Section 100 Bbls. Strokes Per P.S.I. ____ Gallons Per P.S.I. ____

Filling Time: From 12:00 to 1:30 8-25-94 Pressure Time: From ____ to ____

Time of Line Failure ____ Pressure at Failure ____

Temperature Observation at 4:15 ☑ AM ☐ PM

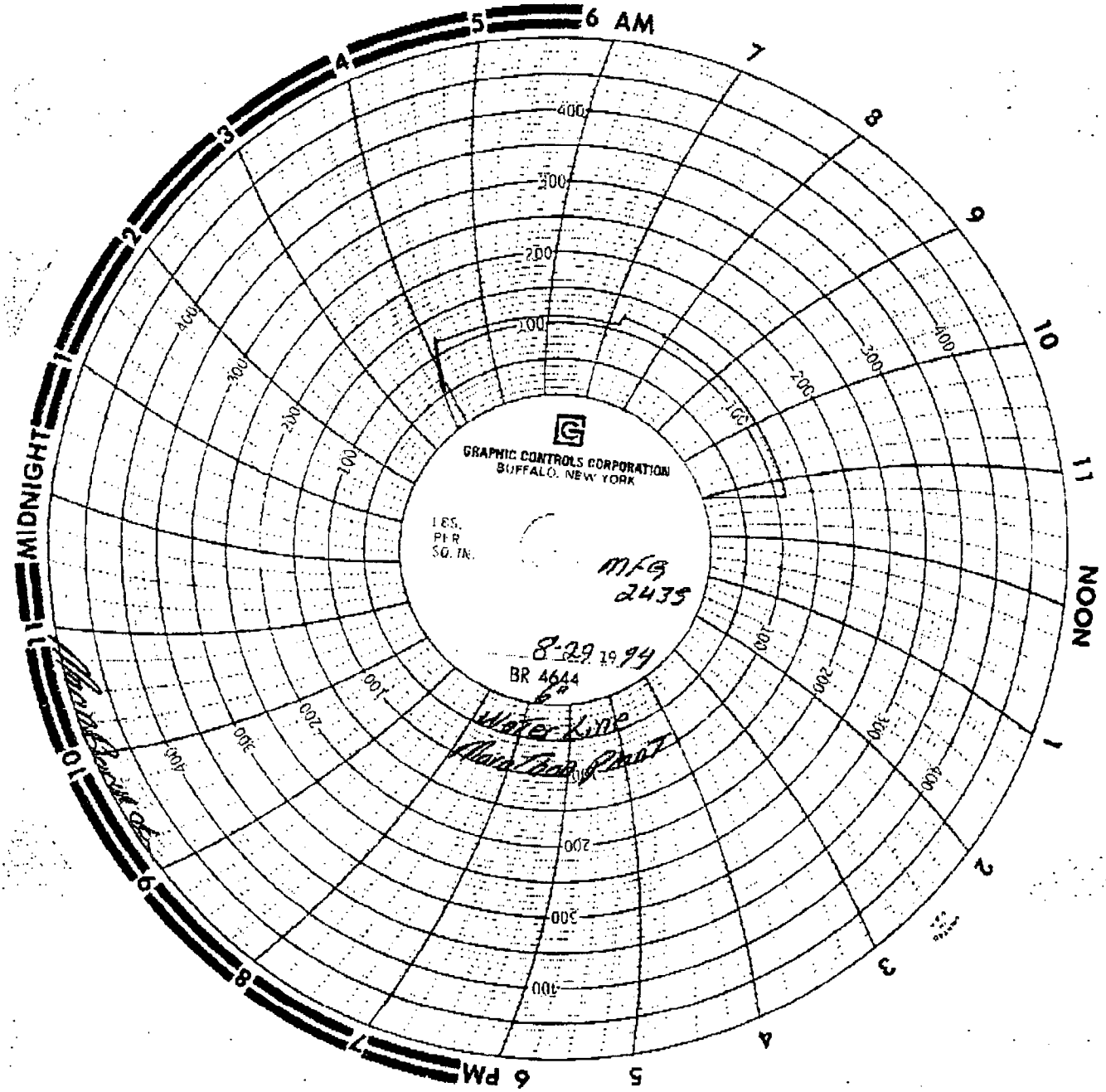
Water ____ °F Soil at Pipe Level ____ °F FERGUSON Rep. Marin Borunda

Atmosphere 70° °F CUSTOMER Rep. ____

DEAD WT.	TIME	8-25-94	AMB. TEMP.	SOIL TEMP.	DEAD WT.	TIME		AMB. TEMP.	SOIL TEMP.
0	12:00	Line was filled,			117	8:30		75°	
70	1:30	Left overnite to settle			117	8:45		76°	
58	4:00	8-29-94			117	9:00		78°	
120	4:15		70°		117	9:15		80°	
116	4:30		70°		117	9:30		81°	
115	4:45		69°		117	9:45		82°	
114	5:00		68°		117	10:00		84°	
113	5:15		67°		116	10:15		86°	
113	5:30		66°		116	10:30		87°	
112	5:45		65°		116	10:45		88°	
112	6:00		64°		116	11:00		89°	
111	6:15		63°		116	11:15		90	
111	6:30		63°						
110	6:45		63°						
110	7:00		64°						
120	7:15	Rep.	65°						
118	7:30		67°						
117	7:45		69°				DW: #14301		
117	8:00		72°				Chart Pres. mFG #2435		
117	8:15		74°				Chart Temp: #2517		

PIPE SIZE 6"

Company Representative ____


6 AM
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NOON
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4
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6 PM
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10
11
MIDNIGHT
1
2
3
4
5
GRAPHIC CONTROLS CORPORATION
BUFFALO, NEW YORK
LBS.
PER
SQ. IN.
MFG
2435
8-29 1994
BR 4644
6"
Water Line
Marathon Plant
100
200
300
400

CALIBRATION PLUS

CALIBRATION REPORT

Date: 7-23-94

I Frank Ramos Jr., Certify that the following Epuipment has been Deadweight Tested at following PSI.

TYPE 8" single pen Mitutoyo

S/N 2435

RANGE 0-500#

DEADWEIGHT	LEFT	THERMOMETOR	LEFT
0	0		
100	100		
200	200		
300	300		
400	400		
500	500		

CERIFIED BY Frank Ramos Jr.

American
Valve & Meter Service
1115 W. BROADWAY
HOBBS, NEW MEXICO 88240
PHONE: 505-393-5478

TO: FERGUSON CONSTRUCTION COMPANY DATE: 05-10-94

THIS IS TO CERTIFY THAT:

I, DON MARTIN, METER TECHNICIAN FOR AMERICAN VALVE & METER SERVICE, HAVE CHECKED THE CALIBRATION ON THE FOLLOWING INSTRUMENT BRISTOL 12" TEMPERATURE RECORDER SERIAL NUMBER 2517. AT THE FOLLOWING POINTS.

0 -- 25%	3750'
0 -- 50%	75'
0 -- 75%	110'
0 -- 100%	150'

SIGNED: [signature]

REMARKS:

METER OFF 3" ON LOW END AND 6" OFF AT HIGH. ADJUSTED AND RECALIBRATED.

CALIBRATION PLUS

05-13-94 Calibration Report

I Frank A. Harris Jr. Certify that the following Equipment has been Deadweight Tested at following psi.

Type CHANDLER DEADWEIGHT

S/N 14301

Range 0 - 5000

0 - 5000#

Deadweight	Left	Deadweight	Left
0			
1000	0 - 20%		
2000	0 - 40%		
3000	0 - 60%		
4000	0 - 80%		
5000	0 - 100%		

Certified by. Frank A. Harris

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 15, 1994

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from a water sample obtained on August 24, 1994 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less that the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue monthly sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 408398

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMED.

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	LYMAN	AQUEOUS	08/24/94	NA	08/28/94	1
02	ARROYO	AQUEOUS	08/24/94	NA	08/28/94	1
03	SW-1	AQUEOUS	08/24/94	NA	08/28/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	102	103	105

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 408398

DATE RECEIVED : 08/25/94

REPORT DATE : 09/13/94

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : INDIAN BASIN REMED.

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	11.5	12.7	21

Mid-Continent Region
Production - United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 15, 1994

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: Well Water Analysis

Dear Ms. Lyman:

Enclosed are analytical results from a water sample obtained on August 24, 1994 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less that the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 408398

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMED.

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	LYMAN	AQUEOUS	08/24/94	NA	08/28/94	1
02	ARROYO	AQUEOUS	08/24/94	NA	08/28/94	1
03	SW-1	AQUEOUS	08/24/94	NA	08/28/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	102	103	105

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 408398

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : INDIAN BASIN REMED.

DATE RECEIVED : 08/25/94
REPORT DATE : 09/13/94

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	11.5	12.7	21

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 15, 1994

Mr. and Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

RE: Water Analysis

Enclosed are analytical results of a water sample obtained on August 24, 1994 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 408398

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMED.

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	LYMAN	AQUEOUS	08/24/94	NA	08/28/94	1
02	ARROYO	AQUEOUS	08/24/94	NA	08/28/94	1
03	SW-1	AQUEOUS	08/24/94	NA	08/28/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	102	103	105

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 408398

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : INDIAN BASIN REMED.

DATE RECEIVED : 08/25/94
REPORT DATE : 09/13/94

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	11.5	12.7	21

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 30, 1994

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from water samples obtained on June 23 and July 21, 1994 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less that the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue monthly sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATON OIL CO. ATI I.D.: 406409

PROJECT # : (NONE)

PROJECT NAME : INDIAN BASIN REMED.

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	ARROYO	AQUEOUS	06/23/94	NA	06/30/94	1
02	LYMAN	AQUEOUS	06/23/94	NA	06/29/94	1
03	SW-1	AQUEOUS	06/23/94	NA	06/29/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	100	101	99

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 406409

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : INDIAN BASIN REMED.

DATE RECEIVED : 06/25/94
REPORT DATE : 07/15/94

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	13	12	21

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 407399

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMED

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	LYMAN	AQUEOUS	07/21/94	NA	07/23/94	1
05	BIEBBLE	AQUEOUS	07/21/94	NA	07/23/94	1
06	ARROYO	AQUEOUS	07/21/94	NA	07/25/94	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	-	-	98
TRIFLUOROTOLUENE (%)	99	93	-

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 407399
Project Name: MARATHON OIL COMPANY/INDIAN BASIN REMED.

ATI I.D.: 407275

Sample #	Client ID	Matrix	Date Sampled	Date Received
1	407399-03	WATER	21-JUL-94	23-JUL-94
2	407399-04	WATER	21-JUL-94	23-JUL-94
3	407399-05	WATER	21-JUL-94	23-JUL-94
4	407399-06	WATER	21-JUL-94	23-JUL-94
5	407399-07	WATER	19-JUL-94	23-JUL-94

Parameter	Units	1	2	3	4	5
CHLORIDE	MG/L	22.0	12.0	15.0	8.0	8.0

Mid-Continent Region
Production - United States

OIL CONSERVATION DIVISION
RECEIVED
1994 SEP 2 AM 8 50

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 30, 1994

Mr. and Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

RE: Water Analysis

Enclosed are analytical results of water samples obtained on June 23 and July 21, 1994 from a natural spring in Rocky Arroyo. In addition, attached are results of a water sample collected on July 21 from the small tank adjacent to your well. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATON OIL CO. ATI I.D.: 406409

PROJECT # : (NONE)

PROJECT NAME : INDIAN BASIN REMED.

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	ARROYO	AQUEOUS	06/23/94	NA	06/30/94	1
02	LYMAN	AQUEOUS	06/23/94	NA	06/29/94	1
03	SW-1	AQUEOUS	06/23/94	NA	06/29/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	100	101	99

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 406409

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : INDIAN BASIN REMED.

DATE RECEIVED : 06/25/94
REPORT DATE : 07/15/94

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	13	12	21

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 407399

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMED

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	LYMAN	AQUEOUS	07/21/94	NA	07/23/94	1
05	BIEBBLE	AQUEOUS	07/21/94	NA	07/23/94	1
06	ARROYO	AQUEOUS	07/21/94	NA	07/25/94	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	-	-	98
TRIFLUOROTOLUENE (%)	99	93	-

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 407399
Project Name: MARATHON OIL COMPANY/INDIAN BASIN REMED.

ATI I.D.: 407275

Sample #	Client ID	Matrix	Date Sampled	Date Received
1	407399-03	WATER	21-JUL-94	23-JUL-94
2	407399-04	WATER	21-JUL-94	23-JUL-94
3	407399-05	WATER	21-JUL-94	23-JUL-94
4	407399-06	WATER	21-JUL-94	23-JUL-94
5	407399-07	WATER	19-JUL-94	23-JUL-94

Parameter	Units	1	2	3	4	5
CHLORIDE	MG/L	22.0	12.0	15.0	8.0	8.0

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 30, 1994

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: Well Water Analysis

Enclosed are analytical results of water samples obtained on June 23 and July 21, 1994 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were anlyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATON OIL CO. ATI I.D.: 406409

PROJECT # : (NONE)

PROJECT NAME : INDIAN BASIN REMED.

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	ARROYO	AQUEOUS	06/23/94	NA	06/30/94	1
02	LYMAN	AQUEOUS	06/23/94	NA	06/29/94	1
03	SW-1	AQUEOUS	06/23/94	NA	06/29/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	100	101	99

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 406409

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : INDIAN BASIN REMED.

DATE RECEIVED : 06/25/94
REPORT DATE : 07/15/94

PARAMETER	UNITS	01	02	03
CHLORIDE (EPA 325.2)	MG/L	13	12	21

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL CO. ATI I.D.: 407399

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMED

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
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05	BIEBBLE	AQUEOUS	07/21/94	NA	07/23/94	1
06	ARROYO	AQUEOUS	07/21/94	NA	07/25/94	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	-	-	98
TRIFLUOROTOLUENE (%)	99	93	-

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

Client : ANALYTICAL TECHNOLOGIES, INC.
Project # : 407399
Project Name: MARATHON OIL COMPANY/INDIAN BASIN REMED.

ATI I.D.: 407275

Sample #	Client ID	Matrix	Date Sampled	Date Received
1	407399-03	WATER	21-JUL-94	23-JUL-94
2	407399-04	WATER	21-JUL-94	23-JUL-94
3	407399-05	WATER	21-JUL-94	23-JUL-94
4	407399-06	WATER	21-JUL-94	23-JUL-94
5	407399-07	WATER	19-JUL-94	23-JUL-94

Parameter	Units	1	2	3	4	5
CHLORIDE	MG/L	22.0	12.0	15.0	8.0	8.0

Mid-Continent Region
Production United States

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
'94 AUG 24

Marathon Oil Company

August 25, 1994

Mr. William Olson
Hydrogeologist
Environmental Bureau
New Mexico Oil Conservation Division
Land Office Building
Santa Fe, New Mexico 87504-2088

RE: Indian Basin Remediation Project
Underground Pipeline Hydrostatic Test

Dear Mr. Olson:

Marathon Oil Company is notifying your office of the required pressure test of an 0.8-mile length of 6-inch, polyethylene pipeline which conveys contaminated groundwater from offsite groundwater recovery wells to the air stripper compound at the Indian Basin Gas Plant. In order comply with the Oil Conservation Division's 48-hour notification condition, Marathon has scheduled the test for 8:00 am, Monday, August 29, 1994.

This test will satisfy the requirement of a pressure test of three psi above operating pressure for a four-hour duration described in your certified letter to Marathon dated August 18, 1994. The results of the pressure test will be submitted to you upon completion of a successful test. If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental Representative

xc: C. M. Schweser, IBGP

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 25, 1994

Mr. William Olson
Hydrogeologist
Environmental Bureau
New Mexico Oil Conservation Division
Land Office Building
Santa Fe, New Mexico 87504-2088

RE: Indian Basin Remediation Project
Underground Pipeline Hydrostatic Test

Dear Mr. Olson:

Marathon Oil Company is notifying your office of the required pressure test of an 0.8-mile length of 6-inch, polyethylene pipeline which conveys contaminated groundwater from offsite groundwater recovery wells to the air stripper compound at the Indian Basin Gas Plant. In order comply with the Oil Conservation Division's 48-hour notification condition, Marathon has scheduled the test for 8:00 am, Monday, August 29, 1994.

This test will satisfy the requirement of a pressure test of three psi above operating pressure for a four-hour duration described in your certified letter to Marathon dated August 18, 1994. The results of the pressure test will be submitted to you upon completion of a successful test. If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Production Environmental Representative

xc: C. M. Schweser, IBGP

Production Operations, United States

Marathon Oil Company

P. O. Box 1324
Artesia, New Mexico 88210
Telephone (505) 457-2621

August 16, 1994

William Olson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
Santa Fe, NM 87504-2088

RE: Indian Basin Remediation Project
Gathering Line Replacement

Dear Mr. Olson:

Marathon Oil Company is requesting approval to replace an 0.8-mile section of the Indian Basin Remediation project gathering line which contains water contaminated with condensate. The 0.8-mile section to be replaced is between MW-59 and the treatment compound located on the northeast side of the Indian Basin Gas Plant. The existing 4-inch polyvinyl chloride (PVC) pipe will be exposed by trenching along the existing Marathon right-of-way approved by the Bureau of Land Management (BLM). The 4-inch pipe will be left in place and a new 6-inch polyethylene pipe will be placed in the trench over the 4-inch PVC pipe.

Trenching activities to uncover the existing 4-inch PVC pipe were initiated today. The 6-inch polyethylene pipe is scheduled for delivery on Monday, August 22. Installation of the pipe will begin as soon as the pipe arrives at the gas plant.

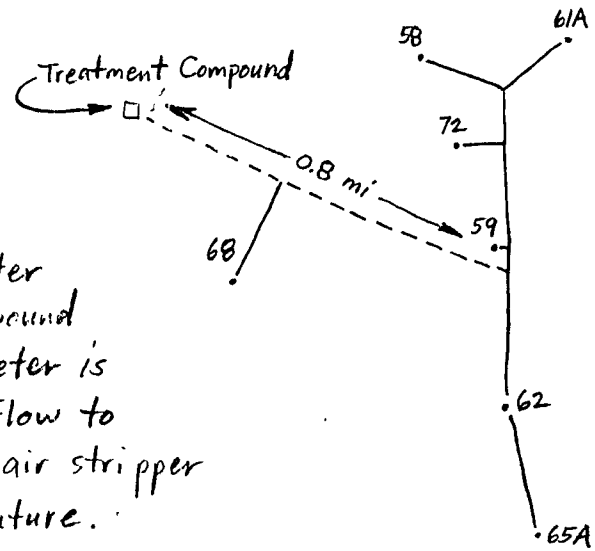
Sincerely,

Robert J. Menzie, Jr.
Production Environmental Representative

Attachment

xc: N. R. Garza

Robert J. Menzie, Jr.
August 16, 1994



Note: Gathering inlet meter to Treatment Compound to be removed. Meter is not functioning. Flow to be gauged with air stripper meter in the future.

N

------ 4-inch PVC existing being replaced by 6-inch polypipe

——— existing 2-, 3-, and 4-inch PVC <u>not</u> being replaced

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
AUG 12 AM 8 50

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 10, 1994

Mr. Roger C. Anderson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
Land Office Building
Santa Fe, New Mexico 87504-2088

Dear Mr. Anderson:

Enclosed is the Second Quarter 1994 Treatment Project Report for the Indian Basin Remediation Project. This report is submitted on behalf of the Indian Basin Gas Plant owners in accordance with the Indian Basin Treatment Project Plan prepared by Marathon and approved by the Oil Conservation Division on April 2, 1992.

If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental & Safety Representative

Enclosure

xc: William C. Olson, Oil Conservation Division, Santa Fe
Mark Ashley, Oil Conservation Division, Artesia

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
94 AUG 5 AM 8 50

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 2, 1994

Mr. William Olson
Hydrogeologist
Environmental Bureau
New Mexico Oil Conservation Division
Land Office Building
Santa Fe, New Mexico 87504-2088

RE: Specific Conductivity Unit Conversion

Dear Mr. Olson:

Per your request during the Indian Basin remediation project Third Quarter groundwater sampling episode during the week of July 18, the specific conductivity units conversion from Siemens to micromhos is:

1 milliSiemen per meter = 10 micromhos per centimeter.

The conductivity meter that Carter and Burgess, Inc. utilized reported values in Siemen units. You may want to update your field notes with the units conversion information. I will request that Carter and Burgess, Inc. use micromhos per centimeter units to construct the field data table included in the quarterly monitoring report.

I have scheduled the Fourth Quarter groundwater sampling episode for October 4 through October 7, 1994. If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental Representative

xc: Mark Ashley, OCD-Artesia

Mid-Continent Region
Production United States

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
AM 8 50

Marathon Oil Company

July 29, 1994

Mr. William Olson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

RE: Indian Basin Gas Plant
Line #1 Release Remediation Workplan

Dear Mr. Olson:

Per the 15-day written report requirement in the State of New Mexico Water Quality Control Commission (WQCC) Regulations Part 1, Section 1-203(6), "Notification of Discharge-Removal," Marathon Oil Company is submitting a workplan for Oil Conservation Division approval to address contaminated soil related to a 552-barrel spill consisting of 125 barrels of condensate and 427 barrels of produced water from Line #1 at the Indian Basin Gas Plant. Marathon intends to initiate work as described in the attached workplan on the morning of August 31, 1994 following a site safety meeting scheduled for 7:00 am.

If you have any questions concerning this project, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Production Environmental Representative

Attachment

xc: Mark Ashley, NMOCD, Artesia
N. R. Garza, Indian Basin Gas Plant

INDIAN BASIN GAS PLANT
LINE #1 RELEASE
REMEDIATION WORKPLAN

Indian Basin Gas Plant
329 Marathon Road
Lakewood, New Mexico 88254
Eddy County

Submitted by
Marathon Oil Company
on behalf of the
Indian Basin Gas Plant Owners

July 29, 1994

INTRODUCTION

This proposed workplan has been prepared in response to the 15-day written report requirement in the State of New Mexico Water Quality Control Commission (WQCC) Regulations Part 1, Section 1-203(6), "Notification of Discharge - Removal." At the Oil Conservation Division's (OCD) request, Marathon Oil Company is submitting a workplan for OCD approval to address contaminated soil related to a 552-barrel spill of condensate and produced water from a production pipeline within the Indian Basin Gas Plant on Marathon-owned property that occurred on July 15, 1994. The spill consisted of approximately 125 barrels of condensate and 427 barrels of produced water. The Indian Basin Gas Plant is located at 329 Marathon Road, Lakewood, New Mexico 88254 in Eddy County (Figure 1).

INTERIM MEASURES

The Line #1 leak was discovered on the afternoon of July 13 by a plant operator on routine rounds. A wet area was observed above Line #1 at the southern plant area approximately 80 feet west of the inlet separators (Figure 2). Marathon immediately took steps to shut in and blow down Line #1. One high pressure dry gas pipeline is buried beneath Line #1 and presented a safety hazard during the excavation to repair Line #1. Marathon shut in and blew down this dry gas pipeline. Shovels and a backhoe were then used to excavate around the pipelines to expose the problem area. A corroded dresser coupling connecting two lengths of polyvinyl chloride (PVC) piping was leaking from one 1/8-inch hole. This faulty coupling was replaced with a section of poly pipe and the excavation was backfilled.

VERBAL AND WRITTEN SPILL REPORTING

On July 15, 1994 a verbal notification of the spill event was made to Mark Ashley with the OCD, Artesia office. On July 22, 1994 a written report summarizing the spill nature, volume, and description of repair was submitted to OCD offices in Santa Fe and Artesia via an OCD Notification of Fire, Breaks, Spills, Leaks, and Blowouts standard reporting form.

WORKPLAN

The following corrective action steps are identified for source reduction associated with contaminated soil adjacent to and below the Line #1 pipeline. Workplan activities are scheduled for August 31, 1994.

Excavation

Marathon proposes to initially excavate contaminated soil related to the pipeline leak with

hand shovels to expose all pipelines in the area of the excavation. After these pipelines have been located exactly, a backhoe will be used to excavate the remaining contaminated soil to approximately 12 feet or to the depth that the backhoe can safely operate. An exclusion or safe zone will be established around the excavation to prevent onsite personnel from approaching the edge of the excavation. Sloping of one or more of the sidewalls or construction of earthen benches may be necessary to allow the backhoe to excavate to the target depth.

Soil Sampling

One grab soil sample will be collected from contaminated soils immediately below the pipeline where the release occurred. A three by three grid consisting of nine grab soil samples will be collected from the bottom of the excavation. In addition, two soil samples will be collected from each sidewall of the excavation (i.e. east, west, north, and south). A total of 18 samples will be collected. The backhoe will be used to remove undisturbed soil from the bottom and sidewalls of the excavation for sampling purposes. Soil samples will be collected by Marathon personnel from the backhoe bucket at the edge of the exclusion zone. The soil samples will be collected in wide-mouth jars and placed on ice in a cooler at the site.

Laboratory Analysis

The soil samples will be sent overnight to Analytical Technologies, Inc. in Albuquerque, New Mexico for benzene, toluene, ethylbenzene, and total xylene (BTEX; EPA Method 8020), and total recovery petroleum hydrocarbon (TRPH; EPA Method 418.1) analyses. The turn-around time for BTEX and TRPH preliminary results will be 24 hours.

Excavation Cleanup Standards

Marathon proposes to remove soil that exceeds the suggested concentrations in the New Mexico Spill and Leak Guidelines for sites where the depth to groundwater is less than 50 feet. Therefore, the proposed excavation cleanup standards for TRPH, total BTEX, and benzene concentration in the soil are 100 mg/kg, 50 mg/kg, and 10 mg/kg, respectively.

Backfill of Excavation

If the laboratory results indicate that the cleanup standards proposed above have been met, the excavation will be backfilled with clean fill dirt and compacted. This clean fill dirt will be acquired from previously treated soil removed from the Indian Basin Gas Plant landfarm.

If the laboratory results indicate that the proposed cleanup standards have not been met, additional soil will be excavated, if possible, from the area where the laboratory results indicated the proposed cleanup standard was exceeded. Additional soil samples will be collected from this area after sufficient material is removed to satisfy the Marathon project manager. These samples

will be submitted for laboratory analysis of only the constituent that did not meet the proposed standards. Upon receipt of results that are below the proposed cleanup standard, the excavation will be backfilled with clean fill dirt and compacted.

Soil Treatment and Disposition

Marathon proposes to treat the nonhazardous, contaminated soil in the Indian Basin Gas Plant landfarm to reduce the TRPH and total BTEX concentrations in the soil to below 3,000 mg/kg and 50 mg/kg, respectively. Bioremediation of the soil to these levels can be accomplished by performing nutrient and freshwater addition, as well as periodic tilling. Marathon proposes to stockpile the excavated contaminated soil on plastic sheeting in an area adjacent to the Indian Basin Gas Plant landfarm until the soil removed from the Line #1 excavation can be loaded into the landfarm treatment cell and treated separately from soil removed from other locations. Marathon will test periodically to determine when soil meets the cleanup standards.

Upon determination that cleanup standards have been met, Marathon proposes to use the treated soil for construction of secondary containment berms within the gas plant or stormwater berms on the south side of the plant.

Health and Safety Plan

A site safety meeting will be conducted by Marathon personnel before work begins on the morning of August 31, 1994. Excavation safety and other hazards associated with the workscope activities described above will be discussed.

NEW MEXICO OIL CONSERVATION COMMISSION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

NAME OF OPERATOR	MARATHON OIL CO.				ADDRESS	P.O. BOX 1324, ARTESIA, NM 88210	
REPORT OF	FIRE	BREAK	SPILL X	LEAK X	BLOWOUT	OTHER*	
TYPE OF FACILITY	DRLG WELL	PROD WELL	TANK BTTY	PIPE LINE	GASO PLNT X	OIL RFY	OTHER*
NAME OF FACILITY	INDIAN BASIN GAS PLANT						
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION)	SW/NE			SEC. 23	TWP. 21S	RGE. 23E	COUNTY EDDY
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK	25 MILES WEST OF CARLSBAD						
DATE AND HOUR OF OCCURENCE	APP. 10:00 p.m. 7/10/94				DATE AND HOUR OF DISCOVERY	7/13/94 APP. 1:00 p.m.	
WAS IMMEDIATE NOTICE GIVEN?	YES X	NO	NOT REQUIRED		IF YES, TO WHOM	MARK ASHLEY - NMOCD	
BY WHOM	NOEL GARZA				DATE AND HOUR	* 8:30 a.m. 7/15/94	
TYPE OF FLUID LOST	CONDENSATE/PRODUCED WATER				QUANTITY OF LOSS	125 bbls Cond. 427 bbls Prod. H_2O	VOLUME RECOVERED bbls
DID ANY FLUIDS REACH A WATERCOURSE?	YES	NO X	QUANTITY				

IF YES, DESCRIBE FULLY**

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN**

Leak was inside the Plant fence, south of the Skimmer Basin on Line 1 Liquid Line (PVC). Caused by externally corroded hole in a steel dresser coupling. The coupling was removed and a section of poly pipe flanged on both ends to the PVC was installed. All steel was eliminnated.

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**

The area on surface was approximately seven feet in diameter as was the area on the pipeline around the dresser. Excavation work will continue on 8/31/94 when the plant is down for 24 hours maintenence. At this time all the lines will be located while the plant is down to permit further excavation after start-up if necessary.

DESCRIPTION OF AREA	FARMING	GRAZING	URBAN	OTHER*			
SURFACE CONDITIONS	SANDY X	SANDY LOAM	CLAY	ROCKY X	WET	DRY	SNOW

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**

Hot dry and breezy. Ambient temp. in the high 90's to 100's.

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED Noel R. Garza TITLE Plant Supt. DATE 7/15/94

*SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

* Mark Ashley & Jim Morrow out of town on 7/14/94 (3:30 p.m.) when volumes of product spilled were determined to be reportable.

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

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

[X] Telephone [ ] Personal	Time 1115	Date 7/15/94

Originating Party	Other Parties
Noel Garza, Bob Menzie - Marathon	Bill Olson - Envir. Bureau
Mark Ashley - OCD Artesia	

Subject

Marathon Indian Basin Spill Conference Spill

Discussion

Spill estimated at 125 bbls condensate 400 bbls produced water noticed through metering at gathering system. Shut in line. Spill surfaced at plant boundary. Dug up and discovered leak in a dresser coupling. Leak has been repaired

Told them to follow leak & Spill guidelines and submit report on spill and work plan for remediation within 1 week as required by regs.

Conclusions or Agreements

They will submit written report and work plan within one week.

Distribution DP
file < Remediation
Roger Anderson

Signed Bill Olson

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

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☑ Telephone ☐ Personal	Time 0850 hrs.	Date 7/15/94

Originating Party	Other Parties
Mark Ashley - OCD Artesia	Bill Olson - Envir. Bureau

Subject

Marathon Indian Basin Gas Plant

Discussion

Noel Garcia just called to report spill between Rocky Arroyo (site of last leak) and the plant. 125 bbls condensate lost and 400 bbls produced water lost.

Conclusions or Agreements

He is leaving for the site to inspect and will report back upon return to office

Distribution
file
Roger Anderson

Signed Bill Olson

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 10, 1994

Mr. and Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

RE: Water Analysis

Enclosed are analytical results of water samples obtained on May 19, 1994 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 405391

PROJECT # : (NONE)

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	ARROYO	AQUEOUS	05/19/94	NA	05/23/94	1
02	LYMAN	AQUEOUS	05/19/94	NA	05/23/94	1
03	STRIPPER OUTLET	AQUEOUS	05/19/94	NA	05/23/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	0.7
TOLUENE	UG/L	<0.5	<0.5	2.1
ETHYLBENZENE	UG/L	<0.5	<0.5	2.8
TOTAL XYLENES	UG/L	<0.5	<0.5	2.5

SURROGATE:

BROMOFLUOROBENZENE (%)	89	93	85

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 405391

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : INDIAN BASIN

DATE RECEIVED : 05/20/9
REPORT DATE : 05/31/9

PARAMETER	UNITS	01	02	05
CHLORIDE (EPA 325.2)	MG/L	12.2	12.1	21

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

RECEIVED
JUN 13 1994
OIL CONSERVATION DIV.
SANTA FE

June 10, 1994

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: Well Water Analysis

Enclosed are analytical results of water samples obtained on May 19, 1994 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were anlyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 405391

PROJECT # : (NONE)

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	ARROYO	AQUEOUS	05/19/94	NA	05/23/94	1
02	LYMAN	AQUEOUS	05/19/94	NA	05/23/94	1
03	STRIPPER OUTLET	AQUEOUS	05/19/94	NA	05/23/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	0.7
TOLUENE	UG/L	<0.5	<0.5	2.1
ETHYLBENZENE	UG/L	<0.5	<0.5	2.8
TOTAL XYLENES	UG/L	<0.5	<0.5	2.5

SURROGATE:

BROMOFLUOROBENZENE (%)	89	93	85

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 405391

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : INDIAN BASIN

DATE RECEIVED : 05/20/94
REPORT DATE : 05/31/94

PARAMETER	UNITS	01	02	05
CHLORIDE (EPA 325.2)	MG/L	12.2	12.1	21

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 10, 1994

RECEIVED
JUN 13 1994
OIL CONSERVATION DIV.
SANTA FE

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from a water sample obtained on May 19, 1994 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less that the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue monthly sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 405391

PROJECT # : (NONE)

PROJECT NAME : INDIAN BASIN REMEDIATION

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	ARROYO	AQUEOUS	05/19/94	NA	05/23/94	1
02	LYMAN	AQUEOUS	05/19/94	NA	05/23/94	1
03	STRIPPER OUTLET	AQUEOUS	05/19/94	NA	05/23/94	1

PARAMETER	UNITS	01	02	03
BENZENE	UG/L	<0.5	<0.5	0.7
TOLUENE	UG/L	<0.5	<0.5	2.1
ETHYLBENZENE	UG/L	<0.5	<0.5	2.8
TOTAL XYLENES	UG/L	<0.5	<0.5	2.5

SURROGATE:

BROMOFLUOROBENZENE (%)	89	93	85

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 405391

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : INDIAN BASIN

DATE RECEIVED : 05/20/9
REPORT DATE : 05/31/9

PARAMETER	UNITS	01	02	05
CHLORIDE (EPA 325.2)	MG/L	12.2	12.1	21

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 25, 1994

Mr. and Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

RE: Water Analysis

Enclosed are analytical results of water samples obtained on March 16 and April 5 from a natural spring in Rocky Arroyo and April 5 results of water from your well. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

March 16 and April 5 BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL COMPANY ATI I.D.: 403380
PROJECT # : (NONE)
PROJECT NAME: INDIAN BASIN

SAMPLE I.D. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	LYMAN	AQUEOUS	03/16/94	NA	03/21/94	1
05	ARROYO	AQUEOUS	03/16/94	NA	03/21/94	1
06	TRIP BLANK	AQUEOUS	01/17/94	NA	03/21/94	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5
BROMOFLUOROBENZENE (%)		95	95	94

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 403380

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : INDIAN BASIN

DATE RECEIVED : 03/17/94
REPORT DATE : 04/01/94

PARAMETER	UNITS	03	04	05
CHLORIDE (EPA 325.2)	MG/L	22	13	13

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 4C4345

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMED.

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	LYMAN	AQUEOUS	04/05/94	NA	04/14/94	1
05	BIEBBLE	AQUEOUS	04/05/94	NA	04/14/94	1
06	ARROYO	AQUEOUS	04/05/94	NA	04/14/94	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	92	88	94

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 404345

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : INDIAN BASIN REMED.

DATE RECEIVED : 04/11/94
REPORT DATE : 05/02/94

PARAMETER	UNITS	03	04	05	06	07
CHLORIDE (EPA 325.2)	MG/L	22	12.5	10.5	14	10.7

Mid[redacted]tinent Region
Production United States

DIVISION
8 50

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 25, 1994

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Well Water Analysis**

Dear Mr. Gregory:

Enclosed are analytical results from a water sample obtained on March 16 and April 5, 1994 from a natural spring in Rocky Arroyo. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less that the federal and state standards for drinking water.

BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue monthly sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL COMPANY ATI I.D.: 403380
PROJECT # : (NONE)
PROJECT NAME: INDIAN BASIN

SAMPLE I.D. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	LYMAN	AQUEOUS	03/16/94	NA	03/21/94	1
05	ARROYO	AQUEOUS	03/16/94	NA	03/21/94	1
06	TRIP BLANK	AQUEOUS	01/17/94	NA	03/21/94	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5
BROMOFLUOROBENZENE (%)		95	95	94

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 403380

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : INDIAN BASIN

DATE RECEIVED : 03/17/94
REPORT DATE : 04/01/94

PARAMETER	UNITS	03	04	05
CHLORIDE (EPA 325.2)	MG/L	22	13	13

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 404345

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMED.

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	LYMAN	AQUEOUS	04/05/94	NA	04/14/94	1
05	BIEBBLE	AQUEOUS	04/05/94	NA	04/14/94	1
06	ARROYO	AQUEOUS	04/05/94	NA	04/14/94	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	92	98	94

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 404345

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : INDIAN BASIN REMED.

DATE RECEIVED : 04/11/94
REPORT DATE : 05/02/94

PARAMETER	UNITS	03	04	05	06	07
CHLORIDE (EPA 325.2)	MG/L	22	12.5	10.5	14	10.7

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 25, 1994

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

Re: Well Water Analysis

Enclosed are analytical results of water samples obtained on March 16 and April 5, 1994 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, total xylene (BTEX) and chloride concentrations are less than the federal and state standards for drinking water.

BTEX and chloride samples were anlyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL COMPANY ATI I.D.: 403380
PROJECT # : (NONE)
PROJECT NAME: INDIAN BASIN

SAMPLE I.D. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	LYMAN	AQUEOUS	03/16/94	NA	03/21/94	1
05	ARROYO	AQUEOUS	03/16/94	NA	03/21/94	1
06	TRIP BLANK	AQUEOUS	01/17/94	NA	03/21/94	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5
BROMOFLUOROBENZENE (%)		95	95	94

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 403380

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : INDIAN BASIN

DATE RECEIVED : 03/17/94
REPORT DATE : 04/01/94

PARAMETER	UNITS	03	04	05
CHLORIDE (EPA 325.2)	MG/L	22	13	13

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)

CLIENT : MARATHON OIL COMPANY ATI I.D.: 404345

PROJECT # : 44999

PROJECT NAME : INDIAN BASIN REMED.

SAMPLE ID. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
04	LYMAN	AQUEOUS	04/05/94	NA	04/14/94	1
05	BIEBBLE	AQUEOUS	04/05/94	NA	04/14/94	1
06	ARROYO	AQUEOUS	04/05/94	NA	04/14/94	1

PARAMETER	UNITS	04	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5

SURROGATE:

BROMOFLUOROBENZENE (%)	92	88	94

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 404345

CLIENT : MARATHON OIL COMPANY
PROJECT # : 44999
PROJECT NAME : INDIAN BASIN REMED.

DATE RECEIVED : 04/11/94
REPORT DATE : 05/02/94

PARAMETER	UNITS	03	04	05	06	07
CHLORIDE (EPA 325.2)	MG/L	22	12.5	10.5	14	10.7

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 13, 1994

Mr. Roger C. Anderson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
Land Office Building
Santa Fe, New Mexico 87504-2088

RECEIVED
MAY 16 1994
OIL CONSERVATION DIV.
SANTA FE

Dear Mr. Anderson:

Enclosed is the First Quarter 1994 Treatment Project Report for the Indian Basin Remediation Project. This report is submitted on behalf of the Indian Basin Gas Plant owners in accordance with the Indian Basin Treatment Project Plan prepared by Marathon and approved by the Oil Conservation Division on April 2, 1992.

If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental & Safety Representative

Enclosure

xc: William C. Olson, Oil Conservation Division, Santa Fe

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED

Marathon Oil Company

'94 APR 5 AM 8 49

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

March 28, 1994

Mr. William Olson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

RE: INDIAN BASIN REMEDIATION PROJECT
SECOND QUARTER SAMPLING NOTIFICATION

Dear Mr. Olson:

The Second Quarter sampling episode for the Indian Basin remediation project will be conducted during the week of April 4, 1994. Depth-to-water measurements will be recorded in the compliance wells on Monday, April 4, followed by purging and sampling activities on Tuesday, April 5 through Friday, April 8. If you have any questions concerning this project, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Production Environmental Representative

RJM32894/nrt

xc: Mark Ashley, NMOCD, Artesia

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

RECEIVED
FEB 10 1994
OIL CONSERVATION DIV.
SANTA FE

February 9, 1994

Mr. Roger C. Anderson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
Land Office Building
Santa Fe, New Mexico 87504-2088

Dear Mr. Anderson:

Enclosed is the Fourth Quarter 1993 Treatment Project Report for the Indian Basin Remediation Project. This report is submitted on behalf of the Indian Basin Gas Plant owners in accordance with the Indian Basin Treatment Project Plan prepared by Marathon and approved by the Oil Conservation Division on April 2, 1992.

If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental & Safety Representative

Enclosure

xc: Mr. William C. Olson, Oil Conservation Division, Santa Fe

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

January 7, 1994

Mr. and Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

RE: Water Analysis

Enclosed are analytical results from water samples obtained on November 10 and December 6, 1993 from a natural spring in Rocky Arroyo you use for stock water. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, and total xylene (BTEX) concentrations are less than the Environmental Protection Agency (EPA) standards for drinking water.

Chloride concentrations for November 10 and December 6 were 493 and 10.7 mg/L, respectively. Although the recent result is consistent with previous chloride analyses, the former result is greater than the Environmental Protection Agency (EPA) standard for drinking water of 250 mg/L. This result is anomalous and is probably due to lab error.

November 10 samples were analyzed by Core Laboratories in Aurora, Colorado using EPA-approved methods. December 6 BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
11/29/93

JOB NUMBER: 932203 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....:
DATE SAMPLED.....: 11/10/93
TIME SAMPLED.....: 13:45
WORK DESCRIPTION...: #2 ARROYO

LABORATORY I.D...: 932203-0003
DATE RECEIVED....: 11/12/93
TIME RECEIVED....: 10:42
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	493	1.5	mg/L	325.2 (1)	11/17/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/17/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	94	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

The analyses, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgment of Core Laboratories. Core Laboratories, however assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, proper operations, or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced except in its entirety, without the written approval of Core Laboratories.

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL COMPANY ATI I.D.: 312321
PROJECT # : (NONE)
PROJECT NAME: INDIAN BASIN REMEDIATION

SAMPLE I.D. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	12/06/93	NA	12/09/93	1
02	#1 LYMAN	AQUEOUS	12/06/93	NA	12/09/93	1
05	#2 ARROYO	AQUEOUS	12/06/93	NA	12/09/93	1
06	TRIP BLANK	AQUEOUS	12/01/93	NA	12/09/93	1

PARAMETER	UNITS	01	02	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5	<0.5
BROMOFLUOROBENZENE (%)		100	95	98	100

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 312321

DATE RECEIVED : 12/07/93

REPORT DATE : 12/29/93

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : INDIAN BASIN REMEDIATION

PARAMETER	UNITS	01	02	03	04	05
CHLORIDE (EPA 325.2)	MG/L	20	14	15	4400	10.7

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

January 7, 1994

Ms. Patricia Lyman
Queens Route
Carlsbad, New Mexico 88220

RE: Water Well Analysis

Enclosed are analytical results from water samples obtained on November 10 and December 6, 1993 from your well. These analyses are utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, and total xylene (BTEX) concentrations are less than the Environmental Protection Agency (EPA) standards for drinking water.

Chloride concentrations for November 10 and December 6 were 482 and 14 mg/L, respectively. Although the recent result is consistent with previous chloride analyses, the former result is greater than the Environmental Protection Agency (EPA) standard for drinking water of 250 mg/L. This result is anomalous and is probably due to lab error.

November 10 samples were analyzed by Core Laboratories in Aurora, Colorado using EPA-approved methods. December 6 BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling your well and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
11/29/93

JOB NUMBER: 932203 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....:
DATE SAMPLED.....: 11/10/93
TIME SAMPLED.....: 13:23
WORK DESCRIPTION...: #1 LYMAN

LABORATORY I.D...: 932203-0002
DATE RECEIVED....: 11/12/93
TIME RECEIVED....: 10:42
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	482	1.5	mg/L	325.2 (1)	11/17/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/17/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	96	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

The analyses, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgment of Core Laboratories. Core Laboratories, however, assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, proper operations, or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced except in its entirety, without the written approval of Core Laboratories.

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 312321

DATE RECEIVED : 12/07/93

REPORT DATE : 12/29/93

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : INDIAN BASIN REMEDIATION

PARAMETER	UNITS	01	02	03	04	05
CHLORIDE (EPA 325.2)	MG/L	20	14	15	4400	10.7

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL COMPANY ATI I.D.: 312321
PROJECT # : (NONE)
PROJECT NAME: INDIAN BASIN REMEDIATION

SAMPLE I.D. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	12/06/93	NA	12/09/93	1
02	#1 LYMAN	AQUEOUS	12/06/93	NA	12/09/93	1
05	#2 ARROYO	AQUEOUS	12/06/93	NA	12/09/93	1
06	TRIP BLANK	AQUEOUS	12/01/93	NA	12/09/93	1

PARAMETER	UNITS	01	02	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5	<0.5
BROMOFLUOROBENZENE (%)		100	95	98	100

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

January 7, 1994

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

RE: Water Analysis

Enclosed are analytical results from water samples obtained on November 10 and December 6, 1993 from a natural spring in Rocky Arroyo you use for stock water. These analyses evaluate potential impact to your water by released fluids from the leak discovered in April 1991 in the Indian Basin Field.

Benzene, toluene, ethylbenzene, and total xylene (BTEX) concentrations are less than the Environmental Protection Agency (EPA) standards for drinking water.

Chloride concentrations for November 10 and December 6 were 493 and 10.7 mg/L, respectively. Although the recent result is consistent with previous chloride analyses, the former result is greater than the Environmental Protection Agency (EPA) standard for drinking water of 250 mg/L. This result is anomalous and is probably due to lab error.

November 10 samples were analyzed by Core Laboratories in Aurora, Colorado using EPA-approved methods. December 6 BTEX and chloride samples were analyzed by Analytical Technologies, Inc. in Albuquerque, New Mexico and Phoenix, Arizona, respectively, using EPA-approved methods.

Short term plans are to continue sampling the natural spring in Rocky Arroyo closest to the plant and provide analytical results to you. If you have any questions, please contact me at the Midland office (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
11/29/93

JOB NUMBER: 932203 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....:
DATE SAMPLED.....: 11/10/93
TIME SAMPLED.....: 13:45
WORK DESCRIPTION...: #2 ARROYO

LABORATORY I.D....: 932203-0003
DATE RECEIVED....: 11/12/93
TIME RECEIVED....: 10:42
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	493	1.5	mg/L	325.2 (1)	11/17/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/17/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	94	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Analytical Technologies, Inc.

GAS CHROMATOGRAPHY RESULTS

TEST : BTEX (EPA 8020)
CLIENT : MARATHON OIL COMPANY ATI I.D.: 312321
PROJECT # : (NONE)
PROJECT NAME: INDIAN BASIN REMEDIATION

SAMPLE I.D. #	CLIENT I.D.	MATRIX	DATE SAMPLED	DATE EXTRACTED	DATE ANALYZED	DIL. FACTOR
01	SW-1	AQUEOUS	12/06/93	NA	12/09/93	1
02	#1 LYMAN	AQUEOUS	12/06/93	NA	12/09/93	1
05	#2 ARROYO	AQUEOUS	12/06/93	NA	12/09/93	1
06	TRIP BLANK	AQUEOUS	12/01/93	NA	12/09/93	1

PARAMETER	UNITS	01	02	05	06
BENZENE	UG/L	<0.5	<0.5	<0.5	<0.5
TOLUENE	UG/L	<0.5	<0.5	<0.5	<0.5
ETHYLBENZENE	UG/L	<0.5	<0.5	<0.5	<0.5
TOTAL XYLENES	UG/L	<0.5	<0.5	<0.5	<0.5
BROMOFLUOROBENZENE (%)		100	95	98	100

Analytical Technologies, Inc.

GENERAL CHEMISTRY RESULTS

ATI I.D. : 312321

CLIENT : MARATHON OIL COMPANY
PROJECT # : (NONE)
PROJECT NAME : INDIAN BASIN REMEDIATION

DATE RECEIVED : 12/07/93
REPORT DATE : 12/29/93

PARAMETER	UNITS	01	02	03	04	05
CHLORIDE (EPA 325.2)	MG/L	20	14	15	4400	10.7

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

January 5, 1994

Mr. Richard C. Cibak
Assistant District II Supervisor
State of New Mexico
State Engineer Office
1900 West Second St.
Roswell, New Mexico 88201

RE: FILE RA-5131-S-15

Dear Mr. Cibak:

As a follow-up to our phone conversation yesterday, enclosed is the completed Proof of Completion of Well form for Lower Queen recovery well MW-72. In addition, Marathon has installed a 2-inch Brooks turbine meter (Serial #2881532) with an initial reading of 470 gallons. Per your verbal approval received yesterday, continuous pumping will begin today.

If you have any questions concerning this project, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental Representative

xc: Mr. Roger Anderson, NMOCD, w/o attachment

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
New Mexico State Office
1474 Rodeo Rd.
P.O. Box 27115
Santa Fe, New Mexico 87502-0115

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

1703 (93012)

DEC 1993
RECEIVED

Mr. Lon Biasco
Federal Facilities Coordinator
Superfund Site Assessment Section (6H-MA)
U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Dear Mr. Biasco:

Recently the Environmental Protection Agency (EPA) informed the Bureau of Land Management (BLM) that BLM's earlier statement regarding private ownership of the site identified as BLM-Marathon Oil Co., Indian Basin Plant must be supported with documentation. The enclosed information supports BLM's recommendation that the site be removed from the Federal Facility Docket because the site is not Federally owned.

Enclosure No. 1 is a copy of the Master Title Plat (MTP) of the township in which the Indian Basin Plant is located. The MTP is the Federal Government's official record of public land ownership and shows that Township 21 South, Range 23 East, Section 23, Northeast quarter was patented from Federal ownership in 1966. The Indian Basin Plant is located within the Southwest quarter of that private quarter section.

Enclosure No. 2 is a copy of the patent conveying the land from Federal to private ownership. The land in question is the last tract listed in the list of conveyed land on the second page. It should be noted that the Federal Government does not track the ownership of the land once it is transferred from the public domain, thus BLM has no records regarding whether C. L. Crowder Investment Company still retains ownership of the parcel or if subsequent private transfers have taken place.

Enclosure No. 3 is a copy of the face sheet of an EPA prepared Preliminary Assessment of the site done in 1981 which correctly identified the site as privately owned.

This documentation proves that the site in question is not on BLM-administered Federal lands and thus should be removed from the Federal Facilities Docket. If you desire additional information regarding this information, please contact Mark Blakeslee at 505-438-7424.

Sincerely,

Malcolm J. Schnitker
Deputy State Director
Renewable Resources

3 Enclosures

Form 1860-9
(March 1965)
(formerly 4-1043)

New Mexico 0556411

The United States of America

To all to whom these presents shall come, Greeting:

WHEREAS, under the provisions of Section 8 of the Act of June 28, 1934 (48 Stat. 1269), entitled "An Act to stop injury to the public grazing lands by preventing overgrazing and soil deterioration, to provide for their orderly use, improvement, and development, to stabilize the livestock industry dependent upon the public range, and for other purposes," as amended by Section 3 of the Act of June 26, 1936 (49 Stat. 1976), C. L. Crowder Investment Company, in exchange for certain other land situated in the State of New Mexico, has selected the following described tracts of land:

New Mexico Principal Meridian, New Mexico.

T. 12 N., R. 20 W.,
Sec. 6, Lots 1, 2, 3, 4, 5, S½NE¼, SE¼NW¼.

T. 13 N., R. 20 W.,
Sec. 6, Lots 1, 2, 3, 4, 5, 6, 7, S½NE¼, SE¼NW¼, E½SW¼, SE¼;
Sec. 8, All;
Sec. 10, NE¼;
Sec. 14, NE¼;
Sec. 16, All;
Sec. 18, NE¼;
Sec. 20, All;
Sec. 22, All;
Sec. 28, W½, SE¼;
Sec. 30, Lots 1, 2, 3, 4, E½, E½W½;
Sec. 32, All.

T. 14 N., R. 20 W.,
Sec. 20, NE¼;
Sec. 28, All;
Sec. 30, Lots 1, 2, 3, 4, E½W½;
Sec. 32, E½NE¼, W½W½, E½SW¼.

T. 12 N., R. 21 W.,
Sec. 2, Lots 1, 2, 3, 4, S½N½, S½;
Sec. 10, Lots 1, 2, 3, 4, E½;
Sec. 14, W½;
Sec. 22, Lots 1, 2, 3, 4, E½;
Sec. 24, W½;
Sec. 26, All.

Patent Number 30-66-0017

New Mexico 0556411

T. 13 N., R. 21 W.,
Sec. 2, Lots 1, 2, 3, 4, S½N½, S½;
Sec. 12, N½;
Sec. 14, All;
Sec. 22, Lots 1, 2, 3, 4;
Sec. 24, SW¼NE¼, SW¼, W½SE¼, SE¼SE¼;
Sec. 26, All;
Sec. 34, Lots 3, 4;
Sec. 36, All.

T. 14 N., R. 21 W.,
Sec. 34, Lots 1, 2, 3, 4;
Sec. 36, E½, NW¼.

T. 21 S., R. 23 E.,
Sec. 23, NE¼.

The areas described aggregate 14,086.08 acres, according to the Official Plats of the Surveys of the said Lands, on file in the Bureau of Land Management:

NOW KNOW YE, That the UNITED STATES OF AMERICA, in consideration of the premises, and in conformity with the said Acts of Congress, HAS GIVEN AND GRANTED and by these presents DOES GIVE AND GRANT unto the said C. L. Crowder Investment Company, and to its successors, in fee simple, the tracts of Land above described; TO HAVE AND TO HOLD the same, together with all the rights, privileges, immunities, and appurtenances, of whatsoever nature, thereunto belonging, unto the said C. L. Crowder Investment Company, and to its successors and assigns forever; subject to any vested and accrued water rights for mining, agricultural, manufacturing, or other purposes, and rights to ditches and reservoirs used in connection with such water rights, as may be recognized and acknowledged by the local customs, laws, and decisions of courts; and there is reserved from the lands hereby granted, a right-of-way thereon for ditches or canals constructed by the authority of the United States.

Reserving, also, to the United States all minerals in the lands so granted, together with the right to prospect for, mine, and remove the same as authorized by the provisions of said Section 8 as amended as aforesaid.

This entry is made under Section 29 of the Act of February 25, 1920 (41 Stat. 437) and the Act of March 4, 1933 (47 Stat. 1570) and the patent is issued subject to the rights of prior permittees or lessees to use so much of the surface of said lands as is required for mining operations without compensation to the patentee for damages resulting from proper mining operations.

The E½NE¼, NW¼NE¼, SW¼NE¼ Sec. 20; Lot 4, E½SW¼, SE¼NW¼ Sec. 30, T. 14 N., R. 20 W.; Lot 4, Sec. 6, T. 13 N., R. 20 W. and NW¼NW¼ Sec. 12, T. 13 N., R. 21 W. are subject to a right-of-way for a Federal Aid Highway under 23 U.S.C. sec. 317.

Lots 4, 5, Sec. 6, T. 13 N., R. 20 W.; E½NE¼, SW¼NE¼ Sec. 20, T. 14 N., R. 20 W. and NW¼NW¼ Sec. 12, T. 13 N., R. 21 W. are subject to such rights for electric transmission line purposes as the Continental Divide Electric Cooperative, Incorporated may have under the Act of March 4, 1911 (36 Stat. 1253), as amended (43 U.S.C. sec. 961).

PATENT NO. 30-66-0017

Form 1860-10
(March 1965)
(formerly 4-1044)

New Mexico 0556411

The NW¼NE¼ Sec. 20; Lots 2, 3, 4, E½NW¼ Sec. 30, T. 14 N., R. 20 W. and NE¼ Sec. 36, T. 14 N., R. 21 W. are subject to such rights for telephone and telegraph line purposes as The Mountain States Telephone and Telegraph Company may have under the Act of March 4, 1911 (36 Stat. 1253), as amended (43 U.S.C. sec. 961).

The NE¼ Sec. 23, T. 21 S., R. 23 E. is subject to such rights for pipe line purposes as the Marathon Oil Company may have under Section 28 of the Act of February 25, 1920 (41 Stat. 437), as amended by the Act of August 21, 1935 (49 Stat. 674).

Reserving unto the United States that certain school bus road and all appurtenances thereto, constructed by the United States, through, over, or upon the SW¼NE¼ Sec. 6, T. 12 N., R. 20 W., and the right of the United States, its officers, agents, or employees to maintain, operate, repair, or improve the same so long as needed or used for or by the United States.

IN TESTIMONY WHEREOF, the undersigned authorized officer of the Bureau of Land Management, in accordance with the provisions of the Act of June 17, 1948 (62 Stat. 476), has, in the name of the United States, caused these letters to be made Patent, and the Seal of the Bureau to be hereunto affixed.

[SEAL]

GIVEN under my hand, in Santa Fe, New Mexico, the TWELFTH day of AUGUST in the year of our Lord one thousand nine hundred and SIXTY-FIVE and of the Independence of the United States the one hundred and NINETIETH.

By William J. Anderson
State Director, New Mexico.

Patent Number 30-66-0017

EPA

POTENTIAL HAZARDOUS WASTE SITE
IDENTIFICATION AND PRELIMINARY ASSESSMENT

REGION: 6

SITE NUMBER (to be assigned by Hq): NM 1404

NOTE: This form is completed for each potential hazardous waste site to help set priorities for site inspection. The information submitted on this form is based on available records and may be updated on subsequent forms as a result of additional inquiries and on-site inspections.

GENERAL INSTRUCTIONS: Complete Sections I and III through X as completely as possible before Section II *(Preliminary Assessment)*. File this form in the Regional Hazardous Waste Log File and submit a copy to: U.S. Environmental Protection Agency; Site Tracking System; Hazardous Waste Enforcement Task Force *(EN-335)*; 401 M St., SW; Washington, DC 20460.

I. SITE IDENTIFICATION

PO BOX 1324

A. SITE NAME: MARTHON Oil Co. - INDIAN BASIN

B. STREET *(or other identifier)*: SEC. 23, T21S, R. 23E

C. CITY: ARTESIA

D. STATE: NM

E. ZIP CODE: 88210

F. COUNTY NAME: Eddy

G. OWNER/OPERATOR *(if known)*

1. NAME: Michael Miller MARATHON Oil Co. - HOUSTON, TX

2. TELEPHONE NUMBER: 713/629-6600

H. TYPE OF OWNERSHIP

☐ 1. FEDERAL ☐ 2. STATE ☐ 3. COUNTY ☐ 4. MUNICIPAL ☒ 5. PRIVATE ☐ 6. UNKNOWN

I. SITE DESCRIPTION

Site was formerly a gas processing facility

J. HOW IDENTIFIED *(i.e., citizen's complaints, OSHA citations, etc.)*: CERCLA NOTIFICATION NM 1025

K. DATE IDENTIFIED *(mo., day, & yr.)*: 6/12/81

L. PRINCIPAL STATE CONTACT

1. NAME:

2. TELEPHONE NUMBER:

II. PRELIMINARY ASSESSMENT *(complete this section last)*

A. APPARENT SERIOUSNESS OF PROBLEM

☐ 1. HIGH ☐ 2. MEDIUM ☐ 3. LOW ☒ 4. NONE ☐ 5. UNKNOWN

B. RECOMMENDATION

☒ 1. NO ACTION NEEDED *(no hazard)*

☐ 2. IMMEDIATE SITE INSPECTION NEEDED
a. TENTATIVELY SCHEDULED FOR:
b. WILL BE PERFORMED BY:

☐ 3. SITE INSPECTION NEEDED
a. TENTATIVELY SCHEDULED FOR:
b. WILL BE PERFORMED BY:

☐ 4. SITE INSPECTION NEEDED *(low priority)*

C. PREPARER INFORMATION

1. NAME: A.L. GARDNER GAW-SR

2. TELEPHONE NUMBER: 214/767-4076

3. DATE *(mo., day, & yr.)*: 8-19-82

III. SITE INFORMATION

A. SITE STATUS

☐ 1. ACTIVE *(Those industrial or municipal sites which are being used for waste treatment, storage, or disposal on a continuing basis, even if infrequently.)*

☒ 2. INACTIVE *(Those sites which no longer receive wastes.)* 1969

☐ 3. OTHER *(specify)*: *(Those sites that include such incidents like "midnight dumping" where no regular or continuing use of the site for waste disposal has occurred.)*

B. IS GENERATOR ON SITE?

☒ 1. NO ☐ 2. YES *(specify generator's four-digit SIC Code)*:

C. AREA OF SITE *(in acres)*:

D. IF APPARENT SERIOUSNESS OF SITE IS HIGH, SPECIFY COORDINATES

1. LATITUDE *(deg.—min.—sec.)*:

2. LONGITUDE *(deg.—min.—sec.)*:

E. ARE THERE BUILDINGS ON THE SITE?

☐ 1. NO ☐ 2. YES *(specify)*:

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 15, 1993

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: **Water Well Analysis**

Dear Ms. Lyman:

Enclosed are the final analytical results from a water sample obtained from your well on October 14, 1993. The results indicate your water is below the standards for benzene, toluene, ethylbenzene, total xylenes, and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 that occurred in the Indian Basin Field.

Short term plans are to continue sampling your well. We will provide you with analytical results as they become available. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

RJM91193/nrt

Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
11/05/93

JOB NUMBER: 932031 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....:
DATE SAMPLED.....: 10/14/93
TIME SAMPLED.....: 08:16
WORK DESCRIPTION...: #1 LYMAN

LABORATORY I.D...: 932031-0007
DATE RECEIVED....: 10/16/93
TIME RECEIVED....: 09:15
REMARKS.....: REC'D @ 15 DEGREE C

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	14.6	0.5	mg/L	325.2 (1)	11/01/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/26/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	99	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 15, 1993

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

Final analytical results from a water sample obtained on October 14, 1993 from a natural spring located in Rocky Arroyo that you utilize are attached. The results indicate this water is below the standards for benzene, toluene, ethylbenzene, total xylenes, and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to the water by released fluids from the leak discovered in April 1991 that occurred in the Indian Basin Field.

Short term plans are to continue monthly sampling of the natural spring which is closest to the plant. We will provide you with analytical results as they become available. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

RJM11993/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
11/05/93

JOB NUMBER: 932031 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....:
DATE SAMPLED.....: 10/14/93
TIME SAMPLED.....: 08:45
WORK DESCRIPTION...: #2 ARROYO

LABORATORY I.D...: 932031-0008
DATE RECEIVED....: 10/16/93
TIME RECEIVED....: 09:15
REMARKS.....: REC'D @ 15 DEGREE C

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.3	0.5	mg/L	325.2 (1)	11/01/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/26/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	114	0	% Recovery	Limits (85-115)		

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Aurora, CO 80014
(303) 751-1780

The analyses, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgment of Core Laboratories. Core Laboratories, however, assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, proper operations, or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced except in its entirety, without the written approval of Core Laboratories.

OIL CONSERVATION DIVISION
RECEIVED
NOV 22 AM 9 45

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 15, 1993

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Final analytical results from water samples obtained on October 14, 1993 from a natural spring located in Rocky Arroyo that you utilize for stock water and your well are attached. The results indicate the water is below the standards for benzene, toluene, ethylbenzene, total xylenes, and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of the water was conducted at Core Laboratories in Aurora, Colorado utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to the water by released fluids from the leak discovered in April 1991 that occurred in the Indian Basin Field.

Short term plans are to continue quarterly sampling of your well. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. We will continue to provide you with analytical results as they become available. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

RJM11993/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
11/05/93

JOB NUMBER: 932031 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....:
DATE SAMPLED.....: 10/14/93
TIME SAMPLED.....: 08:45
WORK DESCRIPTION...: #2 ARROYO

LABORATORY I.D...: 932031-0008
DATE RECEIVED....: 10/16/93
TIME RECEIVED....: 09:15
REMARKS.....: REC'D @ 15 DEGREE C

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.3	0.5	mg/L	325.2 (1)	11/01/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/26/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	114	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Western Atlas International
A Litton-Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
11/05/93

JOB NUMBER: 932031 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....:
DATE SAMPLED.....: 10/14/93
TIME SAMPLED.....: 09:10
WORK DESCRIPTION...: #3 BIEBBLE

LABORATORY I.D....: 932031-0009
DATE RECEIVED.....: 10/16/93
TIME RECEIVED.....: 09:15
REMARKS.....: REC'D @ 15 DEGREE C

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.4	0.5	mg/L	325.2 (1)	11/01/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/26/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	110	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 11, 1993

RECEIVED
NOV 12 1993
OIL CONSERVATION DIV
SANTA FE

Mr. Roger C. Anderson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
Land Office Building
Santa Fe, New Mexico 87504-2088

Dear Mr. Anderson:

Enclosed is the Third Quarter 1993 Treatment Project Report for the Indian Basin Remediation Project. This report is submitted on behalf of the Indian Basin Gas Plant owners in accordance with the Indian Basin Treatment Project Plan prepared by Marathon and approved by the Oil Conservation Division on April 2, 1992.

If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Production Environmental & Safety Representative

Enclosure

cc: Mr. William C. Olson, Oil Conservation Division, Santa Fe

bcc: R. A. Biernbaum, Midland, w/ o attachments
C. K. Curlee, Midland, w/ o attachments
D. E. Kenyon, PTC-Littleton, w/ attachments
T. C. Lowry, Midland, w/ o attachments
C. M. Schweser, IBGP-Lakewood, w/ attachments
R. F. Unger, Midland, w/ attachments

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

'93 NOV 10 24

November 9, 1993

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

Final analytical results from a water sample obtained on September 21, 1993 from a natural spring located in Rocky Arroyo that you utilize are attached. The results indicate this water is below the standards for benzene, toluene, ethylbenzene, total xylenes, and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to the water by released fluids from the leak discovered in April 1991 that occurred in the Indian Basin Field.

Short term plans are to continue monthly sampling of the natural spring which is closest to the plant. We will provide you with analytical results as they become available. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

RJM11993/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
10/14/93

JOB NUMBER: 931871 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....:
DATE SAMPLED.....: 09/21/93
TIME SAMPLED.....: 13:40
WORK DESCRIPTION...: #2

LABORATORY I.D...: 931871-0003
DATE RECEIVED....: 09/24/93
TIME RECEIVED....: 12:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.5	0.5	mg/L	325.2 (1)	10/12/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		624 (1)	10/05/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	97	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

Novembe 9, 1993

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Final analytical results from water samples obtained on September 21, 1993 from a natural spring located in Rocky Arroyo that you utilize for stock water are attached. The results indicate the water is below the standards for benzene, toluene, ethylbenzene, total xylenes, and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to the water by released fluids from the leak discovered in April 1991 that occurred in the Indian Basin Field.

Short term plans are to continue quarterly sampling of your well. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. We will continue to provide you with analytical results as they become available. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

RJM11993/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
10/14/93

JCB NUMBER: 931871 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....:
DATE SAMPLED.....: 09/21/93
TIME SAMPLED.....: 13:40
WORK DESCRIPTION...: #2

LABORATORY I.D...: 931871-0003
DATE RECEIVED....: 09/24/93
TIME RECEIVED....: 12:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.5	0.5	mg/L	325.2 (1)	10/12/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		624 (1)	10/05/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	97	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

November 9, 1993

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: **Water Well Analysis**

Dear Ms. Lyman:

Enclosed are the final analytical results from a water sample obtained from your well on September 21, 1993. The results indicate your water is below the standards for benzene, toluene, ethylbenzene, total xylenes, and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to your water by released fluids from the leak discovered in April 1991 that occurred in the Indian Basin Field.

Short term plans are to continue sampling your well. We will provide you with analytical results as they become available. If you have any questions, please contact me at the Midland office, (800) 351-1417.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

RJM91193/nrt

Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
10/14/93

JOB NUMBER: 931871 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....:
DATE SAMPLED.....: 09/21/93
TIME SAMPLED.....: 12:55
WORK DESCRIPTION...: #1

LABORATORY I.D...: 931871-0002
DATE RECEIVED....: 09/24/93
TIME RECEIVED....: 12:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	12.4	0.5	mg/L	325.2 (1)	10/12/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		624 (1)	10/05/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	97	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Con[illegible]nt Region
Production United States

OIL CONSERV[illegible] DIVISION
RE[illegible]ED

'93 OC[illegible] AM 9 18

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 7, 1993

Mr. Richard C. Cibak
Roswell Basin Supervisor
State of New Mexico
State Engineer Office
1900 West Second St.
Roswell, N.M. 88201

Dear Mr. Cibak:

Enclosed are an application for permit and a check for $25 for Marathon Oil Company's Permit to supplement the Lower Queen aquifer of the State of New Mexico No. RA-5131-S-2 through RA-5131-S-14. Marathon has completed an additional recovery well (MW-72) and is requesting this well be permitted for withdrawal from the Lower Queen.

If you have any questions or if you require any additional information, please call me (915-687-8312).

Sincerely,

Robert J. Menzie Jr.

Robert J. Menzie, Jr.
Production Environmental Representative

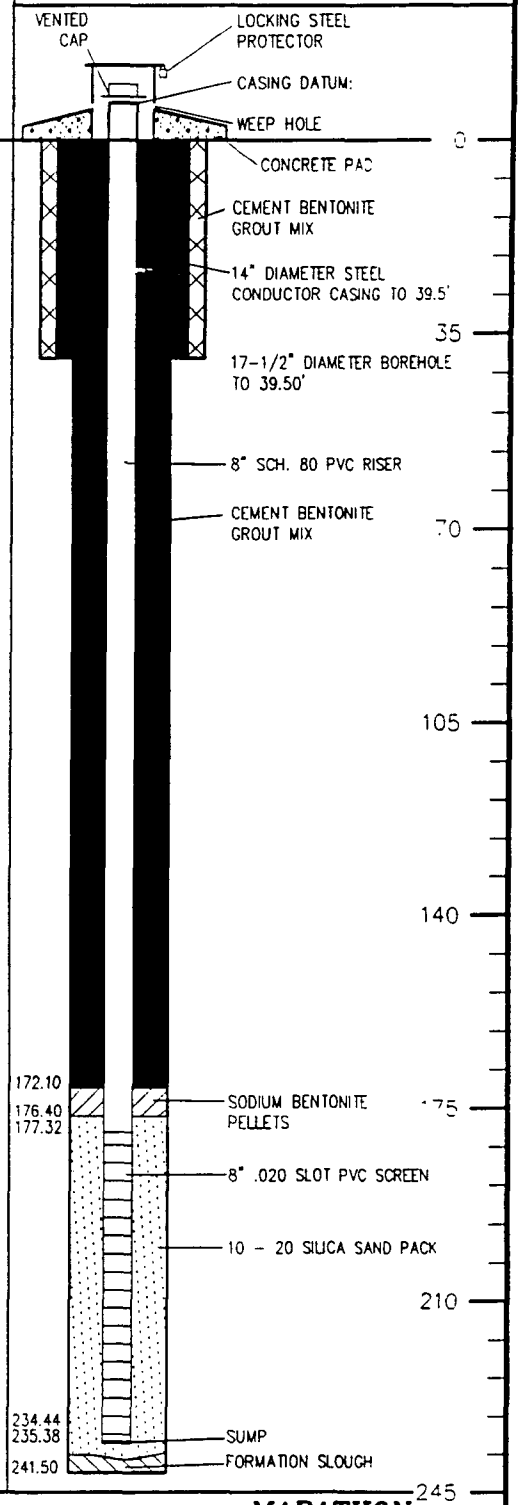
RJM5003/pe

cc: Roger C. Anderson/William Olson
Oil Conservation Division, Santa Fe

WELL COMPLETION RECO

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		Start: 19:05 Stop: 20:00 (8/25/93) Resume: 15:00 (8/29/93) GROUND SURFACE:				
	0	SILTY SAND	SM		1 GC	
	7.0	DOLOMITIC SANDSTONE	DOLOMITIC SANDSTONE			
	15.0		SANDSTONE			
	18.0	SANDSTONE	SANDY		10 GC	
	21.0	SANDY DOLOMITE	DOLOMITE SANDSTONE			
	25.0	SANDSTONE	DOLOMITIC SANDSTONE			
	35	DOLOMITIC SANDSTONE			20 GC	
	41.0	SANDSTONE	SANDSTONE			
	55.0	DOLOMITE	DOLOMITE		30 GC	
	59.0	SANDSTONE	SANDSTONE			
	70				40 GC	
	81.0	DOLOMITE	DOLOMITE			
	89.0	SANDY DOLOMITE	SANDY DOLOMITE		50 GC	
	101.0	DOLOMITE	DOLOMITE			
	105				60 GC	
					70 GC	
	140				80 GC	
	159.0		DOLOMITIC SANDSTONE			
	161.0	DOLOMITIC SANDSTONE	DOLOMITE			
	165.0	DOLOMITE	DOLOMITIC SANDSTONE			
	169.0	DOLOMITIC SANDSTONE			90 12.0	
	175	DOLOMITE	DOLOMITE			
8/30/93 ▽ 188.85					100 GC	
	198.0		DOLOMITIC			
	200.0	DOLOMITIC LIMESTONE	LIMESTONE			
	207.0	DOLOMITE	DOLOMITE			
	210	DOLOMITIC LIMESTONE	DOLOMITIC LIMESTONE		110 GC	
▽ 220.0	219.0		DOLOMITE			
	220.0	DOLOMITE	LIMESTONE			
	226.0	LIMESTONE				
		SANDSTONE	SANDSTONE		120 GC	
		FOR COMPLETE LITHOLOGICAL DESCRIPTION SEE BH-99			125 GC NR	
	241.5	BORING TERMINATED AT 241.5 FEET				
	245					

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
GC: GRAB COMPOSITE

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

MARATHON

JOB NAME/NUMBER **931601T3**

BORING NUMBER **MW-72 (BH-99)**

DATE DRILLED 8/25/93 TO 8/29/93
DRILLING METHOD AIR HAMMER/AIR ROTARY
DRILLED BY LES
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: TAH
DRAWING NO. 93116B99
PAGE 1 OF

INDEX TO WELL PERMITS

WELL NUMBER	MARATHON MONITORING WELL NO.	SUBDIVISION	SECTION	TOWNSHIP	RANGE
RA-5131-S-2	57	NW1/4SE1/4SW1/4SW1/4	24	21S	23E
RA-5131-S-3	58	SE1/4SW1/4SE1/4NW1/4	24	21S	23E
RA-5131-S-4	59	NE1/4SE1/4NE1/4SW1/4	24	21S	23E
RA-5131-S-5	60	NW1/4NW1/4NE1/4SW1/4	24	21S	23E
RA-5131-S-6	61A	NW1/4SW1/4NW1/4NE1/4	24	21S	23E
RA-5131-S-7	62	SE1/4SW1/4SW1/4SE1/4	24	21S	23E
RA-5131-S-8	63	SE1/4NW1/4NE1/4SW1/4	23	21S	23E
RA-5131-S-9	64	NE1/4SW1/4SE1/4SE1/4	24	21S	23E
RA-5131-S-10	65A	NW1/4NW1/4NW1/4NE1/4	25	21S	23E
RA-5131-S-11	66	SW1/4SW1/4SE1/4SW1/4	13	21S	23E
RA-5131-S-12	67	NW1/4NE1/4SE1/4NE1/4	25	21S	23E
RA-5131-S-13	68	SE1/4SE1/4SE1/4SE1/4	23	21S	23E
RA-5131-S-14	70	NW1/4NW1/4NE1/4NE1/4	26	21S	23E
RA-5131-S-15	72	NE1/4SE1/4NW1/4	24	21S	23E

M008/1r

Revised August 1967

IMPORTANT—READ INSTRUCTIONS ON BACK BEFORE FILLING OUT THIS FORM

APPLICATION FOR PERMIT

To ~~Appropriate~~ Supplement the Underground Waters of the State of New Mexico

Date Received _____ File No. RA-5131-S-2 thru S-14

1. Name of applicant Marathon Oil Company
   Mailing address P. O. Box 552
   City and State Midland, TX 79702-0552
2. Source of water supply Artesian (artesian or shallow water aquifer), located in Roswell Artesia Basin (name of underground basin)
3. The well is to be located in the NE ¼ SE ¼ NW ¼, Section 24 Township 21S Range 23E N.M.P.M., or Tract No. ____ of Map No. ____ of the _____ District, on land owned by Bureau of Land Management.
4. Description of well: name of driller Layne Environmental Services; Inside Diameter of casing 8.0 inches; Approximate depth to be drilled 238 feet;
5. Quantity of water to be appropriated and beneficially used 87.165 (consumptive use, diversion) acre feet, for Industrial (Gas Processing) and Domestic purposes.
6. Acreage to be irrigated or place of use Indian Basin Gas Plant acres.

Subdivision	Section	Township	Range	Acres	Owner

7. Additional statements or explanations Application to supplement Permits RA-5131-S-2 through S-14 for additional groundwater recovery from Lower Queen aquifer with new recovery well (No. MW-72). Well construction diagram for MW-72 is attached and was completed similar to other permitted wells. Lower Queen groundwater recovery is associated with ongoing treatment project approved by the NM Oil Conservation Division.

   Attached is a revised index to well permits for RA-5131.

I, A. R. Kukla, affirm that the foregoing statements are true to the best of my knowledge and belief and that development shall not commence until approval of the permit has been obtained.

Marathon Oil Company, Permittee,

By: A R Kukla.

Subscribed and sworn to before me this 12th day of October, A.D., 1993.

My commission expires 4-27-97 Dixie A. Hertel
Notary Public

DIXIE A. HERTEL
MY COMMISSION EXPIRES
April 27, 1997

Number of this permit _____

ACTION OF STATE ENGINEER

After notice pursuant to statute and by authority vested in me, this application is approved provided it is not exercised to the detriment of any others having existing rights; further provided that all rules and regulations of the State Engineer pertaining to the drilling of _____ wells be complied with; and further subject to the following conditions: _____

Proof of completion of well shall be filed on or before _____, 19_____

Proof of application of water to beneficial use shall be filed on or before _____, 19 _____

Witness my hand and seal this _____ day of _____, A.D., 19_____.

S. E. Reynolds, State Engineer

By: _____.

INSTRUCTIONS

This form shall be executed, preferably typewritten, in triplicate and shall be accompanied by a filing fee of ~~$5.00~~. 25.00 Each of triplicate copies must be properly signed and attested.

A separate application for permit must be filed for each well used.

Secs. 1—4—Fill out all blanks fully and accurately.

Sec. 5—Irrigation use shall be stated in acre feet of water per acre per annum to be applied on the land. If for municipal or other purposes, state total quantity in acre feet to be used annually.

Sec. 6—Describe only the lands to be irrigated or where water will be used. If on unsurveyed lands describe by legal subdivision "as projected" from the nearest government survey corners, or describe by metes and bounds and tie survey to some permanent, easily located natural object.

Sec. 7—If lands are irrigated from any other source, explain in this section. Give any other data necessary to fully describe water right sought.

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
1993 OCT 12 AM 9 19

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 7, 1993

Mr. William Olson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

RE: INDIAN BASIN REMEDIATION PROJECT
FOURTH QUARTER SAMPLING NOTIFICATION

Dear Mr. Olson:

This letter is a follow-up to our phone conversation today informing your office of our fourth quarter sampling episode at the Indian Basin remediation project site. Lower Queen depth-to-water measurements will be recorded on Monday, October 11, 1993 followed by purging and sampling activities on Tuesday through Thursday, October 12-14, 1993.

The first quarter (January 1994) sampling episode is tentatively scheduled for Monday, January 10 through Thursday, January 13, 1994. If you have any questions concerning this project, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Production Environmental Representative

RJM5002\pae

cc: Mr. Roger Anderson, NMOCD

Mid-Continent Region
Production - United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 22, 1993

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

Final analytical results from a water sample obtained on August 3, 1993 from a natural spring located in Rocky Arroyo utilized by you are attached. The results of this analysis indicate this water to be within standards for hydrocarbons and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to your water by released fluids from the April 1991 leak that occurred in the Indian Basin Field.

Short term plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant. We will continue to provide you with analytical results as they become available. In the meantime, should you have any questions, please contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

RJM93992/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
08/27/93

JOB NUMBER: 931479 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....: MONTHLY
DATE SAMPLED.....: 08/03/93
TIME SAMPLED.....: 12:15
WORK DESCRIPTION...: #2

LABORATORY I.D...: 931479-0002
DATE RECEIVED....: 08/04/93
TIME RECEIVED....: 09:40
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.8	0.5	mg/L	325.2 (1)	08/25/93	VKN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	08/16/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	110	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production - United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 22, 1993

Ms Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: **Water Well Analysis**

Dear Ms. Lyman:

Enclosed are the final analytical results from a water sample obtained from your well on August 3, 1993. The results of these analyses indicate your water to be within standards for hydrocarbons and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Short term plans are to continue to conduct sampling of your well. We will continue to provide you with analytical results as they become available. In the meantime, should you have any questions, please contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

RJM93922/nrt

Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Tenneco Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
08/27/93

JOB NUMBER: 931479 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....: MONTHLY
DATE SAMPLED.....: 08/03/93
TIME SAMPLED.....: 11:50
WORK DESCRIPTION...: #1

LABORATORY I.D...: 931479-0001
DATE RECEIVED....: 08/04/93
TIME RECEIVED....: 09:40
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.1	0.5	mg/L	325.2 (1)	08/25/93	VKN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	08/17/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	106	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Con[illegible]t Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 22, 1993

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Final analytical results from water samples obtained on August 3, 1993 from a natural spring located in Rocky Arroyo utilized by you for stock water are attached. The results of this analysis indicate your water to be within standards for hydrocarbons and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of the water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to your water by released fluids from the April 1991 leak that occurred in the Indian Basin Field.

Short term plans are to continue to conduct quarterly sampling of your well. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. We will continue to provide you with analytical results as they become available. In the meantime, should you have any questions, please contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

RJM93993/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
08/27/93

JOB NUMBER: 931479 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....: MONTHLY
DATE SAMPLED.....: 08/03/93
TIME SAMPLED.....: 12:15
WORK DESCRIPTION...: #2

LABORATORY I.D...: 931479-0002
DATE RECEIVED....: 08/04/93
TIME RECEIVED....: 09:40
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.8	0.5	mg/L	325.2 (1)	08/25/93	VKN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	08/16/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	110	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
'93 AUG 23 AM 9 34

August 18, 1993

Mr. William Olson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

RE: INDIAN BASIN REMEDIATION PROJECT

Dear Mr. Olson:

As a follow-up to our phone conversation on Monday, August 16, 1993, this letter is to inform you that drilling of monitoring well MW-71 is scheduled to commence on Sunday morning, August 22, 1993. Your office approved the proposed location and well construction in your letter of May 17, 1993. In addition, Marathon is planning to drill an additional recovery well (MW-72) and construct both wells in the same manner as previously approved for wells completed in the Lower Queen aquifer.

Marathon anticipates completing MW-71 on Tuesday, August 24, 1993. Drilling of recovery well MW-72 between MW-58 (BH-84) and MW-59 (BH-85) will commence immediately following the completion of MW-71. Construction of MW-72 is anticipated on Friday, August 27, 1993.

Well development is scheduled for Saturday, August 28, 1993 or the day following drilling and completion activities. Marathon anticipates sampling the groundwater in both wells on Tuesday, August 31, 1993.

If you have any questions concerning this project, please contact me at (915) 687-8312.

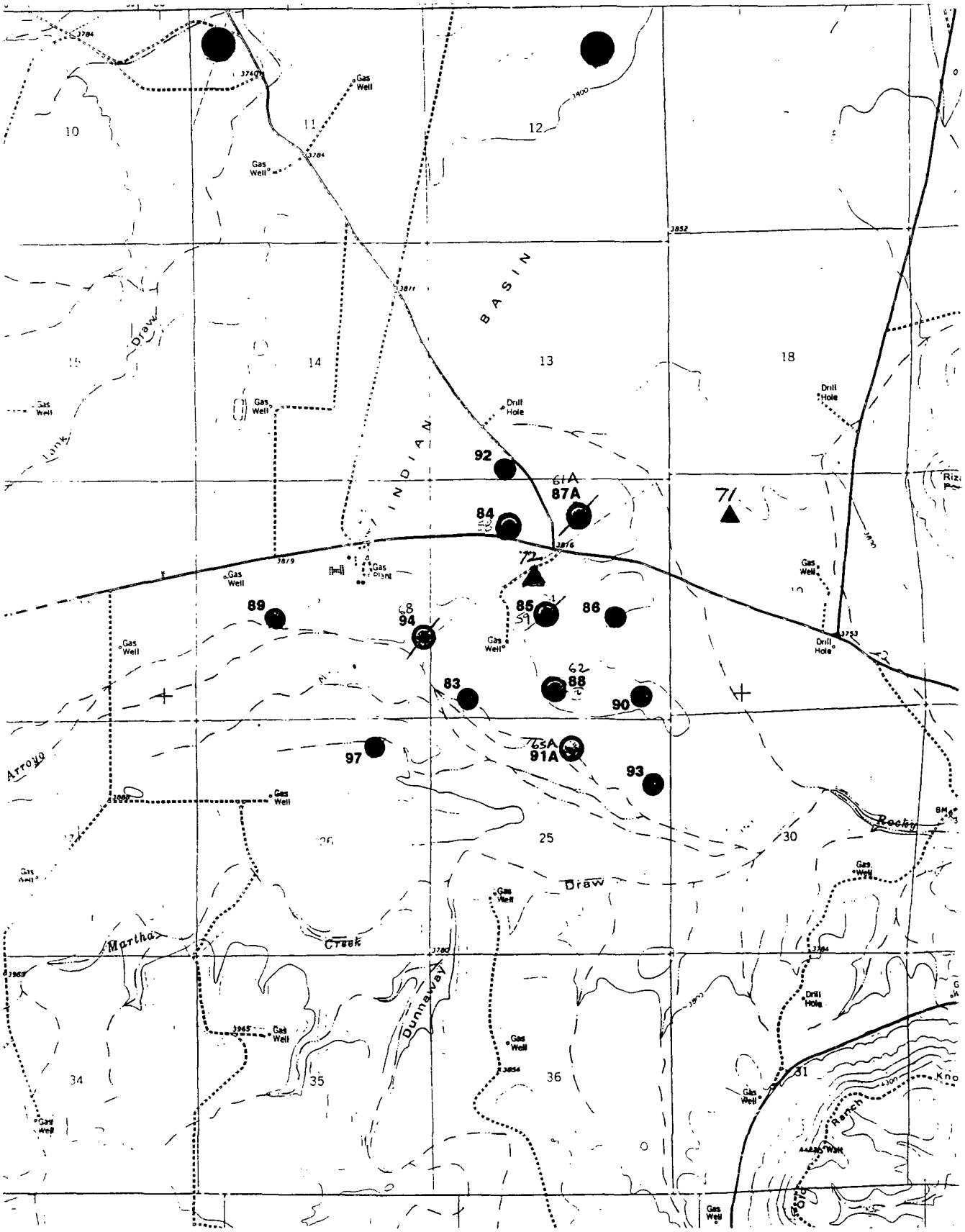
Sincerely,

Robert J. Menzie, Jr.
Production Environmental Representative

RJM93817/nrt

Attachment

cc: Mr. Roger Anderson, NMOCD



LQ MONITOR WELL

LQ RECOVERY WELL

Free product well

PROPOSED LOCATION

35 BOREHOLE NUMBER

MARATHON OIL COMPANY
MID-CONTINENT REGION

MARTHA CREEK
7.5' QUAD
1" = 2000'

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

August 11, 1993

RECEIVED
AUG 12 1993
OIL CONSERVATION DIV.
SANTA FE

Mr. Roger C. Anderson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
Land Office Building
Santa Fe, New Mexico 87504-2088

Dear Mr. Anderson:

Enclosed is the Second Quarter 1993 Treatment Project Report for the Indian Basin Remediation Project. This report is submitted on behalf of the Indian Basin Gas Plant owners in accordance with the Indian Basin Treatment Project Plan prepared by Marathon and approved by the Oil Conservation Division on April 2, 1992.

If you have any questions, please contact me at (915) 687-8312.

Sincerely,

Robert J. Menzie, Jr.
Production Environmental & Safety Representative

Enclosure

cc: Mr. William C. Olson,
Oil Conservation Division, Santa Fe

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
93 AUG 10 AM 10 00

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

August 10, 1993

Ms Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: **Water Well Analysis**

Dear Ms. Lyman:

Enclosed are the final analytical results from a water sample obtained from your well on June 28 and July 15, 1993. The results of these analyses indicate your water to be within standards for hydrocarbons and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Short term plans are to continue to conduct sampling of your well. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Robert J. Menzie Jr.

Robert J. Menzie Jr.
Environmental Representative

RJM93810/nrt

Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
07/27/93

JOB NUMBER: 931230 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....: MARATHON OIL CO.
DATE SAMPLED.....: 06/28/93
TIME SAMPLED.....: 12:12
WORK DESCRIPTION...: #1

LABORATORY I.D...: 931230-0002
DATE RECEIVED....: 06/29/93
TIME RECEIVED....: 10:18
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	12.5	0.5	mg/L	325.2 (1)	07/19/93	SLS
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/13/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	103	1	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
08/05/93

JOB NUMBER: 931392 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE

CLIENT I.D.....:
DATE SAMPLED.....: 07/15/93
TIME SAMPLED.....: 08:31
WORK DESCRIPTION...: SAMPLE NO. 1

LABORATORY I.D....: 931392-0006
DATE RECEIVED....: 07/21/93
TIME RECEIVED....: 10:25
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	15.0	0.5	mg/L	325.2 (1)	08/02/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/27/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	ND	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

August 10, 1993

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Final analytical results from water samples obtained on June 28 and July 15, 1993 from a natural spring located in Rocky Arroyo utilized by you for stock water and your well are attached. Hydrocarbons or abnormally high chloride concentrations were not found.

Analysis of the water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to your water by released fluids from the April 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chloride as established by EPA for drinking water.

Short term plans are to continue to conduct quarterly sampling of your well. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

RJM93811/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
07/27/93

JOB NUMBER: 931230 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....: MARATHON OIL CO.
DATE SAMPLED.....: 06/28/93
TIME SAMPLED.....: 12:30
WORK DESCRIPTION...: #2

LABORATORY I.D...: 931230-0003
DATE RECEIVED....: 06/29/93
TIME RECEIVED....: 10:18
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.4	0.5	mg/L	325.2 (1)	07/19/93	SLS
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/12/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	102	1	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
08/05/93

JOB NUMBER: 931392 CUSTOMER: MARATHON OIL COMPANY ATTN: DOD MENZIE

CLIENT I.D.....:
DATE SAMPLED.....: 07/15/93
TIME SAMPLED.....: 08:50
WORK DESCRIPTION...: SAMPLE NO. 2

LABORATORY I.D...: 931392-0005
DATE RECEIVED....: 07/21/93
TIME RECEIVED....: 10:25
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (unfilt.)	12.9	0.5	mg/L	325.2 (1)	08/02/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/26/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	ND	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
08/05/93

JOB NUMBER: 931392 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE

CLIENT I.D.....:
DATE SAMPLED.....: 07/15/93
TIME SAMPLED.....: 09:44
WORK DESCRIPTION...: SAMPLE NO. 3

LABORATORY I.D....: 931392-0007
DATE RECEIVED.....: 07/21/93
TIME RECEIVED.....: 10:25
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.3	0.5	mg/L	325.2 (1)	08/02/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/27/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	ND	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

August 10, 1993

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

Final analytical results from a water sample obtained on June 28 and July 15, 1993 from a natural spring located in Rocky Arroyo utilized by you are attached. The results of this analysis indicate this water to be within standards for hydrocarbons and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to your water by released fluids from the April 1991 leak that occurred in the Indian Basin Field.

Short term plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

RJM93812/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
07/27/93

JOB NUMBER: 931230 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE, JR.

CLIENT I.D.....: MARATHON OIL CO.
DATE SAMPLED.....: 06/28/93
TIME SAMPLED.....: 12:30
WORK DESCRIPTION...: #2

LABORATORY I.D...: 931230-0003
DATE RECEIVED....: 06/29/93
TIME RECEIVED....: 10:18
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.4	0.5	mg/L	325.2 (1)	07/19/93	SLS
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/12/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	102	1	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
08/05/93

JOB NUMBER: 931392 CUSTOMER: MARATHON OIL COMPANY ATTN: BOB MENZIE

CLIENT I.D.....:
DATE SAMPLED.....: 07/15/93
TIME SAMPLED.....: 08:50
WORK DESCRIPTION...: SAMPLE NO. 2

LABORATORY I.D...: 931392-0005
DATE RECEIVED....: 07/21/93
TIME RECEIVED....: 10:25
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (unfilt.)	12.9	0.5	mg/L	325.2 (1)	08/02/93	DME
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/26/93	CLT
Benzene	ND	0.5	ug/L			
Toluene	ND	0.5	ug/L			
Ethyl Benzene	ND	0.5	ug/L			
Xylenes	ND	0.5	ug/L			
4-Bromofluorobenzene (surrogate)	ND	0	% Recovery	Limits (85-115)		

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☑ Telephone ☐ Personal	Time 1430	Date 8/16/93

Originating Party	Other Parties
Bob Menzie - Marathon	Bill Olson - Envir Bureau

Subject

Marathon Indian Basin

Discussion

Will start drilling new MW on 8/23/93

Expect to sample on Mon or Tues of following week

Conclusions or Agreements

He will call back on exact sampling date

Distribution

Signed Bill Olson

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
'93 JUL 16 AM 8 54

July 7, 1993

William C. Olson
State of New Mexico
Oil Conservation Division
Energy, Minerals and Natural Resources Department
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

RE: INDIAN BASIN REMEDIATION PROJECT
THIRD QUARTER 1993
GROUNDWATER SAMPLING EPISODE NOTIFICATION

Dear Mr. Olson:

The Third Quarter 1993 groundwater sampling episode will commence at the Indian Basin site on Monday, July 12 and continue through Thursday, July 15, 1993 or until gauging, purging, and sampling activities are completed.

If you have any questions, please contact me at my office in Midland, Texas (915) 687-8312.

Sincerely,

Robert J. Menzie Jr.

Robert J. Menzie Jr.
Production Environmental and Safety Representative

cc: C.K. Curlee
D.E. Kenyon
R.F. Unger

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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'93 JUN 22 AM 9 20

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

June 10, 1993

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Final analytical results from water samples obtained on May 12, 1993 from a natural spring located in Rocky Arroyo utilized by you for stock water are attached. Hydrocarbons or abnormally high chloride concentrations were not found.

Analysis of the water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to your water by released fluids from the April 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chloride as established by EPA for drinking water.

Short term plans are to continue to conduct quarterly sampling of your well. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

RJM93612/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
06/04/93

JOB NUMBER: 930780 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 05/12/93
TIME SAMPLED.....: 08:40
WORK DESCRIPTION...: #2 ARROYO

LABORATORY I.D...: 930780-0002
DATE RECEIVED....: 05/13/93
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.0	0.5	mg/L	325.2 (1)	05/19/93	KDS
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/14/93	KJA
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

June 10, 1993

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

Final analytical results from a water sample obtained on May 12, 1993 from a natural spring located in Rocky Arroyo utilized by you are attached. The results of this analysis indicate this water to be within standards for hydrocarbons and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to your water by released fluids from the April 1991 leak that occurred in the Indian Basin Field.

Short term plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Robert J. Menzie, Jr.
Environmental Representative

RJM93610/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
06/04/93

JOB NUMBER: 930780 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 05/12/93
TIME SAMPLED.....: 08:40
WORK DESCRIPTION...: #2 ARROYO

LABORATORY I.D...: 930780-0002
DATE RECEIVED....: 05/13/93
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.0	0.5	mg/L	325.2 (1)	05/19/93	KDS
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/14/93	KJA
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

June 10, 1993

Ms Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: **Water Well Analysis**

Dear Ms. Lyman:

Enclosed are the final analytical results from a water sample obtained from your well on May 12, 1993. The results of these analyses indicate your water to be within standards for hydrocarbons and chloride as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential impact to your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Short term plans are to continue to conduct sampling of your well. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Robert J. Menzie, Jr.

Robert J. Menzie, Jr.
Environmental Representative

RJM93611/nrt

Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
06/04/93

JOB NUMBER: 930780 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 05/12/93
TIME SAMPLED.....: 08:15
WORK DESCRIPTION...: #1 LYMAN

LABORATORY I.D...: 930780-0001
DATE RECEIVED....: 05/13/93
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.0	0.5	mg/L	325.2 (1)	05/19/93	KDS
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/14/93	KJA
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

June 7, 1993

Mr. William Olson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

RE: Indian Basin Gas Plant Remediation Project

Dear Mr. Olson:

The Third Quarter 1993 sampling of Indian Basin monitor wells is currently scheduled to commence Tuesday, July 13 and will continue throughout the week until sampling is completed. You will be notified if there are changes from this schedule.

Mr. Bob Menzie has assumed responsibility for the Indian Basin remediation project. If you have any questions concerning this project, please contact Bob at this office (915/687-8312).

Sincerely,

Al Learned

Al Learned

cc. Mr. Roger Anderson, NMOCD

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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'93 JUN 1 AM 9 10

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

May 28, 1993

William Olson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

RE: IBGP Treatment Facility Temporary Shutdown

Dear Mr. Olson:

The Indian Basin Gas Plant will be shut down for plant maintenance from June 2 through June 9, 1993. This planned maintenance will require temporary cessation of remediation activities at the gas plant. Groundwater withdrawals and air stripping activities will cease during this period.

During this period, remedial maintenance may be conducted on some of the recovery wells as time and manpower permits. It is anticipated that acid treatments may be conducted on BH-84 and BH-88. You will recall that an acid treatment has previously been conducted at BH-85.

If you have any questions concerning this shutdown, please call at this office (915/687-8312).

Sincerely,

Al Learned

Al Learned

AOL93528/nrt

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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93 MAY 27 AM 9 10

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

May 24, 1993

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Final analytical results from water samples obtained on April 15, 1993 from your water well and a natural spring located in Rocky Arroyo utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of the water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct quarterly sampling of your well over the near term. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Al Learned

Al Learned

JSL93523/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
05/11/93

JOB NUMBER: 930603 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 04/15/93
TIME SAMPLED.....: 08:45
WORK DESCRIPTION...: #2 ARROYO

LABORATORY I.D...: 930603-0002
DATE RECEIVED....: 04/20/93
TIME RECEIVED....: 10:15
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.5	0.5	mg/L	325.2 (1)	05/06/93	KDS
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	04/24/93	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

[illegible] expressed [illegible] as to the [illegible] of any [illegible] approval of Core Laboratories.

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
05/11/93

JOB NUMBER: 930603 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 04/15/93
TIME SAMPLED.....: 09:07
WORK DESCRIPTION...: #4 BIEBBLE

LABORATORY I.D...: 930603-0003
DATE RECEIVED....: 04/20/93
TIME RECEIVED....: 10:15
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.4	0.5	mg/L	325.2 (1)	05/06/93	KDS
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	04/24/93	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

[illegible] interpretations or opinions expressed [illegible] proper operations, or profitableness of any [illegible] without the written approval of Core Laboratories

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

May 24, 1993

RECEIVED
MAY 27 1993
OIL CONSERVATION DIV.
SANTA FE

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

Final analytical results from a water sample obtained on April 15, 1993 from a natural spring located in Rocky Arroyo utilized by you are attached. The results of this analysis indicate this water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilzing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Al Learned

Al Learned

AOL93521/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
05/11/93

JOB NUMBER: 930603 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 04/15/93
TIME SAMPLED.....: 08:45
WORK DESCRIPTION...: #2 ARROYO

LABORATORY I.D...: 930603-0002
DATE RECEIVED....: 04/20/93
TIME RECEIVED....: 10:15
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.5	0.5	mg/L	325.2 (1)	05/06/93	KDS
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	04/24/93	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

[illegible] interpretations contained [illegible] has been made. The interpretations or opinions expressed [illegible] the best judgement of Core Laboratories [illegible] as to the productivity, proper operations, or profitableness of any [illegible] property, well or sand [illegible] except in its entirety without the written approval of Core Laboratories.

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, TX 79702-0552
Telephone 915/682-1626

RECEIVED
MAY 27 1993
OIL CONSERVATION DIV.
SANTA FE

May 24, 1993

Ms Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: **Water Well Analysis**

Dear Ms. Lyman:

Attached please find the final analytical results from a water sample obtained from your well on April 15, 1993. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct sampling of your well over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Al Learned

Al Learned

AOL93522/nrt

Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS

05/11/93

JOB NUMBER: 930603 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 04/15/93
TIME SAMPLED.....: 08:25
WORK DESCRIPTION...: #1 LYMAN

LABORATORY I.D...: 930603-0001
DATE RECEIVED....: 04/20/93
TIME RECEIVED....: 10:15
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.0	0.5	mg/L	325.2 (1)	05/06/93	KDS
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	04/24/93	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

interpretations or opinions expressed
operations, or profitableness of any
written approval of Core Laboratories

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 19, 1993

Ms Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: **Water Well Analysis**

Dear Ms. Lyman:

The analysis previously sent to you for the March 4, 1993 sample collected from your well was found to be incorrect by the laboratory and was subsequently amended to reflect no detectable hydrocarbon. To confirm these laboratory results, your well was re-sampled on April 13. Both the amended and re-sampling results are attached and indicate your water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct sampling of your well over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Al Learned

Al Learned

AOL93519/nrt

Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/20/93

JOB NUMBER: 930389 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 03/04/93
TIME SAMPLED.....: 11:03
WORK DESCRIPTION...: #1 Lyman Water Well

LABORATORY I.D...: 930389-0001
DATE RECEIVED....: 03/12/93
TIME RECEIVED....: 13:30
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	12.5	0.5	mg/L	325.2 (1)	03/30/93	KJA
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/17/93	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

AMENDED REPORT

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/30/93

JOB NUMBER: 930580 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL -- INDIAN BASIN
DATE SAMPLED.....: 04/13/93
TIME SAMPLED.....: 07:55
WORK DESCRIPTION...: #1 Lyman Water Well

LABORATORY I.D...: 930580-0001
DATE RECEIVED....: 04/14/93
TIME RECEIVED....: 09:30
REMARKS.....: SAMPLES RECEIVED @ 10C

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	12.7	0.5	mg/L	325.2 (1)	04/28/93	VKN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	04/14/93	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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OIL CONSERVATION DIVISION
RECEIVED
'93 MAY 21 AM 8 53

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 19, 1993

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

The analysis previously sent to you for the March 4, 1993 sample collected from Rocky Arroyo was found to be incorrect by the laboratory and was subsequently amended to reflect no detectable hydrocarbons. To confirm these laboratory results, the natural spring in Rocky Arroyo was re-sampled on April 13. Both the amended and re-sampling results are attached and indicate this water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Al Learned

Al Learned

AOL93513/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/20/93

JOB NUMBER: 930389 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 03/04/93
TIME SAMPLED.....: 10:30
WORK DESCRIPTION...: #2 Upper Indian Hills Spring Water

LABORATORY I.D...: 930389-0002
DATE RECEIVED....: 03/12/93
TIME RECEIVED....: 13:30
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.7	0.5	mg/L	325.2 (1)	03/30/93	KJA
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/17/93	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

AMENDED REPORT

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

The analyses, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgment of Core Laboratories. Core Laboratories, however, assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, proper operations, or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced except in its entirety, without the written approval of Core Laboratories.

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/30/93

JOB NUMBER: 930580 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL -- INDIAN BASIN
DATE SAMPLED.....: 04/13/93
TIME SAMPLED.....: 08:38
WORK DESCRIPTION...: #2 Upper Indian Hills Spring West

LABORATORY I.D...: 930580-0002
DATE RECEIVED....: 04/14/93
TIME RECEIVED....: 09:30
REMARKS.....: SAMPLES RECEIVED @ 10C

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.7	0.5	mg/L	325.2 (1)	04/28/93	VKN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	04/14/93	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

'93 MAY 21 AM 8 53

May 19, 1993

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

The analysis previously sent to you for the March 4, 1993 sample collected from Rocky Arroyo was found to be incorrect by the laboratory and was subsequently amended to reflect no detectable hydrocarbons. To confirm these laboratory results, the natural spring in Rocky Arroyo was re-sampled on April 13. Both the amended and re-sampling results are attached and indicate this water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of the water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct quarterly sampling of your well over the near term. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Al Learned

Al Learned

AOL93519/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/20/93

JOB NUMBER: 930389 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 03/04/93
TIME SAMPLED.....: 10:30
WORK DESCRIPTION...: #2 Upper Indian Hills Spring West

LABORATORY I.D...: 930389-0002
DATE RECEIVED....: 03/12/93
TIME RECEIVED....: 13:30
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.7	0.5	mg/L	325.2 (1)	03/30/93	KJA
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/17/93	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

AMENDED REPORT

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/30/93

JOB NUMBER: 930580 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL -- INDIAN BASIN
DATE SAMPLED.....: 04/13/93
TIME SAMPLED.....: 08:38
WORK DESCRIPTION...: #2 Upper Indian Hills Spring West

LABORATORY I.D...: 930580-0002
DATE RECEIVED....: 04/14/93
TIME RECEIVED....: 09:30
REMARKS.....: SAMPLES RECEIVED @ 10C

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.7	0.5	mg/L	325.2 (1)	04/28/93	VKN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	04/14/93	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
1993 MAY 8 AM 8 56

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 12, 1993

Mr. Roger C. Anderson
Mr. William Olson
New Mexico Oil Conservation Division
P. O. Box 2088
Land Office Building
Santa Fe, NM 87504-2088

Gentlemen:

Attached please find the First Quarter 1993 Indian Basin Gas Plant Treatment Project Report. This report is submitted on behalf of the Indian Basin Gas Plant Owners in accordance with the April 2, 1992 Oil Conservation Division Indian Basin Treatment Project Plan approval.

Should you have any questions, please contact me at your convenience.

Sincerely,

Al Learned

Al Learned

AOL93512/nrt

Attachment

Mid-Continent Region
Production United States

OIL CONSERV. DIVISION
RECEIVED
'93 APR 14 AM 8 48

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

April 13, 1993

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

Final analytical results from a water sample obtained on March 4, 1993 from a natural spring located in Rocky Arroyo utilized by you for are attached. The results of this analysis indicate this water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilzing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Al Learned

Al Learned

AOL93412/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/05/93

JOB NUMBER: 930389 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 03/04/93
TIME SAMPLED.....: 10:30
WORK DESCRIPTION...: #2 Upper Indian Hills Spring

LABORATORY I.D...: 930389-0002
DATE RECEIVED....: 03/12/93
TIME RECEIVED....: 13:30
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.7	0.5	mg/L	325.2 (1)	03/30/93	KJA
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/17/93	MLD
Benzene	ND	1	ug/L			
Toluene	10	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

April 13, 1993

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Final analytical results from a water sample obtained on March 4, 1993 from a natural spring located in Rocky Arroyo utilized by you for stock water are attached. The results of this analysis indicate this water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of the water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct monthly sampling of your well over the near term. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Al Learned

AOL93412/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/05/93

JOB NUMBER: 930389 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 03/04/93
TIME SAMPLED.....: 10:30
WORK DESCRIPTION...: #2 Upper Indian Hills Spring

LABORATORY I.D...: 930389-0002
DATE RECEIVED....: 03/12/93
TIME RECEIVED....: 13:30
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.7	0.5	mg/L	325.2 (1)	03/30/93	KJA
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/17/93	MLD
Benzene	ND	1	ug/L			
Toluene	10	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

April 13, 1993

Ms Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: **Water Well Analysis**

Dear Ms. Lyman:

Attached please find the final analytical results from a water sample obtained from your well on March 4, 1993. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct sampling of your well over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Al Learned Ty NT

AOL93414/nrt

Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/05/93

JOB NUMBER: 930389 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 03/04/93
TIME SAMPLED.....: 11:03
WORK DESCRIPTION...: #1 Lyman Water Well

LABORATORY I.D...: 930389-0001
DATE RECEIVED....: 03/12/93
TIME RECEIVED....: 13:30
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	12.5	0.5	mg/L	325.2 (1)	03/30/93	KJA
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/17/93	MLD
Benzene	ND	1	ug/L			
Toluene	9	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
93 APR 12 AM 8 42

April 7, 1993

William Olson
State of New Mexico
Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

RE: Indian Basin Gas Plant Remediation Activities

Dear Mr. Olson:

Pursuant to our April 6 meeting in Santa Fe, Marathon Oil Company proposes to install an additional Lower Queen monitor well as part of the Indian Basin Treatment Project. This proposed well will be located approximately 900 feet FNL and 1,350 feet FWL of Section 19, T21S, R24E. A map showing the approximate location was left with you after our April 6 meeting. This location is approximately 3,250 feet from BH-87A and 3,350 feet from BH-86. While construction details are not finalized, it is anticipated this well will be similar to the other Lower Queen monitoring wells. Those wells were completed using 4 inch diameter PVC casing and screen with a slot size of 0.020 inches.

It is expected that the monitoring well would be drilled early this summer. While a rig is mobilized, Marathon is also considering drilling a replacement well for BH-85, pending results of remedial workover efforts to increase recovery rates on that well. Although an exact location has not been selected, it is anticipated that the replacement well location would be adjacent to the existing recovery system pipeline between BH-85 and BH-84.

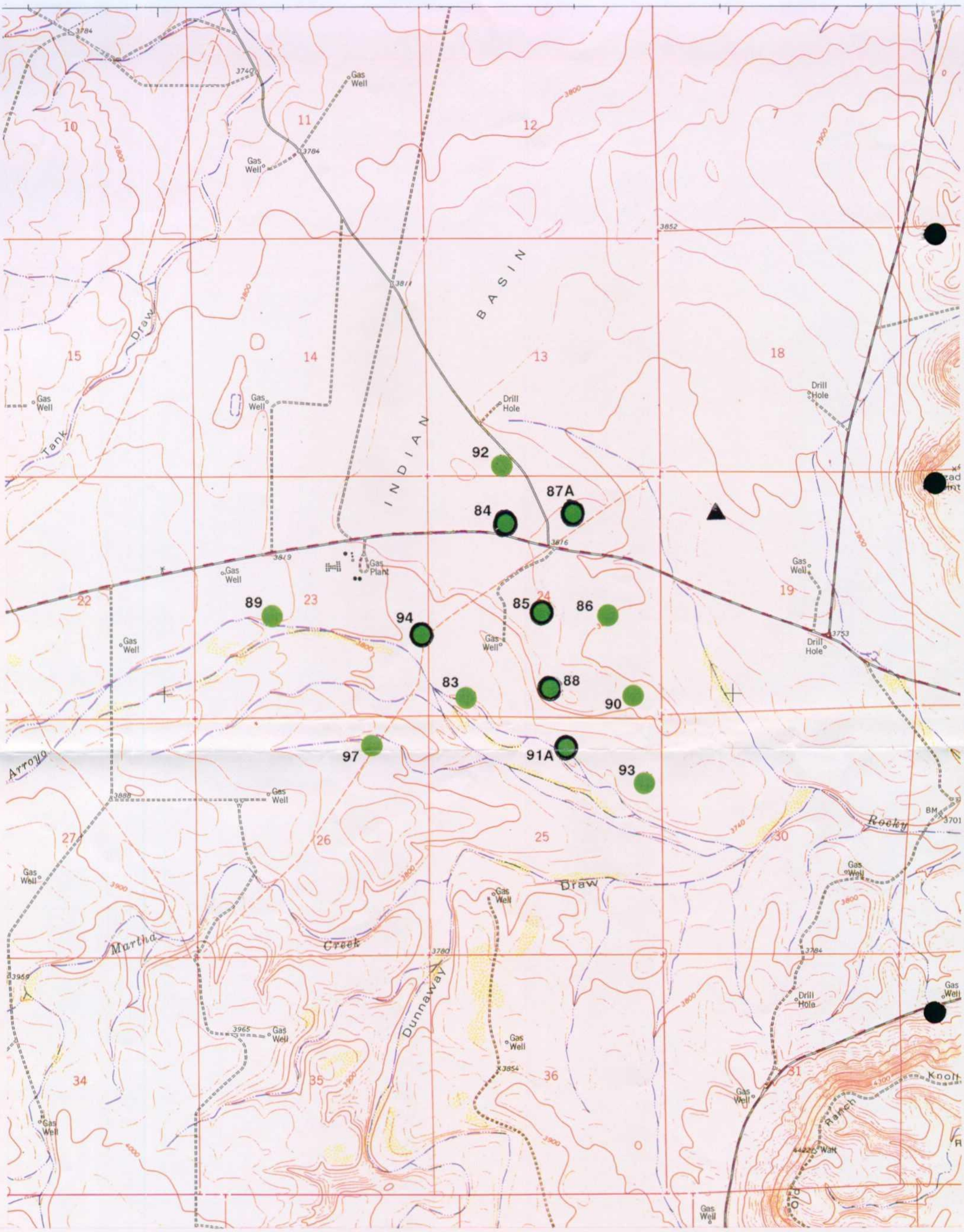
In other treatment project developments, the soil vent system has been moved to BH-82. Venting activities will commence at this location after the generator has been repaired.

If you have any questions or need additional information regarding these activities, please call me at this office (915/687-8312).

Sincerely,

Al Learned

Al Learned



LQ MONITOR WELL

LQ RECOVERY WELL

PROPOSED LOCATION

35 BOREHOLE NUMBER

RECEIVED
APR 06 1993
OIL CONSERVATION DIV.
SANTA FE

MARATHON OIL COMPANY
MID-CONTINENT REGION

MARTHA CREEK

7.5' QUAD

1" = 2000'

OCD/Marathon Meeting 4/6/93 1:00 pm

attendees - Bill Olson - OCD
- Roger Anderson - OCD
- Doug Kenyan - Marathon
Al Learned - Marathon
Charlie Curley - Marathon

Map handout of MW locations, propose one additional MW downgradient of 87A, 86

June 3rd - 9th plant will be shutdown

Well located approx 900' from NL
1350' " WL
sec 19

April 13th, 14th, 15th quarterly point in time sampling

Will send proposal on MW's to OCD for approval

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

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☑ Telephone ☐ Personal	Time 1545	Date 3/30/93

Originating Party	Other Parties
Charlie Kurley - Marathon	Bill Olson - Envir. Bureau

Subject

Marathon Indian Basin

Discussion

Jeff Lynn left Marathon
Al Learned is replacing him temporarily
Want to meet with us on either April 6, 12, 15
to discuss locations of additional MW's

Conclusions or Agreements

Will meet on April 6th at 1:00pm

Distribution

Marathon Indian Basin File

Signed Bill Olson

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
'93 MAR 29 AM 9 03

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

March 23, 1993

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Final analytical results from a water sample obtained on February 12, 1993 from a natural spring located in Rocky Arroyo utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of the water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct quarterly sampling of your well over the near term. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL9308/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
03/16/93

JOB NUMBER: 930250 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 02/12/93
TIME SAMPLED.....: 11:22
WORK DESCRIPTION...: ARROYO #2

LABORATORY I.D....: 930250-0004
DATE RECEIVED....: 02/17/93
TIME RECEIVED....: 13:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.8	0.5	mg/L	325.2 (1)	03/05/93	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/19/93	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

March 23, 1993

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

Dear Mr. Gregory:

Final analytical results from a water sample obtained on February 12, 1993 from a natural spring located in Rocky Arroyo are attached. Mr. Walter Biebelle, indicated that this water is utilized by himself and you as stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilzing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL9307/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Member Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
03/16/93

JOB NUMBER: 930250 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 02/12/93
TIME SAMPLED.....: 11:22
WORK DESCRIPTION...: ARROYO #2

LABORATORY I.D...: 930250-0004
DATE RECEIVED....: 02/17/93
TIME RECEIVED....: 13:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.8	0.5	mg/L	325.2 (1)	03/05/93	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/19/93	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
93 MAR 25 AM 9 03

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

March 23, 1993

Ms Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: **Water Well Analysis**

Dear Ms. Lyman:

Attached please find the final analytical results from a water sample obtained from your well on February 12, 1993. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPS) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, whick is certified by the EPA, conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct sampling of your well over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL9306/nrt

Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
03/16/93

JOB NUMBER: 930250 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 02/12/93
TIME SAMPLED.....: 11:44
WORK DESCRIPTION...: LYMAN #1

LABORATORY I.D...: 930250-0003
DATE RECEIVED....: 02/17/93
TIME RECEIVED....: 13:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.1	0.5	mg/L	325.2 (1)	03/05/93	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/19/93	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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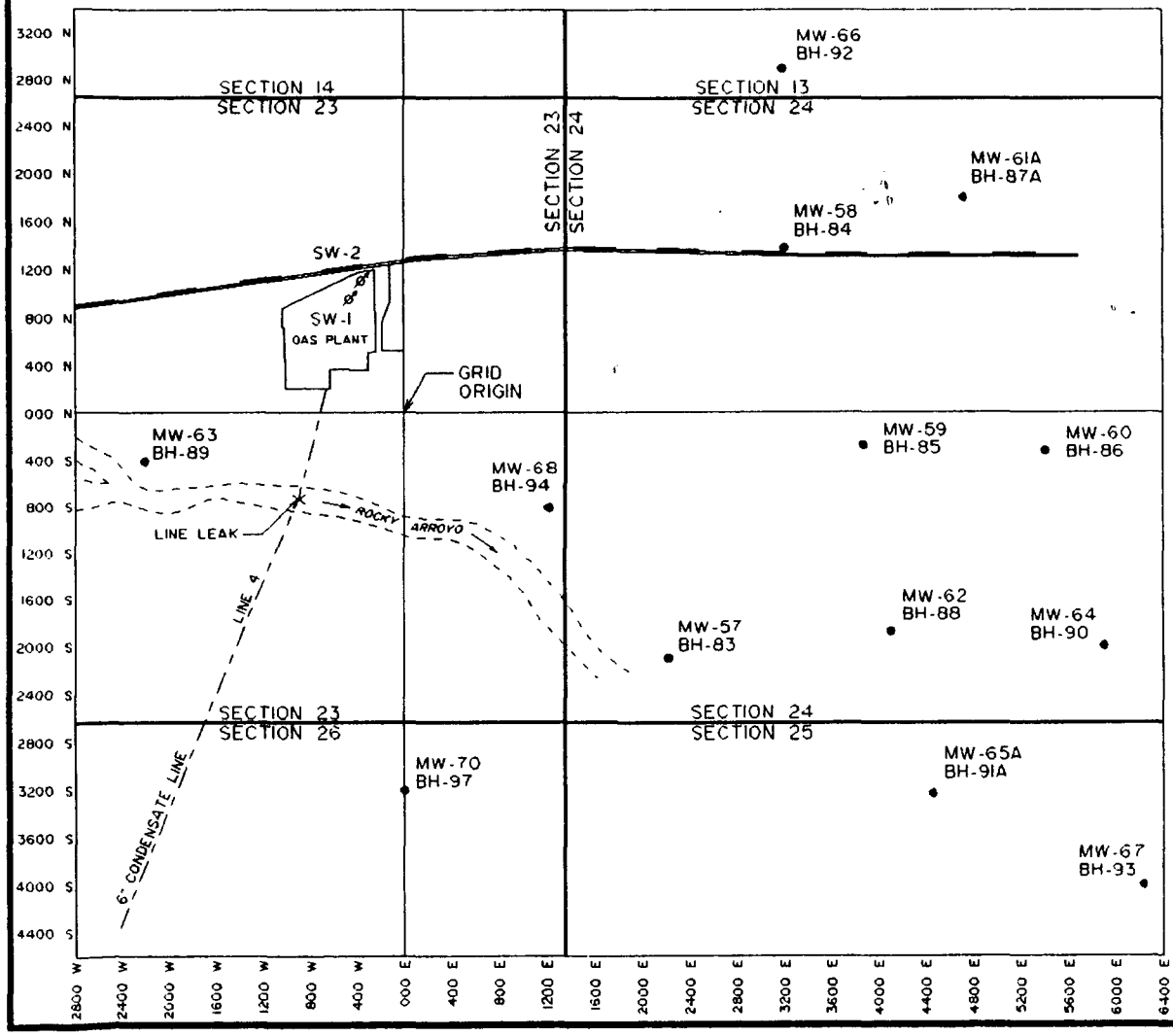
Handout 1
2/19/93
Marathon Meeting

INDIAN BASIN GAS PLANT
ARTESIA, NEW MEXICO



SCALE

0 1000' 2000'

FEET

LEGEND

MW-64 BH-90 ● DEEP BEDROCK (LOWER QUEEN) WELL AND SOIL BORING LOCATION

SW-1 ø WATER SUPPLY WELL (DEEP BEDROCK, LOWER QUEEN)

IBGASPLT2.STY OPER

Figure Title:	MARATHON OIL COMPANY
Document Title:	Location: INDIAN BASIN GAS PLANT
IBGP TREATMENT PROJECT LOWER QUEEN MONITORING WELL BASE MAP	DATE: / PREPARED BY:
	SCALE: / CHECKED BY:
	DRAFTED BY:
	PROJECT NO: / FIGURE NO:

Attachment #2
2/19/93 Marathon Meeting

INDIAN BASIN TREATMENT PROJECT
LOWER QUEEN
BENZENE CONCENTRATIONS

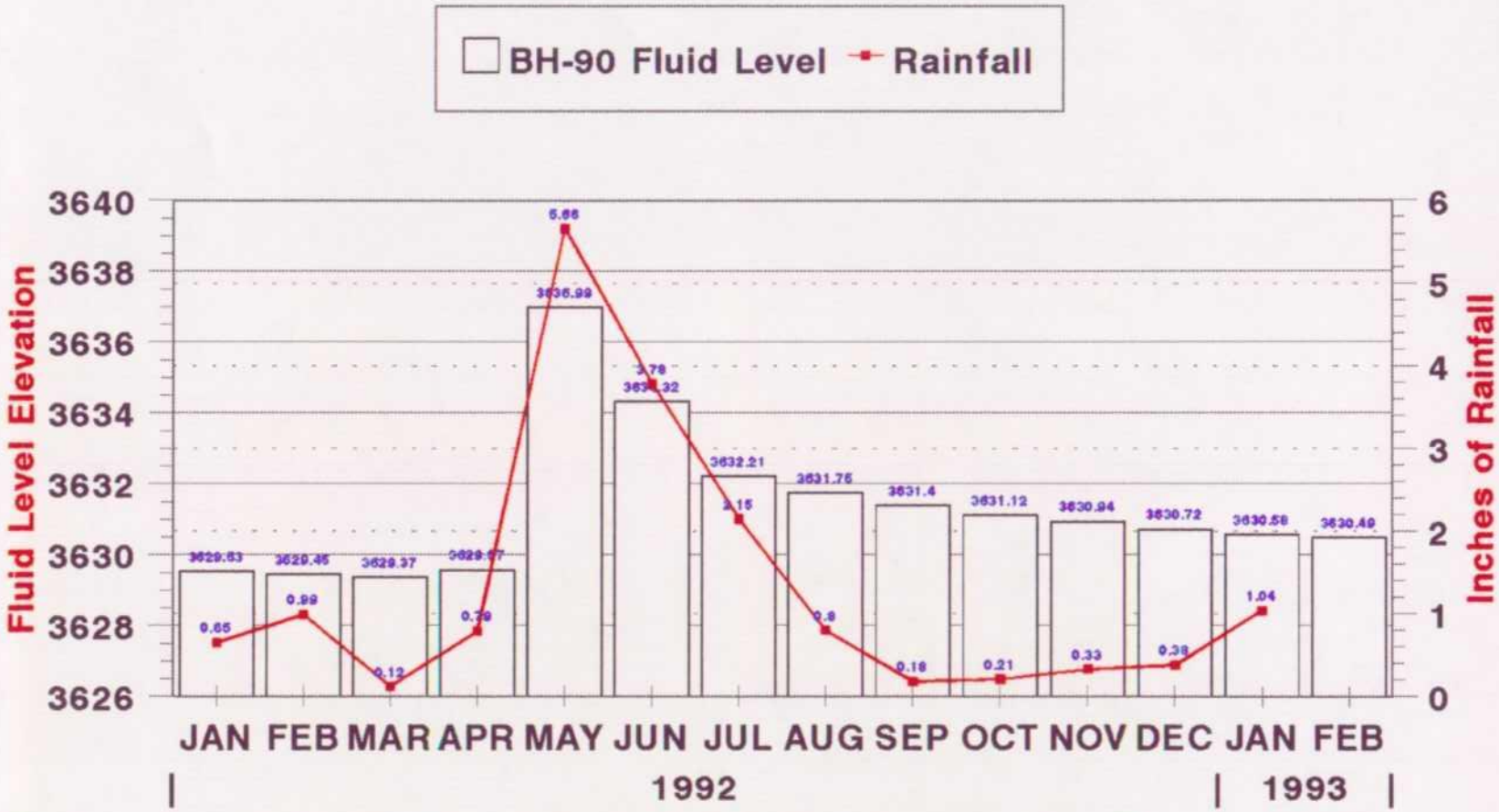
WELL NUMBER	SEP 1991	DEC 1991	APR # 1992	JUL # 1992	OCT # 1992	JAN # 1993
BH-83	1600	350	91*@	948*	15	21
BH-84	40	90	202*	178*	190	192
BH-85	540	420	40*	268*	99	26
BH-86	33	1	3*@	19*	32	138
BH-87A	190	10	5*	359*	470	585
BH-88	2200	1400	258*	357*	212	78
BH-89	1	1	4*	12*	4	12
BH-90	150	130	130*@	115*	37	15
BH-91A	680	150	25*	413*	11	3
BH-92	1	1	3*@	8*	12	3
BH-93	280	320	4*	103*	3	8
BH-94	240	1900	1865*	160*	2208*	376
BH-97	1	1	2*	15*	11	1
SW-1	1	1	5*	15*	16	6
SW-2	1	1	8*	7*	68	47

ALL DATA GIVEN IN PPB
* AVERAGE OF MORE THAN ONE ANLAYSIS
@ AVERAGE OF PUMP AND BAIL SAMPLE

Handout #3
2/19/93 Marathon Meeting

IBGP TREATMENT PROJECT

MONTHLY LQ FLUID LEVEL FOR BH-90 & MONTHLY RAINFALL STATISTICS



BH-90 Fluid Level	3629.63	3629.45	3629.37	3629.57	3636.99	3634.32	3632.21	3631.75	3631.4	3631.12	3630.94	3630.72	3630.58	3630.49
Rainfall	0.65	0.99	0.12	0.79	5.66	3.78	2.15	0.8	0.18	0.21	0.33	0.38	1.04	

Monthly Statistics

2/17/93
JSLynn

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
'93 FEB 22 AM 10 15

February 18, 1993

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Final analytical results from water samples obtained on January 18, 1993 from your water well and a natural spring located in Rocky Arroyo utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of the water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct quarterly sampling of your well over the near term. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL9308/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/08/93

JOB NUMBER: 930097 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL CO
DATE SAMPLED.....: 01/18/93
TIME SAMPLED.....: 14:50
WORK DESCRIPTION...: #4 Biesaie Water Well

LABORATORY I.D...: 930097-0003
DATE RECEIVED....: 01/26/93
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	10.6	0.5	mg/L	325.2 (1)	02/01/93	KJA
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/29/93	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Western Atlas International
A Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/08/93

JOB NUMBER: 930097 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL CO
DATE SAMPLED.....: 01/18/93
TIME SAMPLED.....: 14:28
WORK DESCRIPTION...: #2 Indian Hills Spring West

LABORATORY I.D...: 930097-0002
DATE RECEIVED....: 01/26/93
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	11.4	0.5	mg/L	325.2 (1)	02/01/93	KJA
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/29/93	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production
United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

February 18, 1993

Ms Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: **Water Well Analysis**

Dear Ms. Lyman:

Attached please find the final analytical results from a water sample obtained from your well on January 18, 1993. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPS) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, whick is certified by the EPA, conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct sampling of your well over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL9306/nrt

Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/08/93

JOB NUMBER: 930097 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL CO
DATE SAMPLED.....: 01/18/93
TIME SAMPLED.....: 14:05
WORK DESCRIPTION...: #1 Lyman Water Well

LABORATORY I.D...: 930097-0001
DATE RECEIVED....: 01/26/93
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.2	0.5	mg/L	325.2 (1)	02/01/93	KJA
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/29/93	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Product United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

February 18, 1993

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: Water Analysis

Dear Mr. Gregory:

Final analytical results from a water sample obtained on January 18, 1993 from a natural spring located in Rocky Arroyo are attached. Mr. Walter Biebelle, indicated that this water is utilized by himself and you as stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilzing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL9307/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Union Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/08/93

JOB NUMBER: 930097 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL CO
DATE SAMPLED.....: 01/18/93
TIME SAMPLED.....: 14:28
WORK DESCRIPTION...: #2 Indian Hills Spring West

LABORATORY I.D...: 930097-0002
DATE RECEIVED....: 01/26/93
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	11.4	0.5	mg/L	325.2 (1)	02/01/93	KJA
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/29/93	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
'93 FEB 11 PM 3 30

February 9, 1993

Mr. Roger C. Anderson
Mr. William Olson
New Mexico Oil Conservation Division
P. O. Box 2088
Land Office Building
Santa Fe, New Mexico 87504-2088

Gentlemen:

Attached please find the Fourth Quarter 1992 Indian Basin Gas Plant Treatment Project Report. This report is submitted on behalf of the Indian Basin Gas Plant Owners in accordance with the April 2, 1992 Oil Conservation Division Indian Basin Treatment Project Plan approval.

Should you have any questions, please contact me at your convenience.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL:kfh

Attachment

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

MEMORANDUM OF MEETING OR CONVERSATION

☑ Telephone ☐ Personal	Time 130 PM	Date 1-12-93

Originating Party	Other Parties
JEFF LYNN (MARATHON OIL)	CHRIS EUSTICE

Subject: QUARTERLY SAMPLING AT INDIAN BASIN GAS PLANT

Discussion: JEFF WANTED TO ~~[illegible]~~ INFORM OCD-EB THAT SAMPLING FOR QUARTERLY ANALYSES WOULD TAKE PLACE AT INDIAN BASIN GAS PLANT JAN. 19, 1993

Conclusions or Agreements: I passed word to Roger & Willie

Distribution

Signed: Chris Eustice

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED

Marathon Oil Company

'93 JAN 14 AM 8 51

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

January 12, 1993

Ms Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: **Water Well Analysis**

Dear Ms. Lyman:

Attached please find the final analytical results from a water sample obtained from your well on December 10, 1992. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the EPA, conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct sampling of your well over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL9306/nrt

Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
01/07/93

JOB NUMBER: 922227 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON, MIDLAND
DATE SAMPLED.....: 12/10/92
TIME SAMPLED.....: 10:10
WORK DESCRIPTION...: #1 Lyman Water Well

LABORATORY I.D...: 922227-0001
DATE RECEIVED....: 12/14/92
TIME RECEIVED....: 08:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.9	0.5	mg/L	325.2 (1)	12/31/92	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/16/92	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

January 12, 1993

Mr. & Mrs. Walter Biebelle
646 Queens Route
Carlsbad, New Mexico 88220

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Re: **Water Analysis**

Dear Mr. & Mrs. Biebelle:

Final analytical results from a water sample obtained on December 10, 1992 from a natural spring located in Rocky Arroyo utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct quarterly sampling of your well over the near term. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL9308/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
01/07/93

JOB NUMBER: 922227 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON, MIDLAND
DATE SAMPLED.....: 12/10/92
TIME SAMPLED.....: 10:36
WORK DESCRIPTION...: #2 Indian Hills Spring West

LABORATORY I.D...: 922227-0002
DATE RECEIVED....: 12/14/92
TIME RECEIVED....: 08:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.3	0.5	mg/L	325.2 (1)	12/31/92	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/16/92	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

[illegible] interpretations [illegible] based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed [illegible] Core Laboratories [illegible] responsibility and makes no warranty or representations [illegible] or profitableness of any [illegible] property, well or land [illegible] used or relied upon for any reason whatsoever. This report [illegible] written approval of Core Laboratories

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

January 12, 1993

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: **Water Analysis**

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Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL9307/nrt

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM - Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
01/07/93

JOB NUMBER: 922227 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON, MIDLAND
DATE SAMPLED.....: 12/10/92
TIME SAMPLED.....: 10:36
WORK DESCRIPTION...: #2 Indian Hills Spring West

LABORATORY I.D...: 922227-0002
DATE RECEIVED....: 12/14/92
TIME RECEIVED....: 08:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.3	0.5	mg/L	325.2 (1)	12/31/92	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/16/92	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

10703 East Bethany Drive
Aurora, CO 80014
(303) 751-1780

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SEPTEMBER 8, 1992 WQCC MARATHON REMEDIATION BRIEFING

INCIDENT

4/12/91 OCD notified of leak in underground 6" low pressure (35-150psi) condensate pipeline feeding Indian Basin Gas Plant

Location - outside Marathon Indian Basin Gas Plant west of Carlsbad at pipeline crossing of Rocky Arroyo

Cause - H_2S internal corrosion

Volume lost - 35,000 barrels condensate (1.5 million gallons)
- 20,000 barrels produced water (800,000 gallons)

GEOLOGY

Shallow alluvium
- 12-16 feet thick
- cobbles and boulders in sand and gravel matrix
- sporadically contains ground water

Dolomite
- predominantly dolomite with interbedded limestone and discontinuous sandstones
- highly fractured
- 175 feet thick
- localized ground water

Lower Queen
- large sandstone unit
- high quality drinking water aquifer
- local ranches and gas plant tap this aquifer
- hydraulic gradient to east
- @ 200 feet depth

IMMEDIATE ACTIONS

Shut-in pipeline

Installed recovery trenches/recovery wells downgradient and recover fluids

Sample downgradient ranch wells and springs (3 miles downgradient)

Pressure test all pipelines for other leaks (none found)

SHORT TERM ACTIONS

Drill 100 boreholes to delineate plume (from 6/91 - 9/91)

Complete 80 as monitor/recovery wells
- 13 in Lower Queen
- 66 in Shallow zone

Weekly monitoring of downgradient ranch wells and springs

Installation of gathering lines and electricity

Pump contaminated ground water from shallow zone and Lower Queen (11/91) and dispose by deep well injection (class II well)

Pilot soil venting project 9/91 - 12/91

LONG TERM ACTIONS

Remediation plan submitted and approved

- Pump and treat contaminated ground water from both Lower Queen (6 recovery wells) and Shallow Alluvial Aquifer (6 varying recovery wells)
- Mobile soil vapor extraction system installed to remediate soils in shallow zone
- Treated water used for gas plant process water
- Quarterly monitoring of
  - Lower Queen
  - Shallow Zone
- Monthly monitoring of ranch wells and springs
- Quarterly updates supplied to ranchers
- Quarterly reports to OCD

Installed metering equipment throughout pipeline gathering system for detection of volume losses

RECOVERY DATA

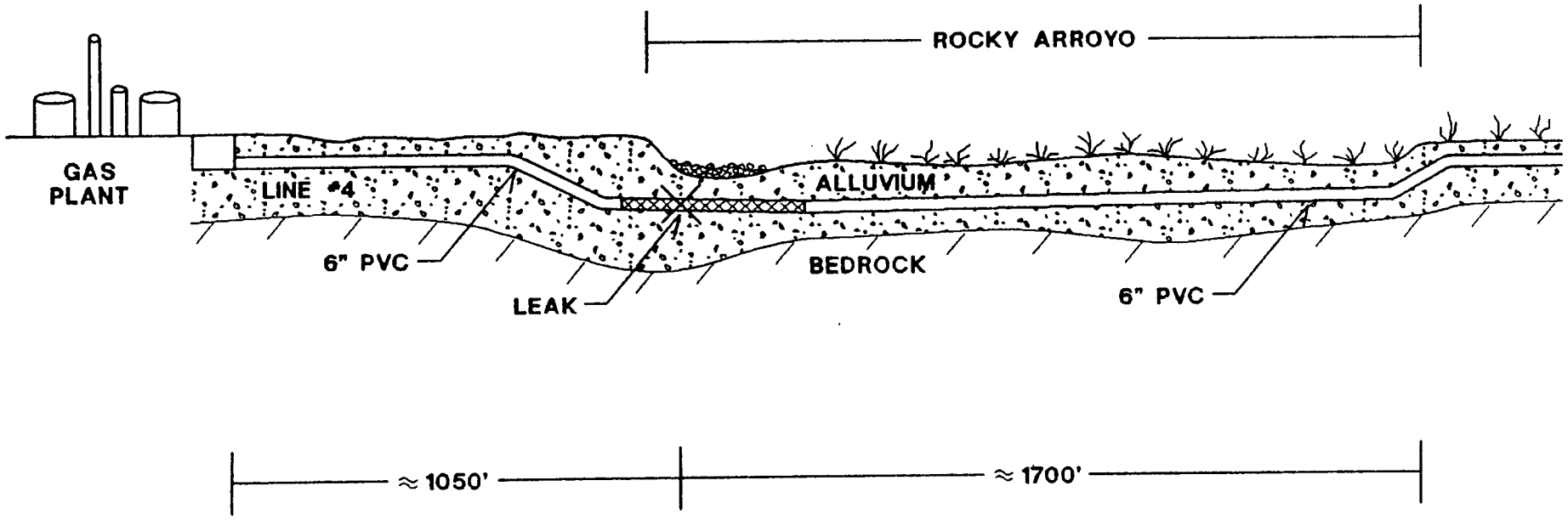
5.6 million gallons total fluids pumped from Lower Queen as of 5/92

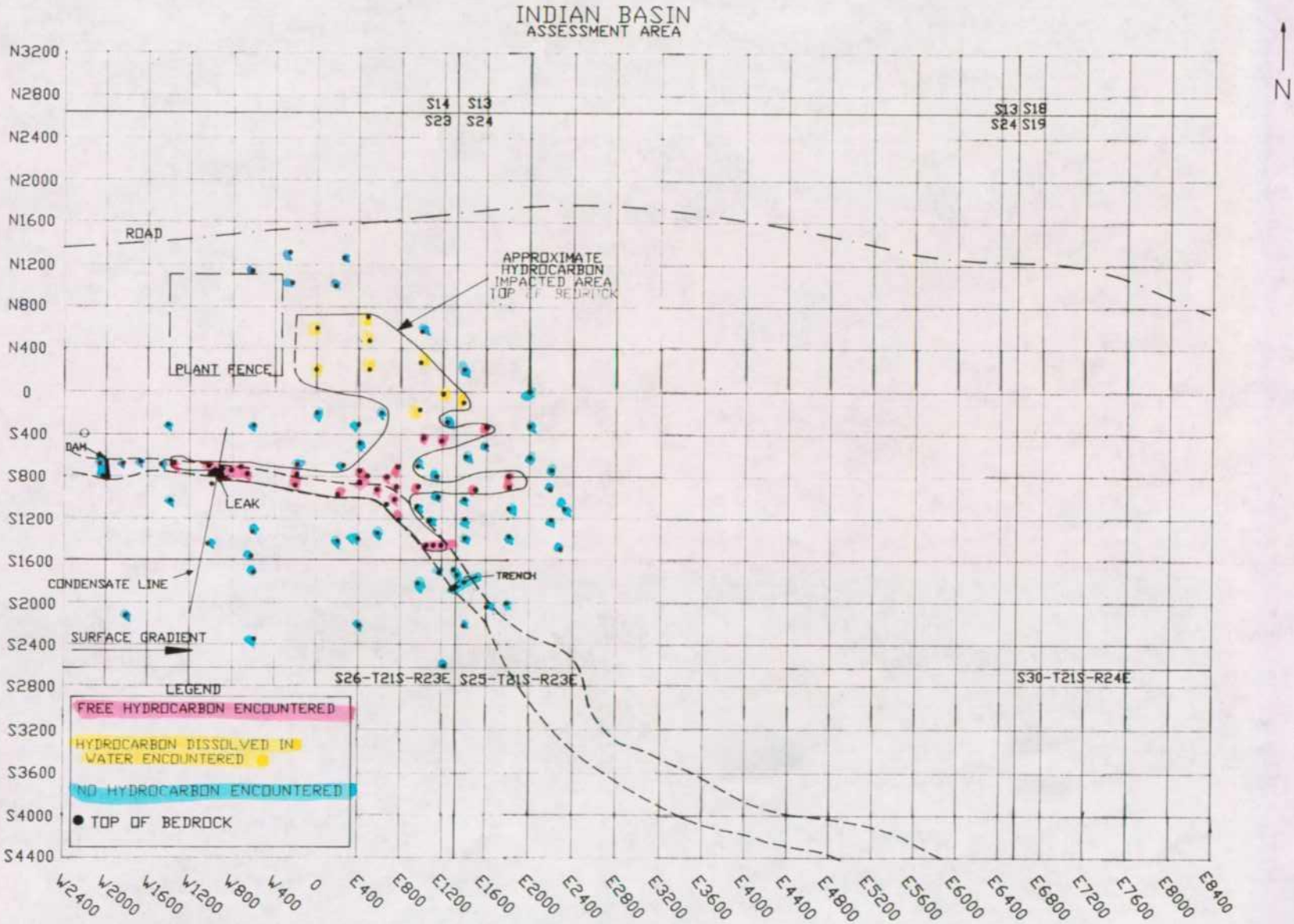
42,000 gallons contaminated water treated per day
- @ 3,500 gallons/day from Shallow Alluvial Aquifer
- @ 38,500 gallons/day from Lower Queen

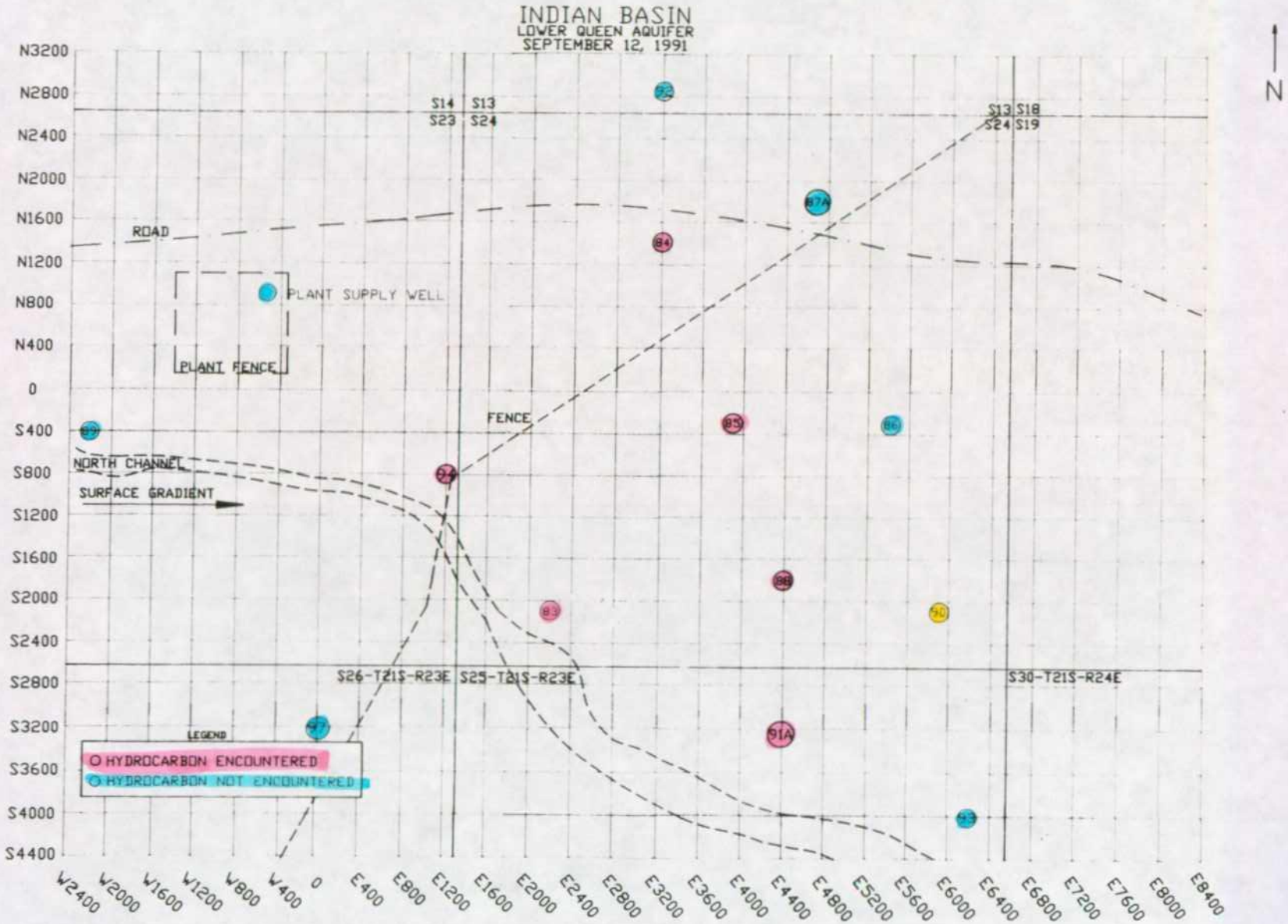
4,000 barrels (168,000 gallons) of condensate recovered

INDIAN BASIN LINE #4 LEAK

SCHEMATIC




INDIAN BASIN
ASSESSMENT AREA
N
S14 S13
S23 S24
S13 S18
S24 S19
ROAD
APPROXIMATE
HYDROCARBON
IMPACTED AREA
TOP OF BEDROCK
PLANT FENCE
DAM
LEAK
CONDENSATE LINE
SURFACE GRADIENT
TRENCH
S26-T21S-R23E
S25-T21S-R23E
S30-T21S-R24E
LEGEND
FREE HYDROCARBON ENCOUNTERED
HYDROCARBON DISSOLVED IN WATER ENCOUNTERED
NO HYDROCARBON ENCOUNTERED
TOP OF BEDROCK
N3200
N2800
N2400
N2000
N1600
N1200
N800
N400
0
S400
S800
S1200
S1600
S2000
S2400
S2800
S3200
S3600
S4000
S4400
W2400
W2000
W1600
W1200
W800
W400
0
E400
E800
E1200
E1600
E2000
E2400
E2800
E3200
E3600
E4000
E4400
E4800
E5200
E5600
E6000
E6400
E6800
E7200
E7600
E8000
E8400


INDIAN BASIN
LOWER QUEEN AQUIFER
SEPTEMBER 12, 1991
N
N3200
N2800
N2400
N2000
N1600
N1200
N800
N400
0
S400
S800
S1200
S1600
S2000
S2400
S2800
S3200
S3600
S4000
S4400
W2400
W2000
W1600
W1200
W800
W400
0
E400
E800
E1200
E1600
E2000
E2400
E2800
E3200
E3600
E4000
E4400
E4800
E5200
E5600
E6000
E6400
E6800
E7200
E7600
E8000
E8400
S14 S13
S23 S24
S13 S18
S24 S19
ROAD
PLANT SUPPLY WELL
PLANT FENCE
FENCE
NORTH CHANNEL
SURFACE GRADIENT
S26-T21S-R23E
S25-T21S-R23E
S30-T21S-R24E
LEGEND
HYDROCARBON ENCOUNTERED
HYDROCARBON NOT ENCOUNTERED
72
87A
84
89
85
86
24
88
83
90
47
91A
93

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

November 5, 1992

RECEIVED
NOV 09 1992
OIL CONSERVATION DIV.
SANTA FE

Mr. Roger C. Anderson
Mr. William Olson
New Mexico Oil Conservation Division
P. O. Box 2088
Land Office Building
Santa Fe, NM 87504-2088

Gentlemen:

Attached please find the Third Quarter 1992 Indian Basin Gas Plant Treatment Project Report. This report is submitted on behalf of the Indian Basin Gas Plant Owners in accordance with the April 2, 1992 Oil Conservation Division Indian Basin Treatment Project Plan approval. Should you have any questions, please contact me at your convenience.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL020/nrt

Attachment

xc: R. F. Unger
R. A. Biernbaum, w/o attach
C. K. Curlee, w/o attach
T. C. Lowry, w/o attach
D. E. Kenyon - Littleton, w/o attach

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED

'92 OCT 23 AM 9 11

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 16, 1992

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Attached please find the final analytical results from a water sample obtained from your well on September 10, 1992. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the EPA, conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct sampling of your well over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL032/nrt
Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
10/07/92

JOB NUMBER: 921734 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: LAKEWOOD,NM
DATE SAMPLED.....: 09/10/92
TIME SAMPLED.....: 10:01
WORK DESCRIPTION...: 1 Lyman Well

LABORATORY I.D...: 921734-0001
DATE RECEIVED....: 09/17/92
TIME RECEIVED....: 09:30
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.8	0.5	mg/L	325.2 (1)	10/01/92	KJA
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	09/18/92	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 16, 1992

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: Water Analysis

Dear Mr. Gregory:

Final analytical results from a water sample obtained on September 10, 1992 from a natural spring located in Rocky Arroyo are attached. Mr. Walter Biebelle, indicated that this water is utilized by himself and you as stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL033/nrt
Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
10/07/92

JOB NUMBER: 921734 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: LAKEWOOD,NM
DATE SAMPLED.....: 09/10/92
TIME SAMPLED.....: 09:30
WORK DESCRIPTION...: 2 Upper Indian Hills Spring West

LABORATORY I.D...: 921734-0002
DATE RECEIVED....: 09/17/92
TIME RECEIVED....: 09:30
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	14.3	0.5	mg/L	325.2 (1)	10/01/92	KJA
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	09/18/92	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 16, 1992

Mr. & Mrs. Walter Biebelle
646 Queen Route
Carlsbad, New Mexico 88220

Re: Water Analysis

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Dear Mr. & Mrs. Biebelle:

Final analytical results from a water sample obtained on September 10, 1992 from a natural spring located in Rocky Arroyo utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present in any of the samples.

Analysis of the water was conducted at Core Labortories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established EPA for drinking water.

Plans are to continue to conduct quarterly sampling of your well over the near term. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL034/nrt
Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS

10/07/92

JOB NUMBER: 921734 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: LAKEWOOD,NM
DATE SAMPLED.....: 09/10/92
TIME SAMPLED.....: 09:30
WORK DESCRIPTION...: 2 Upper Indian Hill

LABORATORY I.D...: 921734-0002
DATE RECEIVED....: 09/17/92
TIME RECEIVED....: 09:30
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	14.3	0.5	mg/L	325.2 (1)	10/01/92	KJA
8020 - AROMATIC VOLATILE ORGANICS		**		8020 (2)	09/18/92	MAD
Benzene	ND	*	ug/L			
Toluene	ND	*	ug/L			
Ethyl Benzene	ND	*	ug/L			
Xylenes	ND	*	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

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

September 25, 1992

Jeffrey S. Lynn
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702

RE: WATER QUALITY SAMPLING
MARATHON INDIAN BASIN GAS PLANT
EDDY COUNTY, NEW MEXICO

Dear Mr. Lynn:

Enclosed you will find a copy of the New Mexico Oil Conservation Division's (OCD) analytic results of ground water samples that OCD split with Marathon on July 7, 1992. If you have any questions, please contact me at (505) 827-5885.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

Enclosure

xc: Mike Williams, OCD Artesia District Office

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED

Marathon Oil Company

'92 SEP 15 AM 9 05

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 11, 1992

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lynn:

Attached please find the final analytical results from a water sample obtained from your well on August 19, 1992. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the EPA, conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct sampling of your well over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn

Jeffrey S. Lynn
Advanced Environmental Representative

JSL021/nrt
Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
09/02/92

JOB NUMBER: 921595 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON
DATE SAMPLED.....: 08/19/92
TIME SAMPLED.....: 15:15
WORK DESCRIPTION...: 1 Lyman Well

LABORATORY I.D...: 921595-0001
DATE RECEIVED....: 08/21/92
TIME RECEIVED....: 17:01
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.8	0.5	mg/L	325.2 (1)	08/31/92	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	08/26/92	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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OIL CONSER... DIVISION
RE...
'92 SEP 15 AM 9 05

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 11, 1992

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: Water Analysis

Dear Mr. Gregory:

Final analytical results from a water sample obtained on August 19, 1992 from a natural spring located in Rocky Arroyo are attached. Mr. Walter Biebelle, indicated that this water is utilized by himself and you as stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn

Jeffrey S. Lynn
Advanced Environmental Representative

JSL022/nrt
Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
09/02/92

JOB NUMBER: 921595 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON
DATE SAMPLED.....: 08/19/92
TIME SAMPLED.....: 15:32
WORK DESCRIPTION...: 2 Upper Indian Hills Spring - West

LABORATORY I.D...: 921595-0002
DATE RECEIVED....: 08/21/92
TIME RECEIVED....: 17:01
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	9.0	0.5	mg/L	325.2 (1)	08/31/92	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	08/26/92	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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OIL CONSERVATION DIVISION
RECEIVED
1992 SEP 15 AM 9 05

Marathon Oil Company

Mid-Continent Region
Production United States

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 10, 1992

Mr. & Mrs. Walter Biebelle
646 Queen Route
Carlsbad, New Mexico 88220

Re: Water Analysis

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Dear Mr. & Mrs. Biebelle:

Final analytical results from a water sample obtained on August 19, 192 from a natural spring located in Rocky Arroyo utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present in any of the samples.

Analysis of the water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established EPA for drinking water.

Plans are to continue to conduct quarterly sampling of your well over the near term. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL023/nrt
Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
09/02/92

JOB NUMBER: 921595 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON
DATE SAMPLED.....: 08/19/92
TIME SAMPLED.....: 15:32
WORK DESCRIPTION...: 2 Upper Indian Hills Spring - West

LABORATORY I.D...: 921595-0002
DATE RECEIVED....: 08/21/92
TIME RECEIVED....: 17:01
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	9.0	0.5	mg/L	325.2 (1)	08/31/92	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	08/26/92	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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SEPTEMBER 8, 1992 WQCC MARATHON REMEDIATION BRIEFING

INCIDENT

4/12/91 OCD notified of leak in underground 6" low pressure (35-150psi) condensate pipeline feeding Indian Basin Gas Plant

Location - outside Marathon Indian Basin Gas Plant west of Carlsbad at pipeline crossing of Rocky Arroyo

Cause - H_2S internal corrosion

Volume lost - 35,000 barrels condensate (1.5 million gallons)
- 20,000 barrels produced water (800,000 gallons)

GEOLOGY

Shallow alluvium
- 12-16 feet thick
- cobbles and boulders in sand and gravel matrix
- sporadically contains ground water

Dolomite
- predominantly dolomite with interbedded limestone and discontinuous sandstones
- highly fractured
- 175 feet thick
- localized ground water

Lower Queen
- large sandstone unit
- high quality drinking water aquifer
- local ranches and gas plant tap this aquifer
- hydraulic gradient to east
- @ 200 feet depth

IMMEDIATE ACTIONS

Shut-in pipeline

Installed recovery trenches/recovery wells downgradient and recover fluids

Sample downgradient ranch wells and springs (3 miles downgradient)

Pressure test all pipelines for other leaks (none found)

SHORT TERM ACTIONS

Drill 100 boreholes to delineate plume (from 6/91 - 9/91)

Complete 80 as monitor/recovery wells
- 13 in Lower Queen
- 66 in Shallow zone

Weekly monitoring of downgradient ranch wells and springs

Installation of gathering lines and electricity

Pump contaminated ground water from shallow zone and Lower Queen (11/91) and dispose by deep well injection (class II well)

Pilot soil venting project 9/91 - 12/91

LONG TERM ACTIONS

Remediation plan submitted and approved

- Pump and treat contaminated ground water from both Lower Queen (6 recovery wells) and Shallow Alluvial Aquifer (6 varying recovery wells)
- Mobile soil vapor extraction system installed to remediate soils in shallow zone
- Treated water used for gas plant process water
- Quarterly monitoring of
  - Lower Queen
  - Shallow Zone
- Monthly monitoring of ranch wells and springs
- Quarterly updates supplied to ranchers
- Quarterly reports to OCD

Installed metering equipment throughout pipeline gathering system for detection of volume losses

RECOVERY DATA

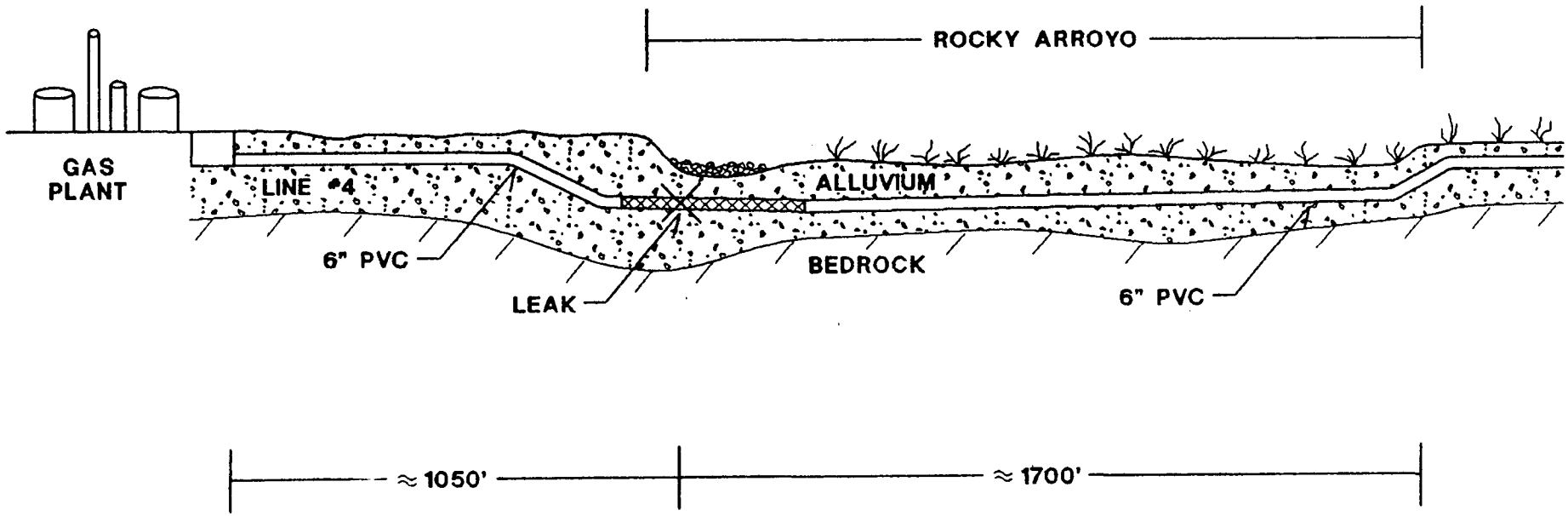
5.6 million gallons total fluids pumped from Lower Queen as of 5/92

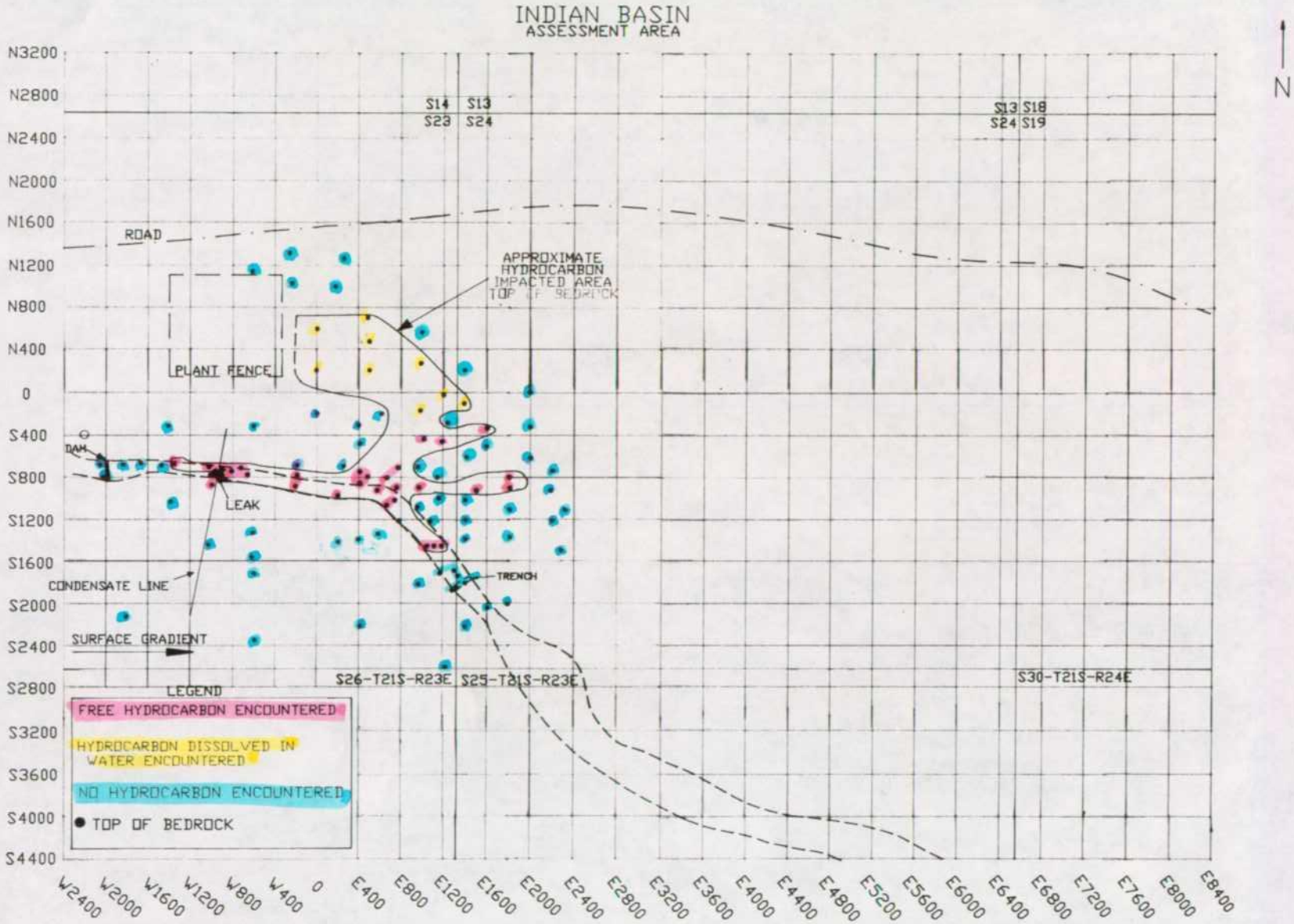
42,000 gallons contaminated water treated per day
- @ 3,500 gallons/day from Shallow Alluvial Aquifer
- @ 38,500 gallons/day from Lower Queen

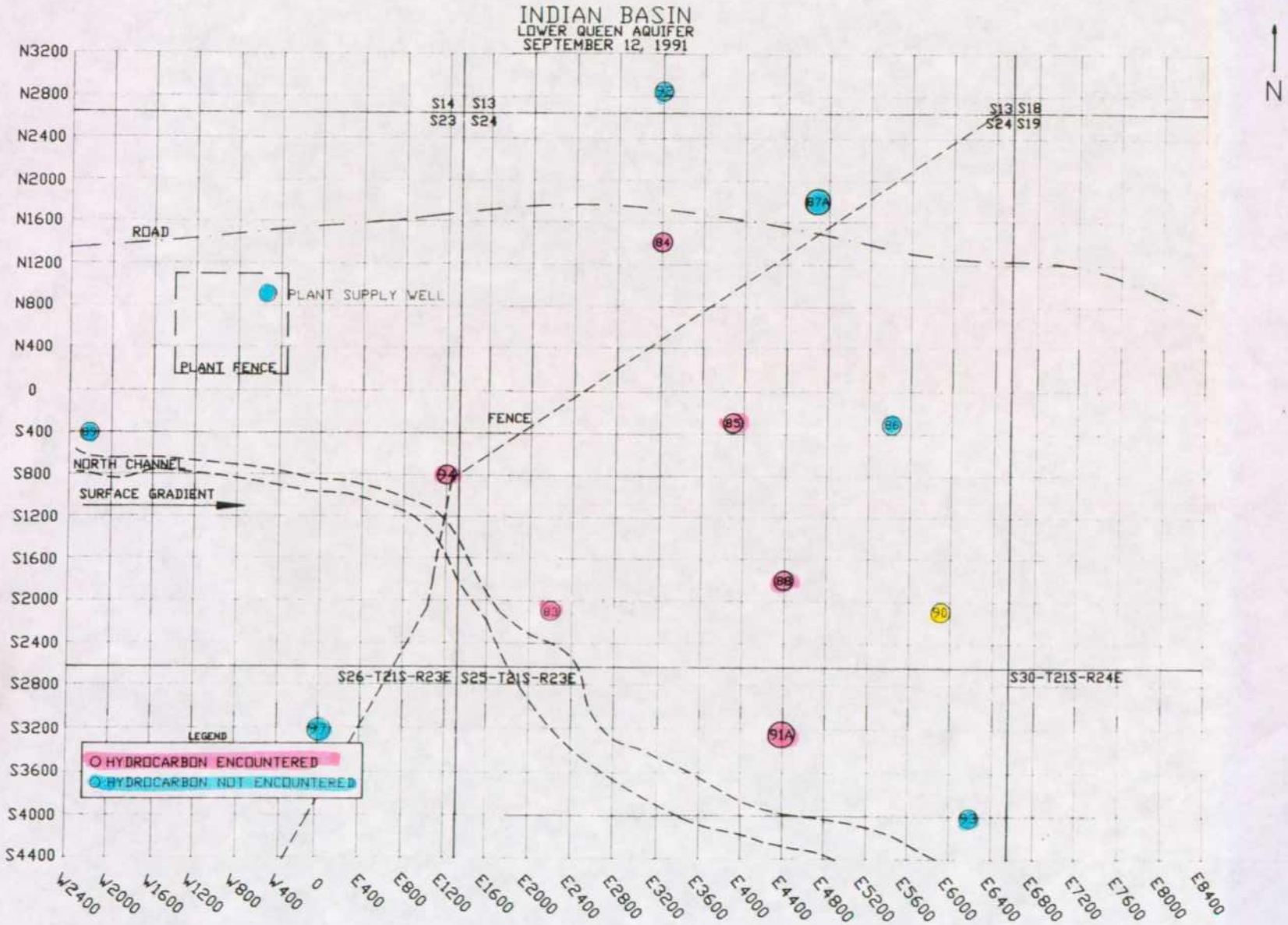
4,000 barrels (168,000 gallons) of condensate recovered

INDIAN BASIN LINE #4 LEAK

SCHEMATIC




INDIAN BASIN
ASSESSMENT AREA
N
S14 S13
S23 S24
S13 S18
S24 S19
ROAD
APPROXIMATE
HYDROCARBON
IMPACTED AREA
TOP OF BEDROCK
PLANT FENCE
DAM
LEAK
CONDENSATE LINE
SURFACE GRADIENT
TRENCH
S26-T21S-R23E
S25-T21S-R23E
S30-T21S-R24E
LEGEND
FREE HYDROCARBON ENCOUNTERED
HYDROCARBON DISSOLVED IN WATER ENCOUNTERED
NO HYDROCARBON ENCOUNTERED
TOP OF BEDROCK
N3200
N2800
N2400
N2000
N1600
N1200
N800
N400
0
S400
S800
S1200
S1600
S2000
S2400
S2800
S3200
S3600
S4000
S4400
W2400
W2000
W1600
W1200
W800
W400
0
E400
E800
E1200
E1600
E2000
E2400
E2800
E3200
E3600
E4000
E4400
E4800
E5200
E5600
E6000
E6400
E6800
E7200
E7600
E8000
E8400


INDIAN BASIN
LOWER QUEEN AQUIFER
SEPTEMBER 12, 1991
N
S14 S13
S23 S24
S13 S18
S24 S19
ROAD
PLANT SUPPLY WELL
PLANT FENCE
FENCE
NORTH CHANNEL
SURFACE GRADIENT
S26-T21S-R23E
S25-T21S-R23E
S30-T21S-R24E
LEGEND
HYDROCARBON ENCOUNTERED
HYDROCARBON NOT ENCOUNTERED
N3200
N2800
N2400
N2000
N1600
N1200
N800
N400
0
S400
S800
S1200
S1600
S2000
S2400
S2800
S3200
S3600
S4000
S4400
W2400
W2000
W1600
W1200
W800
W400
0
E400
E800
E1200
E1600
E2000
E2400
E2800
E3200
E3600
E4000
E4400
E4800
E5200
E5600
E6000
E6400
E6800
E7200
E7600
E8000
E8400

OIL CONSER N DIVISION
RE ED
'92 AUG 27 AM 8 53

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 25, 1992

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Attached please find the final analytical results from a water sample obtained from your well on July 28, 1992. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the EPA, conducted the analysis utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct sampling of your well over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL006/cb
Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
08/23/92

JOB NUMBER: 921360 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 07/28/92
TIME SAMPLED.....: 14:35
WORK DESCRIPTION...: #1

LABORATORY I.D...: 921360-0001
DATE RECEIVED....: 07/30/92
TIME RECEIVED....: 09:30
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.2	1	mg/L	325.2 (1)	08/20/92	KDS
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/31/92	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
'92 AUG 24 PM 9 17

August 17, 1992

Mr. & Mrs. Walter Biebelle
646 Queen Route
Carlsbad, New Mexico 88220

Re: Water Analysis

CERTIFIED MAIL RETURN
RECEIPT REQUESTED

Dear Mr. & Mrs. Biebelle:

Final analytical results from water samples obtained on July 8, 193 from your well and a natural spring located in Rocky Arroyo utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present in any of the samples.

Analysis of the water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct quarterly sampling of your well over the near term. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

Attachment

xc: R. C. Anderson (NMOCD - Santa Fe)
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
08/11/92

JOB NUMBER: 921250 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 07/08/92
TIME SAMPLED.....: 11:48
WORK DESCRIPTION...: #4 Biebelle Water Well

LABORATORY I.D...: 921250-0003
DATE RECEIVED....: 07/14/92
TIME RECEIVED....: 09:35
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	7.8	0.5	mg/L	325.2 (1)	08/03/92	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/17/92	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Western Atlas International
A Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
08/11/92

JOB NUMBER: 921250 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 07/08/92
TIME SAMPLED.....: 11:30
WORK DESCRIPTION...: #2 Upper Indian Hills Spring West

LABORATORY I.D...: 921250-0002
DATE RECEIVED....: 07/14/92
TIME RECEIVED....: 09:35
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	8.5	0.5	mg/L	325.2 (1)	08/03/92	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/17/92	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 17, 1992

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: Water Analysis

Dear Mr. Gregory:

Final analytical results from a water sample obtained on July 8, 1992 from a natural spring located in Rocky Arroyo are attached. Mr. Walter Biebelle, indicated that this water is utilized by himself and you as stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL016/nrt
Attachment

xc: R. C. Anderson (NMOCD-Santa Fe) ✓
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
08/11/92

JOB NUMBER: 921250 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 07/08/92
TIME SAMPLED.....: 11:30
WORK DESCRIPTION...: #2 Upper Indian Hills Spring West

LABORATORY I.D...: 921250-0002
DATE RECEIVED....: 07/14/92
TIME RECEIVED....: 09:35
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	8.5	0.5	mg/L	325.2 (1)	08/03/92	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/17/92	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 6, 1992

RECEIVED
AUG 13 1992
OIL CONSERVATION DIV.
SANTA FE

Mr. Roger C. Anderson
Mr. William Olson
New Mexico Oil Conservation Division
P. O. Box 2088
Land Office Building
Santa Fe, NM 87504-2088

Gentlemen:

Attached please find the Second Quarter 1992 Indian Basin Gas Plant Treatment Project Report. This report is submitted on behalf of the Indian Basin Gas Plant Owners in accordance with the April 2, 1992 Oil Conservation Division Indian Basin Treatment Project Plan approval. The Treatment Project is now fully operational and functioning as designed. Should you have any questions please contact met at your convenience.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL012/cb
Attachment

xc: R. F. Unger
R. A. Biernbaum, w/o attachment
C. K. Curlee, w/o attachment
T. C. Lowry, w/o attachment
D. E. Kenyon - Littleton, w/o attachment

NOEL GARZA
FAX # 457-2544

OIL CONSERVATION DIVISION
RECEIVED
'92 AUG 20 PM 8 15

Albq. Journal 8/1/92

BLM Award Raises Question, Critic Says

By Chuck McCutcheon

JOURNAL STAFF WRITER

A recent Bureau of Land Management environmental award to a company responsible for one of the state's largest recent oil spills raises questions about the agency's attitude toward polluters, an environmentalist says.

New Mexico BLM director Larry Woodard gave Marathon Oil Co. a 1992 Environmental Initiatives Award for the company's work on improving the population of upland game birds in southeastern New Mexico.

Marathon has been blamed for an underground leak of more than 2 million gallons of crude oil and salt water containing small amounts of dissolved oil at its Indian Basin gas processing plant near Carlsbad. It has spent more than $4 million on the problem, which was detected in April 1991.

Chris Shuey, director of the community water quality program for Albuquerque's Southwest Research and Information Center, said Friday he doesn't have any basis to dispute the award.

But Shuey said, "It sends the wrong message, and it makes one wonder about the attitudes of BLM. The next time a major contamination problem happens at a place where there's a major oil spill, how much credibility can the public put in that agency?"

A BLM official said Marathon deserved the award.

"We felt they demonstrated very well their interest in protecting the environment," spokeswoman Mary O'Keeffe said. "This does not mean we will compromise on what happened with the leak."

The bureau's law enforcement division is continuing to investigate the leak, she said.

A spokesman for USX Corp., the company of which Marathon is a subsidiary, said officials have worked hard to clean up the leak. Regular tests have found no contamination of nearby drinking wells.

El Paso Times 8/2/92

Environmental award goes to company blamed for huge 1991 oil leak

Associated Press

CARLSBAD — An oil company blamed for an underground leak of more than 2 million gallons of crude oil and salt water has received a U.S. Bureau of Land Management environmental award for a bird-protection initiative.

Marathon Oil Co. received the 1992 Environmental Initiatives Award, which was presented for the company's work on improving the population of upland game birds in southeastern New Mexico.

The award was criticized by Chris Shuey, director of the community water quality program for the Southwest Research and Information Center, an environment activist organization in Albuquerque.

"It sends the wrong message, and it makes one wonder about the attitudes of the Bureau of Land Management," Shuey said.

"The next time a major contamination problem happens at a place where there's a major oil spill, how much credibility can the public put in that agency?" Shuey asked.

The Marathon leak was discovered in April 1991 at Marathon's Indian Basin gas processing plant near Carlsbad.

The company has spent more than $4 million on the problem.

But Bureau of Land Management spokeswoman Mary O'Keeffe said Marathon deserved the recognition.

"We felt they demonstrated very well their interest in protecting the environment," O'Keeffe said.

"This does not mean we will compromise on what happened with the leak."

She said the federal agency's enforcement division is still investigating that.

A spokesman for Marathon's parent, USX Corp., said the company has worked hard to clean it up.

Tests have discerned no drinking water contamination.

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
92 JUL 23 AM 8 58

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

July 17, 1992

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Final analytical results from water samples obtained from your well on June 9, June 30 and July 8, 1992 have been received and are attached. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by the Environmental Protection Agency (EPA) for drinking water.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the EPA, conducted the analysis utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field.

Plans are to continue to conduct sampling of your well over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn

Jeffrey S. Lynn
Advanced Environmental Representative

JSL006/cb
Attachments

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
06/30/92

JCB NUMBER: 921071 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: WATER
DATE SAMPLED.....: 06/09/92
TIME SAMPLED.....: 13:00
WORK DESCRIPTION...: #1 Lyman Well

LABORATORY I.D...: 921071-0001
DATE RECEIVED....: 06/11/92
TIME RECEIVED....: 10:15
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	12.8	0.5	mg/L	325.2 (1)	06/30/92	KDS
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	06/12/92	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	2	1	ug/L			

JUL 7 1992

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Western Atlas International
A Union/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
07/02/92

JOB NUMBER: 921191 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 06/30/92
TIME SAMPLED.....: 15:50
WORK DESCRIPTION...: #1 Lyman Well

LABORATORY I.D...: 921191-0001
DATE RECEIVED....: 07/02/92
TIME RECEIVED....: 09:19
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/02/92	MAD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

JUL 10 1992
Health & Safety

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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LABORATORY TESTS RESULTS
07/15/92

JOB NUMBER: 921250 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 07/08/92
TIME SAMPLED.....: 11:00
WORK DESCRIPTION...: #1

LABORATORY I.D...: 921250-0001
DATE RECEIVED....: 07/14/92
TIME RECEIVED....: 09:35
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	N/A	1	mg/L	325.2 (1)	N/A	N/A
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	07/15/92	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

MAR
JUL 15 1992
Environmental & Safety

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 12, 1992

Mr. & Mrs. Walter Biebelle
646 Queen Route
Carlsbad, New Mexico 88220

Re: Water Analysis

CERTIFIED MAIL RETURN RECEIPT REQUESTED

Dear Mr. & Mrs. Biebelle:

Final analytical results from the water samples obtained on May 13, 1992 from a natural spring located in Rocky Arroyo utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present in any of the samples.

Analysis of the water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct quarterly sampling of your well over the near term. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/cb
Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

LABORATORY TESTS RESULTS
06/11/92

JOB NUMBER: 920864 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 05/13/92
TIME SAMPLED.....: 10:40
WORK DESCRIPTION...: #2 Upper Indian Hills Spring West

LABORATORY I.D...: 920864-0002
DATE RECEIVED....: 05/15/92
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.3	0.5	mg/L	325.2 (1)	06/08/92	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/19/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 12, 1992

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Final analytical results from the water sample obtained from your well on May 13, 1992 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct sampling of your well over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/cb
Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

LABORATORY TESTS RESULTS
06/11/92

JOB NUMBER: 920864 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 05/13/92
TIME SAMPLED.....: 10:15
WORK DESCRIPTION...: #1 Lyman Water Well

LABORATORY I.D...: 920864-0001
DATE RECEIVED....: 05/15/92
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	12.9	0.5	mg/L	325.2 (1)	06/08/92	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/19/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
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Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED

Marathon Oil Company

92 JUN 15 AM 9 07

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 12, 1992

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: Water Analysis

Dear Mr. Gregory:

Final analytical results from a water sample obtained on May 13, 1992 from a natural spring located in Rocky Arroyo are attached. Mr. Biebelle, indicated that this water is utilized by himself and you as stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the April, 1991 leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/cb
Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
T. C. Lowry
R. F. Unger

LABORATORY TESTS RESULTS
06/11/92

JOB NUMBER: 920864 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL
DATE SAMPLED.....: 05/13/92
TIME SAMPLED.....: 10:40
WORK DESCRIPTION...: #2 Upper Indian Hills Spring West

LABORATORY I.D...: 920864-0002
DATE RECEIVED....: 05/15/92
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.3	0.5	mg/L	325.2 (1)	06/08/92	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	05/19/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

Mid-Continent Region
Production United States

OIL CONSER... ...N DIVISION
RE... ...VED

'92 MAY 21 AM 8 38

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 18, 1992

Mr. Jim Amos
U.S. Department of Interior
Bureau of Land Management
Carlsbad Resource Area Headquarters
P. O. Box 1778
Carlsbad, New Mexico 88221-1778

Re: Temporary Installation of Shallow Well Flowlines
Indian Basin Treatment Project

Dear Mr. Amos:

My April 7 letter to you proposed using 3 shallow wells, BH-14, BH-37 and BH-44, to produce shallow water to a collection point at BH-94 for entry into the treatment project gathering system. It has been identified that BH-14 and BH-44 will pump insufficient volumes to maintain the temporary surface gathering lines to these wells. Temporary lines to these two wells will be removed.

In lieu of BH-14 and BH-44, two additional wells have been identified as potential withdrawal points. BH-59 and BH-36 will be designated as shallow pumping wells along with the previously selected BH-37. As before, these wells will be produced through a poly fast line which will be laid on the surface back to BH-94 where they will be tied into the main gathering line. Additionally, a small poly fast line will also be laid on the surface from BH-94 to each pumping well to supply air to operate the pneumatic pumps.

As in the April 7 letter your approval of these surface flowlines is requested. Should you have additional questions, please contact met at your convenience.

Sincerely,

Jeffrey S. Lynn

Jeffrey S. Lynn
Advanced Environmental Representative

xc: W. Olson - NMOCD, Santa Fe
R. A. Biernbaum - Midland
D. E. Kenyon - Littleton
C. M. Schweser - IBGP

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED

Marathon Oil Company

'92 MAY 15 AM 8 53

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 12, 1992

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Final analytical results from the water sample obtained from your well on April 16, 1992 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct sampling of your well over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/cb
Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

"CONFIDENTIAL BUSINESS STATEMENT"

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
05/01/92

JOB NUMBER: 920669 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL CO.
DATE SAMPLED.....: 04/16/92
TIME SAMPLED.....: 09:29
WORK DESCRIPTION...: #1 Lyman Well

LABORATORY I.D...: 920669-0004
DATE RECEIVED....: 04/21/92
TIME RECEIVED....: 09:32
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	12.6	0.5	mg/L	325.2 (1)	04/22/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	04/24/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 12, 1992

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. Gregory:

Final analytical results from a water sample obtained on April 16, 1992 from a natural spring located in Rocky Arroyo are attached. Mr. Biebelle, indicated that this water is utilized by himself and you as stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/cb
Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

CONFIDENTIAL BUSINESS STATEMENT

Western Atlas International
Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
05/01/92

JOB NUMBER: 920669 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL CO.
DATE SAMPLED.....: 04/16/92
TIME SAMPLED.....: 09:50
WORK DESCRIPTION...: #2 Upper Indian Hills Spring West

LABORATORY I.D...: 920669-0005
DATE RECEIVED....: 04/21/92
TIME RECEIVED....: 09:32
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	16.2	0.5	mg/L	325.2 (1)	04/22/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	04/24/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 12, 1992

Mr. & Mrs. Walter Biebelle
646 Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. & Mrs. Biebelle:

Final analytical results from the water samples obtained on April 16, 1992 from your well and a natural spring located in Rocky Arroyo utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present in any of the samples.

Analyses of the water were conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the leak that occurred in the Indian Basin Field. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct quarterly sampling of your well over the near term. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/cb
Attachment

xc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

CONFIDENTIAL BUSINESS STATEMENT

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
05/01/92

JOB NUMBER: 920669 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL CO.
DATE SAMPLED.....: 04/16/92
TIME SAMPLED.....: 10:12
WORK DESCRIPTION...: #4 Biebelle Well - 2nd Qtr 1992 Sample

LABORATORY I.D...: 920669-0006
DATE RECEIVED....: 04/21/92
TIME RECEIVED....: 09:32
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.5	0.5	mg/L	325.2 (1)	04/22/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	04/24/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CONFIDENTIAL BUSINESS STATEMENT

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
05/01/92

JOB NUMBER: 920669 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: MARATHON OIL CO.
DATE SAMPLED.....: 04/16/92
TIME SAMPLED.....: 09:50
WORK DESCRIPTION...: #2 Upper Indian Hills Spring West

LABORATORY I.D...: 920669-0005
DATE RECEIVED....: 04/21/92
TIME RECEIVED....: 09:32
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	16.2	0.5	mg/L	325.2 (1)	04/22/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	04/24/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
'92 APR 13 AM 9 18

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

April 9, 1992

Mr. & Mrs. Howell
P. O. Box 94
Lakewood, New Mexico 88254

Re: Water Well Analysis

Dear Mr. & Mrs. Howell:

Final analytical results from the water samples obtained from your domestic and stock wells on March 13, 1992 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analyses of your water were conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the leak that occurred in the Indian Basin Field. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Due to the continued lack of petroleum-related contaminants in your wells and in conjunction with indications of contaminant containment at the leak site and with initiation of Lower Queen water withdrawals to promote additional contaminant cleanup, the New Mexico Oil Conservation Division (OCD) has approved a reduction in the frequency and number of area rancher wells to be routinely sampled. The OCD has approved plans to discontinue routine sampling of your wells. You will continue to be provided information on the overall Treatment Program at the Indian Basin Gas Plant through quarterly updates. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk
Attachments

cc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 836

"CONFIDENTIAL BUSINESS STATEMENT"

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/06/92

JOB NUMBER: 920470 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 03/13/92
TIME SAMPLED.....: 12:42
WORK DESCRIPTION...: 10
Howell Water Well

LABORATORY I.D...: 920470-0010
DATE RECEIVED....: 03/17/92
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	98	1	mg/L	325.2 (1)	04/03/92	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/18/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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"CONFIDENTIAL BUSINESS STATEMENT"

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/06/92

JOB NUMBER: 920470 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 03/13/92
TIME SAMPLED.....: 12:42
WORK DESCRIPTION...: 10
Howell Water Well

LABORATORY I.D...: 920470-0010
DATE RECEIVED....: 03/17/92
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	98	1	mg/L	325.2 (1)	04/03/92	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/18/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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"CONFIDENTIAL BUSINESS STATEMENT"

Western Atlas International
a Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/06/92

JOB NUMBER: 920470 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 03/13/92
TIME SAMPLED.....: 13:12
WORK DESCRIPTION...: 11
Howell Windmill Well

LABORATORY I.D...: 920470-0011
DATE RECEIVED....: 03/17/92
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	17.7	0.5	mg/L	325.2 (1)	04/03/92	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/18/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

April 9, 1992

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Final analytical results from the water sample obtained from your well on March 13, 1992 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct monthly sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk
Attachments

cc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

CONFIDENTIAL BUSINESS STATEMENT

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/06/92

JOB NUMBER: 920470 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 03/13/92
TIME SAMPLED.....: 11:26
WORK DESCRIPTION...: 1 Lyman Water Well

LABORATORY I.D...: 920470-0001
DATE RECEIVED....: 03/17/92
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.3	0.5	mg/L	325.2 (1)	04/03/92	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/18/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production - United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

April 9, 1992

Mr. & Mrs. Walter Biebelle
646 Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. & Mrs. Biebelle:

Final analytical results from the water samples obtained on March 13, 1992 from your well and from natural springs located in Rocky Arroyo utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present in any of the samples.

Analyses of the water were conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the leak that occurred in the Indian Basin Field. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Due to the lack of petroleum-related contaminants in your well and the natural springs located in Rocky Arroyo the New Mexico Oil Conservation Division has approved a reduction in the frequency and the number of locations to be routinely sampled. Additional reasoning for the sampling reductions include: 1) Indications of containment and reduction of hydrocarbon contamination in the Lower Queen aquifer from monitoring well sample data and 2) Initiation of water withdrawals from the Lower Queen to promote contaminant cleanup.

Plans are to continue to conduct quarterly sampling of your well over the near term. Additionally, the natural spring which is closest to the plant will continue to be monitored on a monthly basis. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk
Attachments

cc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 838

"CONFIDENTIAL BUSINESS STATEMENT"

Western Atlas International
— Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/06/92

JOB NUMBER: 920470 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 03/13/92
TIME SAMPLED.....: 09:45
WORK DESCRIPTION...: 2
Upper Indian Hills Spring - West

LABORATORY I.D...: 920470-0002
DATE RECEIVED....: 03/17/92
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.4	0.5	mg/L	325.2 (1)	04/03/92	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/18/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
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(303) 751-1780

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"CONFIDENTIAL BUSINESS STATEMENT"

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/06/92

JOB NUMBER: 920470 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 03/13/92
TIME SAMPLED.....: 10:50
WORK DESCRIPTION...: 3
Lower Indian Hills Spring

LABORATORY I.D...: 920470-0003
DATE RECEIVED....: 03/17/92
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.9	0.5	mg/L	325.2 (1)	04/03/92	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/18/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
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Western Atlas International
a The Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/06/92

JOB NUMBER: 920470 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 03/13/92
TIME SAMPLED.....: 11:14
WORK DESCRIPTION...: 4
Biebelle Water Well

LABORATORY I.D...: 920470-0004
DATE RECEIVED....: 03/17/92
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.4	0.5	mg/L	325.2 (1)	04/03/92	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/18/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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"CONFIDENTIAL BUSINESS STATEMENT"

Western Atlas International
- The Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/06/92

JOB NUMBER: 920470 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 03/13/92
TIME SAMPLED.....: 10:26
WORK DESCRIPTION...: 5
Arroyo Spring Water

LABORATORY I.D...: 920470-0005
DATE RECEIVED....: 03/17/92
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.5	0.5	mg/L	325.2 (1)	04/03/92	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/18/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Western Atlas International
A Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/06/92

JOB NUMBER: 920470 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 03/13/92
TIME SAMPLED.....: 09:55
WORK DESCRIPTION...: 6

LABORATORY I.D....: 920470-0006
DATE RECEIVED....: 03/17/92
TIME RECEIVED....: 09:45
REMARKS.....:

Upper Indian Hills Spring - East

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.9	0.5	mg/L	325.2 (1)	04/03/92	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/18/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

April 9, 1992

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. Wayne Gregory:

Final analytical results from the water sample obtained on March 13, 1992 from a natural spring located in Rocky Arroyo are attached. Mr. Biebelle, indicated that this water is utilized by himself and you as stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of spring water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the leak that occurred in the Indian Basin Field. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Due to the continued lack of petroleum-related contaminants in the natural springs located in Rocky Arroyo, the New Mexico Oil Conservation Division has approved a reduction in the frequency and the number of locations to be routinely sampled. Additional reasoning for the sampling reductions include: 1) Indications of containment and reduction of hydrocarbon contamination in the Lower Queen aquifer from monitoring well sample data and 2) Initiation of water withdrawals in the leak contaminated area to promote contaminant cleanup.

Plans are to continue to conduct monthly sampling of the natural spring which is closest to the plant over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk
Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

"CONFIDENTIAL BUSINESS STATEMENT"

Western Atlas International
a Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/06/92

JOB NUMBER: 920470 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 03/13/92
TIME SAMPLED.....: 10:26
WORK DESCRIPTION...: 5
Arroyo Spring Water

LABORATORY I.D...: 920470-0005
DATE RECEIVED....: 03/17/92
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.5	0.5	mg/L	325.2 (1)	04/03/92	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/18/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
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Mid-Continent Region
Production - United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

April 9, 1992

Mr. & Mrs. Lee
P. O. Box 89
Lakewood, New Mexico 88254

Re: Water Well Analysis

Dear Mr. & Mrs. Lee:

Final analytical results from the water sample obtained on March 13 1992 from your well located next to the paved road approximately 0.5 miles west of Marathon's Indian Basin Gas Plant have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water by released fluids from the leak that occurred in the Indian Basin Field. The results of the analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Due to the continued lack of petroleum-related contaminants in your well and in conjunction with indications of contaminant containment at the leak site and with initiation of Lower Queen water withdrawals to promote additional contaminant cleanup, the New Mexico Oil Conservation Division (OCD) has approved a reduction in the frequency and number of area rancher well to be routinely sampled. The OCD has approved plans to discontinue routine sampling of your well. You will continue to be provided information on the overall Treatment Program at the Indian Basin Gas Plant through quarterly updates. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 682-1626.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk
Attachments

cc: R. C. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 837

"CONFIDENTIAL BUSINESS STATEMENT"

Western Atlas International
A Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
04/06/92

JOB NUMBER: 920470 CUSTOMER: MARATHON OIL COMPANY ATTN: JEFFREY S. LYNN

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 03/13/92
TIME SAMPLED.....: 13:52
WORK DESCRIPTION...: 9
Lee Water Well

LABORATORY I.D...: 920470-0009
DATE RECEIVED....: 03/17/92
TIME RECEIVED....: 09:45
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.8	0.5	mg/L	325.2 (1)	04/03/92	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	03/18/92	KRB
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED

'92 APR 13 AM 9 03

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

April 7, 1992

Mr. Jim Amos
U. S. Department of the Interior
Bureau of Land Management
Carlsbad Resource Area Headquarters
P. O. Box 1778
Carlsbad, New Mexico 88221-1778

Re: Temporary Installation of Flowlines to Test the Shallow Soil Water Zone at the Indian Basin Gas Plant Treatment Site

Dear Mr. Amos:

This letter is in response to the phone conversation you had with Steven Pohler on January 17, 1992. You informed Mr. Pohler that it would be acceptable to make use of temporary surface flowlines to test the shallow soil water zone, as long as a letter followed to explain which wells were to be produced.

The initial wells designated to be produced from the shallow soil water zone are BH-14, BH-37 and BH-44. They will be produced through a poly fast line which will be laid on the surface back to BH-94 where they will be tied into the main gathering line. A small poly fast line will also be laid on the surface from BH-94 to each pumping well to supply air to operate the pneumatic pumps. If more information is required, please contact me at your earliest convenience.

Yours truly,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk

cc: W. Olson - NMOCD
R. F. Unger
S. A. Pohler
D. E. Kenyon

Mid-Continent Region
Produ United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

March 9, 1992

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Final analytical results from the water sample obtained from your well on February 17, 1992 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water from the released fluids described above. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8312.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk
Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

"CONFIDENTIAL BUSINESS STATEMENT"

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
03/02/92

JOB NUMBER: 920315 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 02/17/92
TIME SAMPLED.....: 08:45
WORK DESCRIPTION...: 1
Lyman Well

LABORATORY I.D...: 920315-0001
DATE RECEIVED....: 02/19/92
TIME RECEIVED....: 16:20
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	11.4	0.5	mg/L	325.2 (1)	02/28/92	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/24/92	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

March 9, 1992

Mr. William Olson
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Re: Indian Basin Gas Plant Air Stripper Water Analyses

Dear Mr. Olson:

Attached please find two water analeses prepared by Southwestern Laboratories from samples caught during testing of the air stripper at Indian Basin. The two samples represent the influent and effluent from the air stripper. The following table summarizes the analysis:

	INFLUENT	EFFLUENT
Benzene	520	<4
Toluene	1020	30
Ethyl Benzene	220	<4
Total Xylenes	1430	26

EPA standard methodology was used to determine the above data. Should you have any questions, please contact me at your convenience.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk

Attachments

cc: D. E. Kenyon
R. F. Unger
J. L. Benson

SwL SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

1703 West Industrial Avenue • P.O. Box 2150 • Midland, Texas 79702

Report of tests on	Water	**File No.**	6546001
Client	Marathon Oil	**Report No.**	76149
Delivered by	Steven Pohler	**Report Date**	3-4-92
		Date Received	2-28-92

Identification Air Stripper Outlet, Sample No. 1, Sampled 2-27-92 @ 4:57 by Steven Pohler and Kevin Miller

REPORT OF ORGANICS ANALYSIS

Date of Analysis	3-3-92	**Matrix**	**Water**
Analyst	L. Duty	**Method**	**SW846 5030/8020A**
		MDL	**0.004 mg/L**

Compound	ug/L
Benzene	* 4
Toluene	30
Ethyl Benzene	* 4
Total Xylenes	26

*Denotes "less than"

Copies: Marathon Oil
Attn: Jeff Lynn

LLC
Reviewed by

SOUTHWESTERN LABORATORIES

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SwL SOUTHWESTERN LABORATORIES

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

1703 West Industrial Avenue • P.O. Box 2150 • Midland, Texas 79702

Report of tests on	Water	**File No.**	6546001
Client	Marathon Oil	**Report No.**	76148
Delivered by	Steven Pohler	**Report Date**	3-4-92
		Date Received	2-28-92

Identification Air Stripper Inlet, Sample No. 1, Sampled 2-27-92 @ 5:08 pm by Steven Pohler and Kevin Miller

REPORT OF ORGANICS ANALYSIS

		Matrix	**Water**
Date of Analysis	**3-3-92**	**Method**	**SW846 5030/8020A**
Analyst	**L. Duty**	**MDL**	**0.004 mg/L**

Compound	**ug/L**
Benzene	520
Toluene	1020
Ethyl Benzene	220
Total Xylenes	1430

*Denotes "less than"

Copies: Marathon Oil
Attn: Jeff Lynn

LLC

Reviewed by

SOUTHWESTERN LABORATORIES

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

March 5, 1992

RECEIVED
MAR 06 1992
OIL CONSERVATION DIV.
SANTA FE

William Olson
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Olson:

The following is a request for OCD concurrence with a proposal to reduce the frequency of rancher water well and surface water monitoring activities in the vicinity of the Indian Basin Gas Plant. Marathon presently monitors the following locations:

	LOCATION	PRESENT SAMPLING FREQUENCY
1.	P. Lyman Water Tank	Twice/month
2.	Upper Indian Hills Spring West	Once/month
3.	Lower Indian Hills Spring West	Once/month
4.	Biebelle Water Well	Once/month
5.	Spring Feeding Surface Water	Once/month
6.	Upper Indian Hills Spring East	Once/month
7.	Plant Water Supply Well No. 1	Once/month
8.	Plant Well No. 1A	Once/month
9.	Lee Water Well	Once/month
10.	R. Howell Water Well	Once/month
11.	R. Howell Windmill Well	Once/month

The reasoning for the proposed sampling reductions are as follows: 1) To date, sampling of the rancher and surface water springs has yielded no indication of hydrocarbons and/or abnormally high chloride concentrations; 2) The December 1991 point-in-time data indicates containment and reduction of hydrocarbon concentration in the Lower Queen; 3) Full implementation of Lower Queen water withdrawals was commenced in December and will continue as per the requirements of the Treatment Plan. The proposed sampling frequency is outlined as follows:

	LOCATION	PROPOSED FREQUENCY
1.	P. Lyman	One Per Month
2.	Upper Indian Hills Spring West	One Per Month
3.	Lower Indian Hills Spring West	Delete Sampling
4.	Biebelle Water Well	One Per Quarter
5.	Spring Feeding Surface Water	Delete Sampling
6.	Upper Indian Hills Spring East	Delete Sampling
7.	Plant Water Supply Well No. 1	One Per Month
8.	Plant Well No. 1A	One Per Month
9.	Lee Water Well	Delete Sampling
10.	R. Howell Water Well	Delete Sampling
11.	R. Howell Windmill Well	Delete Sampling

We would appreciate your earliest possible response to this proposal. Should you need additional information, please contact me at your convenience at 915/687-8312.

Sincerely,

Jeffrey S. Lynn

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

March 5, 1992

RECEIVED
MAR 06 1992
OIL CONSERVATION DIV.
SANTA FE

Mr. Roger Anderson
New Mexico Oil Conservation Division
310 Old Santa Fe Trail
Santa Fe, New Mexico 87501

Re: Indian Basin Environmental Treatment Plan

Dear Mr. Anderson:

Enclosed for your review and approval, is the formal written Indian Basin Environmental Treatment Plan submitted by Marathon Oil Company on behalf of the Indian Basin Gas Plant owners.

As a brief recap the history of this problem, a few items should be mentioned. On April 12, 1991, a leak of condensate and produced water was discovered in Line 4 south of the Indian Basin Gas Plant, located in Eddy County, New Mexico. After immediate notification to the appropriate governmental agencies, including the New Mexico Oil Conservation Division (the "OCD"), emergency remediation actions were undertaken. Simultaneously, Marathon on behalf of the gas plant owners, instituted an in-depth site assessment. We have had extensive communications with members of the OCD staff and the Bureau of Land Management (the land owner). This includes numerous written submissions, technical meetings, and conversations. At the most recent of these technical meetings,in December of 1991, we described to you the general principles contained in our proposed treatment plan. These principles, which met with your preliminary approval in December, are incorporated in the enclosed document.

We believe that this plan presents an environmentally sound mechanism to contain and to treat the hydrocarbon contamination discovered at the site. We believe this program removes the risk to potential receptors and is consistent with good technical management.

We believe the most efficient approval mechanism would be a written communication from Bill LeMay, as Director of the OCD, indicating the division's position on the plan. Approval by the OCD of this plan at the earliest possible date is requested. This will enable us to continue its implementation at the fastest rate possible and therefore, allow us to achieve the primary goal of all parties concerned -- containment and treatment of the environmental problem presented.

We stand ready to assist in your understanding of this program and are available to answer any questions you may have, both by telephone and in person, if that should be desired.

I also want to take this time to express our appreciation to the OCD and all the members of the staff for their continuing cooperation and understanding in working with us in addressing this problem. We believe that our ability to go from discovery to submission of a final written treatment plan, and hopefully, its early approval, in less that one year is a tribute to the professionalism of you and your staff, in particular.

We look forward to your early response.

Very truly yours,

Robert F. Unger

Robert F. Unger

Enclosure

xc: William Olson
Robert Stovall

RFU\IBGPLEAK\JBL010\mlp

3/5/91 OCD/BLM/Marathon Meeting 1:00 pm

Name	Affiliation	
Bill Olson	NM OCD	Santa Fe
Roger Anderson	"	"
Al Collins	BLM	Roswell
Kathy Brown	NMOCD	Santa Fe
Gary Stephens	BLM	Santa Fe
Doug Kenyon	MOC	Littleton
Jeff Lynn	"	Midland
Jeff Benson	"	"
Robert Linger	"	"

3/5/92 OCD/BLM/Marathon Meeting 1:00 pm

participants - see sign in sheet

J.L - Review past activities
SEO approval on pumping wells in December
after Lyman product dropped

December 16 point in time
Air stripper (tray) system tested, already built on site
benzene influent 530 ppb
effluent < 4 ppb
Soil vac unit

handout & discuss request to reduce random sampling frequency

D.K. review alternate sampling analytical techniques
High Performance Liquid Chromatography
he will send copy of literature on system

J.L. Review remediation plan

monitoring vapor extraction ?
2 months prior to arrow discharge used to modify P.P.
monitoring when go to reinjection

IBGP TREATMENT PLAN
OCD/BLM MEETING AGENDA
MARCH 5, 1992

ACTIVITY UPDATE
DECEMBER POINT-IN-TIME
RANCHER SAMPLING FREQUENCY
SAMPLE ANALYSIS TECHNIQUE COMPARISON
TREATMENT PLAN DISCUSSION

Table 1 Analytical Data from January, 1992, Sampling Round

well_no	Analyst	benzene	toluene	eth_benz	xylenes
BH-14	Beazley HPLC	127	7	227	16
BH-14	Core P&T	140	40	210	5
BH-14	Core P&T	140	45	180	10
BH-14	Core P&T	130	35	160	5
BH-14	Louch P&T	277	0	192	17
BH-14	Louch/Hooper P&T	278	0	190	17
BH-14	Louch/Hooper P&T	302	0	193	18
BH-14	Louch/Hooper P&T	294	0	193	18
BH-14	Spectra Physics	110	51	154	7
BH-44	Beazley HPLC	861	38	120	684
BH-44	Core P&T	1200	50	150	1000
BH-44	Core P&T	1200	25	150	900
BH-44	Core P&T	1100	25	180	900
BH-44	Louch P&T	1359	0	189	965
BH-44	Spectra Physics	657	56	115	595
BH-64	Beazley HPLC **	180	28	367	43
BH-64	Beazley HPLC **	164	8	389	9
BH-64	Core P&T	200	40	480	10
BH-64	Core P&T	200	40	490	10
BH-64	Core P&T	210	40	520	10
BH-64	Louch P&T	329	0	314	21
BH-64	Louch/Hooper P&T	242	0	323	16
BH-64	Louch/Hooper P&T	334	0	314	24
BH-64	Louch/Hooper P&T	321	0	306	23
BH-69	Beazley HPLC	43		121	0
BH-69	Core P&T	55	35	130	5
BH-69	Core P&T	55	30	120	5
BH-69	Core P&T	55	30	120	5
BH-69	Louch P&T	234	0	136	16
BH-69	Louch/Hooper P&T	167	0	108	19
BH-69	Louch/Hooper P&T	123	0	96	14
BH-69	Louch/Hooper P&T	184	0	111	19
BH-69	Spectra Physics	50	6	124	23
BH-70	Beazley HPLC	1876	29	862	32
BH-70	Core P&T	1800	50	650	50
BH-70	Core P&T	2300	50	800	50
BH-70	Core P&T	2200	50	800	50
BH-70	Louch P&T	1917	0	732	34
BH-70	Spectra Physics	1803	103	726	22
BH-73	Core P&T	1	1	1	1
BH-73	Core P&T	1	1	1	1
BH-73	Core P&T	1	1	1	1
BH-73	Louch P&T	0	0	0	0
BH-73	Louch/Hooper P&T	3	1	1	3
BH-73	Louch/Hooper P&T	3	1	1	3
BH-73	Louch/Hooper P&T	3	1	2	3

well_no	Analyst	benzene	toluene	eth_benz	xylenes
BH-84	Core P&T	210	30	60	20
BH-84	Core P&T	240	30	55	20
BH-84	Core P&T	240	30	55	30
BH-84	Louch P&T	213	0	91	0
BH-84	Louch/Hooper P&T	212	0	92	20
BH-84	Louch/Hooper P&T	216	0	94	21
BH-84	Louch/Hooper P&T	180	0	87	20
BH-84	Spectra Physics	216	35	76	29
BH-84	Spectra Physics	213	44	59	22
BH-84	Spectra Physics	208	47	52	15
BH-88	Beazley HPLC	515	36	269	726
BH-88	Beazley spcl	472	43	244	783
BH-88	Core P&T	550	100	250	750
BH-88	Core P&T	520	50	250	880
BH-88	Core P&T	580	50	260	990
BH-88	Louch P&T	920	0	345	942
BH-88	Louch/Hooper P&T	785	0	357	906
BH-88	Louch/Hooper P&T	794	0	360	885
BH-88	Louch/Hooper P&T	789	0	354	892
BH-88	Spectra Physics	169	28	55	17
BH-88	Spectra Physics	194	30	49	11
BH-88	Spectra Physics	184	41	47	11
BH-91A	Beazley HPLC	34			0
BH-91A	Core P&T	46	10	5	15
BH-91A	Core P&T	46	5	3	16
BH-91A	Core P&T	40	8	4	13
BH-91A	Louch P&T	40	0	0	0
BH-91A	Louch/Hooper P&T	39	3	11	22
BH-91A	Louch/Hooper P&T	39	5	7	27
BH-91A	Louch/Hooper P&T	37	2	7	20
BH-91A	Spectra Physics	48	22	4	9
BH-91A	Spectra Physics	38	19	4	8
BH-91A	Spectra Physics	38	22	4	8

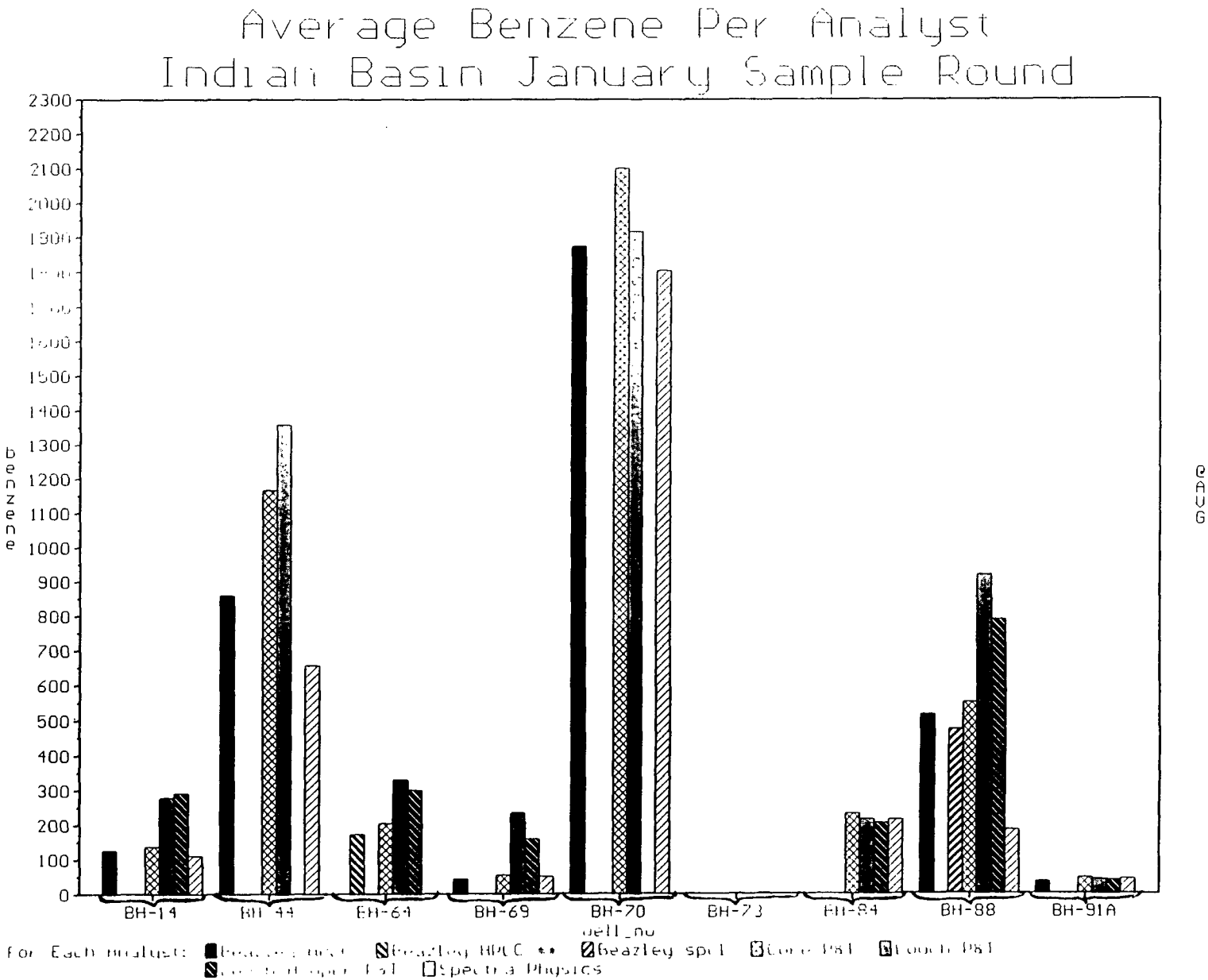

Fig. 1 Average Benzene

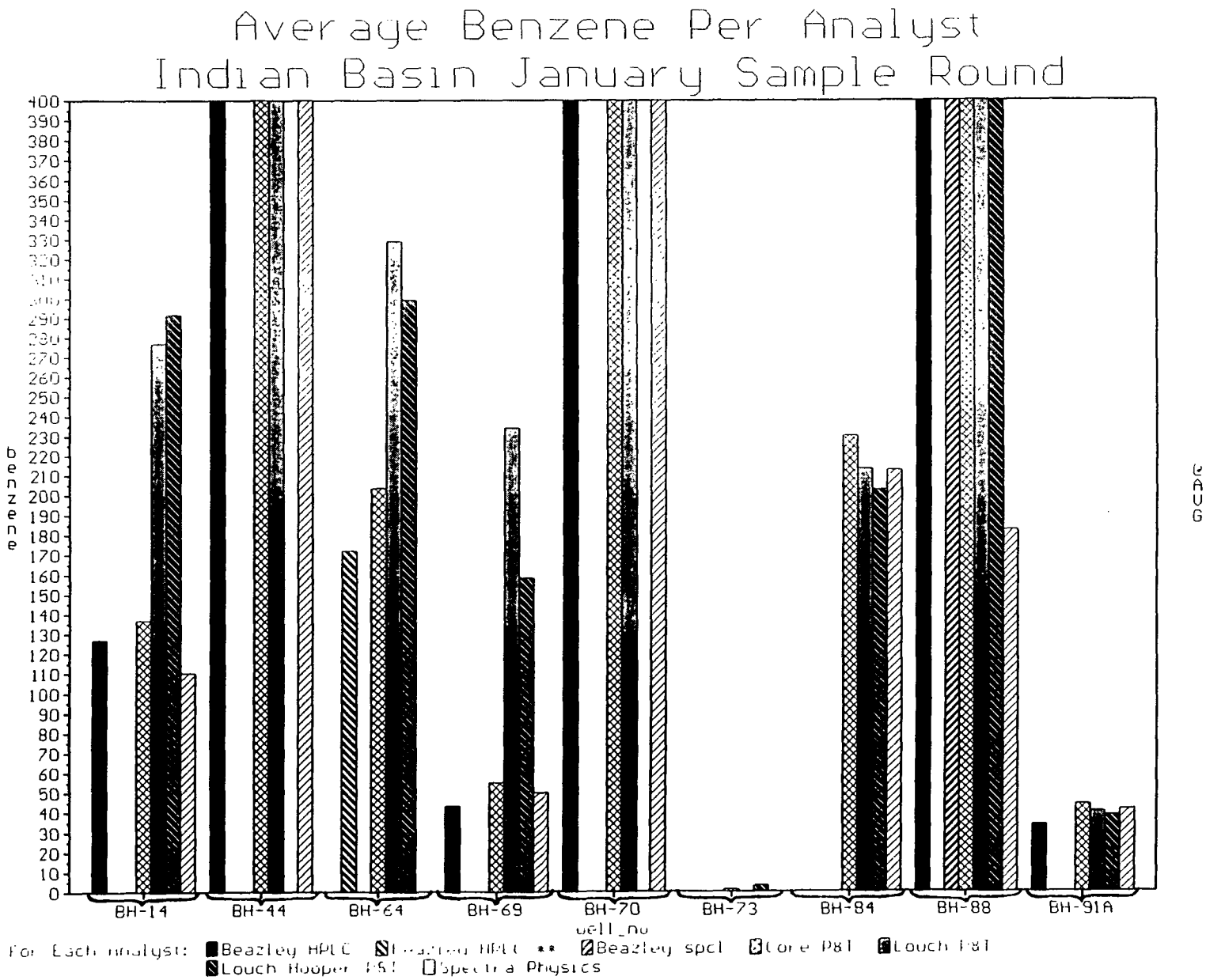

Fig. 2 Average Benzene (y-scale changed for comparison of small values)

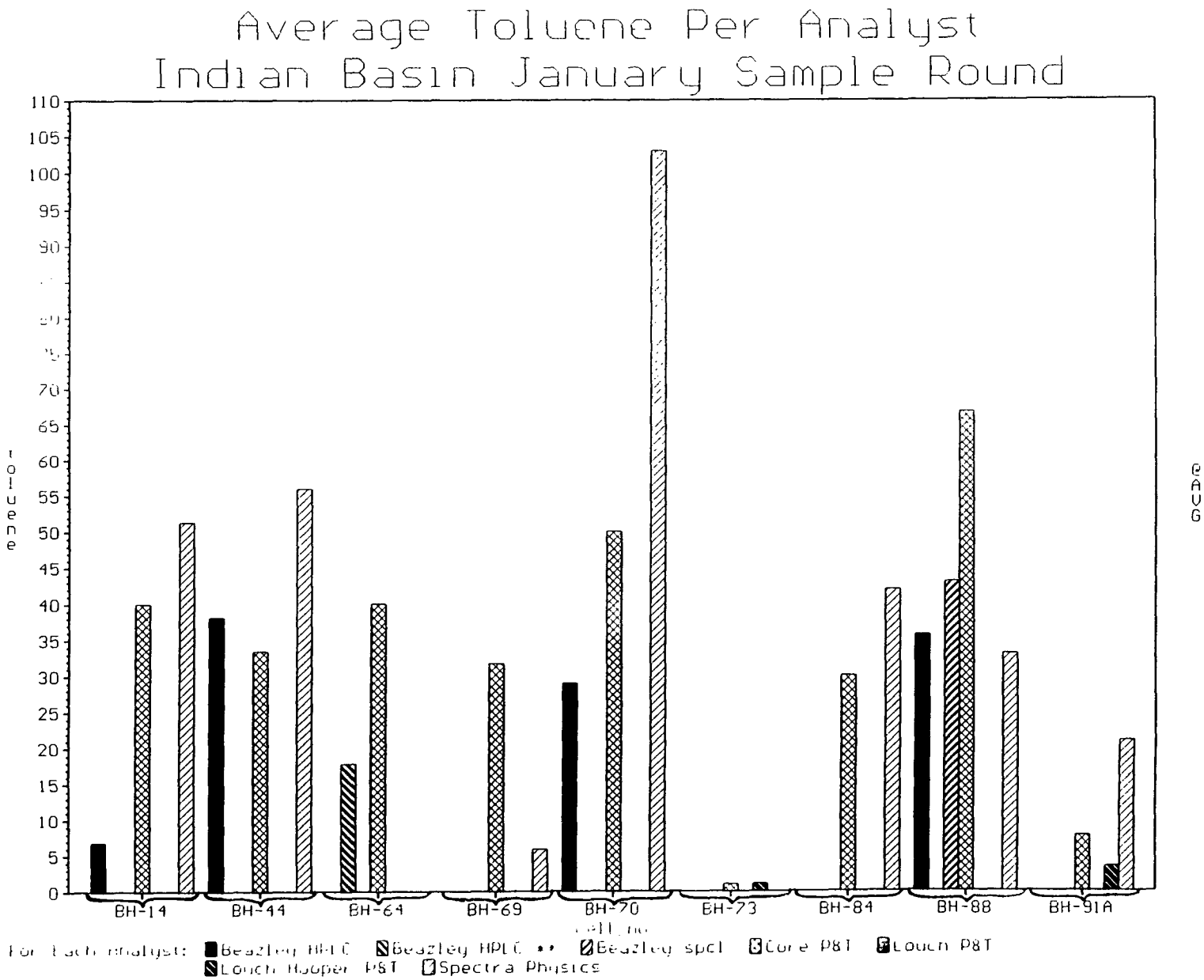

Fig. 3 Average Toluene

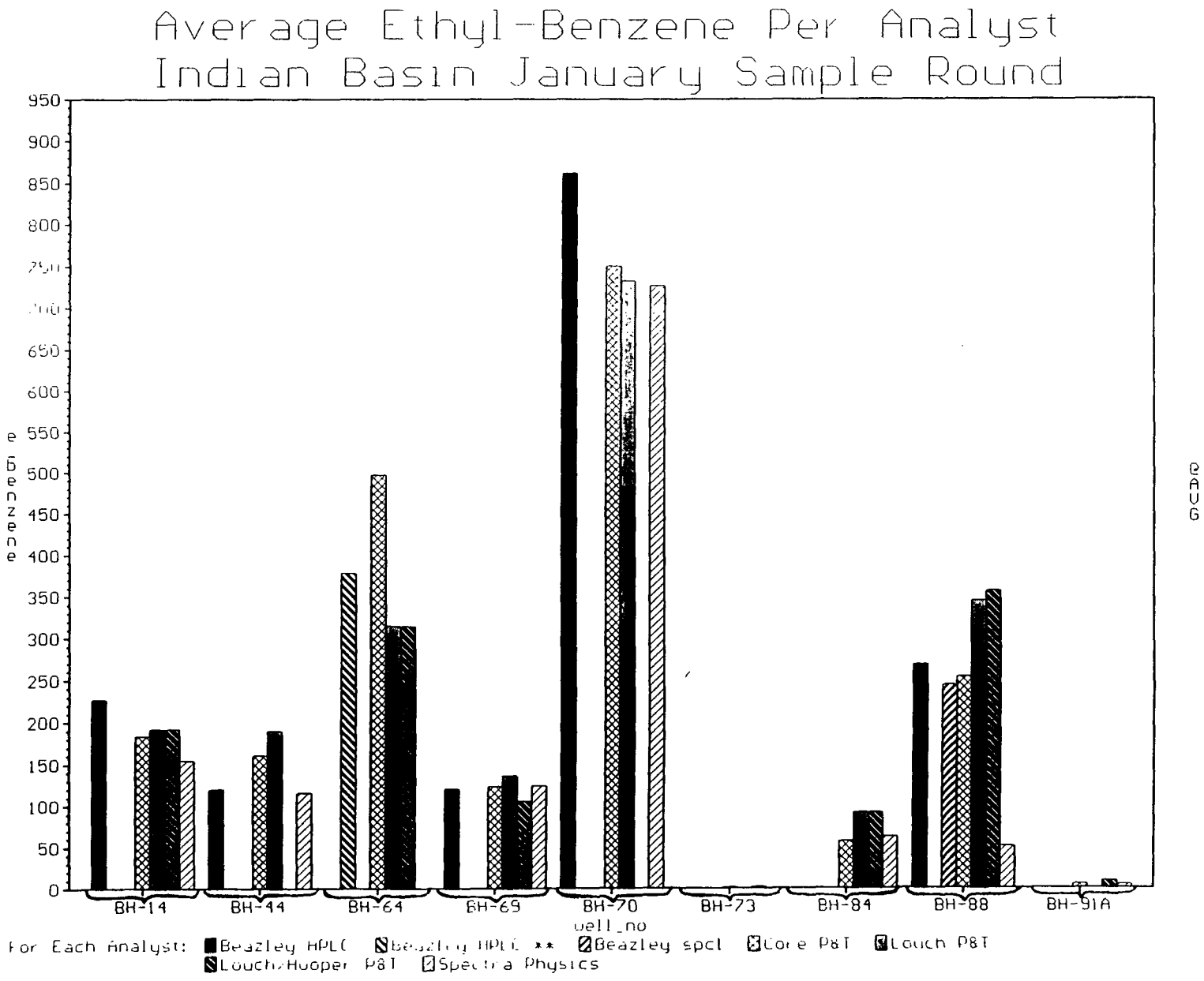

Fig. 4 Average Ethyl-Benzene

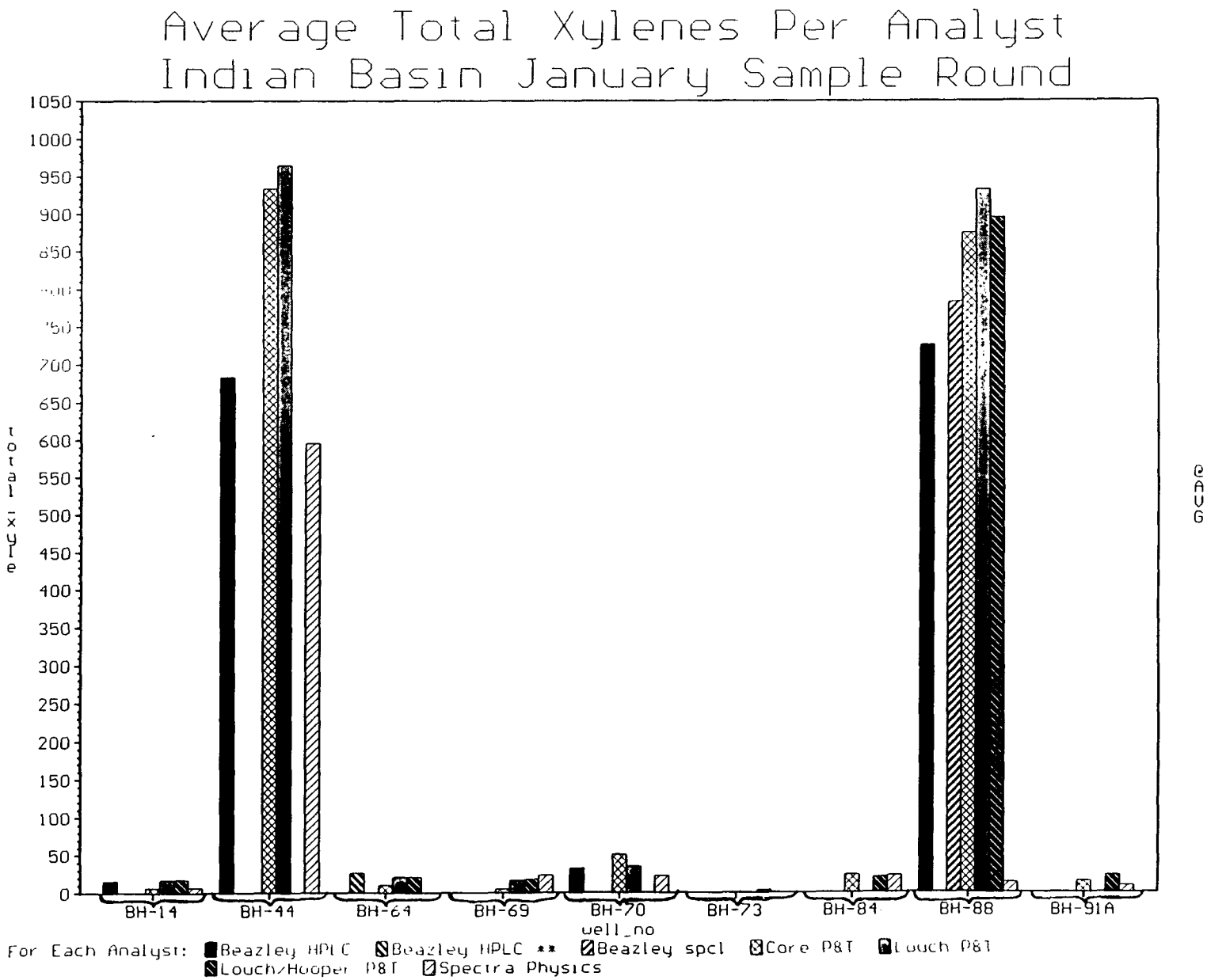

Fig. 5 Average Xylenes

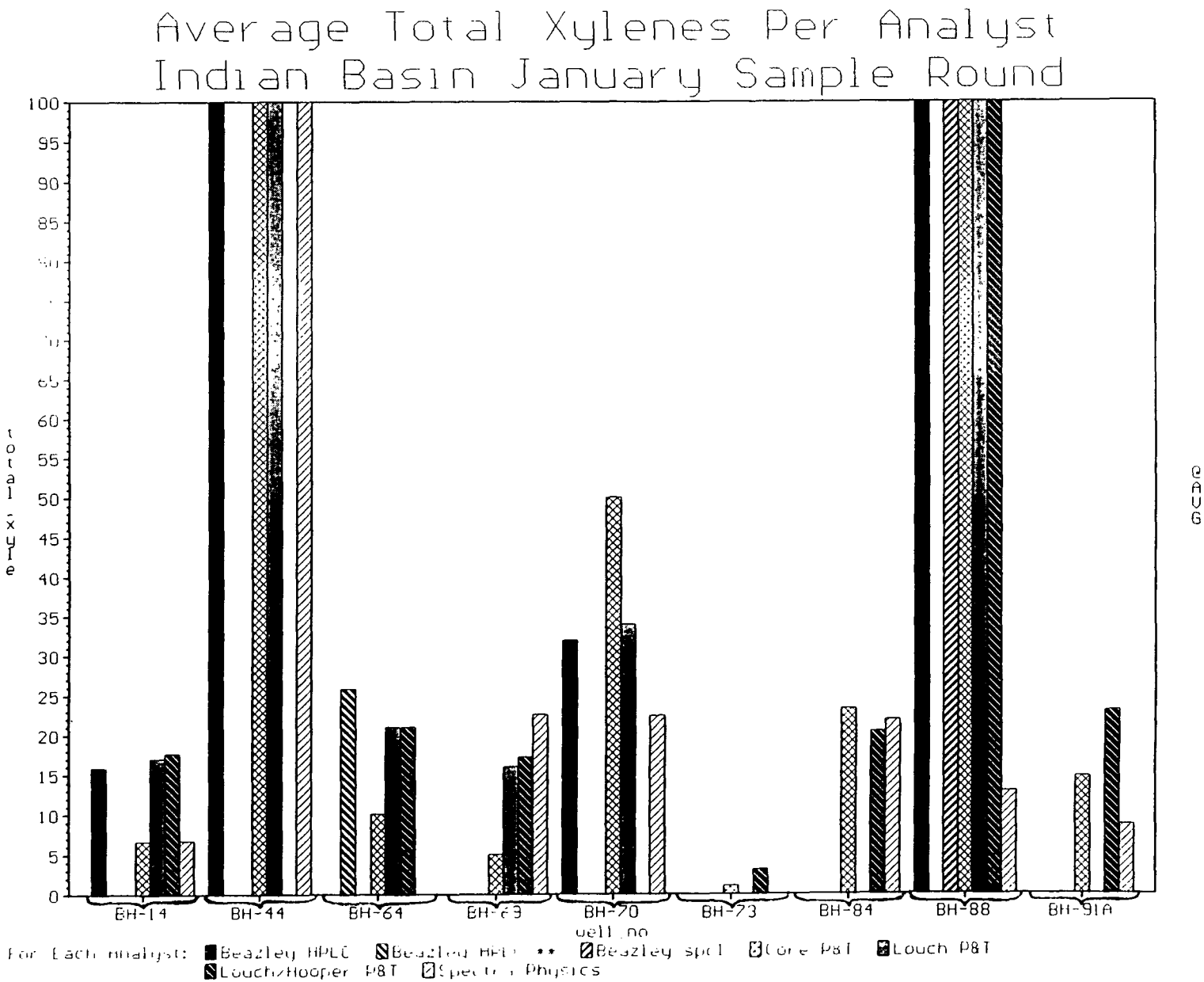

Fig. 6 Average Xylenes (y-scale changed for comparison of small values)

Mid-Con[illegible]nt Region
Production United States

OIL CONSER[illegible] DIVISION
[illegible] 10 11

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

February 28, 1992

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Final analytical results from the water sample obtained from your well on February 5, 1992 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water from the released fluids described above. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8312.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk
Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

"CONFIDENTIAL BUSINESS STATEMENT"

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/19/92

JOB NUMBER: 920246 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 02/05/92
TIME SAMPLED.....: 12:25
WORK DESCRIPTION...: 1
Lyman Water Well

LABORATORY I.D...: 920246-0001
DATE RECEIVED....: 02/10/92
TIME RECEIVED....: 09:55
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	12.2	0.5	mg/L	325.2 (1)	02/17/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/11/92	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
1992 MAR 10 11

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

February 29, 1992

Mr. & Mrs. Walter Biebelle
646 Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. & Mrs. Biebelle:

Final analytical results from the water samples obtained on February 5, 1992 from your well and from natural springs located in Rocky Arroyo and utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present in any of the samples.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of the water were conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8312.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk
Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 684 817 838

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Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/19/92

JOB NUMBER: 920246 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 02/05/92
TIME SAMPLED.....: 09:00
WORK DESCRIPTION...: 2

LABORATORY I.D...: 920246-0002
DATE RECEIVED....: 02/10/92
TIME RECEIVED....: 09:55
REMARKS.....:

Upper Indian Hills Spring - West

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.2	0.5	mg/L	325.2 (1)	02/17/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/11/92	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Western Atlas International
Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/19/92

JOB NUMBER: 920246 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 02/05/92
TIME SAMPLED.....: 10:00
WORK DESCRIPTION...: 3
Lower Indian Hills Spring

LABORATORY I.D...: 920246-0003
DATE RECEIVED....: 02/10/92
TIME RECEIVED....: 09:55
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.3	0.5	mg/L	325.2 (1)	02/17/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/11/92	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
02/19/92

JOB NUMBER: 920246 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 02/05/92
TIME SAMPLED.....: 10:22
WORK DESCRIPTION...: 4

LABORATORY I.D...: 920246-0004
DATE RECEIVED....: 02/10/92
TIME RECEIVED....: 09:55
REMARKS.....:

Biebelle Water Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.1	0.5	mg/L	325.2 (1)	02/17/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/11/92	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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Aurora, CO 80012
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CORE LABORATORIES

LABORATORY TESTS RESULTS
02/19/92

JOB NUMBER: 920246 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 02/05/92
TIME SAMPLED.....: 09:36
WORK DESCRIPTION...: 5
Arroyo Spring Water

LABORATORY I.D...: 920246-0005
DATE RECEIVED....: 02/10/92
TIME RECEIVED....: 09:55
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.1	0.5	mg/L	325.2 (1)	02/17/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/11/92	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/19/92

JOB NUMBER: 920246 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 02/05/92
TIME SAMPLED.....: 09:05
WORK DESCRIPTION...: 6

LABORATORY I.D...: 920246-0006
DATE RECEIVED....: 02/10/92
TIME RECEIVED....: 09:55
REMARKS.....:

Upper Indian Hills Spring - East

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.4	0.5	mg/L	325.2 (1)	02/17/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/11/92	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

February 28, 1992

Mr. & Mrs. Howell
P. O. Box 94
Lakewood, New Mexico 88254

Re: Water Well Analysis

Dear Mr. & Mrs. Howell:

Final analytical results from the water samples obtained from your domestic and stock wells on February 5, 1992 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water were conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8312

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk

Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 684 817 839

CONFIDENTIAL BUSINESS STATEMENT

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/19/92

JOB NUMBER: 920246 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 02/05/92
TIME SAMPLED.....: 11:15
WORK DESCRIPTION...: 10

LABORATORY I.D...: 920246-0010
DATE RECEIVED....: 02/10/92
TIME RECEIVED....: 09:55
REMARKS.....:

Howell Water Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	103	1	mg/L	325.2 (1)	02/17/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/11/92	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CONFIDENTIAL BUSINESS STATEMENT

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/19/92

JOB NUMBER: 920246 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 02/05/92
TIME SAMPLED.....: 11:44
WORK DESCRIPTION...: 11

LABORATORY I.D...: 920246-0011
DATE RECEIVED....: 02/10/92
TIME RECEIVED....: 09:55
REMARKS.....:

Howell Windmill Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	15.6	0.5	mg/L	325.2 (1)	02/17/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/11/92	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

February 28, 1992

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. Wayne Gregory:

Final analytical results from the water sample obtained on February 5, 1992 from a natural spring located in Rocky Arroyo are attached. Mr. Biebelle, indicated that this water is utilized by himself and you as stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water from the released fluids described above. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8312.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk
Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

CONFIDENTIAL BUSINESS STATEMENT

Western Atlas International
a The Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/19/92

JOB NUMBER: 920246 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 02/05/92
TIME SAMPLED.....: 09:36
WORK DESCRIPTION...: 5
Arroyo Spring Water

LABORATORY I.D...: 920246-0005
DATE RECEIVED....: 02/10/92
TIME RECEIVED....: 09:55
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	10.1	0.5	mg/L	325.2 (1)	02/17/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/11/92	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

February 28, 1992

Mr. & Mrs. Lee
P. O. Box 89
Lakewood, New Mexico 88254

Re: Water Well Analysis

Dear Mr. & Mrs. Lee:

Final analytical results from the water sample obtained on February 5, 1992 from your well located next to the paved road approximately 0.5 miles west of Marathon's Indian Basin Gas Plant have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water from the released fluids described above. The results of the analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8312.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk
Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 684 817 680

CONFIDENTIAL BUSINESS STATEMENT

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/19/92

JOB NUMBER: 920246 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 02/05/92
TIME SAMPLED.....: 13:45
WORK DESCRIPTION...: 9

LABORATORY I.D...: 920246-0009
DATE RECEIVED....: 02/10/92
TIME RECEIVED....: 09:55
REMARKS.....:

Lee Water Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	16.6	0.5	mg/L	325.2 (1)	02/17/92	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	02/11/92	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

February 28, 1992

Roger Anderson
Environmental Engineer
State of New Mexico
Energy, Minerals, and Natural
Resources Department
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
U. S. Government
Department of Interior
Bureau of Land Management
Roswell District Office
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

This is to confirm that the next OCD/BLM meeting concerning Indian Basin will be held at 1:00 p.m., Thursday, March 5, 1992, at the Albuquerque BLM office building (located at 435 Montano NE). The office number there is (505) 761-8700.

The primary agenda items will be:

1. Presentation of the written treatment plan

2. Review of December's point-in-time analysis

3. Reduced rancher sampling frequency.

If you have any questions, please feel free to contact me at (915) 687-8214.

Very truly yours,

Robert F. Unger
Production Manager
Midland Operations

RFU/jmh/024

xc: J. L. Benson
D. E. Kenyon
J. S. Lynn

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

February 20, 1992

William Olson
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Re: Indian Basin Gas Plant
Winter Quarter Point-in-Time
Sampling Analysis

Dear Mr. Olson:

Enclosed please find the results from the Indian Basin Gas Plant winter quarter point-in-time sampling analysis. Sampling was completed using EPA protocol during the time frame from December 16-18. Analyses were made for 39 samples by Core Laboratories using EPA approved methodologies for BTEX and chloride. Sampling locations included monitoring wells and pits.

The attached table has been assembled for your convenience. Should you have additional questions concerning these analyses, feel free to call me at (915) 687-8312.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk

Enclosure

Location	Monitor Well	Date	Benzene, ppb	Toluene, ppb	Ethyl Benzene, ppb	Xylenes, ppb	BTEX, ppb	Chloride, mg/l
A-11		12/16/91	2900	3500	300	4000	10700	670
A-16		12/16/91	2000	1000	<500	3500	6500	683
BH-14	MW-1	12/17/91	200	200	300	100	800	152
BH-33	MW-10	12/17/91	2300	<100	200	2500	5000	323
BH-34	MW-11	12/17/91	3800	5800	500	5200	15300	790
BH-36	MW-13	12/17/91	3000	750	500	3300	7550	780
BH-44	MW-21	12/17/91	1100	<50	<50	1000	2100	343
BH-49	MW-26	12/17/91	3000	<100	400	3700	7100	344
BH-49D	MW-26D	12/17/91	3000	<100	400	3700	7100	356
BH-61	MW-38	12/17/91	15	<1	15	<1	30	111
BH-64	MW-41	12/17/91	170	30	400	<10	600	108
BH-65	MW-42	12/18/91	<1	<1	<1	<1		571
BH-68	MW-45	12/17/91	<1	<1	<1	<1		354
BH-70	MW-47	12/18/91	2000	<50	<50	<50	2000	433
BH-71	MW-48	12/18/91	<1	5	10	<1	15	400
BH-73	MW-50	12/18/91	<1	<1	<1	<1		380
BH-73D	MW-50D	12/18/91	<1	<1	<1	<1		386
BH-74	MW-51	12/18/91	<1	<1	<1	<1		38
BH-80	MW-54	12/18/91	<1	<1	<1	<1		87
BH-81	MW-55	12/18/91	400	25	<25	<25	425	501
BH-82	MW-56	12/18/91	1000	2000	3000	6000	12000	197
BH-83	MW-57	12/18/91	350	<10	<10	<10	350	31
BH-83D	MW-57D	12/18/91	290	<10	<10	<10	290	32
BH-84	MW-58	12/17/91	90	40	20	80	230	124
BH-85	MW-59	12/17/91	420	40	240	420	1120	149
BH-86	MW-60	12/17/91	<1	<1	<1	<1		9.8
BH-87	MW-61	12/18/91	<1	<1	<1	<1		413
BH-87A	MW-61A	12/17/91	10	10	5	75	100	12.4
BH-87D	MW-61D	12/18/91	<1	<1	<1	<1		
BH-88	MW-62	12/17/91	1400	<200	400	2400	4200	247

Location	Monitor Well	Date	Benzene, ppb	Toluene, ppb	Ethyl Benzene, ppb	Xylenes, ppb	BTEX, ppb	Chloride, mg/l
BH-89	MW-63	12/16/91	<1	<1	<1	<1		7.6
BH-90	MW-64	12/17/91	130	<10	40	160	330	17.6
BH-91	MW-65	12/18/91	<1	<1	<1	<1		3.4
BH-91A	MW-65A	12/17/91	150	15	5	15	185	22
BH-92	MW-66	12/17/91	<1	<1	<1	<1		8.8
BH-93	MW-67	12/17/91	320	<10	<10	<10	320	6.8
BH-94	MW-68	12/17/91	1900	4500	500	4000	10900	39
BH-95	MW-69	12/18/91	2100	1100	150	4200	7550	154
BH-97	MW-70	12/17/91	<1	<1	<1	<1		10

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

February 20, 1992

William Olson
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Olson:

As per our February 19 telephone conversation, I am enclosing information on a variable speed groundwater sampling pump which is capable of both purging and sampling. The pump is designed to have negligible impact on sample integrity including volatile contaminants. Marathon is considering the use of this type of equipment and seeks your input as to its acceptability.

Sincerely,

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk

Enclosure

Test Results

of the

Grundfos Ground-Water Sampling Pump

Tyler E. Gass

Blasland, Bouch & Lee, Inc.

Syracuse, New York

James F. Barker
R. Dickhout
J.S. Fyfe

University of Waterloo

Waterloo, Ontario

Compliments of Grundfos Pumps Corporation

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TEST RESULTS OF THE

GRUNDFOS GROUND-WATER SAMPLING PUMP

Tyler E. Gass

Blasland, Bouck & Lee, Inc.
Syracuse, New York

James F. Barker
R. Dickhout
J.S. Fyfe

University of Waterloo
Waterloo, Ontario

Abstract

One major criteria of the 'ideal' ground-water sampling device is that it be able to purge a monitoring well of stagnant water at a relatively high rate of flow (e.g., more than 10 liters per minute) and be able to sample ground water at a low flow rate (e.g., 0.1 - 1 liter per minute) so as not to impact the integrity of the sample. Sampling devices for two-inch diameter wells generally have been able to deliver water at low flow rates, but have been relatively ineffective during the purging phase because their maximum flow rates are generally less than four to six liters per minutes.

Grundfos Pump Corporation has developed a new small diameter pump for purging and sampling ground water from small-diameter (2-inch) monitoring wells. Blasland, Bouck & Lee, in conjunction with the University of Waterloo Centre for Groundwater Research ran a series of tests on the pump under controlled (laboratory) conditions to evaluate the ability of the pump to deliver 'representative' ground-water samples. The performance of the pump was also evaluated under field operating conditions to examine its effectiveness for purging as well as sampling monitoring wells and its long term reliability.

Laboratory test results indicate that the pumping rates can be effectively varied from rates as low as 0.1 liter per minute to rates in excess of 30 liters per minute at pumping levels between 6 to 30 meters. Special laboratory mixtures of water with specific concentrations of organic and inorganic compounds were created to determine the pump's ability to deliver "representative" samples.

Test results indicate that there were no statistically significant losses in the low and high concentration organic solutions for the compounds Methane, 1,1-DCE, t-1,2-DCE, Benzene, TCE and Toluene. There were no statistically significant changes in the concentrations of inorganic compounds. Based on comparative data with most commonly used mechanical sampling devices, the Grundfos pump equals or exceeds their ability to provide representative samples for organic and inorganic chemical analyses.

Field testing verified the practicality of using the pump for purging and sampling. The pump was also found to be able to pump water with considerable turbidity without experiencing operation difficulties.

The Grundfos small-diameter ground-water sampling pump offers the ability to deliver "representative" samples of water from two-inch monitoring wells, throughout a broad range of depth. It also offers the flexibility of being able to purge water at flow rates in excess of 30 liters per minute during the process of preparing the well for sampling in a reasonable length of time.

Introduction

Grundfos Pumps Corporation (Grundfos) contracted Blasland, Bouck & Lee in July 1989 to conduct a series of performance tests on a new small-diameter pump (MP1 Redi-Flow 2-inch Environmental Submersible Pump) developed by Grundfos for the purpose of purging and sampling ground water from ground-water monitoring wells. Blasland, Bouck & Lee subcontracted with the University of Waterloo Centre for Groundwater Research (Waterloo) to run a series of tests on the pump under controlled conditions and provide a scientific, unbiased evaluation of the ability of the pump to deliver a "representative" sample. This evaluation was designed specifically to determine whether or not the new Grundfos pump could compete in the existing ground-water sampling market as a purging and sampling pump.

Blasland, Bouck & Lee staff also conducted a field evaluation of the new Grundfos pump to provide information on the pump's operational characteristics. This evaluation was designed specifically to determine the pump's ease of operation, maintenance, and decontamination under actual field conditions, and to identify any operational difficulties or design flaws that should be corrected prior to marketing the pump for ground-water purging and sampling applications.

Experimental Design and Test Method

An artificial "well" was installed in a stairwell at Waterloo. The well consisted of a 15.24-centimeter diameter stainless steel tube, 10 meters high, with a control sampling port near its bottom. The well was filled and drained at the bottom with an air-driven pump connected to a stainless steel reservoir.

The organic compounds used in the evaluation were:

Compound	Henry's Constant
methane	67.4
1,1-dichloroethene (1,1-DCE)	15.6
trans-1,2-dichloroethene (t-1,2-DEC)	0.669
benzene	0.550
trichloroethene (TCE)	0.915
toluene	0.670

The organics (except for methane) were introduced into the system by injecting and mixing a methanolic stock solution below the surface of the water in the reservoir, prior to being pumped up the column. Inorganic constituents, including sulfate, nitrate, arsenic, chromium, and iron were added in a similar manner.

Three separate pumping experiments were conducted at flow rates of 0.1 liters per minute (l/m). This is the flow rate that U.S. EPA recommends for sampling ground water with volatile organic compounds (VOCs). The first experiment involved water containing 20 ppb of VOCs (low loading). The second experiment involved using water with a VOC concentration of 200 ppb (high loading). The third experiment involved examination of the influence of the pump on the inorganic chemicals listed above.

The experiments entailed pumping 60 liters of organic-spiked or inorganic-spiked water into the column and simultaneously collecting five pumped and five control samples, in duplicate, in 60-ml hypo-vials for organic analyses and 100 ml polyethylene bottles for inorganics analyses for each set of conditions. The pumping lift was approximately 20 feet.

Pre- and post-test "in-line" parameters were obtained for all of the experiments. These consisted of measuring pH, temperature, and conductivity at the control port and the pump outlet before and after sample collection.

Each set of organic samples (i.e., from one sampler) was randomized and split in two; five for the methane determinations, five for the other organics (or in the case of the control experiment, three and three). Samples from a given experiment were always randomized for analysis and run in one session. Methane determinations were done using

GC/FID (static headspace injection). The organic solvents were determined by GC/PID (static headspace injection). Inorganic analyses were performed following approved EPA methods. Syringe blanks and external standards were run periodically to maintain data quality.

The method detection limits for the various organic parameters were:

Compound	Detection Limit (ppb)
methane	0.22
1,1-DCE	0.14
trans-1,2-DCE	0.20
benzene	0.26
trichloroethylene	0.58
toluene	0.56

Test Results

Data were tabulated and the means and relative standard deviations calculated for each set of five values. The SYSTAT statistical package was used to obtain box plots and perform Bartlett's tests, analyses of variance, and t-tests, where applicable. Statistical outliers found in the box plots and values below detection levels (for inorganic compounds) were discarded. A confidence interval of 95 percent was used throughout.

In the first experiment, at a low concentration of organic compounds (20 ppb), there were no statistically significant differences between samples from the pump and the control samples for the compounds analyzed. Likewise, in the second experiment at high concentrations of organic compounds (200 ppb), there were no statistically significant differences between the samples from the pump and the control samples for the compounds analyzed. There were also no statistically significant difference observed for inorganic compounds for the pump samples and control samples in experiment number 3.

Tables 1 through 3 contain the actual test data for each of the experiments. Pump sample data are compared to control sample data as a function of percent recovery for each compound in Figures 1 through 3. The figures more readily present an impartial comparison of the pump and control data for specific compounds. It should also be noted that for the volatile organic compounds there was no perceived relationships observed between compound volatility and the percent recovery of the compound.

Field Evaluation of Pump Performance

Blasland, Bouck & Lee conducted limited testing of the Grundfos pump to evaluate pump performance in the field. Specifically, Blasland, Bouck & Lee attempted to determine the following:

- the effect of varying pump depth on pump discharge rates;
- the ability of the device to pump silt-laden ground water; and
- general pump operational characteristics.

Geologic environments in which the pump was used included bedrock wells completed in limestone and fractured sandstone, and screened wells completed in clay-rich glacial till and sandy alluvial aquifers. Well depths varied from 15 to 120 feet and well diameters varied from 2 to 4 inches.

Operation of the Pump

There are two primary components to the Grundfos pump system. The MP1 Environmental Submersible Pump and the BT1/MP1 Converter. Both the pump and converter are compact and relatively light, 5.5 pounds and 25 pounds, respectively. Used in a portable operating mode, a two-person crew can conveniently manage a multiple well sampling operation. If the MP1 is dedicated to each well, then one person could operate the system assuming an appropriate power source is readily available.

The pump is constructed primarily of 316 stainless and teflon components. Overall length of the pump is 287 millimeters (mm) or 11.30 inches. Maximum pump diameter is 46 mm or 1.81 inches. The dimensions of the converter are 228.6 mm (9 inches) by 355.6 mm (14 inches) by 469.9 mm (18.5 inches).

The system requires a single-phase, 230 volt source of electricity. In remote locations, where an appropriate power source is not available, a properly sized portable generator is required. When using a portable generator, a two-person sampling crew will be required.

Normal procedures require the placement of the pump down to the desired depth in the well. Note that pump power leads are available in 3.62-meters (25-foot) increments of length. The unit is then attached to its power source and turned on at the converter. A dial on the converter permits adjustment of the pump frequency, allowing the operator to increase or decrease the flow rate within the operating limits of the pump for a given amount of total hydraulic head (pumping lift).

Pump Performance

Field evaluations of the Grundfos "MP1 Redi-Flow 2" Environmental Sampling Pump were performed by Blasland, Bouck & Lee staff from the Syracuse and Columbus offices. Staff members using the pump evaluated its performance in terms of flexibility for purging and sampling the well, ease of decontamination and maintenance, and overall reliability.

Initial attempts to use the pump at low sampling rates (0.1 l/min) were not achieved due to confusion over proper operation of the pump. Much of this confusion was due to the absence of a detailed operating manual during the early sampling attempts. Subsequent direction from Grundfos enabled the sampling teams to obtain flow rates as low as 0.1 l/min.

The pump was tested in deep bedrock wells, and shallow and deep wells in unconsolidated materials. The Syracuse office staff routinely used the pump to perform well development, as well as purging and sampling. At no time did silt or clay size particles suspended in the well water significantly impact the performance of the pump.

Well purging rates ranged from 31 l/min (8.2 gpm) in a well with a pumping level of about 12 feet to 24 l/min (6.3 gpm) with a pumping level of 110 feet. Sampling rates ranged from less than 0.1 l/min to over 0.2 l/min. The ability to achieve 0.1 l/min increased with the operator's familiarity with the equipment. Eventually, all operators were capable of obtaining the 0.1 l/min flow rate for both shallow and deep pumping levels.

The pump proved to be extremely reliable in the field. Its capability to discharge turbid samples enabled field crews to use it in the well development process. The pump was never used, however, to pump water with significant amounts of sand. Discharge under positive pressure made in-line filtration convenient.

The ability to purge wells at rates greater than 20 l/min (6 gpm) and then reduce flow to 0.1 l/min makes the pump ideal for ground water sampling. This is especially true where ground-water has to be purged from deep wells or large diameter wells prior to sampling. Of the pumps designed to fit into 2-inch diameter monitoring wells, the Grundfos pump's ability to purge at flow rates as high as 30 l/min and sample at the recommended flow rate of 0.1 l/min offers an advantage not yet otherwise achieved by other commonly available pumps. The combination of stainless steel and teflon construction materials also reduces the likelihood that the pump would impact ground-water quality samples.

The use of dedicated discharge tubing expedites the decontamination process. In general, the pump exterior can be cleaned by mild detergent and/or solvent followed by a distilled water rinse. Detergent

and/or solvent followed by distilled water can be flushed readily through the interior of the pump by operating the pump in a bucket containing the appropriate solution. The pump can also be readily dissembled in the field for more rigorous cleaning or repair.

Conclusions

From the laboratory and field testing of the Grundfos pump conducted by the project team, several conclusions can be drawn regarding the overall performance of the pump.

1. Based on controlled laboratory testing of the pump at flow rates of 0.1 l/min, there were no observed statistically significant differences between the control data and the data for the Grundfos MP1 pump during the three experiments.

2. Purge rates as high as 31 liters per minute could be achieved. Purge rates varied with depth of water in the well, but generally were found to range from 20 liters per minute to 30 liters per minute.

3. Flow rates for sampling purposes can be reduced to 0.10 l/min (0.026 gpm) for sensitive parameters such as volatile organic compound (VOCs) and selected metals. This pumping rate achieves U.S. EPA's recommended sampling rate for VOCs.

4. The pump was found to operate equally well in 4-inch and 2-inch diameter wells.

5. Clay, silt, and fine sand seemed to have had no effect on the pump. The experience of the Blasland, Bouck & Lee personnel using the pump in silty wells indicate that the pump can operate up to 40 minutes while purging silty water.

6. The ability to achieve high flow rates makes the pump a more practical tool for sampling since the combination of reasonable purge rates and controlled low flow rates expedite operations for ground-water monitoring programs.

7. The pump can be used as a portable sampling device or as a dedicated sampling device.

TABLE 1

RESULT OF TEST
FOR LOW VOC LOADING
AT FLOW RATE OF 0.1 l/min

Sample	Methane	1,1-DCE	t-1,2-DCE	Benzene	TCE
Control 1	0.259	2.22	2.49	3.18	5.15
Control 2	0.244	2.05	2.18	3.07	4.75
Control 3	0.248	2.10	2.09	2.95	4.65
Control 4	0.252	2.27	2.43	3.31	5.50
Control 5	0.240	2.45	2.19	2.89	4.70
AVG	0.249	2.22	2.28	3.08	4.95
N	5	5	5	5	5
VAR	0.0000	0.02	0.03	0.03	0.13
STD	0.007	0.16	0.17	0.17	0.36
Grund 1	0.232	2.12	2.00	2.82	4.33
Grund 2	0.244	1.46	1 65	2.32	3.38
Grund 3	0.254	2.73	2.72	3.51	5.22
Grund 4	0.244	2.34	2.15	3.10	4.85
Grund 5	0.244	2.56	2.22	3.08	4.30
AVG	0.244	2.24	2.15	2.97	4.41
N	5	5	5	5	5
VAR	0.000	0.25	0.15	0.19	0.48
STD	0.008	0.50	0.39	0.44	0.69
			PERCENT OF RECOVERY		
	97.99	101.02	94.4	96.36	89.19

TABLE 2

RESULT OF TEST
HIGH VOC CONCENTRATION
AT FLOW RATE OF 0.1 l/min

Sample	CH4	1,1-DCE	t-1,2-DCE	Benzene	TCE	Toluene
Control 1	0.934	22.71	22.25	33.27	53.92	67.57
Control 2	1.005	26.98	27.11	38.69	62.74	78.27
Control 3	0.994	27.29	27.33	37.05	-	75.01
Control 4	0.970	27.18	27.68	41.87	64.76	82.58
Control 5	0.982	28.28	30.83	41.73	69.80	77.47
AVG	0.977	26.49	27.04	38.52	62.81	76.18
N	5	5	5	5	4	5
VAR	0.001	4.71	9.45	12.82	43.90	30.62
STD	0.027	2.17	3.07	3.58	6.63	5.53
Grund 1	0.978	27.74	30.65	39.06	67.21	82.77
Grund 2	0.974	24.95	26.52	37.05	61.87	70.90
Grund 3	0.942	24.73	25.65	38.24	60.24	74.99
Grund 4	0.974	29.21	29.81	40.74	68.41	79.90
Grund 5	1.014	25.14	25.08	36.60	57.60	76.55
AVG	0.976	26.35	27.54	38.34	63.07	77.02
N	5	5	5	5	5	5
VAR	0.001	4.04	6.37	2.75	21.26	20.79
STD	0.026	2.01	2.52	1.66	4.61	4.56
			PERCENT OF RECOVERY			
	99.94	99.49	101.86	99.52	100.42	101.11

TABLE 3

RESULT OF TEST
INORGANIC COMPOUND DATA
AT FLOW RATE OF 0.1 l/min

Sample	Total Iron	Total Chromium	Sulfate	NO3/NO4
Control 1	<0.05	0.23	44	2.7
Control 2	0.06	0.23	56	3.0
Control 3	<0.05	0.23	61	2.9
Control 4	0.05	0.21	49	2.9
Control 5	<0.05	0.22	44	3.0
Grund 1	<0.05	0.23	56	2.9
Grund 2	<0.05	0.22	46	3.0
Grund 3	<0.05	0.22	57	2.9
Grund 4	0.06	0.21	44	3.0
Grund 5	0.05	0.22	53	2.9
			PERCENT OF RECOVERY	
	100	98.2	100.7	100

FIGURE 1

RESULTS OF TEST/LOW VOC LOADING AT FLOW RATE OF 0.1 l/min

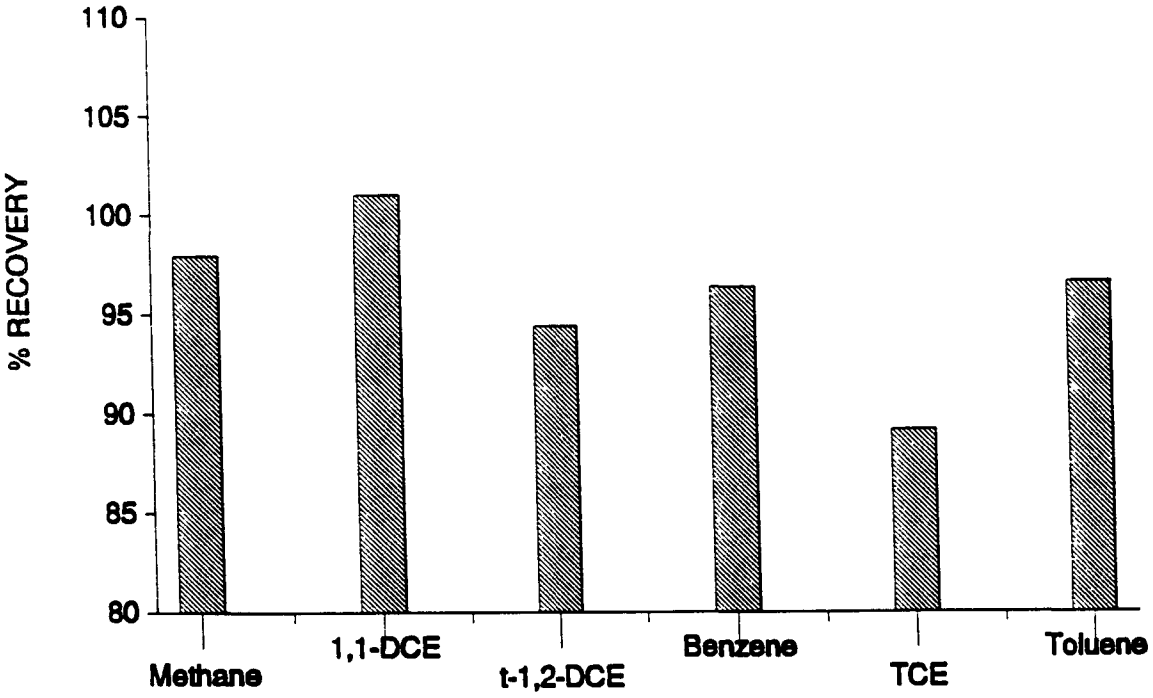


FIGURE 2

RESULTS OF TEST/HIGH VOC CONCENTRACTION AT FLOW RATE OF 0.1 l/min

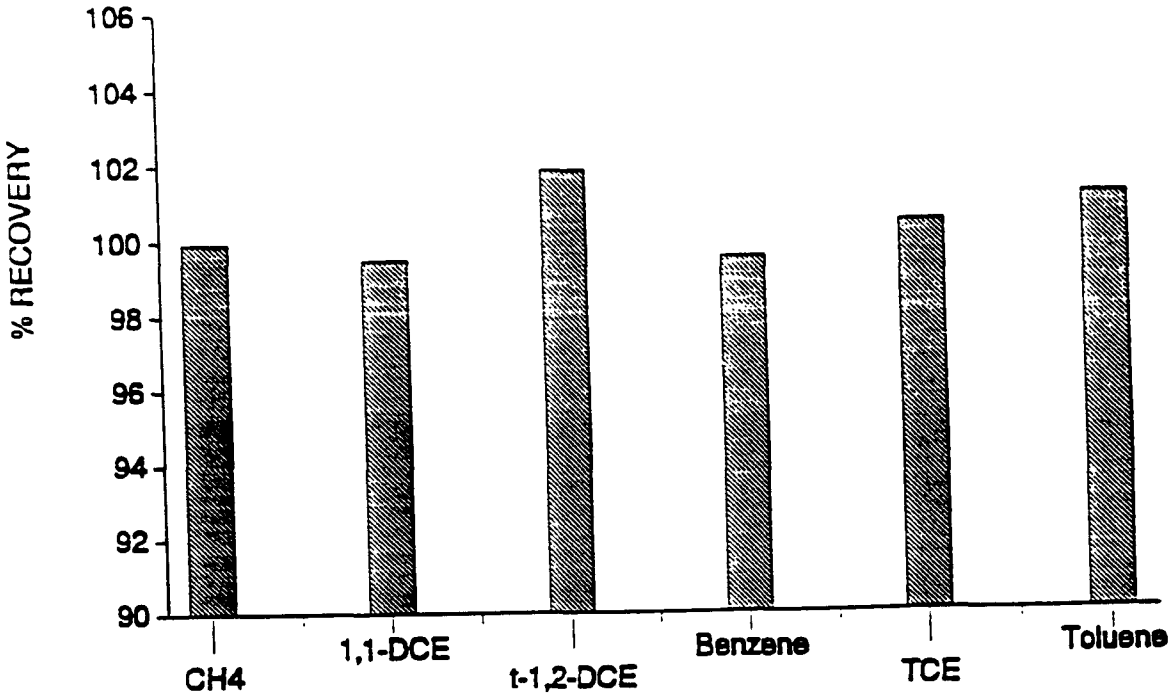
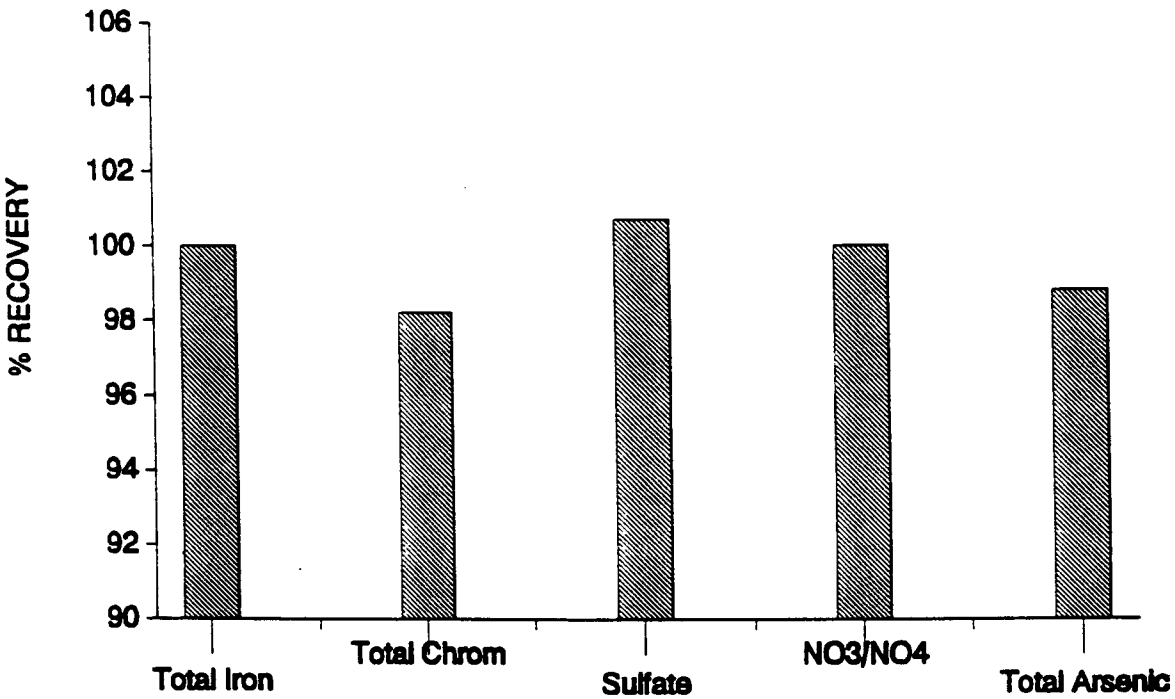
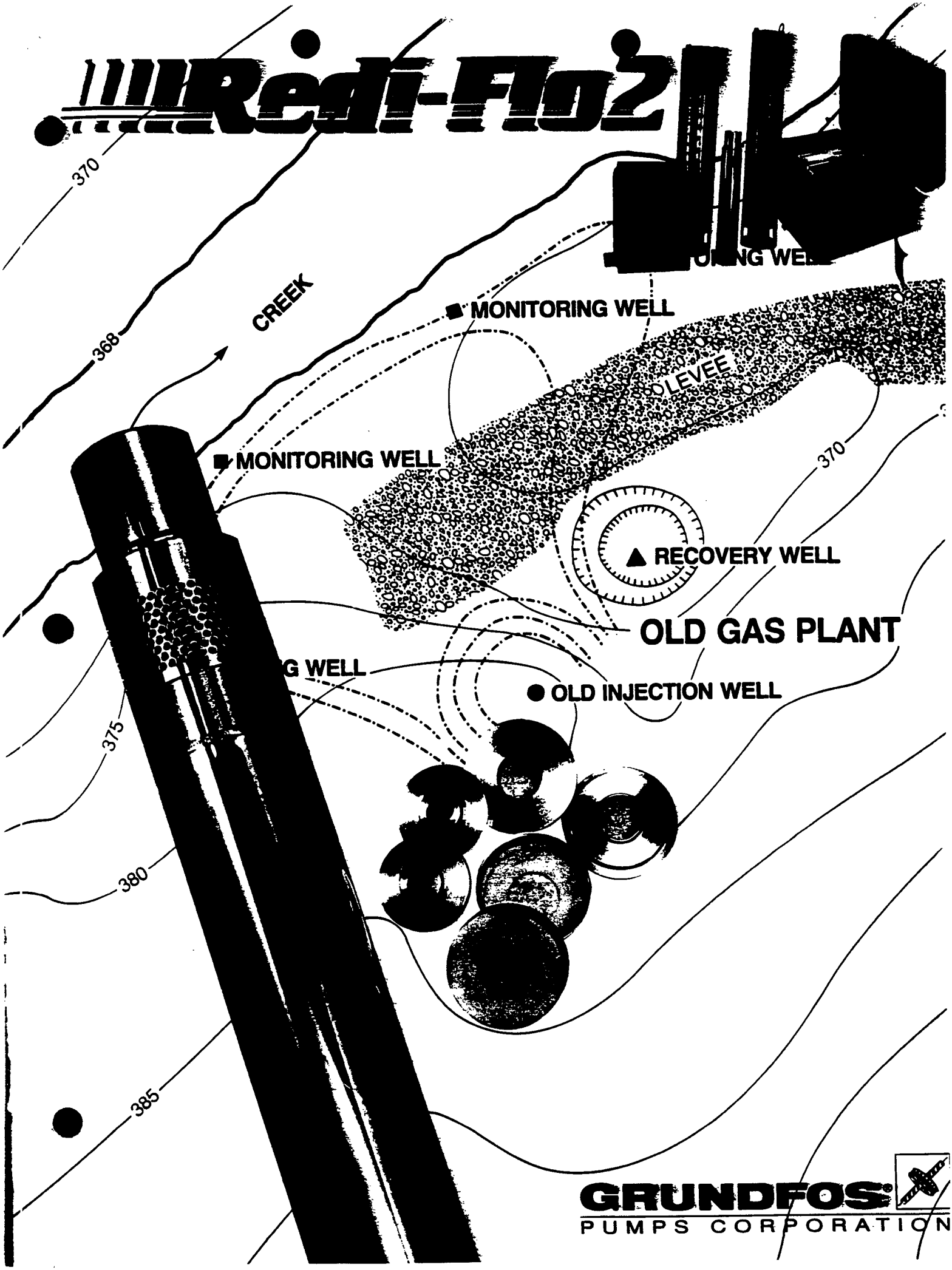


FIGURE 3

RESULTS OF TEST/INORGANIC COMPOUND DATA AT FLOW RATE OF 0.1 l/min

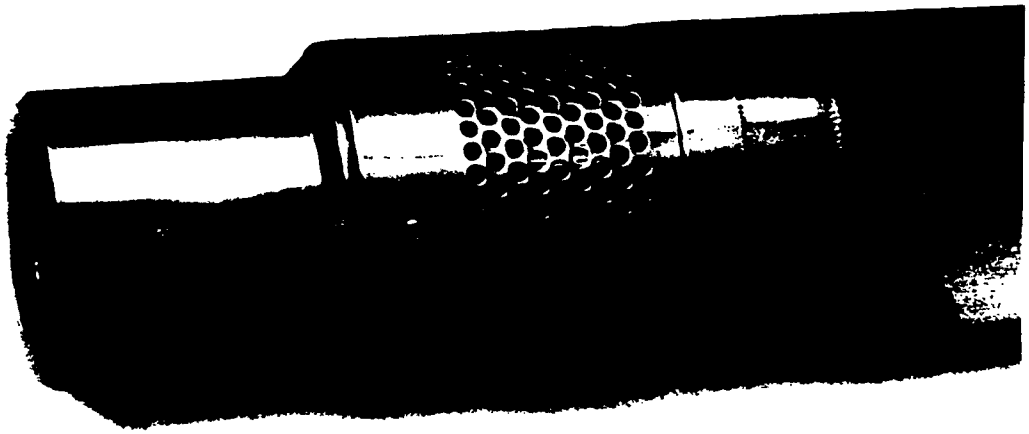


Redi-Flo2



GRUNDFOS
PUMPS CORPORATION

We've Taken The
Groundwater Monit



Redi-Flo2... Setti
For Environ

For years, Grundfos Pumps has pioneered better ways to work with our most precious resource... water. You've trusted Grundfos, and the Redi-Flo submersible pump line in the past for quality and dependability. Now, after years of design, engineering and field testing, Grundfos proudly introduces the Redi-Flo2 system.

COMPACT DESIGN

No other pump on the market combines the compact design and power of Redi-Flo2. Measuring just over 11" tall, 1.8" in diameter and weighing 5.5 pounds, this compact pump ensures easy access into 2" wells.

QUALITY CONSTRUCTION

The sturdy pumping components of Redi-Flo2 are made of 316 Stainless Steel and virgin Teflon®. These chemically inert materials assure maximum sample integrity, limit cross-contamination, and simplify the decontamination process.

FLEXIBLE PERFORMANCE

The portable, solid state converter eliminates the need for "throttling" or control valves.

mplex Process Of
ıg & Made It Simple!

PUMP SHOWN ACTUAL SIZE.

ıg New Standards
ıental Pumps.

Flow rates ranging from 9 gpm to as little as 100 ml/min are controlled with the simple turn of a dial.

CONTINUOUS FLOW

Redi-Flo2 is ideal for groundwater sampling or conducting aquifer tests to depths of 250 feet because of its smooth, uninterrupted flow.

PURGING & SAMPLING

This pump does it all! The ingenious design of Redi-Flo2 makes it a natural for groundwater purging and sampling. Both high flow rates needed for purging and low flows recommended for sampling are achieved with the same pump!

DEDICATED OR PORTABLE INSTALLATIONS

Redi-Flo2 is designed for both dedicated and non-dedicated sampling installations. By attaching the pump to a reel of tubing, it becomes fully portable.

GRUNDFOS
PUMPS CORPORATION

Purge & Sample With Redi-Flo2

1. Lower Redi-Flo2 into the well.

2. Connect Teflon® motor leads.

3. Dial in flow rate without throttling.

4. Purge at 9 gpm without pulsing.

5. Adjust the flow rate and collect samples from a smooth, uninterrupted stream.

The With

REDI-FLO2 ALLOWS FOR O
FOR GROUNDWATER CONT
YOUR SAMPLES A

PURGING & SAMPLING

with the same pump is extremely efficient. With Redi-Flo2, there is no delay between purging the well and collecting your sample.

FASTER PURGING is

achieved with the powerful 9 gpm capacity. Using a bailer for purging can be costly and tiresome. Field tests demonstrate operators prefer the Redi-Flo2 system because of its purging power.

CONTINUOUS FLOW

allows for a cleaner, simpler sample catch. Partially filled sample containers are a thing of the past. Redi-Flo2 allows you to fill your containers completely, without having to wait for additional water to be extracted from the well. Uninterrupted sample collection improves sample integrity.

•Redi-Flo2 Delivers Sample Integrity You Need The Purging Power You Want!

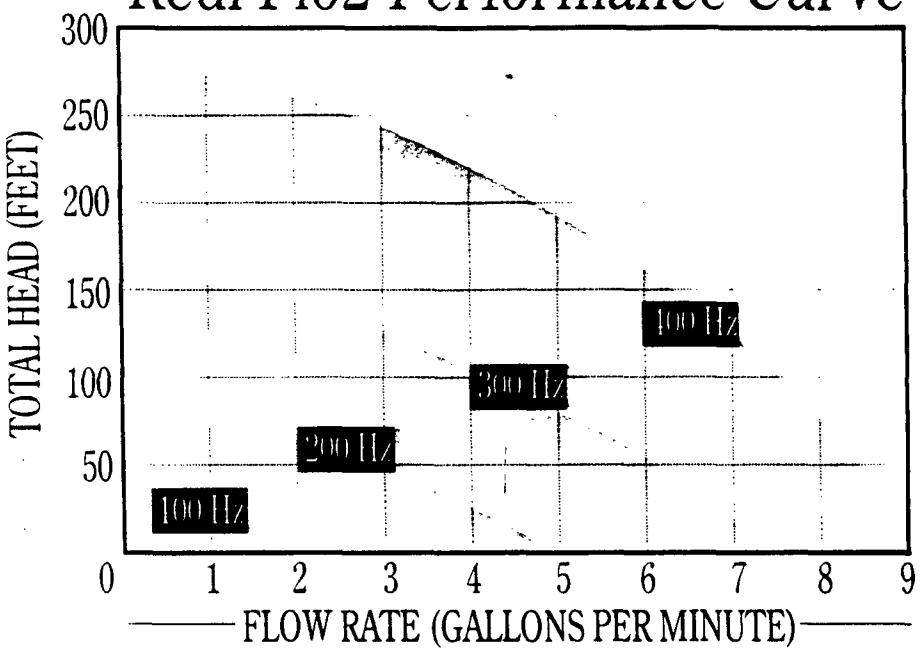
TIMUM SAMPLE INTEGRITY MINATES. WITH REDI-FLO2, E AT THEIR BEST.

100 ML/MIN FLOW RATE allows for maximum control when sampling. In addition, the 100 ml/min flow rate recommended for volatile compound sampling is easily achieved in seconds, simply by turning a dial.

OPTIMUM SAMPLE INTEGRITY is critical! With dedicated installations of Redi-Flo2, there is no risk of cross-contamination between wells. In addition, the risk of contaminants from the surface or well casing entering into samples is reduced.

FAST DECONTAMINATION is achieved each and every time. The unique design and superior materials of construction make "decon" a snap. Redi-Flo2 is designed for easy disassembly and re-assembly in minutes. That means less down time and higher productivity.

Redi-Flo2 Performance Curve



CONTINUOUS FLOW is available from 100 ml/min to 9 gpm.

MINIMAL TRAINING is required to effectively operate the converter. Its construction and dial design make the Redi-Flo2 system easy to operate, without extensive training. Operator error is virtually zero.

SAMPLE EXPOSURE IS MINIMIZED since the pump is submerged and water flows directly into your sample container. Less contact with the atmosphere produces better samples.

Redi-Flo2

Materials & Components

INLET SCREEN (316 Stainless Steel) — non-corrosive inlet screen prevents impellers from clogging.

PUMP HOUSING (316 Stainless Steel) — corrosion resistant with 1/2 inch NPT discharge connection.

GUIDE VANE (316 Stainless Steel) — increases pump efficiency and resists clogging.

WEAR RING (Teflon®) — placed at each stage; reduces upthrust and vibration.

IMPELLER (316 Stainless Steel) — long-wearing, abrasion and corrosion resistant with high strength-to-mass ratio. The fabricated design allows for optimum hydraulic performance.

SPACER RING (316 Stainless Steel) — heavy-duty, corrosion resistant.

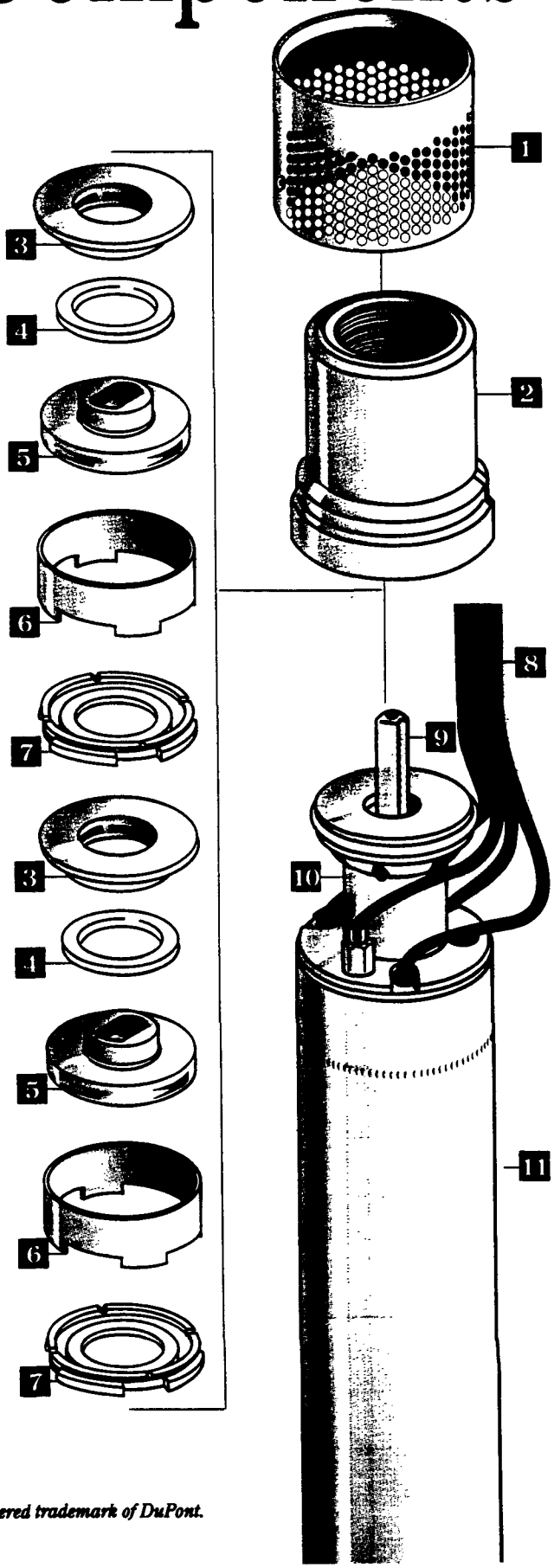
WEAR PLATE (Teflon®) — placed at each stage; eliminates vibration and maintains pump efficiency.

MOTOR LEAD (Teflon® insulated wire) — corrosion resistant; reduces the risk of sample bias.

SHAFT (329 Stainless Steel) — splined shaft prevents slippage of the impellers while allowing for easy disassembly and re-assembly of the pump for cleaning or service.

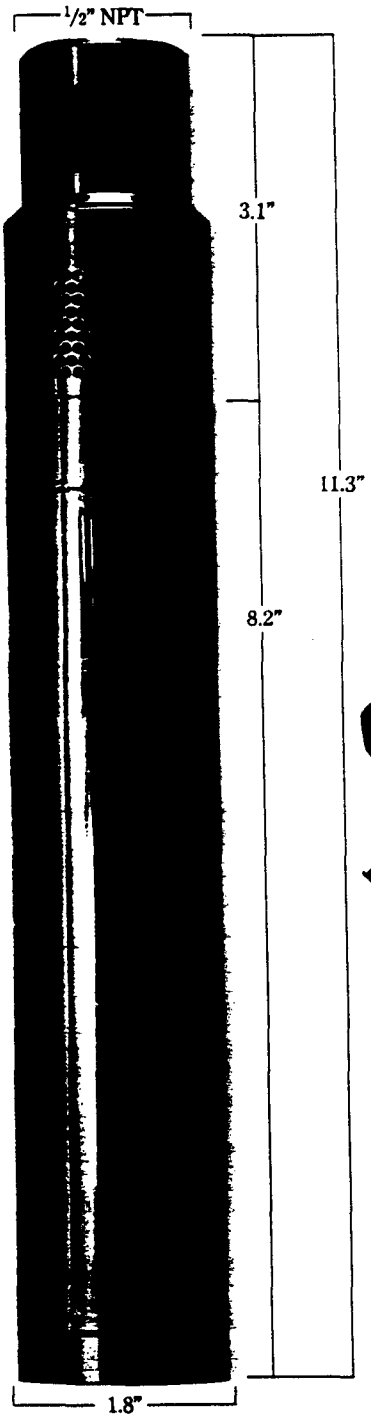
SUCTION INTERCONNECTOR (316 Stainless Steel) — rugged design with large flow openings. Provides positive pump and motor alignment.

MOTOR HOUSING (316 Stainless Steel) — meets the specifications required for environmental applications.



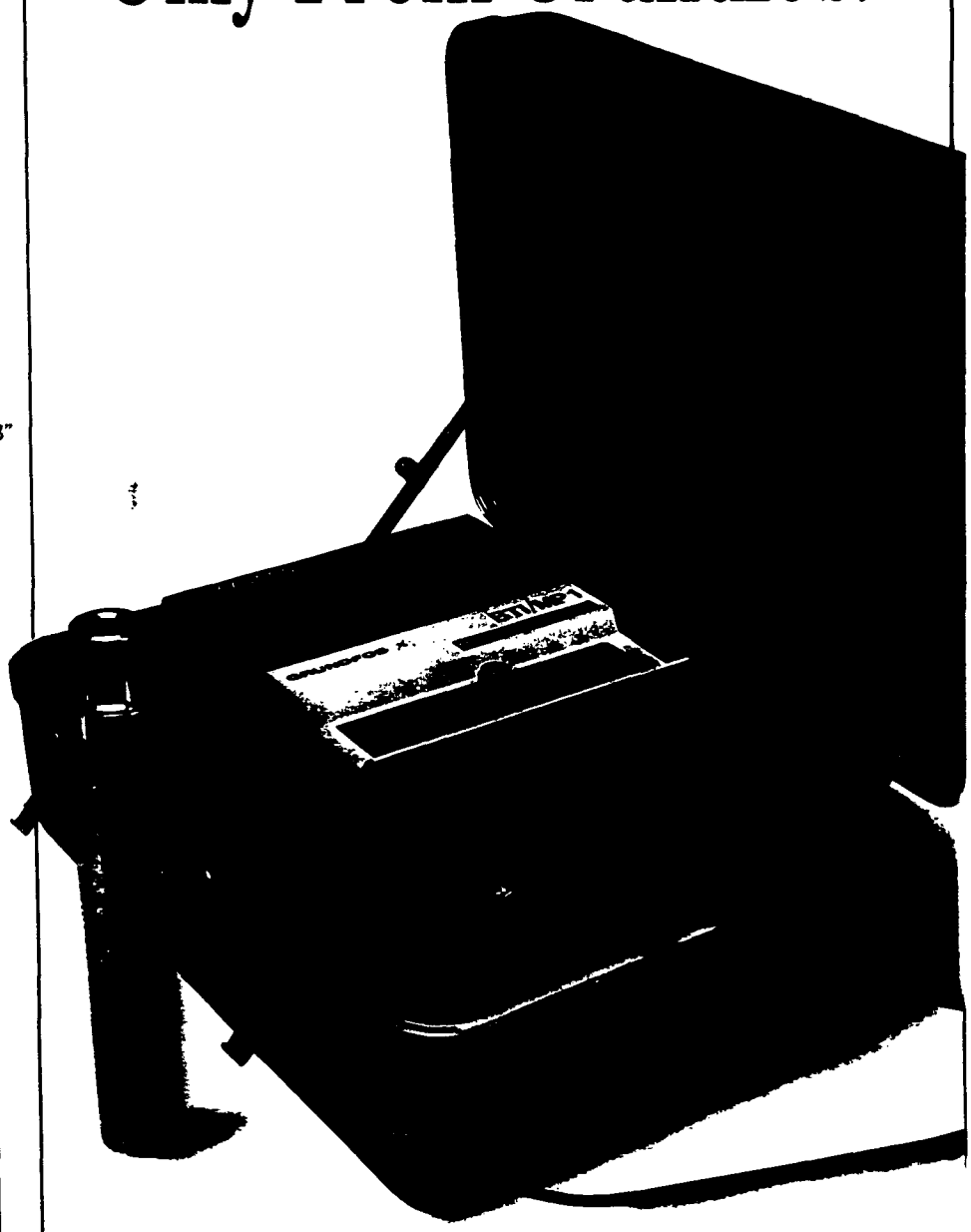
E: Specifications are subject to change without notice. Teflon® is a registered trademark of DuPont.

Redi-Flo2 Compact Design



No other pump on the market combines compact design and power like Redi-Flo2. Measuring just over 11" tall, 1.8" in diameter and weighing 5.5 pounds, this pump ensures easy access into 2" wells.

The Complete Purge & Sample System Only From Grundfos.

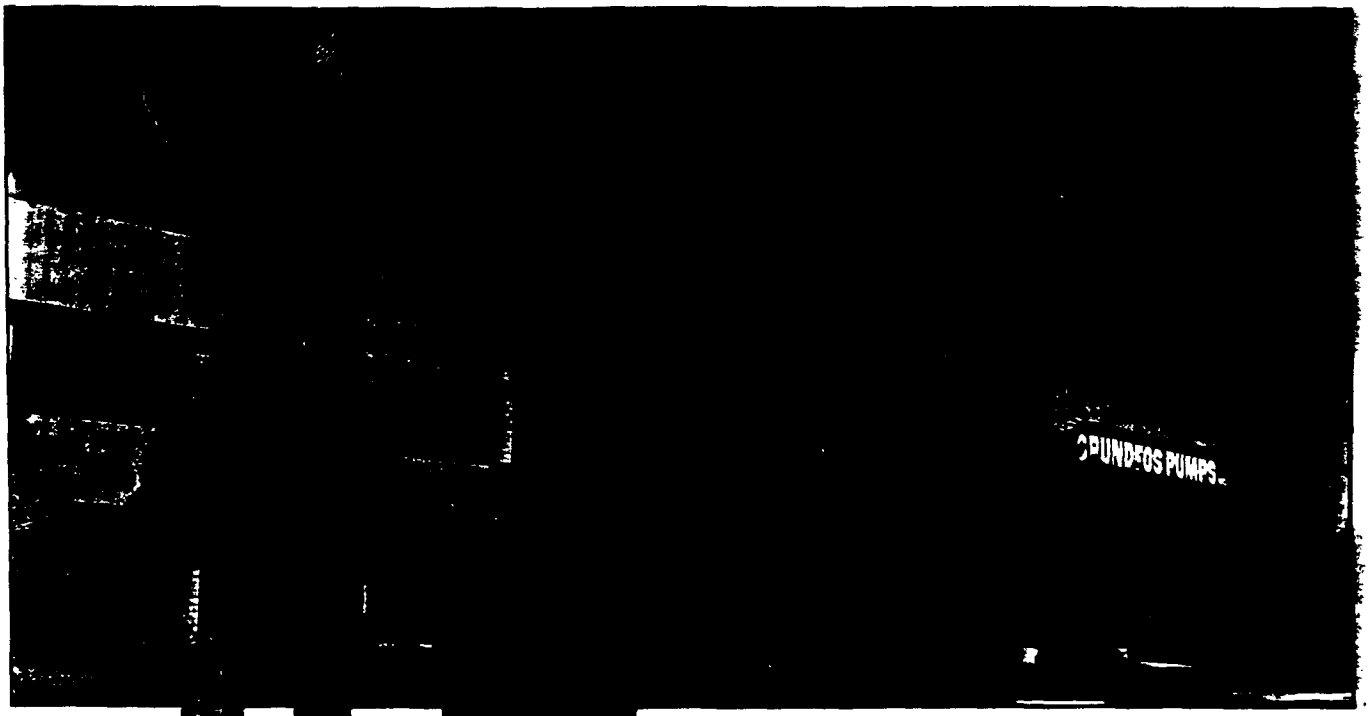


Redi-Flo2 is designed for dedicated or non-dedicated sampling installations. By attaching the pump to a reel of tubing, it becomes fully portable.

Put the power of Redi-Flo2 into your daily operation. Once this pump is part of your sampling protocol, you'll wonder how you ever got along without Redi-Flo2.

Redi-Flo2

Redi-Flo2



The Grundfos Redi-Flo Environmental family featuring the new 2" Redi-Flo2 and the 4" Redi-Flo4 submersible pumps.

By using Stainless Steel and Teflon® the Redi-Flo family of pumps represents the highest quality pump components available.

Redi-Flo4

With off-the-shelf availability in a wide range of capacities and heads, the Redi-Flo4 submersible pump has become the industry choice for environmental applications.

Put the power of Redi-Flo2 and Redi-Flo4 into your operations.

AVAILABLE FROM:

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PUMPS CORPORATION
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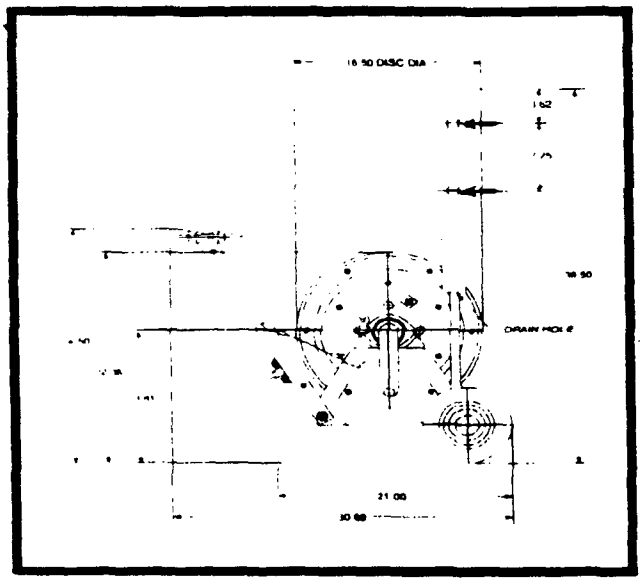
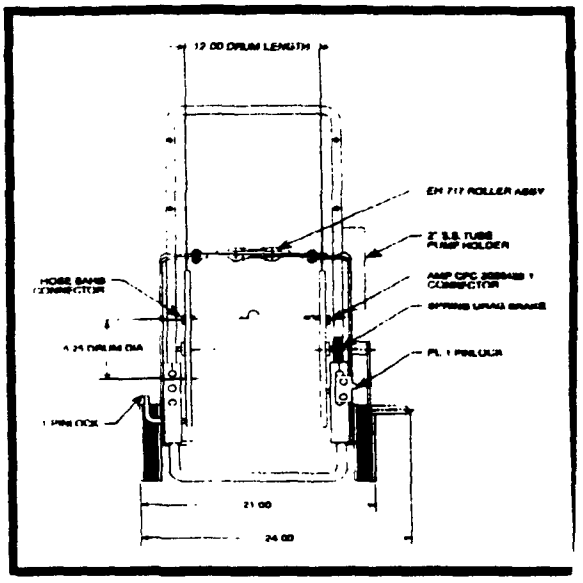
SAVE 10%

EI 2" PUMP REEL AND CADDY
with hangers for the Grundfos converter

The new EI hose reel is specifically manufactured for the Rediflo 2" pump. A representative from Grundfos calls it "the best reel currently on the market." Comes standard with reel brake, pump holster , large diameter wheels for mobility around sites on a sturdy steel and aluminum frame.





EI REEL CAPACITY without roller arm	WAS PRICE	SALE PRICE
150	$660	$594
200	$700	$630

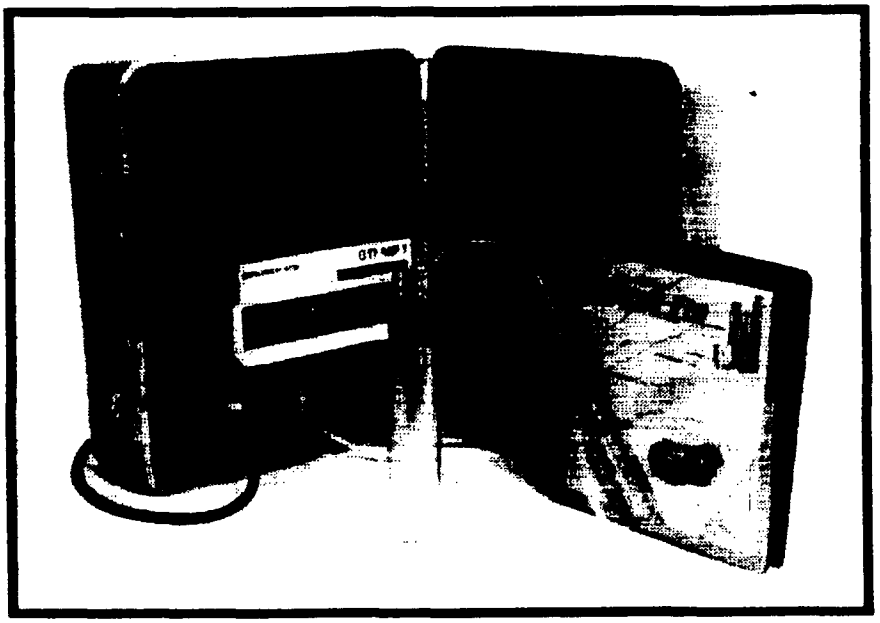
EI CADDY WITH ROLLERARM (as pictured above)		
CAPACITY	WAS PRICE	SALE PRICE
150	$870	$783
200	$910	$819

CALL TOLL FREE: 1-800-648-9355

SAVE 15% PLUS 100' OF PVC HOSE FREE

GRUNDFOS REDI-FLO 2
2" ENVIRONMENTAL PUMP

Fits into 2" well, pumps up to 9 GPM. Stainless steel & Teflon® construction. Flow rates are continously adjustable down to a minimum of 100 ml per minute to a maximum of 9 GPM. Options include hose reel and tubing. Rentals available.



TYPE	PH	INPUT VOLTAGE TO CONVERTER	MOTOR LEAD LENGTH	WAS PRICE	SALE PRICE
MP1 100	1	230	100	**710**	**604**
MP1 150	1	230	150	**815**	**693**
MP1 200	1	230	200	**920**	**782**

REDI-FLO 2" CONVERTER*
with protective case

MODEL	PHASE	VOLTAGE	POWER CORD	WAS	SALE PRICE
BLTI/	1	230	10'	**2050**	**1950**
MP1	1	115	10'	CALL FOR PRICE	

***Our converters are the only type warranted by Grundfos.**

GRUNDFOS

Redi-Flo2 2" Environmental Submersible Pumps

MP1

Submittal Data 2300-23000 RPM 46-400 Cycles

JOB or CUSTOMER:

ENGINEER:

CONTRACTOR:

SUBMITTED BY: DATE:

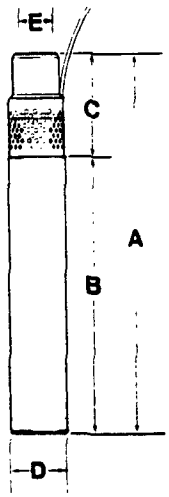
APPROVED BY: DATE:

ORDER NO.: DATE:

SPECIFICATION REF.:

QUANTITY	TAG NO.	MODEL NO.	GPM	FEET	LEAD LENGTH	COMMENTS

Dimensions



Technical Data

FLOW RANGE: Continuous/Variable (100 ml/min - 9 US GPM)

INTEGRAL PUMP/MOTOR UNIT

Motor Type: Water-filled, canned, variable speed submersible
Maximum Fluid Temperature: 86°F (30°C)
Minimum Fluid Temperature: 34°F (1°C)
Maximum Input Power: 1.5 KW (2 HP)
Maximum Motor Voltage: 3 PH X 220 Volts at 400 Hz
Maximum Motor Current: 5.5 Amps
Motor Protection: Thermal Overload – Thermik Geratebau, Series SY6
Disconnect Temperature: 176°F (80°C)
Rate Current: 5 Amps
Current Overload – Incorporated into MP1 Converter

DISCHARGE SIZE: ½" Female NPT

PUMP END CONSTRUCTION MATERIALS: Stainless Steel and Teflon® (See reverse side.)

INSTALLATION: Unit to be installed vertically for submerged operation.

AVAILABLE LEAD LENGTHS: 50 Ft., 75 Ft, 100 Ft., 125 Ft., 150 Ft., 175 Ft., 200 Ft., 250 Ft., and 300 Ft.

Dimensions and Weights

DIMENSIONS IN INCHES (mm)						
PUMP TYPE	OVERALL LENGTH (A)	MOTOR LENGTH (B)	PUMP END LENGTH (C)	MAX. DIA (D)	DISCH. PIPE SIZE (NPT) (E)	NET WEIGHT①
MP1	11.30" (287)	8.19" (208)	3.11" (79)	1.81" (46)	½"	5.5 LBS.

① Weight does not include motor lead.

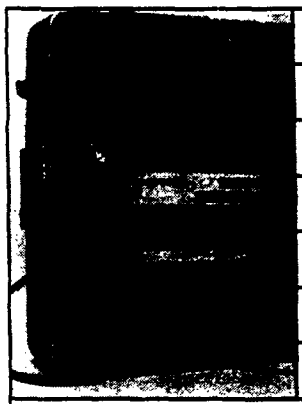
Teflon® is a registered trademark of Dupont.

GRUNDFOS

Redi-Flo2 Converter

BTI/MP1

Submittal Data



JOB or CUSTOMER:	
ENGINEER:	
CONTRACTOR:	
SUBMITTED BY:	DATE:
APPROVED BY:	DATE:
ORDER NO.:	DATE:
SPECIFICATION REF.:	

Technical Data

ELECTRICAL:

INPUT

Voltage: 1 PH × 220 - 230 V ± 10%
Frequency: 50 - 60 Hz ± 2%
Maximum Current: 10 Amps

OUTPUT

Voltage: 3 PH × 25 V - 3 PH × 220 V
Frequency: 46 - 400 Hz
Maximum Current: 5.5 Amps
Power: 1.5 KW (2HP)

ACCELERATION TIME:
0 to 400 Hz: 10 seconds

DECELERATION TIME:
400 to 0 Hz: 10 seconds

INPUT LINE FUSE:
2 each T 30 A. type FERRAZ

MOTOR LEAD CONNECTOR:
AMP CPC Plug, Type 206429-1

POWER CABLE:
Type SJOW, 14 AWG, 10' long

OPERATING CONDITIONS:

AMBIENT TEMPERATURE:
32° F to 104° F (0° C to 40°C)

RELATIVE AIR HUMIDITY: Maximum 95%

NOTE (Radio Noise): When the converter is connected to public electrical supply, radio noise may occur. This can be eliminated by adding a Siemens filter type B 84112-B-A 120/20 A.

STORAGE CONDITIONS:

AMBIENT TEMPERATURE:
-13° F to 149° F (-25° C to 65° C)

RELATIVE AIR HUMIDITY:
Maximum 50% at 104° F (40° C) unlimited
Maximum 90% at 68° F (20° C) for periods not exceeding 30 days per year
75% annual average
Non-condensing

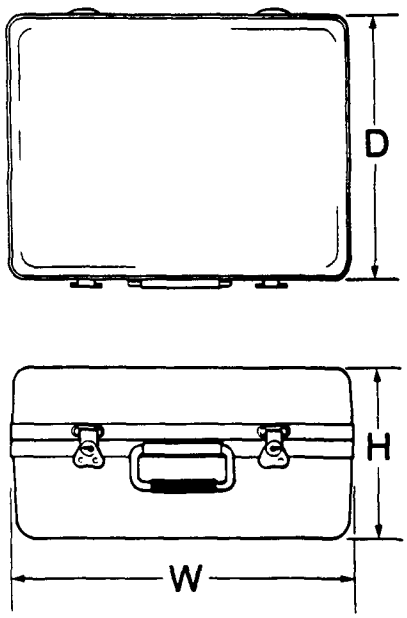
PROTECTIVE CASE CONTRUCTION:

CASE: High density polyethylene

TRIM: Aluminum

LOCK: Military twist-type – steel with zinc plating

Dimensions



Dimensions and Weights

DIMENSIONS IN INCHES (mm)				
TYPE	HEIGHT (H)	DEPTH (D)	WIDTH (W)	NET WEIGHT
BTI / MP1	9" (228.6)	14" (355.6)	18.5" (469.9)	25 LBS.

Teflon® is a registered trademark of Du Pont.

GRUNDFOS

Redi-Flo2
2" Environmental
Submersible Pumps

PRICE LIST

EFFECTIVE DATE: February 1, 1991

Redi-Flo2 Environmental Pumps

TYPE	MOTOR LEAD LENGTH (FT.)	PRODUCT NUMBER	APPROXIMATE SHIPPING WEIGHT (LBS.)	LIST PRICE ($)
MP1	50	1A106103	9	605
	75	1A106203	11	655
	100	1A106303	12	710
	125	1A106403	13	765
	150	1A106503	14	815
	175	1A106603	15.5	870
	200	1A106703	16.5	920
	250	1A106803	19	1030
	300	1A106903	21	1135

NOTE: Prices are effective only in the USA and are subject to change without notice.

GRUNDFOS Pumps Corp. • 2555 Clovis Ave. • Clovis, CA 93612
Support Centers: Allentown, PA • Atlanta, GA • Mississauga, Ontario, Canada

GRUNDFOS

Redi-Flo2 Converter and Accessories

PRICE LIST

EFFECTIVE DATE: February 1, 1991

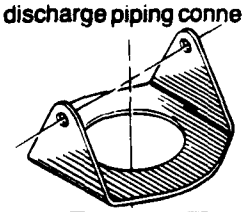
Redi-Flo2 Converter*

with protective case

TYPE	PH	INPUT VOLTAGE TO CONVERTER	PRODUCT NUMBER	APPROX. SHIPPING WT. (LBS.)	LIST PRICE ($)
BTI/MP1	1	230	1A0051065	27	2050.00

*Includes 10' power cord.

Redi-Flo2 Accessories

ITEM	PRODUCT NUMBER	APPROX. SHIPPING WT. (LBS.)	LIST PRICE ($)
Safety Cable Bracket (Placed between the top of pump and discharge piping connector.) 	1A0019	1	10.00

NOTE: Prices are effective only in the USA and are subject to change without notice.

GRUNDFOS Pumps Corp. • 2555 Clovis Ave. • Clovis, CA 93612
Support Centers: Allentown, PA • Atlanta, GA • Mississauga, Ontario, Canada

L-RF-PL-002 | 2/1/91
PRINTED IN U.S.A

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
'92 FEB 17 AM 9 27

Fax received 2/13/92

February 13, 1992

Roger Anderson, Environmental Engineer
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major activities relating to the Indian Basin site since the report of January 3.

SHALLOW IMPACTED AREA

- Final design of soil venting blower and manifolding is complete. Orders have been placed for a 7.5 HP blower and generator for long-term soil venting.

- Application for the existing shallow wells was submitted to the State Engineer.

LOWER QUEEN

- Withdrawals have continued at 500 - 1,300 BWPD from the six wells. Cumulative withdrawal has been 56,000 BW and 42 BC.

- Mrs. Lyman withdrew her protest to the Lower Queen well applications following receipt of a summary report.

- Air stripper arrived at location and the treatment system is presently being installed.

OTHER

- Extensive time has been committed to draft the Treatment Plan; it is hoped that the Plan will be ready for submittal within 2-3 weeks.

- A point-in-time water sampling program was conducted December 16-20, 1991. The results indicate containment (and possible contraction) of the Lower Queen plume, even prior to high-rate withdrawals which began on December 23; the benzene analyses are summarized below:

PPB BENZENE

	9/91	12/91	
BH-83	1600	350	MONITOR WELL
BH-84	40	90	PUMPING WELL
BH-85	540	420	PUMPING WELL
BH-86	33	<1	MONITOR WELL
BH-87A	190	10	PUMPING WELL
BH-88	2200	1400	PUMPING WELL
BH-89	<1	<1	MONITOR WELL
BH-90	150	130	MONITOR WELL
BH-91A	680	150	PUMPING WELL
BH-92	<1	<1	MONITOR WELL
BH-93	280	320	MONITOR WELL
BH-94	240	1900	PUMPING WELL
BH-97	<1	<1	MONITOR WELL
SW-1	<1	<1	PUMPING WELL
SW-1A	<1	<1	MONITOR WELL

A complete report of the December sampling will be forwarded under separate cover.

- Routine sampling of nearby domestic and stock wells continues. No BTEX or elevated chlorides were seen.

- Personal visits were made to most of the nearby ranchers explaining the concepts of the present and future treatment plans.

- Comparison sampling was performed to identify alternative methods (other than EPA labs) for BTEX and chloride analysis for "operational samples" in the future. Domestic water supply samples will continue to be analyzed by EPA labs.

- Effective February 1, I have returned to my position of Production Manager, Midland Operations. Jeff Lynn will assume coordinator responsibility for the Indian Basin Treatment activities. Any other issues relating to the Indian Basin field and plant should be directed to me.

Very truly yours,

Robert F. Unger
Production Manager
Midland Operations

RFU/jmh/013

xc: J. L. Benson
D. E. Kenyon
A. R. Kukla
J. S. Lynn
S. A. Pohler
C. E. Eustice (OCD - Hobbs)
M. B. Williams (OCD - Artesia)

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

'92 FE 1 AM 9 34

February 12, 1992

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Final analytical results from the water sample obtained from your well on January 20, 1992 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analysis of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analysis utilizing procedures approved by the EPA. The analysis was utilized to evaluate potential contamination of your water from the released fluids described above. The results of this analysis indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8526.

Sincerely,

Jeffrey S. Lynn

Jeffrey S. Lynn
Advanced Environmental Representative

JSL/elk
Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson
R. F. Unger

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A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
02/05/92

JOB NUMBER: 920101 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 01/20/92
TIME SAMPLED.....: 12:10
WORK DESCRIPTION...: 1
Lyman Well

LABORATORY I.D...: 920101-0001
DATE RECEIVED....: 01/22/92
TIME RECEIVED....: 11:38
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
Chloride (Unfilt.)	12.1	0.5	mg/L	325.2 (1)	01/31/92
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/23/92
Benzene	ND	1	ug/L		
Toluene	ND	1	ug/L		
Ethyl Benzene	ND	1	ug/L		
Xylenes	ND	1	ug/L		

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

January 29, 1992

Mr. & Mrs. Walter Biebelle
646 Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. & Mrs. Biebelle:

Final analytical results from the water samples obtained on January 6, 1992 from your well and from natural springs located in Rocky Arroyo and utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present in any of the samples.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager
Midland Operations

RFU/SAP/elk

Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 816

CONFIDENTIAL

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A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
01/20/92

JOB NUMBER: 920040 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 01/06/92
TIME SAMPLED.....: 09:28
WORK DESCRIPTION...: 2

LABORATORY I.D...: 920040-0002
DATE RECEIVED....: 01/08/92
TIME RECEIVED....: 15:26
REMARKS.....:

Upper Indian Hills Springs - West

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
Chloride (Unfilt.)	10.2	0.5	mg/L	325.2 (1)	01/17/92
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/09/92
Benzene	ND	1	ug/L		
Toluene	ND	1	ug/L		
Ethyl Benzene	ND	1	ug/L		
Xylenes	ND	1	ug/L		

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
01/20/92

JOB NUMBER: 920040 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 01/06/92
TIME SAMPLED.....: 10:26
WORK DESCRIPTION...: 3

LABORATORY I.D...: 920040-0003
DATE RECEIVED....: 01/08/92
TIME RECEIVED....: 15:26
REMARKS.....:

Sower Indian Hills Spring

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
Chloride (Unfilt.)	10.2	0.5	mg/L	325.2 (1)	01/17/92
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/09/92
Benzene	ND	1	ug/L		
Toluene	ND	1	ug/L		
Ethyl Benzene	ND	1	ug/L		
Xylenes	ND	1	ug/L		

1300 South Potomac, Suite 130
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LABORATORY TESTS RESULTS
01/20/92

JOB NUMBER: 920040 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 01/06/92
TIME SAMPLED.....: 10:51
WORK DESCRIPTION...: 4

LABORATORY I.D...: 920040-0004
DATE RECEIVED....: 01/08/92
TIME RECEIVED....: 15:26
REMARKS.....:

Bicbello Water Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
Chloride (Unfilt.)	10.1	0.5	mg/L	325.2 (1)	01/17/92
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/09/92
Benzene	ND	1	ug/L		
Toluene	ND	1	ug/L		
Ethyl Benzene	ND	1	ug/L		
Xylenes	ND	1	ug/L		

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LABORATORY TESTS RESULTS
01/20/92

JOB NUMBER: 920040 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 01/06/92
TIME SAMPLED.....: 10:07
WORK DESCRIPTION...: 5

LABORATORY I.D...: 920040-0005
DATE RECEIVED....: 01/08/92
TIME RECEIVED....: 15:26
REMARKS.....:

Arroyo Spring Water

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
Chloride (Unfilt.)	10.0	0.5	mg/L	325.2 (1)	01/17/92
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/09/92
Benzene	ND	1	ug/L		
Toluene	ND	1	ug/L		
Ethyl Benzene	ND	1	ug/L		
Xylenes	ND	1	ug/L		

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
01/20/92

JOB NUMBER: 920040 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 01/06/92
TIME SAMPLED.....: 09:38
WORK DESCRIPTION...: 6

LABORATORY I.D...: 920040-0006
DATE RECEIVED....: 01/08/92
TIME RECEIVED....: 15:26
REMARKS.....:

Upper Hills Spring - East

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
Chloride (Unfilt.)	10.2	0.5	mg/L	325.2 (1)	01/17/92
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/09/92
Benzene	ND	1	ug/L		
Toluene	ND	1	ug/L		
Ethyl Benzene	ND	1	ug/L		
Xylenes	ND	1	ug/L		

1300 South Potomac, Suite 130
Aurora, CO 80012
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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

January 29, 1992

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. Wayne Gregory:

Final analytical results from the water samples obtained on January 6, 1992 from a natural spring located in Rocky Arroyo are attached. In discussing this water source with Mr. Biebelle, he indicated that the water it supplies is utilized by the Biebelle's for stock water, and also by you for stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager
Midland Operations

SAP/RFU/elk

Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
01/20/92

JOB NUMBER: 920040 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 01/06/92
TIME SAMPLED.....: 10:07
WORK DESCRIPTION...: 5

LABORATORY I.D...: 920040-0005
DATE RECEIVED....: 01/08/92
TIME RECEIVED....: 15:26
REMARKS.....:

Arroyo Spring Water

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
Chloride (Unfilt.)	10.0	0.5	mg/L	325.2 (1)	01/17/92
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/09/92
Benzene	ND	1	ug/L		
Toluene	ND	1	ug/L		
Ethyl Benzene	ND	1	ug/L		
Xylenes	ND	1	ug/L		

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

January 29, 1992

Mr. & Mrs. Howell
P. O. Box 94
Lakewood, New Mexico 88254

Re: Water Well Analysis

Dear Mr. & Mrs. Howell:

Final analytical results from the water samples obtained from your domestic and stock wells on January 6, 1992 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager
Midland Operations

RFU/SAP/elk

Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 818

"CONFIDENTIAL BUSINESS STATEMENT"

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
01/20/92

JOB NUMBER: 920040 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 01/06/92
TIME SAMPLED.....: 11:53
WORK DESCRIPTION...: 10

LABORATORY I.D...: 920040-0010
DATE RECEIVED....: 01/08/92
TIME RECEIVED....: 15:26
REMARKS.....:

Howell Matey Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
Chloride (Unfilt.)	85	4	mg/L	325.2 (1)	01/17/92
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/09/92
Benzene	ND	1	ug/L		
Toluene	ND	1	ug/L		
Ethyl Benzene	ND	1	ug/L		
Xylenes	ND	1	ug/L		

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
01/20/92

JOB NUMBER: 920040 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 01/06/92
TIME SAMPLED.....: 12:23
WORK DESCRIPTION...: 11

LABORATORY I.D...: 920040-0011
DATE RECEIVED....: 01/08/92
TIME RECEIVED....: 15:26
REMARKS.....:

Howell Windmill Mill

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
Chloride (Unfilt.)	19.3	0.5	mg/L	325.2 (1)	01/17/92
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/09/92
Benzene	ND	1	ug/L		
Toluene	ND	1	ug/L		
Ethyl Benzene	ND	1	ug/L		
Xylenes	ND	1	ug/L		

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

January 29, 1992

Mr. & Mrs. Lee
P. O. Box 89
Lakewood, New Mexico 88254

Re: Water Well Analysis

Dear Mr. & Mrs. Lee:

Final analytical results from the water samples obtained on January 6, 1992 from your well located next to the paved road approximately 0.5 miles west of Marathon's Indian Basin Gas Plant have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager
Midland Operations

RFU/SAP/elk

Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 817

CONFIDENTIAL BUSINESS

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
01/20/92

JOB NUMBER: 920040 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 01/06/92
TIME SAMPLED.....: 11:36
WORK DESCRIPTION...: 9

LABORATORY I.D...: 920040-0009
DATE RECEIVED....: 01/08/92
TIME RECEIVED....: 15:26
REMARKS.....:

See Notes Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
Chloride (Unfilt.)	17.3	0.5	mg/L	325.2 (1)	01/17/92
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/09/92
Benzene	ND	1	ug/L		
Toluene	ND	1	ug/L		
Ethyl Benzene	ND	1	ug/L		
Xylenes	ND	1	ug/L		

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
'92 FEB 3 AM 9

January 29, 1992

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Final analytical results from the water sample obtained from your well on December 30, 1991 and January 6, 1992 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager

RFU/SAP/elk
Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
01/20/92

JOB NUMBER: 920006 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 12/30/91
TIME SAMPLED.....: 11:55
WORK DESCRIPTION...: 1

LABORATORY I.D...: 920006-0001
DATE RECEIVED....: 01/02/92
TIME RECEIVED....: 16:55
REMARKS.....:

LYMAN WELL

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
Chloride (Unfilt.)	12.3	0.5	mg/L	325.2 (1)	01/17/92
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/03/92
Benzene	ND	1	ug/L		
Toluene	ND	1	ug/L		
Ethyl Benzene	ND	1	ug/L		
Xylenes	ND	1	ug/L		

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
01/20/92

JOB NUMBER: 920040 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 01/06/92
TIME SAMPLED.....: 11:14
WORK DESCRIPTION...: 1

LABORATORY I.D...: 920040-0001
DATE RECEIVED....: 01/08/92
TIME RECEIVED....: 15:26
REMARKS.....:

LYMAN WELL

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
Chloride (Unfilt.)	12.3	0.5	mg/L	325.2 (1)	01/17/92
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	01/09/92
Benzene	ND	1	ug/L		
Toluene	ND	1	ug/L		
Ethyl Benzene	ND	1	ug/L		
Xylenes	ND	1	ug/L		

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION

January 6, 1992

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. Wayne Gregory:

Final analytical results from the water samples obtained on November 18 and December 2, 1991 from a natural spring located in Rocky Arroyo are attached. In discussing this water source with Mr. Biebelle, he indicated that the water it supplies is utilized by the Biebelle's for stock water, and also by you for stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager
Midland Operations

SAP/RFU/elk

Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

Western Atlas International
A Union Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/09/91

JOB NUMBER: 912213 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 11/18/91
TIME SAMPLED.....: 09:32
WORK DESCRIPTION...: 5

LABORATORY I.D...: 912213-0005
DATE RECEIVED....: 11/20/91
TIME RECEIVED....: 13:50
REMARKS.....:

Arroyo Spring Water

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	9.2	0.5	mg/L	325.2 (1)	12/04/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/20/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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CORE LABORATORIES

LABORATORY TESTS RESULTS
12/13/91

JOB NUMBER: 912289 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 12/02/91
TIME SAMPLED.....: 09:28
WORK DESCRIPTION...: 5

LABORATORY I.D...: 912289-0005
DATE RECEIVED....: 12/04/91
TIME RECEIVED....: 13:08
REMARKS.....:

Arroyo Spring Water

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	9.3	0.5	mg/L	325.2 (1)	12/05/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
JAN 9 03

January 6, 1992

Mr. & Mrs. Walter Biebelle
646 Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. & Mrs. Biebelle:

Final analytical results from the water samples obtained on November 18 and December 2, 1991 from your well and from natural springs located in Rocky Arroyo and utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present in any of the samples.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager
Midland Operations

RFU/SAP/elk

Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 753

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CORE LABORATORIES

LABORATORY TESTS RESULTS
12/09/91

JOB NUMBER: 912213 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 11/18/91
TIME SAMPLED.....: 08:56
WORK DESCRIPTION...: 2

LABORATORY I.D...: 912213-0002
DATE RECEIVED....: 11/20/91
TIME RECEIVED....: 13:50
REMARKS.....:

Upper Indian Hills Spring - West

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	9.6	0.5	mg/L	325.2 (1)	12/04/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/20/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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LABORATORY TESTS RESULTS
12/09/91

JOB NUMBER: 912213 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 11/18/91
TIME SAMPLED.....: 09:57
WORK DESCRIPTION...: 3

LABORATORY I.D...: 912213-0003
DATE RECEIVED....: 11/20/91
TIME RECEIVED....: 13:50
REMARKS.....:

Sowu Indian Hills Spring

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	9.2	0.5	mg/L	325.2 (1)	12/04/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/20/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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LABORATORY TESTS RESULTS
12/09/91

JOB NUMBER: 912213 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 11/18/91
TIME SAMPLED.....: 10:15
WORK DESCRIPTION...: 4

LABORATORY I.D...: 912213-0004
DATE RECEIVED....: 11/20/91
TIME RECEIVED....: 13:50
REMARKS.....:

Bielbelle Water Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	9.3	0.5	mg/L	325.2 (1)	12/04/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/20/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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LABORATORY TESTS RESULTS
12/09/91

JOB NUMBER: 912213 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 11/18/91
TIME SAMPLED.....: 09:32
WORK DESCRIPTION...: 5

LABORATORY I.D...: 912213-0005
DATE RECEIVED....: 11/20/91
TIME RECEIVED....: 13:50
REMARKS.....:

Arroyo Spring Water

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	9.2	0.5	mg/L	325.2 (1)	12/04/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/20/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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LABORATORY TESTS RESULTS
12/09/91

JOB NUMBER: 912213 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 11/18/91
TIME SAMPLED.....: 09:03
WORK DESCRIPTION...: 6

LABORATORY I.D...: 912213-0006
DATE RECEIVED....: 11/20/91
TIME RECEIVED....: 13:50
REMARKS.....:

Upper Hills Spring - East

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	9.7	0.5	mg/L	325.2 (1)	12/04/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/20/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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CORE LABORATORIES

LABORATORY TESTS RESULTS
12/13/91

JOB NUMBER: 912289 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 12/02/91
TIME SAMPLED.....: 08:43
WORK DESCRIPTION...: 2

LABORATORY I.D...: 912289-0002
DATE RECEIVED....: 12/04/91
TIME RECEIVED....: 13:08
REMARKS.....:

Upper Indian Hills Spring West

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	9.7	0.5	mg/L	325.2 (1)	12/05/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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A Unit of Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/13/91

JOB NUMBER: 912289 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 12/02/91
TIME SAMPLED.....: 09:52
WORK DESCRIPTION...: 3

LABORATORY I.D...: 912289-0003
DATE RECEIVED....: 12/04/91
TIME RECEIVED....: 13:08
REMARKS.....:

Sower Indian Hills Spring

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	9.5	0.5	mg/L	325.2 (1)	12/05/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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LABORATORY TESTS RESULTS
12/13/91

JOB NUMBER: 912289 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 12/02/91
TIME SAMPLED.....: 10:13
WORK DESCRIPTION...: 4

LABORATORY I.D...: 912289-0004
DATE RECEIVED....: 12/04/91
TIME RECEIVED....: 13:08
REMARKS.....:

Bicbelle Water Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	9.4	0.5	mg/L	325.2 (1)	12/05/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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Aurora, CO 80012
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CORE LABORATORIES

LABORATORY TESTS RESULTS
12/13/91

JOB NUMBER: 912289 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 12/02/91
TIME SAMPLED.....: 09:28
WORK DESCRIPTION...: 5

LABORATORY I.D...: 912289-0005
DATE RECEIVED....: 12/04/91
TIME RECEIVED....: 13:08
REMARKS.....:

Arroyo Spring Water

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	9.3	0.5	mg/L	325.2 (1)	12/05/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
12/13/91

JOB NUMBER: 912289 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 12/02/91
TIME SAMPLED.....: 08:52
WORK DESCRIPTION...: 6

LABORATORY I.D...: 912289-0006
DATE RECEIVED....: 12/04/91
TIME RECEIVED....: 13:08
REMARKS.....:

Upper Hills Spring - East

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	9.5	0.5	mg/L	325.2 (1)	12/05/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
'92 JAN 10 AM 9 03

January 6, 1992

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Final analytical results from the water sample obtained from your well on November 11, 18 and December 2 and 16, 1991 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager

RFU/SAP/elk

Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CONFIDENTIAL BUSINESS INFORMATION

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/09/91

JOB NUMBER: 912162 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 11/11/91
TIME SAMPLED.....: 13:35
WORK DESCRIPTION...: 1

LABORATORY I.D...: 912162-0001
DATE RECEIVED....: 11/13/91
TIME RECEIVED....: 15:16
REMARKS.....:

LYMAN WELL

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.8	0.5	mg/L	325.2 (1)	12/04/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/14/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
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Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/09/91

JOB NUMBER: 912213 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 11/18/91
TIME SAMPLED.....: 10:40
WORK DESCRIPTION...: 1

LABORATORY I.D...: 912213-0001
DATE RECEIVED....: 11/20/91
TIME RECEIVED....: 13:50
REMARKS.....:

LYMAN WELL

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	12.9	0.5	mg/L	325.2 (1)	12/04/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/20/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/13/91

JOB NUMBER: 912289 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 12/02/91
TIME SAMPLED.....: 10:39
WORK DESCRIPTION...: 1

LABORATORY I.D...: 912289-0001
DATE RECEIVED....: 12/04/91
TIME RECEIVED....: 13:08
REMARKS.....:

Symcon Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	12.2	0.5	mg/L	325.2 (1)	12/05/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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CONFIDENTIAL BUSINESS STATEMENT

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/30/91

JOB NUMBER: 912392 CUSTOMER: MARATHON OIL COMPANY ATTN: AL LEARNED

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 12/16/91
TIME SAMPLED.....: 08:50
WORK DESCRIPTION...: 1

LABORATORY I.D...: 912392-0001
DATE RECEIVED....: 12/18/91
TIME RECEIVED....: 14:22
REMARKS.....:

Symon Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.8	0.5	mg/L	325.2 (1)	12/19/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/20/91	MLD
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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(303) 751-1780

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

January 6, 1992

Mr. & Mrs. Howell
P. O. Box 94
Lakewood, New Mexico 88254

Re: Water Well Analysis

Dear Mr. & Mrs. Howell:

Final analytical results from the water samples obtained from your domestic and stock wells on November 18 and December 2, 1991 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager
Midland Operations

RFU/SAP/elk

Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 752

CONFIDENTIAL BUSINESS INFORMATION

Western Atlas International
A Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/09/91

JOB NUMBER: 912213 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 11/18/91
TIME SAMPLED.....: 10:10
WORK DESCRIPTION...: 10

LABORATORY I.D...: 912213-0010
DATE RECEIVED....: 11/20/91
TIME RECEIVED....: 13:50
REMARKS.....:

Howell Water Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	91	1	mg/L	325.2 (1)	12/04/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/20/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
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Western Atlas International
A Unit of Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/09/91

JOB NUMBER: 912213 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 11/18/91
TIME SAMPLED.....: 10:40
WORK DESCRIPTION...: 11

LABORATORY I.D...: 912213-0011
DATE RECEIVED....: 11/20/91
TIME RECEIVED....: 13:50
REMARKS.....:

Howell Windmill Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	16.2	0.5	mg/L	325.2 (1)	12/04/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/20/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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CORE LABORATORIES

LABORATORY TESTS RESULTS
12/13/91

JOB NUMBER: 912289 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 12/02/91
TIME SAMPLED.....: 12:30
WORK DESCRIPTION...: 10

LABORATORY I.D...: 912289-0010
DATE RECEIVED....: 12/04/91
TIME RECEIVED....: 13:08
REMARKS.....:

Howell Water Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	82	1	mg/L	325.2 (1)	12/11/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/13/91

JOB NUMBER: 912289 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 12/02/91
TIME SAMPLED.....: 13:01
WORK DESCRIPTION...: 11

LABORATORY I.D....: 912289-0011
DATE RECEIVED....: 12/04/91
TIME RECEIVED....: 13:08
REMARKS.....:

Howell Windmill Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	18.5	0.5	mg/L	325.2 (1)	12/05/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production - United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

January 6, 1992

Mr. & Mrs. Lee
P. O. Box 89
Lakewood, New Mexico 88254

Re: Water Well Analysis

Dear Mr. & Mrs. Lee:

Final analytical results from the water samples obtained on November 18 and December 2, 1991 from your well located next to the paved road approximately 0.5 miles west of Marathon's Indian Basin Gas Plant have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager
Midland Operations

RFU/SAP/elk

Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 754

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/09/91

JOB NUMBER: 912213 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 11/18/91
TIME SAMPLED.....: 11:40
WORK DESCRIPTION...: 9

LABORATORY I.D...: 912213-0009
DATE RECEIVED....: 11/20/91
TIME RECEIVED....: 13:50
REMARKS.....:

See Water Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	17.9	0.5	mg/L	325.2 (1)	12/04/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/20/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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Western Atlas International
A Litton-Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
12/13/91

JOB NUMBER: 912289 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 12/02/91
TIME SAMPLED.....: 11:32
WORK DESCRIPTION...: 9

LABORATORY I.D...: 912289-0009
DATE RECEIVED....: 12/04/91
TIME RECEIVED....: 13:08
REMARKS.....:

See Water Well

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	12.0	0.5	mg/L	325.2 (1)	12/05/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	12/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED

'92 JAN 7 AM 8 59

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

January 3, 1992

Roger Anderson, Environmental Engineer
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major activities relating to the Indian Basin site since the report of November 21. Some of the following was reported at the routine update meeting on December 13.

SHALLOW IMPACTED AREA

- Downhole airflow logging in the active vent well was completed.

- The first, passive (wind turbine) venting system was tested but proved to draw too little suction. Improved turbine designs are being sought as well as improved instrumentation to measure these low rate air flows.

LOWER QUEEN

- Approval was received from the Watermaster to continue withdrawals using meters appropriate for hydrocarbon recovery; despite the fact those were not "standard" water well meters.

- Mrs. Lyman filed a protest to the application for the Lower Queen wells on December 6. Marathon representatives met with Mrs. Lyman and legal counsel on December 16 in an effort to reach an agreement. A report describing the Lower Queen treatment plan was sent to those parties on December 19 with a request for withdrawal of the protest. We await response.

- The permanent PVC gathering system and electrical power were completed to the six Lower Queen wells and on December 23, high rate withdrawals began. Since that time, total rates have averaged 1300-1500 BWPD with cumulative water withdrawals from the Lower Queen now approximately 32,000 BW and 29 BC.

- The air stripper delivery is expected by January 15 after which, installation of the water processing vessels (separator, tank, air stripper) will commence.

OTHER

- A routine update was provided to the NMOCD and BLM on December 13 in Santa Fe. The concepts and content of the anticipated Treatment Plan were presented. Much time has since been directed toward drafting that Plan.

- Samples were collected from December 16 - 20 for the second point-in-time analysis.

- Routine sampling of nearby domestic and stock wells continues, at the revised frequency approved by the OCD on December 2. To date, no BTEX has been detected but the plant's standby well has shown elevated (400 - 600 ppm) chlorides. The main plant supply well remains at 17 ppm chlorides.

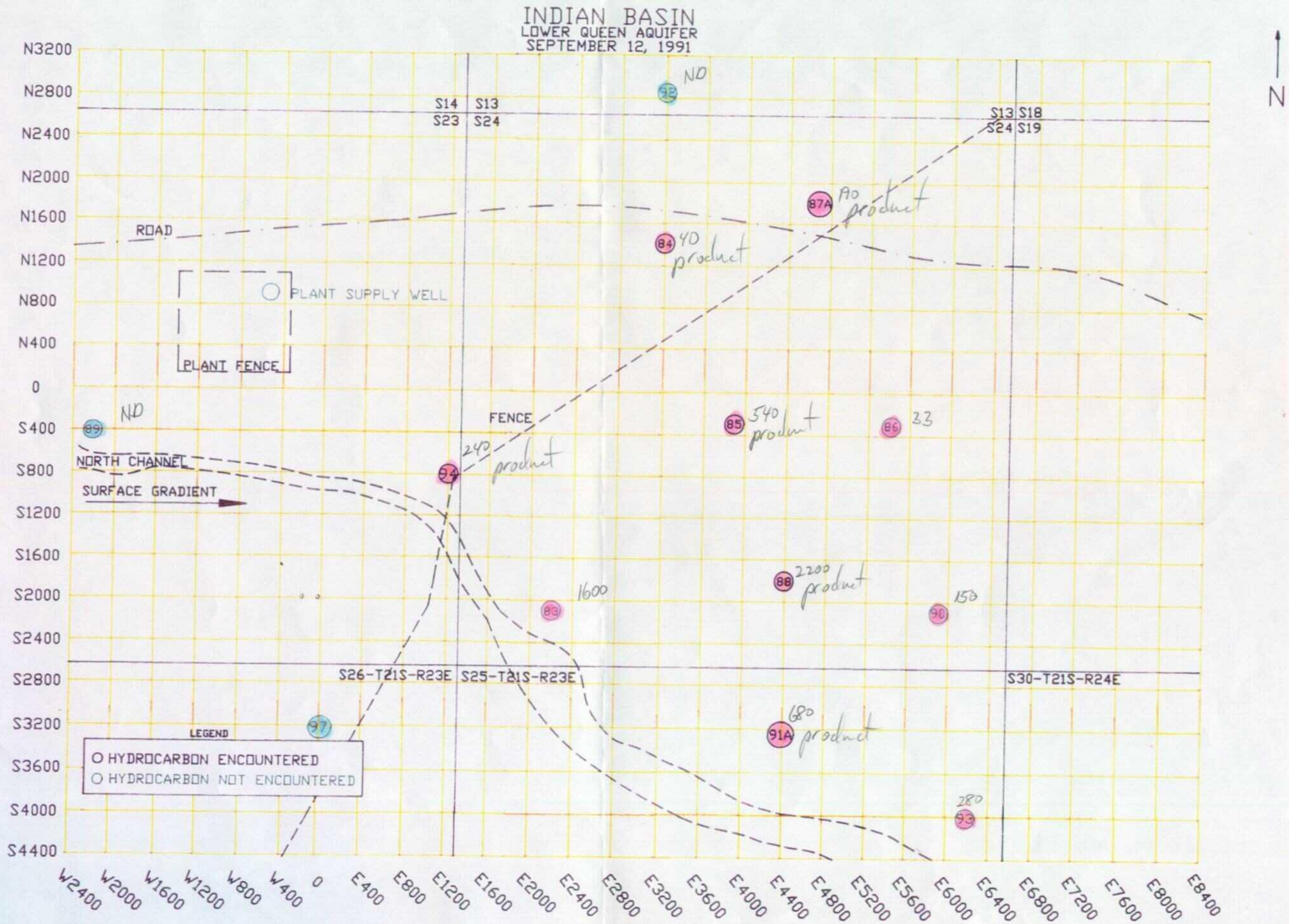
Very truly yours,

Robert F. Unger

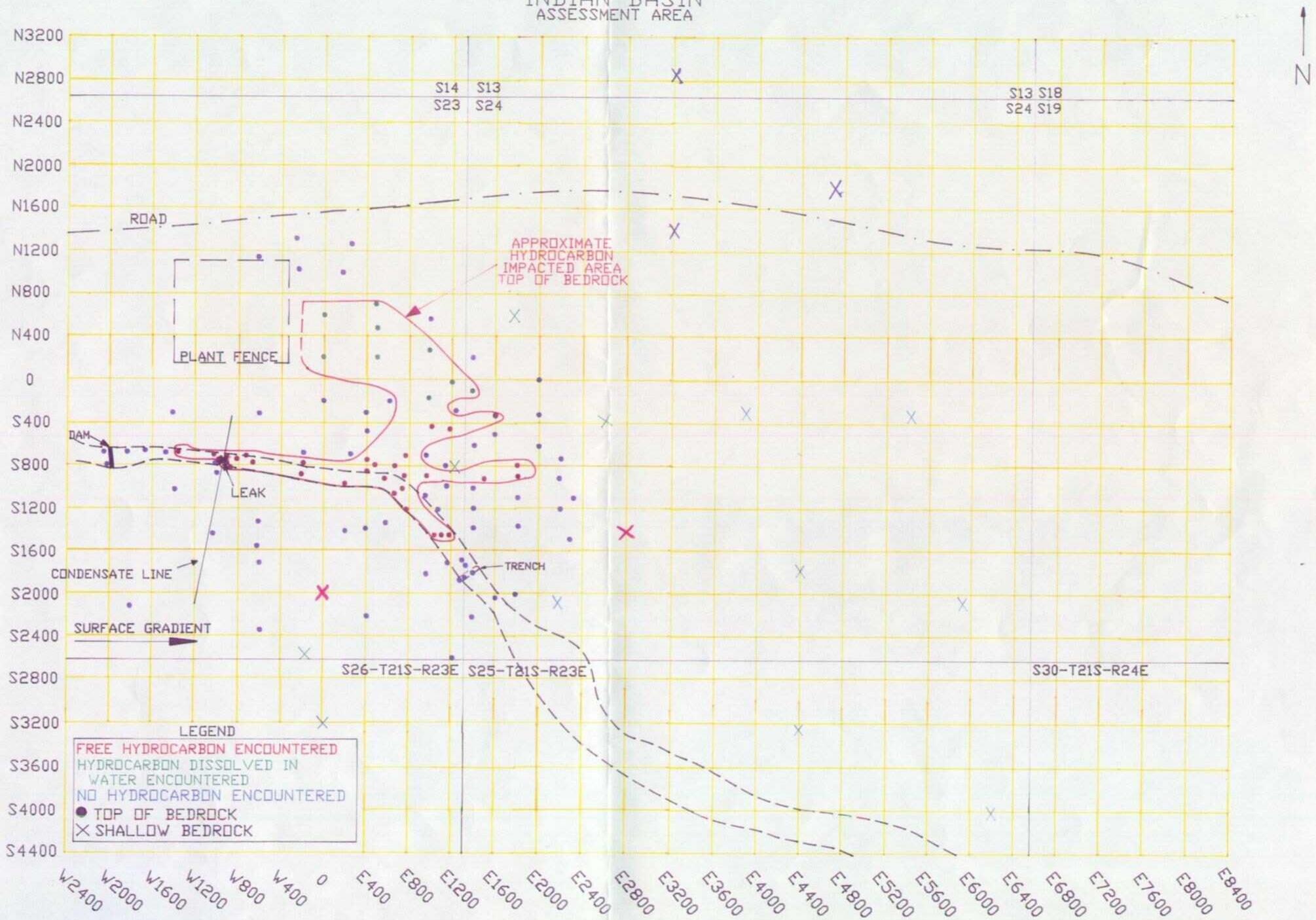
Robert F. Unger
Production Manager
Midland Operations

RFU/elk

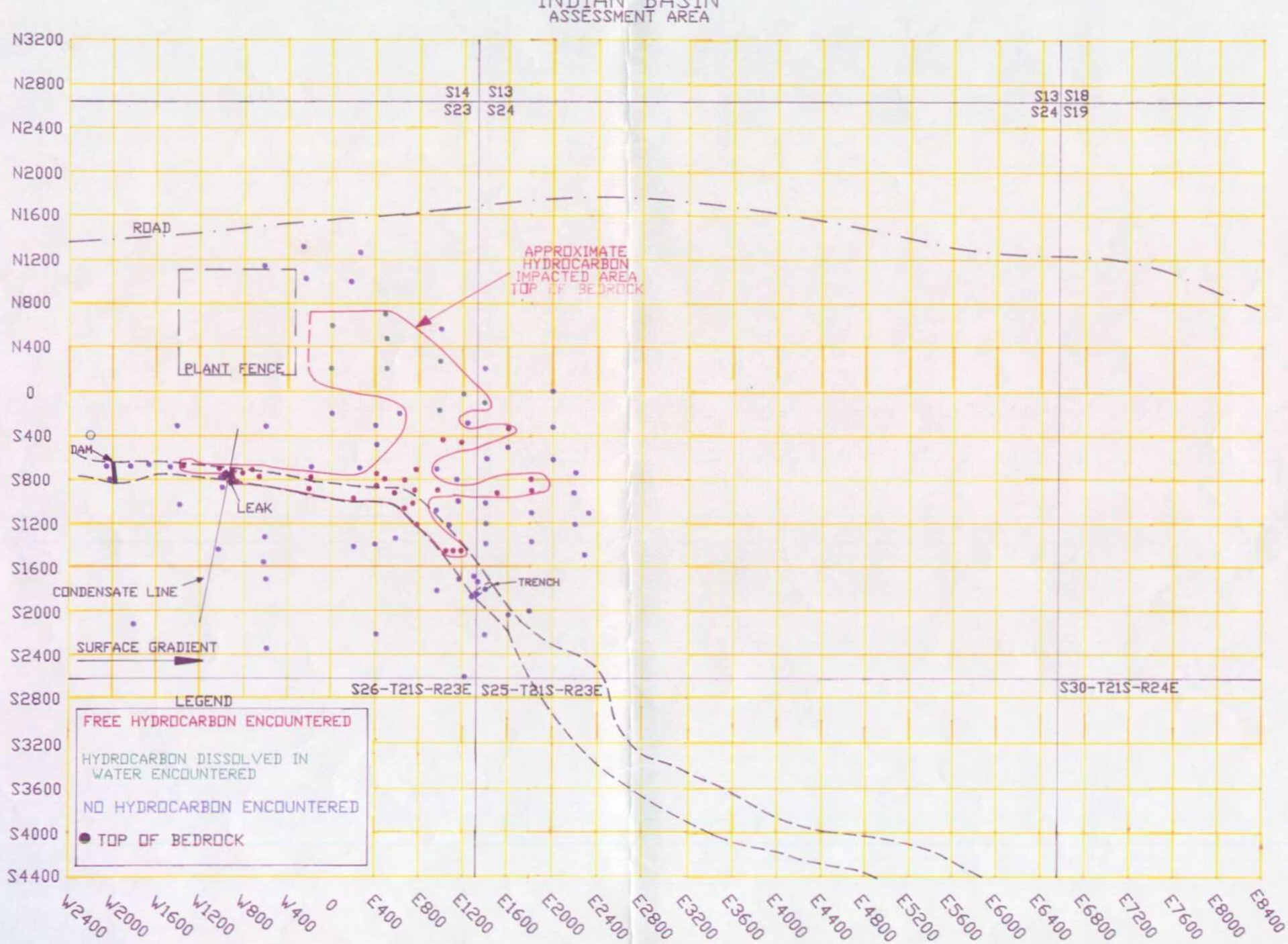
cc: J. L. Benson
D. E. Kenyon
A. R. Kukla
J. S. Lynn
S. A. Pohler
C. E. Eustice (OCD - Hobbs)
M. B. Williams (OCD - Artesia)


INDIAN BASIN
LOWER QUEEN AQUIFER
SEPTEMBER 12, 1991
N
N3200
N2800
N2400
N2000
N1600
N1200
N800
N400
0
S400
S800
S1200
S1600
S2000
S2400
S2800
S3200
S3600
S4000
S4400
W2400
W2000
W1600
W1200
W800
W400
0
E400
E800
E1200
E1600
E2000
E2400
E2800
E3200
E3600
E4000
E4400
E4800
E5200
E5600
E6000
E6400
E6800
E7200
E7600
E8000
E8400
S14 S13
S23 S24
S13 S18
S24 S19
S26-T21S-R23E
S25-T21S-R23E
S30-T21S-R24E
ROAD
PLANT SUPPLY WELL
PLANT FENCE
FENCE
NORTH CHANNEL
SURFACE GRADIENT
92 ND
87A 40 product
84 40 product
89 ND
94 240 product
85 540 product
86 33
88 2200 product
83 1600
96 150
91A 680 product
93 280
97
LEGEND
HYDROCARBON ENCOUNTERED
HYDROCARBON NOT ENCOUNTERED

INDIAN BASIN
ASSESSMENT AREA



INDIAN BASIN
ASSESSMENT AREA



Marathon Indian Basin

Table 1 Analytical Data from January, 1992, Sampling Round

well_no	Analyst	benzene	toluene	eth_benz	xylenes
BH-14	Beazley HPLC	127	7	227	16
BH-14	Core P&T	140	40	210	5
BH-14	Core P&T	140	45	180	10
BH-14	Core P&T	130	35	160	5
BH-14	Louch P&T	277	0	192	17
BH-14	Louch/Hooper P&T	278	0	190	17
BH-14	Louch/Hooper P&T	302	0	193	18
BH-14	Louch/Hooper P&T	294	0	193	18
BH-14	Spectra Physics	110	51	154	7
BH-44	Beazley HPLC	861	38	120	684
BH-44	Core P&T	1200	50	150	1000
BH-44	Core P&T	1200	25	150	900
BH-44	Core P&T	1100	25	180	900
BH-44	Louch P&T	1359	0	189	965
BH-44	Spectra Physics	657	56	115	595
BH-64	Beazley HPLC **	180	28	367	43
BH-64	Beazley HPLC **	164	8	389	9
BH-64	Core P&T	200	40	480	10
BH-64	Core P&T	200	40	490	10
BH-64	Core P&T	210	40	520	10
BH-64	Louch P&T	329	0	314	21
BH-64	Louch/Hooper P&T	242	0	323	16
BH-64	Louch/Hooper P&T	334	0	314	24
BH-64	Louch/Hooper P&T	321	0	306	23
BH-69	Beazley HPLC	43		121	0
BH-69	Core P&T	55	35	130	5
BH-69	Core P&T	55	30	120	5
BH-69	Core P&T	55	30	120	5
BH-69	Louch P&T	234	0	136	16
BH-69	Louch/Hooper P&T	167	0	108	19
BH-69	Louch/Hooper P&T	123	0	96	14
BH-69	Louch/Hooper P&T	184	0	111	19
BH-69	Spectra Physics	50	6	124	23
BH-70	Beazley HPLC	1876	29	862	32
BH-70	Core P&T	1800	50	650	50
BH-70	Core P&T	2300	50	800	50
BH-70	Core P&T	2200	50	800	50
BH-70	Louch P&T	1917	0	732	34
BH-70	Spectra Physics	1803	103	726	22
BH-73	Core P&T	1	1	1	1
BH-73	Core P&T	1	1	1	1
BH-73	Core P&T	1	1	1	1
BH-73	Louch P&T	0	0	0	0
BH-73	Louch/Hooper P&T	3	1	1	3
BH-73	Louch/Hooper P&T	3	1	1	3
BH-73	Louch/Hooper P&T	3	1	2	3

well_no	Analyst	benzene	toluene	eth_benz	xylenes
BH-84	Core P&T	210	30	60	20
BH-84	Core P&T	240	30	55	20
BH-84	Core P&T	240	30	55	30
BH-84	Louch P&T	213	0	91	0
BH-84	Louch/Hooper P&T	212	0	92	20
BH-84	Louch/Hooper P&T	216	0	94	21
BH-84	Louch/Hooper P&T	180	0	87	20
BH-84	Spectra Physics	216	35	76	29
BH-84	Spectra Physics	213	44	59	22
BH-84	Spectra Physics	208	47	52	15
BH-88	Beazley HPLC	515	36	269	726
BH-88	Beazley spcl	472	43	244	783
BH-88	Core P&T	550	100	250	750
BH-88	Core P&T	520	50	250	880
BH-88	Core P&T	580	50	260	990
BH-88	Louch P&T	920	0	345	942
BH-88	Louch/Hooper P&T	785	0	357	906
BH-88	Louch/Hooper P&T	794	0	360	885
BH-88	Louch/Hooper P&T	789	0	354	892
BH-88	Spectra Physics	169	28	55	17
BH-88	Spectra Physics	194	30	49	11
BH-88	Spectra Physics	184	41	47	11
BH-91A	Beazley HPLC	34			0
BH-91A	Core P&T	46	10	5	15
BH-91A	Core P&T	46	5	3	16
BH-91A	Core P&T	40	8	4	13
BH-91A	Louch P&T	40	0	0	0
BH-91A	Louch/Hooper P&T	39	3	11	22
BH-91A	Louch/Hooper P&T	39	5	7	27
BH-91A	Louch/Hooper P&T	37	2	7	20
BH-91A	Spectra Physics	48	22	4	9
BH-91A	Spectra Physics	38	19	4	8
BH-91A	Spectra Physics	38	22	4	8

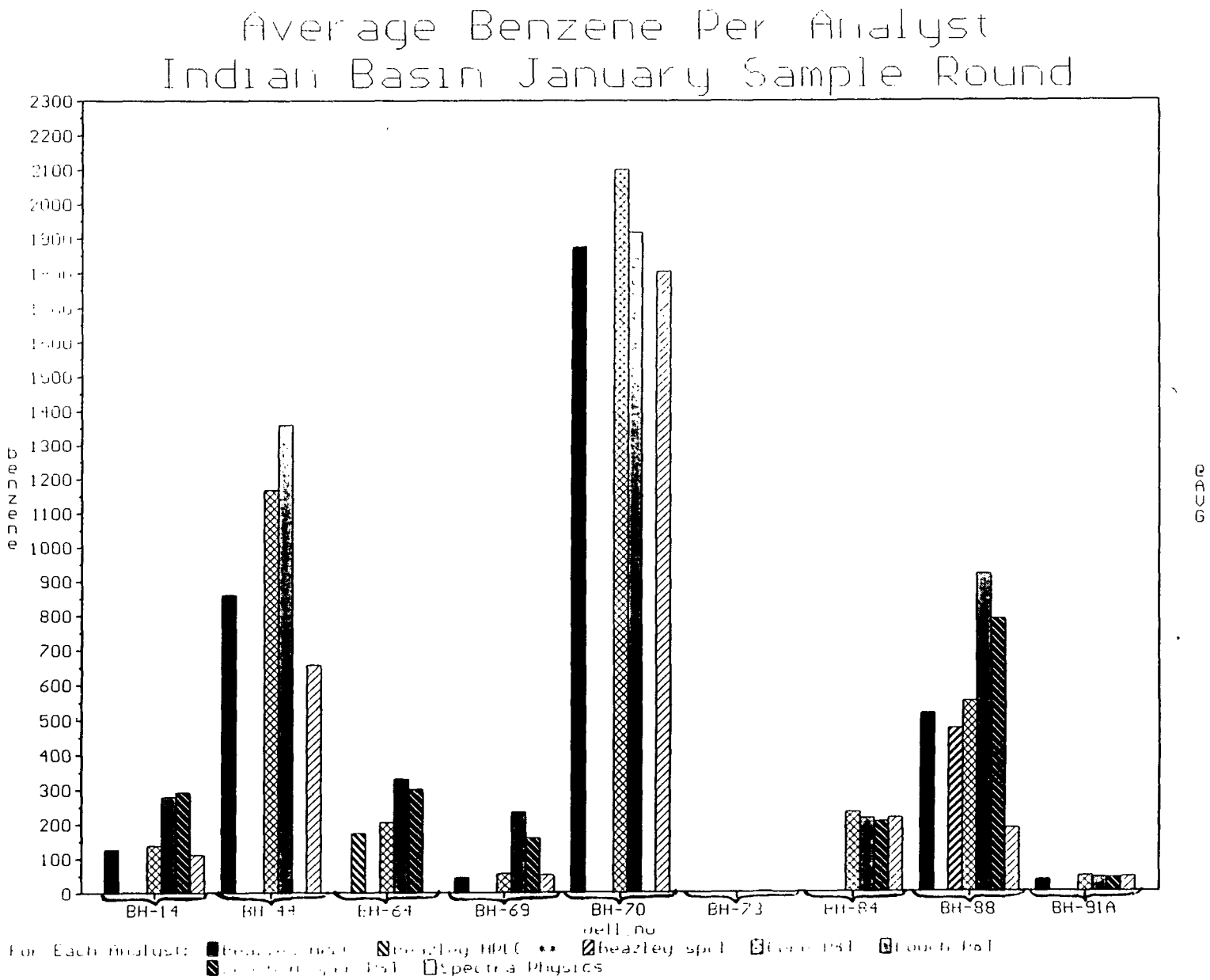


Fig. 1 Average Benzene

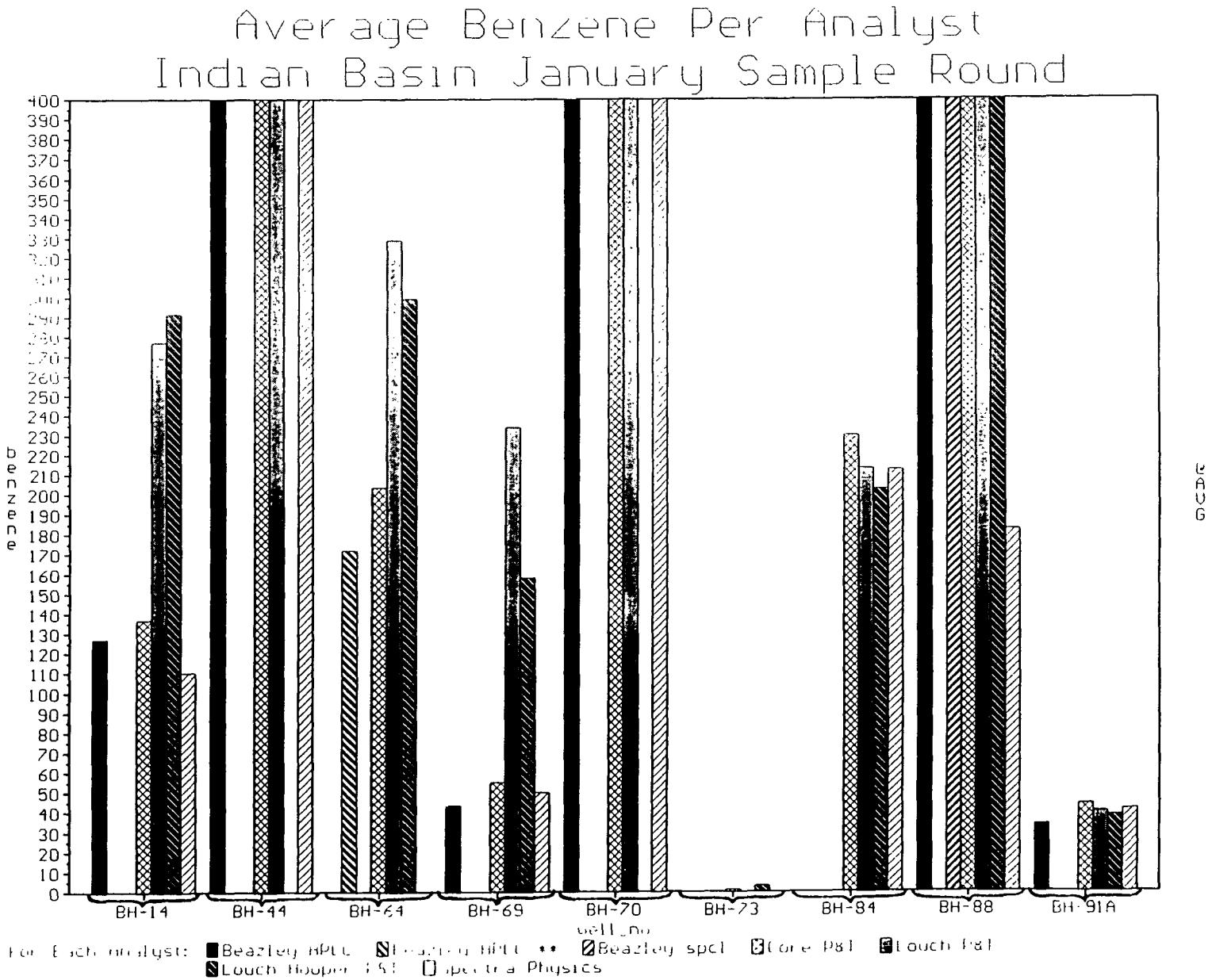


Fig. 2 Average Benzene (y-scale changed for comparison of small values)

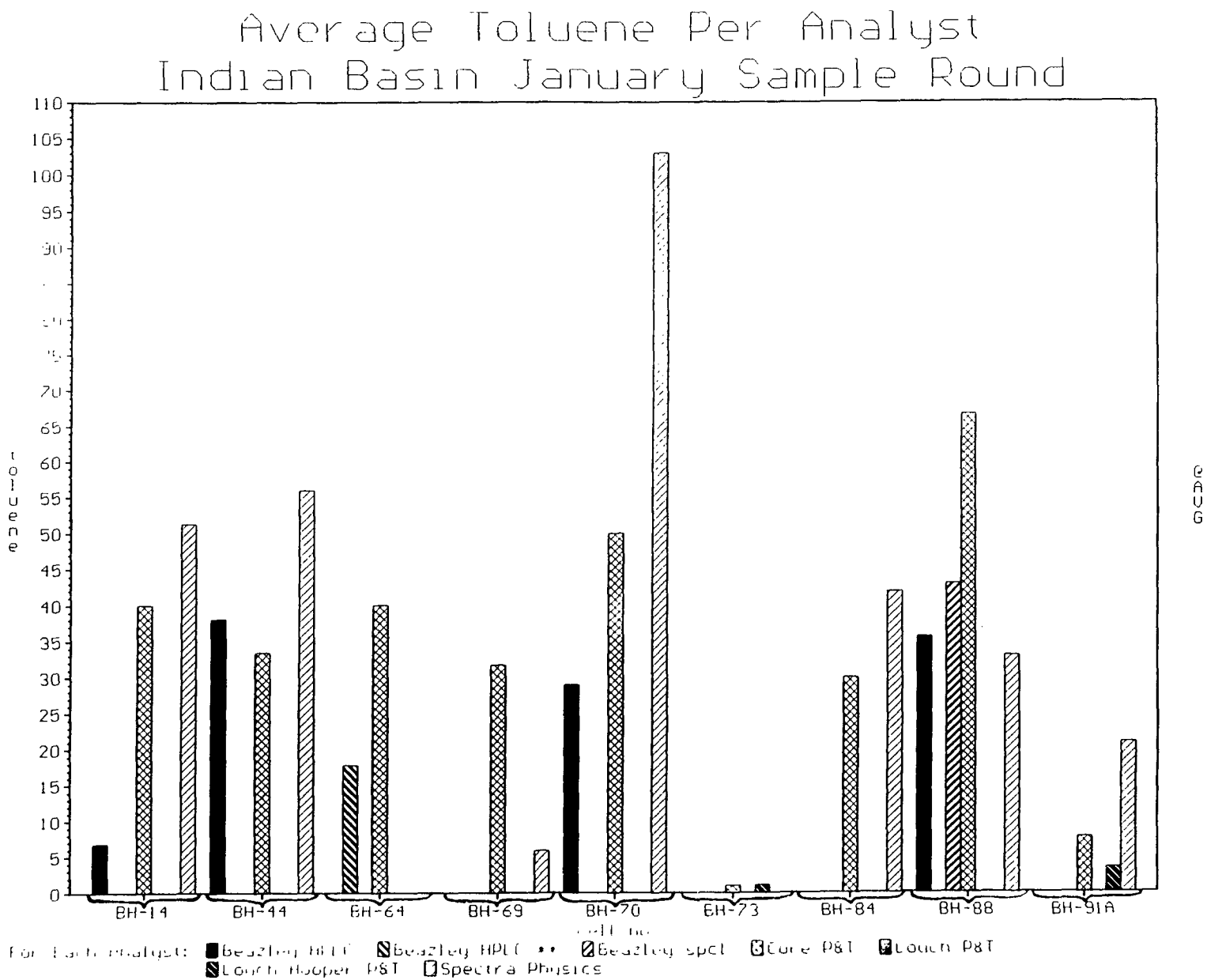


Fig. 3 Average Toluene

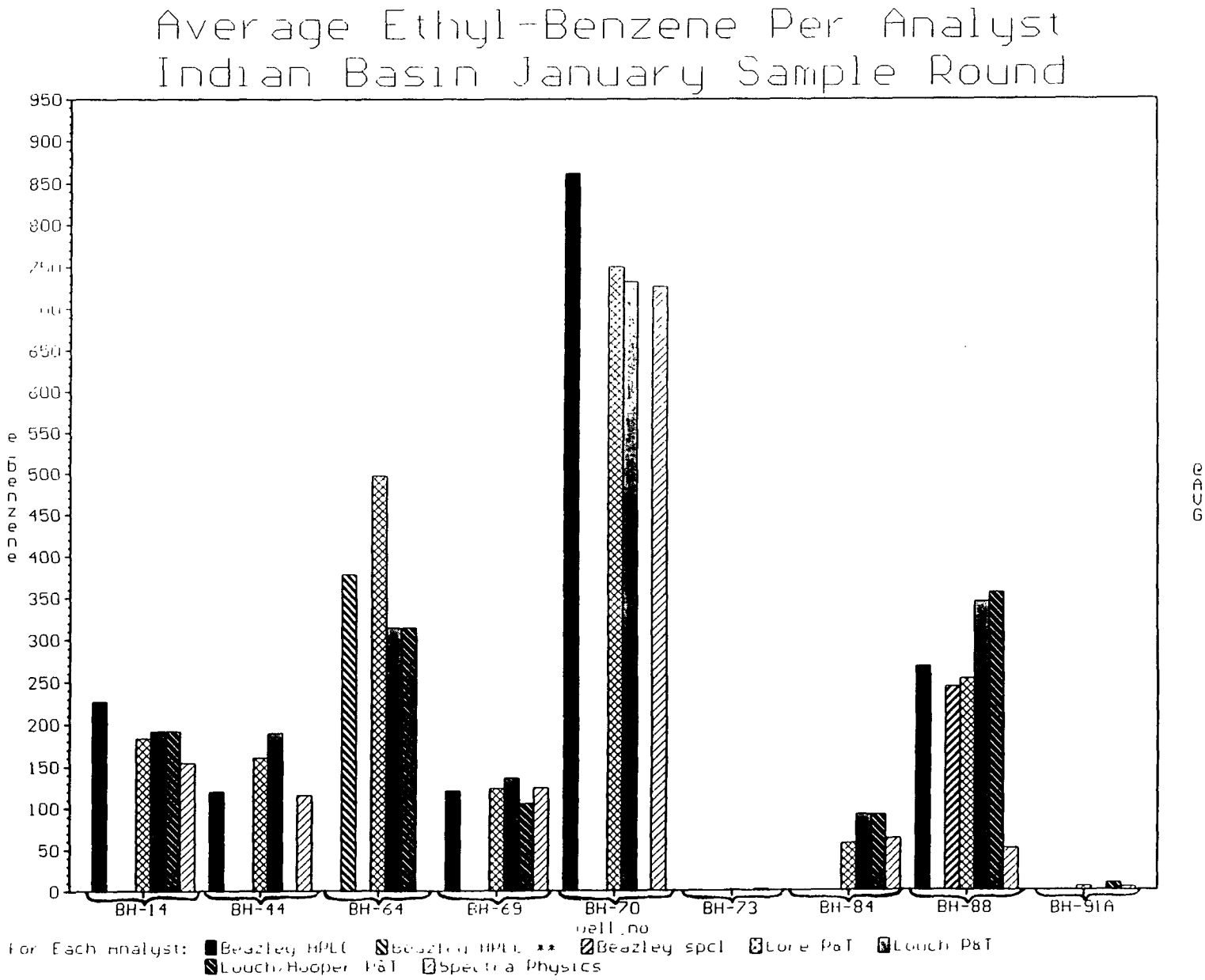


Fig. 4 Average Ethyl-Benzene

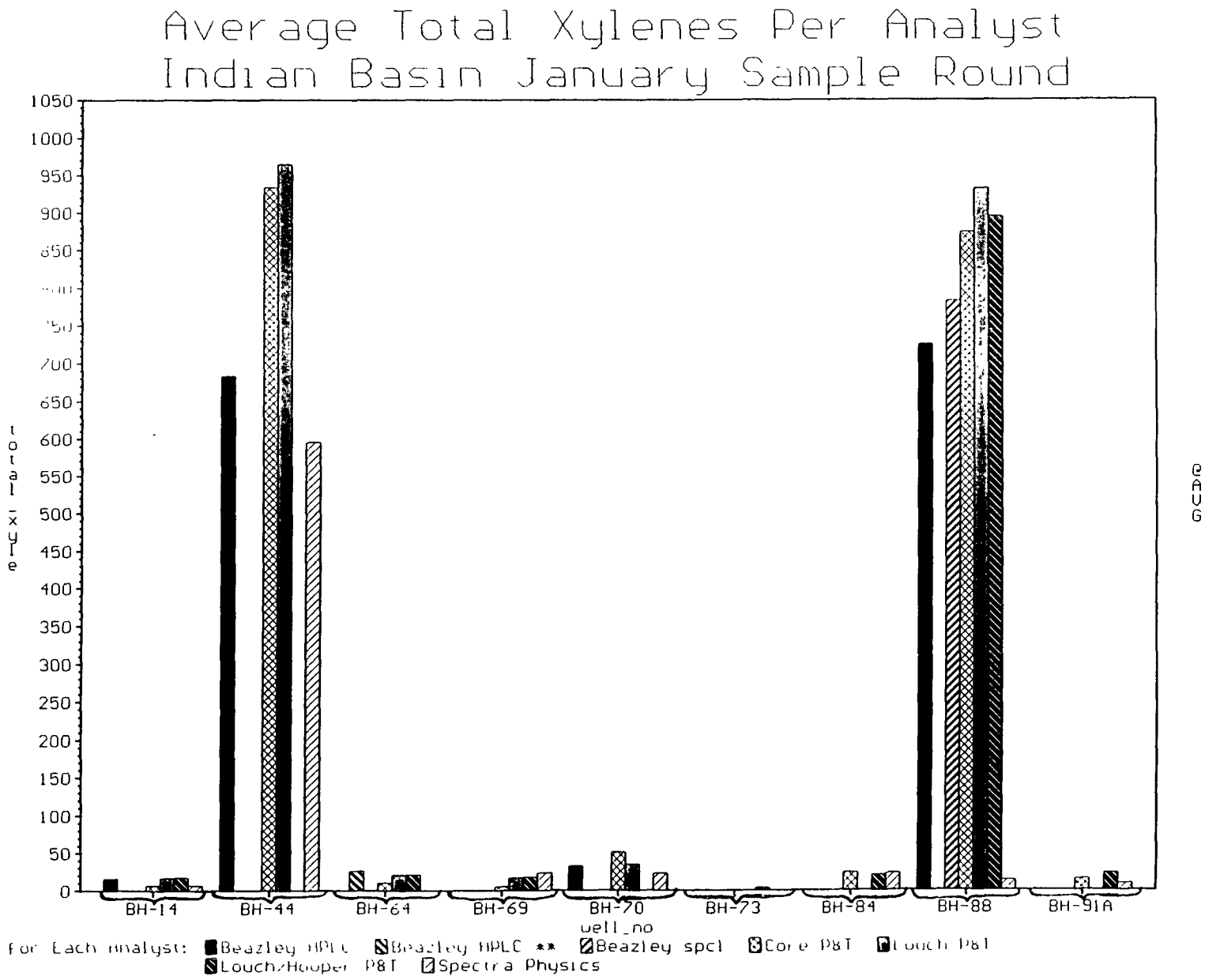


Fig. 5 Average Xylenes

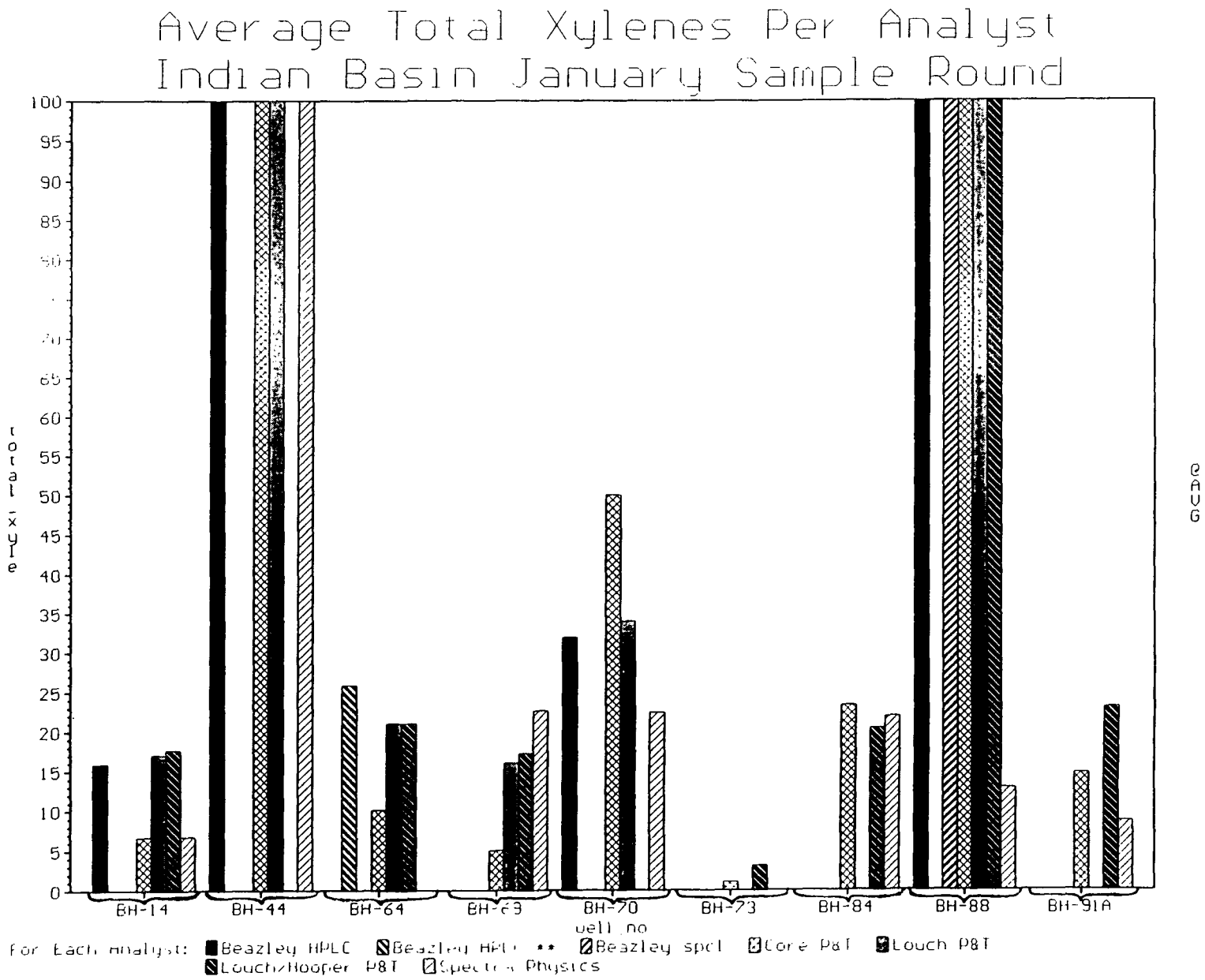


Fig. 6 Average Xylenes (y-scale changed for comparison of small values)

- Winton Quarter pt in time sampling will begin next week
  40 wells to be sampled
    9 Lower Queen
    31 Shallow

- Treatment plan

  - metals below stds. AH-83
    chloride " " in Lower Queen
  - Lower Queen is exposure pathway (G.W.)
    soils and shallow G.W. to be cleaned since act as continuing source

Risk Assessment

Monitoring Program

OCD/BLM/Marathon Meeting 12/13/91

participants -
Bill Olson - OCD Santa Fe
Joe Chester - BLM "
Roger Anderson - OCD
Chris Eustice - " Hobbs
Doug Kenyon - Marathon
Jeff Lynn - "
Lee Wilson - Wilson + Assoc.
Dave Schaffhauser - BLM, Santa Fe
Bob Unger - Marathon

RU. Review last documents

JL - Review recent activity since Nov. 1, 1991 (get copies)
3930 ~~[illegible]~~ lbs condensate removed in 51 days of vapor venting

- Review Dec. sampling program

- Environmental Treatment Plan
Chloride Isopleth maps - 200 ppm Cl^- in BH-88
(ie chemicals of concern)
Review receptors risk assessment

DK. Review - water treatment
gathering system for recovery wells to be completed by next week, pumping will then be increased
- condensate in 94 appears to be mix of old new condensate

STATE OF NEW MEXICO

STATE ENGINEER OFFICE
SANTA FE

ELUID L. MARTINEZ
State Engineer

BATAAN MEMORIAL BUILDING, ROOM 101
POST OFFICE BOX 25102
SANTA FE, NEW MEXICO 87504-5102

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

December 9, 1991

Marathon Oil Company
P.O. Box 552
Midland, TX 79702

William H. Schaffer Ranch
c/o Hennighausen & Olsen
Fred H. Hennighausen
Suite 650 Hinkle Bldg.
108 E 3rd St.
Roswell, NM 88201

File Nos.: RA-5131-S-2 thru RA-5131-S-14
Applicant: Marathon Oil Company
Protestant: William H. Schaffer Ranch

Greetings:

Protest to the granting of the above-numbered application have been filed in this office.

If an agreement cannot be reached between the applicant and protestant to which the State Engineer can agree, a hearing date will be set by the State Engineer upon receipt of a written request from the applicant.

If a hearing is necessary on this matter, each party will be required to submit a hearing deposit in an amount that will be specified when the hearing is announced by the State Engineer.

We are enclosing a copy of the protest for the applicant's files.

Sincerely,

Eluid L. Martinez
State Engineer

by:
Calvin Chavez
Assistant Chief
Water Rights Division

CC:egr
Enclosure
cc: District II
Lee Wilson & Associates

RECEIVED
MARATHON OIL COMPANY
DEC 1 2 1991
PRODUCTION MANAGER
MIDLAND OPERATIONS
MIDLAND, TEXAS

HENNIGHAUSEN & OLSEN
ATTORNEYS AT LAW
SUITE 650 HINKLE BUILDING
108 EAST 3RD STREET
ROSWELL, NEW MEXICO 88201

F. H. HENNIGHAUSEN
A. J. OLSEN

AREA CODE 505
TELEPHONE 624-2463
FAX 624-2159

December 4, 1991

'91 DEC 6 AM 9 45
STATE ENGINEER OFFICE
SANTA FE NEW MEXICO

Eluid Martinez
State Engineer
1900 West Second St.
Roswell, New Mexico 88202

RE: RA-5131-S-2 thru RA-5131-S-14

Dear Mr. Martinez:

Enclosed is Protest to Application of Marathon Oil Company's Application No. RA-5131-S thru RA-5131-S-14.

Sincerely,

Fred H. Hennighausen

FHH/cj

enclosure

'91 DEC 5 AM 10 43
STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

BEFORE THE NEW MEXICO STATE ENGINEER

'91 DEC 6 AM 9 45
STATE ENGINEER OFFICE
SANTA FE NEW MEXICO

In the Matter of the Application of Application No. RA-5131-S thru RA-5131-S-14 of Marathon Oil Company.

PROTEST

The William H. Schaffer Ranch, by Patricia Schaffer Lyman et al. hereby protests Application No. RA-5131-S-2 thru RA-5131-S-14 of Marathon Oil Company filed with the State Engineer on September 27, 1991.

The Schaffer Ranch objects that the granting of the application may be detrimental to the domestic and stock water rights of the Schaffer ranch and may be contrary to the conservation of water within the state and detrimental to the public welfare of the state.

Protestant is not objecting to efforts to clean up any pollution which has occurred nor to delay the initiation of such efforts but is unable to ascertain from the publication how the pollution which has occurred may be directed by pumping from the proposed wells, nor where it is now located. For these reasons protestant cannot specifically, at this time, ascertain the possible affects. Schaffer Ranch anticipates by filing of this protest that that this information will be provided.

William H. Schaffer Ranch
Patricia Schaffer Lyman et al.

By: Fred H. Hennighausen
Fred H. Hennighausen
Hennighausen & Olsen

DEC 5 AM 10 43
STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

DIVISION
DEC 9 05

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

December 3, 1991

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Final analytical results from the water sample obtained from your well on October 21, 28 and November 4, 1991 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager

RFU/SAP/elk

Attachments (filed separately)

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

December 3, 1991

Mr. & Mrs. Walter Biebelle
646 Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. & Mrs. Biebelle:

Final analytical results from the water samples obtained on October 21 and November 4, 1991 from your well and from natural springs located in Rocky Arroyo and utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present in any of the samples.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager
Midland Operations

RFU/SAP/elk

Attachments (filed separately)

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 876

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

December 3, 1991

RECEIVED
DEC 0 9 1991
OIL CONSERVATION DIV.
SANTA FE

Mr. & Mrs. Lee
P. O. Box 89
Lakewood, New Mexico 88254

Re: Water Well Analysis

Dear Mr. & Mrs. Lee:

Final analytical results from the water samples obtained on October 21 and November 4, 1991 from your well located next to the paved road approximately 0.5 miles west of Marathon's Indian Basin Gas Plant have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager
Midland Operations

RFU/SAP/elk

Attachments (filed separately)

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 804

OIL CONSERVATION DIVISION
RECEIVED
'91 DEC 9 AM 9 05

Mid-Continent Region
Production United States

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

December 3, 1991

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. Wayne Gregory:

Final analytical results from the water samples obtained on October 21 and November 4, 1991 from a natural spring located in Rocky Arroyo are attached. In discussing this water source with Mr. Biebelle, he indicated that the water it supplies is utilized by the Biebelle's for stock water, and also by you for stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager
Midland Operations

SAP/RFU/elk

Attachments (filed separately)

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
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'91 DEC 9 AM 9 05

December 3, 1991

RECEIVED
DEC 0 9 1991
OIL CONSERVATION DIV.
SANTA FE

Mr. & Mrs. Howell
P. O. Box 94
Lakewood, New Mexico 88254

Re: Water Well Analysis

Dear Mr. & Mrs. Howell:

Final analytical results from the water samples obtained from your domestic and stock wells on October 21 and November 4, 1991 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

Robert F. Unger
Production Manager
Midland Operations

RFU/SAP/elk

Attachments (filed under analyses)

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 805

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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1991 NOV 25 AM 9 29

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

November 21, 1991

Roger Anderson, Environmental Engineer
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin site since the report of November 1. This report begins the recently agreed frequency of monthly updates.

SHALLOW IMPACTED AREA

- The venting pilot recoveries displayed a decay which will now allow for total system design. Downhole air flow logging (with Marathon proprietary device) is underway.

- Experimentation continues with various wind vane designs, in an effort to prove passive venting as an alternative to electric-driven motors.

- Routine sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo continues. The samples have been forwarded to Core Laboratories in Aurora, Colorado for BTEX and chloride analyses. To date, no BTEX or elevated chlorides have been detected.

LOWER QUEEN

- After approval from the State Engineer's office on November 1, continuous pumping of the six Lower Queen recovery wells began. Initially, withdrawals are being limited to ±200 BPD in an effort to "skim" the product off the top of the aquifer. Recoveries to date from the Lower Queen are 10 BC and 4954 BW. It is felt that high rate withdrawals may cause water to under ride the product. Once the permanent PVC gathering system is installed, rates may be increased to the maximum well deliverability.

- Right-of-way for the gathering system was approved by the BLM on November 20; construction of the permanent electrical system is underway. The meters which were installed at the directive of the Watermaster have proven to be incompatible with the fluids being produced. The rubber components swell, apparently when in contact with even low concentrations of product. Well 87A was shut-in for this reason. Negotiations are underway in an effort to secure the Watermaster's approval for an alternative.

- Final designs and quotes have been received from air stripper manufacturers.

- Preliminary experiments of spray-extraction of hydrocarbons from Lower Queen water have demonstrated that it will provide water quality which is within the State discharge standards. This technique will continue to be pursued as an option to air stripping.

Very truly yours,

Robert F. Unger

Robert F. Unger
Production Manager
Midland Operations

RFU/elk

cc: J. L. Benson
D. E. Kenyon
A. R. Kukla
J. S. Lynn
S. A. Pohler
M. B. Williams (OCD - Artesia)

OIL CONSER ON DIVISION
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'91 NOV 25 AM 10 30

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

November 20, 1991

William Olson
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Olson:

I am writing to request OCD concurrence with a Marathon proposal to reduce the frequency of rancher water well and surface water monitoring activity in the vicinity of Marathon's Indian Basin Gas Plant. During our October 31st meeting, a presentation was given discussing sampling frequency of the rancher wells and nearby surface waters. Marathon continues to routinely monitor the following locations:

	LOCATION	PRESENT FREQUENCY
1.	P. Lyman Water Tank	One Per Week
2.	Upper Indian Hills Spring West	One Per Two Weeks
3.	Lower Indian Hills Spring	One Per Two Weeks
4.	Biebelle Water Well	One Per Two Weeks
5.	Spring Feeding Surface Water	One Per Two Weeks
6.	Upper Indian Hills Spring East	One Per Two Weeks
7.	MOC Water Well No. 1	One Per Two Weeks
8.	MOC Well 1A (Emergency Well)	One Per Two Weeks
9.	Lee Water Well	One Per Two Weeks
10.	Richard Howell Water Well (Home)	One Per Two Weeks
11.	Richard Howell Windmill Well	One Per Two Weeks

The location of these sampling points has been previously transmitted to you on November 15 along with the point-in-time sample analysis data. To date, Marathon continues to sample the above points at the listed frequencies with no indications of hydrocarbons and/or abnormally high chloride concentrations. Over 140 samples have been analyzed thus far.

On November 1, Marathon initiated a program of emergency withdrawal from the Lower Queen to recover free product identified during the site characterization work. This program is designed to pump six Lower Queen wells to promote free product recovery and aid Lower Queen plume containment. The cumulative recoveries to date are 10 BC 4954 BW.

Based upon the lack of hydrocarbons or elevated chlorides evidenced in the numerous samplings to date and the initiation of the Lower Queen emergency pumping program, Marathon proposes a phased reduction in the frequency of rancher water well and surface water sampling. The first step is outlined below:

	LOCATION	PROPOSED FREQUENCY
1.	P. Lyman Water Tank	One Per Two Weeks
2.	Upper Indian Hills Spring West	One Per Month
3.	Lower Indian Hills Spring	One Per Month
4.	Biebelle Water Well	One Per Month
5.	Spring Feeding Surface Water	One Per Month
6.	Upper Indian Hills Spring East	One Per Month
7.	MOC Water Well No. 1	One Per Month
8.	MOC Well 1A (Emergency Well)	Discontinue Sampling
9.	Lee Water Well	One Per Month
10.	Richard Howell Water Well (Home)	One Per Month
11.	Richard Howell Windmill Well	One Per Month

As more data is acquired relevant to the Lower Queen withdrawals, we would envision proposals for further adjustments.

We would appreciate your earliest possible response to this requested change. Should you need additional information, please contact either myself or Jeffrey Lynn of my staff at your convenience.

Sincerely,

Robert F. Unger
Production Manger
Midland Operations

RFU/JSL/elk

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 684 817 676

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

November 20, 1991

William Olson, Hydrogeologist
State of New Mexico
Oil Conservation Division
P.O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
P. O. Box 1397
Roswell, New Mexico 88202

Enclosed for your files are final records of borehole and monitor wells for the Indian Basin Project. These replace and update previous versions submitted August 22, 1991. New borehole records are submitted for wells BH-91A, BH-92, BH-93, BH-94, BH-95, BH-96, and BH-97 as these were not available at the last submission.

Any changes from previous versions are small, representing attempts for completeness or clarity, and in no way alter interpretations or conclusions.

If you have any questions or would like to see a detailed itemized list of the nature of the changes in each borehole please do not hesitate to call.

Very truly yours,

Robert F. Unger
Production Manager
Midland Operations

RFU/dk

Enclosures

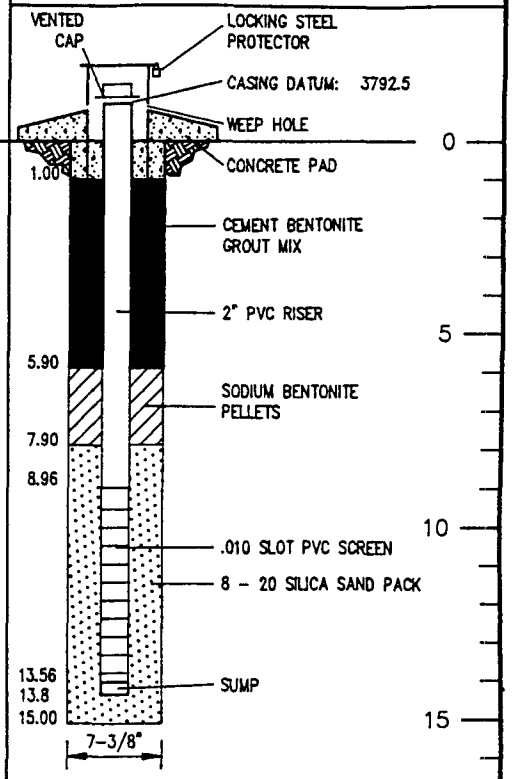
WELL COMPLETION AND SOIL BORING RECORDS

SHALLOW ALLUVIUM

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3789.14				
	0	CLAYEY SILT: BROWN, 7.5YR5/2, DRY FROM 0.0 TO 9.0', LOW TO MEDIUM PLASTICITY, VERY FINE QUARTZ, 60% SILT, 40% CLAY	ML		1 NS	
					2 NR NS	1.1
	5					
		MOIST BELOW 9.0'			3 NR NS	0.8
	10	SATURATED BELOW 11.26'				
11.26'						
	13.5	SANDY GRAVEL: DARK GRAY, 10 YR 5/1, COARSE GRAVEL, FINE GRAIN SAND, SATURATED, QUARTZ, ROUNDED TO ROUNDED SUBANGULAR, POORLY SORTED, STRONG ODOR	GM		6 7	1.5
	15	15.1 DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 5/2, MASSIVE	DOLOMITE		NR	
		AUGER REFUSAL AT 15.1'				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-1 (BH-14)*

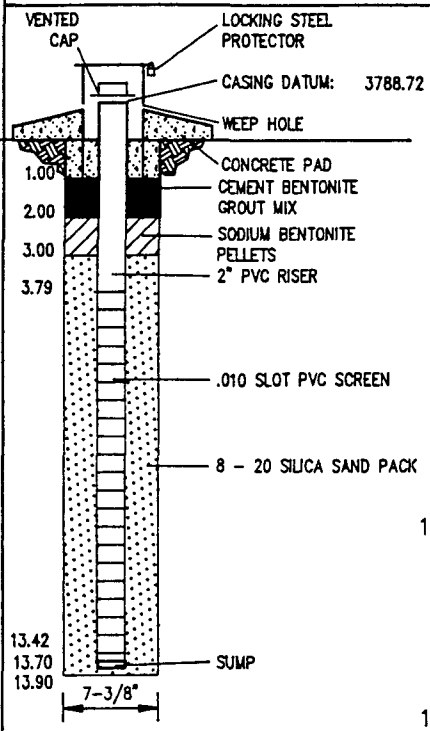
DATE DRILLED 4/25/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3786.9				
	0	CLAYEY SILT: 10% CLAY, 90% SILT, LOW PLASTICITY, 7.5 YR 6/4, LIGHT BROWN, DRY, MASSIVE	ML		NS; 1 (1.2'); NR	
	4.0	SANDY CLAYEY SILT: 10% SAND, 10% CLAY, 80% SILT, VERY FINE GRAIN SILICA SAND, LOW PLASTICITY, 7.5 YR 7/2, PINKISH GRAY, DRY	ML		NS; 2 (1.4'); NR; NS; 3 (0.3')	
	7.3	COBBLEY SILT: ABUNDANT DOLOMITE COBBLES, MINOR SUBROUNDED DOLOMITE GRAVEL, UNCONSOLIDATED, DRY, 5 YR 7/1, LIGHT GRAY	GM		NS; 4 (0.9'); NR; NS; 5 (0.8'); NR; NS	
	13.9	AUGER REFUSAL 13.9'				
		NO GROUNDWATER WHILE DRILLING				

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-2 (BH-23)***

DATE DRILLED 5/2/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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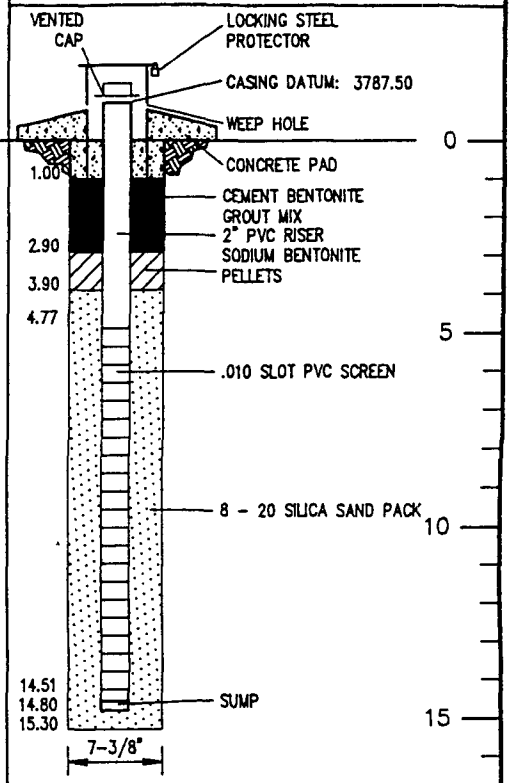
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3785.4				
	0	SANDY CLAYEY SILT: 10% SAND, 10% CLAY, 80% SILT, VERY FINE GRAIN SAND, MINOR DOLOMITE GRAVEL, 10 YR 6/4, LIGHT YELLOWISH BROWN, DRY, UNCONSOLIDATED	ML		NS	
					1	1.5
					NS	
	5				2	1.0
					NR	
					NS	
					3	1.1
					NR	
					NS	
	10				4	0.8
	10.8	COBBLEY SILT: 10 YR 7/3, VERY PALE BROWN, DOLOMITE COBBLES, DRY, UNCONSOLIDATED, MINOR DOLOMITE GRAVEL > 0.1' DIAMETER	GM		NR	
					NS	
					5	0.8
					NR	
					6	1.0
	15					
	15.3	SANDY DOLOMITE: VERY FINE GRAIN SAND, 10 YR 6/3, PALE BROWN, VERY HARD, DRY	DOLOMITE		NR	
		AUGER REFUSAL 15.3'				
		NO GROUNDWATER WHILE DRILLING				
		BOREHOLE OVM: 0.0 PPM				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-3 (BH-24)***

DATE DRILLED 5/2/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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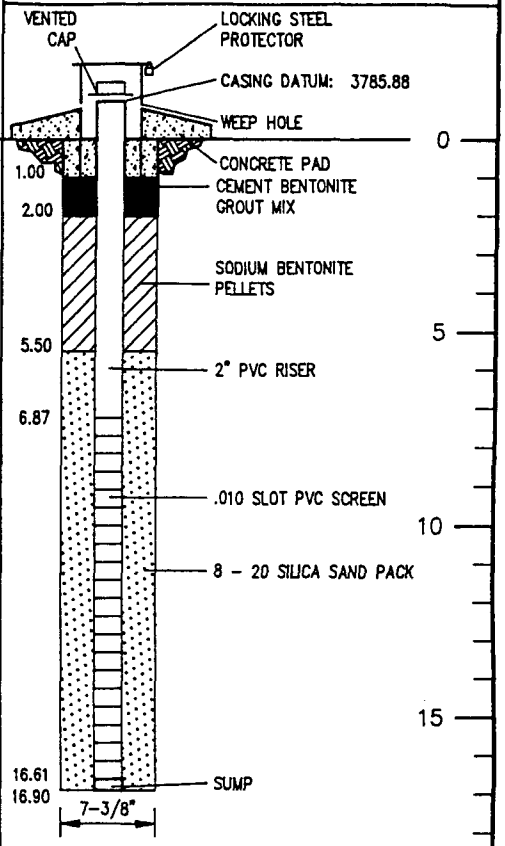
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3784.1				
	0	SANDY CLAYEY SILT: VERY FINE GRAIN SAND, 10% SAND, 10% CLAY, 80% SILT, LOW PLASTICITY, 10 YR 6/4, LIGHT YELLOWISH BROWN, DRY, UNCONSOLIDATED, MINOR SUBROUNDED DOLOMITE GRAVEL	ML		NS	
	2.0	COBBLEY SILT: DOLOMITE, COBBLES, 10 YR 7/2, LIGHT GRAY, DRY, UNCONSOLIDATED, ABUNDANT GRAVEL TO 0.15' IN DIAMETER	GM		1	0.9
					NR	
					2	1.5
	5				NS	
					3	1.0
					NR	
					NS	
					4	0.8
	10				NR	
					NS	
					NR	
					NS	
					5	0.6
					NR	
	15				NS	
	16.8					
	16.9	SANDSTONE: VERY FINE GRAIN QUARTZ, 10 YR 7/2, LIGHT GRAY, DRY, HARD, WEAK CEMENTATION, FRIABLE	SANDSTONE			
		AUGER REFUSAL AT 16.9' NO GROUNDWATER ENCOUNTERED WHILE DRILLING BOREHOLE OVM: 0.0 PPM				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-4 (BH-26)***

DATE DRILLED 5/3/91 - 5/4/91
DRILLING METHOD HSA
DRILLED BY SBH
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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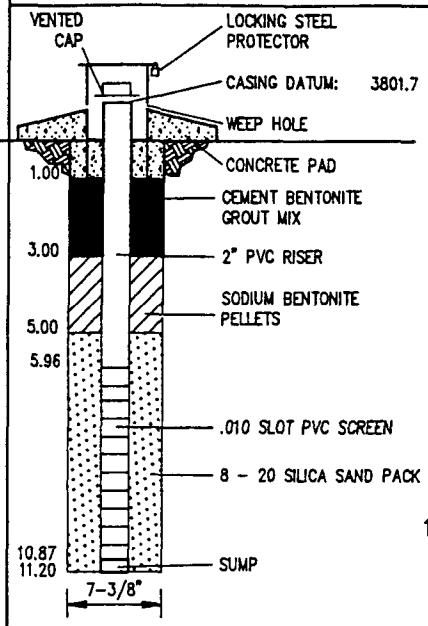
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3799.8				
	0	SANDY SILT: 20% VERY FINE GRAIN SAND, 80% SILT, NO PLASTICITY, 10 YR 7/3, VERY PALE BROWN, DRY, UNCONSOLIDATED	SM		NS	
					1	1.2
	3.7	SILTY SANDSTONE: VERY FINE GRAIN QUARTZ, 10 YR 8/2, WHITE, DRY, WEAKLY CEMENTED, FRIABLE	SILTY SANDSTONE		NR	
					NS	
	5				2	1.0
					NS	
					3	0.6
		MOIST AT 8.0', 2.5 Y 7/4, PALE YELLOW,			NS	
		VERY MOIST AT 9.0'			4	0.3
					NS	
	10	AFTER 11.0', VERY HARD			5	0.2
	11.2	AUGER REFUSAL 11.2' NO GROUNDWATER ENCOUNTERED WHILE DRILLING BOREHOLE OVM: 8.0 PPM				
	15					
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/90129***

BORING NUMBER ***MW-5 (BH-28)***

DATE DRILLED 5/5/91
DRILLING METHOD HSA
DRILLED BY SBH
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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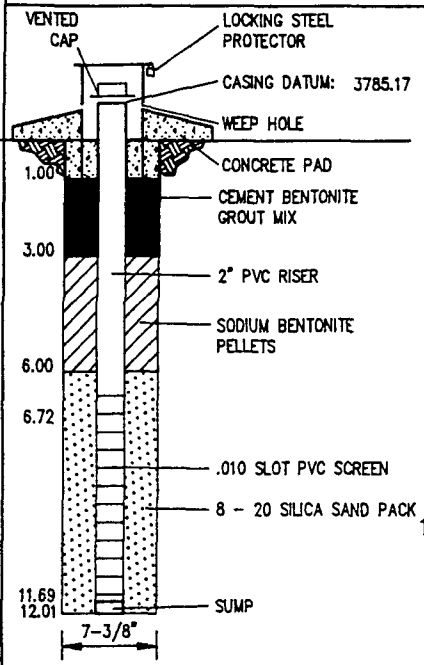
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3783.2				
	0	COBBLEY SILT: DOLOMITE COBBLES TO 1.5' IN DIAMETER, 10 YR 5/3, BROWN, DRY, UNCONSOLIDATED AFTER 0.9', 10 YR 8/2, WHITE, ABUNDANT SUBROUND DOLOMITE GRAVEL	GM		NS 1 1.1 NR NS 2 0.7 NS 3 1.2 NS 4 0.6 NS	
	5					
	10					
	12.3	AUGER REFUSAL 12.3' NO GROUNDWATER ENCOUNTERED WHILE DRILLING				
	15					
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

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JOB NAME/NUMBER *MARATHON/90129*

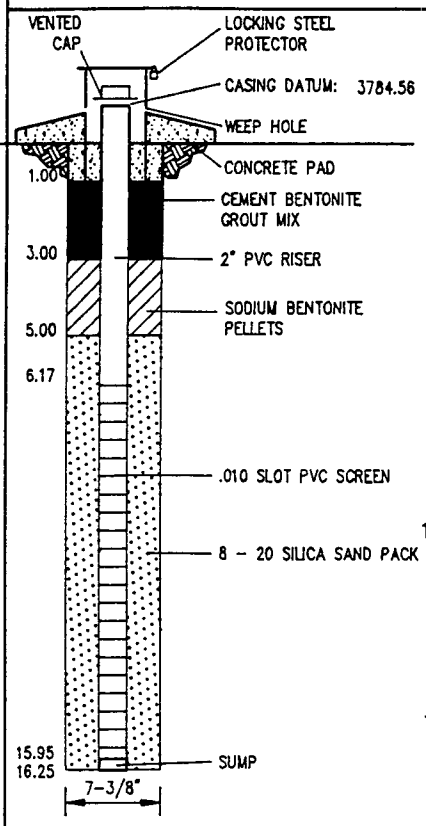
BORING NUMBER *MW-6 (BH-29)*

DATE DRILLED 5/5/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3783.5				
	0	GRAVELLY BOULDERY COBBLEY SILT: BROWN, 7.5YR5/6, DRY, UNCONSOLIDATED, COBBLES AND BOULDERS FROM 5 CM TO 1 M, VERY FINE QUARTZ, WELL ROUNDED GRAVEL	GM		1 NS; 2; 3 NS; NR; 4 NR NS; 5 NR	GC; 1.5; 0.0; 0.4; 0.6
	13.5	SILTY CLAY: BROWN, 10 YR 5/6, VERY FINE QUARTZ, LOW PLASTICITY, DRY, MEDIUM COMPACTION, ABUNDANT CALICHE AND ROOT CHANNELS, 60% CLAY, 40% SILT, WEATHERED AT CONTACT, CALICHE CEMENTED	CL		6 NS	1.5
	15.5		DOLOMITE		NR	
	16.3	DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 5/2, VERY HARD, SANDY, MASSIVE				
		AUGER REFUSAL AT 16.3'				
		GROUNDWATER NOT OBSERVED DURING DRILLING				

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-7 (BH-30)***

DATE DRILLED 5/6/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
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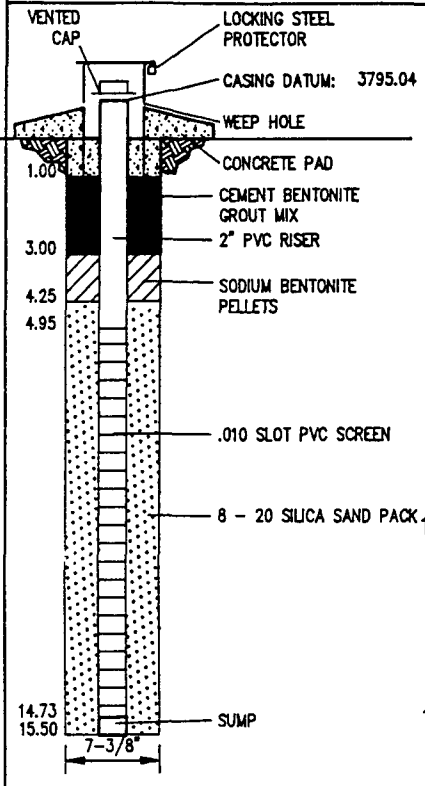
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3792.8				
	0	BOULDERY COBBLEY GRAVELLY SILT: BROWN, 10YR 5/6, DRY, VERY LOW PLASTICITY, UNCONSOLIDATED, COBBLES AND BOULDERS FROM 5CM TO 1M, ROUNDED	GM		1 NS	1.0
					2 NR	0.8
					3 NR	1.1
	5				NS	
					4 NR	0.8
					NS	
					5 NS	1.0
	10					
					6 NS	0.4
					7 NS	0.1
	15				NR	0.0
	15.3	AUGER REFUSAL AT 15.5'				
		GROUNDWATER NOT ENCOUNTERED WHILE DRILLING				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-8 (BH-31)***

DATE DRILLED 5/6/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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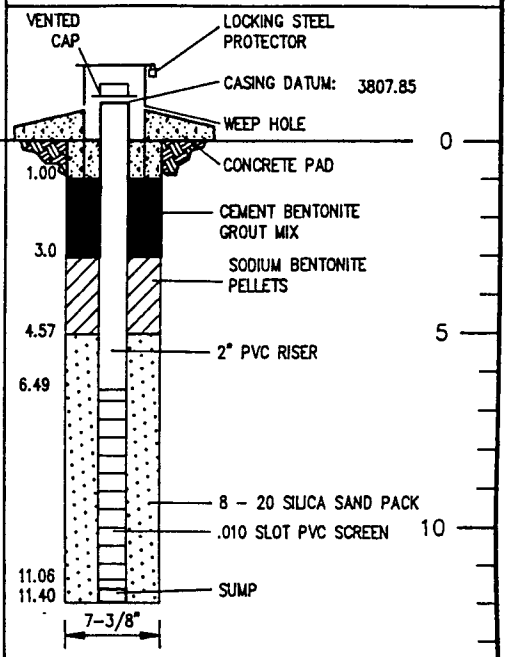
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3805.6				
	0	CLAYEY SILT: DARK BROWN, 7.5 YR 4/2, VERY FINE QUARTZ, DRY, VERY LOW PLASTICITY, GRAVELLY, 60% SILT, 40% CLAY, CALICHE DEPOSITS	ML		1 GC NS; 2 0.6 NR; 3 0.3 NR 0.5	
	5	BOULDERY COBBLEY GRAVELLY SILT: BROWN, 7.5 YR 5/2, DRY, UNCONSOLIDATED, COBBLES AND BOULDER FROM 5 CM TO 50 CM, ROUNDED	GM		NS; 4 0.1 NS; 5 0.6 NR NS	
	9.5	SANDSTONE: QUARTZ, GRAYISH YELLOW TO YELLOWISH GRAY, 5 Y 8/4 TO 7/2, FINE GRAIN, WELL SORTED, POORLY CEMENTED, FRIABLE	SANDSTONE			
	10					
	12.0	AUGER REFUSAL AT 12.0' GROUNDWATER NOT ENCOUNTERED WHILE DRILLING				
	15					
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-9 (BH-32)***

DATE DRILLED 5/7/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
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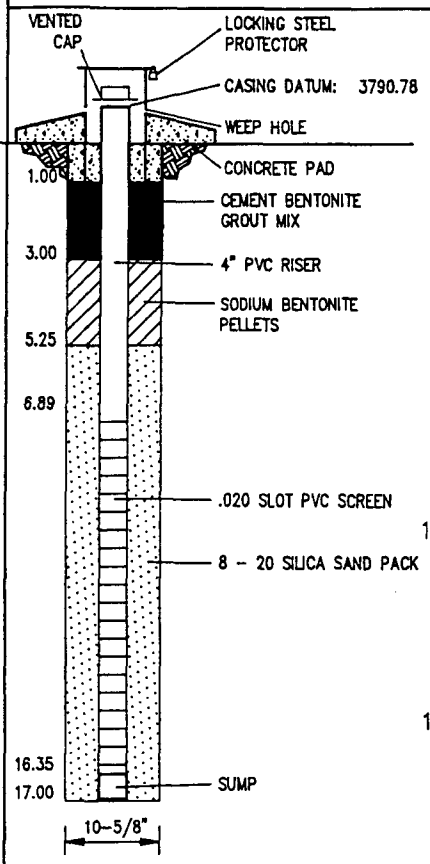
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3788.7				
	0	CLAYEY SILT: YELLOWISH BROWN, 10 YR 5/4, DRY, VERY LOW PLASTICITY, VERY FINE QUARTZ, CALICHE DEPOSITS, 60% SILT, 40% CLAY	ML		1 NS; 2 NR; 3	GC; 0.6; 1.1
	5 5.0	SILTY CLAY: DARK BROWN, 10 YR 4/3, VERY FINE QUARTZ, LOW PLASTICITY, MODERATELY COMPACTED	CL		NR NS; 4 NR NS	0.8
	10	MOIST BELOW 9.5', LOW PLASTICITY			5 NR NS	0.7
	12.6	BOULDERY COBBLEY GRAVEL: LIGHT GRAYISH BROWN, 10 YR 5/2 TO 6/2, ROUNDED, CALICHE CEMENTED, HARD	GM			
	13.5	CLAYEY SAND TO SANDY CLAY: BROWN, 10YR5/3, QUARTZ, FINE GRAIN, WELL SORTED, SATURATED, MEDIUM PLASTICITY, STRONG HYDROCARBON ODOR	SM		6 NR NS; NR	4.3
▽ 16.0'	15					
	16.6	AUGER REFUSAL AT 16.5'				
		NOTE: BOREHOLE REEMED 10 INCHES TO A DEPTH OF 17.01', 5/8/91				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-10 (BH-33)***

DATE DRILLED 5/8/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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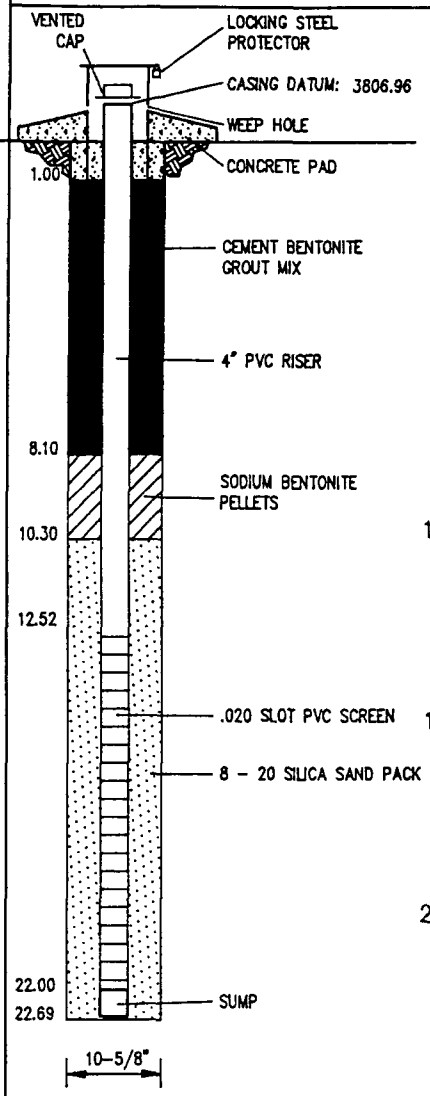
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3804.8				
	0	CLAYEY SILT: YELLOWISH BROWN, 10 YR 5/4, DRY, UNCONSOLIDATED, VERY LOW PLASTICITY, VERY FINE GRAIN QUARTZ, 70% SILT, 30% CLAY	ML		1 NS; 2 NR; 3 NR NS	GC; 1.1
	4.5	GRAVELLY COBBLEY SILT: GRAYISH BROWN, 10 YR 5/2, VERY FINE QUARTZ, POORLY SORTED, UNCONSOLIDATED, COBBLES AND PEBBLES FROM 3 TO 10CM, ROUNDED, DOLOMITE	SM		4 NR NS	1.1
	7.5	SILTY SAND: YELLOWISH BROWN, 10YR5/4, QUARTZ, VERY FINE TO MEDIUM GRAIN, POORLY SORTED, ANGULAR, ABUNDANT K-FELDSPAR AND BIOTITE, MODERATELY COMPACTED, STRUCTURELESS	SM		5 NR NS	1.3
	10	COBBLEY BOULDERY SILT: GRAYISH BROWN, 10YR 5/2, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO 1 M, ROUNDED DOLOMITE	GM		6 NR NS	1.5
	15	HYDROCARBON ODOR BELOW 18.01', MOIST			7 NS	1.5
	20				8 NR NS	1.2
	22.2	HYDROCARBON SATURATED AT CONTACT				
	22.5	SANDSTONE: LIGHT OLIVE GRAY, 5 Y 6/2, QUARTZOSE, FINE GRAIN, WELL SORTED, MICACEOUS, FRIABLE, NONCALCAREOUS	SANDSTONE		9	2.5
		AUGER REFUSAL AT 22.5'				
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-11 (BH-34)*

DATE DRILLED 5/9/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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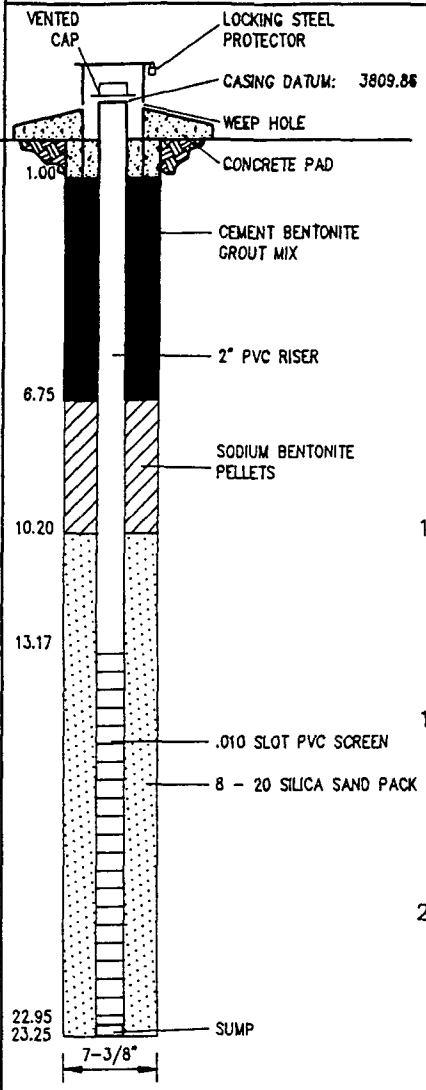
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3807.9				
	0	CLAYEY SILT: LIGHT YELLOWISH BROWN, 10 YR 6/4, DRY, VERY FINE GRAIN QUARTZ, UNCONSOLIDATED, 60% SILT, 40% CLAY, CALICHE DEPOSITS	ML		1 NS GC; 2 1.5	
	4.0	BOULDERY COBBLEY GRAVELLY SILT: LIGHT GRAYISH BROWN, 10YR 6/2, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO 1 M, ROUNDED	GM		3 NR NS 0.5; 4 NS 1.5; 5 NR NS 1.0; NR NS NS 0.3; 7 NR NS 0.8; 8 1.5; 9 NR NS 0.7; 10 NS 0.5	
	5					
	10					
	15					
	20	CLAYEY BELOW 19.5', SANDY, QUARTZ, MEDIUM GRAIN, MOIST, MEDIUM PLASTICITY, STRONG HYDROCARBON ODOR				
	23.0	SANDSTONE: LIGHT OLIVE GRAY, 5 Y 6/2, QUARTZOSE, FINE GRAIN, POORLY CEMENTED, NONCALCAREOUS, FRIABLE, MICACEOUS	SANDSTONE			
	23.2					
	25	BORING TERMINATED 23.2'				
		GROUNDWATER NOT OBSERVED DURING DRILLING				
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-12 (BH-35)***

DATE DRILLED 5/10/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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NORMAN, OKLAHOMA 73072
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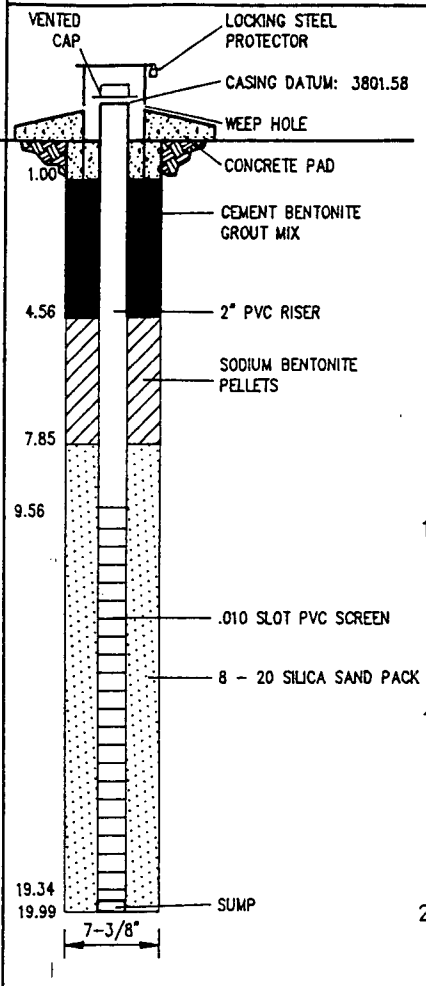
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3799.5				
	0	CLAYEY SILT: YELLOWISH BROWN, 10 YR 5/4, VERY FINE GRAIN QUARTZ, DRY, VERY LOW PLASTICITY, 70% SILT, 30% CLAY	ML		1 GC; NS; 2 1.0; NR; 3 0.5; NR; NS	
	5					
	7.2	BOULDERY COBBLEY GRAVELLY SILT: LIGHT GRAYISH BROWN, 10 YR 6/2, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO 1 M, ROUNDED	GM		4 0.4; NR; NS; 5 1.1; NR; NS	
	10					
	12.5	SANDY GRAVELLY CLAY: BROWN, 7.5 YR 5/4, MOIST, MEDIUM PLASTICITY, FINE GRAIN QUARTZ, FIRM, OCCASIONAL LARGE PEICES OF GRAVEL, 60% CLAY, 40% SAND, CALICHE DEPOSITS	CL		6 1.5	
	13.5	BOULDERY COBBLEY GRAVELLY SILT: LIGHT GRAYISH BROWN, 10 YR 6/2, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO 1 M, ROUNDED	GM		NS; 7 0.4; NS	
	15					
▽17.5	17.5	GRAVEL: GRAY, 10 YR 5/1, MODERATELY WELL SORTED, ANGULAR, GRAVEL 5 TO 10 MM, HYDROCARBON SATURATED	GP		8 1.0; NR; NS	
	19.7	SANDSTONE: PALE OLIVE, 5 Y 6/4, FINE GRAIN, WELL SORTED, POORLY CEMENTED, FRIABLE, NONCALCAREOUS, MICACIOUS	SANDSTONE		9 0.7	
	20	BORING TERMINATED AT 19.7'				
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-13 (BH-36)***

DATE DRILLED 5/10/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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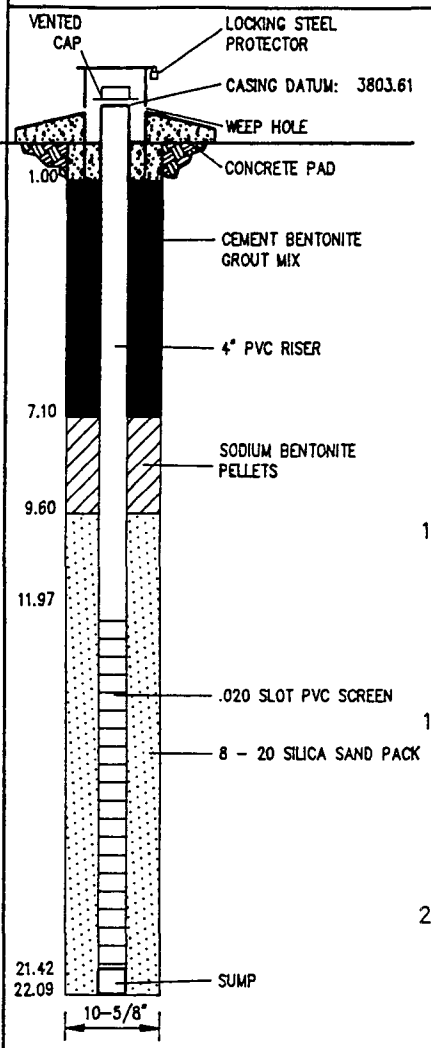
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3801.6				
	0	CLAYEY SILT: BROWN, 7.5 YR 5/4, DRY, VERY LOW PLASTICITY, CALICHE DEPOSITS, VERY FINE QUARTZ, 70% SILT, 30% CLAY	ML		1 GC; NS; 2 1.3; NR; 3 1.1; NR; NS	
	7.3	BOULDER COBBLEY GRAVELLY SILT: LIGHT BROWNISH GRAY, 10 YR 6/2, GRAVELLY, POORLY SORTED, COBBLES AND BOULDERS FROM 5 TO 50CM, ROUNDED	GM		4 0.4; NR; NS; 5 0.7; NR; NS	
		ABUNDANT GRAVEL FROM 12.0–14.0', FROM 1.0 CM TO 3.0 CM			6 1.0; NS	
		CLAYEY FROM 14.0–14.5', SANDY, MOIST, MEDIUM GRAIN QUARTZ, MEDIUM PLASTICITY BOULDERS > 1M BELOW 14.5'			7 0.5; NS	
▽ 17.0	17.2	GRAVEL: GRAY TO GRAYISH BROWN, 10 YR 5/1 TO 5/2, MODERATELY SORTED, VERY COARSE GRAIN QUARTZ, GRAVEL 0.5 TO 1.0 CM, ROUND TO SUBROUND., COBBLEY, HYDROCARBON SATURATED CLAYEY BELOW 17.0'	GP		8 0.8; NR 0.0; NS; 9 0.5; NS	
	20.5	SANDSTONE: BROWN, 10 YR 5/3, FINE GRAIN, QUARTZOSE, WELL SORT, POORLY CEMENTED, FRIABLE	SANDSTONE		10 0.5	
	22.0	BORING TERMINATED AT 22.0'				
		BOREHOLE REEMED TO .10" DIAMETER HOLE				

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-14 (BH-37)***

DATE DRILLED 5/11/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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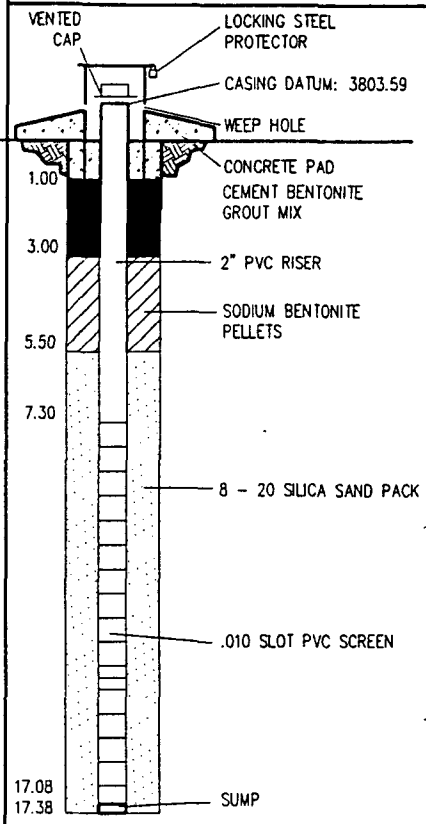
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3801.5				
	0	CLAYEY SILT: LIGHT YELLOWISH BROWN, 10 YR 6/4, VERY FINE GRAIN QUARTZ, DRY, VERY LOW PLASTICITY, CALICHE DEPOSITS, 70% SILT, 30% CLAY			1 GC; NS 0.0; 2 1.2; NR; 3 1.1; NR; NS 0.0	
	6.5	BOULDERY COBBLEY GRAVELLY SILT: LIGHT GRAYISH BROWN TO YELLOWISH BROWN, 10 YR 6/2 TO 6/4, POORLY SORTED, COBBLES AND BOULDERS FROM 3 TO 50CM, ROUNDED TO SUBROUNDED CLAYEY FROM 9.0' TO 9.8', SANDY, FINE TO MEDIUM GRAIN QUARTZ, FIRM, MODERATE TO LOW PLASTICITY			4 0.4; NR; NS 0.0; 5 0.8; NR; NS 0.0; 6 0.4; NS 0.0; 7 1.0; NR; NS 0.0; NR	
	17.38	AUGER REFUSAL AT 17.38' GROUNDWATER NOT ENCOUNTERED WHILE DRILLING.				

WELL COMPLETION DETAIL



0 5 10 15 20 25 30 35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-15 (BH-38)***

DATE DRILLED 5/11/91 & 5/12/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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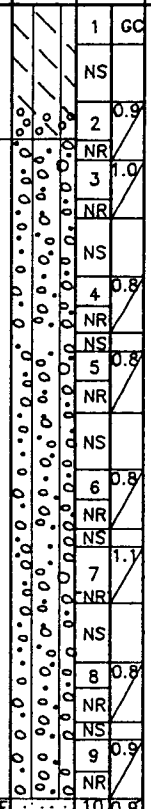
WELL COMPLETION RECORD

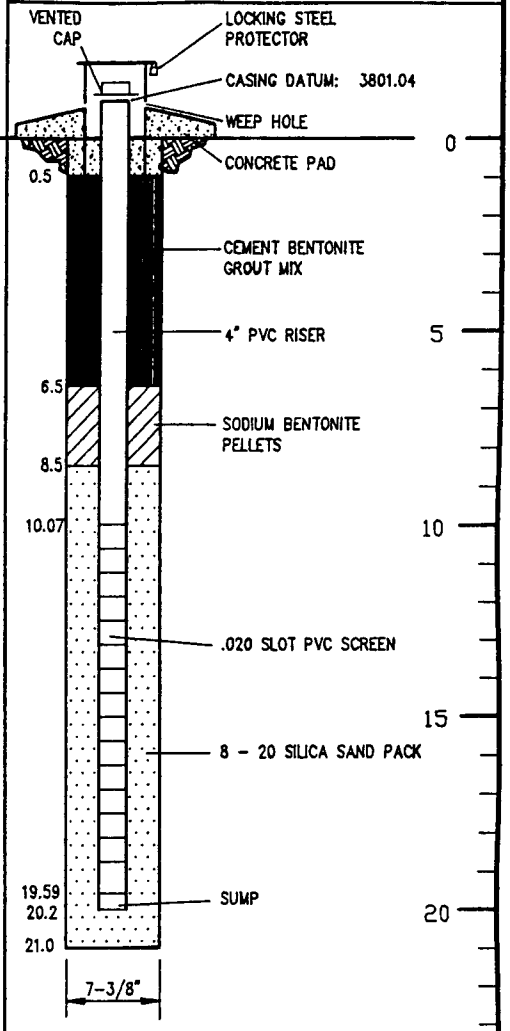
GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3798.4	
	0	CLAYEY SILT: VERY PALE BROWN TO LIGHT YELLOWISH BROWN, 10 YR 7/4 TO 6/4, DRY, VERY LOW PLASTICITY, GRAVELLY BELOW 3.0', GRAVEL TO 1CM. ROUNDED, VERY FINE QUARTZ MATRIX, 65% SILT, 35% CLAY, 5% GRAVEL	ML
	3.5	GRAVELLY BOULDERY COBBLEY SILT: LIGHT BROWNISH GRAY, 10 YR 6/2, POORLY SORTED, COBBLES AND BOULDERS FROM 4CM TO 1M, ROUNDED CLAYEY FROM 4.5' TO 5.0'	GM
	5		
	10		
	15		
▽ 19.9	20		
	20.5		
	21.0	SANDSTONE: LIGHT OLIVE GRAY, 5Y 6/2, QUARTZOSE, FINE GRAIN, WELL SORTED, POORLY CEMENTED, FRIABLE, MICACEOUS, NON-CALCAREOUS	SANDSTONE
		BORING TERMINATED AT 21.0'	
	25	GROUNDWATER NOT OBSERVED DURING DRILLING.	
	30		
	35		

GRAPHIC LOG



SAMPLE INTERVAL		"N" VALUE
1	GC	
NS		
2	0.9	
NR		
3	1.0	
NR		
NS		
4	0.8	
NR		
NS		
5	0.8	
NR		
NS		
6	0.8	
NR		
NS		
7	1.1	
NR		
NS		
8	0.8	
NR		
NS		
9	0.9	
NR		
10	0.9	

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-16 (BH-39)***

DATE DRILLED 5/12/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
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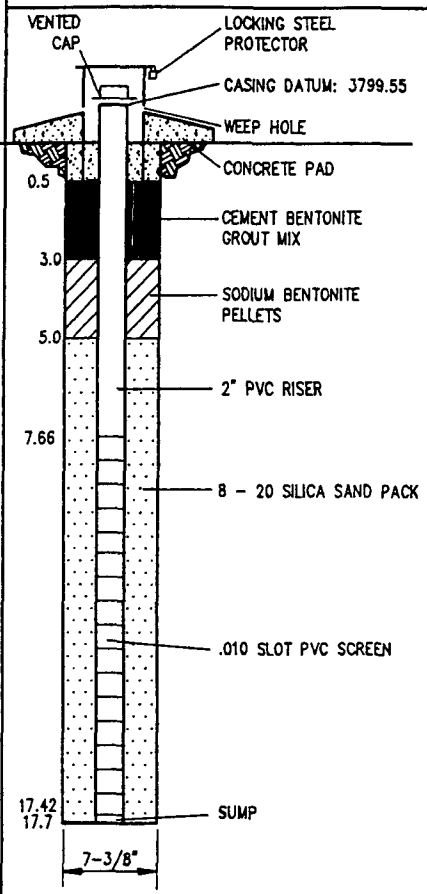
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3797.5				
	0	CLAYEY SANDY SILT: VERY FINE GRAINED SAND, 10% CLAY, 10% SAND, 80% SILT, UNCONSOLIDATED, DRY, 7.5 YR 7/4 PINK	ML		1 NR NS	0.9
	5	ABUNDANT COBBLES AFTER 6.0'			2 NR NS	0.4
					3 NS	1.1
	9.4					
	10	COBBLEY SILTY SAND: 10% COBBLES, 20% SILT, 70% SAND, VERY FINE GRAINED SILICA SAND, SLIGHTLY MOIST, 7.5 YR 7/4 PINK, UNCONSOLIDATED, DOLOMITE COBBLES	GM		4 NR NS	0.5
					5 NS	0.1
					6 NS	0.3
	14.0					
	15	COBBLEY SANDY SILT: VERY FINE GRAINED SAND, SLIGHTLY MOIST, 7.5 YR 7/4 PINK, UNCONSOLIDATED, DOLOMITE COBBLES	ML		7 NS	0.5
15.9'					8 NS	0.1
	17.7	AUGER REFUSAL AT 17.7'				
	20	GROUNDWATER NOT ENCOUNTERED DURING DRILLING.				
		BOREHOLE OVM READING: 19.0 PPM				
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MW-17 (BH-40)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 5/13/91 & 5/14/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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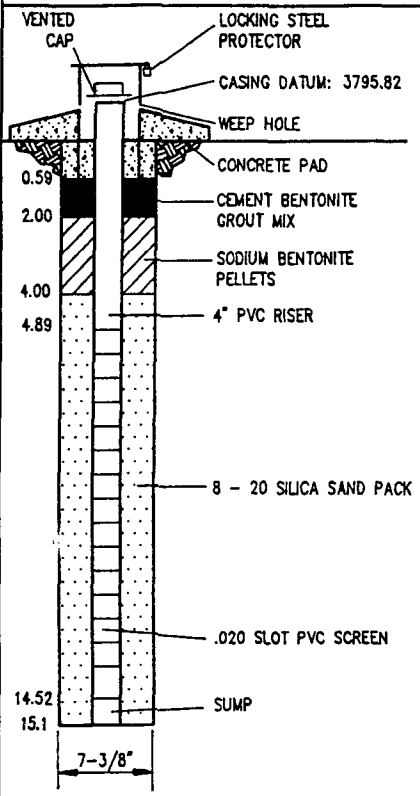
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3793.5				
	0	CLAYEY SILT: 10% CLAY, 90% SILT, LOW PLASTICITY, 10 YR 6/3 PALE BROWN, UNCONSOLIDATED, DRY	SC		NS; 1 NR; NS; 2 NR	1.2; 1.1
	5					
	6.0	GRAVELLY COBBLEY SILT: 10 YR 7/2 LIGHT GRAY, UNCONSOLIDATED, SUB-ROUNDED, DOLOMITE GRAVEL AND COBBLES, DRY	GM		NS; 3 NR	1.0
	9.0	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10% COBBLES, 20% SAND, 70% SILT, SLIGHTLY MOIST, 10 YR 7/2 LIGHT GRAY, UNCONSOLIDATED, STRONG CON-DENSATE ODOR	GM		4 NR; NS; 5 NR; 6 NS	1.0; 0.5; 0.1
	10	VERY MOIST AFTER 12.5'				
▽ 13.9	13.4					
	15					
	15.2	AUGER REFUSAL AT 15.2'				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-18 (BH-41)***

DATE DRILLED 5/14/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
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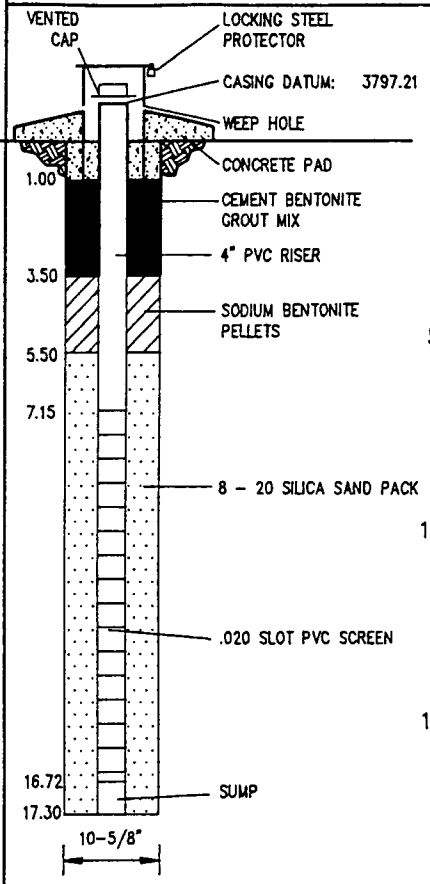
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3795.4				
	0	CLAYEY SILT: 10% CLAY, 90% SILT, 10 YR 6/3 PALE BROWN, DRY, UNCONSOLIDATED	ML		NS; 1; NR; NS; 2	.98; 1.3
	5	SLIGHTLY MOIST AFTER 5.0'				
	6.0	COBBLEY CLAYEY SILT: 10% COBBLES, 10% CLAY, 80% SILT, 10 YR 6/3, PALE BROWN, SLIGHTLY MOIST, UNCONSOLIDATED	GM		NR; NS; 3; NR; 4	1.0; 0.9
	10					
	10.2	COBBLEY SANDY SILT: VERY FINE GRAINED SAND, DOLOMITE COBBLES, 10 YR 7/1 LIGHT GRAY, DRY, UNCONSOLIDATED	GM		NR; NS; 5	1.1
	12.3	COBBLEY CLAYEY SILT: 10 YR 7/1 LIGHT GRAY, DOLOMITE COBBLES, 10 YR 5/4 YELLOW BROWN, SILTY CLAY MATRIX, MOIST, MODERATELY CONSOLIDATED	GM		NS; 6	1.0
▽ 14.8	14.6					
	15	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, DOLOMITE COBBLES, 10 YR 7/1 LIGHT GRAY, SATURATED, STRONG CONDENSATE ODOR AT 17.0', SATURATED WITH 5 YR 3/1 VERY DARK GRAY VISCOUS MATERIAL, STRONG CONSENSATE ODOR	GM		NS; 7	0.3
16.7	17.3					
		AUGER REFUSAL AT 17.3'				
	20	GROUNDWATER ENCOUNTERED AT 14.8'				
		HEAVING SANDS AT T.D. 17.3'				
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

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JOB NAME/NUMBER ***MARATHON/91029***

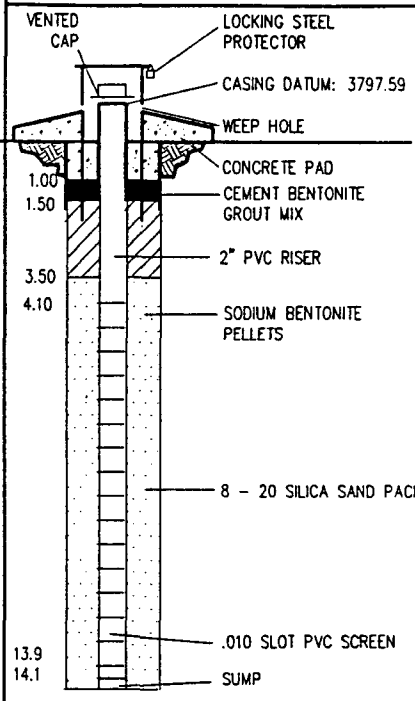
BORING NUMBER ***MW-19 (BH-42)***

DATE DRILLED 5/16/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3794.8				
	0	CLAYEY SILT: 10% CLAY, 90% SILT, 10 YR 6/3 PALE BROWN, DRY TO SLIGHTLY MOIST, NO PLASTICITY	ML		NS; 1 NR	0.9
	6.0	COBBLEY SANDY SILT: 10 YR 7/3 VERY PALE BROWN, SLIGHTLY MOIST TO DRY, UNCONSOLIDATED, DOLOMITE COBBLES TO APPROXIMATE 0.5 FEET DIAMETER AFTER 6.0', CLAYEY SILT MATRIX, SLIGHTLY MOIST	GM		NS; 2 NR; 3 NS	0.4; 0.3
	9.0	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 8/2 WHITE, DRY, UNCONSOLIDATED, DOLOMITE COBBLES, MINOR DOLOMITE GRAVEL MINOR CLAYEY SILT MATRIX AFTER 12.0', SLIGHTLY MOIST	GM		4 NS; 5 NR NS	0.9; 0.7
	14.1	AUGER REFUSAL AT 14.1' GROUNDWATER NOT ENCOUNTERED DURING BORING.				

WELL COMPLETION DETAIL



0 5 10 15 20 25 30 35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-20 (BH-43)***

DATE DRILLED 5/16/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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NORMAN, OKLAHOMA 73072
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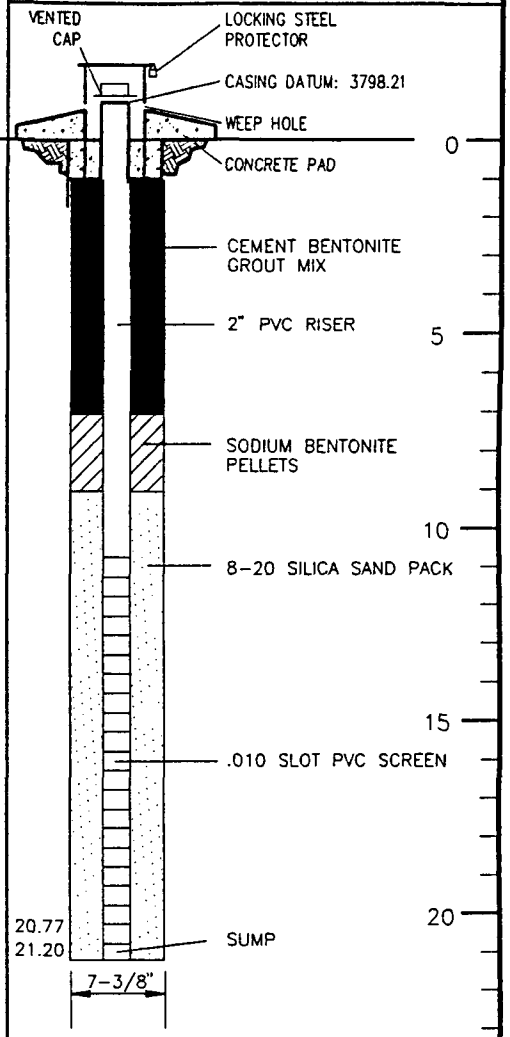
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3796.1				
	0	SANDY CLAYEY SILT: VERY FINE GRAIN SAND, 10% SAND, 10% CLAY, 80% SILT, NO PLASTICITY, 7.5 YR 7/2 PINK GRAY, DRY, MINOR CALICHE, UNCONSOLIDATED	ML		NS, 1, NR, NS, 2, NR	1.3, 1.1
	5					
	6.5	COBBLEY GRAVELLY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 7/2 LIGHT GRAY, DOLOMITE COBBLES AND GRAVEL, DRY, UNCONSOLIDATED	GM		NS, 3, NS, 4, NS, 5, NS, 6, NR, NS, 7, NS, 8, NR, 9, NR	0.7, 0.6, 0.4, 0.9, 1.5, 1.1, 0.1
	10	AFTER 12.0' CALICHE CEMENTATION, MINOR SLIGHTLY MOIST, 7.5 YR 6/4 LIGHT BROWN, CLAY MATRIX				
	15	SLIGHTLY MOIST AFTER 14.0'				
	18.0	SANDSTONE: VERY FINE GRAIN SILICA HIGHLY WEATHERED AND FRACTURED, 2.5 YR 7/4 PALE YELLOW, FRACTURE IN FILLING WITH MOTTLED 7.5 YR 5/4 BROWN SILTY CLAY, SLIGHTLY MOIST IN FRACTURE, MOIST IN SANDSTONE, HIGHLY FRIABLE AND MOIST AFTER 20.0', AFTER 20.6' VERY HARD SANDSTONE	SANDSTONE			
20.44	20					
	21.20	AUGER REFUSAL AT 21.20'				
	25	GROUNDWATER NOT ENCOUNTERED DURING DRILLING.				
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-21 (BH-44)***

DATE DRILLED 5/16/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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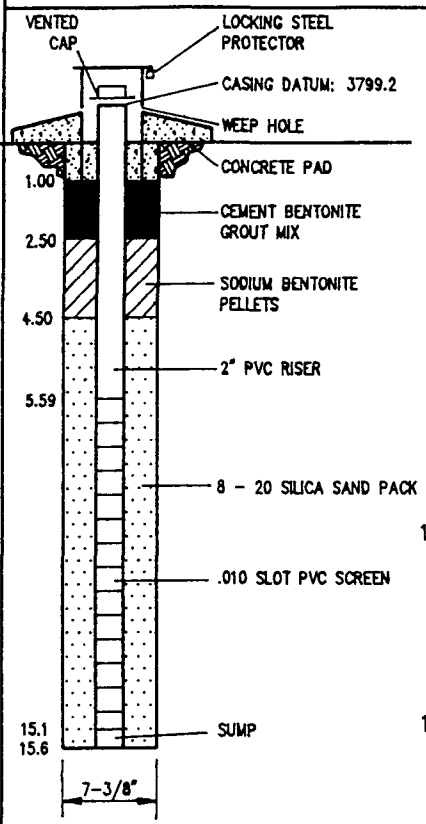
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3797.5				
	0	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 6/3 PALE BROWN, DRY, UNCONSOLIDATED, DOLOMITE COBBLES AND GRAVEL, AFTER 3.0' 10 YR 7/2 LIGHT GRAY, CALICHE CEMENTATION 2'-3'	GM		NS 1 NR	0.1
	4.0	COBBLEY SILTY SAND: 10% COBBLES, 30% SILT, 60% SAND, VERY FINE TO FINE SAND, 10 YR 8/3 VERY PALE BROWN, DRY, DENSE	GM		2 NS 3	1.2 0.5
	5					
	8.0	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 7/4 VERY PALE BROWN, SLIGHTLY MOIST, UNCONSOLIDATED, DOLOMITE COBBLES AFTER 12.0' MINOR 7.5 YR 6/4 LIGHT BROWN, MOIST CLAYEY SAND BINDER	GM		NS 4 NR NS 5 NS	1.1 0.7
	10					
	14.5	SILTY CLAY: 40% SILT, 60% CLAY, LOW PLASTICITY, STIFF, 10 YR 5/4 YELLOW BROWN, MOIST, MINOR SUBROUNDED DOLOMITE GRAVEL	CL		6 NS	1.1
	15					
	15.5 15.6	DOLOMITE: VERY HARD, MICROCRYSTALLINE, 10 YR 6/1 LIGHT GRAY TO GRAY, DRY	DOLO.			
	20	AUGER REFUSAL AT 15.6' GROUNDWATER NOT OBSERVED DURING BORING NO GROUNDWATER AFTER 24 HOURS				
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **MW-22 (BH-45)**

DATE DRILLED 5/17/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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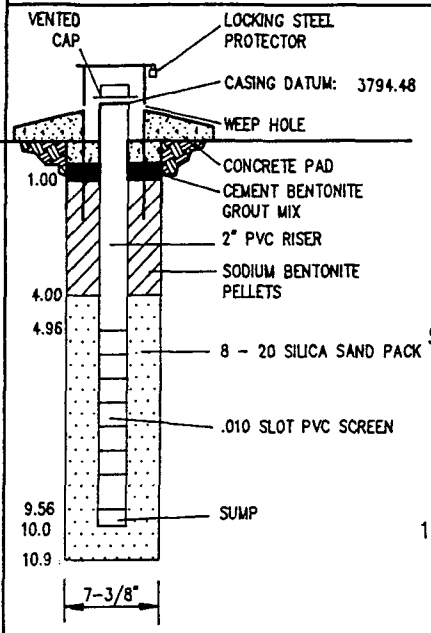
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3792.4				
	0	CLAYEY SILT: 10% CLAY, 90% SILT, 10 YR 7/4 VERY PALE BROWN, DRY TO SLIGHTLY MOIST, UNCONSOLIDATED, NO PLASTICITY	ML		NS; 1	1.5
	4.5				NS	
	5	GRAVELLY SILT: 10 YR 8/3, VERY PALE BROWN, DRY TO SLIGHTLY MOIST, SUB-ROUNDED DOLOMITE GRAVEL TO 0.08' IN DIAMETER	GM		2	1.1
	6.0				NR; NS	
		COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 8/3 VERY PALE BROWN, DRY SLIGHTLY MOIST, UNCONSOLIDATED, DOLOMITE COBBLES, MINOR CALICHE CEMENTATION	GM		3; NS	1.5
	10				NR	
	10.8					
	10.9	SANDY DOLOMITE: VERY FINE GRAIN SAND, 10 YR 7/2 LIGHT GRAY, VERY HARD, DRY	DOLO.		NS	
		AUGER REFUSAL AT 10.9'				
		GROUNDWATER NOT ENCOUNTERED DURING DRILLING				
	15	NO GROUNDWATER OBSERVED AFTER 24 HOURS				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-23 (BH-46)***

DATE DRILLED 5/18/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
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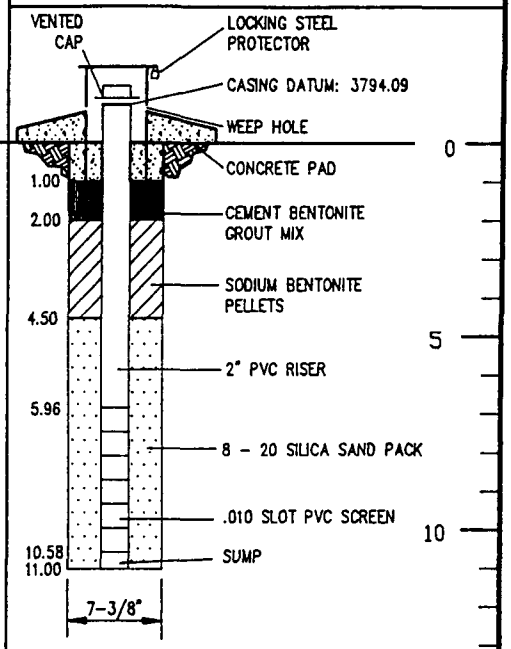
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	'N' VALUE
		GROUND SURFACE: 3791.0				
	0	CLAYEY SILT: 10% CLAY, 90% SILT, 10 YR 7/4 VERY PALE BROWN, NO PLASTICITY, DRY, UNCONSOLIDATED	ML		NS; 1; NR; NS; 2; NR; NS	1.0; 1.1
	5	SLIGHTLY MOIST AFTER 6.0'				
	6.5	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 8/2 WHITE, DRY, SUB-ROUNDED DOLOMITE COBBLES AND MINOR GRAVEL, UNCONSOLIDATED, CALICHE CEMENTATION AFTER 8.5'	GM		3; NR; NS	1.5
	9.5		CL		4	1.0
	10	COBBLEY SILTY CLAY: 10% COBBLES, 30% SILT, 60% CLAY, MINOR CALICHE CEMENTATION, 10 YR 5/4 YELLOW BROWN, MOIST, DOLOMITE COBBLES, UNCONSOLIDATED				
	10.9		DOLO.		NS; 5	0.1
	11.0	SANDY DOLOMITE: VERY FINE GRAIN SILICA, 10 YR 7/1 LIGHT GRAY, DRY				
	15	AUGER REFUSAL AT 11.0'				
		GROUNDWATER NOT ENCOUNTERED DURING DRILLING				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-24 (BH-47)***

DATE DRILLED 5/18/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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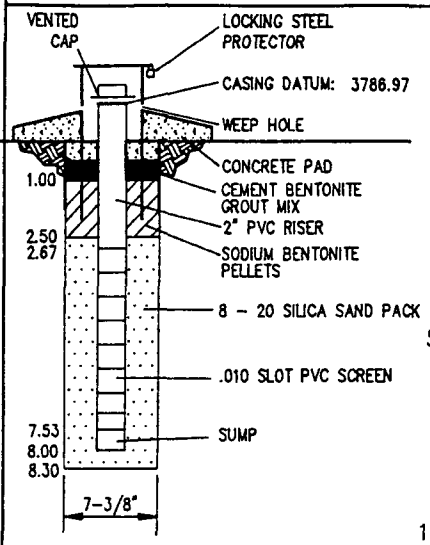
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3784.7				
	0	CLAYEY SILT: 10% CLAY, 90% SILT, 10 YR 7/3 VERY PALE BROWN, DRY, UNCONSOLIDATED	ML		NS	
	1.0	GRAVELLY SANDY SILT: 10 YR 8/3 VERY PALE BROWN, DRY, UNCONSOLIDATED	GM		1 NR NS 2 NR NS 3 NS 4	1.1 1.0 0.9 0.1
	5					
		SLIGHTLY MOIST AFTER 7.0'				
	8.2 8.3	SANDY DOLOMITE: VERY FINE GRAIN SAND, 10 YR 7/1 LIGHT GRAY, DRY, VERY HARD	DOLO.			
	10	AUGER REFUSAL AT 8.3'				
		GROUNDWATER NOT ENCOUNTERED DURING DRILLING				
		NO GROUNDWATER OBSERVED AFTER 24 HOURS				
	15					
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-25 (BH-48)***

DATE DRILLED 5/18/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
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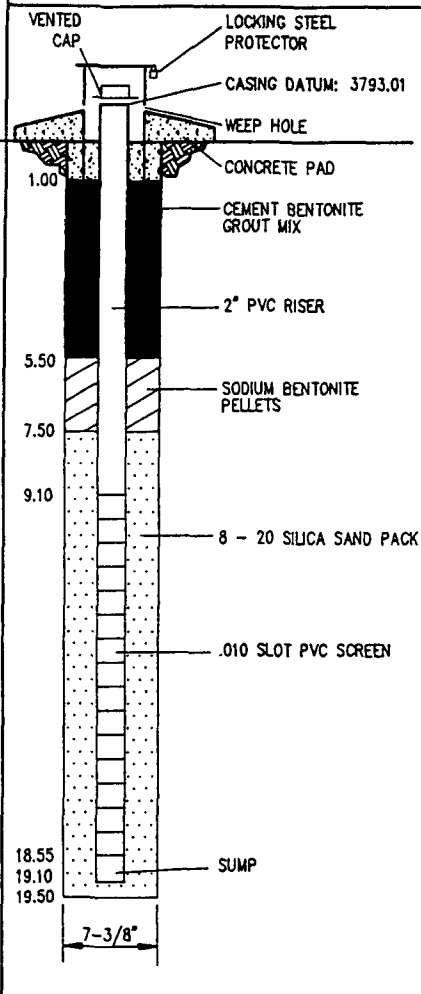
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3791.0				
	0	CLAYEY SANDY SILT: VERY FINE GRAIN SILICA SAND, 10% CLAY, 10% SAND, 80% SILT, 10 YR 8/4 VERY PALE BROWN, DRY, NO PLASTICITY, UNCONSOLIDATED, MINOR CALICHE	ML		NS; 1 (1.5)	
	4.0	COBBLEY GRAVELLY SANDY SILT: VERY FINE GRAIN SILICA SAND, 10YR8/3 VERY PALE BROWN, CALICHE CEMENTATION, DRY TO SLIGHTLY MOIST, ABUNDANT SUBROUNDED DOLOMITE GRAVEL	GM		2 (1.1); NS; 3 (1.0); NS; 4 (1.0); NS; 5 (1.1); NR; NS; 6 (1.0); NR; NS; 7 (0.9); NR; NS; NS	
	5					
	10	AFTER 12.0', MINOR MOIST 7.5 YR 5/4 BROWN, SILTY CLAY MATRIX				
	15					
▽ 17.66		SATURATION AFTER 17.0', STRONG CONDENSATE ODOR				
	19.4					
	19.5	SANDSTONE: VERY FINE GRAIN SILICA SAND, 2.5 YR 7/2 LIGHT GRAY WITH 2.5 YR 5/0 GRAY BANDS, VERY HARD	SS		8 (0.1)	
	20	AUGER REFUSAL AT 19.5'				
		GROUNDWATER ENCOUNTERED DURING DRILLING AT 17.66'				
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-26 (BH-49)***

DATE DRILLED 5/19/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
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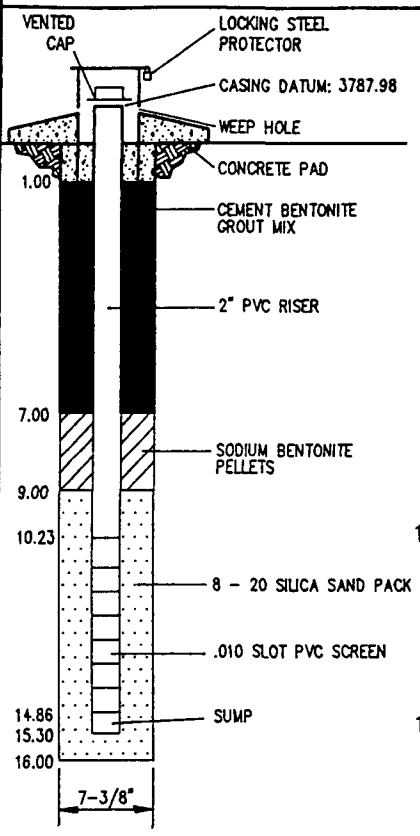
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3791.9				
	0	SANDY SILT: VERY FINE GRAIN SAND, 10 YR 6/4 LIGHT YELLOW BROWN, DRY, UNCONSOLIDATED	SM		NS	
	2.8	COBBLEY SANDY SILT: VERY FINE GRAIN SILICA SAND, 10 YR 8/2 WHITE, DRY, UNCONSOLIDATED, ABUNDANT DOLOMITE GRAVEL	GM		1 / NR / NS	0.6
	4.5	SILTY SAND: VERY FINE TO FINE GRAIN SILICA SAND, 20% SILT, 80% SAND, 10 YR 6/4, LIGHT YELLOW BROWN, SLIGHTLY MOIST, UNCONSOLIDATED	SM		2 / NR / NS	0.6
	5				3	1.1
	8.3	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 7/3 VERY PALE BROWN, DRY, UNCONSOLIDATED, DOLOMITE COBBLES AND MINOR SUBROUNDED GRAVEL	GM		NR / NS	
	10	CALICHE CEMENTATION AFTER 12.5'			4 / NS	0.4
		AFTER 15.5', SLIGHTLY MOIST 5 YR 5/4 RED BROWN, SILTY CLAY MATRIX			5 / NS	0.2
	15				6 / NS	0.8
	16.0				7	0.3
		AUGER REFUSAL AT 16.0'				
		GROUNDWATER NOT ENCOUNTERED DURING DRILLING.				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-27 (BH-50)***

DATE DRILLED 5/19/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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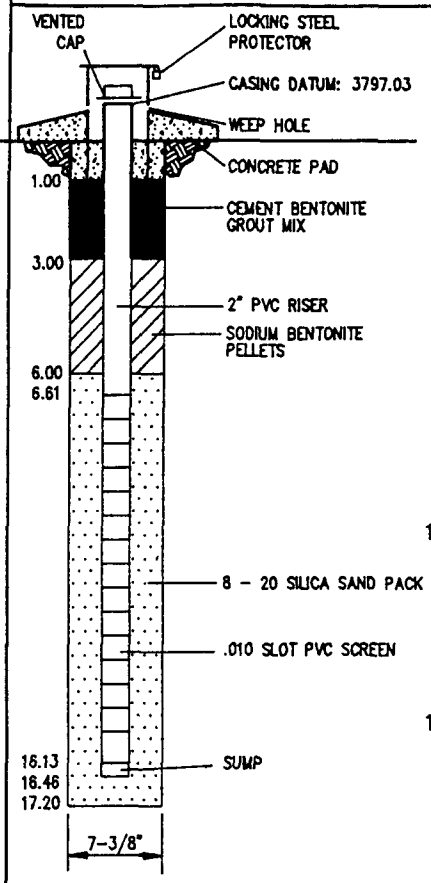
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3794.9				
	0	CLAYEY SILT: LIGHT YELLOWISH BROWN, 10 YR 6/4, DRY, VERY LOW PLASTICITY, CALICHE DEPOSITS, 70% SILT, 30% CLAY	ML		1 GC; NS; 2 NR 1.0; 3 NR 1.0	
	5					
	6.0	BOULDERY GRAVELLY COBBLEY SILT: LIGHT YELLOWISH BROWN TO LIGHT BROWNISH GRAY, 10YR 6/2 TO 6/4, POORLY SORTED, DOLOMITE COBBLES AND BOULDERS FROM 3 CM TO 0.5M, ROUNDED	GM		NS; 4 NR 0.4; NS; 5 NR 0.4; NS; 6 NR 0.2	
	10					
	12.5	CLAYEY GRAVELLY SAND: BROWN, 7.5 YR 7/2, MOIST, VERY FINE TO FINE GRAIN QUARTZ, MANGANESE NODULES, LOW PLASTICITY, DOLOMITE PEBBLES FROM 0.5 TO 1CM ROUND, 70% SAND, 20% CLAY, 10% GRAVEL	SC		NS; 7 NR 1.0; NS; NR	
	15					
	17.0	AUGER REFUSAL AT 17.0' GROUNDWATER NOT ENCOUNTERED DURING DRILLING.				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-28 (BH-52)***

DATE DRILLED 5/20/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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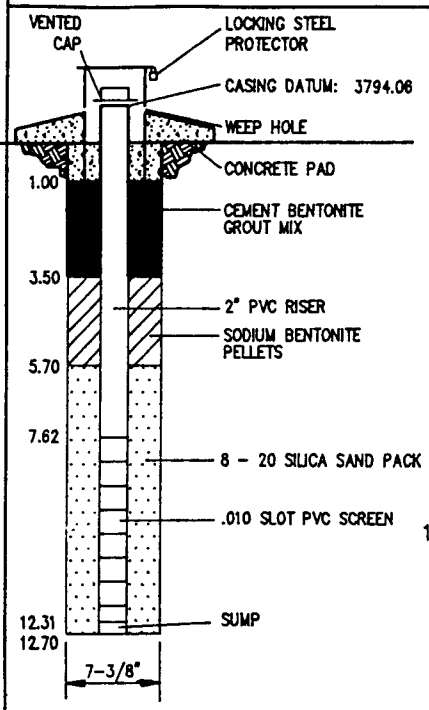
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3792.0				
	0	SANDY CLAYEY SILT: BROWN, 10 YR 5/5, DRY, VERY LOW PLASTICITY, VERY FINE QUARTZ 70% SILT, 10% CLAY, 20% SAND	ML		1 GC; NS	
	3.0	BOULDERY COBBLEY SILT: BROWN TO LIGHT BROWNISH GRAY, 10 YR 5/3 TO 6/2, GRAVELLY, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO 0.5 M, ROUNDED TO SUBROUNDED, DOLOMITE	GM		2 0.2; NR; 3 0.5; NR; NS; 4 1.0; NR; NS; 5 0.9; NR; NS; NR; NR	
	5					
	10	CLAYEY FROM 9.0' TO 10.0', SANDY AND GRAVELLY, BROWN TO STRONG BROWN, 10 YR 5/4 TO 5/6, MOIST, LOW PLASTICITY, FINE TO VERY FINE QUARTZ				
	12.7	AUGER REFUSAL AT 12.7'				
		GROUNDWATER NOT ENCOUNTERED DURING DRILLING.				
	15					
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-29 (BH-53)***

DATE DRILLED 5/20/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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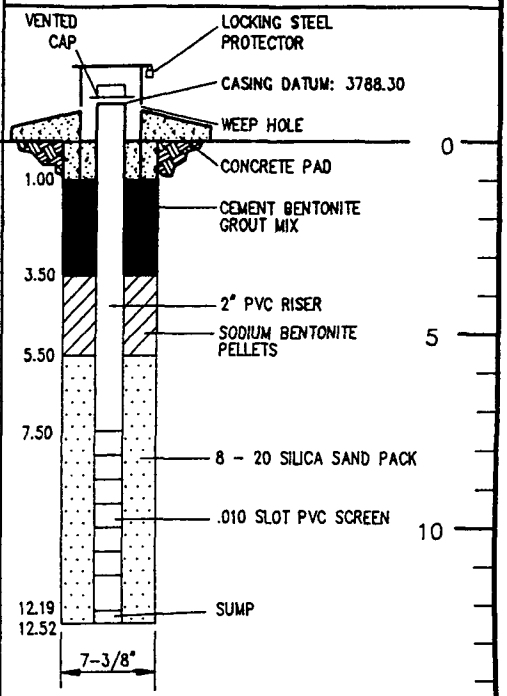
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3786.0				
	0	CLAYEY SILT: BROWN TO BROWNISH YELLOW, 10 YR 5/3 TO 5/4, DRY, VERY LOW PLASTICITY, CALICHE DEPOSITS, 70% SILT, 30% CLAY, VERY FINE QUARTZ	ML		1 NS 2 NR 3 NR NS	1.1 1.0
	7.5	COBBLEY GRAVELLY SILT:, BROWN TO LIGHT GRAYISH BROWN, 10 YR 5/2 TO 5/2, MODERATELY WELL SORTED, COBBLES FROM 4 TO 10 CM, GRAVEL, ROUNDED TO SUBROUNDED	GM		4 NR NS NR	0.7
	10.5	DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 6/2, MASSIVE, HARD	DOLOMITE		NS NR	
	12.5	BORING TERMINATED AT 12.5' GROUNDWATER NOT ENCOUNTERED DURING DRILLING				
	15					
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-30 (BH-54)***

DATE DRILLED 5/21/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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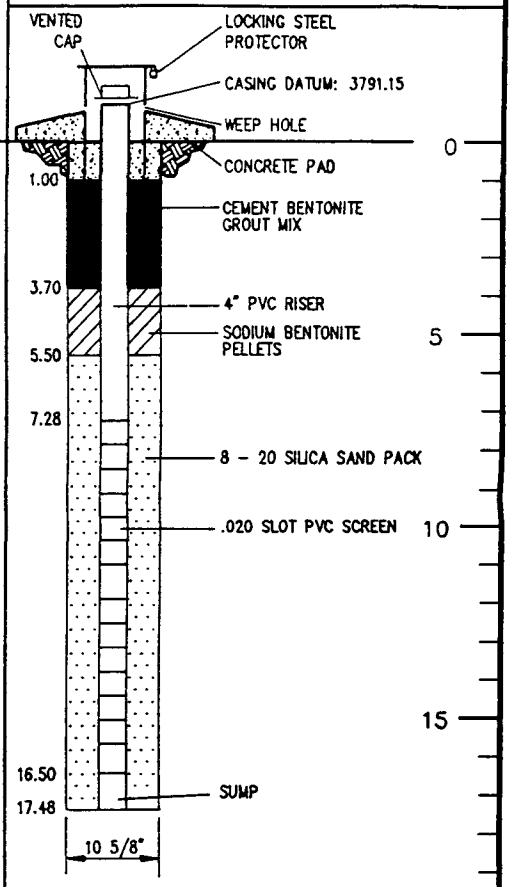
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3788.7				
	0	CLAYEY SILT: BROWN TO VERY PALE BROWN, 10 YR 5/3 TO 7/4, DRY VERY LOW PLASTICITY, CALICHE DEPOSITS, 70% SILT, 30% CLAY, VERY FINE GRAIN QUARTZ	ML		1 GC; NS; 2 NR 1.1; 3 NR 1.1; NS; 4 NR 1.1; NS	
	5	SLIGHTLY MOIST BELOW 7.0' MOIST FROM 9.0' TO 9.5', GRAVELLY, DARK BROWN, 10 YR 4/3				
	9.5					
	10	BOULDERY GRAVELLY COBBLEY SILT: DARK BROWN TO LIGHT GRAYISH BROWN, 10YR4/3 TO 6/2, POORLY SORTED, COBBLES/BOULDERS FROM 3.0 CM TO >20 CM, ROUNDED TO SUBROUNDED CLAYEY FROM 12.0' TO 12.5', MOIST VERY HARD FROM 13.0' TO 14.0', CLAYEY FROM 14.0' TO 14.5', MOIST	GM		5 0.7; NR; NS; 6 0.5 NR; NS; 7 0.5 NR; NS	
▽ 16.96	15	CLAYEY FROM 17.0 TO 17.4' SATRUATED AT 16.96'				
	17.4	AUGER REFUSAL AT 17.4'			8 0.4	
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

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JOB NAME/NUMBER ***MARATHON/91029***

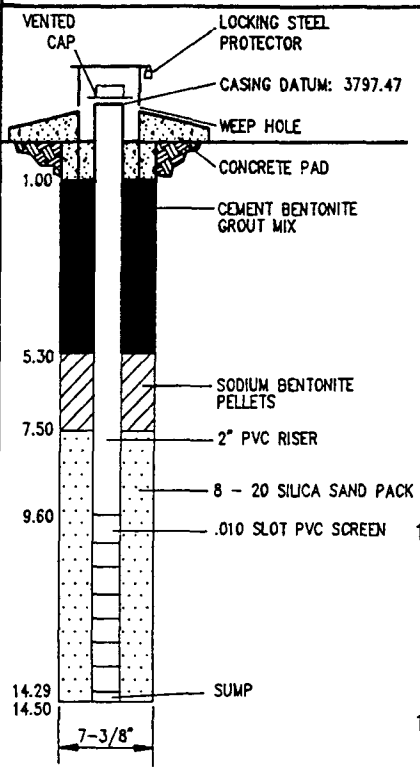
BORING NUMBER ***MW-31 (BH-55)***

DATE DRILLED 5/22/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3795.2				
	0	CONGLOMERATE: VERY PALE BROWN TO LIGHT GRAYISH BROWN, 10 YR 7/3 TO 6/2, LIMESTONE/DOLOMITE GRAVEL, COBBLES AND BOULDERS FROM 5 CM TO 2 M, ROUNDED TO SUBROUNDED, CARBONATE CEMENT, WEATHERED AT SURFACE, HARD	CONGLOM-ERATE		NS NR NS 1 NR 0.4 NS 2 NR 0.2	
	8.5	BOULDERY COBBLEY GRAVELLY SILT: BROWN TO LIGHT GRAYISH BROWN, 10YR5/3 TO 6/2, POORLY SORTED, COBBLES AND BOULDERS FROM 4 CM TO 20 CM, ROUNDED TO SUBROUNDED, VERY FINE GRAIN QUARTZ	GM		NS 3 1.0 NS NR NS NR	
	14.5	AUGER REFUSAL AT 14.5' GROUNDWATER NOT OBSERVED DURING DRILLING.				

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **MW-32 (BH-56)**

DATE DRILLED 5/22/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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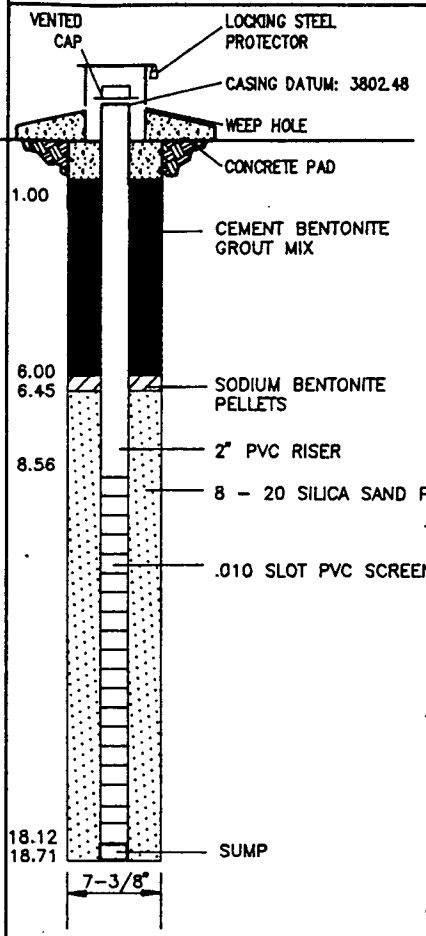
(405) 321-3898

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3800.9				
	0	CLAYEY SILT: LIGHT BROWN, 7.5 YR 6/4, DRY, VERY LOW PLASTICITY, VERY FINE GRAIN QUARTZ, CALICHE DEPOSITS, 70% SILT, 30% CLAY	ML		GC; NS; 2; NR	1.1
	4.5				3; NR	0.8
	5	BOULDERY COBBLEY GRAVELLY SILT: LIGHT BROWN TO LIGHT BROWNISH GRAY, 7.5YR6/4 TO 10 YR 6/2, POORLY SORTED, COBBLES AND BOULDERY FROM 2 CM TO >15 CM, ROUNDED TO SUBROUND	GM		NS; 4; NS; 5; NR	1.5; 0.5
	10				NS; 6; NR; NS; 7; NR	1.0; 0.2
	15	CLAYEY BELOW 17.5', SANDY, FINE TO MEDIUM GRAIN QUARTZ, MOIST, VERY STRONG HYDROCARBON ODOR			NS	
18.0'		CONDENSATE SATURATED BELOW 18.0'			8; NR; NS	0.8
	18.5 / 18.65	DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 6/2, MASSIVE, HARD	DOLOMITE		9	15
	20	AUGER REFUSAL AT 18.65'				
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-33 (BH-57)***

DATE DRILLED 5/23/91 & 5/24/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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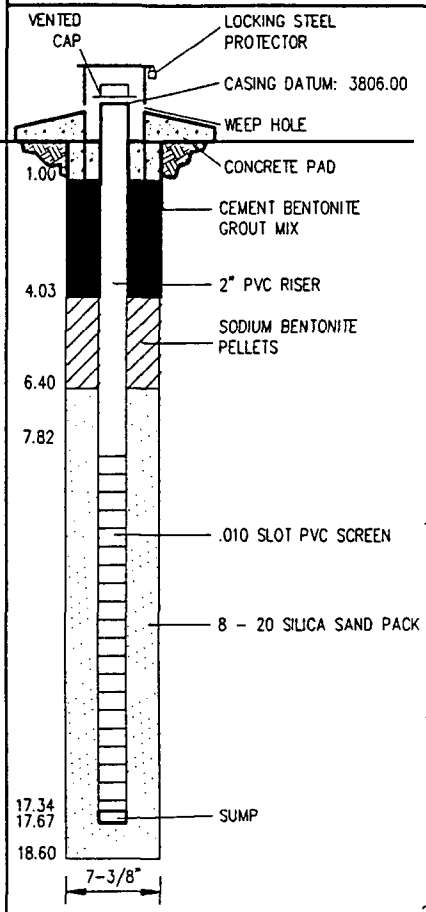
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3803.7				
	0	CLAYEY SILT: PALE BROWN TO BROWN, 10 YR 5/3 TO 6/3, DRY, VERY LOW PLASTICITY, VERY FINE GRAIN QUARTZ, CALICHE DEPOSITS, 70% SILT, 30% CLAY	ML		1 NS	
	2.7	BOULDERY COBBLEY GRAVELLY SILT: BROWN TO LIGHT GRAYISH BROWN, 10YR5/3 TO 6/4,, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO > 50 CM, ROUNDED TO SUBROUNDED, DOLOMITE WITH CALICHE WEATHERING,	GM		2 NR 0.6; NR; NS	
	5	HYDROCARBON ODOR FROM 9.0' TO 9.9', DRY			3 NR 0.5; NS	
	10	STRONG HYDROCARBON ODOR BELOW 14.0', VERY MOIST, SANDY, COARSE GRAIN QUARTZ			4 NR 0.9; NS	
	15				5 NR 1.0; NS; NR; NS	
					6 NR 0.5; 7 0.8	
	18.6	AUGER REFUSAL AT 18.6'				
	20	GROUNDWATER NOT OBSERVED DURING DRILLING.				
	25					
	30					
	35					

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-34 (BH-58)***

DATE DRILLED 5/24/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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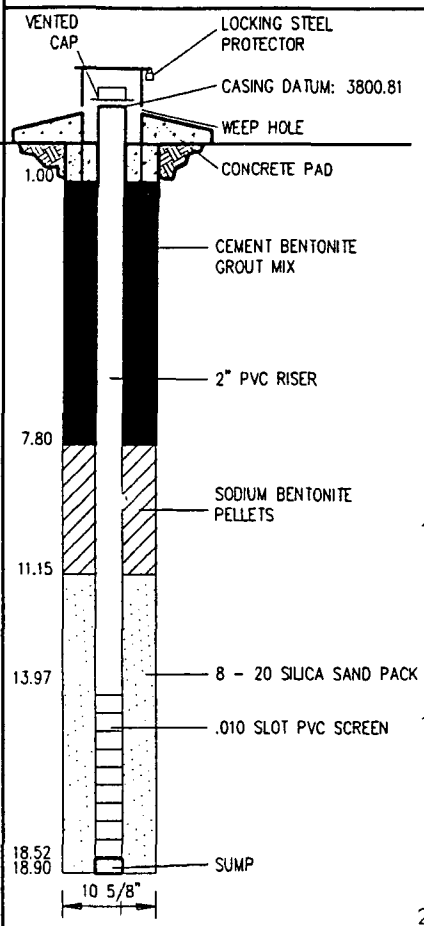
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3799.0				
	0	CLAYEY SILT: YELLOWISH GRAY, 5Y7/2, LOOSE, DRY, NONPLASTIC, CALICHE DEPOSITS TO 2.9', 10% CLAY, CALICHE 60%	ML		1 GC; NS	
	2.9	CLAYEY SILT: DUSKY YELLOW 5YR6/4, DRY, LOOSE, VERY LOW PLASTICITY, 10% CLAY	ML		2 1.0; NR	
	4.0	CLAYEY SILT: LIGHT BROWN 5YR6/4 LOW PLASTICITY, 30% CLAY, CALICHE DEPOSITS 25%, 45% SILT, DRY	ML		3 1.1; NR; NS	
	5					
	8.0	CLAYEY SILT: LIGHT BROWN 7.5 YR 6/4, FIRM, 30% CLAY, LOW PLASTICITY, FRIABLE, DRY	ML		4 1.5; 5 0.9; NR; NS	
	10					
	11.0	GRAVEL AND COBBLES IN CLAYEY SILT: 50% COARSE, 50% FINE, GRAVEL FINE TO COARSE, 5 TO 75MM, SEGMENTS OF COBBLES SIZE UNKNOWN, CLAYEY SILT, PINKISH GRAY 7.5 YR 7/2, LOOSE, DRY, VERY LOW PLASTICITY, DOLOMITIC GRAY LIMESTONE COBBLES AND GRAVEL WELL ROUNDED, POORLY SORTED,	GM		6 0.9; NR	
	14.5				7 0.7; NR; NS	
	15					
17.37'		GRAVEL AND COBBLES: COARSE GRAVEL 25–75MM, COBBLES POSSIBLEY TO BOULDER SIZE, DECREASING CLAYEY SILT TO 20% LIMESTONE FACTION TYPICALLY LIGHT BROWNISH GRAY (2.5 YR 6/2), FAIR ODOR OF HYDROCARBON AT 14.5', VERY SLIGHTLY MOIST, 30% COARSE GRAVEL, 50% COBBLES, SATURATED WITH HYDROCARBONS	GM		8 0.5; NR	
	18.9					
	20	AUGER REFUSAL AT 18.9'				
		DOLOMITIC LIMESTON: LIGHT BROWNISH, 10YR6/2, GRAY, DENSE				
		LOST SPLIT SPOON SAMPLER WHEN DRIVING 12.5 TO 14.0', SAMPLE INTERVAL COULD NOT RETRIEVE. WILL GROUT UP HOLE. MOVE RIG 10.0' EAST AND REDRILL				
	25	FLUID LEVEL 16.54' (CONDENSATE) WATER LEVEL 17.37' 3 HOURS AFTER DRILLING				
	30					
	35					

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-35 (BH-59)***

DATE DRILLED 5/25/91

DRILLING METHOD HSA

DRILLED BY SHB

LOGGED BY GHR

CHECKED BY BJS

DRAWN BY: BDR

PAGE 1 OF 1

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NORMAN, OKLAHOMA 73072
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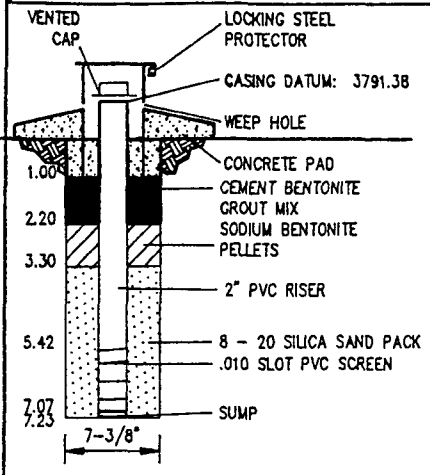
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3791.4				
	0	GRAVELLY SILT: GRAVEL TO 0.5' DIAMETER 10% GRAVEL, 90% SILT, 10 YR 6/3, PALE BROWN TO 0.6', TO YR 8/2, WHITE AFTER 0.6', DRY	GM		NS; 1 1.0; NS; 2 1.0	
	5 5.1	AUGER REFUSAL AT 5.1'				
	10	* MONITOR WELL MW-36 INSTALLED APPROXIMATELY 30.0' FROM BOREHOLE 21 THE BOREHOLE MONITOR WELL MW-36 WAS INSTALLED IN WAS NOT LOGGED. AUGER REFUSAL OCCURED AT 7.25'.				
	15					
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***MW-36 (BH-21)*** * NEAR

DATE DRILLED 4/30/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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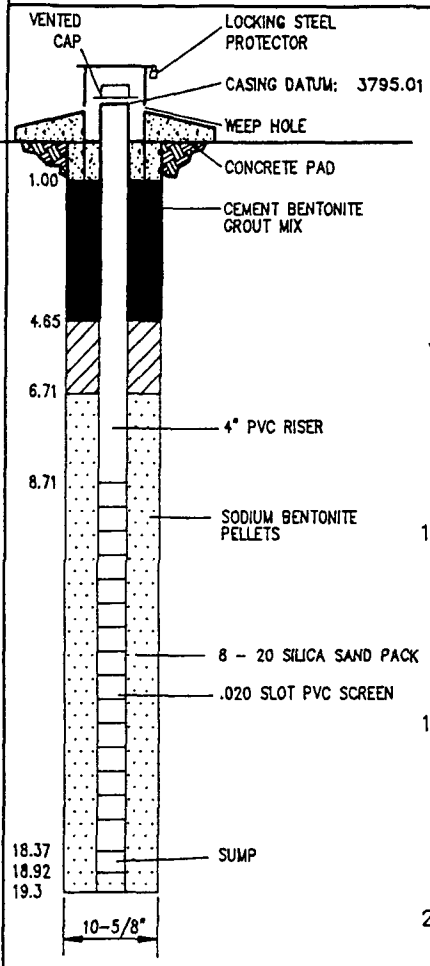
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3795.5				
	0	SILT: BROWN 7.5 YR 5/3, LOOSE NO PLASTICITY, DRY	ML		1 GC; NS	
	2.7	CLAYEY SILT: LIGHT BROWN 7.5 YR 6/4 SLIGHTLY PLASTIC, DRY, 10% CLAY, SOME CALICHE DEPOSITS (10%), SOFT LOOSE	ML		2 1.3; NR; 3 1.5; NS	
	5					
	7.8	CLAYEY SILT: LIGHT BROWN, 7.5 YR 6/4 AND PINK 7.5 YR 7/3, SLIGHTLY PLASTIC, FIRM, DRY, 25% CLAY, 20% CALICHE DEPOSITS	ML		4 1.5	
	9.3				5 1.3; NR; NS	
	10	SILTY CLAY: BROWN 7.5 YR 5/3, 20% SILT, 5% CALICHE DEPOSITS, SLIGHT PLASTICITY, HARD, DRY, SLIGHTLY MOIST AT 12.5' TO 12.9', NO ODOR	CL			
12.95'	12.9	SILTY GRAVEL: BROWN 7.5, YR 6/4, GRAVELS COARSE WITH SOME FINE 5 MM TO 30 MM, SLIGHTLY MOIST, WELL GRADED, HYDROCARBON SATURATION BELOW 13.4'	GM		6 0.9; NR	
	14.0				7 0.5; NR; NS	
	15	SANDY GRAVEL: DARK GRAY 7.5 YRN4/0, SATURATED, SAND 10%, COARSE GRAINED, SUBANGULAR, GRAVEL FINE TO COARSE 10 TO 50 MM, STRONG HYDROCARBON ODOR, WELL GRADED, LARGER GRAVEL WELL ROUNDED	GP			
	19.2				8 1.0; NS	
	19.3	BEDROCK, LIMESTONE, BROWN, DOLOMITIC, DENSE, HARD, WEATHERED GRAY OF SURFACES	DOLOMITE		9 0.3	
	20	AUGER REFUSAL AT 19.3'				
		BOREHOLE OVM READING 32.3 PPM				
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-37 (BH-60)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 5/26/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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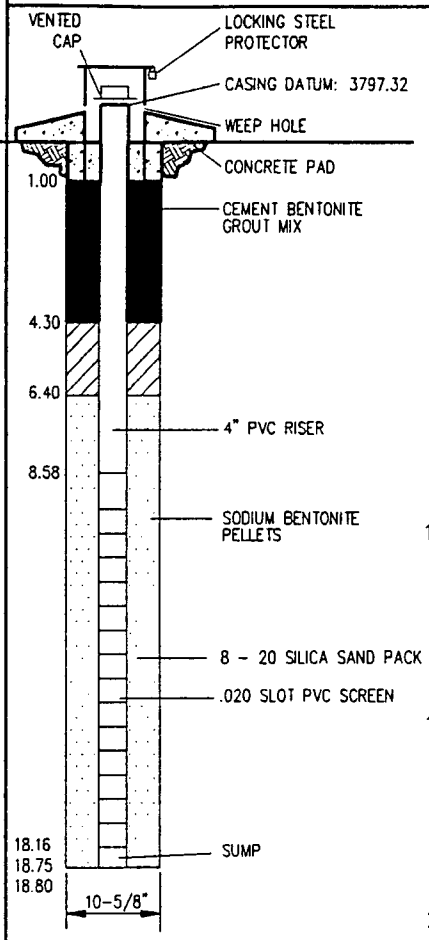
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3795.5				
	0	SILT: BROWN 7.5 YR 5/3, LOOSE, NO PLASTICITY, DRY	ML		1 GC; NS	
	3.2	CLAYEY SILT: BROWN 7.5 YR 5/4, CLAY 20%, CALICHE DEPOSITS 10%, FIRM, FRIABLE, DRY	CL		2 1.3; NR	
	4.6	CLAYEY SILT: LIGHT BROWN 7.5 YR 6/4, 30% CLAY, 20% CALICHE DEPOSITS, LOW PLASTICITY, FIRM FRIABLE, DRY	ML		3 1.5; NS; 4 1.5; 5 0.6; NR; NS	
	5					
	10					
	12.0	SILTY GRAVEL: LIGHT REDDISH BROWN 5 YR 6/3, SILT 30%, GRAVEL COARSE UP TO 50MM AND FINE TO 5MM, POORLY SORTED, DRY, GRAVEL DOLOMITIC LIMESTONE, LIGHT GRAY 7.5 YR 7/0, DENSE, DRY	GM		6 0.6; NR	
14.95	14.2	DOLOMITIC LIMESTONE: WEATHERED, FRACTURES, DENSE IN PART, LIGHT GRAY 7.5 YR 7/0, SATURATED	DOLOMITE		7 0.8; NR; NS	
	15					
	18.3	SANDSTONE: GRAY 7.5 YR N5/0, POORLY CEMENTED, FRIABLE, STRONG HYDROCARBON ODOR, VERY FINE TO FINE GRAINED, SATURATED	SANDSTONE		8 0.4; NR	
	18.8	REFUSAL REFUSAL AT 18.8				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-38 (BH-61)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 5/27/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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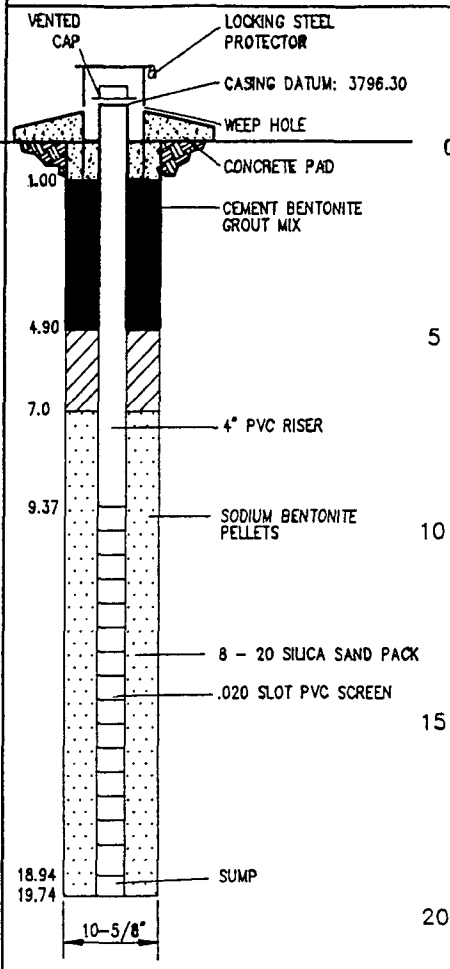
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3795.5				
	0	SILT: BROWN 7.5 YR 5/3, LOOSE, NO PLASTICITY, DRY	ML		1 GC; NS; 2 1.5	
	3.6	CLAYEY SILT: PALE RED 10 R 6/3, 10% CLAY, 20% CALICHE DEPOSITS, FIRM, FRIABLE, DRY, GRADING TO PINKISH WHITE 5 YR 8/2 BELOW 4.0'	ML		3 0.4; NR; NS	
	5					
	7.5	SILTY GRAVELLY SAND: PINKISH WHITE 5 YR 8/2, LOOSE, ANGULAR, FINE GRAINED, DRY, 30% SILT, 15% GRAVEL	GM		4 0.8; NR	
	9.5	CLAYEY SILT: BROWN 7.5 YR 5/4, 25% CLAY, TRACE CALICHE DEPOSITS, SOFT, LOOSE, DRY	ML		5 0.9; NR; NS	
	10					
	12.5	CLAYEY GRAVEL AND POSS. COBBLES: LIGHT BROWN 7.5 YR 6/4, CLAY 25%, VERY SLIGHT PLASTICITY, MOIST, NO ODOR, GRAVEL 50%, GRAY 7.5 YR N 5/0, COARSE AND FINE, 5-40 MM	GC		6 1.5	
14.3'	14.3				7 0.8; NR	
	15	SILTY GRAVEL AND COBBLES: SILT 10%, GRAVEL 50%, COBBLES 40%, WELL ROUNDED, SOME GREASY DARK GRAY SUBSTANCE, ON GRAVEL SURFACES, 7.5 YR N 4/0, STRONG HYDROCARBON ODOR, WET	GP		NS	
	17.8				8 0.5	
	19.2	WEATHERED SANDSTONE: LIGHT BROWN 7.5YR 6/3, VERY FINE GRAINED, POORLY CEMENTED, FRIABLE, HYDROCARBON ODOR, WET, SOME SILT 20%	SANDSTONE		NS	
	19.5		SANDSTONE		9	
	20	SILTY SANDSTONE: LIGHT GRAY, 2.5 YR N 6/0, CALCAREOUS CEMENT, VERY FINE GRAINED, WET, SOFT, POORLY CEMENT, FRIABLE				
		HSA REFUSAL AT 19.5'				
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-39 (BH-62)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 5/28/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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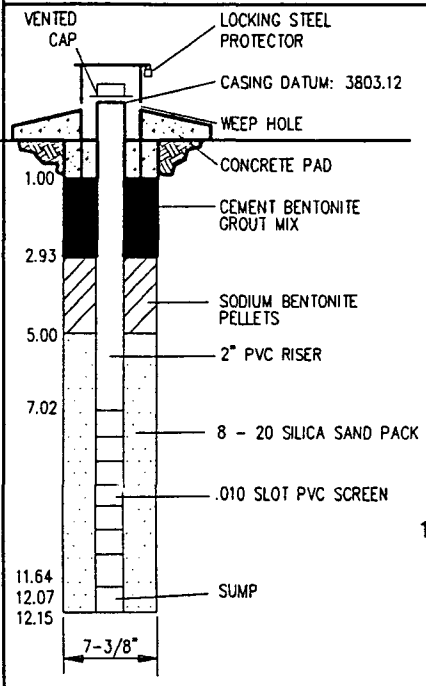
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3801.2				
	0	SILT: PINKISH GRAY 7.5 YR 7/2, LOOSE, DRY	ML		1 GC; NS	
	3.0	CLAYEY SILT: LIGHT BROWN 7.5 YR 6/4 20% CLAY, 10% CALICHE DEPOSITS, VERY LOW PLASTICITY, FRIABLE TO LOOSE, GRADING TO PINKISH WHITE 7.5 YR 8/2 AT 7.0', DRY	ML		2 .5; 3 .0; NR; NS; 4 0.5; NS	
	9.2	SANDSTONE: VERY PALE BROWN 10 YR 8/3, VERY FINE GRAINED, SILTY, CALCAREOUS CEMENT, MODERATELY CEMENTED, FRIABLE, DRY	SANDSTONE		5 0.2; NS	
	12.1	DOLOMITE: LIGHT BROWNISH GRAY 10 YR 6/2, DENSE, HARD, DRY	DOLOMITE		6 0.1	
		AUGER REFUSAL AT 12.1'				
	15	GROUNDWATER NOT ENCOUNTERED WHILE DRILLING				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-40 (BH-63)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 5/29/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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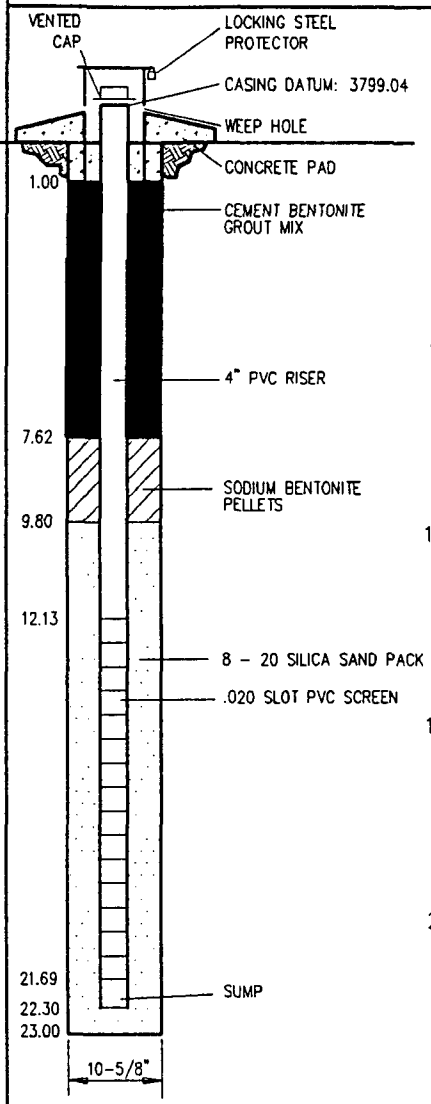
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3797.3				
	0	SILT: WEAK RED 2.5 YR 5/2, LOOSE, DRY	ML		1 GC; NS	
	2.8	SILTY CLAY: REDDISH BROWN 5 YR 5/3, 25% SILT, 15% CALICHE DEPOSITS, FIRM, FRIABLE, DRY	CL		2 .3; NR; 3 1.2	
	4.7 / 5	SILTY CLAY: PINK 7.5 YR 7/3, 20% SILT, 30% CALICHE DEPOSITS, FIRM, FRIABLE, DRY	CL		NR; NS; 4 .5	
	8.5	CLAYEY GRAVEL AND COBBLES: GRAVEL IS DOLOMITIC LIMESTONE, GRAY 5 YR 5/1, DENSE, 60% GRAVEL, 10% COBBLES, 30% CLAY, CLAY IS LIGHT BROWN 9.5 YR 6/3, DRY	GC		5 1.0; NR; NS; 6 1.0; NR	
15.03'	14.5 / 15	CLAYEY GRAVEL AND COBBLES: AS ABOVE BUT SATURATED BELOW 14.5' WITH STRONG HYDROCARBON ODOR	GC		7 0.8; NR; NS; 8 0.8; NR	
	18.0	SILTY SANDSTONE: OLIVE GRAY 5 YR 5/2, VERY SOFT, VERY FINE GRAINED, VERY POORLY CEMENTED, VERY FINELY BEDDED, SATURATED, STRONG HYDRO-CARBON ODOR	SILTY SAND STONE		9 0.5; NS	
	22.5 / 23.0	POSSIBLY DOLOMITE BELOW 22.8', VERY HARD	DOLOMITE		10 0.3; NS	
	25	AUGER REFUSAL AT 23.0'				
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-41 (BH-64)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 5/30/91
DRILLING METHOD HSA/SS
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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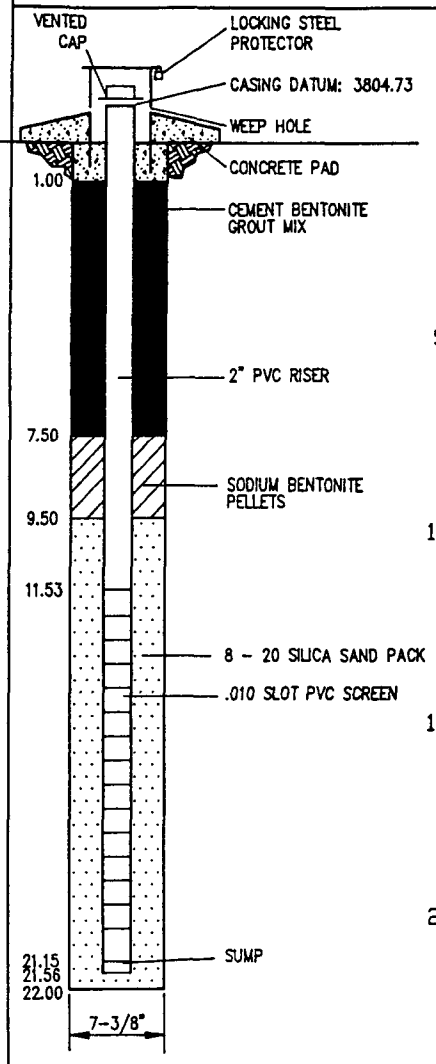
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3802.7				
	0	SILT: BROWN 7.5 YR 5/4, LOOSE, DRY	ML		1 GC NS	
	2.8	CLAYEY SILT: PINK 7.5 YR 7/3, 25% CLAY, SLIGHTLY LOOSE, DRY, VERY LOW PLASTICITY	ML		2	1.5
	4.8	CLAYEY SILT: PINKISH WHITE 5 YR 8/2, LOOSE, DRY, 25% CLAY, CONTAINS TRACE OF GRAVEL	ML		3 NR NS	1.0
	7.5	SANDSTONE: PINKISH GRAY 7.5 YR 7/2, POORLY CEMENTED, CALCAREOUS CEMENT FRIABLE, DRY, VERY FINE GRAINED, SILTY	SILTY SANDSTONE		4 NS	0.2
	9.0	SANDSTONE: VERY SILTY, LIGHT GRAY 5 YR 7/1, HARD, FRIABLE, VERY FINE GRAINED, FAIRLY WELL CEMENTED, CALCAREOUS, DRY, VERY FINELY BEDDED	SILTY SANDSTONE		5 NS 6 NS 7 NS	0.3 0.3 0.1
	14.0	SANDSTONE: BROWN 7.5 YR 5/2, SLIGHTLY DOLOMITIC, CALCAREOUS CEMENT, FAIRLY WELL CEMENTED, HARD, VERY SLIGHTLY FRIABLE, DRY	SANDSTONE		8 NS 9 NS 10 NS	0.2 0.1 0.1
	22.0	AUGER REFUSAL AT 22.0'				
	25	GROUNDWATER NOT ENCOUNTERED WHILE DRILLING				
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-42 (BH-65)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 5/30/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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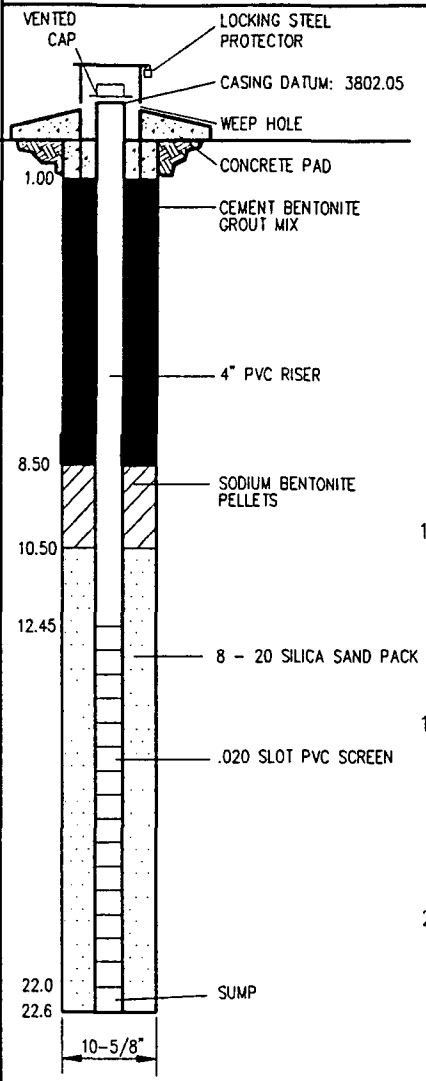
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3800.1				
	0	SILT: LIGHT BROWN 7.5 YR 6/4, LOOSE, DRY	ML		1 GC; NS	
	3.0	CLAYEY SILT: BROWN 7.5 YR 5/4, FIRM, FRIABLE, 20% CLAY, 10% CALICHE DEPOSITS, DRY, NO PLASTICITY	ML		2 1.2; 3 1.0	
	5					
	6.0	SILT, GRAVEL AND COBBLES: 20% SILT, 60% GRAVEL, COARSE TO FINE 10-40MM, TRACE POSSIBLE COBBLES, DRY, LOOSE, GRAVEL SLIGHTLY DOLOCITIC LIMESTONE AND CHERTY LIMESTONE, VUGULAR IN PART, SILT PINKISH WHITE 5 YR 8/2	GM		NS; 4 0.2; NR; 5 1.1; NR; NS; 6 0.5; NR; 7 1.1; NS; 8 1.3; NR; 9 0.6; NR; NS; 10 0.4	
	10	15% CLAY IN MATRIX AT 14.5'-18.5'				
	15	WET AT 17.7'				
17.7'		STRONG HYDROCARBON ODOR AND DARK COLOR (BLACK) AT 17.7'-19.4'				
	19.4					
	20	SANDSTONE: 2.5 Y 5/4, LIGHT OLIVE BROWN, VERY FINE GRAIN, MODERATELY HARD, HYDROCARBON ODOR	SANDSTONE			
	22.6	AUGER REFUSAL AT 22.4'				
	25	BOREHOLE OVM READING: 1.0PPM				
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-43 (BH-66)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 5/31/91
DRILLING METHOD HSA/SS
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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ENVIRONMENTAL CONSULTANTS
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NORMAN, OKLAHOMA 73072
(405) 321-3895

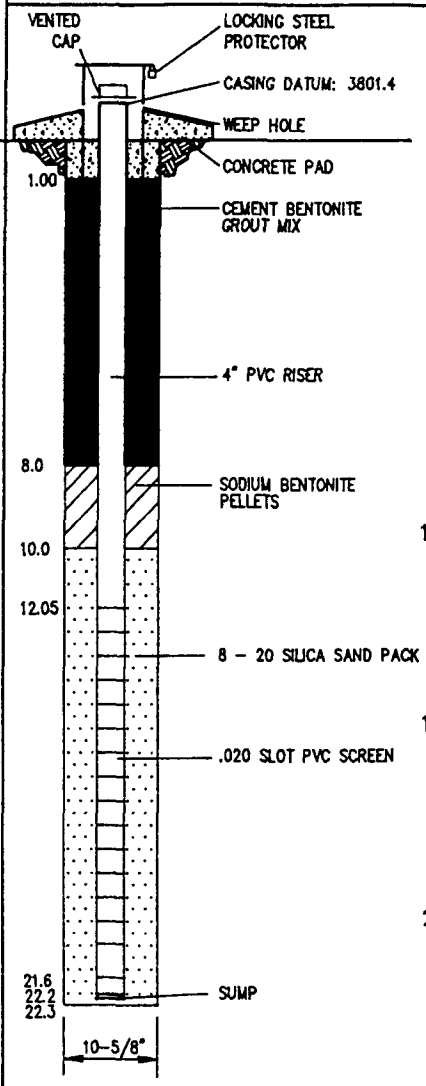
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3801.1				
	0	SILT: LIGHT BROWN 7.5 YR 6/4, SOFT, DRY, LOOSE	ML		1 GC; NS	
	3.3	CLAYEY SILT: 7.5 YR 5/4, BROWN, FIRM, CALICHE NODULES, DRY, FRIABLE, 15% CLAY, 10% CALICHE, 75% SILT	ML		2 1.2; NR; 3 1.0; NR; NS; 4 1.3; NR	
	9.0	SILT, GRAVEL & COBBLES: 2.5 YR 6/2, LIGHT BROWNISH GRAY AND 7.5 YR 7/2 PINKISH GRAY, LIGHTLY CEMENTED, HARD, DRY, VERY SILTY DOLOMITIC LIMESTONE GRAVEL, WET AT 14.3'	GM		5 0.8; NR; NS; 6 1.0; NR	
14.3'		CLAYEY SILT: 10 YR 4/4, DARK YELLOWISH BROWN, SOFT, WET, LOW PLASTICITY, STRONG HYDROCARBON ODOR, 30% CLAY, 70% SILT (LENS) AT 14.4–15.0	ML		7 1.0; NR; NS; 8 1.3; NR; 9 1.2; NR; NS	
	22.1 22.3	SANDSTONE: 2.5 YR 5/4, LIGHT OLIVE BROWN, FINE GRAINED, SILTY, HARD, STRONG HYDROCARBON ODOR	SANDSTONE		10 0.3	

AUGER REFUSAL AT 22.3'

BOREHOLE OVM READING: 35.0 PPM

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-44 (BH-67)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 6/1/91

DRILLING METHOD HSA

DRILLED BY SHB

LOGGED BY JMB

CHECKED BY BJS

DRAWN BY: SAR

ROBERTS/SCHORNICK

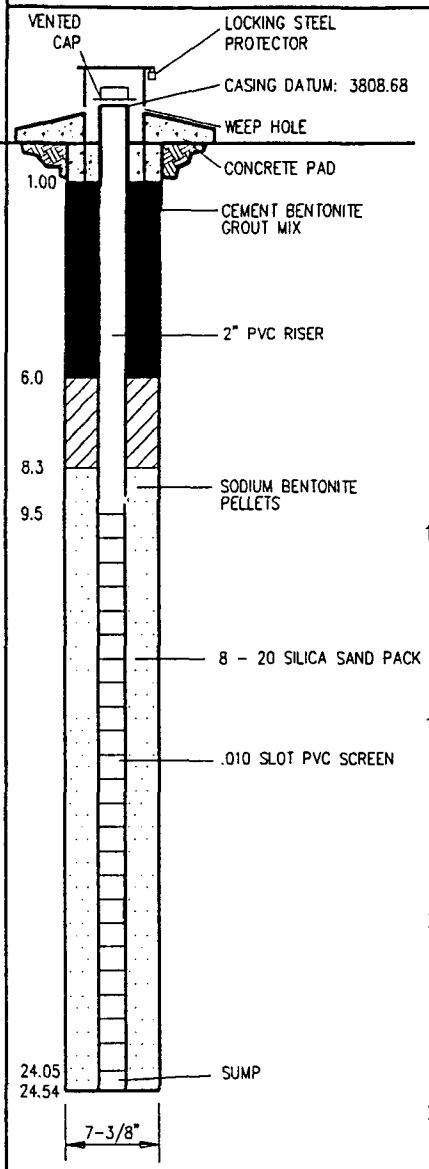
& ASSOCIATES, INC.

ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3806.6				
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, LOOSE, SOFT, DRY	ML		1 GC; NS	
	2.7	CLAYEY SILT: 7.5 YR 5/4, BROWN, NON-PLASTIC, DRY, FRIABLE, CALICHE NODULES, 15% CLAY, 10% CALICHE, 75% SILT	ML		2 1.5; 3 1.5; NS; 4 1.5	
	9.3	SANDSTONE: 2.5 YR 8/4, PALE YELLOW, MODERATELY HARD, SLIGHTELY CEMENTED, FINE GRAINED, SILTY	GM		5 0.9; NR; NS	
	10	COLOR CHANGES TO 2.5 Y 5/6 LIGHT OLIVE BROWN WITH INCREASED MOISTURE			NS	
	15	2.5 Y 4/4, OLIVE BROWN AND 2.5 Y 5/6 LIGHT OLIVE BROWN AT 17.5', CEMENTED, HARD AT 18.0, WET AT 18.5'			6 0.2; NR; NS; 7 0.6; NR; NS; 8 0.6; NR; NS; 9 0.4; NR; NS	
18.5'	20					
	24.5	AUGER REFUSAL AT 24.5'				
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-45 (BH-68)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 6/2/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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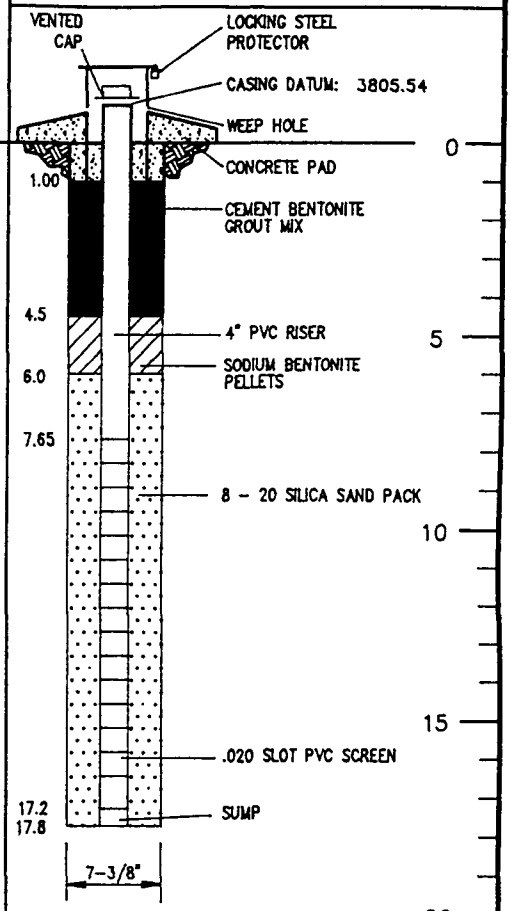
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3803.5				
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, LOOSE, SOFT, DRY	ML		1 GC; NS	
	3.2	CLAYEY SILT: 7.5 YR 5/4, BROWN, DRY, FRIABLE, CALICHE NODULES AND PRECIPITATIONS, 15% CLAY, 10% CALICHE, 75% SILT	ML		2 NR 1.0	
	4.0	SILT, GRAVEL AND COBBLES: 7.5 YR 7/2 PINKISH GRAY, GRAVEL FINE TO COARSE, DRY, DOLOMITIC LIMESTONE AND CHERTY GRAVELS AND COBBLES	GM		3 NR 1.1; NS	
	5	WET AT 12.5'			4 NR 1.1	
	10	DARK GRAY SLUDGE AT 11.0'			5 NR 0.4; 6 NR 0.5; NS	
12.5'					7 NR 0.8	
	15				8 NR 1.0; NS	
	17.9	SANDSTONE: 2.5 YR 5/4, LIGHT OLIVE BROWN, FINE GRAINED, HARD	SANDSTONE		9	
	20	AUGER REFUSAL AT 18.2' BOREHOLE OVM READING: 80 PPM				
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-46 (BH-69)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 6/3/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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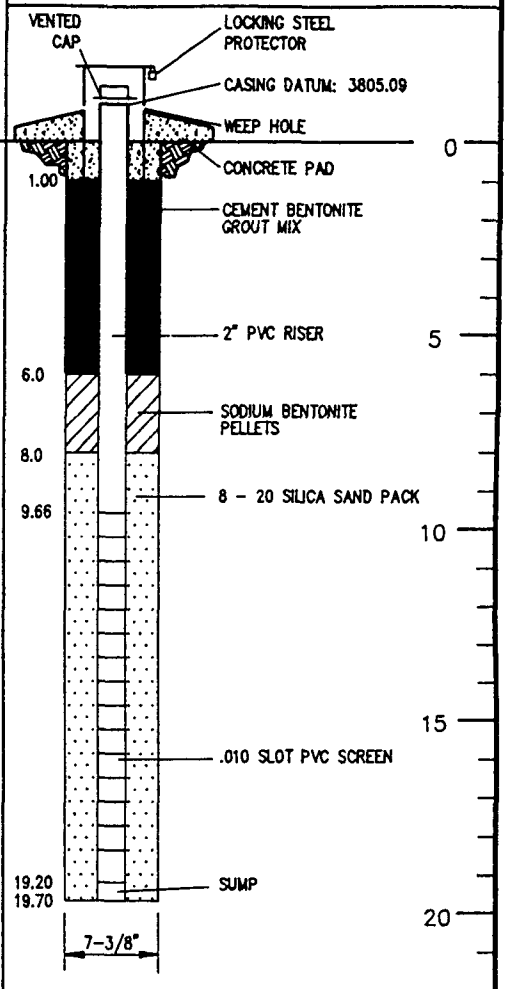
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3803.0				
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, LOOSE, SOFT, DRY	ML		1 GC; NS	
	3.0	CLAYEY SILT: 7.5 YR 5/4, BROWN, HARD, DRY, CALICHE, 15% CLAY, 25% CALICHE, 60% SILT	ML		2 NR	1.0
	3.7	SILT, GRAVEL & COBBLES: 7.5 YR 7/2, PINKISH GRAY, DOLOMITIC LIMESTONE, VERY HARD, DRY, BLACK HYDROCARBON SLUDGE AT 4.8' TO 5.0', COBBLES AND GRAVEL ARE 10 YR 7/1, LIGHT GRAY AT 6.5' TO T.D.	GM		3 NR; NS; 4 NR; 5 NR; NS; 6 NR; 7 NR; NS; 8 NR; 9	1.0; 0.5; 0.4; 1.0; 1.0; 1.0; 0.5
	19.7	AUGER REFUSAL AT 19.7'				
		GROUNDWATER NOT ENCOUNTERED WHILE DRILLING				

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-47 (BH-70)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 6/4/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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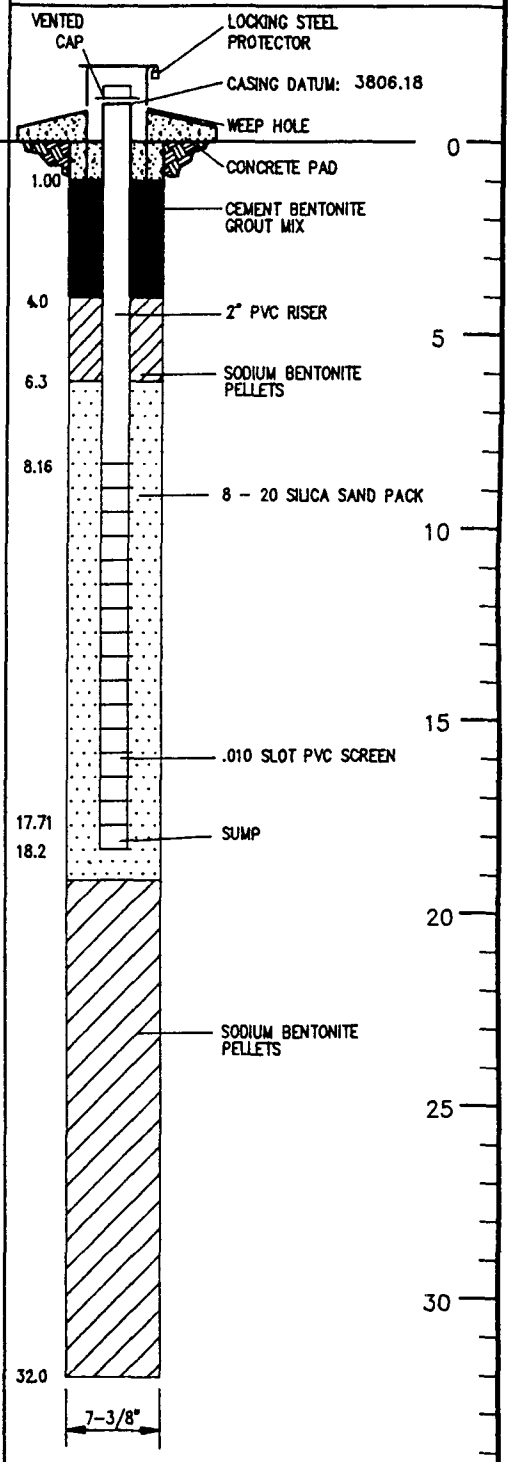
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3804.4				
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, LOOSE, SOFT, DRY	ML		1 GC; NS	
	3.0	CLAYEY SILT: 7.5 YR 5/4, BROWN, NON-PLASTIC, DRY, FRIABLE, CALICHE PRESENT, 15% CLAY, 10% CALICHE	ML		2 NR 1.0; 3 NR 1.0	
	5	SILT, GRAVEL, COBBLES: SILT IS 7.5 YR 7/2, PINKISH GRAY, GRAVEL & COBBLES ARE 10 YR 7/1 LIGHT GRAY TO 7.5 YR 6/4 LIGHT BROWN, GRAVELS ARE DOLOMITIC LIMESTONE, LOOSE, CALICHE IN SILT	GM		NS; 4 NR 0.5; 5 NR 0.3; NS; 6 NR 0.7; 7 NR 1.0; NS; 8 NR 0.2	
	19.0	SANDSTONE: 2.5 YR 5/6, LIGHT OLIVE BROWN, MODERATELY, HARD, FINE GRAINED, SLIGHT HYDROCARBON ODOR, MOIST AT 22.0', COLOR CHANGES TO 2.5 YR 4/4, OLIVE BROWN AT 22.0'	SANDSTONE		9 NR 0.3; NS; 10 NR 0.3; 11 NR 0.5; NS; 12 NR 0.5	
	29.0	SANDSTONE: 2.5 YR 6/0 TO 7/0, GRAY TO LIGHT GRAY, DRY, HARD, FINE GRAINED	SANDSTONE		13 NR 0.5; NS	
	32.0	AUGER REFUSAL AT 32.0' GROUNDWATER NOT ENCOUNTERED WHILE DRILLING				
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-48 (BH-71)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 6/4/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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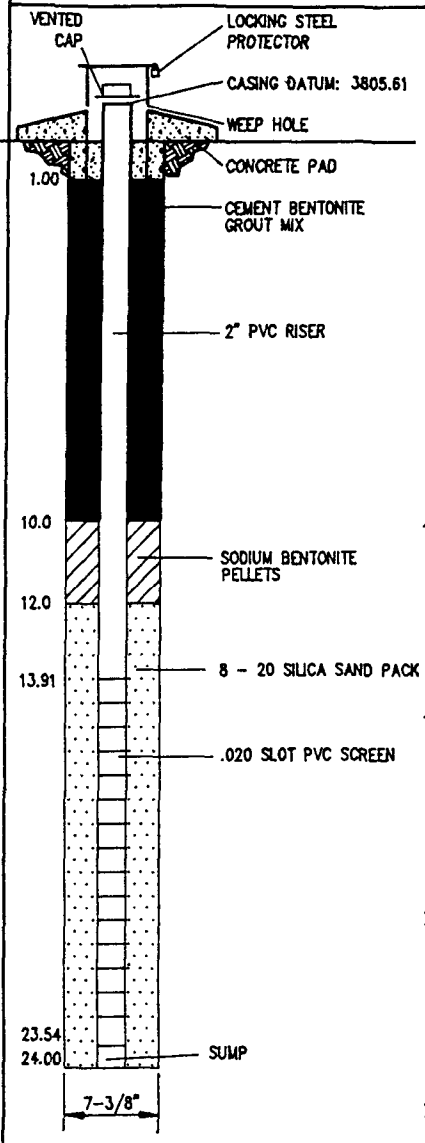
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3803.7				
	0	SILT: 10 YR 7/3, VERY PALE BROWN, LOOSE, DRY, SOFT	ML		1 GC; NS	
	3.0	SANDSTONE: 2.5 YR 8/2, WHITE, FRIABLE, HIGHLY WEATHERED, SOFT TO MODERATELY HARD, SILTY, SLIGHTLY MOIST AT 4.0', 2.4 YR 7/4, PALE YELLOW, SLIGHTLY CEMENTED AT 7.5', MODERATELY HARD TO HARD, COLOR CHANGES TO 2.5 YR 7/2, LIGHT GRAY, 2.5 YR 6/8, OLIVE YELLOW AT 9.5' HARD CEMENTED LAYERS AT 17'–17.3', AND 17.8'–18.0	SANDSTONE		2 1.5; 3 0.5; NR NS; 4 NR 0.2; 5 NR 0.2; NS; 6 NR 0.3; 7 NR 0.3; NS; 8 NR 0.2; 9 NR 0.6; NS; NR; 10 0.4	
	5					
	10					
	15					
	20					
	24.0	AUGER REFUSAL AT 24.0'				
	25	BOREHOLE OVM READING: 59.0 PPM				
		GROUNDWATER NOT ENCOUNTERED WHILE DRILLING				
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-49 (BH-72)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 6/5/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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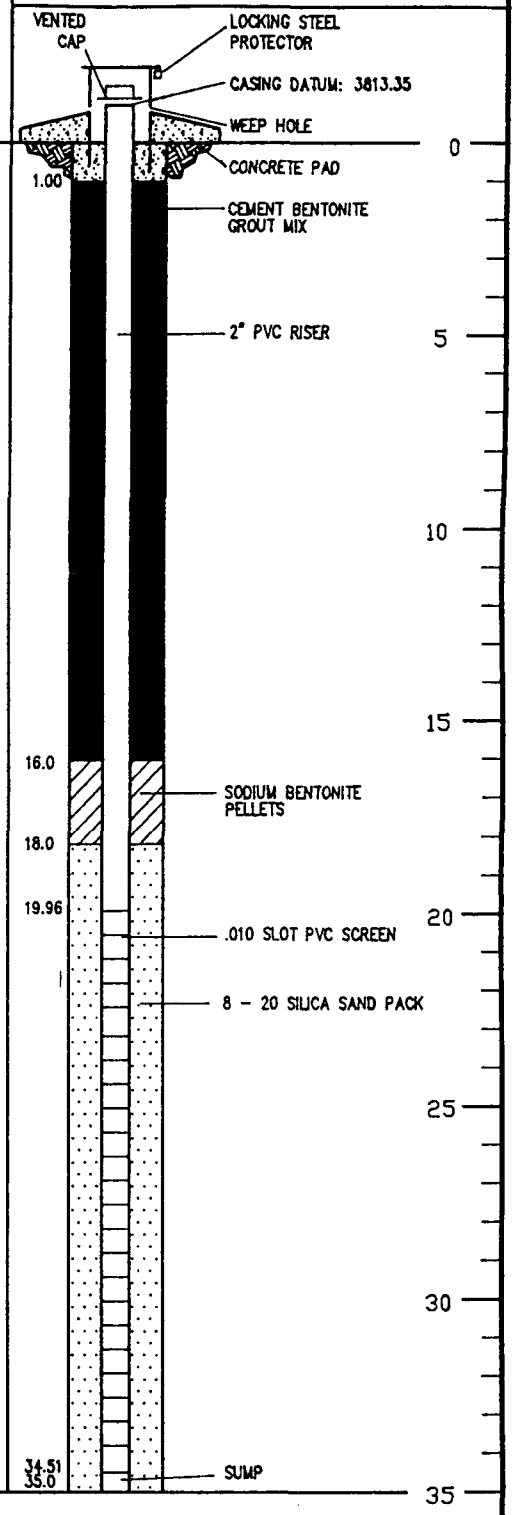
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3811.2				
	0	SILT: 10 YR 7/3, VERY PALE BROWN, LOOSE, DRY, SOFT	ML		1 GC	
					NS	
	2.5	SANDSTONE: 2.5 Y 8/2, WHITE, DRY, MODERATELY HARD, VERY FINE GRAINED, SILTY, WEATHERED			2 1.3	
					NR	
		2.5 Y 7/4 PALE YELLOW AT 4.0'			3 0.3	
	5				NR	
					NS	
		2.5 Y 6/8 OLIVE YELLOW AT 8.5'			4 0.3	
		MOIST AT 9.0'			NS	
	10				NS	
		CEMENTED LAYER SET 13.0'–17.5'			5 0.3	
					NR	
	15				NS	
			SANDSTONE			
					6 0.6	
		VERY MOIST TO WET AT 19.0'			NR	
					7 0.5	
	20	2.5 YR 4/4 OLIVE BROWN AT 20.0'			NR	
					NS	
					8 0.2	
					NR	
		VERY HARD & CEMENTED AT 24.0'–25.0'				
	25				NR	
					NS	
26.5						
					NR	
28.5						
					NS	
					9 0.5	
					NR	
	30				NS	
					10 0.5	
					NR	
		T.D. 35.0'			11 1.0	
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-50 (BH-73)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 6/6/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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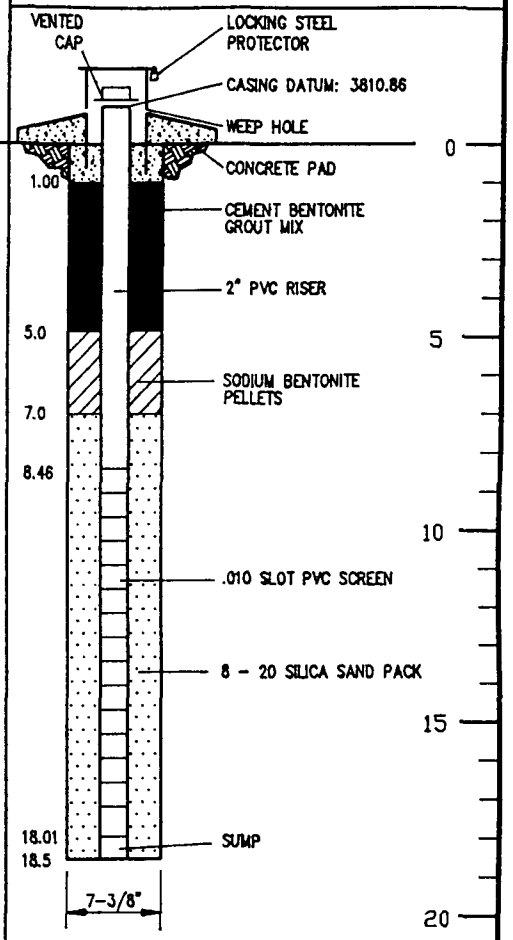
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3809.3				
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, LOOSE, DRY, SOFT	ML		1 GC; NS	
	2.8	CLAYEY SILT: 7.5 YR 5/4, BROWN, FIRM, FRIABLE, DRY, 15% CLAY, 10% CALICHE	ML		2 NR 1.0; 3 NR 0.1; NS; 4 1.0	
	8.5	SILT, GRAVEL, COBBLES: SILT IS 10 YR 6/4 TO 5/4, LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY, GRAVEL & COBBLES ARE 2.5 YR 5/0 TO 4/0, GRAY TO DARK GRAY AND ARE DOLOMITIC LIMESTONE, VUGGY POROSITY, LIMESTONE IS ALSO 2.5 Y 6/2 LIGHT BROWNISH GRAY	GM		NR; 5 0.6; NR; NS; 6 0.6; NR; 7 0.7; NR; NS	
16.5	17.9	SANDSTONE: 2.5 Y 6/6, OLIVE YELLOW HARD, FINE GRAINED, SILTY	SS		8 0.5; NR	
	18.5	AUGER REFUSAL AT 18.5' BOREHOLE OVM READING: 0.0 PPM				

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MW-51 (BH-74)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 6/6/91
DRILLING METHOD HSA/SS
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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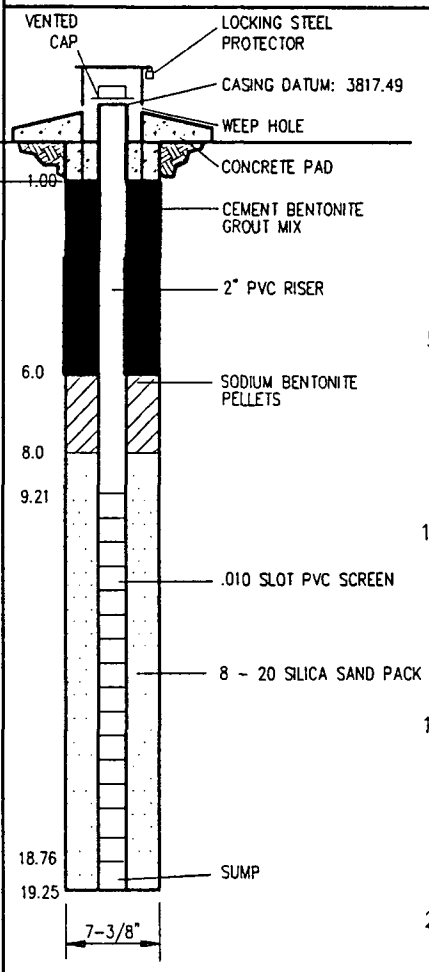
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3815.3				
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, ROOTLETS TOP 2.0', LOOSE, SOFT, DRY	ML		1 NS	GC
	2.8	CLAYEY SILT: 7.5 YR 5/4, BROWN, FRIABLE, FIRM, NON-PLASTIC, DRY, 15% CLAY, 10% CALICHE	ML		2 NR 1.2'	
	4.7	SILT, GRAVEL & COBBLES: SILT IS 10 YR 6/4 TO 5/4, LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY, GRAVEL & COBBLES ARE 2.5 Y 5/0 TO 4/0, GRAY TO LIGHT GRAY TO 2.5 Y 6/2 LIGHT BROWNISH GRAVEL, GRAVELS ARE DOLOMITIC LIMESTONE, VUGGY POROSITY	GM		3 NR 0.9 NS 4 NR 0.6' 5 NR 1.0' NS NR 6 NR 1.0' NS 7 NR 0.5	
	19.0 19.25	DOLOMITIC LIMESTONE: 7.5 YR 6/2, PINKISH GRAY, VERY HARD, VUGGY POROSITY, MOIST	LIMESTONE		8 0.35	

AUGER REFUSAL AT 19.25'
BOREHOLE OVM READING: 0.0 PPM

GROUNDWATER NOT ENCOUNTERED WHILE DRILLING

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-52 (BH-75)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 6/7/91
DRILLING METHOD HSA/SS
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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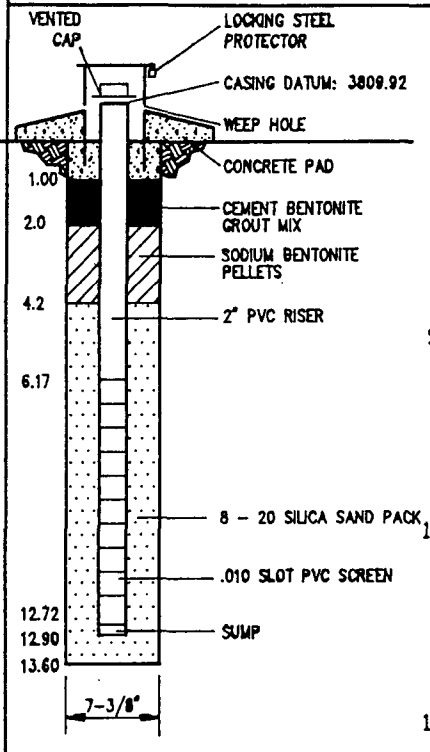
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 3807.5				
	0	COBBLEY CLAYEY SILT: BROWN, 10 YR 4/3, DRY, VERY LOW PLASTICITY, COBBLES FROM 3 CM TO 10 CM, SUB-ROUNDED	GM		1 GC; NS; 2 1.0; NR; 3 0.2; NR; NS; 4 0.7; NR; NS; 5 0.6; 6 0.2; NR; NS; 7 0.6; NR; NS; 8 0.2; NR	
	5	BOULDERY BELOW 7.5', ROUNDED, > 50CM				
	10	CLAYEY AND GRAVELLY BELOW 11.5'				
	13.6	AUGER REFUSAL AT 13.6'				
	15	GROUNDWATER NOT OBSERVED DURING DRILLING				
	20					
	25					
	30					
	35					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MW-53 (BH-77)***

BORING NUMBER ***MARATHON/91029***

DATE DRILLED 6/7/91
DRILLING METHOD HSA/SS
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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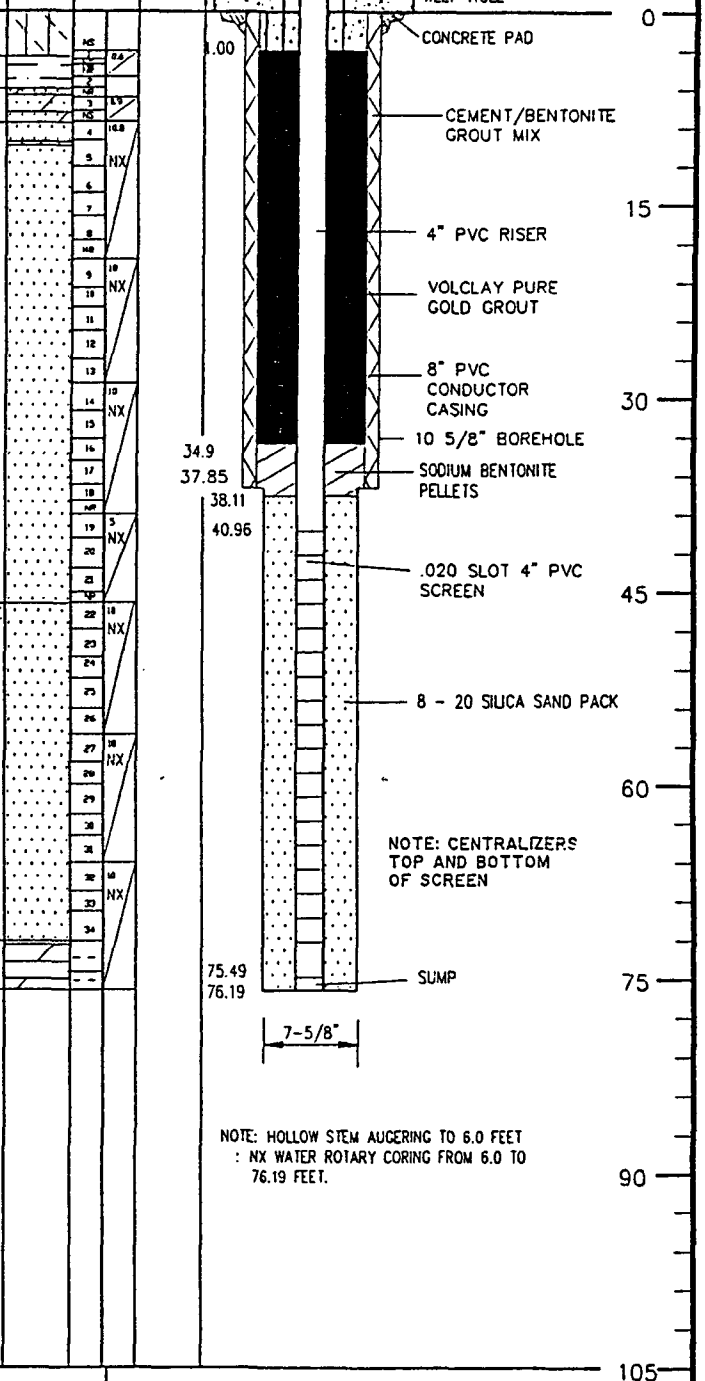
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD # 80 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3821.90	
	0	CLAYEY SILT: 10% CLAY, 90% 7.5 YR 6/4, UNCONSOLIDATED, DRY	ML
	3.5	SILTSTONE: 2.5 YR 8/1 WHITE, HARD, DRY	SILTSTONE
	6.0	SANDY DOLOMITE: VERY FINE GRAIN SILICA SAND, 10 YR 7/1 LT. GRAY, VERY HARD, FRACTURED, DRY	SANDY DOLOMITE
	8.0	SANDSTONE: VERY FINE GRAIN SILICA, WELL SORTED, HARD, MOIST, 10 YR 7/2 LT. GRAY, MASSIVE, MINOR IRON OXIDE MOTTLING FRACTURES (HORIZONTAL) AT 8.1, 8.8, 9.7, 10. & 10.3 FEET, SANDY DOLOMITE INTERBEDDED AT 10.3' TO 10.8', FRACTURES AT 6.2, 9.0, 10.2, 11.7, 12.9, 13.4, 13.9, 15.9	SANDSTONE
▽14.90*	15	SANDSTONE VERY MOIST AFTER 12.6' VARYING DEGREES OF CARBONATE CEMENTATION	
		AFTER 22.0', 10 YR 5/2 GRAY BROWN, NO CARBONATE CEMENTATION, MODERATELY HARD, FRACTURES AT 17.7, 18.8, 20.5, 20.9, 24.5 FEET	
		27.0' TO 27.3', 2.5 YR 7/4, PALE YELLOW	
	30	2.5 YR GRAY BROWN AFTER 30', FRACTURES AT 29.7, 29.8, 29.9, 30.1, 30.2, 30.4, 30.6, 31.0, 32.2, 31.5, 31.9, 32.3, 32.5, 33.1, 33.5, 33.9, 34.1, 34.5, 34.9, 35.5, 36.6, 37.2, 37.5, 37.9, CALCITE AND IRON OXIDE FRACTURE FILL AFTER 34.0'	
▽42.86		AFTER 35.1', MODERATELY WELL CEMENTED, ABUNDANT FRACTURES – EVERY .2 FEET	
	45	AFTER 36.0', 2.5 YR 6/2, LIGHT BROWN GRAY TO 2.5 YR 6/4 LIGHT YELLOW BROWN IRON OXIDE STAINING, MOIST MOD. WELL CEMENTED AFTER 38.8', 2.5 YR 4/2 DARK GRAY BROWN GRADING INTO 10 YR 3/1 VERY DARK GRAY, VERY FINE GRAIN SANDSTONE BETWEEN 42.5' AND 43.5', VERY FINE GRAIN SILTY SANDSTONE 5 YR 4/1 DARK GRAY	SANDSTONE
	46.2	SANDSTONE: VERY FINE GRAIN, 10 YR 5/1 GRAY TO 10 YR 3/1 VERY DARK GRAY, VERY HARD, MODERATELY FRACTURED, AFTER 47.0' 2.5 YR 7/0 LIGHT GRAY, MOTTLED WITH 10 YR 6/3 PALE BROWN, SLIGHTLY DOLOMITIC AFTER 50.7', BETWEEN 54.8' AND 55' 5 YR 4/1 DARK GRAY	
	60	CONTINUING ALTERNATING BANDS OF 10 YR 5/1 GRAY AND 2.5 YR 7/6 LIGHT GRAY MOTTLED WITH 10 YR 6/3 PALE BROWN	
		BETWEEN 62.6' AND 62.7': SILTY SANDSTONE 5 YR 5/2 OLIVE GRAY, HIGHLY WEATHERED	
	72.0		
	75	DOLOMITE: GRADATIONAL CONTACT WITH SANDSTONE, 5 YR 5/1 GRAY, VERY HARD, HORIZONTAL FRACTURES AT 72.6, 73, 73.3, 73.4, 74.7, 75.0, STRONG CONDENSATE ODOR AT 76.0'	DOLO.
	76.19	T.D. 76.19'	
		W/L AFTER DRILLING 14.90'	
		NOTE: WATER ROTARY CORING AFTER 11.0 FEET, WATER LEVEL UNABLE TO BE DETERMINED DUE TO WET ROTARY DRILLING METHODS.	
	90	: LOST CIRCULATION AT 11.0 FEET	
		: BOREHOLE DRY AT 46.1 FEET ON 6/18/91	
		* LEVEL PRIOR TO WELL PURGING WATER LEVEL NOT OBSERVED DURING DRILLING. OPEN HOLE LEVEL ~ 43 FEET	
	105		

GRAPHIC LOG / SAMPLE INTERVAL / "N" VALUE



NOTE: HOLLOW STEM AUGERING TO 6.0 FEET : NX WATER ROTARY CORING FROM 6.0 TO 76.19 FEET.

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-54 (BH-80)*

DATE DRILLED	6/27/91	CONDUCTOR INSTALLED 6/16-17/91
DRILLING METHOD	AIR ROTARY/WATER NX CORE	
DRILLED BY	SHB AND BOYLES BROS.	
LOGGED BY	GBR	
CHECKED BY	BJS	
DRAWN BY:	SAR	PAGE 1 OF 1

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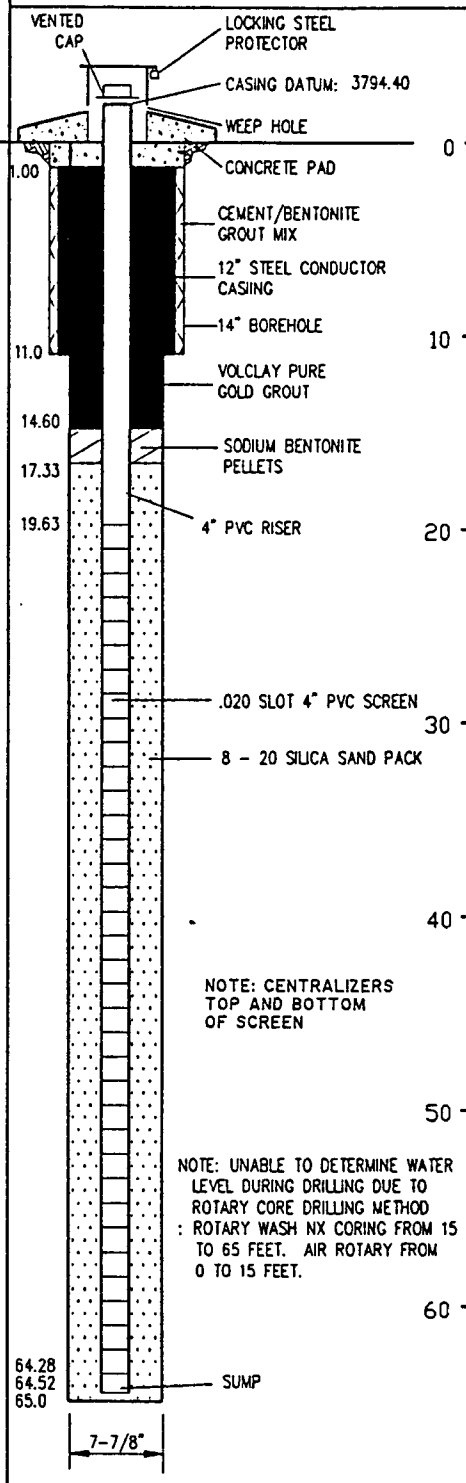
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD # 81 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3792.60				
	0	SILT: WELL GRADED, VERY FINE GRAIN, 90% SILT, 10% SAND, NO PLASTICITY, 10 YR 8/4, VERY PALE BROWN, NO ODOR, DRY SOFT NON-STARATIFIED, CALCITE CEMENT, HCL(+) COLOR CHANGE TO 10 YR 6/8, BROWNISH YELLOW AT 5 FEET	ML		1, NS, 2	
	6.0	SANDSTONE: VERY FINE GRAINED SILICA, 10 YR 6/3, PALE BROWN, 10 YR 5/3, BROWN, MODERATELY HARD TO VERY HARD, SLIGHTLY MOIST, WEATHERED, MOIST AND FRIABLE BETWEEN 18.5 AND 21.5', AFTER 21.5' VERY HARD, FRACTURES LARGELY CEMENTED, FRACTURES AT 15.2, 16.0, 16.8, 17.2, 17.5, 18.5, 19.7, 20.0, 20.8, 21-21.5, 23.3, 24.0, NO ODOR	SANDSTONE		3, 4, 5, 6	
	10					
▽15.9		10 YR 5/2 GRAY BROWN AFTER 25.0'			1, 2, 3, 4, 5	10
		FRACTURE (HORIZONTAL) AT 28.5'				
	20					
▽23.39					6, 7, 8	10
	30					
	30.5	SANDY DOLOMITE: VERY FINE GRAIN SAND, 10 YR 6/1, LT. GRAY-GRAY, VERY HARD	SANDY DOLO.		9	
	31.5	DOLOMITE: MICROCRYSTAL, 2.5 YR 6/2, LIGHT BROWN GRAY, VERY HARD, FRACTURES AT 31.6,32.1, 32.2, 32.5-33.5, 33.8, 33.9, 35.1, 35.7 32.1 TO 32.2 FEET FRIABLE, SANDSTONE INTERBED, 5 YR 5/3 OLIVE, MOIST, IRON OXIDE AND PYRITE ALONG FRACTURES BELOW 33' AFTER 34.3', VERY HARD, FRACTURES LARGELY CEMENTED AFTER 35', GRADES	DOLOMITE		10	
	35.0	DOLOMITIC SANDSTONE: VERY FINE GRAIN SAND, GRADATIONAL CONTACT WITH DOLOMITE, VERY HARD 10 YR 6/1 LIGHT GRAY-GRAY 10 YR 5/2 GRAY BROWN 38.9' TO 39.6', FRACTURES 36.7', 37.8', 38.8', 42.4', 43.8', 44, 44.7'	DOLOMITIC SANDSTONE		11, 12	10
	39.6					
	40		SANDSTONE		13, 14, 15	
	46.0	SANDSTONE: VERY FINE GRAIN SILICA 2.5 YR 6/2 LIGHT BROWN GRAY, VERY HARD BETWEEN 6.9 AND 7.4 FEET, 10 YR 4/1 DARK GRAY ZONE, SILTSTONE INTERBED BETWEEN 42.6 AND 43.4 FEET: HIGHLY FRIABLE AND WEATHERED, 2.5 YR 4/2 DARK GRAY BROWN BETWEEN 43.4 AND 44.4 FEET DOLOMITIC SANDSTONE: VERY FINE GRAINED, 10 YR 6/1 LIGHT GRAY TO GRAY AFTER 44.4 FEET SANDSTONE: VERY FINE GRAIN 5 YR 4/1 DARK GRAY, MOD. HARD, 5 YR 4/1 DARK GRAY 45 TO 46.1 FEET	DOLOMITIC SANDSTONE		16, 17	10
	50		SANDY DOLOMITE		18, 19, 20	
	55.0	DOLOMITIC SANDSTONE: VERY FINE GRAIN, 7.5 YR 7/0 LIGHT GRAY, VERY HARD, HORIZONTAL FRACTURES AT 44.1'	DOLOMITE		21, 22	10
	60	SANDY DOLOMITE: VERY FINE GRAIN 10 YR 6/2 LIGHT BROWN GRAY, VERY HARD, HORIZONTAL FRACTURES AT 49.9', 51.9', 52.7', 53.5', 53.7', 45° FRACTURE AT 49.9', VERTICAL FRACTURE AT 44.2' TO 55.0', PYRITE, CALCITE AND HEMATITE FRACTURE FILL, STRONG CONDENSATE ODOR AFTER 53.0'			23, 24, 25	
	65.0	DOLOMITE: 10 YR 6/2 LIGHT BROWN GRAY, HIGHLY FRACTURED WITH THIN INTERBEDS OF DOLOMITIC SILTSTONE AND SANDSTONE, STRONG CONDENSATE ODOR				
	70	T.D. 65.0'				

WELL COMPLETION DETAIL



NOTE: CENTRALIZERS TOP AND BOTTOM OF SCREEN

NOTE: UNABLE TO DETERMINE WATER LEVEL DURING DRILLING DUE TO ROTARY CORE DRILLING METHOD : ROTARY WASH NX CORING FROM 15 TO 65 FEET. AIR ROTARY FROM 0 TO 15 FEET.

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-55 (BH-81)*

DATE DRILLED 6/25/91 CONDUCTOR INSTALLED 6/15-16/91

DRILLING METHOD AIR ROTARY/WATER ROTARY CORE

DRILLED BY SHB AND BOYLES BROS.

LOGGED BY CBR

CHECKED BY BJS

DRAWN BY: SAR

PAGE 1 OF 1

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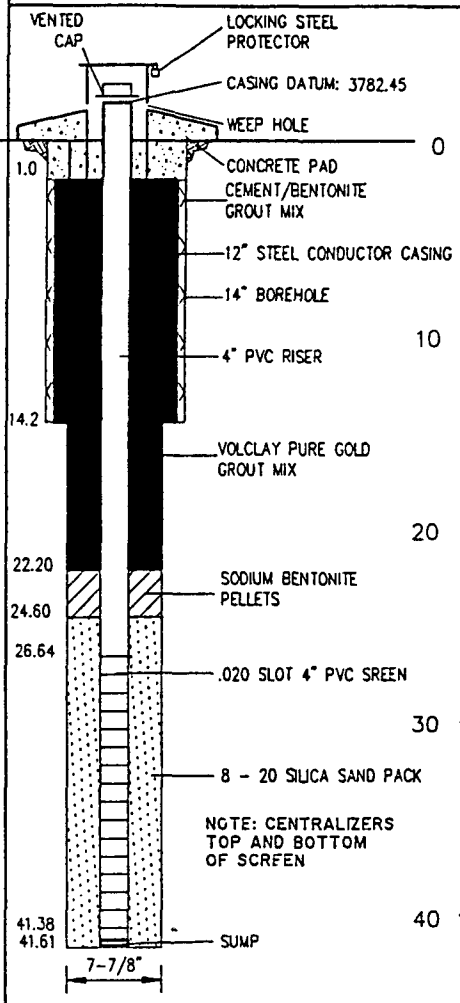
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD # 82 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3780.3				
	0	CLAYEY SILT: 20% CLAY, 80% SILT, 10 YR 5/3, BROWN, DRY, UNCONSOLIDATED, LOW PLASTICITY	ML		1 NS; 2 NS	
	6.0	SILTY CLAY: 30% SILT, 70% CLAY, 10 YR 5/3, BROWN, SOFT, MED. PLASTICITY, MINOR SUBANG DOLOMITE GRAVEL TO 1/4 INCH, MINOR DOLOMITE COBBLES TO APPROXIMATELY 3 INCHES	CL		3 NS; 4	
	9.5	DOLOMITE: 10 YR 4/1, DARK GRAY TO 10 YR 6/1, GRAY-LIGHT GRAY, DRY, HARD. VERTICAL FRACTURE BETWEEN 16.2-17.0' MODERATELY FRACTURED BELOW 17.0'	DOLOMITE		5, 6, 7, 8, 9, 10, 11	8.0 NX
	17.7	DOLOMITE: WITH INTERBEDS OF SILTY DOLOMITE, 10 YR 5/2, GRAYISH BROWN, 10 YR 6/2, LIGHT BROWNISH GRAY, AND 10 YR 5/1, GRAY, ABUNDANT HEMATITE-REPLACED FOSSIL - POSSIBLY GRAPTOLITES OR SPONCESPICULES, AFTER 21.0', CHERT-LIKE CONCOIDAL FRACTURING	DOLOMITE/ SILTY DOLO.		NR	
	25.0	DOLOMITE: 10 YR 5/2, GRAYISH BROWN, MICRO-CRYSTALLINE, VERY HARD, HIGHLY FRACTURED, 2.5 Y 6/2, LIGHT BROWNISH GRAY SILT ALONG FRACTURES, MINOR IRON OXIDE STAINING	DOLOMITE		12, 13, 14, 15, 16	9.0 NX
		STRONG CONDENSATE ODOR IN FRACTURE AT 32.8' IN FRACTURE 45° FROM VERTICAL			NR	
		STRONG CONDENSATE ODOR IN FRACTURES TO 35.6'			17, 18, 19	5.0 NX
		AFTER 35.6', FRACTURES LARGELY CEMENTED				
	41.61	T.D. 41.61			NS	
		GROUNDWATER AT 32.75' 1/8" FLOATING PRODUCT STRONG CONDENSATE ODOR 6/21/91				
		NOTE: AIR ROTARY FROM 0 TO 15 FEET. : ROTARY WASH NX CORE FROM 15.0 TO 41.61 FEET				

29.65

6/21/91 32.75'

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-56 (BH-82)*

		CONDUCTOR INSTALLED
DATE DRILLED	6/27/91	6/15/91
DRILLING METHOD	AIR ROTARY/WATER WASH NX CORE	
DRILLED BY	BOYLES BROS. AND SHB	
LOGGED BY	GHR	
CHECKED BY	BJS	
DRAWN BY:	SAR	

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WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD # 83 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3785.6	
	0 / 2.0	SANDY SILT:	SM
		SANDY DOLOMITE:	SANDY DOLOMITE
	10.0	INTERBEDDED DOLOMITE/SILTSTONE/CHERT	SILTSTONE DOLOMITE CHERT
	20.0	DOLOMITE:	DOLOMITE
	25		
	40.0	DOLOMITE:	DOLOMITE
	44.0	DOLOMITE:	DOLOMITE
	46.0	DOLOMITE:	DOLOMITE
	50		
	50.5	DOLOMITE:	DOLOMITE
	56.0		
	58.0	DOLOMITE:	DOLOMITE
		DOLOMITE:	DOLOMITE
	65.0		GYPSUM
	65.5	GYPSUM:	DOLOMITE
	67.0	DOLOMITE:	DOLOMITE
		DOLOMITE:	
	74.0		DOLOMITE
	75 / 76.0	DOLOMITE:	DOLOMITE
		DOLOMITE:	DOLOMITE
	80.0	DOLOMITE:	DOLOMITE
	87.5		DOLOMITE
	88.0	DOLOMITE:	DOLOMITE
	90.0	DOLOMITE:	SILTSTONE
	91.5	SILTSTONE:	DOLOMITE
	96.0	DOLOMITE:	DOLOMITE
	100	DOLOMITE:	
	106.0		DOLOMITE
	108.0	DOLOMITE:	LIMESTONE
		LIMESTONE:	
	119.5	LIMESTONE:	LIMESTONE
	122.0	DOLOMITE:	DOLOMITE
	125 / 126.0	LIMESTONE:	LIMESTONE
	140.0		LIMESTONE
	142.0	LIMESTONE:	SILTSTONE
		SILTSTONE:	
	148.0		LIMESTONE
	149.0	LIMESTONE:	LIMESTONE
	150	LIMESTONE:	
	154.0	LIMESTONE:	LIMESTONE
	158.0	LIMESTONE:	LIMESTONE
	162.0	LIMESTONE:	LIMESTONE
	166.0	DOLOMITE:	DOLOMITE
	172.0	SANDSTONE: DOLOMITIC	SANDSTONE
	175		

GRAPHIC LOG

SAMPLE INTERVAL

"N" VALUE

SEE BORING RECORD FOR MORE DETAIL DESCRIPTION

7/18/91 18.5'

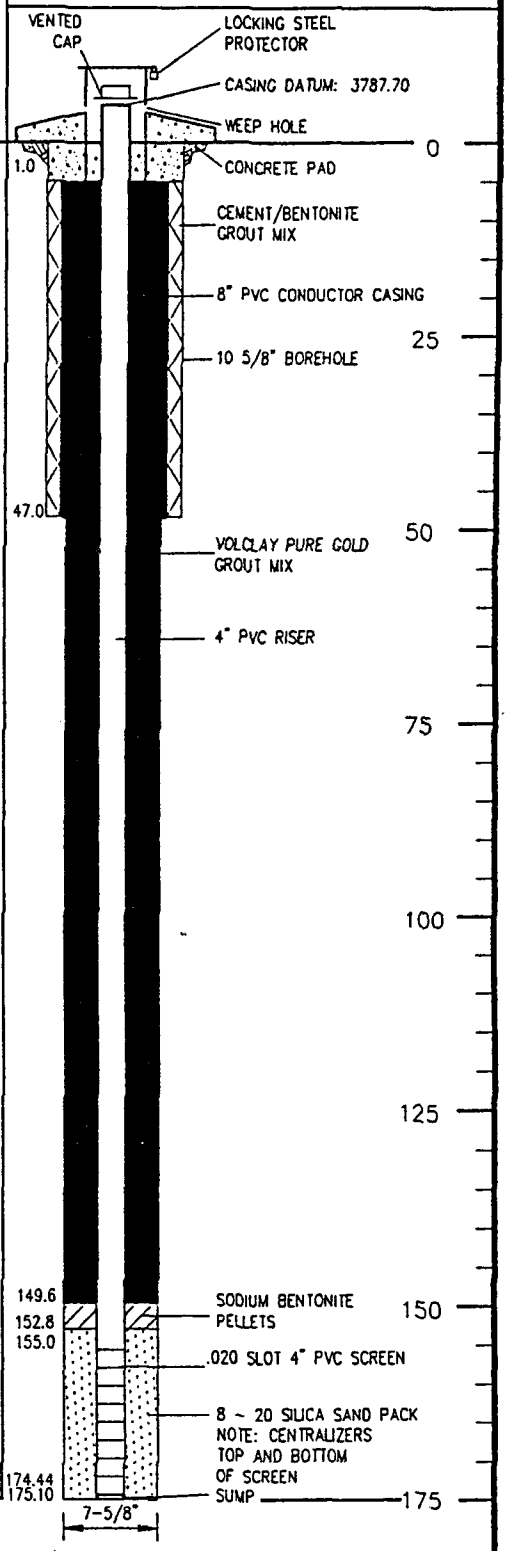
6/17/91 29.52

6/20/91 41.7

155.0

158.42

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

+ PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-57 (BH-83)*

DATE DRILLED 6/25/91 — CONDUCTOR INSTALLED: 6/17-18/91

DRILLING METHOD AIR ROTARY/WATER ROTARY CORE/HSA

DRILLED BY BOYLES BROS.

LOGGED BY GHR

CHECKED BY BJS

DRAWN BY: SAR

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WELL COMPLETION RECORD

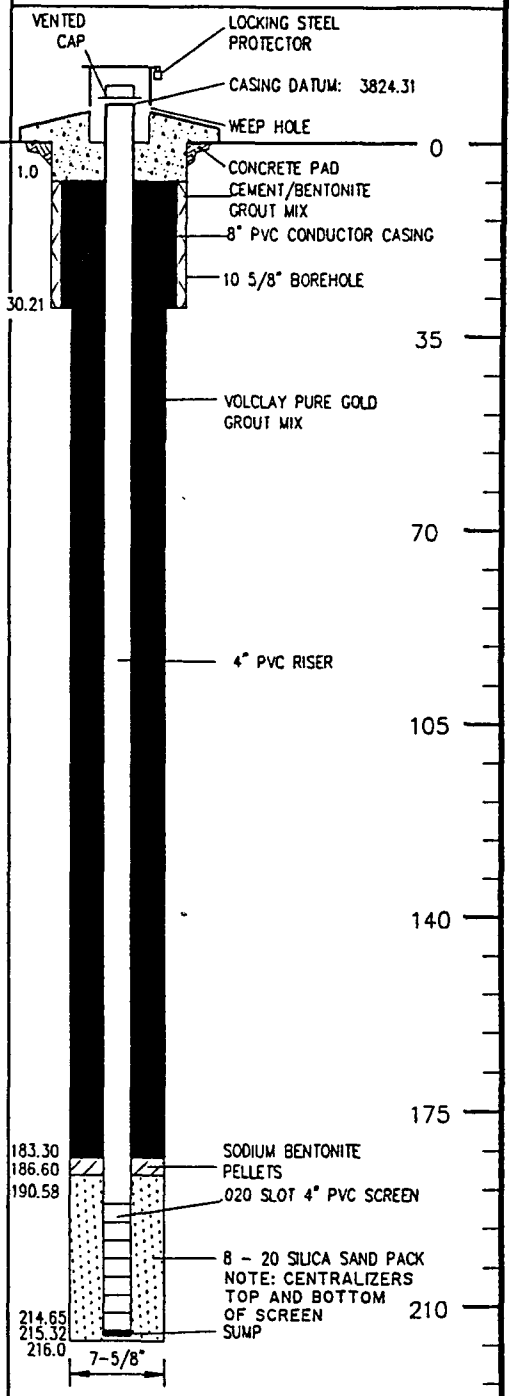
GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD # 84 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3821.60	
	0	CLAYEY SILT:	ML
	5.0	SILTSTONE:	SILTSTONE
	10.0	DOLOMITE:	DOLOMITE
	15.0	DOLOMITE:	DOLOMITE
	18.0	DOLOMITE:	DOLOMITE
	20.5	DOLOMITE:	SANDSTONE
	22.0	SANDSTONE:	DOLOMITE
	28.0	DOLOMITE:	SANDSTONE
	30.0	SANDSTONE:	SANDSTONE
	35	SANDSTONE:	
	42.0	SANDSTONE:	SANDSTONE
	44.0	SANDSTONE:	SANDSTONE
	48.0	SANDSTONE:	SANDSTONE
	56.0	SANDSTONE:	SANDSTONE
	65.0	SANDSTONE:	SANDSTONE
	70		
	76.0	DOLOMITE:	DOLOMITE
	82.0	SANDSTONE:	SANDSTONE
	84.0	SANDSTONE:	SANDSTONE
	94.0		
	97.0	SANDSTONE:	SANDSTONE
	100.0	DOLOMITE:	DOLOMITE
	104.0	DOLOMITE:	DOLOMITE
	105	DOLOMITE:	DOLOMITE
	112.0	SANDY DOLOMITE:	DOLOMITE
	118.0	SANDY DOLOMITE:	DOLOMITE
	124.0	DOLOMITE:	DOLOMITE
	135.0		DOLOMITE
	138.0	DOLOMITE:	DOLOMITE
	140	DOLOMITE:	DOLOMITE
	142.0	SANDY DOLOMITE:	DOLOMITE
	164.0	SILTSTONE:	SILTSTONE
	172.0		
	175	DOLOMITE:	DOLOMITE
▽190.55	192.0	DOLOMITE:	DOLOMITE
	198.0	DOLOMITIC LIMESTONE:	LIMESTONE
	202.0		
▽207.4	205.0	LIMESTONE:	LIMESTONE
	207.0	LIMESTONE:	LIMESTONE
	210	SANDSTONE:	SANDSTONE
	216.0	T.D. 216.0'	
	245		

GRAPHIC LOG

SAMPLE INTERVAL: SEE BORING RECORD FOR DETAILED DESCRIPTION

"N" VALUE

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-58 (BH-84)*

		CONDUCTOR INSTALLED
DATE DRILLED	6/31/91	6/27/91
DRILLING METHOD	7-5/8" AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	GHR	
CHECKED BY	BJS	
DRAWN BY:	SAR	

PAGE 1 OF 1

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WELL COMPLETION RECORD

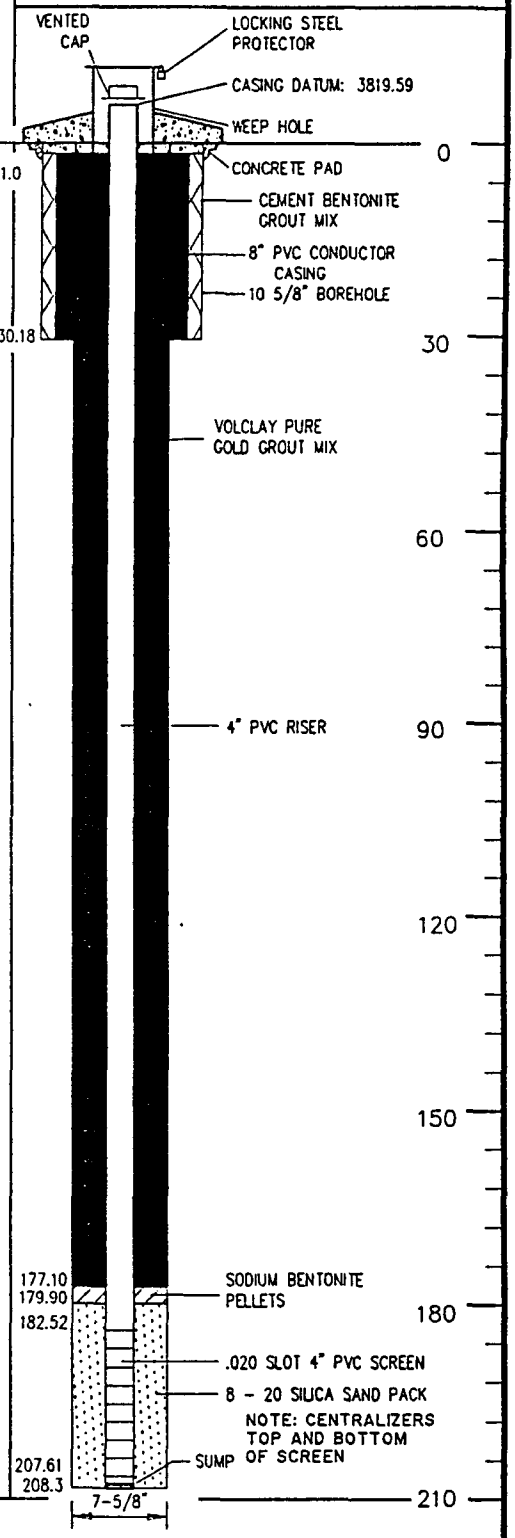
GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD #85 FOR MORE DETAILED LITHOLOGIC DESCRIPTION.	
		GROUND SURFACE: 3816.60	
	0	CLAYEY SILT:	ML
	3.0	DOLOMITE:	DOLOMITE
	8.0	SILTSTONE:	SILTSTONE
	11.0	SANDSTONE:	SANDSTONE
	16.0	DOLOMITE:	DOLOMETE
	20.0	SANDSTONE:	SANDSTONE
	30.0		
	30 32.0	SANDSTONE:	SANDSTONE
		DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	47.0	SANDSTONE:	SANDSTONE
	48.0	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	60		
	74.0	CHERTY DOLOMITE:	DOLOMITE
	79.0	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	84.0	SANDSTONE:	SANDSTONE
	87.0	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	90		
	96.0	CHERTY DOLOMITE:	DOLOMITE
	100.0	CHERTY DOLOMITE:	DOLOMITE
	110.0	DOLOMITE:	DOLOMITE
	116.0	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	120		
	122.0	DOLOMITE:	DOLOMITE
	128.0	SANDY DOLOMITE:	SANDY DOL.
	130.5	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	135.5	DOLOMITE:	DOLOMITE
	141.6	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	150		
	152.0	DOLOMITE:	DOLOMITE
	180		
▽ 191.00	190.0		DOL./LIME.
	192.0	DOLOMITIC LIMESTONE:	DOLOMITE
7/4/91	194.0	DOLOMITE:	
▽ 200.00		LIMESTONE:	LIMESTONE
	201.0		
	204.0	SANDY DOLOMITE:	SAND/DOL.
		SANDSTONE:	SANDSTONE
	208.0		
	210		

GRAPHIC LOG

SAMPLE INTERVAL: SEE BORING RECORD FOR DETAILED DESCRIPTION

"N" VALUE

WELL COMPLETION DETAIL



T.D. 208.3' FEET, W/L 1 HR. AFTER DRILLING 191 FEET,, 0.9 FEET, OF FLOATING PRODUCT

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON*

BORING NUMBER *MH-59 (BH-85)*

		CONDUCTOR INSTALLED
DATE DRILLED	7/5/91	6/28/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	CHR	
CHECKED BY	BJS	
DRAWN BY:	BDR	PAGE 1 OF 1

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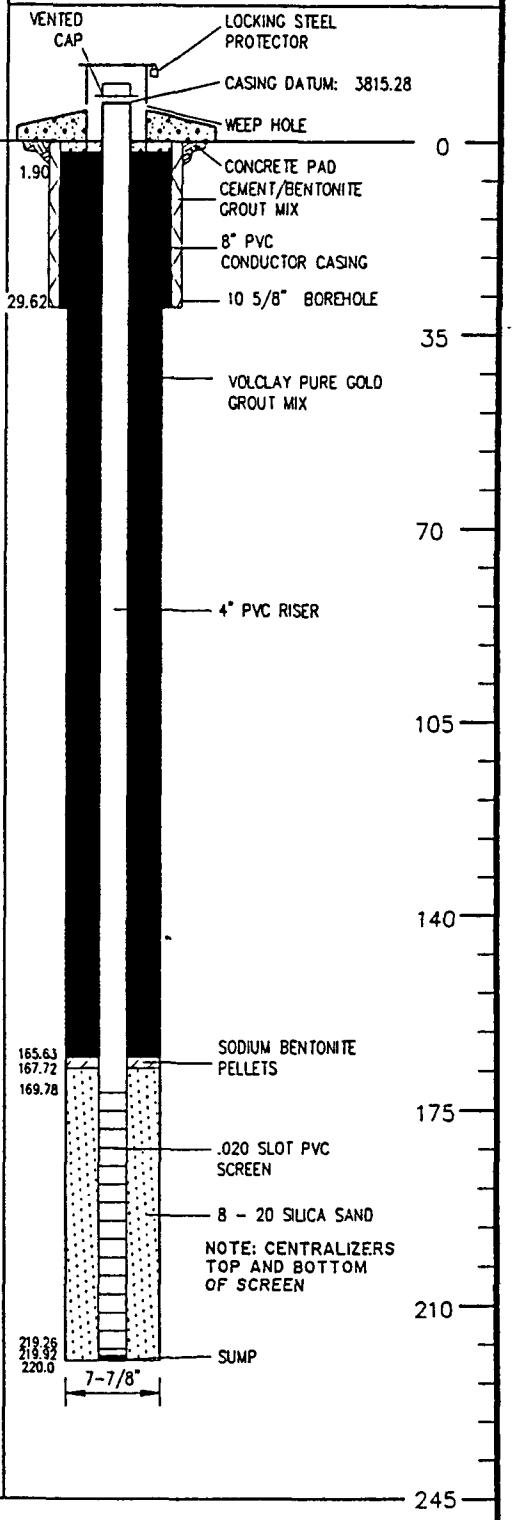
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD # 86 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3812.20				
	0	1.5 CLAYEY SILT:	ML		SEE BORING RECORD FOR DETAILED DESCRIPTION	
		DOLOMITE:	DOLOMITE			
	9.0	DOLOMITIC SANDSTONE:	SANDSTONE			
	15.0	SANDSTONE:	SANDSTONE			
	19.0	DOLOMITIC SANDSTONE:	SANDSTONE			
	27.0					
	30.0	SANDSTONE:	SANDSTONE			
	32.5	SILTSTONE:	SILTSTONE			
	34.5		DOLOMITE			
	35 37.0	DOLOMITE:	SANDSTONE			
			DOLOMITE			
	40.0	DOLOMITIC SANDSTONE:	SANDSTONE			
	45.0	DOLOMITE:	SANDSTONE			
	49.5	DOLOMITIC SANDTONE:	SANDSTONE			
	50.5	SANDSTONE:	SANDSTONE			
		DOLOMITIC SANDSTONE:				
	59.0	SANDSTONE:	SANDSTONE			
		DOLOMITIC SANDSTONE:				
	70 71.0		SANDSTONE			
	72.0	SANDSTONE:	SANDSTONE			
	73.0		DOLOMITE			
	77.5	DOLOMITIC SANDSTONE:	DOLOMITE			
	81.0	DOLOMITE:	SANDSTONE			
		SANDY DOLOMITE:				
		SANDSTONE:				
	93.0		DOLOMITE			
	95.0	SANDY DOLOMITE:	DOLOMITE			
	100.0	DOLOMITE:	DOLOMITE			
	105	DOLOMITE:	DOLOMITE			
	109.0	SANDY DOLOMITE:	DOLOMITE			
	115.0	DOLOMITIC SANDSTONE:	SANDSTONE			
	121.0	DOLOMITE:	DOLOMITE			
	127.0	SANDY DOLOMITE:	DOLOMITE			
	131.0	DOLOMITIC SANDSTONE:	SANDSTONE			
	137.0	SANDY DOLOMITE:	DOLOMITE			
	140	SANDY DOLOMITE:	DOLOMITE			
	145.0	DOLOMITIC SANDSTONE:	SANDSTONE			
	169.0		SILTSTONE			
	170.0	SILTSTONE:	DOLOMITE			
	175	SANDY DOLOMITE:	DOLOMITE			
7/12/91 185.59'	176.0	DOLOMITE:	DOLOMITE			
	185.0		SANDSTONE			
	185.5	SANDSTONE:	DOLOMITE			
		DOLOMITE:				
	203.0	DOLOMITIC SANDSTONE:	SANDSTONE			
210.0'	210	SANDSTONE:	SANDSTONE			
	220.0	BORING TERMINATED AT 220.0'				
	245					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-60 (BH-86)*

		CONDUCTOR INSTALLED
DATE DRILLED	7/12/91	7/9/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	MJL	
CHECKED BY	BJS	
DRAWN BY:	SAR	

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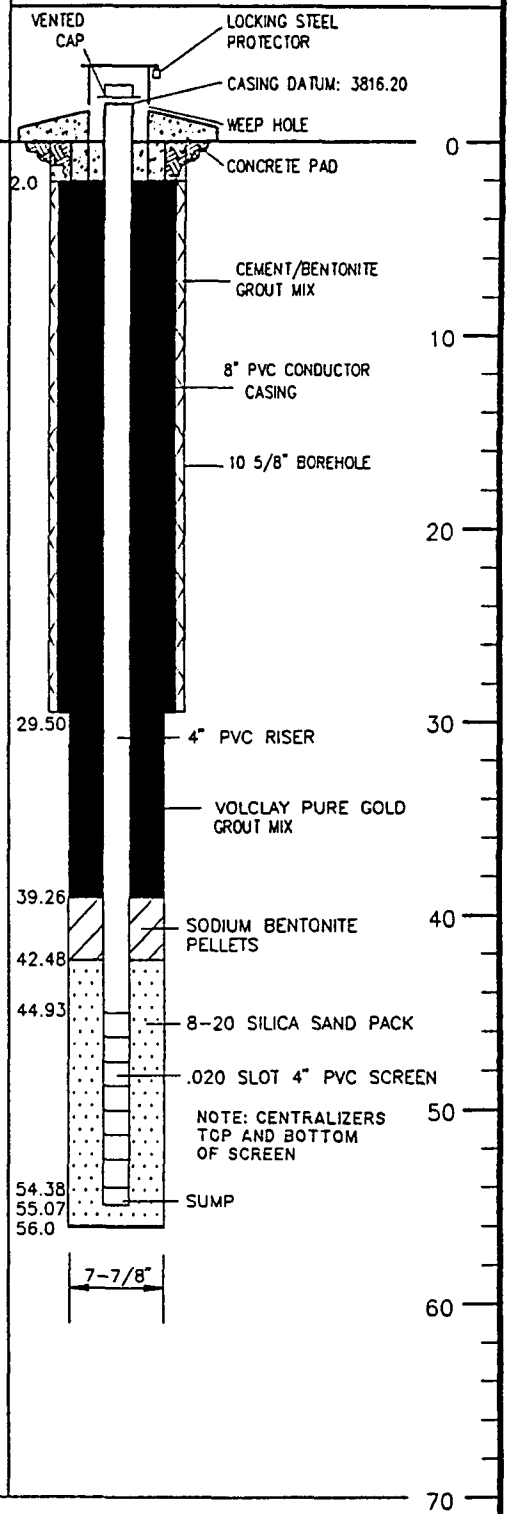
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD # 87 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3813.30				
	0	CLAYEY SILT:	ML		1 GC, 2 GC	
	3.5	SANDSTONE:	SAND-STONE		3 GC, 4 GC	
	9.0	SANDY DOLOMITE:	SANDY DOLO.		5 GC, 6 GC	
	13.0	SANDSTONE:	SAND-STONE		7 GC, 8 GC	
	17.0	DOLOMITE – SANDY DOLOMITE:	DOLO. & SANDY DOLO.		9 GC, 10 GC	
	21.0	SANDSTONE:	SAND-STONE		11 GC, 12 GC, 13 GC, 14 GC, 15 GC	
	30	SANDSTONE:	SAND-STONE		16 GC, 17 GC, 18 GC, 19 GC, 20 GC, 21 GC, 22 GC, 23 GC, 24 GC, 25 GC, 26 GC, 27 GC, 28 GC	
7/13/91 ▽ 45.49	40					
▽ 53.0	50					
	56.0	BORING TERMINATED AT 56.0'				
	60	NOTE: SEE LOG BH-87 FOR MORE IN-DEPTH DESCRIPTION.				
	70					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-61 (BH-87)*

		CONDUCTOR INSTALLED
DATE DRILLED	7/12/91	7/9/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROTHERS	
LOGGED BY	MJL	
CHECKED BY	BJS	
DRAWN BY:	SAR	

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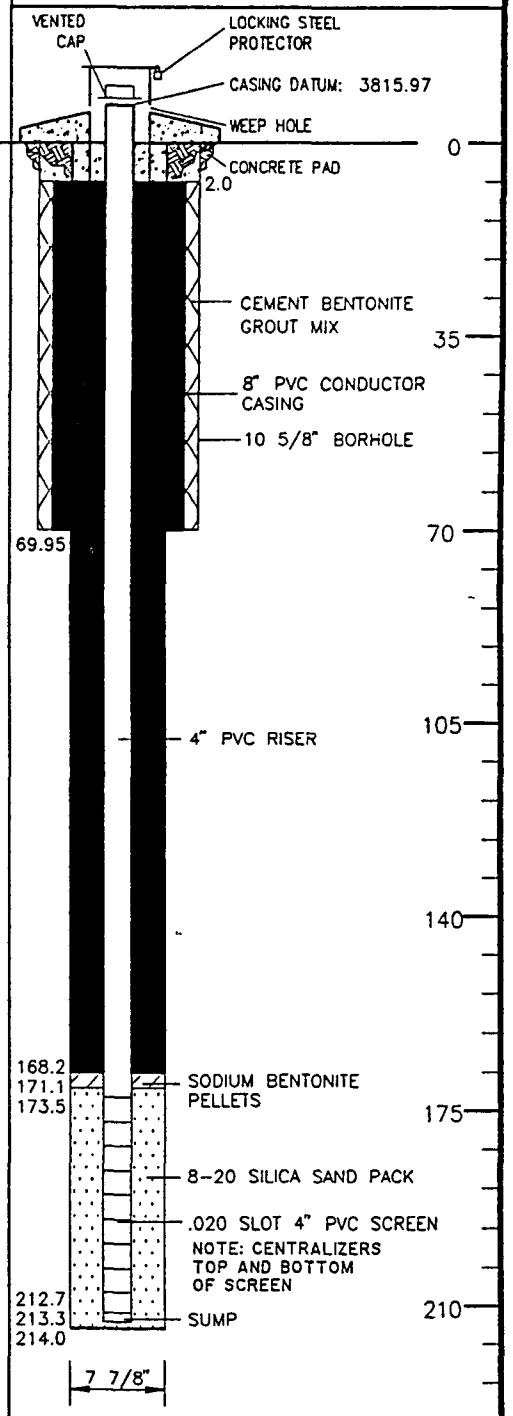
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #87A FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3813.6				
	0 1.0	CLAYEY SILT:	ML			
		SANDSTONE:	SANDSTONE			
	9.0	DOLOMITE:	DOLOMITE			
	15.0	SANDSTONE:	SANDSTONE			
	23.0	SANDSTONE:	SANDSTONE			
	35	SANDSTONE:	SANDSTONE			
	70	SANDSTONE:	SANDSTONE			
	77.0	SANDY DOLOMITE:	SDY.DOLO			
	83.0	SANDSTONE:	SANDSTONE			
	95.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	101.0	SANDY DOLOMITE:	SDY.DOLO			
	105 107.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	111.0	SANDSTONE:	SANDSTONE			
	122.0	SANDY DOLOMITE:	SDY.DOLO			
	131.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	140 141.0	SANDY DOLOMITE:	SDY.DOLO			
	147.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	149.0	SANDSTONE:	SANDSTONE			
	171.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	175	DOLOMITIC SANDSTONE:	DOLO.SS			
▽ 182.62	185.0					
	187.0	SANDSTONE:	SANDSTONE			
▽ 194.0		SANDY DOLOMITE:	SANDY DOLOMITE			
	206.0	SANDSTONE:	SANDSTONE			
	210 214.0	SANDSTONE:	SANDSTONE			
		BORING TERMINATED AT 214.0'				
		NOTE: SEE LOG BH-87A FOR MORE IN-DEPTH DESCRIPTION.				
	245					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-61A (BH-87A)*

DATE DRILLED 7/15/91 CONDUCTOR INSTALLED 7/13/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
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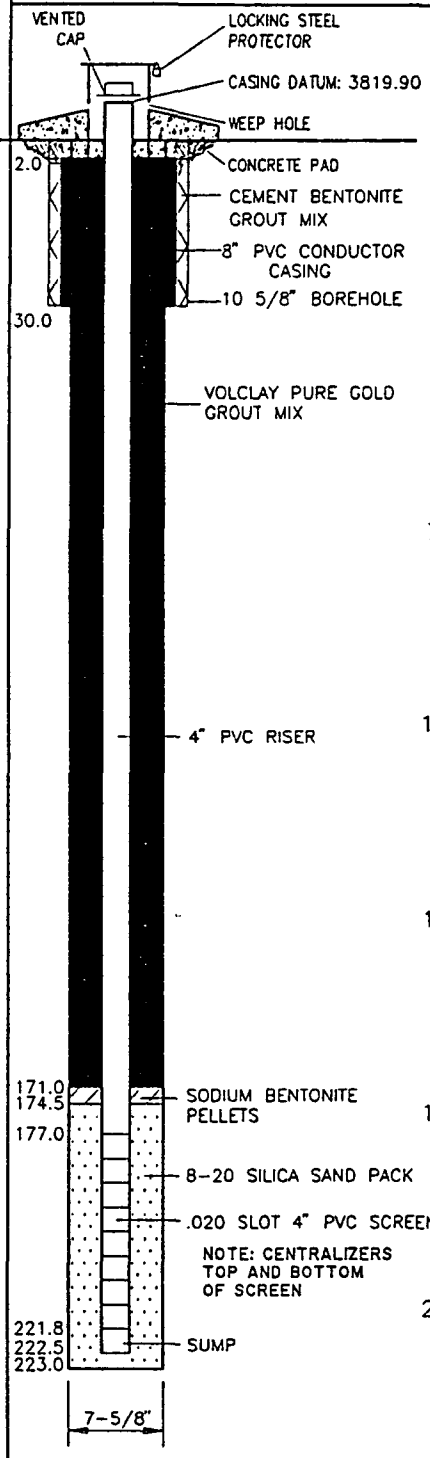
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #88 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3817.00				
	0 0.3	CLAYEY SILT:	ML			
	8.0	CHERTY DOLOMITE:	CRT.DOLO.			
	10.0	SILTSTONE CHERTY DOLOMITE:	CRT.DOLO.			
	12.0	CHERTY DOLOMITE:	CRT.DOLO.			
	22.0	DOLOMITIC SILTSTONE:	DOLO. SILTSTONE			
	30.0	SANDSTONE:	SS			
	34.0	SANDSTONE:	SS			
	35 40.0	SANDSTONE:	SS			
	42.0	SANDSTONE:	SS			
	50.0	SANDSTONE:	SS			
	52.0	SANDSTONE:	SS			
	54.0	SANDSTONE:	SS			
	66.0	SANDSTONE:	SS			
	70 72.0	CHERTY DOLOMITE:	CRT.DOLO.			
	74.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	77.0	DOLOMITIC SANDSTONE:	DOLO.SS			
		DOLOMITIC SANDSTONE:	DOLO.SS			
	92.0	CHERTY DOLOMITE:	CRT.DOLO.			
	96.0	CHERT:	CHERT			
	100.0	CHERTY DOLOMITE:	CRT.DOLO.			
	102.0	CHERTY DOLOMITE:	CRT.DOLO.			
	105 106.0	CHERTY DOLOMITE:	CRT.DOLO.			
	114.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	116.0	CHERTY DOLOMITE:	CRT.DOLO.			
	128.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	134.0	SANDSTONE & CHERTY DOLOMITE:	SS/CT.DOL			
	136.0	CHERTY DOLOMITE:	CRT.DOLO.			
	140	DOLOMITIC SANDSTONE:	DOLO.SS			
	150.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	154.0	CHERTY DOLOMITE:	CRT.DOLO.			
	162.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	164.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	174.0 175	CHERTY DOLOMITE:	CRT.DOLO.			
▽188.36	184.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	190.0	CHERTY DOLOMITE:	CRT.DOLO.			
	198.0					
	200.0	CHERTY DOLOMITE:	CRT.DOLO.			
▽205.0	202.0	CHERTY DOLOMITE:	CRT.DOLO.			
	204.0	CHERTY DOLOMITE:	CRT.DOLO.			
	210 211.0	CHERTY DOLOMITE:	CRT.DOLO.			
		SANDSTONE:	SS			
	223.0	BORING TERMINATED AT 223.0'				
		NOTE: SEE LOG BH-88 FOR MORE IN-DEPTH DESCRIPTION.				
	245					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-62 (BH-88)*

DATE DRILLED 7/24/91 CONDUCTOR INSTALLED 7/20/91

DRILLING METHOD AIR HAMMER

DRILLED BY BOYLES BROTHERS

LOGGED BY DHC

CHECKED BY BJS

DRAWN BY: SAR

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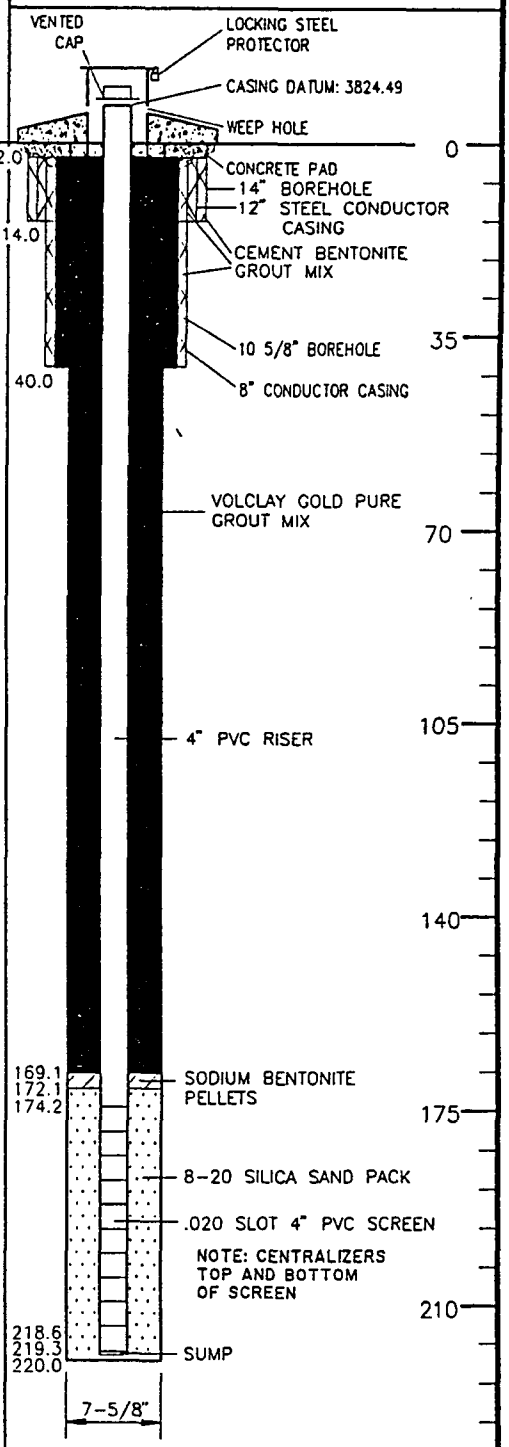
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #89 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3823.30				
	0	GRAVELLY COBBLEY SILT:	SILT			
	14.0	CHERTY DOLOMITE:	CHERTY DOLOMITE			
	20.0	CHERTY DOLOMITE:	CRT.DOLO.			
	24.0	SANDSTONE:	SANDSTONE			
	24.5	DOLOMITE:	DOLOMITE			
	35					
	64.0	SANDSTONE:	SANDSTONE			
	70					
	76.0	DOLOMITE:	DOLOMITE			
	88.0	SANDSTONE:	SANDSTONE			
	96.0	DOLOMITE:	DOLOMITE			
	99.0	SANDSTONE:	SANDSTONE			
	105					
	108.0	DOLOMITE:	DOLOMITE			
	140					
	175					
185.77	187.0	SANDSTONE:	SANDSTONE			
204.0	204.0	DOLOMITE:	DOLOMITE			
	209.0	SANDSTONE:	SANDSTONE			
	210					
	215.0	SANDY DOLOMITE:	DOLOMITE			
	220.0	BORING TERMINATED AT 220.0'				
		NOTE: SEE LOG BH-89 FOR MORE IN-DEPTH DESCRIPTION.				
	245					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-63 (BH-89)*

DATE DRILLED 7/20-30/91 CONDUCTOR INSTALLED 7/20-26/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
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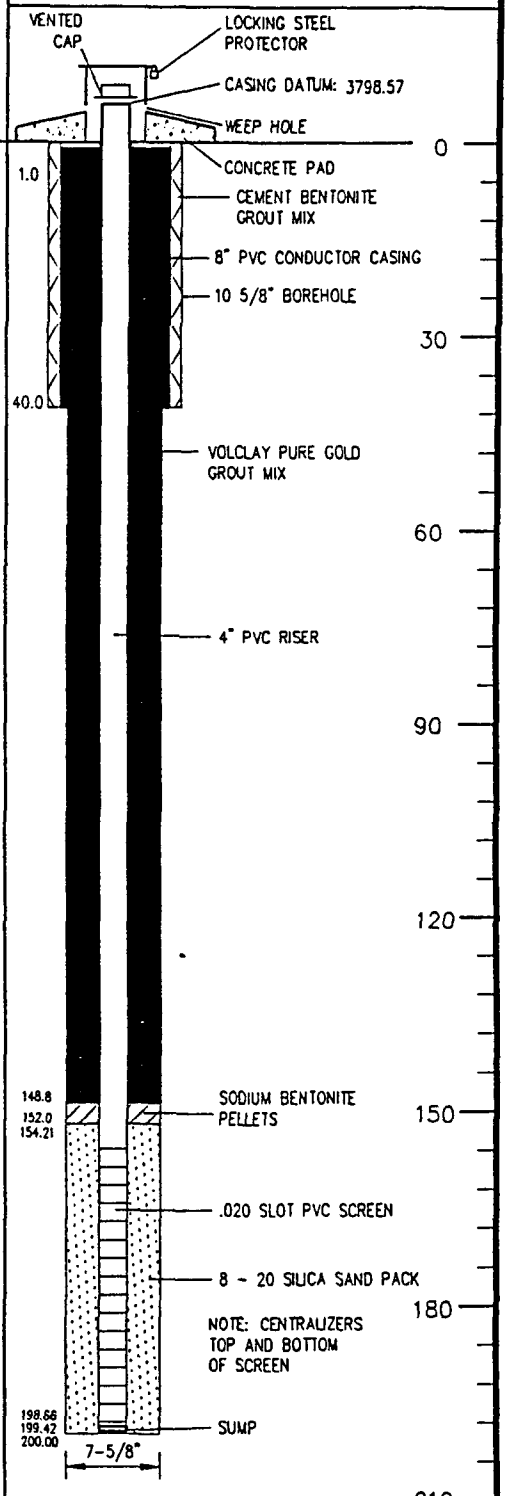
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #90 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3796.2				
	0–2.0	SILTY SANDY LOAM:	ML			
		SANDSTONE:	SANDSTONE			
	10.0					
	12.0	SANDSTONE:	SANDSTONE			
	14.0	SANDSTONE:	SANDSTONE			
	16.0	SANDSTONE:	SANDSTONE			
	18.0	SANDSTONE:	SANDSTONE			
	22.0	SANDSTONE:	SANDSTONE			
	24.0	SANDSTONE:	SANDSTONE			
	26.0	SANDSTONE:	SANDSTONE			
	28.0	SANDSTONE:	SANDSTONE			
	30	SANDSTONE:	SANDSTONE			
	36.0	SANDSTONE:	DOLOMITIC SANDSTONE			
	40.0	DOLOMITIC SANDSTONE:	SANDSTONE			
		SANDSTONE:				
	50.0	SANDSTONE:	SANDSTONE			
	59.0					
	60	DOLOMITIC CHERT:	DOLOMITIC CHERT			
	64.0	SANDY DOLOMITE:	SANDY DOLOMITE			
	70.0	SANDSTONE:	SANDSTONE			
	81.0	DOLOMITE:	DOLOMITE			
	90					
	112.0	DOLOMITIC LIMESTONE:	DOLOMITIC LIMESTONE			
	120					
	125.0	LIMESTONE:	LIMESTONE			
	130.0					
	131.0	DOLOMITIC LIMESTONE:	LIMESTONE			
		SANDSTONE:	SANDSTONE			
	144.0					
	146.0	SANDSTONE:	SANDSTONE			
		DOLOMITIC LIMESTONE:	LIMESTONE			
	150					
	151.0	SANDSTONE:	SANDSTONE			
▽167.3	160.0	DOLOMITIC LIMESTONE:	DOLOMITIC LIMESTONE			
▽172.0						
	180					
	200.0	T.D. 200.0'				
	210					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-64 (BH-90)*

CONDUCTOR INSTALLED 8/5/91

DATE DRILLED 8/11/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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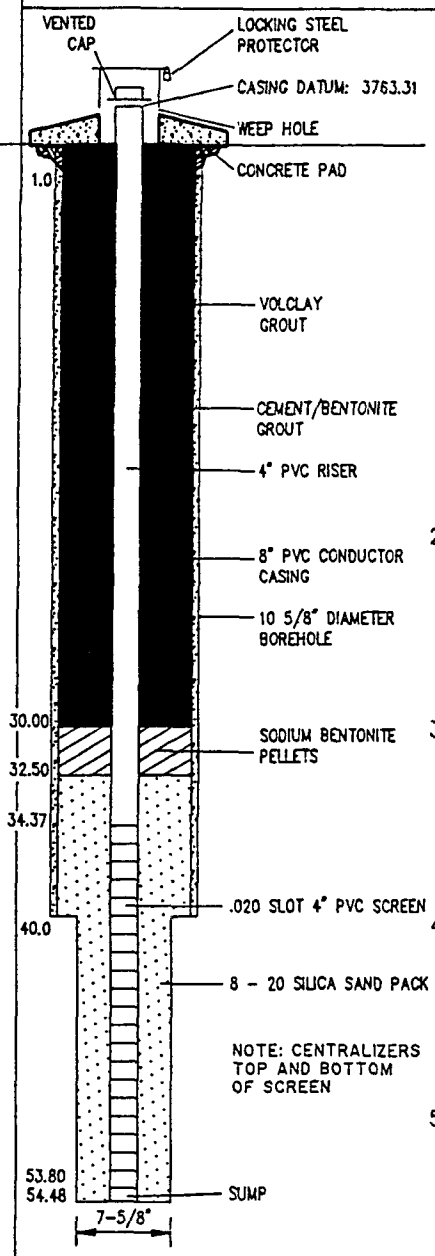
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #91 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3760.1				
	0	SANDY SILTY LOAM: 10 YR 5/6, YELLOWISH BROWN, DRY	ML		1 GC, 2 GC	
	4.0	CHERTY DOLOMITIC LIMESTONE: 10 YR 6/2, LIGHT BROWNISH GRAY, INTERBEDDED WITH CLAYEY SILTSTONE, 10 YR 6/0, LIGHT BROWNISH YELLOW, DRY	LIMESTONE/ SILTSTONE		3 GC, 4 GC, 5 GC	
	10	CHERTY DOLOMITIC LIMESTONE: 10 YR 5/3, BROWN INTERBEDDED WITH SILTSTONE, 10 YR 6/6, LIGHT BROWNISH YELLOW, DRY	LIMESTONE/ SILTSTONE		6 GC	
	12.0	CHERTY DOLOMITIC LIMESTONE: 10 YR 5/2, GRAYISH BROWN, AND CHERT, 10 YR 6/4, BROWNISH YELLOW, DRY	LIMESTONE/ CHERT		7 GC, 8 GC, 9 GC, 10 GC	
	20	CHERTY DOLOMITE: 10 YR 6/1, GRAY AND CHERT, 5 Y 7/3, PINK, DRY	CHERTY DOLOMITE		11 GC, 12 GC, 13 GC, 14 GC	
	28.0	DOLOMITE: 10 YR 7/1, LIGHT GRAY, VERY HARD, DRY	DOLOMITE		15 GC, 16 GC, 17 GC, 18 GC, 19 GC, 20 GC, 21 GC	
▽ 43.4	42.5	SANDSTONE: 5 YR 4/3, REDDISH BROWN, VERY FINE GRAIN, SOFT, MOIST TO WET	SANDSTONE		22 GC	
	44.0	CHERTY DOLOMITE: DOLOMITE, 10 YR 5/2, GRAYISH BROWN, CHERT IS 10 YR 5/6, YELLOWISH BROWN, HARD, CHERT EXHIBITS CONCHOIDAL FRACTURING, DOLOMITE – MICROCRYSTALLINE	CHERTY DOLOMITE		23 GC, 24 GC, 25 GC, 26 GC, 27 GC	
▽ 52.5	54.4	T.D. 54.4'				
	60					
	70					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-65 (BH-91)*

		CONDUCTOR INSTALLED
DATE DRILLED	8/12/91	8/8/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	JMB	
CHECKED BY	BJS	
DRAWN BY:	SAR	

PAGE 1 OF 1

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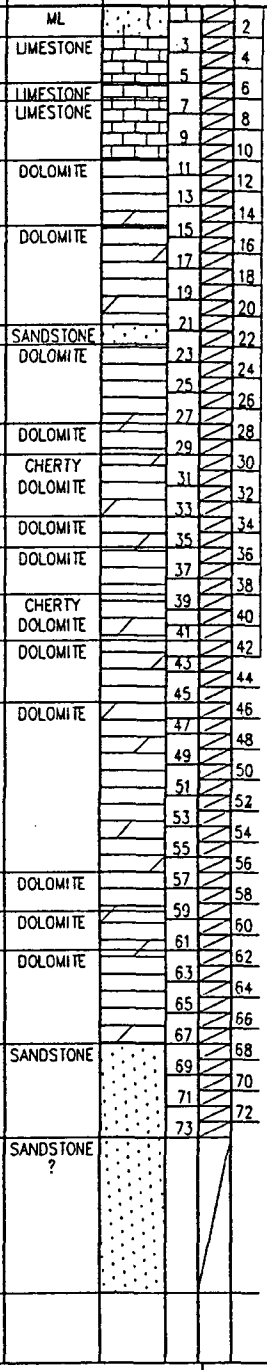
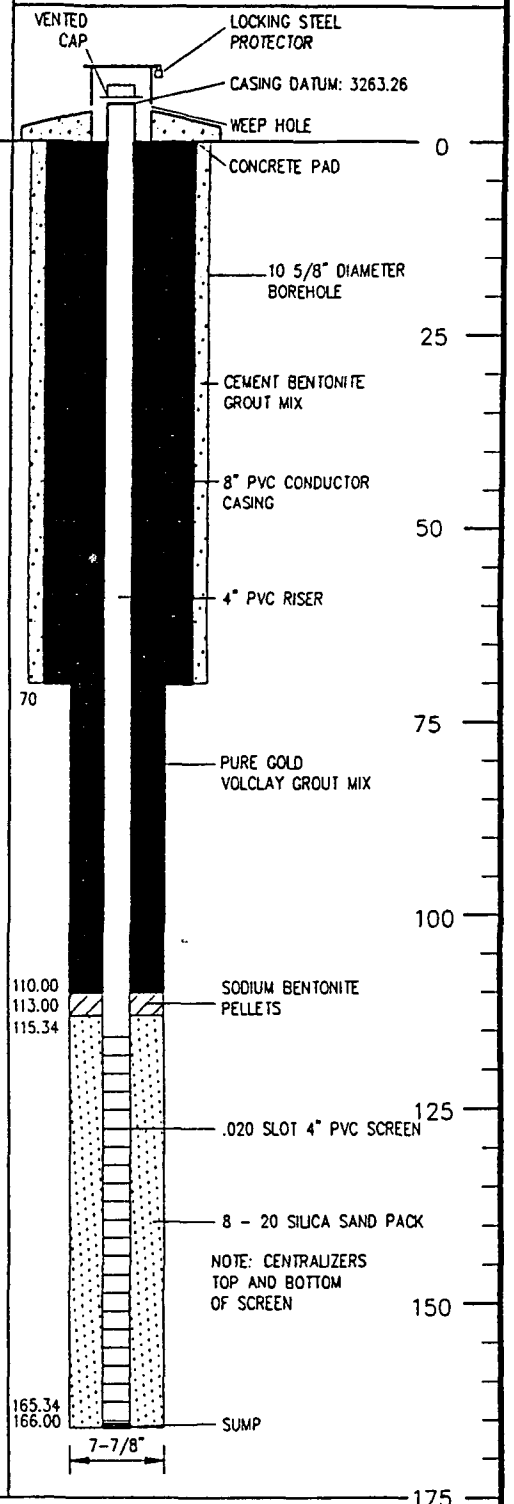
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD #91A FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3760.7	
	0	SANDY SILTY LOAM:	ML
	4.0	CHERTY DOLOMITIC LIMESTONE:	LIMESTONE
	10.0	CHERTY DOLOMITIC LIMESTONE:	LIMESTONE
	12.0	CHERTY DOLOMITIC LIMESTONE:	LIMESTONE
	20.0	CHERTY DOLOMITE:	DOLOMITE
	25		
	28.0	DOLOMITE:	DOLOMITE
	42.5	SANDSTONE:	SANDSTONE
	44.0	CHERTY DOLOMITE:	DOLOMITE
	50		
	54.0	DOLOMITE:	DOLOMITE
	58.0	CHERTY DOLOMITE:	CHERTY DOLOMITE
	66.0	DOLOMITE:	DOLOMITE
	70.0	DOLOMITE:	DOLOMITE
	75		
	76.0	CHERTY DOLOMITE:	CHERTY DOLOMITE
	82.0	DOLOMITE:	DOLOMITE
	90.0	DOLOMITE:	DOLOMITE
	100		
	112.0	DOLOMITE:	DOLOMITE
	118.0	DOLOMITE:	DOLOMITE
	122.0	DOLOMITE:	DOLOMITE
	125		
130.77			
134.50	134.0	SANDSTONE:	SANDSTONE
	146.0	NO SAMPLE RETURN FROM 146'-166' DRILLED UKE SANDSTONE	SANDSTONE ?
	150		
	166.0	T.D. 166.0'	
	175		

GRAPHIC LOG / SAMPLE INTERVAL / "N" VALUE



WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-65A (BH-91A)*

		CONDUCTOR INSTALLED
DATE DRILLED	8/16/91	8/12/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	KMH	
CHECKED BY	BJS	
DRAWN BY:	BDR	PAGE 1 OF 1

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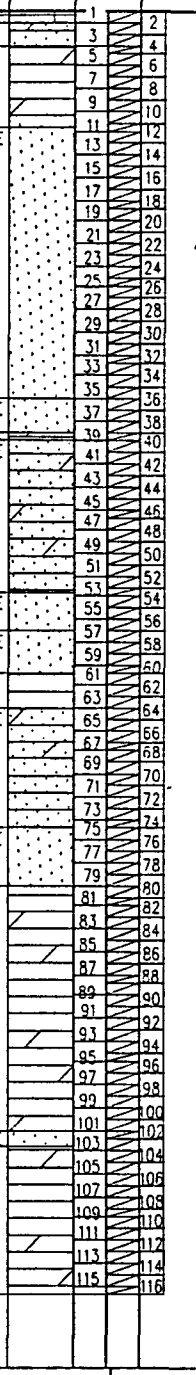
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD # 92 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3826.3	SOIL
	0		SS/LS
	0.2	TOP SOIL	
	2.0	SANDSTONE/ LIMESTONE:	SS/DOL
	6.0	SANDSTONE/ DOLOMITE:	DOLOMITE
		DOLOMITE:	
	20.0	SANDSTONE:	SANDSTONE
	35		
	70	SANDSTONE:	SANDSTONE
	76.0		DOLOMITE
	78.0	DOLOMITE:	SANDSTONE
		SANDSTONE / DOLOMITE:	DOLOMITE
	105	SANDSTONE:	SANDSTONE
	112.0	SANDSTONE:	SANDSTONE
	120.0	DOLOMITE:	DOLOMITE
	125.0	SANDSTONE:	SANDSTONE
	140		
	148.0	SANDSTONE:	SANDSTONE
	158.0	DOLOMITE:	DOLOMITE
	175		
▽202.0	202.0	SANDSTONE:	SANDSTONE
▽208.0	205.0	DOLOMITE:	DOLOMITE
	210		
	232.5	T.D. 232.5'	
	245		

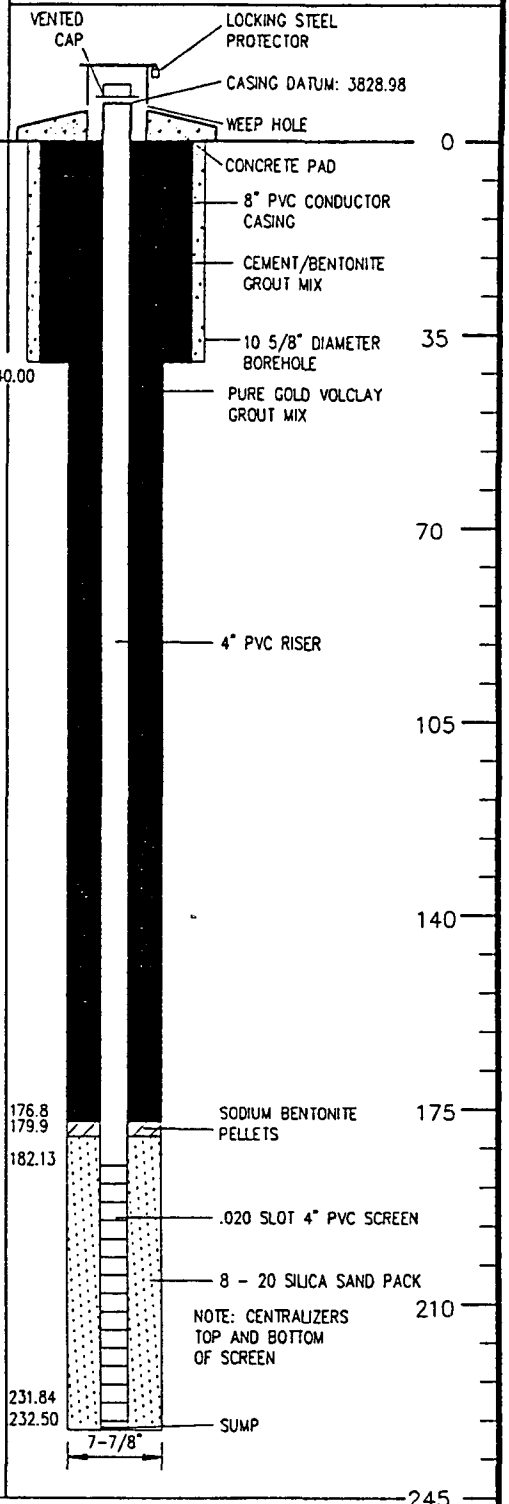
GRAPHIC LOG



SAMPLE INTERVAL / "N" VALUE

Sample	"N" value
1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34
35	36
37	38
39	40
41	42
43	44
45	46
47	48
49	50
51	52
53	54
55	56
57	58
59	60
61	62
63	64
65	66
67	68
69	70
71	72
73	74
75	76
77	78
79	80
81	82
83	84
85	86
87	88
89	90
91	92
93	94
95	96
97	98
99	100
101	102
103	104
105	106
107	108
109	110
111	112
113	114
115	116

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-66 (BH-92)*

		CONDUCTOR INSTALLED
DATE DRILLED	8/18/91	8/18/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS	
LOGGED BY	TPG	
CHECKED BY	BJS	
DRAWN BY:	BDR	

PAGE 1 OF 1

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NORMAN, OKLAHOMA 73072
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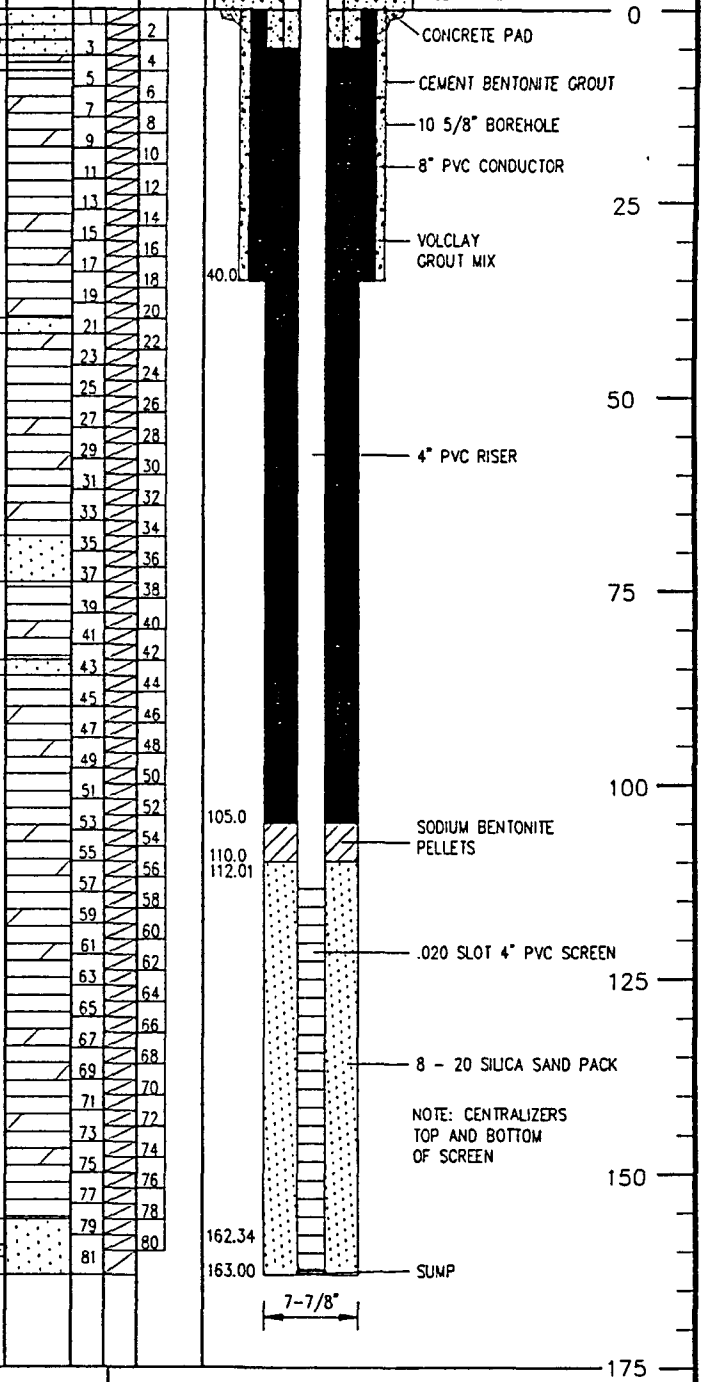
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD #93 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3763.1	
	0		
	2.0	SAND:	SAND
	4.0	SANDSTONE:	SANDSTONE
	6.0	SANDSTONE:	SANDSTONE
	8.0	DOLOMITE:	DOLOMITE
		DOLOMITE:	DOLOMITE
	25		
	40.0		
	42.0	SANDSTONE:	SANDSTONE
		DOLOMITE:	DOLOMITE
	50		
	68.0	SANDSTONE:	SANDSTONE
	74.0	DOLOMITE:	DOLOMITE
	75		
	84.0		
	86.0	SANDSTONE:	SANDSTONE
		DOLOMITE:	DOLOMITE
	100		
	125		
▽131.14			
▽136.0			
	150		
	156.0	SANDSTONE	SANDSTONE
	163.0	T.D. 163.0'	
	175		

GRAPHIC LOG / SAMPLE INTERVAL / "N" VALUE



CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-67 (BH-93)*

DATE DRILLED 8/23/91 CONDUCTOR INSTALLED 8/19/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY TPC
CHECKED BY BJS
DRAWN BY: BDR

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NORMAN, OKLAHOMA 73072
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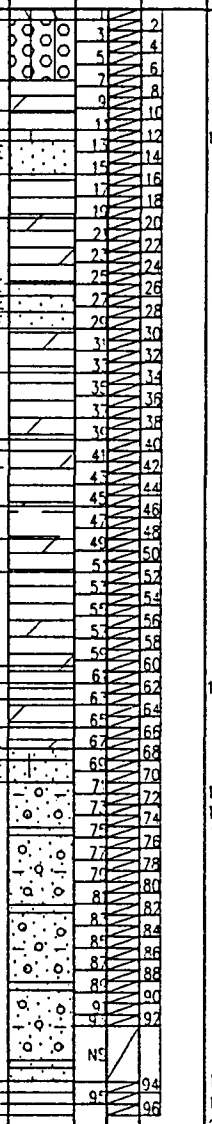
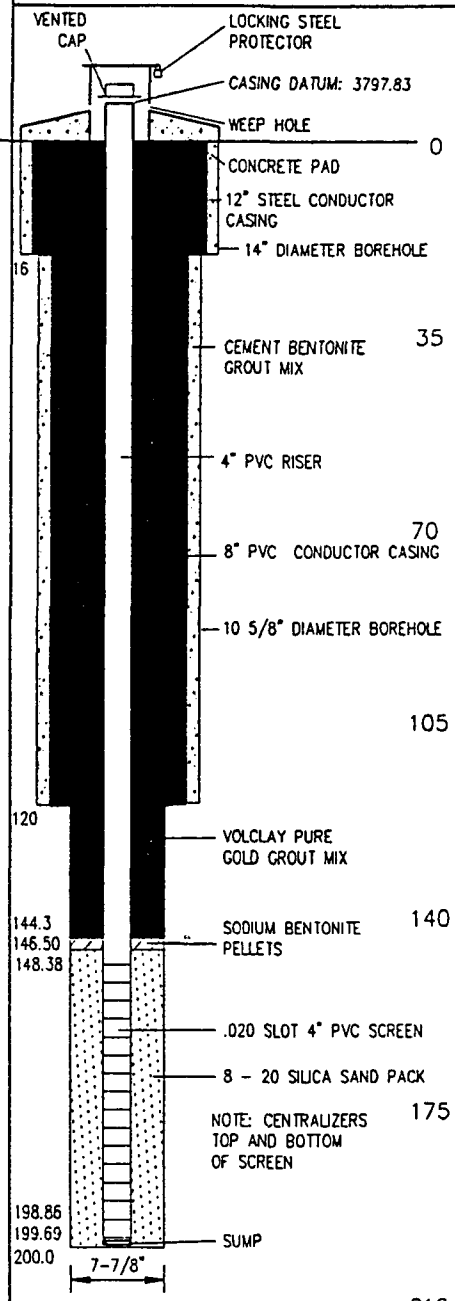
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	"N" VALUE
		NOTE: SEE BORING RECORD #94 FOR MORE DETAILED LITHOLOGIC DESCRIPTION		
		GROUND SURFACE: 3794.4		
	0 / 4.2	CLAYEY SILT	ML	
		GRAVELLY COBBLELY SILT:	GM	
▽ 18.0	13.0	DOLOMITE:	DOLOMITE	
	20.0	DOLOMITE:	DOLOMITE	
▽ 24.5	22.0	SILTY SANDSTONE:	SILTY SANDSTONE	
	24.0	SANDSTONE:		
	30.0	DOLOMITE:	DOLOMITE	
	35 / 38.0	DOLOMITE:	DOLOMITE	
	50.0			
	52.0	SANDSTONE:	SANDSTONE	
	55.0	SANDSTONE:	SANDSTONE	
	58.0	SANDSTONE:	SANDSTONE	
		DOLOMITE:	DOLOMITE	
	66.0	DOLOMITE:	DOLOMITE	
	70			
	78.0	DOLOMITIC SANDSTONE:	DOL/SS	
	80.0	SANDY DOLOMITE:	SANDY/DOL	
	90.0	SILTSTONE:	SILTSTONE	
	96.0	CHERTY DOLOMITE:	CHT/DOL	
	102.0	DOLOMITE:	DOLOMITE	
	105			
	120.0			
	122.0	DOLOMITE:	DOLOMITE	
	126.0	CHERTY DOLOMITE:	CHT/DOL	
	130.0	DOLOMITE:	DOLOMITE	
	134.0	DOLOMITE:	DOLOMITE	
	136.0	SILTY SANDSTONE:	SANDSTONE	
	140	SILTY SANDSTONE:	SANDSTONE	
		CONGLOMERATE	CLAY/SILT	
			CONGLOMERATE	
▽ 162.47				
▽ 174.0	175			
▽ 197.0	194.0			
	196.0	DOLOMITE:	DOLOMITE	
	198.0	DOLOMITE	DOLOMITE	
	200.0	DOLOMITIC SANDSTONE:	SANDSTONE	
	210	TOTAL DEPTH 200.0 FT		
	245			

GRAPHIC LOG / SAMPLE INTERVAL



WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-68 (BH-94)*

DATE DRILLED	8/31/91	CONDUCTOR INSTALLED 8/24/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	TPG	
CHECKED BY	BJS	
DRAWN BY:	BDR	PAGE 1 OF 1

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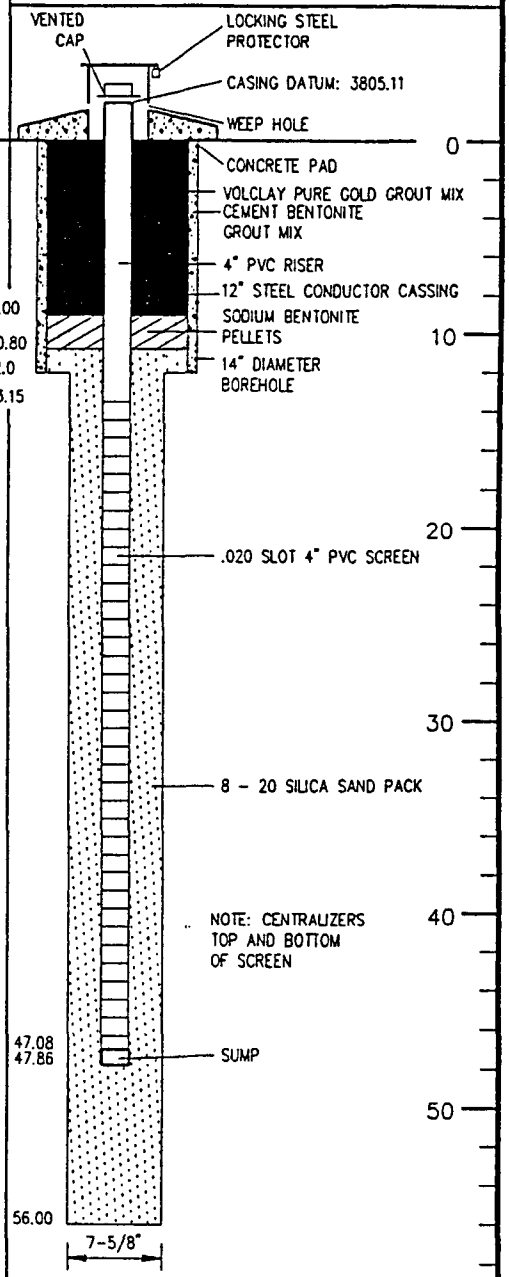
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #95 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3801.7				
	0	SANDY SILT:	ML		1, 2, 3	
	6.0	SANDSTONE:	SANDSTONE		4	
	8.0	DOLOMITE:	DOLOMITE		5, 6, 7, 8, 9, 10	
▽21.61	20	DOLOMITE:	DOLOMITE		11, 12	
	24.0	DOLOMITE:	DOLOMITE		13	
	26.0	DOLOMITE:	DOLOMITE		14	
	28.0	SANDSTONE:	SANDSTONE		15, 16	
	32.0	SILTSTONE:	SILTSTONE		17	
	34.0	SILTY SANDSTONE:	SILTY SANDSTONE		18	
	36.0	SILTSTONE:	SILTSTONE		19, 20	
▽42.0	40	DOLOMITE:	DOLOMITE		21, 22, 23, 24, 25, 26	
	52.0	DOLOMITE:	DOLOMITE		27, 28	
	56.0	T.D. 56.0'				
	60					
	70					

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-69 (BH-95)*

		CONDUCTOR INSTALLED
DATE DRILLED	8/30/91	8/25/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	TPG/DHC	
CHECKED BY	BJS	
DRAWN BY:	BDR	

PAGE 1 OF 1

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WELL COMPLETION RECORD

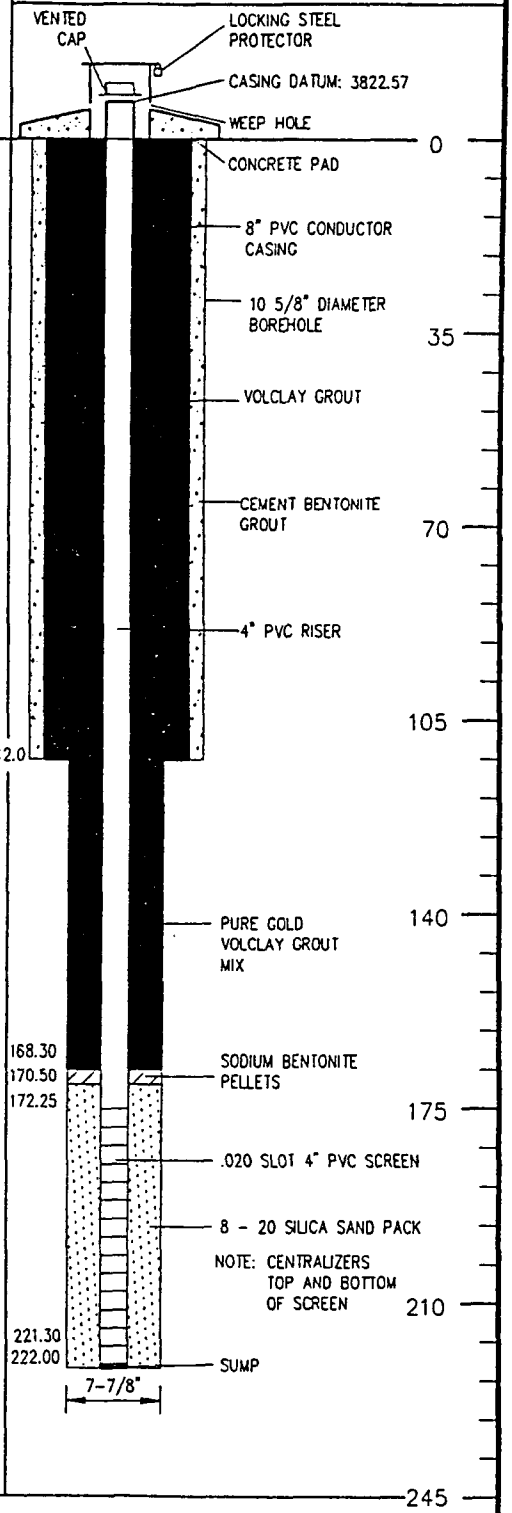
GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD #97 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3919.5	
	0	COBBLES:	COBBLES
	6.0	DOLOMITE:	DOLOMITE
	18.0	DOLOMITE:	DOLOMITE
	24.0	SANDY DOLOMITE:	SANDY DOLOMITE
	34.0		
	35	DOLOMITE:	DOLOMITE
	46.0	CHERTY DOLOMITE:	CHERTY DOLOMITE
	59.0	SANDSTONE:	SANDSTONE
	62.0	DOLOMITE:	DOLOMITE
	70		
	74.0	DOLOMITE:	DOLOMITE
	105		
	120.0	SANDSTONE:	SANDSTONE
	140		
	175		
▽190.4 ▽193.0			
	210		
	222.0	T.D. 222.0'	
	245		

GRAPHIC LOG

SAMPLE INTERVAL

"N" VALUE

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-70 (BH-97)*

DATE DRILLED 9/12/91 CONDUCTOR INSTALLED 9/11/91

DRILLING METHOD AIR HAMMER

DRILLED BY BOYLES BROS.

LOGGED BY KMH

CHECKED BY BJS

DRAWN BY: BDR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3804.8								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.2 PPM
	0	BOULDERY COBBLELY SILT: UNCONSOLIDATED, COBBLES AND BOULDERS FROM 1.0 CM TO 3 M., ROUNDED, DOLOMITIZED, DRY, GRAYISH BROWN, 10 YR 5/2, TO PALE BROWN, 5YR 5/2, (ALLUVIUM)	GM			NS				0
									2.5	
						1	0.1	0.8	3.3	
						NR			4.0	
						2	0.1	1.1	5.1	
	5	BORING TERMINATED AT 5.0'				NR			5.5	5
		GROUNDWATER NOT OBSERVED DURING BORING								
		BOREHOLE OVM READING: 4.0 PPM								
		SOIL VENT INSTALLED AT 3.2'								
		SOIL VENT OVM READING AFTER 24 HOURS: 4.6 PPM								
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-1***

DATE DRILLED 4/18/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3809.5								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.2 PPM
	0	BOULDERY COBBLELY GRAVELLY SILT: NONIMBRICATED, UNCONSOLIDATED, BOULDERS AND COBBLES FROM 10CM TO 3M., DOLOMITE, WELL ROUNDED GRAVEL, (ALLUVIAL)	GM			NS			2.5	0
	3.0	AUGER REFUSAL AT 3.0' GROUNDWATER NOT OBSERVED				1	1.0	1.2	3.7	
						NR			4.0	
	5	SOIL VENT AT 2.37'								5
		BOREHOLE OVM READING: 0.3 PPM								
		BACKGROUND: 0.3 PPM								
		SOIL VENT OVM READING AFTER 24 HOURS: 0.1 PPM								
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-2***

DATE DRILLED 4/19/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3805.3								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.1 PPM
	0	BOULDERY COBBLELY SILT: UNCONSOLIDATED, COBBLES AND BOULDERS FROM 10CM TO 3M., ROUNDED., DOLOMITIZED, DRY, GRAYISH BROWN, 10 YR 5/2, (ALLUVIAL)	GM			1	0.1	GC	1.5	0
						NS			2.5	
						2	1.8	0.8	3.3	
						NR			4.0	
	5					3	4.8	1.1	5.1	5
						NR			5.5	
						NS				
									9.0	
	10					4	0.3	1.2	10.2	10
						NR			10.5	
						NS			12.0	
						5	0.2	0.4	12.4	
	12.7					NR			12.7	
		AUGER REFUSAL AT 12.7'								
		GROUNDWATER NOT OBSERVED DURING DRILLING								
	15	BOREHOLE OVM READING: 0.21 PPM								15
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-3***

DATE DRILLED 4/19/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3806.6		
	0	BOULDERY COBBLELY GRAVELLY SILT: UNCONSOLIDATED, LIGHT BROWNISH GRAY TO GRAYISH BROWN, 10 YR 6/2 TO 5/2, DRY, VERY HARD DRILLING, COBBLES TO BOULDERS FROM 10CM TO 2M., GRAVELLY, ROUNDED, POORLY SORTED, (ALLUVIUM	GM	
	5			
	10			
	11.0 / 11.2	DOLOMITE: GRAYISH BROWN, 10 YR 5/2, MASSIVE, HARD	DOLOMITE	
		AUGER REFUSAL AT 11.2'		
		GROUNDWATER NOT OBSERVED DURING DRILLING		
	15	BOREHOLE OVM (THROUGH AUGERS): 0.1 PPM		
		SOIL VENT INSTALLED TO 8.0' SOIL VENT HEADSPACE AFTER 24 HOURS: 0.1 PPM		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.2	GC	1.0
NS			2.5
2	0.4	1.5	4.0
3	0.4	1.5	5.5
NS			9.0
4	0.2	0.8	9.8
NR			10.5

REMARKS

BACKGROUND OVM READING:
SOIL: 0.1 PPM
AIR: 0.4 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-4*

DATE DRILLED 4/22/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3797.8								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.2 PPM
	0	BOULDERY COBBLELY SILT: GRAYISH BROWN, 10 YR 5/2 TO LIGHT BROWNISH GRAY, 10 YR 6/2, COBBLES–BOULDERS FROM 10CM TO 1.5M, GRAVELLY, DRY, VERY HARD DRILLING, (ALLUVIUM)	GM			1	0.7	GC	1.0	0
						NS			2.5	
						2	1.8	1.2	3.7	
						NR			4.0	
	5					3	0.8	1.2	5.2	5
						NR			5.5	
						NS			6.0	
						4	0.6	1.2	7.2	
	7.5					NR			7.5	
		AUGER REFUSAL AT 7.5 GROUNDWATER NOT OBSERVED DURING DRILLING BOREHOLE OVM : 1.2 PPM SOIL VENT TUBE AT 6.25' BOREHOLE OVM FROM SOIL VENT TUBE AFTER 24 HOURS: 7.0 PPM								
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH–5***

DATE DRILLED 4/20/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3781.6								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.1 PPM
	0	BOULDERY COBBLELY GRAVELLY SILT: LIGHT GRAYISH BROWN, 10 YR 6/2, POORLY SORTED, GRAVEL FROM 1.0CM TO 10CM., COBBLES AND BOULDERS FROM 10CM TO 1M., ROUNDED., DOLOMITIZED, (ALLUVIUM)	GM			NS				0
									2.5	
						1	0.1	0.5	3.0	
						NR			3.5	
	4.0	DOLOMITE: LIGHT BROWN, 10 YR 5/2, MASSIVE, JOINTED, FRACTURED	DOLOMITE			NS			4.0	
	5									5
		AUGER REFUSAL AT 5.0'								
		GROUNDWATER NOT OBSERVED DURING DRILLING								
		BOREHOLE OVM THROUGH AUGERS: 0.1 PPM								
	10	SOIL VENT TUBE AT 2.5'								10
		SOIL VENT OVM READING AFTER 24 HOURS: 0.1 PPM								
	15									15
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-6*

DATE DRILLED 4/21/91
DRILLING METHOD HSA
DRILLED BY HSB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3782.5								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.1 PPM
	0	BOULDERY COBBLELY GRAVELLY SILT: LIGHT GRAYISH BROWN, 10YR 6/2, TO GRAYISH BROWN, 10YR 5/2, UNCONSOLIDATED, DRY, COBBLES AND BOULDERS FROM 10CM TO 3M, ROUNDED, DOLOMITE, POORLY SORTED, (ALLUVIUM)	GM			NS			2.5	
	4.0					1	0.1	1.4	3.9	
	4.1	DOLOMITE: GRAYISH BROWN, 10 YR 6/2, MASSIVE FRACTURED, JOINTED	DOLOMITE			NR			4.0	
	5	AUGER REFUSAL AT 4.1'								
		GROUNDWATER NOT OBSERVED DURING DRILLING								
		BOREHOLE OVM READING (THROUGH AUGERS): 0.1 PPM								
	10	SOIL VENT TUBE INSTALLED TO 2.0'								
		SOIL VENT HEADSPACE READING AFTER 24 HOURS: 0.1 PPM								
	15									
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-7***

DATE DRILLED 4/21/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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ENVIRONMENTAL CONSULTANTS
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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3795.9								BACKGROUND OVM READING: SOIL: 0.2 PPM AIR: 0.4 PPM
	0	BOULDERY COBBLELY SILT: UNCONSOLIDATED, GRAYISH BROWN, 10 YR 5/2, POORLY SORTED, ROUNDED, COBBLES TO BOULDERS FROM 10CM TO 2MM, GRAVELLY, VERY HARD DRILLING, (ALLUVIUM)	GM			1	0.7	GC	1.0	0
						NS			4.0	
	5					2	0.4	0.8	4.8	5
						NR			5.5	
						NS			9.0	
	10					3	1.0	0.9	9.9	10
						NR			10.5	
	11.0		DOLOMITE			NR			11.2	
	11.2	DOLOMITE: GRAYISH BROWN, 10 YR 5/2, MASSIVE, VERY HARD								
		AUGER REFUSAL AT 11.2'								
		BOREHOLE OVM READING (THROUGH AUGERS): 0.1 PPM								
	15	GROUNDWATER NOT OBSERVED DURING DRILLING								15
		SOIL VENT TUBE INSTALLED TO 8.0'								
		SOIL VENT HEADSPACE 24 HOURS: 0.1 PPM								
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-8***

DATE DRILLED 4/22/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3798.8								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.2 PPM
	0	CLAYEY SILT: YELLOWISH BROWN, 10 YR 5/4, DRY, UNCONSOLIDATED, ROOTLETS TO 1.0', CALICHE VEINS BELOW 1.7', VERY FINE QUARTZ, 60% SILT, 40% CLAY, VERY LOW PLASTICITY	ML			1	0.4	2.6	2.0	0
						2	0.2		2.6	
						NR			3.0	
						3	0.2	2.0	5.0	
	5					NR			6.1	5
	6.0	COBBLELY BOULDERY SILT: GRAYISH BROWN 10 YR 5/2, WELL ROUNDED, POORLY SORTED, UNCONSOLIDATED	GM			NS			9.0	
	9.0					NR			9.5	
	10	AUGER REFUSAL AT 9.5' GROUNDWATER NOT OBSERVED DURING DRILLING SOIL VENT TUBE INSTALLED TO 7.5' SOIL VENT OVM READING AFTER 24 HOURS: 0.9 PPM BACKGROUND: 0.5 PPM								10
	15									15
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-9***

DATE DRILLED 4/23/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3808.9								BACKGROUND OVM READING: SOIL: 0.2 PPM AIR: 0.2 PPM
	0	CLAYEY SILT: BROWN, 10 YR 5/3, DRY, VERY LOW PLASTICITY, VERY FINE QUARTZ, 60% SILT, 40% CLAY, CALICHE VEINS, UNCONSOLIDATED	ML			1	0.3	GC	1.0	
						NS			2.5	
						2	0.7	1.5	4.0	
						3	0.5	0.8	4.8	
	5					NR			5.5	
	5.5	BOULDERY COBBLELY SILT: GRAYISH BROWN, 10 YR 5/2, UNCONSOLIDATED, POORLY SORTED, COBBLES AND BOULDERS FROM 10 CM TO 1M	GM			NS			9.0	
						4	0.4	0.5	9.5	
	10					NS				
	13.0					5	0.2	0.2	13.0 13.2	
	15	AUGER REFUSAL AT 13.0' GROUNDWATER NOT OBSERVED DURING DRILLING BOREHOLE OVM THROUGH AUGER: 7.8 PPM								
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-10***

DATE DRILLED 4/23/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 21.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3801.2								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.1 PPM
	0	CLAYEY SILT: BROWN, 7.5 YR 5/2, DRY, MODERATELY COMPACTED, VERY LOW PLASTICITY, CALICHE VEINS BELOW 3.0', 60% SILT, 40% CLAY, VERY FINE QUARTZ	ML			1	0.3	GC	1.0	
						NS			2.5	
						2	0.1	1.5	4.0	
						3	0.1	1.2	5.2	
	5					NR			5.5	
						NS				
	6.5	GRAVELLY BOULDERY COBBLELY SILT: GRAYISH BROWN, 10YR 5/2, UNCONSOLIDATED, POORLY SORTED, COBBLES AND BOULDERS FROM 10CM TO 0.5M, ROUNDED	GM						9.0	
						4	0.1	0.6	9.6	
	10					NR			10.5	
						NS				
	13.0								13.0	
	13.1	DOLOMITE: GRAY, 5 Y 6/1, CRYSTALLINE, MASSIVE, VERY HARD, NONEFFERVESCENT ON SURFACE, EFFERVESCENT ON SCRATCHED SURFACE WITH HCL	DOLOMITE			5	420.0	0.1	13.1	
	15	BORING TERMINATED AT 13.1'								
		GROUNDWATER NOT OBSERVED DURING DRILLING								
		BOREHOLE OVM READING AT 13.0' THROUGH AUGERS: 152 PPM								
		NO FREE PRODUCT								
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-11***

DATE DRILLED 4/24/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 11.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3793.7								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.1 PPM
	0	CLAYEY SILT: BROWN, 7.5 YR 5/2, DRY, UNCONSOLIDATED, VERY LOW PLASTICITY, CALICHE VEINS, 60% SILT, 40% CLAY, VERY FINE QUARTZ, (ALLUVIUM)	ML			1	0.2	GC	1.0	0
						NS			2.5	
						2	0.3	1.3	3.8	
						NR			4.0	
						3	0.3	1.0	5.0	
	5 5.2	BOULDERY COBBLELY SILT: GRAYISH BROWN, 10 YR 5/2, DRY, UNCONSOLIDATED, POORLY SORTED, COBBLES AND BOULDERS FROM 10CM TO 50CM, ROUNDED, GRAVELLY, (ALLUNIUM)	GM			NR			5.5	5
						NS			9.0	
						4	0.2	0.8	9.8	
	10					NR			10.5	10
						NS			12.0	
	12.1		CL			5	220.0		12.2	
	12.3	CLAYEY SAND: BROWN, 7.5 YR 5/2, MOIST, MEDIUM PLASTICITY, QUARTZ, FINE GRAIN, STRONG HYDROCARBON ODOR, SAMPLE SATURATED WITH HYDROCARBON, 60% CLAY, 25% SAND, 15% SILT				NR		0.2	12.5	
	12.5	DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 5/2, MASSIVE, VERY HARD	DOLOMITE							
	15									15
		AUGER REFUSAL AT 12.5'								
		BOREHOLE OVM READING THROUGH AUGERS: 5.0 PPM								
	20	GROUNDWATER NOT OBSURVED DURING DRILLING								20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-12***

DATE DRILLED 4/24/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 16.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3790.6								BACKGROUND OVM READING: SOIL: 0.2 PPM AIR: 1.5 PPM
	0	CLAYEY SILT: BROWN, 7.5 YR 5/2, DRY, VERY LOW PLASTICITY, UNCONSOLIDATED FROM 0.0 TO 1.5', MODERATELY COMPACTED BELOW 1.5',, CALICHE VEINS, 60% SILT, 40% CLAY, VERY FINE QUARTZ	ML			1	0.6	GC	1.0	
						NS			2.5	
						2	0.2	1.2	3.7	
						NR			4.0	
	5					3	0.2	1.5	5.5	
						NS				
	8.0	BOULDERY COBBLELY SILT: GRAYISH BROWN, 10 YR 5/2, UNCONSOLIDATED TO MODERATELY COMPACTED, GRAVELLY, COBBLES AND BOULDERS FROM 5 CM TO 20 CM, GRAVEL TO 5 CM, ROUNDED TO SUBROUNDED	GM						9.0	
	10					4	0.2	1.5	10.5	
						NS				
	14.0		CL						14.0	
	14.1	SANDY CLAY: GRAYISH BROWN, 10 YR 5/2, WET WITH HYDROCARBON, STRONG ODOR, FINE QUARTZ				5	320.0	0.1	14.1	
	14.2	DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 6/2, MASSIVE	DOLOMITE			NR			14.2	
	15									
		AUGER REFUSAL AT 14.2',								
		BOREHOLE OVM THROUGH AUGERS AT 13.5': 220 PPM								
		GROUNDWATER NOT OBSERVED DURING DRILLING								
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-13***

DATE DRILLED 4/25/91
DRILLING METHOD HSA
DRILLED BY HSB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 11.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3791.4								BACKGROUND OVM READING: SOIL: 0.2 PPM AIR: 0.3 PPM
	0	CLAYEY SILT: BROWN, 7.5YR5/2, DRY FROM 0.0 TO 9.0', LOW TO MEDIUM PLASTICITY, VERY FINE QUARTZ, 60% SILT, 40% CLAY	ML			1	0.2	GC	1.0	
						NS			2.5	
						2	0.2	1.1	3.6	
						NR			4.0	
						NS				
	5									
									9.0	
		MOIST BELOW 9.0'				3	0.4	0.8	9.8	
	10					NR			10.5	
11.26'		SATURATED BELOW 11.26'				NS				
	13.5	SANDY GRAVEL: DARK GRAY, 10 YR 5/1, COARSE GRAVEL, FINE GRAIN SAND, SATURATED, QUARTZ, ROUNDED TO ROUNDED SUBANGULAR, POORLY SORTED, STRONG ODOR	GM			6	11.1	1.5	13.5	
						7	220.0		14.7	
	15								15.0	
	15.1	DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 5/2, MASSIVE	DOLOMITE			NR			15.1	
		AUGER REFUSAL AT 15.1'								
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-14 (MW-1)*

DATE DRILLED 4/25/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
(405) 321-3885

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3794.1								BACKGROUND OVM READING: SOIL: 0.1 PPM AIR: 0.8 PPM
	0	CLAYEY SILT: BROWN, 7.5YR 5/2, DRY, VERY LOW PLASTICITY, UNCONSOLIDATED FROM 0.0 TO 1.5', CALICHE DEPOSITS, 60% SILT, 40% CLAY	ML			1	0.2	GC	1.0	
						NS	0.1		2.5	
						2	0.8	0.8	3.3	
						NR			4.0	
	4.2	GRAVELLY COBBLEY SILT: UNCONSOLIDATED TO MODERATELY CONSOLIDATED, GRAVEL TO 2 CM, COBBLES TO 10CM, ROUNDED	GM			3	1.0	0.9	4.9	
	5					NR			5.0	
						NS			9.0	
						4	2.6	0.6	9.6	
	10					NR			10.5	
						NS			13.0	
	13.0					5	2.0	0.1	13.1	
		AUGER REFUSAL AT 13.0'								
	15	GROUNDWATER NOT OBSERVED DURING DRILLING								
		BOREHOLE OVM READING THROUGH AUGER 0.6PPM								
	20									
	25									
	30									
	35									

CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-15***

DATE DRILLED 4/25/91

DRILLING METHOD HSA

DRILLED BY SHB

LOGGED BY MJL

CHECKED BY BJS

DRAWN BY: BDR

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ENVIRONMENTAL CONSULTANTS
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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 0.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3806.2								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SILTY CLAY: DARK YELLOWISH BROWN, 10 YR 4/6, DRY, VERY LOW PLASTICITY, VERY FINE GRAIN QUARTZ, 60% CLAY, 40% SILT	ML			1	0.6	GC	0 1.0	
						NS			2.5	
	3.5	BOULDERY COBBLEY SILT: GRAYISH BROWN, 10 YR 5/2, POORLY SORTED, MODERTELY TO POORLY CONSOLIDATED, COBBLES/BOULDERS FROM 5 CM TO 15 CM, GRAVELLY , ROUND	GM			2	0.0	0.6	3.3	
						NR			4.0	
						3	0.0	0.5	4.5	
	5					NR			5.5	
						NS				
									8.0	
						4	0.0	1.0	9.0	
						NR			9.5	
	10					NS				
	14.0	AUGER REFUSAL AT 14.0'				NR		0.0	14.0 14.2	
	15	GROUNDWATER NOT OBSERVED DURING DRILLING.								
		BOREHOLE OVM THROUGH AUGERS: 22 PPM								
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **BH-16**

DATE DRILLED 4/26/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) [illegible]

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 0.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3799.5								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SILTY CLAY: BROWN, 10 YR 5/3, VERY LOW PLASTICITY, DRY, VERY FINE GRAIN QUARTZ, 60% CLAY, 40% SILT	CL			1	0.0	GC	0 1.0	
						NS			2.5	
	3.0	BOULDERY COBBLEY SILT: GRAYISH BROWN, 10 YR 5/2, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO 15 CM, ROUNDED	GM			2	0.0	1.5	4.0	
						3	0.0	0.5	4.5	
	5					NR			5.5	
						NS			9.0	
						4	0.0	0.8	9.8	
	10	AUGER REFUSAL AT 10.0'				NR			10.0	
		GROUNDWATER NOT OBSERVED DURING DRILLING.								
		BOREHOLE OVM THROUGH AUGERS: 66 PPM								
	15									
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-17***

DATE DRILLED 4/26/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3896

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3788.6		
	0	SILTY CLAY: BROWN, 7.5 YR 5/4, DRY, VERY LOW PLASTICITY, CALICHE VEINS, DARK BROWN, 10 YR 4/5 BELOW 4.0'	CL	
	5			
	9.0	CLAYEY SILT: DARK BROWN 10 YR 4/3, VERY FINE GRAIN QUARTZ, MOIST, LOW PLASTICITY, ROOT CHANNELS, SANDY, CALICHE VEINS, 60% SILT, 40% CLAY	ML	
	10			
	14.0			
	14.5	GRAVELLY CLAY: BROWN 10 YR 4/3, PEBBLES TO 3 CM, ROUNDED, 60% CLAY, 20% SILT, 20% GRAVEL	CL	
	15	DOLOMITE: GRAYISH BROWN, 10 YR 7/2, MASSIVE	DOLOMITE	
		AUGER REFUSAL AT 14.5'		
		GROUNDWATER NOT OBSERVED DURING DRILLING.		
	20	BOREHOLE OVM THROUGH AUGERS: 0.6 PPM		
	25			
	30			
	35			

OVM SOIL GAS PPM X 0.0

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	0 / 1.0
NS			2.5
2	0.0	1.0	3.5
NR			4.0
3	0.0	0.5	4.5
NR			5.5
NS			9.0
4	0.0	1.5	10.5
NS			14.0
5	0.0	1.5	15.5

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-18***

DATE DRILLED 4/26/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 0.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: NO DATA								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 2.0 PPM
	0	SANDY SILT: VERY FINE GRAIN SAND, 10% SAND, 90% SILT, NONPLASTIC, 10 YR 5/3, BROWN, DRY, SUBROUND, DOLOMITE COBBLES TO 1.0' DIAMETER, GRASS AND ROOTS AT SURFACE	SM			NS				
	1.0	COBBLEY GRAVELLY SILT: GRAVEL TO 0.15" DIAMETER, SUBROUND, DOLOMITE, VERY FINE GRAIN SAND, 20% GRAVEL AND COBBLES, 80% SILT, 10 YR 6/2, LIGHT GRAYISH BROWN, DRY, UNCONSOLIDATED	GM						2.5	
						1	0.0	0.6	3.1	
						NR			4.0	
						NS			5.0	
	5					2	0.0	0.9	5.9	
						NR			6.5	
						NS			7.5	
						3	0.0	1.3	8.8	
						NR			9.0	
						NS			10.0	
	10	SLIGHTLY MOIST AT 11.5'				4	0.0	1.2	11.2	
						NR			11.5	
						NS			12.5	
						5	0.0	0.5	13.0	
	13.6	AUGER REFUSAL 13.6'				6	0.0	0.6	13.6	
	15	NO GROUNDWATER AFTER DRILLING BOREHOLE OVM: 0.0 PPM								
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-19***

DATE DRILLED 4/27/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: NO DATA		
	0	SANDY SILT: VERY FINE GRAIN SAND, 10% SAND, 90% SILT, NONPLASTIC, 10 YR 6/3, PALE BROWN, DRY, UNCONSOLIDATED	SM	
	1.0	COBBLELY GRAVELLY SILT: SUBROUND, DOLOMITE GRAVEL AND COBBLES, 10 YR 6/2, LIGHT GRAYISH BROWN, DRY, UNCONSOLIDATED	GM	
	5			
	10			
	11.5	DOLOMITE: 10 YR 6/1, GRAY TO LIGHT GRAY, VERY HARD	DOLOMITE	
	12.0	AUGER REFUSAL 12.0'		
		NO GROUNDWATER AT TIME OF BORING		
	15	BOREHOLE OVM READING 0.0 PPM		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 0.0 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.0	0.8	3.3
NR			4.0
NS			5.0
2	0.0	0.9	5.9
NR			6.5
NS			7.5
3	0.0	1.5	9.0
NS			10.0
4	0.0	1.3	11.3
NR			11.5
5	0.0	0.3	11.8
NS			12.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 2.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-20***

DATE DRILLED 4/28/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3791.4								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	GRAVELLY SILT: GRAVEL TO 0.5' IN DIAMETER 10% GRAVEL, 90% SILT, 10 YR 6/3, PALE BROWN TO 0.6', TO YR 8/2, WHITE AFTER 0.6', DRY	SM			NS				0
									2.5	
						1	1.4	1.0	3.5	
						NS			4.1	
	5					2	1.0	1.0	5.1	5
	5.1	AUGER REFUSAL 5.1'								
		GROUNDWATER NOT ENCOUNTERED DURING DRILLING								
		BOREHOLE OVM: 0.0 PPM								
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-21 (NEAR MW-36)*

DATE DRILLED 4/30/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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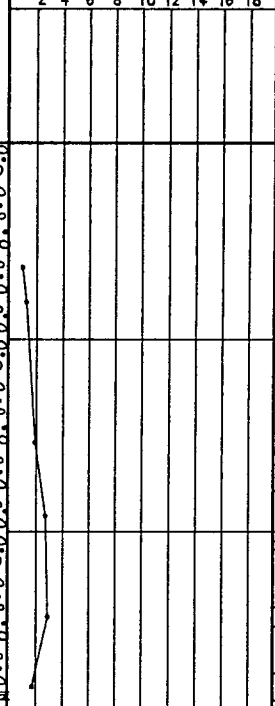
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3792.7	
	0	COBBLELY SILT: 10% DOLOMITE COBBLES, 90% SILT, NO PLASTICITY, 10 YR 6/3, PALE BROWN, AFTER 0.5', 10 YR 7/2, LIGHT GRAY, DRY, COBBLES TO 0.6' IN DIAMETER AFTER 2.0', 30% COBBLES, 70% SILT	GM
	5	INCREASING COBBLES WITH DEPTH	
	10	12.8 TO 13.3', 7.5 YR 5/4, BROWN, SLIGHTLY MOIST, SILT MINOR GRAVEL TO .05' DIAMETER 5% CLAY, BINDED, MOIST	
	14.2	SANDY DOLOMITE: VERY FINE GRAIN SAND, 20% SAND, 80% DOLOMITE, VERY HARD, DRY, MINOR 2.5 Y 8/6, YELLOW TO 10 YR 6/8, BROWNISH YELLOW, IRON OXIDE, POSSIBLE SULFUR STAINING	SANDY/ DOLOMITE
	14.4	NO GROUNDWATER ENCOUNTERED TO 14.4' BORING TERMINATED AT 14.4'	
	15		
	20		
	25		
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM X 1.0



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			
1	0.9	1.4	2.5
NR			3.9
2	1.2	0.2	4.0 – 4.2
NS			
3	1.9	0.5	7.5 – 8.0
NS			
4	2.7	1.3	9.0
NR			10.3 – 10.5
NS			
5	2.9	1.5	12.0 – 13.5
NS			
6	1.7	0.7	13.7 – 14.4

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-22***

DATE DRILLED 4/30/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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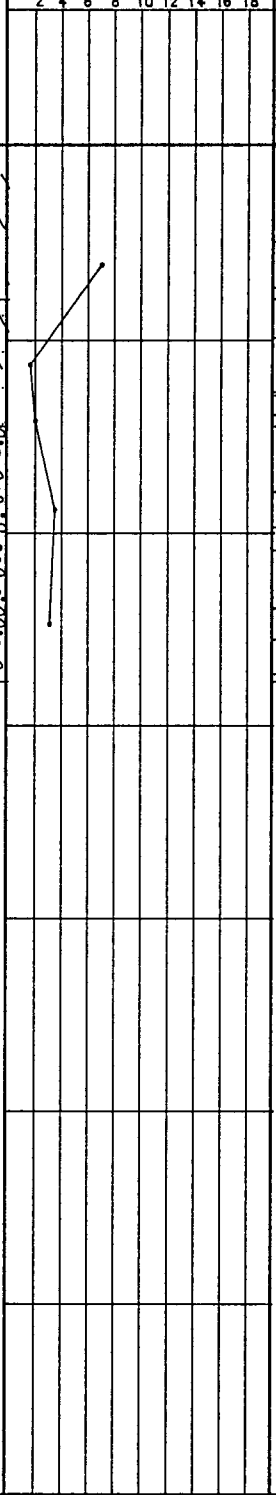
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3786.9		
	0	CLAYEY SILT: 10% CLAY, 90% SILT, LOW PLASTICITY, 7.5 YR 6/4, LIGHT BROWN, DRY, MASSIVE	ML	
	4.0	SANDY CLAYEY SILT: 10% SAND, 10% CLAY, 80% SILT, VERY FINE GRAIN SILICA SAND, LOW PLASTICITY, 7.5 YR 7/2, PINKISH GRAY, DRY	ML	
	7.3	COBBLEY SILT: ABUNDANT DOLOMITE COBBLES, MINOR SUBROUNDED DOLOMITE GRAVEL, UNCONSOLIDATED, DRY, 5 YR 7/1, LIGHT GRAY	GM	
	13.9	AUGER REFUSAL 13.9'		
	15	NO GROUNDWATER WHILE DRILLING		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 1.0



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	7.0	1.2	3.7
NR			4.0
NS			5.0
2	1.6	1.4	6.4
NR			6.5
NS			7.0
3	2.0	0.3	7.3
NS			9.0
4	3.5	0.9	9.9
NR			10.5
NS			12.0
5	3.1	0.8	12.8
NR			13.7
NS			13.9

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-23 (MW-2)***

DATE DRILLED 5/1/91
DRILLING METHOD HSA
DRILLED BY SBH
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3785.4	
	0	SANDY CLAYEY SILT: 10% SAND, 10% CLAY, 80% SILT, VERY FINE GRAIN SAND, MINOR DOLOMITE GRAVEL, 10 YR 6/4, LIGHT YELLOWISH BROWN, DRY, UNCONSOLIDATED	ML
	10.8	COBBLEY SILT: 10 YR 7/3, VERY PALE BROWN, DOLOMITE COBBLES, DRY, UNCONSOLIDATED, MINOR DOLOMITE GRAVEL > 0.1' DIAMETER	GM
	15.3	SANDY DOLOMITE: VERY FINE GRAIN SAND, 10 YR 6/3, PALE BROWN, VERY HARD, DRY	DOLOMITE
		AUGER REFUSAL 15.3'	
		NO GROUNDWATER WHILE DRILLING	
		BOREHOLE OVM: 0.0 PPM	

GRAPHIC LOG

OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.0	1.5	4.0
NS			5.0
2	0.0	1.0	6.0
NR			6.3
NS			7.5
3	0.0	1.1	8.6
NR			9.0
NS			10.0
4	0.0	0.8	10.8
NR			11.5
NS			12.5
5	0.8	0.8	13.3
NR			14.0
6	2.9	1.0	15.0
NR			15.3

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/90129***

BORING NUMBER ***BH-24 (MW-3)***

DATE DRILLED 5/2/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3789.8								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SANDY CLAYEY SILT: VERY FINE GRAIN SAND, 10% SAND, 10% CLAY, 80% SILT, 10 YR 6/3, PALE BROWN, DRY, UNCONSOLIDATED, AFTER 0.3', 10 YR 7/2, LIGHT GRAY	ML			NS			2.0	0
	2.6	AUGER REFUSAL 2.6' NOT ABLE TO SAMPLE BEDROCK NO GROUNDWATER ENCOUNTERED WHILE DRILLING BOREHOLE OVM: 1.1 PPM				1	3.5	0.6	2.6	
	5									5
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-25*

DATE DRILLED 5/3/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 0.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3784.1								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SANDY CLAYEY SILT: VERY FINE GRAIN SAND, 10% SAND, 10% CLAY, 80% SILT, LOW PLASTICITY, 10 YR 6/4, LIGHT YELLOWISH BROWN, DRY, UNCONSOLIDATED, MINOR SUBROUNDED DOLOMITE GRAVEL	ML			NS				0
	2.0	COBBLEY SILT: DOLOMITE, COBBLES, 10 YR 7/2, LIGHT GRAY, DRY, UNCONSOLIDATED, ABUNDANT GRAVEL TO 0.15' IN DIAMETER	GM						2.5	
						1	0.0	0.9	3.4	
						NR			4.0	
						2	0.0	1.5	5.5	
	5					NS				5
									7.0	
						3	0.0	1.0	8.0	
						NR			8.5	
						NS			9.0	
						4	0.0	0.8	9.8	
	10					NR			10.5	10
						NS				
									12.5	
						NR		0.0	13.0	
						NS			13.5	
						5	0.0	0.6	14.1	
						NR			14.5	
	15					NS				15
	16.8									
	16.9	SANDSTONE: VERY FINE GRAIN QUARTZ, 10 YR 7/2, LIGHT GRAY, DRY, HARD, WEAK CEMENTATION, FRIABLE	SANDSTONE						16.9	
		AUGER REFUSAL AT 16.9' NO GROUNDWATER ENCOUNTERED WHILE DRILLING BOREHOLE OVM: 0.0 PPM								
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-26 (MW-4)***

DATE DRILLED 5/3/91 - 5/4/91
DRILLING METHOD HSA
DRILLED BY SBH
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 2.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3793.1								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SANDY CLAYEY SILT: NO PLASTICITY, VERY FINE GRAIN SAND, 10 YR 6/3, 80% SILT, 10% SAND, 10% CLAY, PALE BROWN, DRY, MINOR SUBROUND DOLOMITE GRAVEL UNCONSOLIDATED	SM			NS			2.5	0
						1	37.0	0.9	3.4	
	3.4	AUGER REFUSAL AT 3.4' NO GROUNDWATER ENCOUNTERED WHILE DRILLING								
	5									5
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-27***

DATE DRILLED 5/4/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3799.8								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SANDY SILT: 20% VERY FINE GRAIN SAND, 80% SILT, NO PLASTICITY, 10 YR 7/3, VERY PALE BROWN, DRY, UNCONSOLIDATED	SM			NS			2.5	
						1	0.0	1.2	3.7	
	3.7	SILTY SANDSTONE: VERY FINE GRAIN QUARTZ, 10 YR 8/2, WHITE, DRY, WEAKLY CEMENTED, FRIABLE	SILTY SANDSTONE			NR			4.0	
						NS			5.0	
	5					2	0.0	1.0	6.0	
						NS			7.0	
						3	2.0	0.6	7.6	
		MOIST AT 8.0', 2.5 Y 7/4, PALE YELLOW,				NS			9.0	
		VERY MOIST AT 9.0'				4	0.0	0.3	9.3	
	10					NS			11.0	
		AFTER 11.0', VERY HARD				5	0.0	0.2	11.2	
	11.2	AUGER REFUSAL 11.2' NO GROUNDWATER ENCOUNTERED WHILE DRILLING BOREHOLE OVM: 8.0 PPM								
	15									
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/90129*

BORING NUMBER *BH-28 (MW-5)*

DATE DRILLED 5/4/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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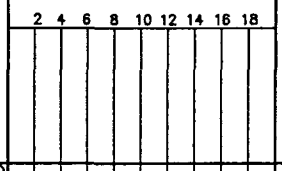
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3783.2		
	0	COBBLEY SILT: DOLOMITE COBBLES TO 1.5' IN DIAMETER, 10 YR 5/3, BROWN, DRY, UNCONSOLIDATED AFTER 0.9', 10 YR 8/2, WHITE, ABUNDANT SUBROUND DOLOMITE GRAVEL	GM	
	5			
	10			
	12.3	AUGER REFUSAL 12.3' NO GROUNDWATER ENCOUNTERED WHILE DRILLING		
	15			
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 1.0



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			
			2.5
1	13.0	1.1	
			3.6
NR			4.0
NS			
			5.0
2	6.0	0.7	5.7
NS			
			7.0
3	6.0	1.2	
			8.2
NS			8.5
4	11.0	0.6	9.1
NS			
			12.3

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/90129*

BORING NUMBER *BH-29 (MW-6)*

DATE DRILLED 5/5/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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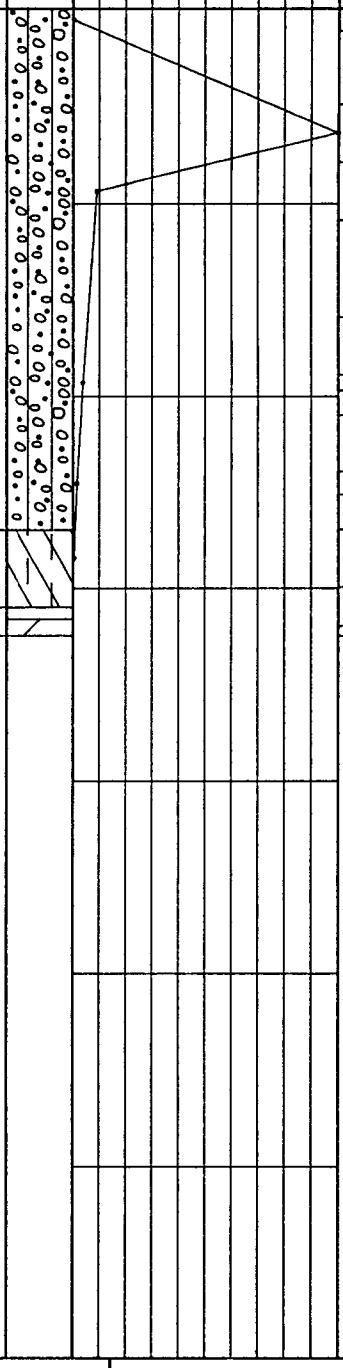
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3783.5	
	0	GRAVELLY BOULDERY COBBLEY SILT: BROWN, 7.5YR5/6, DRY, UNCONSOLIDATED, COBBLES AND BOULDERS FROM 5 CM TO 1 M, VERY FINE QUARTZ, WELL ROUNDED GRAVEL	GM
	13.5	SILTY CLAY: BROWN, 10 YR 5/6, VERY FINE QUARTZ, LOW PLASTICITY, DRY, MEDIUM COMPACTION, ABUNDANT CALICHE AND ROOT CHANNELS, 60% CLAY, 40% SILT, WEATHERED AT CONTACT, CALICHE CEMENTED	CL
	15.5	DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 5/2, VERY HARD, SANDY, MASSIVE	DOLOMITE
	16.3	AUGER REFUSAL AT 16.3'	
		GROUNDWATER NOT OBSERVED DURING DRILLING	

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.2	GC	0.6
NS			2.5
2	42.0	1.5	4.0
3	3.8	1.5	5.5
NS			8.0
NR		0.0	9.5
4	1.6	0.4	9.9
NR			10.5
NS			12.0
5	0.7	0.6	12.6
NR			13.5
6	0.2	1.5	15.0
NS			16.0
NR			16.3

REMARKS

BACKGROUND OVM READING:
SOIL: 0.2 PPM
AIR: 0.2 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-30 (MW-7)***

DATE DRILLED 5/6/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 18.5 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3792.8								BACKGROUND OVM READING: SOIL: 0.2 PPM AIR: 0.2 PPM
	0	BOULDERY COBBLEY GRAVELLY SILT: BROWN, 10YR 5/6, DRY, VERY LOW PLASTICITY, UNCONSOLIDATED, COBBLES AND BOULDERS FROM 5CM TO 1M, ROUNDED	GM			1	0.9	1.0	1.0	0
						NS			2.5	
						2	369.0	0.8	3.3	
						NR			4.0	
	5					3	5.3	1.1	5.1	5
						NR			5.5	
						NS			7.0	
						4	24.1	0.8	7.8	
						NR			8.5	
						NS			9.0	
	10					5	0.2	1.0	10.0	10
						NS			12.0	
						6	0.2	0.4	12.4	
						NS			14.0	
						7	0.2	0.1	14.1	
						NS			15.0	
	15 15.5					NR			15.3	15
		AUGER REFUSAL AT 15.5'								
		GROUNDWATER NOT ENCOUNTERED WHILE DRILLING								
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-31 (MW-8)***

DATE DRILLED 5/6/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 1.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3805.6								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	CLAYEY SILT: DARK BROWN, 7.5 YR 4/2, VERY FINE QUARTZ, DRY, VERY LOW PLASTICITY, GRAVELLY, 60% SILT, 40% CLAY, CALICHE DEPOSITS	ML			1	0.2	GC	0.6	
						NS			2.5	
						2	0.2	0.6	3.1	
						NR			4.0	
						3	0.2	0.3	4.3	
						NR			5.5	
	5	BOULDERY COBBLEY GRAVELLY SILT: BROWN, 7.5 YR 5/2, DRY, UNCONSOLIDATED, COBBLES AND BOULDER FROM 5 CM TO 50 CM, ROUNDED	GM			NS				
						4	0.2	0.1	7.0	
						NS			7.1	
									9.0	
	9.5	SANDSTONE: QUARTZ, GRAYISH YELLOW TO YELLOWISH GRAY, 5 Y 8/4 TO 7/2, FINE GRAIN, WELL SORTED, POORLY CEMENTED, FRIABLE	SANDSTONE			5	0.2	0.6	9.6	
	10					NR			10.0	
						NS				
	12.0	AUGER REFUSAL AT 12.0'							12.0	
		GROUNDWATER NOT ENCOUNTERED WHILE DRILLING								
	15									
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-32 (MW-9)***

DATE DRILLED 5/7/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3788.7		
	0	CLAYEY SILT: YELLOWISH BROWN, 10 YR 5/4, DRY, VERY LOW PLASTICITY, VERY FINE QUARTZ, CALICHE DEPOSITS, 60% SILT, 40% CLAY	ML	
	5	SILTY CLAY: DARK BROWN, 10 YR 4/3, VERY FINE QUARTZ, LOW PLASTICITY, MODERATELY COMPACTED	CL	
	10	MOIST BELOW 9.5', LOW PLASTICITY		
	12.6	BOULDERY COBBLEY GRAVEL: LIGHT GRAYISH BROWN, 10 YR 5/2 TO 6/2, ROUNDED, CALICHE CEMENTED, HARD	GM	
	13.5	CLAYEY SAND TO SANDY CLAY: BROWN, 10YR5/3, QUARTZ, FINE GRAIN, WELL SORTED, SATURATED, MEDIUM PLASTICITY, STRONG HYDROCARBON ODOR	SM	
▽ 16.0'	15			
	16.5	AUGER REFUSAL AT 16.5' NOTE: BOREHOLE REEMED 10 INCHES TO A DEPTH OF 17.01', 5/8/91		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 27.0 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	1.0	GC	0.5
NS			2.5
2	1.1	0.6	3.1
NR			4.0
3	0.2	1.1	5.1
NR			5.5
NS			9.0
4	0.2	0.8	9.8
NR			10.5
NS	0.0		12.0
5	23.0	0.7	12.7
NR			13.0
NS			13.5
6	540.0	1.3	14.8
NR			15.0
NS			16.5
NR			16.6

REMARKS

BACKGROUND OVM READING:
SOIL: 0.2 PPM
AIR: 0.7 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-33 (MW-10)*

DATE DRILLED 5/7/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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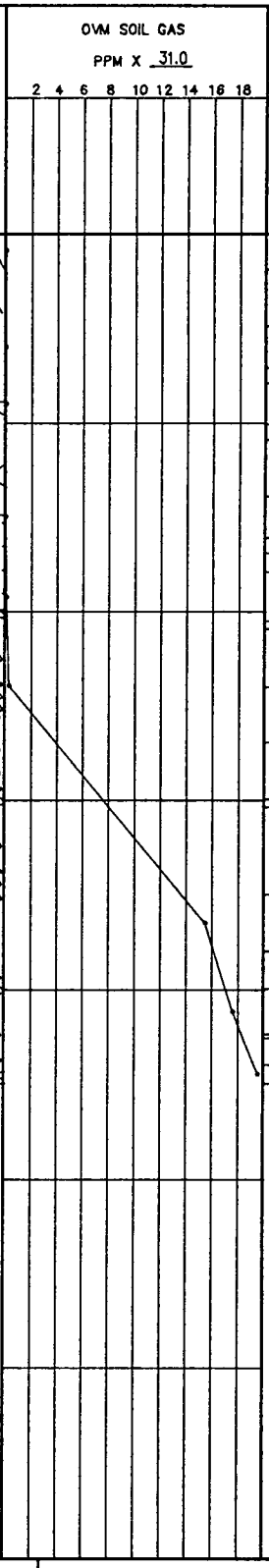
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3804.8	
	0	CLAYEY SILT: YELLOWISH BROWN, 10 YR 5/4, DRY, UNCONSOLIDATED, VERY LOW PLASTICITY, VERY FINE GRAIN QUARTZ, 70% SILT, 30% CLAY	ML
	4.5	GRAVELLY COBBLEY SILT: GRAYISH BROWN, 10 YR 5/2, VERY FINE QUARTZ, POORLY SORTED, UNCONSOLIDATED, COBBLES AND PEBBLES FROM 3 TO 10CM, ROUNDED, DOLOMITE	SM
	7.5	SILTY SAND: YELLOWISH BROWN, 10YR5/4, QUARTZ, VERY FINE TO MEDIUM GRAIN, POORLY SORTED, ANGULAR, ABUNDANT K-FELDSPAR AND BIOTITE, MODERATELY COMPACTED, STRUCTURELESS	SM
	10	COBBLEY BOULDERY SILT: GRAYISH BROWN, 10YR 5/2, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO 1 M, ROUNDED DOLOMITE	GM
	15	HYDROCARBON ODOR BELOW 18.01', MOIST	
22.0'	20	HYDROCARBON SATURATED AT CONTACT	
	22.2	SANDSTONE: LIGHT OLIVE GRAY, 5 Y 6/2, QUARTZOSE, FINE GRAIN, WELL SORTED, MICACEOUS, FRIABLE, NONCALCAREOUS	SANDSTONE
	22.5	AUGER REFUSAL AT 22.5'	
	25		
	30		
	35		



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.1	3.6
NR			4.0
3	0.0	1.1	5.1
NR			5.5
NS			7.0
4	0.0	1.1	8.1
NR			8.5
NS			9.0
5	2.5	1.3	10.3
NR			10.5
NS			12.0
6	8.6	1.5	13.5
NS			15.0
NR			15.2
NS			17.5
7	479.0	1.5	19.0
NS			20.0
8	545.0	1.2	21.2
NR			21.3
NS			22.0
9	605.0	2.5	22.5

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.2 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

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JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-34 (MW-11)*

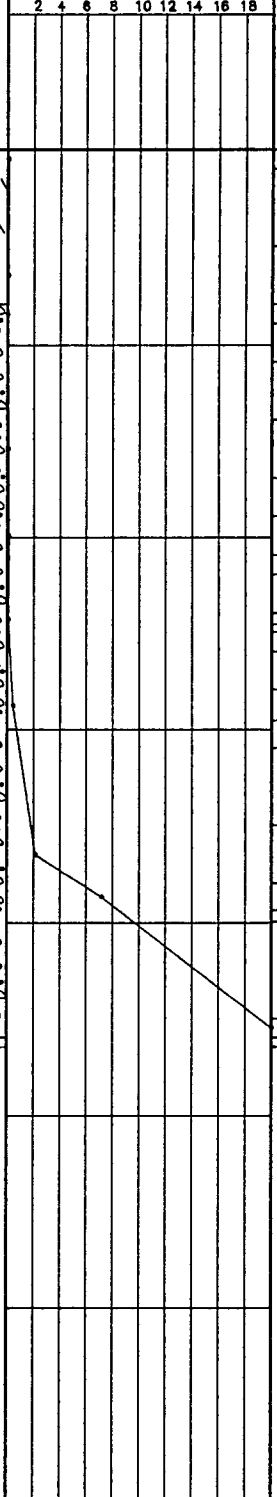
DATE DRILLED 5/8/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3807.9	
	0	CLAYEY SILT: LIGHT YELLOWISH BROWN, 10 YR 6/4, DRY, VERY FINE GRAIN QUARTZ, UNCONSOLIDATED, 60% SILT, 40% CLAY, CALICHE DEPOSITS	ML
	4.0	BOULDERY COBBLEY GRAVELLY SILT: LIGHT GRAYISH BROWN, 10YR 6/2, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO 1 M, ROUNDED	GM
	5		
	10		
	15		
	20	CLAYEY BELOW 19.5', SANDY, QUARTZ, MEDIUM GRAIN, MOIST, MEDIUM PLASTICITY, STRONG HYDROCARBON ODOR	
	23.0	SANDSTONE: LIGHT OLIVE GRAY, 5 Y 6/2, QUARTZOSE, FINE GRAIN, POORLY CEMENTED, NONCALCAREOUS, FRIABLE, MICACEOUS	SANDSTONE
	23.2	BORING TERMINATED 23.2'	
	25	GROUNDWATER NOT OBSERVED DURING DRILLING	
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM X 22.0



SAMPLE

NUMBER	OVM READING	RECOVERY	DEPTH
1	0.8	GC	0.5
NS			2.5
2	1.1	1.5	4.0
3	0.2	0.5	4.5
NR			5.5
NS			7.0
4	1.6	1.5	8.5
NS			9.5
5	2.5	1.0	10.5
NR			11.0
NS			12.0
6	1.1	0.3	12.3
NR			12.5
NS			13.0
NS			14.0
7	9.1	0.8	14.8
NR			15.5
NS			17.5
8	47.1	1.5	19.0
9	157.5	0.7	19.7
NR			20.0
NS			22.5
10	440.0	0.5	23.0
NS			23.3

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-35 (MW-12)***

DATE DRILLED 5/9/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

Start: 13:10
Stop: 15:00

GROUND SURFACE: 3799.5

OVM SOIL GAS PPM X 23.0

BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
	0	CLAYEY SILT: YELLOWISH BROWN, 10 YR 5/4, VERY FINE GRAIN QUARTZ, DRY, VERY LOW PLASTICITY, 70% SILT, 30% CLAY	ML	1	0.0	GC	1.0	
				NS			2.5	
				2	0.0	1.0	3.5	
				NR			4.0	
				3	0.0	0.5	4.5	
	5			NR			5.5	
				NS			7.0	
	7.2	BOULDERY COBBLEY GRAVELLY SILT: LIGHT GRAYISH BROWN, 10 YR 6/2, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO 1 M, ROUNDED	GM	4	0.0	0.4	7.4	
				NR			8.5	
				NS			9.0	
				5	0.0	1.1	10.1	
	10			NR			10.5	
				NS			12.0	
	12.5	SANDY GRAVELLY CLAY: BROWN, 7.5 YR 5/4, MOIST, MEDIUM PLASTICITY, FINE GRAIN QUARTZ, FIRM, OCCASIONAL LARGE PEICES OF GRAVEL, 60% CLAY, 40% SAND, CALICHE DEPOSITS	CL	6	0.0	1.5	13.5	
	13.5	BOULDERY COBBLEY GRAVELLY SILT: LIGHT GRAYISH BROWN, 10 YR 6/2, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO 1 M, ROUNDED	GM	NS			14.0	
				7	0.0	0.4	14.4	
	15			NS			17.0	
17.5'	17.5	GRAVEL: GRAY, 10 YR 5/1, MODERATELY WELL SORTED, ANGULAR, GRAVEL 5 TO 10 MM, HYDROCARBON SATURATED	GP	8	204.0	1.0	18.0	
				NR			18.8	
	19.2			NS			19.0	
	19.7	SANDSTONE: PALE OLIVE, 5 Y 6/4, FINE GRAIN, WELL SORTED, POORLY CEMENTED, FRIABLE, NONCALCAREOUS, MICACIOUS	SANDSTONE	9	460.0	0.7	19.7	
	20	BORING TERMINATED AT 19.7'						
	25							
	30							
	35							

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-36 (MW-13)***

DATE DRILLED 5/10/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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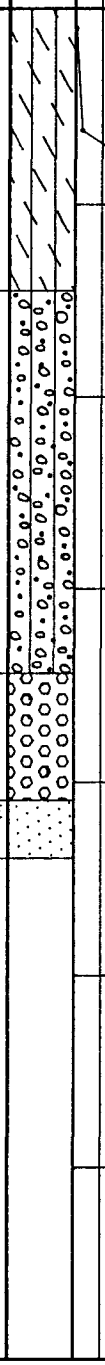
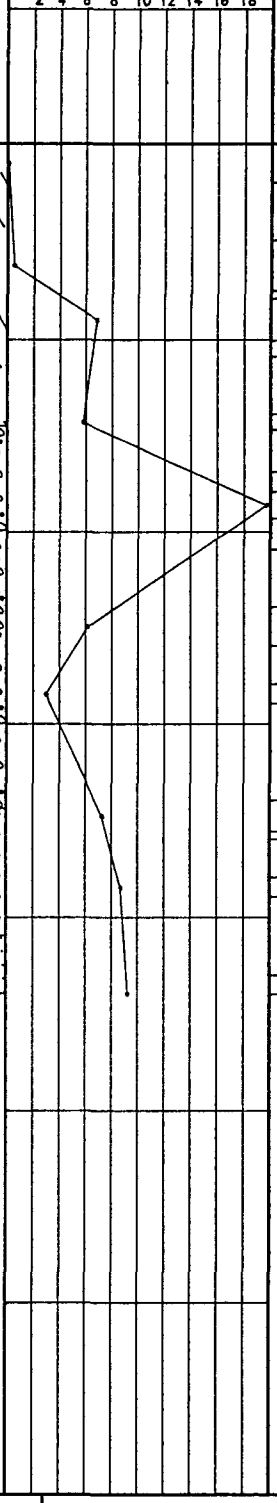
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3801.6	
	0	CLAYEY SILT: BROWN, 7.5 YR 5/4, DRY, VERY LOW PLASTICITY, CALICHE DEPOSITS, VERY FINE QUARTZ, 70% SILT, 30% CLAY	ML
	7.3	BOULDER COBBLEY GRAVELLY SILT: LIGHT BROWNISH GRAY, 10 YR 6/2, GRAVELLY, POORLY SORTED, COBBLES AND BOULDERS FROM 5 TO 50CM, ROUNDED	GM
		ABUNDANT GRAVEL FROM 12.0–14.0', FROM 1.0 CM TO 3.0 CM	
		CLAYEY FROM 14.0–14.5', SANDY, MOIST, MEDIUM GRAIN QUARTZ, MEDIUM PLASTICITY BOULDERS > 1M BELOW 14.5'	
17.0 ▽	17.2	GRAVEL: GRAY TO GRAYISH BROWN, 10 YR 5/1 TO 5/2, MODERATELY SORTED, VERY COARSE GRAIN QUARTZ, GRAVEL 0.5 TO 1.0 CM, ROUND TO SUBROUND., COBBLEY, HYDROCARBON SATURATED CLAYEY BELOW 17.0'	GP
	20.5	SANDSTONE: BROWN, 10 YR 5/3, FINE GRAIN, QUARTZOSE, WELL SORT, POORLY CEMENTED, FRIABLE	SANDSTONE
	22.0	BORING TERMINATED AT 22.0'	
		BOREHOLE REEMED TO 10" DIAMETER HOLE	

GRAPHIC LOG



OVM SOIL GAS PPM X 37.0



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	1.7	GC	1.0
NS			2.5
2	18.1	1.3	3.8
NR			4.0
3	253.0	1.1	5.1
NR			5.5
NS			7.0
4	213.0	0.4	7.4
NR			8.5
NS			9.0
5	728.0	0.7	9.7
NR			10.5
NS			12.0
6	228.0	1.0	13.0
NS			14.0
7	109.0	0.5	14.5
NS			17.0
8	269.0	0.8	17.8
NR		0.0	18.0
NS			19.0
9	322.0	0.5	19.5
NS			21.5
10	342.0	0.5	22.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.2 PPM
AIR: 0.2 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-37 (MW-14)***

DATE DRILLED 5/11/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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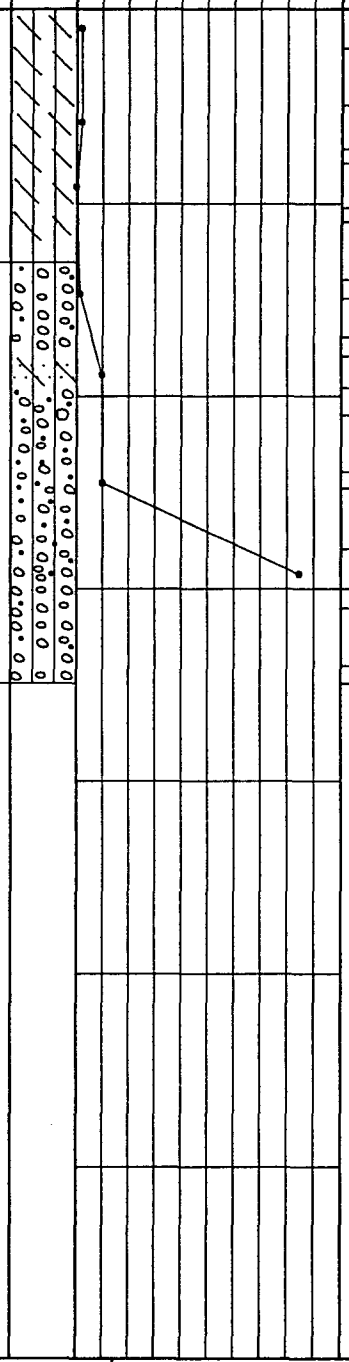
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3801.5	
	0	CLAYEY SILT: LIGHT YELLOWISH BROWN, 10 YR 6/4, VERY FINE GRAIN QUARTZ, DRY, VERY LOW PLASTICITY, CALICHE DEPOSITS, 70% SILT, 30% CLAY	ML
	5		
	6.5	BOULDERY COBBLEY GRAVELLY SILT: LIGHT GRAYISH BROWN TO YELLOWISH BROWN, 10 YR 6/2 TO 6/4, POORLY SORTED, COBBLES AND BOULDERS FROM 3 TO 50CM, ROUNDED TO SUBROUNDED CLAYEY FROM 9.0' TO 9.8', SANDY, FINE TO MEDIUM GRAIN QUARTZ, FIRM, MODERATE TO LOW PLASTICITY	GM
	10		
	15		
	17.38	AUGER REFUSAL AT 17.38' GROUNDWATER NOT ENCOUNTERED WHILE DRILLING.	
	20		
	25		
	30		
	35		

GRAPHIC LOG



OVM SOIL GAS PPM X 2

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	1.1	GC	1.0
NS			2.5
2	1.0	1.2	3.7
NR			4.0
3	0.2	1.1	5.1
NR			5.5
NS			7.0
4	1.1	0.4	7.4
NR			8.5
NS			9.0
5	4.4	0.8	9.8
NR			10.5
NS			12.0
6	4.9	0.4	12.4
NS			14.0
7	35.0	1.0	15.0
NR			15.5
NS			17.0
NR			17.4

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **BH-38 (MW-15)**

DATE DRILLED 5/11/91 & 5/12/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GROUND SURFACE: 3798.4

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
	0 – 3.5	CLAYEY SILT: VERY PALE BROWN TO LIGHT YELLOWISH BROWN, 10 YR 7/4 TO 6/4, DRY, VERY LOW PLASTICITY, GRAVELLY BELOW 3.0', GRAVEL TO 1CM. ROUNDED, VERY FINE QUARTZ MATRIX, 65% SILT, 35% CLAY, 5% GRAVEL	ML
	3.5 – 20.5	GRAVELLY BOULDERY COBBLEY SILT: LIGHT BROWNISH GRAY, 10 YR 6/2, POORLY SORTED, COBBLES AND BOULDERS FROM 4CM TO 1M, ROUNDED CLAYEY FROM 4.5' TO 5.0'	GW
	20.5 – 21.0	SANDSTONE: LIGHT OLIVE GRAY, 5Y 6/2, QUARTZOSE, FINE GRAIN, WELL SORTED, POORLY CEMENTED, FRIABLE, MICACEOUS, NON-CALCAREOUS	SANDSTONE

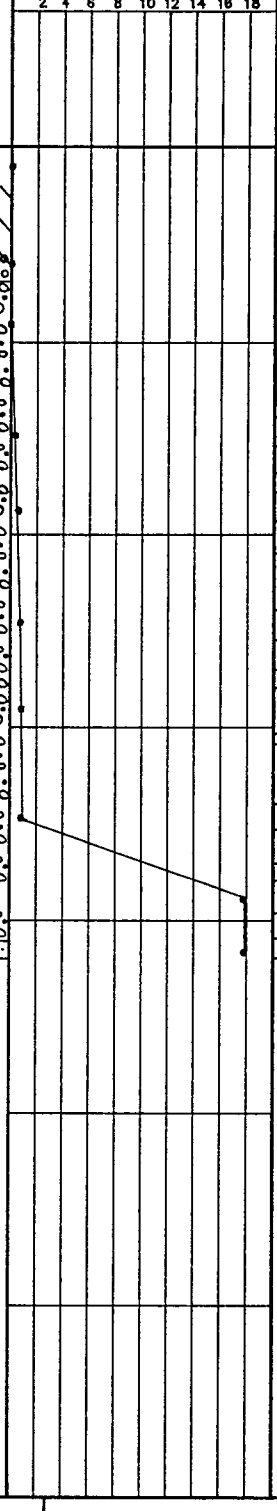
BORING TERMINATED AT 21.0'

GROUNDWATER NOT OBSERVED DURING DRILLING.

▽ 19.9

GRAPHIC LOG

OVM SOIL GAS PPM X 15



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.8	GC	1.0
NS			2.5
2	2.1	0.9	3.4
NR			4.0
3	0.2	1.0	5.0
NR			5.5
NS			7.0
4	0.7	0.8	7.8
NR			8.5
NS			9.0
5	0.7	0.8	9.8
NR			10.5
NS			12.0
6	2.6	0.8	12.8
NR			13.5
NS			14.0
7	6.8	1.1	15.1
NR			15.5
NS			17.0
8	17.1	0.8	17.8
NR			18.5
NS			19.0
9	269	0.9	19.9
NR			20.5
10	268	0.5	21.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.1 PPM
AIR: 0.1 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

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JOB NAME/NUMBER ***MARATHON/91029***

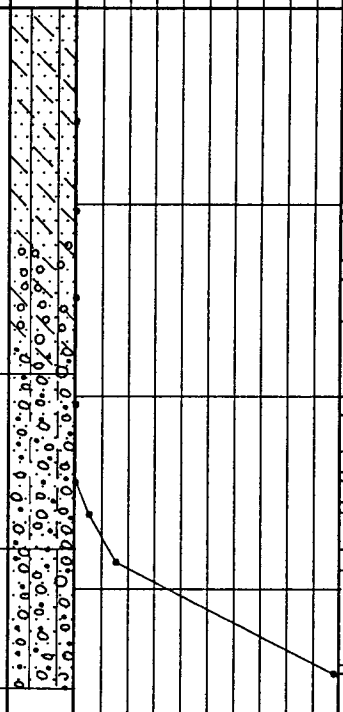
BORING NUMBER ***BH-39 (MW-16)***

DATE DRILLED 5/12/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3797.5	
	0	CLAYEY SANDY SILT: VERY FINE GRAINED SAND, 10% CLAY, 10% SAND, 80% SILT, UNCONSOLIDATED, DRY, 7.5 YR 7/4 PINK	ML
	5	ABUNDANT COBBLES AFTER 6.0'	
	9.4		
	10	COBBLEY SILTY SAND: 10% COBBLES, 20% SILT, 70% SAND, VERY FINE GRAINED SILICA SAND, SLIGHTLY MOIST, 7.5 YR 7/4 PINK, UNCONSOLIDATED, DOLOMITE COBBLES	GM
	14.0		
15.9'	15	COBBLEY SANDY SILT: VERY FINE GRAINED SAND, SLIGHTLY MOIST, 7.5 YR 7/4 PINK, UNCONSOLIDATED, DOLOMITE COBBLES	ML
	17.7	AUGER REFUSAL AT 17.7'	
	20	GROUNDWATER NOT ENCOUNTERED DURING DRILLING.	
		BOREHOLE OVM READING: 19.0 PPM	
	25		
	30		
	35		

GRAPHIC LOG



OVM SOIL GAS PPM X 20 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.0	0.9	3.4
NR			4.0
NS			5.0
2	0.0	0.4	5.4
NR			6.5
NS			7.0
3	7	1.1	8.1
NS			10.0
4	0.0	0.5	10.5
NR			11.5
NS			12.0
5	0.0	0.1	12.1
NS			12.7
6	11	0.3	13.0
NS			14.0
7	30	0.5	14.5
NS			17.0
8	376	0.1	17.1
NS			17.7

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

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JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-40 (MW-17)***

DATE DRILLED 5/13/91 & 5/14/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3793.5	
	0	CLAYEY SILT: 10% CLAY, 90% SILT, LOW PLASTICITY, 10 YR 6/3 PALE BROWN, UNCONSOLIDATED, DRY	ML
	5		
	6.0	GRAVELLY COBBLEY SILT: 10 YR 7/2 LIGHT GRAY, UNCONSOLIDATED, SUB-ROUNDED, DOLOMITE GRAVEL AND COBBLES, DRY	GM
	9.0	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10% COBBLES, 20% SAND, 70% SILT, SLIGHTLY MOIST, 10 YR 7/2 LIGHT GRAY, UNCONSOLIDATED, STRONG CON-DENSATE ODOR	GM
	10	VERY MOIST AFTER 12.5'	
▽ 13.9	▽13.4		
	15		
	15.2	AUGER REFUSAL AT 15.2'	
	20		
	25		
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM X 23

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	11.5	1.2	3.7
NR			4.0
NS			5.0
2	0.0	1.1	6.1
NR			6.5
NS			7.5
3	2.8	1.0	8.5
NR			9.0
4	50	1.0	10.0
NR			10.5
NS			12.0
5	378	0.5	12.5
NR			13.5
6	408	0.1	13.6
NS			15.2

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-41 (MW-18)***

DATE DRILLED 5-14-91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3795.4		
	0	CLAYEY SILT: 10% CLAY, 90% SILT, 10 YR 6/3 PALE BROWN, DRY, UNCONSOLIDATED	ML	
	5	SLIGHTLY MOIST AFTER 5.0'		
	6.0	COBBLEY CLAYEY SILT: 10% COBBLES, 10% CLAY, 80% SILT, 10 YR 6/3, PALE BROWN, SLIGHTLY MOIST, UNCONSOLIDATED	GM	
	10 / 10.2	COBBLEY SANDY SILT: VERY FINE GRAINED SAND, DOLOMITE COBBLES, 10 YR 7/1 LIGHT GRAY, DRY, UNCONSOLIDATED	GM	
	12.3	COBBLEY CLAYEY SILT: 10 YR 7/1 LIGHT GRAY, DOLOMITE COBBLES, 10 YR 5/4 YELLOW BROWN, SILTY CLAY MATRIX, MOIST, MODERATELY CONSOLIDATED	GM	
▽ 14.8	14.6 / 15	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, DOLOMITE COBBLES, 10 YR 7/1 LIGHT GRAY, SATURATED, STRONG CONDENSATE ODOR AT 17.0', SATURATED WITH 5 YR 3/1 VERY DARK GRAY VISCOUS MATERIAL, STRONG CONSENSATE ODOR	GM	
16.7	17.3	AUGER REFUSAL AT 17.3'		
	20	GROUNDWATER ENCOUNTERED AT 14.8'		
		HEAVING SANDS AT T.D. 17.3'		
	25			
	30			
	35			

OVM SOIL GAS PPM X 40 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.0	.98	3.5
NR			4.0
NS			5.0
2	0.0	1.3	6.3
NR			6.5
NS			7.5
3	0.0	1.0	8.5
NR			9.0
4	59	0.9	9.9
NR			10.5
NS			12.0
5	124	1.1	13.1
NS			14.0
6	344	1.2	15.2
NS			17.0
7	716	0.3	17.3

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-42 (MW-19)***

DATE DRILLED 5/15/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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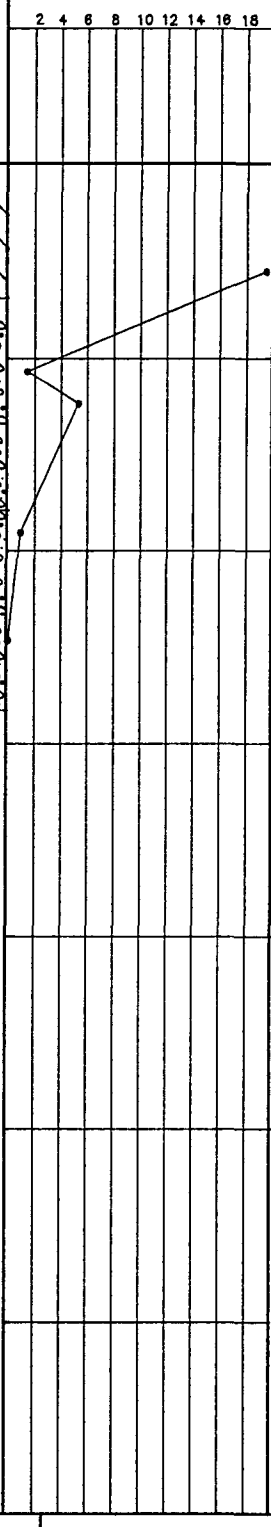
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3794.8		
	0	CLAYEY SILT: 10% CLAY, 90% SILT, 10 YR 6/3 PALE BROWN, DRY TO SLIGHTLY MOIST, NO PLASTICITY	ML	
	6.0	COBBLEY SANDY SILT: 10 YR 7/3 VERY PALE BROWN, SLIGHTLY MOIST TO DRY, UNCONSOLIDATED, DOLOMITE COBBLES TO APPROXIMATE 0.5 FEET DIAMETER AFTER 6.0', CLAYEY SILT MATRIX, SLIGHTLY MOIST	GM	
	9.0	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 8/2 WHITE, DRY, UNCONSOLIDATED, DOLOMITE COBBLES, MINOR DOLOMITE GRAVEL MINOR CLAYEY SILT MATRIX AFTER 12.0', SLIGHTLY MOIST	GM	
	14.1	AUGER REFUSAL AT 14.1' GROUNDWATER NOT ENCOUNTERED DURING BORING.		

OVM SOIL GAS PPM X 31



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	609	0.9	3.4
NR			4.0
NS			5.0
2	55	0.4	5.4
NR			6.0
3	168	0.3	6.3
NS			9.0
4	51	0.9	9.9
NS			12.0
5	13	0.7	12.7
NR			13.0
NS			14.1

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-43 (MW-20)***

DATE DRILLED 5/16/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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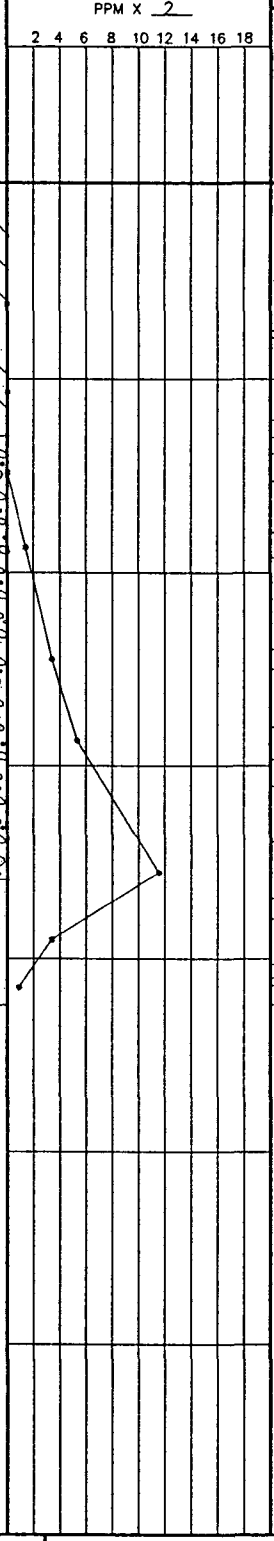
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3796.1	
	0	SANDY CLAYEY SILT: VERY FINE GRAIN SAND, 10% SAND, 10% CLAY, 80% SILT, NO PLASTICITY, 7.5 YR 7/2 PINK GRAY, DRY, MINOR CALICHE, UNCONSOLIDATED	ML
	5		
	6.5	COBBLEY GRAVELLY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 7/2 LIGHT GRAY, DOLOMITE COBBLES AND GRAVEL, DRY, UNCONSOLIDATED	GM
	10	AFTER 12.0' CALICHE CEMENTATION, MINOR SLIGHTLY MOIST, 7.5 YR 6/4 LIGHT BROWN, CLAY MATRIX SLIGHTLY MOIST AFTER 14.0'	
	15		
	18.0	SANDSTONE: VERY FINE GRAIN SILICA HIGHLY WEATHERED AND FRACTURED, 2.5 YR 7/4 PALE YELLOW, FRACTURE IN FILLING WITH MOTTLED 7.5 YR 5/4 BROWN SILTY CLAY, SLIGHTLY MOIST IN FRACTURE, MOIST IN SANDSTONE, HIGHLY FRIABLE AND MOIST AFTER 20.0', AFTER 20.6' VERY HARD SANDSTONE	SANDSTONE
20.44	20		
	21.20	AUGER REFUSAL AT 21.20' GROUNDWATER NOT ENCOUNTERED DURING DRILLING.	
	25		
	30		
	35		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.0	1.3	3.8
NR			4.0
NS			5.0
2	0.0	1.1	6.1
NR			6.5
NS			7.0
3	0.0	0.7	7.7
NS			9.0
4	3.0	0.6	9.6
NS			12.0
5	7.0	0.4	12.4
NS			14.0
6	11	0.9	14.9
NR			15.5
NS			17.0
7	23	1.5	18.5
NS			19.0
8	7	1.1	20.1
NR			20.5
9	2	0.1	20.6
NR			21.2

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-44 (MW-21)***

DATE DRILLED 5/16/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3797.5		
	0	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 6/3 PALE BROWN, DRY, UNCONSOLIDATED, DOLOMITE COBBLES AND GRAVEL, AFTER 3.0' 10 YR 7/2 LIGHT GRAY, CALICHE CEMENTATION 2'-3'	GM	
	4.0	COBBLEY SILTY SAND: 10% COBBLES, 30% SILT, 60% SAND, VERY FINE TO FINE SAND, 10 YR 8/3 VERY PALE BROWN, DRY, DENSE	GM	
	5			
	8.0	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 7/4 VERY PALE BROWN, SLIGHTLY MOIST, UNCONSOLIDATED, DOLOMITE COBBLES AFTER 12.0' MINOR 7.5 YR 6/4 LIGHT BROWN, MOIST CLAYEY SAND MATRIX	GM	
	10			
	14.5	SILTY CLAY: 40% SILT, 60% CLAY, LOW PLASTICITY, STIFF, 10 YR 5/4 YELLOW BROWN, MOIST, MINOR SUBROUNDED DOLOMITE GRAVEL	CL	
	15			
	15.5			
	15.6	DOLOMITE: VERY HARD, MICROCRYSTALLINE, 10 YR 6/1 LIGHT GRAY TO GRAY, DRY	DOLOMITE	
		AUGER REFUSAL AT 15.6' GROUNDWATER NOT OBSERVED DURING BORING NO GROUNDWATER AFTER 24 HOURS		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM x 1.0: 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.0	0.1	2.6
NR			4.0
2	0.0	1.2	5.2
NS			7.0
3	0.0	0.5	7.5
NS			9.0
4	3.0	1.1	10.1
NR			10.5
NS			12.0
5	0.0	0.7	12.7
NS			14.0
6	3.0	1.1	15.1
NS		0.1	15.5
7	0.0		15.6

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-45 (MW-22)***

DATE DRILLED 5/17/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3792.4		
	0	CLAYEY SILT: 10% CLAY, 90% SILT, 10 YR 7/4 VERY PALE BROWN, DRY TO SLIGHTLY MOIST, UNCONSOLIDATED, NO PLASTICITY	ML	
	4.5			
	5	GRAVELLY SILT: 10 YR 8/3, VERY PALE BROWN, DRY TO SLIGHTLY MOIST, SUB-ROUNDED DOLOMITE GRAVEL TO 0.08' IN DIAMETER	GM	
	6.0	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 8/3 VERY PALE BROWN, DRY SLIGHTLY MOIST, UNCONSOLIDATED, DOLOMITE COBBLES, MINOR CALICHE CEMENTATION	GM	
	10			
	10.8			
	10.9	SANDY DOLOMITE: VERY FINE GRAIN SAND, 10 YR 7/2 LIGHT GRAY, VERY HARD, DRY	DOLO.	
		AUGER REFUSAL AT 10.9'		
		GROUNDWATER NOT ENCOUNTERED DURING DRILLING		
	15	NO GROUNDWATER OBSERVED AFTER 24 HOURS		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 0.0

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	0.0	1.5	4.0
NS			5.0
2	0.0	1.1	6.1
NR			6.5
NS			7.0
3	0.0	1.5	8.5
NS			9.0
NR			10.5
NS			10.9

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-46 (MW-23)***

DATE DRILLED 5/17/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
(405) 321-3885

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 2.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3791.0								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	CLAYEY SILT: 10% CLAY, 90% SILT, 10 YR 7/4 VERY PALE BROWN, NO PLASTICITY, DRY, UNCONSOLIDATED	ML			NS			2.5	
						1	3.0	1.0	3.5	
						NR			4.0	
						NS			5.0	
	5	SLIGHTLY MOIST AFTER 6.0'				2	10.0	1.1	6.1	
						NR			6.5	
						NS			7.0	
	6.5	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 8/2 WHITE, DRY, SUB-ROUNDED DOLOMITE COBBLES AND MINOR GRAVEL, UNCONSOLIDATED, CALICHE CEMENTATION AFTER 8.5'	GM			3	1.5	1.1	8.1	
						NR			8.5	
						NS			9.0	
	9.5					4	21.0	1.0	10.0	
	10		CL							
	10.9	COBBLEY SILTY CLAY: 10% COBBLES, 30% SILT, 60% CLAY, MINOR CALICHE CEMENTATION, 10 YR 5/4 YELLOW BROWN, MOIST, DOLOMITE COBBLES, UNCONSOLIDATED				NS			10.9	
	11.0		DOLO.			5	0.0	0.1	11.0	
		SANDY DOLOMITE: VERY FINE GRAIN SILICA, 10 YR 7/1 LIGHT GRAY, DRY								
	15	AUGER REFUSAL AT 11.0'								
		GROUNDWATER NOT ENCOUNTERED DURING DRILLING								
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-47 (MW-24)***

DATE DRILLED 5/18/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 2.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3784.7								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	CLAYEY SILT: 10% CLAY, 90% SILT, 10 YR 7/3 VERY PALE BROWN, DRY, UNCONSOLIDATED	ML			NS				
	1.0	GRAVELLY SANDY SILT: 10 YR 8/3 VERY PALE BROWN, DRY, UNCONSOLIDATED	GM						2.5	
						1	0.0	1.1	3.6	
						NR			4.0	
						NS			5.0	
	5					2	0.0	1.0	6.0	
						NR			6.5	
		SLIGHTLY MOIST AFTER 7.0'				NS			7.0	
						3	0.0	0.9	7.9	
	8.2					NS			8.2	
	8.3	SANDY DOLOMITE: VERY FINE GRAIN SAND, 10 YR 7/1 LIGHT GRAY, DRY, VERY HARD	DOLO.			4	25	0.1	8.3	
	10	AUGER REFUSAL AT 8.3'								
		GROUNDWATER NOT ENCOUNTERED DURING DRILLING								
		NO GROUNDWATER OBSERVED AFTER 24 HOURS								
	15									
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-48 (MW-25)***

DATE DRILLED 5/18/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 28 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3791.0								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	CLAYEY SANDY SILT: VERY FINE GRAIN SILICA SAND, 10% CLAY, 10% SAND, 80% SILT, 10 YR 8/4 VERY PALE BROWN, DRY, NO PLASTICITY, UNCONSOLIDATED, MINOR CALICHE	ML			NS			2.5	0
						1	0.0	1.5	4.0	
	4.0	COBBLEY GRAVELLY SANDY SILT: VERY FINE GRAIN SILICA SAND, 10YR8/3 VERY PALE BROWN, CALICHE CEMENTATION, DRY TO SLIGHTLY MOIST, ABUNDANT SUBROUNDED DOLOMITE GRAVEL	GM			2	0.0	1.1	5.1	5
						NS			7.0	
						3	0.0	1.0	8.0	
						NS			9.0	
	10					4	0.0	1.0	10.0	10
		AFTER 12.0', MINOR MOIST 7.5 YR 5/4 BROWN, SILTY CLAY MATRIX				NS			12.0	
						5	4.6	1.1	13.1	
						NR			13.5	
						NS			14.0	
	15					6	35	1.0	15.0	15
						NR			15.6	
						NS			17.0	
▽ 17.66		SATURATION AFTER 17.0', STRONG CONDENSATE ODOR				7	296	0.9	17.9	
						NR			18.5	
						NS			19.0	
	19.4					NS			19.4	
	19.5	SANDSTONE: VERY FINE GRAIN SILICA SAND, 2.5 YR 7/2 LIGHT GRAY WITH 2.5 YR 5/0 GRAY BANDS, VERY HARD	SS			8	546	0.1	19.5	
	20									20
		AUGER REFUSAL AT 19.5'								
		GROUNDWATER ENCOUNTERED DURING DRILLING AT 17.66'								
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-49 (MW-26)***

DATE DRILLED 5/18/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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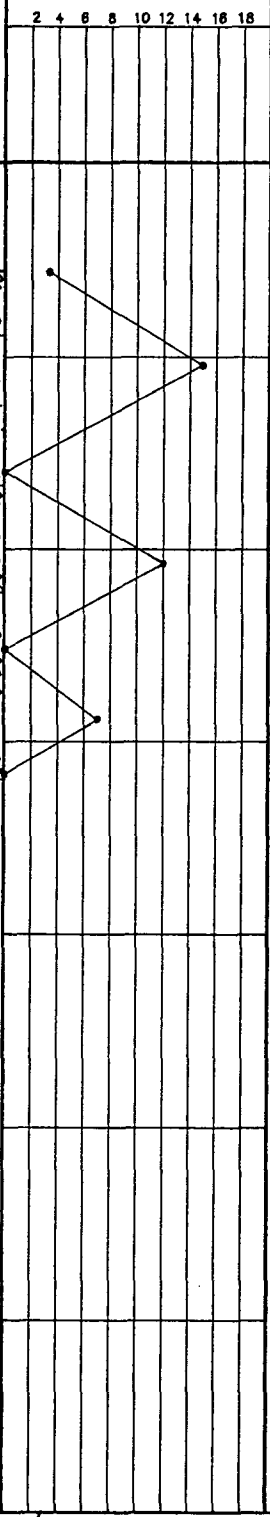
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3791.9		
	0	SANDY SILT: VERY FINE GRAIN SAND, 10 YR 6/4 LIGHT YELLOW BROWN, DRY, UNCONSOLIDATED	SM	
	2.8	COBBLEY SANDY SILT: VERY FINE GRAIN SILICA SAND, 10 YR 8/2 WHITE, DRY, UNCONSOLIDATED, ABUNDANT DOLOMITE GRAVEL	GM	
	4.5	SILTY SAND: VERY FINE TO FINE GRAIN SILICA SAND, 20% SILT, 80% SAND, 10YR6/4, LIGHT YELLOW BROWN, SLIGHTLY MOIST, UNCONSOLIDATED	SM	
	5			
	8.3	COBBLEY SANDY SILT: VERY FINE GRAIN SAND, 10 YR 7/3 VERY PALE BROWN, DRY, UNCONSOLIDATED, DOLOMITE COBBLES AND MINOR SUBROUNDED GRAVEL	GM	
	10	CALICHE CEMENTATION AFTER 12.5'		
		AFTER 15.5', SLIGHTLY MOIST 5 YR 5/4 RED BROWN, SILTY CLAY MATRIX		
	15			
	16.0	AUGER REFUSAL AT 16.0'		
		GROUNDWATER NOT ENCOUNTERED DURING DRILLING.		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 3.0



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
1	10.7	0.6	3.1
NR			4.0
NS			5.0
2	46	0.6	5.6
NR			6.5
NS			7.5
3	0.0	1.1	8.6
NR			9.0
NS			10.0
4	36	0.4	10.4
NS			12.3
5	0.0	0.2	12.5
NS			14.0
6	21	0.8	14.8
NS			15.7
7	0.0	0.3	16.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **BH-50 (MW-27)**

DATE DRILLED 5/19/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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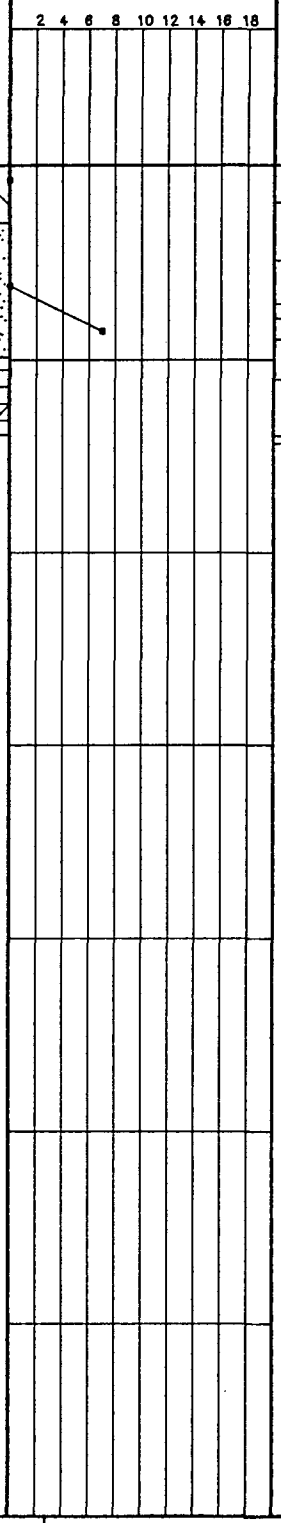
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3790.8		
	0	CLAYEY SILT: BROWN, 10 YR 5/3, DRY, VERY LOW PLASITICY, 70% SILT, 30% CLAY	ML	
	1.5	SANDSTONE: WHITE TO PALE YELLOW, 2.5 YR 8/2 TO 8/4, QUARTZOSE, FINE GRAIN, WELL SORTED, FLAT BEDDED, INTERBEDDED WITH MUDSTONE SEAMS, ~0.5' THICK, THINBEDDED	SS	
	5	DOLOMITE: LIGHT BROWNISH GRAY, 10 YR 6/2, MASSIVE, VERY HARD	DOLO.	
	7.0	AUGER REFUSAL AT 7.0' GROUNDWATER NOT ENCOUNTERED DURING DRILLING.		
	10			
	15			
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 0.5



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.1	3.6
NR			4.0
3	3.5	0.5	4.5
NR			5.5
NS			6.5
NR			7.2

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-51***

DATE DRILLED 5/20/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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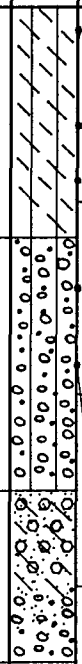
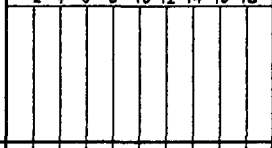
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3794.9	
	0	CLAYEY SILT: LIGHT YELLOWISH BROWN, 10 YR 6/4, DRY, VERY LOW PLASTICITY, CALICHE DEPOSITS, 70% SILT, 30% CLAY	ML
	5		
	6.0	BOULDERY GRAVELLY COBBLEY SILT: LIGHT YELLOWISH BROWN TO LIGHT BROWNISH GRAY, 10YR 6/2 TO 6/4, POORLY SORTED, DOLOMITE COBBLES AND BOULDERS FROM 3 CM TO 0.5M, ROUNDED	GM
	10		
	12.5	CLAYEY GRAVELLY SAND: BROWN, 7.5 YR 7/2, MOIST, VERY FINE TO FINE GRAIN QUARTZ, MANGANESE NODULES, LOW PLASTICITY, DOLOMITE PEBBLES FROM 0.5 TO 1CM ROUND, 70% SAND, 20% CLAY, 10% GRAVEL	SC
	15		
	17.0	AUGER REFUSAL AT 17.0' GROUNDWATER NOT ENCOUNTERED DURING DRILLING.	
	20		
	25		
	30		
	35		

GRAPHIC LOG



OVM SOIL GAS PPM X 1.5



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.0	3.5
NR			4.0
3	0.0	1.0	5.0
NR			5.5
NS			7.0
4	0.0	0.4	7.4
NR			8.0
NS			9.0
5	0.0	0.4	9.4
NR			10.0
NS			12.0
6	1.5	0.2	12.2
NR			13.0
NS			14.0
7	24.6	1.0	15.0
NR			15.5
NS			17.0
NR			17.2

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-52 (MW-28)***

DATE DRILLED 5/20/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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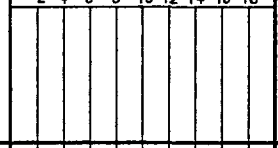
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3792.0	
	0	SANDY CLAYEY SILT: BROWN, 10 YR 5/5, DRY, VERY LOW PLASTICITY, VERY FINE QUARTZ 70% SILT, 10% CLAY, 20% SAND	ML
	3.0	BOULDERY COBBLEY SILT: BROWN TO LIGHT BROWNISH GRAY, 10 YR 5/3 TO 6/2, GRAVELLY, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO 0.5 M, ROUNDED TO SUBROUNDED, DOLOMITE	GM
	5		
		CLAYEY FROM 9.0' TO 10.0', SANDY AND GRAVELLY, BROWN TO STRONG BROWN, 10 YR 5/4 TO 5/6, MOIST, LOW PLASTICITY, FINE TO VERY FINE QUARTZ	
	10		
	12.3	AUGER REFUSAL AT 12.3'	
		GROUNDWATER NOT ENCOUNTERED DURING DRILLING.	
	15		
	20		
	25		
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM X 0.1



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	1.5	GC	1.0
NS			2.5
2	0.0	0.2	2.7
NR			4.0
3	0.0	0.5	4.5
NR			5.5
NS			7.0
4	0.0	1.0	8.0
NR			8.5
NS			9.0
5	0.0	0.9	9.9
NR			10.5
NS			12.0
NR			12.3
NR			12.7

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

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JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-53 (MW-29)***

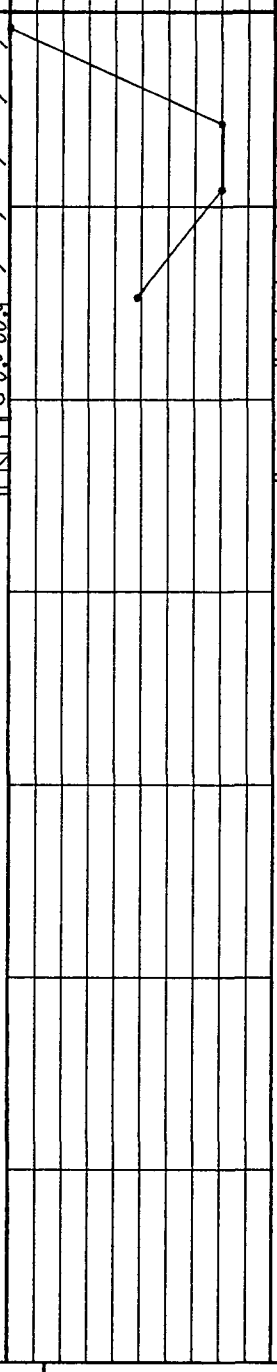
DATE DRILLED 5/20/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3786.0	
	0	CLAYEY SILT: BROWN TO BROWNISH YELLOW, 10 YR 5/3 TO 5/4, DRY, VERY LOW PLASTICITY, CALICHE DEPOSITS, 70% SILT, 30% CLAY, VERY FINE QUARTZ	ML
	7.5	COBBLEY GRAVELLY SILT:, BROWN TO LIGHT GRAYISH BROWN, 10 YR 5/2 TO 5/2, MODERATELY WELL SORTED, COBBLES FROM 4 TO 10 CM, GRAVEL, ROUNDED TO SUBROUNDED	GM
	10.5	DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 6/2, MASSIVE, HARD	DOLOMITE
	12.5	BORING TERMINATED AT 12.5'	

GROUNDWATER NOT ENCOUNTERED DURING DRILLING

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.2	GC	1.0
NS			2.5
2	32.5	1.1	3.6
NR			4.0
3	32.3	1.0	5.0
NR			5.5
NS			7.0
4	19.9	0.7	7.7
NR			8.5
NS			9.0
NR			9.2
NS			12.0
NR			12.1

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-54 (MW-30)***

DATE DRILLED 5/21/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

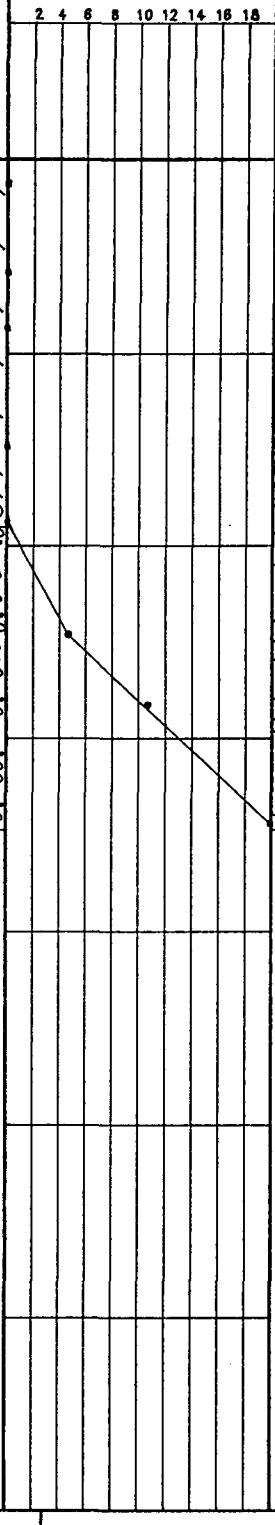
ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3885

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3788.7	
	0	CLAYEY SILT: BROWN TO VERY PALE BROWN, 10 YR 5/3 TO 7/4, DRY VERY LOW PLASTICITY, CALICHE DEPOSITS, 70% SILT, 30% CLAY, VERY FINE GRAIN QUARTZ	ML
	5	SLIGHTLY MOIST BELOW 7.0'	
		MOIST FROM 9.0' TO 9.5', GRAVELLY, DARK BROWN, 10 YR 4/3	
	9.5		
	10	BOULDERY GRAVELLY COBBLEY SILT: DARK BROWN TO LIGHT GRAYISH BROWN, 10YR4/3 TO 6/2, POORLY SORTED, COBBLES/BOULDERS FROM 3.0 CM TO >20 CM, ROUNDED TO SUBROUNDED	GM
		CLAYEY FROM 12.0' TO 12.5', MOIST	
		VERY HARD FROM 13.0' TO 14.0', CLAYEY FROM 14.0' TO 14.5', MOIST	
	15		
16.96		CLAYEY FROM 17.0 TO 17.4' SATRUATED AT 16.96'	
	17.4	AUGER REFUSAL AT 17.4'	
	20		
	25		
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM X 2.0



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	0 – 1.0
NS			2.5
2	0.0	1.1	3.6
NR			4.0
3	0.0	1.1	5.1
NR			5.5
NS			7.0
4	0.0	1.1	8.1
NR			8.5
NS			9.0
5	0.0	0.7	9.7
NR			10.5
NS			12.0
6	9.2	0.5	12.5
NR			13.0
NS			14.0
7	21.5	0.5	14.5
NR			14.7
NS			17.0
8	41.5	0.4	17.4

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **BH-55 (MW-31)**

DATE DRILLED 5/21/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3795.2		
	0	CONGLOMERATE: VERY PALE BROWN TO LIGHT GRAYISH BROWN, 10 YR 7/3 TO 6/2, LIMESTONE/DOLOMITE GRAVEL, COBBLES AND BOULDERS FROM 5 CM TO 2 M, ROUNDED TO SUBROUNDED, CARBONATE CEMENT, WEATHERED AT SURFACE, HARD	CONGLOM-ERATE	
	5			
	8.5	BOULDERY COBBLEY GRAVELLY SILT: BROWN TO LIGHT GRAYISH BROWN, 10YR5/3 TO 6/2, POORLY SORTED, COBBLES AND BOULDERS FROM 4 CM TO 20 CM, ROUNDED TO SUBROUNDED, VERY FINE GRAIN QUARTZ	GM	
	10			
	14.5			
	15	AUGER REFUSAL AT 14.5' GROUNDWATER NOT OBSERVED DURING DRILLING.		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 20

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS			2.5
NR			2.7
NS			4.0
1	10.7	0.4	4.4
NR			5.0
NS			7.0
2	0.0	0.2	7.2
NR			7.5
NS			9.0
3	470	1.0	10.0
NR			10.5
NS			12.0
NR			12.2
NS			14.0
NR			14.5

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **BH-56 (MW-32)**

DATE DRILLED 5/22/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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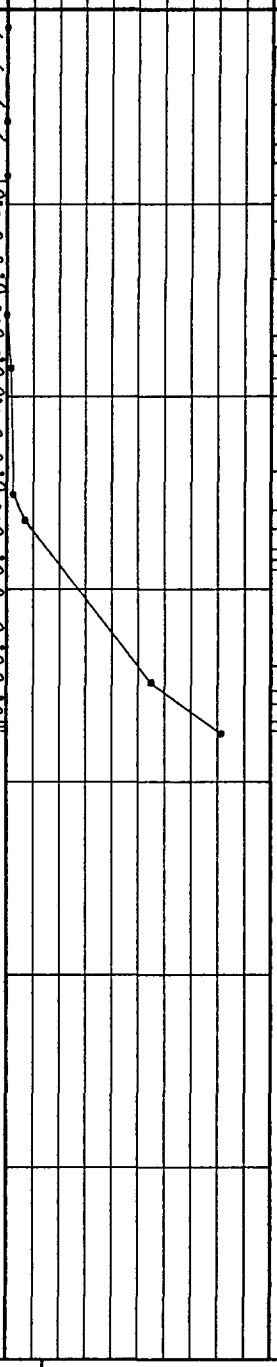
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3800.9	
	0	CLAYEY SILT: LIGHT BROWN, 7.5 YR 6/4, DRY, VERY LOW PLASTICITY, VERY FINE GRAIN QUARTZ, CALICHE DEPOSITS, 70% SILT, 30% CLAY	ML
	4.5	BOULDERY COBBLEY GRAVELLY SILT: LIGHT BROWN TO LIGHT BROWNISH GRAY, 7.5YR6/4 TO 10 YR 6/2, POORLY SORTED, COBBLES AND BOULDERY FROM 2 CM TO >15 CM, ROUNDED TO SUBROUND	GM
	5		
	10		
	15	CLAYEY BELOW 17.5', SANDY, FINE TO MEDIUM GRAIN QUARTZ, MOIST, VERY STRONG HYDROCARBON ODOR	
		SATURATED BELOW 18.0', CONDENSATE	
18.0'			
	18.5		
	18.65	DOLOMITE: LIGHT GRAYISH BROWN, 10 YR 6/2, MASSIVE, HARD	DOLO.
	20	AUGER REFUSAL AT 18.65'	
	25		
	30		
	35		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.1	3.6
NR			4.0
3	0.0	0.8	4.8
NR			5.5
NS			7.0
4	0.0	1.5	8.5
NS			9.0
5	1.5	0.5	9.5
NR			10.0
NS			12.0
6	6.1	1.0	13.0
NR			13.5
NS			14.0
7	12.2	0.2	14.2
NR			14.5
NS			17.0
8	232	0.8	17.8
NR			18.0
NS			18.5
9	330	0.15	18.65

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **BH-57 (MW-33)**

DATE DRILLED 5/23/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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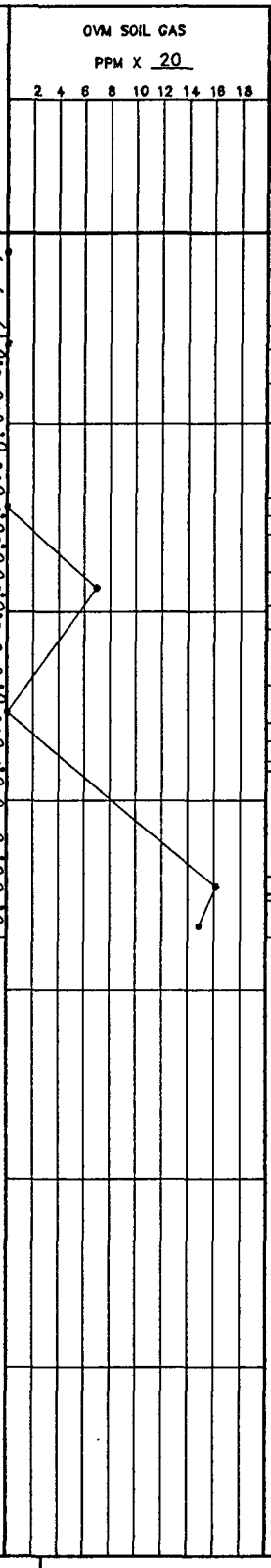
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3803.7	
	0	CLAYEY SILT: PALE BROWN TO BROWN, 10 YR 5/3 TO 6/3, DRY, VERY LOW PLASTICITY, VERY FINE GRAIN QUARTZ, CALICHE DEPOSITS, 70% SILT, 30% CLAY	ML
	2.7	BOULDERY COBBLEY GRAVELLY SILT: BROWN TO LIGHT GRAYISH BROWN, 10YR5/3 TO 6/4,, POORLY SORTED, COBBLES AND BOULDERS FROM 5 CM TO > 50 CM, ROUNDED TO SUBROUNDED, DOLOMITE WITH CALICHE WEATHERING, HYDROCARBON ODOR FROM 9.0' TO 9.9', DRY STRONG HYDROCARBON ODOR BELOW 14.0', VERY MOIST, SANDY, COARSE GRAIN QUARTZ	GM
	18.6	AUGER REFUSAL AT 18.6' GROUNDWATER NOT OBSERVED DURING DRILLING.	

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	0.6	3.1
NR			4.0
NR			5.0
NS			7.0
3	0.0	0.5	7.5
NR			8.0
NS			9.0
4	150.7	0.9	9.9
NR			10.5
NS			12.0
5	0.0	1.0	13.0
NR			13.5
NS			14.0
NR			14.2
NS			17.0
6	327	0.5	17.5
NR			17.8
7	298	0.8	18.6

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **BH-58 (MW-34)**

DATE DRILLED 5/23/91 & 5/24/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3799.0	
	0	CLAYEY SILT: YELLOWISH GRAY, 5Y7/2, LOOSE, DRY, NONPLASTIC, CALICHE DEPOSITS TO 2.9', 10% CLAY, CALICHE 60%	ML
	2.9	CLAYEY SILT: DUSKY YELLOW 5YR6/4, DRY, LOOSE, VERY LOW PLASTICITY, 10% CLAY	ML
	5	CLAYEY SILT: LIGHT BROWN 5YR6/4 LOW PLASTICITY, 30% CLAY, CALICHE DEPOSITS 25%, 45% SILT, DRY	ML
	8.0	CLAYEY SILT: LIGHT BROWN 7.5 YR 6/4, FIRM, 30% CLAY, LOW PLASTICITY, FRIABLE, DRY	ML
	10		
	11.0	GRAVEL AND COBBLES IN CLAYEY SILT: 50% COARSE, 50% FINE, GRAVEL FINE TO COARSE, 5 TO 75MM, SEGMENTS OF COBBLES SIZE UNKNOWN, CLAYEY SILT, PINKISH GRAY 7.5 YR 7/2, LOOSE, DRY, VERY LOW PLASTICITY, DOLOMITIC	GM
	14.5	GRAVEL AND COBBLES: COARSE GRAVEL 25–75MM, COBBLES POSSIBLEY TO BOULDER SIZE, DECREASING CLAYEY SILT TO 20% LIMESTONE FACTION TYPICALLY LIGHT BROWNISH GRAY (2.5 YR 6/2), FAIR ODOR OF HYDROCARBON AT 14.5', VERY SLIGHTLY MOIST, 30% COARSE GRAVEL, 50% COBBLES, SATURATED WITH HYDROCARBONS	GM
	15		
17.37'	18.9		
	20	AUGER REFUSAL AT 18.9'	
		DOLOMITIC LIMESTON: LIGHT BROWNISH , 10YR6/2, GRAY, DENSE	
	25	LOST SPLIT SPOON SAMPLER WHEN DRIVING 12.5 TO 14.0', SAMPLE INTERVAL COULD NOT RETRIEVE. WILL GROUT UP HOLE. MOVE RIG 10.0' EAST AND REDRILL	
		FLUID LEVEL 16.54' (CONDENSATE) WATER LEVEL 17.37' 3 HOURS AFTER DRILLING	
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM X 20 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.0	3.5
NR			4.0
3	0.0	1.1	5.1
NR			5.5
NS			7.5
4	14.8	1.5	9.0
5	1.6	0.9	9.9
NR			10.5
NS			12.5
6	7.0	0.9	13.4
NR			14.0
7	46.7	0.7	14.7
NR			15.5
NS			17.5
8	414	0.5	18.0
NR			18.9

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-59 (MW-35)***

DATE DRILLED 5/24/91 TO 5/25/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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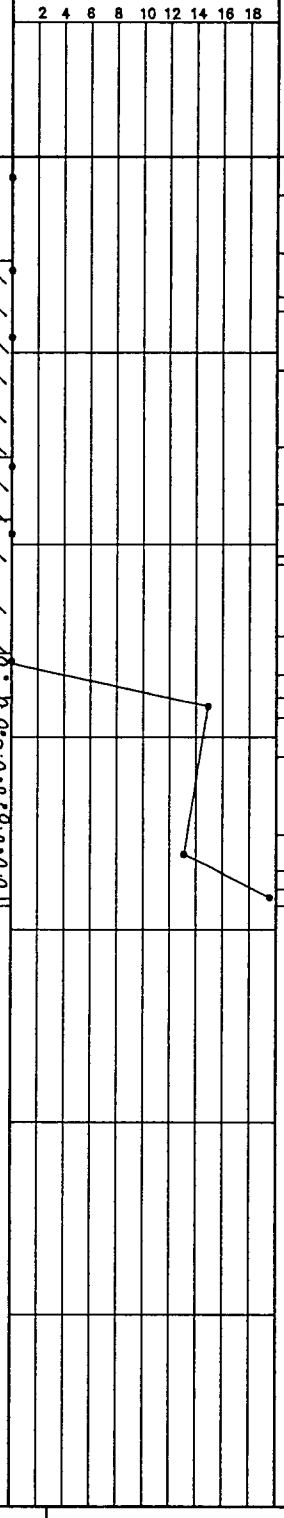
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3795.5	
	0	SILT: BROWN 7.5 YR 5/3, LOOSE NO PLASTICITY, DRY	ML
	2.7	CLAYEY SILT: LIGHT BROWN 7.5 YR 6/4 SLIGHTLY PLASTIC, DRY, 10% CLAY, SOME CALICHE DEPOSITS (10%), SOFT LOOSE	ML
	5		
	7.8	CLAYEY SILT: LIGHT BROWN, 7.5 YR 6/4 AND PINK 7.5 YR 7/3, SLIGHTLY PLASTIC, FIRM, DRY, 25% CLAY, 20% CALICHE DEPOSITS	ML
	9.3		
	10	SILTY CLAY: BROWN 7.5 YR 5/3, 20% SILT, 5% CALICHE DEPOSITS, SLIGHT PLASTICITY, HARD, DRY, SLIGHTLY MOIST AT 12.5' TO 12.9', NO ODOR	CL
12.95'	12.9	SILTY GRAVEL: BROWN 7.5, YR 6/4, GRAVELS COARSE WITH SOME FINE 5 MM TO 30 MM, SLIGHTLY MOIST, WELL GRADED, HYDROCARBON SATURATION BELOW 13.4'	GM
	14.0		
	15	SANDY GRAVEL: DARK GRAY 7.5 YRN4/0, SATURATED, SAND 10%, COARSE GRAINED, SUBANGULAR, GRAVEL FINE TO COARSE 10 TO 50 MM, STRONG HYDROCARBON ODOR, WELL GRADED, LARGER GRAVEL WELL ROUNDED	GP
	19.2		
	19.3	BEDROCK, LIMESTONE, BROWN, DOLOMITIC, DENSE, HARD, WEATHERED GRAY OF SURFACES	DOLOMITE
	20	AUGER REFUSAL AT 19.3'	
		BOREHOLE OVM READING 32.3 PPM	
	25		
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM X 30



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.3	3.8
NR			4.0
3	0.0	1.5	5.5
NS			7.5
4	0.0	1.5	9.0
5	0.0	1.3	10.3
NR			10.5
NS			12.5
6	0.0	0.9	13.4
NR			14.0
7	449	0.5	14.5
NR			15.5
NS			17.5
8	388	1.0	18.5
NS			19.0
9	583	0.3	19.3

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-60 (MW-37)***

DATE DRILLED 5/26/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3795.5	
	0	SILT: BROWN 7.5 YR 5/3, LOOSE, NO PLASTICITY, DRY	ML
	3.2	CLAYEY SILT: BROWN 7.5 YR 5/4, CLAY 20%, CALICHE DEPOSITS 10%, FIRM, FRIABLE, DRY	CL
	4.6	CLAYEY SILT: LIGHT BROWN 7.5 YR 6/4, 30% CLAY, 20% CALICHE DEPOSITS, LOW PLASTICITY, FIRM FRIABLE, DRY	ML
	12.0	SILTY GRAVEL: LIGHT REDDISH BROWN 5 YR 6/3, SILT 30%, GRAVEL COARSE UP TO 50MM AND FINE TO 5MM, POORLY SORTED, DRY, GRAVEL DOLOMITIC LIMESTONE, LIGHT GRAY 7.5 YR 7/0, DENSE, DRY	GM
14.95	14.2	DOLOMITIC LIMESTONE: WEATHERED, FRACTURES, DENSE IN PART, LIGHT GRAY 7.5 YR 7/0, SATURATED	DOLOMITE
	18.3	SANDSTONE: GRAY 7.5 YR N5/0, POORLY CEMENTED, FRIABLE, STRONG HYDROCARBON ODOR, VERY FINE TO FINE GRAINED, SATURATED	SANDSTONE
	18.8	REFUSAL REFUSAL AT 18.8	

GRAPHIC LOG

OVM SOIL GAS PPM X 63

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.3	3.8
NR			4.0
3	0.0	1.5	5.5
NS			7.5
4	0.0	1.5	9.0
5	0.0	0.6	9.6
NR			10.5
NS			12.5
6	0.0	0.6	13.1
NR			14.0
7	112	0.8	14.8
NR			15.5
NS			17.5
8	1265	0.4	18.4
NR			18.8

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

0 5 10 15 20 25 30 35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **BH-61 (MW-38)**

DATE DRILLED 5/27/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
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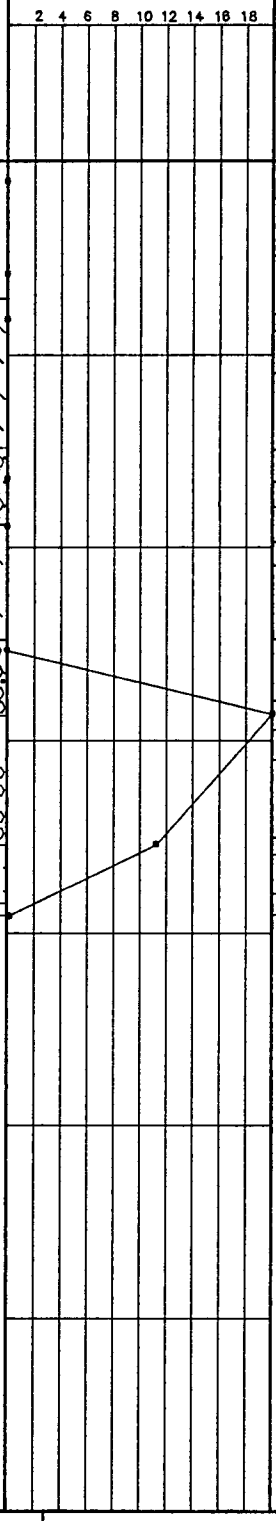
BORING RECORD

GROUND SURFACE: 3795.5

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
	0	SILT: BROWN 7.5 YR 5/3, LOOSE, NO PLASTICITY, DRY	ML
	3.6	CLAYEY SILT: PALE RED 10 R 6/3, 10% CLAY, 20% CALICHE DEPOSITS, FIRM, FRIABLE, DRY, GRADING TO PINKISH WHITE 5 YR 8/2 BELOW 4.0'	ML
	7.5	SILTY GRAVELLY SAND: PINKISH WHITE 5 YR 8/2, LOOSE, ANGULAR, FINE GRAINED, DRY, 30% SILT, 15% GRAVEL	GM
	9.5	CLAYEY SILT: BROWN 7.5 YR 5/4, 25% CLAY, TRACE CALICHE DEPOSITS, SOFT, LOOSE, DRY	ML
	12.5	CLAYEY GRAVEL AND POSS. COBBLES: LIGHT BROWN 7.5 YR 6/4, CLAY 25%, VERY SLIGHT PLASTICITY, MOIST, NO ODOR, GRAVEL 50%, GRAY 7.5 YR N 5/0, COARSE AND FINE, 5-40 MM	GC
14.3'	14.3	SILTY GRAVEL AND COBBLES: SILT 10%, GRAVEL 50%, COBBLES 40%, WELL ROUNDED, SOME GREASY DARK GRAY SUBSTANCE ON GRAVEL SURFACES, 7.5 YR N 4/0, STRONG HYDROCARBON ODOR, WET	GP
	17.8	WEATHERED SANDSTONE: LIGHT BROWN 7.5YR 6/3, VERY FINE GRAINED, POORLY CEMENTED, FRIABLE, HYDROCARBON ODOR, WET, SOME SILT 20%	SANDSTONE
	19.2	SILTY SANDSTONE: LIGHT GRAY, 2.5 YR N 6/0, CALCAREOUS CEMENT, VERY FINE GRAINED, WET, SOFT, POORLY CEMENT, FRIABLE	SANDSTONE
	19.5	AUGER REFUSAL AT 19.5'	

GRAPHIC LOG

OVM SOIL GAS PPM X 47



SAMPLE

NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.5	4.0
3	0.0	0.4	4.4
NR			5.5
NS			7.5
4	0.0	0.8	8.3
NR			9.0
5	0.0	0.9	9.9
NR			10.5
NS			12.5
6	0.0	1.5	14.0
7	935	0.8	14.8
NR			15.5
NS			17.5
8	538	0.5	18.0
NS			19.0
9	30	0.5	19.5

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **BH-62 (MW-39)**

DATE DRILLED 5/27/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 0.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3801.2								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SILT: PINKISH GRAY 7.5 YR 7/2, LOOSE, DRY	ML			1	0.0	GC	1.0	
						NS			2.5	
	3.0	CLAYEY SILT: LIGHT BROWN 7.5 YR 6/4 20% CLAY, 10% CALICHE DEPOSITS, VERY LOW PLASTICITY, FRIABLE TO LOOSE, GRADING TO PINKISH WHITE 7.5 YR 8/2 AT 7.0', DRY	ML			2	0.0	1.5	4.0	
						3	0.0	1.0	5.0	
	5					NR			5.5	
						NS			7.5	
						4	0.0	0.5	8.0	
						NS			9.0	
	9.2	SANDSTONE: VERY PALE BROWN 10 YR 8/3, VERY FINE GRAINED, SILTY, CALCAREOUS CEMENT, MODERATELY CEMENTED, FRIABLE, DRY	SANDSTONE			5	0.0	0.2	9.2	
	10		DOLOMITE			NS			12.0	
	12.1	DOLOMITE: LIGHT BROWNISH GRAY 10 YR 6/2, DENSE, HARD, DRY				6	0.0	0.1	12.1	
		AUGER REFUSAL AT 12.1'								
	15	GROUNDWATER NOT ENCOUNTERED WHILE DRILLING								
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-63 (MW-40)***

DATE DRILLED 5/28/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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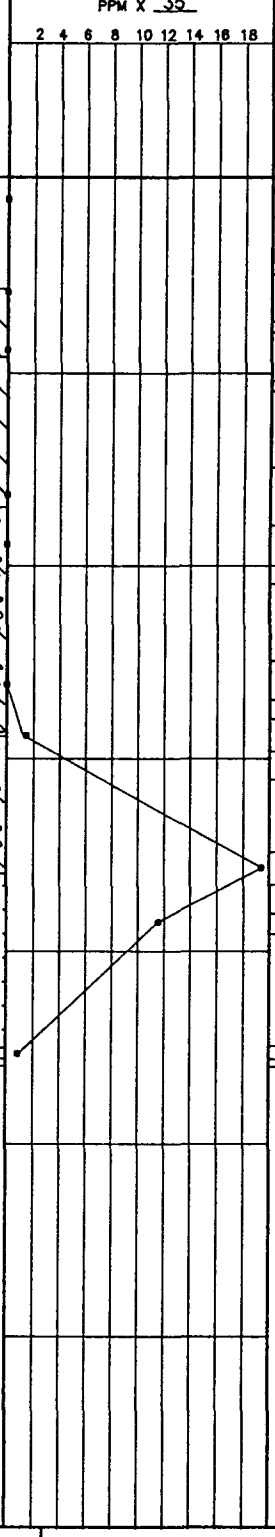
BORING RECORD

GROUND SURFACE: 3797.3

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
	0	SILT: WEAK RED 2.5 YR 5/2, LOOSE, DRY	ML
	2.8	SILTY CLAY: REDDISH BROWN 5 YR 5/3, 25% SILT, 15% CALICHE DEPOSITS, FIRM, FRIABLE, DRY	CL
	4.7 / 5	SILTY CLAY: PINK 7.5 YR 7/3, 20% SILT, 30% CALICHE DEPOSITS, FIRM, FRIABLE, DRY	CL
	8.5	CLAYEY GRAVEL AND COBBLES: GRAVEL IS DOLOMITIC LIMESTONE, GRAY 5 YR 5/1, DENSE, 60% GRAVEL, 10% COBBLES, 30% CLAY, CLAY IS LIGHT BROWN 9.5 YR 6/3, DRY	GC
15.03'	14.5 / 15	CLAYEY GRAVEL AND COBBLES: AS ABOVE BUT SATURATED BELOW 14.5' WITH STRONG HYDROCARBON ODOR	GC
	18.0	SILTY SANDSTONE: OLIVE GRAY 5 YR 5/2, VERY SOFT, VERY FINE GRAINED, VERY POORLY CEMENTED, VERY FINELY BEDDED, SATURATED, STRONG HYDRO-CARBON ODOR	SILTY SAND STONE
	22.5 / 23.0	POSSIBLY DOLOMITE BELOW 22.8', VERY HARD	DOLOMITE
	25	AUGER REFUSAL AT 23.0'	
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM X 35



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.3	3.8
NR			4.0
3	0.0	1.2	5.2
NR			5.5
NS			7.5
4	0.0	1.5	9.0
5	0.0	1.0	10.0
NR			10.5
NS			12.5
6	0.0	1.0	13.5
NR			14.0
7	46	0.8	14.8
NR			15.5
NS			17.5
8	685	0.8	18.3
NR			19.0
9	407	0.5	19.5
NS			22.5
10	39	0.3	22.8
NS			23.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-64 (MW-41)***

DATE DRILLED 5/29/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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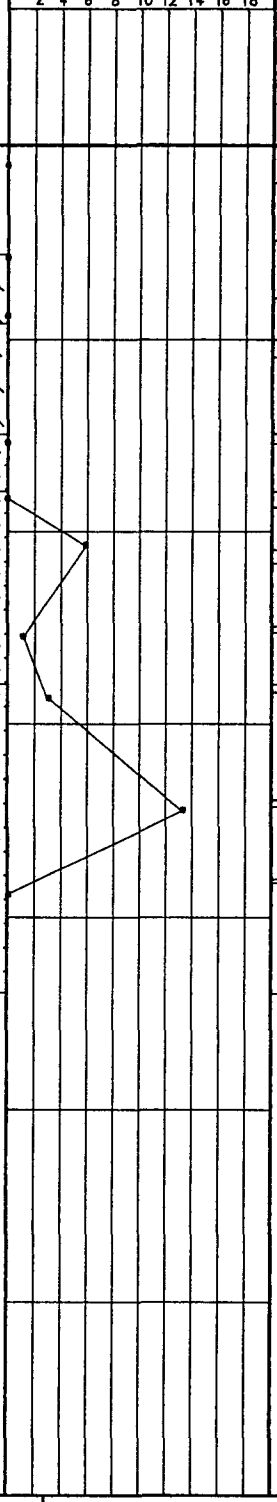
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3802.7	
	0	SILT: BROWN 7.5 YR 5/4, LOOSE, DRY	ML
	2.8	CLAYEY SILT: PINK 7.5 YR 7/3, 25% CLAY, SLIGHTLY LOOSE, DRY, VERY LOW PLASTICITY	ML
	4.8	CLAYEY SILT: PINKISH WHITE 5 YR 8/2, LOOSE, DRY, 25% CLAY, CONTAINS TRACE OF GRAVEL	ML
	7.5	SANDSTONE: PINKISH GRAY 7.5 YR 7/2, POORLY CEMENTED, CALCAREOUS CEMENT FRIABLE, DRY, VERY FINE GRAINED, SILTY	SILTY SANDSTONE
	9.0	SANDSTONE: VERY SILTY, LIGHT GRAY 5 YR 7/1, HARD, FRIABLE, VERY FINE GRAINED, FAIRLY WELL CEMENTED, CALCAREOUS, DRY, VERY FINELY BEDDED	SILTY SANDSTONE
	14.0	SANDSTONE: BROWN 7.5 YR 5/2, SLIGHTLY DOLOMITIC, CALCAREOUS CEMENT, FAIRLY WELL CEMENTED, HARD, VERY SLIGHTLY FRIABLE, DRY	SANDSTONE
	22.0	AUGER REFUSAL AT 22.0'	
		GROUNDWATER NOT ENCOUNTERED WHILE DRILLING	

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.5	4.0
3	0.0	1.0	5.0
NR			5.5
NS			7.5
4	0.0	0.2	7.7
NS			9.0
5	0.0	0.3	9.3
NS			10.5
6	6.6	0.3	10.8
NS			12.5
7	1.6	0.1	12.6
NS			14.0
8	3.3	0.2	14.2
NS			17.0
9	13.2	0.1	17.1
NS			19.0
10	0.0	0.1	19.1
NS			22.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-65 (MW-42)***

DATE DRILLED 5/30/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3800.1		
	0	SILT: LIGHT BROWN 7.5 YR 6/4, LOOSE, DRY	ML	
	3.0	CLAYEY SILT: BROWN 7.5 YR 5/4, FIRM, FRIABLE, 20% CLAY, 10% CALICHE DEPOSITS, DRY, NO PLASTICITY	ML	
	5			
	6.0	SILT, GRAVEL AND COBBLES: 20% SILT, 60% GRAVEL, COARSE TO FINE 10–40MM, TRACE POSSIBLE COBBLES, DRY, LOOSE, GRAVEL SLIGHTLY DOLOCITIC LIMESTONE AND CHERTY LIMESTONE, VUGULAR IN PART, SILT PINKISH WHITE 5 YR 8/2	GM	
	10	15% CLAY IN MATRIX AT 14.5'–18.5'		
	15	WET AT 17.7'		
17.7'		STRONG HYDROCARBON ODOR AND DARK COLOR (BLACK) AT 17.7'–19.4'		
	19.4			
	20	SANDSTONE: 2.5 Y 5/4, LIGHT OLIVE BROWN, VERY FINE GRAIN, MODERATELY HARD, HYDROCARBON ODOR	SS	
	22.4	AUGER REFUSAL AT 22.4'		
	25	BOREHOLE OVM READING: 1.0PPM		
	30			
	35			

OVM SOIL GAS PPM X 42 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.2	3.7
NR			4.0
3	0.0	1.5	5.0
NR			5.5
NS			7.5
4	0.0	0.2	7.7
NR			9.0
5	0.0	1.1	10.1
NR			10.5
NS			12.5
6	0.0	0.5	13.0
NR			14.0
7	0.0	1.1	15.1
NR			15.5
NS			17.0
8	781	1.3	18.3
NR			18.5
NS			19.0
9	826	0.6	19.6
NR			20.5
NS			22.0
10	246	0.4	22.4

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-66 (MW-43)***

DATE DRILLED 5/31/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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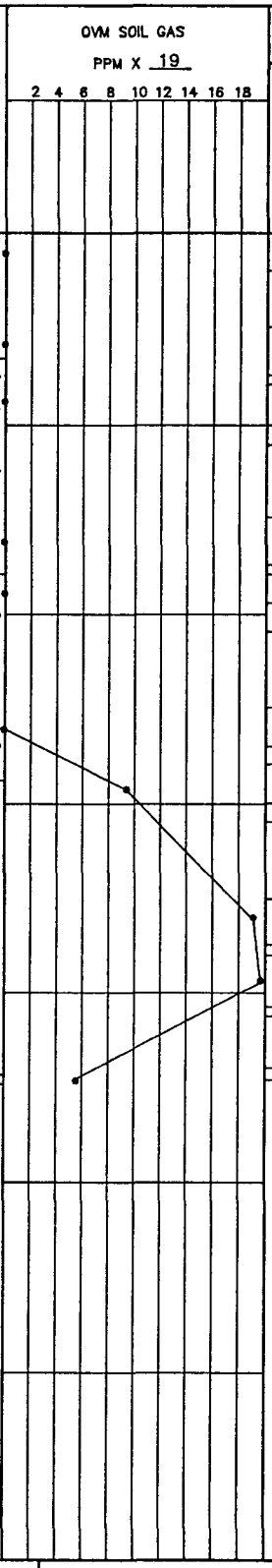
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3801.1	
	0	SILT: LIGHT BROWN 7.5 YR 6/4, SOFT, DRY, LOOSE	ML
	3.3	CLAYEY SILT: 7.5 YR 5/4, BROWN, FIRM, CALICHE NODULES, DRY, FRIABLE, 15% CLAY, 10% CALICHE, 75% SILT	ML
	5		
	9.0	SILT, GRAVEL & COBBLES: 2.5 YR 6/2, LIGHT BROWNISH GRAY AND 7.5 YR 7/2 PINKISH GRAY, LIGHTLY CEMENTED, HARD, DRY, VERY SILTY DOLOMITIC LIMESTONE GRAVEL, WET AT 14.3'	GM
	10		
14.3'	14.4	CLAYEY SILT: 10 YR 4/4, DARK YELLOWISH BROWN, SOFT, WET, LOW PLASTICITY, STRONG HYDROCARBON ODOR, 30% CLAY, 70% SILT (LENS) AT 14.4–15.0	ML
	15		
	20		
	22.1	SANDSTONE: 2.5 YR 5/4, LIGHT OLIVE BROWN, FINE GRAINED, SILTY, HARD, STRONG HYDROCARBON ODOR	SS
	22.3	AUGER REFUSAL AT 22.3'	
	25	BOREHOLE OVM READING: 35.0 PPM	
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM X 19



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.2	3.7
NR			4.0
3	0.0	1.0	5.0
NR			5.5
NS			7.5
4	0.0	1.3	8.8
NR			9.0
5	0.0	0.8	9.8
NR			10.5
NS			12.5
6	0.0	1.0	13.5
NR			14.0
7	180	1.0	15.0
NR			15.5
NS			17.5
8	359	1.3	18.8
NR			19.0
9	375	1.2	20.2
NR			20.5
NS			22.0
10	107	0.3	22.3

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-67 (MW-44)***

DATE DRILLED 6/1/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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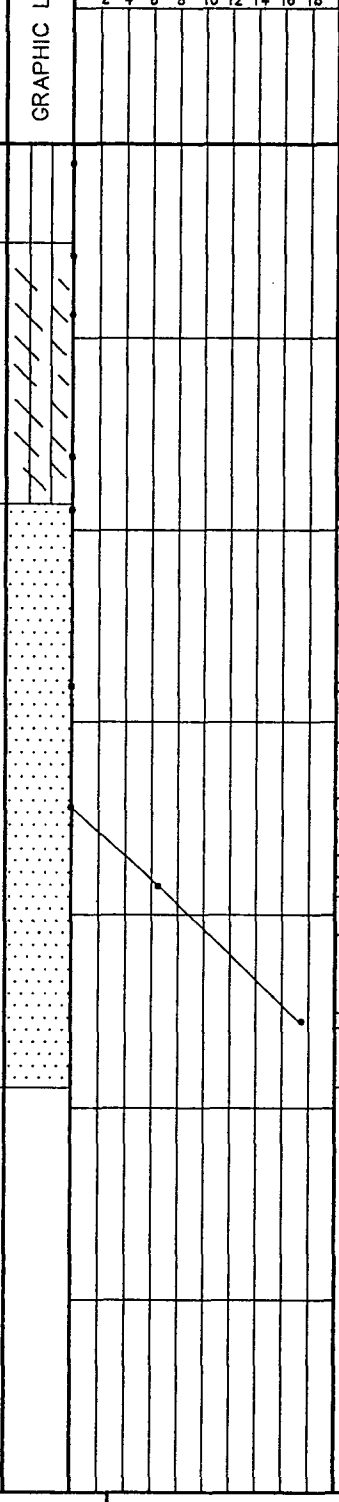
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3806.6	
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, LOOSE, SOFT, DRY	ML
	2.7	CLAYEY SILT: 7.5 YR 5/4, BROWN, NON-PLASTIC, DRY, FRIABLE, CALICHE NODULES, 15% CLAY, 10% CALICHE, 75% SILT	ML
	9.3	SANDSTONE: 2.5 YR 8/4, PALE YELLOW, MODERATELY HARD, SLIGHTELY CEMENTED, FINE GRAINED, SILTY COLOR CHANGES TO 2.5 Y 5/6 LIGHT OLIVE BROWN WITH INCREASED MOISTURE 2.5 Y 4/4, OLIVE BROWN AND 2.5 Y 5/6 LIGHT OLIVE BROWN AT 17.5', CEMENTED, HARD AT 18.0, WET AT 18.5'	GM
18.5'			
		AUGER REFUSAL AT 24.5'	

GRAPHIC LOG



OVM SOIL GAS PPM X 1.5 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.5	4.0
3	0.0	1.5	5.5
NS			7.5
4	0.0	1.5	9.0
5	0.0	0.9	9.9
NR			10.5
NS			12.5
NS			14.0
6	0.0	0.2	14.2
NR			15.5
NS			17.0
7	0.0	0.6	17.6
NR			18.5
NS			19.0
8	9.9	0.6	19.6
NR			20.5
NS			22.5
9	28	0.4	22.9
NR			24.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **BH-68 (MW-45)**

DATE DRILLED 6/1/91 & 6/2/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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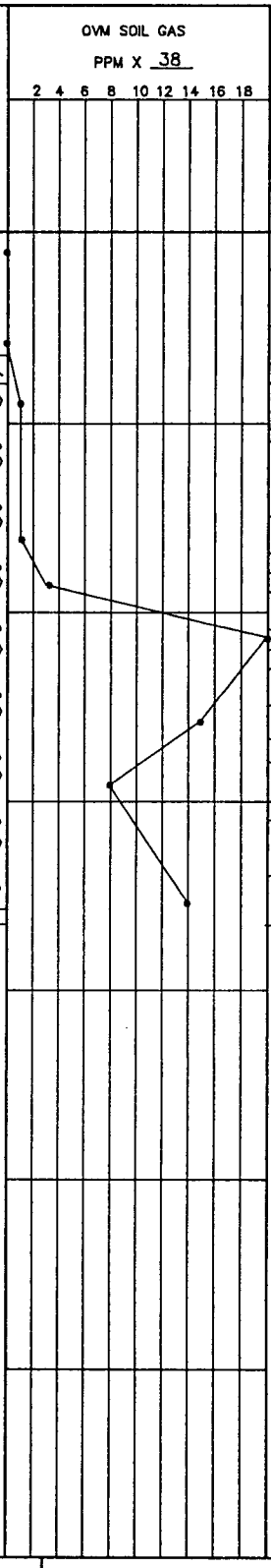
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3803.5	
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, LOOSE, SOFT, DRY	ML
	3.2	CLAYEY SILT: 7.5 YR 5/4, BROWN, DRY, FRIABLE, CALICHE NODULES AND PRECIPITATIONS, 15% CLAY, 10% CALICHE, 75% SILT	ML
	4.0	SILT, GRAVEL AND COBBLES: 7.5 YR 7/2 PINKISH GRAY, GRAVEL FINE TO COARSE, DRY, DOLOMITIC LIMESTONE AND CHERTY GRAVELS AND COBBLES	GM
	5	WET AT 12.5'	
	10	DARK GRAY SLUDGE AT 11.0'	
12.5'			
	15		
	17.9	SANDSTONE: 2.5 YR 5/4, LIGHT OLIVE BROWN, FINE GRAINED, HARD	SS
	18.2	AUGER REFUSAL AT 18.2'	
	20	BOREHOLE OVM READING: 80 PPM	
	25		
	30		
	35		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.0	3.5
NR			4.0
3	47	1.1	5.1
NR			5.5
NS			7.5
4	49	1.1	8.6
NR			9.0
5	120	0.4	9.4
NR			10.5
6	764	0.5	11.0
NR			11.5
NS			12.5
7	575	0.8	13.3
NR			14.0
8	305	1.0	15.0
NR			15.5
NS			17.5
9	556	0.7	18.2

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-69 (MW-46)***

DATE DRILLED 6/2/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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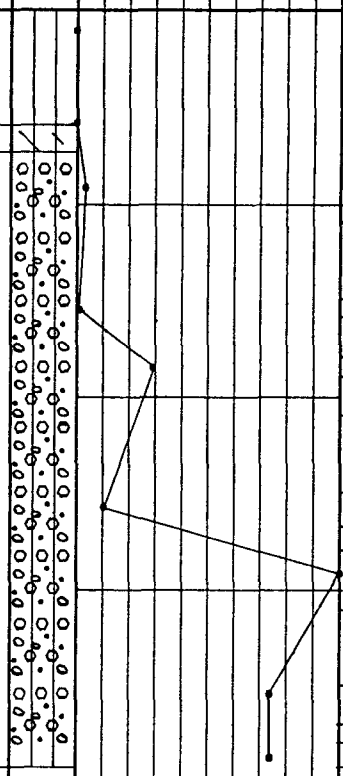
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3803.0	
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, LOOSE, SOFT, DRY	ML
	3.0	CLAYEY SILT: 7.5 YR 5/4, BROWN, HARD, DRY, CALICHE, 15% CLAY, 25% CALICHE, 60% SILT	ML
	3.7	SILT, GRAVEL & COBBLES: 7.5 YR 7/2, PINKISH GRAY, DOLOMITIC LIMESTONE, VERY HARD, DRY, BLACK HYDROCARBON SLUDGE AT 4.8' TO 5.0', COBBLES AND GRAVEL ARE 10 YR 7/1, LIGHT GRAY AT 6.5' TO T.D.	GM
	19.7	AUGER REFUSAL AT 19.7'	
		GROUNDWATER NOT ENCOUNTERED WHILE DRILLING	

GRAPHIC LOG



OVM SOIL GAS PPM X 38

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.0	3.5
NR			4.0
3	33	1.0	5.0
NR			5.5
NS			7.5
4	11.5	0.5	8.0
NR			9.0
5	231	0.4	9.4
NR			10.5
NS			12.5
6	87.2	1.0	13.5
NR			14.0
7	767	1.0	15.0
NR			15.5
NS			17.5
8	562	1.0	18.5
NR			19.0
9	540	0.5	19.5
NR			19.7

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-70 (MW-47)***

DATE DRILLED 6/3/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

ROBERTS/SCHORNICK
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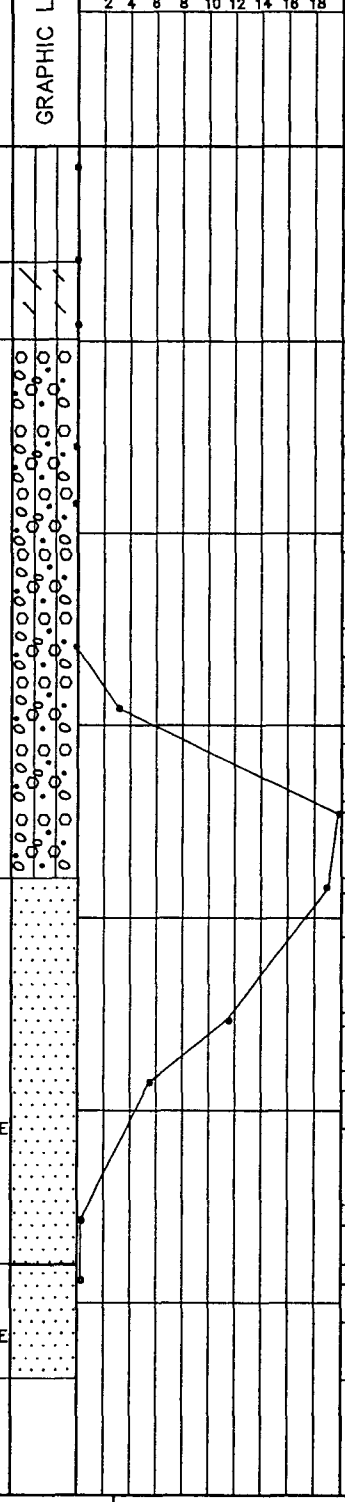
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3804.4	
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, LOOSE, SOFT, DRY	ML
	3.0	CLAYEY SILT: 7.5 YR 5/4, BROWN, NON-PLASTIC, DRY, FRIABLE, CALICHE PRESENT, 15% CLAY, 10% CALICHE	ML
	5	SILT, GRAVEL, COBBLES: SILT IS 7.5 YR 7/2, PINKISH GRAY, GRAVEL & COBBLES ARE 10 YR 7/1 LIGHT GRAY TO 7.5 YR 6/4 LIGHT BROWN, GRAVELS ARE DOLOMITIC LIMESTONE, LOOSE, CALICHE IN SILT	GM
	19.0	SANDSTONE: 2.5 YR 5/6, LIGHT OLIVE BROWN, MODERATELY, HARD, FINE GRAINED, SLIGHT HYDROCARBON ODOR, MOIST AT 22.0', COLOR CHANGES TO 2.5 YR 4/4, OLIVE BROWN AT 22.0'	SANDSTONE
	29.0	SANDSTONE: 2.5 YR 6/0 TO 7/0, GRAY TO LIGHT GRAY, DRY, HARD, FINE GRAINED	SANDSTONE
	32.0	AUGER REFUSAL AT 32.0'	
		GROUNDWATER NOT ENCOUNTERED WHILE DRILLING	

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.0	3.5
NR			4.0
3	0.0	1.0	5.0
NR			5.5
NS			7.5
4	0.0	0.5	8.0
NR			9.0
5	0.0	0.3	9.3
NR			10.5
NS			12.5
6	0.0	0.7	13.2
NR			14.0
7	109	1.0	15.0
NR			15.5
NS			17.5
8	738	0.2	17.7
NR			19.0
9	694	0.3	19.3
NR			20.5
NS			22.5
10	428	0.3	22.8
NR			24.0
11	216	0.5	24.5
NR			25.5
NS			27.5
12	11	0.5	28.0
NR			29.0
13	16	0.5	29.5
NR			30.5
NS			32.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-71 (MW-48)***

DATE DRILLED 6/4/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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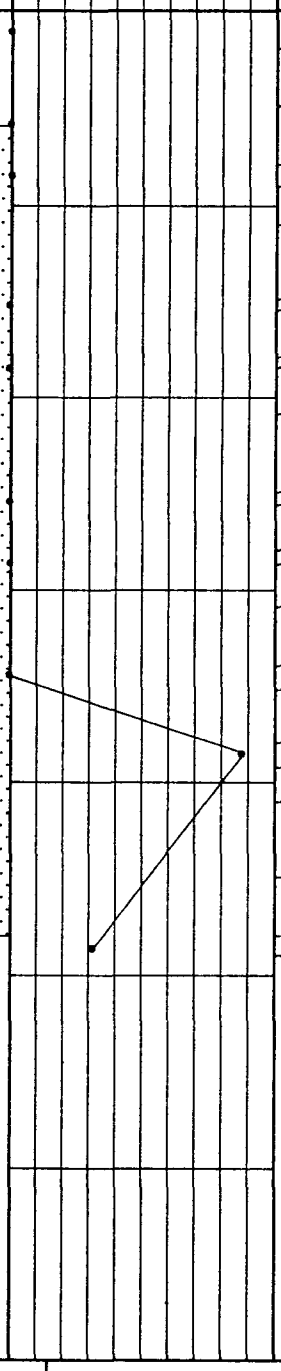
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3803.7	
	0	SILT: 10 YR 7/3, VERY PALE BROWN, LOOSE, DRY, SOFT	ML
	3.0	SANDSTONE: 2.5 YR 8/2, WHITE, FRIABLE, HIGHLY WEATHERED, SOFT TO MODERATELY HARD, SILTY, SLIGHTLY MOIST AT 4.0', 2.4 YR 7/4, PALE YELLOW, SLIGHTLY CEMENTED AT 7.5', MODERATELY HARD TO HARD, COLOR CHANGES TO 2.5 YR 7/2, LIGHT GRAY, 2.5 YR 6/8, OLIVE YELLOW AT 9.5' HARD CEMENTED LAYERS AT 17'–17.3', AND 17.8'–18.0	SANDSTONE
	24.0	AUGER REFUSAL AT 24.0' BOREHOLE OVM READING: 59.0 PPM GROUNDWATER NOT ENCOUNTERED WHILE DRILLING	

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.5	4.0
3	0.0	0.5	4.5
NR			5.5
NS			7.5
4	0.0	0.2	7.7
NR			9.0
5	0.0	0.2	9.2
NR			10.5
NS			12.5
6	0.0	0.3	12.8
NR			14.0
7	0.0	0.3	14.3
NR			15.5
NS			17.0
8	0.0	0.2	17.7
NR			19.0
9	71	0.6	19.6
NS			22.5
NR			24.0
10	26	0.4	24.4

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-72 (MW-49)***

DATE DRILLED 6/5/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 8 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3811.2								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SILT: 10 YR 7/3, VERY PALE BROWN, LOOSE, DRY, SOFT	ML			1	0.0	GC	1.0	
						NS			2.5	
	2.5	SANDSTONE: 2.5 Y 8/2, WHITE, DRY, MODERATELY HARD, VERY FINE GRAINED, SILTY, WEATHERED				2	0.0	1.3	3.8	
						NR			4.0	
		2.5 Y 7/4 PALE YELLOW AT 4.0'				3	0.0	0.3	4.3	
	5					NR			5.5	5
						NS			7.5	
						4	0.0	0.3	7.8	
		2.5 Y 6/8 OLIVE YELLOW AT 8.5' MOIST AT 9.0'				NS			9.0	
	10					NS			12.5	10
		CEMENTED LAYER SET 13.0'–17.5'				5	0.0	0.3	12.8	
						NR			14.0	
	15		SANDSTONE			NS			17.5	15
						6	0.0	0.6	18.1	
		VERY MOIST TO WET AT 19.0'				NR			19.0	
						7	0.0	0.5	19.5	
	20	2.5 YR 4/4 OLIVE BROWN AT 20.0'				NR			20.5	20
						NS			22.5	
						8	0.0	0.2	22.7	
						NR			24.0	
	25	VERY HARD & CEMENTED AT 24.0'–25.0'				NR			25.5	25
						NS			26.0	
26.5						NR			27.5	
28.5						NS			28.5	
						9	125	0.5	29.0	
						NR			30.0	
	30					NS			32.5	30
						10	160	0.5	33.0	
						NR			34.0	
		T.D. 35.0'				11	74	1.0	35.0	
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-73 (MW-50)***

DATE DRILLED 6/5/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3809.3		
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, LOOSE, DRY, SOFT	ML	
	2.8	CLAYEY SILT: 7.5 YR 5/4, BROWN, FIRM, FRIABLE, DRY, 15% CLAY, 10% CALICHE	ML	
	5			
	8.5	SILT, GRAVEL, COBBLES: SILT IS 10 YR 6/4 TO 5/4, LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY, GRAVEL & COBBLES ARE 2.5 YR 5/0 TO 4/0, GRAY TO DARK GRAY AND ARE DOLOMITIC LIMESTONE, VUGGY POROSITY, LIMESTONE IS ALSO 2.5 Y 6/2 LIGHT BROWNISH GRAY	GM	
	10			
	15			
16.5				
	17.9	SANDSTONE: 2.5 Y 6/6, OLIVE YELLOW HARD, FINE GRAINED, SILTY	SS	
	18.5	AUGER REFUSAL AT 18.5' BOREHOLE OVM READING: 0.0 PPM		
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 0

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	0.0	1.0	3.5
NR			4.0
3	0.0	0.1	4.1
NR			5.5
NS			7.5
4	0.0	1.0	8.5
NR			9.0
5	0.0	0.6	9.6
NR			10.5
NS			12.5
6	0.0	0.6	13.1
NR			14.0
7	0.0	0.7	14.7
NR			15.5
NS			17.5
8	0.0	0.5	18.0
NR			18.5

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-74 (MW-51)***

DATE DRILLED 6/6/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3815.3								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SILT: 7.5 YR 6/4, LIGHT BROWN, ROOTLETS TOP 2.0', LOOSE, SOFT, DRY	ML			1	0.0	GC	1.0	
						NS			2.5	
	2.8	CLAYEY SILT: 7.5 YR 5/4, BROWN, FRIABLE, FIRM, NON-PLASTIC, DRY, 15% CLAY, 10% CALICHE	ML			2	0.0	1.2	3.7	
						NR			4.0	
	4.7					3	0.0	0.9	4.9	
	5	SILT, GRAVEL & COBBLES: SILT IS 10 YR 6/4 TO 5/4, LIGHT YELLOWISH BROWN TO YELLOWISH BROWN, DRY, GRAVEL & COBBLES ARE 2.5 Y 5/0 TO 4/0, GRAY TO LIGHT GRAY TO 2.5 Y 6/2 LIGHT BROWNISH GRAVEL, GRAVELS ARE DOLOMITIC LIMESTONE, VUGGY POROSITY	GM			NR			5.5	
						NS			7.5	
						4	0.0	0.6	8.1	
						NR			9.0	
						5	0.0	1.0	10.0	
	10					NR			10.5	
						NS			12.5	
						NR			14.0	
						6	0.0	1.0	15.0	
	15					NR			15.5	
						NS			17.5	
						7	0.0	0.5	18.0	
						NR			19.0	
	19.0									
	19.25	DOLOMITIC LIMESTONE: 7.5 YR 6/2, PINKISH GRAY, VERY HARD, VUGGY POROSITY, MOIST	LIMESTONE			8	0.0	0.35	19.35	
	20	AUGER REFUSAL AT 19.25' BOREHOLE OVM READING: 0.0 PPM								
		GROUNDWATER NOT ENCOUNTERED WHILE DRILLING								
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-75 (MW-52)***

DATE DRILLED 6/6/91 & 6/7/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 2.5 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3814.4								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SILT: 10 YR 4/3 BROWN TO DARK BROWN, LOOSE, SOFT, DRY	ML			1	0.0	GC	1.0	
						NS			2.5	
	3.0					2	49.0	0.7	3.2	
	3.5	SILT, GRAVELS: 5 YR 7/1, LIGHT GRAY, GRAVEL IS LIMESTONE, VUGGY POROSITY, DRY	GM	O O O						
	5	T.D. 3.5'								
		ARGER REFUSAL IN DOLOMITE AT 3.5'								
	10									
	15									
	20									
	25									
	30									
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-76***

DATE DRILLED 6/7/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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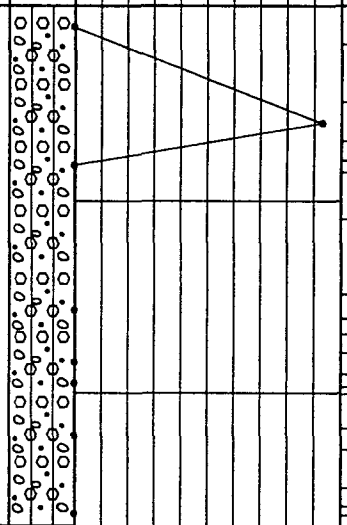
NORMAN, OKLAHOMA 73072
(405) 321-3895

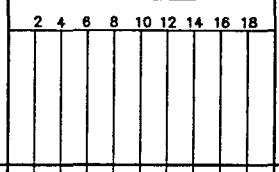
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3807.5	
	0	COBBLEY CLAYEY SILT: BROWN, 10 YR 4/3, DRY, VERY LOW PLASTICITY, COBBLES FROM 3 CM TO 10 CM, SUB-ROUNDED	GM
	5	BOULDERY BELOW 7.5', ROUNDED, > 50CM	
	10	CLAYEY AND GRAVELLY BELOW 11.5'	
	13.6	AUGER REFUSAL AT 13.6'	
	15	GROUNDWATER NOT OBSERVED DURING DRILLING	
	20		
	25		
	30		
	35		

GRAPHIC LOG



OVM SOIL GAS PPM X 2.5



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
2	46.2	1.0	3.5
NR			4.0
3	0.0	0.2	4.2
NR			5.5
NS			7.5
4	0.0	0.7	8.2
NR			8.5
NS			9.0
5	0.0	0.5	9.5
6	0.0	0.2	9.7
NR			10.0
NS			11.0
7	0.0	0.6	11.6
NR			12.5
NS			13.0
8	0.0	0.2	13.2
NR			13.6

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER **MARATHON/91029**

BORING NUMBER **BH-77 (MW-53)**

DATE DRILLED 6/7/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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ENVIRONMENTAL CONSULTANTS
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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 0.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3812.3								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	COBBLEY CLAYEY SILT: BROWN, 10 YR 5/3, DRY, VERY LOW PLASTICITY, VERY FINE GRAIN QUARTZ, COBBLES FROM 3 TO 10 CM, SUBROUNDED	GM			1	0.0	GC	1.0	0
						NS			2.5	
						2	0.0	0.3	2.8	
						NR			4.0	
						3	0.0	0.4	4.4	
	5					NR			5.5	5
	6.4					NR			6.4	
		AUGER REFUSAL AT 6.4'								
		GROUNDWATER NOT OBSERVED DURING DRILLING								
	10									10
	15									15
	20									20
	25									25
	30									30
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH-78***

DATE DRILLED 6/8/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3820.2		
	0	GRAVELLY CLAYEY SILT: YELLOWISH BROWN, 10 YR 5/4, QUARTZ, VERY FINE GRAIN, DRY	ML	
	2.0	SANDSTONE: PALE TO VERY PALE BROWN, 10 YR 6/3 TO 7/5, QUARTZOSE, VERY FINE GRAIN, WEATHERED FROM 2.5 TO 3.0', COMPETENT–HARD BELOW 3.0',	SANDSTONE	
	3.0			
	3.8	DOLOMITE: LIGHT BROWNISH GRAY, 10 YR 6/2, SANDY, MASSIVE, VERY HARD	DOLOMITE	
	5	AUGER REFUSAL AT 3.8'		
		GROUNDWATER NOT OBSERVED DURING DRILLING		
	10			
	15			
	20			
	25			
	30			
	35			

OVM SOIL GAS PPM X 0.0

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	1.0
NS			2.5
NR			3.1
NS			3.8
NR			3.9

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT–SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER ***MARATHON/91029***

BORING NUMBER ***BH–79***

DATE DRILLED 6/8/91
DRILLING METHOD HSA
DRILLED BY SHB
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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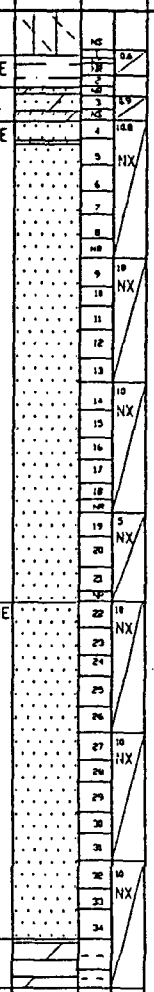
WELL COMPLETION AND SOIL BORING RECORDS

DEEP BEDROCK

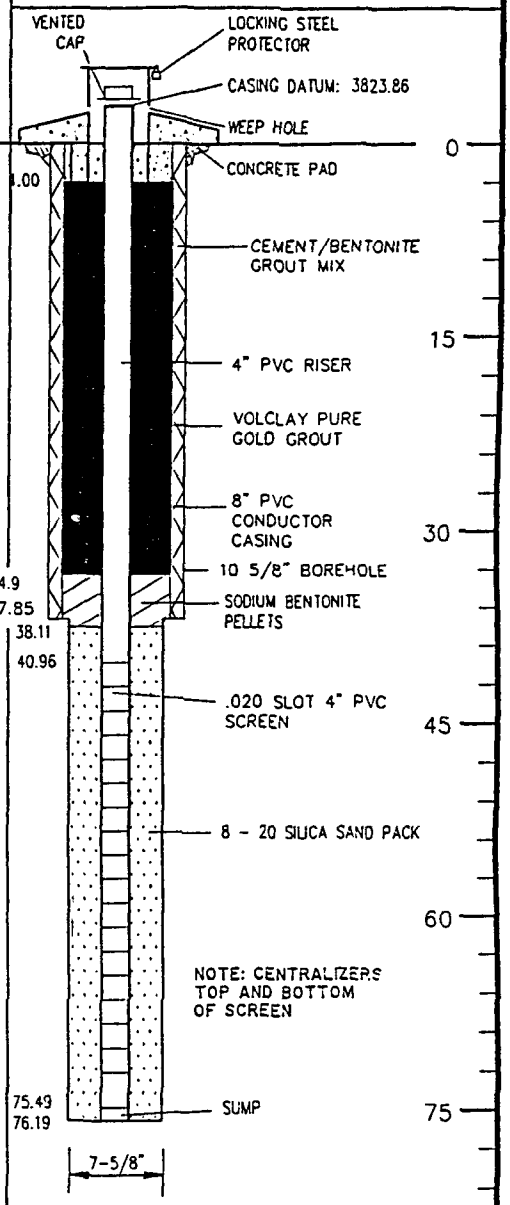
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD # 80 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3821.90	
	0	CLAYEY SILT: 10% CLAY, 90% 7.5 YR 6/4, UNCONSOLIDATED, DRY	ML
	3.5	SILTSTONE: 2.5 YR 8/1 WHITE, HARD, DRY	SILTSTONE
	6.0	SANDY DOLOMITE: VERY FINE GRAIN SILICA SAND, 10 YR 7/1 LT. GRAY, VERY HARD, FRACTURED, DRY	SANDY DOLOMITE
	8.0	SANDSTONE: VERY FINE GRAIN SILICA, WELL SORTED, HARD, MOIST, 10 YR 7/2 LT. GRAY, MASSIVE, MINOR IRON OXIDE MOTTLING FRACTURES (HORIZONTAL) AT 8.1,.8.8,9.7,10, & 10.3 FEET, SANDY DOLOMITE INTERBEDDED AT 10.3' TO 10.6', FRACTURES AT 6.2, 9.0, 10.2, 11.7, 12.9, 13.4, 13.9, 15.9 SANDSTONE VERY MOIST AFTER 12.6' VARYING DEGREES OF CARBONATE CEMENTATION	SANDSTONE
▽14.90*	15	AFTER 22.0', 10 YR 5/2 GRAY BROWN, NO CARBONATE CEMENTATION, MODERATELY HARD, FRACTURES AT 17.7, 18.8, 20.5, 20.9, 24.5 FEET	
		27.0' TO 27.3', 2.5 YR 7/4, PALE YELLOW	
	30	2.5 YR GRAY BROWN AFTER 30', FRACTURES AT 29.7, 29.8, 29.9, 30.1, 30.2, 30.4, 30.6, 31.0, 32.2, 31.5, 31.9, 32.3, 32.5, 33.1, 33.5, 33.9, 34.1, 34.5, 34.9, 35.5, 36.6, 37.2, 37.5, 37.9, CALCITE AND IRON OXIDE FRACTURE FILL AFTER 34.0'	
▽42.86		AFTER 35.1', MODERATELY WELL CEMENTED, ABUNDANT FRACTURES - EVERY .2 FEET	
	45	AFTER 36.0', 2.5 YR 6/2, LIGHT BROWN GRAY TO 2.5 YR 6/4 LIGHT YELLOW BROWN IRON OXIDE STAINING, MOIST MOD. WELL CEMENTED AFTER 38.8', 2.5 YR 4/2 DARK GRAY BROWN GRADING INTO 10 YR 3/1 VERY DARK GRAY, VERY FINE GRAIN SANDSTONE BETWEEN 42.5' AND 43.5', VERY FINE GRAIN SILTY SANDSTONE 5 YR 4/1 DARK GRAY	SANDSTONE
	46.2	SANDSTONE: VERY FINE GRAIN, 10 YR 5/1 GRAY TO 10 YR 3/1 VERY DARK GRAY, VERY HARD, MODERATELY FRACTURED, AFTER 47.0' 2.5 YR 7/0 LIGHT GRAY, MOTTLED WITH 10 YR 6/3 PALE BROWN, SLIGHTLY DOLOMITIC AFTER 50.7', BETWEEN 54.8' AND 55' 5 YR 4/1 DARK GRAY	
	60	CONTINUING ALTERNATING BANDS OF 10 YR 5/1 GRAY AND 2.5 YR 7/6 LIGHT GRAY MOTTLED WITH 10 YR 6/3 PALE BROWN	
		BETWEEN 62.6' AND 62.7': SILTY SANDSTONE 5 YR 5/2 OLIVE GRAY, HIGHLY WEATHERED	
	72.0	DOLOMITE: GRADATIONAL CONTACT WITH SANDSTONE, 5 YR 5/1 GRAY, VERY HARD, HORIZONTAL FRACTURES AT 72.6, 73, 73.3, 73.4, 74.7, 75.0, STRONG CONDENSATE ODOR AT 76.0'	DOLO.
	75		
	76.19	T.D. 76.19'	
		W/L AFTER DRILLING 14.90'	
		NOTE: WATER ROTARY CORING AFTER 11.0 FEET, WATER LEVEL UNABLE TO BE DETERMINED DUE TO WET ROTARY DRILLING METHODS. : LOST CIRCULATION AT 11.0 FEET : BOREHOLE DRY AT 46.1 FEET ON 6/18/91	
	90	* LEVEL PRIOR TO WELL PURGING WATER LEVEL NOT OBSERVED DURING DRILLING. OPEN HOLE LEVEL ~ 43 FEET	
	105		

GRAPHIC LOG / SAMPLE INTERVAL / "N" VALUE



WELL COMPLETION DETAIL



NOTE: HOLLOW STEM AUGERING TO 6.0 FEET : NX WATER ROTARY CORING FROM 6.0 TO 76.19 FEET.

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-54 (BH-80)*

		CONDUCTOR INSTALLED
DATE DRILLED	6/27/91	6/16-17/91
DRILLING METHOD	AIR ROTARY/WATER NX CORE	
DRILLED BY	SHB AND BOYLES BROS.	
LOGGED BY	GBR	
CHECKED BY	BJS	
DRAWN BY:	SAR	

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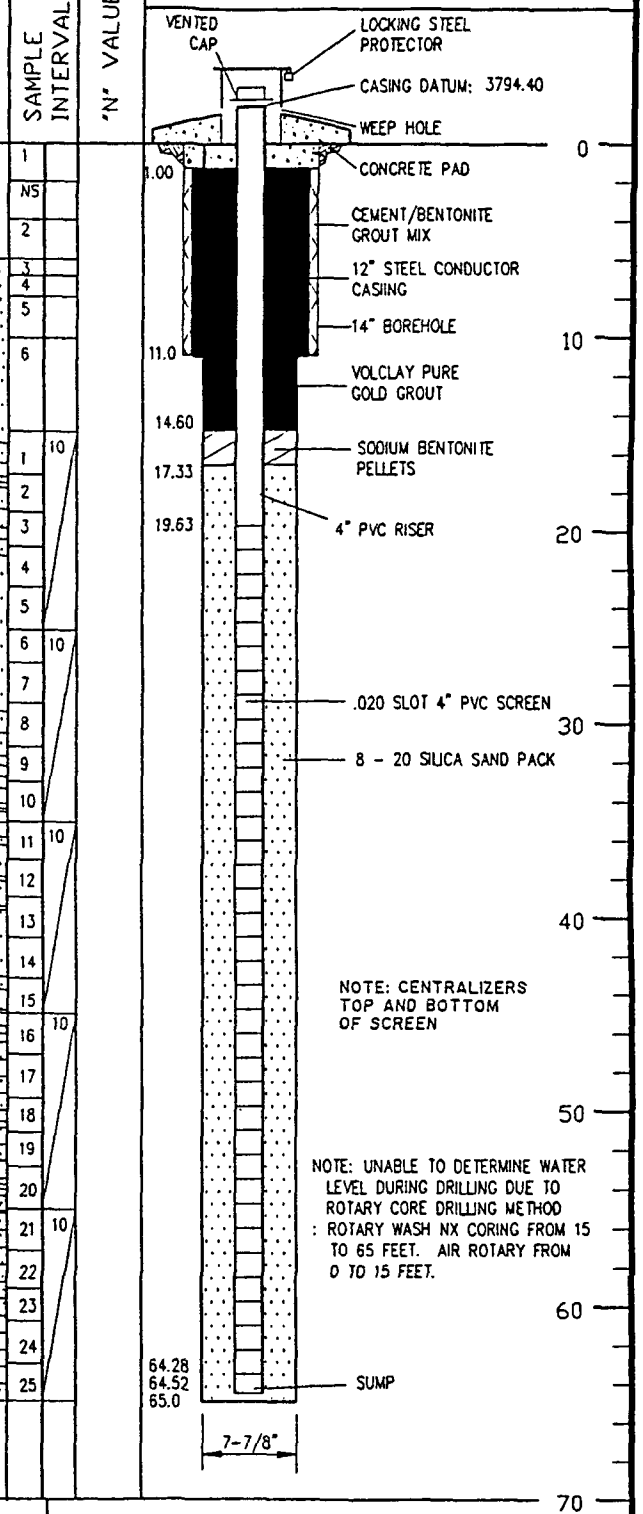
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD # 81 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3792.60	
	0	SILT: WELL GRADED, VERY FINE GRAIN, 90% SILT, 10% SAND, NO PLASTICITY, 10 YR 8/4, VERY PALE BROWN, NO ODOR, DRY SOFT NON-STARATIFIED, CALCITE CEMENT, HCL(+) COLOR CHANGE TO 10 YR 6/8, BROWNISH YELLOW AT 5 FEET	ML
	6.0	SANDSTONE: VERY FINE GRAINED SILICA, 10 YR 6/3, PALE BROWN, 10 YR 5/3, BROWN, MODERATELY HARD TO VERY HARD, SLIGHTLY MOIST, WEATHERED, MOIST AND FRIABLE BETWEEN 18.5 AND 21.5', AFTER 21.5' VERY HARD, FRACTURES LARGELY CEMENTED, FRACTURES AT 15.2, 16.0, 16.8, 17.2, 17.5, 18.5, 19.7, 20.0, 20.8, 21-21.5, 23.3, 24.0, NO ODOR	SANDSTONE
	10		
▽15.9		10 YR 5/2 GRAY BROWN AFTER 25.0'	
		FRACTURE (HORIZONTAL) AT 28.5'	
	20		
▽23.39			
	30		
	30.5	SANDY DOLOMITE: VERY FINE GRAIN SAND, 10 YR 6/1, LT. GRAY-GRAY, VERY HARD	SANDY DOLO.
	31.5	DOLOMITE: MICROCRYSTAL, 2.5 YR 6/2, LIGHT BROWN GRAY, VERY HARD, FRACTURES AT 31.6,32.1, 32.2, 32.5-33.5, 33.8, 33.9, 35.1, 35.7 32.1 TO 32.2 FEET FRIABLE, SANDSTONE INTERBED, 5 YR 5/3 OLIVE, MOIST, IRON OXIDE AND PYRITE ALONG FRACTURES BELOW 33' AFTER 34.3', VERY HARD, FRACTURES LARGELY CEMENTED AFTER 35'. GRADES	DOLOMITE
	35.0		DOLOMITIC SANDSTONE
	39.6		
	40	DOLOMITIC SANDSTONE: VERY FINE GRAIN SAND, GRADATIONAL CONTACT WITH DOLOMITE, VERY HARD 10 YR 8/1 LIGHT GRAY-GRAY 10 YR 5/2 GRAY BROWN 38.9' TO 39.6', FRACTURES 36.7', 37.8', 38.8', 42.4', 43.8', 44, 44.7'	SANDSTONE
	46.0	SANDSTONE: VERY FINE GRAIN SILICA 2.5 YR 6/2 LIGHT BROWN GRAY, VERY HARD BETWEEN 6.9 AND 7.4 FEET, 10 YR 4/1 DARK GRAY ZONE, SILTSTONE INTERBED BETWEEN 42.6 AND 43.4 FEET: HIGHLY FRIABLE AND WEATHERED, 2.5 YR 4/2 DARK GRAY BROWN BETWEEN 43.4 AND 44.4 FEET DOLOMITIC SANDSTONE: VERY FINE GRAINED, 10 YR 6/1 LIGHT GRAY TO GRAY AFTER 44.4 FEET SANDSTONE: VERY FINE GRAIN 5 YR 4/1 DARK GRAY, MOD. HARD, 5 YR 4/1 DARK GRAY 45 TO 46.1 FEET	DOLOMITIC SANDSTONE
	50		SANDY DOLOMITE
	55.0	DOLOMITIC SANDSTONE: VERY FINE GRAIN, 7.5 YR 7/0 LIGHT GRAY, VERY HARD, HORIZONTAL FRACTURES AT 44.1'	DOLOMITE
	60	SANDY DOLOMITE: VERY FINE GRAIN 10 YR 6/2 LIGHT BROWN GRAY, VERY HARD, HORIZONTAL FRACTURES AT 49.9', 51.9', 52.7', 53.5', 53.7', 45' FRACTURE AT 49.9', VERTICAL FRACTURE AT 44.2' TO 55.0', PYRITE, CALCITE AND HEMATITE FRACTURE FILL, STRONG CONDENSATE ODOR AFTER 53.0'	
	65.0	DOLOMITE: 10 YR 6/2 LIGHT BROWN GRAY, HIGHLY FRACTURED WITH THIN INTERBEDS OF DOLOMITIC SILTSTONE AND SANDSTONE, STRONG CONDENSATE ODOR	
	70	T.D. 65.0'	

GRAPHIC LOG / SAMPLE INTERVAL / "N" VALUE



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-55 (BH-81)*

DATE DRILLED 6/25/91 CONDUCTOR INSTALLED 6/15-16/91

DRILLING METHOD AIR ROTARY/WATER ROTARY CORE

DRILLED BY SHB AND BOYLES BROS.

LOGGED BY GBR

CHECKED BY BJS

DRAWN BY: SAR

PAGE 1 OF 1

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(405) 321-3895

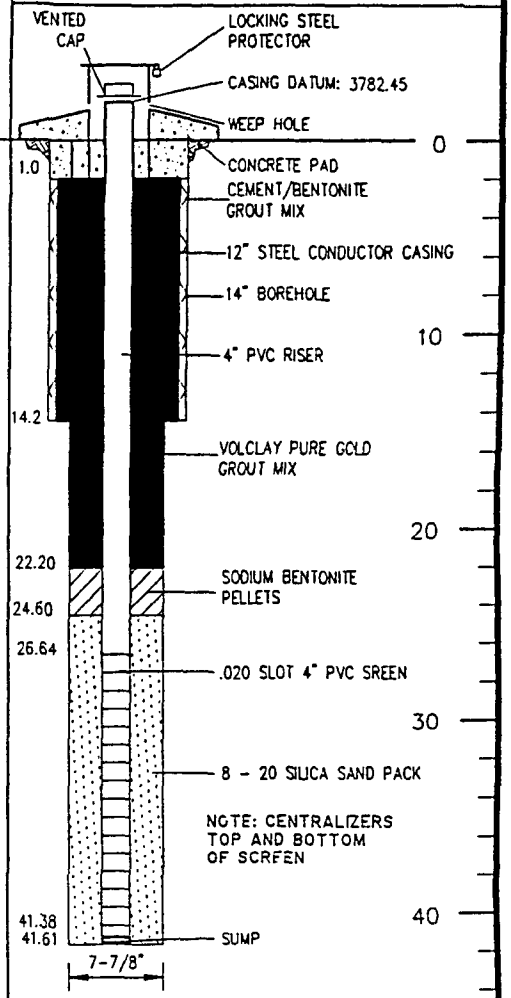
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD # 82 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3780.3				
	0	CLAYEY SILT: 20% CLAY, 80% SILT, 10 YR 5/3, BROWN, DRY, UNCONSOLIDATED, LOW PLASTICITY	ML		1, NS, 2, NS	
	6.0	SILTY CLAY: 30% SILT, 70% CLAY, 10 YR 5/3, BROWN, SOFT, MED. PLASTICITY, MINOR SUBANG DOLOMITE GRAVEL TO 1/4 INCH, MINOR DOLOMITE COBBLES TO APPROXIMATELY 3 INCHES	CL		3, NS, 4	
	9.5	DOLOMITE: 10 YR 4/1, DARK GRAY TO 10 YR 6/1, GRAY-LIGHT GRAY, DRY, HARD. VERTICAL FRACTURE BETWEEN 16.2-17.0' MODERATELY FRACTURED BELOW 17.0'	DOLOMITE		5, 6, 7, 8	8.0 NX
	17.7	DOLOMITE: WITH INTERBEDS OF SILTY DOLOMITE, 10 YR 5/2, GRAYISH BROWN, 10 YR 6/2, LIGHT BROWNISH GRAY, AND 10 YR 5/1, GRAY, ABUNDANT HEMATITE-REPLACED FOSSIL - POSSIBLY GRAPTOLITES OR SPONCESPICULES, AFTER 21.0', CHERT-LIKE CONCOIDAL FRACTURING	DOLOMITE/ SILTY DOLO.		9, 10, 11, NR	
	25.0	DOLOMITE: 10 YR 5/2, GRAYISH BROWN, MICRO-CRYSTALLINE, VERY HARD, HIGHLY FRACTURED, 2.5 Y 6/2, LIGHT BROWNISH GRAY SILT ALONG FRACTURES, MINOR IRON OXIDE STAINING	DOLOMITE		12, 13, 14, 15, 16, NR	9.0 NX
		STRONG CONDENSATE ODOR IN FRACTURE AT 32.8' IN FRACTURE 45° FROM VERTICAL				
		STRONG CONDENSATE ODOR IN FRACTURES TO 35.6' AFTER 35.6', FRACTURES LARGELY CEMENTED			17, 18, 19	5.0 NX
	41.61	T.D. 41.61			NS	
		GROUNDWATER AT 32.75' 1/8" FLOATING PRODUCT STRONG CONDENSATE ODOR 6/21/91				
		NOTE: AIR ROTARY FROM 0 TO 15 FEET. : ROTARY WASH NX CORE FROM 15.0 TO 41.61 FEET				

29.65

6/21/91 32.75'

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-56 (BH-82)*

DATE DRILLED	6/27/91	CONDUCTOR INSTALLED 6/15/91
DRILLING METHOD	AIR ROTARY/WATER WASH NX CORE	
DRILLED BY	BOYLES BROS. AND SHB	
LOGGED BY	GHR	
CHECKED BY	BJS	
DRAWN BY:	SAR	PAGE 1 OF 1

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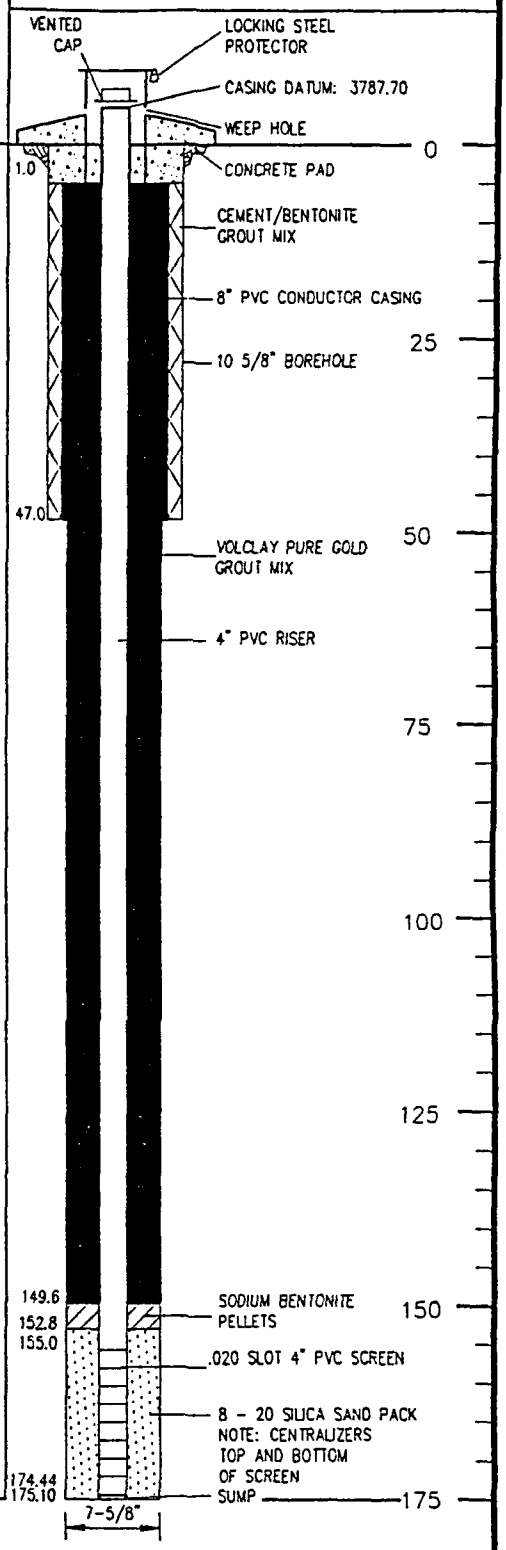
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION*	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD # 83 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3785.6				
	0	2.0 SANDY SILT:	SM		SEE BORING RECORD FOR MORE DETAIL DESCRIPTION*	
		SANDY DOLOMITE:	SANDY DOLOMITE			
	10.0	INTERBEDDED DOLOMITE/SILTSTONE/CHERT	SILTSTONE DOLOMITE CHERT			
7/18/91 18.5'	20.0	DOLOMITE:	DOLOMITE			
6/17/91 29.52	25					
6/20/91 41.7	40.0	DOLOMITE:	DOLOMITE			
	44.0	DOLOMITE:	DOLOMITE			
	46.0	DOLOMITE:	DOLOMITE			
	50					
	50.5	DOLOMITE:	DOLOMITE			
	56.0	DOLOMITE:	DOLOMITE			
	58.0	DOLOMITE:	DOLOMITE			
	65.0		GYPSUM			
	65.5	GYPSUM:	DOLOMITE			
	67.0	DOLOMITE:	DOLOMITE			
	74.0	DOLOMITE:	DOLOMITE			
	75					
	76.0	DOLOMITE:	DOLOMITE			
	80.0	DOLOMITE:	DOLOMITE			
	87.5		DOLOMITE			
	88.0	DOLOMITE:	DOLOMITE			
	90.0	DOLOMITE:	SILTSTONE			
	91.5	SILTSTONE:	DOLOMITE			
	96.0	DOLOMITE:	DOLOMITE			
	100	DOLOMITE:				
	106.0		DOLOMITE			
	108.0	DOLOMITE:	LIMESTONE			
		LIMESTONE:				
	119.5	LIMESTONE:	LIMESTONE			
	122.0	DOLOMITE:	DOLOMITE			
	125					
	126.0	LIMESTONE:	LIMESTONE			
	140.0		LIMESTONE			
	142.0	LIMESTONE:	SILTSTONE			
		SILTSTONE:				
	148.0		LIMESTONE			
155.0	149.0	LIMESTONE:	LIMESTONE			
	150					
		LIMESTONE:				
158.42	154.0	LIMESTONE:	LIMESTONE			
	158.0	LIMESTONE:	LIMESTONE			
	162.0	LIMESTONE:	LIMESTONE			
	166.0	DOLOMITE:	DOLOMITE			
	172.0	SANDSTONE: DOLOMITIC	SANDSTONE			
	175					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-57 (BH-83)*

DATE DRILLED 6/25/91 CONDUCTOR INSTALLED: 6/17-18/91

DRILLING METHOD AIR ROTARY/WATER ROTARY CORE/HSA

DRILLED BY BOYLES BROS.

LOGGED BY GHR

CHECKED BY BJS

DRAWN BY: SAR

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WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD # 84 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3821.60	
	0	CLAYEY SILT:	ML
	5.0	SILTSTONE:	SILTSTONE
	10.0	DOLOMITE:	DOLOMITE
	15.0	DOLOMITE:	DOLOMITE
	18.0		DOLOMITE
	20.5	DOLOMITE:	SANDSTONE
	22.0	SANDSTONE:	DOLOMITE
	28.0	DOLOMITE:	SANDSTONE
	30.0	SANDSTONE:	SANDSTONE
	35	SANDSTONE:	
	42.0		SANDSTONE
	44.0	SANDSTONE:	SANDSTONE
	48.0	SANDSTONE:	SANDSTONE
		SANDSTONE:	
	56.0	SANDSTONE:	SANDSTONE
	65.0	SANDSTONE:	SANDSTONE
	70		
	76.0	DOLOMITE:	DOLOMITE
	82.0		SANDSTONE
	84.0	SANDSTONE:	SANDSTONE
		SANDSTONE:	
	94.0		
	97.0	SANDSTONE:	SANDSTONE
	100.0	DOLOMITE:	DOLOMITE
	104.0		DOLOMITE
	105	DOLOMITE:	DOLOMITE
		DOLOMITE:	
	112.0	SANDY DOLOMITE:	DOLOMITE
	118.0	SANDY DOLOMITE:	DOLOMITE
	124.0	DOLOMITE:	DOLOMITE
	135.0		
	138.0	DOLOMITE:	DOLOMITE
	140	DOLOMITE:	DOLOMITE
	142.0	SANDY DOLOMITE:	DOLOMITE
	164.0	SILTSTONE:	SILTSTONE
	172.0		
	175	DOLOMITE:	DOLOMITE
▽190.55			
	192.0	DOLOMITE:	DOLOMITE
	198.0		
	202.0	DOLOMITIC LIMESTONE:	LIMESTONE
	205.0	LIMESTONE:	LIMESTONE
▽207.4	207.0	LIMESTONE:	LIMESTONE
	210	SANDSTONE:	SANDSTONE
	216.0	T.D. 216.0'	
	245		

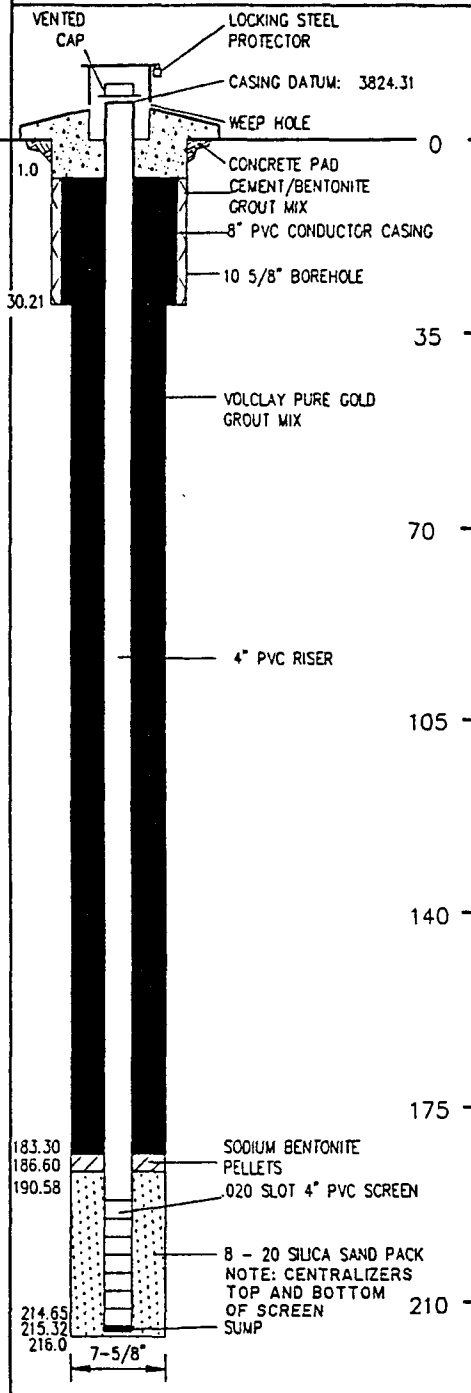
GRAPHIC LOG

SAMPLE INTERVAL

"N" VALUE

SEE BORING RECORD FOR DETAILED DESCRIPTION

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

ROBERTS/SCHORNICK

& ASSOCIATES, INC.

ENVIRONMENTAL CONSULTANTS
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(405) 321-3895

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-58 (BH-84)*

		CONDUCTOR INSTALLED
DATE DRILLED	6/31/91	6/27/91
DRILLING METHOD	7-5/8" AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	GHR	
CHECKED BY	BJS	
DRAWN BY:	SAR	

WELL COMPLETION RECORD

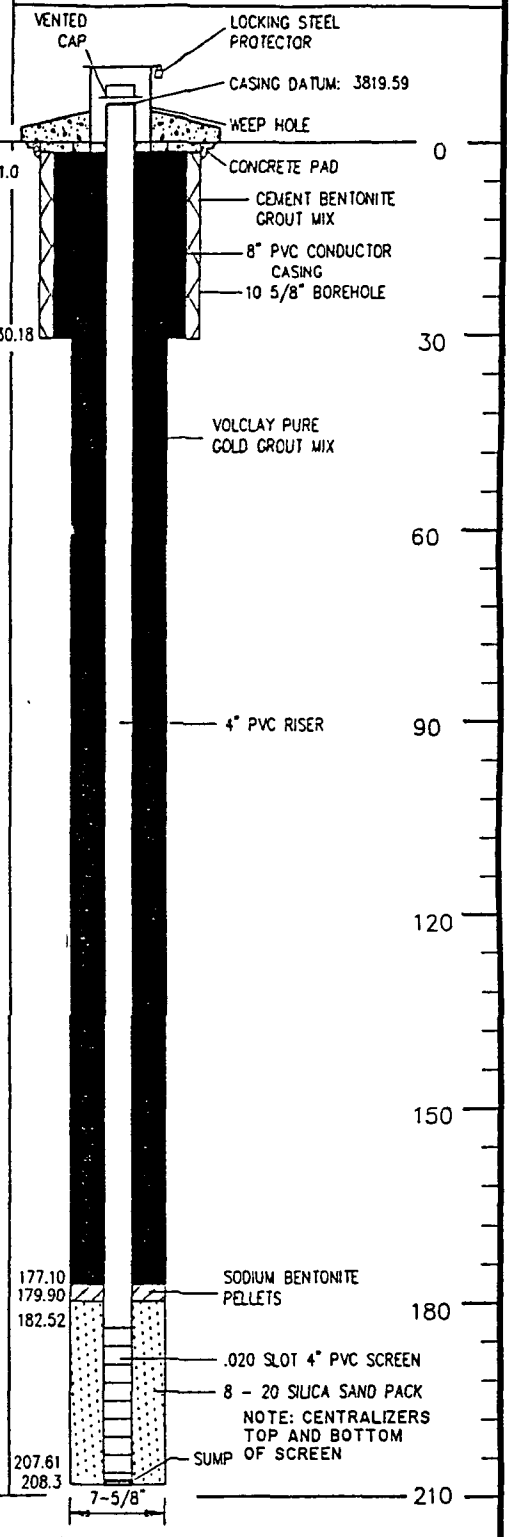
GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD #85 FOR MORE DETAILED LITHOLOGIC DESCRIPTION.	
		GROUND SURFACE: 3816.60	
	0	CLAYEY SILT:	ML
	3.0	DOLOMITE:	DOLOMITE
	8.0	SILTSTONE:	SILTSTONE
	11.0	SANDSTONE:	SANDSTONE
	16.0	DOLOMITE:	DOLOMETE
	20.0	SANDSTONE:	SANDSTONE
	30.0		
	30 32.0	SANDSTONE:	SANDSTONE
		DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	47.0		SANDSTONE
	48.0	SANDSTONE:	DOLOMITIC SANDSTONE
		DOLOMITIC SANDSTONE:	
	60		
	74.0	CHERTY DOLOMITE:	DOLOMITE
	79.0	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	84.0	SANDSTONE:	SANDSTONE
	87.0	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	90		
	96.0	CHERTY DOLOMITE:	DOLOMITE
	100.0	CHERTY DOLOMITE:	DOLOMITE
	110.0	DOLOMITE:	DOLOMITE
	116.0	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	120		
	122.0	DOLOMITE:	DOLOMITE
	128.0	SANDY DOLOMITE:	SANDY DOL.
	130.5	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	135.5	DOLOMITE:	DOLOMITE
	141.6	DOLOMITIC SANDSTONE:	DOLOMITIC SANDSTONE
	150		
	152.0	DOLOMITE:	DOLOMITE
	180		
▽ 191.00	190.0		DOL./LIME.
	192.0	DOLOMITIC LIMESTONE:	DOLOMITE
7/4/91	194.0	DOLOMITE:	
▽ 200.00		LIMESTONE:	LIMESTONE
	201.0		
	204.0	SANDY DOLOMITE:	SAND/DOL.
		SANDSTONE:	SANDSTONE
	208.0		
	210		

GRAPHIC LOG

SAMPLE INTERVAL: SEE BORING RECORD FOR DETAILED DESCRIPTION

"N" VALUE

WELL COMPLETION DETAIL



T.D. 208.3' FEET, W/L 1 HR. AFTER DRILLING 191 FEET,, 0.9 FEET, OF FLOATING PRODUCT

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON*

BORING NUMBER *MH-59 (BH-85)*

		CONDUCTOR INSTALLED
DATE DRILLED	7/5/91	6/28/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	GHR	
CHECKED BY	BJS	
DRAWN BY:	BDR	

PAGE 1 OF 1

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NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

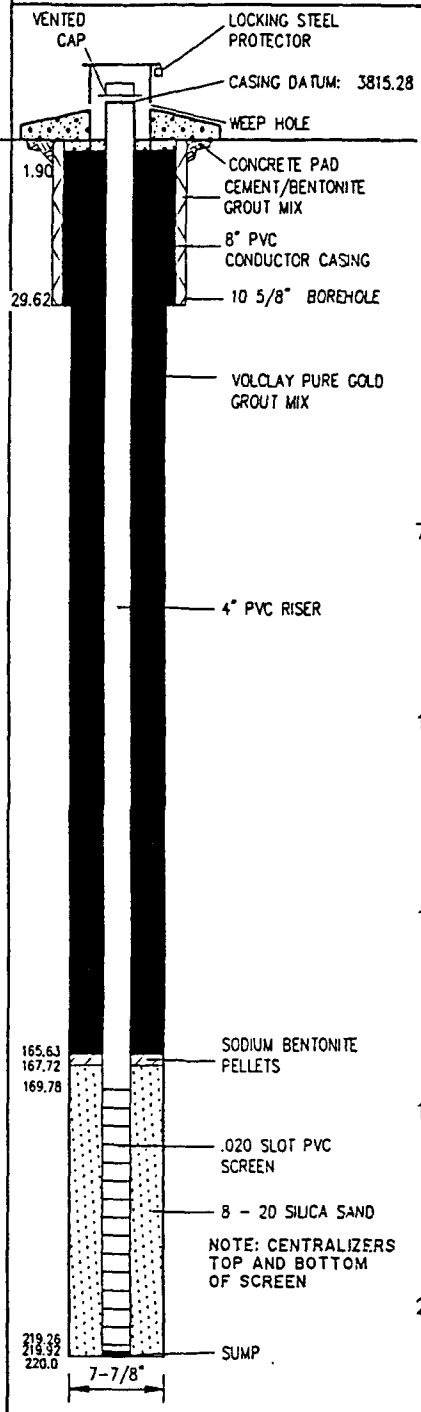
GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD # 86 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3812.20	
	0		ML
	1.5	CLAYEY SILT:	DOLOMITE
		DOLOMITE:	
	9.0	DOLOMITIC SANDSTONE:	SANDSTONE
	15.0	SANDSTONE:	SANDSTONE
	19.0	DOLOMITIC SANDSTONE:	SANDSTONE
	27.0		
	30.0	SANDSTONE:	SANDSTONE
	32.5		SILTSTONE
	34.5	SILTSTONE:	DOLOMITE
	35		
	37.0	DOLOMITE:	SANDSTONE
	40.0		DOLOMITE
		DOLOMITIC SANDSTONE:	SANDSTONE
	45.0	DOLOMITE:	SANDSTONE
	49.5	DOLOMITIC SANDTONE:	SANDSTONE
	50.5	SANDSTONE:	SANDSTONE
		DOLOMITIC SANDSTONE:	
	59.0	SANDSTONE:	SANDSTONE
		DOLOMITIC SANDSTONE:	
	70		
	71.0		SANDSTONE
	72.0	SANDSTONE:	SANDSTONE
	73.0		DOLOMITE
	77.5	DOLOMITIC SANDSTONE:	
	81.0	DOLOMITE:	DOLOMITE
		SANDY DOLOMITE:	SANDSTONE
		SANDSTONE:	
	93.0		DOLOMITE
	95.0	SANDY DOLOMITE:	DOLOMITE
	100.0	DOLOMITE:	DOLOMITE
	105		
	109.0	SANDY DOLOMITE:	DOLOMITE
	115.0	DOLOMITIC SANDSTONE:	SANDSTONE
	121.0	DOLOMITE:	DOLOMITE
	127.0	SANDY DOLOMITE:	DOLOMITE
	131.0	DOLOMITIC SANDSTONE:	SANDSTONE
	137.0	SANDY DOLOMITE:	DOLOMITE
	140		
		SANDY DOLOMITE:	DOLOMITE
	145.0	DOLOMITIC SANDSTONE:	SANDSTONE
	169.0		SILTSTONE
	170.0	SILTSTONE:	DOLOMITE
		SANDY DOLOMITE:	
	175		
	176.0	DOLOMITE:	DOLOMITE
7/12/91 185.59'	185.0		SANDSTONE
	185.5	SANDSTONE:	DOLOMITE
		DOLOMITE:	
	203.0	DOLOMITIC SANDSTONE:	SANDSTONE
210.0'	210	SANDSTONE:	SANDSTONE
	220.0	BORING TERMINATED AT 220.0'	
	245		

GRAPHIC LOG

SAMPLE INTERVAL: SEE BORING RECORD FOR DETAILED DESCRIPTION

"N" VALUE

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-60 (BH-86)*

DATE DRILLED 7/12/91 CONDUCTOR INSTALLED 7/9/91

DRILLING METHOD AIR HAMMER

DRILLED BY BOYLES BROS.

LOGGED BY MJL

CHECKED BY BJS

DRAWN BY: SAR

PAGE 1 OF 1

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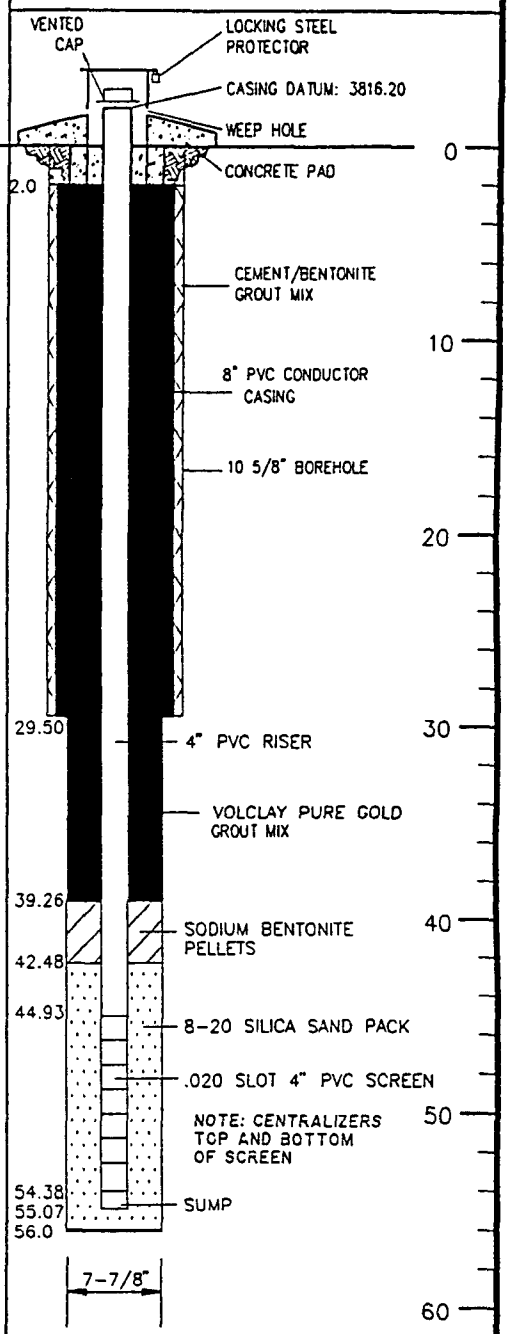
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD # 87 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3813.30				
	0	CLAYEY SILT:	ML		1 GC	
					2 GC	
	3.5	SANDSTONE:	SAND-STONE		3 GC	
					4 GC	
	9.0				5 GC	
	10	SANDY DOLOMITE:	SANDY DOLO.		6 GC	
	13.0				7 GC	
		SANDSTONE:	SAND-STONE		8 GC	
	17.0				9 GC	
		DOLOMITE – SANDY DOLOMITE:	DOLO. & SANDY DOLO.		10 GC	
	20					
	21.0	SANDSTONE:	SAND-STONE		11 GC	
					12 GC	
					13 GC	
					14 GC	
					15 GC	
	30	SANDSTONE:	SAND-STONE		16 GC	
					17 GC	
					18 GC	
					19 GC	
					20 GC	
	40				21 GC	
7/13/91 ▽ 45.49					22 GC	
					23 GC	
					24 GC	
					25 GC	
	50				26 GC	
▽ 53.0					27 GC	
					28 GC	
	56.0	BORING TERMINATED AT 56.0'				
	60	NOTE: SEE LOG BH-87 FOR MORE IN-DEPTH DESCRIPTION.				
	70					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-61 (BH-87)*

		CONDUCTOR INSTALLED
DATE DRILLED	7/12/91	7/9/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROTHERS	
LOGGED BY	MJL	
CHECKED BY	BJS	
DRAWN BY:	SAR	

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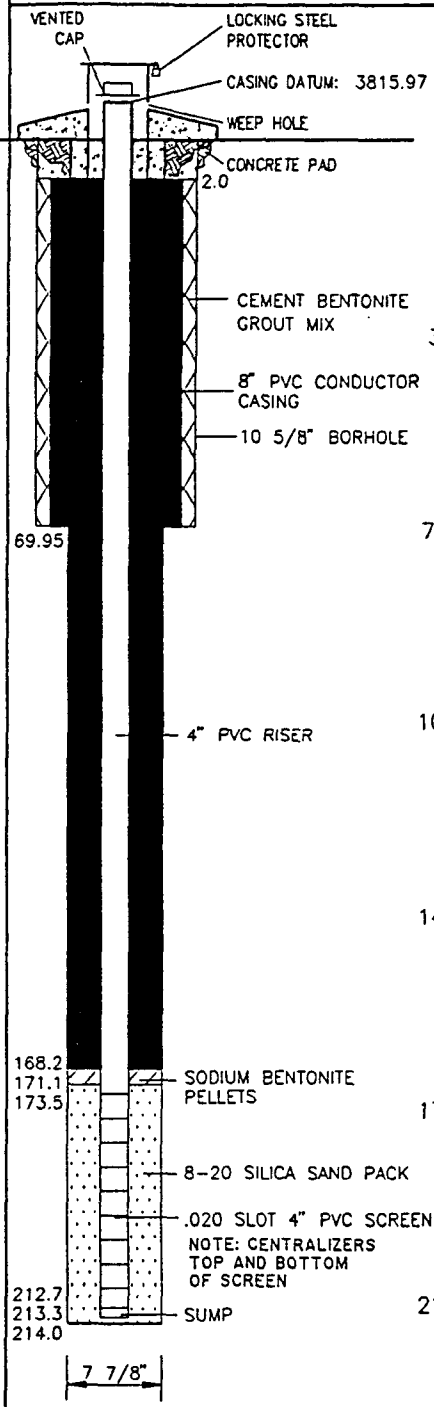
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #87A FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3813.6				
	0 1.0	CLAYEY SILT:	ML			
		SANDSTONE:	SANDSTONE			
	9.0	DOLOMITE:	DOLOMITE			
	15.0	SANDSTONE:	SANDSTONE			
	23.0	SANDSTONE:	SANDSTONE			
	35	SANDSTONE:	SANDSTONE			
	70	SANDSTONE:	SANDSTONE			
	77.0	SANDY DOLOMITE:	SDY.DOLO			
	83.0	SANDSTONE:	SANDSTONE			
	95.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	101.0	SANDY DOLOMITE:	SDY.DOLO			
	105 107.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	111.0	SANDSTONE:	SANDSTONE			
	122.0	SANDY DOLOMITE:	SDY.DOLO			
	131.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	140 141.0	SANDY DOLOMITE:	SDY.DOLO			
	147.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	149.0	SANDSTONE:	SANDSTONE			
	171.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	175	DOLOMITIC SANDSTONE:	DOLO.SS			
▽ 182.62	185.0					
	187.0	SANDSTONE:	SANDSTONE			
▽ 194.0		SANDY DOLOMITE:	SANDY DOLOMITE			
	206.0	SANDSTONE:	SANDSTONE			
	210	SANDSTONE:	SANDSTONE			
	214.0	BORING TERMINATED AT 214.0'				
		NOTE: SEE LOG BH-87A FOR MORE IN-DEPTH DESCRIPTION.				
	245					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-61A (BH-87A)*

DATE DRILLED 7/15/91 CONDUCTOR INSTALLED 7/13/91

DRILLING METHOD AIR HAMMER

DRILLED BY BOYLES BROTHERS

LOGGED BY MJL

CHECKED BY BJS

DRAWN BY: SAR

PAGE 1 OF 1

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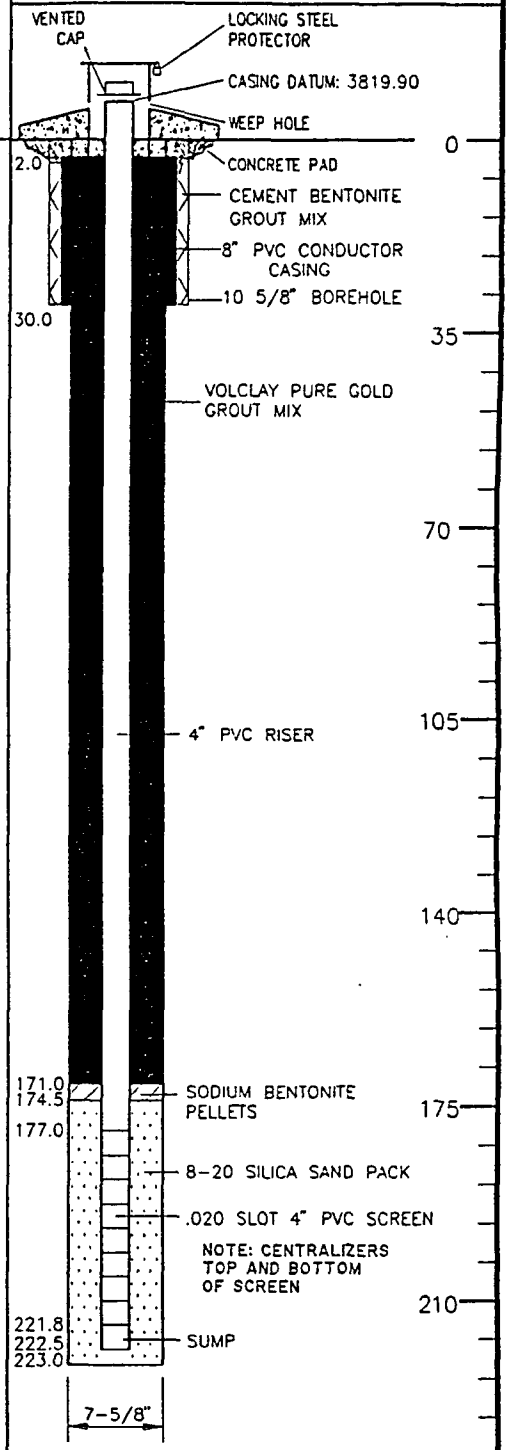
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #88 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3817.00				
	0 0.3	CLAYEY SILT:	ML			
	8.0	CHERTY DOLOMITE:	CRT.DOLO.			
	10.0	SILTSTONE CHERTY DOLOMITE:	CRT.DOLO.			
	12.0	CHERTY DOLOMITE:	CRT.DOLO.			
		DOLOMITIC SILTSTONE:	DOLO. SILTSTONE			
	22.0	SANDSTONE:	SS			
	30.0					
	34.0	SANDSTONE:	SS			
	35	SANDSTONE:	SS			
	40.0					
	42.0	SANDSTONE:	SS			
		SANDSTONE:	SS			
	50.0					
	52.0	SANDSTONE:	SS			
	54.0	SANDSTONE:	SS			
		SANDSTONE:	SS			
	66.0					
	70 72.0	CHERTY DOLOMITE:	CRT.DOLO.			
	74.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	77.0	DOLOMITIC SANDSTONE:	DOLO.SS			
		DOLOMITIC SANDSTONE:	DOLO.SS			
	92.0					
	96.0	CHERTY DOLOMITE:	CRT.DOLO.			
		CHERT:	CHERT			
	100.0	CHERTY DOLOMITE:	CRT.DOLO.			
	102.0	CHERTY DOLOMITE:	CRT.DOLO.			
	105 106.0	CHERTY DOLOMITE:	CRT.DOLO.			
	114.0					
	116.0	DOLOMITIC SANDSTONE:	DOLO.SS			
		CHERTY DOLOMITE:	CRT.DOLO.			
	128.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	134.0					
	136.0	SANDSTONE & CHERTY DOLOMITE:	SS/CT.DOL			
		CHERTY DOLOMITE:	CRT.DOLO.			
	140	DOLOMITIC SANDSTONE:	DOLO.SS			
	150.0					
	154.0	DOLOMITIC SANDSTONE:	DOLO.SS			
		CHERTY DOLOMITE:	CRT.DOLO.			
	162.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	164.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	174.0					
	175	CHERTY DOLOMITE:	CRT.DOLO.			
▽ 188.36	184.0	DOLOMITIC SANDSTONE:	DOLO.SS			
	190.0	CHERTY DOLOMITE:	CRT.DOLO.			
	198.0					
	200.0	CHERTY DOLOMITE:	CRT.DOLO.			
	202.0	CHERTY DOLOMITE:	CRT.DOLO.			
▽ 205.0	204.0	CHERTY DOLOMITE:	CRT.DOLO.			
		CHERTY DOLOMITE:	CRT.DOLO.			
	210 211.0	SANDSTONE:	SS			
	223.0					
		BORING TERMINATED AT 223.0'				
		NOTE: SEE LOG BH-88 FOR MORE IN-DEPTH DESCRIPTION.				
	245					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-62 (BH-88)*

DATE DRILLED 7/24/91 CONDUCTOR INSTALLED 7/20/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY DHC
CHECKED BY BJS
DRAWN BY: SAR

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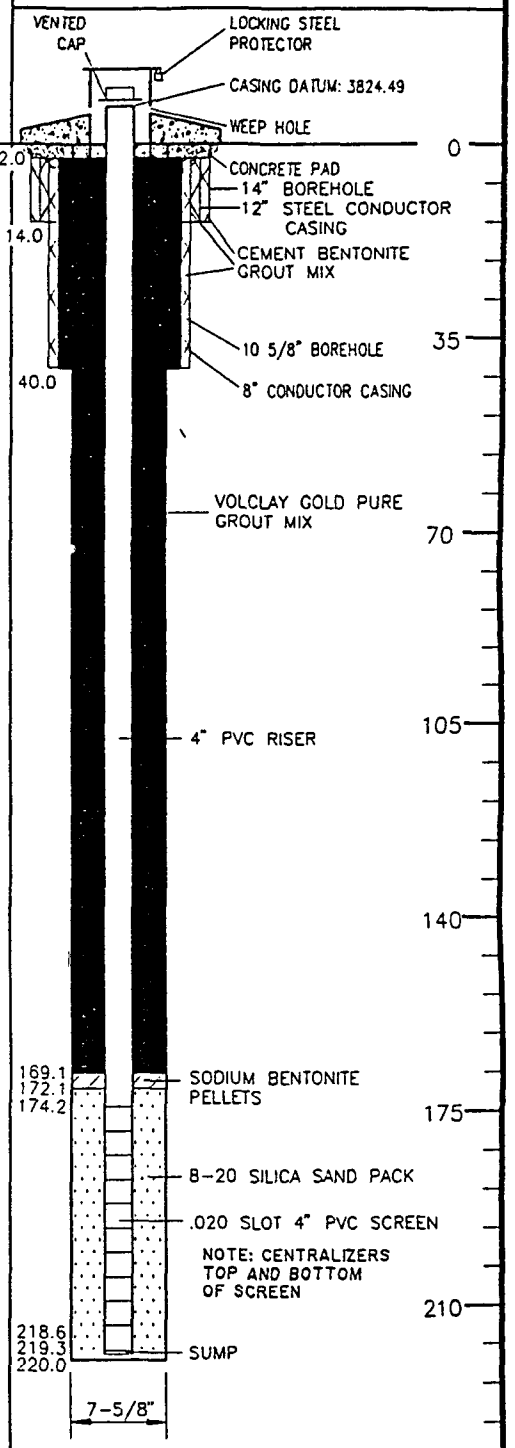
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #89 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3823.30				
	0	GRAVELLY COBBLEY SILT:	SILT			
	14.0	CHERTY DOLOMITE:	CHERTY DOLOMITE			
	20.0					
	24.0	CHERTY DOLOMITE:	CRT.DOLO.			
	24.5	SANDSTONE:	SANDSTONE			
		DOLOMITE:				
	35		DOLOMITE			
	64.0	SANDSTONE:	SANDSTONE			
	70					
	76.0	DOLOMITE:	DOLOMITE			
	88.0	SANDSTONE:	SANDSTONE			
	96.0	DOLOMITE:	DOLOMITE			
	99.0	SANDSTONE:	SANDSTONE			
	105					
	108.0	DOLOMITE:				
	140		DOLOMITE			
	175					
185.77						
	187.0	SANDSTONE:	SANDSTONE			
204.0						
	204.0	DOLOMITE:	DOLOMITE			
	209.0					
	210	SANDSTONE:	SANDSTONE			
	215.0					
	220.0	SANDY DOLOMITE:	DOLOMITE			
		BORING TERMINATED AT 220.0'				
		NOTE: SEE LOG BH-89 FOR MORE IN-DEPTH DESCRIPTION.				
	245					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *MW-63 (BH-89)*

DATE DRILLED 7/20-30/91 CONDUCTOR INSTALLED 7/20-26/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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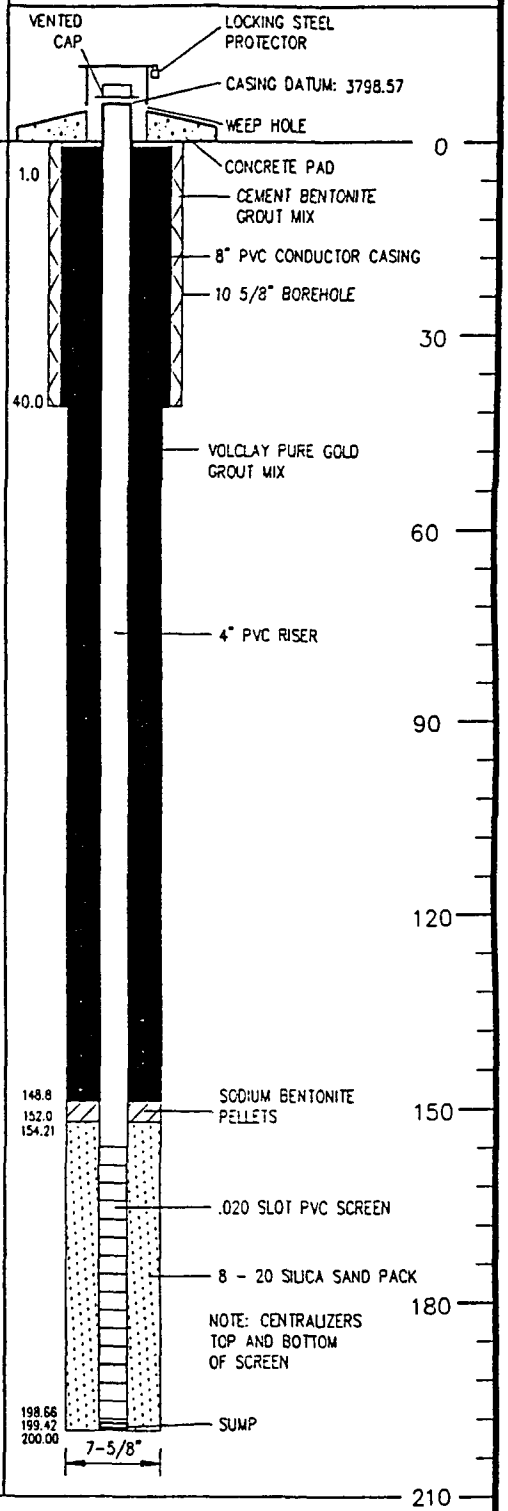
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #90 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3796.2				
	0		ML			
	2.0	SILTY SANDY LOAM:	SANDSTONE			
		SANDSTONE:				
	10.0					
	12.0	SANDSTONE:	SANDSTONE			
	14.0		SANDSTONE			
		SANDSTONE:	SANDSTONE			
	16.0		SANDSTONE			
	18.0	SANDSTONE:	SANDSTONE			
	22.0	SANDSTONE:	SANDSTONE			
	24.0		SANDSTONE			
	26.0	SANDSTONE:	SANDSTONE			
	28.0		SANDSTONE			
	30	SANDSTONE:	SANDSTONE			
		SANDSTONE:				
	36.0	SANDSTONE:	DOLOMITIC			
	40.0	SANDSTONE:	SANDSTONE			
		DOLOMITIC SANDSTONE:	SANDSTONE			
		SANDSTONE:				
	50.0	SANDSTONE:	SANDSTONE			
	59.0					
	60	DOLOMITIC CHERT:	DOLOMITIC CHERT			
	64.0	SANDY DOLOMITE:	SANDY DOLOMITE			
	70.0	SANDSTONE:	SANDSTONE			
	81.0	DOLOMITE:	DOLOMITE			
	90					
	112.0	DOLOMITIC LIMESTONE:	DOLOMITIC LIMESTONE			
	120					
	125.0	LIMESTONE:	LIMESTONE			
	130.0		LIMESTONE			
	131.0	DOLOMITIC LIMESTONE:				
		SANDSTONE:	SANDSTONE			
	144.0		SANDSTONE			
	146.0	SANDSTONE:	LIMESTONE			
		DOLOMITIC LIMESTONE:				
	150					
	151.0	SANDSTONE:	SANDSTONE			
	160.0	DOLOMITIC LIMESTONE:	DOLOMITIC LIMESTONE			
▽167.3						
▽172.0						
	180					
	200.0	T.D. 200.0'				
	210					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-64 (BH-90)*

CONDUCTOR INSTALLED 8/5/91

DATE DRILLED 8/11/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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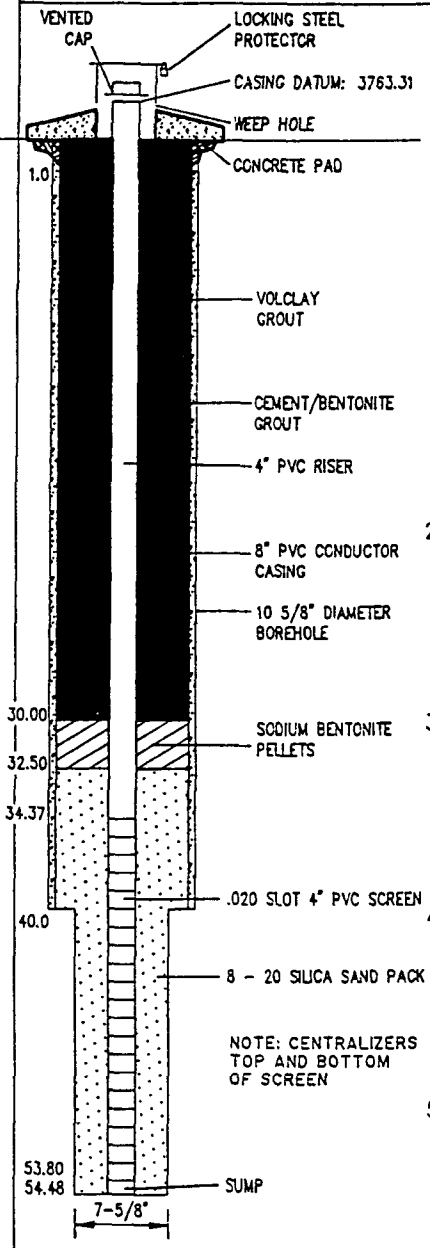
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #91 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3760.1				
	0	SANDY SILTY LOAM: 10 YR 5/6, YELLOWISH BROWN, DRY	ML		1 GC, 2 GC	
	4.0	CHERTY DOLOMITIC LIMESTONE: 10 YR 6/2, LIGHT BROWNISH GRAY, INTERBEDDED WITH CLAYEY SILTSTONE, 10 YR 6/0, LIGHT BROWNISH YELLOW, DRY	LIMESTONE/ SILTSTONE		3 GC, 4 GC, 5 GC	
	10	CHERTY DOLOMITIC LIMESTONE: 10 YR 5/3, BROWN INTERBEDDED WITH SILTSTONE, 10 YR 6/6, LIGHT BROWNISH YELLOW, DRY	LIMESTONE/ SILTSTONE		6 GC	
	12.0	CHERTY DOLOMITIC LIMESTONE: 10 YR 5/2, GRAYISH BROWN, AND CHERT, 10 YR 6/4, BROWNISH YELLOW, DRY	LIMESTONE/ CHERT		7 GC, 8 GC, 9 GC, 10 GC	
	20	CHERTY DOLOMITE: 10 YR 6/1, GRAY AND CHERT, 5 Y 7/3, PINK, DRY	CHERTY DOLOMITE		11 GC, 12 GC, 13 GC, 14 GC	
	28.0	DOLOMITE: 10 YR 7/1, LIGHT GRAY, VERY HARD, DRY	DOLOMITE		15 GC, 16 GC, 17 GC, 18 GC, 19 GC, 20 GC, 21 GC	
▽ 43.4	42.5	SANDSTONE: 5 YR 4/3, REDDISH BROWN, VERY FINE GRAIN, SOFT, MOIST TO WET	SANDSTONE		22 GC	
	44.0	CHERTY DOLOMITE: DOLOMITE, 10 YR 5/2, GRAYISH BROWN, CHERT IS 10 YR 5/6, YELLOWISH BROWN, HARD, CHERT EXHIBITS CONCHOIDAL FRACTURING, DOLOMITE – MICROCRYSTALLINE	CHERTY DOLOMITE		23 GC, 24 GC, 25 GC, 26 GC, 27 GC	
▽ 52.5	54.4	T.D. 54.4'				

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-65 (BH-91)*

		CONDUCTOR INSTALLED
DATE DRILLED	8/12/91	8/8/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	JMB	
CHECKED BY	BJS	
DRAWN BY:	SAR	

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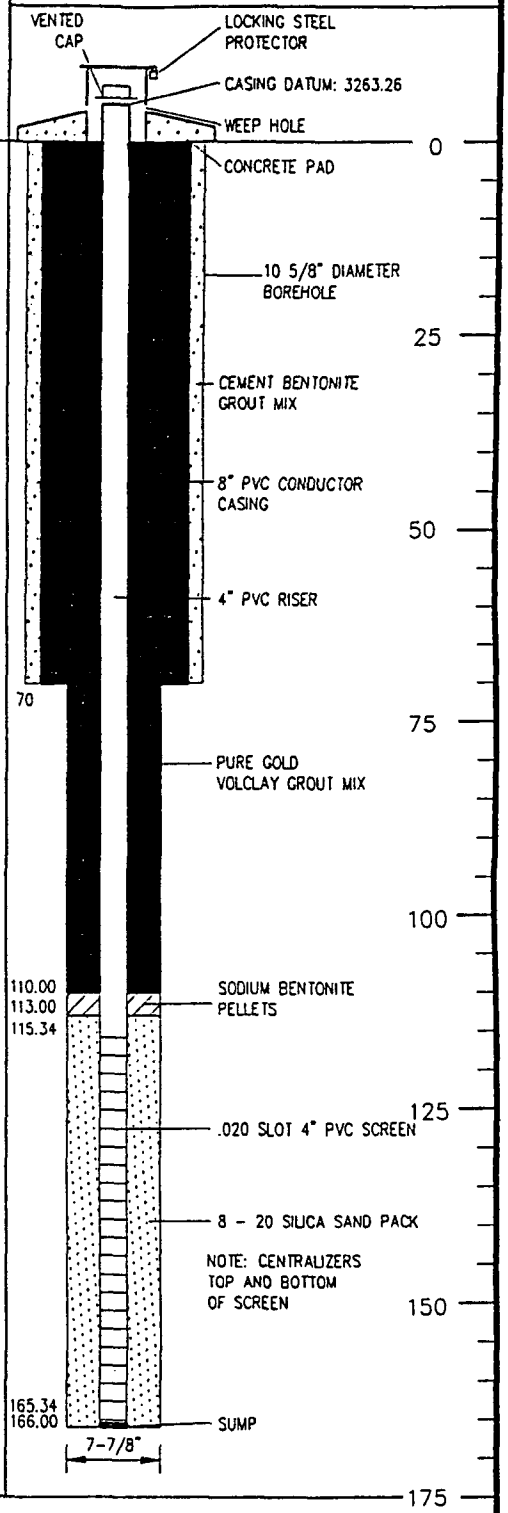
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #91A FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3760.7				
	0	SANDY SILTY LOAM:	ML		1	2
	4.0	CHERTY DOLOMITIC LIMESTONE:	LIMESTONE		3	4
	10.0	CHERTY DOLOMITIC LIMESTONE:	LIMESTONE		5	6
	12.0	CHERTY DOLOMITIC LIMESTONE:	LIMESTONE		7	8
					9	10
	20.0	CHERTY DOLOMITE:	DOLOMITE		11	12
	25				13	14
	28.0	DOLOMITE:	DOLOMITE		15	16
					17	18
					19	20
	42.5	SANDSTONE:	SANDSTONE		21	22
	44.0	CHERTY DOLOMITE:	DOLOMITE		23	24
	50				25	26
	54.0	DOLOMITE:	DOLOMITE		27	28
	58.0	CHERTY DOLOMITE:	CHERTY DOLOMITE		29	30
					31	32
	66.0	DOLOMITE:	DOLOMITE		33	34
	70.0	DOLOMITE:	DOLOMITE		35	36
	75				37	38
	76.0	CHERTY DOLOMITE:	CHERTY DOLOMITE		39	40
	82.0	DOLOMITE:	DOLOMITE		41	42
					43	44
	90.0	DOLOMITE:	DOLOMITE		45	46
					47	48
					49	50
	100				51	52
					53	54
					55	56
	112.0	DOLOMITE:	DOLOMITE		57	58
	118.0	DOLOMITE:	DOLOMITE		59	60
	122.0	DOLOMITE:	DOLOMITE		61	62
	125				63	64
130.77 ▽					65	66
134.50 ▽					67	68
	134.0	SANDSTONE:	SANDSTONE		69	70
					71	72
	146.0	NO SAMPLE RETURN FROM 146'-166' DRILLED LIKE SANDSTONE	SANDSTONE ?		73	
	150					
	166.0	T.D. 166.0'				
	175					

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-65A (BH-91A)*

		CONDUCTOR INSTALLED
DATE DRILLED	8/16/91	8/12/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	KMH	
CHECKED BY	BJS	
DRAWN BY:	BDR	PAGE 1 OF 1

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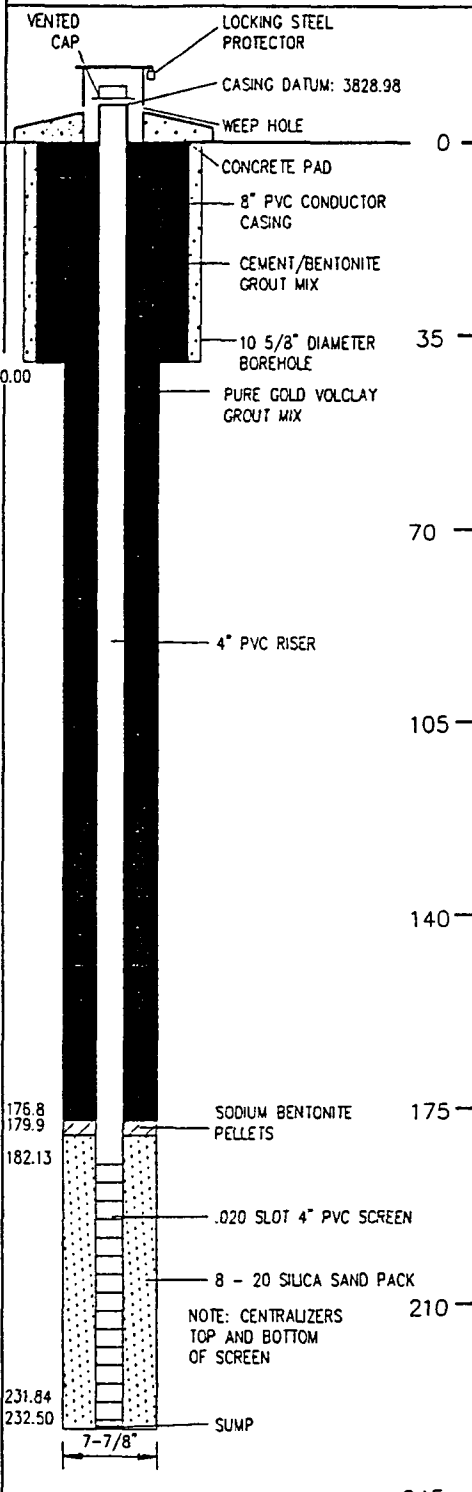
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD # 92 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3826.3	SOIL
	0		SS/LS
	0.2	TOP SOIL	
	2.0	SANDSTONE/ LIMESTONE:	SS/DOL
	6.0	SANDSTONE/ DOLOMITE:	DOLOMITE
		DOLOMITE:	
	20.0	SANDSTONE:	SANDSTONE
	35		
	70	SANDSTONE:	SANDSTONE
	76.0		DOLOMITE
	78.0	DOLOMITE:	SANDSTONE
		SANDSTONE / DOLOMITE:	DOLOMITE
	105	SANDSTONE:	SANDSTONE
	112.0	SANDSTONE:	SANDSTONE
	120.0	DOLOMITE:	DOLOMITE
	125.0	SANDSTONE:	SANDSTONE
	140		
	148.0	SANDSTONE:	SANDSTONE
	158.0	DOLOMITE:	DOLOMITE
	175		
▽202.0	202.0	SANDSTONE:	SANDSTONE
▽208.0	205.0	DOLOMITE:	DOLOMITE
	210		
	232.5	T.D. 232.5'	
	245		

GRAPHIC LOG / SAMPLE INTERVAL / "N" VALUE



CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-66 (BH-92)*

		CONDUCTOR INSTALLED
DATE DRILLED	8/18/91	8/18/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS	
LOGGED BY	TPG	
CHECKED BY	BJS	
DRAWN BY:	BDR	

PAGE 1 OF 1

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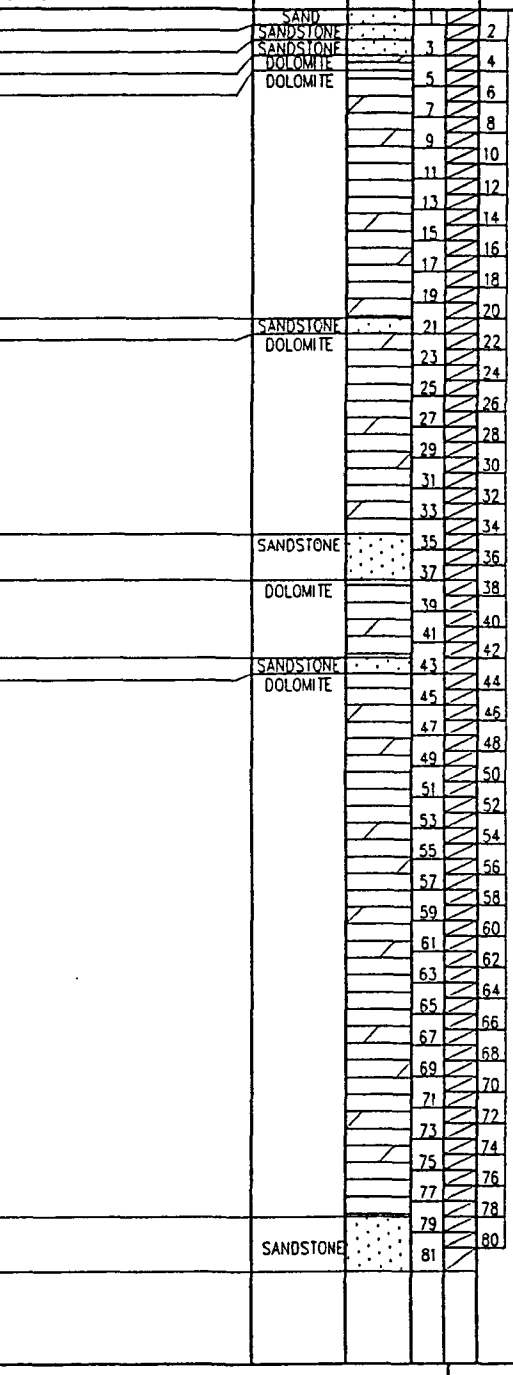
WELL COMPLETION RECORD

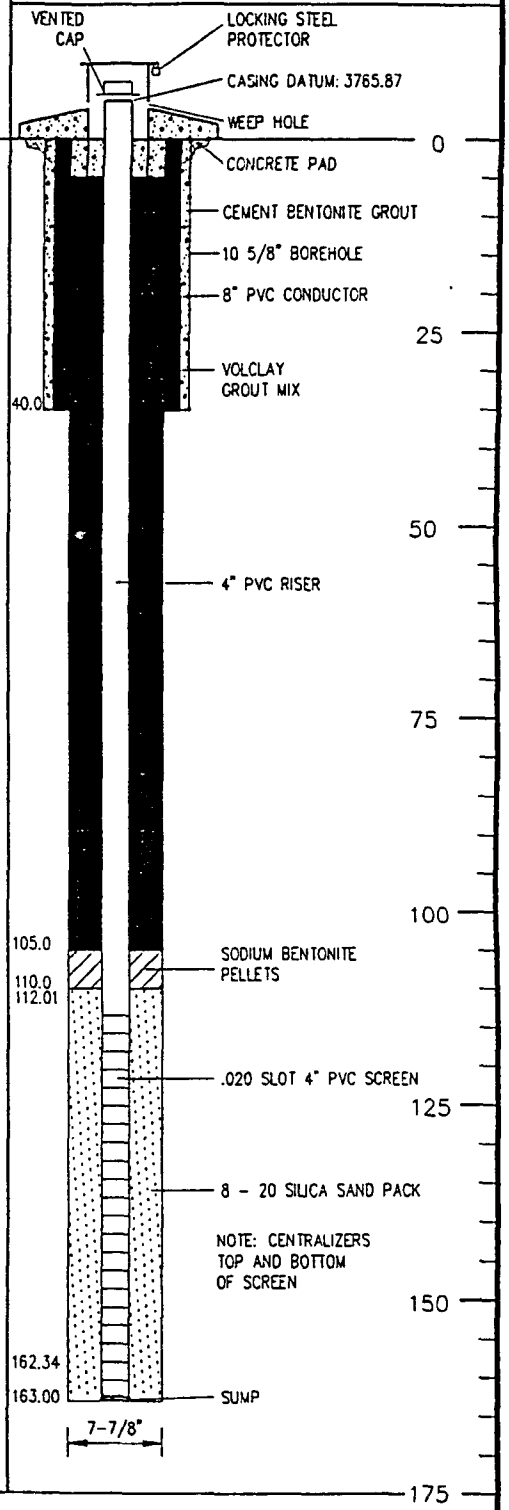
GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD #93 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3763.1	
	0		
	2.0	SAND:	SAND
	4.0	SANDSTONE:	SANDSTONE
	6.0	SANDSTONE:	SANDSTONE
	8.0	DOLOMITE:	DOLOMITE
		DOLOMITE:	DOLOMITE
	25		
	40.0		
	42.0	SANDSTONE:	SANDSTONE
		DOLOMITE:	DOLOMITE
	50		
	68.0	SANDSTONE:	SANDSTONE
	74.0	DOLOMITE:	DOLOMITE
	75		
	84.0		
	86.0	SANDSTONE:	SANDSTONE
		DOLOMITE:	DOLOMITE
	100		
	125		
▽131.14			
▽136.0			
	150		
	156.0	SANDSTONE	SANDSTONE
	163.0	T.D. 163.0'	
	175		

GRAPHIC LOG

SAMPLE INTERVAL / "N" VALUE



WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-67 (BH-93)*

CONDUCTOR INSTALLED 8/19/91

DATE DRILLED 8/23/91

DRILLING METHOD AIR HAMMER

DRILLED BY BOYLES BROS.

LOGGED BY TPG

CHECKED BY BJS

DRAWN BY: BDR

PAGE 1 OF 1

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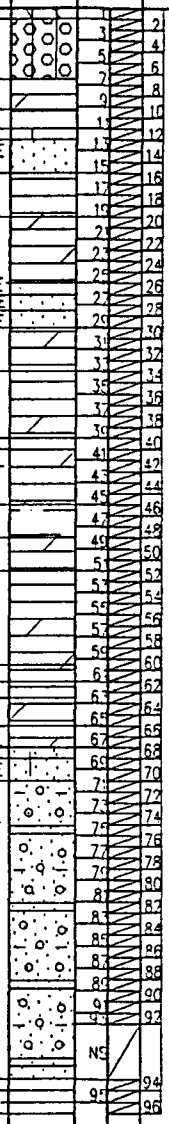
WELL COMPLETION RECORD

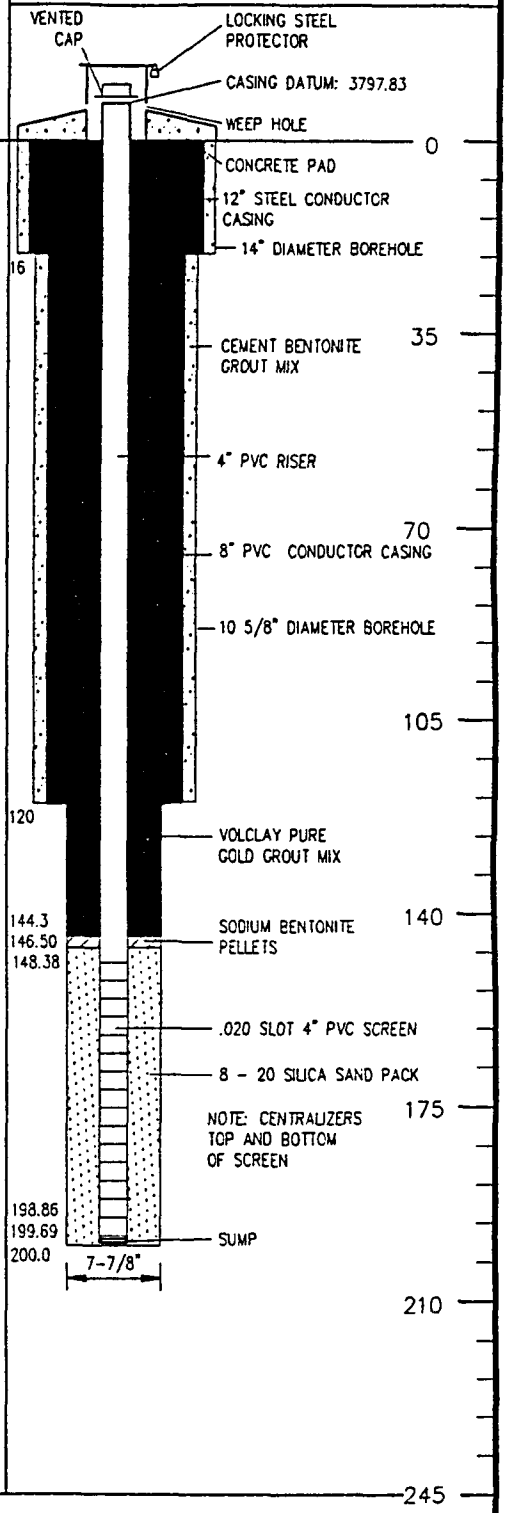
GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD #94 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3794.4	
	0 4.2	CLAYEY SILT	ML
		GRAVELLY COBBLELY SILT:	GM
	13.0	DOLOMITE:	DOLOMITE
▽ 18.0	20.0	DOLOMITE:	DOLOMITE
▽ 24.5	22.0	SILTY SANDSTONE:	SILTY SANDSTONE
	24.0	SANDSTONE:	
	30.0	DOLOMITE:	DOLOMITE
	35 38.0	DOLOMITE:	DOLOMITE
	50.0		
	52.0	SANDSTONE:	SANDSTONE
	55.0	SANDSTONE:	SANDSTONE
	58.0	SANDSTONE:	SANDSTONE
		DOLOMITE:	DOLOMITE
	66.0	DOLOMITE:	DOLOMITE
	70		
	78.0	DOLOMITIC SANDSTONE:	DOL/SS
	80.0	SANDY DOLOMITE:	SANDY/DOL
	90.0	SILTSTONE:	SILTSTONE
	96.0	CHERTY DOLOMITE:	CHT/DOL
	102.0	DOLOMITE:	DOLOMITE
	105		
	120.0		
	122.0	DOLOMITE:	DOLOMITE
	126.0	CHERTY DOLOMITE:	CHT/DOL
	130.0	DOLOMITE:	DOLOMITE
	134.0	DOLOMITE:	DOLOMITE
	136.0	SILTY SANDSTONE:	SANDSTONE
	140	SILTY SANDSTONE:	SANDSTONE
		CONGLOMERATE	CLAY/SILT
			CONGLOMERATE
▽ 162.47			
▽ 174.0	175		
▽ 197.0	194.0		
	196.0	DOLOMITE:	DOLOMITE
	198.0	DOLOMITE	DOLOMITE
	200.0	DOLOMITIC SANDSTONE:	SANDSTONE
	210	TOTAL DEPTH 200.0 FT	
	245		

GRAPHIC LOG



SAMPLE INTERVAL	"N" VALUE
1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34
35	36
37	38
39	40
41	42
43	44
45	46
47	48
49	50
51	52
53	54
55	56
57	58
59	60
61	62
63	64
65	66
67	68
69	70
71	72
73	74
75	76
77	78
79	80
81	82
83	84
85	86
87	88
89	90
91	92
NS	
93	94
95	96

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-68 (BH-94)*

		CONDUCTOR INSTALLED
DATE DRILLED	8/31/91	8/24/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	TPG	
CHECKED BY	BJS	
DRAWN BY:	BDR	

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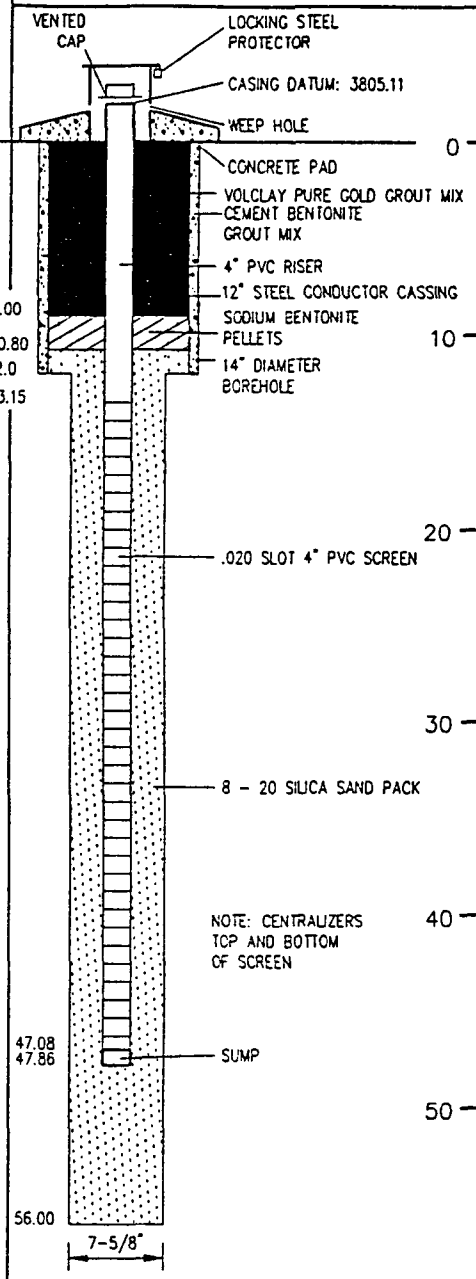
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD #95 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3801.7				
	0	SANDY SILT:	ML		1, 2, 3	
	6.0	SANDSTONE:	SANDSTONE		4	
	8.0	DOLOMITE:	DOLOMITE		5, 6, 7, 8, 9, 10	
▽21.61	20	DOLOMITE:	DOLOMITE		11, 12	
	24.0	DOLOMITE:	DOLOMITE		13	
	26.0	DOLOMITE:	DOLOMITE		14	
	28.0	SANDSTONE:	SANDSTONE		15, 16	
	32.0	SILTSTONE:	SILTSTONE		17	
	34.0	SILTY SANDSTONE:	SILTY SANDSTONE		18	
	36.0	SILTSTONE:	SILTSTONE		19, 20	
▽42.0	40	DOLOMITE:	DOLOMITE		21, 22, 23, 24, 25, 26	
	52.0	DOLOMITE:	DOLOMITE		27, 28	
	56.0	T.D. 56.0'				
	60					
	70					

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER

STANDARD PENETRATION TEST

UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-69 (BH-95)*

		CONDUCTOR INSTALLED
DATE DRILLED	8/30/91	8/25/91
DRILLING METHOD	AIR HAMMER	
DRILLED BY	BOYLES BROS.	
LOGGED BY	TPG/DHC	
CHECKED BY	BJS	
DRAWN BY:	BDR	

PAGE 1 OF 1

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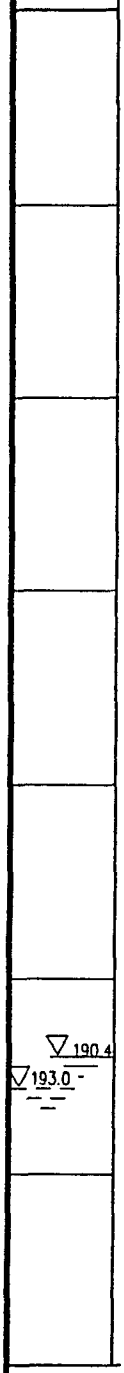
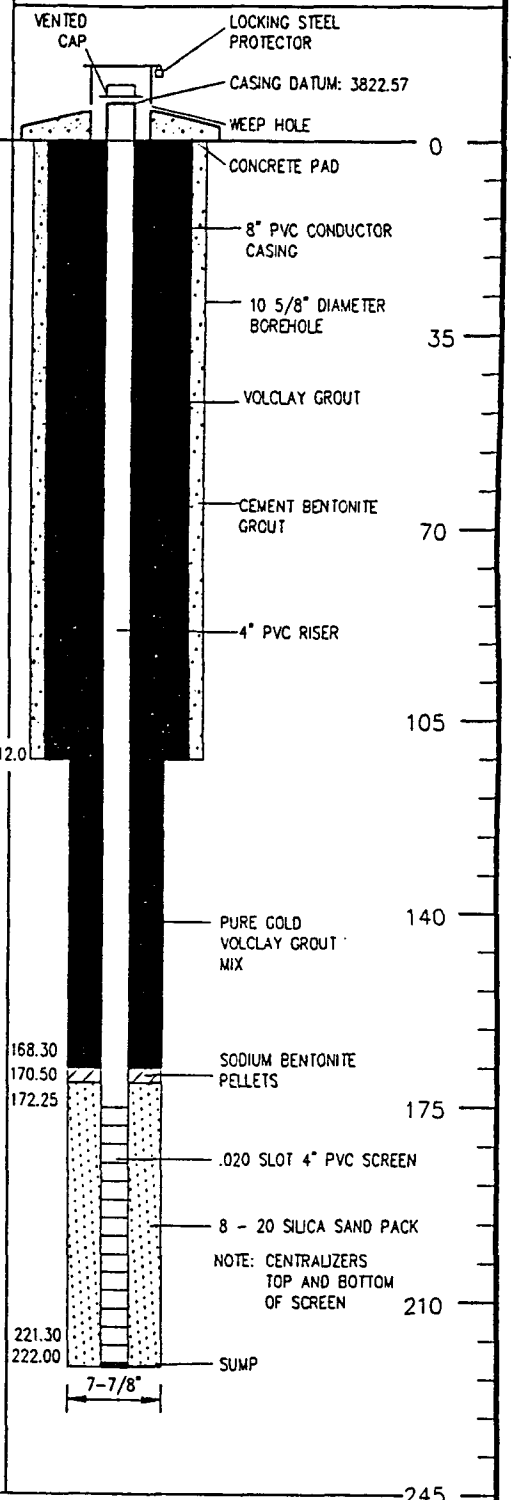
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		NOTE: SEE BORING RECORD #97 FOR MORE DETAILED LITHOLOGIC DESCRIPTION	
		GROUND SURFACE: 3919.5	
	0	COBBLES:	COBBLES
	6.0	DOLOMITE:	DOLOMITE
	18.0	DOLOMITE:	DOLOMITE
	24.0	SANDY DOLOMITE:	SANDY DOLOMITE
	34.0	DOLOMITE:	DOLOMITE
	46.0	CHERTY DOLOMITE:	CHERTY DOLOMITE
	59.0	SANDSTONE:	SANDSTONE
	62.0	DOLOMITE:	DOLOMITE
	74.0	DOLOMITE:	DOLOMITE
	120.0	SANDSTONE:	SANDSTONE
	222.0	T.D. 222.0'	

GRAPHIC LOG / SAMPLE INTERVAL / "N" VALUE



WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *MW-70 (BH-97)*

DATE DRILLED 9/12/91 CONDUCTOR INSTALLED 9/11/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY KMH
CHECKED BY BJS
DRAWN BY: BDR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 4.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3821.90								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	CLAYEY SILT: 10% CLAY, 90% 7.5YR 6/4, UNCONSOLIDATED, DRY	CL			NS			3.0	HOLLOW STEM AUGERING TO 6.0 FEET
	3.5	SILTSTONE: 2.5YR 8/1, WHITE, HARD, DRY	SILTSTONE			1	0.0	0.6	3.6	
						NR			4.0	
						NS			5.0	
	5					2	0.0	0.9	5.9	
	6.0	SANDY DOLOMITE: VERY FINE GRAIN SILICA SAND, 10YR 7/1, LIGHT GRAY, VERY HARD, FRACTURED, DRY	SANDY DOLOMITE			NR			6.0	
						3	4.0	0.9	6.9	
						NS			8.0	
	8.0	SANDSTONE: VERY FINE GRAIN SILICA, WELL SORTED, HARD, MOIST, 10YR 7/2, LIGHT GRAY, MASSIVE, MINOR IRON OXIDE MOTTLING, FRACTURES (HORIZONTAL) AT 8.1,.8.8,9.7,10, & 10.3 FEET, SANDY DOLOMITE INTERBEDDED AT 10.3' TO 10.6', FRACTURES AT 6.2, 9.0, 10.2, 11.7, 12.9, 13.4, 13.9, 15.9 SANDSTONE VERY MOIST AFTER 12.6'	SANDSTONE			4	0.0	10.8 NX	10.0	
	10					5	0.0		12.0	
						6	0.0		14.0	
▽14.9	15					7	0.0		16.0	
						8	82		18.8	
						NR			19.5	
	20	VARYING DEGREES OF CARBONATE CEMENTATION				9	9	10.0 NX	21.5	
		AFTER 2,2,.0', 10YR 5/2, GRAY BROWN, NO CARBONATE CEMENTATION, MODERATELY HARD, FRACTURES AT 17.7, 18.8, 20.5, 20.9, 24.5 FEET				10	0.0		23.5	
	25					11	0.0		25.5	
		27.0' TO 27.3', 2.5YR 7/4, PALE YELLOW				12	47		27.5	
						13	0.0		29.5	
	30	2.5YR GRAY BROWN AFTER 30', FRACTURES AT 29.7, 29.8, 29.9, 30.1, 30.2, 30.4, 30.6, 31.0, 32.2, 31.5, 31.9, 32.3, 32.5, 33.1, 33.5, 33.9, 34.1, 34.5, 34.9, 35.5, 36.6, 37.2, 37.5, 37.9, CALCITE AND IRON OXIDE FRACTURE, FILL AFTER 34.0'				14	0.0	10.0 NX	31.5	
						15	0.0		33.5	
	35					16	0.0		35.5	

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-80 (MW-54)*

DATE DRILLED 6/16/91 TO 6/21/91
DRILLING METHOD HSA\WATER CORE
DRILLED BY SHB/BOYLES BROS.
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
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ENVIRONMENTAL CONSULTANTS
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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 4.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3821.90								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35	AFTER 35.1', MODERATELY WELL CEMENTED, ABUNDANT FRACTURES – EVERY .2 FEET	SANDSTONE			16	0.0	NX	35.5	35
PVC CONDUCTOR CASING SET AT 37.85'		AFTER 36.0', 2.5YR 6/2 LIGHT BROWN GRAY TO 2.5YR 6/4 LIGHT YELLOW BROWN IRON OXIDE STAINING, MOIST MOD. WELL CEMENTED AFTER 38.8', 2.5 YR 4/2 DARK GRAY BROWN GRADING INTO 10YR 3/1 VERY DARK GRAY, VERY FINE GRAIN SANDSTONE BETWEEN 42.5' AND 43.5', VERY FIN,E GRAIN, SILTY SANDSTONE, 5YR 4/1, DARK GRAY				17	4.6		37.5	
						18	0.0		38.8	
						NR			39.5	
	40					19	0.0	5.0 NX	41.5	40
▽ 42.86						20	0.0		43.5	
						21	0.0		44.5	
	45					NR			46.1	45
		SANDSTONE: VERY FINE GRAIN, 10YR 5/1, GRAY TO 10YR 3/1, VERY DARK GRAY, VERY HARD, MODERATELY FRACTURED, AFTER 47.0' 2.5YR 7/0, LIGHT GRAY, MOTTLED WITH 10 YR 6/3, PALE BROWN, SLIGHTLY DOLOMITIC AFTER 50.7', BETWEEN 54.8' AND 55' 5YR 4/1 DARK GRAY	SANDSTONE			22	1.0	10.0 NX	48.0	
						23	1.0		50.0	
	50					24	7.2		52.0	50
		CONTINUING ALTERNATING BANDS OF 10 YR 5/1 GRAY AND 2.5YR 7/6, LIGHT GRAY MOTTLED WITH 10YR 6/3, PALE BROWN				25	39		54.0	
	55					26	4.6		56.0	55
						27	1.0	10.0 NX	58.0	
						28	0.0		60.0	
	60					29	7.0		62.0	60
		BETWEEN 62.6' AND 62.7', SILTY SANDSTONE, 5YR 5/2, OLIVE GRAY, HIGHLY WEATHERED				30	3.3		64.0	
	65					31	3.3		66.0	65
						32	1.0	10.0 NX	68.0	
						33	58		70.0	
	70									70

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-80 (MW-54)*

DATE DRILLED 6/16/91 TO 6/21/91
DRILLING METHOD HSA\WATER CORE
DRILLED BY SHB/BOYLES BROS.
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 4.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3821.90								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	70	SAME AS ABOVE	SAND-STONE			34	3.0	NX	72.0	70
	72.0	DOLOMITE: GRADATIONAL CONTACT WITH SANDSTONE, 5YR 5/1, GRAY, VERY HARD, HORIZONTAL FRACTURES AT 72.6, 73, 73.3, 73.4, 74.7, 75.0, STRONG CONDENSATE ODOR AT 76.0'	DOLOMITE			*			74.0	
	75					*			76.0	75
		T.D. 76.19 WATER LEVEL AFTER DRILLING 14.90'								
	80	* SAMPLES BROKEN PRIOR TO OVM UNABLE TO NOTE WATER LEVEL DUE TO WATER ROTARY DRILLING METHOD BOREHOLE DRY AT 46.1 FEET ON 6/18/91								80
	85									85
	90									90
	95									95
	100									100
	105									105

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)
. k: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-80 (MW-54)*

DATE DRILLED 6/16/91 TO 6/21/91
DRILLING METHOD HSA\WATER CORE
DRILLED BY SHB/BYLES BROS
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 18.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3792.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SILT: WELL GRADED, VERY FINE GRAIN, 90% SILT, 10% SAND, NO PLASTICITY, 10YR 8/4, VERY PALE BROWN, NO ODOR, DRY, SOFT, NON-STARATIFIED, CALCITE CEMENT, HCL(+)	ML			1	0.0	GC	2	
						NS			5	
	5	-COLOR CHANGE TO 10YR 6/8, BROWNISH YELLOW				2	0.0	GC	6	
		SANDSTONE: VERY FINE GRAINED SILICA, 10YR 6/3, PALE BROWN, 10YR 5/3, BROWN, MIDERATELY HARD TO VERY HARD SLIGHTLY MOIST, WEATHERED, MOIST AND FRIABLE BETWEEN 18.5 AND 21.5', AFTER 21.5' VERY HARD, FRACTURES LARGELY CEMENTED, FRACTURES AT 15.2, 16.0, 16.8, 17.2, 17.5, 18.5, 19.7, 20.0, 20.8, 21-21.5, 23.3, 24.0, NO ODOR	SANDSTONE			3	0.0	GC	7	
						4	0.0	GC	8	
	10	12" CONDUCTOR TO 11 FEET				5	0.0	GC	10	AIR ROTARY
						6	7.3	GC	13	
						NS			15	
15.90 ▽	15					7	1.9	NX	17	NX ROTARY WASH CORE
						8	0.0		19	
	20					9	0.0	10	21	
23.39 ▽						10	0.0		23	
						11	0.0		25	
	25					12	13	NX	27	
						13	20		29	
	30					14	9.9	10	31	
	30.5	SANDY DOLOMITE: VERY FINE SAND, 10 YR 6/1, LIGHT GRAY TO GRAY, VERY HARD	SANDY DOLOMITE							
	31.5	DOLOMITE: MICROCRYSTALLINE, 2.5YR 6/2, LT BROWN GRAY, VERY HARD, FRACTURES AT 31.6, 32.1, 32.2, 32.5-33.5, 33.8, 33.9, 35.1, 35.7 FEET	DOLOMITE			15	0.0		33	
						16	0.0		35	
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-81 (MW-55)*

DATE DRILLED 6/15/91 TO 6/21/91
DRILLING METHOD AIR ROTARY\WATER CORE
DRILLED BY SHB/ BOYLES BROS.
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 18.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3792.6								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35	32.1 TO 32.2 FEET FRIABLE, SANDSTONE INTERBED, 5 YR 5/3 OLIVE, MOIST, IRON OXIDE AND PYRITE ALONG FRACTURES BELOW 33' AFTER 34.3', VERY HARD, FRACTURES LARGELY CEMENTED AFTER 35', GRADES	DOLOMITIC SANDSTONE			11	3.3	10	37.0	35
						12	16.5	NX	39.0	
	39.6 40	DOLOMITIC SANDSTONE: VERY FINE GRAIN SAND, GRADATIONAL CONTACT WITH DOLOMITE, VERY HARD 10YR 6/1 LIGHT GRAY-GRAY 10YR 5/2 GRAY BROWN 38.9' TO 39.6', FRACTURES 36.7', 37.8', 38.8', 42.4', 43.8', 44, 44.7'	SANDSTONE			13	84		41.0	40
		SANDSTONE: VERY FINE GRAIN SILICA SAND, 2,.5YR 6/2, LIGHT BROWN GRAY, VERY HARD BETWEEN 6.9 AND 7.4 FEET, 10YR 4/1, DARK GRAY ZONE, SILTSTONE INTERBED BETWEEN 42.6 AND 43.4 FEET, HIGHLY FRIABLE AND WEATHERED, 2.5YR 4/2, DARK GRAY BROWN BETWEEN 43.4 AND 44.4 FEET DOLOMITIC				14	15.2		43.0	
						15	9.0		45.0	
	45 46.2	SANDSTONE: VERY FINE GRAINED, 10YR 6/1, LIGHT GRAY TO GRAY AFTER 44.4 FEET SANDSTONE: VERY FINE GRAIN 5YR 4/1, DARK GRAY, MODERATELY HARD, 5YR 4/1, DARK GRAY 45 TO 46.1 FEET	DOLOMITIC SANDSTONE			16	44	10 NX	47.0	45
						17	9.9		49.0	
	50	DOLOMITIC SANDSTONE: VERY FINE GRAIN, 7.5YR 7/0, LIGHT GRAY, VERY HARD, HORIZONTAL FRACTURES AT 44.1'	SANDY DOLOMITE			18	78		51.0	50
		SANDY DOLOMITE: VERY FINE GRAIN 10YR 6/2, LIGHT BROWN GRAY, VERY HARD, HORIZONTAL FRACTURES AT 49.9', 51.9', 52.7', 53.5', 53.7', 45' FRACTURE AT 49.9', VERTICAL FRACTURE AT 44.2' TO 55.0', PYRITE, CALCITE AND HEMA-TITE FRACTURE FILL, STRONG				19	7.0		53.0	
						20	362		55.0	
	55	CONDENSATE ODOR AFTER 53.0'	DOLOMITE			21	4.0	10	57.0	55
		DOLOMITE: 10YR 6/2, LIGHT BROWN GRAY, HIGHLY FRACTURED WITH THIN INTERBEDS OF DOLOMITIC SILTSTONE AND SANDSTONE, STRONG CONDENSATE ODOR				22	7.2	NX	59.0	
	60					23	3.0		61.0	60
						24	1.0		63.0	
						25	36		65.0	
	65	T.D. 65.0' NOTE: UNABLE TO DETERMINE WATER LEVEL DURING DRILLING, DUE TO ROTARY WASH CORE DRILLING METHOD. AIR ROTARY 0-15' NX ROTARY WASH CORE 15-65'								65
	70									70

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-81 (MW-55)*

DATE DRILLED 6/15/91 TO 6/21/91
DRILLING METHOD AIR ROTARY\WATER CORE
DRILLED BY SHB/BOYLES BROS.
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
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ENVIRONMENTAL CONSULTANTS
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(405) 321-3895

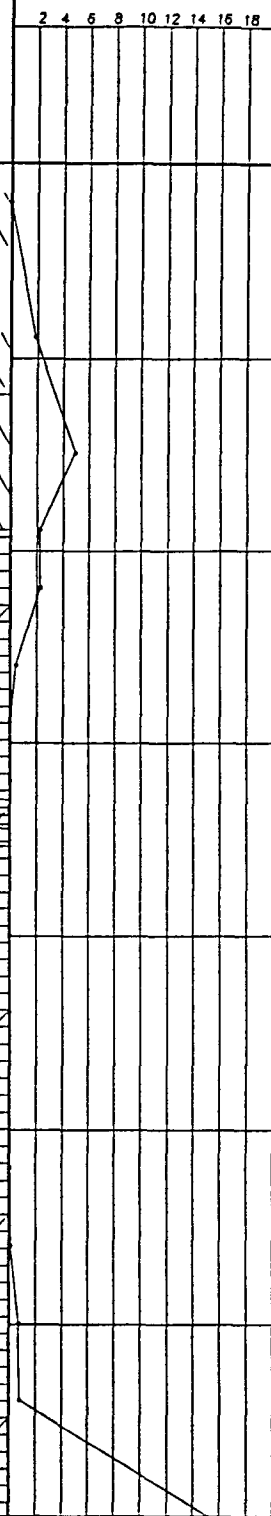
BORING RECORD

GROUND SURFACE: 3780.30

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
	0	CLAYEY SILT: 20% CLAY, 80% SILT, 10YR 5/3, BROWN, DRY, UNCONSOLIDATED, LOW PLASTICITY	ML
	6.0	SILTY CLAY: 30% SILT, 70% CLAY, 10 YR 5/3 BROWN, SOFT, MEDIUM PLASTICITY, MINOR SUBANGULAR DOLOMITE GRAVEL TO 1/4 INCH, MINOR DOLOMITE COBBLES TO APPROXIMATELY 3 INCHES	CL
	9.5	DOLOMITE: 10YR 4/1, DARK GRAY TO 10YR 6/1, GRAY TO LIGHT GRAY, DRY, HARD VERTICAL FRACTURE BETWEEN 16.2-17.0' MODERATELY FRACTURED BELOW 17.0'	DOLOMITE
	17.7	DOLOMITE: WITH INTERBEDS OF SILTY DOLOMITE 10YR 5/2, GRAYISH BROWN, 10YR 6/2, LIGHT BROWNISH GRAY, AND 10YR 5/1, GRAY, ABUNDANT HEMATITE-REPLACED FOSSILS - POSSIBLY GRAPTOLITES OR SPONGE SPICULES, AFTER 21.0', CHERT-LIKE CONCOIDAL FRACTURING	DOLOMITE/ SILTY DOLOMITE
▽29.65	25	DOLOMITE: 10YR 5/2, GRAYISH BROWN, MICRO-CRYSTALLINE, VERY HARD, HIGHLY FRACTURED, 2.5YR 6/2, LIGHT BROWNISH GRAY, SILT ALONG HORIZONTAL FRACTURES, MINOR IRON OXIDE STAINING	DOLOMITE
6/21/91 ▽32.75	30	STRONG CONDENSATE ODOR IN FRACTURE AT 32.8' IN FRACTURE 45° FROM VERTICAL	
	35		

GRAPHIC LOG

OVM SOIL GAS PPM X 11.2



SAMPLE

NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	2.0
NS			4.0
2	20.0	GC	5.0
NS			7.0
3	55.0	GC	8.0
NS			9.0
4	25.0	GC	10.0
5	25.3	GC	12.0
6	5.0	GC	14.0
7	0.0	GC	15.0
8	0.0	8.0 NX	17.0
9	0.0		19.0
10	0.0		21.0
11	0.0		23.0
NR			25.0
12	1.0	9.0 NX	27.0
13	1.7		29.0
14	8.0		31.0
15	9.0		33.0
16	--		34.0
NR			35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

AIR ROTARY

ROTARY WASH CORE

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLE
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-82 (MW-56)*

DATE DRILLED 6/15/91 TO 6/19/91
DRILLING METHOD AIR FOTARY/WATER WASH CORE
DRILLED BY BOYLES BROS & SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 11.2 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3780.30								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35	STRONG CONDENSATE ODOR IN FRACTURES TO 35.6'	DOLOMITE			17	224.0	6.0 NX	37.0	35
						18	0.0		39.0	
	40	AFTER 35.6', FRACTURES LARGELY CEMENTED				19	0.0		41.0	40
	41.6	T.D. 41.6'				NS			41.6	
		GROUNDWATER AT 32.75' 1/8" FLOATING PRODUCT STRONG CONDENSATE ODOR 6/21/91								
	45									45
	50									50
	55									55
	60									60
	65									65
	70									70

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-82 (MW-56)*

DATE DRILLED 6/15/91 TO 6/19/91
DRILLING METHOD AIR ROTARY/WATER WASH CORE
DRILLED BY BOYLES BROS & SHB
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

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GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 48.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3785.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SANDY SILT: VERY FINE GRAIN SAND, 20% SAND, 80% SILT, LOOSE, UNCONSOLIDATED, MASSIVE, 7.5YR 5/4, BROWN, DRY	SM			1	--	GC	1.0	HSA
	2.0					NS			2.1	
		SANDY DOLOMITE: VERY FINE TO FINE GRAIN SILICA SAND, 10YR 6/2, LIGHT BROWNISH GRAY TO 7.5YR 6/2, PINKISH GRAY, VERY HARD, DRY, PITTED, HEMATITE AND CALCITE FRACTURE FILL ~10% PRIMARY POROSITY HORIZONTAL FRACTURES AT 2.3',2.5',2.6',2.9',3.1',3.3',3.7',4.0',4.1',4.5', 5.0',5.4', VERTICAL FRACTURES AT 3.3–4.0', CHERTY AFTER 7.0', 7.3–7.5', SILTSTONE, 10YR 5/2, GRAYISH BROWN, HIGHLY WEATHERED, FIRM, VERY MOIST, IRON OXIDE STAINING, HORIZONTAL FRACTURES AT 9.4',9.8',10.0',10.2', AND 10.7', MINOR VERTICAL FRACTURES	SANDY DOLOMITE			NS			3.1	ROTARY WASH CORE TO 38.0'
						2	0.0	3.9 NX	5.0	
	5					3	0.0		7.0	
						4	0.0	2.0 NX	9.0	
						NR			10.0	
	10	DOLOMITE/SILTSTONE/CHERT: INTERBEDDED, VERY HARD, 10YR 6/2, LIGHT BROWNISH GRAY, 10YR 7/2, LIGHT GRAY AND 7.5YR 7/2, PINKISH GRAY, MODERATELY FRACTURED, POSSIBLE CHLORITE ALONG FRACTURE AT 11.2', CONCOIDAL FRACTURE IN CHERT	SILTSTONE/ DOLOMITE/ CHERT			5	0.0	9.5 NX	12.0	
						6	0.0		14.0	
	15					7	0.0		16.0	
7/18/91 ▽ 18.5'						8	0.0		18.0	
						9	0.0		19.5	
						NR			20.0	
	20	DOLOMITE: MICROCRYSTALLINE, 10YR 5/2, GRAYISH BROWN, 10YR 5/1, GRAY AND 10YR 4/1, DARK GRAY, VERY HARD, UNSATURATED, VERY LOW PRIMARY POROSITY, HORIZONTAL FRACTURES AT 20.3',20.8',21.6',22.0',22.4',25.0', 27.2',28.0',28.5',28.8',29.2',29.7', MINOR IRON OXIDE STAINING IN FRACTURES, ALSO 10YR 3/1, DARK GRAY ALONG PARTINGS	DOLOMITE			NS		0.0 NX		
	25									
6/17/91 ▽ 29.52'									30.0	
	30	HIGHLY FRACTURED AFTER 30.5–32.6' SOLUTION CAVITY @ 31.0'				10	0.0	8.0 NX	32.0	
						11	0.0		34.0	
		10YR 6/3, PALE BROWN, MINOR POSSIBLE CHORLITE AND HEMATITE ALONG FRACTURES				12	0.0		35.0	
	35									

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-83 (MW-57)*

DATE DRILLED 6/17/91 – 6/25/91
DRILLING METHOD HSA, ROTARY WASH CORE/ AIR ROTATY
DRILLED BY SHB / BOYLES BROS.
LOGGED BY WEP/GHR
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
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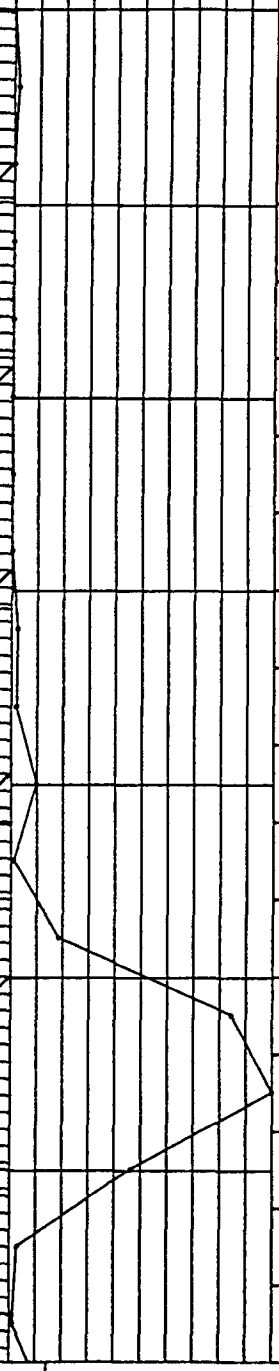
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3785.80	
	35	DOLOMITE: 10YR 6/2, LIGHT BROWNISH GRAY, SLIGHT ODOR, DRY, DENSE, THIN SILTSTONE LAYERS, HCl (+) ON SCRATCHING	DOLOMITE
6/20/91 ▽ 41.7'	40	DOLOMITE: INTERBEDDED WITH SILTY DOLOMITE, HCL (+), DRILLED SOFT AT 41.0', MINOR HEMATITE	DOLOMITE
	44.0	DOLOMITE, INTERBEDDED DIFFERENT COLORS, 10 YR 6/1, GRAY, 10YR 6/1, BROWNISH YELLOW, 10YR 3/1, VERY DARK GRAY, DRY, DENSE, NO ODOR, MINOR BLACK REDUCED STAINING	DOLOMITE
	45		
	48.0	DOLOMITE: DOMINANT COLOR 10YR 6/3, PALE BROWN, PROMINANT BLACK STAINING, NO ODOR, DENSE	DOLOMITE
	50		
	50.5	DOLOMITE: DARK GRAY, 2.5YR 4/0, AND LIGHT GRAY, 7.5YR 7/0, VERY FINE CRYSTALLINE, NO PRIMARY POROSITY OBSERVED, VERY SLIGHTLY SANDY TEXTURE DRY AT 50.1', 1HR AFTER END OF DRILLING.	DOLOMITE
	55		
	56.0	DOLOMITE: 7.5YR 6/0, GRAY AND PINKISH GRAY, 7.5YR 6/2, MICROCRYSTALLINE, DENSE, HARD, DRY	DOLOMITE
	58.0	DOLOMITE: LIGHT GRAY, 7.5YR 7/0, VERY FINE CRYSTALLINE, SLIGHTLY SANDY TEXTURE, DENSE, HARD, DRY, LIGHT HYDROCARBON ODOR IN 60.0–62.0' SAMPLE, POSSIBLE CONDENSATE ODOR PRESENT IN 62.0–64.0' SAMPLE	DOLOMITE
	60		
	65		
	65.5	GYPSUM: WHITE, 5YR 8/1, SOFT, DRY, CHALKY	GYPSUM
		DOLOMITE: LIGHT GRAY, 10 YR 7/1, VERY FINE CRYSTALLINE, HARD, DENSE, DRY, LIGHT HYDRO-CARBON ODOR	DOLOMITE
	67.0	DOLOMITE: GRAYISH BROWN, 10YR 5/2, AND PINKISH GRAY, 7.5YR 7/2, MICROCRYSTALLINE, CHERTY, HARD, DENSE, DRY, HYDROCARBON ODOR DECREASING SLIGHTLY FROM ABOVE	DOLOMITE
	70		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
12	0.0		36.0
13	18.0	NX	38.0
14	--	GC	40.0
15	--	GC	42.0
16	--	GC	44.0
17	--	GC	46.0
18	--	GC	48.0
19	--	GC	50.0
20	23.1	GC	52.0
21	17.8	GC	54.0
22	93.3	GC	56.0
23	9.9	GC	58.0
24	175.4	GC	60.0
25	809.0	GC	62.0
26	957.0	GC	64.0
27	442.0	GC	66.0
28	27.1	GC	68.0
29	8.6	GC	70.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

ROTARY AIR FROM 38.0 FEET

35 40 45 50 55 60 65 70

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-83 (MW-57)*

DATE DRILLED 6/17/91 – 6/25/91
DRILLING METHOD HSA, ROTARY WASH CORE, AIR ROTARY
DRILLED BY SHB/ BOYLES BROS.
LOGGED BY WEP/GHR
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 48.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3785.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	70	CONTINUED FROM PREVIOUS PAGE	DOLOMITE			30	130.4	GC	70.0–72.0	70
						31	141.7	GC	74.0	
	74.0	DOLOMITE: DARK GRAY, 7.5YR N 4/0, VERY FINE CRYSTALLINE, DENSE, HARD, DRY, FAIR ODOR	DOLOMITE			32	305.0	GC	76.0	75
	75									
	76.0	DOLOMITE: PINKISH GRAY, 7.5YR 6/2, MICRO – CRYSTALLINE, DENSE, HARD, DRY, CHERTY, SLIGHT HYDROCARBON ODOR	DOLOMITE			33	114.5	GC	78.0	
		DRY HOLE @ 80.0'				34	130.4	GC	80.0	
	80 80.0	DOLOMITE: LIGHT BROWNISH GRAY, 10YR 6/2, AND PINKISH GRAY, 7.5YR 6/2, MICROCRYSTALLINE, DENSE, CHERTY, DRY, NO ODOR OBSERVED	DOLOMITE			35	4.8	GC	82.0	80
						36	0.6	GC	84.0	
	85					37	1.0	GC	86.0	85
						38	1.0	GC	88.0	
	87.5 88.0	DOLOMITE: AS ABOVE WITH COLOR GRADING TO GRAY, 2.5YR 5/0, AT 87.0'	DOLOMITE							
		DOLOMITE: LIGHT BROWNISH GRAY, 10YR 6/2, VERY FINE CRYSTALLINE, DENSE, DRY	DOLOMITE			39	0.0	GC	90.0	
	90	SILTSTONE: DUSKY YELLOW GREEN, 5GY 5/2, SOFT, FRIABLE, DRY	SILTSTONE			40	0.0	GC	92.0	90
	91.5	DOLOMITE: LIGHT BROWNISH GRAY, 10YR 6/2, VERY FINE CRYSTALLINE, DENSE, DRY, HARD, NO ODOR OBSERVED	DOLOMITE			41	0.0	GC	94.0	
						42	0.0	GC	96.0	
	95									95
	96.0	DOLOMITE: PINKISH GRAY 7.5YR 6/2, MICRO CRYSTALLINE, DENSE, CHERTY WITH INTERBEDDED MINOR SILTSTONE, DUSKY YELLOWISH GREEN, 5GY 5/2, SOFT, FRIABLE	DOLOMITE WITH INTER-BEDDED SILTSTONE			43	0.0	GC	98.0	
						44	0.0	GC	100.0	
	100	DOLOMITE, PINKISH GRAY, 7.5YR 6/2, AND 7.5YR 7/2, VERY FINE CRYSTALLINE, DENSE, HARD, DRY, WITH MINOR INTERBEDDED SILTSTONE, DUSKY YELLOWISH GREEN, 5GY 5/2, HARD, FRIABLE, FISSILE				45	0.0	GC	102.0	100
						46	0.0	GC	104.0	
	105					47	0.0	GC	105.0	105

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-83 (MW-57)*

DATE DRILLED 6/17/91 – 6/25/91
DRILLING METHOD HSA, ROTARY WASH CORE/ AIR ROTARY
DRILLED BY SHB/BOYLES BROS.
LOGGED BY WEP/GHR
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 48.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3785.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	105	CONTINUES FROM PREVIOUS PAGE								105
	106.0	DOLOMITE: LIGHT GRAY, 10YR 7/2, FINE CRYSTALLINE TO SLIGHTLY SANDY, SOME CALCAREOUS CEMENT, SOME INTERBEDDED SILTSTONE, CALCAREOUS FIRM, FRIABLE, VERY PALE BROWN, 10YR 8/3	DOLOMITE & SILTSTONE			47	0.0	GC	106.0	
	108.0	LIMESTONE: PINKISH GRAY, 5YR 8/2, SLIGHTLY DOLOMITIC, VERY FINE CRYSTALLINE, MODERATELY HARD, CHALKY INTERBEDDED WITH SILTSTONE, POORLY CEMENTED, SOFT, POWDERY IN CUTTINGS, DRY, NO ODOR	LIMESTONE			48	0.0	GC	108.0	
						49	0.0	GC	110.0	
	110					50	0.0	GC	112.0	110
						51	0.0	GC	114.0	
	115					52	0.0	GC	116.0	115
						53	0.0	GC	118.0	
	119.5					54	0.0	GC	120.0	
	120	LIMESTONE: VERY PALE BROWN, 10YR 8/4, VERY SILTY, FIRM TO SOFT, VERY CHALKY, DRY NO ODOR	LIMESTONE			55	0.0	GC	122.0	120
	122.0	DOLOMITE: LIGHT GRAY, 5YR 7/1, SCATTERED HEMATITE, YELLOWISH RED, 5YR 3/6, HARD, VERY FINE CRYSTALLINE, SLIGHTLY CALCAREOUS, WITH MINOR INTERBEDDED SILTSTONE, CALCAREOUS, SOFT	DOLOMITE			56	0.0	GC	124.0	
	125					57	1.3	GC	126.0	125
	126.0	LIMESTONE: VERY PALE BROWN, 10 YR 8/4, FINE CRYSTALLINE, SOFT TO FIRM, CHALKY, SILTY, SLIGHTLY GYPSIFEROUS LIMESTONE, POWDERY APPEARANCE IN CUTTINGS, NO ODOR, DRY	LIMESTONE			58	0.0	GC	128.0	
						59	0.0	GC	130.0	
	130					60	0.0	GC	132.0	130
		LIMESTONE, VERY PALE BROWN, 10YR 8/4, TO WHITE, 5YR 8/1, FINE CRYSTALLINE, FIRM TO SOFT, SLIGHTLY GYPSIFEROUS, VERY CHALKY, SILTY, 50% OF CUTTINGS ARE POWDER ON SAMPLE, NO ODOR, DRY				61	0.0	GC	134.0	
	135					62	0.0	GC	136.0	135
						63	0.0	GC	138.0	
	140.0					64	0.0	GC	140.0	
	140									140

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-83 (MW-57)*

DATE DRILLED 6/17/91 - 6/25/91
DRILLING METHOD HSA, ROTARY WASH CORE/AIR ROTARY
DRILLED BY SHB/BOYLES BROS.
LOGGED BY WEP/GHR
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
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ENVIRONMENTAL CONSULTANTS
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 48.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3785.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	140	LIMESTONE: AS ABOVE, BECOMING VERY SILTY AND INTERBEDDED WITH SILTSTONE	LIMESTONE & SILTSTONE			65	0.0	GC	142.0	140
	142	SILTSTONE: LIGHT BROWNISH GRAY, 10YR 6/2, VERY POORLY CEMENTED, VERY SLIGHTLY MOIST, CALCAREOUS CEMENT, INTERBEDDED WITH MINOR LIMESTONE AS ABOVE	SILTSTONE			66	1.0	GC	144.0	
	145					67	4.6	GC	146.0	145
						68	3.3	GC	148.0	
	148	LIMESTONE: LIGHT YELLOWISH BROWN, 10 YR 6/4, SANDY, COARSELY CRYSTALLINE, FIRM, FRIABLE	LIMESTONE			69	0.6	GC	150.0	
	149		LIMESTONE & INTER-BEDDED SANDSTONE & SILTSTONE							
	150	LIMESTONE: VERY PALE BROWN, 10YR 8/3, SANDY, INTERBEDDED WITH SANDSTONE AND SILTSTONE, VERY FINE GRAINED, CALCAREOUS, POORLY CEMENTED, VERY SLIGHTLY MOIST, LIGHT BROWNISH GRAY, 10YR 6/2				70	0.0	GC	152.0	150
						71	0.0	GC	154.0	
	154	AS ABOVE: BUT PREDOMINANTLY SILTSTONE AND VERY FINE GRAINED SANDSTONE, VERY SLIGHTLY MOIST, CALCAREOUS, NO FREE WATER, SLIGHTLY POROUS	SILTSTONE & SANDSTONE			72	0.0	GC	156.0	
▽155.0	155					73	1.9	GC	158.0	155
▽158.42	158	LIMESTONE: VERY PALE BROWN, 10 YR 8/3 VERY SANDY, INTERBEDDED WITH SILTSTONE, VERY SLIGHTLY MOIST, MOISTURE INCREASING, BELOW 162.0'	LIMESTONE & SILTSTONE			74	3.3	GC	160.0	
	160					75	1.0	GC	162.0	160
	162	LIMESTONE: PINKISH GRAY, 5YR 7/2, VERY FINE CRYSTALLINE, DOLOMITIC, CHALKY DULL APPEARANCE, VUGULAR, FRACTURED, HARD, SATURATED, HOLE IS MAKING SMALL VOLUME OF WATER, NO HYDROCARBON ODOR OBSERVED	LIMESTONE			76	0.0	GC	164.0	
	165					77	0.0	GC	166.0	165
	166	DOLOMITE: LIGHT BROWNISH GRAY, 10YR 6/2, VERY FINE CRYSTALLINE, TRACE AMOUNT OF VUGULAR POROSITY, HARD, SATURATED, NO ODOR, SLIGHTLY CALCAREOUS, BECOMING DENSE BELOW 170.0'. WITH TRACE OF FRACTURES	DOLOMITE			78	0.0	GC	168.0	
						79	0.0	GC	170.0	
	170	GRADING TO DOLOMITIC SANDSTONE, MEDIUM GRAINED AND SANDY DOLOMITE, GRAYISH BROWN, 10YR 5/2, AND LIGHT BROWNISH GRAY, 10YR 6/2, MODERATELY CEMENTED, GOOD INTERGRANULAR POROSITY, SATURATED, HOLE IS MAKING LARGE VOLUME OF WATER BELOW 172.0'				80	0.0	GC	172.0	170
	172		DOLOMITIC SANDSTONE			81	0.0	GC	174.0	
		T.D. 175.0'				82	0.0	GC	175.0	
	175									175

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-83 (MW-57)*

DATE DRILLED 6/17/91 TO 6/25/91
DRILLING METHOD AIR HAMMER, HSA, ROTARY WASH CORE
DRILLED BY SHB/BOYLES BROS.
LOGGED BY GHR/WEP
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	CLAYEY SILT: LIGHT BROWN, 7.5YR 6/3. 30% CLAY, 60% SILT, FIRM TO LOOSE, FRIABLE, 10% CALICHE DEPOSITS, DRY	ML			1	0.0	GC	2.0	AIR HAMMER TO T.D.
						2	0.0	GC	4.0	
						3	0.0	GC	6.0	
	5	SILTSTONE: LIGHT GRAY, 5YR 7/1, SLIGHTLY HARD, FRIABLE, DRY, WEATHERED APPEARANCE, SILICEOUS	SILTSTONE			4	0.0	GC	8.0	
						5	0.0	GC	10.0	
	10	DOLOMITE: SANDY, LIGHT GRAY, 5Y 7/1, AND LIGHT BROWNISH GRAY 10YR 6/2, VERY SLIGHTLY CALCAREOUS, HARD, DRY, DENSE, SCATTERED HEMATITE ~ 5% THROUGHOUT	SANDY DOLOMITE			6	0.0	GC	12.0	
						7	0.0	GC	14.0	
	15	DOLOMITE: 10YR 6/1, GRAY, VERY HARD, VERY FINE MICROCRYSTALLINE, DENSE, CHERTY, DRY, FRACTURED INTERVAL FROM 15.0–15.2', AND 16.2–16.4', DRY	DOLOMITE			8	0.0	GC	16.0	
						9	0.0	GC	18.0	
	18.0	DOLOMITE: AS ABOVE, INTERBEDDED WITH SANDSTONE, VERY FINE GRAIN, LIGHT BROWNISH GRAY, 10YR 6/2, AND PALE BROWN, 10YR 6/3, SILICEOUS CEMENT, DRY, DENSE	DOLOMITE /SANDSTONE			10	0.0	GC	20.0	
	20 / 20.5	SANDSTONE: PALE BROWN, 10YR 6/3, AND GRAYISH BROWN, 2.5YR 5/2, ARGILLACEOUS, MODERATELY SOFT, SILICEOUS CEMENT, DRY	SANDSTONE			11	0.0	GC	22.0	
	22.0	DOLOMITE, LIGHT GRAY, VERY FINE CRYSTALLINE, VERY SLIGHTLY SANDY, SLIGHTLY CALCAREOUS, 10 YR 7/1, VERY HARD, DENSE, DRY, INTERBEDDED WITH SANDSTONE, AS ABOVE, BELOW 25.0'	DOLOMITE			12	0.0	GC	24.0	
	25					13	0.0	GC	26.0	
						14	0.0	GC	28.0	
	28.0	SANDSTONE: GRAY, 2.5YR N6/0, AND GRAYISH BROWN, 10 YR 5/2, VERY FINE GRAIN, SLIGHTLY CALCAREOUS CEMENT, MODERATELY CEMENTED, MODERATELY HARD, SLIGHTLY FRIABLE, DENSE	SANDSTONE			15	0.0	GC	30.0	
	30	SANDSTONE: LIGHT BROWNISH GRAY, 10 YR 6/2, AND PALE BROWN, 10YR 6/3, SLIGHTLY HARD TO SOFT, VERY FINE GRAIN, VERY SLIGHTLY CALCEREOUS, PREDOMINATELY SILICEOUS, DRY, MASSIVE, WEAKLY CEMENTED	SANDSTONE			16	2.0	GC	32.0	
						17	79.0	GC	34.0	
	35					18	0.0	GC	35.0	

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/7/91 TO 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER ROTARY
DRILLED BY BOYLES BROS.
LOGGED BY GHR/WEP
CHECKED BY BJS
DRAWN BY: SAR

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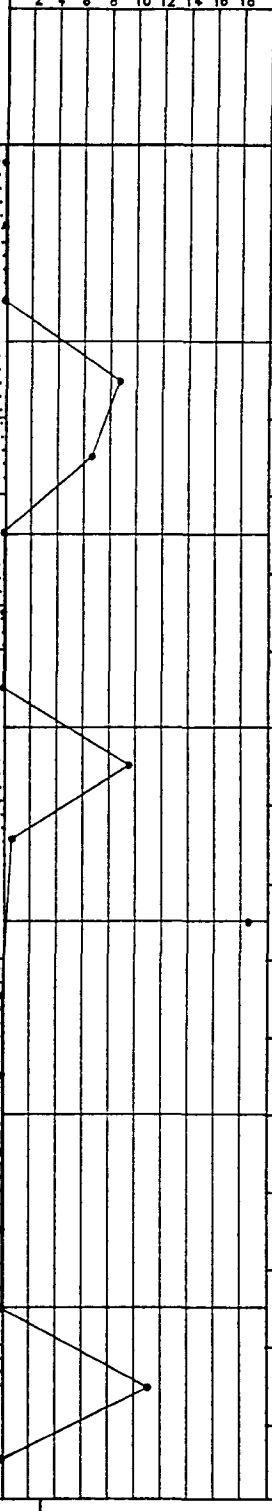
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3821.60		
	35	SANDSTONE, AS ABOVE BUT BECOMING VERY POORLY CEMENTED TO UNCON-SOLIDATED BELOW 40.0', SILTY	SANDSTONE	
	40			
	42.0	SANDSTONE: LIGHT GRAY 7.5 YR N 7/0, SLIGHTLY DOLOMITIC, SILICEOUS, VERY FINE GRAIN, MODERATELY HARD, FRIABLE, DRY	SANDSTONE	
	44.0	SANDSTONE: LIGHT BROWN, 7.5 YR 6/3, SILICEOUS, VERY FINE GRAIN, VERY POORLY CEMENTED, DRY, SILTY	SANDSTONE	
	45			
	48.0	GRADING TO SANDSTONE: LIGHT BROWNISH GRAY, 10 YR 6/2, VERY FINE GRAIN, SLIGHTLY DOLOMITIC, HARD, DRY, WELL CEMENTED	SANDSTONE	
	50			
	55			
	56.0	SANDSTONE: BROWN, 7.5 YR 5/3, VERY FINE GRAIN, SILICEOUS, VERY POORLY CEMENTED, LOOSE, MOIST, SILTY	SANDSTONE	
	60			
	65	SANDSTONE: BROWN, 7 YR 5/3, VERY FINE GRAIN, SILICEOUS, VERY POORLY CEMENTED, LOOSE, MOIST, SILTY, INTERBEDDED WITH MINOR DOLOMITIC SANDSTONE	SANDSTONE	
	70			

OVM SOIL GAS PPM X 14.0



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
18	0.0	GC	36.0
19	0.0	GC	38.0
20	0.0	GC	40.0
21	115.0	GC	42.0
22	91.8	GC	44.0
23	0.0	GC	46.0
24	0.0	GC	48.0
25	0.0	GC	50.0
26	122.0	GC	52.0
27	13.9	GC	54.0
28	260.0	GC	56.0
29	0.0	GC	58.0
30	0.0	GC	60.0
31	0.0	GC	62.0
32	0.0	GC	64.0
33	0.0	GC	66.0
34	152.0	GC	68.0
35	0.0	GC	70.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/7/91 TO 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER ROTARY
DRILLED BY BOYLES BROS.
LOGGED BY GHR
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	70	SANDSTONE: CONTINUED FROM PREVIOUS PAGE	SANDSTONE			36	0.0	GC	72.0	70
						37	146.0	GC	74.0	
	75					38	0.0	GC	76.0	75
	76.0	DOLOMITE: LIGHT GRAY, 5 YR 6/1, MICRO-CRYSTALLINE, CHERT, HARD, DRY	DOLOMITE			39	0.0	GC	78.0	
						40	0.0	GC	80.0	
	80					41	0.0	GC	82.0	80
	82.0	SANDSTONE: LIGHT GRAY, 7.5 YR N 7/0, VERY FINE GRAIN, SLIGHTLY DOLOMITIC, MODERATELY HARD, FRIABLE, DRY	SANDSTONE			42	0.0	GC	84.0	
	84.0	SANDSTONE: GRAYISH BROWN, 10 YR 5/2, SOFT, VERY POORLY CEMENTED, VERY FINE GRAIN, MOIST	SANDSTONE			43	0.0	GC	86.0	
	85	BELOW 88.0', SANDSTONE AS ABOVE INTER-BEDDED WITH SANDSTONE, 7.5 YR N 7/0, VERY FINE GRAIN, VERY SLIGHTLY DOLO-MITIC, MODERATELY SILICEOUS CEMENT, FRIABLE, THINLY BEDDED				44	0.0	GC	88.0	85
						45	0.0	GC	90.0	
	90					46	47.4	GC	92.0	90
						47	0.0	GC	94.0	
	94	SANDSTONE: DOLOMITIC, GRAY, 10 YR 6/1, MODERATELY HARD, VERY FINE GRAIN, MODERATELY CEMENTED, DRY	DOLOMITIC SANDSTONE			48	18.3	GC	96.0	
	95					49	66.1	GC	98.0	95
	97	DOLOMITE: GRAYISH BROWN,, 10 YR 5/2, PREDOMINATELY MICROCRYSTALLINE, TRACE FINE CRYSTALLINE SLIGHTLY SANDY DOLO-MITE, HARD, DENSE, DRY	DOLOMITE			50	0.0	GC	100.0	
	100	DOLOMITE: GRAYISH BROWN, 10 YR 5/2, MICROCRYSTALLINE, SOME FINE CRYSTALLINE WITH SANDY TEXTURE, HARD, DENSE, DRY, VERY SLIGHTLY CALCAREOUS	DOLOMITE			51	0.0	GC	102.0	100
						52	0.0	GC	104.0	
	104	SEE NEXT PAGE	DOLOMITE			53	0.0	GC	105.0	
	105									105

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/7/91 TO 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER ROTARY
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
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ENVIRONMENTAL CONSULTANTS
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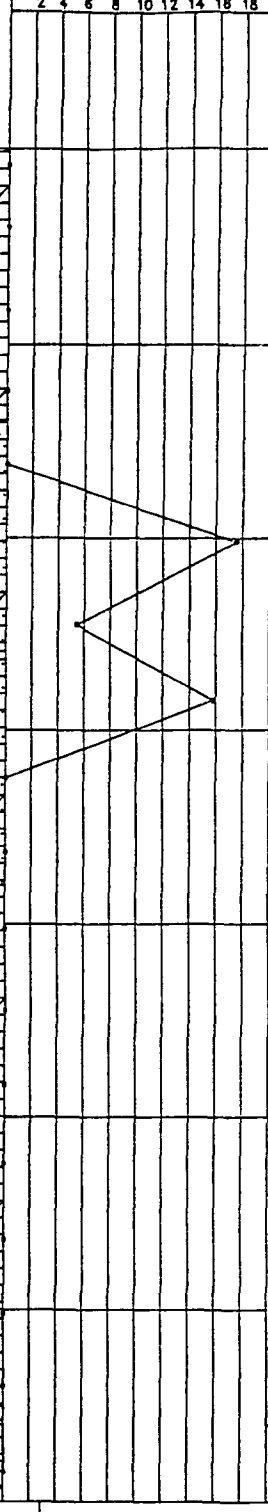
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3821.60	
	105	DOLOMITE: GRAYISH BROWN, 10YR 5/2, AND BROWN, 10 YR 5/3, MICROCRYSTALLINE, CHERTY, DENSE, HARD, DRY, INTERBEDDED WITH SILTSTONE, MINOR DUSKY YELLOWISH GREEN, 5 GY 5/2, SOFT, FISSILE	DOLOMITE
	110	BECOMING VERY SILTY DOLOMITE BELOW, 110.0'	
	112.0	SANDY DOLOMITE: LIGHT GRAY, 10 YR 6/1, COARSELY CRYSTALLINE, DENSE, HARD, DRY, INTERBEDDED WITH SILT, LIGHT GRAY 10 YR 7/1, VERY SOFT, UNCONSOLIDATED POWDERY IN CUTTINGS, DRY	SANDY DOLOMITE
	115		
	118.0	SANDY DOLOMITE: GRAY, 7.5 YR N 6/0, FINE CRYTSTALLINE, SANDY, DULL APPEARANCE, HARD, MASSIVE, DRY	SANDY DOLOMITE
	120		
	124.0	DOLOMITE: LIGHT GRAY, 10 YR 6/1, MICROCRYSTALLINE, DENSE, CHERTY, HARD, DRY, VERY SLIGHTLY SILTY	DOLOMITE
	125		
	130		
	135	DOLOMITE: LIGHT GRAY, 10 YR 6/1, MICROCRYSTALLINE, DENSE, CHERTY, HARD, DRY, SOME VERY SLIGHTLY SILTY	DOLOMITE
	138.0	DOLOMITE, AS ABOVE, INTERBEDDED WITH SANDSTONE, GRAYISH BROWN, 10 YR 5/2, SOFT, VERY POORLY CEMENTED, DRY	DOLOMITE WITH INTERBEDDED SANDSTONE
	140		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
53	0.0	GC	106.0
54	0.0	GC	108.0
55	0.0	GC	110.0
56	0.0	GC	112.0
57	0.0	GC	114.0
58	246.0	GC	116.0
59	78.0	GC	118.0
60	223.0	GC	120.0
61	0.0	GC	122.0
62	0.0	GC	124.0
63	0.0	GC	126.0
64	0.0	GC	128.0
65	0.0	GC	130.0
66	0.0	GC	132.0
67	0.0	GC	134.0
68	0.0	GC	136.0
69	0.0	GC	138.0
70	0.0	GC	140.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/7/91 TO 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	140	(CONTINUED FROM PREVIOUS PAGE)	DOLOMITE			71	0.0	GC	142.0	140
	142.0	SANDY DOLOMITE: LIGHT BROWNISH GRAY 10 YR 6/2, VERY FINE CRYSTALLINE, SLIGHTLY SILTY, DENSE, HARD, DRY	SANDY DOLOMITE			72	0.0	GC	144.0	
	145					73	0.0	GC	146.0	145
						74	0.0	GC	148.0	
						75	0.0	GC	150.0	
	150	SANDY DOLOMITE, AS ABOVE, GRADING TO GRAY, 7.5 YR N 6/0, HARD, DRY, MASSIVE, DENSE				76	0.0	GC	152.0	150
						77	0.0	GC	154.0	
	155					78	0.0	GC	156.0	155
						79	0.0	GC	158.0	
						80	0.0	GC	160.0	
	160					81	1.4	GC	162.0	160
						82	1.4	GC	164.0	
	164.0	SILTSTONE: WHITE 10 YR 8/2, TO PINKISH WHITE 7.5 YR 8/2, INTERBEDDED WITH DOLOMITE, VERY FINE CRYSTALLINE, DENSE, HARD, SILTSTONE, VERY POORLY CEMENTED, POWDERY IN SAMPLES, LOOSE, DRY, CALCAREOUS WITH INCREASING DOLOMITE BELOW 168.0'	SILTSTONE WITH INTERBEDDED DOLOMITE			83	2.8	GC	166.0	
	165					84	0.0	GC	168.0	165
						85	0.0	GC	170.0	
	170					86	1.4	GC	172.0	170
	172.0		DOLOMITE & SANDY DOLOMITE			87	0.0	GC	174.0	
	175					88	0.0	GC	175.0	175

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84* *(MW-58)*

DATE DRILLED 6/27/91 TO 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER
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LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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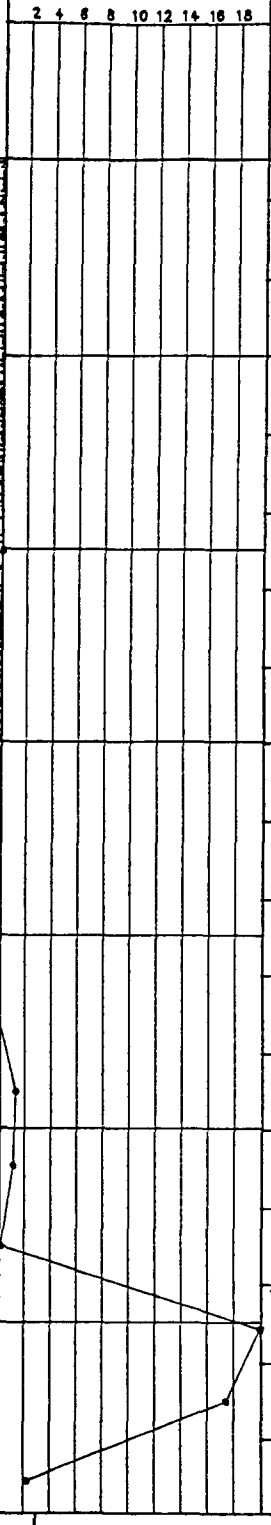
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3821.60	
	175	DOLOMITE: LIGHT BROWNISH GRAY, 10 YR 6/2, VERY FINE CRYSTALLINE TO MICRO-CRYSTALLINE, DENSE, HARD, DRY, INTER-BEDDED WITH SOME DOLOMITE, SANDY, VERY PALE BROWN, 10 YR 7/3, POORLY CEMENTED, VERY SLIGHTLY CALCAREOUS, DRY, MASSIVE	DOLOMITE & SANDY DOLOMITE
	180		
	185		
▽190.55	190		
	192.0	DOLOMITE: LIGHT GRAY, 5 YR 6/1, MICRO-CRYSTALLINE, CHERTY, DENSE, MASSIVE, HARD, DRY	DOLOMITE
	195		
	198.0	DOLOMITIC LIMESTONE: PINK, 7.5 YR 8/3, AND PINKISH GRAY, 7.5 YR 7/2, SOFT, MODERATELY HARD, CHALKY, FINE CRYSTALLINE, DRY, HYDROCARBON ODOR IN SAMPLE #100	DOLOMITIC LIMESTONE
	200		
	202.0	LIMESTONE: WHITE, 10 YR 8/2, SOFT, ARGILLACEOUS, VERY CHALKY WITH FAIR HYDROCARBON ODOR IN SAMPLE #103	LIMESTONE
	205	LIMESTONE: AS ABOVE, AND VERY SANDY LIMESTONE, VERY PALE BROWN, 10 YR 8/3 AND WHITE 10 YR 8/2, FAIR HYDROCARBON ODOR, MODERATELY CONSOLIDATED, VERY SLITHTLY MOIST	LIMESTONE SANDY
▽207.4	207.0	SEE NEXT PAGE FOR DESCRIPTION	SANDSTONE
	210		

GRAPHIC LOG

OVM SOIL GAS PPM X 14.0



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
88	0.0	GC	176.0
89	0.0	GC	178.0
90	0.0	GC	180.0
91	0.0	GC	182.0
92	0.0	GC	184.0
93	1.4	GC	186.0
94	0.0	GC	188.0
95	0.0	GC	190.0
96	0.0	GC	192.0
97	0.0	GC	194.0
98	0.0	GC	196.0
99	0.0	GC	198.0
100	25.0	GC	200.0
101	21.0	GC	202.0
102	2.8	GC	204.0
103	250.0	GC	206.0
104	245.0	GC	208.0
105	29.5	GC	210.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

175 180 185 190 195 200 205 210

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/27/91 TO 6/30/91
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	210	SANDSTONE: LIGHT BROWNISH GRAY, 10 YR 6/2, DOLOMITIC, VERY POORLY CEMENTED, MEDIUM GRAINED, SOME FINE GRAINED, POORLY GRADED, ANGULAR	SANDSTONE			106	1.0	GC	212.0	210
						107	0.0	GC	214.0	
	215	VERY PERMEABLE, SATURATED, NO HYDROCARBON ODOR DETECTED				108	0.0	GC	216.0	215
	216.0	T.D. 216.0'								
		BOREHOLE MAKING LARGE AMOUNT OF WATER								
	200									220
	225									225
	230									230
	235									235
	240									240
	245									245

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/27/91 TO 6/30/91
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BORING RECORD

GROUND SURFACE: 3816.60

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
	0	CLAYEY SILT: LIGHT BROWN, 7.5YR 6/3, 10% CLAY, SOFT, VERY FRIABLE, DRY	ML	
	3.0	DOLOMITE: LIGHT GRAY, 10YR 7/2, VERY FINE CRYSTALLINE TO MICROCRYSTALLINE, CHERTY, DENSE, DRY	DOLOMITE	
	5			
	8.0	SILTSTONE: YELLOW 10YR 7/8, LIMONITIC, SILICEOUS CEMENT, SLIGHT BANDED APPEARANCE, MODERATELY HARD, DRY	SILTSTONE	
	10			
	11.0	SANDSTONE: LIGHT GRAY, 2.5YR 7/2, TO LIGHT BROWNISH GRAY, 2.5Y 6/2, VERY FINE GRAIN, SILICEOUS CEMENT, DENSE, DRY	SANDSTONE	
	15			
	16.0	DOLOMITE: LIGHT GRAY, 10YR 7/2, MICRO - CRYSTALLINE, WITH TRACE OF COARSELY CRYSTALLINE DOLOMITE, DENSE, DRY, INTERBEDDED WITH MINOR SILTSTONES AND SANDSTONES, AS ABOVE	DOLOMITE	
	20	SANDSTONE: PINKISH GRAY, 7.5YR 6/2, VERY FINE GRAIN, VERY SILTY, MASSIVE, SLIGHTLY HARD, FRIABLE, SLIGHTLY CALCAREOUS CEMENT, PREDOMINATELY SILICEOUS, DRY	SANDSTONE	
	25			
	30	SANDSTONE: VERY FINE GRAIN, SILTY, 10YR 5/2, GRAYISH BROWN, MODERATELY HARD, DRY, WEAKLY CEMENTED	SANDSTONE	
	32.0	DOLOMITIC SANDSTONE: VERY FINE GRAINED SILICA SAND, 2.5YR 5/2, GRAY BROWN, MODERATELY HARD, SLIGHT CONDENSATE ODOR, SLIGHTLY MOIST, MINOR INTERBEDS AT 10YR 5/1, GRAY, HARD DOLOMITIC SANDSTONE	DOLOMITIC SANDSTONE	
	35			

OVM SOIL GAS PPM X 18.3 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	2.0
2	0.0	GC	4.0
3	0.0	GC	6.0
4	0.0	GC	8.0
5	0.0	GC	10.0
6	2.4	GC	12.0
7	0.0	GC	14.0
8	19.9	GC	16.0
9	0.0	GC	18.0
10	0.0	GC	20.0
11	0.0	GC	22.0
12	14.2	GC	24.0
13	0.0	GC	26.0
14	0.0	GC	28.0
15	3.9	GC	30.0
16	9.0	GC	32.0
17	44.0	GC	34.0
18	65.0	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

AIR HAMMER DRILLING

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-85 (MW-59)*

DATE DRILLED 6/28/91 TO 7/4/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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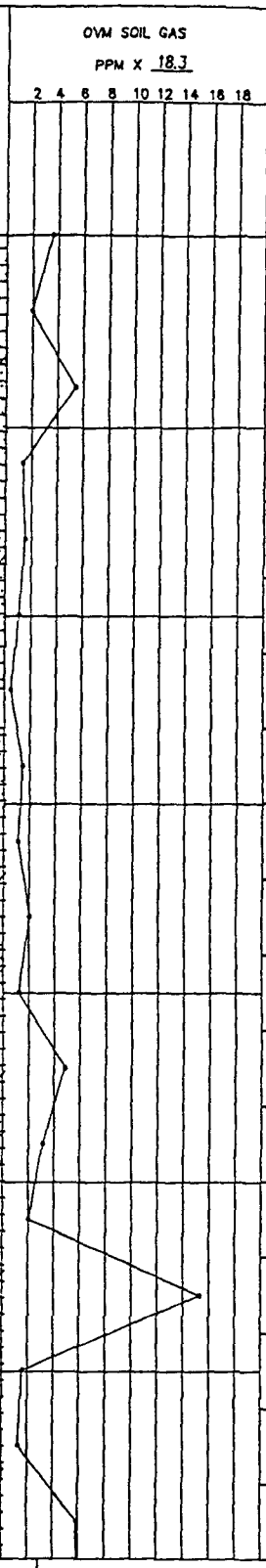
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3816.60	
	35	CONTINUED FROM PREVIOUS PAGE	DOLOMITIC SANDSTONE
	47.0	SANDSTONE: VERY FINE GRAIN SILICA SAND, WELL SORTED, WEAKLY CEMENTED, SILTY, 2.5Y 5/2, GRAYISH BROWN, SLIGHTLY MOIST	SANDSTONE
	48.0	DOLOMITIC SANDSTONE: VERY FINE GRAIN SAND, 10YR 5/1, GRAY WITH MINOR 10YR 3/1, VERY DARK GRAY, VERY FINE GRAIN SANDSTONE INTERBEDS, MODERATELY HARD, MASSIVE, COLOR VARIES FROM 10Y 5/1, GRAY, TO 2.5Y 4/2, DARK GRAY WITH DEPTH, MINOR VERY FINE GRAIN IRON PYRITE OBSERVED	DOLOMITIC SANDSTONE

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
18	65.0	GC	36.0
19	34.9	GC	38.0
20	98.0	GC	40.0
21	23.2	GC	42.0
22	27.0	GC	44.0
23	18.6	GC	46.0
24	7.8	GC	48.0
25	26.0	GC	50.0
26	20.0	GC	52.0
27	37.0	GC	54.0
28	21.0	GC	56.0
29	88.0	GC	58.0
30	56.0	GC	60.0
31	36.0	GC	62.0
32	278.0	GC	64.0
33	28.0	GC	66.0
34	22.0	GC	68.0
35	106.0	GC	70.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

35 40 45 50 55 60 65 70

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-85 (MW-59)*

DATE DRILLED 6/28/91 TO 7/4/91
DRILLING METHOD AIR HAMMER
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3816.60							BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	70	CONTINUED FROM PREVIOUS PAGE	DOLOMITIC SANDSTONE		36	106.0	GC	72.0	70
		AFTER 72.0 FEET, ABUNDANT IRON OXIDE STAINING			37	75.0	GC	74.0	
	74.0	CHERTY DOLOMITE: 2.5Y 5/2, GRAYISH BROWN, VERY HARD, CONCOIDIAL FRACTURES	DOLOMITE		38	13.0	GC	76.0	75
	75				39	10.0	GC	78.0	
	79.0	DOLOMITIC SANDSTONE: VERY FINE GRAIN SILICA SAND, VERY HARD, 2.5Y 5/2, GRAYISH BROWN, 10YR 6/1, LIGHT GRAY TO GRAY, AND 10YR 4/2, DARK GRAYISH BROWN, MINOR IRON OXIDE STAINING, DRY, MINOR CHERTY DOLOMITE INTER-BEDS	DOLMITIC SANDSTONE		40	16.0	GC	80.0	
	80				41	18.0	GC	82.0	80
					42	48.0	GC	84.0	
	84.0	SANDSTONE: VERY FINE GRAIN SILICA, MODERATELY HARD, SLIGHT CARBONATE CEMENT, IRON OXIDE STAINING, SILTY, 2.5Y 6/2, LIGHT BROWNISH GRAY, DRY	SANDSTONE		43	52.0	GC	86.0	
	85				44	66.0	GC	88.0	85
	87.0	DOLOMITIC SANDSTONE: VERY FINE GRAIN SILICA SAND, MODERATELY HARD, 2.5 Y 4/2, DARK GRAYISH BROWN	DOLMITIC SANDSTONE		45	132.0	GC	90.0	
	90				46	23.0	GC	92.0	90
					47	26.0	GC	94.0	
		AFTER 94.0', ABUNDANT HEMATITE			48	8.0	GC	96.0	
	95								95
	96.0	CHERTY DOLOMITE: HARD, CONCOIDAL FRACTURES, DRY, 10 YR 6/3, PALE BROWN, MINOR IRON OXIDE STAINING	DOLOMITE CHERTY		49	35.0	GC	98.0	
					50	19.0	GC	100.0	
	100	CHERTY DOLOMITE: 10 YR 6/3, PALE BROWN, VERY HARD, HIGHLY FRACTURED, HORIZONTAL FRACTURES AT 100.2',100.3',100.6',100.8',101.0', 101.2',101.6',101.8', AND102.0', VERTICAL FRAC-TURE BETWEEN 100.5–102.3', IRON OXIDE STAIN, CALCITE AND MINOR MANGANESE OXIDE ALONG FRACTURES, HIGHLY FRACTURED BETWEEN 102.3–104.9', VERTICAL FRACTURED BETWEEN 104.9 AND 107.3'	CHERTY DOLOMITE		51	9.0	2.3	101.0	100
					52	21.0		102.3	
					53	3.8	5.0	104.3	
	105				54	3.2			105

OVM SOIL GAS PPM X 18.3 (2 4 6 8 10 12 14 16 18)

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-85 (MW-59)*

DATE DRILLED 6/28/91 TO 7/4/91
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 18.3 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3818.60								BACKGROUND OVM READING: SOIL: 0 PPM AIR: 0 PPM
	105	CONTINUED FROM PREVIOUS PAGE	CHERTY DOLOMITE			54	3.2		106.3	105
						55	4.0		107.3	
						56	9.2	5.0	109.3	
	110	DOLOMITE: 10 YR 6/2, LIGHT BROWNISH GRAY, GRADATIONAL CONTACT WITH CHERTY DOLOMITE, SUGARY, VERY HARD, FRACTURES LARGELY REPLACED WITH CALCITE, MINOR CHLORITE, IRON OXIDE, DRY	DOLOMITE			57	2.8		111.3	110
						58	30.0		112.3	
						59	30.0	GC	114.0	
						60	70.0	GC	116.0	
	115									115
	116.0	DOLOMITIC SANDSTONE: VERY FINE GRAIN SAND, 10 YR 3/1, VERY DARK GRAY, MODERATELY HARD, DRY, MINOR 10 YR 5/2, GRAYISH BROWN DOLOMITE INTERBEDS AFTER 120.0', COLOR CHANGE TO 10 YR 5/2, GRAYISH BROWN, DOLOMITIC SANDSTONE	DOLOMITIC SANDSTONE			61	161	GC	118.0	
						62	365.0	GC	120.0	
	120					63	64.0	GC	122.0	120
	122.0	DOLOMITE: MICROCRYSTALLINE, 10 YR 5/2, GRADATIONAL CONTACT WITH DOLOMITIC SANDSTONE, DRY MINOR IRON OXIDE STAINING AFTER 126.0'	DOLOMITE			64	71.0	GC	124.0	
						65	61.0	GC	126.0	
	125					66	76.0	GC	128.0	125
	128.0	SANDY DOLOMITE: VERY FINE GRAIN SAND, GRADATIONAL CONTACT WITH DOLOMITE, 10 YR 5/2, GRAYISH BROWN, HARD, DRY	SANDY DOLOMITE			67	53.0	GC	130.0	
	130					NS		5.0		130
	130.5	DOLOMITIC SANDSTONE: VERY FINE GRAIN SILICA, VERY HARD, 5 Y 8/1, LIGHT GRAY TO GRAY, AFTER 133.0', DISCONTINUOUS BANDS OF 10 YR 3/1, VERY DARK GRAY COLOR, HORIZONTAL FRACTURES AT 130.2',130.5',131.1',133.1',134.4', AND 134.9'	DOLOMITIC SANDSTONE						135.0	
	135					NS		4.7		135
	135.5	DOLOMITE: MICROCRYSTALLINE AND SUGARY, GRADATIONAL CONTACT WITH DOLOMITIC SANDSTONE, ABUNDANT FRACTURES LARGELY FILLED WITH CALCITE, IRON PYRITE, AND MANGANESE OXIDE, OCCASIONAL VERY THIN INTERBEDS OF DOLOMITIC SANDSTONE, 2.5 Y 5/2, GRAYISH BROWN AND 5 YR 5/2, REDDISH GRAY, 10 YR 5/1, GRAY ALONG FRACTURES, FRACTURES 135.3',135.7',136.1',136.6',136.9',137.5',	DOLOMITE						139.7	
	140									140

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-85 (MW-59)*

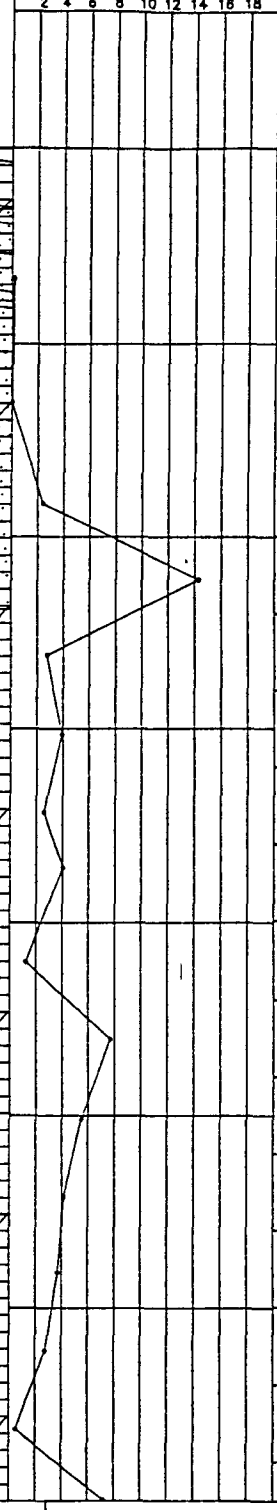
DATE DRILLED 6/28/91 TO 7/4/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3816.60	
	140	CONTINUED FROM PREVIOUS PAGE 137.9',138.6',140.1',141.0',141.3', AND 141.5'	DOLOMITE
	141.6	DOLOMITIC SANDSTONE: VERY FINE GRAIN SAND, 2.5 Y 5/2, GRAYISH BROWN, MASSIVE, VERY HARD, WELL CEMENTED, HORIZONTAL FRACTURES AT 141.6', 142.3',143.3', AND 143.8', FRACTURES LARGELY CEMENTED WITH CALCITE, ABUNDANT VERY FINE PYRITE, HIGHLY WEATHERED SILTY SANDSTONE INTERBEDDED BETWEEN 143.4' AND 143.7', ABUNDANT IRON OXIDE STAINING AND IRON PYRITE WITHIN INTERBED ,	DOLOMITIC SANDSTONE
	145	AFTER 148.0', 10YR 5/2, GRAYISH BROWN	
	150		
	152	DOLOMITE: MICROCRYSTALLINE, 10YR 6/2, LIGHT BROWNISH GRAY, VERY HARD, DRY, MINOR INTERBEDS OF 10YR 3/1, GRAY, VERY FINE GRAIN SANDSTONE	DOLOMITE
	155	MINOR INTERBED OF 2.5Y 7/4, PALE YELLOW SILTY SANDSTONE @ 162.0'	
	160		
	165		
	170		
	175		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
NS		5.3	
68	5.0		143.4 143.7
NS			145.0
69	3.2	GC	148.0
70	42.0	GC	150.0
71	263.0	GC	152.0
72	48.0	GC	154.0
73	66.0	GC	156.0
74	44.0	GC	158.0
75	67.0	GC	160.0
76	33.0	GC	162.0
77	137.0	GC	164.0
78	108.0	GC	166.0
79	80.0	GC	168.0
80	64.0	GC	170.0
81	44.0	GC	172.0
82	23.0	GC	174.0
83	127.0	GC	175.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-85 (MW-59)*

DATE DRILLED 6/28/91 TO 7/4/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
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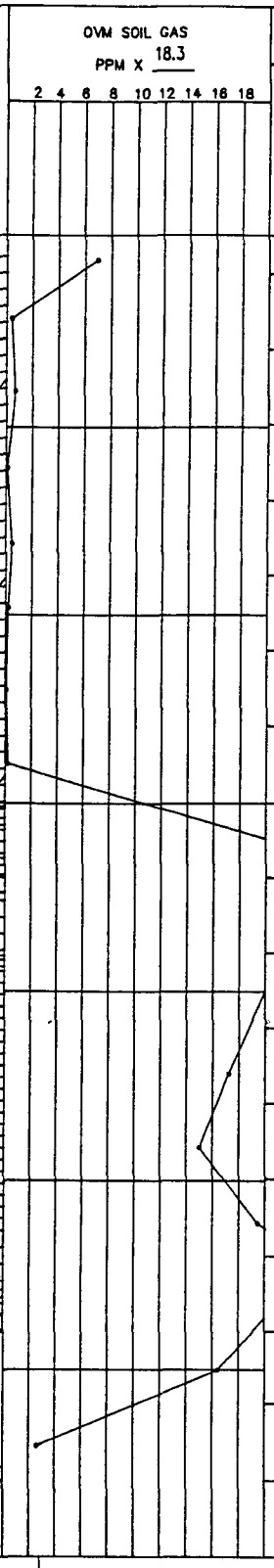
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3816.60	
	175	CONTINUED FROM PREVIOUS PAGE	DOLOMITE
	180	SUGARY WITH MINOR IRON PYRITE AFTER 180.0'	
	185	AFTER 186.0' MINOR IRON OXIDE STAINING	
▽ 191.0	190	DOLOMITIC LIMESTONE: 7.5YR 8/4, PINK, 7.5YR 7/2, PINKISH GRAY, HARD, SATURATION AND STRONG CONDENSATE ODOR AT 191.0', AFTER 192.0', NO OBVIOUS SATURATED, CHALKY, MICROCRYSTALLINE	DOLOMITIC LIMESTONE
	192	DOLOMITE: 10YR 6/2, LIGHT BROWNISH GRAY, HARD, MICROCRYSTALLINE, DRY	DOLOMITE
	194	LIMESTONE: 10YR 6/2, LIGHT BROWNISH GRAY, HARD, CHALKY IN CUTTINGS, DRY, STRONG CONDENSATE ODOR	LIMESTONE
	195		
▽ 200.0	200	SATURATION AFTER 200.0'	
	201	SANDY DOLOMITE: VERY FINE GRAIN SAND, MICROCRYSTALLINE, 10YR 6/2 LIGHT BROWNISH GRAY, SATURATED, CONDENSATE ODOR	SANDY DOLOMITE
	204	SANDSTONE: CARBONATE CEMENT, VERY FINE GRAIN SAND, 10YR 7/3, VERY PALE BROWN, CONDENSATE ODOR, HARD, SATURATED, MINOR IRON OXIDE STAINNING, HIGHLY CEMENTED AFTER 206.0', INTERBEDDED 10YR 5/1, GRAY SANDSTONE	SANDSTONE
	205		
	208	T.D. 208.0' WATER LEVEL 1 HOUR AFTER DRILLING 191.0', 0.9' OF FLOATING PRODUCT	
	210		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
83	127.0	GC	176.0
84	10.0	GC	178.0
85	15.0	GC	180.0
86	2.0	GC	182.0
87	11.0	GC	184.0
88	6.0	GC	186.0
89	2.6	GC	188.0
90	3.5	GC	190.0
91	660.0	GC	192.0
92	572.0	GC	194.0
93	619.0	GC	196.0
94	273.0	GC	198.0
95	143.0	GC	200.0
96	343.0	GC	202.0
97	591.0	GC	204.0
98	297.0	GC	206.0
99	44.0	GC	208.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-85 (MW-59)*

DATE DRILLED 6/28/91 TO 7/4/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
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NORMAN, OKLAHOMA 73072
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3812.10	
	0	CLAYEY SILT: YELLOWISH BROWN, 10YR 5/6, VERY LOW PLASTICITY, DRY, 60% SILT, 40% CLAY	ML
	1.5	DOLOMITE: LIGHT GRAY, 10YR 7/2, MASSIVE, HARD, INTERBEDDED WITH SILTSTONE AND SANDSTONE, QUARTZ, VERY FINE GRAIN, NONCALCAREOUS, CONCOIDAL FRACTURE	DOLOMITE
	9.0	DOLOMITIC SANDSTONE: LIGHT GRAY TO PINKISH GRAY, 10YR 7/2 TO 6/2, MASSIVE, MODERATELY HARD, MODERATELY WELL CEMENTED, NONCALCAREOUS	DOLOMITIC SANDSTONE
	15	SANDSTONE: LIGHT GRAY TO YELLOW, 10YR 7/2 TO 7/8, VERY FINE GRAIN, THIN BEDDED, MODERATELY WELL CEMENTED, NONCALCAREOUS, VERY FINE GRAIN FROM 16 TO 18 FEET	SANDSTONE
	19.0	DOLOMITIC SANDSTONE: LIGHT GRAY TO GRAY, 10YR 7/2 TO 5/1, VERY FINE GRAIN, MASSIVE, WELL CEMENTED, HARD, NONCALCAREOUS	DOLOMITIC SANDSTONE
	27.0	SANDSTONE: YELLOW, 10YR 7/8, VERY FINE GRAIN, THIN BEDDED, ABUNDANT IRON STAIN, WELL CEMENTED, NONCALCAREOUS	SANDSTONE
	30	SILTSTONE: YELLOW, 10YR 7/8, VERY FINE QUARTZ, CALCAREOUS, DRY	SILTSTONE
	32.5	DOLOMITE: LIGHT GRAY, 10YR 7/2, SANDY, FINE GRAIN QUARTZ, INTERBEDDED SANDSTONE – SILTSTONE, YELLOW, 10YR 7/8, CALCAREOUS, MODERATELY HARD	DOLOMITE WITH SANDSTONE & SILTSTONE
	34.5		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM x 20.0: 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.6	GC	2.0
2	0.0	GC	4.0
3	0.0	GC	6.0
4	0.0	GC	8.0
5	0.0	GC	10.0
6	0.0	GC	12.0
7	5.1	GC	14.0
8	0.0	GC	16.0
9	0.8	GC	18.0
10	0.6	GC	20.0
11	0.0	GC	22.0
12	0.8	GC	24.0
13	0.0	GC	26.0
14	1.1	GC	28.0
15	1.1	GC	30.0
16	2.2	GC	32.0
17	2.9	GC	34.0
18	5.7	GC	35.0

REMARKS

BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM

AIR HAMMER DRILLING

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-86 (MW-60)*

DATE DRILLED 7-9-91 TO 7-12-91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
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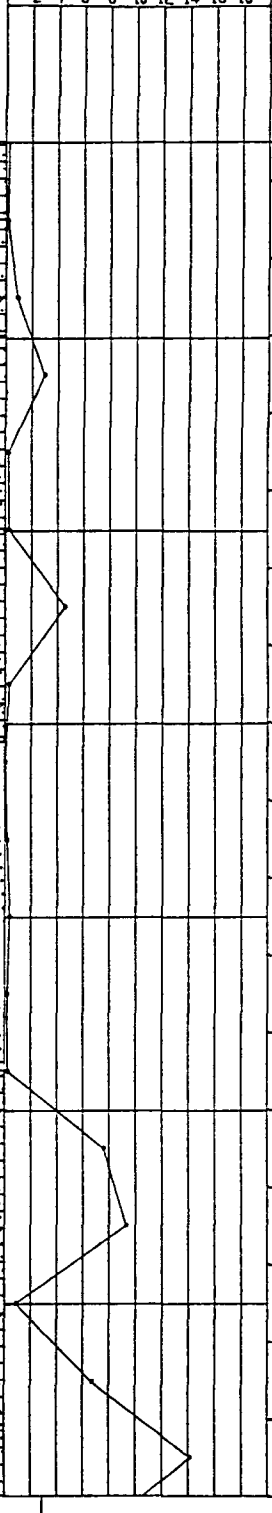
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3812.10	
	35	DOLOMITIC SANDSTONE: GRAY, 10YR 5/1 TO PINKISH GRAY, 7.5YR 6/2, VERY FINE GRAIN, MASSIVE, MODERATELY WELL CEMENTED	DOLOMITIC SANDSTONE
	37.0	DOLOMITE: LIGHT GRAY, 10YR 7/2, INTERBEDDED WITH SANDSTONE, YELLOW, 10YR 7/8, MODERATELY TO POORLY CEMENTED, NONCALCAREOUS	DOLOMITE W/ INTER-BEDDED SANDSTONE
	40	DOLOMITIC SANDSTONE: LIGHT GRAY TO GRAY, 10YR 7/2 TO 5/1, MASSIVE, MODERATELY HARD, VERY FINE GRAIN QUARTZ	DOLOMITIC SANDSTONE
	45	SANDSTONE: GRAY, 10YR 5/1 TO YELLOW, 10YR 7/8, VERY FINE QUARTZ, THIN BEDDED, WEAKLY CEMENTED, ABUNDANT BIOTITE AND K. FELDSPAR, NONCALCAREOUS, INTERBEDDED WITH THIN DOLOMITIC SANDSTONE	SANDSTONE AND DOLOMITIC SANDSTONE
	49.5	DOLOMITIC SANDSTONE: GRAY, 10YR 5/1, VERY FINE QUARTZ, MASSIVE, MODERATELY HARD	DOLOMITIC SANDSTONE
	50		
	50.5	SANDSTONE: YELLOW, 10YR 5/1 TO LIGHT GRAY, 10YR 7/2, VERY FINE QUARTZ, WEAKLY CEMENTED, THIN BEDDED, IRON STAINING, GRAY, 10YR 5/1 FROM 53 TO 54 FEET, MASSIVE MODERATELY WELL CEMENTED, YELLOWISH BROWN, 10YR 5/4 FROM 54.0 TO 59.0', VERY POORLY CEMENTED, FRIABLE, MOIST	SANDSTONE
	55		
	59.0	DOLOMITIC SANDSTONE: GRAY, 10YR 5/1, VERY FINE GRAIN, MASSIVE, MODERATELY HARD, WELL CEMENTED, INTERBEDDED WITH SANDSTONE FROM 63 TO 68 FEET, YELLOWISH BROWN, 10YR 5/4, WEAKLY CEMENTED	DOLOMITIC SANDSTONE AND INTER-BEDDED SANDSTONE
	60		
	65		
	70		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
18	5.7	GC	36.0
19	2.9	GC	38.0
20	18.1	GC	40.0
21	59.0	GC	42.0
22	4.9	GC	44.0
23	5.8	GC	46.0
24	92.0	GC	48.0
25	6.0	GC	50.0
26	1.3	GC	52.0
27	4.2	GC	54.0
28	8.2	GC	56.0
29	4.2	GC	58.0
30	5.1	GC	60.0
31	151.8	GC	62.0
32	166.0	GC	64.0
33	17.4	GC	66.0
34	134.0	GC	68.0
35	283.0	GC	70.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-86 (MW-60)*

DATE DRILLED 7-9-91 TO 7-12-91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: DKS

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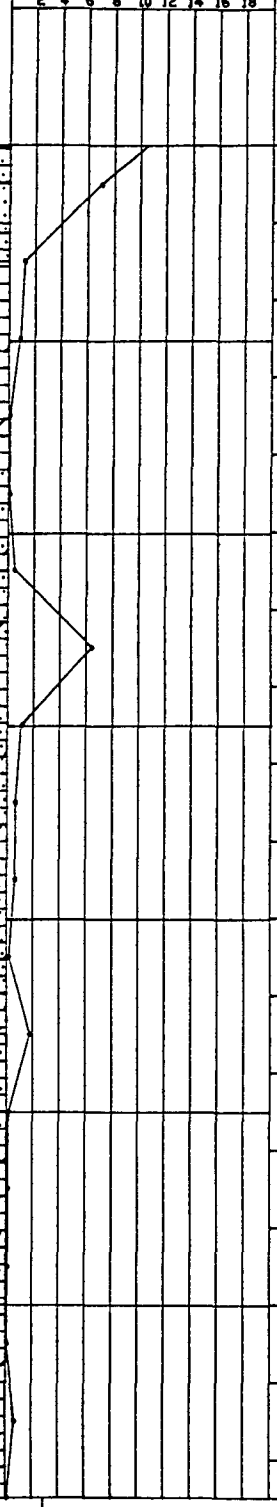
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3812.10	
	70		
	71.0	CONTINUED FROM PREVIOUS PAGE	
	72.0	SANDSTONE: YELLOW, 10YR 5/1, VERY FINE QUARTZ, WEAKLY CEMENTED, THIN BEDDED, MOIST	SANDSTONE
	73.0	DOLOMITIC SANDSTONE: GRAY, 10YR 5/1, VERY FINE GRAIN, MASSIVE, MOIST, WELL CEMENTED, INTERBEDDED WITH SANDY DOLOMITE, LIGHT GRAY TO VERY PALE BROWN, 10YR 7/2 TO 7/3, VERY FINE QUARTZ, MASSIVE	DOLOMITIC SANDSTONE
	75	DOLOMITE: LIGHT GRAY TO VERY PALE BROWN, 10YR 7/2 TO 7/3, MICROCRYSTALLINE, MASSIVE, CONCOIDAL FRACTURE	DOLOMITE
	77.5	SANDY DOLOMITE: GRAY TO LIGHT BROWNISH GRAY, 10YR 5/1 TO 6/2, MASSIVE, VERY FINE GRAIN TO CRYSTALLINE	SANDY DOLOMITE
	80		
	81.0	SANDSTONE: BROWN TO YELLOWISH BROWN, 10YR 5/3 TO 5/4, VERY FINE QUARTZ, MODERATELY CEMENTED TO WEAKLY CEMENTED, INTERBEDDED WITH MINOR DOLOMITIC SANDSTONE, GRAY, 10YR 5/1, HARD, MASSIVE, MOIST	SANDSTONE AND INTER-BEDDED DOLOMITIC SANDSTONE
	85		
	90		
	93.0	SANDY DOLOMITE: GRAY TO LIGHT BROWNISH GRAY, 10YR 5/1 TO 6/2, MASSIVE, VERY FINE GRAIN TO CRYSTALLINE	SANDY DOLOMITE
	95	DOLOMITE - SANDY DOLOMITE: VERY PALE BROWN TO GRAY, 10YR 7/2 TO 5/1, INTERBEDDED	DOLOMITE INTER-BEDDED WITH SANDY DOLOMITE
	100	DOLOMITE: LIGHT GRAY TO VERY PALE BROWN, 10YR 7/2 TO 7/3, MICROCRYSTALLINE, MASSIVE, CONCOIDAL FRACTURE	DOLOMITE
	105		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
36	140.0	GC	72.0
37	24.0	GC	74.0
38	17.4	GC	76.0
39	2.0	GC	78.0
40	2.4	GC	80.0
41	10.5	GC	82.0
42	129.2	GC	84.0
43	21.9	GC	86.0
44	13.8	GC	88.0
45	13.2	GC	90.0
46	3.8	GC	92.0
47	36.2	GC	94.0
48	3.8	GC	96.0
49	3.5	GC	98.0
50	3.5	GC	100.0
51	2.0	GC	102.0
52	13.2	GC	104.0
53	2.9	GC	105.0

REMARKS

BACKGROUND OVM READING
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-86 (MW-60)*

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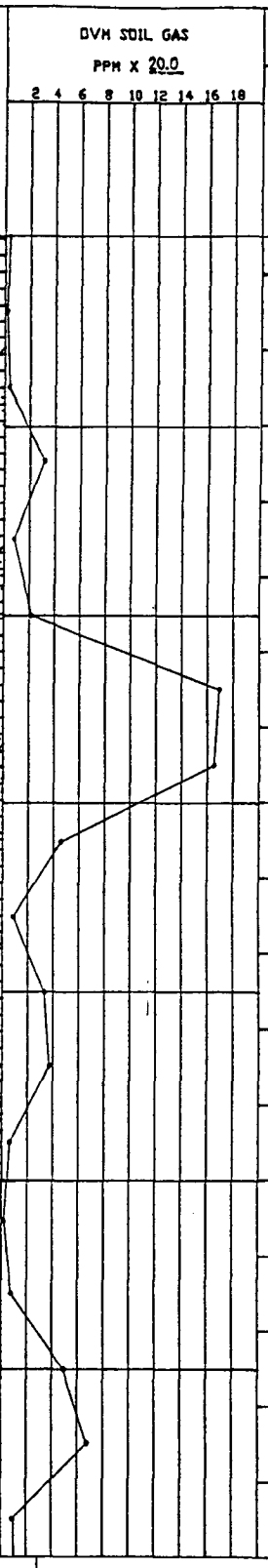
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3812.10		
	105	CONTINUED FROM PREVIOUS PAGE	DOLOMITE	
	109.0	SANDY DOLOMITE: GRAY 10YR 5/1, MASSIVE, HARD, INTERBEDDED WITH SANDSTONE, YELLOWISH BROWN, 10YR 5/4, QUARTZ, VERY FINE GRAIN, THIN BEDDED, NONCALCAREOUS	SANDY DOLOMITE INTER-BEDDED WITH SANDSTONE	
	110			
	115	DOLOMITIC SANDSTONE: GRAY, 10YR 5/1, QUARTZ, VERY FINE GRAIN, MODERATELY HARD, WELL CEMENTED, MASSIVE, INTERBEDDED WITH SANDSTONE, QUARTZ VERY FINE GRAIN, THIN BEDDED, WEAKLY CEMENTED	DOLOMITIC SANDSTONE INTER-BEDDED WITH SANDSTONE	
	120			
	121.0	DOLOMITE: VERY PALE BROWN, 10YR 7/2, MICROCRYSTALLINE, MASSIVE, CONCOIDAL FRACTURE	DOLOMITE	
	125			
		MINOR SAND BELOW 126.0 FEET, QUARTZ		
	127.0	SANDY DOLOMITE: GRAY, 10YR 5/1, VERY FINE GRAIN, MASSIVE	SANDY DOLOMITE	
	130			
	131.0	DOLOMITIC SANDSTONE: GRAY, 10YR 5/1 TO PINKISH GRAY, 7.5YR 7/2, VERY FINE GRAIN, WELL CEMENTED, MODERATELY HARD, MASSIVE	DOLOMITIC SANDSTONE	
	135			
	137.0	SANDY DOLOMITE: LIGHT BROWNISH GRAY, 5YR 7/1, VERY FINE GRAIN, MASSIVE, HARD	SANDY DOLOMITE	
		MINOR DOLOMITIC SANDSTONE FROM 142 TO 144 FEET		
	140			



SAMPLE NUMBER	DVM READING	RECOVERY	DEPTH
53	2.9	GC	106.0
54	1.7	GC	108.0
55	2.6	GC	110.0
56	62.7	GC	112.0
57	15.4	GC	114.0
58	48.1	GC	116.0
59	343.0	GC	118.0
60	316.0	GC	120.0
61	91.5	GC	122.0
62	21.9	GC	124.0
63	68.2	GC	126.0
64	76.3	GC	128.0
65	11.8	GC	130.0
66	2.6	GC	132.0
67	15.8	GC	134.0
68	100.2	GC	136.0
69	132.7	GC	138.0
70	20.5	GC	140.0

REMARKS

BACKGROUND DVM READING
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-86 (MW-60)*

DATE DRILLED 7-9-91 TO 7-12-91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: DKS

ROBERTS/SCHORNICK
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ENVIRONMENTAL CONSULTANTS
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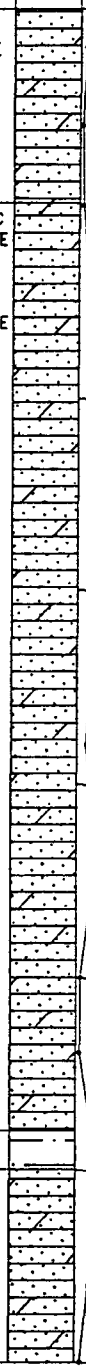
NORMAN, OKLAHOMA 73072
(405) 321-3895

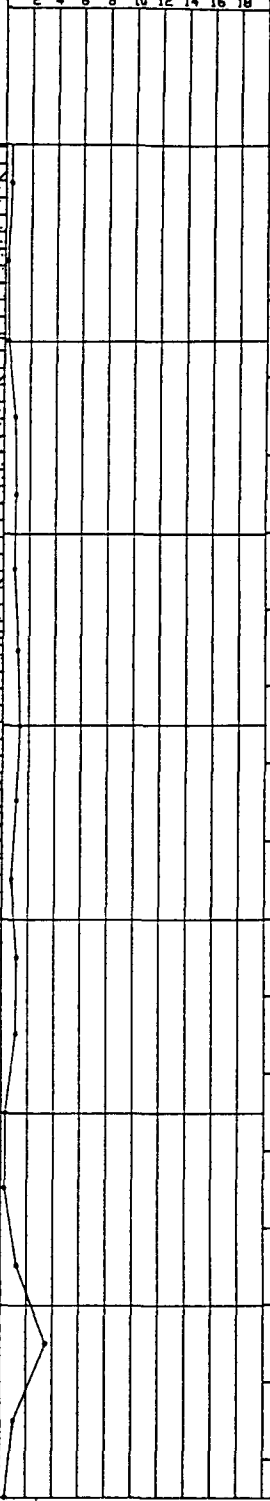
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3812.10	
	140	SANDY DOLOMITE: LIGHT BROWNISH GRAY, 5YR 7/1, VERY FINE GRAIN, MASSIVE, HARD	SANDY DOLOMITE
		MINOR DOLOMITIC SANDSTONE FROM 142 TO 144 FEET	
	145	DOLOMITIC SANDSTONE: GRAY, 10YR 5/1 TO LIGHT BROWNISH GRAY, 5YR 7/1, VERY FINE GRAIN, WELL CEMENTED, HARD, MASSIVE, INTERBEDDED WITH SANDSTONE, LIGHT GRAY, 10YR 7/2, TO YELLOWISH BROWN, 10YR 5/4, VERY FINE GRAIN, WEAKLY CEMENTED, MINOR IRON STAINING AND SMALL SCALE FRACTURES	DOLOMITIC SANDSTONE WITH INTER-BEDDED SANDSTONE
	150		
	155		
	160		
	165		
	169.0	SILTSTONE: VERY PALE ORANGE TO GRAYISH ORANGE, 10YR 8/2 TO 7/4, VERY FINE QUARTZ, INTERBEDDED, MOIST, $CaCO_3$ CEMENTED	SILTSTONE
	170	SANDY DOLOMITE: LIGHT BROWNISH GRAY, 5YR 7/1, VERY FINE GRAIN TO CRYSTALLINE, MASSIVE	SANDY DOLOMITE
	175		

GRAPHIC LOG



OVM SOIL GAS PPM X 20.0



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
71	10.0	GC	142.0
72	6.2	GC	144.0
73	7.6	GC	146.0
74	15.6	GC	148.0
75	19.0	GC	150.0
76	16.3	GC	152.0
77	24.1	GC	154.0
78	27.0	GC	156.0
79	22.3	GC	158.0
80	16.7	GC	160.0
81	24.3	GC	162.0
82	24.1	GC	164.0
83	4.9	GC	166.0
84	6.7	GC	168.0
85	25.7	GC	170.0
86	75.6	GC	172.0
87	20.1	GC	174.0
88	8.5	GC	175.0

REMARKS

BACKGROUND OVM READING
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-86 (MW-60)*

DATE DRILLED 7-9-91 TO 7-12-91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: DKS

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NORMAN, OKLAHOMA 73072
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 20.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3812.10								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	175	CONTINUED FROM PREVIOUS PAGE				88	8.5	GC	176.0	175
	176.0	DOLOMITE: GRAY, 10YR 5/1 TO 6/1, MICRO-CRYSTALLINE, MODERATELY HARD, MASSIVE, CONCOIDAL FRACTURE	DOLOMITE			89	7.8	GC	178.0	
						90	4.0	GC	180.0	
	180					91	2.2	GC	182.0	180
						92	4.9	GC	184.0	
07:45 7-12-91 185.59						93	4.0	GC	186.0	
	185									185
	185.5	SANDSTONE: GRAYISH ORANGE TO MODERATELY YELLOWISH BROWN, 10YR 7/4 TO 5/4, FINE TO MEDIUM GRAIN, ROUND TO SUBROUND, WELL SORTED, CaCO3 CEMENTED, MODERATELY HARD	SANDSTONE			94	2.9	GC	188.0	
		DOLOMITE: GRAY, 10YR 5/1 TO 6/1, MICRO-CRYSTALLINE, MODERATELY HARD, MASSIVE, CONCOIDAL FRACTURE	DOLOMITE			95	4.2	GC	190.0	
	190					96	2.6	GC	192.0	190
						97	1.5	GC	194.0	
		MINOR INTERBEDDED LIMESTONE FROM 193.5 TO 197.0 FEET, VERY PALE ORANGE, 10YR 2/2, SILTY, MASSIVE, CONCOIDAL FRACTURE, EFFERVESENCE IN HCL	DOLOMITE WITH INTER-BEDDED LIMESTONE			98	2.4	GC	196.0	
	195									195
						99	2.4	GC	198.0	
			DOLOMITE			100	2.2	GC	200.0	
	200									200
		INTERBEDDED DOLOMITIC SANDSTONE FROM 201 TO 203 FEET, QUARTZ, VERY FINE GRAIN, LIGHT GRAY, 10YR 7/1, MODERATELY CEMENTED, NONCALCAREOUS				101	2.2	GC	202.0	
	203.0	DOLOMITIC SANDSTONE: GRAY, 10YR 5/1, VERY FINE GRAIN, WELL CEMENTED, MODERATELY HARD	DOLOMITIC SANDSTONE			102	2.2	GC	204.0	
	205					103	12.9	GC	206.0	205
						104	30.4	GC	208.0	
210.0						105	7.6	GC	210.0	
	210									210

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-86 (MW-60)*

DATE DRILLED 7-9-91 TO 7-12-91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: DKS

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 20.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
210.0 ▽		GROUND SURFACE: 3812.10								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	210	SANDSTONE: LIGHT GRAY TO YELLOW, 10YR 7/1 TO 7/6, QUARTZ, FINE TO MEDIUM GRAIN, ANGULAR TO SUBROUND, WEAKLY TO VERY POORLY CEMENTED, MODERATELY SORTED, SATURATED, INTERBEDDED WITH SANDY DOLOMITE, LIGHT BROWNISH GRAY, 5YR 7/1, SANDSTONE MEDIUM GRAIN BELOW 215 FEET, SUBROUND	SANDSTONE WITH INTER-BEDDED SANDY DOLOMITE			106	1.7	GC	210.2	210
						107	2.2	GC	212.0	
						108	2.2	GC	214.0	
	215					109	1.5	GC	216.0	215
						110	0.4	GC	218.0	
						111	0.0	GC	220.0	
	220	BORING TERMINATED AT 220.0 FEET GC – GRAB COMPOSITE SAMPLE								220
	225									225
	230									230
	235									235
	240									240
	245									245

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-86 (MW-60)*

DATE DRILLED 7-9-91 TO 7-12-91
DRILLING METHOD AIR HAMMER
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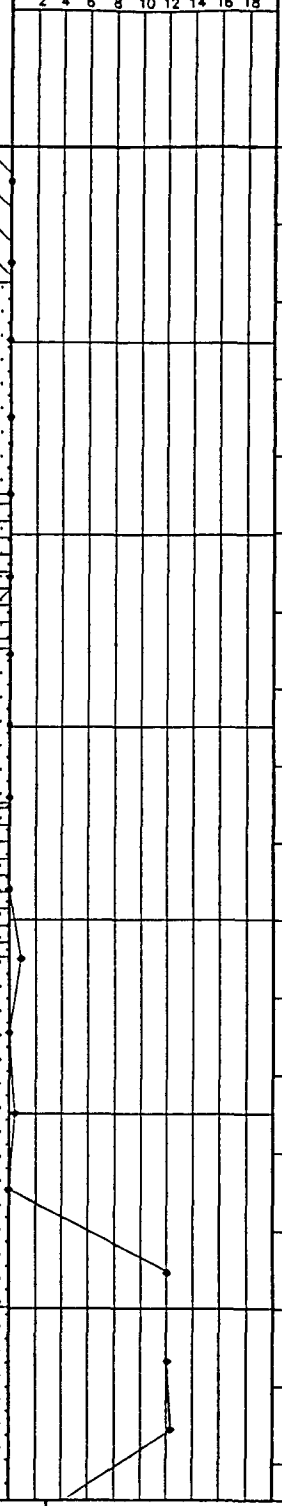
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3813.3	
	0	CLAYEY SILT: VERY PALE BROWN, 10 YR 7/3, VERY FINE QUARTZ, DRY, VERY LOW PLASTICITY, 70% SILT, 30% CLAY	ML
	3.5	SANDSTONE: WHITE TO LIGHT GRAY, 10 YR 8/2 TO 7/1, QUARTZ, VERY FINE GRAIN, CALICHE CEMENTED, WEAK, CALCAREOUS	SAND-STONE
	5		
	9.0	SANDY DOLOMITE: GRAY, 10 YR 5/1, VERY FINE GRAIN, MASSIVE, HARD TO MODERATELY HARD, MINOR Fe STAIN	SANDY DOLO.
	10		
	13.0	SANDSTONE: WHITE TO LIGHT BROWNISH GRAY, 2.5 YR 8/2 TO 6/2, QUARTZ, VERY FINE GRAIN, VERY POORLY CEMENTED, ABUNDANT Fe STAIN	SAND-STONE
	15		
	17.0	DOLOMITE-SANDY DOLOMITE: LIGHT GRAY TO LIGHT BROWNISH GRAY, 10 YR 7/1 TO 6/2, MICROCRYSTALLINE TO VERY FINE GRAIN, MASSIVE	DOLOMITE AND SANDY DOLOMITE
	20		
	21.0	SANDSTONE: WHITE TO LIGHT GRAY, 10 YR 8/1, QUARTZ, FINE TO VERY FINE GRAIN, WEAKLY CEMENTED, FRIABLE, VERY WELL SORTED	SAND-STONE
	25		
		GRAYISH ORANGE, 10 YR 7/4 BELOW 28.0'	
	30	SANDSTONE: GRAY TO DARK GRAYISH BROWN, 10 YR 6/1 TO 4/2, QUARTZ, VERY FINE GRAIN, WELL SORTED, MINOR BIOTITE, POORLY TO WEAKLY CEMENTED, FRIABLE, NONCALCAROUS	SAND-STONE
		GRAYISH BROWN, 2.5 YR 5/2 FROM 33' TO , VERY POORLY CEMENTED, STRUCTURELESS, MOIST	
	35		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	2.0
2	0.0	GC	4.0
3	0.0	GC	6.0
4	0.0	GC	8.0
5	0.0	GC	10.0
6	0.0	GC	12.0
7	0.0	GC	14.0
8	0.8	GC	16.0
9	0.0	GC	18.0
10	0.0	GC	20.0
11	2.6	GC	22.0
12	0.0	GC	24.0
13	1.7	GC	26.0
14	0.0	GC	28.0
15	36.2	GC	30.0
16	36.1	GC	32.0
17	37.1	GC	34.0
18	6.0	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87 (MW-61)*

DATE DRILLED 7/9/91 & 7/12/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 3.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3813.30								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35		SAND-STONE			18	6.0	GC	36.0	35
						19	12.6	GC	38.0	
						20	12.5	GC	40.0	
	40					21	12.2	GC	42.0	40
						22	12.2	GC	44.0	
7-13-91 ▽ 45.49	45					23	18.3	GC	46.0	45
						24	17.1	GC	48.0	
						25	51.3	GC	50.0	
	50	LIGHT OLIVE GRAY, 5 YR 6/1 TO GRAY, 10 YR 5/1, MODERATELY HARD, ABUNDANT BIOTITE				26	66.4	GC	52.0	50
▽ 53.0		SATURATED AT 53.0'				27	6.9	GC	54.0	
	55	OLIVE GRAY 5 YR 4/1 BELOW 54', VERY FINE GRAIN, VERY WELL CEMENTED, HARD, NONCALCAREOUS				28	3.1	GC	56.0	55
	56.0	BORING TERMINATED AT 56.0'								
	60									60
	65									65
	70									70

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87 (MW-61)*

DATE DRILLED 7/9/91 & 7/12/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
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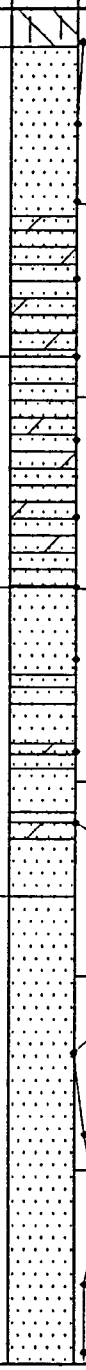
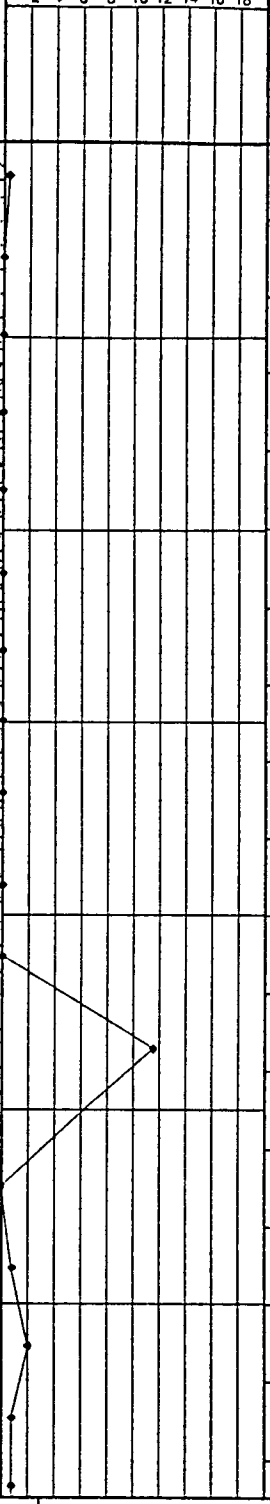
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3813.60	
	0	CLAYEY SILT: BROWN, 10 YR 5/3, VERY FINE QUARTZ, DRY, VERY LOW PLASTICTIY, 70% SILT, 30% CLAY	ML
	1.0	SANDSTONE: GRAY TO DARK GRAY, 10 YR 6/1 TO 4/2, QUARTZ, VERY FINE GRAIN, WELL SORTED, MINOR BIOTITE, WEAKLY TO MODERATELY CEMENTED, FRIABLE, NONCALCAREOUS INTERBEDDED THIN, DOLOMITE BELOW 5.0', LIGHT GRAY, 2.5 YR 7/2, MICRO-CRYSTALLINE, CONCOIDAL FRACTURE	SAND-STONE WITH INTER-BEDDED DOLO.
	5		
	9.0	DOLOMITE: LIGHT GRAY TO LIGHT BROWN-ISH GRAY, 10 YR 7/2 TO 6/2, MICRO-CRYSTALLINE, MASSIVE, CONCOIDAL FRACTURE INTERBEDDED WITH SANDY DOLOMITE, GRAY 10 YR 6/1, VERY FINE GRAIN	DOLO. WITH INTER-BEDDED SANDY DOLO.
	10		
	15	SANDSTONE: LIGHT OLIVE GRAY, 5 YR 5/2 TO LIGHT OLIVE BROWN, 5 YR 5/6, QUARTZ, VERY FINE GRAIN, WEAKLY CEMENTED, ABUNDANT, Fe STAIN INTERBEDDED SANDY DOLOMITE FROM 17.0' TO 23.0', LIGHT BROWNISH GRAY, 10 YR 6/2, VERY FINE GRAIN TO MICROCRYSTALLINE, MASSIVE, HARD	SAND-STONE WITH INTER-BEDDED SANDY DOLO.
	20		
	23.0	SANDSTONE: LIGHT BROWNISH GRAY TO GRAYISH BROWN, 2.5 YR 6/2 TO 5/2, QUARTZ, VERY FINE GRAIN, WELL SORTED, ROUND TO SUBROUND, MODER-ATELY TO WEAKLY CEMENTED, NONCAL-CAREOUS, YELLOWISH BROWN, 10 YR 5/4 BELOW 28.0', VERY POORLY CEMENTED, LOOSE, LIGHT GRAY, 2.5 YR 7/N FROM 31' TO 35.3', MODERATELY HARD, WELL CEMENTED, NONCALCAREOUS	SAND-STONE
	25		
	30		
	35		

GRAPHIC LOG



OVM SOIL GAS PPM x 18.0



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	10.7	GC	2.0
2	0.0	GC	4.0
3	0.0	GC	6.0
4	0.0	GC	8.0
5	0.4	GC	10.0
6	0.2	GC	12.0
7	0.4	GC	14.0
8	1.1	GC	16.0
9	0.0	GC	18.0
10	2.6	GC	20.0
11	3.5	GC	22.0
12	211	GC	24.0
13	109	GC	26.0
14	3.1	GC	28.0
15	22.1	GC	30.0
16	38.0	GC	32.0
17	20.5	GC	34.0
18	22.3	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

DATE DRILLED 7/13/91 TO 7/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
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NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 18.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3813.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35	SANDSTONE: LIGHT BROWNISH GRAY, 2.5 YR 6/2, QUARTZ, VERY FINE GRAIN, VERY POORLY TO WEAKLY CEMENTED BELOW 35.0', STRUCTURELESS, MOIST, MINOR Fe STAIN	SAND-STONE			18	22.3	GC	36.0	35
						19	5.3	GC	38.0	
						20	11.4	GC	40.0	
	40					21	11.8	GC	42.0	40
						22	10.0	GC	44.0	
	45					23	17.6	GC	46.0	45
						24	18.1	GC	48.0	
						25	13.6	GC	50.0	
	50	GRAYISH BROWN, 2.5 YR 5/2 BELOW 48.0', MOIST				26	90.4	GC	52.0	50
		MODERATELY WELL CEMENTED FROM 49.0' TO 51.0', DRY WELL CEMENTED BELOW 51.0', HARD, MASSIVE, SATURATION AT GRADATIONAL CHANGE, VERY DARK GRAYISH BROWN TO GRAY, 10 YR 3/2 TO 5/1, MASSIVE				27	49.9	GC	54.0	
▽56.0	55					28	16.1	GC	56.0	55
						29	2.9	GC	58.0	
						30	2.4	GC	60.0	
	60					31	4.2	GC	62.0	60
						32	15.1	GC	64.0	
	65					33	8.5	GC	66.0	65
		BORING TERMINATED AT 70.0' REEM HOLE TO 10"				34	8.6	GC	68.0	
						35	6.2	GC	70.0	
	70									70

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

DATE DRILLED 7/13/91 TO 7/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

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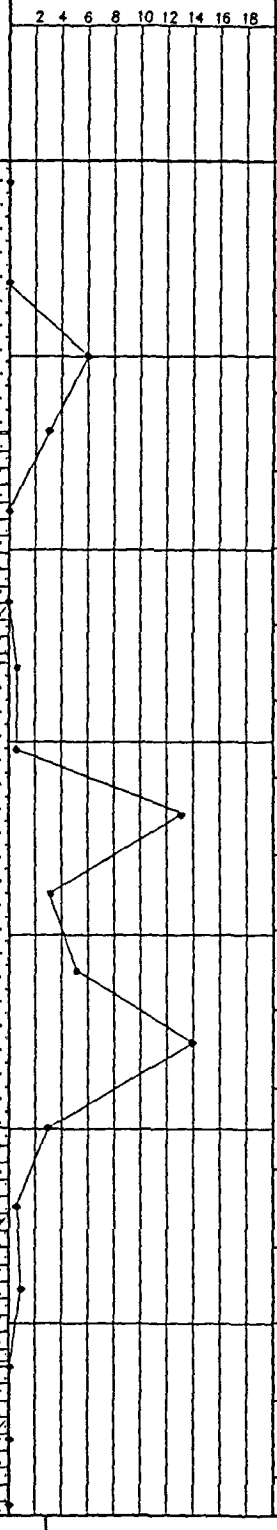
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3813.60	
	70	SANDSTONE: VERY DARK GRAYISH BROWN, 10 YR 3/2, VERY FINE GRAIN, MODERATELY CEMENTED, MODERATELY HARD, DRY	SANDSTONE
	75		
	77.0	SANDY DOLOMITE: GRAY 10 YR 5/1, VERY FINE GRAIN TO CRYSTALLINE, HARD, MASSIVE	SANDY DOLOMITE
	80		
	83.0	SANDSTONE: GRAY, 10 YR 5/1, QUARTZ, VERY FINE TO FINE GRAIN, WELL SORTED, ROUND TO SUBROUND, NONCALCAREOUS, MODERATELY TO WELL CEMENTED, MASSIVE	SANDSTONE
	85		
	90		
	95	DOLOMITIC SANDSTONE: GRAY, 10 YR 6/1, VERY FINE GRAIN TO CRYSTALLINE, NONCALCAREOUS, MASSIVE, HARD	DOLOMITIC SANDSTONE
	100		
	101.0	SANDY DOLOMITE: LIGHT GRAY, 10 YR 6/1, CRYSTALLINE, MINOR VERY FINE SAND, MASSIVE, HARD, CONCOIDAL FRACTURE	SANDY DOLOMITE
	105		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
36	5.5	GC	72.0
37	8.0	GC	74.0
38	114.6	GC	76.0
39	57.5	GC	78.0
40	4.2	GC	80.0
41	2.6	GC	82.0
42	25.2	GC	84.0
43	26.4	GC	86.0
44	241	GC	88.0
45	62.2	GC	90.0
46	89.5	GC	92.0
47	265	GC	94.0
48	62.4	GC	96.0
49	14.9	GC	98.0
50	18.8	GC	100
51	10.7	GC	102
52	13.4	GC	104
53	11.1	GC	105

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

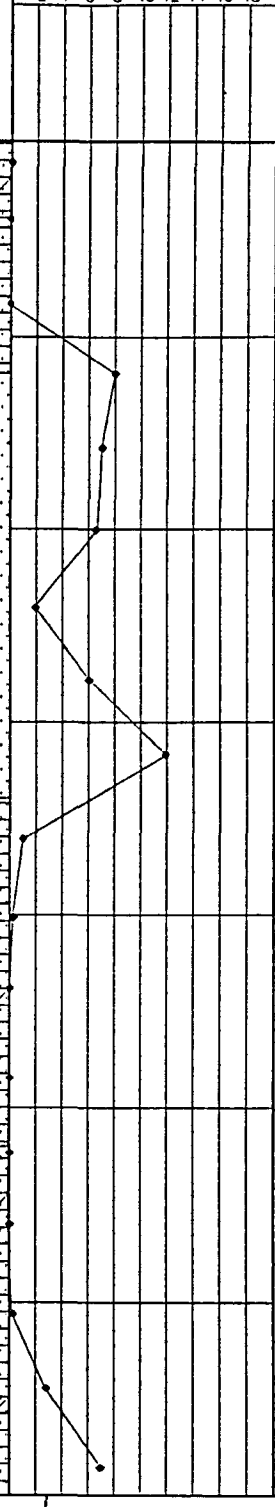
DATE DRILLED 7/13/91 TO 7/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY MJL
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3813.60	
	105	SANDY DOLOMITE: LIGHT GRAY TO LIGHT BROWNISH GRAY, 10 YR 6/1 TO 6/2, CRYSTALLINE, MINOR VERY FINE SAND, MASSIVE, HARD, CONCOIDAL FRACTURE	SANDY DOLOMITE
	107.0	DOLOMITIC SANDSTONE W/ INTERBEDDED SANDY DOLOMITE: LIGHT GRAY TO LIGHT BROWNISH GRAY, 10 YR 6/1 TO 5/1, MASSIVE	DOLOMITIC SAND-STONE W/INTER-BEDDED SANDY DOLO.
	110		
	111.0	SANDSTONE: LIGHT GRAY, 10 YR 7/1, QUARTZ, VERY FINE GRAIN, WELL SORTED, MINOR BIOTITE, MODERATELY WELL CEMENTED	SANDSTONE
	115		
	120		
	122.0	SANDY DOLOMITE: LIGHT GRAY TO LIGHT BROWNISH GRAY, 6/1 TO 6/2, VERY FINE GRAIN TO MICROCRYSTALLINE, MASSIVE, HARD	SANDY DOLOMITE
	125		
	130		
	131.0	DOLOMITIC SANDSTONE: GRAY, 10 YR 5/1, VERY FINE GRAIN, MODERATELY HARD, MODERATELY WELL CEMENTED	DOLOMITIC SANDSTONE
	135		
	140		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
53	11.1	GC	106
54	8.7	GC	108
55	9.4	GC	110
56	147	GC	112
57	140.1	GC	114
58	124	GC	116
59	34.4	GC	118
60	115.9	GC	120
61	213.9	GC	122
62	16.7	GC	124
63	12.3	GC	126
64	3.8	GC	128
65	0.4	GC	130
66	2.4	GC	132
67	0.4	GC	134
68	7.6	GC	136
69	56.8	GC	138
70	139.3	GC	140

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

DATE DRILLED 7/13/91 TO 7/15/91
DRILLING METHOD AIR HAMMER
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DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
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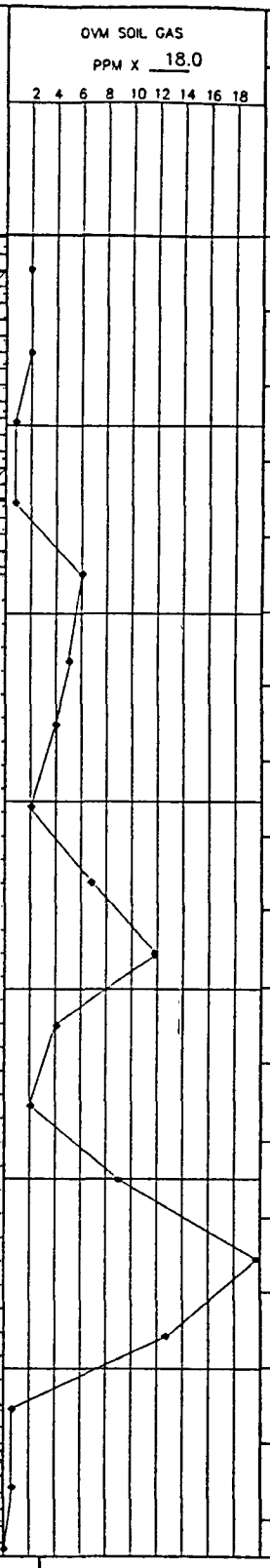
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3813.60	
	140	DOLOMITIC SANDSTONE: GRAY, 10 YR 5/1 VERY FINE GRAIN, MODERATELY HARD, MODERATELY WELL CEMENTED, MASSIVE	DOLOMITIC SANDSTONE
	141.0	SANDY DOLOMITE: GRAY TO LIGHT BROWNISH GRAY, 10 YR 5/1 TO 7/2, VERY FINE GRAIN TO CRYSTALLINE, HARD, MASSIVE	SANDY DOLOMITE
	145		
	147.0	DOLOMITIC SANDSTONE: GRAY 10 YR 5/1, VERY FINE GRAIN, MODERATELY HARD, MODERATELY WELL CEMENTED, MASSIVE	DOLOMITIC SANDSTONE
	149.0	SANDSTONE: YELLOWISH GRAY, 5 Y 7/2 QUARTZ, VERY FINE GRAIN, MODERATELY WELL SORTED, WEAKLY CEMENTED, ABUNDANT BIOTITE, NONCALCAREOUS ABUNDANT K-FELDSPAR BELOW 152', FINE TO VERY FINE GRAIN, MODERATELY WELL SORTED, MODERATELY WELL TO WELL CEMENTED	SANDSTONE
	150		
	155	VERY THIN SANDY MUDSTONE SEAM AT 156.5', MOIST, BANDED LIGHT GRAY TO DARK GRAY, ORGANIC ODOR INTERBEDDED WHITE TO VERY LIGHT GRAY, N/8 TO N/9 SANDSTONE FROM 157' TO VERY FINE GRAIN, VERY WELL SORTED, WEAKLY TO MODERATELY CEMENTED	
	160		
	165	FINE TO MEDIUM GRAIN FROM 170' TO 171', MODERATELY SORTED, VERY PALE BROWN TO BROWNISH YELLOW, 10 YR 7/4 TO 6/6	
	170		
	171.0	DOLOMITIC SANDSTONE: GRAY TO LIGHT BROWNISH GRAY, 10 YR 6/1 TO 6/2, VERY FINE GRAIN TO CRYSTALLINE, MODERATELY HARD, MASSIVE	DOLOMITIC SANDSTONE
	175		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
71	39.2	GC	142
72	37.8	GC	144
73	15.4	GC	146
74	18.3	GC	148
75	119.9	GC	150
76	83.2	GC	152
77	71.6	GC	154
78	31.7	GC	156
79	119.5	GC	158
80	221.8	GC	160
81	75.6	GC	162
82	32.0	GC	164
83	167.3	GC	166
84	360	GC	168
85	245.9	GC	170
86	13.8	GC	172
87	13.4	GC	174
88	7.8	GC	175

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 18.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3813.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	175	DOLOMITIC SANDSTONE: GRAY TO LIGHT BROWNISH GRAY, 10 YR 6/1 TO 6/2, VERY FINE GRAIN TO CRYSTALLINE, MODERATELY HARD, MASSIVE	DOLOMITIC SANDSTONE			88	7.8	GC	176	175
						89	113.7	GC	178	
						90	190.9	GC	180	
	180					91	14.3	GC	182	180
182.62						92	10.0	GC	184	
	185	SANDSTONE: GRAYISH BROWN, 10 YR 5/4, QUARTZ, VERY FINE GRAIN, WELL SORTED, MODERATELY WELL CEMENTED	SANDSTONE			93	127.3	GC	186	185
	187.0	SANDY DOLOMITE: DOLOMITIC SANDSTONE, GRAY TO LIGHT BROWNISH GRAY, 10 YR 6/1 TO 6/2, INTERBEDDED UNITS 1.5 FT. THICK, CRYSTALLINE TO VERY FINE GRAIN, MASSIVE	SANDY DOLOMITE W/INTER-BEDDED DOLOMITIC SANDSTONE			94	29.0	GC	188	
						95	6.9	GC	190	
	190					96	46.1	GC	192	190
194						97	2.4	GC	194	
	195	SATURATED BELOW 194.0' NO ODOR				98	1.3	GC	196	195
						99	0.0	GC	198	
						100	15.8	GC	200	
	200	FRACTURED BELOW 200'				101	0.6	GC	202	200
						102	0.4	GC	204	
	205					103	0.4	GC	206	205
	206.0	SANDSTONE: VERY PALE BROWN TO BROWNISH YELLOW, 10 YR 6/3 TO 6/6, MEDIUM TO COARSE GRAIN, ANGULAR TO SUBROUND, VERY POORLY SORTED, CALCAREOUS, SATURATED, ABUNDANT ANGULAR DOLOMITE AND LIMESTONE FRAGMENTS	SANDSTONE			104	0.0	GC	208	
						105	1.1	GC	210	
	210									210

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 18.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	SAMPLE OVM READING	SAMPLE RECOVERY	SAMPLE DEPTH	REMARKS
		GROUND SURFACE: 3813.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	210	SANDSTONE: PALE BROWN TO BROWNISH YELLOW, 10 YR 6/3 TO 6/6, MEDIUM TO COARSE GRAIN, VERY POORLY SORTED, ANGULAR TO SUBROUND, CALCAREOUS, SATURATED, ABUNDANT, ANGULAR DOLOMITE AND LIMESTONE FRAGMENTS, MODERATELY WELL CEMENTED, HARD	SANDSTONE			106	0.8	GC	212	210
						107	0.4	GC	214	
	214.0	BORING TERMINATED AT 214.0'								
	215									215
	220									220
	225									225
	230									230
	235									235
	240									240
	245									245

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-87A (MW-61A)*

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 88 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3817.00								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0 / 0.3	SILT: SOME CHERT AND DOLOMITE FRAGMENTS, 10 YR 6/3 PALE BROWN, DRY	ML							AIR HAMMER DRILLING
		CHERTY DOLOMITE: DRY FRAGMENTS, CHERT 10 YR 5/4, YELLOWISH BROWN DOLOMITE, 10 YR 5/2 GRAYISH BROWN	CHERTY DOLOMITE			1	0.0	GC	2.0	
						2	0.0	GC	4.0	
	5					3	9.0	GC	6.0	5
						4	5.0	GC	8.0	
	8.0	SILTSTONE: CHERTY, DOLOMITIC, DRY, 10 YR 6/4 LIGHT YELLOWISH BROWN	CHERTY DOLOMITIC SILTSTONE			5	11	GC	10.0	
	10	CHERTY DOLOMITE: 10 YR 5/4 YELLOWISH BROWN, SILTSTONE INTERBEDS, IRON OXIDE STAIN ON SOME SILTSTONE, DRY, 10 YR 5/8 (IRON STAIN) BROWNISH YELLOW	CHERTY DOLOMITE			6	7.0	GC	12.0	10
	12.0	DOLOMITIC SILTSTONE: DRY 10 YR 7/1 LIGHT GRAY, SOME CHERT 10 YR 7/3 VERY PALE YELLOW BROWN	DOLOMITIC SILTSTONE			7	102	GC	14.0	
	15					8	97	GC	16.0	15
						9	3.0	GC	18.0	
						10	2.0	GC	20.0	
	20					11	4.0	GC	22.0	20
	22.0	SANDSTONE: VERY FINE, DRY, 10 YR 8/1 WHITE, GRADATIONAL CONTACT WITH OVERLYING SILTSTONE, SOME CHERTY SILTSTONE, DRY	SANDSTONE			12	2.0	GC	24.0	
	25					13	2.0	GC	26.0	25
						14	2.0	GC	28.0	
						15	NS	GC	30.0	
	30	SANDSTONE: VERY FINE, DRY, 10 YR 8/1, WHITE TO 10 YR 8/2 VERY PALE BROWN, SOME SILTSTONE	SANDSTONE			16	4.0	GC	32.0	30
						17	8.0	GC	34.0	
	34.0	SEE TOP OF NEXT PAGE	SANDSTONE			18	16	GC	35.0	
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-88 (MW-62)*

DATE DRILLED 7/19/91 TO 7/24/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY DHC
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 88 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3817.00								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35	SANDSTONE: VERY FINE, 5 YR 6/1 GRAY, CHERT 10 YR 7/3 VERY PALE BROWN, DRY, WELL CEMENTED, 10 YR 6/1 GRAY	SANDSTONE			18	16	GC	36.0	35
						19	8	GC	38.0	
						20	20	GC	40.0	
	40	SANDSTONE: FINE, LOOSELY CEMENTED, 10 YR 7/4 VERY PALE BROWN, FINE SAND	SANDSTONE			21	2	GC	42.0	40
	42.0	SANDSTONE: VERY FINE, 7.5 YR 7/0 LIGHT GRAY, DRY, WELL CEMENTED				22	2	GC	44.0	
	45		SANDSTONE			23	4	GC	46.0	45
						24	4	GC	48.0	
						25	8.5	GC	50.0	
	50	SANDSTONE: FINE, 10 YR 7/7 LIGHT GRAY, DRY, MODERATELY CEMENTED	SANDSTONE			26	25	GC	52.0	50
	52.0	SANDSTONE: FINE, 10 YR 7/1 LIGHT GRAY, SLIGHT MOISTURE, POOR TO MODERATELY CEMENTED	SANDSTONE			27	8	GC	54.0	
	54.0	SANDSTONE: VERY FINE, 7.5 YR 8/0 WHITE TO 7.5 YR 7/0 LIGHT GRAY, WELL CEMENTED, DRY, PROBABLY DOLOMITE CEMENT				28	14	GC	56.0	
	55					29	70	GC	58.0	55
			SANDSTONE			30	7	GC	60.0	
	60					31	17	GC	62.0	60
						32	102	GC	64.0	
	65					33	8	GC	66.0	65
	66.0	CHERTY DOLOMITE: DRY, 5 YR 7/1 LIGHT GRAY	CHERTY DOLOMITE			34	26	GC	68.0	
						35	6	GC	70.0	
	70									70

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-88 (MW-62)*

DATE DRILLED 7/19/91 TO 7/24/91
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 88 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3817.00								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	70	CHERTY DOLOMITE: SAME AS ABOVE	CHERTY DOLOMITE			36	4	GC	72.0	70
	72.0	DOLOMITIC SANDSTONE: VERY FINE, GRAIN WELL CEMENTED, DRY, 2.5 YR 6/0, GRAY	DOLOMITIC SANDSTONE			37	123	GC	74.0	
	74.0	DOLOMITE: 5 YR 7/1 LIGHT GRAY AND DOLOMITIC SANDSTONE, DRY	DOLOMITE			38	67	GC	76.0	
	75									75
	77.0	DOLOMITIC SANDSTONE: VERY FINE, 2.5 YR 6/0 GRAY, WELL CEMENTED, SLIGHTLY MOIST	DOLOMITIC SANDSTONE			39	91	GC	78.0	
						40	84	GC	80.0	
	80									80
						41	18	GC	82.0	
						42	24	GC	84.0	
	85					43	70	GC	86.0	85
						44	43	GC	88.0	
						45	5	GC	90.0	
	90									90
						46	5	GC	92.0	
	92.0	CHERTY DOLOMITE: DRY, 10 YR 7/3, VERY PALE BROWN	CHERTY DOLOMITE			47	5	GC	94.0	
	95					48	7	GC	96.0	95
	96.0	CHERT: 5 YR 7/3 PINKISH GRAY, DRY, CONCOIDAL FRACTURE	CHERT			49	3	GC	98.0	
						50	3	GC	100	
	100	CHERTY DOLOMITE: 7.5 YR 6/2, PINKISH GRAY, DRY	CHERTY DOLOMITE			51	0.3	GC	102	100
	102.0	CHERTY DOLOMITE: 10 YR 6/2, LIGHT BROWNISH GRAY, DRY	CHERTY DOLOMITE			52	3	GC	104	
	105					53	17	GC	105	105

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-88 (MW-62)*

DATE DRILLED 7/19/91 TO 7/24/91
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 88 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3817.00								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	105	CHERTY DOLOMITE: (CONT.)	CHERTY DOLOMITE			53	17	GC	106	105
	106.0	CHERTY DOLOMITE: 10 YR 7/1, LIGHT GRAY, DRY, CONCHOIDAL FRACTURES	CHERTY DOLOMITE			54	37	GC	108	
						55	28	GC	110	
	110					56	5	GC	112	110
						57	5	GC	114	
	114.0	DOLOMITIC SANDSTONE: VERY FINE, 7.5 YR 7/0 LIGHT GRAY AND INTERBEDDED SILTSTONE 10 YR 8/4 VERY PALE BROWN, DRY	DOLOMITIC SANDSTONE			58	78	GC	116	115
	115									
	116.0	CHERTY DOLOMITE: 10 YR 7/1, LIGHT GRAY, DRY (AS ABOVE)	CHERTY DOLOMITE			59	3	GC	118	
						60	4	GC	120	
	120					61	78	GC	122	120
						62	53	GC	124	
	125					63	13	GC	126	125
						64	3	GC	128	
	128.0	DOLOMITIC SANDSTONE: VERY FINE 7.5 YR 7/0 LIGHT GRAY, DRY, WELL CEMENTED	DOLOMITIC SANDSTONE			65	0.3	GC	130	
	130					66	1	GC	132	130
						67	1	GC	134	
	134.0	CHERTY DOLOMITE: DRY, INTERBEDDED, VERY FINE SANDSTONE AND CHERTY DOLOMITE, DRY	SANDSTONE AND DOLOMITE			68	0.7	GC	136	135
	135									
	136.0	CHERTY DOLOMITE: 10 YR 7/1, LIGHT GRAY, DRY, SOME VERY FINE SANDSTONE (AS ABOVE)	CHERTY DOLOMITE			69	0	GC	138	
						70	0.2	GC	140	
	140									140

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-88 (MW-62)*

DATE DRILLED 7/19/91 TO 7/24/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY DHC
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 88 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3817.00								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	140	DOLOMITIC SANDSTONE: VERY FINE. 7.5 YR 8/0 WHITE, WELL CEMENTED, DRY, HAS PETROLEUM ODOR FROM 142 TO 146 FEET	DOLOMITIC SANDSTONE			71	2	GC	142	140
						72	351	GC	144	
	145					73	261	GC	146	145
						74	53	GC	148	
						75	58	GC	150	
	150	DOLOMITIC SANDSTONE: VERY FINE, 7.5 YR 8/0 WHITE AND CHERTY DOLOMITE, 10 YR 7/1, LIGHT GRAY, DRY	DOLOMITIC SANDSTONE AND CHERTY DOLOMITE			76	106	GC	152	150
						77	3	GC	154	
	154.0	CHERTY DOLOMITE: 10 YR 7/1, LIGHT GRAY, DRY								
	155		CHERTY DOLOMITE			78	16	GC	156	155
						79	28	GC	158	
						80	63	GC	160	
	160					81	14	GC	162	160
	162.0	DOLOMITIC SANDSTONE: VERY FINE, 7.5 YR 8/0, WHITE, DRY	DOLOMITIC SANDSTONE			82	7	GC	164	
	164.0	SANDSTONE: VERY FINE, AND CHERTY DOLOMITE INTERBEDDED (AS ABOVE), DRY								
	165		SANDSTONE AND DOLOMITE			83	9	GC	166	165
						84	4	GC	168	
						85	2	GC	170	
	170					86	2	GC	172	170
						87	3	GC	174	
	174.0	CHERTY DOLOMITE:	CHERTY DOLOMITE			88	3	GC	175	
	175									175

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-88 (MW-62)*

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 88 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3817.00								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	175	CHERTY DOLOMITE: 10 YR 7/1 LIGHT GRAY, DRY	CHERTY DOLOMITE			88	3	GC	176	175
						89	1	GC	178	
						90	60	GC	180	
	180					91	1	GC	182	180
						92	1	GC	184	
	184.0	DOLOMITIC SANDSTONE: VERY FINE 7.5 YR 8/0 WHITE, WELL CEMENTED, AND INTERBEDDED CHERTY DOLOMITE, 10 YR 7/1, LIGHT GRAY, DRY	DOLOMITIC SANDSTONE			93	1	GC	186	185
▽188.36	185					94	1	GC	188	
						95	0	GC	190	
	190	VERY CHERTY DOLOMITE, 10 YR 6/1, GRAY, DRY	CHERTY DOLOMITE			96	0	GC	192	190
						97	0	GC	194	
	195					98	0	GC	196	195
						99	0	GC	198	
	198.0	CHERTY DOLOMITE: 5 Y 7/1 LIGHT GRAY, DRY	CHERTY DOLOMITE			100	0	GC	200	
	200	CHERTY DOLOMITE: 10 YR 7/2 LIGHT GRAY, SILTSTONE 5 YR 8/1 WHITE AND VERY FINE SANDSTONE 10 YR 8/1, WHITE, DRY	CHERTY DOLOMITE			101	1	GC	202	200
	202.0	CHERTY DOLOMITE: 2.5 YR 6/2 LIGHT YELLOWISH BROWN (OIL STAIN) DRY, AND SILTY	CHERTY DOLOMITE			102	560	GC	204	
	204.0									
▽205.0	205	CHERTY DOLOMITE: 10 YR 6/3 PALE BROWN (OIL STAIN) STRONG ODOR, & PRODUCT, MAKING LARGE AMOUNTS OF WATER	CHERTY DOLOMITE			103	1520	GC	206	205
						104	1763	GC	208	
						105	639	GC	209	
	210					106	858	GC	210	210

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-88 (MW-62)*

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 88 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3817.00								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	210	CONTINUES FROM PREVIOUS PAGE	CHERTY DOLOMITE							210
	211.0	SANDSTONE: VERY FINE GRAIN 7.5 YR 6/6 REDDISH YELLOW, VERY FINE GRAIN, SATURATED, HYDROCARBON ODOR, THIN LENSES OF HARDER SLIGHTLY MORE COARSE GRAIN SANDSTONE FINE TO MEDIUM ROUND-SUBROUND	SANDSTONE			106	858	GC	211	
						107	930	GC	213	
						108	945	GC	215	
	215									215
						109	918	GC	217	
						110	838	GC	219	
	220					111	675	GC	221	220
	223.0	BORING TERMINATED AT 223.0'				112	833	GC	223	
	225									225
	230									230
	235									235
	240									240
	245									245

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

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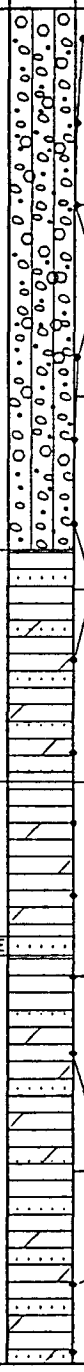
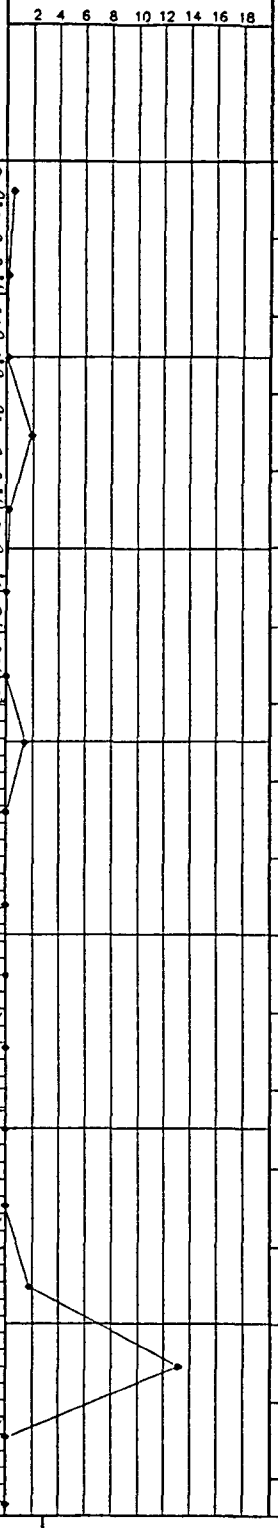
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3823.30	
	0	GRAVELLY COBBLEY SILT: BROWN, 7.5 YR 5/4, DRY, VERY FINE QUARTZ, COBBLES/ BOULDER, GRAVEL, UNCONSOLIDATED	GM
	14.0	CHERTY DOLOMITE: 5 YR 7/0 LIGHT GRAY GRAY, VERY HARD, DRY, MICROCRYSTALLINE WITH FINE GRAIN SAND LENSES THROUGHOUT FROM 14-20'	CHERTY DOLOMITE
	20	CHERTY DOLOMITE: 5 YR 7/0 LIGHT GRAY, VERY HARD, DRY, VERY FINE CRYSTALLINE TO MICROCRYSTALLINE	CHERTY DOLOMITE
	24.0	SANDSTONE: 10 YR 8/8 YELLOW, DRY, HARD, FRIABLE, VERY FINE GRAIN ROUND-SUBROUND	SANDSTONE
	24.5	DOLOMITE: WITH SAND LENSES, SOME CALCIUM CARBONATE PRESENT, FAIR TO GOOD EFFERVESCENCE (ON FINES NOT CHIPS) SOME CHERT PRESENT THROUGHOUT	DOLOMITE

GRAPHIC LOG



OVM SOIL GAS PPM X 10



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	7	GC	2.0
2	5.5	GC	4.0
3	3	GC	6.0
4	23	GC	8.0
5	6	GC	10.0
6	3.6	GC	12.0
7	4	GC	14.0
8	16	GC	16.0
9	3	GC	18.0
10	0	GC	20.0
11	0	GC	22.0
12	0	GC	24.0
13	4	GC	26.0
14	0	GC	28.0
15	18	GC	30.0
16	129	GC	32.0
17	5	GC	34.0
18	2	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
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JOB NAME/NUMBER *MARATHON/91029*

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 10 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3823.30								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35	CONTINUES FROM PREVIOUS PAGE				18	2	GC	36.0	35
						19	3	GC	38.0	
		INTERBEDDED SILTSTONE STARTING AT 38.0', 7.5 YR 7/0 LIGHT GRAY, HARD, DRY, SOME CARBONATE PRESENT PROBABLY DUE TO CARBONATE FILLED FRACTURES CUTTINGS NOT EFFERVESENT POWDER IS EFFERVESENT DOLOMITE-MICROCRYSTALLINE, DENSE, VERY HARD	DOLOMITE WITH INTER-BEDDED SILTSTONE			20	15	GC	40.0	
	40					21	7	GC	42.0	40
						22	2.7	GC	44.0	
	45					23	2.2	GC	46.0	45
						24	10	GC	48.0	
						25	6.1	GC	50.0	
	50					26	6.9	GC	52.0	50
						27	1.7	GC	54.0	
	55					28	7.4	GC	56.0	55
						29	5.9	GC	58.0	
						30	5.6	GC	60.0	
	60					31	4.5	GC	62.0	60
						32	8.0	GC	64.0	
	64.0	SANDSTONE: 7.5 YR 7/0 LIGHT GRAY, FRIABLE, VERY FINE GRAIN, ROUND-SUBROUND, MOTTLED FROM 66.0' WEAK CARBONATE CEMENTATION								
	65		SANDSTONE			33	86	GC	66.0	65
						34	209	GC	68.0	
						35	257	GC	70.0	
	70									70

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
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GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 10 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3823.30								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	70	SOME DOLOMITE MICROCRYSTALLINE IN 72-74', SAMPLE, VERY HARD, DENSE, NO ODOR	SANDSTONE			36	247	GC	72.0	70
						37	5.6	GC	74.0	
	75					38	3.2	GC	76.0	75
	76.0	DOLOMITE: 7.5 YR 7/0 LIGHT GRAY, VERY HARD, DENSE, MICROCRYSTALLINE, COLOR CHANGE ABOUT 77'-78', 2.5 YR 5/2 WEAK RED, VERY HARD, DENSE MICROCRYSTALLINE				39	0.6	GC	78.0	
						40	0.3	GC	80.0	
	80									80
			DOLOMITE			41	0.0	GC	82.0	
						42	0.1	GC	84.0	
	85					43	0.0	GC	86.0	85
						44	0.0	GC	88.0	
	88.0	SANDSTONE: 7.5 YR 7/0 TO 6/0 LIGHT GRAY TO GRAY, DRY TO MOIST (90-92), SOFT, FRIABLE, NO ODOR, VERY FINE TO MEDIUM GRAIN, ROUND-SUBANGULAR, SOME DOLOMITE PRESENT FASTER DRILLING THAN DOLOMITE, ZONES OF MOISTURE 90'-92', 93'-94', 95'-95.5'	SANDSTONE			45	0.0	GC	90.0	
	90					46	1.4	GC	92.0	90
						47	5.3	GC	94.0	
	95					48	6.9	GC	96.0	95
	96.0	DOLOMITE: 7.5 YR 7/0 TO 7/2 LIGHT GRAY TO PINKISH GRAY, DRY, HARD DENSE, MICROCRYSTALLINE, NO ODOR	DOLOMITE			49	14.8	GC	98.0	
	99.0	SANDSTONE: 7.5 YR 7/0 LIGHT GRAY, SOFT, DRY, FRIABLE, NO ODOR TO SLIGHT ODOR, VERY FINE TO FINE GRAIN, ROUND-SUBROUND				50	6.9	GC	100	
	100		SANDSTONE			51	19.8	GC	102	100
						52	5.1	GC	104	
	105					53	27	GC	105	105

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-89 (MW-63)*

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BORING RECORD

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		GROUND SURFACE: 3823.30								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	105	CONTINUED FROM PREVIOUS PAGE	SANDSTONE			53	27	GC	106	105
						54	5	GC	108	
	108.0	DOLOMITE: 5 YR 6/1 TO 6/2, LIGHT GRAY TO PINKISH GRAY, DENSE, VERY HARD, SOME CHERT				55	8.2	GC	110	
	110					56	4.8	GC	112	110
						57	4.5	GC	114	
	115		DOLOMITE			58	8.7	GC	116	115
		SANDSTONE LENSE 117'-117.5', 10 YR 8/8 YELLOW, SOFT, FRIABLE, DRY, NO ODOR				59	6.9	GC	118	
						60	5.9	GC	120	
	120					61	29.5	GC	122	120
						62	17.7	GC	124	
	125					63	30.5	GC	126	125
						64	10.3	GC	128	
		TRACE SAND FROM 128'-130'				65	6.9	GC	130	
	130					66	3.5	GC	132	130
						67	2.2	GC	134	
	135					68	1.7	GC	136	135
						69	4.5	GC	138	
						70	3.8	GC	140	
	140									140

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

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		GROUND SURFACE: 3823.30								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	140	DOLOMITE: GRAY TO PINKISH GRAY, 5 YR 6/1 TO 6/2, MASSIVE, MICRO-CRYSTALLINE TO VERY FINE GRAIN								140
						71	4.3	GC	142	
						72	6.8	GC	144	
	145					73	18.2	GC	146	145
						74	14.3	GC	148	
						75	9.3	GC	150	
	150					76	3.2	GC	152	150
						77	5.9	GC	154	
	155		DOLOMITE			78	6.4	GC	156	155
						79	4.3	GC	158	
						80	1.7	GC	160	
	160					81	0.9	GC	162	160
						82	5.9	GC	164	
	165					83	5.6	GC	166	165
						84	0.9	GC	168	
						85	6.6	GC	170	
	170					86	3.8	GC	172	170
						87	5.1	GC	174	
	175					88	3.8	GC	175	175

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
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		GROUND SURFACE: 3823.30								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	175	DOLOMITE: GRAY TO PINKISH GRAY, 5 YR 6/1 TO 6/2, MASSIVE, MICROCRYSTALLINE TO VERY FINE GRAIN	DOLOMITE			88	3.8	GC	176	175
						89	3.5	GC	178	
						90	3.8	GC	180	
	180					91	4.5	GC	182	180
						92	3.5	GC	184	
▽ 185.77	185					93	4.0	GC	186	185
	187.0	SANDSTONE: WHITE TO GRAY, 10 YR 8/2 TO 6/1, QUARTZOSE, VERY FINE TO FINE GRAIN, MODERATELY WELL SORTED, MODERATELY TO POORLY CEMENTED, CaCo3 CEMENT	SANDSTONE			94	3.2	GC	188	
						95	3.5	GC	190	
	190					96	2.7	GC	192	190
						97	4.0	GC	194	
	195					98	2.7	GC	196	195
						99	3.0	GC	198	
						100	1.7	GC	200	
	200	MOIST FROM 200' TO 202' SATURATED AT 204'				101	4.0	GC	202	200
						102	1.7	GC	204	
▽ 204'	204.0	DOLOMITE: PINKISH GRAY, 5 YR 6/1, INTERBEDDED WITH SANDSTONE, WHITE, 10 YR 8/2	DOLOMITE WITH SANDSTONE INTER-BEDDED SECTIONS			103	2.7	GC	206	205
	205					104	0.6	GC	208	
	209.0	SANDSTONE: DARK REDDISH BROWN, 2.5 YR 3/4, QUARTZOSE, VERY FINE GRAIN, MODERATELY WELL SORTED, ROUND TO SUBROUND, THIN BEDDED, MODERATELY CEMENTED, NONCALCAREOUS	SANDSTONE			105	6.9	GC	210	
	210									210

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-89 (MW-63)*

DATE DRILLED 7/20/91 TO 7/30/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY TPG
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 10 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3823.30								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	210	SANDSTONE: (CONT. AS ABOVE)	SANDSTONE			106	2.4	GC	212	210
		COARSE GRAIN FROM 213' TO 215'. POORLY SORTED, ANGULAR, POORLY CEMENTED				107	1.1	GC	214	
	215	SANDY DOLOMITE: GRAY TO PINKISH GRAY, 5 YR 6/1 TO 6/2, VERY FINE GRAIN TO CRYSTALLINE, MASSIVE	SANDY DOLOMITE			108	4.0	GC	216	215
						109	4.0	GC	218	
						110	2.2	GC	220	
	220	BORING TERMINATED AT 220.0'								220
	225									225
	230									230
	235									235
	240									240
	245									245

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER *MARATHON/91029*

BORING NUMBER *BH-89 (MW-63)*

DATE DRILLED 7/20/91 TO 7/30/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY TPG
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 43.2 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3796.2								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	0	SILTY SANDY LOAM: 10 YR 6/4, LIGHT YELLOWISH BROWN, DRY	ML			1	0.0	GC	2.0	0
	2.0	SANDSTONE: FINE GRAIN, DRY, 2.5 YR 7/4, PALE YELLOW	SANDSTONE			2	2.0	GC	4.0	
	5					3	2.0	GC	6.0	5
						4	1.0	GC	8.0	
						5	1.0	GC	10.0	
	10	SANDSTONE: FINE GRAIN, DRY, 7.5 YR 7/8, REDDISH YELLOW, IRON STAIN, WELL CEMENTED	SANDSTONE			6	0.0	GC	12.0	10
	12.0	SANDSTONE: FINE GRAIN, DRY, 10 YR 8/1, WHITE	SANDSTONE			7	0.0	GC	14.0	
	14.0	SANDSTONE: VERY FINE GRAIN, DRY, 7.5 YR 7/6, REDDISH YELLOW, WELL CEMENTED	SANDSTONE			8	0.0	GC	16.0	
	15									15
	16.0	SANDSTONE: VERY FINE GRAIN, DRY, 7.5 YR 8/2, PINKISH WHITE	SANDSTONE			9	1.0	GC	18.0	
	18.0	SANDSTONE: VERY FINE GRAIN, DRY, 10 YR 8/4, VERY PALE BROWN	SANDSTONE			10	4.0	GC	20.0	
	20					11	0.0	GC	22.0	20
	22.0	SANDSTONE: FINE GRAIN, 7.5 Y 7/2, PINKISH GRAY, INTERBEDDED WITH CHERT, 10 YR 6/4, PALE RED, DRY	SANDSTONE			12	2.0	GC	24.0	
	24.0	SANDSTONE: 10 YR 7/1, LIGHT GRAY, VERY FINE GRAIN, INTERBEDDED WITH CHERTY DOLOMITE, 7.5 YR 7/4 PINK, DRY	SANDSTONE			13	8.0	GC	26.0	
	25									25
	26.0	SANDSTONE: FINE GRAIN, 10 YR 8/4, VERY PALE BROWN, DRY	SANDSTONE			14	3.0	GC	28.0	
	28.0	SANDSTONE: FINE GRAIN, 10 YR 8/3, VERY PALE BROWN, INTERBEDDED WITH VERY FINE SANDSTONE WELL CEMENTED, 10 YR 7/1, LIGHT GRAY, AND CHERT, 7.5 YR 7/4, PINK, DRY	SANDSTONE			15	0.0	GC	30.0	
	30					16	0.0	GC	32.0	30
						17	1.0	GC	34.0	
						18	1.0	GC	35.0	
	35									35

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-90 (MW-64)*

DATE DRILLED 8/5-10/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY DHC, WEP
CHECKED BY BJS
DRAWN BY: SAR

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NORMAN, OKLAHOMA 73072
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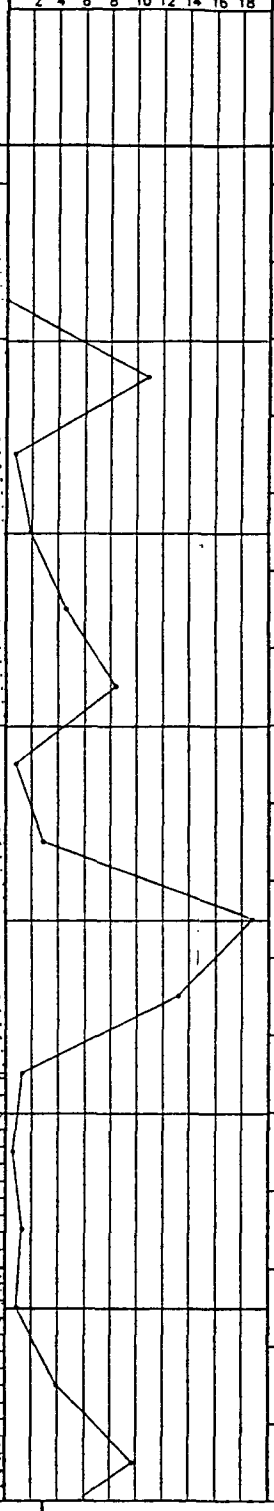
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3796.2	
	35		
	36.0	DOLOMITIC SANDSTONE: VERY FINE GRAIN, 10 YR 6/1, GRAY, INTERBEDDED WITH SANDY DOLOMITIC LIMESTONE, 10 YR 7/3, VERY PALE BROWN, DRY	DOLOMITIC SANDSTONE
	40	SANDSTONE: VERY FINE GRAIN, 10 YR 5/4, YELLOWISH BROWN, 10 YR 4/2, DARK GRAYISH BROWN, CARBONATE CEMENT, HARD, DRY	SANDSTONE
	45		
	50	SANDSTONE: VERY FINE GRAIN, 10 YR 5/2, GRAYISH BROWN, WITH 10 YR 3/1, VERY DARK GRAY MOTTLING AND MINOR IRON OXIDE STAINING, VERY HARD, DRY, MINOR INTERBEDS OF DOLOMITIC SANDSTONE, MINOR IRON PYRITE CRYSTALS MINOR 10 YR 5/3, BROWN CHERT INTERBEDS	SANDSTONE
	55		
	59.0	DOLOMITIC CHERT: 10 YR 6/3, PALE BROWN, CONCHOIDAL FRACTURE, VERY HARD	DOLOMITIC CHERT
	60		
	64.0	SANDY DOLOMITE/DOLOMITIC SANDSTONE: VERY FINE GRAIN SANDSTONE, 10 YR 4/1, DARK GRAY, 10 YR 5/3, BROWN, HARD, DRY	SANDY DOLOMITE/ DOLOMITIC SANDSTONE
	65		
	70		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
18	1.0	GC	36.0
19	0.0	GC	38.0
20	0.0	GC	40.0
21	467.0	GC	42.0
22	29.1	GC	44.0
23	80.9	GC	46.0
24	197.5	GC	48.0
25	362.0	GC	50.0
26	33.8	GC	52.0
27	124.6	GC	54.0
28	812.0	GC	56.0
29	568.0	GC	58.0
30	54.2	GC	60.0
31	24.6	GC	62.0
32	53.5	GC	64.0
33	36.7	GC	66.0
34	167.9	GC	68.0
35	419.0	GC	70.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-90 (MW-64)*

DATE DRILLED 8/5-10/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 43.2 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3796.2								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	70	SANDSTONE: VERY FINE GRAIN, 10 YR 6/4, LIGHT YELLOWISH BROWN, HARD, DRY, MINOR IRON OXIDE STAIN, AFTER 72.0', MINOR 10 YR 3/2, SANDSTONE	SANDSTONE			36	56.7	GC	72.0	70
						37	389.0	GC	74.0	
	75					38	95.3	GC	76.0	75
						39	81.2	GC	78.0	
						40	467.0	GC	80.0	
	80					41	864.0	GC	82.0	80
	81.0	DOLOMITE: 10 YR 6/3, PALE BROWN VERY HARD, DRY, MINOR SANDY DOLOMITE INTERBEDS	DOLOMITE			42	31.2	GC	84.0	
	85					43	76.8	GC	86.0	85
						44	48.3	GC	88.0	
						45	37.5	GC	90.0	
	90					46	31.2	GC	92.0	90
						47	198.3	GC	94.0	
	95					48	12.7	GC	96.0	95
						49	126.8	GC	98.0	
						50	194.4	GC	100.0	
	100					51	394.0	GC	102.0	100
						52	409.0	GC	104.0	
	105					53	219.4	GC	105.0	105

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-90 (MW-64)*

DATE DRILLED 8/5-10/91
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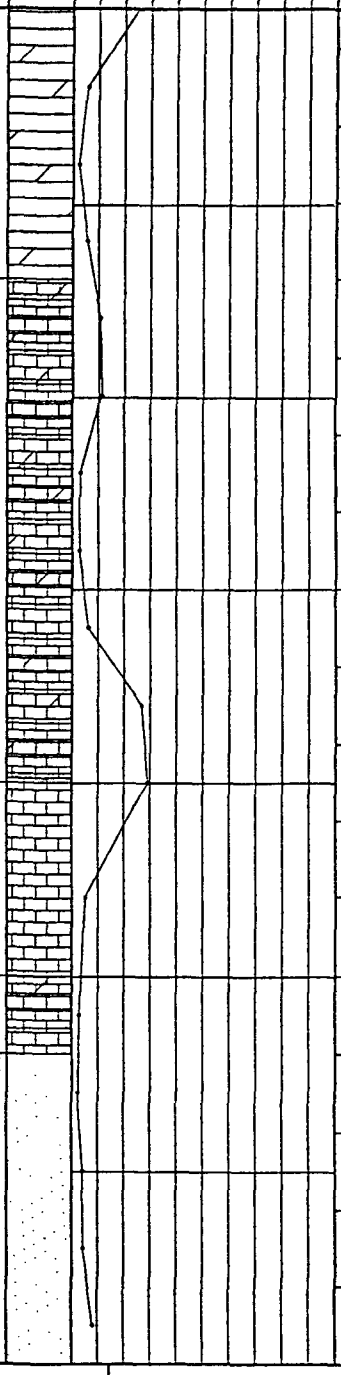
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3796.2	
	105	DOLOMITE: FRACTURED WITH CALCITE IN-FILLING 104-106'	DOLOMITE
		MINOR 10 YR 4/1, DARK GRAY, SANDY DOLOMITE INTERBEDS 108.0-110.0'	
	110		
	112.0	DOLOMITIC LIMESTONE: 10 YR 7/2, LIGHT GRAY, VERY HARD, DRY, INTERBED OF VERY FINE GRAIN DOLOMITE, 10 YR 5/1, GRAY, PACKSTONE	DOLOMITIC LIMESTONE
	115	MINOR IRON PYRITE	
		10 YR 7/3, VERY PALE BROWN AND 10 YR 5/1, GRAY, AFTER 120.0'	
	120		
	125	LIMESTONE: 5 YR 7/4, PINK, 10 YR 6/2, HARD, DRY, WITH 10 YR 7/3, VERY FINE GRAIN SANDSTONE INTERBED	LIMESTONE
	130	DOLOMITIC LIMESTONE: 10 YR 5/2, DRY, HARD	DOLOMITIC LIMESTONE
	132.0	SANDSTONE: VERY FINE GRAIN, 10 YR 5/2, GRAYISH BROWN, HARD, DRY, WELL CEMENTED,	SANDSTONE
	135	MODERATELY HARD, POORLY CEMENTED AND MOIST AFTER 136.0'	
	140		

GRAPHIC LOG



OVM SOIL GAS PPM X 43.2

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
53	219.4	GC	106.0
54	50.1	GC	108.0
55	20.5	GC	110.0
56	49.8	GC	112.0
57	93.0	GC	114.0
58	97.0	GC	116.0
59	27.0	GC	118.0
60	24.0	GC	120.0
61	55.0	GC	122.0
62	232.0	GC	124.0
63	252.0	GC	126.0
64	66.0	GC	128.0
65	44.0	GC	130.0
66	25.0	GC	132.0
67	20.0	GC	134.0
68	36.0	GC	136.0
69	37.0	GC	138.0
70	69.9	GC	140.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-90 (MW-64)*

DATE DRILLED 8/5-10/91
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DRILLED BY BOYLES BROTHERS
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 43.2 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3796.2								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	140	SANDSTONE: CONTINUED FROM PREVIOUS PAGE	SANDSTONE			71	101.7	GC	142.0	140
						72	64.9	GC	144.0	
	144.0	SANDSTONE: VERY FINE GRAIN, 10 YR 5/2, GRAYISH BROWN, HARD, SLIGHTLY MOIST, CARBONATE CEMENT	SANDSTONE			73	35.9	GC	146.0	
	145									145
	146.0	DOLOMITIC LIMESTONE: 2.5 Y 6/2, LIGHT BROWNISH GRAY, HARD, DRY	DOLOMITIC LIMESTONE			74	30.5	GC	148.0	
						75	16.8	GC	150.0	
	150									150
	151.0	SANDSTONE: VERY FINE GRAIN, 10 YR 7/3, VERY PALE BROWN CARBONATE CEMENT, HARD, SLIGHTLY MOIST	SANDSTONE			76	17.5	GC	152.0	
						77	40.9	GC	154.0	
	155					78	10.5	GC	156.0	155
						79	12.7	GC	158.0	
						80	9.2	GC	160.0	
	160	DOLOMITIC LIMESTONE: 10 YR 5/2, GRAYISH BROWN, HARD, DRY, MINOR INTERBEDS OF 10 YR 7/3, SAND STONE	DOLOMITIC LIMESTONE			81	4.6	GC	162.0	160
						82	10.5	GC	164.0	
	165					83	12.4	GC	166.0	165
167.30						84	27.0	GC	168.0	
						85	42.0	GC	170.0	
	170	10 YR 6/2, LIGHT BROWNISH GRAY, FRACTURED WITH CALCITE, CHLORITE, AND IRON OXIDE, FRACTURE FILL, SATURATION AFTER 172.0'				86	55.0	GC	172.0	170
172.0'						87	10.0	GC	174.0	
	175					88	33.0	GC	175.0	175

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-90 (MW-64)*

DATE DRILLED 8/5-10/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY DHC, WEP
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 43.2 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3796.2								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	175		DOLOMITIC LIMESTONE			88	33.0		176.0	175
						89	13.5	GC	178.0	
						90	8.0	GC	180.0	
	180					91	2.0	GC	182.0	180
						92	12.0	GC	184.0	
	185					93	14.6	GC	186.0	185
						94	14.2	GC	188.0	
						95	5.7	GC	190.0	
	190					96	9.0	GC	192.0	190
		AFTER 192.0', PREDOMINATELY 10 YR 7/3, VERY PALE BROWN AND 10 YR 5/1, GRAY, SATURATED				97	3.8	GC	194.0	
	195					98	3.1	GC	196.0	195
						99	6.4	GC	198.0	
						100	9.0	GC	200.0	
	200	T.D. 200.0'								200
		GROUNDWATER ENCOUNTERED AT 172.0'								
		24 HOURS GROUNDWATER AT 167.30								
	205									205
	210									210

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-90 (MW-64)*

DATE DRILLED 8/5-10/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
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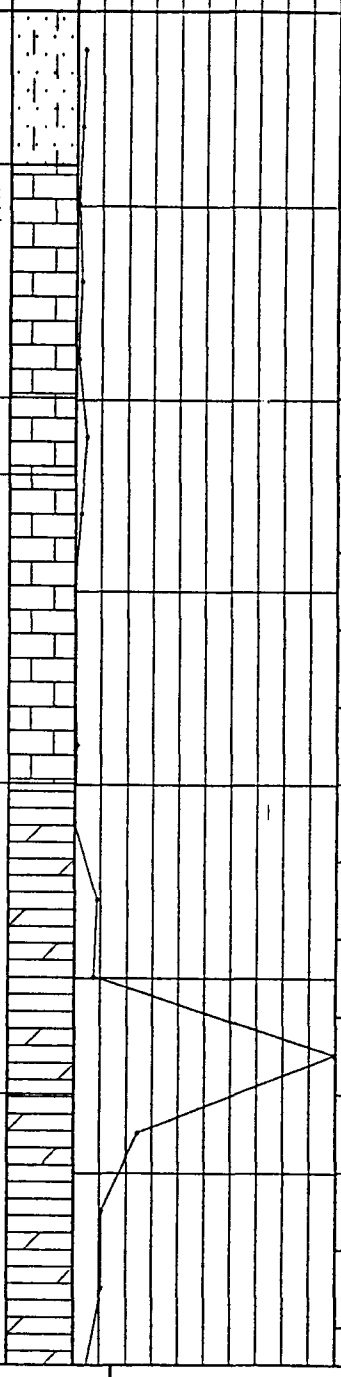
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3760.1	
	0	SANDY SILTY LOAM: 10YR 5/6, YELLOWISH BROWN, DRY	ML
	4.0	CHERTY DOLOMITIC LIMESTONE: 10YR 6/2, LIGHT BROWNISH GRAY, INTERBEDDED WITH CLAYEY SILTSTONE, 10YR 6/6, LIGHT BROWNISH YELLOW, DRY	CHERTY DOLOMITIC LIMESTONE
	5		
	10	CHERTY DOLOMITIC LIMESTONE: 10YR 5/3, BROWN, INTERBEDDED WITH SILTSTONE, 10YR 6/6, LIGHT BROWNISH YELLOW, DRY	CHERTY DOLOMITIC LIMESTONE
	12.0	CHERTY DOLOMITIC LIMESTONE: 10YR 5/2, GRAYISH BROWN AND CHERT, 10YR 6/4, BROWNISH YELLOW, DRY	CHERTY DOLOMITIC LIMESTONE
	15		
	20	CHERTY DOLOMITE: 10YR 6/1, GRAY, AND CHERT, 5YR 7/3, PINK, DRY	CHERTY DOLOMITE
	25		
	28.0	DOLOMITE: 10YR 7/1, LIGHT GRAY, VERY HARD, DRY	DOLOMITE
	30		
	35		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	3.0	GC	2.0
2	2.0	GC	4.0
3	1.0	GC	6.0
4	2.0	GC	8.0
5	1.0	GC	10.0
6	4.0	GC	12.0
7	2.0	GC	14.0
8	0.0	GC	16.0
9	0.0	GC	18.0
10	1.0	GC	20.0
11	0.0	GC	22.0
12	7.9	GC	24.0
13	6.8	GC	26.0
14	91.3	GC	28.0
15	22.4	GC	30.0
16	9.8	GC	32.0
17	9.8	GC	34.0
18	4.6	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-91 (MW-65)*

DATE DRILLED 8/7-8/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY DHC/JMB
CHECKED BY BJS
DRAWN BY: SAR

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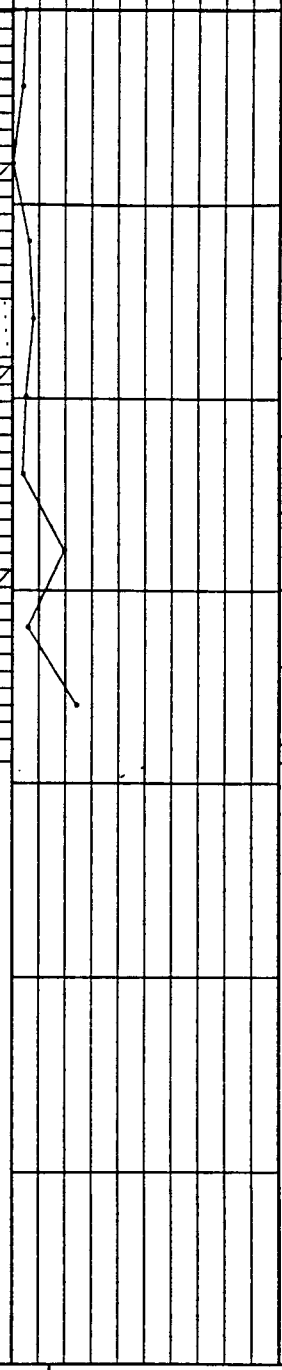
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3760.1	
	35	DOLOMITE: 10YR 7/1, LIGHT GRAY, VERY HARD, DRY	DOLOMITE
	40		
	42.5	SANDSTONE: 5YR 4/3, REDDISH BROWN, VERY FINE GRAIN, SOFT, MOIST TO WET	SANDSTONE
43.3'	44.0	CHERTY DOLOMITE: DOLOMITE 10YR 5/2, GRAYISH BROWN, CHERT IS 10YR 5/6, YELLOWISH BROWN, HARD, CHERT EXHIBITS CONCHOIDAL FRACTURING, DOLOMITE- MICROCRYSTALLINE	DOLOMITE
	45		
	50		
52.5			
	54.4	T.D. 54.4'	
	55		
	60		
	65		
	70		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
18	4.6	GC	36.0
19	3.5	GC	38.0
20	0.1	GC	40.0
21	5.7	GC	42.0
22	7.2	GC	44.0
23	4.6	GC	46.0
24	3.5	GC	48.0
25	17.9	GC	50.0
26	5.3	GC	52.0
27	22.2	GC	54.0
NS			54.4

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-91 (MW-65)*

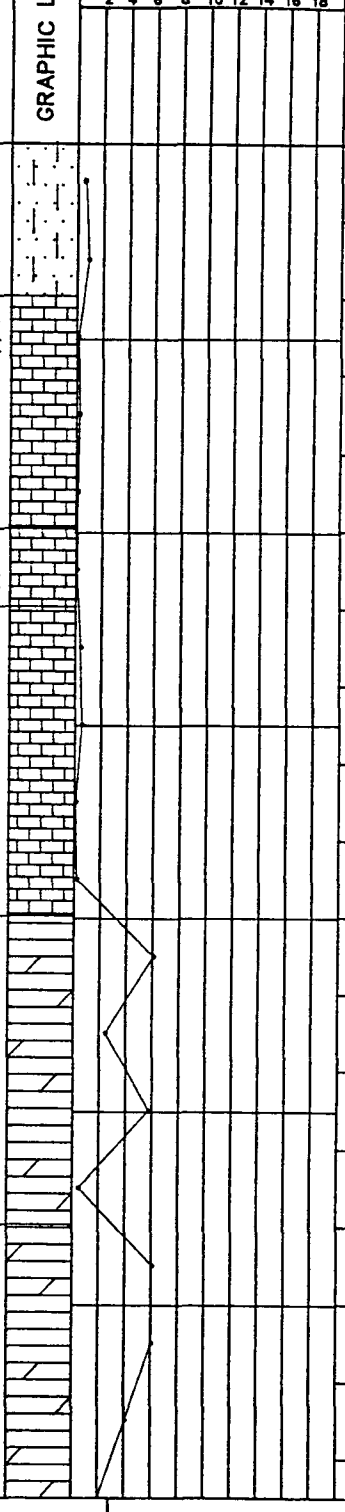
DATE DRILLED 8/7-8/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROTHERS
LOGGED BY DHC/JMB
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3760.7	
	0	SANDY SILTY LOAM: 10 YR 5/6, YELLOWISH BROWN, DRY	ML
	4.0	CHERTY DOLOMITIC LIMESTONE: 10 YR 6/2, LIGHT BROWNISH GRAY, INTERBEDDED WITH CLAYEY SILTSTONE 10 YR 6/6, LIGHT BROWNISH YELLOW, DRY	CHERTY DOLOMITIC LIMESTONE
	10	CHERTY DOLOMITIC LIMESTONE: 10 YR 5/3, BROWN, INTERBEDDED WITH SILTSTONE, 10 YR 6/6, LIGHT BROW,NISH YELLOW, DRY	CHERTY DOLOMITIC LIMESTONE
	12.0	CHERTY DOLOMITIC LIMESTONE: 10 YR 5/2, GRAYISH BROWN AND CHERT, 10 YR 6/4, BROWNISH YELLOW, DRY	CHERTY DOLOMITIC LIMESTONE
	20	CHERTY DOLOMITE: 10 YR 6/1, GRAY AND CHERT, 5 YR 7/3, PINK, DRY	CHERTY DOLOMITE
	28.0	DOLOMITE: 10 YR 7/1, LIGHT GRAY, VERY HARD, DRY	DOLOMITE
	35		

GRAPHIC LOG



OVM SOIL GAS PPM X 5.1

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	3.1	GC	2.0
2	5.3	GC	4.0
3	1.2	GC	6.0
4	1.6	GC	8.0
5	1.2	GC	10.0
6	0.4	GC	12.0
7	2.4	GC	14.0
8	2.4	GC	16.0
9	1.6	GC	18.0
10	2.7	GC	20.0
11	30.3	GC	22.0
12	12.4	GC	24.0
13	29.4	GC	26.0
14	2.4	GC	28.0
15	30.5	GC	30.0
16	30.5	GC	32.0
17	21.2	GC	34.0
18	10.5	GC	35.0

REMARKS

BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM

AIR HAMMER DRILLING

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-91A (MW-65A)*

DATE DRILLED 8/12/91 TO 8/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY KMH
CHECKED BY BJS
DRAWN BY: BDR

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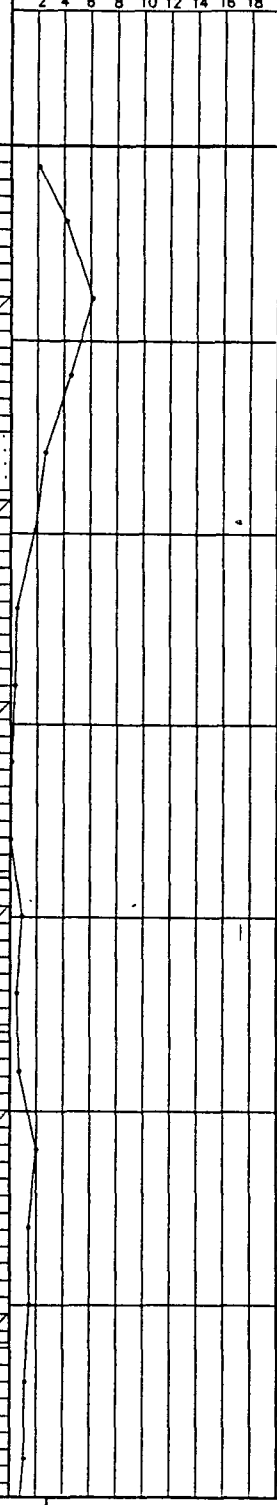
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3760.7	
	35	DOLOMITE: 10 YR 7/1, LIGHT GRAY, VERY HARD, DRY	DOLOMITE
	40		
	42.5	SANDSTONE: 5 YR 4/3, REDDISH BROWN, VERY FINE GRAIN, SOFT, MOIST TO WET	SANDSTONE
43.8'	44.0	CHERTY DOLOMITE: DOLOMITE 10 YR 5/2, GRAYISH BROWN, CHERT IS 10 YR 5/6, YELLOWISH BROWN, HARD, CHERT EXHIBITS CONCHOIDAL FRACTURING, DOLOMITE- MICROCRYSTALLINE	DOLOMITE
	45		
	50		
	54.0	DOLOMITE: 70YR 7/2, LIGHT GRAY, DRY, VERY HARD	DOLOMITE
	55		
	58.0	CHERTY DOLOMITE: 10YR 5/2, GRAYISH BROWN CHERT, 10YR 6/4, YELLOWISH BROWN, HARD, DRY, MICROCRYSTALLINE DOLOMITE, INTERBEDDED FINE GRAINED SANDSTONE LENSES, 10YR 6/6; BROWNISH YELLOW	CHERTY DOLOMITE
	60		
	65		
	66.0	DOLOMITE: 10YR 7/2, LIGHT GRAY, VERY HARD, DRY, POWDER IN SAMPLE	DOLOMITE
	70		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
18	10.5	GC	36.0
19	21.6	GC	38.0
20	32.4	GC	40.0
21	22.4	GC	42.0
22	17.4	GC	44.0
23	9.8	GC	46.0
24	2.4	GC	48.0
25	2.3	GC	50.0
26	1.8	GC	52.0
27	1.6	GC	54.0
28	4.5	GC	56.0
29	2.5	GC	58.0
30	3.4	GC	60.0
31	10.0	GC	62.0
32	7.2	GC	64.0
33	7.4	GC	66.0
34	5.6	GC	68.0
35	5.4	GC	70.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-91A (MW-65A)*

DATE DRILLED 8/12/91 TO 8/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY KMH
CHECKED BY BJS
DRAWN BY: BDR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3760.7	
	70	DOLOMITE: 10YR 5/2, GRAYISH BROWN TO BROWN, DRY	DOLOMITE
	75		
	76.0	CHERTY DOLOMITE: 10YR 5/2, DRY GRAYISH BROWN TO BROWN, CHERT 10YR 6/6 BROWNISH YELLOW INTERBEDDED SANDSTONE, 10YR 7/3, VERY FINE GRAINED, DRY	CHERTY DOLOMITE
	80		
	82.0	DOLOMITE: 10YR 5/2, GRAYISH BROWN TO BROWN INTERBEDDED SANDSTONE 10YR 7/3, VERY FINE GRAINED, DRY	DOLOMITE
	85		
	90	DOLOMITE: 10YR 6/2, LIGHT BROWNISH GRAY, DRY, MICROCRYSTALLINE, SANDSTONE, VERY FINE GRAINED, WELL CEMENTED, CALCITE CEMENTED, 10YR 5/6, YELLOWISH BROWN, DRY	DOLOMITE
	95		
	100		
	105		

GRAPHIC LOG

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
36	3.1	GC	72.0
37	80.2	GC	74.0
38	102.8	GC	76.0
39	69.2	GC	78.0
40	31.2	GC	80.0
41	23.6	GC	82.0
42	24.3	GC	84.0
43	22.8		86.0
44	16.7	GC	88.0
45	16.7	GC	90.0
46	14.1	GC	92.0
47	34.2	GC	94.0
48	11.7	GC	96.0
49	16.1	GC	98.0
50	14.8	GC	100.0
51	15.0	GC	102.0
52	2.0	GC	104.0
53	4.2	GC	105.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-91A (MW-65A)*

DATE DRILLED 8/12/91 TO 8/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 5.1 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3760.7								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	105		DOLOMITE			53	4.2	GC	106.0	105
						54	1.4	GC	108.0	
						55	3.5	GC	110.0	
	110					56	1.6	GC	112.0	110
	112.0	DOLOMITE: 10YR 5/1, GRAY, DRY, HARD	DOLOMITE			57	1.6	GC	114.0	
	115					58	4.0	GC	116.0	115
						59	4.0	GC	118.0	
	118.0	DOLOMITE: 10YR 5/1, GRAY, DRY, HARD. SANDSTONE INTERBEDDED 10YR 6/6, DRY, WELL CEMENTED, CALCITE CEMENTED.	DOLOMITE			60	5.7	GC	120.0	
	120					61	2.4	GC	122.0	120
	122.0	DOLOMITE: 10YR 6/1, DRY, HARD, GRAY, SANDSTONE INTERBEDDED, 10YR 7/1, LIGHT GRAY, FE STAINING ON SANDSTONE, DRY, WELL CEMENTED, CALCITE CEMENTING, VERY FINE GRAINED	DOLOMITE			62	0.6	GC	124.0	
	125	FE STAINING DECREASES				63	1.3	GC	126.0	125
		SMALL AMOUNT OF CHERT 130-132'				64	0.2	GC	128.0	
		SANDSTONE CONTENT INCREASE FROM 132-134'				65	7.0	GC	130.0	
▽ 130.77	130					66	0.2	GC	132.0	130
						67	0.2	GC	134.0	
▽ 134.5	134.0									
	135	SANDSTONE: 10YR 7/6, YELLOW, CALCITE CEMENTED, WELL CEMENTED, VERY FINE GRAINED, ALSO 10YR 7/1, LIGHT GRAY, VERY FINE GRAINED, FE STAININGS,	SANDSTONE			68	2.2	GC	136.0	135
						69	0.8	GC	138.0	
		WATER AT 134.5'				70	0.4	GC	140.0	
	140									140

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-91A (MW-65A)*

DATE DRILLED 8/12/91 TO 8/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY KMH
CHECKED BY BJS
DRAWN BY: BDR

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ENVIRONMENTAL CONSULTANTS
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NORMAN, OKLAHOMA 73072
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 5.1 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3760.7								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	140	SMALL AMOUNT OF DOLOMITE FROM 134-140', 10YR 6/1	SANDSTONE			71	3.9	GC	142.0	140
						72	0.4	GC	144.0	
	145					73	1.1	GC	146.0	145
	146.0	NO CUTTING BLEW OUT OF THE HOLE. AFTER THE HOLE WAS COMPLETE NO CUTTINGS IN THE HOLE, DRILLED LIKE SANDSTONE	SANDSTONE ?			74		NS		
	150									150
	155									155
	160									160
	165									165
	166.0	TOTAL DEPTH 166.0' WATER LEVEL (24 HOURS) 130.77							166.0	
	170									170
	175									175

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-91A (MW-65A)*

DATE DRILLED 8/12/91 TO 8/15/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
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DRAWN BY: BDR

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NORMAN, OKLAHOMA 73072
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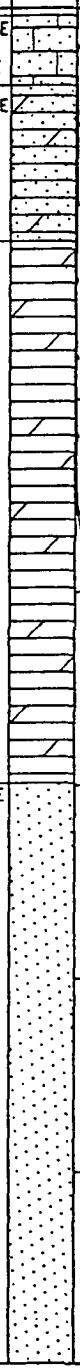
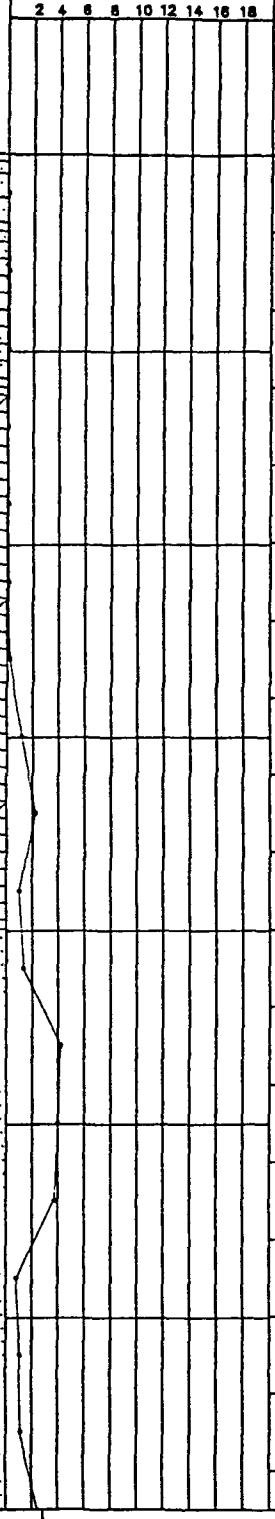
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3826.3	
	0-0.2	TOPSOIL:	
	0.2-2.0	SANDSTONE & LIMESTONE: WEATHERED, SANDSTONE, 7.5YR 7/2, PINKISH GRAY, VERY FINE GRAIN, ROUND TO SUBANGULAR, LIMESTONE, 7.5 YR 7/0, LIGHT GRAY, VERY FINE CRYSTALLINE, DENSE, INCREASE IN SANDSTONE	SANDSTONE AND LIMESTONE
	2.0-6.0	SANDSTONE & DOLOMITE: INTERBEDDED 7.5YR 7/4 TO 7/0, PINKISH TO LIGHT GRAY, SANDSTONE VERY FINE GRAIN, ROUND TO SUBANGULAR, DOLOMITE, HARD, VERY FINE CRYSTALLINE, DENSE, INCREASE IN DOLOMITE WITH DEPTH TO 6.0'	SANDSTONE AND DOLOMITE
	6.0-35	DOLOMITE: 7.5YR 7/0 TO 6/0, LIGHT GRAY TO GRAY, VERY FINE CRYSTALLINE, HARD, DENSE, TRACE SAND 6-8' INCREASE SANDSTONE WITH DEPTH, SANDSTONE HAS LIMESTONE CEMENTATION	DOLOMITE
	20-35	SANDSTONE: 7.5YR 7/4 TO 7/0, PINK TO LIGHT GRAY, VERY FINE GRAIN, ROUND TO SUBANGULAR	SANDSTONE

GRAPHIC LOG



OVM SOIL GAS PPM X 17.7



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	2.0
2	1.9	GC	4.0
3	1.9	GC	6.0
4	0.4	GC	8.0
5	1.3	GC	10.0
6	1.3	GC	12.0
7	3.0	GC	14.0
8	19.4	GC	16.0
9	39	GC	18.0
10	17	GC	20.0
11	22.7	GC	22.0
12	74	GC	24.0
13	70.1	GC	26.0
14	65	GC	28.0
15	13	GC	30.0
16	18	GC	32.0
17	18.3	GC	34.0
18	42	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

AIR HAMMER DRILLING

0 5 10 15 20 25 30 35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-92 (MW-66)*

DATE DRILLED 8/18-21/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY TPG
CHECKED BY BJS
DRAWN BY: BDR

ROBERTS/SCHORNICK
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NORMAN, OKLAHOMA 73072
(405) 321-3893

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 17.7 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3826.3								BACKGROUND OVM READING: SOIL: 0 PPM AIR: 0 PPM
	35	CONTINUES FROM PAGE 1	SANDSTONE			18	42.0	GC	36.0	35
						19	16.8	GC	38.0	
		MOIST 38-40.0' TRACE DOLOMITE THROUGHOUT				20	16.3	GC	40.0	
	40					21	19.4	GC	42.0	40
						22	91.8	GC	44.0	
	45					23	50.3	GC	46.0	45
						24	56.9	GC	48.0	
						25	15.0	GC	50.0	
	50					26	67.7	GC	52.0	50
						27	125	GC	54.0	
	55					28	20.3	GC	56.0	55
						29	25.8	GC	58.0	
						30	11.0	GC	60.0	
	60					31	11.9	GC	62.0	60
						32	126	GC	64.0	
	65					33	15.0	GC	66.0	65
		MOIST 66.0-70.0'				34	9.2	GC	68.0	
						35	55	GC	70.0	
	70									70

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-92 (MW-66)*

DATE DRILLED 8/18-21/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY TPG
CHECKED BY BJS
DRAWN BY: BOR

ROBERTS/SCHORNICK
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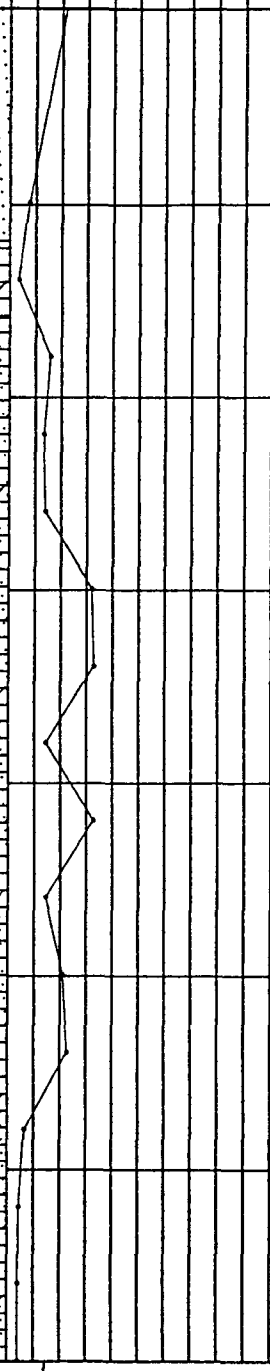
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3826.3	
	70	SANDSTONE: SANDSTONE WITH INCREASE IN DOLOMITE INTERBEDDING WITH DEPTH GRADING TO DOLOMITE @ 76.0'	SANDSTONE
	75		
	76.0	DOLOMITE: 7.5YR 7/0, LIGHT GRAY, DENSE, VERY FINE CRYSTALLINE, HARD, INCREASE IN SANDSTONE STARTING @ 78'	DOLOMITE
	78.0	SANDSTONE & DOLOMITE: INTERBEDDED 7.5YR 7/4 TO 7/0, PINK TO LIGHT GRAY	SANDSTONE AND DOLOMITE INTERBEDDED
	80	84 TO 86' BLACK STAINING IN SANDSTONE HYDROCARBON ODOR	
	85	MOISTURE 94 TO 98', INCREASE IN DOLOMITE BEDDING FROM 98 TO 110'	
	90		
	95		
	100		
	105		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
36	47	GC	72.0
37	247.2	GC	74.0
38	26.2	GC	76.0
39	11.6	GC	78.0
40	55.8	GC	80.0
41	46.3	GC	82.0
42	48.7	GC	84.0
43	113.4	GC	86.0
44	115.6	GC	88.0
45	50.5	GC	90.0
46	115.6	GC	92.0
47	50.5	GC	94.0
48	73.7	GC	96.0
49	80	GC	98.0
50	22	GC	100.0
51	14.7	GC	102.0
52	13.7	GC	104.0
53	13.0	GC	105.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-92 (MW-66)*

DATE DRILLED 8/18-21/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY TPG
CHECKED BY BJS
DRAWN BY: BDR

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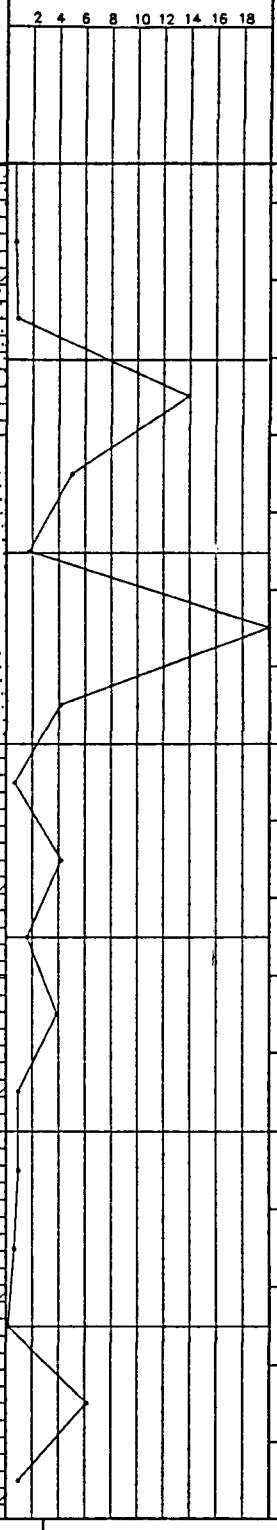
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3826.3	
	105	SANDSTONE: INTERBEDDED DOLOMITE, 7.5YR 7/4 TO 7/0, PINK TO LIGHT GRAY	SANDSTONE AND DOLOMITE
	110		
	112.0	SANDSTONE: 7.5YR 6/2, PINKISH GRAY, DRY TO MOIST, VERY FINE GRAIN, ROUND TO SUBANGULAR, TRACE DOLOMITE INTERBEDDING	SANDSTONE
	115		
	120	DOLOMITE: 7.5YR 7/0 LIGHT GRAY, DENSE, HARD, VERY FINE CRYSTALLINE COLOR 7/4 PINK FROM 122 TO 126' IN ADDITION TO 7/0	DOLOMITE
	125		
	126.0	DOLOMITE: 7.5YR 7/0, LIGHT GRAY, MOSTLY DOLOMITE WITH SOME SANDSTONE BEDS, DOLOMITE, HARD, VERY FINE CRYSTALLINE, DENSE, SANDSTONE, VERY FINE GRAIN, ROUND TO SUBROUND	DOLOMITE
	130		
	135		
	140		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
53	13	GC	106.0
54	13	GC	108.0
55	14.9	GC	110.0
56	246	GC	112.0
57	89	GC	114.0
58	31	GC	116.0
59	354	GC	118.0
60	73	GC	120.0
61	12	GC	122.0
62	74.5	GC	124.0
63	28.8	GC	126.0
64	68.8	GC	128.0
65	16.6	GC	130.0
66	16.6	GC	132.0
67	11.3	GC	134.0
68	3.0	GC	136.0
69	109	GC	138.0
70	17.1	GC	140.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-92 (MW-66)*

DATE DRILLED 8/18-21/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY TPG
CHECKED BY BJS
DRAWN BY: BDR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
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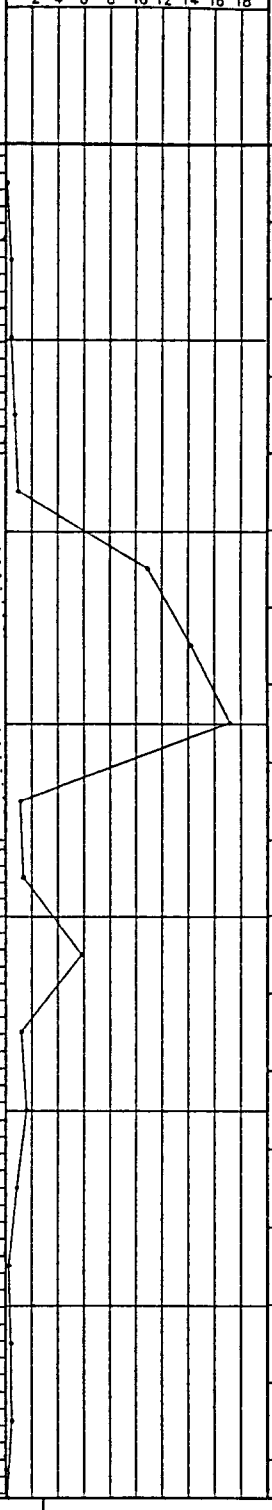
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3826.3	
	140	CONTINUES FROM PAGE 4	DOLOMITE
	145		
	148.0	SANDSTONE: SOME TRACE OF DOLOMITE INTERBEDDED 7.5YR 7/0 TO 7/2, LIGHT GRAY TO PINKISH GRAY, VERY FINE GRAIN, TRACE FINE GRAIN, ROUND TO SUBROUND	SANDSTONE
	150		
	155		
	158.0	DOLOMITE: TRACE OF INTERBEDDED SANDSTONE, 7.5YR 7/0 TO 7/2, LIGHT GRAY TO PINKISH GRAY, HARD, DENSE, VERY FINE CRYSTALLINE, SANDSTONE, VERY FINE GRAIN, ROUND TO SUBROUND	DOLOMITE
	160		
	165		
	170		
	175		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
71	2.0	GC	142.0
72	9.3	GC	144.0
73	7.3	GC	146.0
74	12.0	GC	148.0
75	16.8	GC	150.0
76	193	GC	152.0
77	252	GC	154.0
78	304	GC	156.0
79	19.7	GC	158.0
80	23.7	GC	160.0
81	103	GC	162.0
82	21	GC	164.0
83	28.3	GC	166.0
84	15	GC	168.0
85	4.4	GC	170.0
86	7.0	GC	172.0
87	8.1	GC	174.0
88	2.0	GC	175.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-92 (MW-66)*

DATE DRILLED 8/18-21/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
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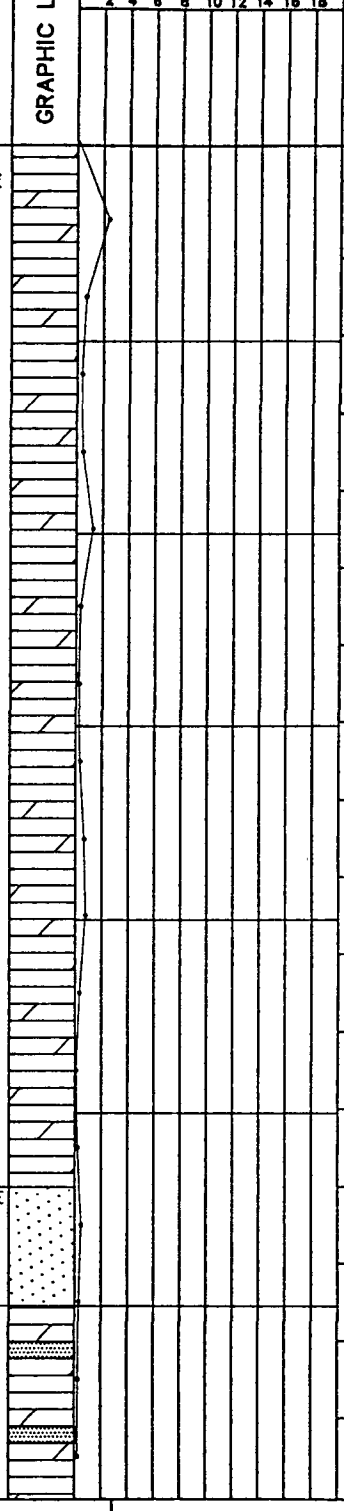
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3826.3	
	175	CONTINUES FROM PAGE 5	DOLOMITE
		DOLOMITE WITH TRACE SAND SOME SANDSTONE WITH CARBONATE CEMENTATION	
	180		
	185		
	190	UMEY ZONE 190–192.0'	
	195		
	200		
▽ 202.0	202.0	SANDSTONE: WITH INTERBEDDED SOME DOLOMITE, 7.5YR 7/0 TO 7/4, LIGHT GRAY TO PINK, HARD, VERY FINE GRAIN, ROUND TO SUBANGULAR	SANDSTONE
	205	DOLOMITE: INTERBEDDED WITH SANDSTONE, PROBABLY FRACTURE POROSITY, 7.5YR 7/0 TO 6/4 LIGHT GRAY TO 6/4 LIGHT BROWN, DOLOMITE, HARD, FINE CRYSTALLINE, DENSE, SANDSTONE, VERY FINE GRAIN, ROUND TO SUBANGULAR	DOLOMITE
▽ 208.0	210		

GRAPHIC LOG



OVM SOIL GAS PPM X 17.7

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
88	2.0	GC	176.0
89	42.4	GC	178.0
90	11.7	GC	180.0
91	5.9	GC	182.0
92	7.9	GC	184.0
93	21.7	GC	186.0
94	5.2	GC	188.0
95	3.2	GC	190.0
96	5.4	GC	192.0
97	11	GC	194.0
98	13	GC	196.0
99	5.4	GC	198.0
100	1.0	GC	200.0
101	3.2	GC	202.0
102	8.1	GC	204.0
103	4.7	GC	206.0
104	4.0	GC	208.0
105	3.1	GC	210.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-92 (MW-66)*

DATE DRILLED 8/18-21/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY TPG
CHECKED BY BJS
DRAWN BY: BDR

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NORMAN, OKLAHOMA 73072
(405) 321-3893

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 17.7 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3826.3								BACKGROUND OVM READING: SOIL: 0 PPM AIR: 0 PPM
	210	CONTINUED FROM PAGE 6	DOLOMITE			106	3.7	GC	212.0	210
						107	3.7	GC	214.0	
	215					108	2.5	GC	216.0	215
						109	4.0	GC	218.0	
						110	2.5	GC	220.0	
	220					111	2.5	GC	222.0	220
						112	3.2	GC	224.0	
	225					113	1.8	GC	226.0	225
						114	1.8	GC	228.0	
						115	1.5	GC	230.0	
	230					116	3.7	GC	232.0	230
	232.5	TOTAL DEPTH 232.5 FT								
	235									235
	240									240
	245									245

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-92 (MW-66)*

DATE DRILLED 8/18-21/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
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NORMAN, OKLAHOMA 73072
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BORING RECORD

GROUND SURFACE: 3763.1

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
	0	SAND: UNCONSOLIDATED SAND WITH GRAVEL, 7.5YR 4/6 TO 8/2, STRONG BROWN TO PINKISH WHITE	
	2.0	SANDSTONE: INTERBEDDED W/ DOLOMITE, SANDSTONE, VERY FINE GRAIN, ROUND TO SUBANGULAR, 7.5YR 7/4, VERY FINE CRYSTALLINE, PINKISH DOLOMITE, 5.0YR 7/1 TO 6/2, LIGHT GRAY TO LIGHT REDDISH BROWN, HARD, SOME LIMESTONE, VERY FINE CRYSTALLINE	SANDSTONE
	4.0	SANDSTONE: 5YR 7/4, PINK, VERY FINE GRAIN ROUND TO SUBANGULAR, HARD, TRACE DOLOMITE THROUGHOUT	SANDSTONE
	5	DOLOMITE: WITH INTERBEDDED SANDSTONE, DOLOMITE, 5YR 7/4, PINK, VERY FINE CRYSTALLINE DENSE, SANDSTONE, 5YR 7/6, REDDISH YELLOW, VERY FINE GRAIN ROUND TO SUBROUND	DOLOMITE
	6.0	DOLOMITE: 7.5YR 7/0 TO 7/4, LIGHT GRAY TO PINK, VERY FINE CRYSTALLINE, DENSE, TRACE SANDSTONE	DOLOMITE
	8.0		DOLOMITE
	10		
	15		
	20		
	25		
	30		
	35		

GRAPHIC LOG

OVM SOIL GAS PPM x 14.6

2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	1.0	GC	2.0
2	0.4	GC	4.0
3	1.1	GC	6.0
4	1.5	GC	8.0
5	1.9	GC	10.0
6	3.0	GC	12.0
7	0.6	GC	14.0
8	0.0	GC	16.0
9	0.0	GC	18.0
10	0.0	GC	20.0
11	0.8	GC	22.0
12	2.2	GC	24.0
13	0.4	GC	26.0
14	4.6	GC	28.0
15	0.0	GC	30.0
16	80.0	GC	32.0
17	12.8	GC	34.0
18	43.0	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-93* *(MW-67)*

DATE DRILLED 8/19/91 TO 8/23/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY TPG
CHECKED BY BJS
DRAWN BY: BDR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3763.1							BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35	CONTINUED FROM PAGE 1	DOLOMITE		18	43.0	GC	36.0	
					19	9.8	GC	38.0	
					20	31.7	GC	40.0	
	40	SANDSTONE: 7.5YR 8/4, PINK, VERY FINE GRAIN, ROUND TO SUBANGULAR, CARBONATE CEMENT, TRACE DOLOMITE	SANDSTONE		21	11.6	GC	42.0	
	42.0	DOLOMITE: WITH INTERBEDDED SANDSTONE 7.5YR 7/0 TO 7/2, LIGHT GRAY TO PINKISH GRAY, DOLOMITE, HARD, DENSE, VERY FINE CRYSTALLINE, SANDSTONE, VERY FINE GRAIN, ROUND TO SUBANGULAR, CARBONATE CEMENT	DOLOMITE		22	10.6	GC	44.0	
	45				23	43	GC	46.0	
					24	75	GC	48.0	
					25	26.1	GC	50.0	
	50				26	11.6	GC	52.0	
					27	99	GC	54.0	
					28	72	GC	56.0	
	55				29	367	GC	58.0	
					30	75.9	GC	60.0	
	60				31	197	GC	62.0	
					32	11.6	GC	64.0	
					33	4.9	GC	66.0	
	65				34	9.8	GC	68.0	
	68.0	SANDSTONE: 7.5YR 8/4, PINK, VERY FINE GRAIN, ROUND TO SUBANGULAR, CARBONATE CEMENT	SANDSTONE		35	10.3	GC	70.0	
	70								

OVM SOIL GAS PPM X 14.6 (2 4 6 8 10 12 14 16 18)

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-93 (MW-67)*

DATE DRILLED 8/19/91 TO 8/23/91
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 14.6 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3763.1								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	70	CONTINUED FROM PAGE 2	SANDSTONE			36	33.1	GC	72.0	70
						37	39	GC	74.0	
	74.0	DOLOMITE: 7.5YR 7/0 TO 7/2, LIGHT GRAY TO PINKISH GRAY, INTERBEDDED SANDSTONE, DOLOMITE, HARD, DENSE, VERY FINE CRYSTALLINE, SANDSTONE, VERY FINE TO FINE GRAIN, ROUND TO SUBANGULAR	DOLOMITE			38	103	GC	76.0	
	75					39	60.9	GC	78.0	75
						40	164	GC	80.0	
	80					41	16.5	GC	82.0	80
						42	112	GC	84.0	
	84.0	SANDSTONE: 10YR 6/3, PALE BROWN, VERY FINE GRAIN, ROUND TO SUBANGULAR, TRACE DOLOMITE	SANDSTONE			43	7.1	GC	86.0	
	85									85
	86.0	DOLOMITE: WITH INTERBEDDED SANDSTONE, 7.5YR 6/0 TO 7/4, GRAY TO PINK, HARD, DENSE, VERY FINE CRYSTALLINE	DOLOMITE			44	123	GC	88.0	
						45	197	GC	90.0	
	90					46	125	GC	92.0	90
						47	291	GC	94.0	
	95					48	82	GC	96.0	95
						49	249	GC	98.0	
						50	202	GC	100.0	
	100					51	6.0	GC	102.0	100
						52	7.0	GC	104.0	
	105					53	3.0	GC	105.0	105

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-93 (MW-67)*

DATE DRILLED 8/19/91 TO 8/23/91
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 14.6 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3763.1								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	105	CONTINUES FROM PAGE 3	DOLOMITE			53	3.0	GC	106.0	105
						54	1.7	GC	108.0	
						55	1.0	GC	110.0	
	110					56	4.9	GC	112.0	110
						57	0.0	GC	114.0	
	115					58	2.0	GC	116.0	115
						59	0.5	GC	118.0	
						60	0.7	GC	120.0	
	120					61	0.2	GC	122.0	120
						62	0.7	GC	124.0	
	125					63	0.0	GC	126.0	125
						64	0.0	GC	128.0	
						65	0.0	GC	130.0	
	130					66	0.7	GC	132.0	130
131.14						67	0.0	GC	134.0	
	135					68	0.0	GC	136.0	135
136.0						69	7.0	GC	138.0	
						70	4.1	GC	140.0	
	140									140

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-93 (MW-67)*

DATE DRILLED 8/19/91 TO 8/23/91
DRILLING METHOD AIR HAMMER
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 14.6 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3763.1								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	140	CONTINUES FROM PAGE 4	DOLOMITE			71	2.0	GC	142.0	140
						72	5.4	GC	144.0	
	145					73	5.2	GC	146.0	145
						74	2.3	GC	148.0	
						75	1.2	GC	150.0	
	150	INCREASE IN SANDSTONE 152.0', TRACE OF DOLOMITIZED OOLITES, GRADES TO SANDSTONE BY 156.0'				76	2.5	GC	152.0	150
						77	2.8	GC	154.0	
	155					78	1.0	GC	156.0	155
	156.0	SANDSTONE: 7.5YR 6/4, LIGHT BROWN, HARD, SATURATED, LOW POROSITY DOLOMITIC CEMENT, TRACE DOLOMITE OOLITES, SOME DOLOMITE INTERBEDDING	SANDSTONE			79	1.2	GC	158.0	
						80	1.8	GC	160.0	
	160					81	7.7	GC	162.0	160
						NS			163.0	
	163.0	TOTAL DEPTH 163.0 FT								
	165									165
	170									170
	175									175

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-93 (MW-67)*

DATE DRILLED 8/19/91 TO 8/23/91
DRILLING METHOD AIR HAMMMER
DRILLED BY BOYLES BROS.
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3794.4		
	0	CLAYEY SILT: BROWN, 7.5YR 5/2, DRY, VERY LOW PLASTICITY, UNCONSOLIDATED FROM 0.0 TO 1.5', CALICHE DEPOSITS, 60% SILT, 40% CLAY	ML	
	4.2	GRAVELLY COBBLELY SILT: UNCONSOLIDATED TO MODERATELY CONSOLIDATED, PEBBLES TO 2 CM., COBBLES TO 10CM., ROUND	GM	
	5			
	10			
	13.0	DOLOMITE: 7.5YR 6/2, PINKISH GRAY, DENSE, HARD, TRACE SANDSTONE, TRACE DOLOMITE SAND FINE TO MEDIUM GRAIN, ROUND TO SUBANGULAR	DOLOMITE	
	15			
▽19.0				
	20	DOLOMITE 10YR 7/1, LIGHT GRAY, DRY, INTER-BEDDED WITH SILTSTONE, 7.5YR 7/4, REDDISH YELLOW, DRY	DOLOMITE	
	22.0	SILTY SANDSTONE: POORLY CEMENTED, 7.5Y,R 8/2, PINKISH WHITE, DRY, VERY FINE GRAIN	SANDSTONE	
▽24.5	24.0	SANDSTONE: VERY FINE SANDSTONE, MODERATE CEMENT, CALCAREOUS, 10YR 5/2, GRAYISH BROWN TO 10YR 3/4, DARK YELLOWISH BROWN, SATURATED, MINOR CHERTY DOLOMITE, 10YR 5/2, GRAYISH BROWN	SANDSTONE	
	25			
	30	DOLOMITE: 10YR 4/2, DARK GRAYISH BROWN TO 10YR 6/2, LIGHT GRAYISH BROWN, SATURATED, MINOR CHERTY DOLOMITE, 10YR 6/2, LIGHT BROWNISH GRAY TO 10YR 7/1 LIGHT GRAY	DOLOMITE	
	35			

OVM SOIL GAS PPM X 108.4 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	6.9	GC	2.0
2	1.1	GC	4.0
3	0.1	GC	6.0
4	0.2	GC	8.0
5	0.0	GC	10.0
6	0.0	GC	12.0
7	.2	GC	14.0
8	0.0	GC	16.0
9	0.0	GC	18.0
10	0.0	GC	20.0
11	0.0	GC	22.0
12	0.0	GC	24.0
13	21	GC	26.0
14	23	GC	28.0
15	14	GC	30.0
16	10	GC	32.0
17	5	GC	34.0
18	3	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

AIR HAMMER DRILLING

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-94 (MW-68)*

DATE DRILLED 8/23 TO 8/31/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY DHC
CHECKED BY BJS
DRAWN BY: BDR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3794.4	
	35		DOLOMITE
	38.0	DOLOMITE: 10YR 4/2, DARK GRAYISH BROWN TO 10YR 6/2, LIGHT GRAYISH BROWN, SATURATED, MINOR CHERTY DOLOMITE, 10YR 6/2, LIGHT BROWNISH GRAY TO 10YR 7/1, LIGHT GRAY, INCREASE IN CHERT	DOLOMITE
	40		
	45	MINOR FINE GRAIN SANDSTONE AT 48' 10YR 5/2, GRAYISH BROWN	
	50	SANDSTONE: FINE GRAIN SANDSTONE, CALCAREOUS, WELL CEMENTED, 10YR 5/2, GRAYISH BROWN TO10YR 4/1, DARK GRAY	SANDSTONE
	52.0	SANDSTONE: FINE GRAIN SANDSTONE, 2.5YR 5/2, GRAYISH BROWN, MODERATE CEMENT, CALCAREOUS AND CHERTY DOLOMITE, 10YR 5/2, GRAYISH BROWN	SANDSTONE
	55	SANDSTONE: INTERBEDDED VERY FINE GRAIN SANDSTONE 10Y,R 4/1, DARK GRAY, TO 2.5Y,R 5/2, GRAYISH BROWN, WELL CEMENTED, DOLOMITIC AND CHERTY DOLOMITE 10YR 5/2, GRAYISH BROWN	SANDSTONE
	58.0	DOLOMITE: 10YR 6/2, LIGHT BROWNISH GRAY TO 10YR 4/1, DARK GRAY, INTERBEDDED WITH SANDY DOLOMITE, 10YR 5/1, GRAY, MOTTLED WITH BLACK SPECKS, POSSIBLE COAL INCLUSIONS	DOLOMITE
	60		
	65		
	66.0	DOLOMITE: 10YR 5/2, GRAYISH BROWN, HARD, DENSE AND VERY FINE GRAIN DOLOMITIC SANDSTONE, 10YR 4/1, DARK GRAY, WELL CEMENTED, SOME VERY FINE SANDSTONE MOTTLED WITH BLACK SPECS	DOLOMITE
	70		

GRAPHIC LOG

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
18	3	GC	36.0
19	9	GC	38.0
20	18	GC	40.0
21	23	GC	42.0
22	186	GC	44.0
23	202	GC	46.0
24	407	GC	48.0
25	297	GC	50.0
26	320	GC	52.0
27	167	GC	54.0
28	85	GC	56.0
29	88	GC	58.0
30	79	GC	60.0
31	58	GC	62.0
32	62	GC	64.0
33	73	GC	66.0
34	54	GC	68.0
35	18	GC	70.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

35 40 45 50 55 60 65 70

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-94 (MW-68)*

DATE DRILLED 8/23/91 TO 8/31/91
DRILLING METHOD AIR HAMMER
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DRAWN BY: BDR

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NORMAN, OKLAHOMA 73072
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 108.4 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3794.4								BACKGROUND OVM READING: SOIL: 0 PPM AIR: 0 PPM
	70	CONTINUED FROM PAGE 2	DOLOMITE			36	17	GC	72.0	70
						37	21	GC	74.0	
	75					38	37	GC	76.0	75
						39	28	GC	78.0	
	78.0	DOLOMITIC SANDSTONE: VERY FINE GRAIN, 10YR 3/1, VERY DARK GRAY, TO 10YR 5/1 GRAY INTERBEDDED WITH DOLOMITE 10YR 6/2, LIGHT BROWNISH GRAY	DOLOMITIC SANDSTONE			40	18	GC	80.0	
	80	SANDY DOLOMITE: 10YR 4/2, DARK GRAYISH BROWN, DOLOMITE, 10YR 5/2, GRAYISH BROWN AND VERY FINE GRAIN DOLOMITIC SANDSTONE 10YR 4/1 DARK GRAY, INCREASING VERY FINE GRAIN SANDSTONE AT 82', DECREASING DOLOMITE POSSIBLE PYRITE IN DOLOMITE	SANDY DOLOMITE			41	43	GC	82.0	80
						42	256	GC	84.0	
	85					43	124	GC	86.0	85
						44	195	GC	88.0	
						45	61	GC	90.0	
	90	SILTSTONE: TALC, LIGHT GREEN AND DOLOMITE, HARD, CRYSTALLINE, 10YR 5/1, GRAY, SOME IRON STAIN, MINOR DOLOMITIC, VERY FINE GRAIN SANDSTONE @ 94' DECREASING LIGHT GREEN SILTSTONE, TALC, INCREASING SANDY DOLOMITE AND DOLOMITE	SILTSTONE			46	25	GC	92.0	90
						47	61	GC	94.0	
	95					48	33	GC	96.0	95
	96.0	CHERTY DOLOMITE: HARD, DENSE, 10YR 7/3, VERY PALE BROWN, SANDY DOLOMITE, 10YR 5/1, GRAY, DOLOMITIC VERY FINE GRAIN SANDSTONE, 10YR 3/1, VERY DARK GRAY, AND LIGHT GREEN SILTSTONE, TALC	CHERTY DOLOMITE			49	26	GC	98.0	
						50	66	GC	100.0	
	100					51	23	GC	102.0	100
	102.0	DOLOMITE: DENSE, HARD, 10YR 6/2, LIGHT BROWNISH GRAY, WITH MINOR VERY FINE GRAIN DOLOMITIC SANDSTONE, 10YR 5/1 GRAY, @ 104' SOME CHERT 7.5YR 7/4, PINK	DOLOMITE			52	26	GC	104.0	
	105					53	19	GC	105.0	105

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-94 (MW-68)*

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 108.4 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3794.4								BACKGROUND OVM READING: SOIL: 0 PPM AIR: 0 PPM
	105	CONTINUES FROM PAGE 3	DOLOMITE			53	19	GC	106.0	105
						54	62	GC	108.0	
						55	4	GC	110.0	
	110					56	115	GC	112.0	110
						57	23	GC	114.0	
	115					58	58	GC	116.0	115
						59	61	GC	118.0	
						60	95	GC	120.0	
	120	DOLOMITE: DENSE, HARD, 10YR 7/1 LIGHT GRAY AND CHERTY DOLOMITE, 7.5YR 7/6 REDDISH YELLOW, MOTTLED, BRITTLE	DOLOMITE			61	43	GC	122.0	120
	122.0	CHERTY DOLOMITE: 10YR 6/2, LIGHT BROWNISH GRAY	CHERTY DOLOMITE			62	54	GC	124.0	
	125					63	65	GC	126.0	125
	126.0	CHERTY DOLOMITE: 10YR 8/1, WHITE TO 10YR 7/3, VERY PALE BROWN INTERBEDDED WITH SILTSTONE 7.5YR 8/0, WHITE, DRY POWDERED RETURNS FOR SILTSTONE, DRY	CHERTY DOLOMITE			64	116	GC	128.0	
						65	55	GC	130.0	
	130	DOLOMITE: DENSE, HARD 10YR 7/2 TO 6/2, LIGHT GRAY TO LIGHT BROWNISH GRAY, DRY	DOLOMITE			66	42	GC	132.0	130
						67	46	GC	134.0	
	134.0	SILTY SANDSTONE: FINE GRAIN, 2.5Y 8/2, WHITE, POORLY CEMENTED AND CHERTY, DOLOMITE, 10YR 5/2 TO 7/3, GRAYISH BROWN TO VERY PALE BROWN, DRY	SILTY SANDSTONE			68	16	GC	136.0	
	135									135
	136.0	SILTY SANDSTONE: FINE SILTY SILICA AND MEDIUM GRAIN CHERT SANDSTONE, POORLY CEMENTED CaCo3, 10YR 8/2, WHITE, MOIST	SILTY SANDSTONE			69	19	GC	138.0	
						70	20	GC	140.0	
	140									140

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-94 (MW-68)*

DATE DRILLED 8/23/91 TO 8/31/91
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DRAWN BY: BDR

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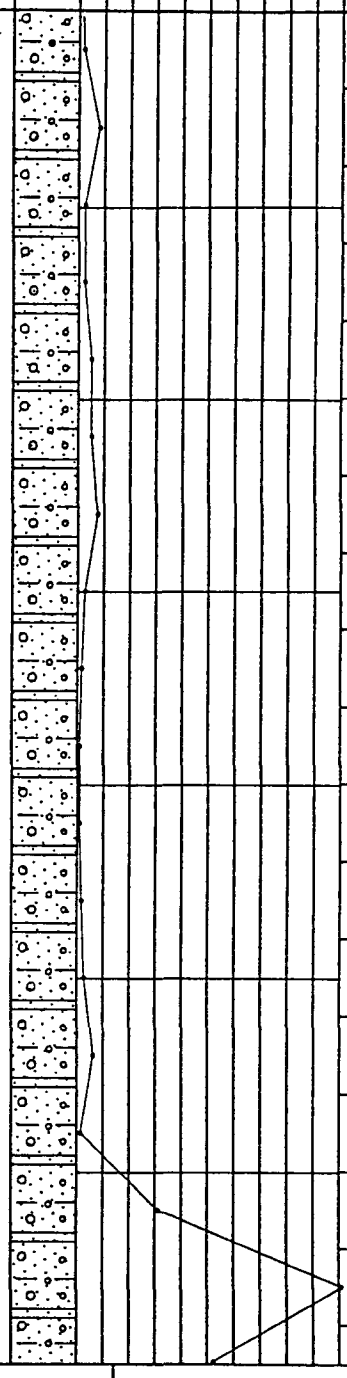
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3794.4	
	140	CONGLOMERATE: CLAY,SILT, SAND, FINE SILICA AND MEDIUM TO LARGE GRAIN CHERT, INCLUSIONS OF DOLOMITE, DOLOMITIC CHERT, AND SILTSTONE, CALCAREOUS	CONGLOM-ERATE
	145	148' INCREASING PEBBLES OF CHERT, MORE SILT AND CLAY, LOTS OF FINE SAND	
		CONGLOMERATE, CLAY, SILT, FINE SILICA, SAND, MEDIUM, LARGE, CHERT GRAINS PEBBLES OF CHERT, DOLOMITIC SANDSTONE, SILTSTONE 10YR 8/0 WHITE, SLIGHTLY MOIST	
	150	168' INCREASE IN VERY FINE TO MEDIUM GRAIN SANDSTONE PEBBLES	
		170' HYDROCARBON ODOR	
		174' PEBBLES OF VERY FINE DOLOMITIC SANDSTONE, HARD, DENSE, 10YR 4/3 DARK BROWN SATURATED, STRONG CONDENSATE ODOR.	
	155	RETURNS FROM 174-194' LOOKS LIKE MUD FROM SILT AND CLAY	
		* SAMPLES FROM 184-194 GOT ACCIDENTLY MIXED TOGETHER. MORE SAND SIZE MATERIAL @ 184'	
	160		
▽162.47			
	165		
	170		
▽174.0			
	175		

GRAPHIC LOG



OVM SOIL GAS PPM X 108.4 (2 4 6 8 10 12 14 16 18)

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
71	39	GC	142.0
72	172	GC	144.0
73	53	GC	146.0
74	47	GC	148.0
75	106	GC	150.0
76	108	GC	152.0
77	161	GC	154.0
78	57	GC	156.0
79	33	GC	158.0
80	18	GC	160.0
81	15	GC	162.0
82	33	GC	164.0
83	54	GC	166.0
84	131	GC	168.0
85	26	GC	170.0
86	673	GC	172.0
87	2186	GC	174.0
88	1104	GC	175.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-94 (MW-68)*

DATE DRILLED 8/23/91 TO 8/31/91
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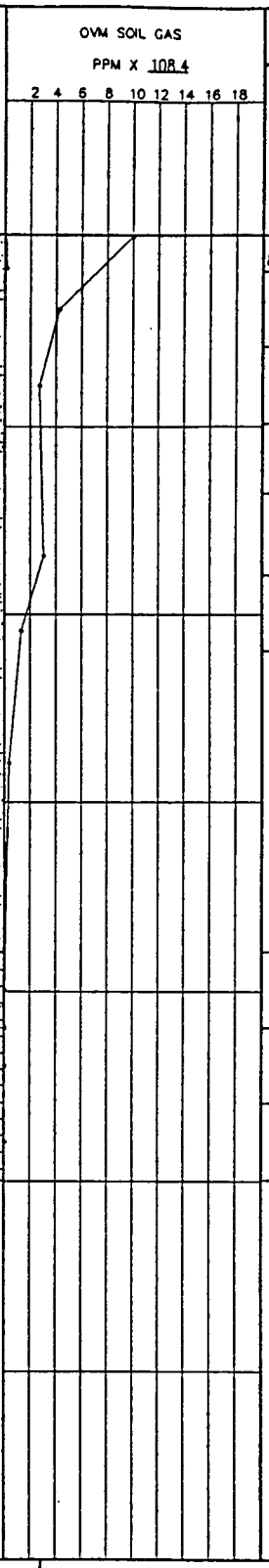
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3794.4	
	175	CONTINUES FROM PAGE 5	CONGLOMERATE
	180		
	185		
	190		
	194.0	DOLOMITE: HARD, DENSE, 10YR 6/3, PALE BROWN	DOLOMITE
	195		
	196.0	DOLOMITE: AS ABOVE AND DOLOMITIC FINE TO MEDIUM GRAIN SILICA SANDSTONE, MODERATE CaCo3 CEMENT, MODERATE POROSITY, 10YR 6/3, PALE BROWN, SATURATED	DOLOMITE
▽ 197.0'	198.0	DOLOMITIC SANDSTONE: DOLOMITIC FINE TO MEDIUM GRAIN SILICA SANDSTONE, MODERATE CaCo3 CEMENT, MODERATE PORSITY, 10YR 6/3, PALE BROWN, SATURATED, INCREASE IN UNCONSOLIDATED SAND GRAINS FROM 196 TO 198'	DOLOMITIC SANDSTONE
	200	TOTAL DEPTH 200.0 FT	
	205		
	210		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
88	1104	GC	176.0
89	460	GC	178.0
90	292	GC	180.0
91	328	GC	182.0
92	140	GC	184.0
93	39	GC	186.0
NS			194.0
94	4	GC	196.0
95	4	GC	198.0
96	5	GC	200.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 20.8 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3801.7								BACKGROUND OVM READING: SOIL: 0 PPM AIR: 0 PPM
	0	SANDY SILT: 5YR 5/4, REDDISH BROWN, MOIST, SOFT, TRACE DOLOMITE AND LIMESTONE GRAVEL	ML			1		GC	2.0	0
						2	16.0	GC	4.0	
	5					3	0.2	GC	6.0	5
	6.0	SANDSTONE: 7.5YR 6/2 PINKISH GRAY, VERY FINE GRAIN, ROUND TO ANGULAR, TRACE DOLOMITE, CARBONATE CEMENT	SANDSTONE			4		GC	8.0	
	8.0	DOLOMITE: 7.5YR 6/0, GRAY, HARD, DENSE, VERY FINE CRYSTALLINE, INTERBEDDED SANDSTONE	DOLOMITE			5	0.5	GC	10.0	
	10					6	5.0	GC	12.0	10
						7	3.9	GC	14.0	
	15					8		GC	16.0	15
						9	0.2	GC	18.0	
						10	1.6	GC	20.0	
▽ 21.61	20	DOLOMITE: HARD, DENSE, 10YR 6/2 LIGHT BROWNISH GRAY, DRY	DOLOMITE			11	2	GC	22.0	20
						12	4	GC	24.0	
	24.0	DOLOMITE: DENSE, HARD, 10YR 5/1, GRAY, INTERBEDDED WITH SILTY FINE GRAIN SANDSTONE MODERATE CaCO3 CEMENT, 5YR 8/2, PINKISH WHITE, DRY	DOLOMITE			13	235	GC	26.0	
	25									25
	26.0	DOLOMITE: AS ABOVE, WITH FINE SANDSTONE, SILICA, MODERATE CaCo3 CEMENT, 10YR 8/1, WHITE, DRY	DOLOMITE			14	97	GC	28.0	
	28.0	SANDSTONE: FINE GRAIN , POORLY CEMENTED CaCo3, 10YR 7/2, LIGHT GRAY, DRY	SANDSTONE			15	29	GC	30.0	
	30					16	42	GC	32.0	30
	32.0	SILTSTONE: POORLY CEMENTED, POWDER RETURNS, 5YR 8/1, WHITE WITH DOLOMITE, DEN,SE HARD, 10YR 5/2, GRAYISH BROWN, AND CHERTY DOLOMITE, 10YR 3/3 DARK BROWN, DRY	SILTSTONE			17	17	GC	34.0	
	34.0		SILTY SANDSTONE			18	11	GC	35.0	
	35									35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-95 (MW-69)*

DATE DRILLED 8/25/91
DRILLING METHOD AIR HAMMER
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 20.8 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3801.7								BACKGROUND OVM READING: SOIL: 0 PPM AIR: 0 PPM
	35									35
	36.0	SILTY SANDSTONE: FINE GRAIN, SANDSTONE, POORLY CEMENTED POWDERED RETURNS 5YR 8/1, WHITE, DRY	SANDSTONE			18	11	GC	36.0	
		SILTSTONE: POORLY CEMENTED POWDERED RETURNS 7.5YR 8/1, WHITE, DRY	SILTSTONE			19	8	GC	38.0	
						20	5	GC	40.0	
	40	DOLOMITE: HARD, DENSE, 10YR 6/3, PALE BROWN, WITH SOME 10% CHERTY DOLOMITE, 10YR 7/2, LIGHT GRAY, LITTLE MOISTURE @ 40'	DOLOMITE			21	7	GC	42.0	40
		SATURATION @ 42' INCREASING CHERTY DOLOMITE @ 42' ~ 30%				22	135	GC	44.0	
	45					23	152	GC	46.0	45
▽ 42.0						24	269	GC	48.0	
						25	304	GC	50.0	
	50					26	181	GC	52.0	50
	52.0	DOLOMITE: HARD, DENSE, 10YR 7/2, LIGHT GRAY, CHERTY DOLOMITE, 10YR 6/3, PALE BROWN, AND VERY FINE GRAIN, DOLOMITIC SANDSTONE, 10YR 4/1, DARK GRAY	DOLOMITE			27	323	GC	54.0	
	55					28	416	GC	56.0	55
		TOTAL DEPTH 56.0 FT								
	60									60
	65									65
	70									70

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

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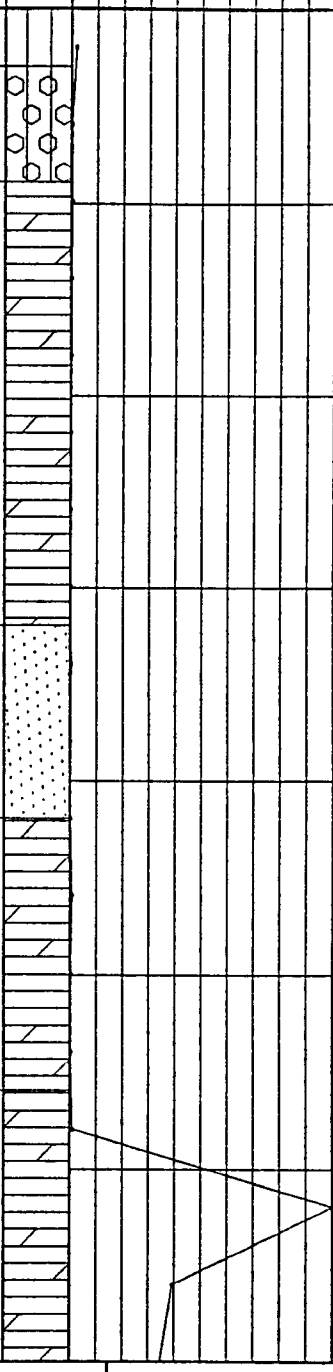
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3798.3	
	0	SILT: 10YR 4/4, DARK YELLOWISH BROWN, DRY, SOFT, ROOTLETS	ML
	1.5	GRAVELY COBBELY SILT: 10YR 6/2, LIGHT BROWNISH GRAY, DRY, DOLOMITE GRAVELS AND COBBLES	ML
	4.5	DOLOMITE: 10YR 6/2, LIGHT BROWNISH GRAY, DRY, HARD, SANDY AT 8-10' AND 12-14'	DOLOMITE
	16.0	SANDSTONE: 10YR 8/2, WHITE MODERATELY HARD, VERY SILTY, FINE GRAINED, VERY MINOR DOLOMITE ZONES	SANDSTONE
	21.0	DOLOMITE: 10YR 6/2, LIGHT BROWNISH GRAY, HARD, DRY SANDY, 10YR 8/2, WHITE, MODERATELY HARD, FINE GRAIN	DOLOMITE
	28.0	DOLOMITE: 10YR 6/2, LIGHT BROWNISH GRAY, HARD, WET AT 30.0'	DOLOMITE
30.0	30	CONTINUED ON NEXT PAGE	
	35		

GRAPHIC LOG



OVM SOIL GAS PPM X 60.9

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	24.9	GC	2.0
2	4.9	GC	4.0
3	7.2	GC	6.0
4	3.8	GC	8.0
5	2.4	GC	10.0
6	2.7	GC	12.0
7	2.4	GC	14.0
8	3.1	GC	16.0
9	4.9	GC	18.0
10	2.4	GC	20.0
11	3.5	GC	22.0
12	10.9	GC	24.0
13	5.3	GC	26.0
14	5.3	GC	28.0
15	13.8	GC	30.0
16	1218	GC	32.0
17	479	GC	34.0
18	422	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0 PPM
AIR: 0 PPM

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-96*

DATE DRILLED 9/4/91 TO 9/5/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: BDR

ROBERTS/SCHORNICK
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ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 60.9 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3798.3								BACKGROUND OVM READING: SOIL: 0 PPM AIR: 0 PPM
	35		DOLOMITE			18	422	GC	36.0	35
						19	196	GC	38.0	
						20	425	GC	40.0	
	40	TOTAL DEPTH 40.0 FT BOREHOLE P/A WITH CEMENT / BENTONITE GROUT MIX.								40
	45									45
	50									50
	55									55
	60									60
	65									65
	70									70

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-96*

DATE DRILLED 9/4/91 TO 9/5/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
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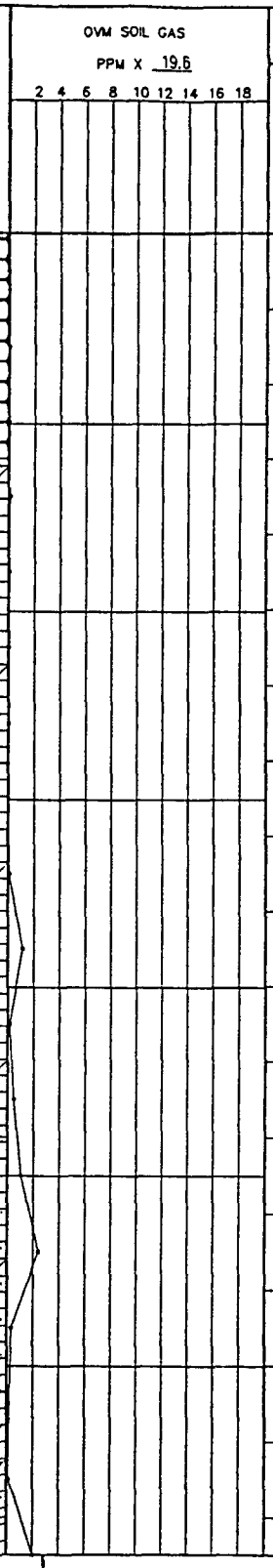
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
		GROUND SURFACE: 3819.5		
	0	COBBLES:	COBBLES	
	5			
	6.0	DOLOMITE: 10YR 7/2, LIGHT GRAY, DRY, HARD, MICROCRYSTALLINE, INTERBEDDED SILSTONE, 7.5YR 6/6, REDDISH YELLOW, DRY, SOFT, POORLY CEMENTED	DOLOMITE	
	10	SILTSTONE DECREASES WITH DEPTH		
	15			
	18.0	DOLOMITE: 10YR 7/2, LIGHT GRAY, MICROCRYSTALLINE, DRY, HARD, 10YR 6/8, BROWNISH YELLOW, STAINING	DOLOMITE	
	20			
	24.0	SANDY DOLOMITE: 10YR 7/2, LIGHT GRAY, SOFT, MICROCRYSTALLINE, INTERBEDS OF SANDSTONE, 10YR 6/6, BROWNISH YELLOW, VERY FINE GRAINED, WELL ROUNDED, POORLY CEMENTED, 7.5YR 4/2, DARK BROWN, SANDSTONE BEDS AT 26.0' POORLY CEMENTED, WELL ROUNDED AMOUNT OF SANDSTONE DECREASES WITH DEPTH MINOR AMOUNTS OF 7.5YR 6/4, DOLOMITE AT 32.0'	SANDY DOLOMITE	
	25			
	30			
	34.0	DOLOMITE:	DOLOMITE	
	35			

OVM SOIL GAS PPM X 19.6



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	2.0
2	0.0	GC	4.0
3	0.0	GC	6.0
4	2.0	GC	8.0
5	0.0	GC	10.0
6	0.0	GC	12.0
7	0.0	GC	14.0
8	0.0	GC	16.0
9	2.0	GC	18.0
10	22.3	GC	20.0
11	3.5	GC	22.0
12	9.4	GC	24.0
13	20.5	GC	26.0
14	47.5	GC	28.0
15	6.8	GC	30.0
16	3.8	GC	32.0
17	3.1	GC	34.0
18	39.7	GC	35.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-97 (MW-70)*

DATE DRILLED 9/10/91 TO 9/12/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY KMH
CHECKED BY BJS
DRAWN BY: BDR

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NORMAN, OKLAHOMA 73072
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 19.6 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3819.5								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35	CONTINUES FROM PAGE 1	DOLOMITE			18	39.7	GC	36.0	35
		DOLOMITE, 10YR 7/1, LIGHT GRAY, DRY, HARD, IRON STAININGS				19	13.8	GC	38.0	
		INTERBEDS OF SANDSTONE, 10YR 6/6, BROWNISH YELLOW, FINE GRAINED, MODERATELY CEMENTED, 36.0 TO 38.0'				20	9.7	GC	40.0	
	40	10YR 4/2, DARK GRAYISH BROWN, SANDSTONE FROM 40.0 TO 42.0', SMALL AMOUNTS OF 7.5YR 5/8, STRONG BROWN, DOLOMITE				21	17.5	GC	42.0	40
						22	19.0	GC	44.0	
	45					23	39.0	GC	46.0	45
	46.0	CHERTY DOLOMITE: 10YR 6/6, BROWNISH YELLOW, DRY, MICROCRYSTALLINE, HARD, CONCHODIAL FRACTURE	CHERTY DOLOMITE			24	19.4	GC	48.0	
						25	--	GC	50.0	
	50					26	--	GC	52.0	50
						27	--	GC	54.0	
	55					28	--	GC	56.0	55
						29	--	GC	58.0	
	59.0					30	--	GC	60.0	
	60	SANDSTONE: 10YR 5/2, GRAYISH BROWN, WELL CEMENTED, VERY FINE GRAINED, WELL ROUNDED, DRY, SMALL AMOUNTS OF 10YR 5/8, YELLOWISH BROWN, SANDSTONE, HARDER THAN THE 10YR 5/2, GRAYISH BROWN, SANDSTONE	SANDSTONE			31	392.0	GC	62.0	60
	62.0	DOLOMITE: 10YR 7/3, VERY PALE BROWN, DRY, HARD, MICROCRYSTALLINE	DOLOMITE			32	193.4	GC	64.0	
		INTERBEDS OF SANDSTONE, 10YR 4/2, DARK GRAYISH BROWN, CEMENTED, WELL ROUNDED, FROM 62.0 TO 64.0'				33	--	GC	66.0	
	65					34	--	GC	68.0	65
		NOTE: NO READING FROM 48.0' TO 72.0' EXCEPT FOR 60.0' TO 62.0' AND 62.0 TO 64.0'				35	--	GC	70.0	
	70									70

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-97 (MW-70)*

DATE DRILLED 9/10/91 TO 9/12/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY KMH
CHECKED BY BJS
DRAWN BY: BDR

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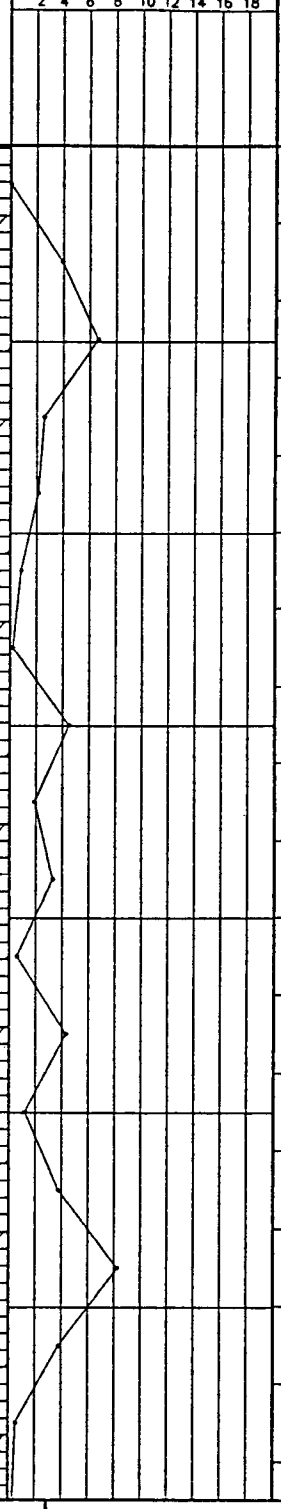
BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3819.5	
	70	CONTINUES FROM PAGE 2	DOLOMITE
	74.0	DOLOMITE: 10YR 6/2, LIGHT GRAYISH BROWN, DRY, HARD, MICROCRYSTALLINE, IRON STAININGS	DOLOMITE
	75	DOLOMITE BECOMES 10YR 7/4, VERY PALE BROWN, FROM 80.0 TO 82.0' NO IRON STAINS	
		INCREASE IN IRON STAINS INTERBEDDED 10YR 6/2, LIGHT GRAYISH BROWN AND 10YR 7/4, VERY PALE BROWN, DOLOMITE, BLACK STAINING ON DOLOMITE, 88.0 TO 90.0'	
	80	BLACK SPECKS ON DOLOMITE 96.0 TO 102.0'	
		DOLOMITE 7.5YR 7/4, PINK, AND 10YR 6/2, LIGHT BROWNISH GRAY, FROM 100.0 TO 104.0'	
	85		
	90		
	95		
	100		
	105		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
36	--	GC	72.0
37	76.4	GC	74.0
38	129.7	GC	76.0
39	50.1	GC	78.0
40	41.1	GC	80.0
41	16.1	GC	82.0
42	3.9	GC	84.0
43	87.6	GC	86.0
44	37.1	GC	88.0
45	63.8	GC	90.0
46	11.2	GC	92.0
47	84.0	GC	94.0
48	23.3	GC	96.0
49	72.8	GC	98.0
50	161.4	GC	100.0
51	74.2	GC	102.0
52	10.3	GC	104.0
53	3.4	GC	105.0

REMARKS

BACKGROUND OVM READING:
SOIL: 0.0 PPM
AIR: 0.0 PPM

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-97 (MW-70)*

DATE DRILLED 9/10/91 TO 9/12/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY KMH
CHECKED BY BJS
DRAWN BY: BDR

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NORMAN, OKLAHOMA 73072
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 19.6 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3819.5								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	105	CONTINUES FROM PAGE 3	DOLOMITE			53	3.4	GC	106.0	105
						54	1.8	GC	108.0	
						55	3.4	GC	110.0	
	110					56	1.2	GC	112.0	110
						57	14.8	GC	114.0	
						58	3.6	GC	116.0	
	115	INTERBEDS OF SANDSTONE, 5Y 5/2, OLIVE GRAY, VERY FINE GRAINED, WELL ROUNDED, MODERATELY CEMENTED				59	5.4	GC	118.0	115
						60	3.9	GC	120.0	
	120	SANDSTONE: 10YR 7/3, VERY PALE BROWN, WELL CEMENTED, CALCITE CEMENTED, VERY FINE GRAINED, HARD, DRY, INTERBEDS OF DOLOMITE, 10YR 4/2, DARK GRAYISH BROWN, HARD, DRY	SANDSTONE			61	5.0	GC	122.0	120
						62	2.1	GC	124.0	
		DOLOMITE BEDS DECREASE WITH DEPTH				63	2.5	GC	126.0	
	125					64	2.8	GC	128.0	125
						65	1.0	GC	130.0	
	130					66	1.2	GC	132.0	130
						67	2.1	GC	134.0	
						68	2.7	GC	136.0	
	135					69	2.3	GC	138.0	135
		FEW SILTSTONE BEDS, 10YR 6/1, LIGHT GRAY, SOFT				70	1.2	GC	140.0	
	140									140

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-97 (MW-70)*

DATE DRILLED 9/10/91 TO 9/12/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY KMH
CHECKED BY BJS
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 19.6 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3819.5								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	140	CONTINUED FROM PREVIOUS PAGE	SANDSTONE			71	0.7	GC	142.0	140
						72	1.6	GC	144.0	
	145	AMOUNT OF SILTSTONE BEDS INCREASE FROM 145.0 TO 150.0' SANDSTONE IS POORLY CEMENTED FROM 145.0 TO 150.0'				73	1.6	GC	146.0	145
						74	0.7	GC	148.0	
		SANDSTONE BECOMES 10YR 6/6, BROWNISH YELLOW, AND WELL CEMENTED FROM 148.0 TO 150.0'				75	0.7	GC	150.0	
	150					76	6.1	GC	152.0	150
		SANDSTONE, 2.5Y 8/6, YELLOW, POORLY CEMENTED, VERY FINE GRAINED FROM 156.0 TO 162.0', SANDSTONE IS WELL CEMENTED TO 164.0'				77	4.2	GC	154.0	
	155					78	2.5	GC	156.0	155
						79	3.9	GC	158.0	
		SANDSTONE: 10YR 6/4, LIGHT YELLOWISH BROWN, WELL CEMENTED, WELL ROUNDED, CALCITE CEMENTED, VERY FINE GRAINED				80	5.4	GC	160.0	
	160	INTERBEDS OF 10YR 7/2, LIGHT GRAY, SANDSTONE, MODERATE TO POORLY CEMENTED				81	4.1	GC	162.0	160
						82	3.9	GC	164.0	
	165					83	0.7	GC	166.0	165
						84	1.6	GC	168.0	
						85	1.6	GC	170.0	
	170					86	1.0	GC	172.0	170
						87	0.3	GC	174.0	
	175					88	0.7	GC	175.0	175

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-97 (MW-70)*

DATE DRILLED 9/10/91 TO 9/12/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY KMH
CHECKED BY BJS
DRAWN BY: BDR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM X 19.6 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3819.5								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	175		SANDSTONE			88	0.7	GC	176.0	175
		SANDSTONE, 10YR 7/2, LIGHT GRAY, COARSE GRAINED, CALCITE CEMENTED, POROUS, SUBANGULAR, MODERATELY CEMENTED				89	1.0	GC	178.0	
						90	0.3	GC	180.0	
	180					91	0.5	GC	182.0	180
		SANDSTONE IS POORLY CEMENTED FROM 186.0 TO 184.0'				92	0.3	GC	184.0	
		SANDSTONE, 10YR 6/2, LIGHT BROWNISH GRAY, FROM 186.0', MODERATELY CEMENTED				93	1.0	GC	186.0	
	185									185
		SANDSTONE IS LESS CEMENTED FROM 190.0 TO 198.0'				94	0.7	GC	188.0	
		SATURATED AT 193.0'				95	0.7	GC	190.0	
190.4	190	INTERBEDS OF DOLOMITE, 10YR 7/2, LIGHT GRAY, FROM 195.0 TO 295.0', HARD				96	2.7	GC	192.0	190
		SANSTONE BECOMES COARSER AND MORE WELL CEMENTED				97	0.5	GC	194.0	
193.0		SANDSTONE, 10YR 6/3, PALE BROWN COARSE GRAINED, POORLY CEMENTED WITH WELL CEMENTED FINE GRAINED SANDTONE BEDS, 10YR 6/3, PALE BROWN, CALCITE CEMENTED.				98	0.3	GC	196.0	
	195					99	0.3	GC	198.0	195
						100	0.7	GC	200.0	
	200					101	0.5	GC	202.0	200
						102	0.3	GC	204.0	
	205					103	1.8	GC	206.0	205
						104	0.3	GC	208.0	
						105	0.0	GC	210.0	
	210									210

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-97 (MW-70)*

DATE DRILLED 9/10/91 TO 9/12/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY KMH
CHECKED BY BJS
DRAWN BY: BDR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 19.6 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3819.5								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	210	SANDSTONE: 10YR 5/2, GRAYISH BROWN, WELL ROUNDED, WELL CEMENTED, CALCITE CEMENTED, FINE GRAINED	SANDSTONE			106	0.3	GC	212.0	210
						107	0.3	GC	214.0	
	215					108	0.0	GC	216.0	215
						109	0.0	GC	218.0	
	220					110	0.0	GC	220.0	220
	222.0					111	0.0	GC	222.0	
		TOTAL DEPTH 222.0 FT W.L. 190.48 AFTER DRILLING (BGL)								
	225									225
	230									230
	235									235
	240									240
	245									245

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSITE

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-97 (MW-70)*

DATE DRILLED 9/10/91 TO 9/12/91
DRILLING METHOD AIR HAMMER
DRILLED BY BOYLES BROS.
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Mid-Continent Region
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November 20, 1991

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Al Collar
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P. O. Box 1397
Roswell, New Mexico 88202

Enclosed for your files are final records of borehole and monitor wells for the Indian Basin Project. These replace and update previous versions submitted August 22, 1991. New borehole records are submitted for wells BH-91A, BH-92, BH-93, BH-94, BH-95, BH-96, and BH-97 as these were not available at the last submission.

Any changes from previous versions are small, representing attempts for completeness or clarity, and in no way alter interpretations or conclusions.

If you have any questions or would like to see a detailed itemized list of the nature of the changes in each borehole please do not hesitate to call.

Very truly yours,

Robert F. Unger
Production Manager
Midland Operations

RFU/dk

Enclosures

OCD FILES

35MM DRAWINGS

2R- 22

FILE NUMBER

General Correspondence

DOCUMENT TYPE

2001- 1991

4 A

NO OF DWGS

64

BOX

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
'91 DEC 19 AM 9 36

December
~~November~~ 15, 1991

William Olson
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Mr. David Schafersman
U. S. Department of Interior
Bureau of Land Management
P. O. Box 27115
Santa Fe, New Mexico 87502

As requested during our December 13 Indian Basin update meeting, I am enclosing copies of the Activity Update view graphs. Should you have any additional questions, please contact me at (915) 687-8526.

Sincerely,

Jeffrey S. Lynn

JSL/elk

Attachments

cc: C. E. Eustice - OCD, Hobbs

ACTIVITY UPDATE
SINCE NOVEMBER 1, 1991

- L. Queen Free Product Recovery
  - November 1 - Cum. 10 BC & 1547 BW (BH-88)
  - November 1 - Start pumping six wells
    BH-84, BH-85, BH-87A, BH-88, BH-91A, & BH-94
  - December 10 - Cum. 29 BC & 9122 BW
  - Meter change required

- Soil Venting
  - Active pilot project
    - Project completed - 51 operational days
    - Results - 3930 Lbs HC extracted
      - Avg. 77 Lbs/day
      - Equivalent to 15 BC
  - Passive pilot project
    - Installed at MW-33
    - Attempting to profile wind speed, direction & VOC removal
    - No cumulative measurements available
    - Search for more efficient wind turbine

ACTIVITY UPDATE
SINCE NOVEMBER 1, 1991

- Spray Nozzle Testing
  - Nozzle can achieve required 5 ppb benzene with influent of 300 ppb benzene
  - Requires special small pore nozzle
  - Larger nozzles can not reach 5 ppb level
  - Special operational considerations needed

- Alternative Sample Analysis Technique
  - Will compare purge & trap analysis with UV liquid chromatography

- Fluid Level Measurements
  - Recording fluid level measurements for 21 wells - 14 L. Queen & 7 shallow
  - Recorded every two days
  - Systematic patern of fluid level change identified
  - May be in response to barometric pressure
  - Further investigation is underway

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

November 15, 1991

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NOV 19 1991
OIL CONSERVATION DIV.
SANTA FE

William Olson
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

As requested, I am enclosing all the point-in-time sample analysis data. The sampling was completed using EPA protocol during the time frame of September 18 - 29. Analyses were made for 91 samples by Core Laboratories using EPA approved methodologies. Sampling not only included the monitoring wells and pits, but also numerous rancher wells.

We have compiled the results of the point-in-time sampling analyses into a table format for your convenience. This incorporates Marathon quality control of the data supplied by Core Laboratories. Additionally, copies of the original laboratory data are included for your files.

Should you have additional questions concerning these analyses, feel free to call.

I have also enclosed maps which locate the various ranchers' wells which have been routinely monitored by Marathon since the discovery of the Line 4 leak in April. I apologize for any inconvenience that the delay of this information may have caused.

Sincerely,

Robert F. Unger

Robert F. Unger
Production Manger
Midland Operations

RFU/JSL/elk

Enclosures

cc: A. Collar (BLM-Roswell)

RECEIVED
NOV 19 1991
OIL CONSERVATION DIV.
SANTA FE

Indian Basin "Point in Time" Water Sampling, Sept 1991

(revised 11/08/91 to reflect Core Lab corrections)

	ppm		parts per billion			ppm	TPH, ppm	
BH	Cl	Ben	Tol	E Ben	Xyl	BTEX	418.1	8015
---	---	---	---	---	---	---	---	---
A9	194	700	500	100	1800	3.100	7	---
A10	199	940	340	80	1300	2.660	2	---
A11	342	1400	1300	200	3400	6.300	<1	19
A16	126	240	55	<5	220	0.515	1	---
B16	202	980	1200	100	1400	3.680	2	---
P16	11.7	<1	<1	<1	2	0.002	6	<10
RS2	54	400	80	80	720	1.280	3	---
RS4	32	30	15	<5	20	0.065	1	---
RS5	78	1100	600	<20	880	2.580	4	---
RS7	19	260	240	<20	780	1.280	3	---
RS8	3.8	<1	1	<1	<1	0.001	<1	---
S6	2.6	60	210	20	1000	1.290	2	---
S9	318	2000	2000	200	2700	6.900	4	---
S10	472	1000	1400	200	2900	5.500	2	---
S17	224	1200	2400	200	2900	6.700	4	---
S19	244	1500	3000	350	3400	8.250	4	---
SW1	18.4	<1	<1	<1	<1	0.000	1	---
SW2	13.2	<1	<1	<1	<1	0.000	1	---
14	85	250	100	200	100	0.650	<1	---
21A	495	1600	2000	150	1900	5.650	5	---
33	335	2300	400	<50	2000	4.700	15	32
34	573	3000	5200	<200	3600	11.800	7	---
35	251	3800	6400	200	3800	14.200	5	---
36	1540	3100	2500	400	2500	8.500	48	110
37	289	5100	<100	<100	2000	7.100	7	---
38	172	5100	1000	200	4100	10.400	3	---
39	94	1700	3800	200	3100	8.800	5	---
40	422	2000	650	<50	650	3.300	203	---
41	301	4300	<100	300	2500	7.100	6	---
42	367	4700	<100	500	900	6.100	4	<10
43	336	110	12	<2	70	0.192	<1	---
44	97	1000	1800	200	2300	5.300	7	---
45	28	4	<1	<1	9	0.013	<1	---
47	454	3400	1300	<100	4500	9.200	30	---
49	328	3100	3200	100	3500	9.900	7	---
52	106	2200	150	100	650	3.100	2	---
55	3.8	<1	<1	<1	<1	0.000	52	---

Indian Basin "Point in Time" Water Sampling, Sept 1991

(revised 11/08/91 to reflect Core Lab corrections)

	ppm		parts per billion			ppm	TPH, ppm		
BH	Cl	Ben	Tol	E Ben	Xyl	BTEX	418.1	8015	
---	---	---	---	---	---	---	---	---	
56	90	200	10	<5	180	0.390	<1	---	
57	573	6300	4900	400	4800	16.400	6	---	
58	978	2500	1800	300	2400	7.000	41	---	
59	521	5700	1100	500	3700	11.000	7	---	
60	66	150	40	140	<10	0.330	3	---	
61	101	15	32	13	17	0.077	<1	---	
62	262	880	20	<20	<20	0.900	1	---	
64	123	200	40	120	<10	0.360	2	---	
65	605	<1	<1	<1	<1	0.000	2	---	
66	94	320	20	<5	<5	0.340	<1	<10	
67	246	59	21	5	3	0.088	1	---	
68	170	<1	<1	<1	<1	0.000	2	<10	
69	136	140	40	280	<20	0.460	3	---	
70	274	2600	100	800	<50	3.500	4	---	
71	414	<1	2	<1	7	0.009	<1	---	
72	273	35	20	30	25	0.110	2	---	
73	384	<1	<1	<1	<1	0.000	<1	---	
74	405	800	3700	<100	6100	10.600	<1	---	
75	4.4	<1	<1	<1	<1	0.000	<1	---	
77	8.5	<1	<1	<1	<1	0.000	<1	---	
80	99	<1	<1	<1	<1	0.000	3	---	
81	628	940	40	140	<20	1.120	1	---	
82	248	2200	400	800	350	3.750	476	410	
83	43	1600	460	80	640	2.780	2	---	
84	74	40	50	50	190	0.330	2	---	
85	77	540	60	240	520	1.360	13	---	
86	12	33	2	<1	2	0.037	<1	---	
87	416	<1	<1	<1	1	0.001	2	---	
87A	10	190	5	10	100	0.305	1	<10	
88	238	2200	100	400	2400	5.100	366	240	
89	9.2	<1	<1	<1	<1	0.000	2	---	
90	10.7	150	6	26	130	0.312	2	---	
91	1.7	<1	<1	<1	<1	0.000	2	---	
91A	6.2	680	190	20	250	1.140	3	---	
92	9.3	<1	<1	<1	<1	0.000	<1	---	
92	9.2	<1	<1	<1	<1	0.000	<1	---	duplicate
93	3.6	280	5	<5	65	0.350	1	---	

Indian Basin "Point in Time" Water Sampling, Sept 1991

(revised 11/08/91 to reflect Core Lab corrections)

	ppm		parts per billion			ppm	TPH, ppm		
BH	Cl	Ben	Tol	E Ben	Xyl	BTEX	418.1	8015	
---	---	---	---	---	---	---	---	---	
94	25	240	280	40	800	1.360	45	---	
95	156	2400	6600	<200	4000	13.000	6	---	9/19/91
95	98	1700	4800	300	4600	11.400	4	---	9/25/91
97	10.4	<1	<1	<1	<1	0.000	<1	---	
100	321	5000	<100	400	2900	8.300	5	---	
101	333	3800	3600	300	3700	11.400	9	---	
102	259	40	30	40	40	0.150	2	---	
103	387	<1	<1	<1	<1	0.000	<1	---	

BH 100 is a duplicate of BH 41.
BH 101 is a duplicate of BH 49.
BH 102 is a duplicate of BH 72.
BH 103 is a duplicate of BH 73.

Benzene, toluene, ethyl benzene, and xylenes are in ppb.
Total BTEX is in parts per million.
TPH for methods 418.1 and 8015 are in parts per million.

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Western Atlas International
Litton/Dresser Company

CORE LABORATORIES

A N A L Y T I C A L R E P O R T

911832

FOR

MARATHON OIL COMPANY
W. NIXON
P.O. BOX 269
LITTLETON, CO 80160

11/06/91

MW 45, 56 inorganics, 418.1 / 8015 TPH

AMENDED REPORT

ADDITIONAL DATA

The analyses, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgement of Core Laboratories. Core Laboratories, however, assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, proper operations, or profitableness of any gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced, except in its entirety, without the written approval of Core Laboratories.

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CORE LABORATORIES

LABORATORY TESTS RESULTS
11/06/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

SAMPLE NUMBER: 21 DATE RECEIVED: 10/01/91 TIME RECEIVED: 10:00 SAMPLE DATE: 09/25/91 SAMPLE TIME: 15:30
PROJECT: 32-03-144 SAMPLE: MW-56 REM:

SAMPLE NUMBER: 23 DATE RECEIVED: 10/01/91 TIME RECEIVED: 10:00 SAMPLE DATE: 09/24/91 SAMPLE TIME: 17:30
PROJECT: 32-03-144 SAMPLE: MW-45 REM:

SAMPLE NUMBER: 34 DATE RECEIVED: 10/01/91 TIME RECEIVED: 10:00 SAMPLE DATE: 09/24/91 SAMPLE TIME: 17:30
PROJECT: 32-03-144 SAMPLE: MW-45 re-analysis REM: RE-ANALYSIS FOR CATIONS/ANIONS.

AMENDED REPORT

ADDITIONAL DATA

TEST DESCRIPTION	SAMPLE 21	SAMPLE 23	SAMPLE 34				UNITS OF MEASURE
Alkalinity, Total (Unfilt.)	871	510					mg/L CaCO3
Bicarbonate (Unfilt.)	1060	623	672				mg/L
Carbonate (Unfilt.)	<1	<1	<1				mg/L
Chloride (Unfilt.)	248	170	175				mg/L
Conductivity (Unfilt.)	1820	3050					umhos/cm @25dC
Hardness, Total (Unfilt.)	847	3670					mg/L(as CaCO3)
pH (Unfilt.)	7.58	7.54					pH Units
Phenols (Unfilt.)	<0.05	<0.05					mg/L
Solids, Total Dissolved (TDS)	1220	3920					mg/L
Solids, Total Suspended, TSS	65	2210					mg/L
Sulfate (Unfilt.)	<10						mg/L
Sulfate (Unfilt.)		2200	2090				mg/L

APPROVED BY: Daniel McWhorter

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
11/06/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

SAMPLE NUMBER: 21 DATE RECEIVED: 10/01/91 TIME RECEIVED: 10:00 SAMPLE DATE: 09/25/91 SAMPLE TIME: 15:30
PROJECT: 32-03-144 SAMPLE: MW-56 REM:

SAMPLE NUMBER: 23 DATE RECEIVED: 10/01/91 TIME RECEIVED: 10:00 SAMPLE DATE: 09/24/91 SAMPLE TIME: 17:30
PROJECT: 32-03-144 SAMPLE: MW-45 REM:

SAMPLE NUMBER: 34 DATE RECEIVED: 10/01/91 TIME RECEIVED: 10:00 SAMPLE DATE: 09/24/91 SAMPLE TIME: 17:30
PROJECT: 32-03-144 SAMPLE: MW-45 REM: RE-ANALYSIS FOR CATIONS/ANIONS

~~ADDITIONAL DATA~~ ~~AMENDED REPORT~~

TEST DESCRIPTION	SAMPLE 21	SAMPLE 23	SAMPLE 34				UNITS OF MEASURE
Barium, Total (Ba)	0.68	0.07					mg/L
Calcium, Total (Ca)	95.2	820	776				mg/L
Iron, Total (Fe)	11.7	54.0					mg/L
Magnesium, Total (Mg)	148	395	387				mg/L
Manganese, Total (Mn)	0.17	2.03					mg/L
Potassium, Total (K)	2.3	6.9					mg/L
Potassium, Total (K)			6.6				mg/L
Sodium, Total (Na)	170	235	216				mg/L
Strontium, Total (Sr)	1.72	2.75					mg/L
Total Petroleum Hydrocarbon	476	2					mg/L
8015(Mod) - Hydrocarbon ID - TPH	410	<10					mg/L Condst.

APPROVED BY: Daniel McWhorter

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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AMENDED REPORT "CONFIDENTIAL BUSINESS INFORMATION"

ADDITIONAL DATA

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

ANALYTICAL REPORT
11/06/91

CUSTOMER: Marathon Oil Company

File No..: 911832

CATION/ANION BALANCE

Client Sample I.D..... MW-45
Remark/Project..... 32-03-144
Date/Time Sampled..... 09-24-91/1730
Date/Time Received..... 10-01-91/1000
Laboratory Sample I.D..... 911832-23

PARAMETER	RESULT		UNITS
pH	7.54		pH Units
Conductivity at 25 degrees C	3050		umhos/cm
Alkalinity (as CaCO3)	551		mg/L
Total Diss. Solids (measured)	3920		mg/L
Total Diss. Solids (calculated)	4097		mg/L
		meq/Liter	
Calcium (Ca)	776	38.72	mg/L
Magnesium (Mg)	387	31.85	mg/L
Sodium (Na)	216	9.40	mg/L
Potassium (K)	6.6	0.17	mg/L
Total Cations meq/Liter		80.13	
		meq/Liter	
Bicarbonate (HCO3)	672	11.01	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	175	4.94	mg/L
Sulfate (SO4)	2200	45.80	mg/L
Total Anions meq/Liter		61.75	

Cation-Anion Balance (RPD) 25.91 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: Daniel McWhorter

1300 South Potomac, St., Suite 130
Aurora, Colorado 80012
Tele. (303) 751-1780

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AMENDED REPORT ADDITIONAL DATA

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

ANALYTICAL REPORT
11/06/91

CUSTOMER: Marathon Oil Company File No..: 911832

CATION/ANION BALANCE

Client Sample I.D..... MW-45 REANALYSIS
Remark/Project..... 32-03-144
Date/Time Sampled..... 09-24-91/1730
Date/Time Received..... 10-01-91/1000
Laboratory Sample I.D..... 911832-23

PARAMETER	RESULT		UNITS
pH	7.54		pH Units
Conductivity at 25 degrees C	3050		umhos/cm
Alkalinity (as CaCO3)	551		mg/L
Total Diss. Solids (measured)	3920		mg/L
Total Diss. Solids (calculated)	3987		mg/L
		meq/Liter	
Calcium (Ca)	776	38.72	mg/L
Magnesium (Mg)	387	31.85	mg/L
Sodium (Na)	216	9.40	mg/L
Potassium (K)	6.6	0.17	mg/L
Total Cations meq/Liter		80.13	
		meq/Liter	
Bicarbonate (HCO3)	672	11.01	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	175	4.94	mg/L
Sulfate (SO4)	2090	43.51	mg/L
Total Anions meq/Liter		59.46	

Cation-Anion Balance (RPD) 29.61 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: Donald McWhorter

1300 South Potomac, St., Suite 130
Aurora, Colorado 80012
Tele. (303) 751-1780

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11/1/91 OCD/BLM/Marathon Meeting

participants

see sign-in sheet

next meeting tentative 12/2/56

presentation by Bob Unger

BU - review Indian Basin Project Team

Michael Schornick - Review activities since Aug 22nd, 1991

Designed Recovery System - ~~[illegible]~~ pumping wells ready to go, waiting on SEO

At this time no product remaining in shallow alluvium

Currently preparing corrective action plan Date?

Condensate recovered 3584 bbls

Water " ~~56693~~ " → 76693?

Alluvial G.W. Flow to SE along arroyo

Benzene isopleths map

Total BTEX " "

Cl- " "

North side of plume was clean but
now has free product

Body of plume in Lower Queen approx 1500-2000 feet
east of leak area

Product in Lower Queen appears defined
Dissolved phase still above WQCC stds. in fringe wells

Rancher wells clean since 4/22/91
- (OCD & Marathon sampling)

Doug Kenyon - Revised Soil Venting - Passive
- Active - Remediation to baseline
in 6 mos?

Jeff Lynn - Bioremediation
6.2 $\times 10^4$ CFU / gram soil
5.6 $\times 10^4$ CFU / gram in water

Review Bioremed.

Bill. Revised condensate & characteristics in
Lower Queen & alluvium (Line 4)
Lower Queen has biomarkers & lower boiling pt.
less light ends

O&M. - Are pumping, BLT-88 (MW-62)
10 bbls condensate
423 " water

6 recovery wells awaiting SEO approval to turn on

Water to plant for separation then class II well may exceed capacity of their UIC well and have to truck offsite for disposal

Future work

DK. Remediation Goal

near term – Lower Queen (emergency action)

long term – pump & treat – air stripper
sprinkling – land application
methane stripping

Discharge – replace plant water with precovery water

Corrective action plan proposal – Jan 1992 (tentative)

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED

'91 NOV 6 AM 8 48

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

November 1, 1991

Roger Anderson, Environmental Engineer
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week.

SHALLOW IMPACTED AREA

- The soil venting pilot resumed and again realized very high recoveries; even higher than the average recoveries during the original extraction period.

- The passive venting (windvane) equipment has been installed and began operation.

- Experiments were conducted (at the site) to determine the reduction of hydrocarbons from contaminated water as a result of spray-irrigation.

- Routine sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo continues. The samples have been forwarded to Core Laboratories in Aurora, Colorado for BTEX and chloride analyses.

LOWER QUEEN

- Well 85 continues to be pumped one hour per day with cumulative recoveries of 10 BC and 423 BW to date.

- Rising BTEX concentrations have been detected in wells 83 (2780 ppb up from 19), 86 (37 ppb up from ND), 90 (312 ppb up from ND) and 93 (350 ppb up from ND). Wells 89, 92, 97 and the plant wells remain clean.

- A meeting was held with the State Engineer's office on October 31, in an effort to resolve their concerns about the use of the Lower Queen wells for water/product withdrawal.

- On Friday evening, November 1, the State Engineer's office finally granted permission to commence pumping the six Lower Queen wells.

GENERAL

- Meetings with the Oil Conservation Division and Bureau of Land Management were held on October 31 and November 1 to provide progress updates, advice of future direction.

- As agreed in that meeting, these weekly updates will be replaced by monthly updates, timed roughly between monthly meetings.

Very truly yours,

Robert F. Unger
Production Manager
Midland Operations

RFU/elk

cc: J. L. Benson
D. D. Conway
D. E. Kenyon
A. R. Kukla
M. B. Williams (OCD - Artesia)

ATTENDANCE LIST.

OCD/BLM INDIAN BASIN

UPDATE 11/1/91

NAME	AGENCY/CO.	POSITION
Dick Manus	BLM/Carlsbad	Area Manager
GARY STEPHENS	BLM SANTA FE	GEOLOGIST
Jim Amos	BLM/Carlsbad	On site Coord.
BOB UNGER	MARATHON	PROD MGR
Jeff Lynn	"	Shallow GW Coord.
Doug Kenyon	Marathon/Littleton	Sci. Tech. Consultants
Bert Smith	RSA/Marathon	Hydrogeologist
Bill Olson	OCD	Hydrogeologist
Al Collar	BLM	Hazardous Materials
RAYMOND P. CHURAN	DEPT. OF THE INTERIOR	REGIONAL ENV OFFICER
LEE Wilson	LWA/Marathon	Hydrogeologist
JEFF BENSON	MARATHON/MIDLAND	REGION COUNSEL
Mike Schornick	RSA, Inc Envir Consult/Marathon	Envir. Engineer

OCD / Marathon Meeting 10/31/91

participants

Bill Olson
Roger Anderson
Kathy Brown
Bob Unger - Marathon
Lee Wilson - Wilson & Assoc.
Jeff Benson
Jeff Lynn
Douglas Kenyon
Mike Schornick - Roberts / Schornick & Assoc.

R.U. Handed out infor site maps
Reviewed command structure, handout
1986 PVC originally broke - 100 barrels lost

Aug 22nd suspended shallow zone emergency removal due to lack of product (with BLM, OCD approval)

Need copy of one time sampling

10/31/91 OCD/Marathon meeting

MARATHON OIL COMPANY
NEW MEXICO OPERATIONS

FIRST OPERATION	1929
OFFICES	FARMINGTON, HOBBS, INDIAN BASIN
EMPLOYEES	55
MARATHON OPERATED WELLS	500+
WORKING INTEREST PROPERTIES OPERATED BY OTHERS	250+
ANNUAL EXPENDITURES	$35.3 MILLION (1991 EST.) $38.2 MILLION (1992 EST.)
SECONDARY RECOVERY OPERATIONS	1 (1990) 3 (1991) 4 (1992 EST.)
ACREAGE	76,300 ACRES DEVELOPED 85,400 ACRES UNDEVELOPED
CURRENT NET PRODUCTION	6400 BPD LIQUID HYDROCARBONS 57 MMCFD GAS

INDIAN BASIN FIELD/PLANT HISTORY

LOCATION	28 MILE S-SW OF ARTESIA, EDDY COUNTY, NEW MEXICO
FIELD DISCOVERY	1962
PLANT CONSTRUCTION	1964-66
MAJOR PLANT UPGRADES	1967, 73, 76, 81, 89
NUMBER OF PLANT OWNERS	40
NUMBER OF PRODUCERS DRILLED	81
NUMBER OF WELLS NOW PRODUCING	43
NUMBER OF WELLS PRODUCING BY MARATHON	13
NUMBER WELL OPERATORS	10
PEAK PRODUCTION	225 MMCFD WET GAS (1971) 5100 BPD PLANT LIQUIDS (1991) 2350 BPD CONDENSATE (1970)
CURRENT PRODUCTION	120 MMCFD NET GAS 4500 BPD PLANT LIQUIDS 400 BPD CONDENSATE
CONDENSATE YIELDS	9+ BBLS/MMCFD - 3 BBLS/MMCFD (OVER FIELD LIFE)
CUMULATIVE PRODUCTION	1.23 TCF WET GAS 8.23 MM BBLS CONDENSATE 30 MM BBLS PLANT LIQUIDS

EXPLANATION OF AREA WATER WELL AND SURFACE WATER SAMPLING SITES

SITE NO.	DESCRIPTION
1	Patsy Lyman water tank
2	Upper Indian Hills Spring West
3	Lower Indian Hills Spring
4	Biebelle Water Well
5	Spring Feeding Surface Water
6	Upper Indian Hills Spring East
7	MOC Water Well No. 1
8	MOC Well 1A (emergency well)
9	Lee Water Well
10	Richard Howell Water Well (home)
11	Richard Howell Windmill Well
12	Water Supply Tank (plant)

Mid-Continent Region
Production United States

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
91 NOV 5 AM 8 52

Marathon Oil Company

October 28, 1991

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Final analytical results from the water sample obtained from your well on October 14, 1991 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

R.F. Unger/SAP

Robert F. Unger
Production Manager

RFU/SAP/elk

Attachments

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
91 NOV 8 AM 8 52

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 25, 1991

Roger Anderson, Environmental Engineer
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week.

SHALLOW IMPACTED AREA

- A replacement motor is still awaited prior to resumption of the soil venting pilot.

- Routine sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo continues. The samples have been forwarded to Core Laboratories in Aurora, Colorado for BTEX and chloride analyses.

LOWER QUEEN

- The six submersible pumps were installed in preparation for emergency withdrawal of product from the Lower Queen. Meters were installed in response to the request of the Roswell Basin Watermaster but approval is still being withheld by the State Engineer's office to begin pumping the wells. The concern appears to be the PVC completions used in these recovery wells (as per EPA protocol) is not consistent with the requirements for water wells. Approval is being sought from the Santa Fe State Engineer's office.

Very truly yours,

R. F. Unger/SAP

Robert F. Unger
Production Manager
Midland Operations

RFU/elk

cc: J. L. Benson
D. D. Conway
D. E. Kenyon
A. R. Kukla
M. B. Williams (OCD - Artesia)

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
91 OCT 30 AM 8 42

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 25, 1991

Roger Anderson, Environmental Engineer
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

This is to confirm that the next Indian Basin technical review will be held on Friday, November 1, 1991 at 1:00PM. The meeting location is as follows:

Kemp, Smith, Duncan & Hammond
500 Marquette NW
Albuquerque, New Mexico
247-2315

Very truly yours,

R.F. Unger/elk

Robert F. Unger
Production Manager
Midland Operations

RFU/elk

cc: D. Manus (BLM - Carlsbad)
F. Cherry (BLM - Roswell)
D. Schafersman (BLM - Sante Fe)

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 24, 1991

RECEIVED
OCT 28 1991
OIL CONSERVATION DIV.
SANTA FE

Mr. Wayne Gregory
617 Queens Highway
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Mr. Wayne Gregory:

Final analytical results from the water samples obtained on October 7, 1991 from a natural spring located in Rocky Arroyo are attached. In discussing this water source with Mr. Biebelle, he indicated that the water it supplies is utilized by the Biebelle's for stock water, and also by you for stock water. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

R. F. Unger /by SAP

Robert F. Unger
Production Manager
Midland Operations

SAP/RFU/elk

Attachments (filed separately)

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 24, 1991

RECEIVED
OCT 28 1991
OIL CONSERVATION DIV.
SANTA FE

Mr. & Mrs. Howell
P. O. Box 94
Lakewood, New Mexico 88254

Re: Water Well Analysis

Dear Mr. & Mrs. Howell:

Final analytical results from the water samples obtained from your domestic and stock wells on October 7, 1991 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

R.F. Unger /SAP

Robert F. Unger
Production Manager
Midland Operations

RFU/SAP/elk

Attachments (filed separately)

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 744

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 24, 1991

RECEIVED
OCT 28 1991
OIL CONSERVATION DIV.
SANTA FE

Mr. & Mrs. Lee
P. O. Box 89
Lakewood, New Mexico 88254

Re: Water Well Analysis

Dear Mr. & Mrs. Lee:

Final analytical results from the water samples obtained on October 7, 1991 from your well located next to the paved road approximately 0.5 miles west of Marathon's Indian Basin Gas Plant have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

R. F. Unger /by SAP

Robert F. Unger
Production Manager
Midland Operations

RFU/SAP/elk

Attachments (filed separately)

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 743

Mid[illegible]tinent Region
Pro[illegible]tion United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSER[illegible]N DIVISION
RE[illegible]ED
[illegible] 10 00

October 24, 1991

RECEIVED
OCT 28 1991
OIL CONSERVATION DIV.
SANTA FE

Ms. Patricia Schaefer Lyman
Queen Route
Carlsbad, New Mexico 88220

Re: Water Well Analysis

Dear Ms. Lyman:

Final analytical results from the water sample obtained from your well on October 7, 1991 have been received and are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

R. F. Unger by S.A.P.

Robert F. Unger
Production Manager

RFU/SAP/elk

Attachments (filed separately)

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 24, 1991

Mr. & Mrs. Walter Biebelle
646 Queen Route
Carlsbad, New Mexico 88220

RECEIVED
OCT 28 1991
OIL CONSERVATION DIV.
SANTA FE

Re: Water Well Analysis

Dear Mr. & Mrs. Biebelle:

Final analytical results from the water samples obtained on October 7, 1991 from your well and from natural springs located in Rocky Arroyo and utilized by you for stock water are attached. No hydrocarbons or abnormally high chloride concentrations were found to be present in any of the samples.

As you know, the leak that occurred in the Indian Basin Field resulted in the release of condensate and produced water. The condensate is a light, clear oil, while the produced water is a brine which is more saline than water from your water well.

Analyses of your water was conducted at Core Laboratories in Aurora, Colorado. This lab, which is certified by the Environmental Protection Agency (EPA), conducted the analyses utilizing procedures approved by the EPA. The analyses were utilized to evaluate potential contamination of your water from the released fluids described above. The results of these analyses indicate your water to be within standards for hydrocarbons and chlorides as established by EPA for drinking water.

Plans are to continue to conduct routine sampling of your water over the near term. You will continue to be provided with the analytical results as they become available. In the meantime, should you have any questions, feel free to contact me collect through Marathon's Midland office, (915) 687-8542.

Sincerely,

R. F. Unger / by SAP

Robert F. Unger
Production Manager
Midland Operations

RFU/SAP/elk

Attachments (filed separately)

cc: R. Anderson (NMOCD-Santa Fe)
A. Collar (BLM-Roswell)
J. L. Benson

CERTIFIED MAIL RETURN RECEIPT REQUESTED - P 546 958 742

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

OIL CONSERVATION DIVISION

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

BRUCE KING
GOVERNOR

ANITA LOCKWOOD
CABINET SECRETARY

MATTHEW BACA
DEPUTY SECRETARY

October 21, 1991

CERTIFIED MAIL
RETURN RECEIPT NO. P-756-903-836

Robert F. Unger
Production Manager/Midland Operations
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702

RE: WATER QUALITY SAMPLING
MARATHON INDIAN BASIN GAS PLANT
EDDY COUNTY, NEW MEXICO

Dear Mr. Unger:

The New Mexico Oil Conservation Division (OCD) has reviewed the Marathon Oil Company's November 20, 1991 request to reduce the frequency of sampling of water wells and springs in the vicinity of Marathon's Indian Basin Gas Plant.

Due to the lack of petroleum-related contaminants in these wells over time, the OCD approves of Marathon's proposed reduced sampling schedule contained in the above referenced correspondence. At the December 13, 1991 OCD/Marathon meeting, OCD will discuss with Marathon additional requirements for investigation and monitoring to ensure containment of ground water contaminants related to Marathon's remedial activities.

If you have any questions, please contact me at (505) 827-5885.

Sincerely,

William C. Olson
Hydrogeologist/Environmental Bureau

xc: OCD Artesia District Office
Al Collar, Bureau of Land Management Roswell Office

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

BRUCE KING
GOVERNOR

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

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

MEMORANDUM

TO: John Pfeil, Geologist, Ground Water and Toxic Sites Bureau
NM Environment Department

FROM: David G. Boyer, Environmental Bureau Chief, Oil Conservation Division

DATE: October 21, 1991

RE: **MARATHON OIL CO., INDIAN BASIN SPILL**

Due to the press of other business, I have not had a chance to provide copies of recent correspondence between Marathon and OCD and the BLM, and I am not sure what material I have already provided to you. Therefore, enclosed you will find copies of all letters and material received from August 15 to date other than Marathon's offsite water quality analyses of domestic wells. Those analyses, which show no impact on currently used supplies, are kept in a notebook file at OCD. However, copies of OCD's onsite and offsite water analyses taken this past summer are included.

As you may know, today is my last day at OCD and Bill Olson will be in charge of their investigation and remediation, at least for the immediate future. Also, Marathon's Midland in-house environmental staff have left for other jobs and apparently they will bring others in from Midland. In the meantime, as you are aware, Lee Wilson continues to work with them as a consultant.

If you have any questions about the material, wish to examine the water quality results, or what there future plans are, contact Bill at ext. 827-5885.

cc. Bill Olson

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

BRUCE KING
GOVERNOR

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

October 21, 1991

Robert F. Unger
Production Manager
Marathon Oil Company
P.O. Box 552
Midland, Texas 79702

**RE: MARATHON INDIAN BASIN SPILL,
OCD WATER ANALYSES**

Dear ~~Mr. Unger~~: Bob

Enclosed you will find copies of all water analyses performed by OCD this past summer. Included are samples from several Lower Queen monitor wells, offsite sampling of Rocky Arroyo during the first runoff event, and analyses from several water wells and springs used by local residents. Copies of the latter analyses were sent to the residents and I enclose a copy of the cover letter.

This is my last day at OCD; Roger Anderson and Bill Olson will be your contact persons from now on. Thank you for your cooperation these past several months and I'm sure we will be talking again.

Sincerely,

Dave

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

Enclosures

cc : OCD Artesia District Office

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED

'91 OCT 25 AM 9 03

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

Fax received 10/22/91

October 18, 1991

Roger Anderson, Environmental Engineer
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week.

SHALLOW IMPACTED AREA

- A burned-out blower used in the soil venting pilot, resulted in the suspension of the pilot throughout the week. Replacement parts are due next week at which time the pilot will resume.

- Routine sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo continues. The samples have been forwarded to Core Laboratories in Aurora, Colorado for BTEX and chloride analyses.

LOWER QUEEN

- Notification was sent to the Oil Conservation Division and Bureau of Land Management (BLM) of our intent to commence pumping the six Lower Queen wells beginning next week. The State Engineer's office was contacted for the necessary permitting and R-O-W requests for the anticipated electric and gathering systems were sent to the BLM.

GENERAL

Field lease operators were notified of the reallocation of production as a result of the leak over those months involved (November, 1990 - April, 1991) Copies were sent to the OCD.

Very truly yours,

Robert F. Unger
Production Manager
Midland Operations

RFU/elk

cc: J. L. Benson
D. D. Conway
D. E. Kenyon
A. R. Kukla
M. B. Williams (OCD - Artesia)

CONSERVATION DIVISION
RECEIVED
'91 OCT 21 AM 9 09

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 17, 1991

Roger Anderson, Environmental Engineer
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

Marathon is prepared to start recovery of product and contaminated water from the Lower Queen wells as was agreed in our meeting of August 22, 1991 and our telephone conversation of today. This is tentatively planned for October 21 - 25, 1991 for Boreholes 84, 85, 87A, 88, 91A and 94 on a 24 hour basis.

We feel this is in keeping with the primary objective of withdrawing product to avoid migration of the plume beyond the eastern line of clean monitoring wells. Product and water will be measured and delivered to the Plant for re-processing. This treatment is identical to that which was used for the alluvium emergency recovery and disposal of fluid. The necessary Bureau of Land Management and State Engineer notification has (or will be) made to address right-of-way and water use issues.

Should you have any questions or comments, please call me at 915/687-8526.

Very truly yours,

Robert F. Unger
Production Manager

RFU/elk

cc: Richard L. Manus, BLM

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682 1626

October 17, 1991

Roger Anderson, Environmental Engineer
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

Marathon is prepared to start recovery of product and contaminated water from the Lower Queen wells as was agreed in our meeting of August 22, 1991 and our telephone conversation of today. This is tentatively planned for October 21 - 25, 1991 for Boreholes 84, 85, 87A, 88, 91A and 94 on a 24 hour basis.

We feel this is in keeping with the primary objective of withdrawing product to avoid migration of the plume beyond the eastern line of clean monitoring wells. Product and water will be measured and delivered to the Plant for re-processing. This treatment is identical to that which was used for the alluvium emergency recovery and disposal of fluid. The necessary Bureau of Land Management and State Engineer notification has (will be) made to address right-of-way and water use is[illegible]

Should you have any questions or comments, please call me at 915/687-8526.

Very truly yours,

Robert F. Unger

Robert F. Unger
Production Manager

RFU/elk

cc: Richard L. Manus, BLM

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

'91 OCT 11 AM 10 47
OIL CONSERVATION DIVISION

October 9, 1991

Mr. William J. LeMay
Director
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87503

Re: Indian Basin Gas Plant
Leak Incident of April 12, 1991

Dear Bill:

During recent conversation with various members of the OCD staff, inquiries were made concerning the accounting for the condensate production lost during the period of the leak discovered on April 12, 1991. As you will recall, the leak commenced in early November, 1990 and continued until its discovery in April.

During the months of November, 1990 through April, 1991, we reported the sales volume on an allocated basis in the same manner we have previously. We did not correct for the loss of condensate that was occurring from those wells connected to gathering line No. 4.

During the last months our efforts have concentrated on the characterization and remediation of this leak. We are now in the process of completing an analysis and reallocation of the production for those months to accurately reflect the true allocation of sales for each of the wells in the field. This information should be provided to the OCD within the next 10 days. At the same time, we expect to provide the appropriate corrections to the Form C-115 (Operator's Monthly Report of Production) and related reports for that period.

If you have any questions in this regard please advise.

Very truly yours,

R. F. Unger

R. F. Unger
Project Manager

JLB14A/le

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 7, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, NM 87504

Francis Cherry, Jr.
District Manager
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, NM 88202

Gentlemen:

This letter is to advise that in light of the broadening issues surrounding the Indian Basin Field remediation and operation, Robert F. Unger will temporarily assume the responsibilities of Project Manager. He will have an organization including environmental, operational, and legal expertise to address any of the issues you may have concerning the remediation, metering, production allocation, etc. This change is an expression of Marathon's responsiveness to the increasing demands concerning Indian Basin and our desire to resolve these pending issues in an acceptable and expeditious manner so that normal operations may resume.

If you should have any questions, please feel free to call on Mr. Unger in Midland at anytime.

Very truly yours,

A. R. Kukla
Production Manager

RFU/246/jmh

xc: Dick Manus - Carlsbad BLM
Al Collar - Roswell BLM

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
'91 OCT 7 AM 8 55

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 11, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week.

SHALLOW IMPACTED AREA

- The soil venting pilot continues. Preliminary results suggest higher recoveries, longer, than were predicted by lab experiments. Measurements will be made to evaluate the radial distance of extraction and a special tool has been designed to evaluate the vertical distribution of air flow through the alluvium. Tests will be designed to investigate varying suction horsepower.

- Routine sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo continues. The samples have been forwarded to Core Laboratories in Aurora, Colorado for BTEX and chloride analyses.

- Marathon's Petroleum Technology Center will conduct spray/flash evaporation tests as an alternative to air stripping.

- Analytical results from the common-point-in-time water analyses are arriving and will be reported separately.

- Work continues on the Shallow Risk Assessment Study.

LOWER QUEEN

- Design of the electrical and liquid gathering systems to pump the contamination from the Lower Queen is nearing completion. The pumps will be run as soon as received and removal of contaminated fluid will commence.

- A separate report will be submitted summarizing the work performed during the plant turnaround which relates to upgrades, inspection and integrity tests of the gathering system.

Sincerely,

Robert F. Unger
Production Manager

RFU/elk

cc: J. L. Benson
D. D. Conway
D. E. Kenyon
A. R. Kukla
M. B. Williams (OCD - Artesia)

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

PANAFAX TRANSMITTAL SHEET

SEND THE FOLLOWING PAGES TO:

NAME David G. Boyer

COMPANY NAME New Mexico Oil Conservation Division

LOCATION Santa Fe, New Mexico

PANAFAX NUMBER: 505/827-5741

FROM:

NAME Robert F. Unger EXT. 526

TOTAL NUMBER OF PAGES: 3 (including cover sheet)

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PHONE 915/687-8526

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Mid-Continent Region
Production nited States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

October 11, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week.

SHALLOW IMPACTED AREA

- The soil venting pilot continues. Preliminary results suggest higher recoveries, longer, than were predicted by lab experiments. Measurements will be made to evaluate the radial distance of extraction and a special tool has been designed to evaluate the vertical distribution of air flow through the alluvium. Tests will be designed to investigate varying suction horsepower.

- Routine sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo continues. The samples have been forwarded to Core Laboratories in Aurora, Colorado for BTEX and chloride analyses.

- Marathon's Petroleum Technology Center will conduct spray/flash evaporation tests as an alternative to air stripping.

- Analytical results from the common-point-in-time water analyses are arriving and will be reported separately.

- Work continues on the Shallow Risk Assessment Study.

LOWER QUEEN

- Design of the electrical and liquid gathering systems to pump the contamination from the Lower Queen is nearing completion. The pumps will be run as soon as received and removal of contaminated fluid will commence.

- A separate report will be submitted summarizing the work performed during the plant turnaround which relates to upgrades, inspection and integrity tests of the gathering system.

Sincerely,

Robert F. Unger
Production Manager

RFU/elk

cc: J. L. Benson
D. D. Conway
D. E. Kenyon
A. R. Kukla
M. B. Williams (OCD - Artesia)

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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'91 OCT 11 AM 8 35

Marathon Oil Company

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Midland, Texas 79702
Telephone 915/682-1626

October 4, 1991

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Environmental Bureau Chief
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Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week.

SHALLOW IMPACTED AREA

- Work continues on the soil venting project. Results are promising.

- Routine sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo continues. The samples have been forwarded to Core Laboratories in Aurora, Colorado for BTEX and chloride analyses.

- A pump and treat and bioremediation systems are still being studied.

LOWER QUEEN ASSESSMENT

- It was decided to meet with the Central Valley Electric Cooperative in the area to see about running electricity to the six wells where hydrocarbon is present.

- Plans are underway on developing some form of gathering system to pump the six wells to the plant where the treated water can be used in the plants process.

- Roberts/Schornick and Associates is working on the bid specifications for an air stripping unit to treat water extracted from the Lower Queen.

GENERAL

The program to sample all of the monitoring and recovery wells was finished and shipped to Core Labs on September 31, 1991.

Should you have any questions, or wish to discuss, please contact R. F. Unger at your convenience.

Sincerely,

A. R. Kukla
Production Manager
Mid-Continent Region

ARK;SAP/elk

cc: J. L. Benson
D. D. Conway
D. E. Kenyon
A. R. Kukla
R. F. Unger

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CORE LABORATORIES

Plus Amended TPH MW45 & S6

ANALYTICAL REPORT

911832

FOR

MARATHON OIL COMPANY
W. NIXON
P.O. BOX 269
LITTLETON, CO 80160

BTEX, G, TPH

10/10/91

S17
21A
S19
A10
A16
B16
SW1
MW64 — BH90
MW65A
MW68
MW66 BH92
MW66 duplicate
S6
S10
S9
MW69 BH95
MW70 BH97
MW70 BH86
MW67
SW2

MW56 BH82 mod 8015, hex etc
MW65
MW45 BH68 mod 8015, hex etc, ion bal
MW49 BH72
MW54 BH80
MW50 BH73
MW55 BH81
MW61 BH87
MW42 BH65
MW63 BH89

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NOV 19 1991
OIL CONSERVATION DIV.
SANTA FE

Ion Bal, 8015, hex, n gin, BTEX
BH86, 68

metals
BH73,

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/23/91
TIME SAMPLED.....: 17:35
WORK DESCRIPTION...: S17

LABORATORY I.D...: 911832-0001
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	224	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	10/07/91	MRC
Benzene	1200	50	ug/L			
Toluene	2400	50	ug/L			
Ethyl Benzene	200	50	ug/L			
Xylenes	2900	50	ug/L			
Total Petroleum Hydrocarbon	4	1	mg/L	418.1 (1)	10/07/91	DTJ

APPROVED BY: Ellen J. Nagel

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/23/91
TIME SAMPLED.....: 19:25
WORK DESCRIPTION...: 21A

LABORATORY I.D...: 911832-0002
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	495	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	10/07/91	MRC
Benzene	1600	50	ug/L			
Toluene	2000	50	ug/L			
Ethyl Benzene	150	50	ug/L			
Xylenes	1900	50	ug/L			
Total Petroleum Hydrocarbon	5	1	mg/L	418.1 (1)	10/07/91	DTJ

APPROVED BY: Ellen J. Nafziger

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Aurora, CO 80012
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10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/23/91
TIME SAMPLED.....: 20:00
WORK DESCRIPTION...: S19

LABORATORY I.D...: 911832-0003
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	244	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	10/04/91	MRC
Benzene	1500	50	ug/L			
Toluene	3000	50	ug/L			
Ethyl Benzene	350	50	ug/L			
Xylenes	3400	50	ug/L			
Total Petroleum Hydrocarbon	4	1	mg/L	418.1 (1)	10/07/91	DT.

APPROVED BY: Ellen J. Nagel

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JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/23/91
TIME SAMPLED.....: 12:30
WORK DESCRIPTION...: A10

LABORATORY I.D...: 911832-0004
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	199	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*20		8020 (2)	10/04/91	MRC
Benzene	940	20	ug/L			
Toluene	340	20	ug/L			
Ethyl Benzene	80	20	ug/L			
Xylenes	1300	20	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/07/91	DTJ

APPROVED BY: Ellen J. Nagger

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10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/23/91
TIME SAMPLED.....: 13:45
WORK DESCRIPTION...: A16

LABORATORY I.D...: 911832-0005
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	126	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*5		8020 (2)	10/07/91	MRC
Benzene	240	5	ug/L			
Toluene	55	5	ug/L			
Ethyl Benzene	ND	5	ug/L			
Xylenes	220	5	ug/L			
Total Petroleum Hydrocarbon	1	1	mg/L	418.1 (1)	10/07/91	DTJ

APPROVED BY: Ellen J. Nagger

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10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/23/91
TIME SAMPLED.....: 16:15
WORK DESCRIPTION...: B16

LABORATORY I.D...: 911832-0006
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	202	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*20		8020 (2)	10/04/91	MRC
Benzene	980	20	ug/L			
Toluene	1200	20	ug/L			
Ethyl Benzene	100	20	ug/L			
Xylenes	1400	20	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/07/91	DTJ

APPROVED BY: Ellen J. Nixon

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10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/27/91
TIME SAMPLED.....: 09:15
WORK DESCRIPTION...: SW-1

LABORATORY I.D...: 911832-0007
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	18.4	0.5	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	1	1	mg/L	418.1 (1)	10/07/91	DTJ

APPROVED BY: Ellen J. Nopper

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10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/27/91
TIME SAMPLED.....: 11:55
WORK DESCRIPTION...: MW-64 BH 90

LABORATORY I.D...: 911832-0008
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	10.7	0.5	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*2		8020 (2)	10/04/91	MRC
Benzene	150	2	ug/L			
Toluene	6	2	ug/L			
Ethyl Benzene	26	2	ug/L			
Xylenes	130	2	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/07/91	DTJ

APPROVED BY: Ellen J. Nagger

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Aurora, CO 80012
(303) 751-1780

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/27/91
TIME SAMPLED.....: 14:55
WORK DESCRIPTION...: MW-65A

LABORATORY I.D...: 911832-0009
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	6.2	0.5	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*10		8020 (2)	10/07/91	MRC
Benzene	680	10	ug/L			
Toluene	190	10	ug/L			
Ethyl Benzene	20	10	ug/L			
Xylenes	250	10	ug/L			
Total Petroleum Hydrocarbon	3	1	mg/L	418.1 (1)	10/07/91	DTJ

APPROVED BY: Ellen J. Hagen

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/26/91
TIME SAMPLED.....: 11:30
WORK DESCRIPTION...: MW-68

LABORATORY I.D...: 911832-0010
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	25	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*20		8020 (2)	10/07/91	MRC
Benzene	240	20	ug/L			
Toluene	280	20	ug/L			
Ethyl Benzene	40	20	ug/L			
Xylenes	800	20	ug/L			
Total Petroleum Hydrocarbon	45	1	mg/L	418.1 (1)	10/07/91	DTJ

APPROVED BY: Ellen J. Naggar

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Aurora, CO 80012
(303) 751-1780

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10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/26/91
TIME SAMPLED.....: 15:10
WORK DESCRIPTION...: MW-66 BH92

LABORATORY I.D...: 911832-0011
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	9.3	0.5	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/07/91	DTJ

APPROVED BY: Ellen J. Nagger

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/26/91
TIME SAMPLED.....: 15:10
WORK DESCRIPTION...: MW-66 DUP BH92

LABORATORY I.D...: 911832-0012
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	9.2	0.5	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/08/91	MRC

A[illegible]VED BY: Ellen J. Napper

1300 South Potomac, Suite 130
Aurora, CO 80012
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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/24/91
TIME SAMPLED.....: 09:15
WORK DESCRIPTION...: S-6

LABORATORY I.D...: 911832-0013
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	2.6	0.5	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*10		8020 (2)	10/04/91	MRC
Benzene	60	10	ug/L			
Toluene	210	10	ug/L			
Ethyl Benzene	20	10	ug/L			
Xylenes	1000	10	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/08/91	MRC

A. VED BY: Ellen J. Nagger

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/24/91
TIME SAMPLED.....: 12:10
WORK DESCRIPTION...: S-10

LABORATORY I.D...: 911832-0014
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	472	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	10/04/91	MRC
Benzene	1000	50	ug/L			
Toluene	1400	50	ug/L			
Ethyl Benzene	200	50	ug/L			
Xylenes	2900	50	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/08/91	MRC

APPROVED BY: Ellen J. Napper

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/24/91
TIME SAMPLED.....: 12:00
WORK DESCRIPTION...: S-9

LABORATORY I.D...: 911832-0015
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	318	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	10/05/91	MRC
Benzene	2000	50	ug/L			
Toluene	2000	50	ug/L			
Ethyl Benzene	200	50	ug/L			
Xylenes	2700	50	ug/L			
Total Petroleum Hydrocarbon	4	1	mg/L	418.1 (1)	10/08/91	MRC

APPROVED BY: Ellen J. Naggen

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/25/91
TIME SAMPLED.....: 17:05
WORK DESCRIPTION...: MW69 BH95

LABORATORY I.D...: 911832-0016
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	98	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	10/05/91	MRC
Benzene	1700	100	ug/L			
Toluene	4800	100	ug/L			
Ethyl Benzene	300	100	ug/L			
Xylenes	4600	100	ug/L			
Total Petroleum Hydrocarbon	4	1	mg/L	418.1 (1)	10/08/91	MRC

APPROVED BY: Ellen J. Nagger

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/25/91
TIME SAMPLED.....: 18:30
WORK DESCRIPTION...: MW70 RH 57

LABORATORY I.D...: 911832-0017
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	10.4	0.5	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/07/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/09/91	MW

A. VED BY: Ellen J. Noggs

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10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/26/91
TIME SAMPLED.....: 16:40
WORK DESCRIPTION...: MW-60 BH86

LABORATORY I.D...: 911832-0018
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	12.0	0.5	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/08/91	MRC
Benzene	33	1	ug/L			
Toluene	2	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	2	1	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/09/91	MW

APPROVED BY: Ellen J. Nagen

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10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/26/91
TIME SAMPLED.....: 18:20
WORK DESCRIPTION...: MW-67

LABORATORY I.D...: 911832-0019
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	3.6	0.5	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*5		8020 (2)	10/04/91	MRC
Benzene	280	5	ug/L			
Toluene	5	5	ug/L			
Ethyl Benzene	ND	5	ug/L			
Xylenes	65	5	ug/L			
Total Petroleum Hydrocarbon	1	1	mg/L	418.1 (1)	10/09/91	MW

APPROVED BY: Ellen J. Nappy

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10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/27/91
TIME SAMPLED.....: 08:20
WORK DESCRIPTION...: SW-2

LABORATORY I.D...: 911832-0020
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	13.2	0.5	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/07/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	1	1	mg/L	418.1 (1)	10/09/91	MW

APPROVED BY: Ellen J. Noggen

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/25/91
TIME SAMPLED.....: 15:30
WORK DESCRIPTION...: MW-56 BH82

LABORATORY I.D...: 911832-0021
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Alkalinity, Total (Unfilt.)	871	5	mg/L CaCO3	310.1 (1)	10/07/91	MRC
Bicarbonate (Unfilt.)	1060	5	mg/L	403 (3)	10/07/91	MRC
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	10/07/91	MRC
Chloride (Unfilt.)	248	1	mg/L	325.2 (1)	10/03/91	MW
Conductivity (Unfilt.)	1820	1	umhos/cm @25dC	120.1 (1)	10/09/91	MRC
Hardness, Total (Unfilt.)	847	1	mg/L(as CaCO3)	314A (3)	10/10/91	TLK
pH (Unfilt.)	7.58	0.01	pH Units	150.1 (1)	10/07/91	MRC
P' ls (Unfilt.)	<0.05	0.05	mg/L	420.1 (1)	10/07/91	RMN
Solids, Total Dissolved (TDS)	1220	10	mg/L	160.1 (1)	10/03/91	PJM
Solids, Total Suspended, TSS	65	4	mg/L	160.2 (1)	10/02/91	KJZ
Sulfate (Unfilt.)	<10	10	mg/L	375.2 (1)	10/09/91	DTJ
Barium, Total (Ba)	0.68	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Calcium, Total (Ca)	95.2	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Iron, Total (Fe)	11.7	0.03	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Magnesium, Total (Mg)	148	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Manganese, Total (Mn)	0.17	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Potassium, Total (K)	2.3	0.01	mg/L	258.1 (1)	10/10/91	TLK
Sodium, Total (Na)	170	5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Strontium, Total (Sr)	1.72	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	10/07/91	MRC
Benzene	2200	50	ug/L			
Toluene	400	50	ug/L			
Ethyl Benzene	800	50	ug/L			
Xylenes	350	50	ug/L			

AP. /ED BY: Eileen G. Nappen

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/25/91
TIME SAMPLED.....: 15:30
WORK DESCRIPTION...: MW-56

LABORATORY I.D...: 911832-0021
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8240 - VOLATILE ORGANICS		*5		8240 (2)	10/08/91	MLD
n-Hexane	14000	500	ug/L			
Naphthalene	ND	25	ug/L			
Total Petroleum Hydrocarbon	476	1	mg/L	418.1 (1)	10/09/91	MW
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Condst.	8015 (Modified) (2)	10/02/91	MRC

APPROVED BY: Ellen J. Nagger

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ANALYTICAL REPORT
10/10/91

CUSTOMER: Marathon Oil Company

File No..: 911832

CATION/ANION BALANCE

Client Sample I.D..... MW-56
Remark/Project..... 32-03-144
Date/Time Sampled..... 09-25-91/1530
Date/Time Received..... 10-01-91/1000
Laboratory Sample I.D..... 911832-21

PARAMETER	RESULT		UNITS
pH	7.58		pH Units
Conductivity at 25 degrees C	1820		umhos/cm
Alkalinity (as CaCO3)	871		mg/L
Total Diss. Solids (measured)	1220		mg/L
Total Diss. Solids (calculated)	1194		mg/L
		meq/Liter	
Calcium (Ca)	95.2	4.75	mg/L
Magnesium (Mg)	148	12.18	mg/L
Sodium (Na)	170	7.40	mg/L
Potassium (K)	2.3	0.06	mg/L
Total Cations meq/Liter		24.38	
		meq/Liter	
Bicarbonate (HCO3)	1060	17.37	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	248	7.00	mg/L
Sulfate (SO4)	ND(10)	0.00	mg/L
Total Anions meq/Liter		24.37	

Cation-Anion Balance (RPD) 0.06 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: Ellen J. Nagger

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/25/91
TIME SAMPLED.....: 16:15
WORK DESCRIPTION...: MW-65

LABORATORY I.D...: 911832-0022
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	1.7	0.5	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/07/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/09/91	MW

APPROVED BY: Ellen J. Nagger

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/24/91
TIME SAMPLED.....: 17:30
WORK DESCRIPTION...: MW-45 B 4168

LABORATORY I.D...: 911832-0023
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Alkalinity, Total (Unfilt.)	510	5	mg/L CaCO3	310.1 (1)	10/07/91	MRC
Bicarbonate (Unfilt.)	623	5	mg/L	403 (3)	10/07/91	MRC
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	10/07/91	MRC
Chloride (Unfilt.)	170	1	mg/L	325.2 (1)	10/03/91	MW
Conductivity (Unfilt.)	3050	1	umhos/cm @25dC	120.1 (1)	10/09/91	MRC
Hardness, Total (Unfilt.)	3670	1	mg/L(as CaCO3)	314A (3)	10/10/91	TLK
pH (Unfilt.)	7.54	0.01	pH Units	150.1 (1)	10/07/91	MRC
Pr !s (Unfilt.)	<0.05	0.05	mg/L	420.1 (1)	10/07/91	RMN
Solids, Total Dissolved (TDS)	3920	10	mg/L	160.1 (1)	10/03/91	PJM
Solids, Total Suspended, TSS	2210	4	mg/L	160.2 (1)	10/02/91	KJZ
Sulfate (Unfilt.)	2200	10	mg/L	375.3 (1)	10/09/91	DTJ
Barium, Total (Ba)	0.07	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Calcium, Total (Ca)	820	2	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Iron, Total (Fe)	54.0	0.2	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Magnesium, Total (Mg)	395	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Manganese, Total (Mn)	2.03	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Potassium, Total (K)	6.9	0.01	mg/L	258.1 (1)	10/10/91	TLK
Sodium, Total (Na)	235	5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Strontium, Total (Sr)	2.75	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/07/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/24/91
TIME SAMPLED.....: 17:30
WORK DESCRIPTION...: MW-45

LABORATORY I.D...: 911832-0023
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8240 - VOLATILE ORGANICS		*1		8240 (2)	10/08/91	MLD
n-Hexane	ND	5	ug/L			
Naphthalene	ND	5	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/09/91	MW
8015(Mod) - Hydrocarbon ID - TPH	~~410~~ <10	10	mg/L Condst.	8015 (Modified) (2)	10/02/91	MRC

APPROVED BY: Ellen J. Nagger

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ANALYTICAL REPORT
10/10/91

CUSTOMER: Marathon Oil Company | File No..: 911832

CATION/ANION BALANCE

Client Sample I.D..... MW-45
Remark/Project..... 32-03-144
Date/Time Sampled..... 09-24-91/1730
Date/Time Received..... 10-01-91/1000
Laboratory Sample I.D..... 911832-23

PARAMETER	RESULT		UNITS
pH	7.54		pH Units
Conductivity at 25 degrees C	3050		umhos/cm
Alkalinity (as CaCO3)	510		mg/L
Total Diss. Solids (measured)	3920		mg/L
Total Diss. Solids (calculated)	4138		mg/L
		meq/Liter	
Calcium (Ca)	820	40.92	mg/L
Magnesium (Mg)	395	32.50	mg/L
Sodium (Na)	235	10.22	mg/L
Potassium (K)	6.9	0.18	mg/L
Total Cations meq/Liter		83.82	
		meq/Liter	
Bicarbonate (HCO3)	623	10.21	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	170	4.80	mg/L
Sulfate (SO4)	2200	45.80	mg/L
Total Anions meq/Liter		60.81	

Cation-Anion Balance (RPD) 31.82 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: Ellen J. Nagger

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Tele. (303) 751-1780

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A Dresser Company

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/24/91
TIME SAMPLED.....: 17:15
WORK DESCRIPTION...: MW-49

BH72

LABORATORY I.D...: 911832-0024
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	273	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*5		8020 (2)	10/04/91	MRC
Benzene	35	5	ug/L			
Toluene	20	5	ug/L			
Ethyl Benzene	30	5	ug/L			
Xylenes	25	5	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/09/91	MW

APPROVED BY: Ellen J. Magger

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Aurora, CO 80012
(303) 751-1780

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/25/91
TIME SAMPLED.....: 10:35
WORK DESCRIPTION...: MW-54

BH 80

LABORATORY I.D...: 911832-0025
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	99	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/07/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	3	1	mg/L	418.1 (1)	10/09/91	MW

APPROVED BY: Ellen J. Nagger

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/25/91
TIME SAMPLED.....: 10:52
WORK DESCRIPTION...: MW-50

GH73

LABORATORY I.D...: 911832-0026
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	384	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/09/91	MW

APPROVED BY: Ellen J. Nafzger

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/25/91
TIME SAMPLED.....: 11:35
WORK DESCRIPTION...: MW-55 B481

LABORATORY I.D...: 911832-0027
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	628	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*20		8020 (2)	10/04/91	MRC
Benzene	940	20	ug/L			
Toluene	40	20	ug/L			
Ethyl Benzene	140	20	ug/L			
Xylenes	ND	20	ug/L			
Total Petroleum Hydrocarbon	1	1	mg/L	418.1 (1)	10/09/91	MW

APPROVED BY: Ellen J. Hoffer

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/25/91
TIME SAMPLED.....: 14:20
WORK DESCRIPTION...: MW-61 B487

LABORATORY I.D...: 911832-0028
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	416	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/07/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	1	1	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/09/91	MW

AP /ED BY: Ellen J. Nagger

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/27/91
TIME SAMPLED.....: 18:00
WORK DESCRIPTION...: MW-50 BH73

LABORATORY I.D...: 911832-0029
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Barium, Total (Ba)	0.02	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Calcium, Total (Ca)	463	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Iron, Total (Fe)	0.90	0.03	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Mercury, Total (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	10/03/91	GG
Magnesium, Total (Mg)	486	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Manganese, Total (Mn)	0.45	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Potassium, Total (K)	7.5	0.01	mg/L	258.1 (1)	10/10/91	TLK
Sc n, Total (Na)	361	5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Strontium, Total (Sr)	2.65	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK

AP. .ED BY: Ellen J. Hagen

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/24/91
TIME SAMPLED.....: 16:30
WORK DESCRIPTION...: MW-42 BH 65

LABORATORY I.D...: 911832-0030
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	605	1	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/07/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/09/91	MW

AI VED BY: Ellen J. Nagger

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/26/91
TIME SAMPLED.....: 10:05
WORK DESCRIPTION...: MW-63 BH89

LABORATORY I.D...: 911832-0031
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	9.2	0.5	mg/L	325.2 (1)	10/03/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/07/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/09/91	MW

APPROVED BY: Ellen G. Nagger

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911832 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144
DATE SAMPLED.....: 09/12/91
TIME SAMPLED.....: :
WORK DESCRIPTION...: TRIP BLANK

LABORATORY I.D...: 911832-0032
DATE RECEIVED....: 10/01/91
TIME RECEIVED....: 10:00
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/05/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

A VED BY: Ellen J. Natzger

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ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: Ralph Skinner Jr.

PTC Project No.: 32-03-144

1. Packed By: RSJr. Date: 9-30-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91
6. Notes/Comments: 1130hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
1 √ (1)	9-23-91	1735	519	Water	3-VOA vials w/HCL	BTEX (8020)
(2)			21A AND		1-VOA vial	CL- unpreserved
(3)					1-1 liter glass w/H2SO4	TPH-418.1
2 √ (4)	9-22-91	1925	21A	Water	3-VOA vials w/HCL	BTEX (8020)
(5)					1-VOA vial	CL- unpreserved
(6)					1-1 liter glass w/H2SO4	TPH-418.1
3 √ (7)	9-23-91	2000	519	Water	3-VOA vials w/HCL	BTEX (8020)
(8)					1-VOA vial	CL- unpreserved
(9)					1-1 liter glass w/H2SO4	TPH-418.1
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed Express Priority One
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 911832

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):	Ellen J. Vaughan	10-1-91	1000

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

3/1/91

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: Ralph S Kinner

PTC Project No.: 32-03-144

##########################

1. Packed By: RS Jr. Date: 9-30-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (*DO NOT USE TAPE!*)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91
6. Notes/Comments: 1130 Hrs.

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

		SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
4	✓(1)	9-23-91	1230 hrs.	~~[illegible]~~ A10	water	3-VOA vials w/HCL	(BTEX 8020)
	(2)					1-VOA vials	CL-(unpreserved)
	(3)					1-1 Liter glass w/H_2SO_4	TPH 418.1
5	✓(4)	9-23-91	1345 hrs	~~[illegible]~~ A16	water	3-VOA vials w/HCL	BTEX (8020)
	(5)					1-VOA vial	CL-unpreserved
	(6)					1-1 Liter glass w/H_2SO_4	TPH 418.1
6	✓(7)	9-23-91	1615 hrs	B16	water	3-VOA vials w/HCL	BTEX (8020)
	(8)					1-VOA vial	CL-(unpreserved)
	(9)					1-1 Liter glass w/H_2SO_4	TPH 418.1
	(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Federal Express Priority #1
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 911832

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):	Ellen J. Nappo	10-1-91	1000

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: Ralph Skinner Jr.

PTC Project No.: 32-03-144

1. Packed By: RSJr. Date: 9-30-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91
6. Notes/Comments: 1130hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
7 (1)	9-27-91	0915	SW-1	Water	3-VOA vials w/HCL	BTEX (8020)
(2)					1-VOA vial	CL- (unpreserved)
(3)					1-1 liter glass w/H_2SO_4	TPH-418.1
8 (4)	9-27-91	1155	MW-64	Water	3-VOA vials w/HCL	BTEX (8020)
(5)					1-VOA vial	CL- (unpreserved)
(6)					1-1 liter glass w/H_2SO_4	TPH-418.1
9 (7)	9-27-91	1455	MW-65A	Water	3-VOA vials w/HCL	BTEX 8020
(8)					1-VOA vial	CL- (unpreserved)
(9)					1-1 liter glass w/H_2SO_4	TPH-418.1
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 911832

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):	[illegible]	10-1-91	1000

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

ANALYSIS REQUEST - CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: Ralph Skinner Jr.

PTC Project No.: 32-03-144

1. Packed By: RS Jr. Date: 9-30-91
2. VOA Vials? (YES) NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? (YES) NO
4. Coolant? ICE (COLD PAK)
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91
6. Notes/Comments: 1130 HRS.

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Premium Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
10 ✓(1)	9-26-91	1130	MW-68	Water	3-VOA vials w/HCL	BTEX (8020)
(2)					1-VOA vial	CL- (unpreserved)
(3)					1-1 liter glass w/H_2SO_4	TPH-418.1
11 ✓(4)	9-26-91	1510	M-W-66	Water	3-VOA vials w/HCL	BTEX (8020)
(5)					1-VOA vial	CL- (unpreserved)
(6)					1-1 liter glass w/H_2SO_4	TPH-418.1
12 ✓(7)	9-26-91	1510	MW-66 Dup.	Water	3-VOA vials w/HCL	BTEX (8020)
(8)					1-1 liter glass w/H_2SO_4	TPH-418.1
(9)					1-VOA vial	CL-(unpreserved)
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Federal Express Priority #1
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 911882

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):	Ellen G. Hagen	10-1-91	1000

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

ST/01

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: Ralph Skinner Jr.

PTC Project No.: 32-03-144

1. Packed By: RS, Jr. Date: 9-30-91
2. VOA Vials? (YES) NO
   Secure caps tightly by hand *(DO NOT USE TAPE!)*
3. OTHER BOTTLES? ~~caps sealed w/tape?~~ (YES) NO
4. Coolant? ICE (COLD PAK)
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91
6. Notes/Comments: 1130 HRS.

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
13 (1)	9-24-91	0915	S-6	Water	3-VOA vials w/HCL	BTEX (8020)
(2)					1-VOA vial	CL- (unpreserved)
(3)					1-1 liter glass w/H_2SO_4	TPH- 418.1
14 (4)	9-24-91	1210	S-10	Water	3-VOA vials w/HCL	BTEX-(8020)
(5)					1-VOA vial	CL- (unpreserved)
(6)					1-1 liter glass w/H_2SO_4	TPH- 418.1
18 (7)	9-24-91	1200	S-9	Water	3-VOA vials w/HCL	BTEX (8020)
(8)					1-VOA vial	CL- unpreserved
(9)					1-1 liter glass w/H_2SO_4	TPH- 418.1
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Federal Express Priority #1
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 911832

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):	[illegible]	10-1-91	1200
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

3/1/91

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: Ralph Skinner Jr.

PTC Project No.: 32-03-144

1. Packed By: RSJr. Date: 9-30-91
2. VOA Vials? (YES) NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? (YES) NO
4. Coolant? ICE (COLD PAK)
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91
6. Notes/Comments: 1130hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
16 ✓ (1)	9-25-91	1705	MW 69	Water	3-VOA vials w/HCL	BTEX (8020).
(2)					1-VOA vial	CL- (unpreserved)
(3)					1-1 liter glass w/H2SO4	TPH-418.1
17 ✓ (4)	9-25-91	1830	MW 70	Water	3-VOA vials w/HCL	BTEX (8020)
(5)					1-VOA vial	CL- (unpreserved)
(6)					1-1 liter glass w/H2SO4	TPH-418.1
(7)						
(8)						
(9)						
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed Express Priority One
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 91832

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):	Ellen J. Hoffman	10-1-91	0000

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

SF4/91

ANALYSIS REQUEST - ...AIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: Ralph Skinner Jr.

FTC Project No.: 32-03-144

1. Packed By: RS Jr. Date: 9-30-91
2. VOA Vials? (YES) NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? (YES) NO
4. Coolant? ICE (COLD PAK)
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91
6. Notes/Comments: 1130 HRS

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
18 ✓(1)	9-26-91	1640	MW-60	Water	3-VOA vials w/HCL	BTEX (8020)
(2)					1-VOA vial	CL-(unpreserved)
(3)					1-1 liter glass w/H_2SO_4	TPH-418.1
19 ✓(4)	9-26-91	1820	MW-67	Water	3-VOA vials w/HCL	BTEX (8020)
(5)					1-VOA vial	CL-(unpreserved)
(6)					1-1 liter glass w/H_2SO_4	TPH-418.1
20 ✓(7)	9-27-91	0820	SW-2	Water	3-VOA vials w/HCL	BTEX (8020)
(8)					1-VOA vial	CL-(unpreserved)
(9)					1-1 liter glass w/H_2SO_4	TPH-418.1
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Federal Express Priority #1
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 911832

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):	Ellen J. Klaffgen	10-1-91	1000

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: Ralph Skinner Jr.

PTC Project No.: 32-03-144

1. Packed By: RS Jr. Date: 9-30-91
2. VOA Vials? YES NO
   Secure caps tightly by hand *(DO NOT USE TAPE!)*
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91
6. Notes/Comments: 1130 Hrs.

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
21 (1)	9-25-91	15:30	MW-56	Water	3-40 ml. VOA Vial w/HCL	BTEX (Method 8020)
(2)					1-40 ml. VOA Vial (Unpres)	Cl^-
(3)					1-1 Hr glass w/H_2SO_4	TPH (Method 418.1)
(4)					2-40 ml VOA Vial	Naphthalene-Hexane TPH (Method 8015)
(5)					2-500 ml Poly (Unpres)	Inorganics
(6)					1-1 Hr glass w/H_2SO_4	Phenols
22 (7)	9-25-91	16:15	MW-65	Water	1-500 ml glass w/HNO_3 3-40 ml. VOA Vial w/HCL	Metals BTEX (Method 8020)
(8)					1-40 ml. VOA Vial (Unpres)	Cl^-
(9)					1-1 Hr glass w/H_2SO_4	
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Federal Express Priority #1
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 911852

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):	Ellen J. Nagger	10-1-91	1000

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER JR.

PTC Project No.: 32-03-144

1. Packed By: RSJr. Date: 9-30-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91
6. Notes/Comments: 1130 hrs.

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

		SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
23	✓(1)	9-24-91	17:30	MW-45	Water	1 - ~~500~~ 1 Liter Poly (unpres)	Inorganics
	(2)					1 - 1 ltr glass w/H2SO4	Phenols
	(3)					1 - 500 ml glass w/HNO3	Metals
24	✓(4)	9-24-91	17:15	MW-49	Water	3 - 40 ml. VOA Vial w/HCL	BTEX (Method 8020)
	(5)					1 - 40 ml. VOA Vial (unpres)	Cl⁻
	(6)	25				1 - 1 ltr. glass w/H2SO4	TPH (Method 418.1)
25	✓(7)	9-24-91	10:30	MW-54	Water	3 - 40 ml. VOA Vial w/HCL	BTEX (Method 8020)
	(8)					1 - 40 ml. VOA Vial (unpres)	Cl⁻
	(9)					1 - 1 ltr. glass w/H2SO4	TPH (Method 418.1)
	(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 911832

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):	Ellen J. [illegible]	10-1-91	1600
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

30401

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: Ralph Skinner Jr.

PTC Project No.: 32-03-144

1. Packed By: [illegible] Date: 9-30-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91
6. Notes/Comments: 1130 hrs.

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

		SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
26 ✓	(1)	9-25-91	10:52	MW-50	Water	3- 40 ml. Voa Vials w/Hcl	BTEX (Method 8020)
	(2)					1- 40 ml Voa Vial (unpres)	CL^-
	(3)					1- 1 ltr. glass w/H_2SO_4	TPH (Method 418.1)
27 ✓	(4)	9-25-91	11:35	MW-55	Water	3- 40 ml Voa Vial w/Hcl	BTEX (Method 8020)
	(5)					1- 40 ml Voa Vial (unpres)	CL^-
	(6)					1- 1 ltr. glass w/ H_2SO_4	TPH (Method 418.1)
28 ✓	(7)	9-25-91	14:20	MW-61	Water	3- 40 ml. Voa Vials w/Hcl	BTEX (Method 8020)
	(8)					1- 40 ml Voa Vial (Unpres)	CL^-
	(9)					1- 1 ltr. glass w/ H_2SO_4	TPH (Method 418.1)
	(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 911832

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):	Ellen J. Hughes	10-1-91	1000
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

ANALYSIS REQUEST - CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: Ralph Skinner Jr.

PTC Project No.: 32-03-144

1. Packed By: RS Jr. Date: 9-30-91
2. VOA Vials? (YES) NO
   Secure caps tightly by hand *(DO NOT USE TAPE!)*
3. OTHER BOTTLES? ~~caps sealed w/tape?~~ (YES) NO
4. Coolant? ICE (COLD PAK)
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91
6. Notes/Comments: 1130 HS

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
(1)	~~9-27-91~~	~~17:30~~	~~MW-61~~	~~Water~~	~~1-500 ml poly w/HNO3~~	~~ICAP Metals, plus arsenic, selenium, mercury~~
(2)						
(3)						
29 ✓ (4)	9-27-91	18:00	MW-50	Water	1-500 ml poly w/HNO3	ICAP Metals plus arsenic, selenium, mercury
(5)						
(6)						
(7)						
(8)						
(9)						
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Federal Express Priority #1
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 911852

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):	Ellen J. Huggins	10-1-91	1000

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

ANALYSIS REQUEST - C... N OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: Ralph Skinner, Jr.

PTC Project No.: 32-03-144

1. Packed By: RSJr. Date: 9-30-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91 1130hrs.
6. Notes/Comments:

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
(1)	~~9-24-91~~	~~12:10~~	~~S-10~~	~~Water~~	~~3-40ml VOA Vial w/HCL~~	~~BTEX (Method 8020)~~
(2)					~~1-40ml VOA Vial (unpres)~~	~~Cl⁻~~
(3)					~~1-1ltr glass w/H2SO4~~	~~TPH (Method 418.1)~~
30 ✓ (4)	9-24-91	16:30	MW-42	Water	3-40ml VOA Vial w/HCL	BTEX (Method 8020)
(5)					1-40ml VOA Vial (unpres)	Cl⁻
(6)					1-1ltr. glass w/H2SO4	TPH (Method 418.1)
~~34~~ 23 ✓ (7)	9-24-91	17:30	MW-45	Water	3-40ml. VOA Vial w/HCL	BTEX (Method 8020)
(8)					1-40ml VOA Vial (unpres)	Cl⁻
(9)					1-1ltr glass w/H2SO4	TPH (418.1)
(10)				(CONT ON ANOTHER PAGE)	2-40ml. VOA Vial w/HCL	Naphthalene Hexane (8015)

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 911832

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):	[illegible]	10-2-91	[illegible]
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

3/1/91

ANALYSIS REQUEST -C[illegible]N OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RAlph Skinner Jr.

PTC Project No.: 32-03-144

##########################

1. Packed By: RSJr. Date: 9-30-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-30-91
6. Notes/Comments: 1130 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
32 31 (1)	9-26-91	1005	MW-63	water	3 -	VOA vials w/HCl BTEX method 8021
(2)					1 -	VOA vial CL- (unpreserved)
(3)					1 -	1 liter glass w/H_2SO_4 TPH- method 418.1
(4)						
(5)						
(6)						
(7)						
(8)						
(9)						
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express
Airbill #: 1335421135
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 911832

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):	[illegible]	10-1-91	1000

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

"CONFIDENTIAL BUSINESS INFORMATION"

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

ANALYTICAL REPORT

911835

FOR

MARATHON OIL COMPANY
W. NIXON
P.O. BOX 269
LITTLETON, CO 80160

10/10/91

BTEX, Cl⁻

MW77 BH103
76 102
58 84
57 83
59 85

RECEIVED
NOV 19 1991
OIL CONSERVATION DIV
SANTA FE

8015, 418.1, BTEX, hex, ngph, etc

MW61A BH87A
62 88

Ion Balance
62, A11, 6 A

metals
pit A11
MW13 BH36
43 66

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ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER JR.

PTC Project No.: 32-03-144

1. Packed By: Ralph Date: 10-1-91
2. VOA Vials? YES NO
   Secure caps tightly by hand *(DO NOT USE TAPE!)*
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 10-1-91 930hrs
6. Notes/Comments:

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
1✓ (1)	9-26-91	1338hrs	MW 77-BH103	WATER	3-VOA VIALS W/HCL	BTEX (8020)
(2)					1-VOA VIAL (unpreserved)	CL-
(3)					1-1 Liter glass w/H_2SO_4	TPH (418.1)
2✓ (4)	9-26-91	1312hrs	MW76-BH102	WATER	3-VOA VIALS W/HCL	BTEX (8020)
(5)					1-VOA VIAL (unpreserved)	CL-
(6)					1-1 Liter glass w/H_2SO_4	TPH (418.1)
3✓ (7)	9-26-91	1710hrs	MW58-BH84	WATER	3-VOA VIALS W/HCL	BTEX (8020)
(8)					1-VOA VIAL (unpreserved)	CL-
(9)					1-1 Liter glass w/H_2SO_4	TPH (418.1)
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420962
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	[illegible]	10-2-91	10:05
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER JR.

FTC Project No.: 32-03-144

1. Packed By: Ralph Date: 10-26-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 10-1-91
6. Notes/Comments: 930hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
4/ (1)	9-27-91	930 hrs.	MW61A-BHB7A	WATER	3-VOA Vials w/HCL	BTEX (8020)
(2)					1-VOA Vial (unpreserved)	CL-
(3)					1-1 Liter glass w/H_2SO_4	TPH (418.1)
(4)					2-VOA Vials w/HCL	NAPHTHALENE-HEXANE TPH (8015)
(5)					1-1 Liter Plastic (unpreserved)	INORGANICS
(6)					1-500ML BROWN w/H_2SO_4	PHENOLS
(7)					1-500ML PLASTIC w/HNO_3	METALS
5/ (8)	9-26-91	930hrs	Pit A11	WATER	1-1 Liter plastic (unpreserved)	INORGANICS
(9)					1-1500ML PLASTIC w/HNO_3	METALS
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420962
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	[illegible]	10-29-91	10:15
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

ST-091

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER, JR.

PTC Project No.: 32-03-144

1. Packed By: LSJr. Date: 10-1-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 10-1-91
6. Notes/Comments: 930hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
6 / (1)	9-27-91	1425hrs	MW 57-BH83	WATER	3-VOA VIALS W/HCL	BTEX (8020)
(2)					1-VOA VIAL (unpreserved)	CL-
(3)					1-1 Liter glass w/ H_2SO_4	TPH (418.1)
2 (4)	9-27-91	1145hrs	MW59-BH85	WATER	3-VOA VIALS W/ HCL	BTEX (8020)
(5)					1-VOA VIAL (unpreserved)	CL-
(6)					1-1 Liter glass w/ H_2SO_4	TPH (418.1)
(7)						
(8)						
(9)						
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420962
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	David Ng-A-Qui	10-2-91	10:05
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

ANALYSIS REQUEST - C...IN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER JR.

PTC Project No.: 32-03-144

1. Packed By: Ralph Date: 10-1-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 10-1-91
6. Notes/Comments: 930 hrs.

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
8 (1)	9-26-91	1558hrs	MW62-BH88	WATER	3-VOA VIALS W/HCL	BTEX (8020)
(2)					1-VOA VIAL (unpreserved)	Cl-
(3)					1-1 Liter glass w/ H_2SO_4	TPH (418.1)
(4)					2-VOA VIALS W/HCL	NAPHTHALENE-HEXANE TPH (8015)
(5)					1-1 Liter PLASTIC (unpreserved)	INORGANICS
(6)					1-500ML BROWN W/ H_2SO_4	PHENOLS
(7)					1-500ML PLASTIC W/ HNO_3	METALS
9 (8)	9-27-91	1717hrs	MW13-BH36	WATER	1-500ML PLASTIC W/ HNO_3	ICAP METALS - MERCURY ARSENIC-SELENIUM
10 (9)	9-19-91	1420hrs	MW43-BH66	WATER	1-500ML PLASTIC W/ HNO_3	METALS
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420962
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	Kenny Hs-Ayu	10-2-91	1005
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

91-01

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/26/91
TIME SAMPLED.....: 13:38
WORK DESCRIPTION...: MW77-BH103

LABORATORY I.D...: 911835-0001
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	387	1	mg/L	325.2 (1)	10/07/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/10/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/10/91	MRC

A. JVED BY: Ellen J. Nagger

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/26/91
TIME SAMPLED.....: 13:12
WORK DESCRIPTION...: MW76-BH102

LABORATORY I.D...: 911835-0002
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	259	1	mg/L	325.2 (1)	10/07/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*10		8020 (2)	10/10/91	MRC
Benzene	40	10	ug/L			
Toluene	30	10	ug/L			
Ethyl Benzene	40	10	ug/L			
Xylenes	40	10	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/10/91	MRC

APPROVED BY: Ellen J. Nagen

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Aurora, CO 80012
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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/26/91
TIME SAMPLED.....: 17:10
WORK DESCRIPTION...: MW58-BH84

LABORATORY I.D...: 911835-0003
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	74	1	mg/L	325.2 (1)	10/07/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*10		8020 (2)	10/10/91	MRC
Benzene	40	10	ug/L			
Toluene	50	10	ug/L			
Ethyl Benzene	50	10	ug/L			
Xylenes	190	10	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/10/91	MRC

A. JVED BY: Ellen J. Morgan

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/27/91
TIME SAMPLED.....: 09:30
WORK DESCRIPTION...: MW61A-BH87A

LABORATORY I.D...: 911835-0004
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Alkalinity, Total (Unfilt.)	253	5	mg/L CaCO3	310.1 (1)	10/07/91	MRC
Bicarbonate (Unfilt.)	309	5	mg/L	403 (3)	10/07/91	MRC
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	10/07/91	MRC
Chloride (Unfilt.)	10.0	0.5	mg/L	325.2 (1)	10/07/91	MW
Conductivity (Unfilt.)	915	1	umhos/cm @25dC	120.1 (1)	10/09/91	MRC
Hardness, Total (Unfilt.)	552	1	mg/L(as CaCO3)	314A (3)	10/10/91	TLK
pH (Unfilt.)	7.51	0.01	pH Units	150.1 (1)	10/07/91	MRC
ols (Unfilt.)	<0.05	0.05	mg/L	420.1 (1)	10/07/91	RMN
Solids, Total Dissolved (TDS)	755	10	mg/L	160.1 (1)	10/03/91	PJM
Solids, Total Suspended, TSS	10	4	mg/L	160.2 (1)	10/03/91	RMN
Sulfate (Unfilt.)	335	10	mg/L	375.2 (1)	10/09/91	DTJ
Barium, Total (Ba)	0.02	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Calcium, Total (Ca)	132	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Iron, Total (Fe)	0.22	0.03	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Magnesium, Total (Mg)	54.1	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Manganese, Total (Mn)	0.15	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Potassium, Total (K)	1.27	0.01	mg/L	258.1 (1)	10/10/91	TLK
Sodium, Total (Na)	12	5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Strontium, Total (Sr)	0.98	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
8020 - AROMATIC VOLATILE ORGANICS		*5		8020 (2)	10/10/91	MRC
Benzene	190	5	ug/L			
Toluene	5	5	ug/L			
Ethyl Benzene	10	5	ug/L			
Xylenes	100	5	ug/L			

A. .OVED BY: Ellen J. Natzger

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/27/91
TIME SAMPLED.....: 09:30
WORK DESCRIPTION...: MW61A-BH87A

LABORATORY I.D...: 911835-0004
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
8240 - VOLATILE ORGANICS		*1		8240 (2)	10/08/91	MLD
n-Hexane	180	5	ug/L			
Naphthalene	ND	5	ug/L			
Total Petroleum Hydrocarbon	1	1	mg/L	418.1 (1)	10/10/91	MRC
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Condst.	8015 (Modified) (2)	10/08/91	MRC

APPROVED BY: Ellen J. Nagen

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/26/91
TIME SAMPLED.....: 09:30
WORK DESCRIPTION...: PIT A11

LABORATORY I.D...: 911835-0005
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Alkalinity, Total (Unfilt.)	376	5	mg/L CaCO3	310.1 (1)	10/07/91	MRC
Bicarbonate (Unfilt.)	459	5	mg/L	403 (3)	10/07/91	MRC
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	10/07/91	MRC
Chloride (Unfilt.)	390	1	mg/L	325.2 (1)	10/07/91	MW
Conductivity (Unfilt.)	1670	1	umhos/cm @25dC	120.1 (1)	10/09/91	MRC
Hardness, Total (Unfilt.)	373	1	mg/L(as CaCO3)	314A (3)	10/10/91	TLK
pH (Unfilt.)	7.55	0.01	pH Units	150.1 (1)	10/07/91	MRC
ids, Total Dissolved (TDS)	1050	10	mg/L	160.1 (1)	10/03/91	PJM
Solids, Total Suspended, TSS	<4	4	mg/L	160.2 (1)	10/03/91	RMN
Sulfate (Unfilt.)	<10	10	mg/L	375.2 (1)	10/09/91	DTJ
Barium, Total (Ba)	0.18	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Calcium, Total (Ca)	99.1	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Iron, Total (Fe)	0.50	0.03	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Magnesium, Total (Mg)	30.5	0.1	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Manganese, Total (Mn)	0.34	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Potassium, Total (K)	6.9	0.01	mg/L	258.1 (1)	10/10/91	TLK
Sodium, Total (Na)	245	5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Strontium, Total (Sr)	1.78	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK

A. .OVED BY: Ellen J. Magger

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/27/91
TIME SAMPLED.....: 14:25
WORK DESCRIPTION...: MW57-BH83

LABORATORY I.D...: 911835-0006
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	43	1	mg/L	325.2 (1)	10/07/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*20		8020 (2)	10/10/91	MRC
Benzene	1600	20	ug/L			
Toluene	460	20	ug/L			
Ethyl Benzene	80	20	ug/L			
Xylenes	640	20	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/10/91	MRC

APPROVED BY: Ellen J. Nagger

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/27/91
TIME SAMPLED.....: 11:45
WORK DESCRIPTION...: MW59-BH85

LABORATORY I.D...: 911835-0007
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	77	1	mg/L	325.2 (1)	10/07/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*20		8020 (2)	10/10/91	MRC
Benzene	540	20	ug/L			
Toluene	60	20	ug/L			
Ethyl Benzene	240	20	ug/L			
Xylenes	520	20	ug/L			
Total Petroleum Hydrocarbon	13	1	mg/L	418.1 (1)	10/10/91	MRC

APPROVED BY: Ellen J. Rogers

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/26/91
TIME SAMPLED.....: 15:58
WORK DESCRIPTION...: MW62-BH88

LABORATORY I.D...: 911835-0008
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....: BUBBLE IN 2 VOA

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Alkalinity, Total (Unfilt.)	766	5	mg/L CaCO3	310.1 (1)	10/07/91	MRC
Bicarbonate (Unfilt.)	934	5	mg/L	403 (3)	10/07/91	MRC
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	10/07/91	MRC
Chloride (Unfilt.)	238	1	mg/L	325.2 (1)	10/07/91	MW
Conductivity (Unfilt.)	1750	1	umhos/cm @25dC	120.1 (1)	10/09/91	MRC
Hardness, Total (Unfilt.)	737	1	mg/L(as CaCO3)	314A (3)	10/10/91	TLK
pH (Unfilt.)	7.49	0.01	pH Units	150.1 (1)	10/07/91	MRC
F[illegible]ols (Unfilt.)	<0.05	0.05	mg/L	420.1 (1)	10/07/91	RMN
Solids, Total Dissolved (TDS)	1120	10	mg/L	160.1 (1)	10/03/91	PJM
Solids, Total Suspended, TSS	60	4	mg/L	160.2 (1)	10/03/91	RMN
Sulfate (Unfilt.)	19	10	mg/L	375.2 (1)	10/09/91	DTJ
Barium, Total (Ba)	2.85	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Calcium, Total (Ca)	88.9	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Iron, Total (Fe)	4.81	0.03	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Magnesium, Total (Mg)	125	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Manganese, Total (Mn)	0.81	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Potassium, Total (K)	1.86	0.01	mg/L	258.1 (1)	10/10/91	TLK
Sodium, Total (Na)	171	5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Strontium, Total (Sr)	1.47	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	10/10/91	MRC
Benzene	2200	100	ug/L			
Toluene	100	100	ug/L			
Ethyl Benzene	400	100	ug/L			
Xylenes	2400	100	ug/L			

A[illegible]JVED BY: Ellen J. Nagger

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/26/91
TIME SAMPLED.....: 15:58
WORK DESCRIPTION...: MW62-BH88

LABORATORY I.D...: 911835-0008
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....: BUBBLE IN 2 VOA

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8240 - VOLATILE ORGANICS		*5		8240 (2)	10/08/91	MLD
n-Hexane	22000	2500	ug/L			
Naphthalene	ND	25	ug/L			
Total Petroleum Hydrocarbon	366	1	mg/L	418.1 (1)	10/10/91	MRC
8015(Mod) - Hydrocarbon ID - TPH	240	10	mg/L Condst.	8015 (Modified) (2)	10/08/91	MRC

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/27/91
TIME SAMPLED.....: 17:17
WORK DESCRIPTION...: MW13-BH36

LABORATORY I.D...: 911835-0009
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Barium, Total (Ba)	0.65	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Calcium, Total (Ca)	193	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Iron, Total (Fe)	6.25	0.03	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Mercury, Total (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	10/08/91	WGL
Magnesium, Total (Mg)	109	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Manganese, Total (Mn)	0.31	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Potassium, Total (K)	2.7	0.01	mg/L	258.1 (1)	10/10/91	TLK
Sodium, Total (Na)	699	5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Strontium, Total (Sr)	1.70	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK

A VED BY: Ellen J. Nagger

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/19/91
TIME SAMPLED.....: 14:20
WORK DESCRIPTION...: MW43-BH66

LABORATORY I.D...: 911835-0010
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Barium, Total (Ba)	0.16	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Calcium, Total (Ca)	166	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Iron, Total (Fe)	3.29	0.03	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Magnesium, Total (Mg)	246	0.5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Manganese, Total (Mn)	0.32	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK
Potassium, Total (K)	2.2	0.01	mg/L	258.1 (1)	10/10/91	TLK
Sodium, Total (Na)	96	5	mg/L	200.7/6010 (1,2)	10/09/91	TLK
ntium, Total (Sr)	2.15	0.01	mg/L	200.7/6010 (1,2)	10/09/91	TLK

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LABORATORY TESTS RESULTS
10/10/91

JOB NUMBER: 911835 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/17/91
TIME SAMPLED.....: :
WORK DESCRIPTION...: TRIP BLANK

LABORATORY I.D...: 911835-0011
DATE RECEIVED....: 10/02/91
TIME RECEIVED....: 10:05
REMARKS.....: BUBBLE IN 1 VOA

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/10/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

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CORE LABORATORIES

ANALYTICAL REPORT
10/10/91

CUSTOMER: Marathon Oil Company

File No..: 911835

CATION/ANION BALANCE

Client Sample I.D..... MW61A-BH87A
Remark/Project..... 32-03-144
Date/Time Sampled..... 09-27-91/0930
Date/Time Received..... 10-02-91/1005
Laboratory Sample I.D..... 911835-4

PARAMETER	RESULT		UNITS
pH	7.51		pH Units
Conductivity at 25 degrees C	915		umhos/cm
Alkalinity (as CaCO3)	253		mg/L
Total Diss. Solids (measured)	755		mg/L
Total Diss. Solids (calculated)	699		mg/L
		meq/Liter	
Calcium (Ca)	132	6.59	mg/L
Magnesium (Mg)	54.1	4.45	mg/L
Sodium (Na)	12	0.52	mg/L
Potassium (K)	1.27	0.03	mg/L
Total Cations meq/Liter		11.59	
		meq/Liter	
Bicarbonate (HCO3)	309	5.06	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	10.0	0.28	mg/L
Sulfate (SO4)	335	6.97	mg/L
Total Anions meq/Liter		12.32	

Cation-Anion Balance (RPD) 6.09 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

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ANALYTICAL REPORT
10/10/91

CUSTOMER: Marathon Oil Company

File No..: 911835

CATION/ANION BALANCE

Client Sample I.D..... PIT A11
Remark/Project..... 32-03-144
Date/Time Sampled..... 09-26-91/0930
Date/Time Received..... 10-02-91/1005
Laboratory Sample I.D..... 911835-5

PARAMETER	RESULT		UNITS
pH	7.55		pH Units
Conductivity at 25 degrees C	1670		umhos/cm
Alkalinity (as CaCO3)	376		mg/L
Total Diss. Solids (measured)	1050		mg/L
Total Diss. Solids (calculated)	1001		mg/L
		meq/Liter	
Calcium (Ca)	99.1	4.95	mg/L
Magnesium (Mg)	30.5	2.51	mg/L
Sodium (Na)	245	10.66	mg/L
Potassium (K)	6.9	0.18	mg/L
Total Cations meq/Liter		18.29	
		meq/Liter	
Bicarbonate (HCO3)	459	7.52	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	390	11.00	mg/L
Sulfate (SO4)	ND(10)	0.00	mg/L
Total Anions meq/Liter		18.52	

Cation-Anion Balance (RPD) 1.28 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

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ANALYTICAL REPORT
10/10/91

CUSTOMER: Marathon Oil Company

File No..: 911835

CATION/ANION BALANCE

Client Sample I.D..... MW62-BH88
Remark/Project..... 32-03-144
Date/Time Sampled..... 09-26-91/1558
Date/Time Received..... 10-02-91/1005
Laboratory Sample I.D..... 911835-8

PARAMETER	RESULT		UNITS
pH	7.49		pH Units
Conductivity at 25 degrees C	1750		umhos/cm
Alkalinity (as CaCO3)	766		mg/L
Total Diss. Solids (measured)	1120		mg/L
Total Diss. Solids (calculated)	1111		mg/L
		meq/Liter	
Calcium (Ca)	88.9	4.44	mg/L
Magnesium (Mg)	125	10.29	mg/L
Sodium (Na)	171	7.44	mg/L
Potassium (K)	1.86	0.05	mg/L
Total Cations meq/Liter		22.21	
		meq/Liter	
Bicarbonate (HCO3)	934	15.31	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	238	6.71	mg/L
Sulfate (SO4)	19	0.40	mg/L
Total Anions meq/Liter		22.42	

Cation-Anion Balance (RPD) 0.94 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: Ellen J. Nagan

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CORE LABORATORIES

ANALYTICAL REPORT

911810

FOR

MARATHON OIL COMPANY
W. NIXON
P.O. BOX 269
LITTLETON, CO 80160.

10/09/91

Inorganics & Ion Balance
MW10 BH 33
19 42
43 66
13 36
pi- 16

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LABORATORY TESTS RESULTS
10/09/91

JOB NUMBER: 911810 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

SAMPLE NUMBER: 1 DATE RECEIVED: 09/27/91 TIME RECEIVED: 10:25 SAMPLE DATE: 09/25/91 SAMPLE TIME: 14:30
PROJECT: 32-03-144 SAMPLE: MW10-BH33 REM:

SAMPLE NUMBER: 2 DATE RECEIVED: 09/27/91 TIME RECEIVED: 10:25 SAMPLE DATE: 09/25/91 SAMPLE TIME: 14:43
PROJECT: 32-03-144 SAMPLE: MW19-BH42 REM:

SAMPLE NUMBER: 3 DATE RECEIVED: 09/27/91 TIME RECEIVED: 10:25 SAMPLE DATE: 09/25/91 SAMPLE TIME: 15:00
PROJECT: 32-03-144 SAMPLE: MW43-BH66 REM:

SAMPLE NUMBER: 4 DATE RECEIVED: 09/27/91 TIME RECEIVED: 10:25 SAMPLE DATE: 09/25/91 SAMPLE TIME: 15:22
PROJECT: 32-03-144 SAMPLE: MW13-BH36 REM:

SAMPLE NUMBER: 5 DATE RECEIVED: 09/27/91 TIME RECEIVED: 10:25 SAMPLE DATE: 09/26/91 SAMPLE TIME: 09:00
PROJECT: 32-03-144 SAMPLE: PIT 16 REM:

TEST DESCRIPTION	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5		UNITS OF MEASURE
Alkalinity, Total (Unfilt.)	901	930	939	536	167		mg/L CaCO3
Bicarbonate (Unfilt.)	1100	1140	1150	654	203		mg/L
Carbonate (Unfilt.)	<1	<1	<1	<1	<1		mg/L
Chloride (Unfilt.)	330	363	128	1460	41		mg/L
Conductivity (Unfilt.)	2240	2430	2170	4610	416		umhos/cm @25dC
Hardness, Total (Unfilt.)	949	886	1310	1040	141		mg/L(as CaCO3)
pH (Unfilt.)	7.34	7.28	7.40	7.29	7.75		pH Units
Phenols (Unfilt.)	0.48	0.55	<0.05	0.12	<0.05		mg/L
Solids, Total Dissolved (TDS)	1440	1460	1600	2790	263		mg/L
Solids, Total Suspended, TSS	38	65	115	71	42		mg/L
Sulfate (Unfilt.)	<10	<10	370	<10	<10		mg/L
Barium, Total (Ba)	0.97	1.80	0.15	0.74	0.08		mg/L

APPROVED BY: Ellen J. Natzger

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LABORATORY TESTS RESULTS
10/09/91

JOB NUMBER: 911810 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

SAMPLE NUMBER: 1 DATE RECEIVED: 09/27/91 TIME RECEIVED: 10:25 SAMPLE DATE: 09/25/91 SAMPLE TIME: 14:30
PROJECT: 32-03-144 SAMPLE: MW10-BH33 REM:

SAMPLE NUMBER: 2 DATE RECEIVED: 09/27/91 TIME RECEIVED: 10:25 SAMPLE DATE: 09/25/91 SAMPLE TIME: 14:43
PROJECT: 32-03-144 SAMPLE: MW19-BH42 REM:

SAMPLE NUMBER: 3 DATE RECEIVED: 09/27/91 TIME RECEIVED: 10:25 SAMPLE DATE: 09/25/91 SAMPLE TIME: 15:00
PROJECT: 32-03-144 SAMPLE: MW43-BH66 REM:

SAMPLE NUMBER: 4 DATE RECEIVED: 09/27/91 TIME RECEIVED: 10:25 SAMPLE DATE: 09/25/91 SAMPLE TIME: 15:22
PROJECT: 32-03-144 SAMPLE: MW13-BH36 REM:

SAMPLE NUMBER: 5 DATE RECEIVED: 09/27/91 TIME RECEIVED: 10:25 SAMPLE DATE: 09/26/91 SAMPLE TIME: 09:00
PROJECT: 32-03-144 SAMPLE: PIT 16 REM:

TEST DESCRIPTION	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5		UNITS OF MEASURE
Calcium, Total (Ca)	94.7	97.5	159	220	42.4		mg/L
Iron, Total (Fe)	6.99	1.39	4.04	7.02	0.73		mg/L
Magnesium, Total (Mg)	173	156	221	118	9.3		mg/L
Manganese, Total (Mn)	0.44	0.20	0.43	0.36	0.18		mg/L
Potassium, Total (K)	1.83	2.2	1.74	2.8	3.7		mg/L
Sodium, Total (Na)					8.4		mg/L
Sodium, Total (Na)	197	239	108	751			mg/L
Strontium, Total (Sr)	1.91	1.71	2.06	1.81	0.07		mg/L

APPROVED BY: Ellen J. Nagger

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A Litton Dresser Company

CORE LABORATORIES

ANALYTICAL REPORT
10/09/91

CUSTOMER: Marathon Oil Company

File No..: 911810

CATION/ANION BALANCE

Client Sample I.D..... MW10-BH33
Remark/Project..... 32-03-144
Date/Time Sampled..... 09-25-91/1430
Date/Time Received..... 09-27-91/1025
Laboratory Sample I.D..... 911810-1

PARAMETER	RESULT		UNITS
pH	7.34		pH Units
Conductivity at 25 degrees C	2240		umhos/cm
Alkalinity (as CaCO3)	901		mg/L
Total Diss. Solids (measured)	1440		mg/L
Total Diss. Solids (calculated)	1347		mg/L
		meq/Liter	
Calcium (Ca)	94.7	4.73	mg/L
Magnesium (Mg)	173	14.24	mg/L
Sodium (Na)	197	8.57	mg/L
Potassium (K)	1.83	0.05	mg/L
Total Cations meq/Liter		27.58	
		meq/Liter	
Bicarbonate (HCO3)	1100	18.03	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	330	9.31	mg/L
Sulfate (SO4)	ND(10)	0.00	mg/L
Total Anions meq/Liter		27.34	

Cation-Anion Balance (RPD) 0.87 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: Ellen J. Morgan

1300 South Potomac, St., Suite 130
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Tele. (303) 751-1780

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CORE LABORATORIES

ANALYTICAL REPORT
10/09/91

CUSTOMER: Marathon Oil Company

File No..: 911810

CATION/ANION BALANCE

Client Sample I.D..... MW19-BH42
Remark/Project..... 32-03-144
Date/Time Sampled..... 09-25-91/1443
Date/Time Received..... 09-27-91/1025
Laboratory Sample I.D..... 911810-2

PARAMETER	RESULT		UNITS
pH	7.28		pH Units
Conductivity at 25 degrees C	2430		umhos/cm
Alkalinity (as CaCO3)	930		mg/L
Total Diss. Solids (measured)	1460		mg/L
Total Diss. Solids (calculated)	1428		mg/L
		meq/Liter	
Calcium (Ca)	97.5	4.87	mg/L
Magnesium (Mg)	156	12.84	mg/L
Sodium (Na)	239	10.40	mg/L
Potassium (K)	2.2	0.06	mg/L
Total Cations meq/Liter		28.16	
		meq/Liter	
Bicarbonate (HCO3)	1140	18.68	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	363	10.24	mg/L
Sulfate (SO4)	ND(10)	0.00	mg/L
Total Anions meq/Liter		28.92	

Cation-Anion Balance (RPD) 2.70 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: Ellen J. Nagy

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Western Atlas International
A Union Pacific Company

CORE LABORATORIES

ANALYTICAL REPORT
10/09/91

CUSTOMER: Marathon Oil Company

File No..: 911810

CATION/ANION BALANCE

Client Sample I.D..... MW43-BH66
Remark/Project..... 32-03-144
Date/Time Sampled..... 09-25-91/1500
Date/Time Received..... 09-27-91/1025
Laboratory Sample I.D..... 911810-3

PARAMETER	RESULT		UNITS
pH	7.40		pH Units
Conductivity at 25 degrees C	2170		umhos/cm
Alkalinity (as CaCO3)	939		mg/L
Total Diss. Solids (measured)	1600		mg/L
Total Diss. Solids (calculated)	1563		mg/L
		meq/Liter	
Calcium (Ca)	159	7.93	mg/L
Magnesium (Mg)	221	18.19	mg/L
Sodium (Na)	108	4.70	mg/L
Potassium (K)	1.74	0.04	mg/L
Total Cations meq/Liter		30.86	
		meq/Liter	
Bicarbonate (HCO3)	1150	18.85	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	128	3.61	mg/L
Sulfate (SO4)	370	7.70	mg/L
Total Anions meq/Liter		30.16	

Cation-Anion Balance (RPD) 2.29 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: Ellen J. Mayer

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A Litton Dresser Company

CORE LABORATORIES

ANALYTICAL REPORT
10/09/91

CUSTOMER: Marathon Oil Company

File No..: 911810

CATION/ANION BALANCE

Client Sample I.D..... MW13-BH36
Remark/Project..... 32-03-144
Date/Time Sampled..... 09-25-91/1522
Date/Time Received..... 09-27-91/1025
Laboratory Sample I.D..... 911810-4

PARAMETER	RESULT		UNITS
pH	7.29		pH Units
Conductivity at 25 degrees C	4610		umhos/cm
Alkalinity (as CaCO3)	536		mg/L
Total Diss. Solids (measured)	2790		mg/L
Total Diss. Solids (calculated)	2879		mg/L
		meq/Liter	
Calcium (Ca)	220	10.98	mg/L
Magnesium (Mg)	118	9.71	mg/L
Sodium (Na)	751	32.67	mg/L
Potassium (K)	2.8	0.07	mg/L
Total Cations meq/Liter		53.43	
		meq/Liter	
Bicarbonate (HCO3)	654	10.72	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	1460	41.19	mg/L
Sulfate (SO4)	ND(10)	0.00	mg/L
Total Anions meq/Liter		51.91	

Cation-Anion Balance (RPD) 2.89 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: Ellen J. Nagger

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Western Atlas International
A Litton-Dresser Company

CORE LABORATORIES

ANALYTICAL REPORT
10/09/91

CUSTOMER: Marathon Oil Company

File No..: 911810

CATION/ANION BALANCE

Client Sample I.D..... PIT 16
Remark/Project..... 32-03-144
Date/Time Sampled..... 09-26-91/0900
Date/Time Received..... 09-27-91/1025
Laboratory Sample I.D..... 911810-5

PARAMETER	RESULT		UNITS
pH	7.75		pH Units
Conductivity at 25 degrees C	416		umhos/cm
Alkalinity (as CaCO3)	167		mg/L
Total Diss. Solids (measured)	263		mg/L
Total Diss. Solids (calculated)	206		mg/L
		meq/Liter	
Calcium (Ca)	42.4	2.12	mg/L
Magnesium (Mg)	9.3	0.77	mg/L
Sodium (Na)	8.4	0.37	mg/L
Potassium (K)	3.7	0.09	mg/L
Total Cations meq/Liter		3.34	
		meq/Liter	
Bicarbonate (HCO3)	203	3.33	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	41	1.16	mg/L
Sulfate (SO4)	ND(10)	0.00	mg/L
Total Anions meq/Liter		4.48	

Cation-Anion Balance (RPD) 29.21 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: Ellen J. Naggar

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ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER, Jr.

PTC Project No.: 32-03-144

1. Packed By: RSJr. Date: 9-26-91
2. VOA Vials? YES (NO)
   Secure caps tightly by hand *(DO NOT USE TAPE!)*
3. OTHER BOTTLES? caps sealed w/tape? (YES) NO
4. Coolant? ICE (COLD PAK)
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-26-91
6. Notes/Comments: 1030hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? (YES) NO
2. Coolant Condition: Good/Cold
3. Condition of Contents? Good

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
223 (1)	9-25-91	1430 hrs	MW10-BH33	WATER	1-1Liter(unpreserved)	INORGANICS
(2)					1-500ml w/HNO3	METALS
233 (3)	9-25-91	1443 hrs	MW19-BH42	WATER	1-1Liter(unpreserved)	INORGANICS
(4)					1-500ml w/HNO3	METALS
243 (5)	9-25-91	1500 hrs	MW43-BH66	WATER	1-1Liter(unpreserved)	INORGANICS
(6)					1-500ml w/HNO3	METALS
253 (7)	9-25-91	1522 hrs	MW13-BH36	WATER	1-1Liter(unpreserved)	INORGANICS
(8)					1-500ml w/HNO3	METALS
263 (9)	9-26-91	900 hrs	Pit 16	WATER	1-1Liter(unpreserved)	INORGANICS
(10)					1-500ml w/HNO3	METALS

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed Express Priority One
Airbill #: 1335421076
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	[illegible]	9-27-91	10:25
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

5/14/91

"CONFIDENTIAL BUSINESS INFORMATION"

Western Atlas International
A Union Dresser Company

CORE LABORATORIES

ANALYTICAL REPORT

911773

FOR

MARATHON OIL COMPANY
W. NIXON
P.O. BOX 269
LITTLETON, CO 80160

10/08/91

BTEX, 418.1, Cl⁻

MW 37	BH 60
39	62
47	70
46	69
21	44
18	41
26	49
14	37
35	59
17	40
74	100
75	101
41	64
44	67
RS 5	
A 9	

8015, hex, ngh, phenol, 418.1, 8020, etc.

MW 13	BH 36
MW 19	BH 42
RS 7	
MW 17	BH 33

RECEIVED
NOV 19 1991
OIL CONSERVATION DIV.
SANTA FE

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A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 14:52
WORK DESCRIPTION...: MW37-BH60

LABORATORY I.D...: 911773-0001
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	66	1	mg/L	325.2 (1)	09/27/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*10		8020 (2)	09/27/91	MRC
Benzene	150	10	ug/L			
Toluene	40	10	ug/L			
Ethyl Benzene	140	10	ug/L			
Xylenes	ND	10	ug/L			
Total Petroleum Hydrocarbon	3	1	mg/L	418.1 (1)	09/27/91	MRC

APPROVED BY: Linda L. Benton

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(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 16:50
WORK DESCRIPTION...: MW39-BH62

LABORATORY I.D...: 911773-0002
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	262	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*20		8020 (2)	09/26/91	MRC
Benzene	880	20	ug/L			
Toluene	20	20	ug/L			
Ethyl Benzene	ND	20	ug/L			
Xylenes	ND	20	ug/L			
Total Petroleum Hydrocarbon	1	1	mg/L	418.1 (1)	09/27/91	MRC

APPROVED BY: Linda L. Berkus

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/19/91
TIME SAMPLED.....: 15:55
WORK DESCRIPTION...: MW47-BH70

LABORATORY I.D...: 911773-0003
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	274	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	09/26/91	MRC
Benzene	2600	50	ug/L			
Toluene	100	50	ug/L			
Ethyl Benzene	800	50	ug/L			
Xylenes	ND	50	ug/L			
Total Petroleum Hydrocarbon	4	1	mg/L	418.1 (1)	09/27/91	MRC

APPROVED BY: Linda L. Benkers

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/19/91
TIME SAMPLED.....: 11:20
WORK DESCRIPTION...: MW46-BH69

LABORATORY I.D...: 911773-0004
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	136	1	mg/L	325.2 (1)	09/27/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*20		8020 (2)	09/26/91	MRC
Benzene	140	20	ug/L			
Toluene	40	20	ug/L			
Ethyl Benzene	280	20	ug/L			
Xylenes	ND	20	ug/L			
Total Petroleum Hydrocarbon	3	1	mg/L	418.1 (1)	09/27/91	MRC

APPROVED BY: Linda L. Renkes

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 11:03
WORK DESCRIPTION...: MW21-BH44

LABORATORY I.D...: 911773-0005
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	97	1	mg/L	325.2 (1)	09/27/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	09/26/91	MRC
Benzene	1000	50	ug/L			
Toluene	1800	50	ug/L			
Ethyl Benzene	200	50	ug/L			
Xylenes	2300	50	ug/L			
Total Petroleum Hydrocarbon	7	1	mg/L	418.1 (1)	09/27/91	MRC

APPROVED BY: Linda L. Burkins

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 13:39
WORK DESCRIPTION...: MW18-BH41

LABORATORY I.D...: 911773-0006
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	301	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	09/27/91	MRC
Benzene	4300	100	ug/L			
Toluene	ND	100	ug/L			
Ethyl Benzene	300	100	ug/L			
Xylenes	2500	100	ug/L			
Total Petroleum Hydrocarbon	6	1	mg/L	418.1 (1)	09/30/91	MRC

APPROVED BY: Linda L. Burkes

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Aurora, CO 80012
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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 14:13
WORK DESCRIPTION...: MW26-BH49

LABORATORY I.D...: 911773-0007
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	328	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	09/27/91	MRC
Benzene	3100	100	ug/L			
Toluene	3200	100	ug/L			
Ethyl Benzene	100	100	ug/L			
Xylenes	3500	100	ug/L			
Total Petroleum Hydrocarbon	7	1	mg/L	418.1 (1)	09/30/91	MRC

APPROVED BY: Linda L. Benbow

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/19/91
TIME SAMPLED.....: 16:45
WORK DESCRIPTION...: MW14-BH37

LABORATORY I.D...: 911773-0008
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	289	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	09/27/91	MRC
Benzene	5100	100	ug/L			
Toluene	ND	100	ug/L			
Ethyl Benzene	ND	100	ug/L			
Xylenes	2000	100	ug/L			
Total Petroleum Hydrocarbon	7	1	mg/L	418.1 (1)	09/30/91	MRC

APPROVED BY: Linda L. Berkins

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 09:35
WORK DESCRIPTION...: MW35-BH59

LABORATORY I.D...: 911773-0009
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	521	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	09/26/91	MRC
Benzene	5700	100	ug/L			
Toluene	1100	100	ug/L			
Ethyl Benzene	500	100	ug/L			
Xylenes	3700	100	ug/L			
Total Petroleum Hydrocarbon	7	1	mg/L	418.1 (1)	09/30/91	MRC

APPROVED BY: Linda L. Berkins

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 10:15
WORK DESCRIPTION...: MW17-BH40

LABORATORY I.D...: 911773-0010
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	422	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	09/26/91	MRC
Benzene	2000	50	ug/L			
Toluene	650	50	ug/L			
Ethyl Benzene	ND	50	ug/L			
Xylenes	650	50	ug/L			
Total Petroleum Hydrocarbon	203	1	mg/L	418.1 (1)	09/30/91	MRC

Corelab reviewed raw data - no evident problems

APPROVED BY: Linda L Berkes

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 12:00
WORK DESCRIPTION...: MW74-BH100

LABORATORY I.D...: 911773-0011
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH.
Chloride (Unfilt.)	321	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	09/26/91	MRC
Benzene	5000	100	ug/L			
Toluene	ND	100	ug/L			
Ethyl Benzene	400	100	ug/L			
Xylenes	2900	100	ug/L			
Total Petroleum Hydrocarbon	5	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Burkes

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 13:00
WORK DESCRIPTION...: MW75-BH101

LABORATORY I.D...: 911773-0012
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	333	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	09/26/91	MRC
Benzene	3800	100	ug/L			
Toluene	3600	100	ug/L			
Ethyl Benzene	300	100	ug/L			
Xylenes	3700	100	ug/L			
Total Petroleum Hydrocarbon	9	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Burkins

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Aurora, CO 80012
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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 08:59
WORK DESCRIPTION...: MW41-BH64

LABORATORY I.D...: 911773-0013
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	123	1	mg/L	325.2 (1)	09/27/91	DT.
8020 - AROMATIC VOLATILE ORGANICS		*10		8020 (2)	09/26/91	MRC
Benzene	200	10	ug/L			
Toluene	40	10	ug/L			
Ethyl Benzene	120	10	ug/L			
Xylenes	ND	10	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/01/91	MK

APPROVED BY: Linda L. Burkes

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 10:05
WORK DESCRIPTION...: MW44-BH67

LABORATORY I.D...: 911773-0014
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	246	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	09/26/91	MRC
Benzene	59	1	ug/L			
Toluene	21	1	ug/L			
Ethyl Benzene	5	1	ug/L			
Xylenes	3	1	ug/L			
Total Petroleum Hydrocarbon	1	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Berkers

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10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 12:20
WORK DESCRIPTION...: MW13-BH36

LABORATORY I.D...: 911773-0015
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	1540	1	mg/L	325.2 (1)	09/30/91	MW
Phenols (Unfilt.)	0.06	0.05	mg/L	420.1 (1)	09/30/91	MRC
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	09/26/91	MRC
Benzene	3100	100	ug/L			
Toluene	2500	100	ug/L			
Ethyl Benzene	400	100	ug/L			
Xylenes	2500	100	ug/L			
8240 - VOLATILE ORGANICS		*10		8240 (2)	09/27/91	MLD
n-Hexane	2100	50	ug/L			
Naphthalene	<50	50	ug/L	8240 (2)	10/04/91	DFM
Total Petroleum Hydrocarbon	48	1	mg/L	418.1 (1)	10/01/91	MW
8015(Mod) - Hydrocarbon ID - TPH	110	10	mg/L as Condst	8015 (Modified) (2)	10/02/91	MRC

APPROVED BY: Linda L. Burkers

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 12:52
WORK DESCRIPTION...: MW19-BH42

LABORATORY I.D...: 911773-0016
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	367	1	mg/L	325.2 (1)	09/30/91	MI
Phenols (Unfilt.)	<0.05	0.05	mg/L	420.1 (1)	09/30/91	MRC
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	09/27/91	MRC
Benzene	4700	100	ug/L			
Toluene	ND	100	ug/L			
Ethyl Benzene	500	100	ug/L			
Xylenes	900	100	ug/L			
8240 - VOLATILE ORGANICS		*10		8240 (2)	09/27/91	MLI
n-Hexane	1100	50	ug/L			
N[illegible]halene	<50	50	ug/L	8240 (2)	10/04/91	DFP
Total Petroleum Hydrocarbon	4	1	mg/L	418.1 (1)	10/01/91	MI
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L as Condst	8015 (Modified) (2)	10/02/91	MRC

APPROVED BY: Linda L. Burkes

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/22/91
TIME SAMPLED.....: 15:20
WORK DESCRIPTION...: RS-7

LABORATORY I.D...: 911773-0017
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	19	1	mg/L	325.2 (1)	09/27/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*20		8020 (2)	09/26/91	MRC
Benzene	260	20	ug/L			
Toluene	240	20	ug/L			
Ethyl Benzene	ND	20	ug/L			
Xylenes	780	20	ug/L			
Total Petroleum Hydrocarbon	3	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Benkes

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 13:45
WORK DESCRIPTION...: MW10-BH33

LABORATORY I.D...: 911773-0018
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	335	1	mg/L	325.2 (1)	09/30/91	MS
Phenols (Unfilt.)	0.07	0.05	mg/L	420.1 (1)	09/30/91	MRC
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	09/27/91	MRC
Benzene	2300	50	ug/L			
Toluene	400	50	ug/L			
Ethyl Benzene	ND	50	ug/L			
Xylenes	2000	50	ug/L			
8240 - VOLATILE ORGANICS		*10		8240 (2)	09/27/91	MLC
n-Hexane	610	50	ug/L			
N[illegible]chalene	<50	50	ug/L	8240 (2)	10/05/91	DFP
Total Petroleum Hydrocarbon	15	1	mg/L	418.1 (1)	10/01/91	MS
8015(Mod) - Hydrocarbon ID - TPH	32	10	mg/L as Condst	8015 (Modified) (2)	10/02/91	MRC

APPROVED BY: Linda L. Benbess

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/22/91
TIME SAMPLED.....: 15:50
WORK DESCRIPTION...: RS-5

LABORATORY I.D...: 911773-0019
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	78	1	mg/L	325.2 (1)	09/27/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*20		8020 (2)	09/26/91	MRC
Benzene	1100	20	ug/L			
Toluene	600	20	ug/L			
Ethyl Benzene	ND	20	ug/L			
Xylenes	880	20	ug/L			
Total Petroleum Hydrocarbon	4	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Berkes

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911773 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGPP)
DATE SAMPLED.....: 09/22/91
TIME SAMPLED.....: 16:23
WORK DESCRIPTION...: A9

LABORATORY I.D...: 911773-0020
DATE RECEIVED....: 09/24/91
TIME RECEIVED....: 10:05
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	194	1	mg/L	325.2 (1)	09/27/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	09/27/91	MRC
Benzene	700	50	ug/L			
Toluene	500	50	ug/L			
Ethyl Benzene	100	50	ug/L			
Xylenes	1800	50	ug/L			
Total Petroleum Hydrocarbon	7	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Berkness

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CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621/Fax (505) 457-2544

CONTACT: Ralph Skinner Jr

PTC Project No.: 32-03-144
Petroleum Technology Center, Marathon Oil Company, Littleton, CO

1. Packed By: R.S.Jr. Date: 9-23-91
2. VOA Vials? (YES) NO
   Secure caps tightly by hand *(DO NOT USE TAPE!)*
3. OTHER BOTTLES? ~~caps sealed w/tape?~~ (YES) NO
4. Coolant? ICE (COLD PAK)
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-23-91
6. Notes/Comments: @ 1515 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Core Laboratories
Street Address: 1300 S. Potomac Street, Suite 130
City/State/ZIP: Aurora, Colorado 80012
Phone: (303) 751-1780
FAX: (303) 751-1784

SHIPMENT RECEIVED - OBSERVATIONS

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

		SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
1	(1)	9-20-91	1452 hrs	MW 37-BH60	WATER	3-VOA Vials w/HCL	BTEX (METHOD 8020)
	(2)					1-VOA Vial	Cl- (unpreserved)
	(3)					1-1 Liter glass w/H_2SO_4	TPH (METHOD 418.1)
	(4)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	(5)					[redacted]	[redacted]
	(6)					[redacted]	[redacted]
2	(7)	9-20-91	1650 hrs	MW 39-BH62	WATER	3-VOA Vials w/HCL	BTEX (METHOD 8020)
	(8)					1-VOA Vial	Cl- (unpreserved)
	(9)					1-1 Liter glass w/H_2SO_4	TPH (METHOD 418.1)
	(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420973
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):	[illegible]	9-24-91	10:05
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):			

Original: Laboratory Retains; 1st Carbon Copy: Laboratory Retains; 2nd Carbon Copy: Sender R

6/1/91

CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621/Fax (505) 457-2544

CONTACT: RALPH SKINNER, Jr.

PTC Project No.: 32-03-144
Petroleum Technology Center, Marathon Oil Company, Littleton, CO

1. Packed By: Ralph Date: 9-23-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? ~~caps sealed w/tape?~~ YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-23-91
6. Notes/Comments: 1515 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Core Laboratories
Street Address: 1300 S. Potomac Street, Suite 130
City/State/ZIP: Aurora, Colorado 80012
Phone: (303) 751-1780
FAX: (303) 751-1784

SHIPMENT RECEIVED - OBSERVATIONS

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
(1)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
(2)					[redacted]	[redacted]
(3)					[redacted]	[redacted]
(4)					[redacted]	[redacted]
(5)					[redacted]	[redacted]
(6)					[redacted] H_2SO_4	[redacted]
(7)					[redacted]	[redacted]
3 (8)	9-19-91	1555hrs	MW47-BH70	WATER	3-VOA Vials w/HCL	BTEX (METHOD 8020)
(9)					1-VOA Vial	Cl^- (unpreserved)
(10)					1-1 Liter glass w/H_2SO_4	TPH (METHOD 418.1)

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420973
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):	[illegible]	9-24-91	10:05
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):			

Original: Laboratory Retains; 1st Carbon Copy: Laboratory Retains; 2nd Carbon Copy: Sender Retains

6/1/91

CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621/Fax (505) 457-2544

CONTACT: RALPH SKINNER, JR.

PTC Project No.: 32-03-144
Petroleum Technology Center, Marathon Oil Company, Littleton, CO

1. Packed By: RSJr. Date: 9-23-91
2. VOA Vials? YES NO
   Secure caps tightly by hand *(DO NOT USE TAPE!)*
3. OTHER BOTTLES? caps ~~sealed~~ w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-23-91
6. Notes/Comments: 1515hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Core Laboratories
Street Address: 1300 S. Potomac Street, Suite 130
City/State/ZIP: Aurora, Colorado 80012
Phone: (303) 751-1780
FAX: (303) 751-1784

SHIPMENT RECEIVED - OBSERVATIONS

1. SEAL Intact? YES NO
2. Coolant Condition: Good/cold
3. Condition of Contents? Good

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
(1)	~~9-18-91~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
(2)					~~[illegible]~~	~~[illegible]~~
(3)					~~[illegible]~~ W/H_2SO_4	~~[illegible]~~
(4)	~~9-18-91~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
(5)					~~[illegible]~~	~~[illegible]~~
(6)					~~[illegible]~~	~~[illegible]~~
4 (7)	9-19-91	1120hrs	MW46-BH69	WATER	3-VOA VIALS W/HCL	BTEX (METHOD 8020)
(8)					1-VOA VIAL	CL- (unpreserved)
(9)					1-1 Liter glass W/H_2SO_4	TPH (METHOD 418.1)
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed Express Priority One
Airbill #: 1335420973
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	[illegible]	9-24-91	10:05
Relinquished by: (signed):			
Received by: (signed):			

Original: Laboratory Retains; 1st Carbon Copy: Laboratory Retains; 2nd Carbon Copy: Sender

6/7/91

CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621/Fax (505) 457-2544

CONTACT: RALPH SKINNER, Jr.

PTC Project No.: 32-03-144
##########################

1. Packed By: RSJr. Date: 9-23-91
2. VOA Vials? (YES) NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? ~~caps sealed w/tape~~ (YES) NO
4. Coolant? ICE (COLD PAK)
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-23-91
6. Notes/Comments: 15/5 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Core Laboratories
Street Address: 1300 S. Potomac Street, Suite 130
City/State/ZIP: Aurora, Colorado 80012
Phone: (303) 751-1780
FAX: (303) 751-1784

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? (YES) NO
2. Coolant Condition: Cold
3. Condition of Contents? Good

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
5 (1)	9-20-91	1103 hrs	MW21-BH44	WATER	3-VOA Vials w/HCL	BTEX (METHOD 8020)
(2)					1-VOA Vial	CL- (unpreserved)
(3)					1-1 Liter glass w/H_2SO_4	TPH (METHOD 418.1)
6 (4)	9-20-91	1339 hrs	MW18-BH41	WATER	3-VOA Vials w/HCL	BTEX (METHOD 8020)
(5)					1-VOA Vial	CL- (unpreserved)
(6)					1-1 Liter glass w/H_2SO_4	TPH (METHOD 418.1)
7 (7)	9-20-91	1413 hrs	MW26-BH49	WATER	3-VOA Vials w/HCL	BTEX (METHOD 8020)
(8)					1-VOA Vial	CL- (unpreserved)
(9)					1-1 Liter glass w/H_2SO_4	TPH (METHOD 418.1)
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420973
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	[illegible]	9-24-91	10:05
Relinquished by: (signed):			
Received by: (signed):			

Original 1 Laboratory Retains; 1st Carbon Copy: Laboratory Retains; 2nd Carbon Copy: Sender Retains

6/1/91

CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621/Fax (505) 457-2544

CONTACT: RALPH SKINNER, Jr.

PTC Project No.: 32-03-144
##########################

1. Packed By: RJS. Date: 9-23-91
2. VOA Vials? YES NO
   Secure caps tightly by hand *(DO NOT USE TAPE!)*
3. OTHER BOTTLES? caps ~~sealed w/tape~~? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-23-91
6. Notes/Comments: 1515 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Core Laboratories
Street Address: 1300 S. Potomac Street, Suite 130
City/State/ZIP: Aurora, Colorado 80012
Phone: (303) 751-1780
FAX: (303) 751-1784

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
8 (1)	9-19-91	1645 hrs	MW14-BH37	WATER	3-VOA VIALS W/HCL	BTEX (METHOD 8020)
(2)					1-VOA VIAL	CL- (unpreserved)
(3)					1-1 Liter glass W/H_2SO_4	TPH (METHOD 418.1)
9 (4)	9-20-91	935 hrs	MW35-BH59	WATER	3-VOA VIALS W/HCL	BTEX (METHOD 8020)
(5)					1-VOA VIAL	CL- (unpreserved)
(6)					1-1 Liter glass W/H_2SO_4	TPH (METHOD 418.1)
10 (7)	9-20-91	1015 hrs	MW17-BH40	WATER	3-VOA VIALS W/HCL	BTEX (METHOD 8020)
(8)					1-VOA VIAL	CL- (unpreserved)
(9)					1-1 Liter glass W/H_2SO_4	TPH (METHOD 418.1)
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420973
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	Darryl Ng	9-24-91	10:05
Relinquished by: (signed):			
Received by: (signed):			

Origin al Laboratory Retains; 1st Carbon Copy: Laboratory Retains; 2nd Carbon Copy: Send ains

6/1/91

CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621/Fax (505) 457-2544

CONTACT: RALPH SKINNER Jr.

PTC Project No.: 32-03-144
##########################

1. Packed By: RJr. Date: 9-23-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-23-91
6. Notes/Comments: 1515 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Core Laboratories
Street Address: 1300 S. Potomac Street, Suite 130
City/State/ZIP: Aurora, Colorado 80012
Phone: (303) 751-1780
FAX: (303) 751-1784

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

		SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
11	(1)	9-20-91	1200 hrs	MW 74-BH 100	WATER	3-VOA VIALS W/HCL	BTEX (METHOD 8020)
	(2)					1-VOA VIAL	CL-(unpreserved)
	(3)					1-1 Literglass w/H_2SO_4	TPH (METHOD 418.1)
12	(4)	9-20-91	1300 hrs	MW 75-BH 101	WATER	3-VOA VIALS W/HCL	BTEX (METHOD 8020)
	(5)					1-VOA VIAL	CL-(unpreserved)
	(6)					1-1 Literglass w/H_2SO_4	TPH (METHOD 418.1)
13	(7)	9-21-91	859 hrs	MW 41-BH 64	WATER	3-VOA VIALS W/HCL	BTEX (METHOD 8020)
	(8)					1-VOA VIAL	CL-(unpreserved)
	(9)					1-1 Literglass w/H_2SO_4	TPH (METHOD 418.1)
	(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420973
Rec'd for Lab: Date: Time:
Assigned Laboratory Number: 4

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	[illegible]	9-23-91	10:05
Relinquished by: (signed):			
Received by: (signed):			

Origin Final Laboratory Retains; 1st Carbon Copy: Laboratory Retains; 2nd Carbon Copy: Sen etains

6/7/91

CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621/Fax (505) 457-2544

CONTACT: Ralph Skinner Jr

PTC Project No.: 32-03-144

\#

1. Packed By: RSJr. Date: 9-23-91
2. VOA Vials? YES NO
   Secure caps tightly by hand *(DO NOT USE TAPE!)*
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-23-91
6. Notes/Comments: 1515 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Core Laboratories
Street Address: 1300 S. Potomac Street, Suite 130
City/State/ZIP: Aurora, Colorado 80012
Phone: (303) 751-1780
FAX: (303) 751-1784

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

		SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
14	(1)	9-21-91	1005 hrs	MW 44-BH67	WATER	3-VOA Vials w/HCL	BTEX (METHOD 8020)
	(2)					1-VOA Vial	CL- (unpreserved)
	(3)					1-1 Liter glass w/ H_2SO_4	TPH (METHOD 418.1)
15	(4)	9-21-91	1220 hrs	MW13-BH36	WATER	3-VOA Vials w/HCL	BTEX (METHOD 8020)
	(5)					1-VOA Vial	CL- (unpreserved)
	(6)					1-1 Liter glass w/ H_2SO_4	TPH (METHOD 418.1)
	(7)					2-VOA Vials w/HCL	NAPHTHALENE-HEXANE-TPH (8015)
	(8)					1-1 Liter plastic	INORGANICS (unpreserved)
	(9)					1-500 ML Brown w/ H_2SO_4	PHENOLS
	(10)					1-VOA Vial	TPH (8015) unpreserved

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420973
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	[illegible]	9-24-91	10:05
Relinquished by: (signed):			
Received by: (signed):			

Original: Laboratory Retains; 1st Carbon Copy: Laboratory Retains; 2nd Carbon Copy: Send ... ains

6/7/91

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER, Jr.

PTC Project No.: 32-03-144

##########################

1. Packed By: RSJr. Date: 9-23-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-23-91
6. Notes/Comments: 155 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
16 (1)	9-21-91	1252 hrs	MW 19-BH42	WATER	3-VOA VIALS W/HCL	BTEX (8020)
(2)					1-VOA VIAL	CL-(unpreserved)
(3)					1-1 Liter glass W/H_2SO_4	TPH (418.1)
(4)					2-VOA VIALS W/HCL	NAPHTHALENE - HEXANE TPH (8015)
(5)					1-1 Liter plastic	INORGANICS (unpreserved)
(6)					1-500ML BROWN W/H_2SO_4	PHENOLS
(7)					1-VOA VIAL	TPH (8015) unpreserved
17 (8)	9-22-91	1520 hrs	RS-7	WATER	3-VOA VIALS W/HCL	BTEX (8020)
(9)					1-VOA VIAL	CL-(unpreserved)
(10)					1-1 Liter glass W/H_2SO_4	TPH (418.1)

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420973
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	[signature]	9-29-91	10:05
Relinquished by: (signed):			
Received by: (signed):			

Origin: al Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retain

5/14/91

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER Jr.

PTC Project No.: 32-03-144

##########################

1. Packed By: RSJr. Date: 9-23-91
2. VOA Vials? YES NO
   Secure caps tightly by hand *(DO NOT USE TAPE!)*
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-23-91
6. Notes/Comments: 1515hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
18 (1)	9-21-91	1345hrs	MW10-BH33	WATER	3-VOA VIALS w/HCL	BTEX(8020)
(2)					1-VOA VIAL	CL-(unpreserved)
(3)					1-1 Liter glass w/H_2SO_4	TPH (418.1)
(4)					2-VOA VIALS w/HCL	NAPHTHALENE - HEXANE - TPH (8015)
(5)					1-1 Liter plastic	INORGANICS(unpreserved)
(6)					1-500ml BROWN w/H_2SO_4	Phenols
(7)					1-VOA VIAL	TPH(8015) unpreserved
19 (8)	9-22-91	1550hrs	RS-5	WATER	3-VOA VIALS w/HCL	BTEX(8020)
(9)					1-VOA VIAL	CL-(unpreserved)
(10)					1-1 Liter glass w/H_2SO_4	TPH (418.1)

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420973
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):	[illegible]	9-23-91	10:05
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):			

Original: Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

3/1/91

CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621/Fax (505) 457-2544

CONTACT: RALPH SKINNER, JR.

PTC Project No.: 32-03-144
Petroleum Technology Center, Marathon Oil Company, Littleton, CO

1. Packed By: RJr. Date: 9-23-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps ~~sealed w/~~tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-23-91
6. Notes/Comments: 1515hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Core Laboratories
Street Address: 1300 S. Potomac Street, Suite 130
City/State/ZIP: Aurora, Colorado 80012
Phone: (303) 751-1780
FAX: (303) 751-1784

SHIPMENT RECEIVED - OBSERVATIONS

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

20

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
(1)	9-22-91	1623 hrs	A9	WATER	3-VOA VIALS w/HCL	BTEX (8020)
(2)					1-VOA VIAL	CL- (unpreserved)
(3)					1-1 Liter glass w/ H_2SO_4	TPH (418.1)
(4)						
(5)						
(6)						
(7)						
(8)						
(9)						
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335420973
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	[illegible]	9-23-91	10:05
Relinquished by: (signed):			
Received by: (signed):			

Original l Laboratory Retains; 1st Carbon Copy: Laboratory Retains; 2nd Carbon Copy: Sende ains

6/7/91

"CONFIDENTIAL BUSINESS INFORMATION"

PC File

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

RECEIVED
NOV 19 1991
OIL CONSERVATION DIV
SANTA FE

ANALYTICAL REPORT

911793

FOR

MARATHON OIL COMPANY
W. NIXON
P.O. BOX 269
LITTLETON, CO 80160

10/08/91

Indian Basin 9/91 "Point in Time"

BH	Cl, ppm	B	T	E	X	BTEX ppm	418. TPH, ppm	8015
		parts per billion						
RS-2	54	400	80	80	720	1.28	3	---
66	94	320	20	<5	<5		<1	<10
61	101	15	32	13	17		<1	---
45	28	4	<1	<1	9		<1	---
P16	11.7	<1	<1	<1	2		6	<10
A11	342	1400	1300	200	3400		<1	19
RS-4	32	30	15	<5	20		1	
RS-8	3.8	<1	1	<1	<1		<1	
55	3.8	<1	<1	<1	<1		52	
71	414	<1	2	<1	7		<1	
74	405	800	3700	<100	6100		<1	
75	4.4	<1	<1	<1	<1		<1	
34	573	3000	5200	<200	3600		7	
38	172	5100	1000	200	4100		3	
57	573	6300	4900	400	4800		6	
35	251	3800	6400	200	3800		5	
58	978	2500	1800	300	2400		41	
77	8.5	<1	<1	<1	<1		<1	
95	156	2400	6600	<200	4000		6	
47	454	3400	1300	<100	4500		30	
52	106	2200	150	100	650		2	
39	94	1700	3800	200	3100		5	
43	336	110	12	<2	70		<1	

Also BTEX 418.1, 8015, naph, hex, phenols
BH66
pitwell 16
pitwell A11

The analyses, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgement of Core Laboratories. Core Laboratories, however, assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, proper operations, or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced, except in its entirety, without the written approval of Core Laboratories.

"CONFIDENTIAL BUSINESS INFORMATION"

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/22/91
TIME SAMPLED.....: 18:23
WORK DESCRIPTION...: RS-2

LABORATORY I.D...: 911793-0001
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	54	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*20		8020 (2)	10/03/91	MRC
Benzene	400	20	ug/L			
Toluene	80	20	ug/L			
Ethyl Benzene	80	20	ug/L			
Xylenes	720	20	ug/L			
Total Petroleum Hydrocarbon	3	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Berkins

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/19/91
TIME SAMPLED.....: 14:20
WORK DESCRIPTION...: MW43-BH66

LABORATORY I.D...: 911793-0002
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	94	1	mg/L	325.2 (1)	09/30/91	MW
Phenols (Unfilt.)	<0.05	0.05	mg/L	420.1 (1)	10/02/91	RMN
8020 - AROMATIC VOLATILE ORGANICS		*5		8020 (2)	10/03/91	MRC
Benzene	320	5	ug/L			
Toluene	20	5	ug/L			
Ethyl Benzene	ND	5	ug/L			
Xylenes	ND	5	ug/L			
8240 - VOLATILE ORGANICS		*1		8240 (2)	09/27/91	MLD
n-Hexane	<5	5	ug/L			
Napnthalene	< 5	5	ug/L	8240 (2)	10/05/91	DFM
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/01/91	MW
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Condst	8015 (Modified) (2)	10/02/91	MRC

APPROVED BY: Linda L. Perkins

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 16:29
WORK DESCRIPTION...: MW38-BH61

LABORATORY I.D...: 911793-0003
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	101	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/01/91	MRC
Benzene	15	1	ug/L			
Toluene	32	1	ug/L			
Ethyl Benzene	13	1	ug/L			
Xylenes	17	1	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Rankins

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10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 15:00
WORK DESCRIPTION...: MW22-BH45

LABORATORY I.D...: 911793-0004
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	28	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/01/91	MRC
Benzene	4	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	9	1	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Benbow

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10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 10:10
WORK DESCRIPTION...: PIT WELL #16

LABORATORY I.D...: 911793-0005
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	11.7	0.5	mg/L	325.2 (1)	10/02/91	PJM
Phenols (Unfilt.)	<0.05	0.05	mg/L	420.1 (1)	10/02/91	RMN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/01/91	MRC
. Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	2	1	ug/L			
8240 - VOLATILE ORGANICS		*1		8240 (2)	09/27/91	MLD
n-Hexane	11	5	ug/L			
Naphthalene	< 5	5	ug/L	8240 (2)	10/05/91	DFM
Total Petroleum Hydrocarbon	6	1	mg/L	418.1 (1)	10/01/91	MW
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Condst	8015 (Modified) (2)	10/02/91	MRC

APPROVED BY: Linda L. Barbour

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 13:52
WORK DESCRIPTION...: PIT WELL A11

LABORATORY I.D...: 911793-0006
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	342	1	mg/L	325.2 (1)	09/30/91	MW
Phenols (Unfilt.)	<0.05	0.05	mg/L	420.1 (1)	10/02/91	RMN
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	10/03/91	MRC
Benzene	1400	100	ug/L			
Toluene	1300	100	ug/L			
Ethyl Benzene	200	100	ug/L			
Xylenes	3400	100	ug/L			
8240 - VOLATILE ORGANICS		*10		8240 (2)	09/28/91	MLD
-Hexane	2600	50	ug/L			
Naphthalene	<10	10	ug/L	8240 (2)	10/05/91	DFM
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/01/91	MW
8015(Mod) - Hydrocarbon ID - TPH	19	10	mg/L Condst	8015 (Modified) (2)	10/02/91	MRC

APPROVED BY: Linda L. Burkes

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10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 18:08
WORK DESCRIPTION...: RS-4 (4"PVC)

LABORATORY I.D...: 911793-0007
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH.
Chloride (Unfilt.)	32	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*5		8020 (2)	10/03/91	MRC
Benzene	30	5	ug/L			
Toluene	15	5	ug/L			
Ethyl Benzene	ND	5	ug/L			
Xylenes	20	5	ug/L			
Total Petroleum Hydrocarbon	1	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Berkins

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 17:40
WORK DESCRIPTION...: RS-8 (4"PVC)

LABORATORY I.D...: 911793-0008
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	3.8	0.5	mg/L	325.2 (1)	10/02/91	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/01/91	MRC
Benzene	ND	1	ug/L			
Toluene	1	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Burkes

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 15:30
WORK DESCRIPTION...: MW-31,BH-55

LABORATORY I.D...: 911793-0009
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	3.8	0.5	mg/L	325.2 (1)	10/02/91	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/01/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	52	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Barbus

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 09:25
WORK DESCRIPTION...: MW-48,BH-71

LABORATORY I.D...: 911793-0010
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	414	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/01/91	MRC
Benzene	ND	1	ug/L			
Toluene	2	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	7	1	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Burkus

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10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 12:30
WORK DESCRIPTION...: MW-51,BH-74

LABORATORY I.D...: 911793-0011
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	405	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	10/03/91	MRC
Benzene	800	100	ug/L			
Toluene	3700	100	ug/L			
Ethyl Benzene	ND	100	ug/L			
Xylenes	6100	100	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Benkine

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 10:20
WORK DESCRIPTION...: MW-52,BH-75

LABORATORY I.D...: 911793-0012
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	4.4	0.5	mg/L	325.2 (1)	10/02/91	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/01/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/01/91	MW

APPROVED BY: Linda L. Burkhart

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JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 14:30
WORK DESCRIPTION...: MW-11,BH-34

LABORATORY I.D...: 911793-0013
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	573	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*200		8020 (2)	10/03/91	MRC
Benzene	3000	200	ug/L			
Toluene	5200	200	ug/L			
Ethyl Benzene	ND	200	ug/L			
Xylenes	3600	200	ug/L			
Total Petroleum Hydrocarbon	7	1	mg/L	418.1 (1)	10/03/91	MRC

APPROVED BY: Linda L. Burkes

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10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 14:00
WORK DESCRIPTION...: MW-15,BH-38

LABORATORY I.D...: 911793-0014
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	172	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	10/03/91	MRC
Benzene	5100	100	ug/L			
Toluene	1000	100	ug/L			
Ethyl Benzene	200	100	ug/L			
Xylenes	4100	100	ug/L			
Total Petroleum Hydrocarbon	3	1	mg/L	418.1 (1)	10/03/91	MRC

APPROVED BY: Linda L. Burkes

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 14:00
WORK DESCRIPTION...: MW-33,BH-57

LABORATORY I.D...: 911793-0015
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	573	1	mg/L	325.2 (1)	09/30/91	MW
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	10/03/91	MRC
Benzene	6300	100	ug/L			
Toluene	4900	100	ug/L			
Ethyl Benzene	400	100	ug/L			
Xylenes	4800	100	ug/L			
Total Petroleum Hydrocarbon	6	1	mg/L	418.1 (1)	10/03/91	MRC

APPROVED BY: Linda J. Benbess

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

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"CONFIDENTIAL BUSINESS INFORMATION"

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 15:40
WORK DESCRIPTION...: MW-12,BH-35

LABORATORY I.D...: 911793-0016
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	251	1	mg/L	325.2 (1)	10/02/91	PJM
8020 - AROMATIC VOLATILE ORGANICS		*200		8020 (2)	10/03/91	MRC
Benzene	3800	200	ug/L			
Toluene	6400	200	ug/L			
Ethyl Benzene	200	200	ug/L			
Xylenes	3800	200	ug/L			
Total Petroleum Hydrocarbon	5	1	mg/L	418.1 (1)	10/03/91	MRC

APPROVED BY: Linda L. Berkins

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Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/21/91
TIME SAMPLED.....: 17:51
WORK DESCRIPTION...: MW-34,BH-58

LABORATORY I.D...: 911793-0017
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	978	1	mg/L	325.2 (1)	10/02/91	PJM
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	10/03/91	MRC
Benzene	2500	50	ug/L			
Toluene	1800	50	ug/L			
Ethyl Benzene	300	50	ug/L			
Xylenes	2400	50	ug/L			
Total Petroleum Hydrocarbon	41	1	mg/L	418.1 (1)	10/03/91	MRC

APPROVED BY: Linda L. Berkins

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Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/19/91
TIME SAMPLED.....: 13:34
WORK DESCRIPTION...: MW-53,BH-77

LABORATORY I.D...: 911793-0018
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	8.5	0.5	mg/L	325.2 (1)	10/02/91	PJM
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/01/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/03/91	MRC

APPROVED BY: Linda L. Benbow

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/19/91
TIME SAMPLED.....: 15:00
WORK DESCRIPTION...: MW-69,BH-95

LABORATORY I.D...: 911793-0019
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	156	1	mg/L	325.2 (1)	10/02/91	PJM
8020 - AROMATIC VOLATILE ORGANICS		*200		8020 (2)	10/03/91	MRC
Benzene	2400	200	ug/L			
Toluene	6600	200	ug/L			
Ethyl Benzene	ND	200	ug/L			
Xylenes	4000	200	ug/L			
Total Petroleum Hydrocarbon	6	1	mg/L	418.1 (1)	10/03/91	MRC

APPROVED BY: Linda L. Berkins

1300 S. Potomac St., Suite 130
Aurora, CO 80012
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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/19/91
TIME SAMPLED.....: 16:44
WORK DESCRIPTION...: MW-24,BH-47

LABORATORY I.D...: 911793-0020
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	454	1	mg/L	325.2 (1)	10/02/91	PJM
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	10/03/91	MRC
Benzene	3400	100	ug/L			
Toluene	1300	100	ug/L			
Ethyl Benzene	ND	100	ug/L			
Xylenes	4500	100	ug/L			
Total Petroleum Hydrocarbon	30	1	mg/L	418.1 (1)	10/03/91	MRC

APPROVED BY: Linda L. Burkes

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/19/91
TIME SAMPLED.....: 17:06
WORK DESCRIPTION...: MW-28,BH-52

LABORATORY I.D...: 911793-0021
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	106	1	mg/L	325.2 (1)	10/02/91	PJM
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	10/03/91	MRC
Benzene	2200	50	ug/L			
Toluene	150	50	ug/L			
Ethyl Benzene	100	50	ug/L			
Xylenes	650	50	ug/L			
Total Petroleum Hydrocarbon	2	1	mg/L	418.1 (1)	10/03/91	MRC

APPROVED BY: Linda L. Benkins

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Aurora, CO 80012
(303) 751-1780

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LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 13:00
WORK DESCRIPTION...: MW-16,BH-39

LABORATORY I.D...: 911793-0022
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	94	1	mg/L	325.2 (1)	10/02/91	PJM
8020 - AROMATIC VOLATILE ORGANICS		*100		8020 (2)	10/03/91	MRC
Benzene	1700	100	ug/L			
Toluene	3800	100	ug/L			
Ethyl Benzene	200	100	ug/L			
Xylenes	3100	100	ug/L			
Total Petroleum Hydrocarbon	5	1	mg/L	418.1 (1)	10/03/91	MRC

APPROVED BY: Linda L. Benbow

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Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

LABORATORY TESTS RESULTS
10/08/91

JOB NUMBER: 911793 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN (IBGP)
DATE SAMPLED.....: 09/20/91
TIME SAMPLED.....: 13:20
WORK DESCRIPTION...: MW-20,BH-43

LABORATORY I.D...: 911793-0023
DATE RECEIVED....: 09/26/91
TIME RECEIVED....: 10:10
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
Chloride (Unfilt.)	336	1	mg/L	325.2 (1)	10/02/91	PJM
8020 - AROMATIC VOLATILE ORGANICS		*2		8020 (2)	10/01/91	MRC
Benzene	110	2	ug/L			
Toluene	12	2	ug/L			
Ethyl Benzene	ND	2	ug/L			
Xylenes	70	2	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	10/03/91	MRC

APPROVED BY: Linda L. Berkas

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

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ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: Ralph Skinner, Jr.

PTC Project No.: 32-03-144

1. Packed By: [illegible] Date: 9-25-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-25-91
6. Notes/Comments: 1100 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
✓(1)	9-22-91	1823 hrs	RS-2	WATER	3-VOA Vials w/HCL	BTEX (8020)
(2)					1-VOA Vial (unpreserved)	Cl-
(3)					1-1 Liter glass w/H_2SO_4	TPH (418.1)
✓(4)	9-19-91	1420 hrs	MW43-BH66	WATER	3-VOA Vials w/HCL	BTEX (8020)
(5)					1-VOA Vial (unpreserved)	Cl-
(6)					1-1 Liter glass w/H_2SO_4	TPH (418.1)
(7)					2-VOA Vials w/HCL	NAPHTHALENE - HEXANE TPH (8015)
(8)					1-500ml BROWN w/H_2SO_4	PHENOLS
(9)						
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335421065
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):	[illegible]	9-26-91	10:10
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

3/14/91

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER, Jr.

PTC Project No.: 32-03-144

1. Packed By: RSJr. Date: 9-25-91
2. VOA Vials? (YES) NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? (YES) NO
4. Coolant? ICE (COLD PAK)
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-25-91
6. Notes/Comments: 1100 hrs

##########

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
3 (1)	9-20-91	1629 hrs	MW 38-BH61	WATER	3-VOA Vials w/HCL	BTEX (8020)
(2)					1-VOA Vial (unpreserved)	CL-
(3)					1-1 Liter glass w/H_2SO_4	TPH (418.1)
4 (4)	9-21-91	1500 hrs	MW 22-BH45	WATER	3-VOA Vial w/HCL	BTEX (8020)
(5)					1-VOA Vial (unpreserved)	CL-
(6)					1-1 Liter glass w/H_2SO_4	TPH (418.1)
(7)						
(8)						
(9)						
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335421065
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):	[illegible]	9-26-9	10:10
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

5/14/91

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER, JR.

PTC Project No.: 32-03-144

1. Packed By: [illegible] Date: 9-25-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-25-91
6. Notes/Comments: 1100 hrs.

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

		SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
5	(1)	9-21-91	1010 hrs	Pit Well #16	WATER	3-VOA VIALS W/HCL	BTEX (8020)
	(2)					1-VOA VIAL (UNPRESERVED)	CL-
	(3)					1-1 Liter glass W/H_2SO_4	TPH (418.1)
	(4)					2-VOA VIALS W/HCL	NAPHTHALENE-HEXANE-TPH (8015)
	(5)					1-500ml BROWN W/H_2SO_4	PHENOLS
6	(6)	9-21-91	1352 hrs	Pit Well A11	WATER	3-VOA VIALS W/HCL	BTEX (8020)
	(7)					1-VOA VIAL (UNPRESERVED)	CL-
	(8)					1-1 Liter glass W/H_2SO_4	TPH (418.1)
	(9)					2-VOA VIALS W/HCL	NAPHTHALENE-HEXANE TPH (8015)
	(10)					1-500ml BROWN W/H_2SO_4	PHENOLS

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner, Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335421065
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):	[illegible]	9-26-91	12:10
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

3/14/91

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER JR.

PTC Project No.: 32-03-144

1. Packed By: RSJr. Date: 9-25-91
2. VOA Vials? YES NO
   Secure caps tightly by hand *(DO NOT USE TAPE!)*
3. OTHER BOTTLES? ~~caps sealed w/tape?~~ YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-25-91
6. Notes/Comments: 1100 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
7 √(1)	9-22-91	1808 HRS	RS-4 (4"pvc)	WATER	3-VOA VIALS w/HCl	BTEX (8020)
(2)					1-VOA VIAL UNPRESERVED	Cl-
(3)					1-1 LITER GLASS w/H_2SO_4	TPH (418.1)
8 √(4)	9-22-91	1740 HRS	RS-8 (4"pvc)	WATER	3-VOA VIALS w/HCl	BTEX (8020
(5)					1-VOA VIAL UNPRESERVED	Cl-
(6)					1-1 LITER GLASS w/H_2SO_4	TPH (418.1)
(7)						
(8)						
(9)						
(10)						

SHIPPING DETAILS

Delivered to Shipper by: RALPH SKINNER JR.
Method of Shipment: FEDERAL EXPRESS
Airbill #: 1335421065
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):	[illegible]	9-26-91	10:10
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

5/14/91

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER JR.

PTC Project No.: 32-03-144

##########################

1. Packed By: RSJr. Date: 9-25-91
2. VOA Vials? (YES) NO
   Secure caps tightly by hand *(DO NOT USE TAPE!)*
3. OTHER BOTTLES? ~~caps sealed w/tape?~~ (YES) NO
4. Coolant? ICE (COLD PAK)
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-25-91
6. Notes/Comments: 1100 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

		SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
9	✓(1)	9-21-91	1530HRS	MW-31, BH-55	WATER	3-VOA VIALS w/HCl	BTEX (8020)
	(2)					1-VOA VIAL	Cl⁻ (UNPRESERVED)
	(3)					1-1 LITER GLASS w/H_2SO_4	TPH (418.1)
10	✓(4)	9-21-91	0925 HRS	MW-48, BH-71	WATER	3-VOA VIALS w/HCl	BTEX (8020)
	(5)					1-VOA VIAL	Cl⁻ (UNPRESERVED)
	(6)					1-1 LITER GLASS w/H_2SO_4	TPH (418.1)
	(7)				WATER	3-VOA VIALS w/HCl	BTEX (8020)
11	✓(8)	9-21-91	1230HRS	MW-51, BH-74		1-VOA VIAL	Cl⁻ (UNPRESERVED)
	(9)					1-1 LITER GLASS w/H_2SO_4	TPH (418.1)
	(10)						

SHIPPING DETAILS

Delivered to Shipper by: RALPH SKINNER
Method of Shipment: FEDERAL EXPRESS
Airbill #: 1335421065
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	Darrell Ng-A-Qui	9-25-9	1010
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

5/1/91

CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621/Fax (505) 457-2544

CONTACT: RALPH SKINNER JR.

PTC Project No.: 32-03-144
Petroleum Technology Center, Marathon Oil Company, Littleton, CO

1. Packed By: [signature] Date: 9-25-91
2. VOA Vials? (YES) NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? (YES) NO
4. Coolant? ICE (COLD PAK)
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-25-91
6. Notes/Comments: 1100 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Core Laboratories
Street Address: 1300 S. Potomac Street, Suite 130
City/State/ZIP: Aurora, Colorado 80012
Phone: (303) 751-1780
FAX: (303) 751-1784

SHIPMENT RECEIVED - OBSERVATIONS

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

		SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
12	✓(1)	9-21-91	1020 Hrs	MW-52, BH-75	WATER	3-VOA VIALS w/HCl	BTEX (8020)
	(2)					1-VOA VIAL	Cl⁻ (UNPRESERVED)
	(3)					1-1 LITER GLASS w/H_2SO_4	TPH (418.1)
13	✓(4)	9-21-91	1430 HRS	MW-11, BH-34	WATER	3-VOA VIALS w/HCl	BTEX (8020)
	(5)					1-VOA VIAL	Cl⁻ (UNPRESERVED)
	(6)					1-1 LITER GLASS w/H_2SO_4	TPH (418.1)
	(7)				WATER	3-VOA VIALS w/HCl	BTEX (8020)
14	✓(8)	9-21-91	1400 HRS	MW-15, BH-38		1-VOA VIAL (UNPRESERVED)	Cl⁻ [redacted]
	(9)					1-1 LITER GLASS w/H_2SO_4	[redacted] TPH (418.1)
	(10)						

SHIPPING DETAILS

Delivered to Shipper by: RALPH SKINNER JR.
Method of Shipment: FEDERAL EXPRESS
Airbill #: 1335421065
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	[signature]	9-26-91	10:10
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon Copy: Laboratory Retains; 2nd Carbon Copy: Sender Retains

6/1/91

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER JR.

PTC Project No.: 32-03-144

1. Packed By: RS Date: 9-25-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? ~~caps sealed w/tape?~~ YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-25-91 1100hrs
6. Notes/Comments:

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

		SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
15	(1)	9-20-91	1400HRS	MW-33, BH-57	WATER	3-VOA VIALS w/HCl	BTEX (8020)
	(2)	~~9-20-91~~	~~1540HRS~~	~~MW-12, BH-35~~		1-VOA VIAL	Cl⁻ (UNPRESERVED)
	(3)					1-1 LITER GLASS w/ H_2SO_4	TPH (418.1)
16	(4)	9-20-91	1540HRS	MW-12, BH-35	WATER	3-VOA VIALS w/HCl	BTEX (8020)
	(5)					1 VOA VIAL	Cl⁻ (UNPRESERVED)
	(6)					1-1 LITER GLASS w/ H_2SO_4	TPH (418.1)
17	(7)	9-20-91	1751 HRS	MW-34, BH-58	WATER	3-VOA VIALS w/HCl	BTEX (8020)
	(8)					1-VOA VIAL	Cl⁻ (UNPRESERVED)
	(9)					1-1 LITER GLASS w/ H_2SO_4	TPH (418.1)
	(10)						

SHIPPING DETAILS

Delivered to Shipper by: RALPH SKINNER JR.
Method of Shipment: FEDERAL EXPRESS
Airbill #: 1335421065
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	[illegible]	9-26-91	10:10
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

5/14/91

ANALYSIS REQUEST -CHAIN CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER JR

PTC Project No.: 32-03-144

1. Packed By: RSJr. Date: 9-25-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-25-91
6. Notes/Comments: 1100 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

		SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
21	✓(1)	9-19-91	1706 HRS	MW-28, BH-52	WATER	3-VOA VIALS w/HCl	BETEX (8020)
	(2)					1-VOA VIAL	Cl⁻ (UNPRESERVED)
	(3)					1-1 LITER GLASS w/H2SO4	TPH (418.1)
22	✓(4)	9-20-91	1300 HRS	MW-16, BH-39	WATER	3-VOA VIALS w/HCl	BTEX (8020)
	(5)					1-VOA VIAL	Cl⁻ (UNPRESERVED)
	(6)					1-1 LITER GLASS w/H2SO4	TPH (418.1)
23	✓(7)	9-20-91	1320 HRS	MW-20, BH-43	WATER	3-VOA VIALS w/HCl	BTEX (8020)
	(8)					1-VOA VIAL	Cl⁻ (UNPRESERVED)
	(9)					1-1 LITER GLASS w/H2SO4	TPH (418.1)
	(10)						

SHIPPING DETAILS

Delivered to Shipper by: RALPH SKINNER JR.
Method of Shipment: FEDERAL EXPRESS
Airbill #: 1335421065
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):			
Received by: (signed):	[illegible]	9-26-91	10:10
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

5/14/91

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621 / Fax (505) 457-2544

CONTACT: RALPH SKINNER JR.

PTC Project No.: 32-03-144

\#

1. Packed By: [illegible] Date: 9-25-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-25-91
6. Notes/Comments: 1100 hrs

ANALYTICAL LABORATORY ADDRESS:

Company: Marathon Oil Company/Petroleum Technology Center
Street Address: 7400 S. Broadway
City/State/ZIP: Littleton, CO 80122
Phone: (303) 794-2601
FAX: (303) 794-1720

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition:
3. Condition of Contents?

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
8 ✓(1)	9-19-91	1334 HRS	MW-~~24~~ 53, BH-77	WATER	3 VOA VIALS w/HCL	BTEX (8020)
(2)					1-VOA VIAL	Cl-(UNPRESERVED)
(3)					1-1 LITER GLASS w/H_2SO_4	TPH (METHOD 418.1)
7 ✓(4)	9-19-91	1500 HRS	MW-69, BH-95	WATER	1-1 LITER GLASS w/H_2SO_4	TPH (418.1)
(5)					3 VOA VIALS w/HCL	BTEX (8020)
(6)					1-VOA VIAL	CL(UNPRESERVED)
10 ✓(7)	9-19-91	1644 HRS	MW-24, BH-47	WATER	3-VOA VIALS w/HCL	BTEX (8020)
(8)					1-VOA VIAL	CL-(UNPRESERVED)
(9)					1-1 LITER GLASS w/H_2SO_4	TPH (418.1)
(10)						

SHIPPING DETAILS

Delivered to Shipper by: RALPH SKINNER JR.
Method of Shipment: FEDERAL EXPRESS
Airbill #: 1335421065
Rec'd for Lab: Date: Time:
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):	[illegible]	9-26-91	[illegible]
Received by: (signed):			
Relinquished by: (signed):			
Received by: (signed):			

Original: Final Laboratory Retains; 1st Carbon: Laboratory Retains; 2nd Carbon: Sender Retains

01281

"CONFIDENTIAL BUSINESS INFORMATION"

Western Atlas International

CORE LABORATORIES

ANALYTICAL REPORT

911757

FOR

MARATHON OIL COMPANY
W. NIXON
P.O. BOX 269
LITTLETON, CO 80160

10/02/91

MW-1 BH14
MW 32 BH56 } TPH, BTEX, Cl⁻

RECEIVED

NOV 19 1991

OIL CONSERVATION DIV.
SANTA FE

CHAIN OF CUSTODY

Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico 88254
(505) 457-2621/Fax (505) 457-2544

CONTACT: RALPH SKINNER JR.

PTC Project No.: 32-03-144
##########

1. Packed By: RSJr. Date: 9-19-91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps ~~sealed w/tape~~? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 9-19-91
6. Notes/Comments: 1000hrs

RUSH - Sampling Randy Samples

ANALYTICAL LABORATORY ADDRESS:

Company: Core Laboratories
Street Address: 1300 S. Potomac Street, Suite 130
City/State/ZIP: Aurora, Colorado 80012
Phone: (303) 751-1780
FAX: (303) 751-1784

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition: Good
3. Condition of Contents? Good

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
(1)	9-18-91	1228 hrs	MW1-BH14	WATER	✓ 1-ONE LITER GLASS w/H_2SO_4	TPH
(2)					✓ 1-VOA VIAL (UNPRESERVED)	CL^-
(3)					✓ 3-VOA VIALS w/ HCL	BTEX
(4)						
(5)	9-18-91	1547 hrs	MW 32-BH56	WATER	✓ 1-ONE LITER GLASS w/H_2SO_4	TPH
(6)					✓ 1-VOA VIAL (UNPRESERVED)	CL^-
(7)					✓ 3-VOA VIALS w/ HCL	BTEX
(8)						
(9)						
(10)						

SHIPPING DETAILS

Delivered to Shipper by: Ralph Skinner Jr.
Method of Shipment: Fed. Express Priority One
Airbill #: 1335421334
Rec'd for Lab: [illegible] Date: 9-20-91 Time: 1030
Assigned Laboratory Number: N/A

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):	James Reid	9-20-91	14:07
Received by: (signed):	[illegible]	9-20-91	14:07
Relinquished by: (signed):			
Received by: (signed):			

Original: P[illegible]aboratory Retains; 1st Carbon Copy: Laboratory Retains; 2nd Carbon Copy: Sender R[illegible]s

6/7/91

Computer Entry

Petroleum Technology Center

ANALYTICAL REQUEST

Call Analyst for estimated completion data

Marathon Oil Company

	Project No.	Requestor	Ext. No.	Date Submitted	No. of Sampl
44931	32-03-144	Dyke S (Last Name / Initial)	321	9/20/91	2

Analyses Requested TPH; Cl⁻; BTEX

Date Required RUSH / /

Project/Sample Description Indian Basin

Estimated Completion / /

Actual Completion / /

Lab Code

	Yes	No	
Hazardous	X		Explain Poss. Hydrocarbon
Return Sample	X		To S. Dyke

Requestor should not write in the shaded areas.

Analysis Codes →									
Sample No.	Lab No.								
MW1-BH14		BTEX	Cl⁻,	TPH					
MW32-BH56		BTEX	, Cl⁻,	TPH					
Analyst									
Time									
Reference									

RUSH Rand Sampling Samples

"CONFIDENTIAL BUSINESS INFORMATION"

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
10/02/91

JOB NUMBER: 911757 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/18/91
TIME SAMPLED.....: 12:28
WORK DESCRIPTION...: MW1-BH14

LABORATORY I.D...: 911757-0001
DATE RECEIVED....: 09/20/91
TIME RECEIVED....: 14:07
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	85	1	mg/L	325.2 (1)	09/24/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	09/27/91	MRC
Benzene	250	50	ug/L			
Toluene	100	50	ug/L			
Ethyl Benzene	200	50	ug/L			
Xylenes	100	50	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	09/25/91	MRC

APPROVED BY: Ellen J. Nafzger

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

The analyses, opinions or interpretations contained in this report are based upon [illegible] whose exclusive and [illegible] represent the best judgement of Core Laboratories. Core Laboratories, however, assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, [illegible] oil, gas, coal or other mineral property, well or sand in connection with which such report is used [illegible] This report shall not be reproduced, except in its entirety, without the written approval of Core Laboratories.

Western Atlas International
A Litton Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
10/02/91

JOB NUMBER: 911757 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 32-03-144 INDIAN BASIN
DATE SAMPLED.....: 09/18/91
TIME SAMPLED.....: 15:47
WORK DESCRIPTION...: MW32-BH56

LABORATORY I.D...: 911757-0002
DATE RECEIVED....: 09/20/91
TIME RECEIVED....: 14:07
REMARKS.....:

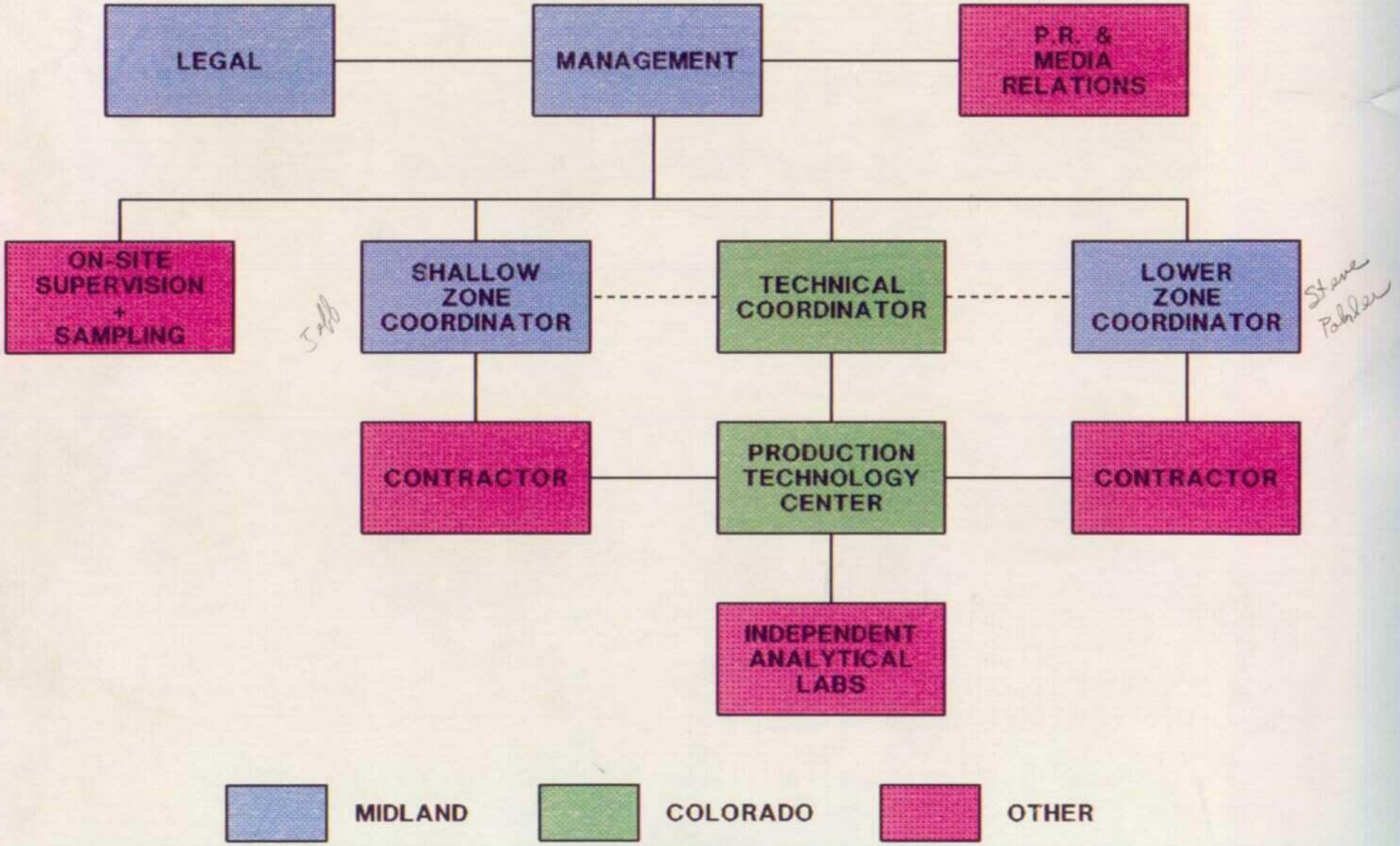
TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Unfilt.)	90	1	mg/L	325.2 (1)	09/24/91	DTJ
8020 - AROMATIC VOLATILE ORGANICS		*5		8020 (2)	09/27/91	MRC
Benzene	200	5	ug/L			
Toluene	10	5	ug/L			
Ethyl Benzene	ND	5	ug/L			
Xylenes	180	5	ug/L			
Total Petroleum Hydrocarbon	<1	1	mg/L	418.1 (1)	09/25/91	MRC

APPROVED BY: Ellen J. Nagger

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

The analyses, opinions or interpretations contained in this report are based upon [illegible] represent the best judgement of Core Laboratories. Core Laboratories, however, assumes [illegible] [illegible] or other mineral property, well or sand in connection with which such report [illegible]

INDIAN BASIN PROJECT TEAM

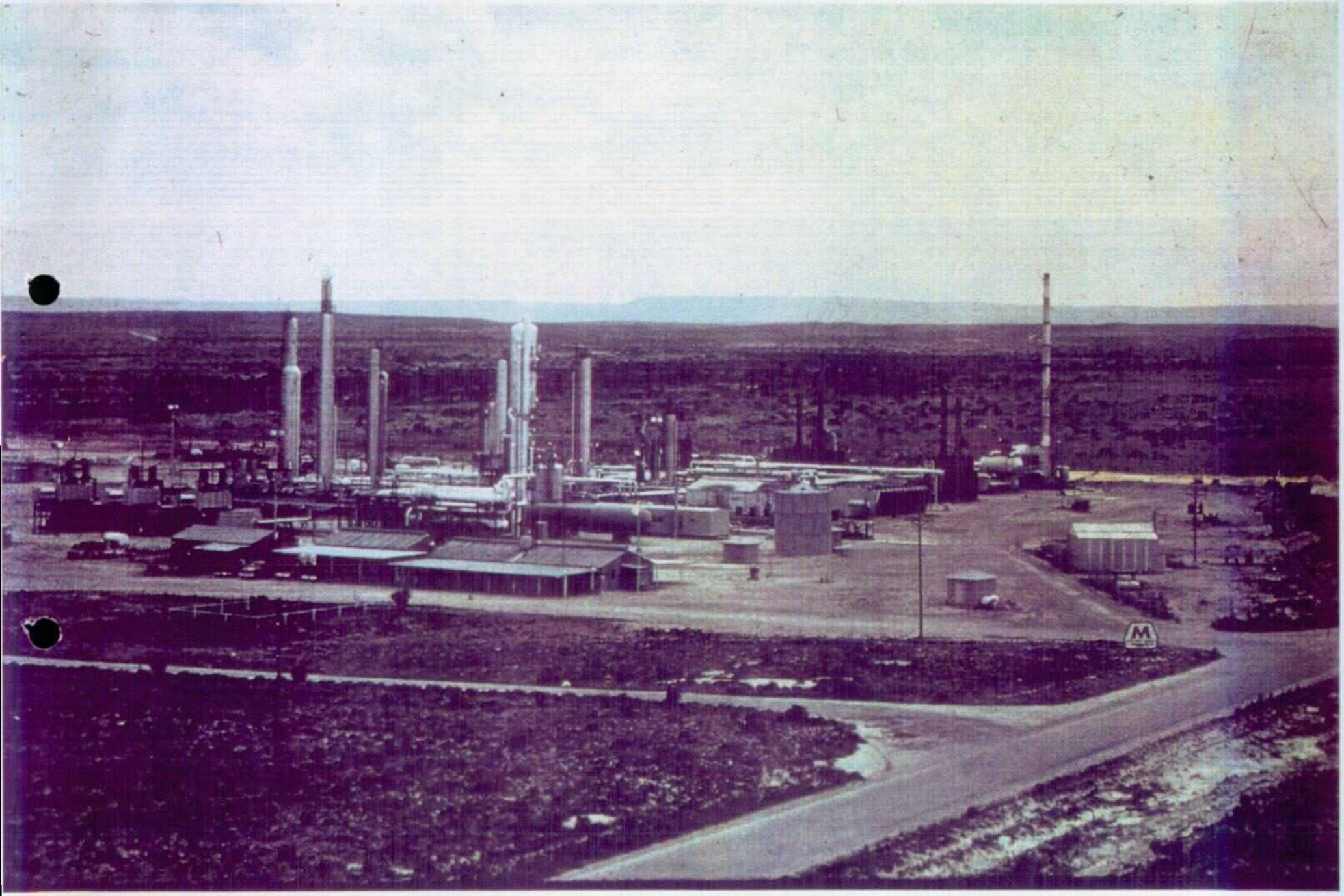


MARATHON OIL COMPANY
NEW MEXICO OPERATIONS

FIRST OPERATION	1929
OFFICES	FARMINGTON, HOBBS, INDIAN BASIN
EMPLOYEES	55
MARATHON OPERATED WELLS	500+
WORKING INTEREST PROPERTIES OPERATED BY OTHERS	250+
ANNUAL EXPENDITURES	$35.3 MILLION (1991 EST.) $38.2 MILLION (1992 EST.)
SECONDARY RECOVERY OPERATIONS	1 (1990) 3 (1991) 4 (1992 EST.)
ACREAGE	76,300 ACRES DEVELOPED 85,400 ACRES UNDEVELOPED
CURRENT NET PRODUCTION	6400 BPD LIQUID HYDROCARBONS 57 MMCFD GAS

INDIAN BASIN FIELD/PLANT HISTORY

LOCATION	28 MILE S-SW OF ARTESIA, EDDY COUNTY, NEW MEXICO
FIELD DISCOVERY	1962
PLANT CONSTRUCTION	1964-66
MAJOR PLANT UPGRADES	1967, 73, 76, 81, 89
NUMBER OF PLANT OWNERS	40
NUMBER OF PRODUCERS DRILLED	81
NUMBER OF WELLS NOW PRODUCING	43
NUMBER OF WELLS PRODUCING BY MARATHON	13
NUMBER WELL OPERATORS	10
PEAK PRODUCTION	225 MMCFD WET GAS (1971) 5100 BPD PLANT LIQUIDS (1991) 2350 BPD CONDENSATE (1970)
CURRENT PRODUCTION	120 MMCFD NET GAS 4500 BPD PLANT LIQUIDS 400 BPD CONDENSATE
CONDENSATE YIELDS	9+ BBLS/MMCFD - 3 BBLS/MMCFD (OVER FIELD LIFE)
CUMULATIVE PRODUCTION	1.23 TCF WET GAS 8.23 MM BBLS CONDENSATE 30 MM BBLS PLANT LIQUIDS



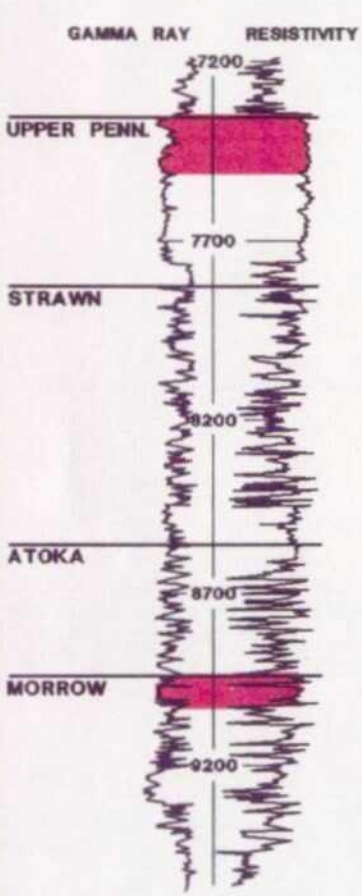
MARATHON OIL COMPANY
MID-CONTINENT REGION

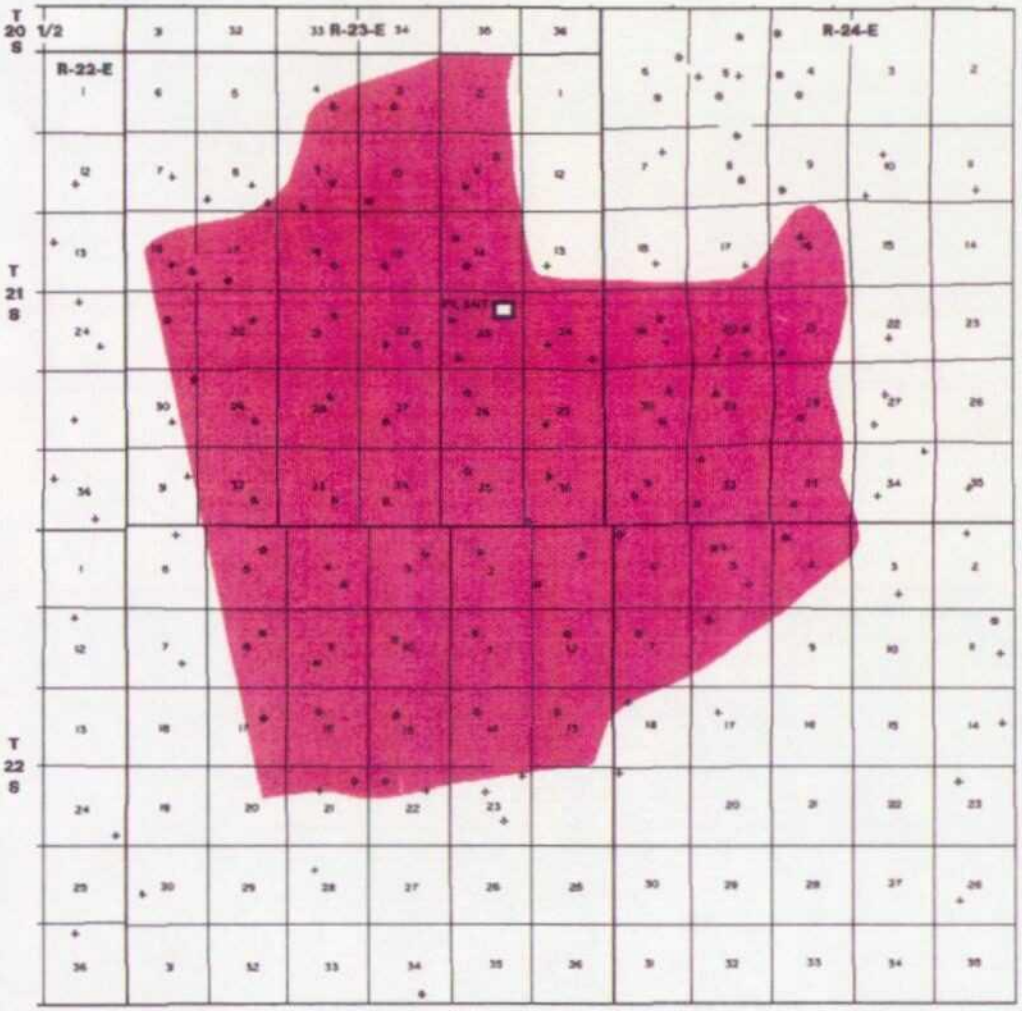
INDIAN BASIN FIELD

EDDY COUNTY, NEW MEXICO

APPROXIMATE INITIAL PRODUCTIVE ACREAGE

TYPE LOG





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MILES

INDIANBF2.BUD OPER

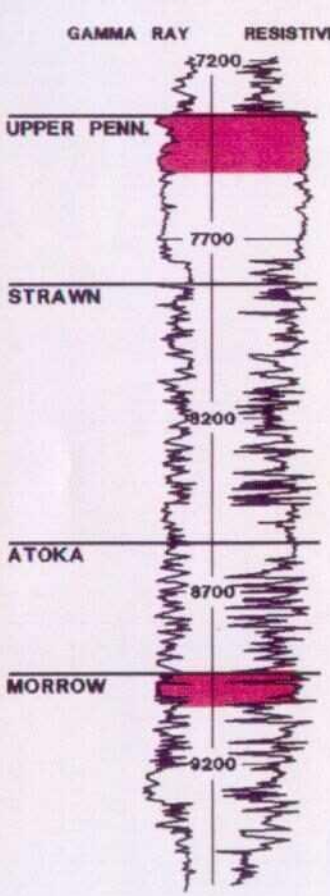
9/91

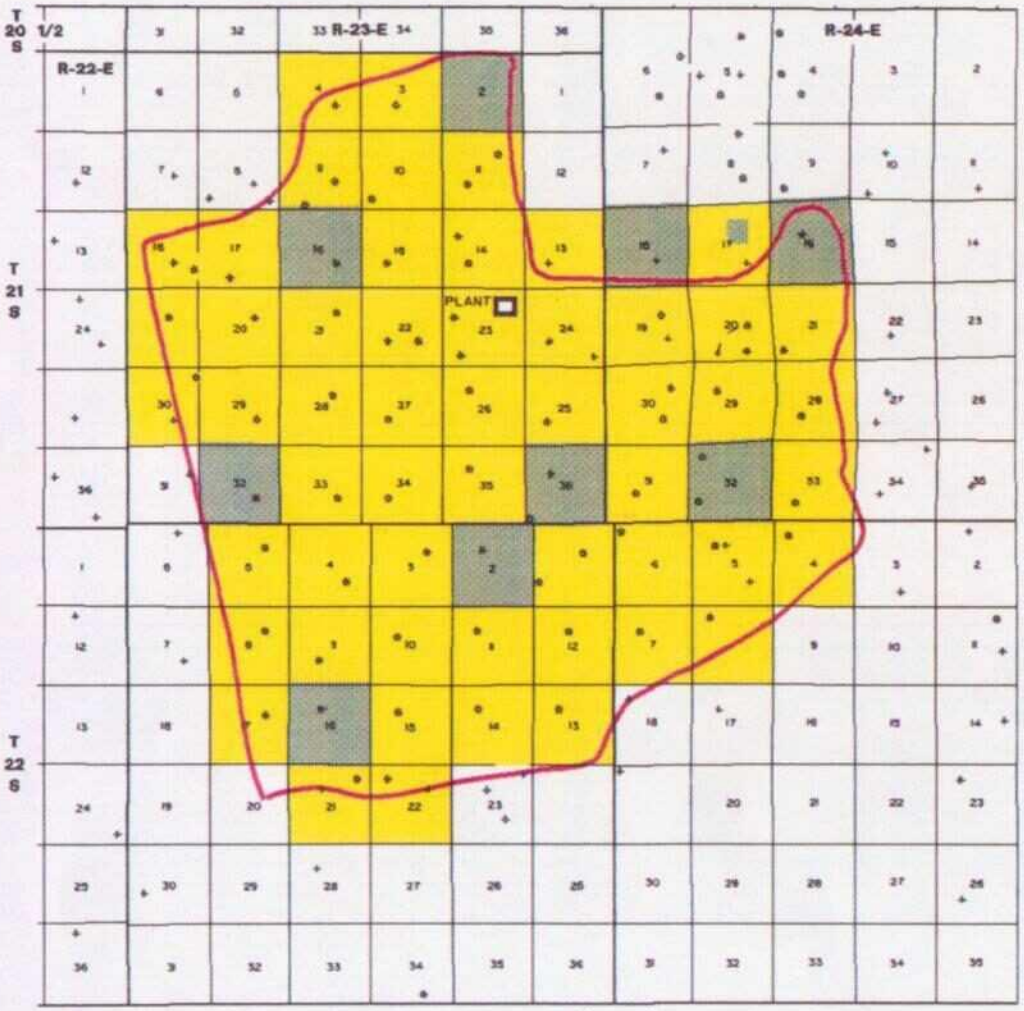
MARATHON OIL COMPANY
MID-CONTINENT REGION

INDIAN BASIN FIELD

EDDY COUNTY, NEW MEXICO

TYPE LOG





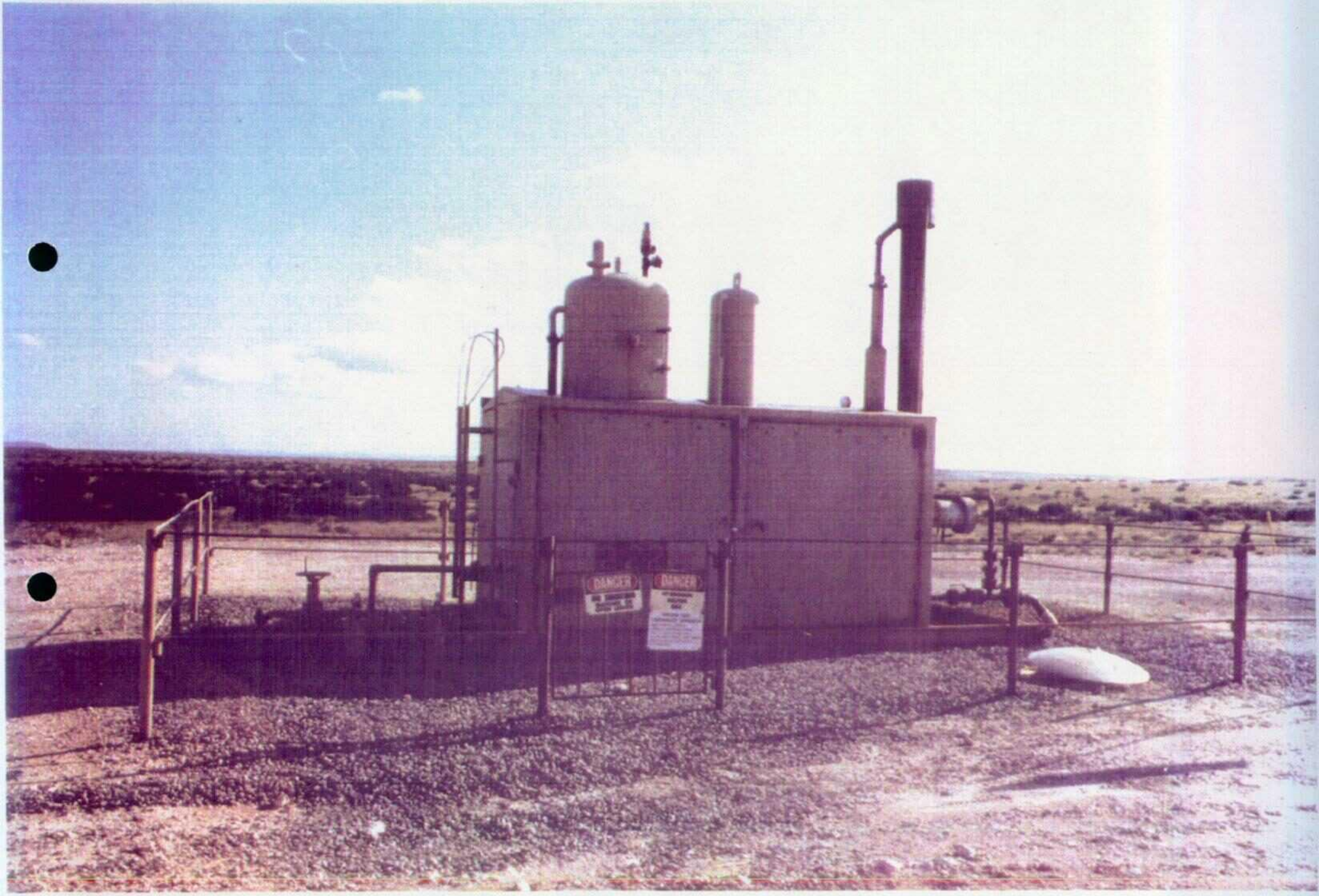
ROYALTY OWNERS

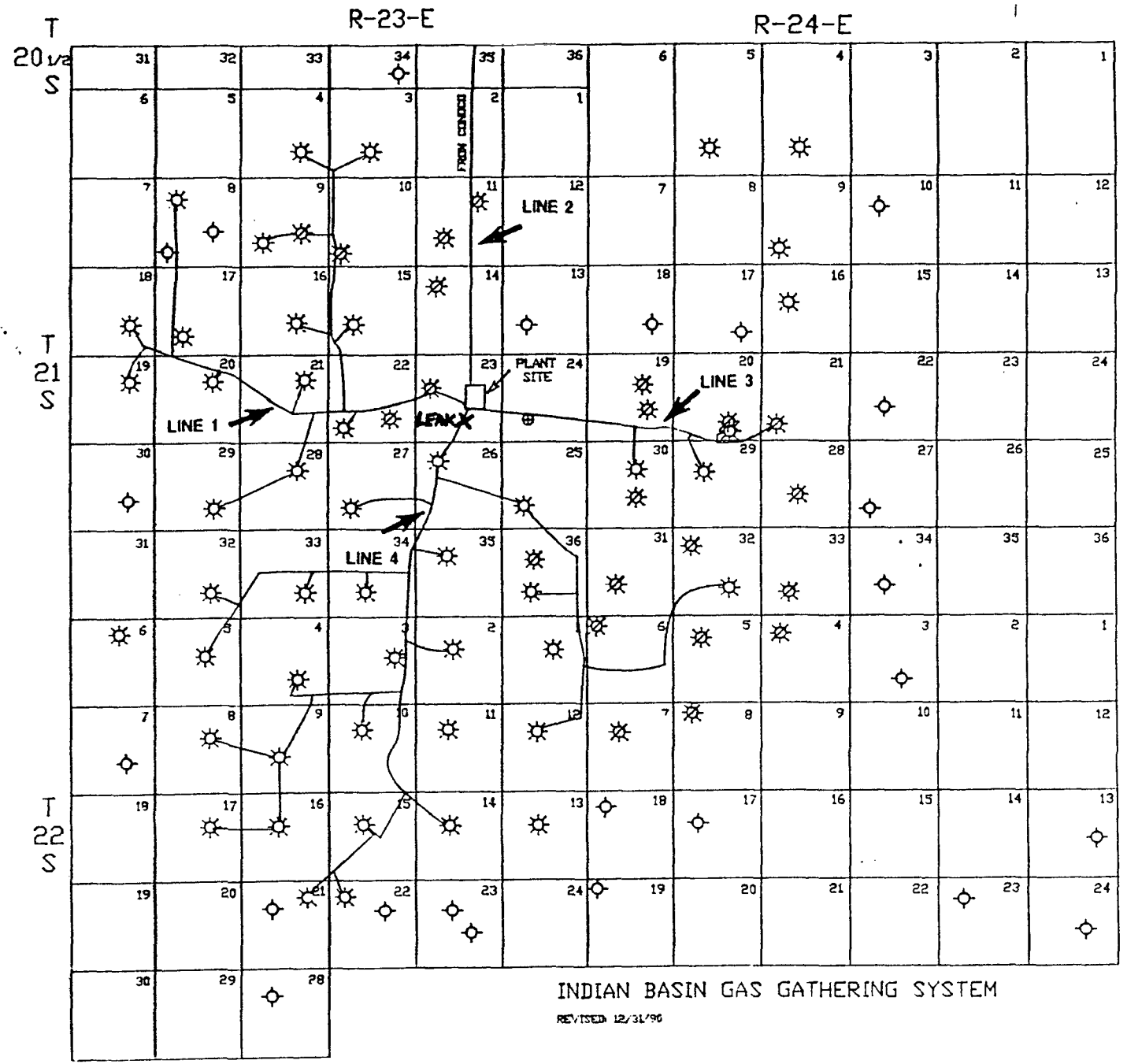
- FEDERAL
- STATE

0 2 4
MILES

INDIANBF2.BUD OPER

9/91


DANGER
DANGER

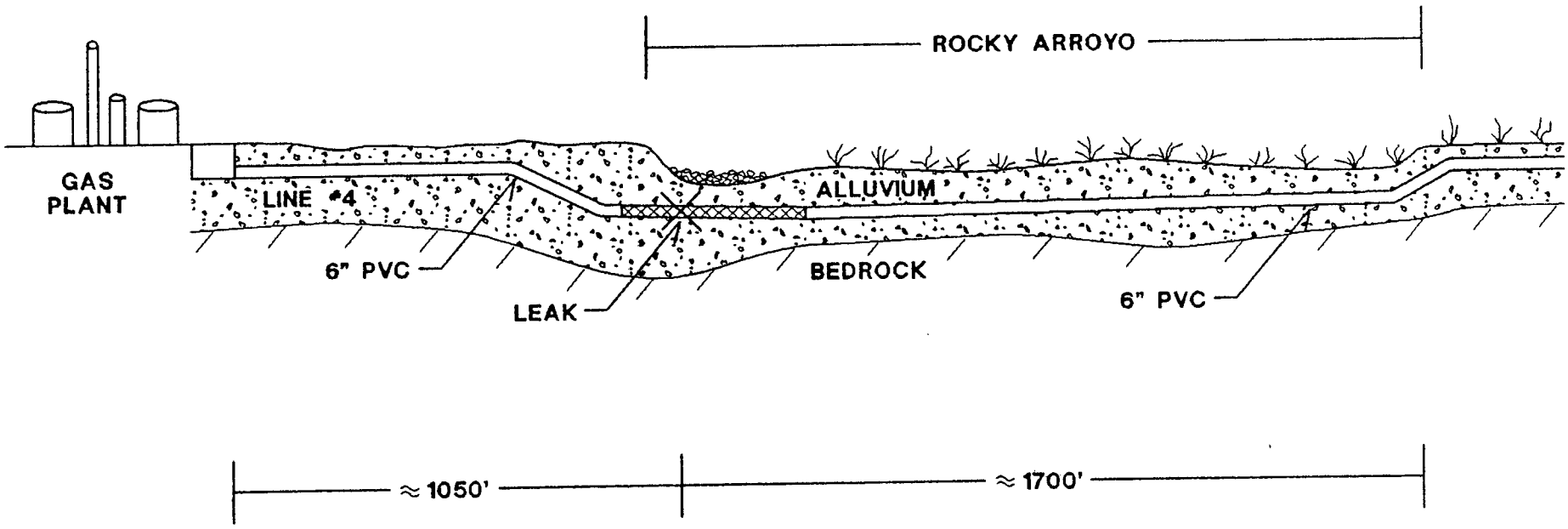


INDIAN BASIN GAS GATHERING SYSTEM

REVISED 12/31/96

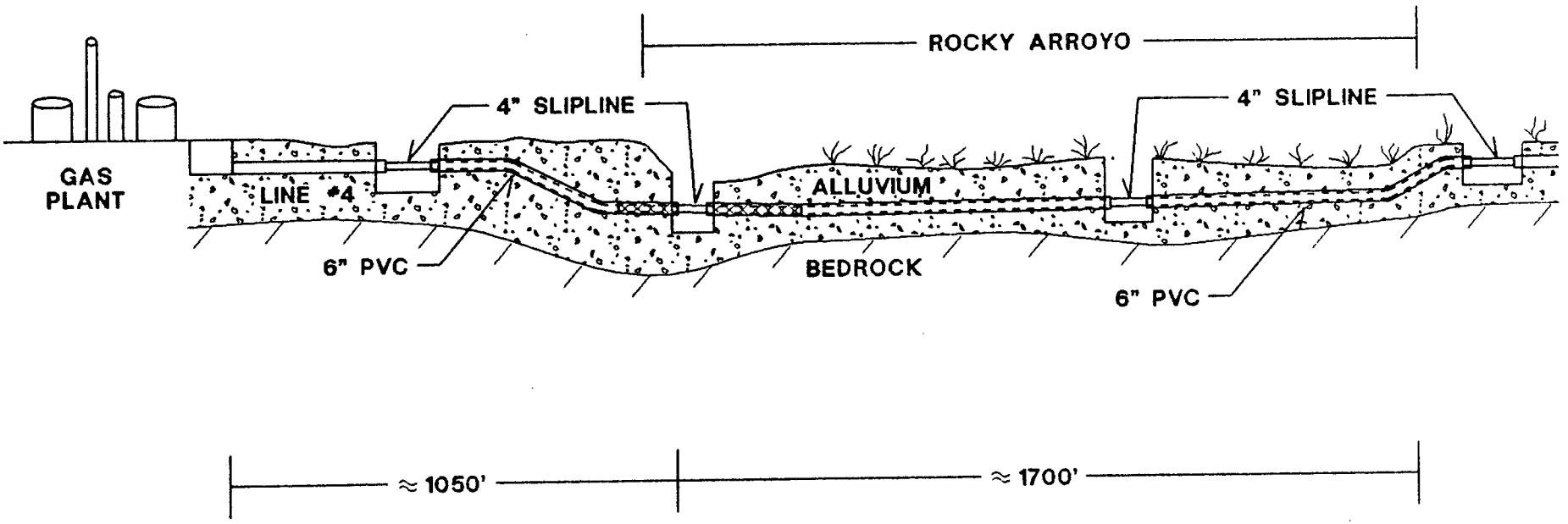
INDIAN BASIN LINE #4 LEAK

SCHEMATIC



INDIAN BASIN LINE #4 REPAIRS

SCHEMATIC

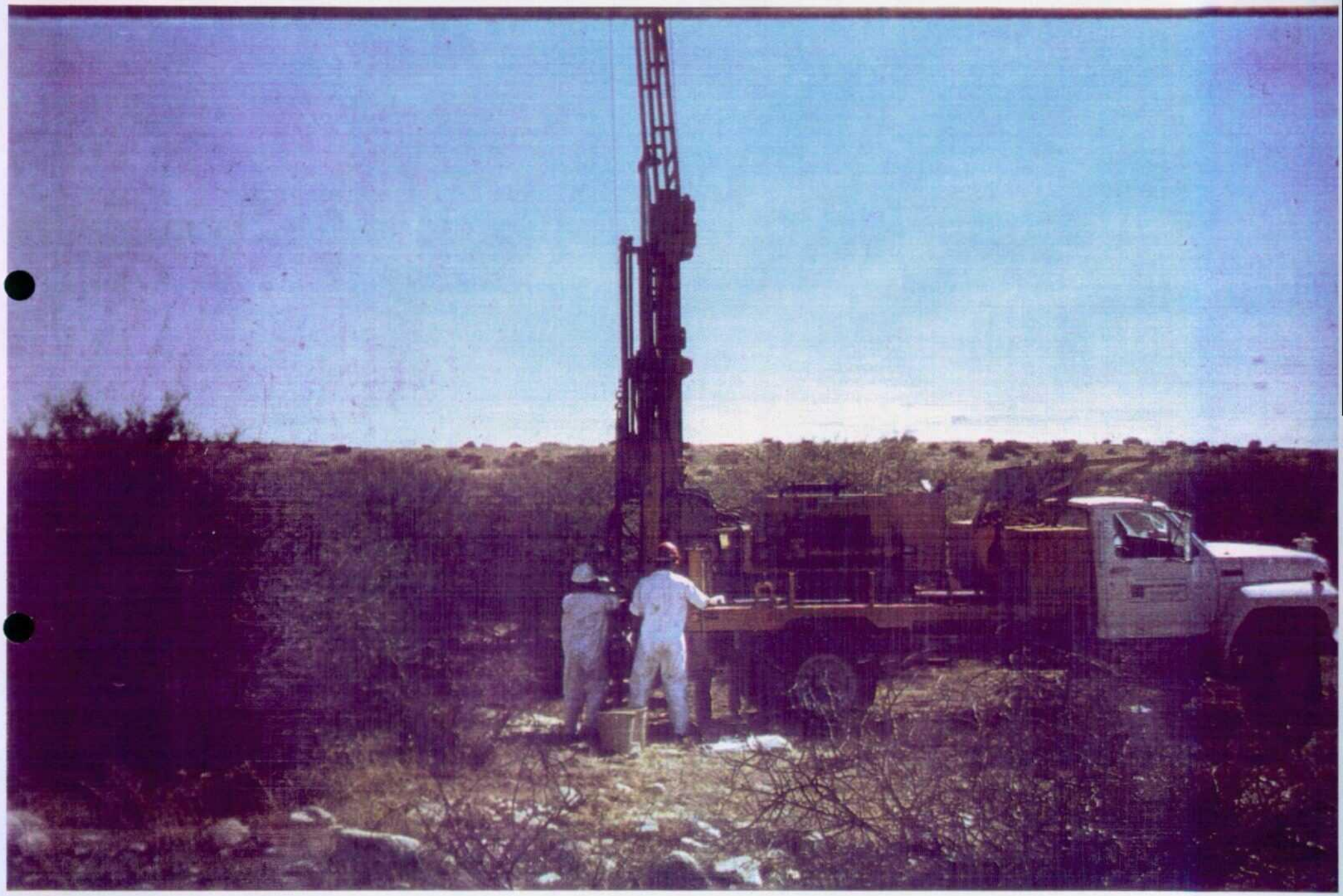


LEAK RESPONSE/NOTIFICATION

- DISCOVERED 10:30 AM, APRIL 12, 1991
- INITIATED SHUTTING-IN WELLS IMMEDIATELY
- NOTIFIED OCD AT 11:12 AM, APRIL 12, 1991
- NOTIFIED BLM AT 11:17 AM, APRIL 12, 1991
- NOTIFIED NRC AT 11:22 AM, APRIL 12, 1991
- EMERGENCY RESPONSE TEAM ON LOCATION

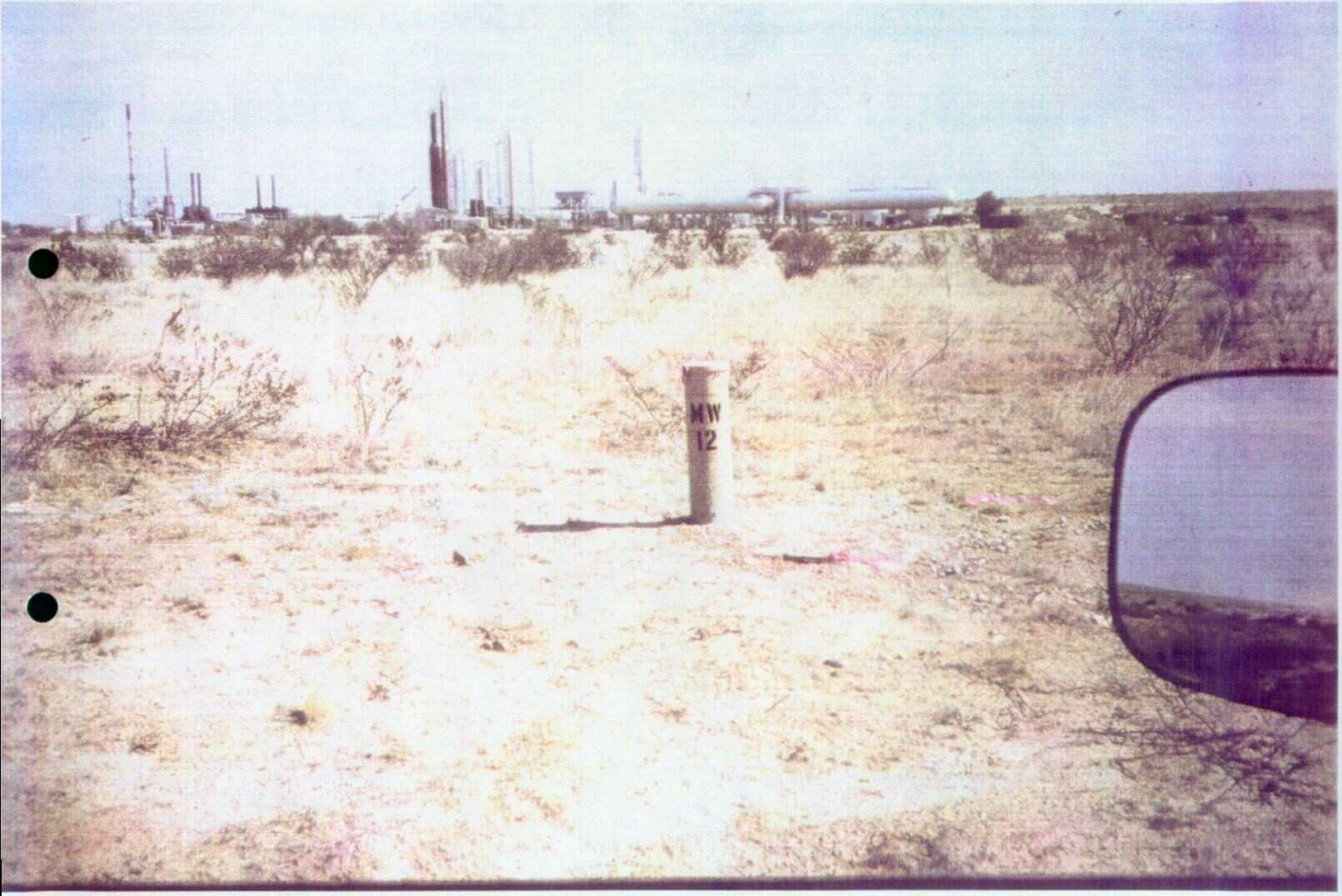
1b
2
4

32NDS
64THS



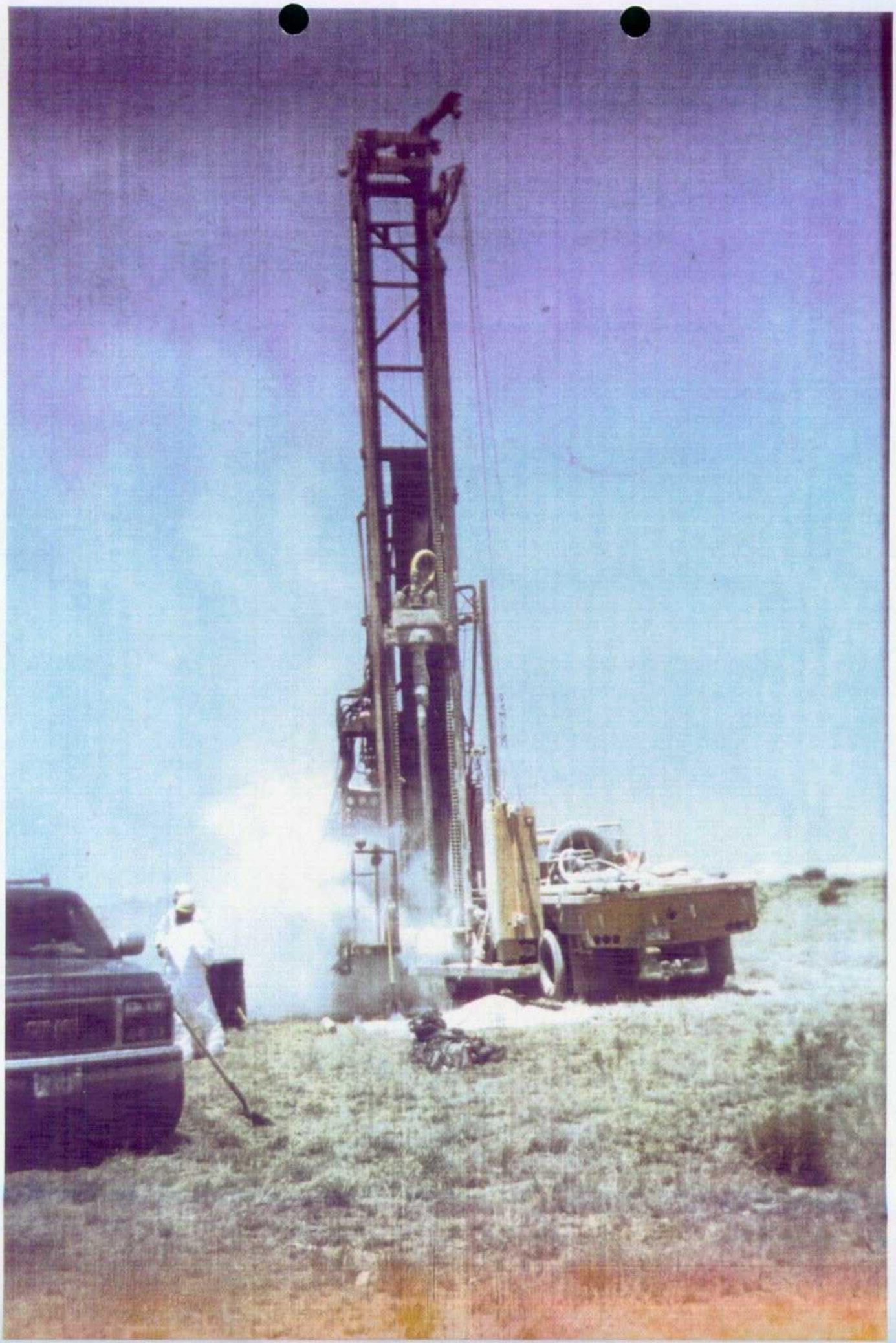
ALLUVIAL ASSESSMENT

- 26 EXCAVATIONS IN THE ARROYO
  - 17 COMPLETED AS RECOVERY/MONITORING WELLS
- 79 BOREHOLES DRILLED
  - 49 COMPLETED AS RECOVERY/MONITORING WELLS


MW
12

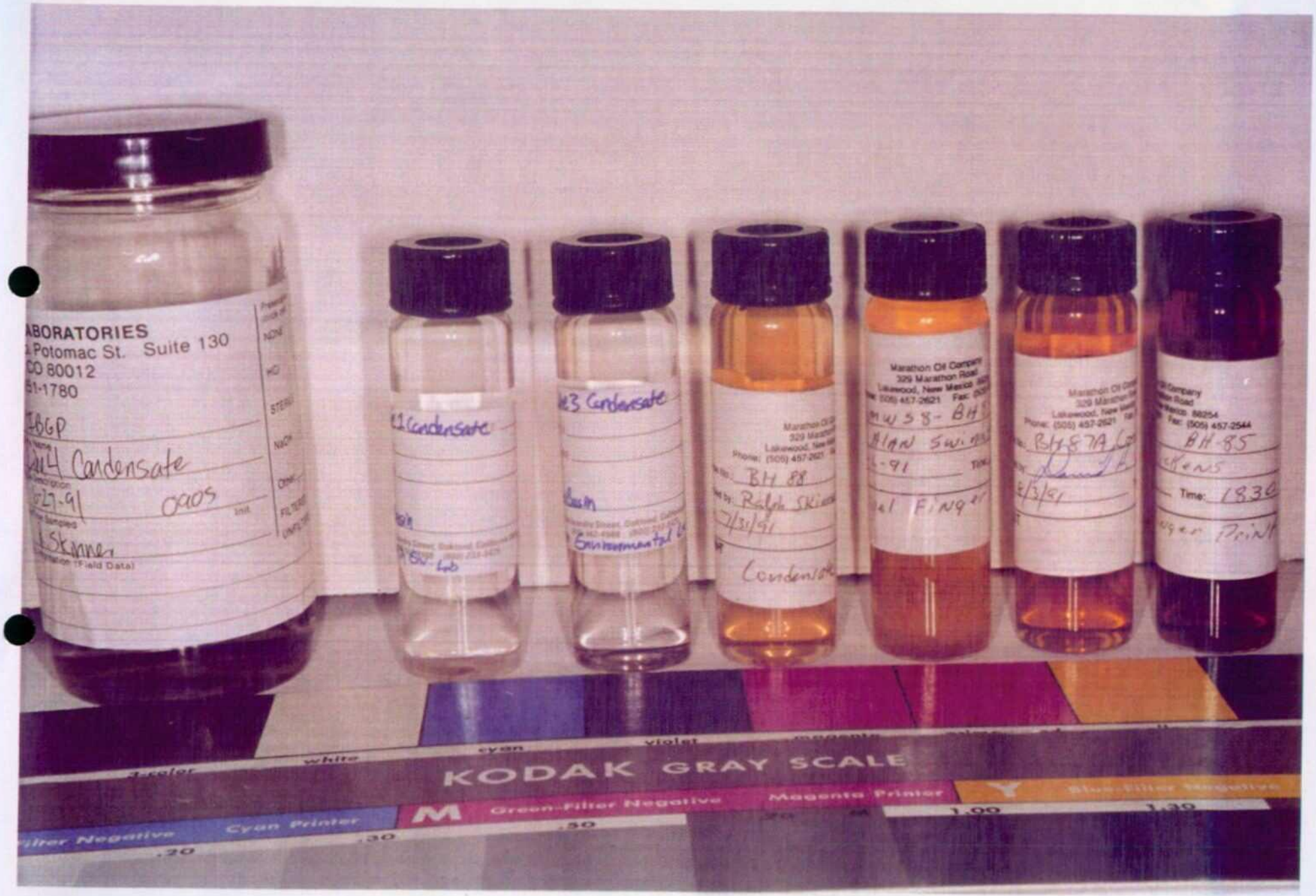
EMERGENCY REMEDIATION

- 28 RECOVERY WELLS EQUIPPED WITH PUMPS
- 3584 BARRELS OF CONDENSATE RECOVERED
- 76,362 BARRELS OF WATER RECOVERED



SHALLOW BEDROCK ASSESSMENT

- 17 BOREHOLES DRILLED
- 6 COMPLETED AS MONITORING/RECOVERY WELLS


ABORATORIES
Potomac St. Suite 130
CO 80012
51-1780
IBGP
4 Condensate
0905
Skinner
(Field Data)
Condensate
Condensate
Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico
BH 88
Ralph Skinner
7/31/91
Condensate
Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico
Phone: (505) 457-2621
BH-85
Time: 1830
KODAK GRAY SCALE
white
cyan
violet
Cyan Printer
Green-Filter Negative
Magenta Printer
Blue-Filter Negative
.20
.30
.50
1.00
1.30

LOWER QUEEN ASSESSMENT

- 13 BOREHOLES DRILLED
- 13 COMPLETED AS MONITORING/RECOVERY WELLS

MEETINGS

BLM/OCD

- APRIL 22, 1991
- JUNE 10, 1991
- JUNE 24, 1991
- JULY 11, 1991
- JULY 18, 1991
- AUGUST 22, 1991
- SEPTEMBER 30, 1991

RANCHERS

- MAY 15, 1991
- AUGUST 14, 1991

SUBMITTALS TO AGENCIES

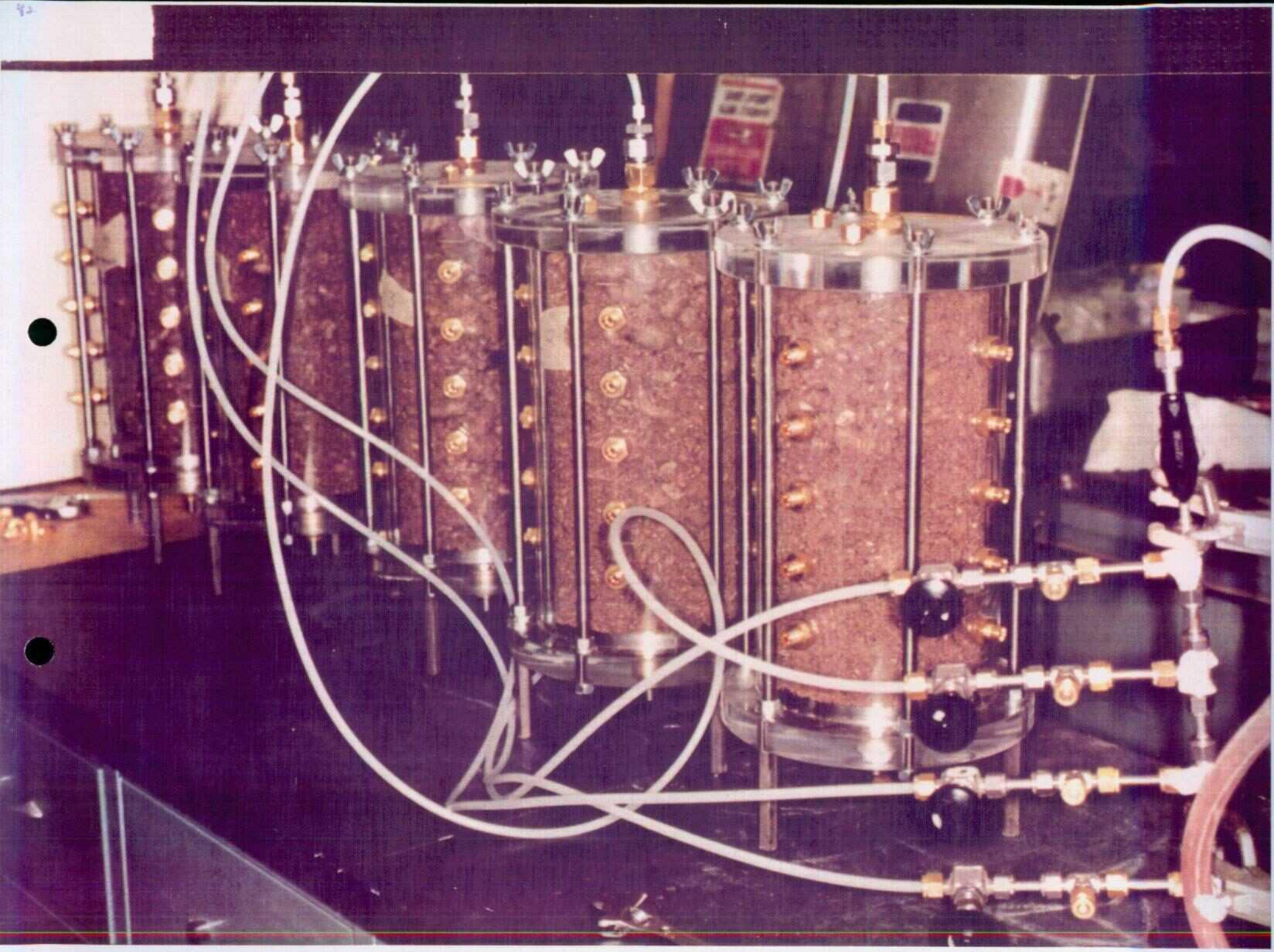
- SITE CHARACTERIZATION PLAN, APRIL 29, 1991
- ADDENDUM TO SITE CHARACTERIZATION PLAN, JUNE 28, 1991
- ADDENDUM TO SITE CHARACTERIZATION PLAN, AUGUST 22, 1991
- BEDROCK MONITORING WELL DRILLING PLAN, JUNE 12, 1991
- SPCC REGULATORY SUBMITTAL TO THE EPA, JUNE 11, 1991
- APPROVAL REQUESTS FOR DRILLING BEDROCK WELLS
- WEEKLY UPDATE REPORTS
- ARCHEOLOGICAL REPORTS

SAMPLING PROGRAM

- APPROXIMATELY 175 SAMPLES OBTAINED
- ANALYTICAL RESULTS :
  - NO DETECTABLE LEVELS OF HYDROCARBONS
  - NO ELEVATED LEVELS OF CHLORIDES
- APPROXIMATELY 65 LETTERS TO WATER USERS

REMEDIATION TECHNOLOGIES

- BIOREMEDIATION
- SOIL VENTING



5
1

WORK IN PROGRESS

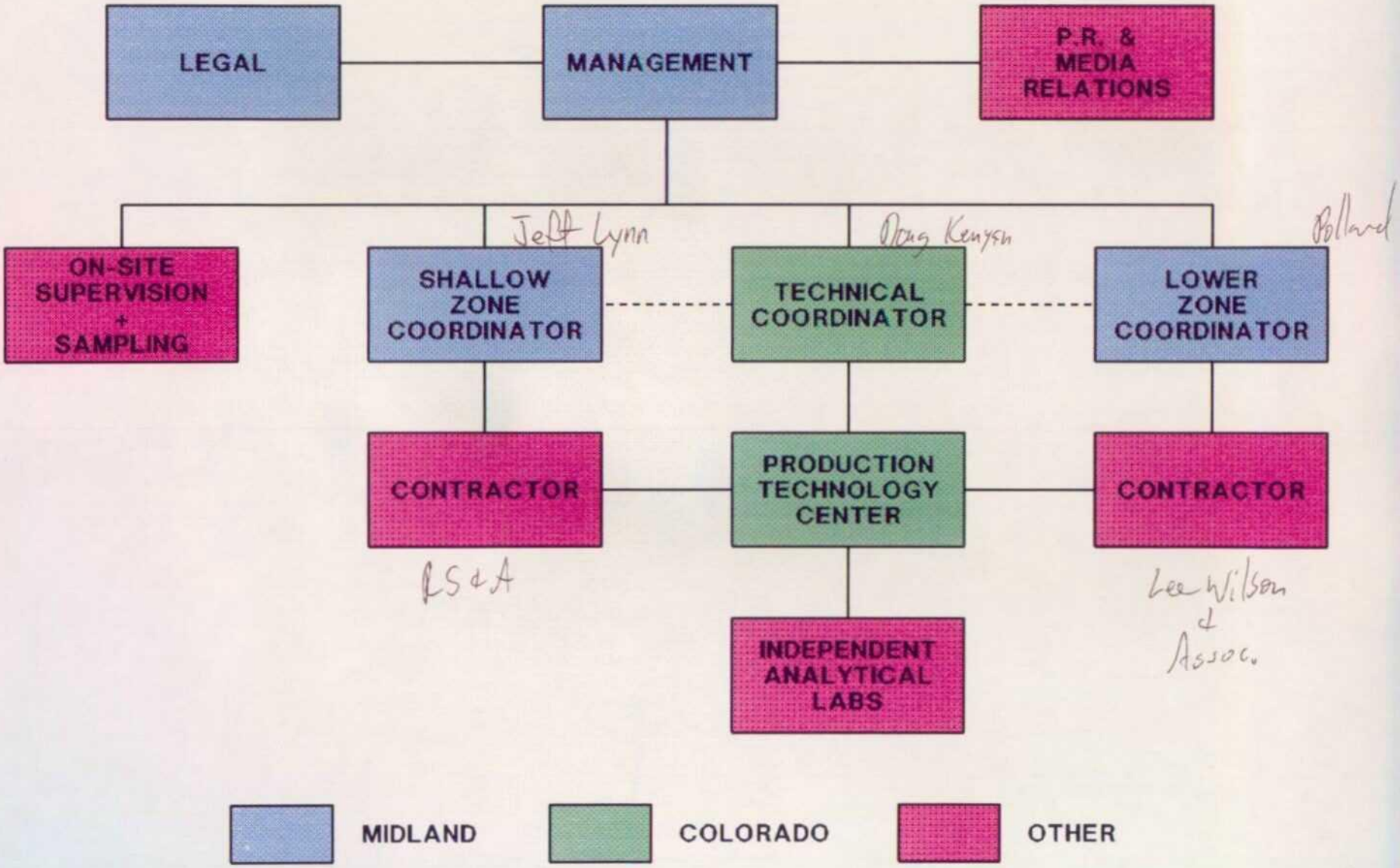
SHALLOW

- BIOFEASIBILITY STUDY UNDER REVIEW
- SOIL VENTING PILOT PROJECT UNDERWAY
- RISK ASSESSMENT STUDY
- POINT IN TIME SAMPLING PROGRAM

LOWER QUEEN

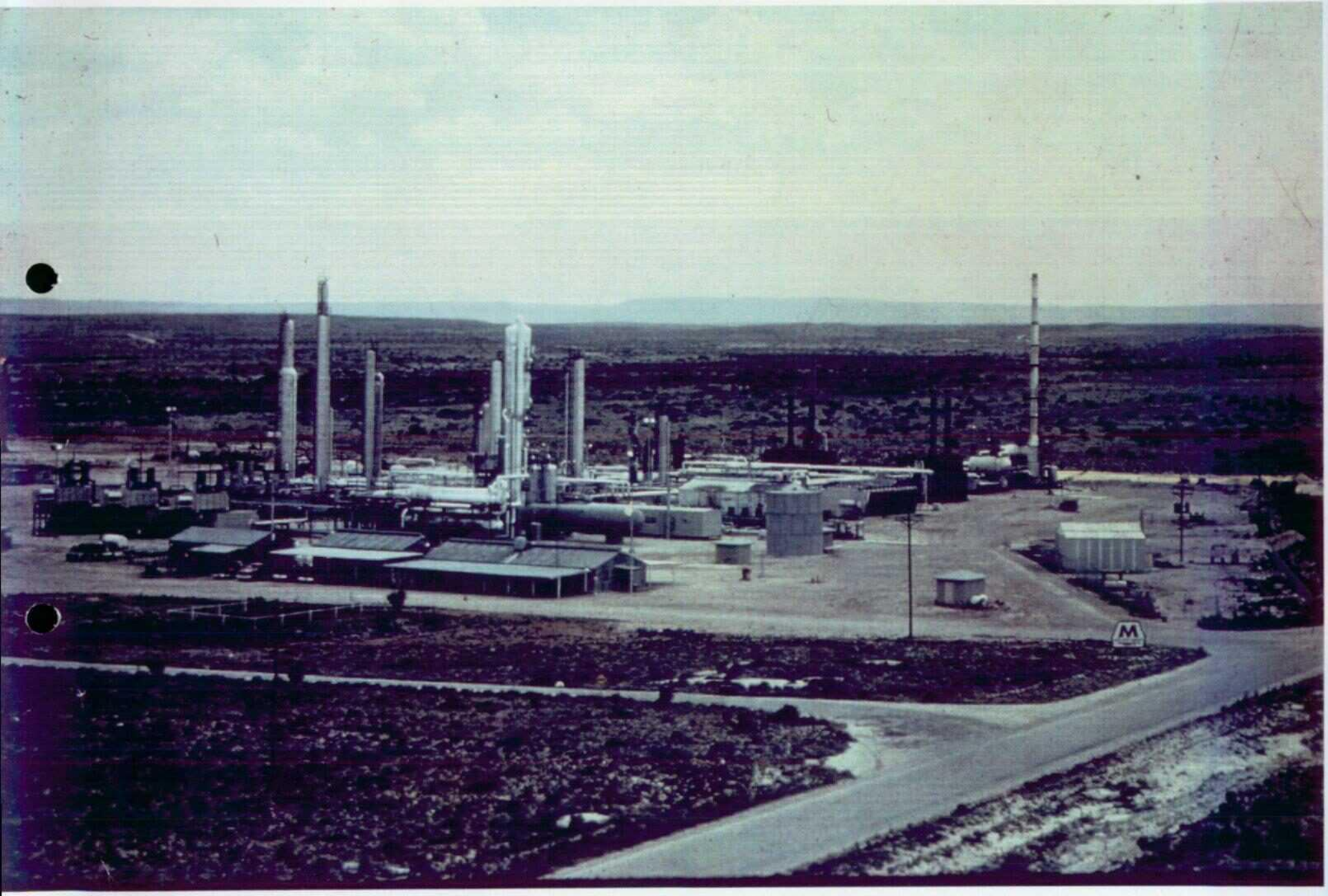
- POINT IN TIME ANALYSIS
- PUMPS ON ORDER
- DESIGN OF POWER SUPPLY
- DESIGN OF GATHERING SYSTEM
- DEVELOPMENT OF BID SPECIFICATIONS FOR AIR STRIPPER

INDIAN BASIN PROJECT TEAM



44999.001 MISC

10/91



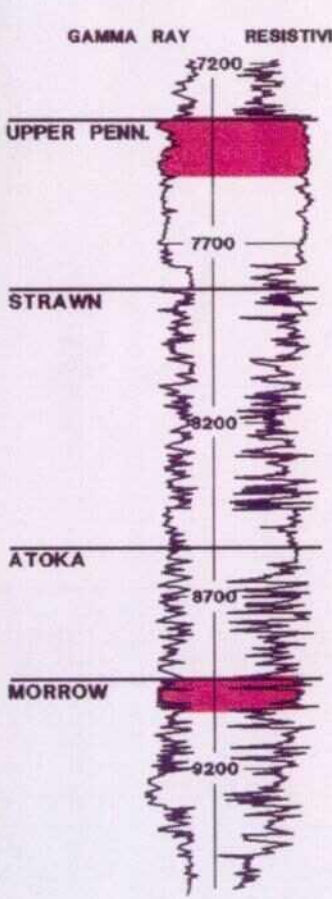
MARATHON OIL COMPANY
MID-CONTINENT REGION

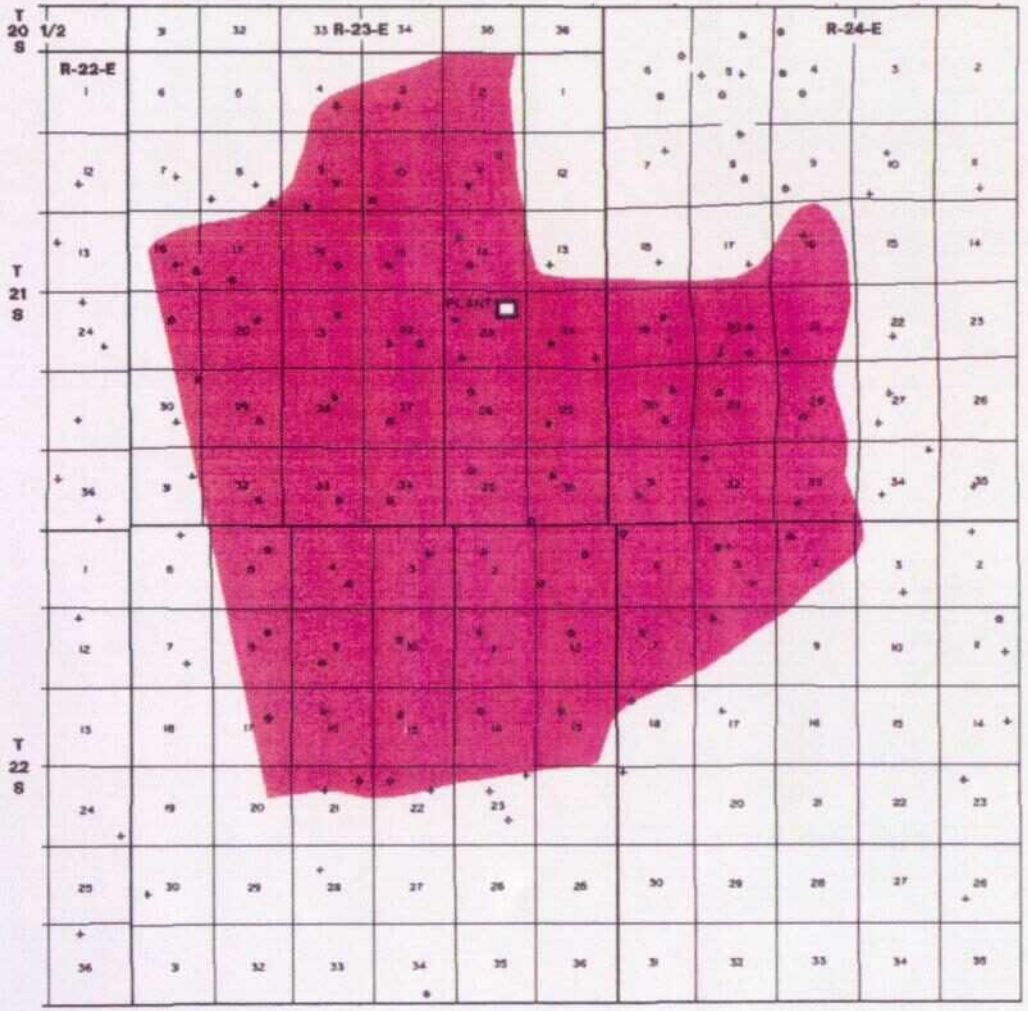
INDIAN BASIN FIELD

EDDY COUNTY, NEW MEXICO

APPROXIMATE INITIAL PRODUCTIVE ACREAGE

TYPE LOG





0 2 4
MILES

INDIANBF2.BUD OPER

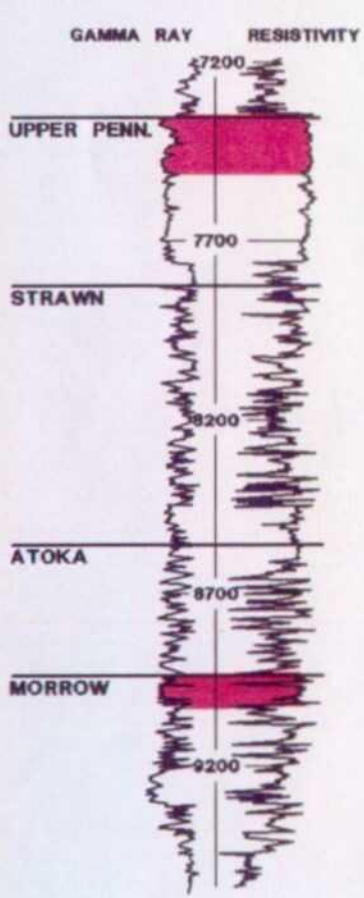
9/91

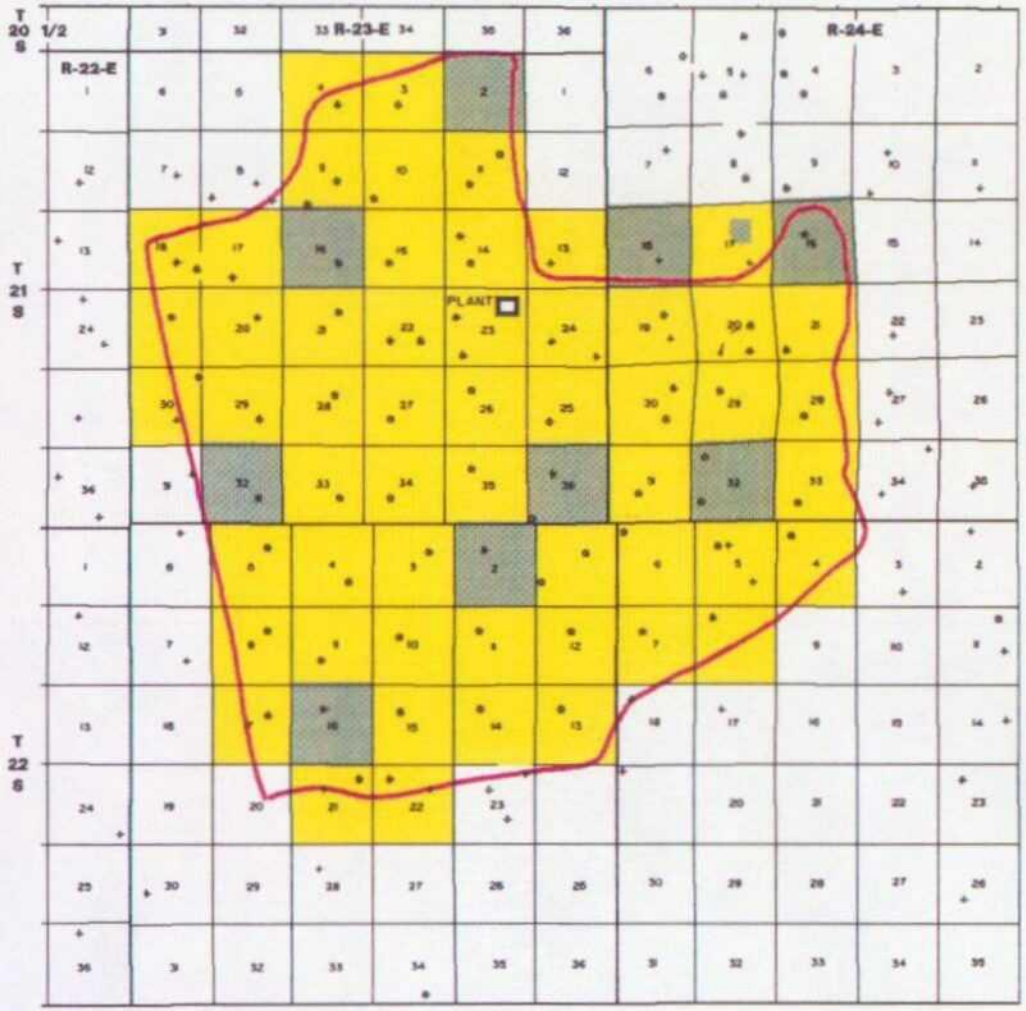
MARATHON OIL COMPANY
MID-CONTINENT REGION

INDIAN BASIN FIELD

EDDY COUNTY, NEW MEXICO

TYPE LOG





ROYALTY OWNERS

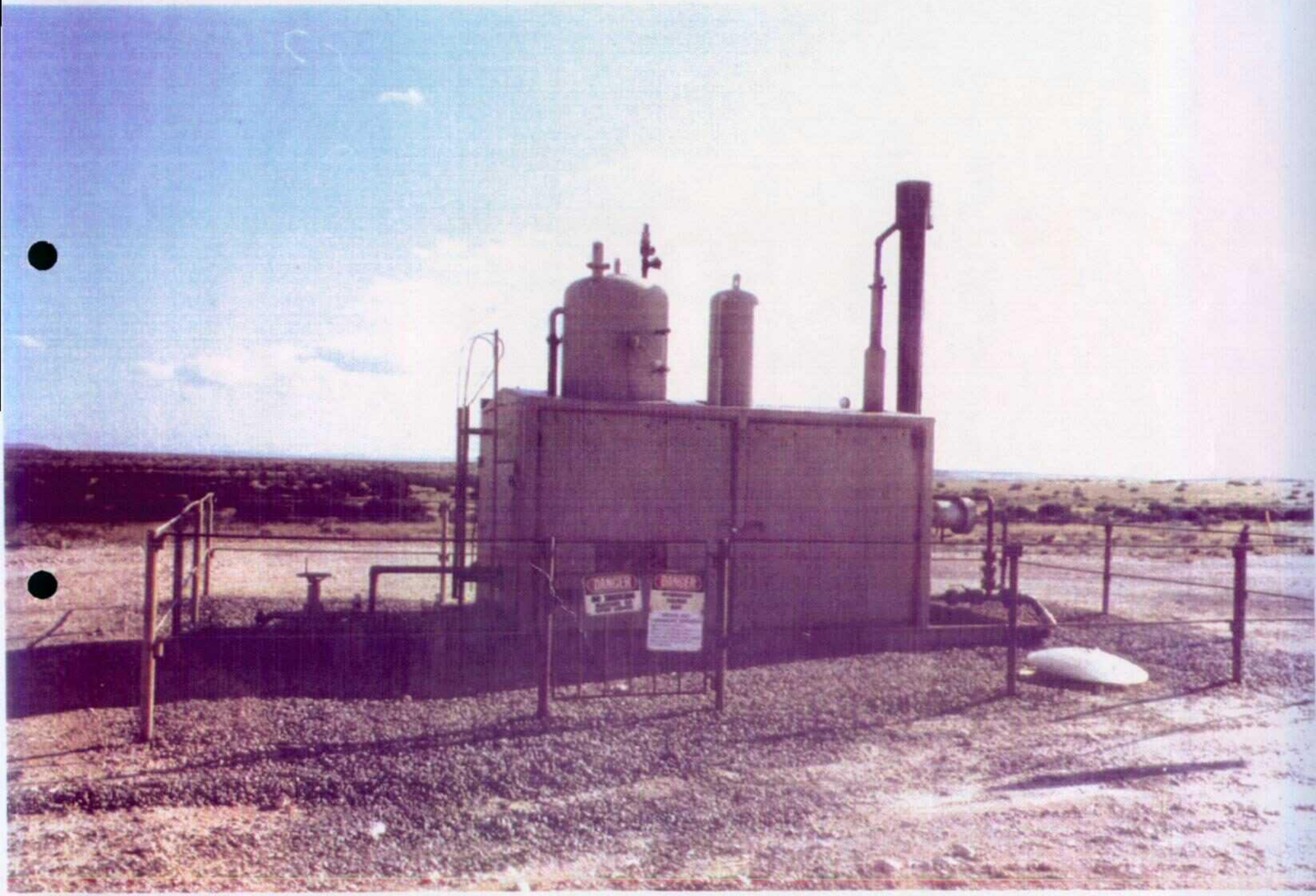
FEDERAL

STATE

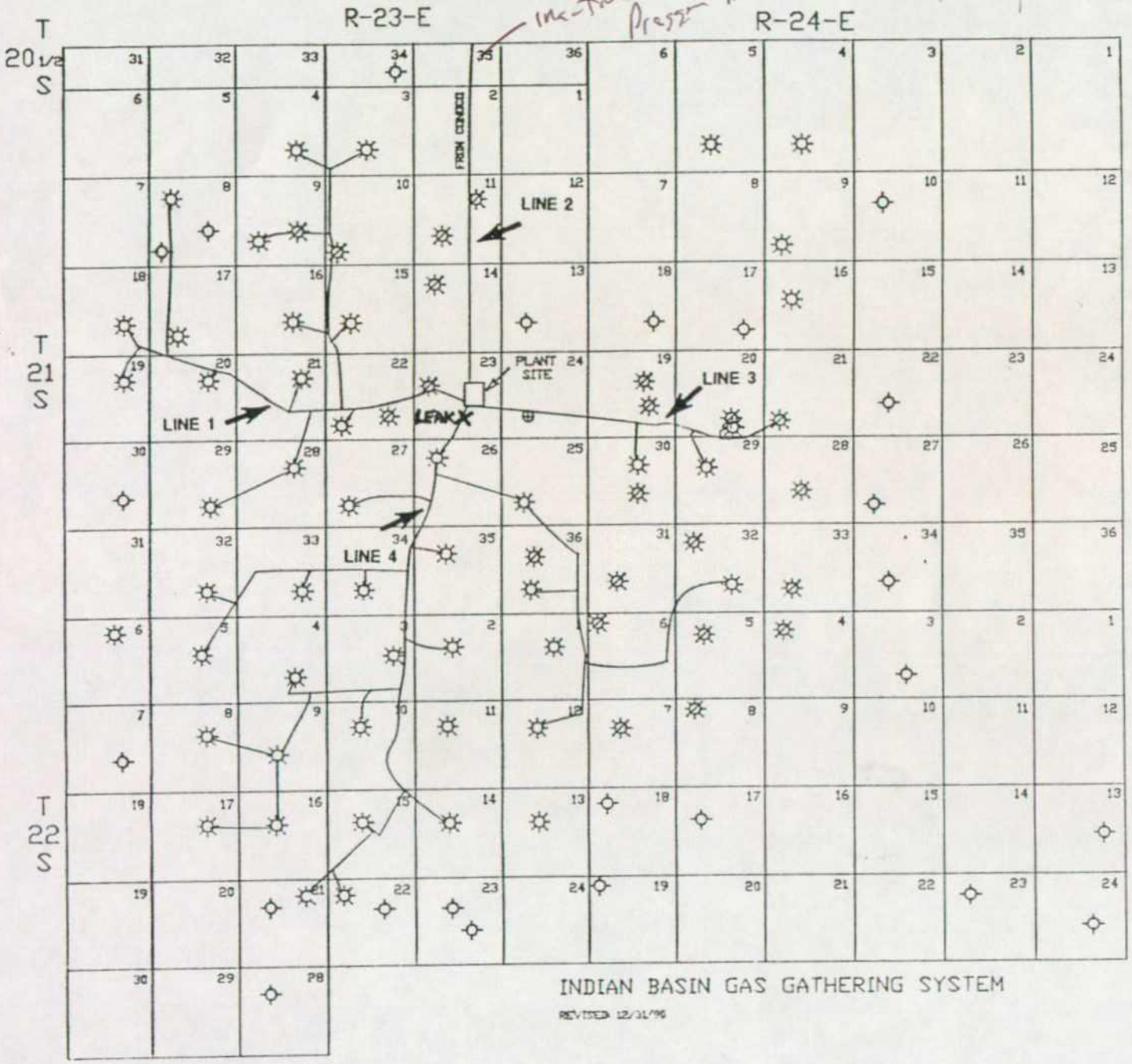
0 2 4

MILES

9/91


DANGER
DANGER

inactive for Pressure Draw Third Party Gas



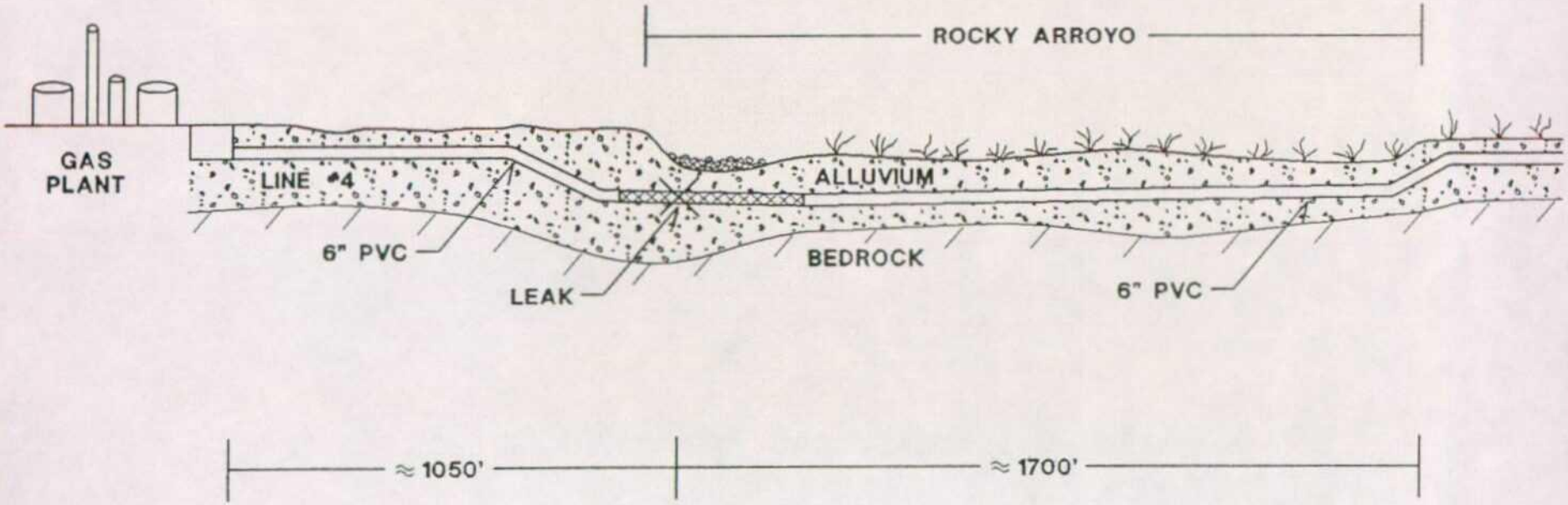
INDIAN BASIN GAS GATHERING SYSTEM

REVISED 12/31/90

Lines 1, 3, 4
Indian Basin
Gas

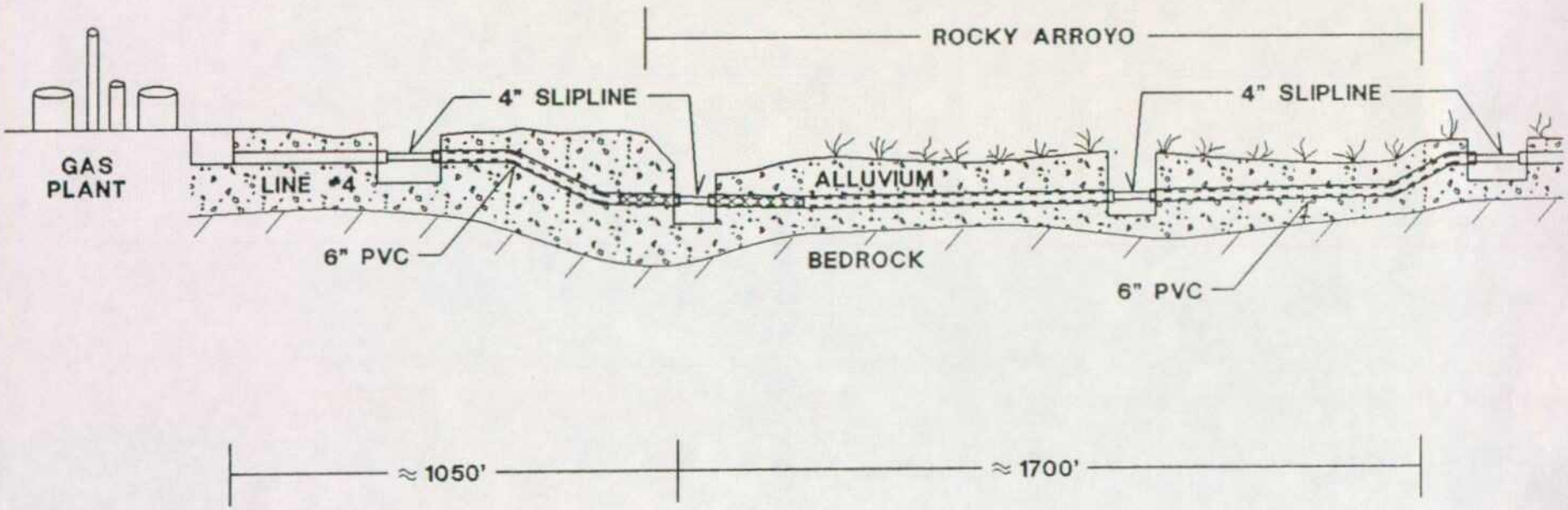
INDIAN BASIN LINE #4 LEAK

SCHEMATIC



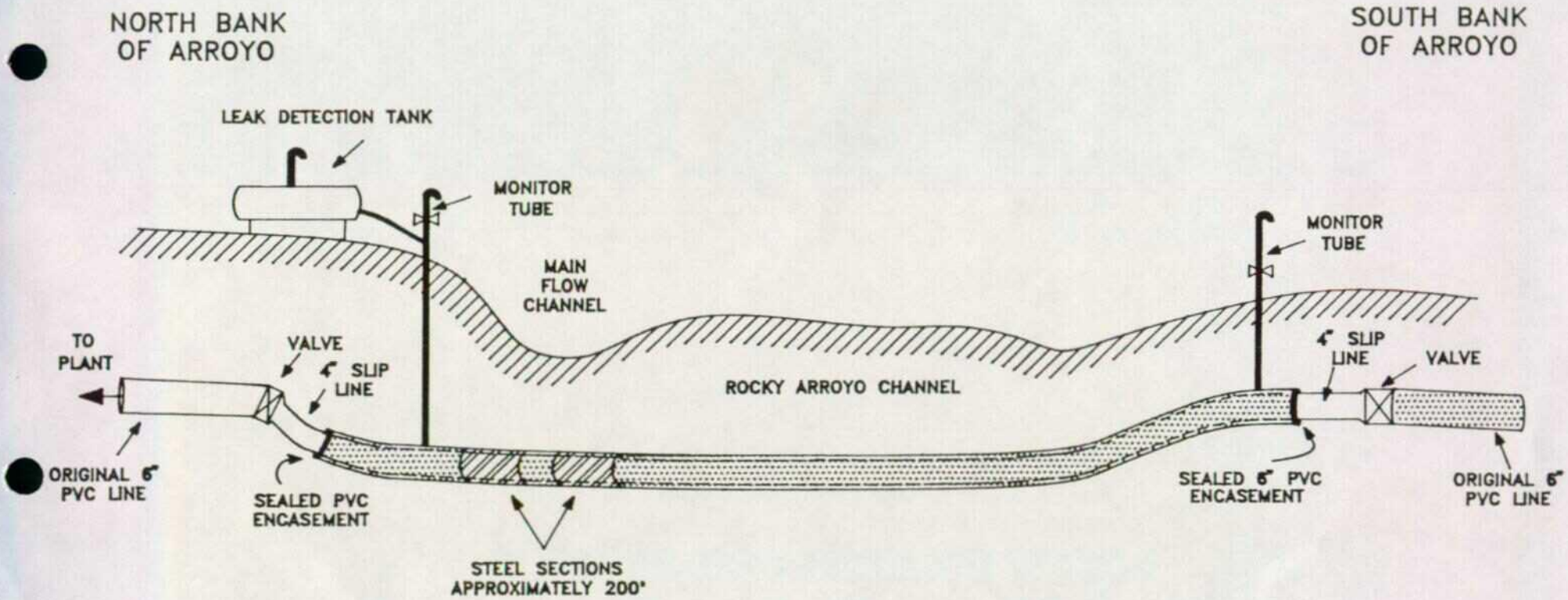
INDIAN BASIN LINE #4 REPAIRS

SCHEMATIC



SCHEMATIC OF
CONDENSATE LINE #4 MODIFICATION

(NOT TO SCALE)



NOTE: 4" PEP SLIP LINE GOES FROM NORTH BANK OF ARROYO TO SOUTH BANK (APPROXIMATELY 1700')

9/27/91

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 27, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week.

SHALLOW IMPACTED AREA

- It rained during two days of this reporting period in quantities ranging up to 0.05", as measured in the rain gauge at the site. This rain did not result in any water flow in the arroyo at the site.

- Routine sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo continues. The samples have been forwarded to Core Laboratories in Aurora, Colorado for BTEX and chloride analyses.

- Work continues on the soil venting pilot project. The vacuum-blower was delivered to the site and subsequently, connected to the vapor extraction well and power supply. The unit has been started. Samples of the vapors being vented by this process are being obtained for analysis. Additionally, the nearby monitoring wells are being monitored to characterize the subsurface air flow which the vapor extraction well is inducing. This phase of the pilot project is anticipated to continue until the latter part of October.

- Analytical results were received from samples obtained from some of the shallow bedrock wells. Results are as follows:

LOCATION	DATE	BENZENE (PPB)	TOLUENE (PPB)	ETHYL BENZENE (PPB)	XYLENES (PPB)	CHLORIDES (PPM)
BH-80	9/12	ND	ND	ND	ND	111
BH-87	9/11	ND	ND	ND	ND	420
BH-91	9/12	ND	ND	ND	ND	1.6
BH-95	9/11	4200	8900	300	4800	348

RECEI

OCT 3 1991

OIL CONSERVATION
SANTA FE

LOWER QUEEN ASSESSMENT

- Pumps have been ordered for each of the six wells where hydrocarbons are present. The type of pump selected was a total fluid pump.

- Roberts/Schornick and Associates (RSA) has been directed to develop bid specifications for an air stripping unit to treat water extracted from the Lower Queen. Once complete, bids will be solicited on such a system.

- Analytical results were received from samples obtained from some of the Lower Queen wells. Results are as follows:

LOCATION	DATE	BENZENE (PPB)	TOLUENE (PPB)	ETHYL BENZENE (PPB)	XYLENES (PPB)	CHLORIDES (PPM)
BH-90	8/30	ND	ND	ND	ND	7.9
BH-93	8/30	1	ND	ND	ND	4.2
BH-94	9/11	550	900	50	2000	21

GENERAL

- The program to sample all of the monitoring and recovery wells at the site continues. As of the end of the day on September 26, 1991, all 76 of the wells in the shallow impacted area had been checked and samples obtained when fluid was present. Additionally, eight of the Lower Queen had also been sampled. Seven Lower Queen wells remain to be sampled.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
D. D. Conway
D. E. Kenyon
A. R. Kukla
R. F. Unger

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

RECEIVED
OCT 3 1991
OIL CONSERVATION DIV.
SANTA FE

September 27, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Please find attached a copy of the ICAP metals analyses originally requested by Mr. D. G. Boyer. The results were not available at the time of the June 28, 1991 submittal of the addendum to the site characterization plan. When the results did come available in early July, they were inadvertently not forwarded to you.

Please accept my apology for this delay. Should you have any questions, contact me at your convenience.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

Attachment

cc: J. L. Benson
D. E. Kenyon
A. R. Kukla
R. F. Unger

"CONFIDENTIAL BUSINESS INFORMATION"

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

ANALYTICAL REPORT

910906

FOR

MARATHON OIL COMPANY
W. NIXON
P.O. BOX 269
LITTLETON, CO 80160

07/09/91

ADDITIONAL DATA

The analyses, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgement of Core Laboratories. Core Laboratories, however, assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, proper operations, or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced, except in its entirety, without the written approval of Core Laboratories.

"CONFIDENTIAL BUSINESS INFORMATION"

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

ADDITIONAL DATA

LABORATORY TESTS RESULTS
07/09/91

JOB NUMBER: 910906 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 IBGP PIPELINE LEAK
DATE SAMPLED.....: 05/28/91
TIME SAMPLED.....: 16:25
WORK DESCRIPTION...: LINE 4 (WATER/CONDENSATE)

LABORATORY I.D...: 910906-0001
DATE RECEIVED....: 05/30/91
TIME RECEIVED....: 13:46
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	DETECTON LIMITS	UNITS OF MEASURE	TEST METHOD	DATE	TECHNIC
Bicarbonate (Unfilt.)	900	5	mg/L	403 (3)	06/03/91	KJZ
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	06/03/91	KJZ
Chloride (Unfilt.)	12000	1	mg/L	325.3 (1)	05/31/91	PJM
Conductivity (Unfilt.)	32800	1	umhos/cm @25dF	120.1 (1)	06/03/91	MK
pH (Unfilt.)	7.43	0.01	pH Units	150.1 (1)	06/03/91	KJZ
Solids, Total Dissolved (TDS)	23900	10	mg/L	160.1 (1)	06/06/91	PJM
Sulfate (Unfilt.)	1960	10	mg/L	375.3 (1)	06/21/91	MK
Aluminum, Total (Al)	0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLM
Antimony, Total (Sb)	<0.1	0.1	mg/L	200.7/6010 (1,2)	06/11/91	TLM
Arsenic, Total (As)	<0.1	0.1	mg/L	206.2 (1)	06/20/91	TLM
Barium, Total (Ba)	0.05	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLM
Beryllium, Total (Be)	<0.005	0.005	mg/L	200.7/6010 (1,2)	06/11/91	TLM
Boron, Total (B)	2.13	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLM
Cadmium, Total (Cd)	<0.005	0.005	mg/L	200.7/6010 (1,2)	06/11/91	TL
Calcium, Total (Ca)	923	5	mg/L	200.7/6010 (1,2)	06/11/91	TL
Chromium, Total (Cr)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TL
Cobalt, Total (Co)	<0.03	0.03	mg/L	200.7/6010 (1,2)	06/11/91	TL
Copper, Total (Cu)	0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLM
Iron, Total (Fe)	0.09	0.03	mg/L	200.7/6010 (1,2)	06/11/91	TLM
Lead, Total (Pb)	<0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLM
Mercury, Total (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	06/20/91	WG
Magnesium, Total (Mg)	160	0.5	mg/L	200.7/6010 (1,2)	06/11/91	TL
Manganese, Total (Mn)	0.04	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TL

APPROVED BY: David McWhorter

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

The analyses, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgement of Core Laboratories. Core Laboratories, however, assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, proper operations, or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced, except in its entirety, without the written approval of Core Laboratories.

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
07/09/91

JOB NUMBER: 910906 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 IBGP PIPELINE LEAK
DATE SAMPLED.....: 05/28/91
TIME SAMPLED.....: 16:25
WORK DESCRIPTION...: LINE 4 (WATER/CONDENSATE)

LABORATORY I.D...: 910906-0001
DATE RECEIVED....: 05/30/91
TIME RECEIVED....: 13:46
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	DETECTON LIMITS	UNITS OF MEASURE	TEST METHOD	DATE	TECHNICI
Molybdenum, Total (Mo)	<0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Nickel, Total (Ni)	<0.04	0.04	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Potassium, Total (K)	97	5	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Selenium, Total (Se)	<0.1	0.1	mg/L	270.2 (1)	06/20/91	WGL
Silver, Total (Ag)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Sodium, Total (Na)	7300	50	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Strontium, Total (Sr)	21.5	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Titanium, Total (Ti)	<0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Vanadium, Total (V)	<0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Zinc, Total (Zn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK

ADDITIONAL DATA

APPROVED BY: Daniel McWhorter

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

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Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
1991 SEP 23 AM 8 47

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 20, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week.

SHALLOW IMPACTED AREA

- It rained during three days of this reporting period, in quantities ranging from 0.03" to 0.65", as measured in the rain gauge at the site. This rain did not result in any water flow in the arroyo at the site.

- Analytical results from routine sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo, were received. Results from those samples obtained on September 9 indicate no presence of BTEX or elevated chloride concentrations.

- Work continues on the soil venting pilot project. The vacuum-blower that will be connected to the vapor extraction well was inspected and tested at the manufacturer's facility. This work was witnessed by both an Environmental Science and Engineering (ESE) and a Marathon representative. Work on the equipment is complete and it has been deployed to the site with arrival expected by September 23, 1991.

LOWER QUEEN ASSESSMENT

- Boreholes 91, 95, and 97 were developed. Subsequently, samples were obtained and submitted to the lab for BTEX and chloride analyses.

- Gamma ray logs were run on boreholes 94 and 97. The information obtained from this effort will be used to complement our understanding of the geology at the site.

GENERAL

- The program to sample all of our monitoring and recovery wells at one point in time has been finalized and initiated at the site. All wells will be appropriately purged prior to obtaining samples. Measurements will be taken in the field for pH, temperature, and conductivity. Samples will be obtained from all wells containing fluids and submitted for TPH, BTEX and chloride analyses. Additionally, samples will be obtained from various wells and submitted for analyses as follows: samples will be obtained from ten representative wells and analyzed for general water chemistry parameters, samples will be obtained from the wells with the five highest conductivity readings and analyzed for Radium 226 and Radium 288, and samples will be obtained from the wells with the two highest conductivity readings and submitted for ICAP metals' analyses, plus arsenic, selenium, and mercury. Data obtained from this sampling will be used to characterize the fluid which presently exists, and to provide design specification data for an air stripping system to treat recovered water. As of the end of the day on September 19, 22 monitoring wells had been checked; 15 were dry and samples could not be obtained, and seven contained water. These wells were purged and samples obtained. Two sampling teams will continue this effort until sampling is complete.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A J Kavran

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
D. D. Conway
D. E. Kenyon
A. R. Kukla
R. F. Unger

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

RECEIVED

SEP 17 1991

OIL CONSERVATION DIV.
SANTA FE

September 13, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week.

SHALLOW IMPACTED AREA

- Borehole 97 was spudded at a location of S3200/W000. The hole was drilled to 112' without encountering any fluid. The zone in which fluid was present in boreholes 95 and 96 existed at approximately 75' at this location.

- Routine sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo, continues. The samples have been forwarded to Core Laboratory in Aurora, Colorado for BTEX and chloride analyses.

- It rained almost daily during this reporting period, in quantities ranging from 0.08" to 3.00", as measured in the rain gauge at the site. These rains did not result in any water flow in the arroyo through the impacted area except, during the night of September 12, when 0.8" of rain fell. During this rain the down gradient catchment trench reached capacity and overfilled.

- A representative from Environmental Science and Engineering (ESE) continued work on-site in relation to the pilot soil venting project. The site selected for this study was adjacent to borehole 37. Four additional wells to the top of bedrock were installed at varying distances from borehole 37. One of the wells will be equipped with a vacuum pump for vapor extraction, while the other three wells, plus borehole 37, will be used to monitor subsurface air movement. Soil samples were obtained while drilling through the impacted zones. The samples have been sent to the laboratory for TPH and BTEX analyses.

LOWER QUEEN ASSESSMENT

- Borehole 97 was deepened to the Lower Queen since it is located outside of the area where hydrocarbon impacted liquid is present in the shallow bedrock. The hole was reamed to 112' and 8" PVC surface casing was run and cemented. The hole was then deepened to 222' after encountering water at 193'. After allowing the well to stabilize overnight, the fluid level was measured at 190.4'. A sample was bailed from the well. There was no free product or hydrocarbon odor present in the water. The well was completed with 4" PVC. Both Mr. D. G. Boyer with the OCD and Mr. T. R. Kreager with the BLM were contacted on the afternoon of September 12, 1991 and informed of these findings from borehole 97. Both agency representatives agreed that they were currently satisfied that the impact characterization is complete, and had no objections to Marathon releasing the drilling rig.

- Analytical results were received from a water sample obtained from borehole 92 on August 28, 1991. Results indicate that there are no detectable levels of BTEX present at an individual component detection limit of 1 ppb. The chloride concentration is 9.4 ppm.

- Fluid level measurements were obtained from all the Lower Queen monitoring wells. This information will be used to develop a final potentiometric map for the Lower Queen.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
D. D. Conway
D. E. Kenyon
A. R. Kukla
R. F. Unger

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

ANALYTICAL REPORT

910906

FOR

MARATHON OIL COMPANY
W. NIXON
P.O. BOX 269
LITTLETON, CO 80160

07/09/91

ADDITIONAL DATA

The analyses, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgement of Core Laboratories. Core Laboratories, however, assumes no responsibility and makes no warranty or representations, express or implied, as to the productivity, proper operations, or profitableness of any oil, gas, coal or other mineral, property, well or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced, except in its entirety, without the written approval of Core Laboratories.

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CORE LABORATORIES

ADDITIONAL DATA

LABORATORY TESTS RESULTS
07/09/91

JOB NUMBER: 910906 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 IBGP PIPELINE LEAK
DATE SAMPLED.....: 05/28/91
TIME SAMPLED.....: 16:25
WORK DESCRIPTION...: LINE 4 (WATER/CONDENSATE)

LABORATORY I.D...: 910906-0001
DATE RECEIVED....: 05/30/91
TIME RECEIVED....: 13:46
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	DETECTON LIMITS	UNITS OF MEASURE	TEST METHOD	DATE	TECHNIC
Bicarbonate (Unfilt.)	900	5	mg/L	403 (3)	06/03/91	KJZ
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	06/03/91	KJZ
Chloride (Unfilt.)	12000	1	mg/L	325.3 (1)	05/31/91	PJM
Conductivity (Unfilt.)	32800	1	umhos/cm @25dF	120.1 (1)	06/03/91	MW
pH (Unfilt.)	7.43	0.01	pH Units	150.1 (1)	06/03/91	KJZ
Solids, Total Dissolved (TDS)	23900	10	mg/L	160.1 (1)	06/06/91	PJM
Sulfate (Unfilt.)	1960	10	mg/L	375.3 (1)	06/21/91	MW
Aluminum, Total (Al)	0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Antimony, Total (Sb)	<0.1	0.1	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Arsenic, Total (As)	<0.1	0.1	mg/L	206.2 (1)	06/20/91	TLK
Barium, Total (Ba)	0.05	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Beryllium, Total (Be)	<0.005	0.005	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Boron, Total (B)	2.13	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Cadmium, Total (Cd)	<0.005	0.005	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Calcium, Total (Ca)	923	5	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Chromium, Total (Cr)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Cobalt, Total (Co)	<0.03	0.03	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Copper, Total (Cu)	0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Iron, Total (Fe)	0.09	0.03	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Lead, Total (Pb)	<0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Mercury, Total (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	06/20/91	WGL
Magnesium, Total (Mg)	160	0.5	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Manganese, Total (Mn)	0.04	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK

APPROVED BY: Donald MacWhorter

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

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A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
07/09/91

JOB NUMBER: 910906 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 IBGP PIPELINE LEAK
DATE SAMPLED.....: 05/28/91
TIME SAMPLED.....: 16:25
WORK DESCRIPTION...: LINE 4 (WATER/CONDENSATE)

LABORATORY I.D...: 910906-0001
DATE RECEIVED....: 05/30/91
TIME RECEIVED....: 13:46
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	DETECTON LIMITS	UNITS OF MEASURE	TEST METHOD	DATE	TECHNICI
Molybdenum, Total (Mo)	<0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Nickel, Total (Ni)	<0.04	0.04	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Potassium, Total (K)	97	5	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Selenium, Total (Se)	<0.1	0.1	mg/L	270.2 (1)	06/20/91	WGL
Silver, Total (Ag)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Sodium, Total (Na)	7300	50	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Strontium, Total (Sr)	21.5	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Titanium, Total (Ti)	<0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Vanadium, Total (V)	<0.05	0.05	mg/L	200.7/6010 (1,2)	06/11/91	TLK
Zinc, Total (Zn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	06/11/91	TLK

ADDITIONAL DATA

APPROVED BY: David McWhorter

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

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FROM MOC BRIERCROFT 09/13/91 15:11 P. 5 9409601 P.05
SEP-12-91 THU 14:54

ANALYSIS REQUEST -CHAIN OF CUSTODY

Marathon Oil Company
Petroleum Technology Center
7400 S. Broadway
Littleton, Colorado 80122
(303) 794-2601/Fax (303) 794-1720

CONTACT: W. A. NIXON

PTC Project No.: 27-98-810

##########################

1. Packed By: W Nixon Date: 5/30/91
2. VOA Vials? YES NO
   Secure caps tightly by hand (DO NOT USE TAPE!)
3. OTHER BOTTLES? caps sealed w/tape? YES NO
4. Coolant? ICE COLD PAK
   Other:
5. COOLER/PACKAGE SEAL Date/Time: 5/30/91 - 12:30 pm
6. Notes/Comments:

ANALYTICAL LABORATORY ADDRESS:

Company: Core Laboratories
Street Address: 1300 S. Potomac Street, Suite 130
City/State/ZIP: Aurora, Colorado 80012
Phone: (303) 751-1780
FAX: (303) 751-1784

ANALYTICAL LABORATORY RECEIPT-OBSERVATIONS:

1. SEAL Intact? YES NO
2. Coolant Condition: Cold
3. Condition of Contents? Good

	SAMPLING DATE	SAMPLING TIME	SAMPLE LABEL ID	SAMPLE TYPE	NO. CONTAINERS	ANALYSIS PARAMETERS
(1)	5/25/91	4:25 pm	LINE 4 H_2O/COND.	WATER	4-qt. btls	Mineral Assay
(2)						(per A.J. KAVRANS list)
(3)						
(4)						
(5)						
(6)						
(7)						
(8)						
(9)						
(10)						

SHIPPING DETAILS

Delivered to LAB Shipper by: David Louck
Method of Shipment: Company truck
Airbill #: N/A
Rec'd for Lab: [illegible] Date: 5-30-91 Time: 13:46
Assigned Laboratory Number:

LAB TO LAB CUSTODY TRANSFERS

	Signature	Date	Time
Relinquished by: (signed):	David Louck	5/30/91	13:46 HTS
Received by: (signed):	[illegible]	5-30-91	13:46
Relinquished by: (signed):			
Received by: (signed):			

Computer Entry

Petroleum Technology Cent

Call Analyst for estimated completion data

Marathon Oil Company

ANALYTICAL REQUEST

	Project No.	Requestor		Ext. No.	Date Submitted	No. of Sa
282	2798810	NIXON	W	471	5/30/91	1
		Last Name	Initial			

Analyses Requested Mineral Assay per attached list from A. J. Kauran/s

Date Required RUSH

Project/Sample Description IBGP Pipeline leak Project

Hazardous Yes ☑ No ☐ Explain Hydrocarbons possibly

Return Sample Yes ☑ No ☐ To W Nixon

Estimated Completion / /

Actual Completion / /

Lab Code

Requestor should not write in the shaded areas.

Analysis Codes →									
Sample No.	Lab No.								
	LINE 4 H_2O/COND - Mineral Assay (per attached faxed list from A. J. KAURAN, 5/29/91)								
Analyst									
Time									
Reference									

OIL CONSERVATION DIVISION
RECEIVED
1991 SEP 16 AM 9 18

Marathon Oil Company

Mid-Continent Region
Production United States

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 11, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

This letter is intended as a follow-up to our telephone conversation on the morning of September 9, 1991. In those conversations approval was requested and subsequently granted to drill an additional delineation well in the Indian Basin area at a location of S3200/W000. A archeological survey had already been completed, and indicated that there were no finds in this area. The procedures utilized in drilling the previous bedrock wells will be utilized in drilling this well.

We will keep you informed of the results obtained from drilling this well. Should you have any questions, please contact me.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
A. R. Kukla
R. F. Unger

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED

Marathon Oil Company

91 SEP 16 AM 9 18

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 11, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

This letter is intended as a follow-up to our telephone conversation on the morning of September 3, 1991. In those conversations approval was requested and subsequently granted to drill an additional delineation well in the Indian Basin area.

The site was proposed at an approximate location of W200/S2600. However, due to an archeological find at this site, the drilling location had to be repositioned 100' to the north at W200/S2500. The procedures utilized in drilling the previous bedrock wells will be utilized in drilling this well.

Should you have any questions or wish to discuss, please contact me.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
A. R. Kukla
R. F. Unger

OCD UPDATE:
MARATHON INDIAN BASIN SPILL
WATER QUALITY CONTROL COMMISSION
SEPTEMBER 10, 1991

List of Handouts:

1. Marathon summary update, August 30, 1991.
2. Produced water analysis, Gathering Line 4 (partial).
3. Monitor well analyses (partial).
4. Well completion record and boring record, Borehole 84 (Monitor Well 58).
5. Possible pollution pathways, Lower Queen aquifer.
6. Numbered well location map (black and white copy).
7. Assessment map (color copy).

Marathon

1. Has temporarily ceased recovery in shallow impacted area - Reason - Only dissolved phase
2. Is installing deep, explosion-proof ~~wells~~ pumps in deep ~~[illegible]~~ wells w/product (aquifer flat, semi-confined, ~~[illegible]~~ concave direction of flow)
3. Continues drilling to South to find extent of contamination
4. Has tested other lines - No leaks
5. Is preparing soil venting in shallow impacted area
6. Sampling all wells at once for "snapshot" of WQ
7. In contact w/ranchers, BLM, State Engineer on all aspects

OCD

1. Will require continued drilling until satisfied w/delineation
2. Has split samples for verification Results not back yet
3. Continues to receive cooperation w/Marathon
4. Satisfied no current use of water will be impacted (except Marathon's own plant well for process water (not used for drinking)

~~[illegible]~~

Issues

1. Shallow Bedrock Fracture System - Complex; not yet well defined - control discharge to aquifer

2.

3. OCD legal action - Position is same as previously stated - We are receiving cooperation and have no plans to ~~and initiate initiate~~ initiate action. Reserve option if cooperation ceases. Main intention is to solve problem, not pay lawyer fees.

4. OCD evaluating (at Director's level) ~~in~~ entire aging infrastructure problem.

APPENDIX K

ALLUVIAL/SHALLOW BEDROCK MONITOR WELL WATER ANALYSES

Monitor Wells (Borehole)	Date Sampled	Concentration (PPM) Benzene	Toluene	E Benzene	Xylene	Chlorides
MW #1 (BH-14)	5/23/91	0.500	ND	1.000	ND	310
MW #10 (BH-33)	5/23/91	5.500	7.000	ND	4.500	60
MW #18 (BH-41)	5/23/91	--	--	--	--	310
MW #19 (BH-42)	5/22/91	--	--	--	--	320
MW #19	7/30/91	4.900	1.000	1.300	2.500	466
MW #21 (BH-44)	5/23/91	0.009	0.009	ND	0.003	230
MW #26 (BH-49)	5/21/91	--	--	--	--	440
MW #37 (BH-60)	6/25/91	ND	ND	ND	ND	52
MW #38 (BH-61)	5/28/91	0.500	ND	0.250	ND	60
MW #38	6/25/91	ND	ND	ND	ND	38
MW #39 (BH-62)	5/28/91	ND	ND	0.011	0.038	9
MW #39	6/25/91	ND	ND	ND	ND	244
MW #41 (BH-64)	6/04/91	--	--	--	--	29
MW #41	7/02/91	0.300	ND	0.350	ND	38
MW #41	7/30/91	0.380	ND	0.220	0.025	71
MW #43 (BH-66)	6/05/91	ND	ND	0.015	0.010	138
MW #43	6/25/91	ND	ND	ND	ND	94
MW #44 (BH-67)	6/04/91	0.075	ND	0.220	ND	33
MW #44	6/25/91	0.050	ND	0.100	ND	34
MW #45 (BH-68)	6/07/91	ND	ND	ND	ND	451
MW #45	6/25/91	ND	ND	ND	ND	507
MW #46 (BH-69)	6/06/91	3.200	ND	0.900	ND	152
MW #46	7/02/91	0.300	ND	0.250	0.250	45
MW #46	7/30/91	0.170	ND	0.260	0.060	76
MW #47 (BH-70)	6/06/91	0.600	ND	2.000	2.700	51
MW #47	6/25/91	0.550	ND	ND	ND	164
MW #49 (BH-72)	6/06/91	0.060	ND	0.060	0.040	365
MW #49	6/25/91	ND	ND	0.020	0.020	310
MW #50 (BH-73)	6/07/91	0.009	0.006	0.001	0.002	376
MW #50	6/25/91	ND	ND	ND	ND	388
MW #54 (BH-80)	6/24/91	ND	ND	ND	ND	97
MW #55 (BH-81)	6/30/91	ND	ND	ND	0.100	200
MW #56 (BH-82)	7/01/91	2.000	0.500	1.000	1.000	102

APPENDIX K

LOWER QUEEN MONITOR WELL WATER ANALYSES

Monitor Wells (Borehole)	Date Sampled	Benzene	Toluene	E Benzene	Xylene	Chlorides
MW-57 (BH-83)	6/25/91	0.005	0.009	ND	0.004	16
MW-57	6/30/91	ND	0.001	ND	ND	15
MW-57	7/19/91	ND	ND	ND	ND	13
MW-58 (BH-84)	7/04/91	0.600	ND	0.200	0.900	65
MW-59 (BH-85)	7/12/91	1.200	ND	0.750	1.500	22
MW-60 (BH-86)	7/14/91	ND	ND	ND	ND	9
MW-60		ND	ND	ND	ND	10
MW-61A (BH-87A)	7/14/91	ND	ND	ND	0.001	10
MW-61A	7/18/91	0.003	0.001	ND	0.003	10

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A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
06/21/91

JOB NUMBER: 910906 CUSTOMER: MARATHON OIL COMPANY ATTN: W. NIXON

CLIENT I.D.....: 27-98-810 IBGP PIPELINE LEAK
DATE SAMPLED.....: 05/28/91
TIME SAMPLED.....: 16:25
WORK DESCRIPTION...: LINE 4 (WATER/CONDENSATE)

LABORATORY I.D...: 910906-0001
DATE RECEIVED....: 05/30/91
TIME RECEIVED....: 13:46
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	DETECTON LIMITS	UNITS OF MEASURE	TEST METHOD	DATE	TECHNIC
Bicarbonate (Unfilt.)	900	5	mg/L	403 (3)	06/03/91	KJ
Carbonate (Unfilt.)	<1	1	mg/L	403 (3)	06/03/91	KJ
Chloride (Unfilt.)	12000	1	mg/L	325.3 (1)	05/31/91	PJ
Conductivity (Unfilt.)	32800	1	umhos/cm @25dF	120.1 (1)	06/03/91	M
pH (Unfilt.)	7.43	0.01	pH Units	150.1 (1)	06/03/91	KJ
Solids, Total Dissolved (TDS)	23900	10	mg/L	160.1 (1)	06/06/91	PJ
Sulfate (Unfilt.)	1960	10	mg/L	375.3 (1)	06/21/91	M
Arsenic, Total (As)	<0.1	0.1	mg/L	206.2 (1)	06/20/91	TL
Calcium, Total (Ca)	923	5	mg/L	200.7/6010 (1,2)	06/11/91	TL
Mercury, Total (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	06/20/91	WG
Magnesium, Total (Mg)	160	0.5	mg/L	200.7/6010 (1,2)	06/11/91	TL
Potassium, Total (K)	97	5	mg/L	200.7/6010 (1,2)	06/11/91	TL
Selenium, Total (Se)	<0.1	0.1	mg/L	270.2 (1)	06/20/91	WG
Sodium, Total (Na)	7300	50	mg/L	200.7/6010 (1,2)	06/11/91	TL

APPROVED BY: Denise McWharter

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

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Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

ANALYTICAL REPORT
06/21/91

CUSTOMER: Marathon Oil Company

File No..: 910887.

CATION/ANION BALANCE

Client Sample I.D..... #1
Remark/Project..... 27-98-810 IBGP Pipeline Leak
Date/Time Sampled..... 05-28-91/1625
Date/Time Received..... 05-30-91/1346
Laboratory Sample I.D..... 910906-1

PARAMETER	RESULT		UNITS
pH	7.43		pH Units
Conductivity at 25 degrees C	32800		umhos/cm
Alkalinity (as CaCO3)	737		mg/L
Total Diss. Solids (measured)	23900		mg/L
Total Diss. Solids (calculated)	22890		mg/L
		meg/Liter	
Calcium (Ca)	923	46.06	mg/L
Magnesium (Mg)	160	13.17	mg/L
Sodium (Na)	7300	317.55	mg/L
Potassium (K)	97	2.48	mg/L
Total Cations meq/Liter		379.26	
		meg/Liter	
Bicarbonate (HCO3)	900	14.75	mg/L
Carbonate (CO3)	ND(1)	0.00	mg/L
Hydroxide (OH)	ND(1)	0.00	mg/L
Chloride (Cl)	12000	338.52	mg/L
Sulfate (SO4)	1960	40.81	mg/L
Total Anions meq/Liter		394.08	

Cation-Anion Balance (RPD) 3.83 Percent

ND = NOT DETECTED AT LEVEL SHOWN IN PARENTHESIS

Approved By: David McWhorter

1300 South Potomac, St., Suite 130
Aurora, Colorado 80012
Tele. (303) 751-1780

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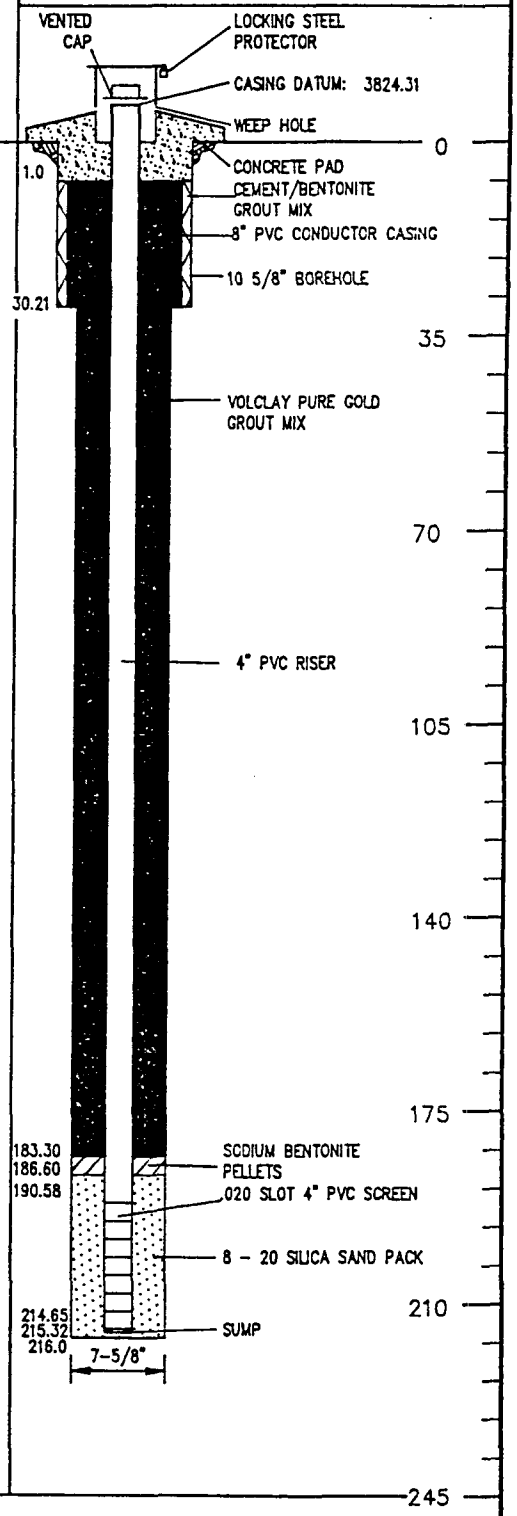
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		NOTE: SEE BORING RECORD # 84 FOR MORE DETAILED LITHOLOGIC DESCRIPTION				
		GROUND SURFACE: 3821.60				
	0	CLAYEY SILT:	ML		SEE BORING RECORD FOR DETAILED DESCRIPTION	
	5.0	SILTSTONE:	SILTSTONE			
	10.0	DOLOMITE:	DOLOMITE			
	15.0	DOLOMITE:	DOLOMITE			
	18.0		DOLOMITE			
	20.5	DOLOMITE:	SANDSTONE			
	22.0	SANDSTONE:	DOLOMITE			
	28.0	DOLOMITE:	SANDSTONE			
	30.0	SANDSTONE:	SANDSTONE			
	35	SANDSTONE:				
	42.0		SANDSTONE			
	44.0	SANDSTONE:	SANDSTONE			
	48.0	SANDSTONE:	SANDSTONE			
		SANDSTONE:				
	55.0	SANDSTONE:	SANDSTONE			
	65.0	SANDSTONE:	SANDSTONE			
	70					
	76.0	DOLOMITE:	DOLOMITE			
	82.0		SANDSTONE			
	84.0	SANDSTONE:	SANDSTONE			
		SANDSTONE:				
	94.0	SANDSTONE:	SANDSTONE			
	97.0	DOLOMITE:	DOLOMITE			
	100.0		DOLOMITE			
	104.0	DOLOMITE:	DOLOMITE			
	105	DOLOMITE:				
	112.0	SANDY DOLOMITE:	DOLOMITE			
	118.0	SANDY DOLOMITE:	DOLOMITE			
	124.0	DOLOMITE:	DOLOMITE			
	135.0		DOLOMITE			
	138.0	DOLOMITE:	DOLOMITE			
	140	DOLOMITE:				
	142.0	SANDY DOLOMITE:	DOLOMITE			
	160.0					
	164.0	SANDY DOLOMITE:	DOLOMITE			
		SILTSTONE:	SILTSTONE			
	172.0					
	175	DOLOMITE:	DOLOMITE			
	192.0	DOLOMITE:	DOLOMITE			
	198.0	DOLOMITIC LIMESTONE:	LIMESTONE			
	202.0	LIMESTONE:	LIMESTONE			
	205.0		LIMESTONE			
	207.0	LIMESTONE:	LIMESTONE			
	210	SANDSTONE:	SANDSTONE			
	216.0	T.D. 216.0'				
	245					

WELL COMPLETION DETAIL



SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY
NS: NOT SAMPLED

JOB NAME/NUMBER ***MARATHON/91029.01***

BORING NUMBER ***MW-58 (BH-84)***

DATE DRILLED 6/31/91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
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BORING RECORD

GROUND SURFACE: 3821.60

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
	0	CLAYEY SILT: LIGHT BROWN, 7.5 YR 6/3, 30% CLAY, 60% SILT, FIRM TO LOOSE, FRIABLE, 10% CALICHE DEPOSITS, DRY	ML
	5	SILTSTONE: LIGHT GRAY, 5 YR 7/1, SLIGHTLY HARD, FRIABLE, DRY, WEATHERED APPEARANCE, SILICEOUS	SILTSTONE
	10	DOLOMITE: SANDY, LIGHT GRAY, 5 Y 7/1, AND LIGHT BROWNISH GRAY 10 YR 6/2, VERY SLIGHTLY CALCAREOUS, HARD, DRY, DENSE, SCATTERED HEMATITE ~ 5% THROUGHOUT	SANDY DOLOMITE
	15	DOLOMITE: 10 YR 6/1, GRAY, VERY HARD, VERY FINE MICROCRYSTALLINE, DENSE, CHERTY, DRY, FRACTURED INTERVAL FROM 15.0–15.2', AND 16.2–16.4', DRY	DOLOMITE
	18.0	DOLOMITE: AS ABOVE, INTERBEDDED WITH SANDSTONE, VERY FINE GRAIN, LIGHT BROWNISH GRAY, 10 YR 6/2, AND PALE BROWN, 10 YR 6/3, SILICEOUS CEMENT, DRY, DENSE	DOLOMITE /SANDSTONE
	20 / 20.5	SANDSTONE: PALE BROWN, 10 YR 6/3, AND GRAYISH BROWN, 2.5 YR 5/2, ARGILLACEOUS, MODERATELY SOFT, SILICEOUS CEMENT, DRY	SANDSTONE
	22.0	DOLOMITE, LIGHT GRAY, VERY FINE CRYSTALLINE, VERY SLIGHTLY SANDY, SLIGHTLY CALC., 10 YR 7/1, VERY HARD, DENSE, DRY, INTERBEDDED WITH SANDSTONE, AS ABOVE, BELOW 25.0'	DOLOMITE
	25		
	28.0	SANDSTONE: GRAY, 2.5 YR N6/0, AND GRAYISH BROWN, 10 YR 5/2, VERY FINE GRAIN SLIGHTLY CALCAREOUS CEMENT, MOD. CEMENTED, MOD. HARD, SLIGHTLY FRIABLE, DENSE	SANDSTONE
	30	SANDSTONE: LIGHT BROWNISH GRAY, 10 YR 6/2, AND PALE BROWN, 10 YR 6/3, SLIGHTLY HARD TO SOFT, VERY FINE GRAIN, VERY SLIGHTLY CALCEREOUS, PREDOMINATELY SILICEOUS, DRY, MASSIVE, WEAKLY CEMENTED	SANDSTONE
	35		

GRAPHIC LOG

OVM SOIL GAS PPM X 14.0 — 2 4 6 8 10 12 14 16 18

SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
1	0.0	GC	2.0
2	0.0	GC	4.0
3	0.0	GC	6.0
4	0.0	GC	8.0
5	0.0	GC	10.0
6	0.0	GC	12.0
7	0.0	GC	14.0
8	0.0	GC	16.0
9	0.0	GC	18.0
10	0.0	GC	20.0
11	0.0	GC	22.0
12	0.0	GC	24.0
13	0.0	GC	26.0
14	0.0	GC	28.0
15	0.0	GC	30.0
1	2.0	GC	32.0
2	79.0	GC	34.0
3	0.0	GC	35.0

REMARKS

BACKGROUND OVM READING: SOIL 0.0 PPM; AIR 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOST

JOB NAME/NUMBER **MARATHON/91029.01**

BORING NUMBER **BH-84 (MW-58)**

DATE DRILLED 6/29/91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
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NORMAN, OKLAHOMA 73072
(405) 321-3168

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM GAS PPM X 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING: SOIL: 0.0 PPM AIR: 0.0 PPM
	35	SANDSTONE, AS ABOVE BUT BECOMING VERY POORLY CEMENTED TO UNCONSOLIDATED BELOW 40.0', SILTY	SANDSTONE			3	0.0	GC	38.0	35
						4	0.0	GC	36.0	
						5	0.0	GC	40.0	
	40					6	115.0	GC	42.0	40
	42.0	SANDSTONE: LIGHT GRAY 7.5 YR N 7/0, SLIGHTLY DOLOMITIC, SILICEOUS, VERY FINE GRAIN, MOD. HARD, FRIABLE, DRY	SANDSTONE			7	91.8	GC	44.0	
	44.0	SANDSTONE: LIGHT BROWN, 7.5 YR 6/3, SILICEOUS, VERY FINE GRAIN, VERY POORLY CEMENDTED, DRY, SILTY	SANDSTONE			8	0.0	GC	46.0	
	45					9	0.0	GC	48.0	45
	48.0	GRADING TO SANDSTONE: LIGHT BROWNISH GRAY, 10 YR 6/2, VERY FINE GRAIN, SLIGHTLY DOLOMITIC, HARD, DRY, WELL CEMENTED	SANDSTONE			10	0.0	GC	50.0	
	50					11	122.0	GC	52.0	50
						12	13.9	GC	54.0	
	55	SANDSTONE: BROWN, 7.5 YR 5/3, VERY FINE GRAIN, SILICEOUS, VERY POORLY CEMENTED, LOOSE, MOIST, SILTY	SANDSTONE			13	260.0	GC	56.0	55
						14	0.0	GC	58.0	
						15	0.0	GC	60.0	
	60					16	0.0	GC	62.0	60
						17	0.0	GC	64.0	
	65	SANDSTONE: BROWN, 7 YR 5/3, VERY FINE GRAIN, SILICEOUS, VERY POORLY CEMENTED, LOOSE, MOIST, SILTY, INTERBEDDED WITH MINOR DOLOMITIC SANDSTONE	SANDSTONE			18	0.0	GC	66.0	65
						19	152.0	GC	68.0	
	70					20	0.0	GC	70.0	70

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC GRAB COMPOST

JOB NAME/NUMBER **MARATHON/91029.01**

BORING NUMBER **BH-84 (MW-58)**

DATE DRILLED 6/29/91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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ENVIRONMENTAL CONSULTANTS
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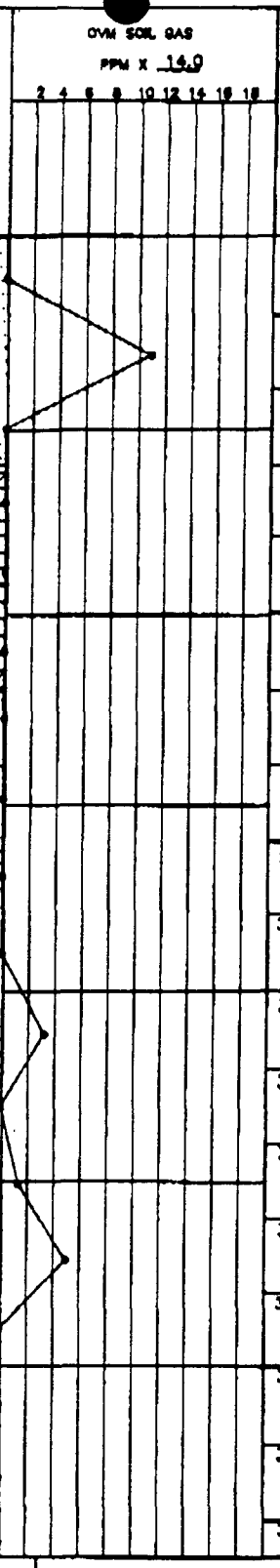
(405) 321-1096

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3821.60	
	70	SANDSTONE: CONTINUED FROM PREVIOUS PAGE	SANDSTONE
	75		
	76.0	DOLOMITE: LIGHT GRAY, 5 YR 6/1, MICRO-CRYSTALLINE, CHERT, HARD, DRY	DOLOMITE
	80		
	82.0	SANDSTONE: LIGHT GRAY, 7.5 YR N 7/0, VERY FINE GRAIN, SLIGHTLY DOLOMITIC, MODERATELY HARD, FRIABLE, DRY	SANDSTONE
	84.0	SANDSTONE: GRAYISH BROWN, 10 YR 5/2, SOFT, VERY POORLY CEMENTED, VERY FINE GRAIN, MOIST	SANDSTONE
	85	BELOW 88.0', SANDSTONE AS ABOVE INTER-BEDDED WITH SANDSTONE, 7.5 YR N 7/0, VERY FINE GRAIN, VERY SLIGHTLY DOLO-MITIC, MOD. SILICEOUS CEMENT, FRIABLE, THINLY BEDDED	
	90		
	94	SANDSTONE: DOLOMITIC, GRAY, 10 YR 6/1, MOD. HARD, VERY FINE GRAIN, MOD. CE-MENTED, DRY	DOLOMITIC SANDSTONE
	95		
	97	DOLOMITE: GRAYISH BROWN, 10 YR 5/2, PREDOMINATELY MICROCRYSTALLINE, TRACE FN CRYSTALLINE, SLIGHTLY SANDY DOLO-MITE, HARD, DENSE, DRY	DOLOMITE
	100	DOLOMITE: GRAYISH BROWN, 10 YR 5/2, MICROCRYSTALLINE, SOME FN CRYSTALLINE WITH SANDY TEXTURE, HARD, DENSE, DRY, VERY SLIGHTLY CALCAREOUS	DOLOMITE
	104	DOLOMITE: GRAYISH BROWN, 10 YR 5/2,	DOLOMITE
	105		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
21	0.0	GC	72.0
22	146.0	GC	74.0
23	0.0	GC	76.0
24	0.0	GC	78.0
25	0.0	GC	80.0
26	0.0	GC	82.0
27	0.0	GC	84.0
28	0.0	GC	86.0
29	0.0	GC	88.0
30	0.0	GC	90.0
31	47.4	GC	92.0
32	0.0	GC	94.0
33	18.3	GC	96.0
34	66.1	GC	98.0
35	0.0	GC	100.0
36	0.0	GC	102.0
37	0.0	GC	104.0
38	0.0	GC	105.0

REMARKS

BACKGROUND OVM READINGS:
SOIL: 0.0 PPM
AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER **MARATHON/91029.01**

BORING NUMBER **BH-84 (MW-58)**

DATE DRILLED 6/29/91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

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3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	ORGANIC VOL. GAS PPM X 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING: SOIL 0.0 PPM AIR 0.0 PPM
	105	AND BROWN, 10 YR 5/3, MICROCRYSTALLINE, CHERTY, DENSE, HARD, DRY, INTERBEDDED WITH SILTSTONE, MINOR DUSKY YELLOWISH GREEN, 5 GY 5/2, SOFT, FISSILE	DOLOMITE			38	0.0	GC	106.0	105
						39	0.0	GC	108.0	
						40	0.0	GC	110.0	
	110	BECOMING VERY SILTY DOLOMITE BELOW, 110.0'				41	0.0	GC	112.0	110
	112.0	SANDY DOLOMITE: LIGHT GRAY, 10 YR 8/1, COARSELY CRYSTALLINE, DENSE, HARD, DRY, INTERBEDDED WITH SILT, LIGHT GRAY 10 YR 7/1, VERY SOFT, UNCONSOLIDATED POWDERY IN CUTTINGS, DRY	DOLOMITE SANDY WITH INTER-BEDDED SILT			42	0.0	GC	114.0	
	115					43	246.0	GC	116.0	115
						44	78.0	GC	118.0	
	118.0	SANDY DOLOMITE: GRAY, 7.5 YR N 6/0, FINE CRYTSTALLINE, SANDY, DULL APPERANCE, HARD, MASSIVE, DRY	SANDY DOLOMITE			45	223.0	GC	120.0	
	120					46	0.0	GC	122.0	120
						47	0.0	GC	124.0	
	124.0	DOLOMITE: LIGHT GRAY, 10 YR 8/1, MICROCRYSTALLINE, DENSE, CHERTY, HARD, DRY, VERY SLIGHTLY SILTY	DOLOMITE			48	0.0	GC	126.0	
	125					49	0.0	GC	128.0	125
						50	0.0	GC	130.0	
	130					51	0.0	GC	132.0	130
						52	0.0	GC	134.0	
	135	DOLOMITE: LIGHT GRAY, 10 YR 8/1, MICRO CRYSTALLINE, DENSE, CHERTY, HARD, DRY, SOME VERY SLIGHTLY SILTY	DOLOMITE			53	0.0	GC	136.0	135
						54	0.0	GC	138.0	
	138.0	DOLOMITE, AS ABOVE, INTERBEDDED WITH SANDSTONE, GRAYISH BROWN, 10 YR 5/2, SOFT, VERY POORLY CEMENTED, DRY	DOLOMITE WITH INTERBEDDED SANDSTONE			55	0.0	GC	140.0	
	140									140

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER **MARATHON/91029.01**

BORING NUMBER **BH-84 (MW-58)**

DATE DRILLED 6/29/91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY CHR
CHECKED BY BJS
DRAWN BY: SAR

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BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVM SOIL GAS PPM x 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING: SOIL 0.0 PPM AIR 0.0 PPM
	140	(CONTINUED FROM PREVIOUS PAGE)	DOLOMITE			56	0.0	GC	142.0	140
	142.0	SANDY DOLOMITE: LIGHT BROWNISH GRAY 10 YR 6/2, VERY FINE CRYSTALLINE, SLIGHTLY SILTY, DENSE, HARD, DRY	SANDY DOLOMITE			57	0.0	GC	144.0	
	145					58	0.0	GC	146.0	145
						59	0.0	GC	148.0	
						60	0.0	GC	150.0	
	150	SANDY DOLOMITE, AS ABOVE, GRADING TO GRAY, 7.5 YR N 6/0, HARD, DRY, MASSIVE, DENSE				61	0.0	GC	152.0	150
						62	0.0	GC	154.0	
	155					63	0.0	GC	156.0	155
						64	0.0	GC	158.0	
						65	0.0	GC	160.0	
	160					66	1.4	GC	162.0	160
						67	1.4	GC	164.0	
	164.0	SILTSTONE: WHITE 10 YR 8/2, TO PINKISH WHITE 7.5 YR 8/2, INTERBEDDED WITH DOLOMITE, VERY FINE CRYSTALLINE, DENSE, HARD, SILTSTONE, VERY POORLY CEMENTED, POWDERY IN SAMPLES, LOOSE, DRY, CALCEREOUS WITH INCREASING DOLOMITE BELOW 168.0'	SILTSTONE WITH INTERBEDDED DOLOMITE			68	2.8	GC	166.0	
	165					69	0.0	GC	168.0	165
						70	0.0	GC	170.0	
	170					71	1.4	GC	172.0	170
	172.0	DOLOMITE: LIGHT BROWNISH GRAY, 10 YR 6/2, VERY FINE CRYSTALLINE TO MICROCRYSTALLINE, DENSE, HARD, DRY, INTERBEDDED WITH SOME DOLOMITE, SANDY, VERY PALE BROWN, 10 YR 7/3, POORLY	DOLOMITE & SANDY DOLOMITE			72	0.0	GC	174.0	
	175					73	0.0	GC	173.0	175

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GS: GRAB COMPOSIT

JOB NAME/NUMBER **MARATHON/910289.01**

BORING NUMBER **BH-84 (MW-58)**

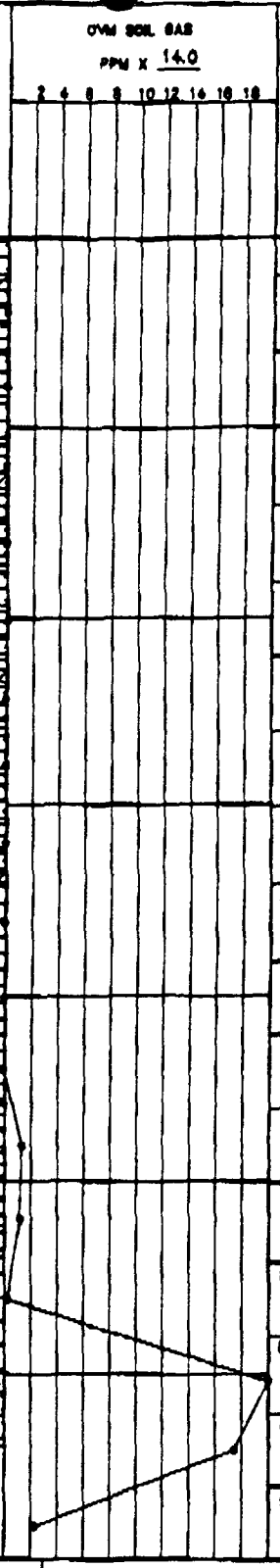
DATE DRILLED 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-[illegible]

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION
		GROUND SURFACE: 3821.80	
	175	CONTINUED FROM PREVIOUS PAGE	DOLOMITE & SANDY DOLOMITE
	180		
	185		
	190		
	192.0	DOLOMITE: LIGHT GRAY, 5 YR 6/1, MICRO-CRYSTALLINE, CHERTY, DENSE, MASSIVE, HARD, DRY	DOLOMITE
	195		
	196.0	DOLOMITIC LIMESTONE: PINK, 7.5 YR 8/3, AND PINKISH GRAY, 7.5 YR 7/2, SOFT, MED. HARD, CHALKY, FINE CRYSTALLINE, DRY, HYDROCARBON ODOR IN SAMPLE #85	DOLOMITIC LIMESTONE
	200		
	202.0	LIMESTONE: WHITE, 10 YR 8/2, SOFT, ARGILLACEOUS, VERY CHALKY WITH FAIR HYDROCARBON ODOR IN SAMPLE #88	LIMESTONE
	205	LIMESTONE: AS ABOVE, AND VERY SANDY LIMESTONE, VERY PALE BROWN, 10 YR 8/3 AND WHITE 10 YR 8/2, FAIR HYDROCARBON ODOR, MOD. CONSOLIDATED, VERY SLIGHTLY MOIST	LIMESTONE SANDY
	207.0	SANDSTONE: LIGHT BROWNISH GRAY, 10 YR 6/2, DOLOMITIC, VERY POORLY CEMENTED, MEDIUM GRAINED, SOME FINE GRAINED, POORLY GRADED, ANGULAR	SANDSTONE
	210		

GRAPHIC LOG



SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH
73	0.0	GC	176.0
74	0.0	GC	178.0
75	0.0	GC	180.0
76	0.0	GC	182.0
77	0.0	GC	184.0
78	1.4	GC	186.0
79	0.0	GC	188.0
80	0.0	GC	190.0
81	0.0	GC	192.0
82	0.0	GC	194.0
83	0.0	GC	196.0
84	0.0	GC	198.0
85	25.0	GC	200.0
86	21.0	GC	202.0
87	2.8	GC	204.0
88	280.0	GC	206.0
89	248.0	GC	208.0
90	29.5	GC	210.0

REMARKS

BACKGROUND OVM READING: SOIL: 0.0 PPM; AIR: 0.0 PPM

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

JOB NAME/NUMBER **MARATHON/91089.01**

BORING NUMBER **BH-84 (MW-58)**

DATE DRILLED 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-[illegible]

BORING RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	OVERALL GAS PPM X 14.0 (2 4 6 8 10 12 14 16 18)	SAMPLE NUMBER	OVM READING	RECOVERY	DEPTH	REMARKS
		GROUND SURFACE: 3821.60								BACKGROUND OVM READING SOIL: 0.0 PPM AIR: 0.0 PPM
	210	PERMAEABLE SATURATED, NO HYDROCARBON ODOR DETECTED	SANSTONE			91	29.5	GC	212.0	210
						92	1.0	GC	214.0	
	215					93	0.0	GC	216.0	215
	216.0	T.D. 216.0'								
	200									220
	225									225
	230									230
	235									235
	240									240
	245									245

SPLIT-SPOON SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)
GC: GRAB COMPOSIT

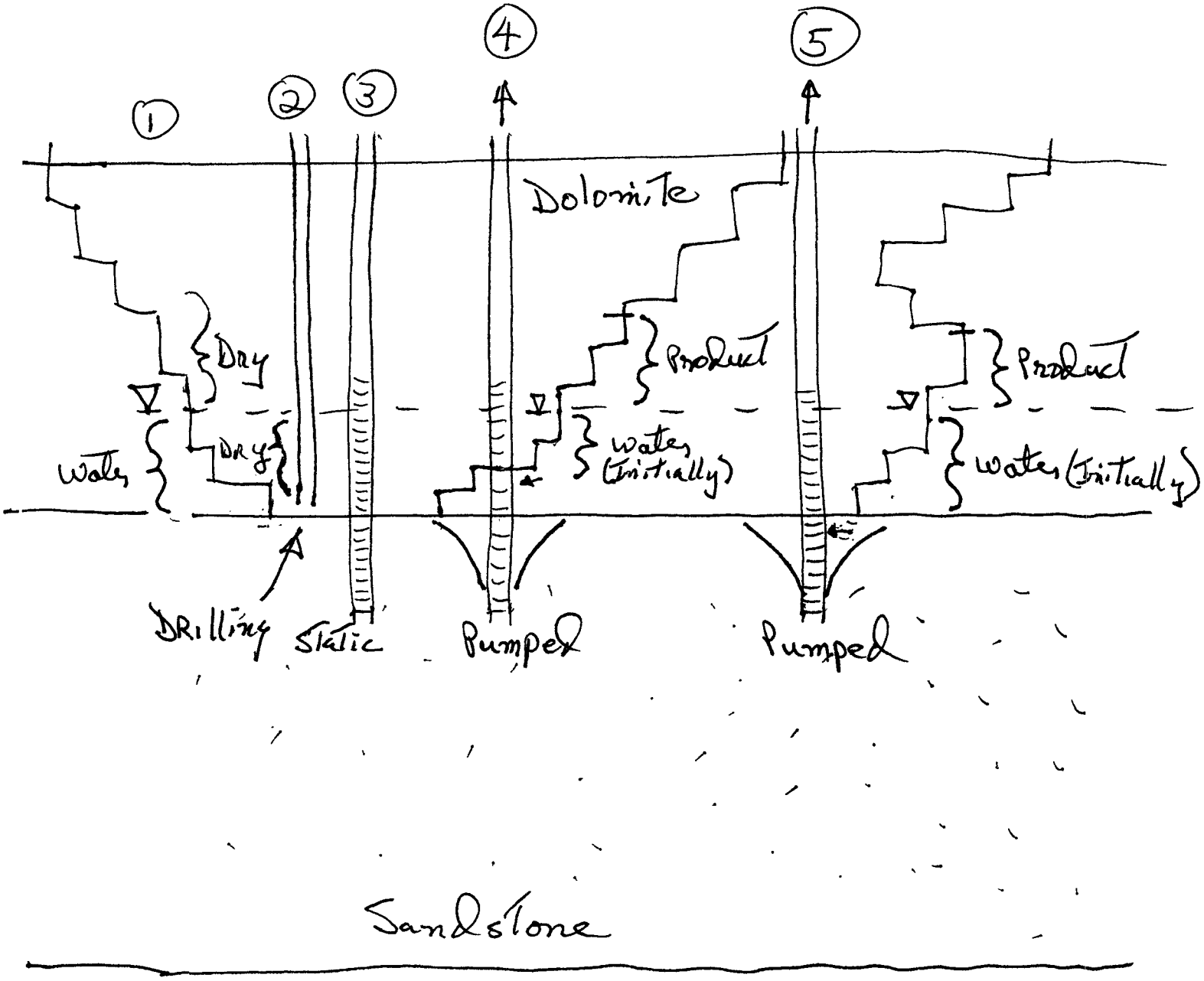
ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-[illegible]

JOB NAME/NUMBER *MARATHON/91029.01*

BORING NUMBER *BH-84 (MW-58)*

DATE DRILLED 6/30/91
DRILLING METHOD 7-5/8" AIR HAMMER
DRILLED BY BOYLES BROS.
LOGGED BY GHR
CHECKED BY BJS
DRAWN BY: SAR

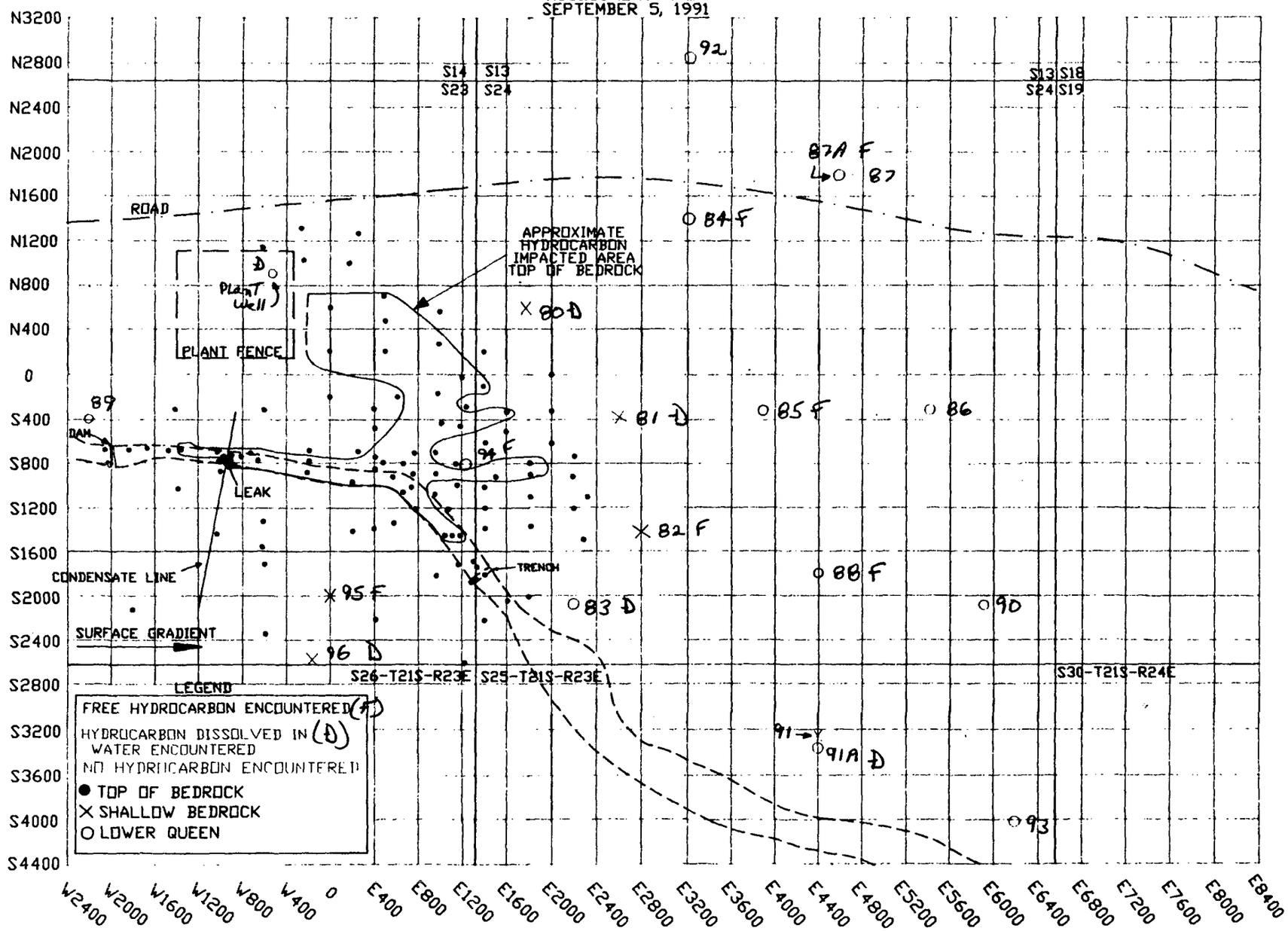
Possible Pollution Pathways
Lower Queen Aquifer



Approx Vertical Scale: 5' [ ]

AWB 9/10/91

INDIAN BASIN
ASSESSMENT AREA
SEPTEMBER 5, 1991



Mid-Continent Region
Production United States

corrected copy

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 6, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88201

RECEIVED
SEP 17 1991
OIL CONSERVATION DIV.
SANTA FE

Gentlemen:

CORRECTED COPY

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week.

SHALLOW IMPACTED AREA

- Borehole 95 was drilled to 56' after encountering water at 42'. After allowing the well to stabilize overnight, the fluid level was measured at 24.5'. A fluid sample was obtained, which contained approximately 1/16" of clear free product. The well was completed with 4" PVC.

- Borehole 96 was drilled at a location of W200/S2500. The hole was drilled to 45' after encountering fluid at 30'. The well was left to stabilize overnight. The next morning the fluid level was at 15.3'. A bailed sample contained no free product, but did have a distinct hydrocarbon odor. A deviation existed in the hole which prohibited it from being completed with 4" PVC.

- Analytical results from routine sampling of nearby domestic and stock wells, as well a surface and spring waters in the arroyo, were received. Results from those samples obtained on August 26 indicate no presence of BTEX or elevated chloride concentrations.

- It rained once during this reporting period, resulting in 0.07", as measured in the rain gauge at the site. This rain did not result in any water flow in the arroyo.

- The Manager of Environmental Assessments and Toxicology with Environmental Science and Engineering, Incorporated (ESE) arrived in Midland to review existing data associated with the shallow impacted area. ESE is the contractor Marathon has selected to complete a risk assessment analysis for the shallow impacted area.

- Another ESE Representative arrived on-site to initiate work associated with the soil venting pilot project. The work has focused on determining present day impact conditions in the alluvium, so that the exact site of the soil venting pilot project can be selected.

LOWER QUEEN ASSESSMENT

- Borehole 94 was drilled to a total depth of 200' after encountering fluid at 174.6'. After allowing the well to stabilize, the fluid level was measured at 164.96'. A fluid sample was obtained, which contained 0.5" of yellowish free product. The well was completed with 4" PVC.

- Analytical results were received from a water sample obtained from borehole 91A on August 22, 1991. Results indicate the presence of BTEX in the following concentrations: benzene - 270 ppb, ethylbenzene - nondetectable, toluene - 480 ppb, and xylenes - 340 ppb. The chloride concentration is 4.1 ppm.

- Borehole 93 was developed. Subsequently, a fluid sample was obtained and submitted to the lab for BTEX and chloride laboratory analyses. There was no hydrocarbon odor or free product present in this sample.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
D. D. Conway
D. E. Kenyon
A. R. Kukla
R. F. Unger

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
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September 6, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week:

Incorrect copy. DGB

SHALLOW IMPACTED AREA

- Borehole 95 was drilled to 45' after encountering fluid at 30'. The well was left to stabilize overnight. The next morning the fluid level was at 15.3'. A bailed sample contained no free product, but did have a distinct hydrocarbon odor. A deviation existed in the hole which prohibited it from being completed with 4" PVC.

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Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
D. D. Conway
D. E. Kenyon
A. R. Kukla
R. F. Unger

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

September 6, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
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Roswell, New Mexico 88202

Gentlemen:

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SHALLOW IMPACTED AREA

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Should you have any questions, or wish to discuss, please contact me at your convenience.

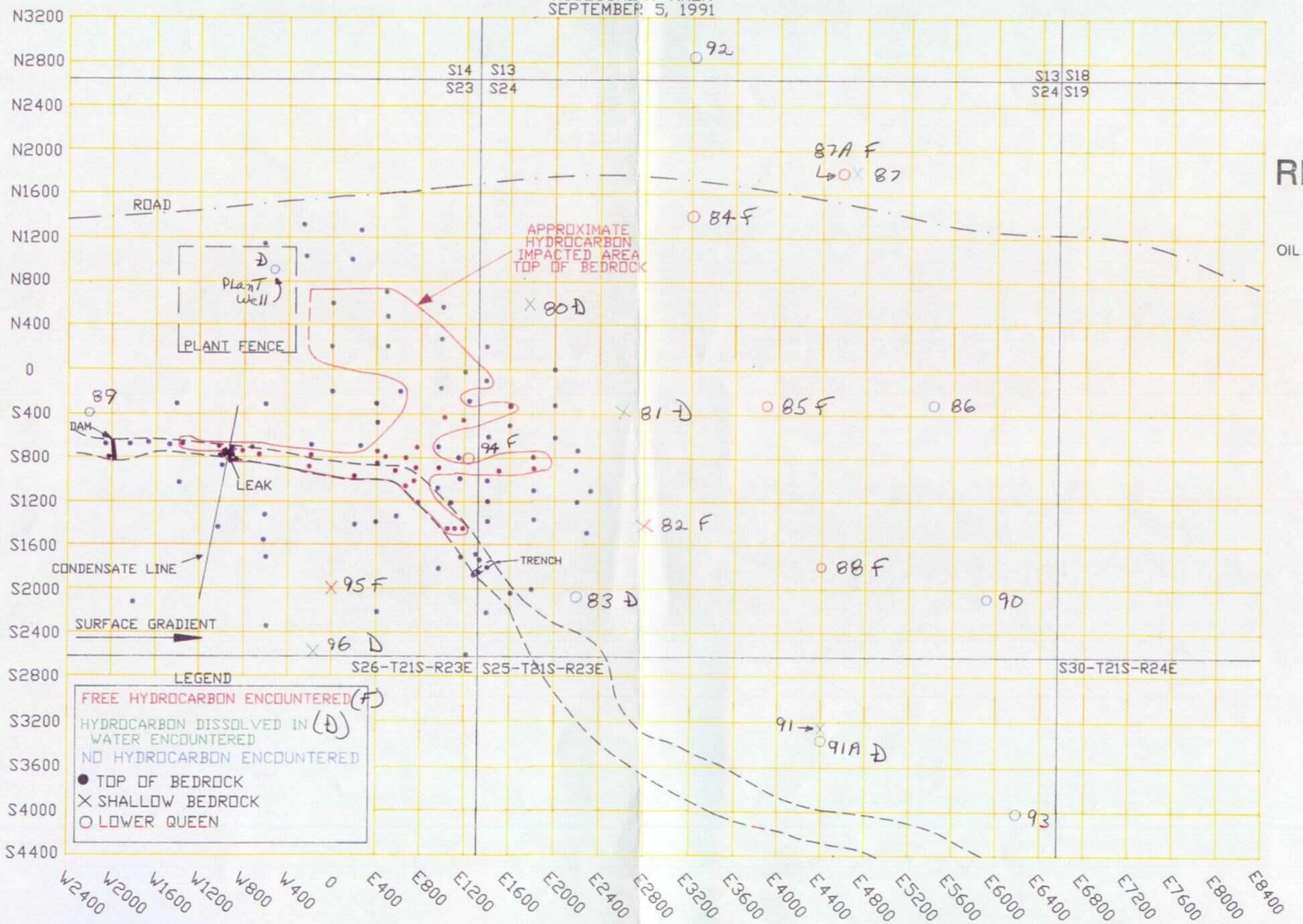
Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
D. D. Conway
D. E. Kenyon
A. R. Kukla
R. F. Unger

INDIAN BASIN
ASSESSMENT AREA
SEPTEMBER 5, 1991



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SANTA FE

Tony Kavran 9/02/91 2PM

BH 97 S3200, OW - Dry Shallow
Clean beep.

Water 193', TD 222
After Sth: 190.4

BH 96 S2500, W200 - Abandoned
(changed because of Arch side) Hole deviation

BH 95 S1900, OEW - Water @ 42 FT
To be recovery well - 1/32" of clear free product

Pumping - electrical supply costs being evaluated

Sampling - BTEX (in absence of product)
- CL, TDS
- Field pH, Temp Cond.
~~Top 5 needed~~ - Cation/Anion - random
- *ICAP (HM) As, Se, Hg Top Five w/cond
- Radium 226-228 Two or three from Top 5

Will call back to discuss specifics on ICAP

Redo Sept 6 letter, left off info.

* Follow-up with A.J.K. 9/16/91: Top Two since ICAP of Line 4 shows little HM. AJK

OCD/Marathon 12/13/91 Meeting

participants - Robert Unger - Marathon
Lee Wilson - Wilson & Assoc
Jeff Lynn - Marathon
Doug Kenyan - Marathon
Chris Fenstin - OCD Hobbs.

Bill Olson - OCD
Roger Anderson - "

LU - Review of past correspondence
- Nov. 1 recieved SEO approval to turn on wells
- Nov. 13 letter to LeMay on maintenance turnaround (not recieved by Envir. Bureau Make Copy!)

- Marathon filed for water rights for recovery has been protest by Mrs. Lyman
Marathon will meet with ranchers again to explain.
Dec. 9th letter from SEO wants parties to settle it or it will go to hearing

J.L. - Lower Queen Recovery, by Dec 10th 29 bbls condensate
BH-88 has highest recovery 9122 " water

- Passive venting pilot occurred on BH-33
- Since pumping (Nov. 1) WL elevations down every 2 days
Pumping approx 200 bbls/day

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OIL CONSERVATION DIV.
SANTA FE

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 30, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

SHALLOW IMPACTED AREA

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week:

- Cumulative recoveries as of August 28, 1991 total 3584 BC and 76,362. Since July 21, 1991, the recovery operations have yielded 63,028 BW and 0 BC. As per our discussions at the August 22, 1991 meeting, withdrawal operations were temporarily suspended on August 23, 1991 until such time that a water treatment system can be installed to treat the low chloride concentration recovered water by removing the dissolved phase hydrocarbon.

- Sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo, continues. Analytical results from those samples obtained on August 19, 1991 have been received indicating no presence of BTEX or elevated chloride concentrations. As per our discussions at the August 22, 1991 meeting, the frequency at which these points are sampled will be reduced from weekly to every other week.

- At the request of the BLM daily sampling of Mrs. Lyman's water well was initiated on July 20, 1991. Analytical results from the daily samples obtained through August 22, 1991 indicate no presence of BTEX or elevated chloride concentrations. As per our discussions at the August 22, 1991 meeting, the frequency at which this point is sampled will be reduced from daily to weekly.

- It rained once during this reporting period, resulting in 0.07", as measured in the rain gauge at the site. This rain did not result in any water flow in the arroyo.

- A contractor has been selected to complete a risk assessment analysis for the shallow impacted area. Environmental Science and Engineering, Incorporated will be in Midland on September 3, 1991 to review existing data and initiate the study.

- Environmental Science and Engineering, Incorporated has also been selected to initiate a pilot scale soil venting project at the site. Preliminary laboratory experiments indicate that vapor extraction can be an effective means for remediating contaminated soil. However, the lab experiments can not fully predict the feasibility or effectiveness of venting at the site. Data obtained from this pilot study will determine the actual effectiveness and define the engineering specifications and parameters for evaluation of full-scale soil venting operations. Personnel will be on-site on September 3, 1991 to initiate the field work.

LOWER QUEEN ASSESSMENT

- The fluid level in BH-93 was measured at 135.4' after allowing the well to stabilize overnight following drilling to 162'. The well was completed with 4" PVC.

- Borehole 94 was spudded at S800/E1200. It was drilled to 18', and 12" steel surface conductor was set at 16'. After allowing the cement to cure, the well was deepened to 120' and an intermediate string of 8" PVC was run and cemented. A shallow water zone was encountered at 19' to 21'. However, there was no hydrocarbon odor or free product present. The well will be deepened to the Lower Queen after allowing the cement to cure.

- Borehole 95 was spudded at S1900/E0. It was drilled to 10', and 12" steel surface conductor was run and set at 9.5'. After allowing the cement to cure, deepening operations were initiated with drilling on August 29, 1991 at 20'.

- Drilling was suspended for most of the day on August 26 and August 27 while the rig underwent repair of a bad kelly bearing.

- Borehole 90 was developed. Subsequently, a fluid sample was obtained and submitted to the lab for BTEX and chloride analyses. There was no free product or hydrocarbon odor present in the fluid sample.

- Borehole 92 was also developed and samples obtained for BTEX and chloride laboratory analyses. There was no hydrocarbon odor or free product present in this sample.

- An odor was detected emanating from the plant water well that was previously pulled and logged. Three samples were obtained from this well over a three day period and analyzed for BTEX and chlorides. Total BTEX concentration in the first sample was 2 ppb. However, the subsequent two samples showed nondetectable for total BTEX. Chloride concentrations in the samples ranged from 26 to 36 ppm in the three samples.

GENERAL

- A team of geologists have completed the field work associated with surface mapping of the structure in the area. It is believed that the information obtained from this effort will complement our understanding of the geology at the site.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
D. D. Conway
A. R. Kukla
R. F. Unger

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

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

MEMORANDUM

TO: **MIKE WILLIAMS, District 3 Supervisor**
Oil Conservation Division

FROM: **DAVID G. BOYER, Bureau Chief**
Environmental Bureau

SUBJECT: **MARATHON INDIAN BASIN SPILL**

DATE: **AUGUST 29, 1991**

Please convey my thanks to Johnny Robinson and Betty Rollins for their assistance to me in Marathon Oil Company's Indian Basin spill incident.

Johnny came out on a Friday evening to take photographs and a video of the arroyo flooding, and Betty spent considerable time looking through old spill reports dating back to 1967 for any previous reported incidents at the site.

Their help made my job much easier and provided valuable information that will be useful as the investigation continues and remedial action commences.

Attached is a copy of a recent Albuquerque Journal article on the investigation. Please share it with staff.

Thanks again.

cc: W. J. LeMay

Mid-Continent Region
Production United States

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91 AUG 28 AM 9 12

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 26, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

This letter is intended as a follow-up to the discussion we had at the August 22 meeting and subsequently, in our telephone conversations on the afternoon of August 23, 1991. During those times approval was requested and subsequently granted for two additional drilling sites for the Lower Queen assessment/monitoring wells in the Indian Basin area.

The first site is at an approximate location of E1200/S800 while the second location is at approximately E000/S1900. An archeologic survey has already been conducted in these areas. The procedures utilized in drilling the previous Lower Queen wells will be utilized in drilling these wells.

We will keep you informed of the results obtained from drilling these wells. However, should you have any questions, or wish to discuss in the interim, please contact me at (915) 687-8528.

Sincerely,

S. A. Polder for A. J. K.

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
D. D. Conway
A. R. Kukla
R. F. Unger

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AUG 27 1991

OIL CONSERVATION DIV.
SANTA FE

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 23, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week:

SHALLOW IMPACTED AREA

- It rained 1.45", as measured in the rain gauge at the site, on Saturday, August 17, 1991. The rain resulted in water flow in the arroyo with the diversion dam reaching capacity and overfilling. However, the down gradient containment trench was able to handle the resulting water flow.

- Cumulative recoveries as of August 22, 1991 total 3584 BC and 71,571 BW. Recovery operations were suspended for a short time during the week due to muddy road conditions following the rain. The road conditions made it impossible for vac trucks to access the recovery tanks to remove fluids without getting stuck. Conditions have since improved, and recovery operations have resumed.

- Weekly sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo, continues. Analytical results from these samples obtained on August 12, 1991 have been received indicating no presence of BTEX or elevated chloride concentrations.

- At the request of the BLM, daily sampling of Mrs. Lyman's water well was initiated on July 20, 1991. Analytical results from the daily samples obtained through August 15, 1991 indicate no presence of BTEX or elevated chloride concentrations.

- Bids were solicited and received from four companies having the capability to complete a risk assessment analysis for the shallow impacted area. At this time, we have narrowed the potential companies to two, and need to resolve some questions prior to committing to the work. Plans are to commit to a company to perform the risk assessment analysis by August 30, 1991.

LOWER QUEEN ASSESSMENT

- Borehole 92 was drilled to a total depth of 232.5' after encountering water at 202'. After allowing the well to stabilize overnight, the fluid level was 196.4'. A fluid sample was obtained and contained no free product or hydrocarbon odor. The well was completed with 4" PVC.

- Borehole 93 was drilled to a total depth of 162' after encountering water at 136'. A fluid sample was obtained and contained no free product or hydrocarbon odor. The well will be completed after allowing it to stabilize.

- Gamma ray logs were run on boreholes 90, 91A and the plant water supply well to obtain additional data.

- The pump test data has been analyzed for boreholes 84, 85, and 88. Suppliers are being contacted in order to determine types and availability of pumps.

- Fluid levels were obtained on several occasions to determine direction of flow in the Lower Queen Aquifer. It was determined that the flow in this area is to the northeast, which is consistent with regional flow direction for the area. However, withdrawal from the plant's water well influences the direction of flow in its immediate area.

GENERAL

- A team of geologists have initiated surface mapping of the structure in the area. It is believed that the information obtained from this effort will complement are understanding of the geology at the site.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
D. D. Conway
A. R. Kukla
R. F. Unger

August 22, 1991

Marathon Meeting
Roswell District Office

Name	Company	
Al Cofar	BLM-RDO	622-9042
Tim Kreager	BLM-RDO	622-9042
BOB UNGER	MARATHON - MIDLAND	682-1626
David Boyer	NM OCD	827-5812
Jim Amos	BLM - CRA	887-6544
Bert Smith	RSA	405 321-3895
Doug Kenyon	MOC - Littleton	(303)794-2601
Tony Kavran	MOC - Midland	
Dave Conway	MOC-Littleton	(303)794-2601
Dick Manus	BLM-Carlsbad	887-6544
Armando Lopez	BLM-Roswell	622-9042
GARY STEPHENS	BLM - SANTA FE	988-6109
DOUG Filer	BLM - Roswell	622-9042
[illegible]	[illegible]	[illegible]
Dave Schafersman	BLM-Santa Fe	988-6231
T.C. Shapard	NMED - Roswell	624-6046
BILL WEBER	NMED-ROSWELL	624-6046
Mike Schornick	RSA, Inc/Marathon	405-321-3895
Bert Smith	RSA Inc/Marathon	" " "
LEE Wilson	LWA/Marathon	988-9811
TONY KAVRAN	Marathon - Midland	915-687-5525

TENTATIVE AGENDA

AUGUST 22, 1991

OCD/BLM MEETING

1. UPDATE - Well Status 93 Boreholes, 66 Mon/Rec wells
   - Recovery Operations 26 Pits, 21 Mon/Rec Pits
   28 Recovery Ops to date.
   8/18: 3584 bbls, 64,000 bbls
   #20
2. Geology Review with Interpretation
   A. Cross Sections (3)
   B. Structure on Top of Bedrock
   C. Potentiometric Map - Alluvium
      - Shallow
      - Deep
   Recovery of cond. static in shallow wells - Dissolved only.
   E. Product Characterization
   F. Product Distribution
   G. Aquifer Characteristics (Pump Test Data)
3. Future Work Plan
   A. One-time sampling of all recovery/monitoring wells for chemical water analysis.
   B. Review the weekly/daily sampling results
   C. Complete Assessment Work
   D. Remediation Activities - Deep Bedrock
      - Initiate Fluid Recovery
   E. Remediation Activities - Shallow Impacted Area
      - Continue Pumping Alluvium
      - Initiate Pumping of Shallow Bedrock
      - Status of Remediation Technologies
        - Bioremediation
        - Soil Venting

#94 S 800, E 1200 - new well
No Product on Borehole 15 (removed)

Product Now on 87A

Pumps 84, 85 & 88
Pumps 80, 81, 82
Alluvium - DP Modification, discharge to arroyo
(infiltration gallery)
Remediation - Shallow alluvium pumping
- Pump & Treat
- Soil venting
- Bioremediation

Risk Assessment - ~~Soil~~ shallow zone contractor
selected w/in 2 weeks
Pilot ~~Zone~~ Test of Shallow zone remediation -
September

Shallow Plan - Submitted before Investigation

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 22, 1991

Mr. Francis Cherry, Jr.
District Manager
Bureau of Land Management
Roswell District
P. O. Box 1397
Roswell, New Mexico 88202-1397

Dear Mr. Cherry:

Please find attached the summary report requested in your July 5, 1991 letter. All requested data is included. With regard to the risk assessment analysis, we have identified potential contractors having the capability to complete such a study. We have subsequently received bid proposals from four of them. At this time, we have narrowed the potential companies to two and need to resolve some questions prior to committing to the work. However, we do plan on committing to a company to perform the risk assessment analysis by August 30, 1991.

If you have any questions, please contact me at your convenience at (915) 687-8528.

Sincerely,

A. J. Kavran

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

Attachment

cc: ✓D. G. Boyer - OCD
J. L. Benson
A. R. Kukla
R. F. Unger

OIL CONSERVATION DIVISION RECEIVED

NEW MEXICO OIL CONSERVATION DIVISION

RECEIVED JUL 31 '91

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

'91 AUG 22 AM 9 35

NAME OF OPERATOR Marathon Oil Company					ADDRESS P. O. Box 552, MIDLAND, TX 79702		
REPORT OF	FIRE	BREAK	SPILL XX	LEAK	BLOWOUT	OTHER*	
TYPE OF FACILITY	DRLG WELL	PROD WELL	TANK BTTY	PIPE LINE	GASO PLNT	OIL RFY	OTHER* Frac Tank
NAME OF FACILITY Southeast of Indian Basin Gas Plant							
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION) NW/4 SE/4					SEC. 23	TWP. 21S	RGE. 23E	COUNTY Eddy
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK Approximately 25 miles NW of Carlsbad							
DATE AND HOUR OF OCCURENCE 7/20/91 Estimated 6:00AM					DATE AND HOUR OF DISCOVERY 7/20/91 7:15AM		
WAS IMMEDIATE NOTICE GIVEN?	YES X	NO	NOT REQUIRED		IF YES, TO WHOM David G. Boyer		
BY WHOM A. J. Kavran					DATE AND HOUR Approximately 10:00AM 7/20/91		
TYPE OF FLUID LOST Condensate and water					QUANTITY OF LOSS Condensate-65 BBLS Water 35 BBLS (Est.)	VOLUME RECOVERED 5 BBLS	
DID ANY FLUIDS REACH A WATERCOURSE?	YES	NO X	QUANTITY				

IF YES, DESCRIBE FULLY**

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN**
Heavy rainfall resulted in increased water in-flow to recovery wells. Consequently, recovery rate increased significantly resulting in tank overfill. Administrative controls have been implemented to prevent recurrence.

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**
Fluid appeared to have pooled in an area approximately 10' x 45' adjactnt to frac tank. Vac truck was used to recovery liquids remaining on surface. David G. Boyer reviewed the area at approximately 10:30AM on 7/20/91.
Frac Tank station 3

DESCRIPTION OF AREA	FARMING	GRAZING X	URBAN	OTHER* Oilfield			
SURFACE CONDITIONS	SANDY	SANDY LOAM	CLAY	ROCKY	WET X	DRY	SNOW

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**
A local rainfall resulting in 2.29" of rain occurred previous evening. Sunny on morning of 7/20/91.

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED A J Kavran A. J. Kavran TITLE Environmental and Safety Supervisor Mid-Continent Region DATE 7/29/91

*SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

7-31-91 OK M.S.

RECEIVED

NEW MEXICO OIL CONSERVATION COMMISSION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

MAY -4 '90

O. C. D. ARTESIA, OFFICE

NAME OF OPERATOR Marathon Oil Co.					ADDRESS P.O. Box 1324 Artesia N.M.		
REPORT OF	FIRE	BREAK	SPILL X	LEAK	BLOWOUT	OTHER*	
TYPE OF FACILITY	DRLG WELL	PROD. WELL	TANK BTTY	PIPE LINE	GASO PLNT X	OIL RFY	OTHER*
NAME OF FACILITY Indian Basin Gas Plant							
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION) SW/NE				SEC. 23	TWP. 21S	RGE. 23E	COUNTY Eddy
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK 20 miles West of Carlsbad							
DATE AND HOUR OF OCCURENCE 4-30-90 5:00 P.M					DATE AND HOUR OF DISCOVERY 4-30-90 5:00 P.M		
WAS IMMEDIATE NOTICE GIVEN?	YES	NO	NOT REQUIRED X		IF YES, TO WHOM		
BY WHOM					DATE AND HOUR		
TYPE OF FLUID LOST Condensate					QUANTITY OF LOSS 15 Bbls	VOLUME RECOVERED 0 Bbls	
DID ANY FLUIDS REACH A WATERCOURSE?	YES	NO X	QUANTITY				

IF YES, DESCRIBE FULLY**

N/A

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN**

Condensate Tanks over filled
Shut down Condensate Feed Pump
Began trucking Condensate to lower tank level

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**

Gravelled area (12'x50') under Condensate Storage Tanks

DESCRIPTION OF AREA	FARMING	GRAZING X	URBAN	OTHER*			
SURFACE CONDITIONS	SANDY X	SANDY LOAM	CLAY	ROCKY	WET	DRY	SNOW

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**

Dry Conditions
Temperature 80°F

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED [signature] TITLE Plant Eng. DATE 5/1/90

*SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

5-11-90 OK M.S.

NEW MEXICO OIL CONSERVATION COMMISSION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

NAME OF OPERATOR Marathon Oil Co.					ADDRESS P.O. Box 1324 Artesia NM 88210		
REPORT OF	FIRE	BREAK	SPILL X	LEAK	BLOWOUT	OTHER*	
TYPE OF FACILITY	DRLG WELL	PROD WELL	TANK BTTY	PIPE LINE	GASO PLNT X	OIL RFY	OTHER*
NAME OF FACILITY Indian Basin Gas Plant							
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION) SW/NE					SEC. 23	TWP. 21S	RGE. 23E	COUNTY Eddy
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK 20 mi West of Carlsbad							
DATE AND HOUR OF OCCURENCE 8-22-90 8:00 AM					DATE AND HOUR OF DISCOVERY 8-22-90 2:00 PM		
WAS IMMEDIATE NOTICE GIVEN?	YES	NO	NOT REQUIRED X		IF YES, TO WHOM		
BY WHOM					DATE AND HOUR		
TYPE OF FLUID LOST Condensate					QUANTITY OF LOSS 5-10 bbls	VOLUME RECOVERED 0	
DID ANY FLUIDS REACH A WATERCOURSE?	YES	NO X	QUANTITY				

IF YES, DESCRIBE FULLY**

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN**
Condensate Tanks overflowed
Trucked out Condensate

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**
Gravelled Base of Condensate Tanks Spreading out 75'x25' Area
South of Tanks. Condensate

DESCRIPTION OF AREA	FARMING	GRAZING X	URBAN	OTHER*			
SURFACE CONDITIONS	SANDY X	SANDY LOAM	CLAY	ROCKY	WET	DRY X	SNOW

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**
80°F Cloudy

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED [signature] TITLE Maintenance Foreman DATE 8-23-90

*SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

9-4-90 Inspected spill site MS.

NEW MEXICO OIL CONSERVATION COMMISSION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

NAME OF OPERATOR	MARATHON OIL COMPANY				ADDRESS	P.O. BOX 1324, ARTESIA	
REPORT OF	FIRE	BREAK	SPILL	LEAK X	BLOWOUT	OTHER*	
TYPE OF FACILITY	DRLG WELL	PROD WELL	TANK BTTY	PIPE LINE	GASO PLNT X	OIL RFY	OTHER*
NAME OF FACILITY	INDIAN BASIN GAS PLANT						
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION)	SWQ OF NEQ			SEC. 23	TWP. 21S	RGE. 23E	COUNTY EDDY
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK	AT INDIAN BASIN GAS PLANT						
DATE AND HOUR OF OCCURENCE	8:00 PM., 2/16/89				DATE AND HOUR OF DISCOVERY	8:30 PM, 2/16/89	
WAS IMMEDIATE NOTICE GIVEN?	YES X	NO	NOT REQUIRED		IF YES, TO WHOM	BETTY ROLLINS	
BY WHOM	MATT BERGHORN				DATE AND HOUR	2-17-89 7:30 AM	
TYPE OF FLUID LOST	CONDENSATE / SALT WATER				QUANTITY OF LOSS	25 BBL - COND 20 BBL - SW	VOLUME RECOVERED 0
DID ANY FLUIDS REACH A WATERCOURSE?	YES	NO X	QUANTITY				

IF YES, DESCRIBE FULLY**

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN** CORROSION PIT IN BURIED PIPELINE. SHUT-OFF SUPPLY TO LEAK WHICH QUICKLY STOPPED LEAKAGE.

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN** MOSTLY CONFINED TO PLANT YARD. NO CLEANUP WAS POSSIBLE AS THE SPILL SPREAD OUT AND SOAKED INTO THE GROUND.

DESCRIPTION OF AREA	FARMING	GRAZING X	URBAN	OTHER*			
SURFACE CONDITIONS	SANDY	SANDY LOAM	CLAY	ROCKY X	WET X	DRY	SNOW

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)** RAINING, TEMP = 37°F MILD WINDS FROM SOUTHEAST.

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED Stephen D York TITLE PLANT SUPT. DATE 2/17/89

SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

3/2/89 OK M.S.

RECEIVED

NEW MEXICO OIL CONSERVATION COMMISSION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

NOV 30 '89

O. C. D.
ARTESIA, OFFICE

NAME OF OPERATOR Marathon Oil Company					ADDRESS P.O. Box 1324 Artesia, NM 88210		
REPORT OF	FIRE	BREAK	SPILL ✓	LEAK	BLOWOUT	OTHER*	
TYPE OF FACILITY	DRLG WELL	PROD. WELL	TANK BTTY	PIPE LINE	GASO PLNT ✓	OIL RFY	OTHER*
NAME OF FACILITY Indian Basin Gas Plant							
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION) SWQ/NEQ				SEC. 23	TWP. 21S	RGE. 23E	COUNTY Eddy
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK 20 miles west of Carlsbad, NM							
DATE AND HOUR OF OCCURENCE 11/22/89 12:00 AM					DATE AND HOUR OF DISCOVERY 11/22/89 7:00AM		
WAS IMMEDIATE NOTICE GIVEN?	YES	NO	NOT REQUIRED X		IF YES, TO WHOM		
BY WHOM					DATE AND HOUR		
TYPE OF FLUID LOST Gas Condensate					QUANTITY OF LOSS 10 bbls	VOLUME RECOVERED Ø	
DID ANY FLUIDS REACH A WATERCOURSE?	YES	NO X	QUANTITY				

IF YES, DESCRIBE FULLY**

N/A

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN**

Storage tanks overflowed. Tanking company was called and level in tanks was dropped

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**

Vaccum truck called but little was recovered. Most evaporated or soaked into the ground.

DESCRIPTION OF AREA	FARMING	GRAZING X	URBAN	OTHER*			
SURFACE CONDITIONS	SANDY	SANDY LOAM	CLAY X	ROCKY	WET	DRY X	SNOW

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**

approx 50°F temp. fair dry day with light winds

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED [signature] TITLE Process Engineer DATE 11/27/89

*SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

12-5-89 Inspected spill. O/K M.S.

RECEIVED BY
JUL 11 1986
O. C. D.
ARTESIA, OFFICE

C/SF
c/ Land Office

NEW MEXICO OIL CONSERVATION DIVISION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

NAME OF OPERATOR	Marathon Oil Company				ADDRESS	P. O. Box 552, Midland, TX 79702	
REPORT OF	FIRE	BREAK	SPILL	LEAK X	BLOWOUT	OTHER*	
TYPE OF FACILITY	DRLG WELL	PROD WELL	TANK BTTY	PIPE LINE	GASO PLNT X	OIL RFY	OTHER*
NAME OF FACILITY	Indian Basin Gas Plant						
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION)					SEC. 23	TWP. 20S	RGE. 23E	COUNTY Eddy
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK	20 miles NW of Carlsbad, N. Mexico						
DATE AND HOUR OF OCCURENCE	July 7, 1986 P.M.				DATE AND HOUR OF DISCOVERY	8:00 a.m. MST July 8, 1986	
WAS IMMEDIATE NOTICE GIVEN?	YES X	NO	NOT REQUIRED		IF YES, TO WHOM	Betty Rollins	
BY WHOM	Tom Zapatka				DATE AND HOUR	July 8, 1986, 2:00 p.m. CST	
TYPE OF FLUID LOST	Condensate				QUANTITY OF LOSS	15 BBL.	VOLUME RECOVERED None
DID ANY FLUIDS REACH A WATERCOURSE?	YES X	NO	QUANTITY 15 BBL.				

IF YES, DESCRIBE FULLY**

See Attachment

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN**

See Attachment

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**

See Attachment

DESCRIPTION OF AREA	FARMING	GRAZING	URBAN	OTHER* Rocky Arroyo			
SURFACE CONDITIONS	SANDY	SANDY LOAM	CLAY	ROCKY X	WET	DRY X	SNOW

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**

See Attachment

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED Thomas G. Zapatka TITLE Prod. Engineer DATE July 9, 1986

*SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

OK MAW 7/15/86

A six-inch PVC line carrying condensate from the field to the gas plant leaked 15 barrels of condensate into a dry rocky arroyo. This line was washed out during heavy rans on June 27, 1986. It was repaired and placed back in service. The leak occurred where two sections of pipe were joined back together.

There was no water in the arroyo. All of the spilled condensate leaked into the dry ground. No recovery was possible. Marathon is replacing this line to prevent this from happening again.

TFZ;tjm

RECEIVED BY
JUL -7 1986
O.C.D.
ARTESIA, OFFICE

C/SF
C/Land Office.

NEW MEXICO OIL CONSERVATION DIVISION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

NAME OF OPERATOR	Marathon Oil Company				ADDRESS	P. O. Box 552, Midland, TX 79702	
REPORT OF	FIRE	BREAK X	SPILL	LEAK	BLOWOUT	OTHER*	
TYPE OF FACILITY	DRLG WELL	PROD WELL	TANK BTTY	PIPE LINE	GASO PLNT X	OIL RFY	OTHER*
NAME OF FACILITY	Indian Basin Gas Plant						
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION)					SEC. 23	TWP. 20S	RGE. 23E	COUNTY Eddy
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK	20 miles NW of Carlsbad, N. Mexico						
DATE AND HOUR OF OCCURENCE	Wed., June 25, 1986				DATE AND HOUR OF DISCOVERY	June 27, 1986 (8:00 a.m. MST)	
WAS IMMEDIATE NOTICE GIVEN?	YES	NO X	NOT REQUIRED		IF YES, TO WHOM	May Morgan	
BY WHOM	Tom Zapatka				DATE AND HOUR	July 1, 1986 (10:00 a.m. (CST)	
TYPE OF FLUID LOST	Condensate				QUANTITY OF LOSS	188 BBL.	VOLUME RECOVERED 0
DID ANY FLUIDS REACH A WATERCOURSE?	YES X	NO	QUANTITY 188 BBL.				

IF YES, DESCRIBE FULLY**

See Attachment

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN**

See Attachment

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**

See Attachment

DESCRIPTION OF AREA	FARMING	GRAZING	URBAN	OTHER* rocky arroyo			
SURFACE CONDITIONS	SANDY	SANDY LOAM	CLAY	ROCKY X	WET X	DRY	SNOW

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**

See Attachment

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED Tom Zapatka TITLE Prod. Eng. DATE July 2, 1986

*SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

OK mw 7/15/86

TFZ;tjm

A six-inch PVC condensate line from the field to the gas plant was washed out during heavy rains discharging an estimated 188 barrels of condensate. This line crosses a normally dry arroyo located 1/4 mile south of the plant. Heavy rains during the week of June 23-27, flooded this arroyo. When the water subsided, a section of this six-inch line was found to have been washed away. There was no evidence of any spilled condensate in the area. It was all washed away.

This section of line will be replaced and steps taken so that this will not happen again. This office, in Midland, Texas, was not notified of the incident until the morning of July 1, 1986. Marathon regrets the delay in reporting this information to you and is also taking steps to insure more timely reporting from field personnel. If any further information is required, please contact my office at (915) 687-8530. Thank you for your cooperation.

TFZ;tjm/i

Copy to S.F.

Attn: W.A. Bussett
Artesia, N.M.

NEW MEXICO OIL CONSERVATION COMMISSION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

NAME OF OPERATOR Marathon Oil Company					ADDRESS P. O. Box 552 - Midland, Texas 79701		
REPORT OF	FIRE x	BREAK	SPILL	LEAK	BLOWOUT	OTHER*	
TYPE OF FACILITY	DRLG WELL	PROD WELL	TANK BTTY	PIPE LINE	GASO PLNT	OIL RFY	OTHER* Gas Plant
NAME OF FACILITY Indian Basin Gas Plant							
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION) SW/4, NE/4					SEC. 23	TWP. 21S	RGE. 23E	COUNTY Eddy
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK Approx. 25 miles West N-W of Carlsbad, N. Mex.							
DATE AND HOUR OF OCCURENCE March 2, 1975; 2:30 PM					DATE AND HOUR OF DISCOVERY March 2, 1975; 2:30 PM		
WAS IMMEDIATE NOTICE GIVEN?	YES	NO x	NOT REQUIRED		IF YES, TO WHOM		
BY WHOM					DATE AND HOUR		
TYPE OF FLUID LOST Refined lean oil					QUANTITY OF LOSS 9000 gallons	VOLUME RECOVERED None	
DID ANY FLUIDS REACH A WATERCOURSE?	YES	NO x	QUANTITY None				

IF YES, DESCRIBE FULLY**

RECEIVED
MAR 13 1975
O.C.C.
ARTESIA, OFFICE

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN**

Rupture in tubes of the lean oil heater; shut down plant and extinguished flame.

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**

DESCRIPTION OF AREA	FARMING	GRAZING	URBAN	OTHER* Plant property			
SURFACE CONDITIONS	SANDY	SANDY LOAM x	CLAY	ROCKY x	WET	DRY x	SNOW

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**

Fair and warm

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED W. A. Dulin TITLE Adv. Petr. Engr. DATE 3-12-75

ECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

WAD:bje

xc: D. E. Morris; G. F. Close; C. S. Hilton

Copy to S.F.

NEW MEXICO OIL CONSERVATION COMMISSION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

NAME OF OPERATOR	Marathon Oil Company				ADDRESS	P.O. Box 552, Midland, Tx. 79701	
REPORT OF	FIRE	BREAK	SPILL	LEAK	BLOWOUT	OTHER* Sweet Gas to Flare	
TYPE OF FACILITY	DRLG WELL	PROD WELL	TANK BTTY	PIPE LINE	GASO PLNT	OIL RFY	OTHER* Gas Plant
NAME OF FACILITY	Indian Basin Gas Plant						
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION)	SW/4, NE/4	SEC. 23	TWP. 21S	RGE. 23E	COUNTY Eddy		
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK	Approx. 25 miles W-NW of Carlsbad, New Mexico						
DATE AND HOUR OF OCCURENCE				DATE AND HOUR OF DISCOVERY	A. M. - April 16, 1975		
WAS IMMEDIATE NOTICE GIVEN?	YES	NO	NOT REQUIRED	IF YES, TO WHOM	Mr. W. A. Gressett (By telephone)		
BY WHOM	W. A. Dulin			DATE AND HOUR	April 17, 1975, 9: AM CDST		
TYPE OF FLUID LOST	X Gas			QUANTITY OF LOSS	950,000 Cu.Ft/Day	VOLUME RECOVERED	None
DID ANY FLUIDS REACH A WATERCOURSE?	YES	NO	QUANTITY				

IF YES, DESCRIBE FULLY**

RECEIVED APR 18 1975 O.C.C. ARTESIA, OFFICE

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN** Cracked recompressor cylinder which causes some low pressure recompressor gas to be sent to the emergency flare. A new cylinder is being shipped immediately for installation, upon arrival, hopefully during the weekend of April 20, 1975. (Compressor placed in operation 4-22-75).

RECEIVED APR 29 1975 O.C.C. ARTESIA, OFFICE

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**

DESCRIPTION OF AREA	FARMING	GRAZING	URBAN	OTHER*			
SURFACE CONDITIONS	SANDY	SANDY LOAM	CLAY	ROCKY	WET	DRY	SNOW

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED W. A. Dulin TITLE Adv. Petr. Engr. DATE 4-17-75

SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

DATE AMENDED: 4-28-75

xc: DEM; GFC; CSH; EDP; USGS-Artesia - File-2
4-17-75

Copy to SF

NEW MEXICO OIL CONSERVATION COMMISSION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

NAME OF OPERATOR	Marathon Oil Company				ADDRESS	P. O. Box 2409, Hobbs, New Mexico 88240	
REPORT OF	FIRE X	BREAK	SPILL	LEAK	BLOWOUT	OTHER*	
TYPE OF FACILITY	DRLG WELL	PROD WELL	TANK BTTY	PIPE LINE	GASO PLNT	OIL RFY	OTHER* Gas Plant
NAME OF FACILITY	Indian Basin Gas Plant						
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION)	SW/4 NE/4			SEC. 23	TWP. 21S	RGE. 23E	COUNTY Eddy
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK	Three and three-fourths miles Northwest of Carlsbad, N.M.						
DATE AND HOUR OF OCCURENCE	August 10, 1974, 2:00 P.M.				DATE AND HOUR OF DISCOVERY	August 10, 1974, 2:00 P.M.	
WAS IMMEDIATE NOTICE GIVEN?	YES X	NO	NOT REQUIRED		IF YES, TO WHOM	W. A. Gressett, N.M.O.C.C., District II	
BY WHOM	C. S. Hilton, Jr.				DATE AND HOUR	August 10, 1974, 4:00 P.M.	
TYPE OF FLUID LOST	Absorption Oil				QUANTITY OF LOSS	50 Bbls.	VOLUME RECOVERED None
DID ANY FLUIDS REACH A WATERCOURSE?	YES	NO X	QUANTITY				

IF YES, DESCRIBE FULLY**

RECEIVED

AUG 13 1974

O. C. C.
ARTESIA, OFFICE

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN**

Tube failed in direct fired heater.

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**

No spill involved. Absorption oil from ruptured tube burned before reaching ground.

DESCRIPTION OF AREA	FARMING	GRAZING		URBAN	OTHER* Plant site		
SURFACE CONDITIONS	SANDY	SANDY LOAM X	CLAY	ROCKY	WET	DRY X	SNOW

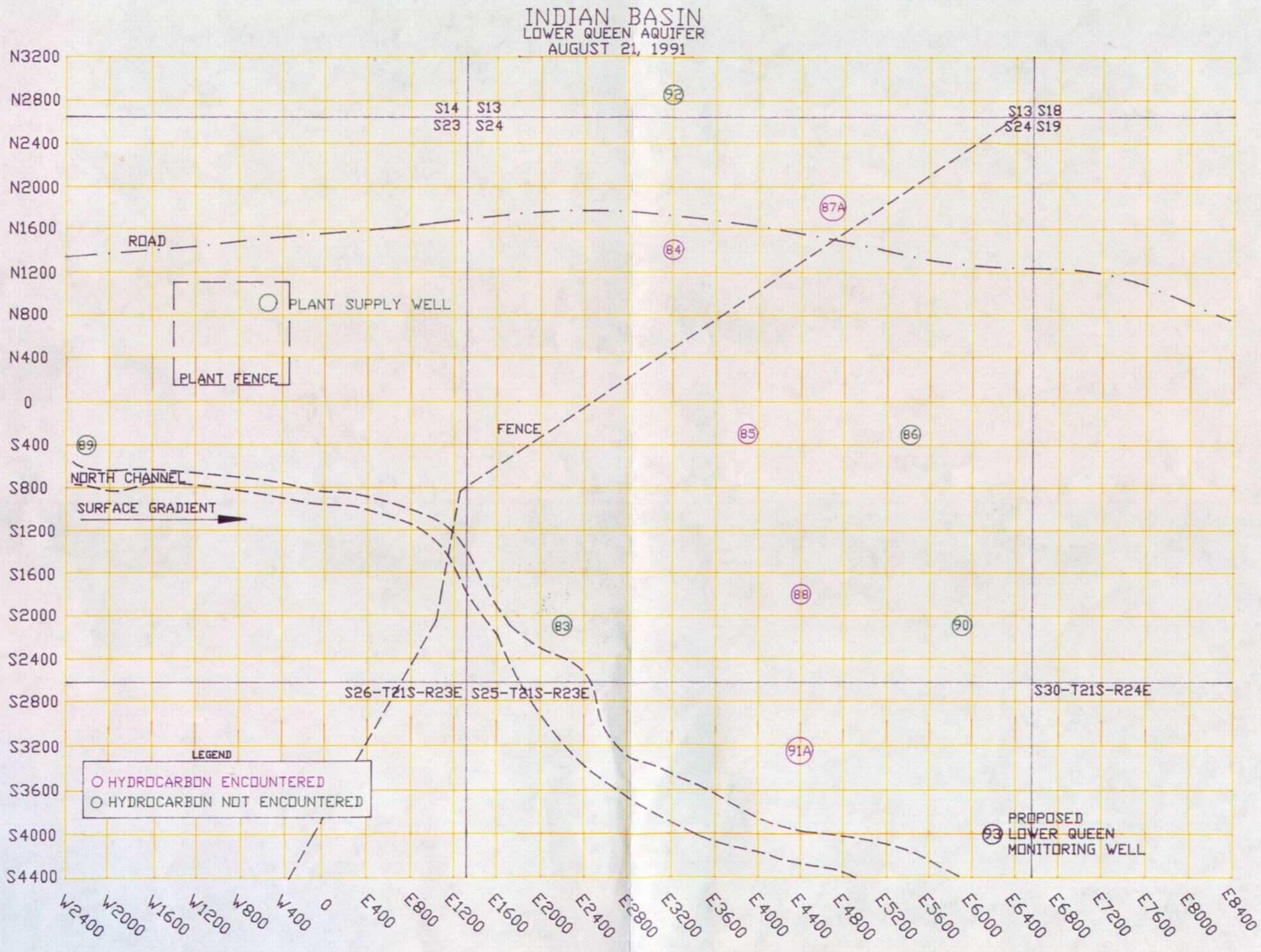
DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**

78°F. Clear, dry day with wind from Northeast at approximately 5 mph.

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED C. S. Hilton Jr., TITLE Operations Supt. DATE August 12, 1974

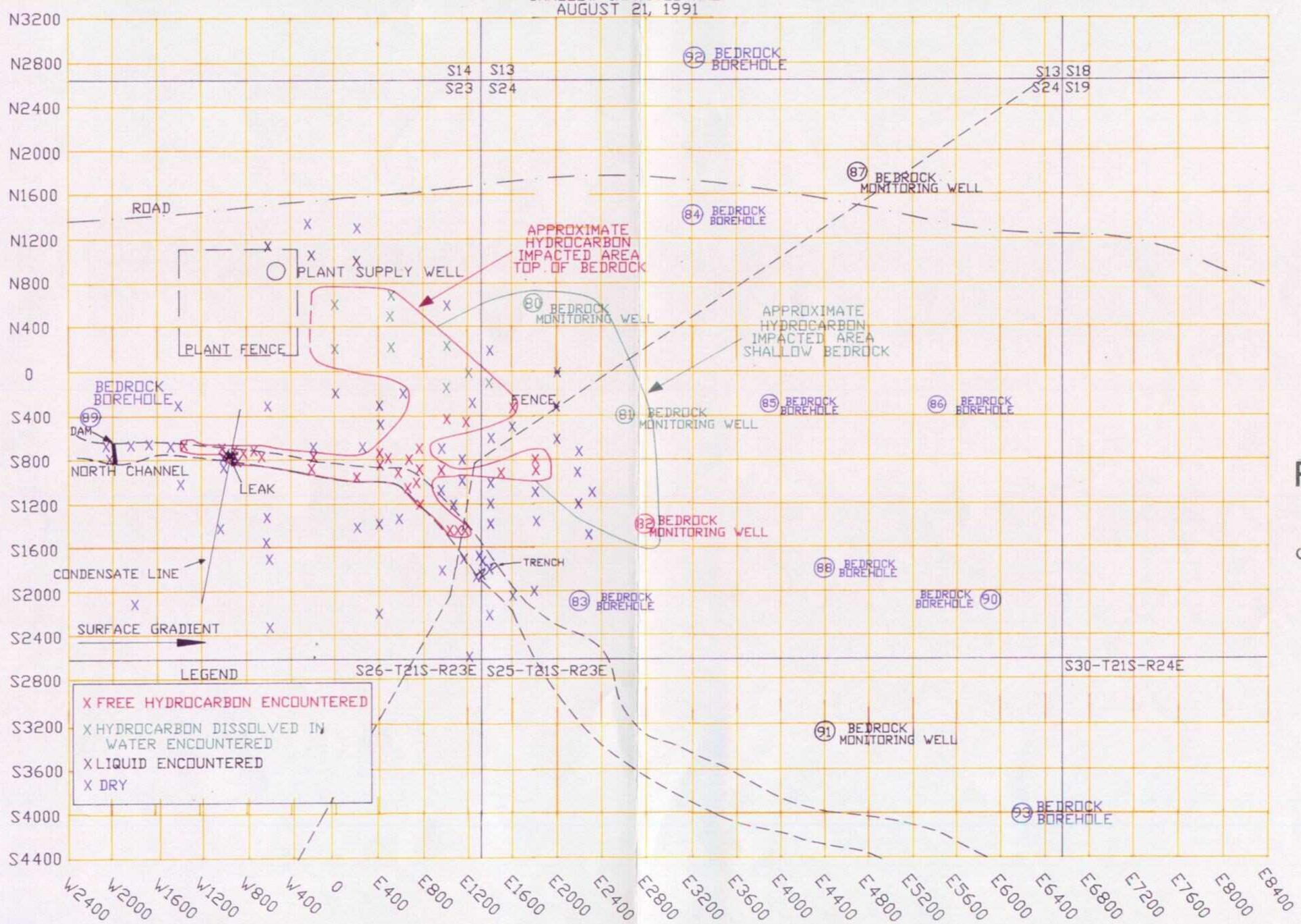
*SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY



RECEIVED
AUG 22 1991
OIL CONSERVATION DIV.
SANTA FE

INDIAN BASIN

SHALLOW IMPACTED AREA
AUGUST 21, 1991



RECEIVED
AUG 22 1991
OIL CONSERVATION DIV.
SANTA FE

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
RECEIVED
'91 AUG 26 AM 9 38

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 19, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, NM 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, NM 88202

Gentlemen:

This letter is intended as a follow-up to the telephone conversation I had with Mr. Bill Olson of the OCD and Mr. Jim Amos of the BLM on Friday afternoon, August 16, 1991. In those conversations approval was requested and subsequently granted for two additional sites for Lower Queen assessment/monitoring wells in the Indian Basin area.

The first site is at an approximate location of N2900/E3200. The second site was proposed at an approximate location of S4000/E5900. However, due to an archeological find at this site, the drilling location had to be repositioned 300' to the east at E6200/S4000. The procedures utilized in drilling the previous Lower Queen wells will be utilized in drilling these wells.

We will keep you informed of the results obtained from drilling these wells. However, should you have any questions, or wish to discuss in the interim, please contact me at (915) 687-8528.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

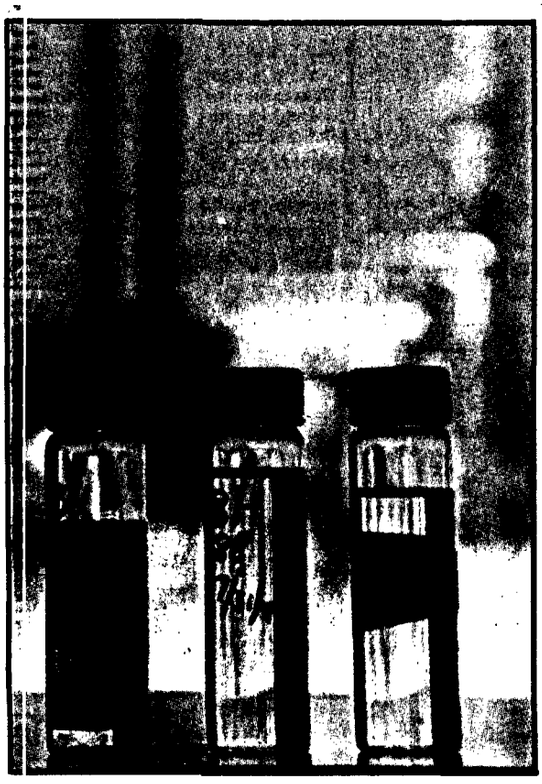
AJK/rks

cc: J. Amos
J. L. Benson
D. D. Conway
A. R. Kukla
R. F. Unger

RICHARD PIPES / JOURNAL

Gas pipelines run near the site of the oil leak at Marathon Oil Co.'s Indian Basin Plant northwest of Carlsbad. A corroded underground pipeline at the plant allowed 1½ million gallons of crude oil to seep into the area's groundwater. The company has spent $1.5 million assessing the extent of the damage. Samples in the lower left photo show the oil content of water taken from monitoring wells near the Marathon plant.

Carlsbad Oil Leak Spreading Concern



By Chuck McCutcheon

JOURNAL STAFF WRITER

CARLSBAD — Every so often, employees at Marathon Oil Co.'s Indian Basin Plant will make a discovery in the stark flatlands enveloping the plant: rattlesnakes.

"They find a lot of them around here, in fact," said Tony Kavran, a Marathon environmental and safety supervisor, one morning as he carefully trudged over unkempt grass and white limestone rocks carpeting the area behind the natural gas processing plant 20 miles northwest of Carlsbad.

What Marathon workers are finding beneath the ground, though, is far more troubling to them — and potentially more threatening to others.

Colorless crude oil, along with salt water containing small amounts of dissolved oil, began leaking from a corroded underground pipeline at the plant last fall. Before the leak was spotted in April, Marathon had lost 1½ million gallons of oil and another 840,000 gallons of wastewater, enough to fill 22 Olympic-size swimming pools and more than enough to arouse fears of widespread groundwater contamination.

Nowadays, the leak has brought unwanted attention to company officials, who over several months have spent $1.5 million trying to determine the extent of the contamination as state officials and others watch from the sidelines.

As extractive errors go, Marathon's mishap doesn't approach 1989's infamous Exxon Valdez spill, which dumped nearly 11 million gallons of petroleum into Alaska's Prince William Sound. But it remains the largest in New Mexico within recent years.

And depending on how the government deals with the leak, some say its impact could be felt for years to come. An Albuquerque environmentalist contends the accident points to a need for the state to be tougher in dealing with industries whose work affects the environment — a position that state officials dispute.

"Oil and gas companies are watching the Marathon spill very closely," said Chris Shuey, director of the Southwest Research and Information Center's community water quality program. "If the state doesn't punish them, doesn't take additional enforcement action, that word is going to get back to the industry."

State laws governing water quality and oil and gas operations appear to contain no specific provisions covering groundwater contamination from oil leaks, said Robert Stovall, an attorney for the Oil Conservation Division.

He said the Oil and Gas Act has language requiring operators to take steps to prevent spills in general. Violators of the act can be fined $1,000 a day.

For now, all sides agree on one thing: The leak is not yet a hazard for the handful of people living near the Marathon plant. Leaked oil is dangerous because it contains benzene, a chemical known to cause cancer.

The farthest point at which the gasolinelike substance has been found in groundwater is almost a mile east of where the leak occurred, on a barren, rocky patch of federally owned land. The nearest drinking well is three miles away.

But the sheer size of the Marathon leak makes it a worry, said David Boyer, the state oil division's environmental bureau chief.

"The problem is," he said, "once you've got a spill like that, it moves to a drinking water source."

Inevitably? "Inevitably."

Even if drinking water remains unaffected, Boyer sees the eventual cleanup of the area as "an immense effort. We're talking years here, easily."

For now, Marathon and state officials estimate the leak is moving underground at a rate of six inches to a foot a day. If it spreads unchecked at that pace, they say it might be decades before it reaches one of the drinking wells.

But they add with some frustration that they don't know exactly how far the leak mo finally discovered.

They don't know whether recent speed the leak's movement underg

And they don't know for certain h to find those answers.

"The sooner we find out, the be Ryder, a spokesman for USX Cor based company of which Marath "We're as upset about this as anyt

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Albuquerque Journal

Page 1, Section F

R CHARD PIPES / JOURNAL

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left photo show the oil
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frustration that they don't know exactly how far the leak moved before it was finally discovered.

They don't know whether recent heavy rains could speed the leak's movement underground.

And they don't know for certain how long it will take to find those answers.

"The sooner we find out, the better," said William Ryder, a spokesman for USX Corp., the Pittsburgh-based company of which Marathon is a subsidiary. "We're as upset about this as anybody."

Once the leak was detected after plant officials noticed a months long decline in production, Marathon reacted quickly, he said. Both the federal Bureau of Land Management and the state were notified, and the company began drilling wells near the leak to find where it had spread.

At the request of the officials, the company drilled several more wells at a further distance, where they found as much as a foot of oil floating above the water table. Because those samples show signs of advanced age, Kavran said, the company thinks the material in those wells came from further back in time.

Holding up rust- and gold-colored samples from two of the wells, he said, "We have a hard time believing the brown stuff and the yellow stuff is from this line leak."

This month, the company put in place a well 7,000 feet from the leak site. That well, which is located near several others the company has installed to pump out contaminated water, has come up clean, Boyer said.

Despite Marathon's contention that the faraway contamination likely isn't from the recent leak, Boyer said his division holds the company accountable because no other firms operate in the area. The company has run its Indian Basin plant since 1966.

Not only was the recent leak unintentional, but the company has kept the state informed of what it has

MORE: See WATER on PAGE F2

RICHARD PIPES / JOURNAL

Tony Kavran, a Marathon environmental and safety supervisor, inspects a recovery well near the oil spill site. The spill's the largest in New Mexico within recent years.

Water Concerns Spread

CONTINUED FROM PAGE F1

been doing, he said. As a result, he said the state has no reason to take the company to court or fine them for violating any laws.

But Southwest Research's Shuey sees the situation differently.

Shuey knows how oil and gas officials work. He spends hours talking with them on the phone and meeting them at conferences he flies to around the country. He can expound at length on industry problems in states ranging from Alaska to Louisiana.

"He does his homework," Boyer said.

Shuey says the mishap could have been prevented if Marathon had installed the proper equipment. He also says it might have been able to find the leak sooner than it did.

But more important, Shuey says, the state needs laws with more teeth in them to go after companies that harm the environment. The current laws, he argues, don't go far enough.

"People are going to say, 'What's the big deal? This is out in the middle of nowhere,' " he said of the leak. "But it's an example of how business is done ... It seems the bigger the problem, the more reluctance there is to go after a company in a court situation."

In recent years, environmental groups have been critical of the state for its handling of several situations involving large industries. Earlier this year, Gov. Bruce King pledged economic development would be balanced with protecting the state's natural resources, while Attorney General Tom Udall vowed his office will keep a close eye on what companies are doing.

The evidence indicates oil and gas leaks could become a more prevalent environmental headache.

Next to underground storage tanks, such leaks are the biggest sources of identifiable groundwater contamination in New Mexico, according to a state Water Quality Control Commission report last year. The report cited a study that found nearly half of those were due to corroding tanks, valves or pipelines, "an issue that will need to be addressed by OCD and the industry in the next few years."

In response to Shuey's concerns, Oil Conservation Division officials say they're satisfied with how the Marathon incident has been handled. Getting tougher with the company not only is unnecessary, they contend, but it would ruin the spirit of cooperation they say has blossomed since the accident.

"If you littered in your yard," Stovall said, "and I said, 'Let's clean it up,' would you cooperate more than if I said, 'You're going to clean it up and I'm going to fine you'? You would."

The important thing, he said, is that the site is eventually cleaned up — whether a fine is imposed or not.

Boyer agreed: "I would be reluctant, even under normal circumstances, to go to court. When the company is cooperating in every way, as long as that attitude is going forward, it just drags you down when you get the lawyers involved."

Santa Rosa Attendant Puts 'Service' in Station

CONTINUED FROM PAGE F1

emergency nature of the situation and asked him to look in the trash can. While I waited on the line, he minutes or so for about 45 minutes."

Finally he got through to Dix's wife, Amy.

"They were really happy, and I was too," Sena says.

Dix and one son, Gordon, 13,

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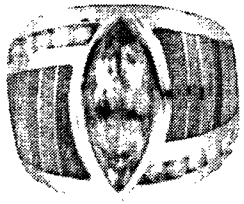

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Upper Level, Coronado Center 883-8078

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AUG 19 1991

OIL CONSERVATION DIV.
SANTA FE

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 16, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week:

SHALLOW IMPACTED AREA

- It rained several times during an early portion of this reporting period. On August 9, 1991, a 1.57" of rain fell, as measured in the rain gauge at the site. The diversion dam and containment dam trench were able to handle the resulting water accumulation.

- On August 10, 1991 an additional 0.95" of rain fell at which point the both the diversion dam and collection trench reached capacity and overfilled. The water flow in the arroyo is not believed to have been very substantial, as the recovery wells in that area were not impacted. A water sample obtained from the containment trench was analyzed for total petroleum hydrocarbon with results indicating none detected.

- Cumulative recoveries as of August 15, 1991 totaled 3584 BC and 56,137 BW. Recovery operations were suspended for a short time during the week due to muddy road conditions following the rains. The road conditions made it impossible for vac trucks to access the recovery tanks to remove fluids without getting stuck. Conditions have since improved, and recovery operations have resumed.

- Weekly sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo, continues. Analytical results from those samples obtained on August 4, 1991 have been received indicating no presence of BTEX or elevated chloride concentrations.

- At the request of the BLM, daily sampling of Mrs. Lyman's water well was initiated on July 20, 1991. Analytical results from the daily samples obtained through August 7, 1991 indicate no presence of BTEX or elevated chloride concentrations.

- A site tour is scheduled on August 16 for representatives from four companies from which bids were solicited to conduct a risk assessment study for the shallow impacted area. The same companies have also been requested to submit bids to design and implement a soil venting pilot program at the site.

LOWER QUEEN ASSESSMENT

- Borehole 90 was drilled to a total depth of 200' after encountering water at 172'. After allowing the well to stabilize overnight, the fluid levels was at 167.3'. A fluid sample was obtained, and contained no free product or hydrocarbon odor. The well was completed with 4" PVC.

- Borehole 91 was drilled to a total depth of 54' after encountering water at 43'. After allowing the well to stabilize, a fluid sample was obtained which contained no free product or hydrocarbon odor. The well was completed with 4" PVC as a shallow bedrock monitoring well.

- Borehole 91A was spudded adjacent to borehole 91. Surface conductor casing was set and cemented at 66' to isolate the shallow water zone. The hole was deepened to 165' after encountering the Lower Queen Aquifer at approximately 145'. A hydrocarbon odor was apparent after the fluid was encountered. After allowing the well to stabilize overnight, fluid levels were obtained with an interface probe on the morning of August 16, 1991 indicating the top of the fluid column was at 130.7, but contained no indication of hydrocarbon free product.

- Pump tests were completed on boreholes 84, 85, and 88. The data obtained is now being analyzed to properly size the recovery pumps. Afterward, the pumps will be ordered.

GENERAL

A meeting was held on the afternoon of August 14 at the Indian Basin Gas Plant office with local residents and ranchers. The purpose of the meeting was to provide them with an overview of the work that has been conducted and the findings that have been obtained. Numerous questions were subsequently addressed. Approximately 15 people attended, including BLM representative Jim Amos. The meeting lasted approximately 1.75 hours.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
D. D. Conway
A. R. Kukla
R. F. Unger

State of New Mexico
ENVIRONMENT DEPARTMENT
Harold Runnels Bulding
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-2850

BRUCE KING
GOVERNOR

JUDITH M. ESPINOSA
SECRETARY

RON CURRY
DEPUTY SECRETARY

OIL CONSERVATION DIVISION
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August 12, 1991

David G. Boyer
Environmental Bureau
Oil Conservation Division
Energy, Minerals and Natural Resources Department
P.O. Box 2088
Santa Fe, New Mexico 87504

Dear Mr. Boyer,

I am in receipt of your letter requesting a technical staff person to act as a liaison between OCD and the NMED on the Marathon Indian Basin Spill. I appreciate your offer to keep this department informed of the progress of the investigation and clean up.

I have designated John Pfeil as the technical liaison. Mr. Pfeil is an experienced geologist working for the Remediation Section of the Ground Water and Toxic Sites Bureau. His telephone number is 827-2776.

This department will provide technical assistance on this matter as appropriate. We are aware of the delegation of authority provided to the OCD in 1989 and recognize the responsibility for ensuring Marathon's compliance with the Water Quality Control Commission Regulations rests with the OCD.

Sincerely,

Kathleen M. Sisneros

Kathleen M. Sisneros
Director
Water and Waste Management Division

xc: Steve Cary, Acting Chief, Ground Water/Toxic Sites Bureau
Anita Lockwood, Secretary, EMNRD
Matt Baca, Deputy Secretary, EMNRD
William J. LeMay, Director, OCD
Judith M. Espinosa, Secretary, NMED
Ron Curry, Deputy Secretary, NMED

Phone Call Tony Kavran 8/12 4:30PM

(1) TD - Borehole 90. This weekend - Clean (well near P & A well). Water at 167 feet - No odor, No visible H/C.

(2) 1 1/4" Rain Thursday, 0.31" Friday, 0.94" Saturday Nite. Saturday Nights Rains breached (overtopped) both dams. Shut down pumps & tested, No H/C. Quagmire again. 10" rain last 30 days.

(3) New Survey shows ground water to water supply wells. Hydrologists doing pump tests, Transducers, log evaluation.

(4) Borehole 91 to be completed 8/14.

(5) Want to evaluate data - need 5 working days. I told them let's meet morning of 8/22 to talk Hydrology (in Roswell) Be prepared to start drilling again 8/26.

D G Boyd

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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'91 AUG 14 AM 8 52

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 12, 1991

D. G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Bldg.
Santa Fe, New Mexico

Bureau of Land Management
P. O. Box 1778
Carlsbad, New Mexico 88220
Attn: Mr. D. L. Manus

Re: Integrity Testing of Buried Lines
Indian Basin Field
Carlsbad, New Mexico

This letter is to advise you of results from pipeline integrity tests conducted on two sections of the Indian Basin Gas Plant's Liquid Gathering System during the week of July 8, 1991. Line 4A, designated on the attached map, was both hydrotested and gas pressure tested. No leakage was indicated by either test. Line 3 was then pressurized with water to evaluate its integrity. Again, no leaks were observed.

Marathon intends to check the integrity of the entire gas and liquid gathering system during a plant turnaround scheduled for the first half of September. We are taking this initiative as part of our overall plan to ensure the pipelines are operated in an environmentally safe manner.

The Line 4A testing was conducted as a pilot with two objectives:

1. We wanted to evaluate and select a testing method that could be performed safely and would not pose any environmental exposure.

2. Two separate test methods were under consideration for the full-scale testing to be conducted during the plant turnaround. This pilot provided an opportunity to ensure the procedures under consideration were sound.

The normal operating pressure of Line 4A is 110 psig. Actual Line 4A final pressures recorded from both 4 hour tests agreed to within 0.5 psig of the calculated final pressure after compensation for temperature effects. The maximum test pressure was determined to be 200 psig based upon the design pressure of the line. The hydrotest pressure at the data collection point was adjusted to 147 psig based on a pressure of 200 psig at the line's lowest point due to hydrostatic head.

Line 3 was tested since this line traverses the area of contamination east of the plant. This was necessary to confirm it was not a potential source of

Line 3 was tested since this line traverses the area of contamination east of the plant. This was necessary to confirm it was not a potential source of contamination. Pressurization with water was performed in order to verify that no detectable leaks were present on the line. The normal operating pressure of Line 3 is 95 psig. The line was tested to 136 psig which resulted in 200 psig at its lowest elevation.

Attached for your records are the Line 4A test results, the test procedures, and copies of the pressure recording charts (originals are available at the gas plant for your review) for the two Line 4A tests as well as the Line 3 test.

Marathon continues in its efforts to verify the integrity of the buried pipelines in the Indian Basin Gas Plant's control. Most of the integrity testing work will be conducted next month during the turnaround. Through recent and ongoing activities we:

1. Have verified that safe and viable test procedures are available for a system of this age.

2. Have successfully tested Lines 4A and 3, and verified their integrity.

3. Are continuing to investigate techniques for detecting underground leaks.

We feel this effort will provide us with insight on how to deal with aging facilities which will be beneficial in the upcoming government/industry committee meetings. We are available to discuss the material presented in the attachments if you so desire. Please contact me with any questions and/or comments you may have.

Sincerely,

R. F. Unger
Midland Operations
Production Manager

RFU/SDY023/pbt

Attachments

xc: Al Collar (BLM Roswell)
T. N. Tipton
A. J. Kavran

TEST RESULT SUMMARY

	LINE 4A HYDROTEST	LINE 4A GAS TEST	LINE 3 PRESSURIZATION
Date	7-10-91	7-11-91	7-12-91
Duration	4 hrs	4 hrs	2 hrs
INITIAL TEST CONDITIONS:			
Pressure	147 psig	192 psig	138 psig
Temperature	86.3° F	83° F	NT
FINAL TEST CONDITIONS:			
Pressure	146 psig	190 psig	136 psig
Temperature	81.8° F	77° F	NT
Pressure Loss During Test	1 psi	2 psi	2 psi
Temperature Loss During Test	4.5° F	6° F	--
Calculated Final Pressure Based on Temperature Change	146.5 psig	189.7 psig	--
Calculated Pressure Loss	0.5 psig	2.3 psig	--

NT = Not Taken

LINE 4A

PRESSURE TEST PROCEDURE

PREPARATION FOR THE TEST

1. Spot frac tanks at both ends of the section to be tested. One tank to be located where the test section ties into the main Line 4 trunkline. One tank to be located at the blowdown near the junction of the lateral from Station 132-M with the test section.

2. Shut-in well 132-M and close the block valve at Line 4 trunkline junction with the test section.

3. Depressurize the test section to the frac tank at the blowdown near the 132-M lateral junction.

4. Excavate and blind the gathering line from Station 132-M at the block valve on the test section. (Note: Station 132-M was shut-in prior to the test so it was not necessary to tie-in a temporary liquid flow line to the frac tank).

5. Excavate the test section line 2 to 3 feet from the junction of the test section with the Line 4 trunkline using a back-hoe. Hand excavate the isolation valve to the test section.

6. Glue and clamp 3-inch by 2-inch and 3-inch by 3/4-inch saddles onto the test section at the 132-M junction.

7. Fabricate a 6-inch by 2-inch swage header for the test section at the trunkline junction with 2-inch and 3/4-inch taps.

8. Allow 24 hours for the glue to dry then tap into the line at the 132-M junction saddle locations.

9. Install valves and risers on the 2-inch taps and thermowells into the 3/4-inch taps.

10. Connect a pressure recording device to the test section at the trunkline junction to provide a record of all subsequent activities. Also connect a test gauge for accurate pressure measurement and a thermometer to record the temperature in the line.

11. Install blind or bull plugs on all valves possible which might leak gas from the test section.

12. Blockade the lease road under which the line passes until testing is completed.

HYDROTEST PROCEDURE

1. Connect a kill truck to the 132-M junction and frac tank to the Line 4 trunkline junction.

2. Slowly begin to pump water into the test section and gradually increase the rate until the pump pressure reached 50 psig. Continue pumping at the low rate until water is received in the frac tank. Increase pumping rate until the pump pressure reaches 100 psig.

3. Pump a total of 300 BBL water into the line at the high pump rate.

4. Shut down pumping, close block valve to frac tank, and move the pump truck to the trunkline end of the test section. Connect the truck and begin pumping slowly into the line until returns to the frac tank at the 132-M junction are verified, then increase the pump rate until the pump pressure reaches 100 psig.

5. Discontinue pumping after 300 BBL of water are pumped and shut in the valve to the frac tank. Resume pumping slowly and pressurize the line to 100 psig.

6. Stop pumping briefly to verify that the line is holding pressure. If not, drive the R. O. W. to search for visual evidence of a leak. Repressurize the line if necessary to assist in locating the leak. Locate and repair any leaks.

7. Resume pumping until the pressure reaches the test pressure of 157 psig at the trunkline test point. This is calculated to be 200 psig at the line's low point.

8. Shut-in the line, record the initial test gauge pressure, temperature and time on the pressure recorder chart.

9. Monitor the line pressure for 4 hours. Record the pressure, temperature and time at the conclusion of the test. If the pressure holds within 5 psig, the test should be considered successful. If not, the effects of any temperature changes should be determined to see if this could be the cause of the pressure loss. If the pressure loss cannot be explained due to temperature change, a leak is indicated. Continue to drive the R. O. W. in search of visual evidence of the leak. Also check any valve which could not be blinded for evidence of leakage. If leakage is indicated, attempt to quantify the leakage. Use other means of leak detection as available.

GAS PRESSURE TEST PROCEDURE

1. Connect a gas line from the gas gathering system to the test section at well 301-U. Open the line to the frac tank at the 132-M junction. Flow gas into the line at a moderate rate such that the

pressure at well 301-U does not exceed 100 psig. Continue flowing until no additional liquid is being recovered in the frac tank. Shut-in the gas supply and the line to the frac tank.

2. Open the line to the frac tank at the trunkline junction. Flow gas into the line at a moderate rate such that the pressure at well 301-U does not exceed 100 psig. Continue flowing until no additional liquid is being recovered in the frac tank. Shut-in the line to the frac tank.

3. Upon ceasing the gas flow, note the pressure at the gas supply point, if any, which remains on the line when the flow to the frac tank stops. Any pressure remaining on the line will be an indication of a liquid seal somewhere in the line. If appreciable pressure remains on the line, repeat steps 1 and 2.

4. Close the valve on the connecting line to the frac tank and begin to pressurize the test section. Pressurize the line to 100 psig. Stop flowing gas briefly to check if any noticeable pressure loss occurs indicating a substantial leak. If a leak is indicated, a two-man team with H2S and LEL detectors should drive the pipeline R. O. W. to search for obvious signs of leaks. Also, check all unblinded valves for leakage.

5. If leaks are found while driving the R. O. W., depressurize the line and repair. If no leaks are found, but are indicated by falling pressure on the line, visually reinspect the line. If no visual indication of the leak can be found, two-man teams should walk the line with H2S and LEL detectors to locate the leak. Continue searching until the leak is located. Depressurize the line and repair the leak.

6. Pressurize the line to 200 psig and allow the pressure to stabilize. If the line holds pressure, note the test gauge pressure, temperature, and time on pressure recording chart, then begin test. If the final pressure is within 5 psi of the initial pressure, the line passed. If not, determine the difference in temperature and the effect any temperature change may have had on the pressure. Inspect all valves which could not be blinded for leakage of pressure from the system. If any valve is determined to be leaking, attempt to quantify the leakage. If neither temperature effects nor valve leakage can explain the pressure loss, a leak is indicated. Depressurize the line to 150 psig, then walk the line with H2S and LEL detectors until the leak is located.

SDY021/pbt

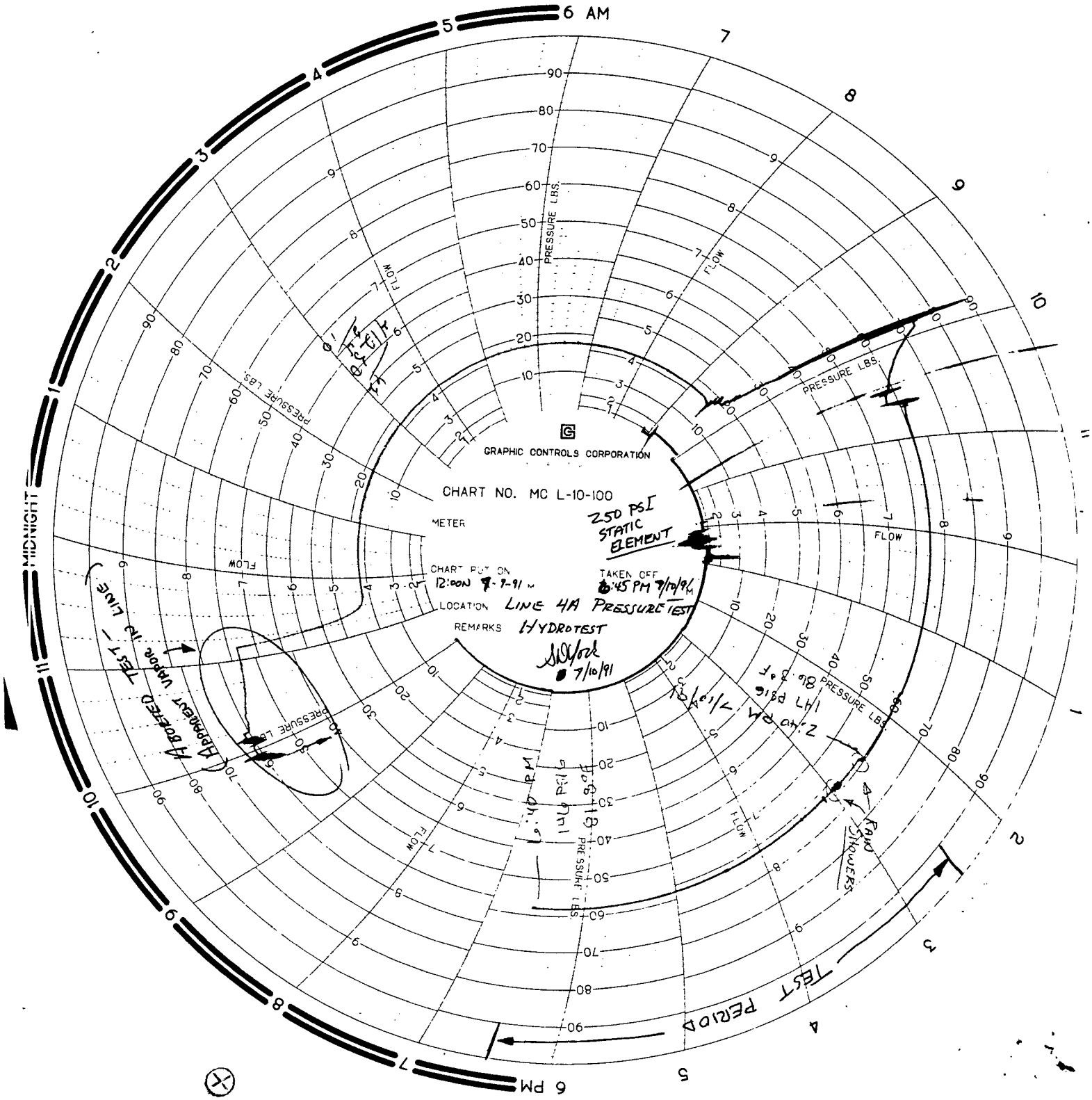
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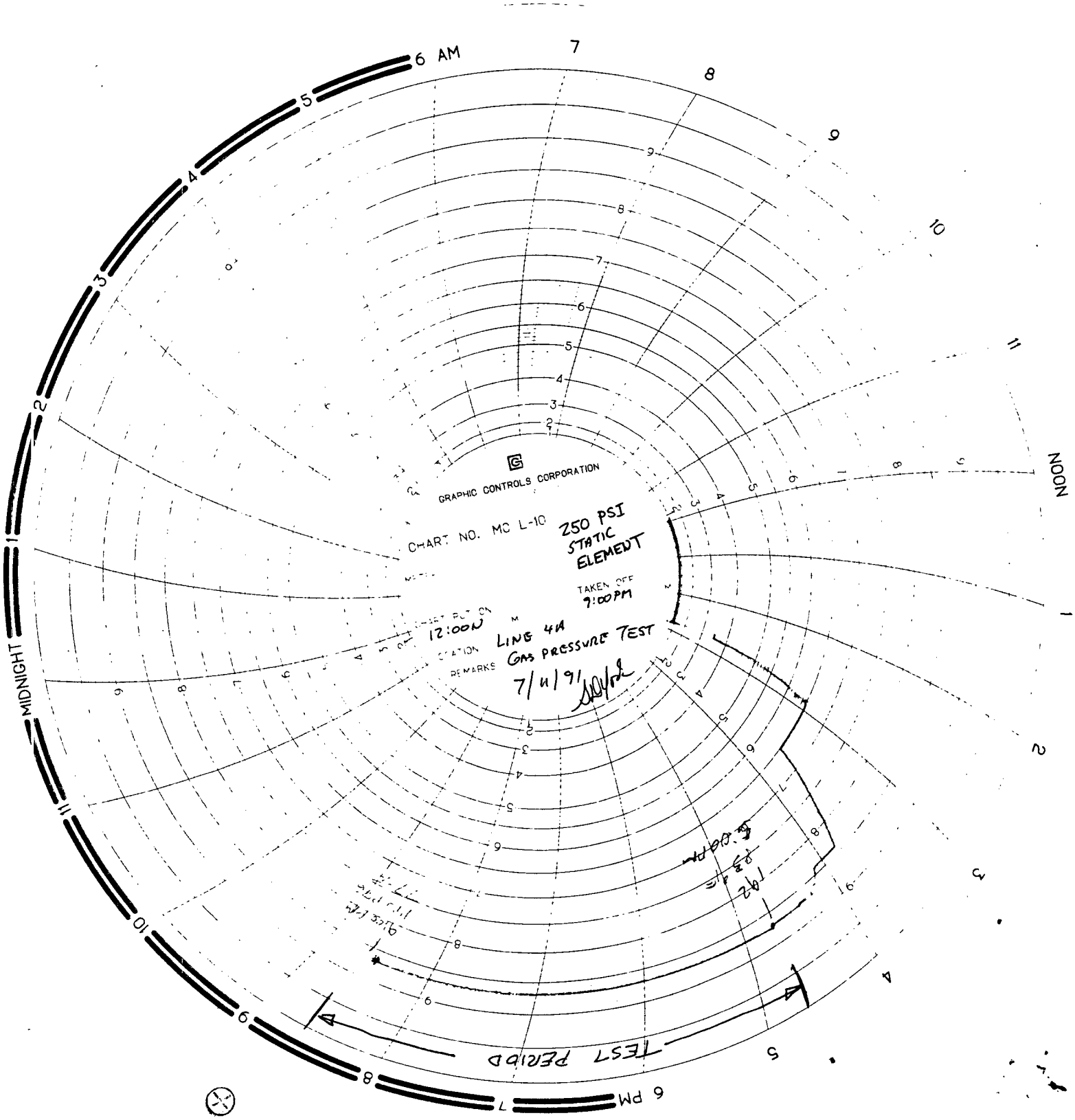
CHART NO. MC L-10-100
METER
CHART PUT ON
12:00N 7-9-91
TAKEN OFF
6:45 PM 7/10/91
LOCATION LINE 4A PRESSURE TEST
REMARKS HYDROTEST
7/10/91
250 PSI STATIC ELEMENT
ABORTED TEST - APPARENT VAPOR IN LINE
RAW SHOWERS
TEST PERIOD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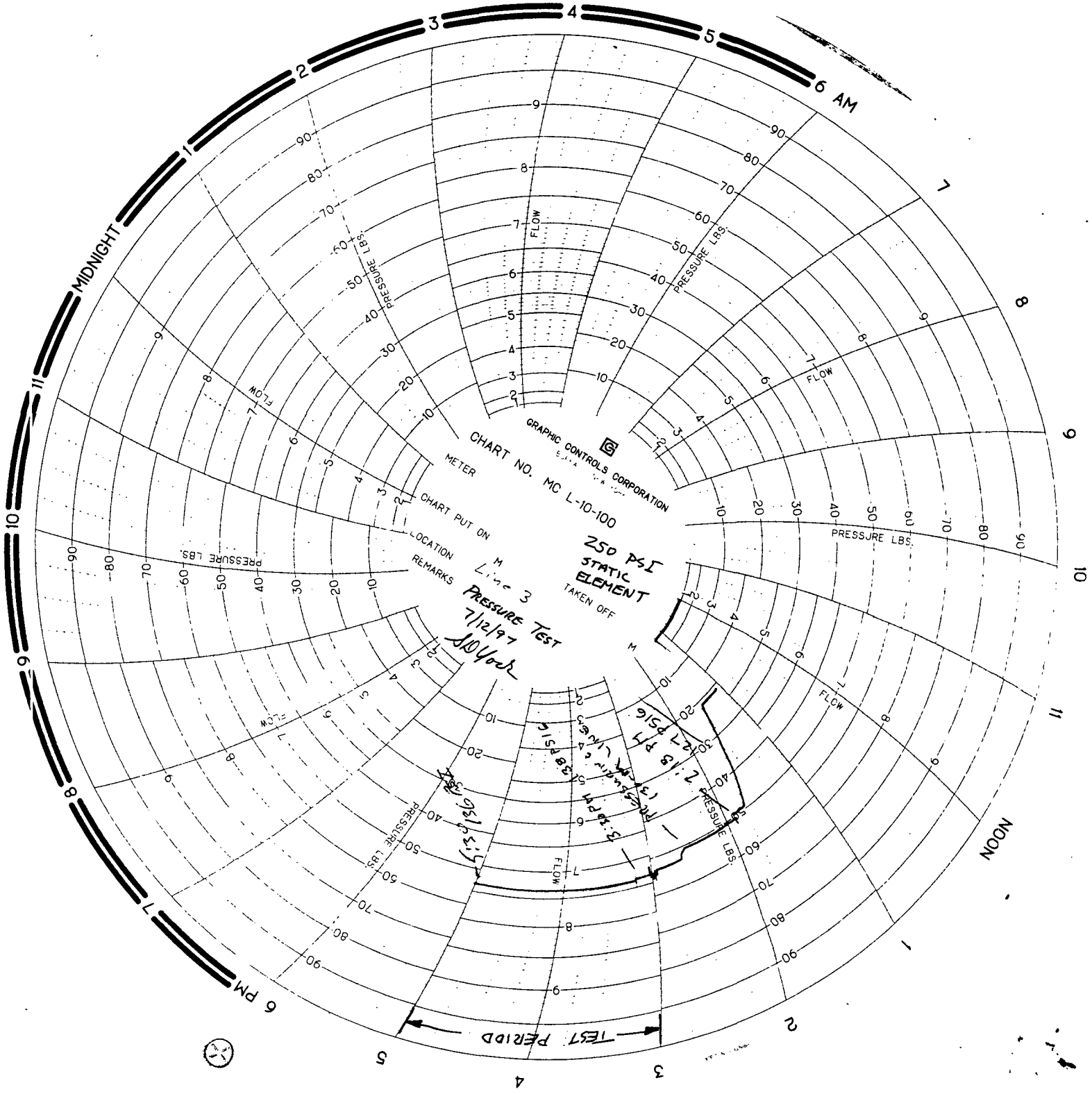
GRAPHIC CONTROLS CORPORATION
CHART NO. MC L-10
250 PSI
STATIC
ELEMENT
TAKEN OFF
9:00PM
12:00N
LINE 4A
GAS PRESSURE TEST
7/11/91
REMARKS
TEST PERIOD


GRAPHIC CONTROLS CORPORATION
CHART NO. MC L-10-100
METER
CHART PUT ON
LOCATION
REMARKS
Line 3
Pressure Test
7/12/97
250 PSI
STATIC
ELEMENT
TAKEN OFF
PRESSURE LBS.
FLOW
MIDNIGHT
6 AM
NOON
6 PM
TEST PERIOD

RECEIVED

AUG 13 1991

OIL CONSERVATION DIV.
SANTA FE

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 9, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week:

SHALLOW IMPACTED AREA

- Fluid recovery operations continue. Cumulative recoveries as of August 8, 1991 totaled 3584 barrels of condensate and 46,970 barrels of water.

- Final analytical results were received from samples obtained throughout the shallow impacted area. The sampling was undertaken to determine the amount of dissolved phase hydrocarbon present in the substantial quantity of water now being recovered. Analytical results are provided below.

LOCATION	BENZENE (ppm)	TOLUENE (ppm)	ETHYL BENZENE (ppm)	XYLENES (ppm)	TOTAL BTEX (PPM)	CHLORIDES (PPM)
Pit A11	1.1	1.6	1.1	0.8	4.6	1470
Pit 21A	1.7	3.4	1.2	2.2	8.5	636
Pit 16A	0.56	0.85	0.1	0.66	2.17	49
BH-42	4.9	1.0	1.3	2.5	9.7	466
BH-64	0.38	<0.025	0.22	0.025	0.625	71
BH-69	0.17	<0.01	0.26	0.06	0.49	76

- Weekly sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo, continues. Analytical results from those samples obtained on July 29, 1991 have been received indicating no presence of BTEX or elevated chloride concentrations.

- At the request of the BLM, daily sampling of Mrs. Lyman's water well was initiated on July 20, 1991. Analytical results from the daily samples obtained through August 1, 1991 indicate no presence of BTEX or elevated chloride concentrations.

LOWER QUEEN ASSESSMENT

- Regulatory agency approval was requested and granted to drill two additional Lower Queen assessment/monitoring wells. Borehole #90 was spudded on August 5, 1991 at a location of S2051/E5884. This location is approximately 50' from a well which was drilled and P&Ad in 1979. The hole was drilled to a depth of 40', and 8" PVC surface conductor casing was run and cemented. Shallow fluid has not been encountered in drilling to the 40' depth. The well will be deepened to the Lower Queen following the appropriate curing time for the cement, as specified in the drilling plan.

- Borehole #91 was spudded on August 7, 1991 at location of S3300/E4400. The hole was drilled to a depth of of 40', and 8" PVC surface conductor casing was run and cemented. Shallow fluid has also not been encountered in drilling this well to the 40' depth. Plans are to deepen this well to the Lower Queen following the appropriate curing time for the cement.

- The pump was pulled on the northeast water supply well at the plant. A fluid sample was taken from the top of the fluid column in the well on August 8, 1991 and submitted for analysis for BTEX and chlorides. There was no hydrocarbon odor or visible indications of hydrocarbon presence in this sample. Plans are to run a gamma ray log on this well when boreholes 90 and 91 are completed and logged, to obtain additional data as the evaluation of the geology in the area continues.

- Pump tests on boreholes 84, 85, and 88 are underway so that the necessary data can be obtained to size individual recovery pumps for the wells. Once the data is obtained, the pumps will be ordered.

- Requests for proposals to conduct a risk assessment study for the shallow impacted area have been distributed to four companies. Interested companies will be allowed to tour the site next week, prior to submitting their bid and project time schedule.

- An oxygen activation log was run on the water disposal well on August 5, 1991. The disposal well is at an approximate grid location of S1000/E2900, which is approximately 1100' west of where monitoring wells have confirmed hydrocarbon contamination is present on the Lower Queen. Results indicated that fluid flow or channeling behind the pipe does not exist in this well. Therefore, it does not appear that this well is in communication with the Lower Queen.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A J Kavran

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
D. D. Conway
A. R. Kukla
R. F. Unger

OIL CONSERVATION DIVISION
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United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Roswell District Office
P.O. Box 1397
Roswell, New Mexico 88202-1397

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
1703 (064)

Marathon Oil Company
Attention: A. J. Kavron
P. O. Box 552
Midland, TX 79702

AUG 08 1991

Gentlemen:

This letter is a follow-up to the meeting held July 18, 1991, and subsequent phone conversations. As discussed, we agree that the final risk assessment can not be completed until the site characterization is finished. therefore, the due date for the final risk assessment analysis is suspended. An interim risk assessment is due at our next meeting. This meeting is scheduled for 1:00 p.m., August 22, 1991, at the Roswell District Office.

This letter is also written approval for the drilling of the next two wells at the site. The general location of these wells is E4400/S1800 and an upgradient well on the W2400 axis.

If you have any questions, please contact Tim Kreager at the Roswell District Office, (505) 622-9042.

Sincerely,

s/T. Kreager

FOR Francis R. Cherry, Jr.
District Manager

cc:
Oil Conservation Division
Attention: Dave Boyer
P. O. Box 2088
Santa Fe, New Mexico 87504

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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'91 AUG 12 AM 9 17

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

August 8, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

This letter is intended as a follow-up to the telephone conversations I had with Mr. Dave Boyer of the OCD and Mr. Jim Amos of the BLM on Monday morning, August 5, 1991. In those conversations approval was requested and subsequently granted for two additional drilling sites for Lower Queen assessment/monitoring wells in the Indian Basin area.

The first site is at an approximate location of E5950/S1950, while the second location is at E4400/S3000. An archeologic survey will be conducted to clear each site prior to commencing any activities. The procedures utilized in drilling the previous Lower Queen wells will be utilized in drilling these wells.

We will keep you informed of the results obtained from drilling these wells. However, should you have any questions, or wish to discuss in the interim, please contact me at (915) 687-8528.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. Amos
J. L. Benson
D. D. Conway
A. R. Kukla
R. F. Unger

Tony Karman 8/5/91 AM

New well locations for approval:
E 5950, S 1950 - Adjacent to P&A well
E 4400, S 2200 - Active well to S. in
Section 25

Location: O.K.

JRB

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
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'91 AUG 2 PM 12 47

August 2, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week:

SHALLOW IMPACTED AREA

- Recovery operations at Stations 2, 3, and 5, those closest to the arroyo, were resumed on July 24, 1991. Cumulative recoveries as of August 1, 1991 totalled 3584 barrels of condensate and 31,000 barrels of water.

- Weekly sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo, continues. Analytical results from those samples obtained on July 22 and 23, 1991 have been received indicating no presence of BTEX or elevated chloride concentrations.

- At the request of the BLM, daily sampling of Mrs. Lyman's water well was initiated on July 20, 1991. Analytical results from the daily samples obtained through July 25, 1991 indicate no presence of BTEX or elevated chloride concentrations.

- The biofeasibility study that has been undertaken is proceeding on schedule, with final report expected before the end of August. Environmental Science and Engineering, Inc. has been contracted to complete this study.

- Basic soil venting laboratory experiments are nearing completion at Marathon's Petroleum Technology Center.

LOWER QUEEN ASSESSMENT

- Borehole 89 (S400/E2200) was drilled to a total depth of 220′ after encountering saturation at 203′. After allowing the well to stabilize overnight, a fluid sample was obtained on July 29, 1991. The sample had no visible evidence of free product, and no hydrocarbon odor was apparent. Subsequently, the well was completed with 4" PVC.

- Gamma ray logs were run on boreholes BH-88 and BH-89 on July 31, 1991. An effort was also initiated to determine what would have to be done to pull the pump on one of the water supply wells at the plant. If it is feasible to pull this well, a fluid sample will be obtained from the top of the fluid column and a gamma ray log will be run to assist in the understanding of the geology in the area.

- Survey work on-site has been undertaken to obtain and/or reaffirm surface elevations of the Lower Queen monitoring wells. Fluid level elevations from boreholes 89, 88, and 87A were used in a calculation which indicated flow to be in a southeasterly direction at a gradient of 0.004 feet/foot. However, fluid levels in the wells are fluctuating somewhat. The change in fluid levels is being investigated further to confirm the flow direction.

- Design of a recovery system has been initiated. Information obtained from suppliers thus far tends to indicate that electric-driven pumps will be preferable over pneumatic. Once work on obtaining static fluid levels is complete, boreholes 84, 85, and 88 will be pump tested in order to obtain necessary data to size the individual recovery pumps.

- Repairs to the drilling rig are being conducted following the completion of BH-89. Work is being undertaken on-site to replace some seals in the power train. Completion of the repair and maintenance work is anticipated on or about August 2, 1991.

- Existing data obtained from work conducted thus far is being evaluated in an effort to select future drilling locations.

- Efforts are underway to determine, if possible, the potential source of the hydrocarbon present in the Lower Queen. This effort includes the review of records on wells and pipelines in the area, drilling records, historical spills, etc.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
A. R. Kukla
R. F. Unger

PIPELINE LEAK UPDATE

The Bureau of Land Management (BLM) is working with Marathon Oil Company and the New Mexico Oil Conservation Division (NMOCD) to assess the impact of the pipeline leak northwest of Carlsbad, New Mexico, and to design a corrective action plan.

On April 12, 1991, Marathon reported the discovery of a subsurface leak of natural gas liquids and produced waters from a buried pipeline near their Indian basin gas plant. This report was sent to BLM, NMOCD, New Mexico Air Quality Board, and the National Response Center.

The leak occurred on BLM land at Rocky Arroyo, an ephemeral wash, 20 miles west-northwest of Carlsbad. Original estimates were that 35,000 barrels of gas condensate and 20,000 barrels of water were released.

Marathon began containment actions immediately: the 23 wells supplying the gathering line were shut down and recovery operations were begun. Within six and a half (6 1/2) hours of discovery, Marathon began removing spilled liquids from shallow recovery pits and wells. By April 21, 1991, 11 recovery and monitoring wells had been drilled around the site of the leak, recovering an estimated 514 barrels of natural gas liquids. A total of 3,500 barrels of condensate have been recovered as of July 16, 1991.

On April 29, 1991, Marathon submitted an initial Site Characterization Plan to BLM and NMOCD describing their method to define the spill area. This plan includes the drilling of shallow soil borings and deeper bedrock wells to investigate contamination. The plan also provides for the weekly testing of water wells in the area. No contamination of these water wells has been found as of July 12, 1991.

A total of 87 test holes have been drilled around the gas plant. Seven (7) of these test holes are bedrock wells that range from 40 to 200 feet deep. Ground water contamination has been discovered in three (3) of the test holes. All three are north of Rocky Arroyo, just east of the plant. Additional test holes will be drilled as needed to determine the areal extent and depth of contamination.

By August ~~5~~ 22, 1991, Marathon will complete an assessment identifying the impacts caused by the leak. Based on this assessment, Marathon will prepare a remedial action plan that describes how they intend to complete recovery operations and remediate contaminated areas. The BLM is receiving technical and regulatory assistance from the NMOCD in the review and approval of these plans.

From Chuck McCutcheon, Albuquerque Journal
8/1/91

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

RECEIVED

July 29, 1991

Mr. M. B. Williams
Supervisor and Oil & Gas Inspector
New Mexico Oil Conservation Division
811 South First Street
P. O. Drawer DD
Artesia, New Mexico 88210

Dear Mr. Williams:

In accordance with the applicable rules and regulations, Mr. David Boyer of the New Mexico Oil Conservation Division (NMOCD) was notified at approximately 10:00AM on July 20, 1991 of the overfilling of a frac tank located directly south of the Marathon-operated Indian Basin Gas Plant. Since he was already in the area, he subsequently reviewed the site of the spill.

Attached is a completed NMOCD report entitled "Notification of Fire, Breaks, Spills, Leaks and Blowouts". This completed written report is intended to fulfill the subsequent notification requirements as specified in Rule 116.

Should you have any question, please direct your inquiries to me at the number indicated on the letterhead.

Sincerely,

A. J. Kavran

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

Attachment

cc: D. G. Boyer

RECEIVED

JUL 30 1991

ARTESIA OFFICE

OIL CONSERVATION DIVISION

NEW MEXICO OIL CONSERVATION DIVISION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

NAME OF OPERATOR Marathon Oil Company					ADDRESS P. O. Box 552, MIDLAND, TX 79702		
REPORT OF	FIRE	BREAK	SPILL XX	LEAK	BLOWOUT	OTHER*	
TYPE OF FACILITY	DRLG WELL	PROD WELL	TANK BTTY	PIPE LINE	GASO PLNT	OIL RFY	OTHER* Frac Tank
NAME OF FACILITY Southeast of Indian Basin Gas Plant							
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION) NW/4 SE/4				SEC. 23	TWP. 21S	RGE. 23E	COUNTY Eddy
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK Approximately 25 miles NW of Carlsbad							
DATE AND HOUR OF OCCURRENCE 7/20/91 Estimated 6:00AM				DATE AND HOUR OF DISCOVERY 7/20/91 7:15AM			
WAS IMMEDIATE NOTICE GIVEN?	YES X	NO	NOT REQUIRED	IF YES, TO WHOM David G. Boyer			
BY WHOM A. J. Kavran				DATE AND HOUR Approximately 10:00AM 7/20/91			
TYPE OF FLUID LOST Condensate and water				QUANTITY OF LOSS Condensate-65 BBLS Water 35 BBLS (Est.)		VOLUME RECOVERED 5 BBLS	
DID ANY FLUIDS REACH A WATERCOURSE?	YES	NO X	QUANTITY				

IF YES, DESCRIBE FULLY**

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN**
Heavy rainfall resulted in increased water in-flow to recovery wells. Consequently, recovery rate increased significantly resulting in tank overfill. Administrative controls have been implemented to prevent recurrence.

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**
Fluid appeared to have pooled in an area approximately 10' x 45' adjactnt to frac tank. Vac truck was used to recovery liquids remaining on surface. David G. Boyer reviewed the area at approximately 10:30AM on 7/20/91.

Frac tank station 3

DESCRIPTION OF AREA	FARMING	GRAZING X	URBAN	OTHER* Oilfield			
SURFACE CONDITIONS	SANDY	SANDY LOAM	CLAY	ROCKY	WET X	DRY	SNOW

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**
A local rainfall resulting in 2.29" of rain occurred previous evening. Sunny on morning of 7/20/91.

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED A J Kavran A. J. Kavran TITLE Environmental and Safety Supervisor Mid-Continent Region DATE 7/29/91

*SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

7-31-91 OK MS.

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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91 JUL 31 PM 1 37

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

July 26, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

Following is a summary of the major events which occurred at the Indian Basin assessment and remediation site during the past week:

* Borehole 88 was drilled at a location of S1800/E4400. The well was initially drilled to 206' after encountering saturation at 203'. After allowing the well to stabilize overnight, a product thickness of 2.7' was measured on the morning of July 24, 1991, with the top of the fluid present at 188.3'.

  Subsequently, the well was deepened to a total depth of 223' and completed with 4" PVC.

* Borehole 89 was spudded at a location of S400/W2200. Steel 12" surface conductor was set at 14' and cemented. The rig has moved back on this well in preparation of deepening it to the Lower Queen.

* Survey work onsite has been undertaken to obtain and/or reaffirm surface elevations of the Lower Queen monitoring wells. The information will ultimately be used to determine/verify the direction of fluid flow in the Lower Queen at this location.

* A significant rainfall occurred on Friday, July 19, 1991. From 2:50PM to 5:35PM, 2.24" of rain fell, as measured in a rain gauge located at the site. Water accumulated in both the up gradient diversion dam and the down gradient collection trench. The pump at the up gradient dam was started, and the fluid level appeared to be

dropping, following the conclusion of the rainfall. However, a substantial flow of water came through the arroyo from upstream after the rainfall event. The capacity of the upgradient dam was reached and water initially flowed over it at 6:45PM. Shortly thereafter, the capacity of the down gradient collection trench was reached, and fluid also flowed over it. The water flow impacted the pumping operations on the recovery wells in the arroyo channel to a varying degree, from very little effect to completely washing out a pump. However, with the exception of one, all recovery pumps had been checked and returned to operable conditions by the afternoon of July 20, 1991.

* Another significant rainfall occurred on Sunday, July 20, 1991. From approximately 4:00PM to 7:00PM, 2.74" of rain fell, as measured in a rain gauge at the site. Both the upgradient diversion dam and the down gradient collection trench filled to capacity and overflowed as a result of this event. Impact on the operations was similar to those following the rain on Friday evening.

* At the request of the BLM, daily sampling of Mrs. Lyman's water well has been initiated, starting on July 20, 1991. Samples have been forwarded to Core Lab in Denver for BTEX and Chloride analyses. There are no analytical results yet available.

* Additional rainfalls of lesser significance have occurred since Sunday, making the site very muddy. Consequently, vac trucks can not gain access to the sites of some of the recovery tanks to remove fluids without getting stuck. As a result, recovery operations at Stations 2, 3, and 5, those closest to the arroyo, have been temporarily suspended until the access roads dry somewhat.

* Weekly sampling of nearby domestic and stock wells, as well as surface and spring waters in the arroyo continues. Analytical results from those samples obtained on July 15 and 16, 1991 have been received, indicating no presence of BTEX or elevated chloride concentrations.

* Cumulative recoveries as of July 25, 1991 totaled 3584 barrels of condensate and 16,258 barrels of water.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elk

cc: J. L. Benson
A. R. Kukla
R. F. Unger

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

BRUCE KING
GOVERNOR

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

July 26, 1991

Ms. Kathleen Sisneros, Director
Water and Waste Management Division
New Mexico Environment Department
1190 St. Francis Drive
Santa Fe, New Mexico 87503

Dear Kathy:

Because of the severity of the Marathon Indian Basin spill it is important that your agency remain informed of the progress of the investigation and remedial action taken. I request that the Environment Department assign a technical staff person to act as a liaison between your agency and the OCD on this issue.

This person would become familiar with the incident and subsequent activities and be able to relay information and brief Environment Department staff as necessary. I believe this method of communication will be the most expeditious way to pass new technical information to the Environment Department and provide for Environment Department management to be updated between WQCC meetings.

If you agree with this approach, please let me know of your agency's choice so that I can meet and provide information to your staff person.

Sincerely,

Dave

David G. Boyer, Hydrogeologist
Environmental Bureau

DGB/sl

cc: Anita Lockwood, Secretary, EMNRD
Matt Baca, Deputy Secretary, EMNRD
William J. LeMay, Director, OCD

Tony Karvan 7/24

#88 Freeproduct, fluids at 203 FT, Am 188', 2.7 FT
S1800, E4400

#89 W2200, S400 - Up gradient well
underdrilling

DJB

BLM Probing Marathon After Massive Oil Leak

The Bureau of Land Management is investigating a 1.47 million-gallon oil leak in southeastern New Mexico that was discovered earlier this year, an agency official said Friday.

Bureau spokeswoman Mary O'Keeffe said officials from the bureau's law enforcement unit in Santa Fe are looking at Marathon Oil Co.'s leak, the state's largest in recent years.

O'Keeffe couldn't provide any further details. But Chris Shuey of Albuquerque's Southwest Research and Information Center, an environmental group, said the agency is looking at whether federal laws have been violated.

A state Oil Conservation Division official said last month Marathon won't be cited or fined for the leak because it didn't violate state laws.

Marathon officials discovered the leak in mid-April but said they believe the oil had been leaking since at least November 1990. About 840,000 gallons of waste water leaked with the spill.

BLM said in a statement Marathon will complete by Aug. 5 an assessment identifying the impacts caused by the leak.

BLM investigating Carlsbad-area oil leak

The Associated Press

The U.S. Bureau of Land Management's law enforcement unit is investigating a 1.47 million gallon oil leak discovered three months ago north of Carlsbad, a BLM spokeswoman said.

Mary O'Keeffe said Friday she could not provide any further details about the investigation.

But Chris Shuey of Albuquerque's Southwest Research and Information Center said the BLM is looking at whether federal laws have been violated.

Robert Stovall, an attorney for the state Oil Conservation Division, said last month Marathon Oil would not be cited or fined for the leak because it did not violate state laws.

Company officials discovered the leak in mid-April but said they believe the oil had been seeping out of an underground pipeline at the company's Lakewood plant since at least November 1990.

Marathon Indian Basin
Friday July 19, 1991
PM Flash Flood

To

Dave Boyer

From

Johnny Robinson

Photo Galaxy®

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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HR 10 04

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

July 19, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Al Collar
Hazardous Materials Coordinator
U. S. Department of Interior
Bureau of Land Management
P. O. Box 1397
Roswell, New Mexico 88202

Gentlemen:

This letter is intended as a follow-up to our meeting yesterday afternoon, July 18, 1991, with both the OCD and the BIM. As per our mutual agreement, Marathon will proceed with the drilling of two wells to the Lower Queen Aquifer. One will be located in the southeast, in the general vicinity of E4400/S1800. The other well will be located upgradient of the line leak. Presently, the intent is to locate this well on the west 2400 axis. The north/south orientation of the well will be determined following the evaluation of the Lower Queen flow gradient data. This effort is still underway as it appears that the fluid level in borehole 85 has not yet stabilized, following its development. Archeological surveys of these areas have already been completed, so that the actual drilling location will be clear of any archeological finds.

The procedures utilized in drilling the first four bedrock wells will be followed in drilling these wells also. Plans are to initiate the drilling of these wells immediately. If you have any questions, or wish to discuss, please contact me at 915/687-8528.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elg

cc: J. L. Benson
A. R. Kukla
R. F. Unger
File

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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JUL 22 AM 9 53

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

July 19, 1991

New Mexico Oil Conservation Division
310 Old Santa Fe Trail, Room 206
Santa Fe, New Mexico 87503

Attn: Mr. David G. Boyer

Re: Indian Basin Gas Plant
Eddy County, New Mexico

Dear David:

As per your request of last week, attached is a brief chronology of the Indian Basin Gas Plant personnel's awareness and actions relative to the production shortfall from December 1990 through April 1991.

If you would like some more detail, please let me know.

Very truly yours,

Robert F. Unger
Production Manager
Midland Operations

RFU/195/jmh

Attachment

INDIAN BASIN GATHERING SYSTEM LEAK
CHRONOLOGICAL ORDER OF EVENTS

Dec. 03, 1990	Calculated production of condensate during November 1990. Noted significant reduction from September 1990 production. Drove rights-of-way and walked rough-terrain locations of gathering systems to check for leaks. No visual indication found.
Dec. 10, 1990	Found large amount of condensate in skim tank of Salt water Disposal System. Thought this could be cause of low production. Worked on interfacial controller on Condensate Inlet Tank in effort to eliminate condensate carryover.
*Dec. 20, 1990	After repeated attempts to repair interfacial controller proved unsuccessful, new controller was ordered. Approximately four-week delivery time.
*Dec. 20, 1990 thru *Jan. 25, 1991	Awaiting receipt of new controller. Worked on existing controller several times during interim.
*Jan. 25, 1991	New controller received.
*Jan. 26, 1991	New controller installed. Interfacial control improved dramatically.
*Jan. 26, 1991 thru *Feb. 07, 1991	Condensate production improved.
*Feb. 07, 1991 thru *Feb. 16, 1991	Plant throughput was reduced to about 50% due to engine exchange on the inlet compressor. Production for all products, including condensate, was low.
*Mar. 13, 1991	Condensate production became very erratic.
*Mar. 20, 1991	Problems with erratic production traced to poor tank gauges caused by dirty sight glasses. Sight glasses were cleaned.
*Apr. 12, 1991	Leak detected on inspection of Arroyo.

*Note: Throughput the entire period of time, all gathering lines were visually inspected approximately once per month. In addition, the field personnel were aware of the production discrepancies and advised to be more vigilant in their daily routines. The Arroyo wherein the leak occurred was inspected numerous times, with the most recent inspections occurring on April 4 and April 9, 1991, respectively. No evidence of the leak was detected on these dates.

The level of activity within the Indian Basin Gas Plant and Field was extremely high during December 1990 through February 1991. Within this interval, some 11 workovers/recompletions, 6 wellhead facility revamps, 4 inlet compressor repairs, 4 wellhead compressor installations and miscellaneous process upsets/repairs occurred. All of these activities resulted in production fluctuations, which compounded leak detection and quantification.

RFU/193/jmh

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

July 18, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

A recap of the last weeks activity is as follows:

BH-86

This well was drilled down to a TD of 220′ on Friday, July 12, 1991. No hydrocarbon product was present on the water surface and there were no odors present in the well. Saturation was encountered in this well at 210′. Four-inch PVC casing was run in this well with 50′ of screen. On Sunday, July 14, the well was developed and sampled. The sample was submitted to Core Labs in Denver for analysis. Slug testing is now being performed on this Lower Queen monitoring well.

BH-87

This well located at N1800, E4700 encountered shallow water saturation at 53′. It was drilled to a TD of 56′ and converted into a shallow monitoring well. The saturation zone was only 3′ thick and the water level after drilling was at 47.8′. It was originally intended to drill this well down to the Lower Queen, but as per our drilling plan it was completed as a shallower well due to the fluid encounter.

BH-87A

This location is 10′ north of BH-87. It was drilled down to 70′ and 8" PVC casing grouted in place to isolate the saturation zone from 53′-56′. The cement in the bottom of the PVC casing was drilled out and the hole checked for any seepage from above. There was none which indicates a good cement seal behind the casing. Drilling continued down to a TD of 214′. Saturation in the Lower Queen was encountered at 196′. The water level stabilized at 187′. There was no evidence of free product on the water surface, and no strong hydrocarbon odor in the water.

On July 15, 1991, this well was completed as a Lower Queen monitoring well. It will be developed and sampled on July 17, 1991.

Other Activities

Slug testing is continuing on the Lower Queen monitoring wells to obtain additional data to calculate hydraulic conductivities.

The slug tests that were run last week on the shallow sandstone wells east of the gas plant indicated a flow velocity of two feet per day. A potentiometric surface of this aquifer indicates a southerly flow pattern. I stated in last weeks letter the Lower Queen is moving in an easterly direction at 0.5′ per day. With the addition of BH-86 and BH-87A, this information will be further refined.

Weekly monitoring of the area water wells and arroyo water continues with no detectable levels of BTEX present in the water.

Cumulative recoveries of July 16, 1991 are 3528 BC and 11539 BW.

Please call if you have any questions.

Sincerely,

Thomas F. Zapatka
Advanced Environmental and Safety Engineer

TFZ/elg

Enclosure

cc: J. L. Benson
A. Collar (BLM-Roswell)
A. R. Kukla
R. F. Unger
File

Tom Zupatka 3PM 7/15/91

#87a 196' Water, Clean Water, No odors
214 TD, DTW 187' (70' Surface)

#87 56' TD, Water @ 53 FT Clean

#86 220' TD, Water @ 210', No odor,
No Cord.

[illegible]

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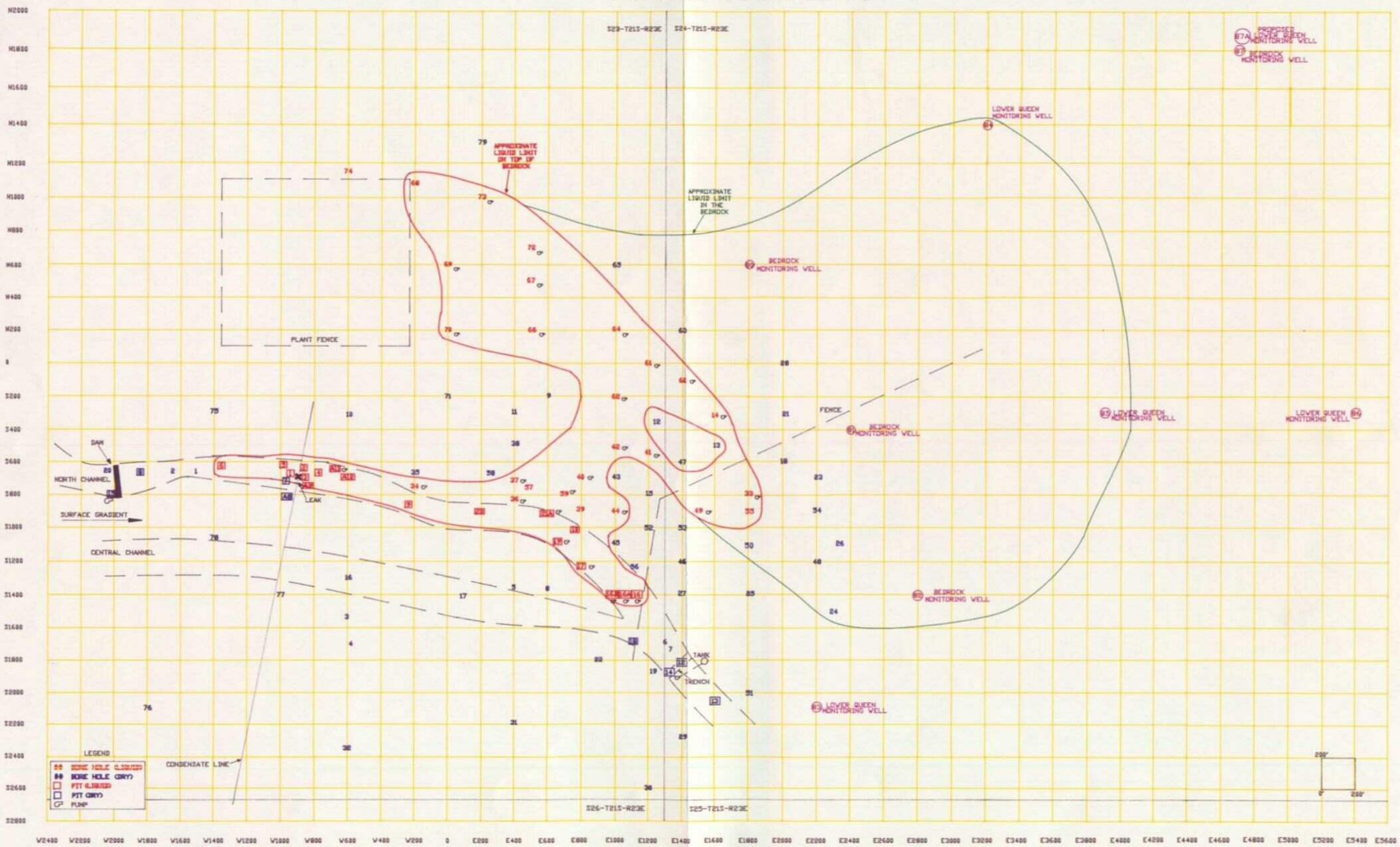
SANTA FE

INDIAN BASIN REMEDIATION

JULY 14, 1991

PRIVILEGED AND CONFIDENTIAL

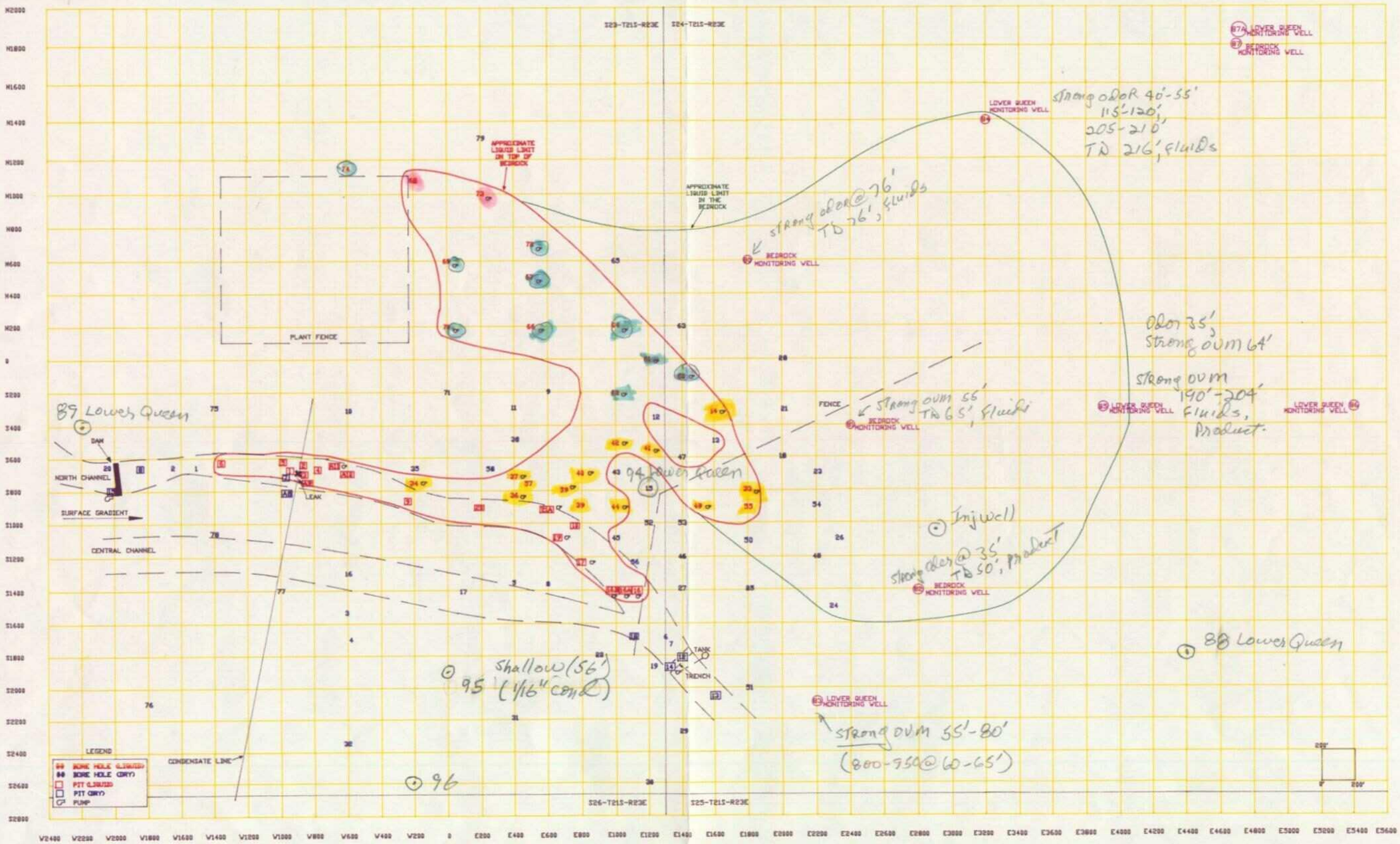


Condensate & water
Contam. water - No condensate, High TDS, Cl
Low TDS, Cl
No info.

INDIAN BASIN REMEDIATION

JULY 14, 1991

PRIVILEGED AND CONFIDENTIAL



#86 7/11 210 FT 1.7 PPM OVM
7/12 185 Water Level/No condensate
To Drill to 220

#87 Start today

Slug Tests - 0.5 FT/day Seepage Velocity
Queen (includes) Easterly

Upper Sand 2 FT/day South

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

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OIL CONSERVATION DIVISION
RECEIVED

July 11, 1991

Jim Amos
Bureau of Land Management
Carlsbad Resource Area
P. O. Box 1778
Carlsbad, New Mexico 88220

Re: Indian Basin Project

Jim:

On Monday, July 8, 1991 archeologists Jim Sciscenti and Dorothy Griffiths of Archeological Survey Consultants (Roswell) were on-site to investigate the locations of the two proposed Lower Queen boreholes. They investigated the area around the borehole locations and the access road in and out of the area. BH-86 is located at S300, E5400; BH-87 is located at N1800, E4700. They found no evidence of archeological sites at these locations and gave a verbal report to the BLM office in Carlsbad of their investigations. Your office in turn gave verbal approval to Marathon to drill the two proposed boreholes. The purpose of this letter is a written follow-up of our conversation regarding this matter.

You also requested proposed borehole locations after BH-86 and BH-87 are completed. The direction we follow upon their completion depends upon the results found in these wells. If BH-86 and BH-87 are clean, the next proposed locations are:

S900	E4100
S 500	E4600
N1100	E4600

If BH-86 and BH-87 are contaminated, we again propose stepping out 1500' in an easterly direction from these wells. Once an outer edge of the plume is defined, the drilling program will then concentrate on delineating the width of the plume. As each new Lower Queen well is drilled and completed, water levels, product thickness, slug tests, and analytical data will be obtained. All of this information is useful in helping determine plume migration, plume size and ultimately plume management.

Marathon also proposes to install one, possibly two upgradient wells at the following tentative locations:

S2100 W1800
S 400 W1800

As in the past, you will be notified immediately of any new findings or developments. If you have any questions or comments, please contact my office at (915) 687-8532. Thank you for your cooperation.

Sincerely,

Thomas F. Zapatka
Advanced Environmental and Safety Engineer

TFZ/elg

cc: J. L. Benson
D. G. Boyer (OCD)
D. L. Manus (BLM)
A. R. Kukla
R. F. Unger
File

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

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July 11, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

A recap of the last week's activity is as follows:

BH-85

This well was drilled down to a TD of 208' on July 4, 1991. Fluid was first encountered at a depth of 191'. The top of the Lower Queen sandstone is at 204'. Above it is a sandy dolomite and limestone. I have attached a boring record of BH-85. After the well was drilled, a bailer was lowered into the hole. Approximately 0.9' of hydrocarbon product was present on the water table. However, this product differed from the previous samples obtained from wells. It is a dark brown color whereas all of the other free product collected to date has been a yellowish color. A sample of this product was obtained and sent to Marathon's lab in Denver for analysis. You will be advised of the results as soon as possible.

On July 5, casing was run into this well and grouted in place. For the next four days no drilling took place.

BH-86

This proposed Lower Queen monitoring well is located at S300, E5400. It was spudded on Tuesday, July 9, 1991 and drilled to 30' where 8" PVC conductor was set. It is presently being drilled down to the Lower Queen.

BH-87

This well is located at N1800, E4700. On July 5, 1991, it was drilled down to 30' and 8" PVC conductor grouted in place. It will be drilled to the Lower Queen upon completion of BH-86.

Other Items

On Saturday, July 6, 1991, all recovery wells in the site area were shut-in for 72 hours. This was to allow the fluid in the wells to attain a static fluid level. Fluid levels and product thickness measurements were taken on all the monitor wells in order to construct a potentiometric map. Preliminary data indicates that the fluid present in the sandstone bedrock east of the gas plant is moving in a southerly direction.

Fluid levels were also taken in the three Lower Queen monitoring wells. The data indicate an easterly movement in the Lower Queen. Slug tests were also conducted on these wells. A flow velocity of 0.5′ per day was calculated. As we drill and complete additional Lower Queen monitoring wells these numbers will be refined even further.

Cumulative recoveries as of July 10, 1991 are 3454 BC and 9673 BW. I will be in touch with you as soon as BH-86 is completed. Please call if you have any questions.

Sincerely,

Thomas F. Zapatka
Advanced Environmental Engineer

TFZ/elg

Attachment

cc: D. L. Manus (BLM-Carlsbad)
J. L. Benson
A. R. Kukla
R. F. Unger
File

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Roswell District Office
P.O. Box 1397
Roswell, New Mexico 88202-1397

OIL CONSERVATION DIVISION
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'91 JUL 8 AM 9 33

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
1703 (064)

Marathon Oil Company
Attention: A. J. Kavran
P.O. Box 552
Midland, Tx 79702

JUL 05 1991

Re: Indian Basin Gas Plant Incident

Gentlemen:

This letter clarifies the Bureau of Land Management's (BLM) position concerning characterization and remediation of the Indian Basin Gas Plant Site. The BLM reporting and approval requirements are also included in this letter.

We reviewed this case with our Washington Office Hazardous Materials Management staff. The following regulatory status is based on that review.

The materials released at the Indian Basin Gas Plant Site were condensate and produced waters. The condensate is exempted from the remediation requirements and liability under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) but is subject to regulation under the Resource Conservation and Recovery Act (RCRA). The produced waters are exempted from RCRA regulation, but if contaminated with hazardous substances, are subject to remediation and liability provisions of CERCLA. The data from the bedrock drilling provides evidence of groundwater contamination. This indicates potential for violation of the Clean Water Act (CWA), the New Mexico Water Quality Act, and CERCLA section 105(g) at the release site.

The site remediation policy set forth in this letter is designed to assure rapid assessment and response to the potential release of hazardous substances, pollutants, and contaminants. It is also meant to reduce future risk and liability to the potentially responsible parties, including the U.S. Government. We intend to assure compliance with Federal and State laws and regulations on authorized public land uses.

In cases such as this, BLM seeks advice from State regulatory agencies regarding compliance. The New Mexico Oil Conservation Division (NMOCD) is responsible for ensuring compliance with the New Mexico Water Quality Act. The standards established by the NMOCD for characterization and remediation at the site are the minimum acceptable standards. The BLM has the authority to establish more stringent standards. Characterization and remediation actions at the site require the written approval of the BLM authorized officer before work begins.

Site characterization and remediation require effective communication and teamwork. To achieve this, the BLM requires Marathon holds weekly meetings with BLM and NMOCD. The first meeting will be on July 11, 1991, at the Roswell District Office at 1:00 p.m. Future meetings will be held every Thursday.

We require a written report of the past weeks' activities at these meetings. The minimum data required in these reports include drilling data, sample reports, water well test data, and recovery/remediation activities. During the meeting we can discuss future work and the need for BLM personnel on site over the weekend. We will discuss additional reporting needs during the first meeting.

The BLM also requires monthly summary reports. The first summary report is due August 5, 1991. The minimum data required in the first reports includes the following:

1. All maps and cross sections presented at the June 10, 1991, meeting. This information shall be updated to include the new data from the bedrock drill holes.

2. A hydrologic report based on "real time" data. The report shall at a minimum include a potentiometric map of the site and copies of water well test data.

The BLM requires a risk assessment analysis before any remedial actions begin at the site. This analysis is also due August 5, 1991. The following items comprise a risk assessment analysis.

1. Hazard Identification: used to determine if there is a causal relationship between the materials released at the site and health effects in man and animals.

2. Dose-Response Assessment: used to determine whether known or predicted levels can cause the effect based upon epidemiological and laboratory bio-assays.

3. Exposure Assessment: used to determine the potential routes of exposure and levels of exposure. This includes a pathway analysis.

4. Risk Characterization: describes the nature of the risk and the uncertainty.

The goal of the risk assessment/risk management process is to identify risks, place risks in perspective, and manage the risks in a cost-effective manner to protect public health and the environment.

One goal in this project is to meet the clean-up and documentation requirements set by Federal and State law. Marathon shall follow the investigation and clean up guidance required by the National Contingency Plan (NCP). The BLM must also protect that public health and public land resources. Pursuant to provisions of the Federal Land Policy and Management Act (FLPMA), all actions at the site require BLM approval.

The first summary report and the risk assessment analysis are due August 5, 1991. The BLM will not authorize any additional remedial or clean up actions at the site until these reports are reviewed and approved. The BLM may seek technical and regulatory review assistance from the BLM Service Center staff, the New Mexico Environment Department, the Environmental Protection Agency, or consultants.

If you have any questions concerning this letter, please contact Al Collar at 505-622-9042.

Sincerely,

Orig. Sgd. Francis R. Cherry, Jr.

Francis R. Cherry, Jr.
District Manager

cc:
NMOCD
Dave Boyer
P.O. Box 2088
Santa Fe, NM 87504

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

BRUCE KING
GOVERNOR

MEMORANDUM

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

TO: JUDITH M. ESPINOSA, Chairperson, New Mexico Water Quality Control Commission

FROM: WILLIAM J. LeMAY, Director, Oil Conservation Division

SUBJECT: Oil Conservation Division Designee and Agenda Request

DATE: July 5, 1991

---

1. I hereby designate William C. Olson of OCD's Environmental Bureau to represent the Division at the Commission's July 9, 1991 meeting. Mr. David Boyer, the Division's usual designee, will be out of town and unable to attend this meeting.

2. Earlier this week, OCD was notified that a deep monitor well, drilled under OCD order at the site of Marathon Oil's Indian Basin pipeline leak, found condensate oil contamination in the Lower Queen Aquifer at a depth of 207 feet. This is the first groundwater aquifer at the location. Because of the seriousness of finding ground water contamination in this drinking water formation, OCD requests that it be allowed to present a 10 to 15 minute briefing on the incident, Marathon's response upon discovery of the leak, and OCD's action to require investigation and remedial action by Marathon.

   We suggest that the appropriate agenda location for this presentation be at the end of agenda Item 8 and before Item 9, (consideration and action on discharge plan user fee amendments to the WQCC regulations).

   Your consideration of this request is appreciated.

cc. Members, WQCC
William C. Olson

SOUTHWEST RESEARCH AND INFORMATION CENTER
P.O. Box 4524 Albuquerque, NM 87106 505-262-1862

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JUL 05 1991

OIL CONSERVATION DIV.
SANTA FE

COPY TO NMED BY FAX, JULY 3, 1991
HARD COPY BY MAIL, JULY 3, 1991

July 3, 1991

Ms. Judith Espinosa, Chair
New Mexico Water Quality Control Commission
c/o New Mexico Environment Department
1190 St. Francis Drive
Santa Fe, NM 87503

Dear Ms. Espinosa:

The purpose of this letter is to request that the Water Quality Control Commission receive reports on and undertake discussion of two matters of importance to New Mexico's water resources.

Marathon Indian Bend Spill. The first issue is the extent and effects of the leak of 2.3 million gallons of petroleum condensate and produced water from a gathering line south of the Marathon Indian Bend plant north of Carlsbad. Data reported by the company to the Oil Conservation Division in early May showed that the spill fluids had traveled nearly three-quarters of a mile from the spill site but had not migrated to ground water more than 180 feet below the land surface. More recent data suggest that the lateral and vertical extent of the spill is much greater than previously thought. OCD reported this week that there is now evidence that ground water has been contaminated by the spill although the extent of that contamination is not yet fully delineated or understood. Nonetheless, the likely presence of benzene, other aromatic hydrocarbons, trace metals, and possible elevated concentrations of radioactivity in the spill fluids point to significance and gravity of this incident.

SRIC is concerned that the Water Quality Act and the Commission's regulations may have been violated by this leak and that enforcement action beyond mere cleanup must be pursued. The leak is certainly one of the largest oil and gas waste spills in the state's history, and may be second only to the hundreds of thousands of barrels of crude oil that have leaked from well casings into ground water in Lea County in the past 70 years.

NORM Wastes. The second issue concerns the emerging record of high levels of radioactivity in produced waters generated in the oil fields of New Mexico. Data collected by OCD in 1989 and 1990, and released to the public this year, show concentrations of radium-226 as high as 6,000 picoCuries per liter -- a level akin to that typically found in uranium mill tailings effluent and some 200 times the Commission's standard for ground water. Of particular concern is the discharge of produced waters containing high levels of naturally occurring radioactive materials (NORM) to playa lakes in southeast New Mexico. The combined discharge of high-salinity oil-field wastes containing radium-226, certain trace metals, and aromatic hydrocarbons with high-salinity wastes from the potash mining industry may present unusual risks to local residents, workers and to ground water in the region.

SRIC is convinced that OCD and the Environment Department need to undertake a comprehensive investigation of the potential impacts of NORM waste on water quality in New Mexico. Such an investigation may reveal the risks posed to people and the environment and may point to the need for statutory and-or regulatory measures to address a problem that is national in scope. Like New Mexico, several states have initiated data collection efforts for NORM wastes and are considering regulatory actions. Only Louisiana has adopted regulations for the handling and disposal of NORM wastes.

SRIC requests that the Commission discuss these issues briefly at its July 9, 1991, meeting and place them on the agenda of its August meeting for more thorough discussion. SRIC staff will be present to assist as needed.

Thank you for your consideration and attention to these important matters.

Sincerely,

Chris Shuey, Director
Community Water Quality Program

xc: Anita Lockwood, Secretary, EMNRD
William LeMay, Director, NMOCD
David Boyer, Environmental Bureau, NMOCD
Kathleen Sisneros, Director, NMED/WWMD

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

July 2, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Re: Indian Basin Gas Plant
Condensate Analysis

Dear Mr. Boyer:

As you requested in our meeting in Santa Fe on Monday, June 24, 1991 an analysis of the field condensate for BTEX was performed. Enclosed is a revised sheet for the gas chromatographic results showing the BTEX composition in the condensate. If you need any additional information, please call.

Sincerely,

Thomas F. Zapatka
Advanced Environmental Engineer

TFZ/elg

Enclosure

cc: D. L. Manus (BLM-Carlsbad)
J. L. Benson
A. R. Kukla
R. F. Unger
File

INTRACOMPANY CORRESPONDENCE

P.G. Varney J.B. Hooper

To:	A.J. Kavran	From:	P.G. Varney/J.B. Hooper
Office:	Midland	Office:	PTC
Subject:	**Gas Chromatographic Characterization of Condensate**	Date:	June 27, 1991

CONFIDENTIAL BUSINESS INFORMATION

Attached is a **revised sheet** for the gas chromatographic results for the Indian Basin condensate sample taken at 1625 on 5/23/91. For clarification, we have spelled out the hydrocarbon component names and as you requested, we added the sample composition data for the C_6-C_8 aromatics; that is, Benzene, Toluene, Ethylbenzene and the Xylenes.

If we can be of further assistance, feel free to contact us.

Attachments
cc: D.D. Conway
S.L. Dyke

MCR
JUL 1 1991
Environmental & Safety

GAS CHROMATOGRAPHIC ANALYSES

Sample Identification: Line 4 Condensate
5/23/91; 1625 HR; W. Nixon

Detailed Hydrocarbon composition through n-C7, C6-C8 Aromatics, and Paraffin, Naphthene, Aromatic (PNA) composition by carbon number

HYDROCARBON COMPONENTS THROUGH n-C7	WEIGHT %
Propane	0.56
iso-Butane	0.64
n-Butane	1.86
neo-Pentane	0.06
iso-Pentane	2.49
n-Pentane	3.13
2,2-Dimethyl-butane	0.30
Cyclopentane	0.20
2,3-Dimethyl-butane	0.41
2-Methyl-pentane	2.60
3-Methyl-pentane	1.69
n-Hexane	4.65
2,2-Dimethyl-pentane	0.22
Methyl-cyclopentane	1.87
2,4-Dimethyl-pentane	0.29
2,2,3-Trimethyl-butane	0.07
3,3-Dimethyl-pentane	0.16
Cyclohexane	3.34
2-Methyl-hexane	2.35
2,3-Dimethyl-pentane	0.52
1,1-Dimethyl-cyclopentane	0.52
3-Methyl-hexane	2.45
c-1,3-Dimethyl-cyclopentane	0.70
t-1,3-Dimethyl-cyclopentane	0.62
3-Ethyl-pentane	0.15
t-1,2-Dimethyl-cyclopentane	1.07
2,2,4-Trimethyl-pentane	0.00
n-Heptane	5.92

CARBON NUMBER	P (WT%)	N (WT%)	A (WT%)	TOTAL
3-5	8.75	0.20	0.00	8.95
6	9.66	5.21	0.23	15.10
7	12.14	11.26	1.80	25.20
8	12.51	7.95	3.04	23.50
9	8.37	3.92	2.03	14.32
10	4.72	2.21	0.84	7.77
11+	3.49	0.69	0.12	4.30
TOTAL	59.64	31.44	8.06	99.14

UNKNOWNS = .86

C6-C8 AROMATICS	WEIGHT %
Benzene	0.23
Toluene	1.80
Ethyl-benzene	0.28
m-Xylene	1.65
p-Xylene	0.56
o-Xylene	0.55

Analyst: J.B. Hooper
Revised 6-27-91

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Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

July 2, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

A recap of the last weeks activity is as follows:

BH-80

Drilled/cored to a TD of 76'. No free product was encountered, but the water did contain a distinctive condensate odor. This well has been completed as a 4" shallow bedrock monitoring well. It is in the process of being developed and samples obtained for laboratory analysis.

BH-81

Drilled/cored to a TD of 65'. No free product encountered, but the water did have a condensate odor. This well has been completed as a 4" shallow bedrock well. It is in the process of being developed and samples obtained for laboratory analysis.

BH-82

Drilled/cored to a TD of 50'. Free product (condensate) was encountered at 41.5'. Approximately 1/4" of free product was found on top of the water as determined by an interface probe. This well was deepened to 50' and completed as a 4" monitoring well. It is being developed and samples being obtained for laboratory analysis.

BH-83

This well was drilled/cored to a TD of 175'. The Lower Queen aquifer was encountered at approximately 172'. No free product was encountered in the water table and no noticeable hydrocarbon odors were evident. This well was completed as a 4" monitoring well and was recently developed. Samples were obtained for laboratory analysis. In all instances, analysis will be performed for chlorides and BTEX.

I have attached for your information field copies of the above borehole logs.

BH-84

This well was drilled to a TD of 215'. The Lower Queen aquifer was encountered at 207'. A water sample taken with a bailer recovered approximately 1/4" of free product (condensate) on top of the water table. The static water level in the hole was at 194'. This well was immediately completed in a Lower Queen as a monitoring/recovery well. It will be developed within 48 hours of completion and samples taken for laboratory analysis. A boring log of this well is attached.

BH-85

This well was drilled down to 30' and 8" PVC casing grouted in place. Drilling operations will continue after BH-84 is completed. The dolomite interval in this well that correlates with that in BH-82 which encountered free product will be cored. It is estimated that it will occur at a depth of 110' - 120'.

Another item of interest that occurred last week was the shutting in of several recovery wells in the area east of the gas plant to obtain static fluid levels. They were shut-in for a period up to 48 hours. This information will allow us to construct a potentiometric map of this upper water table.

Cumulative recovery as of July 1, 1991 is 3372 BC and 8406 BW.

As we discussed on July 1, 1991, I will be in touch with you daily during the present drilling operations. Please call if you have any questions.

Sincerely,

Thomas F. Zapatka
Advanced Environmental Engineer

TFZ/elg

Enclosure

cc: J. L. Benson
A. R. Kukla
D. L. Manus (BLM-Carlsbad)
R. F. Unger
File

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O.C.D.
ARTESIA, OFFICE

JUL 21 1986

SF

NEW MEXICO OIL CONSERVATION DIVISION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

NAME OF OPERATOR Marathon Oil Company					ADDRESS P. O. Box 552, Midland, TX 79702		
REPORT OF	FIRE	BREAK X	SPILL	LEAK	BLOWOUT	OTHER*	
TYPE OF FACILITY	DRLG WELL	PROD WELL	TANK BTTY	PIPE LINE	GASO PLNT X	OIL RFY	OTHER*
NAME OF FACILITY Indian Basin Gas Plant							
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION)					SEC. 23	TWP. 20S	RGE. 23E	COUNTY Eddy
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK 20 miles NW of Carlsbad, N. Mexico							
DATE AND HOUR OF OCCURENCE Wed., June 25, 1986					DATE AND HOUR OF DISCOVERY June 27, 1986 (8:00 a.m. MST)		
WAS IMMEDIATE NOTICE GIVEN?	YES	NO X	NOT REQUIRED		IF YES, TO WHOM May Morgan		
BY WHOM Tom Zapatka					DATE AND HOUR July 1, 1986 (10:00 a.m. (CST)		
TYPE OF FLUID LOST Condensate					QUANTITY OF LOSS 188 BBL.	VOLUME RECOVERED 0	
DID ANY FLUIDS REACH A WATERCOURSE?	YES X	NO	QUANTITY 188 BBL.				

IF YES, DESCRIBE FULLY**

See Attachment

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN**

See Attachment

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**

See Attachment

DESCRIPTION OF AREA	FARMING	GRAZING	URBAN	OTHER* rocky arroyo			
SURFACE CONDITIONS	SANDY	SANDY LOAM	CLAY	ROCKY X	WET X	DRY	SNOW

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**

See Attachment

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED Thom F. Zapatka TITLE Prod. Eng. DATE July 2, 1986

*SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

OK MW 7/15/86

6/86 Lea P Report

TFZ;tjm

A six-inch PVC condensate line from the field to the gas plant was washed out during heavy rains discharging an estimated 188 barrels of condensate. This line crosses a normally dry arroyo located 1/4 mile south of the plant. Heavy rains during the week of June 23-27, flooded this arroyo. When the water subsided, a section of this six-inch line was found to have been washed away. There was no evidence of any spilled condensate in the area. It was all washed away.

This section of line will be replaced and steps taken so that this will not happen again. This office, in Midland, Texas, was not notified of the incident until the morning of July 1, 1986. Marathon regrets the delay in reporting this information to you and is also taking steps to insure more timely reporting from field personnel. If any further information is required, please contact my office at (915) 687-8530. Thank you for your cooperation.

TFZ;tjm/i

OCD FILES

35MM DRAWINGS

2R-22

FILE NUMBER

General Correspondence

DOCUMENT TYPE

2001-1991

6

NO OF DWGS

65

BOX

Tom Zapatka
#84 - Contamination, AM 7/1/91, 2PM
215 FT TD, 207 FT SS, LS above
194 FT Water, 1/4" Cond. Screen 190-215
other spills -
July 86 - 200 bbls at arrayt
To Drill #85 Next, before next [illegible]
10[illegible] Clean [illegible], -2 Thick

OVM	32-[illegible]	19 PPM	52-54	13 PPM
	40-4[illegible]	115	54-56	260
	42-44	9[illegible]	66-68	15[illegible]
	50-52	1[illegible]	72-74	146
			90-92	47

96-98	[illegible] PPM
114-115	246
116-118	78
118-120	223
198-200	25
204-206	280
206-208	24[illegible]
208-210	30

EXHIBIT 3

1 - 24 - 21 - 23

RECEIVED
JUL 01 1991
OIL CONSERVATION DIV.
SANTA FE

Stirl Cat Wolfcat

STATE New Mexico ELEV. 3766.5

COUNTY Eddy

COMPANY The Ohio Oil

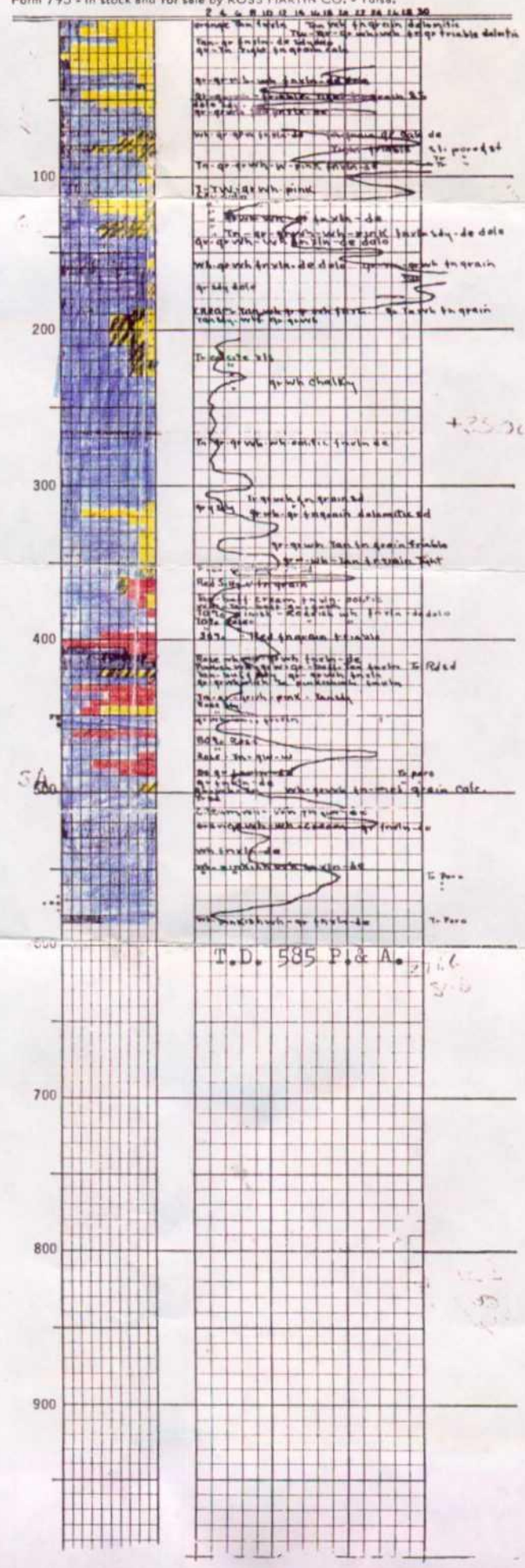
FARM Wheeler - Federal WELL NO. 1-A

LOCATION XXXXX 310' fr. E. & 2400' fr. S. lines of Sec. 24, T21S, R23E.

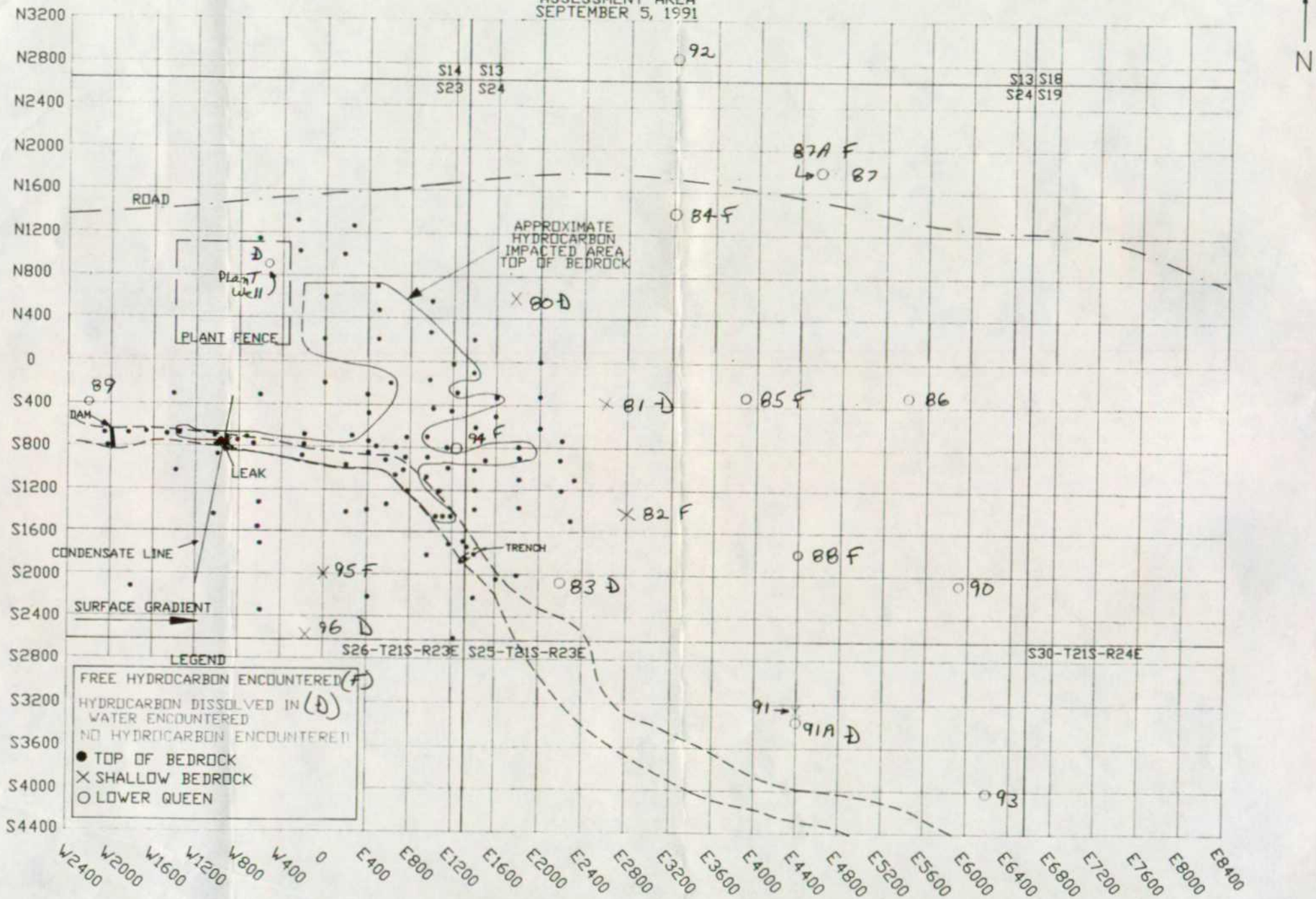
TD. 585 TOOLS Rotary (Mud)

Plotted by J.K.S.

Form 795 - In stock and for sale by ROSS MARTIN CO. - Tulsa.



INDIAN BASIN
ASSESSMENT AREA
SEPTEMBER 5, 1991



Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

RECEIVED
JUL 01 1991
OIL CONSERVATION DIV.
SANTA FE

June 28, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

Please find enclosed the additional information requested in your May 15, 1991 letter pertaining to the subsurface leak discovered south of the Indian Basin Gas Plant on April 12, 1991.

Should you have any questions, please direct them to A. J. Kavran in Midland at (915) 687-8528.

Sincerely,

R. F. Unger
Production Manager
Midland Operations

RFU/elg

Enclosure

cc: A. Collar (BLM-Roswell)
D. L. Manus (BLM-Carlsbad)
G. A. Stephens (BLM-Santa Fe)
J. L. Benson
A. J. Kavran
A. R. Kukla
File

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 25, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

Attached is a copy of a map indicating the drilling activity at our Indian Basin leak site, as per your request. The map shows the locations of the additional Lower Queen Monitoring wells, as agreed upon during our June 24, 1991 meeting. Cumulative recovery as of the morning of June 25, 1991 totaled 3269 barrels of condensate and 6430 barrels of water.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

RECEIVED
JUN 27 1991
OIL CONSERVATION DIV.
SANTA FE

AJK/elg

Attachment

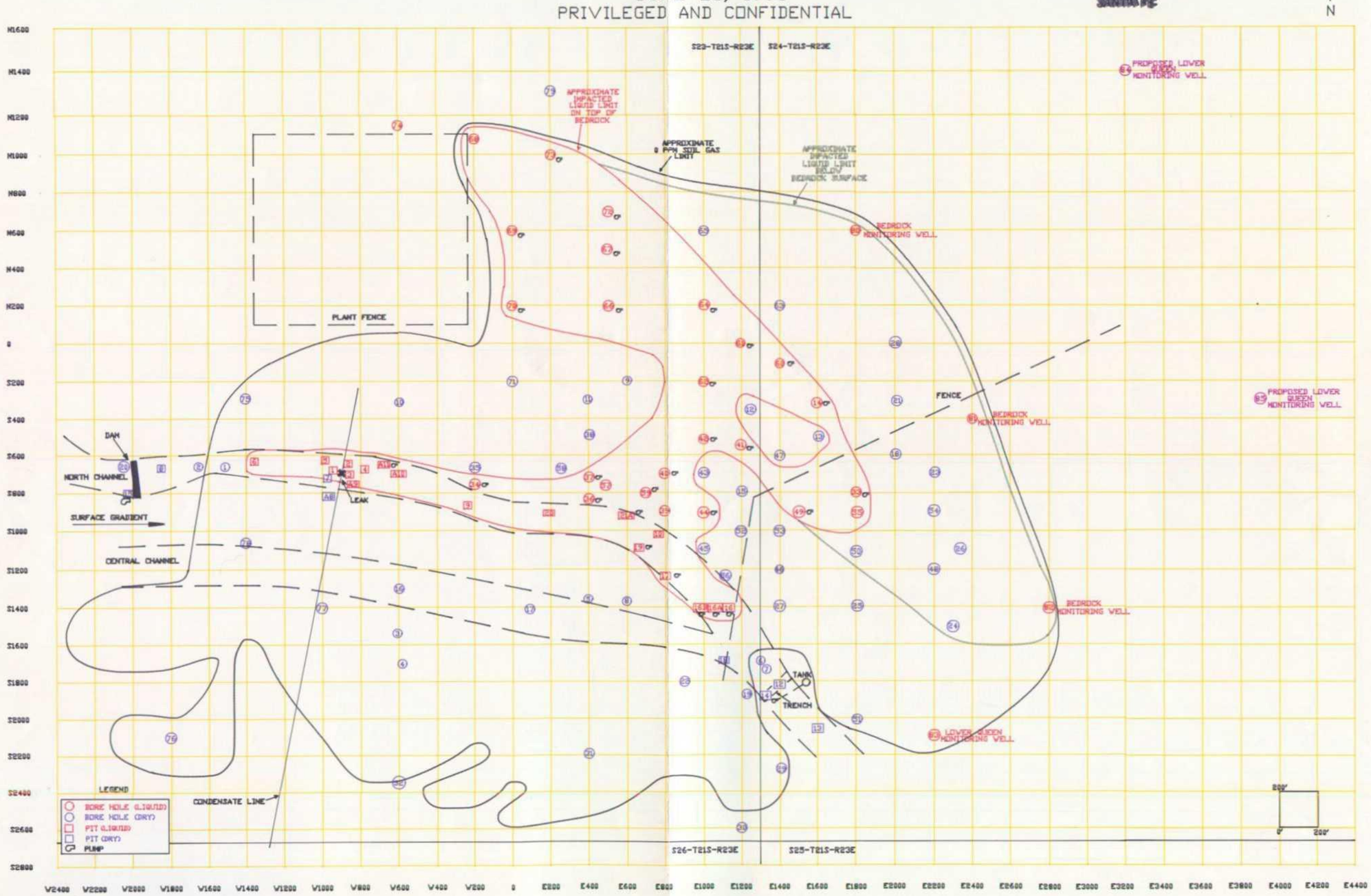
cc: J. L. Benson
A. R. Kukla
R. F. Unger
D. L. Manus (BLM-Carlsbad)
File

RECEIVED
JUN 27 1991
OIL CONSERVATION DIV.
SANTA FE

INDIAN BASIN REMEDIATION

JUNE 25, 1991

PRIVILEGED AND CONFIDENTIAL



STATE OF NEW MEXICO

WATER QUALITY CONTROL COMMISSION

OIL CONSERVATION DIVISION
RECEIVED

'91 JUN 27 AM 8 50

CONSTITUENT AGENCIES:

Environment Department
State Engineer & Interstate Stream Commission
Game and Fish Department
Oil Conservation Division
Department of Agriculture
State Park & Recreation Division
Soil and Water Conservation Bureau
Bureau of Mines and Mineral Resources
Member-at-Large

June 21, 1991

TO: NM Water Quality Control Commission Members

FROM: Judith M. Espinosa, Chairperson

SUBJECT: Proposed Agenda for the July 9, 1991 Water Quality Control Commission Meeting, 9:00 am, at the PERA Building, Room 111, Santa Fe, New Mexico

1. Roll call

2. Approval of the agenda

3. Review of the minutes of the May 21-22, 1991 Water Quality Control Commission Meeting.

4. Review of the minutes of the June 11, 1991 Water Quality Control Commission Meeting.

5. Presentation by the New Mexico Utility Operators Advisory Board on nominees for the Commission's approval and appointment to fill Advisory Board seats on the Commission.

6. Presentation by the Pueblo of Pojoaque on their proposed stream standards.

7. Presentation by the City of Santa Fe on their request for a temporary variance of their discharge plan (DP-289) requirements.

8. Consideration and action on proposed amendments to Water Quality Control Commission regulations to collect user fees on discharge plans presented at a public hearing on April 9, 1991.

9. Report on litigation

The Commission is not confined to the items listed on the agenda. Other items may be considered that are not listed on the agenda.

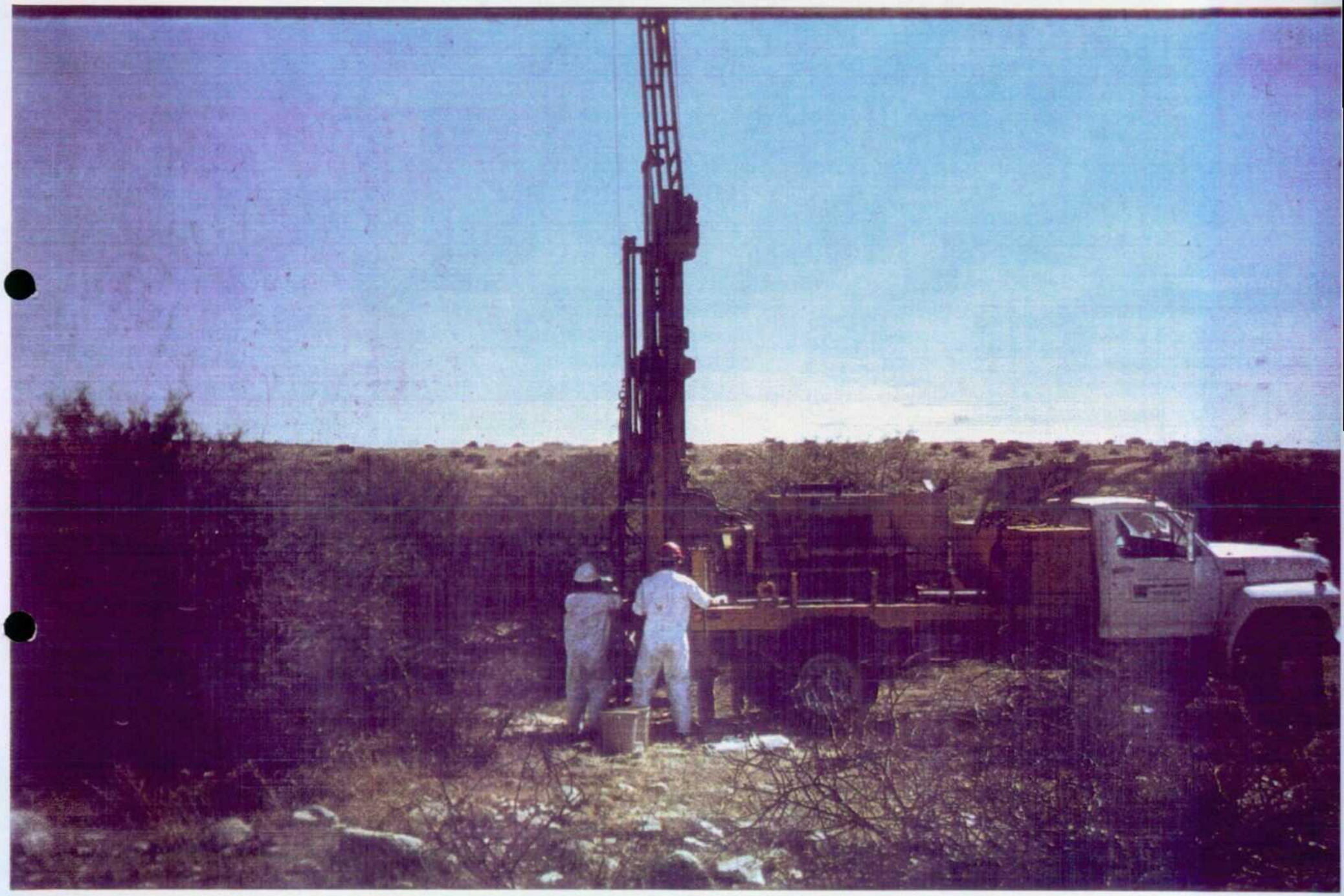
1190 St. Francis Drive
Santa Fe, New Mexico 87503

LEAK RESPONSE/NOTIFICATION

- DISCOVERED 10:30 AM, APRIL 12, 1991
- INITIATED SHUTTING-IN WELLS IMMEDIATELY
- NOTIFIED OCD AT 11:12 AM, APRIL 12, 1991
- NOTIFIED BLM AT 11:17 AM, APRIL 12, 1991
- NOTIFIED NRC AT 11:22 AM, APRIL 12, 1991
- EMERGENCY RESPONSE TEAM ON LOCATION

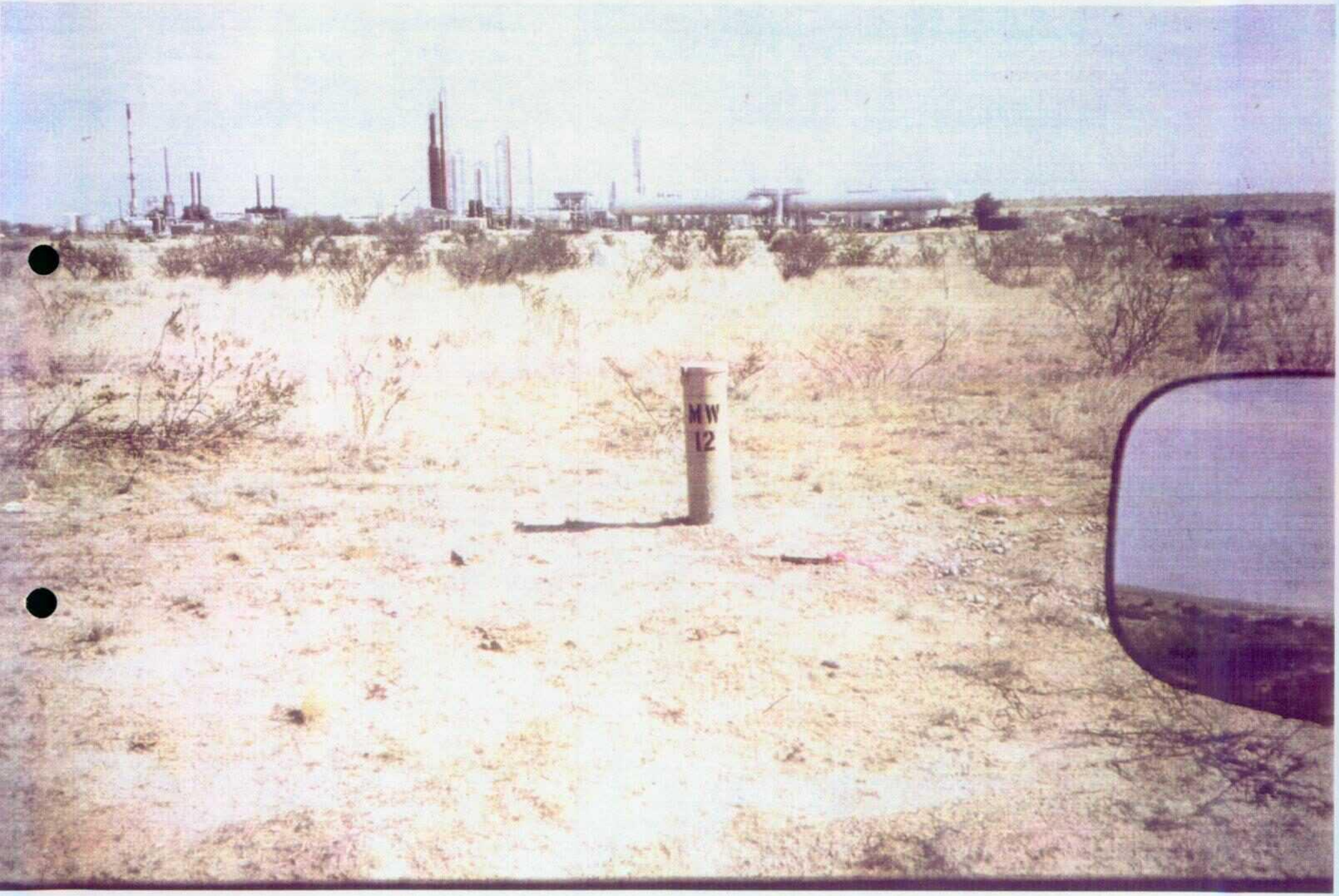
1b
2
3
4

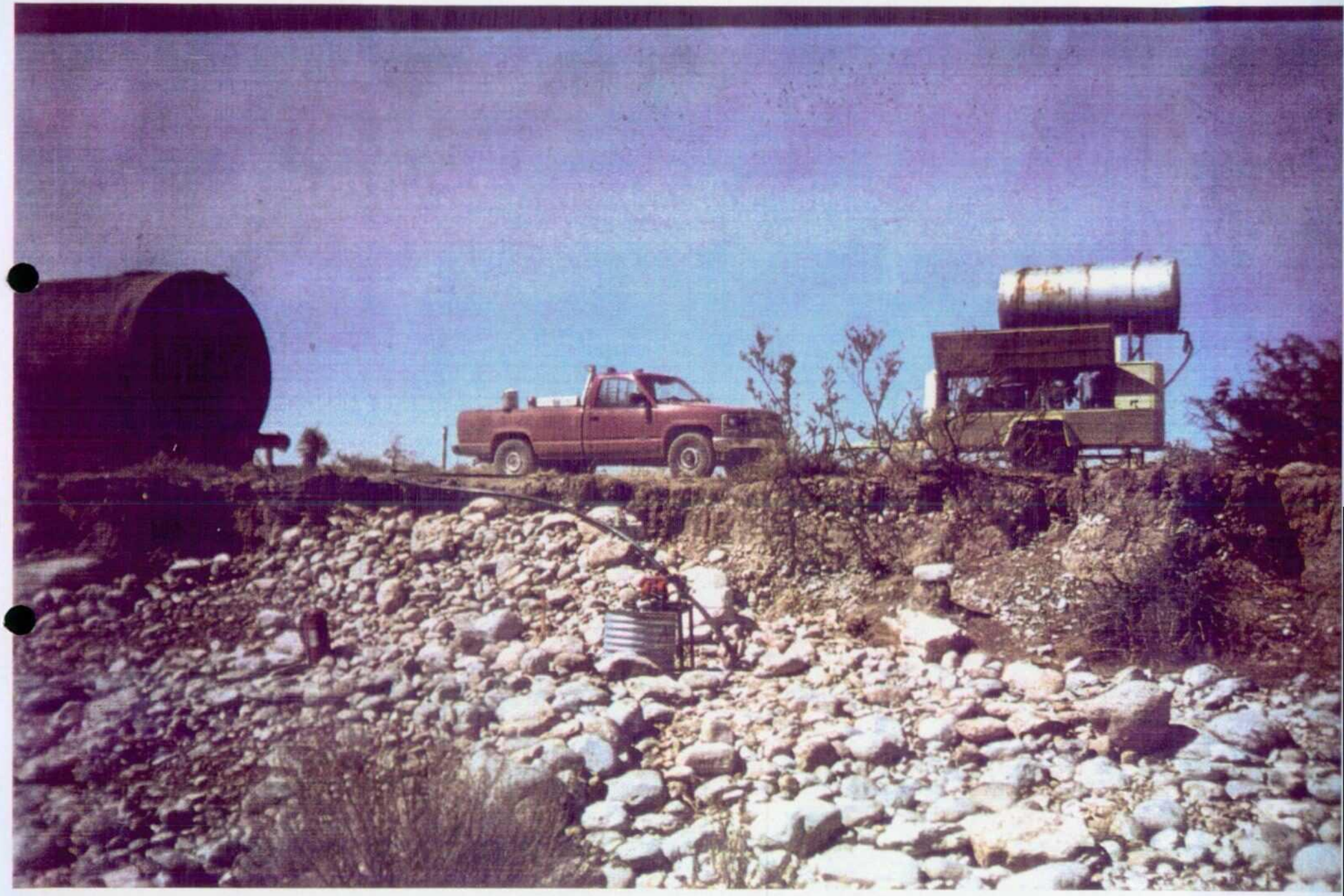
32NDS
64THS



ALLUVIAL ASSESSMENT

- 26 EXCAVATIONS IN THE ARROYO
  - 17 COMPLETED AS RECOVERY/MONITORING WELLS
- 79 BOREHOLES DRILLED
  - 49 COMPLETED AS RECOVERY/MONITORING WELLS

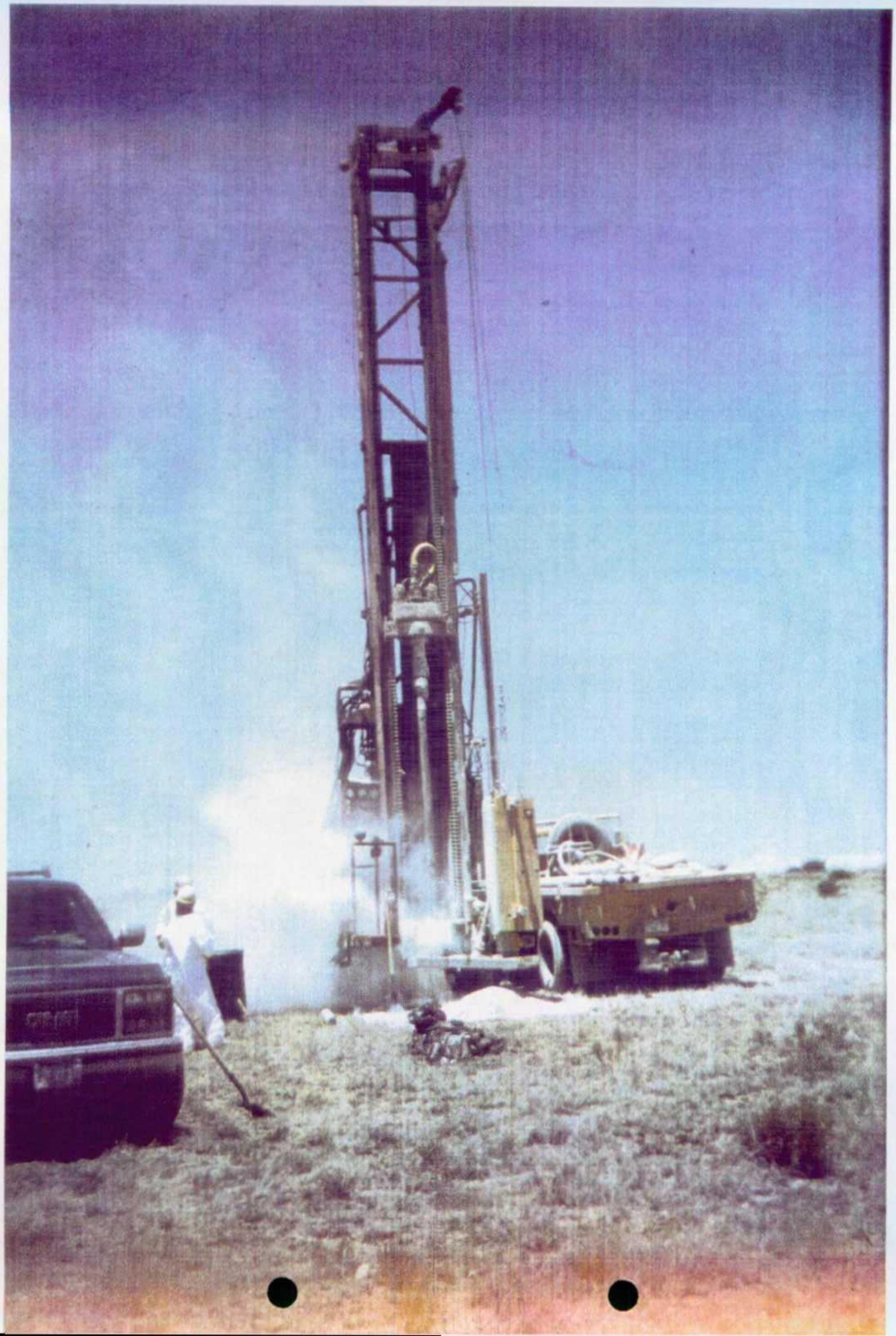

MW
12



EMERGENCY REMEDIATION

- 28 RECOVERY WELLS EQUIPPED WITH PUMPS
- 3584 BARRELS OF CONDENSATE RECOVERED
- 76,362 BARRELS OF WATER RECOVERED

To Aug 22nd when terminated

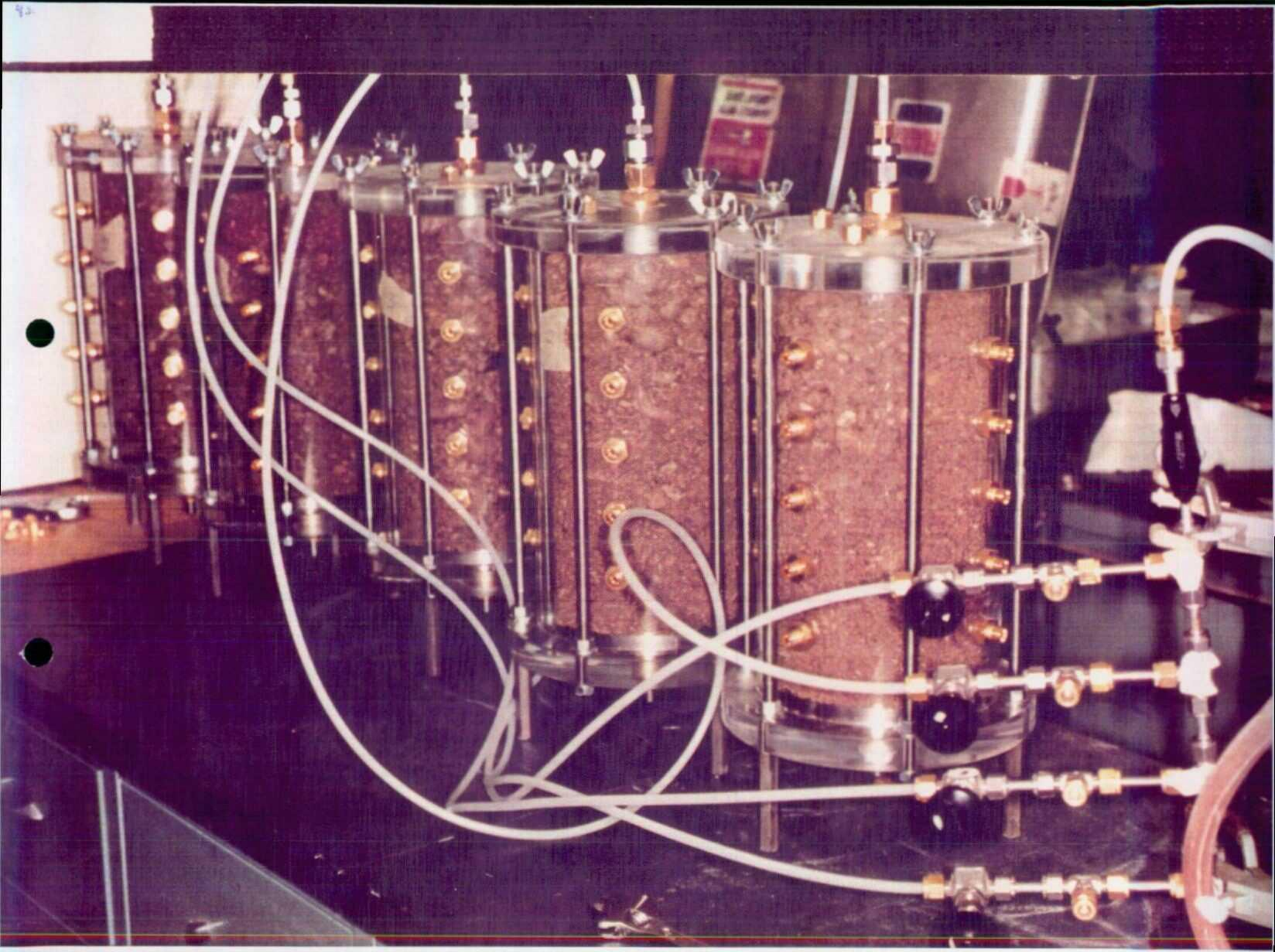


SAMPLING PROGRAM

- APPROXIMATELY 175 SAMPLES OBTAINED
- ANALYTICAL RESULTS :
  - NO DETECTABLE LEVELS OF HYDROCARBONS
  - NO ELEVATED LEVELS OF CHLORIDES
- APPROXIMATELY 65 LETTERS TO WATER USERS

REMEDIATION TECHNOLOGIES

- BIOREMEDIATION
- SOIL VENTING



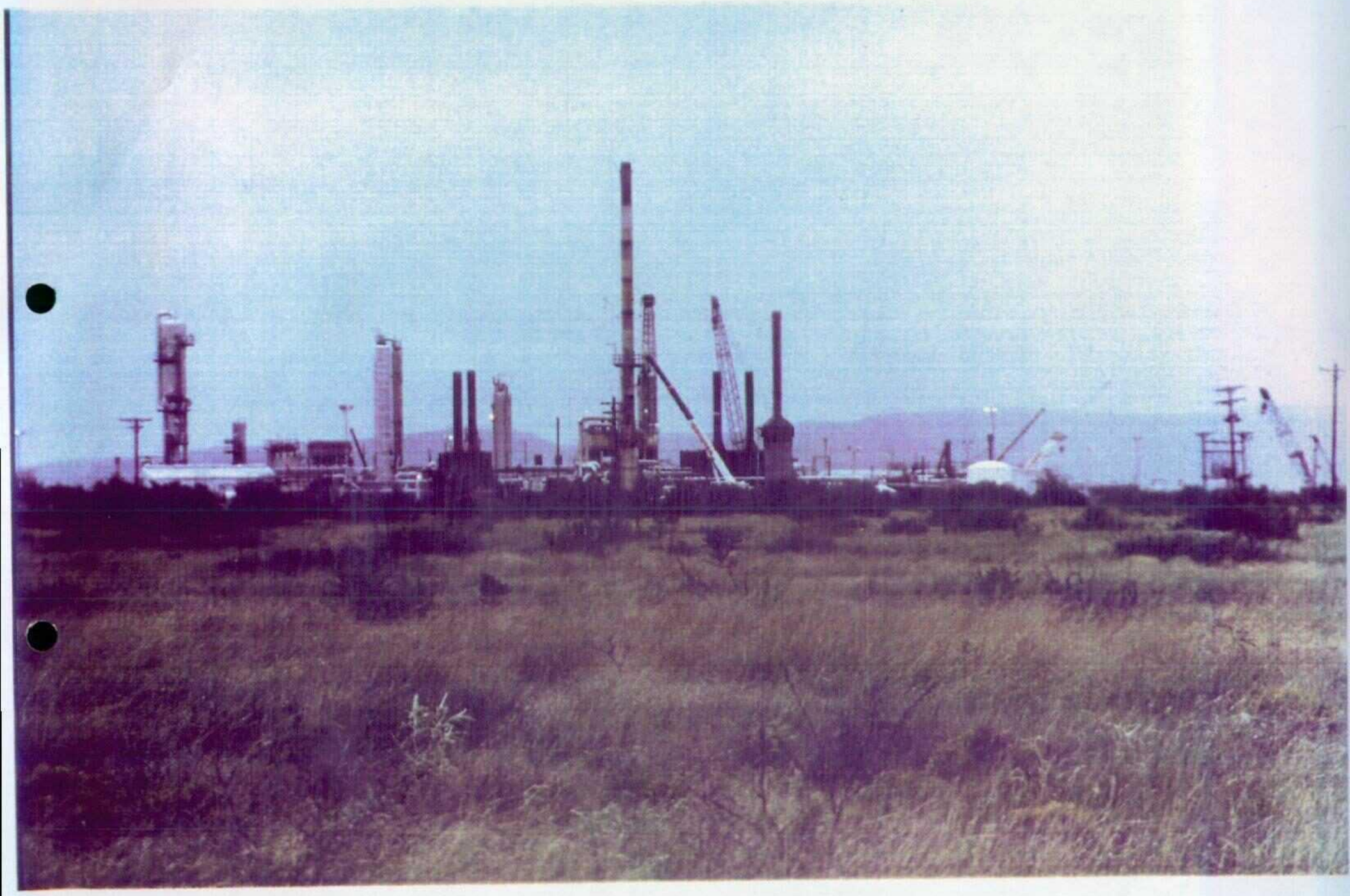
WORK IN PROGRESS

SHALLOW

- BIOFEASIBILITY STUDY UNDER REVIEW
- SOIL VENTING PILOT PROJECT UNDERWAY
- RISK ASSESSMENT STUDY
- POINT IN TIME SAMPLING PROGRAM

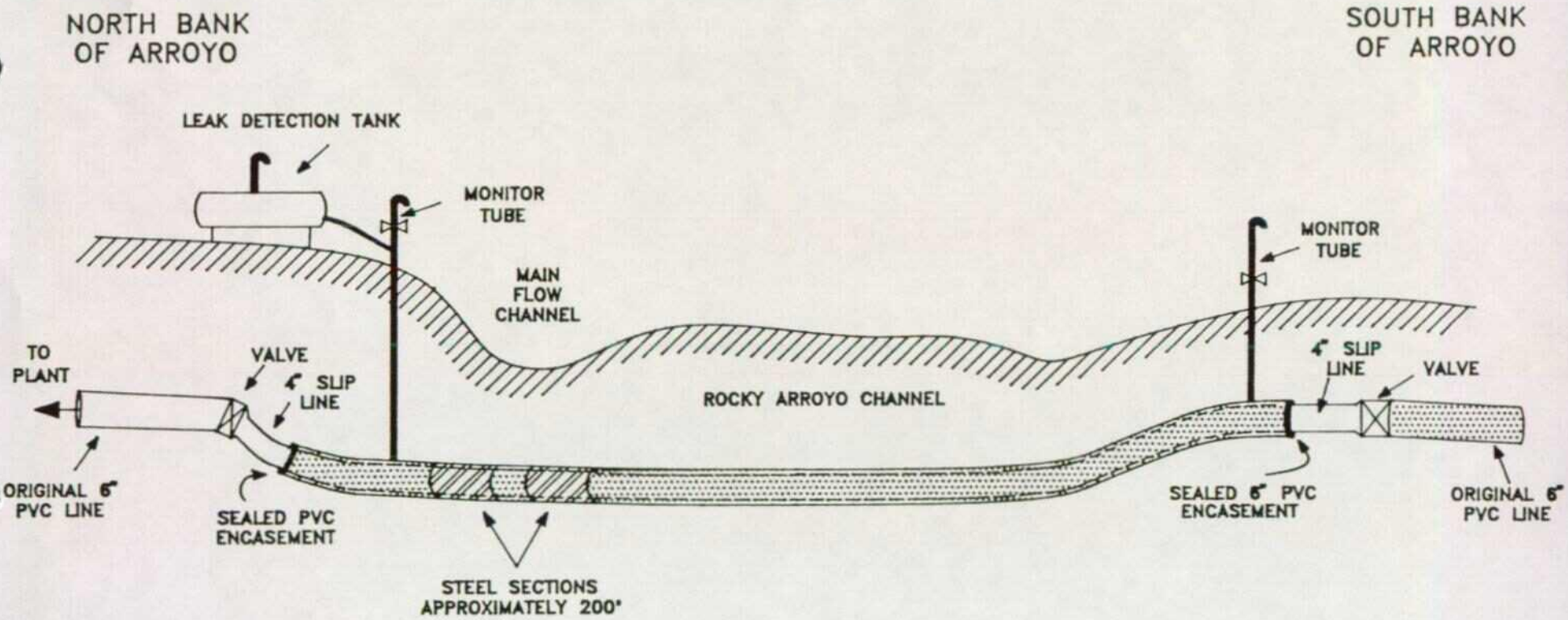
LOWER QUEEN

- POINT IN TIME ANALYSIS
- PUMPS ON ORDER
- DESIGN OF POWER SUPPLY
- DESIGN OF GATHERING SYSTEM
- DEVELOPMENT OF BID SPECIFICATIONS FOR AIR STRIPPER



SCHEMATIC OF
CONDENSATE LINE #4 MODIFICATION

(NOT TO SCALE)

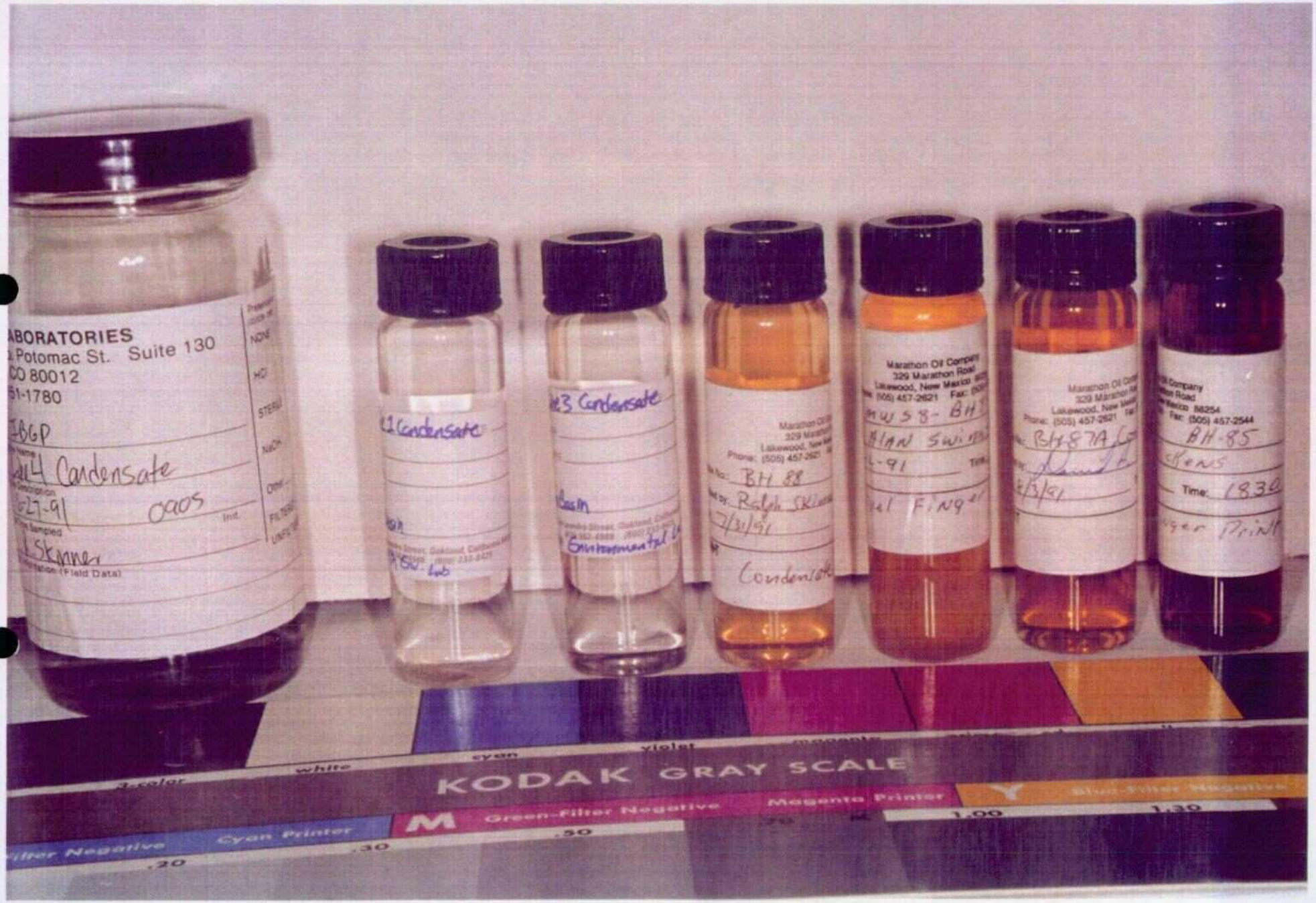


NOTE: 4" PEP SLIP LINE GOES FROM NORTH BANK OF ARROYO TO SOUTH BANK (APPROXIMATELY 1700')

9/27/91

SHALLOW BEDROCK ASSESSMENT

- 17 BOREHOLES DRILLED
- 6 COMPLETED AS MONITORING/RECOVERY WELLS


ABORATORIES
Potomac St. Suite 130
CO 80012
51-1780
IBGP
Condensate
0905
Skinner
(Field Data)
Condensate
Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico
Phone: (505) 457-2621
BH 88
Ralph Skinner
7/31/91
Condensate
Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico
Phone: (505) 457-2621
BH-87A
Marathon Oil Company
329 Marathon Road
Lakewood, New Mexico
Phone: (505) 457-2621
BH-85
Time: 1830
KODAK GRAY SCALE
Recolor
white
cyan
violet
Green-Filter Negative
Magenta Printer
Blue-Filter Negative
Cyan Printer
.20
.30
.50
1.00
1.30

LOWER QUEEN ASSESSMENT

- 13 BOREHOLES DRILLED
- 13 COMPLETED AS MONITORING/RECOVERY WELLS

MEETINGS

BLM/OCD

- APRIL 22, 1991
- JUNE 10, 1991
- JUNE 24, 1991
- JULY 11, 1991
- JULY 18, 1991
- AUGUST 22, 1991
- SEPTEMBER 30, 1991

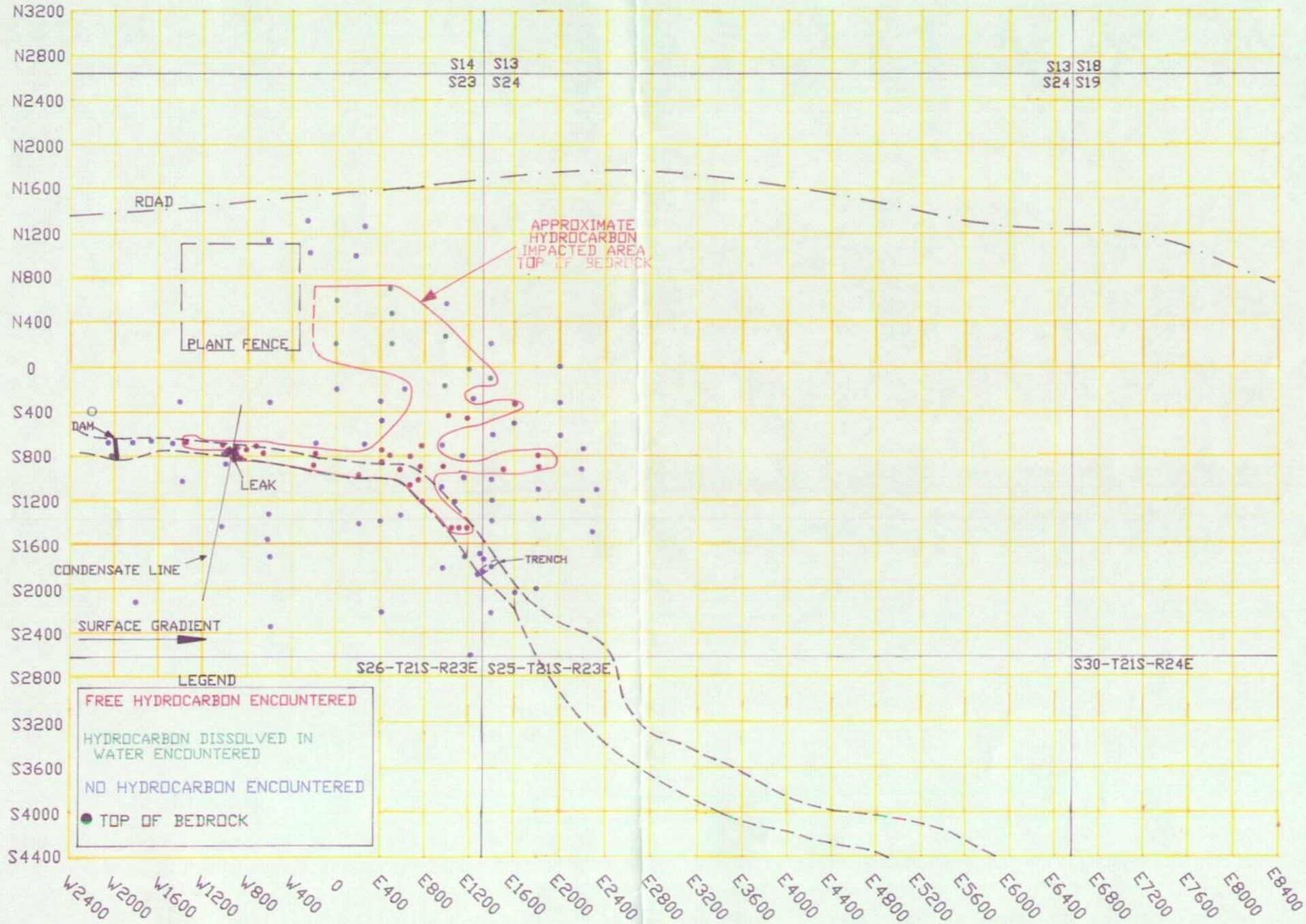
RANCHERS

- MAY 15, 1991
- AUGUST 14, 1991

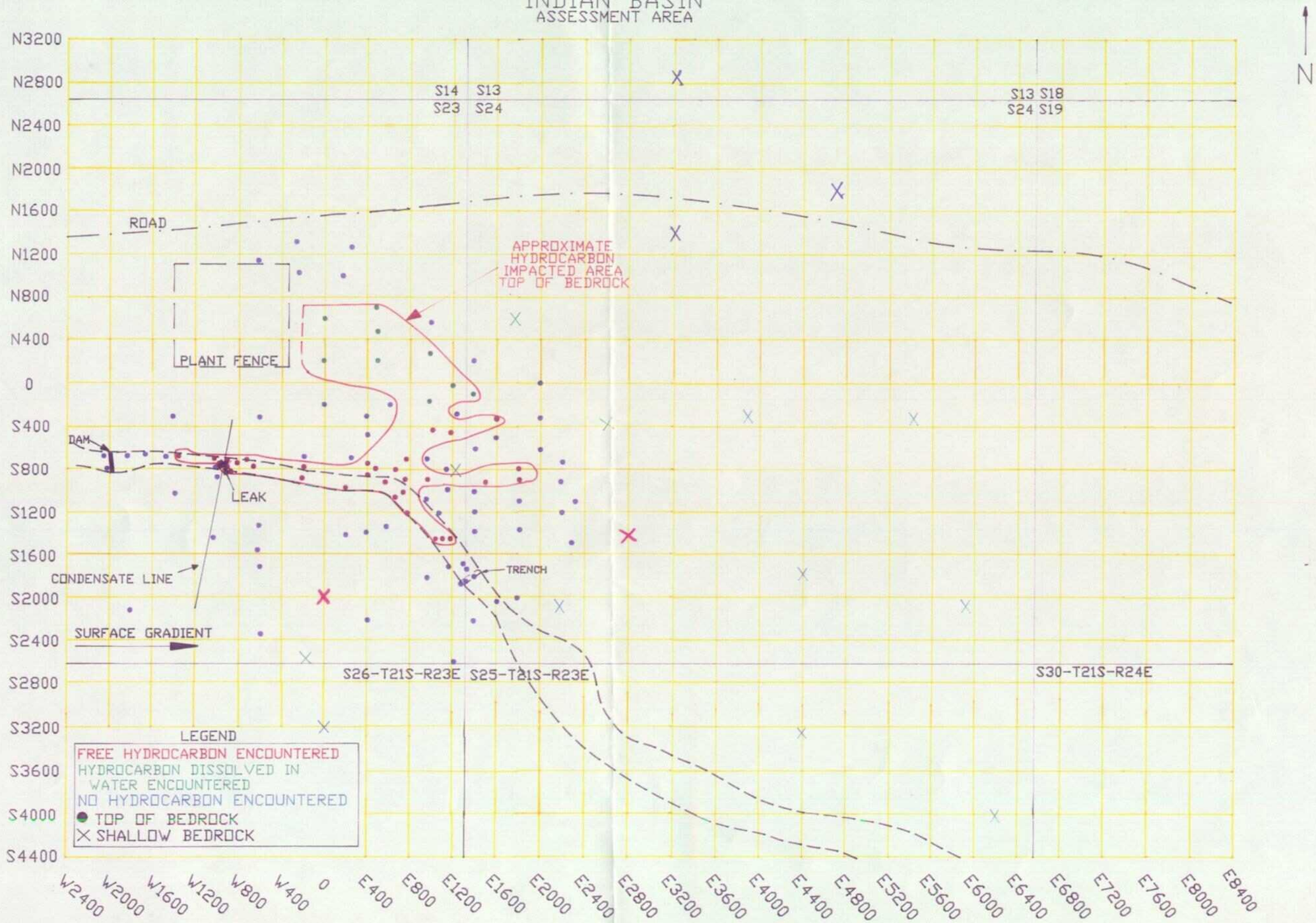
SUBMITTALS TO AGENCIES

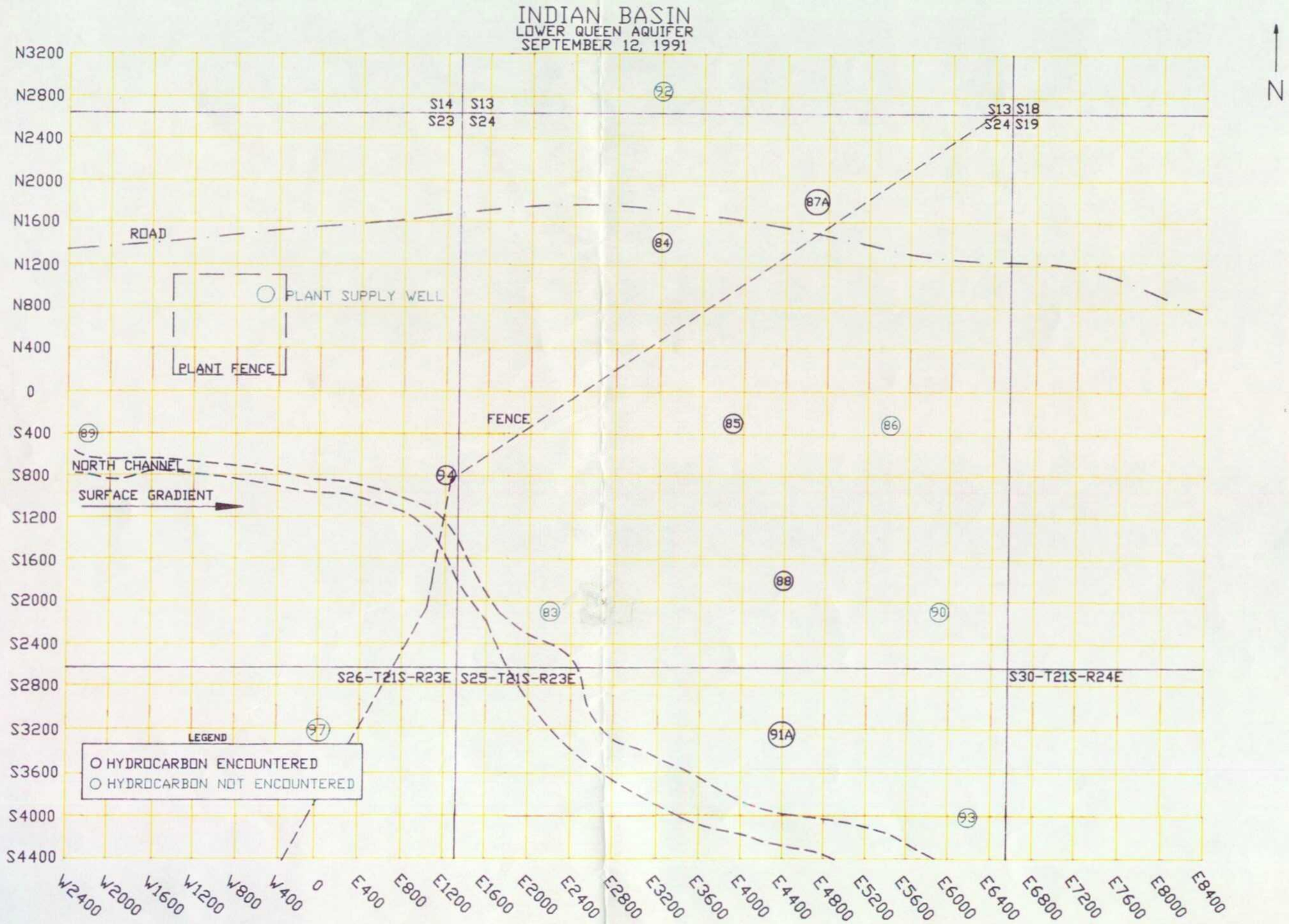
- SITE CHARACTERIZATION PLAN, APRIL 29, 1991
- ADDENDUM TO SITE CHARACTERIZATION PLAN, JUNE 28, 1991
- ADDENDUM TO SITE CHARACTERIZATION PLAN, AUGUST 22, 1991
- BEDROCK MONITORING WELL DRILLING PLAN, JUNE 12, 1991
- SPCC REGULATORY SUBMITTAL TO THE EPA, JUNE 11, 1991
- APPROVAL REQUESTS FOR DRILLING BEDROCK WELLS
- WEEKLY UPDATE REPORTS
- ARCHEOLOGICAL REPORTS

INDIAN BASIN
ASSESSMENT AREA

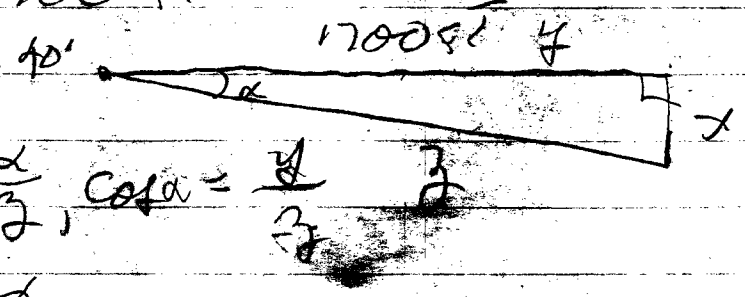


INDIAN BASIN
ASSESSMENT AREA




INDIAN BASIN
LOWER QUEEN AQUIFER
SEPTEMBER 12, 1991
N
N3200
N2800
N2400
N2000
N1600
N1200
N800
N400
0
S400
S800
S1200
S1600
S2000
S2400
S2800
S3200
S3600
S4000
S4400
W2400
W2000
W1600
W1200
W800
W400
0
E400
E800
E1200
E1600
E2000
E2400
E2800
E3200
E3600
E4000
E4400
E4800
E5200
E5600
E6000
E6400
E6800
E7200
E7600
E8000
E8400
S14 S13
S23 S24
S13 S18
S24 S19
S26-T21S-R23E
S25-T21S-R23E
S30-T21S-R24E
ROAD
PLANT SUPPLY WELL
PLANT FENCE
FENCE
NORTH CHANNEL
SURFACE GRADIENT
92
87A
84
85
86
89
94
88
83
90
97
91A
93
LEGEND
HYDROCARBON ENCOUNTERED
HYDROCARBON NOT ENCOUNTERED

2° Dip 1700 FT



$\sin\alpha = \frac{x}{z}$, $\cos\alpha = \frac{y}{z}$

$\tan\alpha = \frac{x}{y}$

$\tan\alpha = \frac{x}{y}$, $\alpha = 2°$, $\tan\alpha = 0.035 = \frac{x}{1700}$

$x = 59'$

Depth $= 40 + 59 = 99 \simeq 100'$

2° Dip 2400 FT, $x = 84$

Depth $= 40 + 84 = 124$ FT

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

OIL CONSERVATION DIVISION
RECEIVED
'91 JUL 1 AM 9 32

June 24, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

This letter is intended as a follow-up to our meeting on the evening of June 24, 1991 with you and Mr. G. A. Stephens of the BLM. Following the review of recent impact assessment activities at the site of the condensate and water release near our Indian Basin Gas Plant, Marathon proposed and we mutually agreed upon the following future characterization work:

- Drill a Lower Queen monitoring well down dip of the impacted area. The planned location of this well is E3200/N1400. The drilling program will allow the evaluation for the presence of hydrocarbon contamination in the shallow subsurface, prior to deepening the well to the Lower Queen. Drilling will stop at any point, should hydrocarbon contaminated liquid be encountered as determined both visually and by an OVM instrument. If the shallow zones in the well and the Lower Queen both show no indication of hydrocarbon contaminated liquid, then a second shallow monitoring well to the uppermost water encountered will be drilled and completed adjacent to this Lower Queen monitoring well.

- Drill a Lower Queen monitoring well to the east of Borehole #81, at a planned location of E3900/S300. Again, the shallow zones will be evaluated for the presence of hydrocarbon contaminated liquid while drilling to the Lower Queen. Drilling will stop at any point, should hydrocarbon contaminated liquid be encountered. As long as hydrocarbon liquid contamination is not encountered in any zone, then a second shallow monitoring well to the uppermost water encountered will be drilled and completed adjacent to this Lower Queen monitoring well.

Should hydrocarbon liquid contamination be encountered at either site, then Marathon would plan to step out a similar distance and initiate the same drilling proposal. Once these monitoring wells are in place beyond the leading edge of any contamination plume in both the shallow subsurface, as well as the Lower Queen Queen Aquifer, then Marathon will move back toward the presently defined plume area and drill sufficient monitoring/recovery wells to adequately delineate the plume in the shallow subsurface.

The procedures utilized in drilling the first four bedrock monitoring wells will be followed in drilling all of these wells also. Plans are to initiate the drilling of these wells immediately following the completion of the first four bedrock monitoring wells. Therefore, drilling operations on these wells may commence as early as the afternoon of June 26, 1991.

At the request of both the OCD and the BLM, Marathon will undertake the necessary work to determine the potentiometric surface of the fluid in the shallower sands, as well as in the Lower Queen Aquifer. This will necessitate interrupting the continuous pumping operations in the area directly east of the gas plant facility for a sufficient period to allow the measurement of static fluid levels in these wells.

I would again like to express my appreciation to both you and the BLM for meeting with us in Albuquerque on such short notice. If you have any questions, or wish to discuss, please contact me at (915) 687-8528.

Sincerely,

A J Kavran

A. J. Kavran
Environmental and Safety Supervisor

AJK/elg

Enclosure

cc: A. Collar (BLM-Roswell)
D. L. Manus (BLM-Carlsbad)
G. A. Stephens (BLM-Santa Fe)
J. L. Benson
R. J. Bruner
D. D. Conway
A. R. Kukla
R. F. Unger
File

MARATHON
INDIAN BASIN MEETING

6-24-91
@ 6:30P START

NAME	COMPANY
Bert Smith	Roberts/Schornick and Assoc.
Tony Kavran	Marathon - Midland
Randy T. Bruner	Marathon - "
Kurt A. Miller	MARATHON - "
David A. Conway	Marathon Littleton, Colo.
David Boyer	OCD - Santa Fe
GARY STEPHENS	BLM - SANTA FE
Tom Zapatka	Marathon - Midland

#80 Cored 76' (TD)
8" PVC, 37' cement to surface
Fluid 47' BGL
No Product, EC 610, 58 ppm @ 70'

#81 65' Cored,
25' BGL
No Product, EC 920, 362 ppm @ 55'
36 ppm @ 65

#82 41.2 ft Cored
32.8' BGL
1/4" Product, 100 ppm CL, 2100 PPB B <50 Tol
2900 EB <50 TX

#83 50 ft Cored, 8" Casing, 80 ft overnight
80 ft → 136' as of 6 PM 6/24, dry.
62 ft - Vapor 957 PPM
116 ft - Limestones/Siltstone

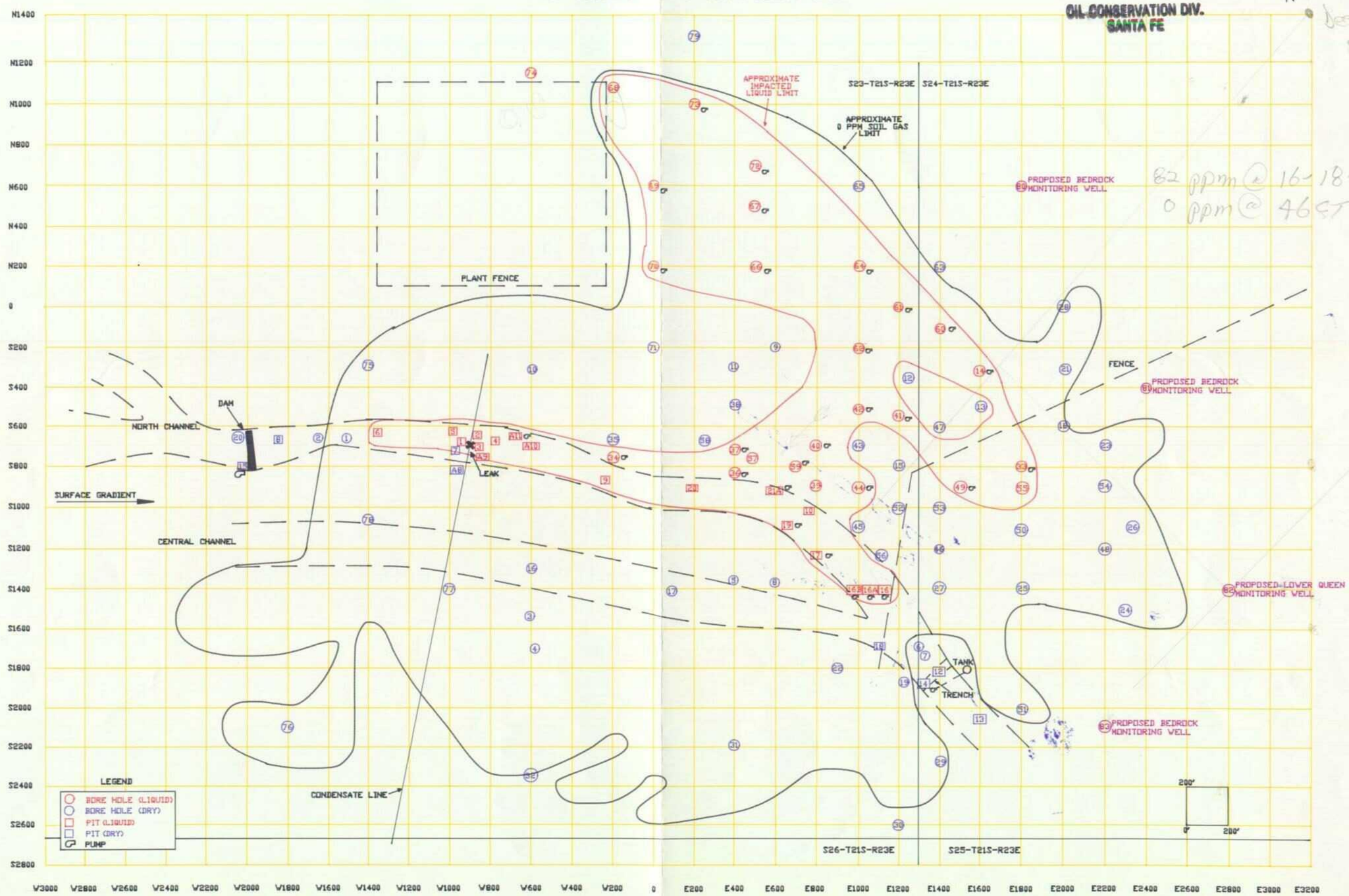
Need Cl, Total BTEX contour map
New wells N400, E3200, S800, E5900
Deep & Shallow
Will send Pictures

INDIAN BASIN REMEDIATION

JUNE 16, 1991

PRIVILEGED AND CONFIDENTIAL

RECEIVED
JUN 19 1991
OIL CONSERVATION DIV.
SANTA FE



Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 18, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

Attached, is a copy of a map indicating the drilling activity at our Indian Basin leak site, as per your request. As indicated in our June 10 meeting, shallow drilling operations at the site concluded on the afternoon of June 8, 1991. This map shows the additional locations of the bedrock monitoring wells which were agreed upon at our meeting. Drilling operations on these wells were initiated on June 15. However, none are yet completed. Cumulative recovery as of the morning of June 18, 1991 totalled 3124 barrels of condensate and 4128 barrels of water.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A J Kavran

A. J. Kavran
Environmental and Safety Supervisor

RECEIVED
JUN 19 1991
OIL CONSERVATION DIV.
SANTA FE

AJK/elg

Attachment

cc: J. L. Benson
A. R. Kukla
R. F. Unger
D. L. Manus (BLM-Carlsbad)
File

OCD FILES

35MM DRAWINGS

2R-22

FILE NUMBER

General Correspondence

DOCUMENT TYPE

2001-1991

2

NO OF DWGS

65

BOX

EXHIBIT 6

(Prior to completing Part I, refer to regulations and instructions page 5.)

SPILL PREVENTION CONTROL & COUNTERMEASURE PLAN

PART I
GENERAL INFORMATION

1. Name of facility: Indian Basin Gas Field
2. Type of facility: Onshore Production Facility
3. Location of facility: Eddy County, New Mexico, approximately 20 miles W-NW of Carlsbad, New Mexico
4. Name and address of owner or operator:

   Name: Marathon Oil Company

   Address: P. O. Box 552
   Midland, Texas 79702

5. Designated person accountable for oil spill prevention at facility:

   Name and title: S. D. York, Plant Superintendent

6. Facility experienced a reportable oil spill event during the twelve months prior to Jan. 10, 1974 (effective date of 40 CFR, Part 112). (If YES, complete Attachment #1.) No

MANAGEMENT APPROVAL

This SPCC Plan will be implemented as herein described.

Signature: J F Strong

Name: John F. Strong

Title: Production Manager

CERTIFICATION

I hereby certify I have examined the facility, and being familiar with the provisions of 40 CFR, Part 112, attest that this SPCC Plan has been prepared in accordance with good engineering practices.

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
DANIEL D. TAIMUTY
ENGINEER
036313E

(Seal)

Daniel D. Taimuty
Printed Name of Registered Professional Engineer

Daniel D. Taimuty
Signature of Registered Professional Engineer

Date: July 28, 1988

Registration No. PE-036313-E State PA

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SANTA FE

7. Potential Spills — Prediction & Control:

Source	Major Type of Failure	Total Quantity (bbls)	Rate (bbls/hr)	Direction of Flow*	Secondary Containment
2 Condensate Storage Tanks	Leaks Tank Rupture	3400		S	No*

Discussion:

Marathon Oil Company has not experienced a spill event at these facilities during the entire time the field and gas plant have been in production.

*Currently in use are two horizontal vessels (old natural gasoline storage tanks) for condensate storage. These vessels do not have containment dikes.

*Attach map if appropriate.

Name of facility Indian Basin Gas Plant and Field Producing Facilities

Operator Marathon Oil Company

PART I
GENERAL INFORMATION

[Response to statements should be: YES, NO, or NA (Not Applicable).]

8. Containment or diversionary structures or equipment to prevent oil from reaching navigable waters are practicable. (If NO, complete Attachment #2.) Yes

9. Inspections and Records
   A. The required inspections follow written procedures. Yes
   B. The written procedures and a record of inspections, signed by the appropriate supervisor or inspector, are attached. Yes
   Discussion:
   The Corporate Risk Division of Marathon Oil Company makes an annual inspection of these facilities. Records are available at plant office.
   Daily visual inspection is made by operating personnel.
   Semi-annual inspection is conducted by the plant superintendent.
   In May, 1988, a new policy was implemented. A Mid-Continent Region spill report (see attached form) is to be completed by any employee following his/her knowledge of a spill into the environment as soon as practical after the spill has been investigated and the source and affected area secured. Such records serve to show the physical integrity of Marathon's operations. (CONTINUED BELOW)

10. Personnel Training and Spill Prevention Procedures
   A. Personnel are properly instructed in the following:
   (1) operation and maintenance of equipment to prevent oil discharges, and Yes
   (2) applicable pollution control laws, rules, and regulations. Yes
   Describe procedures employed for instruction: Instructions are narrative. Environmental Control and Site Security are discussed at safety meetings. Safety meetings are held on a semi-annual basis. Potential spill situations are reported immediately to the foreman and also reported by the safety committee on a monthly basis. Such situations are corrected.

   B. Scheduled prevention briefings for the operating personnel are conducted frequently enough to assure adequate understanding of the SPCC Plan. Yes
   Describe briefing program: Operation Management frequently reviews environmental standards at safety meetings. Such reviews assure an adequate understanding of SPCC. Operating superintendents are periodically requested to update Contingency Plans. Superintendents thereby assess and revise procedures when necessary.

   CONTINUED FROM ABOVE: Site security and loss prevention surveys also serve the inspection requirements of SPCC. Maintenance needs are expressed periodically at safety meetings. The minutes from safety meetings also serve to document Marathon's efforts in SPCC. Through the years, it was not considered practical to attach records to the plan.

Name of facility: Indian Basin Gas Plant and Field Producing Facilities

Operator: Marathon Oil Company

(Prior to completing Part II, Alternate A, refer to regulations and instructions pages 6-7.)

PART II, ALTERNATE A
DESIGN AND OPERATING INFORMATION
ONSHORE FACILITY (EXCLUDING PRODUCTION)

A. **Facility Drainage**

1. Drainage from diked storage areas is controlled as follows (include operating description of valves, pumps, ejectors, etc. *(Note: Flapper-type valves should not be used):*
   By plant operators.
   There are no drains in the dikes. Removal of oil within the dike is accomplished by a vacuum truck. It has not been necessary to remove any such oil in the history of the plant.

2. Drainage from undiked areas is controlled as follows (include description of ponds, lagoons, or catchment basins and methods of retaining and returning oil to facility):
   (Attachment #2 applies.)

3. The procedure for supervising the drainage of rain water from secondary containment into a storm drain or an open watercourse is as follows (include description of (a) inspection for pollutants, and (b) method of valving security). (A record of inspection and drainage events is to be maintained on a form similar to Attachment #3):
   Plant personnel visually inspects fluids.
   Record of such drainage is maintained on Attachment #3.
   There are no drains in the dikes. It has not been necessary to remove rain water in the history of the plant.
   In any case, personnel are instructed not to dispose of such water into a storm drain or open water cause.

Name of facility Indian Basin Gas Plant and Field Producing Facilities

Operator Marathon Oil Company

PART II, ALTERNATE A
DESIGN AND OPERATING INFORMATION
ONSHORE FACILITY (EXCLUDING PRODUCTION)

[*Response to statements should be: YES, NO, or NA (Not Applicable).*]

B. **Bulk Storage Tanks**

1. Describe tank design, materials of construction, fail-safe engineering features, and if needed, corrosion protection: (Atmospheric tanks.) The storage tanks are API design, welded steel. The storage tanks are storing the product (stabilized condensate) under atmospheric conditions.

2. Describe secondary containment design, construction materials, and volume: Earthen dike around condensate storage tanks. Volume sufficient to hold total storage - 6000 bbl.

3. Describe tank inspection methods, procedures, and record keeping: Marathon Oil Company Corporate Risk Division conducts an annual survey visually.

   Operating personnel visually inspect these tanks during each shift. Operating personnel gauge tanks at 7:00AM each morning: Office personnel calculate daily production.

4. Internal heating coil leakage is controlled by one or more of the following control factors:
   (a) Monitoring the steam return or exhaust lines for oil. NA
   Describe monitoring procedure:
   (b) Passing the steam return or exhaust lines through a settling tank, skimmer, or other separation system. NA
   (c) Installing external heating systems. NA

5. Disposal facilities for plant effluents discharged into navigable waters are observed frequently for indication of possible upsets which may cause an oil spill event.
   Describe method and frequency of observations: Continuous blow-down from the cooling tower and condensed steam blow-down from all boilers are commingled and injected with Indian Basin Field produced waters. The blow-down from the cooling tower and the condensed steam are treated in a separate holding tank to assure compatibility with produced waters before injection.

Name of facility Indian Basin Gas Plant and Field Producing Facilities

Operator Marathon Oil Company

PART II, ALTERNATE A
DESIGN AND OPERATING INFORMATION
ONSHORE FACILITY (EXCLUDING PRODUCTION)

[Response to statements should be: YES, NO, or NA (Not Applicable).]

C. **Facility Transfer Operations, Pumping, and In-plant Process**

1. Corrosion protection for buried pipelines:
   (a) Pipelines are wrapped and coated to reduce corrosion. Yes
   (b) Cathodic protection is provided for pipelines if determined necessary by electrolytic testing. Yes
   (c) When a pipeline section is exposed, it is examined and corrective action taken as necessary. Yes

2. Pipeline terminal connections are capped or blank-flanged and marked if the pipeline is not in service or on standby service for extended periods. Yes
   Describe criteria for determining when to cap or blank-flange: Continuous plant operation.

3. Pipe supports are designed to minimize abrasion and corrosion and allow for expansion and contraction. Yes
   Describe pipe support design: Steel stanchion.
   Wear plate protection at points of wear and contact.

4. Describe procedures for regularly examining all above-ground valves and pipelines (including flange joints, valve glands and bodies, catch pans, pipeline supports, locking of valves, and metal surfaces): Annual Corporate Risk Division inspection.
   Nondestructive testing when warranted.
   Visual observation by plant oeprator while on duty.
   Periodic site security inspections.

5. Describe procedures for warning vehicles entering the facility to avoid damaging above-ground piping: Signs and traffic barrier guards where needed.

Name of facility Indian Basin Gas Plant and Field Producing Facilities

Operator Marathon Oil Company

PART II, ALTERNATE A
DESIGN AND OPERATING INFORMATION
ONSHORE FACILITY (EXCLUDING PRODUCTION)

[Response to statements should be: YES, NO, or NA (Not Applicable).]

D. Facility Tank Car & Tank Truck Loading/Unloading Rack

Tank car and tank truck loading/unloading occurs at the facility. (If YES, complete 1 through 5 below.) ~~Yes~~

1. Loading/unloading procedures meet the minimum requirements and regulations of the Department of Transportation. Yes

2. The unloading area has a quick drainage system. No

3. The containment system will hold the maximum capacity of any single compartment of a tank truck loaded/unloaded in the plant. _____
   Describe containment system design, construction materials, and volume: Waterways not vulnerable to such a spill in this remote area.

4. An interlocked warning light, a physical barrier system, or warning signs are provided in loading/unloading areas to prevent vehicular departure before disconnect of transfer lines. No
   Describe methods, procedures, and/or equipment used to prevent premature vehicular departure: Company supervised loading or unloading, on condensate. The truck must be grounded prior to the actual loading of the truck. The groundwire on the truck is necessary to active the electric signal to the transfer pump. The circuit breaker must be unlocked by company personnel prior to any movement of the condensate. Delivery tickets are made for each truck shipment.

5. Drains and outlets on tank trucks and tank cars are checked for leakage before loading/unloading or departure. Yes

Name of facility Indian Basin Gas Plant and Field Producing Facilities

Operator Marathon Oil Company

PART II, ALTERNATE A
DESIGN AND OPERATING INFORMATION
ONSHORE FACILITY (EXCLUDING PRODUCTION)

[Response to statements should be: YES, NO, or NA (Not Applicable).]

E. **Security**

1. Plants handling, processing, or storing oil are fenced. No
2. Entrance gates are locked and/or guarded when the plant is unattended or not in production. NA
3. Any valves which permit direct outward flow of a tank's contents are locked closed when in non-operating or standby status. Yes
4. Starter controls on all oil pumps in non-operating or standby status are:
   (a) locked in the off position; Yes
   (b) located at site accessible only to authorized personnel. Yes
5. Discussion of items 1 through 4 as appropriate:
   Gas plant is attended 24 hours per day each day of the year.
6. Discussion of the lighting around the facility:
   Flood lighting and localized area lighting approved by Marathon Oil Company's Corporate Risk Division.

Name of facility Indian Basin Gas Plant and Field Producing Facilities

Operator Marathon Oil Company

(Prior to comp[illegible] Part II, Alternate B, refer to regulations [illegible]ructions page 7.)

PART II, ALTERNATE B
DESIGN AND OPERATING INFORMATION
ONSHORE OIL PRODUCTION FACILITY

[Response to statements should be: YES, NO, or NA (Not Applicable).]

A. Facility Drainage

1. Drainage from diked storage areas is controlled as follows (include operating description of valves, pumps, ejectors, etc.): No field storage.

2. The procedure for supervising the drainage of rain water from secondary containment into a storm drain or an open watercourse is as follows (include description of (a) inspection for pollutants, and (b) method of valving security). (A record of inspection and drainage events is to be maintained on a form similar to Attachment #3): NA

3. Field drainage ditches, road ditches, and oil traps, sumps, or skimmers, if such exist, are inspected at regularly scheduled intervals for accumulations of oil. Yes
Describe inspection procedures, intervals, and methods employed to remove oil: Daily by the responsible pumper. Semi-annual traverse of all field gathering lines and field facilities by the plant superintendent or his representative. In the instance of a leak disturbed area, are appropriately groomed.

B. Bulk Storage Tanks

1. Describe tank design, materials of construction, and fail-safe engineering features: No field storage.

Name of facility Indian Basin Gas Plant and Field Producing Facilities

Operator Marathon Oil Company

PART II, ALTERNATE B
DESIGN AND OPERATING INFORMATION
ONSHORE OIL PRODUCTION FACILITY

[Response to statements should be: YES, NO, or NA (Not Applicable).]

2. Describe secondary containment design, construction materials, and volume: NA

3. Describe tank examination methods and procedures: No field storage tanks.

C. **Facility Transfer Operations**

1. Describe scheduled basis for examinations of above-ground valves and pipelines and salt water disposal facilities: An annual visual inspection is made by the foreman or other supervisory personnel. Daily inspections are conducted by the pumper. Such inspections are inherent to Marathon's site security.

2. Describe flowline maintenance program to prevent spills: Pipe sleeves or clamps are used to repair leaks. When conditions warrant, new pipe is installed.

D. **Oil Drilling and Workover Facilities**

1. A blowout preventer (BOP) assembly and well control system is installed before drilling below any casing string and, as required during workover operations. Yes
2. The BOP assembly is capable of controlling any expected wellhead pressure. Yes
3. Casing and BOP installations conform to state regulations. Yes

Name of facility Indian Basin Gas Plant and Field Producing Facilities

Operator Marathon Oil Company

SPCC PLAN, ATTACHMENT
OIL SPILL CONTINGENCY PLANS AND
WRITTEN COMMITMENT OF MANPOWER, EQUIPMENT, AND MATERIALS

Secondary containment or diversionary structures are impracticable for this facility for the following reasons (attach additional pages if necessary):

Due to the areal extent of the field and limited hydrocarbons present in the process units and gathering lines, full secondary containment is considered impracticable.

	Yes
A strong oil spill contingency plan is attached.	Yes
A written commitment of manpower, equipment, and materials is attached.	Yes

Name of facility Indian Basin Gas Plant and Field Producing Facilities

Operator Marathon Oil Company

OIL SPILL CONTINGENCY PLAN

In the case of an oil spill from a producing well, a testing vessel, a tank, flowline or any other related oil field equipment, the following action will be implemented to protect human life and regain control of the spill as rapidly as possible. All steps should be carefully considered, to ensure control of the spill is effectively and efficiently regained.

1) Shut off the source contributing to the spill. Analyze the type of spill and determine the most appropriate immediate action to be taken to contain the spill.

2) If the spill contains hydrocarbons, collect lighters and matches from personnel working in the area.

3) Obtain labor and equipment to construct a containment barrier as rapidly as possible. (See the attached directory.)

4) As required have vacuum truck(s) pick up pooled or contained liquids.

5) As necessary the use of absorbent material (straw, dirt, lost circulation material, commercial sorbents, etc) should be utilized to remove standing volume which cannot be efficiently removed by a vacuum truck.

6) Restrict access to the affected area to only those persons involved in control, containment, and clean-up operations.

7) Notify the company representative in charge of the facility of the spill and action being taken who will in turn notify his respective supervisor.

8) As required, the Production Foreman will notify the regulatory agency of the spill.

9) Keep livestock from affected area and if necessary, as appropriate notify the landowner and other surface users of the situation.

10) The person in charge of the spill response activities shall keep a daily log of response activities. The log book shall be bound, not loose leaf. Entries shall be dated, timed and signed.

11) The Duty Officer at the National Response Center must be notified immediately when a spill reaches "waters of the U.S.," or it appears likely that the spill will reach "waters of the U.S."

Mid-[illegible]ent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

SPCC PLAN

COMMITMENT OF MANPOWER, EQUIPMENT AND MATERIALS

TO: OPERATIONS SUPERVISORS

THIS IS YOUR AUTHORITY TO EXPEDITIOUSLY COMMIT MANPOWER, EQUIPMENT AND MATERIALS NECESSARY TO ARREST AND CONTAIN AND INITIATE CLEANUP OF ANY HARMFUL QUANTITY OF OIL OR HAZARDOUS MATERIAL DISCHARGED FROM THIS FACILITY. THIS AUTHORITY MAY BE DELEGATED BY YOURSELVES TO THE PERSON IN CHARGE OF THE FACILITY TO ENSURE THAT NECESSARY ACTIVITIES ARE IMPLEMENTED AS QUICKLY AS POSSIBLE AFTER A SPILL IS NOTED.

J. F. Strong
Production Manager

JFS/elk

7/13/88

Mid-[illegible]nt Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

SPCC PLAN INSPECTION PROCEDURES

INDIAN BASIN FIELD
EDDY COUNTY, NEW MEXICO

1. As part of his normal routine, the pumper(s) will visually inspect the field's production facilities for accumulations, leaks of oil or other hazardous substances. The pumper must perform the inspection at least once a week.

2. The production facilities to be inspected will include but are not limited to wellheads, flowlines, valves, tanks, vessels, miscellaneous fittings (flanges, etc.), sumps and ditches.

3. In the event that an accumulation or leak is discovered, the pumper shall initiate the actions detailed in the current SPCC Plan.

4. The pumper shall record his weekly inspection on the attached Site Security Inspection Form.

W. D. Holmes
Operations Superintendent

LIST OF EMERGENCY EQUIPMENT AND SERVICES

Field Atoka Penn, Indian Basin, Revelation, North Shugart

SPILLS

Equipment and Services Available to Contain and Cleanup Spills on Land, Rivers, Creeks, and/or Coastal Bays

Available Equipment/Service	Source or Organization	Location	Telephone No.
Cleanup Service	Stevenson Roack Tank Co.	Artesia, NM	505-746-3222
Earth Moving	Sweat Constr. Co.	Loco Hills, NM	505-677-3511
	Berry Constr. Co.	Artesia, NM	505-746-3434
	Globe Construction Co.	Hobbs, NM	505-392-6511
Fire Control	Carlsbad Fire Department	Carlsbad, NM	505-885-3124
	Artesia Fire Department	Artesia, NM	505-746-2701
Oil Field Haulers	B. F. Walker	Hobbs, NM	505-392-5546
	W. M. Walker	Hobbs, NM	505-397-2441
Portable Tanks	Hardin-Houston	Hobbs, NM	505-393-5013
	Diamond Rental, Inc.	Hobbs, NM	505-392-6498
Vacuum Trucks	I & W Service	Lovington, NM	505-677-2111

COMPANY PERSONNEL NOTIFICATION LIST

Indian Basin Gas Plant - (505) 457-2621		Home Telephone
York, Stephen D.	Plant Superintendent	(505) 746-3374
Berghorn, Matthew T.	Plant Engineer	(505) 746-2161
Hodges, Joe E.	Gang Pusher	(505) 746-9447
Barnett, Jimmy B.	Operator	(505) 746-2818
Moreno, Manuel S.	Roustabout	(505) 748-2175
Waldrip, Bruce W.	Operator	(505) 457-2252
Canada, Donald R.	Field Operator	(505) 748-1060
Case, Anthony W.	Operator	(505) 746-4014
Garrett, Kenton R.	Electrician	(505) 748-2932
Klein, Timothy P.	Mechanic	(505) 484-3675
Manthei, Don W.	Welder	(505) 457-2213
Rouse, David B.	Operator	(505) 746-2619
Winters, Timonthy L.	Field Operator	(505) 746-4662
Davis, Larry D.	Operator Helper	(505) 748-3752
Bowen, Patrick N.	Operator Helper	(505) 748-3570
Ivy, Jack L.	Operator Helper	(505) 746-9078
Rauch, Jack P.	Operator Helper	(505) 748-3121
Kucel, Joel D.	Roustabout	(505) 748-9050
London, Steve A.	Instrument Repairman	(505) 885-6843
Wilson, James E.	Tester	(505) 746-6481
Harrison, Jerry J.	Field Operator	(505) 365-2962
Miller, Ginger J.	Clerk	(505) 746-9711

Midland, Texas - (915) 682-1626		
Gordy, Craig W.	E/S Supervisor	(915) 687-6051
Holmes, William D.	Operations Supt.	(915) 687-6305
Snyder, William O.	Region Manager Midland Operations	(915) 689-9911

SITE SECURITY INSPECTION

(To be completed by pumper or site supervisor on a weekly basis.)

Date	Location	Inspection Results	Corrective Actions

Code

1.) Thief hatches not secured
2.) Sell line/valve on tank not secured
3.) LACT Unit not secured
4.) Heater treater not secured
5.) Header not secured
6.) Fencing not adequate
7.) Possible electrical hazard
8.) Possible hazard, other
9.) Signs/I.D. not adequate
10.) Oil spill
11.) Other
12.) No deficiencies found
13.) Does not conform to SPCC Plan or Spill Prevention measures.

11/83

MARATHON OIL COMPANY - MID-CONTINENT REGION

SPILL REPORT

This form is to be completed for any spill (regardless of size) of any oilfield liquid onto the surface of the ground.

NOTE: Completion of this form does not eliminate the need to verbally report all discharges to your supervisor as soon as practicable after the source has been stopped and containment/cleanup operations have been mobilized as appropriate.

SPILL DATE MO DA YR	EST. SPILL TIME	AM PM	ESTIMATED SPILL VOLUME	TYPE OF FLUID SPILLED	VOLUME RECOVERED

LOCATION OF SPILL (State, County, Field, Lease, Well or Rig): _____

_____

CAUSE OF SPILL: _____

_____

_____

Did the spill occur on location within a company made containment or drainage catchment area? __ Yes __ No If you checked "Yes" to the proceding question, provided such system adequately contained the spill, it is not necessary to complete the remainder of this form. Simply sign and date the report and forward to your supervisor.

DESCRIPTION OF SPILL AREA (Including proximity to watercourse): _____

_____

ACTION TAKEN TO CONTAIN OR CLEANUP SPILL: _____

_____

_____

SURFACE: Sandy __ Sandy Loam __ Clay __ Rocky __ Wet __ Dry __ Snow __
Cultivated __ Grazing __ Vacant __ Rural __ Residential __

APPARENT DAMAGE TO ENVIRONMENT AND PROPERTY: _____

_____

PROPERTY OWNER NOTIFIED: Yes __ No __ Date: _____ By: _____

Name of Property Owner: _____

HOW WAS SPILL FIRST NOTED: _____

_____

Person Initiating Report/Date	Supervisor Review/Date	Supervisor Review/Date

The back of this form to be completed by Superintendent and/or Environmental Dept., as applicable.

LOCATION OF SPILL (State, County, Field, Lease, Well or Rig): _____

_____

DATE OF SPILL: _____

NOTIFICATION OF REGULATORY AGENCIES:

A. Agency _____ Telephone No. _____ Time _____

Date _____ Person Contacted _____

Comments _____

B. Agency _____ Telephone No. _____ Time _____

Date _____ Person Contacted _____

Comments _____

C. Agency _____ Telephone No. _____ Time _____

Date _____ Person Contacted _____

Comments _____

PERSON MAKING CONTACT WITH AGENCIES: _____

DISTRIBUTION -

ORIGINAL COPY: Environmental and Safety Dept.

OTHER COPIES: _____
(To Be Completed by Supt.) _____
_____

SUPERINTENDENT COMPLETING THIS SECTION: _____

IF CORPORATE OFFICE NOTIFIED:

Person Contacted: _____ Time _____ Date _____

Person Filing Report: _____ _____ _____
Print Name Signature Date

FORM: MCR - 4/27/88

OCD FILES

35MM DRAWINGS

2R-22

FILE NUMBER

General Correspondence

DOCUMENT TYPE

2001-1991

1

NO OF DWGS

65

BOX

PureGold®

Groundwater Monitoring Products

AMERICAN COLLOID COMPANY

Water/Mineral Division

PureGold® Grout

DESCRIPTION:

PureGold® Grout is an easy mixing, single component, organic free, high solids bentonite clay grout. It was engineered specifically to meet the strict regulatory requirements of the groundwater monitoring industry. PureGold® Grout is a technically superior replacement for traditional cement grouts. It will form a low permeable flexible clay seal which impedes interaquifer fluid movement and the infiltration of surface contaminants into the borehole.

RECOMMENDED USE:

PureGold® Grout should be used in the sealing of boreholes or the annular space of monitoring wells to control contaminant infiltration while preserving ambient groundwater quality.

CHARACTERISTICS:

- Contaminant free, all 116 priority pollutants tested for were below CLP detection limits.
- Chemically stable, results from EP Toxicity Metals Analysis are below RCRA limits for hazardous constituents.
- Laboratory test range pH from 4-6.
- Low permeability, laboratory test results range from $1x10^{-7}$ to $1x10^{-9}$ cm/sec.
- Will not damage well casing, no heat generated during mixing or curing.
- Low formation loss, will not flow through highly permeable soils.
- Remains flexible, maintains putty-like consistency over time and will re-hydrate

MIXING AND APPLICATION:

PureGold® Grout should be mixed with a grout mixer or a mud rotary recirculation system and tremied with a positive displacement pump. It can be mixed in a slurry up to 30% solids, remains placeable for up to two hours and sets in eight hours.

To achieve a 30% solids slurry, add one 50 lb. bag of powdered grout to 14 gallons of fresh water. This mixing ratio will yield approximately 2.2 cu. ft. of grout. Prior to placement, the grout should have a mud balance density reading of 10.2 lbs./gal. Grouting is complete once the same mud balance reading is achieved from grout purged from the borehole. This simple quality control test will ensure proper grouting and eliminate inconsistencies in the field.

PACKAGING:

PureGold® Grout is packaged in 50 lb. multi-wall, waterproof bags, shipped 48/50 lb. bags per pallet, and stretch-wrapped.

1500 W. Shure Drive • Arlington Heights, Illinois 60004-1434 • (708) 392-4600

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 12, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

Please find attached the work plan for the drilling of the four wells into bedrock at the locations mutually agreed upon at our meeting on June 10. The plan was developed for Marathon by Roberts/Schornick and Associates and contains additional detail as to the completion procedures. As agreed to at our meeting, drilling operations will be suspended at any of the locations, should saturation be encountered which contains free or dissolved phase condensate. The well would then be completed at that depth as a monitoring/recovery well.

As you know, present plans are for the drill rig to arrive on site Friday, June 14, 1991, with drilling operations to immediately commence thereafter.

Should you have any questions, or wish to further discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elg

Attachment

cc: J. L. Benson
A. R. Kukla
R. F. Unger
D. L. Manus (BLM-Carlsbad)
File

RECEIVED
JUN 14 1991
OIL CONSERVATION DIV.
SANTA FE

PHASE II WORK PLAN

SUBSURFACE INVESTIGATION

BEDROCK MONITORING WELLS

MARATHON OIL COMPANY

INDIAN BASIN GAS PLANT

EDDY COUNTY, NEW MEXICO

Prepared by

Roberts/Schornick and Associates, Inc.

Environmental Consultants

Norman, Oklahoma

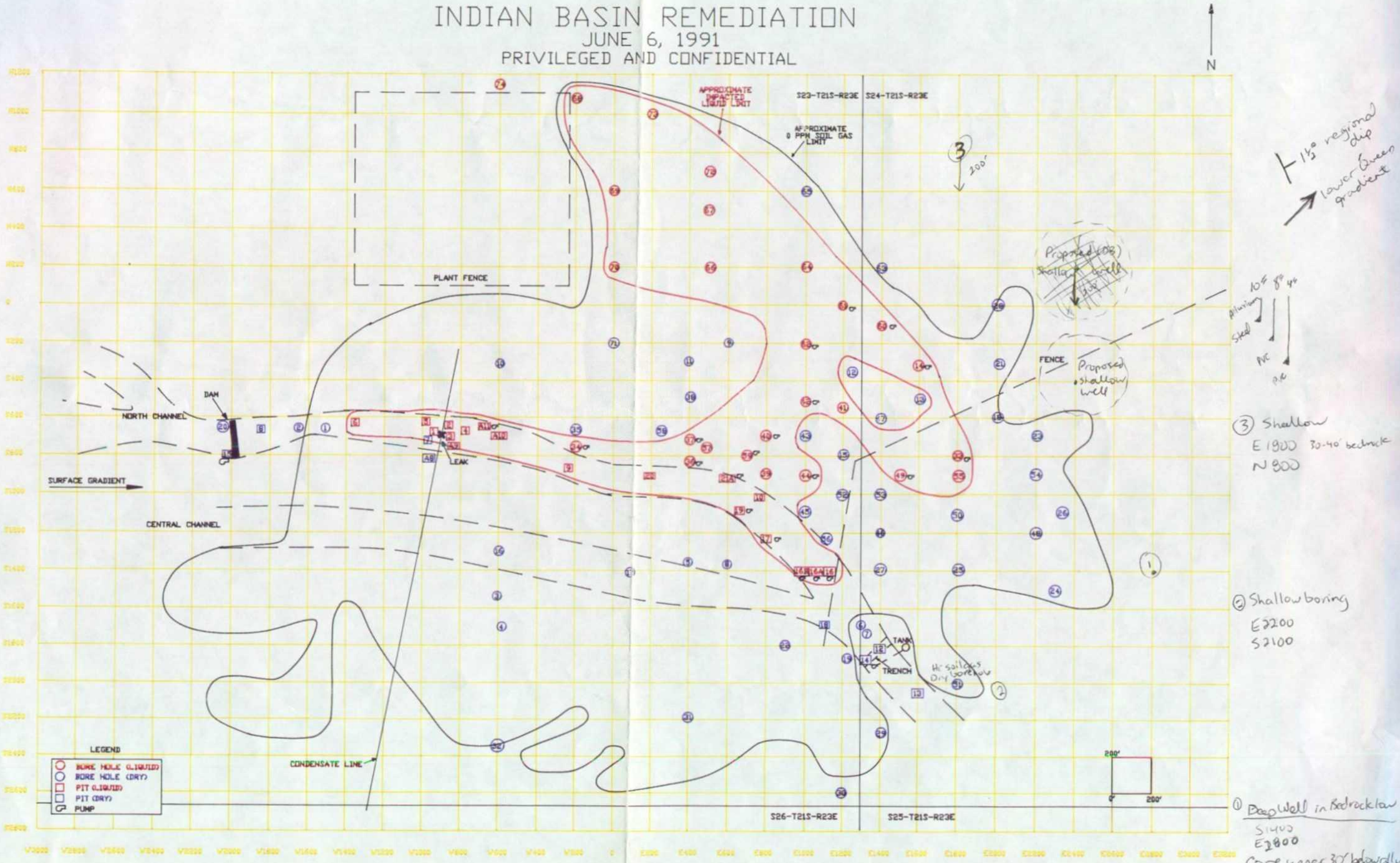
(405) 321-3895

June 12, 1991

INDIAN BASIN REMEDIATION

JUNE 6, 1991

PRIVILEGED AND CONFIDENTIAL



③ Shallow
E 1900 30-40' bedrock
N 800

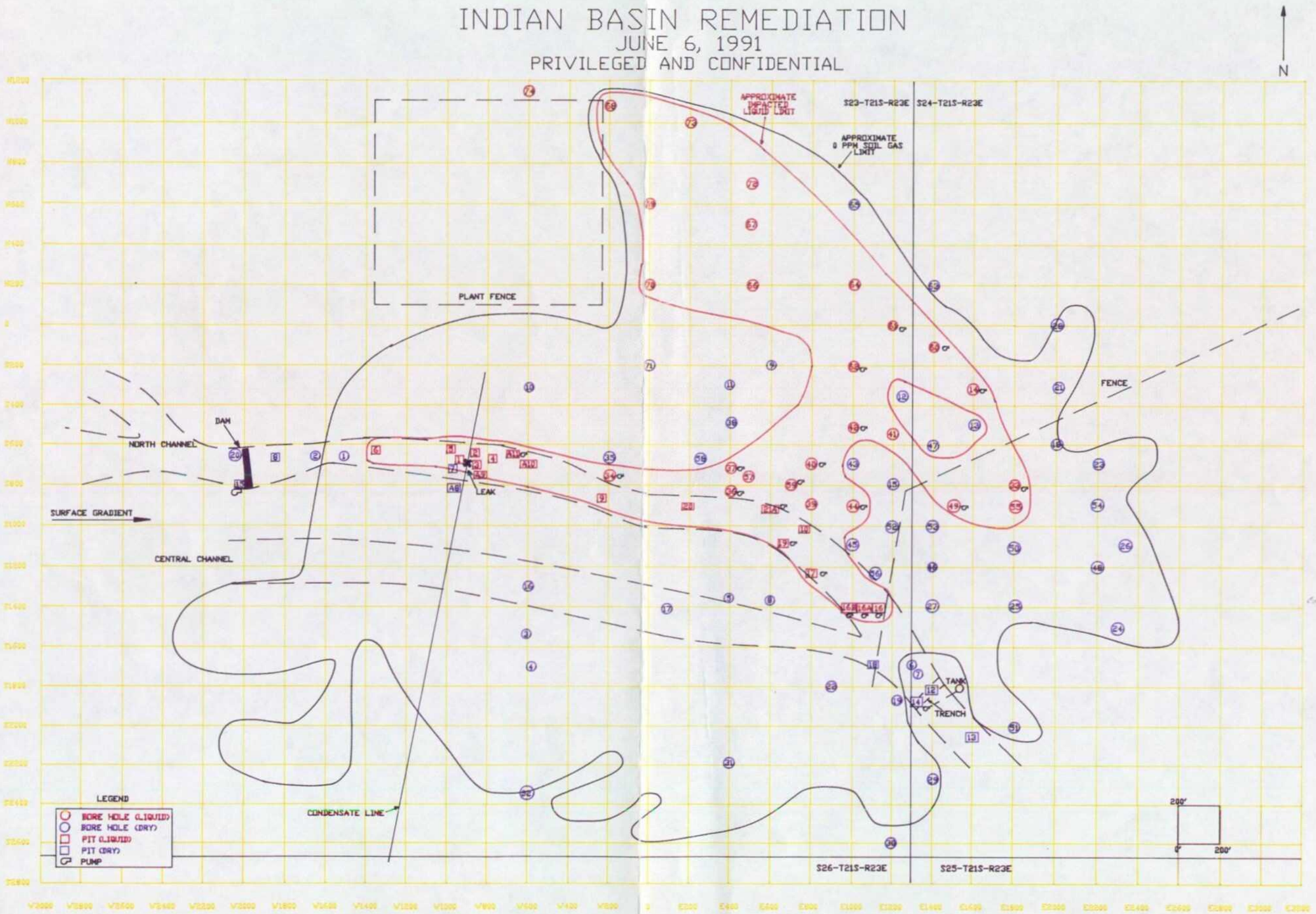
② Shallow boring
E 2200
S 2100

① Deep Well in Bedrock low
S 1400
E 2800
Core upper 30' below alluv
Air → water rotary
180' – 220'

INDIAN BASIN REMEDIATION

JUNE 6, 1991

PRIVILEGED AND CONFIDENTIAL



INDIAN BASIN REMEDIATION

JUNE 9, 1991

PRIVILEGED AND CONFIDENTIAL

OIL CONSERVATION DIVISION
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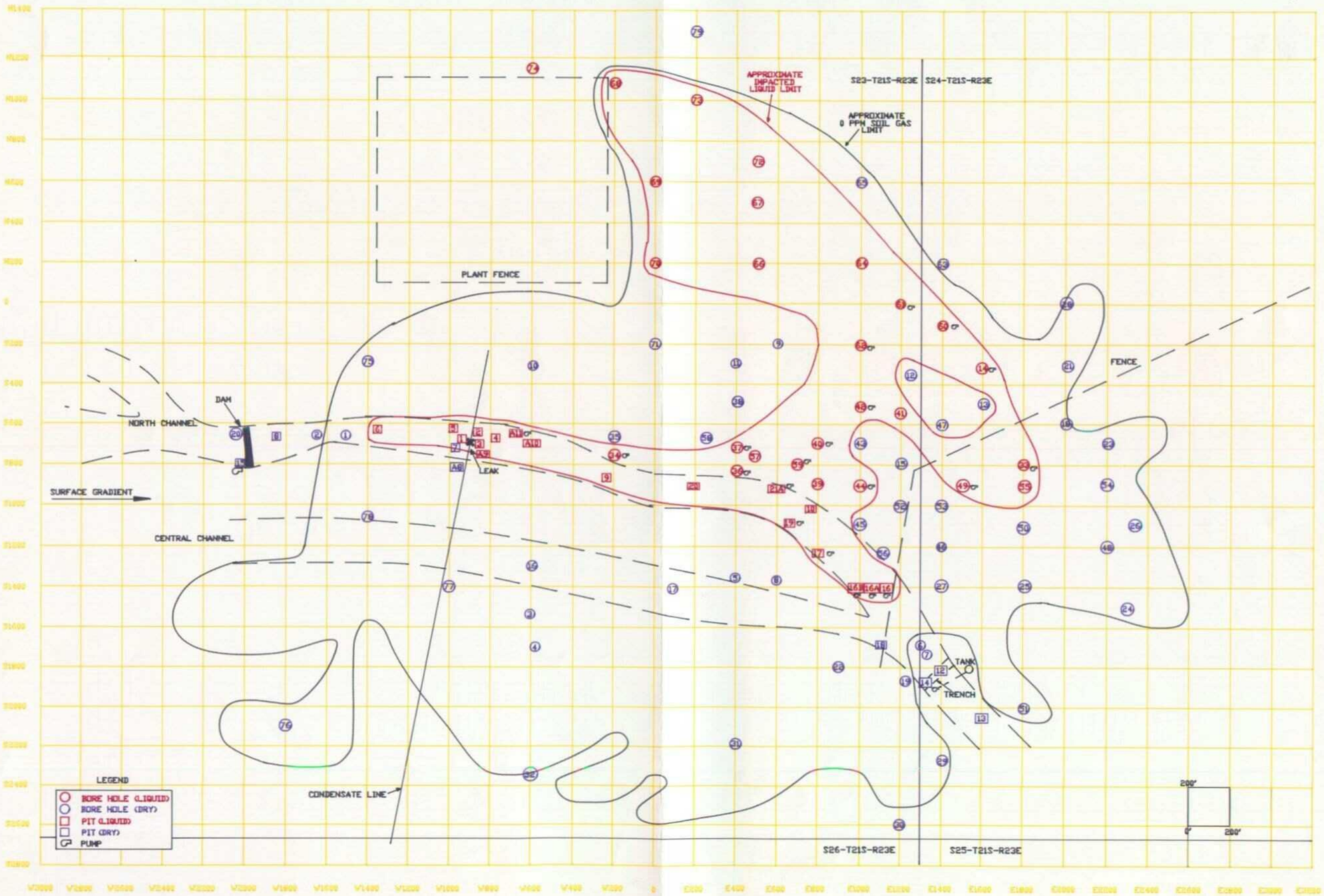

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 11, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

Attached, is a copy of a map indicating recent drilling activity at our Indian Basin leak site, as per your request. As indicated in our June 10 meeting, shallow drilling operations at the site concluded on the afternoon of June 8, 1991. Cumulative recovery as of the morning of June 10, 1991 totalled 2945 barrels of condensate and 2791 barrels of water.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A. J. Kavran
Environmental and Safety Supervisor

AJK/elg

Attachment

cc: J. L. Benson
A. R. Kukla
R. F. Unger
D. L. Manus (BLM-Carlsbad)
File

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 11, 1991

Myron Knudson
Director of Water Management
US EPA Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202

Re: Indian Basin Field Incident
SPCC Plan

Dear Mr. Knudson:

In compliance with SPCC regulations described in Federal Regulation 40 CFR Section 112.4, attached please find the reporting requirements necessitated by the condensate leak which was discovered in Indian Basin Field on April 12, 1991. As stipulated in these regulations, a copy of same has been submitted to Mr. David Boyer, Environmental Bureau Chief, with the New Mexico Oil Conservation District, who has regulatory jurisdiction over water pollution control activities associated with oil and gas operations in the state of New Mexico.

Should you require any additional information regarding the leak, please call me directly at (915) 687-8214.

Yours very truly,

R. F. Unger
Production Manager

RFU;TNT/nrt

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OIL CONSERVATION DIV.
SANTA FE

cc: D. G. Boyer - NMOCD ✓
D. L. Manus - BLM
J. L. Benson
A. J. Kavran
A. R. Kukla
R. F. Unger

Documents stored separately
Documents to WQCC 7/9/91

PHASE II WORK PLAN

SUBSURFACE INVESTIGATION

BEDROCK MONITORING WELLS

MARATHON OIL COMPANY

INDIAN BASIN GAS PLANT

EDDY COUNTY, NEW MEXICO

Prepared by

Roberts/Schornick and Associates, Inc.

Environmental Consultants

Norman, Oklahoma

(405) 321-3895

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JUN 14 1991

OIL CONSERVATION DIV.
SANTA FE

June 12, 1991

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3	Shallow Bedrock Monitoring Well Design #3 (Typical)
4	Deep Bedrock Monitoring Well Design (Typical)

LIST OF PLATES

PLATE

1 Site Plan Showing Borings, Existing Monitoring Wells, and Proposed Bedrock Monitor Wells

1.0 INTRODUCTION

Roberts/Schornick and Associates, Inc. (RSA) has been retained by Marathon Oil Company (Marathon) to prepare and implement a Phase II Subsurface Investigation Work Plan for the Indian Basin Gas Plant (Site) located in Eddy County, New Mexico. Phase I and II investigations are being conducted to assess the extent of impact to soils and groundwater at the Site resulting from a pipeline release of condensate and produced water. The location of the release is shown on Plate 1.

Phase I investigations, which were conducted in accordance with the April 29, 1991 Site Characterization Work Plan, consisted of the sampling of 196 soil gas probes, drilling and sampling of 79 shallow (less then 35 feet deep) boreholes primarily drilled through the alluvial material, and the installation of 53 shallow alluvial monitoring wells. The locations of Phase I borings and monitoring wells are shown on Plate 1. The scope of the Phase II investigation was the subject of a June 10, 1991 meeting between representatives of the United States Bureau of Land Management (BLM), Marathon, New Mexico Oil Commission Division (OCD), and RSA. This work plan for Phase II investigation has been prepared in accordance with the program for site investigation discussed in the June 10, 1991 meeting. The scope of the Phase II investigation will consist of drilling and installation of one (1) deep (approximately 180 to 220 feet) and three (3) shallow

(approximately 60 feet) bedrock monitoring wells. Proposed bedrock monitoring well locations are shown on Plate 1.

2.0 PHASE II INVESTIGATION

2.1 Scope of Investigation

The scope of the Phase II investigation consists of the drilling of three (3) boreholes to depths of approximately 60 feet and installation of three (3) shallow bedrock monitoring wells in each of the boreholes. In addition, one (1) deep borehole will be drilled to a depth of approximately 180 to 220 feet and one (1) deep bedrock monitoring well will be installed. Surface conductor casings will be installed in all borings prior to drilling to prevent possible cross-contamination. Proposed Phase II monitoring well locations are shown on Plate 1.

2.2 Surface Conductor Installation - Shallow Borings

2.2.1 Surface Conductors (Areas With Alluvium)

In areas with alluvial cover greater than five (5) feet, a 12-inch steel surface conductor will be installed from ground surface to approximately five (5) feet into bedrock. The conductor will be installed by drilling a 14-inch borehole with a truck-mounted rotary drill rig with a 14-inch tri-cone bit. The borehole may be drilled using air. If drilling with air is not possible then water as a drilling fluid will be used; however, should borehole stability problems occur, sodium bentonite may be added to the drilling fluid.

During drilling, air monitoring for volatile organics will occur. If drilling fluid is used then the fluid will be monitored for evidence of a hydrocarbon sheen and cuttings samples will be obtained for headspace testing approximately every two (2) feet. Samples will be collected in glass jars, fitted with an aluminum foil seal, and tested in the manner described in Section 2.7.

The 12-inch conductor will be pressure grouted from the base of the conductor up through the annulus to the surface with a cement/bentonite slurry consisting of one sack of Portland Cement, five pounds sodium bentonite, and six gallons of water. The grout will be allowed to set up for 24 hours without being disturbed. After installation of the surface conductor, the borehole will be cored to at least 15 feet into bedrock as described in Section 2.5. If evidence of contamination is observed such as a sheen or staining in the rock core or drill fluid or elevated headspace soil gas readings in the upper portion of bedrock, an additional surface conductor will be installed. The second conductor will be installed by drilling a borehole with a truck-mounted rotary air or water rig fitted with an 11 7/8-inch tri-cone bit. Drilling fluid will be either air or water only unless borehole stability problems necessitate the use of a sodium bentonite additive. An 8-inch conductor pipe will be inserted into the borehole and will be extended from total depth to

ground surface. The 8-inch conductor pipe will be installed with a bottom cap to prevent contamination of the inner casing during installation. The conductor will be pressure grouted from the base of the conductor up through the annulus to the surface with a cement/bentonite slurry. The conductor will be allowed to set up for at least 24 hours without being disturbed. After installation of conductor casings, boreholes will be drilled to depths of approximately 60 feet using the methods described in Section 2.4. Conductor casing installation diagrams for shallow bedrock wells are included as Figures 1, 2, and 3.

2.2.2 Surface Conductors (Areas Where Bedrock Outcrops)

In areas where bedrock outcrops, an 8-inch surface conductor will be utilized. However, prior to conductor installation, the borehole will be cored to at least 15 feet below grade as described in Section 2.5. After coring, the borehole will be evaluated in the field to determine the appropriate depth to install the surface conductor casing.

The surface conductor will be installed by drilling a borehole with a truck-mounted rotary air or water rig fitted with an 11 7/8-inch tri-cone bit. Drilling fluid will be air or water only unless borehole stability problems necessitate the use of a sodium bentonite additive. An 8-inch PVC conductor pipe will be inserted into the borehole and will be extended from

total depth to ground surface. The 8-inch conductor will be installed with a bottom cap to prevent contamination of the inner casing during installation. The conductor will be pressure grouted from the base of the conductor up through the annulus to the surface with a cement/bentonite slurry. The conductor will be allowed to set up for at least 24 hours without being disturbed. After installation of conductor casings, boreholes will be drilled to depths of approximately 60 feet using the methods described in Section 2.4.

2.3 Surface Conductor Installation - Deep Boring

A 12-inch steel surface conductor will be installed from ground surface to approximately five feet into bedrock in the deep boring. The conductor will be installed by drilling a 14-inch borehole with a truck-mounted rotary drill rig with a 14-inch tri-cone bit. The borehole will be drilled using only air or water as a drilling fluid if possible; however, should borehole stability problems occur, sodium bentonite may be added to the drilling fluid.

During drilling, the drilling fluid will be observed for evidence of a hydrocarbon odor or sheen and cuttings samples will be obtained for headspace testing approximately every two (2) feet. Samples will be collected in glass jars fitted with an aluminum foil seal and tested in the manner described in Section 2.7.

The 12-inch conductor will be pressure grouted from the base of the conductor up through the annulus to the surface with a cement bentonite slurry consisting of one sack of Portland Cement, five pounds sodium bentonite, and six gallons of water. The grout will be allowed to set up for 24 hours without being disturbed. After installation of the surface conductor, the borehole will be cored to at least 30 feet into bedrock, as described in Section 2.5. Borehole core samples will be examined to determine the appropriate depth to install the second conductor casing. Depth of installation will likely be approximately 60 feet. The second conductor will be installed by drilling a borehole with a truck-mounted rotary air or water rig fitted with a 11 7/8-inch tri-cone bit. Drilling fluid will be air or water only unless borehole stability problems necessitate the use of a sodium bentonite additive. An 8-inch steel conductor pipe will be inserted into the borehole and will be extended from total depth to ground surface. The conductor will be installed with a bottom cap to prevent contamination of the inner casing during installation. The conductor will be pressure grouted from the base of the conductor up through the annulus to the surface with a cement/bentonite slurry. The conductor will be allowed to set up for at least 24 hours without being disturbed. A diagram of typical conductor casing installation for the bedrock well is included as Figure 4. After installation of surface conductors, the borehole will be drilled to a total

depth of approximately 180 to 220 feet using the methods described in Section 2.4.

2.4 Drilling Methods

After conductor casing installation, boreholes will be drilled and/or cored to total depths using the methods described below. Shallow bedrock borings will be drilled to approximately 60 feet below grade and the deep bedrock boring will be drilled to approximately 180 to 220 feet.

2.4.1 Air Rotary

Air rotary drilling involves the use of circulating air to remove the drill cuttings and maintain an open borehole as drilling progresses. The use of the air-rotary drilling technique is best suited for use in hard rock formations. The air from the compressor on the rig must be filtered to ensure that the oil from the compressor is not introduced into the groundwater system. The air rotary drilling method will be the primarily drilling method used in hard rock formations. To allow for 4-inch monitor well installation, a 7 7/8-inch tri-cone bit will be utilized.

2.4.2 Water Rotary

Water rotary is the second preferred method of drilling in hard rock formations. Water rotary involves the introduction of water into the borehole through the drill pipe and

subsequent circulation of water back up to the hole to remove cutting. If possible, no borehole well stabilization additives will be used. The water used in this drilling method will be obtained from wells located at the Indian Basin Gas Plant to ensure that the water is potable water. To allow for 4-inch monitor well installation, a 7 7/8-inch tri-cone bit will be utilized.

2.5 Sampling Methods

2.5.1 NX or Christianson Corebarrel

An NX or Christianson corebarrel is the preferred sampling method in consolidated rock formations. A hollow diamond or carbide bit that is 3.125 inches outside diameter and 2.2-inches inside diameter cuts a 2.2-inch core approximately 5-feet to 10-feet long. Upon coring 5 to 10-feet the corebarrel is brought to the surface, split open, and the core removed. Once the sample is exposed it will be measured and described by an RSA hydrogeologist. Sample description will include amount of recovery; interval thickness, depth of lithology change; color according to the Munsel Color chart; grain size distribution; macro-features and physical characteristics; mineralogy, and soil classification system (ASTM D2487 and D2488). Samples will be retained or spilt for headspace soil gas testing. All core samples will be labeled, packaged, and placed in water-proof core boxes for storage.

2.5.2 Grab Samples

When not coring, grab samples of cuttings will be obtained at approximately 2-foot intervals. Grab samples will be placed into glass jars, sealed with aluminum foil, and tested for organic vapors as described in Section 2.6. Each sample will be described and logged by an RSA hydrogeologist.

2.6 Monitor Well Construction

After drilling/coring shallow borings to approximately 60 feet below grade and the deep boring to approximately 180 to 220 feet, the boreholes will be reamed with a 7 7/8-inch tri-cone bit to allow for monitoring well installation. Prior to monitoring well installation, borehole water levels will be allowed to stabilize for at least 24 hours and water levels will be measured to determine appropriate screen intervals. Shallow bedrock monitor wells will be screened in the uppermost significant groundwater zone to be determined in the field based on fractures and degree of saturation.

All groundwater monitoring wells will be constructed of 4-inch schedule 40 PVC casing and a factory slotted 0.02 inch screen size. A bottom sump (approximately 0.5 foot long) will extend below the screen for fines catchment. All monitoring wells will be fitted with centralizers to maintain uniform annulus spacings. The PVC screen used in all wells will be no greater than 20 feet in length, but typically will be 10 feet

in length. A clean 8-20 sieve size silicon sand pack will be placed around the screen to serve as a filter medium between the well and screen. The sand pack will extend to approximately 2-feet above the top of the screen. A 2-foot thick layer of sodium bentonite pellets will then be placed on top of the sand pack and then hydrated with deionized water. A cement-bentonite grout (Volclay Gold Grout) will be mixed to a mud weight of 10.6 pounds per gallon and will then be pressure grouted through a tremie line (the line will extend to near the top of the hydrated bentonite) and circulated to approximately 2-feet from ground surface. A vented cap will be placed on top of the PVC well casing. A sloped concrete pad (2′ x 2′ x 6" thick) and a steel locking protector (6 or 8 inches in diameter) will be placed over the well. Monitor well completion diagrams are included on Figures 1, 2, 3, and 4.

2.7 Headspace Gas Survey

A headspace gas survey is the measurement of relative volatile organic hydrocarbon concentrations in the soil pores. This measurement includes both the unsaturated and saturated zones at various intervals, vertically, in the soil boring. In the unsaturated or vadose zone, volatile hydrocarbons can exist as vapor in soil pore spaces, they can be adsorbed onto the soil particles, or exist as free hydrocarbon liquid in soil pore spaces. In the saturated zone, these hydrocarbons will

usually be adsorbed onto aquifer materials over the zone of groundwater fluctuation or exist as free liquid in the soil pore spaces. Obtaining soil gas headspace data vertically at each soil boring provides information that defines the depth of impact. The soil gas headspace survey is used to supplement analytical test results and also acts as a soil screening device.

Samples will be prepared for vapor analysis using the following methodologies. Outer surfaces of the cores collected by the samplers will be trimmed off (if possible) and the remaining sample composited over either one (1) or two (2) foot lengths and placed in glass jars leaving the top 1/4 of the jar vacant for vapor accumulation. A layer of aluminum foil is placed over the top of the jars and the caps screwed in-place, sealing the jars. The organic vapor monitor (OVM) photoionization detector probe is used to pierce the aluminum foil and an organic vapor headspace reading is obtained. The resulting OVM headspace gas readings are in parts per million (ppm) of total ionizable hydrocarbon based upon an isobutylene standard. The OVM detector has a limit of detection of 100 parts per billion (ppb) of total ionizable hydrocarbon.

2.8 Equipment Decontamination and Site Reclamation

All equipment coming into contact with soils or groundwater will be properly cleaned prior to use. Drilling equipment

(i.e. drill bits, drill rod, sampling equipment, etc.) which contacts the borehole will be cleaned using a hot water pressure washer between boreholes. All sampling equipment will be pressure washed and then rinsed with deionized water prior to use. All sampling equipment and the drill rig will be cleaned with the high pressure hot water washer between borings. Sampling equipment will be washed with Alconox and deionized water between sampling events. All monitoring well casings will be washed with Alconox and deionized water prior to installation. Clean surgical gloves will be worn by all personnel handling the monitoring well materials during well completion.

All decontamination will be conducted in an area designated by Marathon. All wash water will be collected in the decontamination area. All protective clothing and wastes generated by the drilling or soil/groundwater sampling programs will also be containerized for proper disposal. In addition, all drilling fluids will be containerized for proper disposal by Marathon.

All drilling activities will be conducted in such a manner as to minimize any disturbance to the ground surface in the drilling area. Only portable mud pits will be utilized at the Site. A minimum number of vehicles will be brought to each drill site. All cuttings generated during drilling activities

will be containerized and removed from the drill site. Steps will be taken to minimize or prevent the discharge of drilling fluids or developed groundwater on the ground surface. Any accidental discharges will be cleaned up.

2.9 Well Development

Following completion of the monitoring well installations, all wells will be thoroughly developed. The purpose of monitoring well development is to remove any fluids lost to the formation during drilling (if fluids were used in the drilling process) and insure proper development of the sand pack and formation surrounding the screen. To insure proper curing of the cement-bentonite grout seals, no development will occur for forty-eight (48) hours following well completion. Development will consist of the removal of sufficient casing volumes until the discharged water is free from suspended sediment and the pH, specific conductivity, and temperature of the groundwater has stabilized. In addition, any fluids lost during drilling will be recorded and, at a minimum, this quantity and at least three (3) times the casing and sand pack volume (assume 30% porosity) will be removed. All development water will be containerized for proper disposal by Marathon.

The basic procedure for well development is to remove any drilling fluids and silt and clay fines from the well screen and surrounding gravel pack by hydraulic surging. Provided that the formation recharge rate is high enough, groundwater will flow from the formation, through the gravel pack and screen, and into the well.

An air-lift pump, or precleaned dedicated bailers will be utilized to develop the wells. All development equipment will be properly decontaminated (cleaned) prior to use in any well. If bailers are used in the development, care will be taken to prevent the bailer line (monofilament nylon line) from contacting the ground. A layer of visquene will be placed around the well during development to prevent the bailer line from accidentally contacting the ground. Clean surgical gloves will be worn by all personnel participating in the well development activities.

Prior to development, the water levels within the well and the well depth will be measured and recorded. These measurements will be used to calculate the fluid volume in the wells and sand pack prior to development. Measurements on the discharge volume, water clarity, pH, temperature and specific conductivity will be recorded on field forms. Water levels will be taken and recorded before, during, and after well development.

2.10 Well Survey for Horizontal and Vertical Control

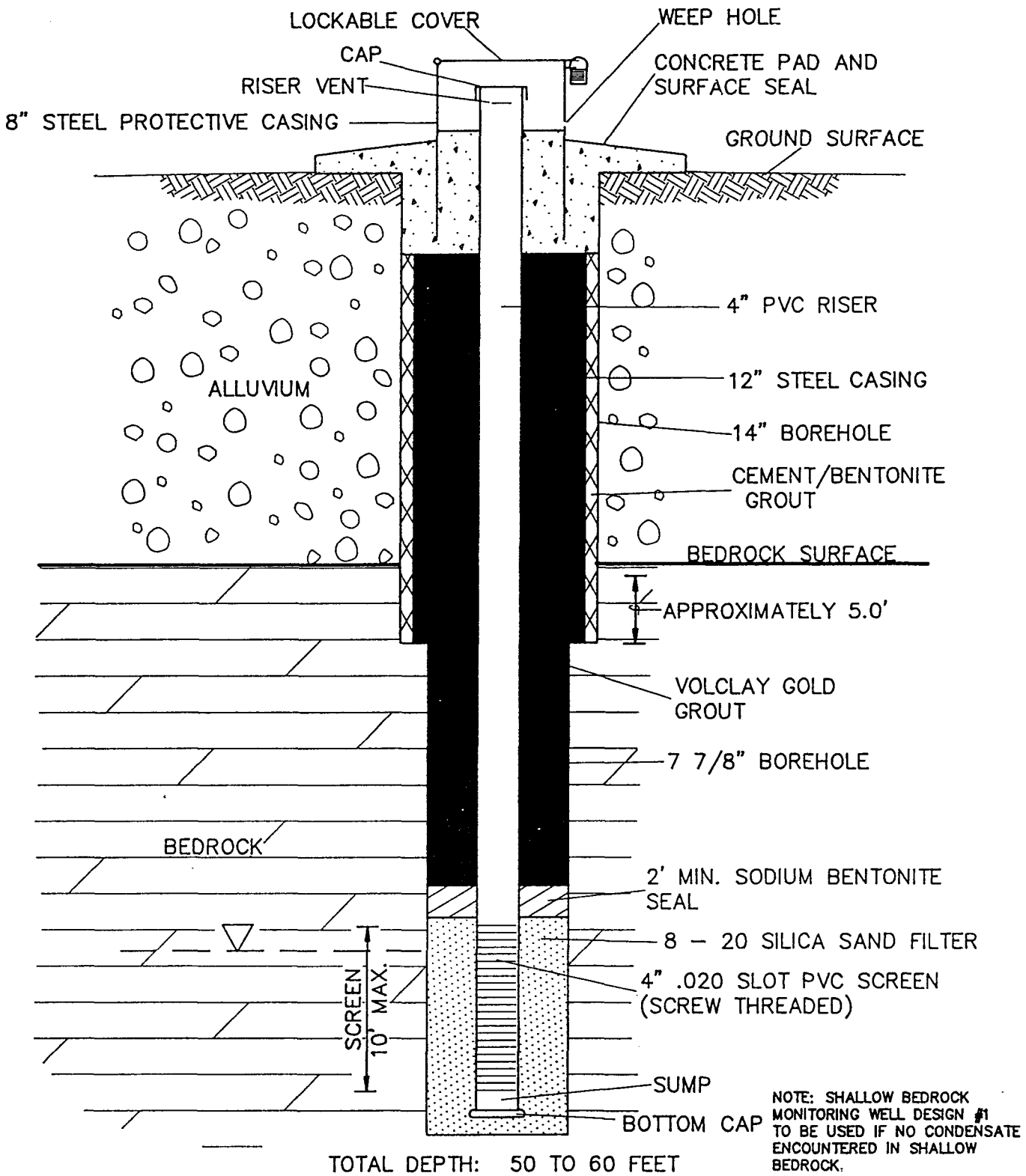
All monitor wells at the site be surveyed for vertical elevation and horizontal control. The top of the inner PVC casing (with cap removed) will be surveyed to the nearest 0.01 foot and referenced to the USGS mean sea level elevation datum. The ground surface elevation next to each well will also be measured and noted to the nearest 0.1 foot. The wells will be located laterally to the nearest 1 foot. All surveying will be conducted by a professional land surveyor licensed to practice in the State of New Mexico.

2.11 Water Level Measurements

Water level measurements will be taken in all wells upon stabilization. The water level data will be evaluated and presented as depth-to-water and potentiometric (groundwater elevation) maps. The potentiometric maps will be prepared to determine the hydraulic gradients and groundwater flow direction. Water level measurements will typically be made with an electric sounder, however an organic interface probe will be used if immiscible organics are present on the groundwater surface in thicknesses greater than 1/8-inch.

2.12 Borehole Geophysics

Geophysical borehole logging may be conducted in each of the bedrock boreholes/wells. The exact suite of geophysical logs (if needed) will be provided by Marathon's Site Geologist.

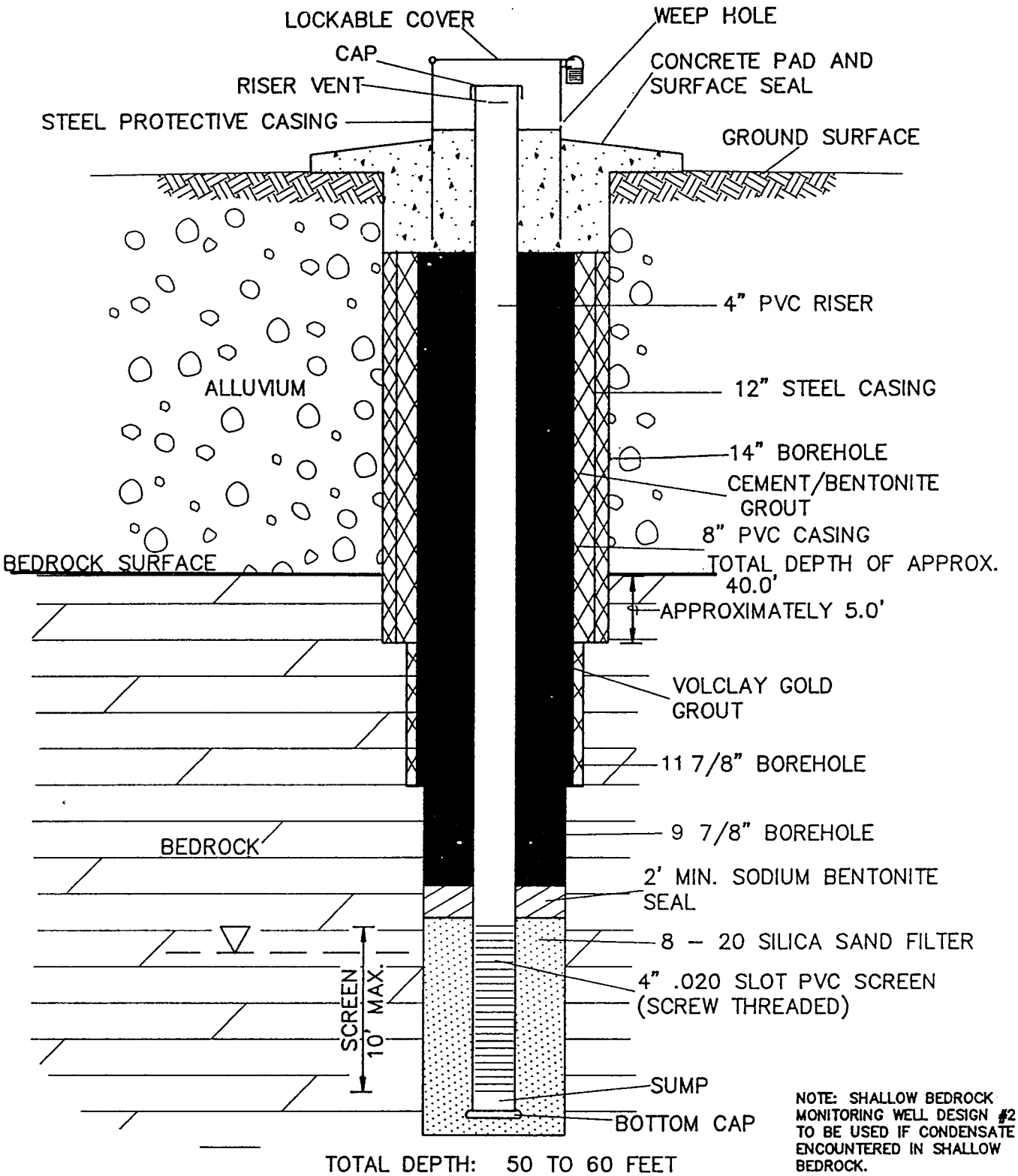


NOTE: SHALLOW BEDROCK MONITORING WELL DESIGN #1 TO BE USED IF NO CONDENSATE ENCOUNTERED IN SHALLOW BEDROCK.

Figure Title: SHALLOW BEDROCK MONITORING WELL DESIGN #1 (TYPICAL)	Client: MARATHON OIL COMPANY
Document Title: PHASE II WORK PLAN	Location: CARLSBAD, NEW MEXICO

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
3700 West Robinson, Suite 200
Norman, Oklahoma 73072
(405) 321-3895

DATE: 6/11/91	PREPARED BY: W.E.P
	CHECKED BY: W.E.P
SCALE: NTS	DRAFTED BY: S.A.R
PROJECT NO: 94029 F04	FIGURE NO.: 1

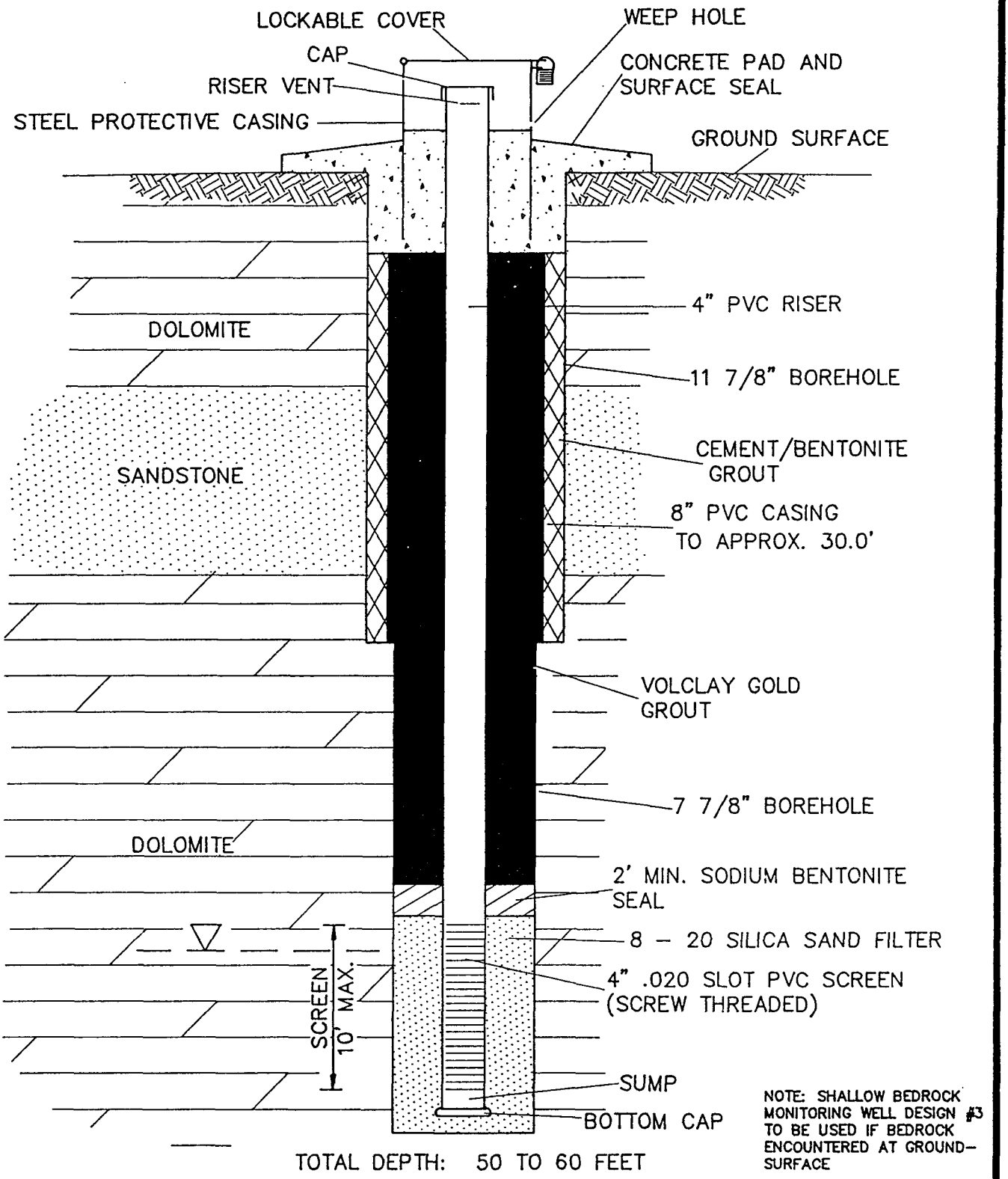


NOTE: SHALLOW BEDROCK MONITORING WELL DESIGN #2 TO BE USED IF CONDENSATE ENCOUNTERED IN SHALLOW BEDROCK.

Figure Title: SHALLOW BEDROCK MONITORING WELL DESIGN #2 (TYPICAL)	Client: MARATHON OIL COMPANY
Document Title: PHASE II WORK PLAN	Location: CARLSBAD, NEW MEXICO

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
3700 West Robinson, Suite 200
Norman, Oklahoma 73072
(405) 321-3895

DATE: 6/11/91	PREPARED BY: W.E.P
	CHECKED BY: W.E.P
SCALE: NTS	DRAFTED BY: S.A.R
PROJECT NO: 91029 F03	FIGURE NO.: 2



NOTE: SHALLOW BEDROCK MONITORING WELL DESIGN #3 TO BE USED IF BEDROCK ENCOUNTERED AT GROUND-SURFACE

Figure Title: SHALLOW BEDROCK MONITORING WELL DESIGN #3 (TYPICAL)	Client: MARATHON OIL COMPANY
Document Title: PHASE II WORK PLAN	Location: CARLSBAD, NEW MEXICO

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
3700 West Robinson, Suite 200
Norman, Oklahoma 73072
(405) 321-3895

DATE: 6/11/91	PREPARED BY: W.E.P
SCALE: NTS	CHECKED BY: W.E.P
	DRAFTED BY: S.A.R
PROJECT NO: 95029 F05	FIGURE NO.: 3

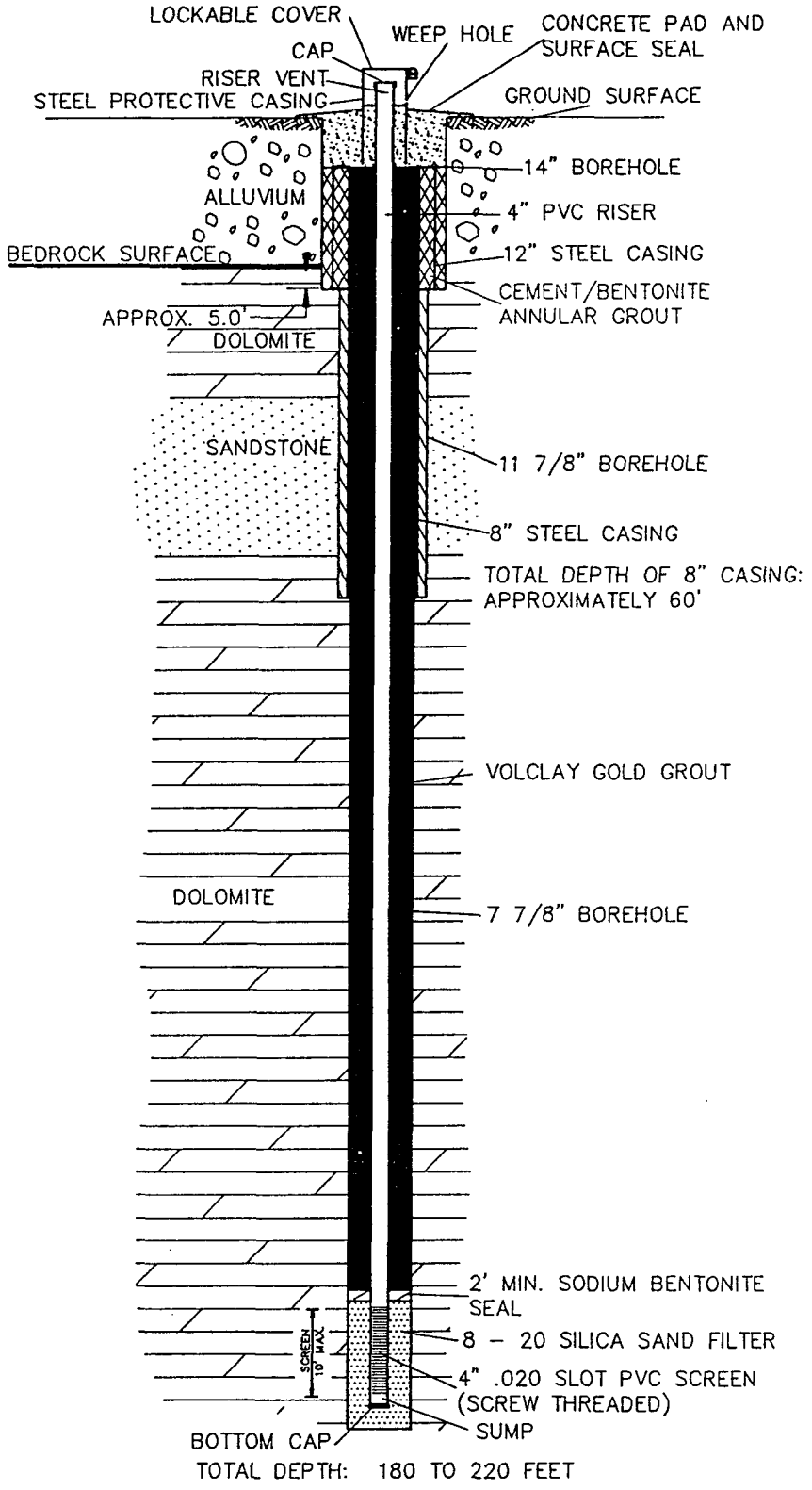


Figure Title: DEEP BEDROCK MONITORING WELL DESIGN (TYPICAL)	Client: MARATHON OIL COMPANY
Document Title: PHASE II WORK PLAN	Location: CARLSBAD, NEW MEXICO

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
3700 West Robinson, Suite 200
Norman, Oklahoma 73072
(405) 321-3895

DATE: 6/11/91	PREPARED BY: W.E.P
	CHECKED BY: W.E.P
SCALE: NTS	DRAFTED BY: S.A.R
PROJECT NO: 91029 F02	FIGURE NO.:

Mid[illegible]tinent Region
Pro[illegible]tion United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 11, 1991

Myron Knudson
Director of Water Management
US EPA Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202

Re: Indian Basin Field Incident
SPCC Plan

Dear Mr. Knudson:

In compliance with SPCC regulations described in Federal Regulation 40 CFR Section 112.4, attached please find the reporting requirements necessitated by the condensate leak which was discovered in Indian Basin Field on April 12, 1991. As stipulated in these regulations, a copy of same has been submitted to Mr. David Boyer, Environmental Bureau Chief, with the New Mexico Oil Conservation District, who has regulatory jurisdiction over water pollution control activities associated with oil and gas operations in the state of New Mexico.

Should you require any additional information regarding the leak, please call me directly at (915) 687-8214.

Yours very truly,

R. F. Unger
Production Manager

RFU;TNT/nrt

RECEIVED
JUN 17 1991
OIL CONSERVATION DIV.
SANTA FE

cc: D. G. Boyer - NMOCD
D. L. Manus - BLM
J. L. Benson
A. J. Kavran
A. R. Kukla
R. F. Unger

MARATHON OIL COMPANY
INDIAN BASIN SPCC PLAN
Filing Addendum

Eddy County, New Mexico

1) NAME OF FACILITY:

Indian Bas Field
Indian Basin Gas Plant (IBGP)

2) NAME OF OPERATOR:

Marathon Oil Company

SIGNIFICANT IBGP OWNERS & WORKING INTEREST PERCENTAGES:

Marathon Oil Company	35.7%
Oryx Energy Company	35.4%
Warren Petroleum Company	14.2%
Kerr-McGee Corporation	4.7%
Phillips Petroleum Company	3.2%
Cima Capitan, Inc.	2.3%
Texaco, Inc.	2.2%
Others (31 Owners)	2.3%

3) LOCATION OF FACILITY (IBGP):

Section 23 of Township 21 South, Range 23 East
Eddy County, New Mexico

4) DATE AND YEAR OF INITIAL FACILITY OPERATIONS:

January, 1966

5) MAXIMUM IBGP STORAGE/HANDLING CAPACITY AND NORMAL DAILY THROUGHPUT:

Material	Handling Capacity	Storage Capacity	Average Throughput
Produced Gas (MSCFPD)	137,000	None	130,000
NGL Product (Bbl/day)	5,875	3,500	5,000
Condensate (Bbl/day)	500	3,000	350
Produced Water (Bbl/day)	1,500	1,000	500

MARATHON OIL COMPANY
INDIAN BASIN SPCC PLAN
Filing Addendum

Eddy County, New Mexico

6) DESCRIPTION OF FACILITY (IBGP) (Maps (Exhibits 1-3), Flow Diagram (Exhibit 4), and Topographical Map (Exhibit 5) attached:

The IBGP processes natural gas, 97% of which is produced in the Indian Basin Field. The remaining 3% of Plant throughput originates from the Dagger Draw Field, located approximately 10 miles north of the Plant. Associated with the gas is approximately 3.5 to 4.0 BBLS/MMCFG of 65 degree API condensate and a varying amount of water. Production originates from 36 wells in the Indian Basin Field, where gas, condensate and water are measured in wellhead separation units before flowing into IBGP gathering systems. The gas is gathered in a high-pressure pipeline system (650 to 1000 Psig depending on IBGP operation). The condensate and water are combined and gathered in a low-pressure liquid gathering system (35 to 150 Psig depending on distance from IBGP). The gas gathering system is constructed of steel pipe, whereas the liquid gathering system consists primarily of PVC. No condensate or produced water is gathered from the Dagger Draw Field.

The gathering systems consists of four distinct lines which service production as follows:

Line 1 - Gas and liquid from the Northeast area of the Indian Basin Field.

Line 2 - Gas from the Dagger Draw Field.

Line 3 - Gas and liquid from the East area of the Indian Basin Field.

Line 4 - Gas and liquid from the South area of the Indian Basin Field.

The liquid gathering system was installed during 1965 and was constructed of PVC. The line sizes vary based on the anticipated throughput at the time of system design. Line sizes range from two inch at the ends of the systems to six inch at the IBGP entrance of Lines 1 and 4 and three inch for Line 3. Since original construction, additions and repairs have utilized polyethylene and PVC pipe except for a 200-foot section of steel that was installed under Rocky Arroyo in 1986. Both gas and liquid gathering systems are buried throughout the field. The depth of coverage is believed to vary from 1 to 8 feet with an average depth of approximately 2-1/2 feet.

MARATHON OIL COMPANY
INDIAN BASIN SPCC PLAN
Filing Addendum

Eddy County, New Mexico

When the gathered liquid reaches the IBGP, the condensate, water and flash gas are separated and processed separately. The condensate is routed to the condensate stabilizer, where it is processed for vapor pressure control purposes. The stabilized condensate product is then routed to storage before it is sold via truck transport through a LACT Unit. Produced water is routed to the disposal system with ultimate disposal via a salt water disposal well owned by the IBGP or trucked to a commercial water disposal service. The flash gas from the condensate is combined with vapors from the condensate stabilizer, and upon compression is commingled with the IBGP inlet gas stream.

A map of the area is attached as Exhibit 1. A Plot Plan, Gathering System map, and Process Flow Diagram are included as Exhibits 2, 3, and 4, respectively. Exhibit 5 is a topographic map of the area.

7) COMPLETE COPY OF SPCC PLAN WITH ANY AMENDMENTS (Exhibit 6, attached):

8) CAUSE OF SPILL, FAILURE ANALYSIS:

The leak occurred within the six-inch liquid gathering system located under Rocky Arroyo, approximately 0.2 miles south of the IBGP. This entire system is constructed of plastic pipe (PVC or PEP), except for a 200-foot section under the Arroyo which had been replaced with externally-coated steel line pipe in 1986. The leak was located within this steel-line section, and subsequent analysis of the failed segment concluded the leak to be the result of interior H_2S corrosion in the bottom, water carrying portion of the pipe. The failure analysis was conducted by Marathon's Production and Technology Center located in Littleton, Colorado.

9) CORRECTIVE ACTIONS/COUNTERMEASURES TAKEN:

Upon discovery of the release on April 12, 1991, the pipeline was immediately shutdown. Within an hour of leak detection, the appropriate Federal and State agencies were notified by telephone. The following agencies were contacted on this date: the National Response Center in Washington, D. C. (Case No. 67729); the Bureau of Land Management in Carlsbad, New Mexico and the New Mexico Oil Conservation Division in Artesia, New Mexico.

Repairs consisted of 1) purging the line with fresh water to displace the produced liquids, 2) excavating the line, 3) removing the failed section of line for subsequent analysis, 4) repairing the breach in the existing line where the failed section had been removed and 5) inserting a four-inch polyethylene "slipline" into the six-inch line for the entire

1800-foot length of the Rocky Arroyo crossing. Prior to resuming operation of this line, the new polyethylene line and approximately 500 feet of the existing six-inch line were hydrotested to two times normal working pressure. This test exceeded the ANSI B31.4 guidelines of 1.25 times normal working pressure for liquid pipeline systems.

The annular space between the six-inch line and four-inch repair line remains open at both ends of the repair. These open ends are checked daily for fluids as a temporary leak detection method. Additionally, surveillance of production statistics has been increased to ensure identification of leaks within this and remaining sections of the liquid gathering system. Personnel have been dedicated to the task of performing daily material balances to confirm that reported production totals match actual sales volumes within acceptable tolerances. Field personnel regularly check the buried pipeline route for surface indications of leakage.

10) ADDITIONAL PREVENTIVE MEASURES TAKEN/CONTEMPLATED:

An engineering study is presently in progress to determine actions necessary to 1) provide additional leak detection and/or leak containment for the liquid gathering system, and 2) improve the material balance accounting between reported wellhead production and LACT Unit sales. At a minimum:

A) Inlet metering equipment may be installed on each of liquid gathering system lines.

B) An integrity test of the entire liquid gathering system may be initiated. While the testing method is still under evaluation, it appears that a pressure test would be the most expeditious alternative. The results of the integrity test would be analyzed to determine its effectiveness and future testing frequency.

C) Additional valves may be installed in the liquid gathering system. These valves would expedite leak detection and allow leaked volumes to be minimized. Additional valves would also simplify future testing of the gathering system.

The actions listed above are under evaluation for implementation during a Plant maintenance shutdown, currently scheduled for mid-September, 1991.

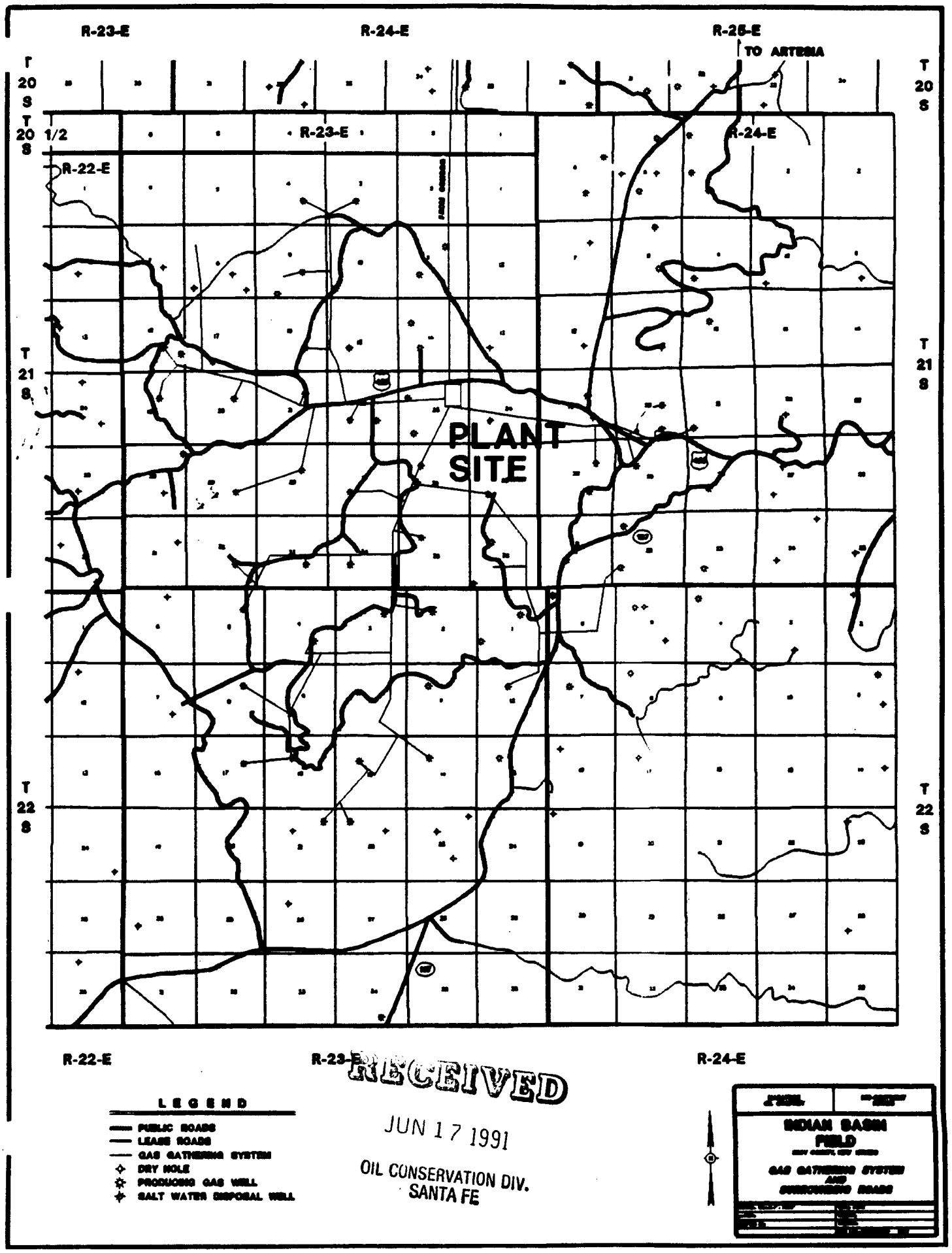
MARATHON OIL COMPANY
INDIAN BASIN SPCC PLAN
Filing Addendum

Eddy County, New Mexico

Additional actions under consideration at this time include:

D) Utilization of the six-inch encasement line as a means of containment and identification of leaks within the Arroyo. If implemented, the annular space between the encasement and the active line would be sealed on both ends. Surface access to this annular space may be provided, and detectors may be installed to continuously monitor the system for hydrocarbon vapors and/or hydrogen sulfide. These detectors may be connected to the IBGP control system, allowing continuous and automatic readings. An action plan may be prepared to outline appropriate responses to specific situations.

EXHIBIT 1



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JUN 17 1991
OIL CONSERVATION DIV.
SANTA FE

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JUN 17 1991
OIL CONSERVATION DIV.
SANTA FE

Marathon Oil Company

Midland, Texas 79702

PRELIMINARY APP.	DATE	FINAL APP.	DATE

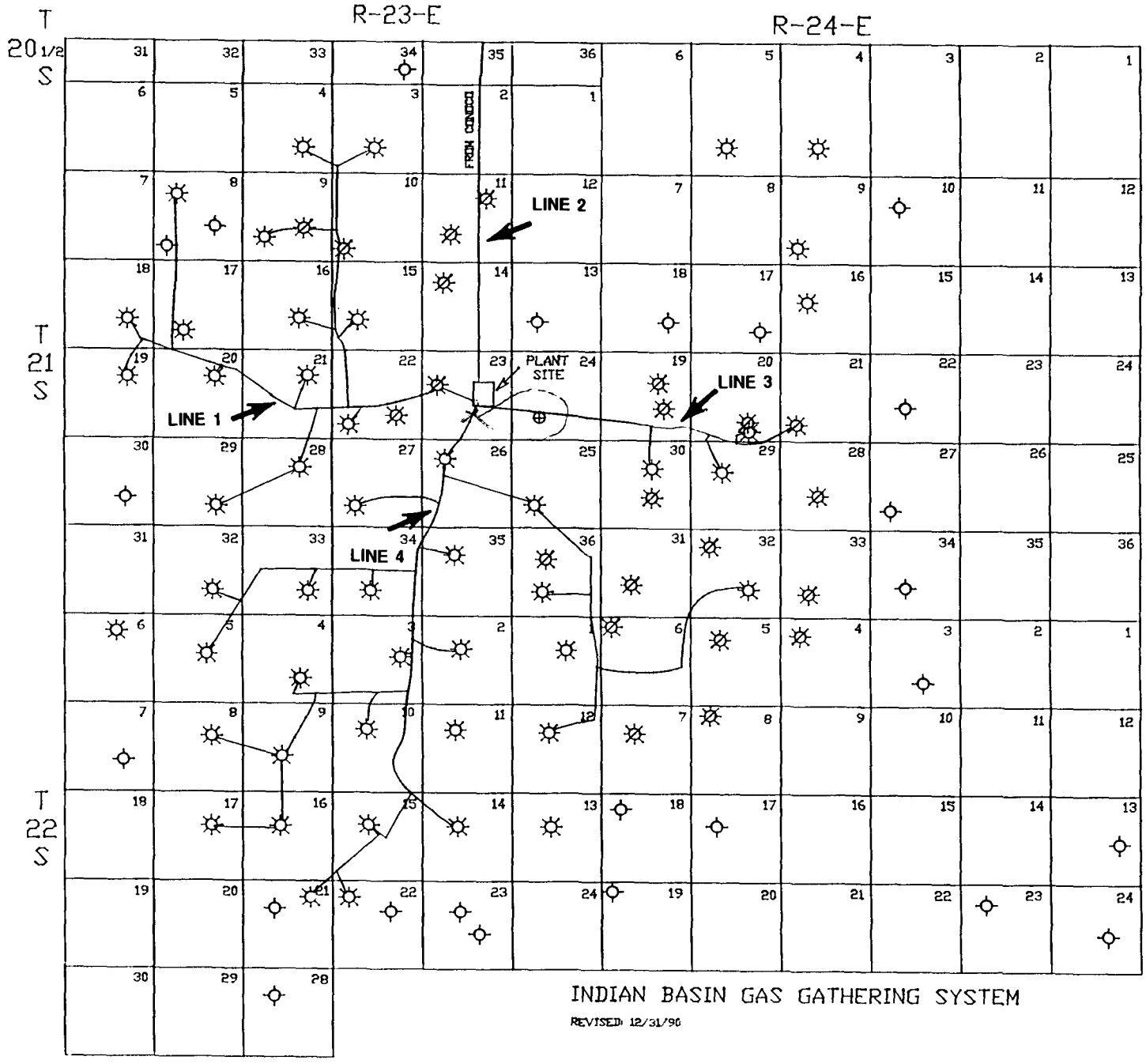
DATE	BY	REVISIONS

EXHIBIT 2

INDIAN BASIN GAS PLANT

SCALE	AS SHOWN	DATE	10 - 12 - 90
DRAWN BY	MICHAEL REED		DWG. NO
BY	ERIC PRINGLE		IBGP-4
INDIAN BASIN GAS FIELD			

EXHIBIT 3



INDIAN BASIN GAS GATHERING SYSTEM

REVISED 12/31/90

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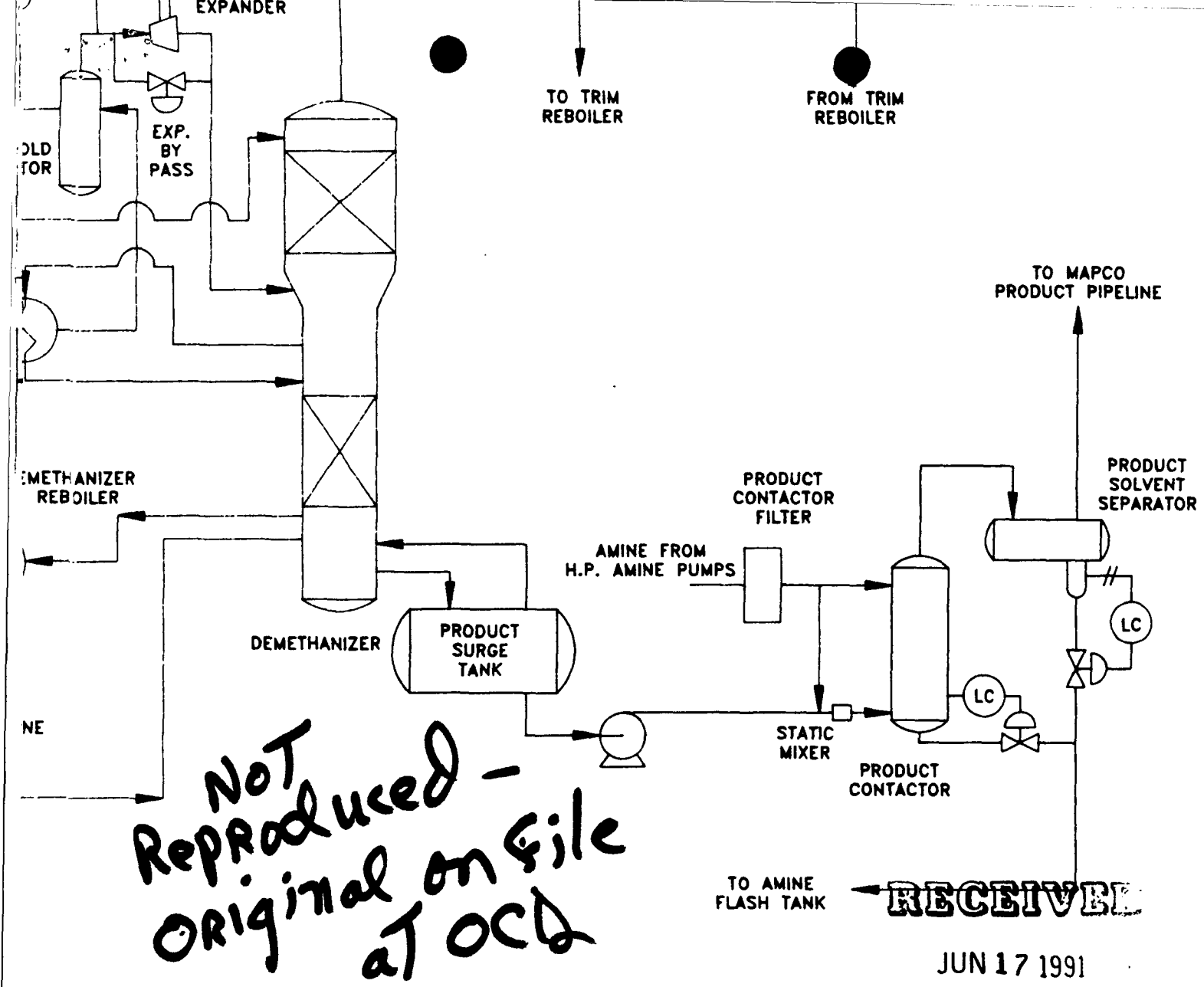
SANTA FE



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SANTA FE

Marathon Oil Company

Midland, Texas 79702

PRELIMINARY APP.	DATE	FINAL APP.	DATE

DATE	BY	REVISIONS

EXHIBIT 4

PROCESS FLOW DIAGRAM

SCALE NONE	DATE 11 - 19 - 90
DRAWN BY MICHAEL REED	DWG. NO
BY ERIC PRINGLE	IBGP-:
INDIAN BASIN GAS PLANT	

OCD FILES

35MM DRAWINGS

2R-22

FILE NUMBER

General Correspondence

DOCUMENT TYPE

2001-1991

1

NO OF DWGS

65

BOX

OCD/ BLM/ MOC Meeting
6/10/91

Name	Affiliation
Tony Kuman	Marathon - Midland
Bert Smith	Roberts / Schornick & Assoc.
Kathy Brown	OCD
J.D. WHITLOCK, Jr	BLM
Johnny Robinson	OCD
David Boyer	OCD
Jim Amos	BLM
Al Collar	BLM
~~Duncan Whitlock~~	
Dick Manus	BLM
BOB STOVALL	OCD
Dave Conway	Marathon - Littleton
Tom Kurzy	Marathon, Midland
R.T. Bruner	MOC, Midland

BLM/OCD/MOC MEETING

JUNE 10, 1991

TENTATIVE AGENDA

1. Tour of site.
   - Overview of on-site activities.

2. Review of geologic findings.
   - Review of confining/bedrock surface.
   - Review of cross sections.

3. MOC plan to drill into bedrock.
   - Purpose
   - Locations
   - Drilling procedure

   Note: Plans are to reach mutual agreement on these wells into the bedrock, so drilling activity can commence by the end of the week.

4. Sampling and analyses.
   - Data management
   - QA/QC

5. Overview of future remediation possibilities.
   - Liquid recovery
   - Soil venting studies
   - Biofeasibility studies
   - Alternative technologies?

79 Boreholes
53 completed as recovery wells
19 Pumping recovery pits and wells

30-35 bbls/day condensate
50-60 up to 100 bbls/day water

Saturday 6/8 - Last shallow hole drilled

(1) Telescoping 10" steel thru alluvial 16 hrs cement
Casing MW. PVC 8" Surface - Thru 50 ft
4" To Queen 10-20 ft/screen
Will core 1st 30' Bedrock, Est. Depth 180-200.
Location S1400, E2800, Headspace, cores
Air hammer percussion Rig
(II) If encounter condensate will complete as Shallow MW
(III) Shallow bedrock 30-40 into bedrock
(2) S 2100 E 2200 Late early
S 400 E 2400 / Submit well
600 construction.
(3) N ~~800~~ E 1800
(4) Monitor wells at gas plant.
all samples weekly

coreholes - 15' ~~Min~~ unless have
signif. feature

4. Sampling & Analyses

Response two weeks from Day in Mail

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INDIAN BASIN REMEDIATION

JUNE 2, 1991

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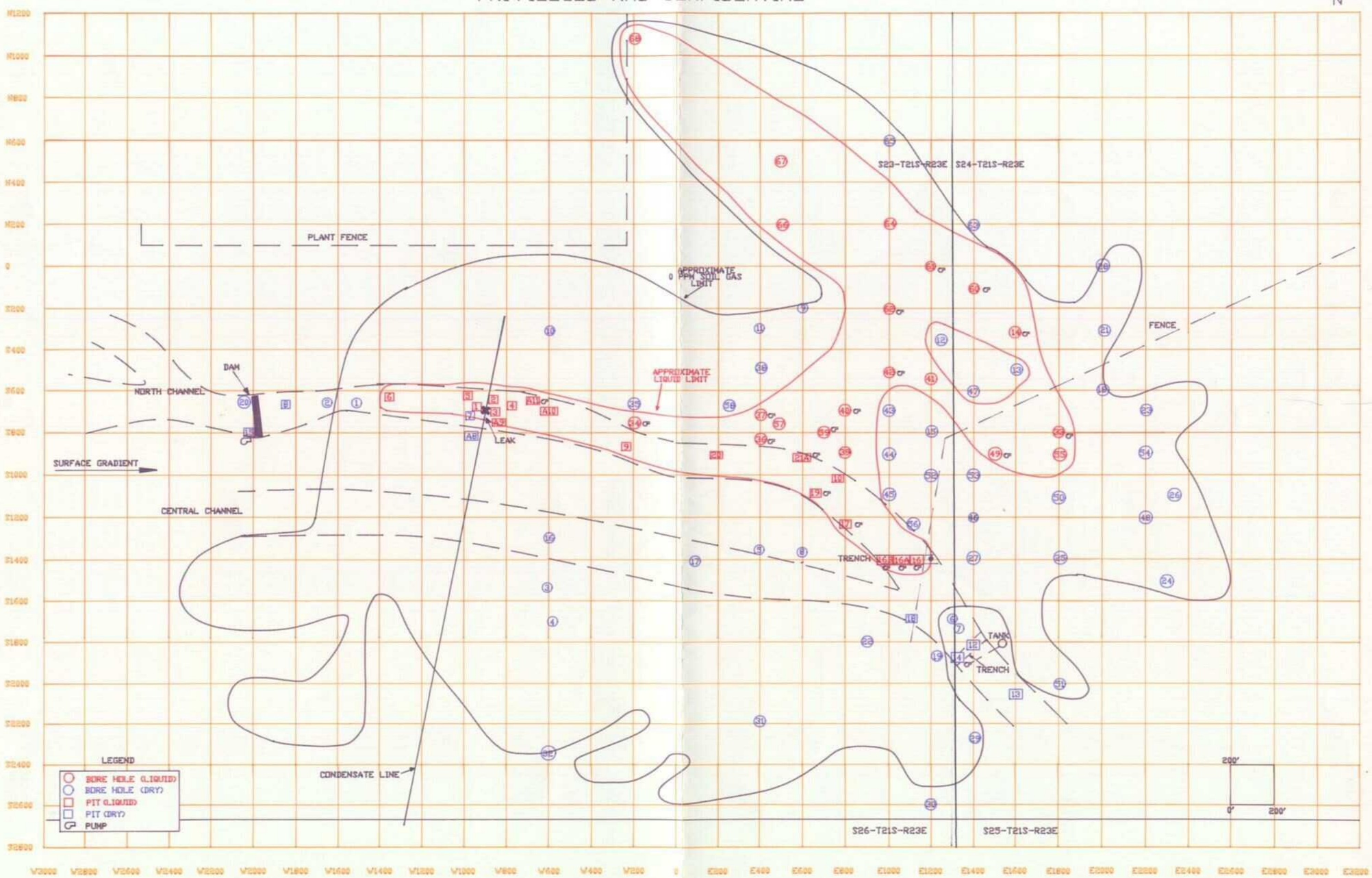

Mid-Continent Region
Production United States

OIL CONSERVATION DIVISION
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Marathon Oil Company

'91 JUN 5 AM 11 34

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

June 4, 1991

David G. Boyer, Hydrogeologist
Environmental Bureau Chief
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Dear Mr. Boyer:

Attached, is a copy of a map indicating recent drilling activity at our Indian Basin leak site, as per your request. Please note that the soil gas probe results have been deleted from the map to make it easier to reference. Soil gas work at the site concluded during the second week of May. Therefore, all soil gas measurements were identified on the map forwarded to you last week. Cumulative recovery as of the morning of June 3, 1991 totaled 2724 barrels of condensate and 2136 barrels of water.

The various fluid samples which you have requested have been submitted to Core Laboratories in Aurora, Colorado for analyses. A response to your recent data request will be provided upon receipt of the final analytical results.

Should you have any questions, or wish to discuss, please contact me at your convenience.

Sincerely,

A J Kavran

A. J. Kavran
Environmental and Safety Supervisor

AJK/elg

Attachment

cc: J. L. Benson
A. R. Kukla
R. F. Unger
D. L. Manus (BLM-Carlsbad)
File

BUSINESS DIGEST

Alb. Journal 6/4/99

COMPILED FROM JOURNAL WIRES

Oil Leak Not Illegal, State Says

SANTA FE — Marathon Oil Co. won't be cited or fined for a 1.47 million-gallon oil leak north of Carlsbad, a state attorney said.

Robert Stovall, a lawyer for the state's oil conservation division, said the leak didn't violate any laws.

Marathon's leak has spread nearly a half-mile from the point where it began dripping from an underground pipeline at the company's plant in Lakewood.

Marathon officials discovered the leak in mid-April but said they believe the oil had been leaking since at least November 1990. About 840,000 gallons of waste water leaked with the spill.

Marathon oil leak doesn't break the law

By TONY DAVIS
Staff reporter

An oil company won't be cited or fined for a recent 1.47 million-gallon oil leak because the leak didn't violate any laws, a state attorney says.

Marathon Oil Co.'s leak has spread nearly a half-mile from the point where it started dribbling from an oil pipeline north of Carlsbad.

Oil company officials discovered the leak in mid-April, but they and state officials say they believe the oil had been leaking since at least November 1990.

About 840,000 gallons of waste water leaked with the oil. The leak was the state's largest in recent years. The waste water is mostly salt water, but it contains small amounts of dissolved oil.

Under state law, spills and leaks do not violate the law unless they are deliberate, they contaminate water, the company fails to report the spill or it refuses to clean it up, says Robert Stovall, a lawyer for the state's oil conservation division.

But an Albuquerque environmentalist, Chris Shuey, says he's "incredulous" and "amazed" that the leak violates no laws.

The law should be changed to make it easier to prosecute and fine companies that have leaks or spills of this scale, Shuey said.

"The message we send to operators is that as long as you report on time and clean it up, it's OK to have a 2.3 million gallon leak," Shuey said.

"If I took my garbage out in front of my house and dumped it on the ground, how long would I get away with that before someone came out and cited me for littering and creating a public nuisance?"

But in this case, Stovall said, Marathon, a subsidiary of Pittsburgh conglomerate USX, formerly U.S. Steel, reported the leak when it occurred and is slowly pumping out the oil. The area's groundwater is in little danger of being contaminated because the water table lies 200 feet deep, beneath a layer of near-impervious bedrock, state officials say. The light, gasoline-like oil lies about 12 feet below the ground, state officials say.

This leak was an accident, caused by a corroded oil pipeline, state officials said.

"The most important thing is that they report the leak, so you can do something about it," Stovall said. "The company lost a lot of money when this stuff disappeared. That should be a big incentive for them right there (to prevent future leaks)."

Currently, state officials are reviewing their regulations to see if they should require oil companies to test their pipelines more often for corrosion.

Marathan has said it hadn't tested the pipeline that leaked since it installed the line five years ago. The state has no testing requirements for pipeline that lead from oil and gas fields to refineries and processing plants.

ALB. Tribune 6/3/91

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'91 MAY 29 AM 11 17

Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 28, 1991

State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Attn: Mr. David G. Boyer, Hydrogeologist
Environmental Bureau Chief

Dear Mr. Boyer:

Attached, for your review, is a copy of a map indicating recent drilling and soil gas probe activity at our Indian Basin leak site, as per your request. Cummulative recovery as of the morning of May 24, 1991 were 2277 barrels of condensate and 1320 barrels of water.

Work is underway in preparation of a response to your written request received on May 20, 1991. Numerous water samples have been obtained for analyses to obtain the data requested in Section C of your letter. A response to your request will be provided upon receipt of the analytical results.

Should you have any questions or wish to discuss, please contact me at your convenience.

Sincerely,

A J Kavran

A. J. Kavran
Environmental & Safety Supervisor

Attachment

AJK/lgh

cc: J. L. Benson
A. R. Kukla
R. F. Unger
D. L. Manus (BLM - Carlsbad)

INDIAN BASIN REMEDIATION

MAY 23, 1991

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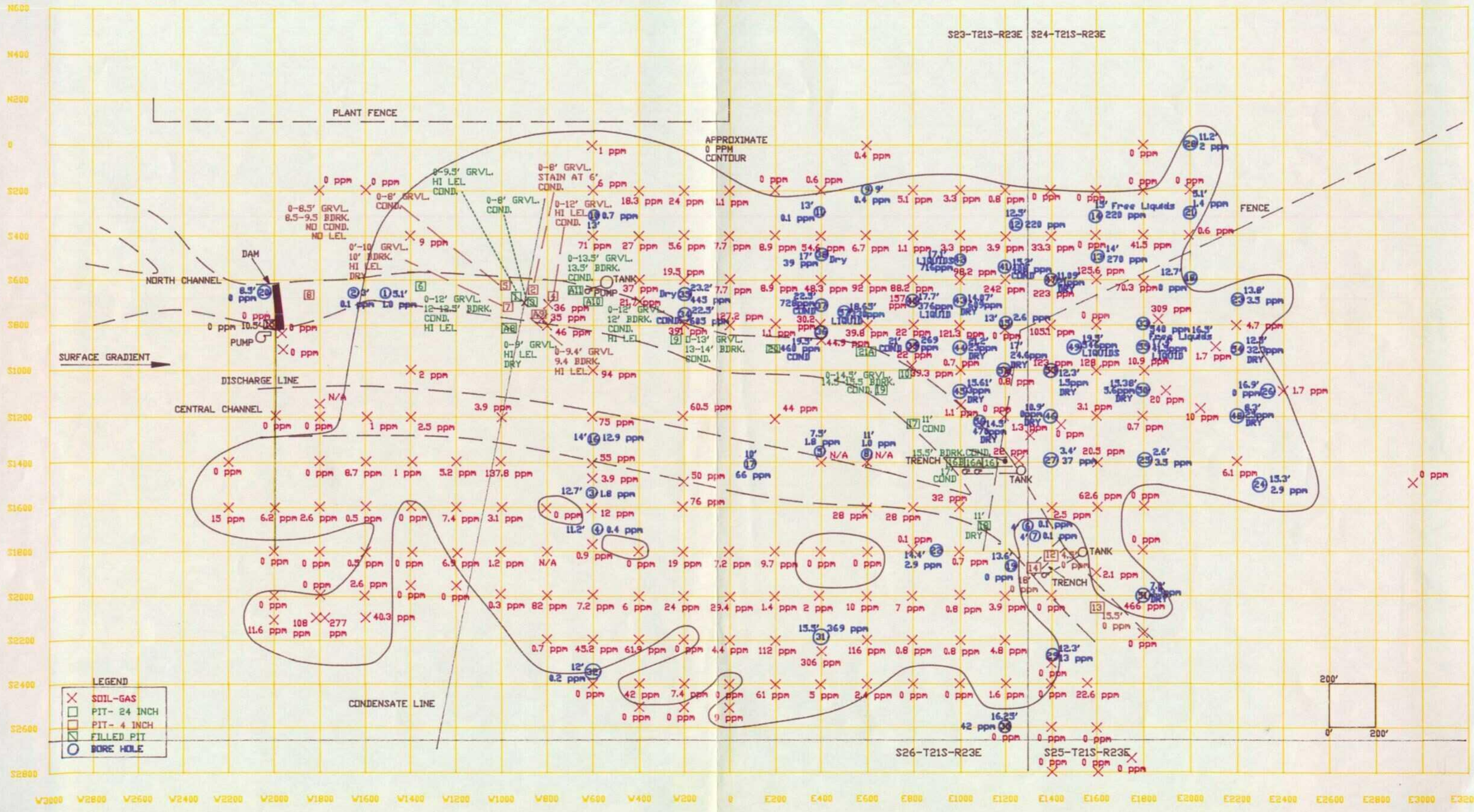

Mid-Continent Region
Production United States

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91 MAY 28 PM 2 12

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

May 22, 1991

State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
P. O. Box 2088
State Land Office Building
Santa Fe, New Mexico 87504

Attn: Mr. David G. Boyer, Hydrogeologist
Environmental Bureau Chief

Dear Mr. Boyer:

I have designated Mr. A. J. (Tony) Kavran as the Project Coordinator for the Indian Basin incident. Tony's normal position was Environmental and Safety Supervisor for Marathon's Mid-Continent Region. In this new temporary assignment he will report directly to me. Our onsite coordinators, remediation contractor, research laboratory and public relations will communicate directly through Tony on all matters concerning this incident and its remediation.

Tony will be responsible for coordinating the continuing delineation effort and developing and acquiring your concurrence with our remediation plan. He will be contacting you in the near future to establish a location and frequency for routine progress updates. Likewise, for any special requests or meetings, feel free to contact him directly. It would be appreciated if site visits would be coordinated through Tony.

Tony's base of operations will primarily be Carlsbad and will be available either at a temporary accommodation or at the Indian Basin Gas Plant. We will supply you with a telephone number at his temporary accommodation when arrangements are complete. The Indian Basin Gas Plant number is (505) 457-2621 and the Indian Basin fax number is (505) 457-2544. The address at the plant is P. O. Box 1324, Artesia, New Mexico 88211-1324.

This assignment is consistent with Marathon's commitment to an expeditious and proper remediation of the leak and as well, to provide a single point contact for Marathon interactions with all jurisdictional agencies.

Should you need to speak with me directly, however, as in the past please feel free to do so.

Very truly yours,

Robert F. Unger
Production Manager
Midland Operations

RFU/118/jmh

xc: Mike Williams - Artesia NMOCD
A. J. Kavran - IBGP

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

BRUCE KING
GOVERNOR

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

May 15, 1991

CERTIFIED MAIL
RETURN RECEIPT NO. P-327-278-118

Mr. R. F. Unger, Production Manager
Midland Operations
Marathon Oil Company
P. O. Box 552
Midland, Texas 79702

RE: April 12, 1991, Leak of Condensate and Produced Water, Marathon Indian Basin Gas Field, Eddy County, New Mexico

Dear Mr. Unger:

The New Mexico Oil Conservation Division (OCD) has received your April 22, 1991, written notification of the above leak of fluids. Verbal notification was provided to OCD on the morning of the leak discovery, as required by OCD Rule 116. Subsequent to the written notification, on April 29, 1991, OCD received a copy of the "Site Characterization Plan" (SCP) provided to the Bureau of Land Management. Both the OCD notification letter and the Site Characterization Plan provide information on the circumstances of the incident, volumes of fluids lost and interim measures being taken to investigate the extent of the spill and recover fluids.

The NMOCD has authority under both the Oil and Gas Act (70-2-1 et seq., NMSA 1978) and the New Mexico Water Quality Act (74-6-1 et seq., NMSA 1978), and rules and regulations adopted thereunder, to require actions be taken to protect public health and the environment and prevent water pollution; and to require corrective actions as are necessary or appropriate to contain, remove or mitigate the damage caused by a discharge of water pollutants. This letter is a request for your continued voluntary compliance in taking the corrective actions needed to investigate, assess, contain, remove and mitigate actual or potential environmental pollution that has been or may be caused by this spill.

OCD requests that further information be provided this agency regarding the circumstances of the incident, the progress of the technical investigation and other actions proposed to be taken by Marathon. OCD will review and comment in writing on actions already taken, review for approval proposed actions, and, if necessary, require that additional actions be undertaken if to prevent or abate pollution. The Site Characterization Plan already submitted was an excellent report providing timely information on the circumstances of the spill and immediately actions taken by Marathon in response to the spill.

Request For Information

In addition to the information provided in the SCP, Marathon is required to provide the following information:

A. Investigation Activities

1. Supply an updated map of remediation locations (soil gas measurement points, pits, borings, etc.) Please provide an updated map weekly during the investigation phase of the remediation.

2. Provide updated copies of Tables 2, 3 and 4 weekly during the investigation phase. Please revise Table 3 (Soil Boring Details) to include information on whether fluids were detected and type (water and/or condensate), fluid thickness, and indicate quality (fresh or produced water) of fluids. Include information as to whether the boreholes were completed as monitor and/or extraction wells.

3. Provide information on trenching activities (locations, rock characteristics, and type and quantity of any fluids encountered).

4. Provide weekly summaries of types and volumes of fluids recovered.

B. Site Geology

1. Provide lithologic information on the bedrock (both sandstone and dolomite) encountered at the leak site.

2. Provide additional information on the lithologic and structural characteristics of subsurface material beneath the spill site to first deep ground water (Lower Queen aquifer). Include information and interpretation on possible occurrence and continuity of vertical joint/fracture patterns in the subsurface. (Several core holes having shallow geoligic data were referenced in the attached site characteristics section of the Gas Plant Discharge Plan.)

3. Some soil boring records (Appendix G) were illegible due to photocopying problems. Please provide complete copies of all logs.

C. Water Quality

1. Provide an analysis of the quality of the produced water discharged with the condensate. The analysis should include both general water chemistry parameters and ICAP metal constituents (both shown on the attached sheets), plus arsenic, selenium and mercury by the appropriate EPA atomic adsorption method.

2. Provide information on whether any shallow fresh water has been detected by the investigation in the vicinity of the spill. Indicate which boreholes, pits or trenches, if any, have intercepted fresh water.

3. In a phone call on May 8th with Mr. Tony Kavran of Marathon and myself, Marathon committed to weekly sampling of nearby domestic water wells. Please furnish the names and locations of those wells to be sampled, and constituents to be analyzed. We request that at least one sample at each well be analyzed for general water chemistry parameters.

4. In addition to the domestic wells we request that you sample the #6 and #13 stock wells shown on Exhibit 8 of the SCP, Indian Big Springs (21S-24E-Sec. 27.210), and the first seepage water in Rocky Arroyo downstream from the spill. Propose a schedule for future periodic monitoring of these locations.

D. Miscellaneous Information

1. Provide information on the material and age of the failed section of condensate line (the SCP does not make clear whether the failed section was PVC or steel, see p. 8 and 21) and whether the failure was likely due to internal or external corrosion.

2. Exhibit 9 (5-7-91) shows elevated soil-gas concentrations at some locations that appear isolated from the spill. These locations require further investigation to determine the source of this gas.

3. Provide information on material, age and testing program for other sections of the Indian Basin Gathering lines so that a reoccurrence of this incident does not occur. Provide a map showing the location of these lines.

Proposed Remediation

A. *Groundwater Monitoring*

Prior to drilling deep (Lower Queen) ground water monitoring wells, locations and construction details must be approved by OCD. Because of the possibility of cross-contamination, OCD discourages the drilling of deep monitor wells within the defined plume area. Any such drilling will require that special precautions be taken to prevent downward movement of contaminated fluids.

B. Remediation Plan

As discussed on page 31 of the SCP, submit a plan for product recovery and remediation of the affected area for OCD review and approval. After review of the plan, OCD will provide comments to Marathon and the BLM. During the time of review, OCD will coordinate with BLM to prevent, to the extent possible, duplication of effort. However, OCD recognizes that as the surface owner, BLM may require work in addition to that which OCD would require. Therefore, it will be necessary for Marathon consult with BLM as to their additional requirements.

Unfortunately, due to staff limitations, OCD can not provide a full-time staff person to be on-site during investigation and remediation efforts. However, OCD Artesia and OCD Santa Fe staff will visit the site periodically to monitor progress and communicate with you or your staff on the remediation.

If you have any questions regarding the information requests in this letter or on any other issue, please contact me at the above address or by phone at (505) 827-5812.

Sincerely,

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

DGB/sl

Enclosures

cc: OCD Artesia Office
Kathy Sisneros, WWMD, Environment Department
Dick Manus, BLM - Carlsbad Office
Al Collar, BLM - Roswell Office

DATE: 8/18/89 REVISED:	SITE CHARACTERISTICS	PAGE 3 of 4

GEOLOGIC DESCRIPTION OF DISCHARGE SITE

The memorandum "Queen and Related Aquifers in the Indian Basin" by R. B. Collins, Jr., (Appendix D) states that no water was encountered above about 240 feet when the Marathon Water Well #1 was drilled in July, 1965. This well is referred to as Water Well 21.23.23.232 in the Collins report. The upper Queen aquifer is not in the vicinity of the gas plant. The available evidence indicates that the upper and lower Queen aquifers are not interconnected.

Information from core hole I-24-21S-23E drilled by Marathon in an adjacent section was correlated with the log of well E-23-21S-23E drilled near the Indian Basin Gas Plant. The formation characteristics from the surface to the lower Queen aquifer are:

0-60' Mainly sandstone with some dolomite
60-130' Mainly dolomite
130-530' Dolomite and Anhydrite

The interpretation of this information indicates the interval from approximately 60 feet to the lower Queen aquifer is a tight formation. This geological condition should protect the lower Queen

aquifer from surface contaminants.

FLOOD PROTECTION

The potential for flooding at the Indian Basin Gas Plant is virtually non-existent. Rocky Arroyo is located at a lower elevation than the gas plant. The arroyo periodically has flowing water due to runoff, but does not pose a threat to the plant.

A diversion berm has been placed on the north and west sides of the gas plant to divert flow that may occur during a major precipitation and runoff event. Runoff tends to flow in a southeasterly direction towards Rocky Arroyo.

EXHIBIT A

ITEM	ANALYSIS DESCRIPTION	ITEM PRICE
032	Metals By [redacted] Method 6010	In Water [redacted]

Aluminum	Lead
Antimony	Magnesium
Arsenic	Manganese
Barium	Molybdenum
Beryllium	Nickel
Boron	Potassium
Cadmium	Selenium
Calcium	Silicon
Chromium	Silver
Cobalt	Sodium
Copper	Thallium
Iron	Vanadium
	Zinc

In Water Method 6010 [redacted]
In Soil Method 3050 [redacted]

033 Cations and Anions (General [redacted])

Method:
From 40 CFR 136.3
List of approved
inorganic test
procedures.

Compond	Method
Calcium	EPA Method 215.1
Potassium	EPA Method 258.1
Magnesium	EPA Method 242.1
Sodium	EPA Method 273.1
Bicarbonate	APHA 263
Carbonate	APHA 263
Chloride	EPA Method 325.3
Sulfate	EPA Method 375.4
Total dissolved solids	EPA Method 160.1
Cation/Anion Balance (5%)	
pH	
Conductivity	

In Water [redacted]

EXHIBIT A

ITEM	ANALYSIS DESCRIPTION		ITEM PRICE
022	[redacted] AA Method 7060	In Water	[redacted]
023	Barium: AA Method 7080	In Water	[redacted]
024	Chromium: AA Method 7190	In Water	[redacted]
025	Chromium (Hexavalent) AA Method 7198	In Water	[redacted]
026	Cadmium: AA Method 7130	In Water	[redacted]
027	Lead: AA Method 7421	In Water	[redacted]
028	[redacted] AA Method 7470	In Water	[redacted]
029	Mercury(S): AA Method 7471	In ~~Water~~ Soil	[redacted]
030	[redacted] AA Method 7741	In Water	[redacted]
	OR		
031	[redacted] AA Method 7740	In Water	[redacted]

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

BRUCE KING
GOVERNOR

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

May 13, 1991

CERTIFIED MAIL
RETURN RECEIPT NO. P-327-278-123

Mr. R. F. Unger, Production Manager
Midland Operations
Marathon Oil Company
P. O. Box 552
Midland, Texas 79702

RE: Site Characterization Plan, Indian Basin Gas Field

Dear Mr. Unger:

As a result of our conversation of May 8th, I am returning, without retaining a copy, Appendix F, ("GC Characterization of Condensate"), of the above document. Without making a determination as to whether the material in that Appendix is "Privileged and Confidential," I believe the detailed information provided is extraneous to OCD's part in the investigation and recovery effort. The remainder of the document is to be available for public use upon request.

In general, materials provided to the state in furtherance of our official duties are considered public records and available for inspection. The grounds on which material may be considered confidential are quite narrow. A copy of the appropriate section of the Water Quality Act (74-6-12.B) is enclosed.

If you have any questions please contact me at (505) 827-5812.

Sincerely,

David G. Boyer, Hydrogeologist
Environmental Bureau Chief

DGB/sl

Enclosure

cc: OCD artesia Office w/enclosure
Dick Manus, BLM Carlsbad Office w/enclosure
Al Collar, BLM Roswell Office w/enclosure

History: 1953 Comp., § 75-39-10, enacted by Laws 1967, ch. 190, § 10; 1970, ch. 64, § 6; 1971, ch. 277, § 52.

Delayed repeals. — See 74-6-14 NMSA 1978.

Environmental improvement agency. — The environmental improvement agency, referred to in this section, was abolished by Laws 1977, ch. 253, § 5. Section 9-7-4 NMSA 1978 creates the health and environment department, consisting of several divisions, including an environmental improvement division, and Laws 1977, ch. 253, § 14 provides that all references to the agency shall mean the division.

Law reviews. — For comment, "Control of Industrial Water Pollution in New Mexico," see 9 Nat. Resources J. 653 (1969).

For article, "The Assurance of Reasonable Toxic Risk?," see 24 Nat. Resources J. 549 (1984).

Am. Jur. 2d, A.L.R. and C.J.S. references. — 61A Am. Jur. 2d Pollution Control §§ 493, 538, 539.

39A C.J.S. Health and Environment § 144.

74-6-12. Limitations. (Effective until July 1, 1994.)

A. The Water Quality Act [74-6-1 to 74-6-4, 74-6-6 to 74-6-13 NMSA 1978] does not grant to the commission or to any other entity the power to take away or modify property rights in water, nor is it the intention of the Water Quality Act to take away or modify such rights.

B. Effluent data obtained by the commission or a constituent agency shall be available to the public. Other records, reports or information obtained by the commission or a constituent agency shall be available to the public, except upon a showing satisfactory to the commission or a constituent agency that the records, reports or information or a particular part thereof, if made public, would divulge methods or processes entitled to protection as trade secrets.

C. The Water Quality Act does not authorize the commission to adopt any regulation with respect to any condition or quality of water if the water pollution and its effects are confined entirely within the boundaries of property within which the water pollution occurs when the water does not combine with other waters.

D. The Water Quality Act does not grant to the commission any jurisdiction or authority affecting the relation between employers and employees with respect to or arising out of any condition of water quality.

E. The Water Quality Act does not supersede or limit the applicability of any law relating to industrial health, safety or sanitation.

F. In the adoption of regulations and water quality standards and in any action for enforcement of the Water Quality Act and regulations adopted thereunder, reasonable degradation of water quality resulting from beneficial use shall be allowed.

G. The Water Quality Act does not permit the adoption of regulations or other action by the commission or other constituent agencies which would interfere with the exclusive authority of the oil conservation commission over all persons and things necessary to prevent water pollution as a result of oil or gas operations through the exercise of the power granted to the oil conservation commission under Section 70-2-12 NMSA 1978, and other laws conferring power on the oil conservation commission.

History: 1953 Comp., § 75-39-11, enacted by Laws 1967, ch. 190, § 11; 1973, ch. 336, § 6.

Delayed repeals. — See 74-6-14 NMSA 1978.

Law reviews. — For comment, "Control of Industrial Water Pollution in New Mexico," see 9 Nat. Resources J. 653 (1969).

For note, "New Mexico Water Pollution Regulations and Standards Upheld," see 19 Nat. Resources J. 693 (1979).

For article, "The Assurance of Reasonable Toxic Risk?," see 24 Nat. Resources J. 549 (1984).

74-6-13. Construction. (Effective until July 1, 1994.)

The Water Quality Act [74-6-1 to 74-6-4, 74-6-6 to 74-6-13 NMSA 1978] provides additional and cumulative remedies to prevent, abate and control water pollution, and nothing abridges or alters rights of action or remedies in equity under the common law or statutory law, criminal or civil. No provision of the Water Quality Act or any act done by virtue thereof estops the state or any political subdivision or person as owner of water rights or otherwise, in the exercise of their rights in equity or under the common law or statutory law to suppress nuisances or to abate pollution.

Recent oil leak calls attention to old pipelines

State lacked staff to deal with problem

By TONY DAVIS
Staff reporter

A recent 1.47 million gallon oil leak in southeast New Mexico may prod state officials into dealing with what they say is an old problem: corrosion of aging oil pipelines.

More than a year and a half ago, state Oil Conservation Division official David Boyer wrote a paper for a conference warning that much oil industry equipment and piping has deteriorated from age and corrosion.

"The first oil fields in southeast New Mexico are now greater than 60 years old," Boyer wrote. "Most of the other major fields are over 25 years old. . . ."

"A combination of decreased maintenance and aging equipment leads to more spills and leaks from failures of lines, tanks and valves," wrote Boyer in the paper presented at a fall 1989 conference of New Mexico State University's Water Resources Research Institute.

This week, after Marathon Oil Co. reported a 1.47 million gallon oil leak in April north of Carlsbad, Boyer said the division plans soon to start discussing what to do about corrosion.

About 840,000 gallons of waste water leaked with the Marathon oil, the state's largest oil leak in recent years.

About a dozen oil leaks and spills, most very small, are reported to the state each week, Boyer said. Corrosion of equipment often is listed on the report as a cause.

Marathon's leak was caused by corrosion, said company spokesman Bill Ryder. This pipeline, however, is not old. It was installed five years ago.

Boyer's office has two file drawers full of spill and leak reports from the past six years he hasn't had time to analyze, he said. Most of the leaks and spills are of less than 100 barrels, or 4,200 gallons.

If nothing is done about corrosion, more leaks and spills will strike, perhaps some that are more serious, Boyer said.

Many crude and refined oil products, including the oil that leaked from Marathon, contain the cancer-causing hydrocarbon chemical benzene.

The oil products also contain non-cancer-causing toxic chemicals such as toluene and xylene.

"It's just like a water main in the ground. It's just like a car that's 25 years old," said Boyer, the division's environmental bureau chief. "Things wear out. Things break."

The oil division, which regulates the oil industry's environmental problems, took no action after his paper came out because it had too much to do and not enough people, Boyer said. It can look at corrosion now because it's hired two new staffers and is catching up with its other work, he said.

Boyer declined to say what steps the division may take. An Albuquerque environmentalist, Chris Shuey of the Southwest Research and Information Center, says new regulations are needed to force companies to monitor pipelines more thoroughly for corrosion and to upgrade corroded lines.

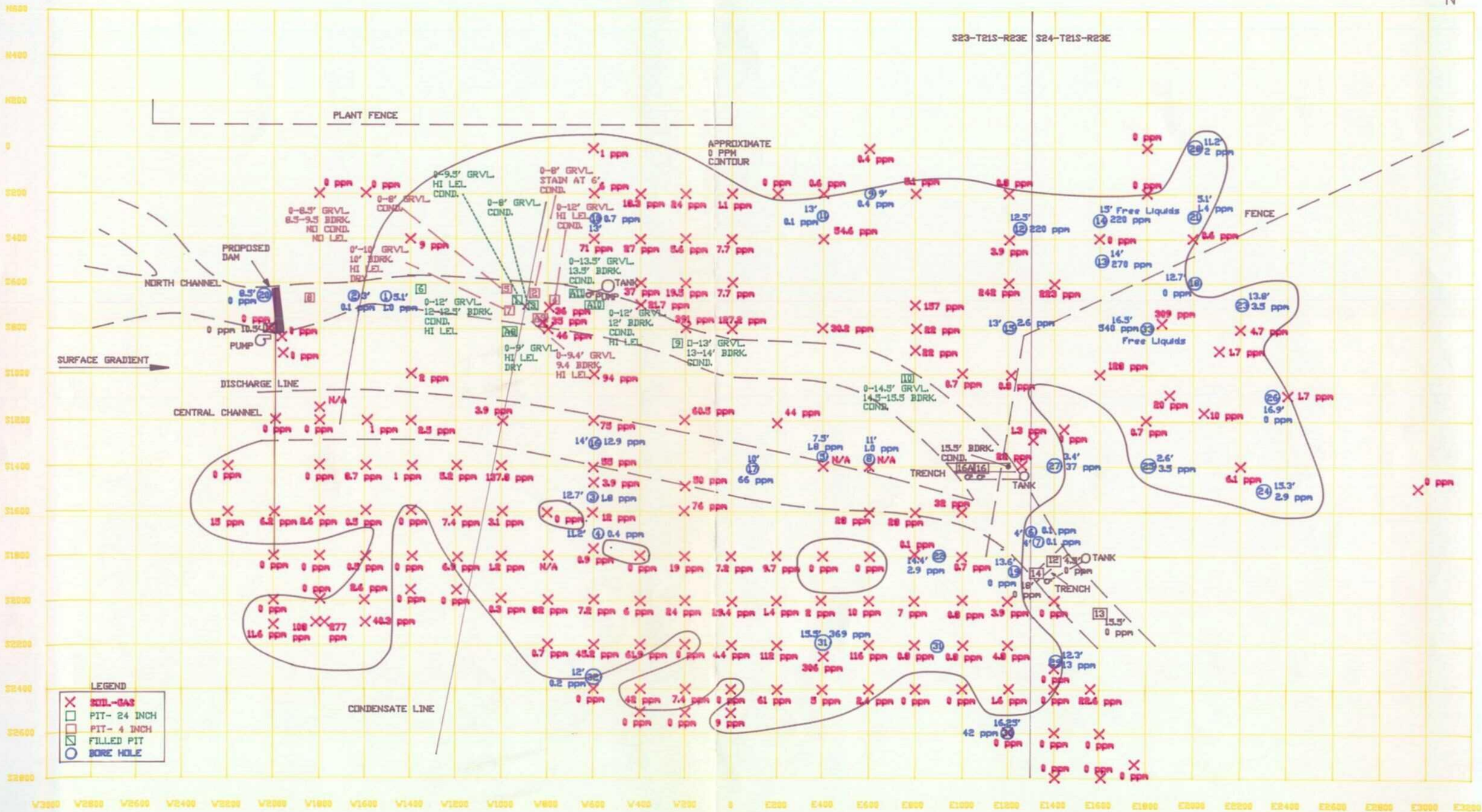
Oil companies appear to be split on the issue, with some saying they can live with new regulations and some saying they are unnecessary.

Among the "very, very" vulnerable areas in the state near oil pipelines and other oil facilities are the Pecos River in southeast New Mexico, the Ogallala Aquifer near Hobbs and the rivers near the oil-gas stronghold of Farmington, Boyer said.

INDIAN BASIN REMEDIATION

MAY 7, 1991

PRIVILEGED AND CONFIDENTIAL



INDIAN BASIN GAS PLANT [1]

	Total Gas Takes (MCF)[2]	Condensate Production (Bbls)	Bbls/MCF
1984			
Jan.	3,170,157	14,961	1:212
Feb.	3,263,743	16,051	1:203
Mar.	3,695,378	17,093	1:216
Apr.	3,103,178	14,033	1:221
May	3,185,543	13,822	1:230
June	2,838,281	12,304	1:231
July	3,433,239	13,839	1:248
Aug.	3,457,194	13,458	1:257
Sept.	3,327,294	11,499	1:289
Oct.	3,036,483	12,162	1:250
Nov.	3,253,865	14,166	1:230
Dec.	3,331,425	14,833	1:225
1985			
Jan.	3,216,499	14,584	1:221
Feb.	2,475,474	11,378	1:218
Mar.	3,375,454	14,573	1:232
Apr.	2,942,880	12,318	1:239
May	3,354,727	14,335	1:234
June	3,337,874	13,644	1:245
July	2,159,949	8,987	1:240
Aug.	1,635,873	6,382	1:256
Sept.	2,610,722	10,559	1:247
Oct.	2,769,006	10,174	1:272
Nov.	3,029,800	11,660	1:260
Dec.	3,212,943	13,212	1:243
1986			
Jan.	3,283,039	13,366	1:246
Feb.	2,865,754	12,857	1:223
Mar.	3,268,182	13,850	1:236
Apr.	2,028,369	8,399	1:242
May	1,503,963	6,386	1:236
June	1,196,568	3,923	1:305
July	856,760	2,658	1:322
Aug.	342,675	920	1:372
Sept.	350,007	1,345	1:260
Oct.	2,324,952	8,879	1:262
Nov.	2,680,605	11,367	1:236
Dec.	2,509,356	9,805	1:256

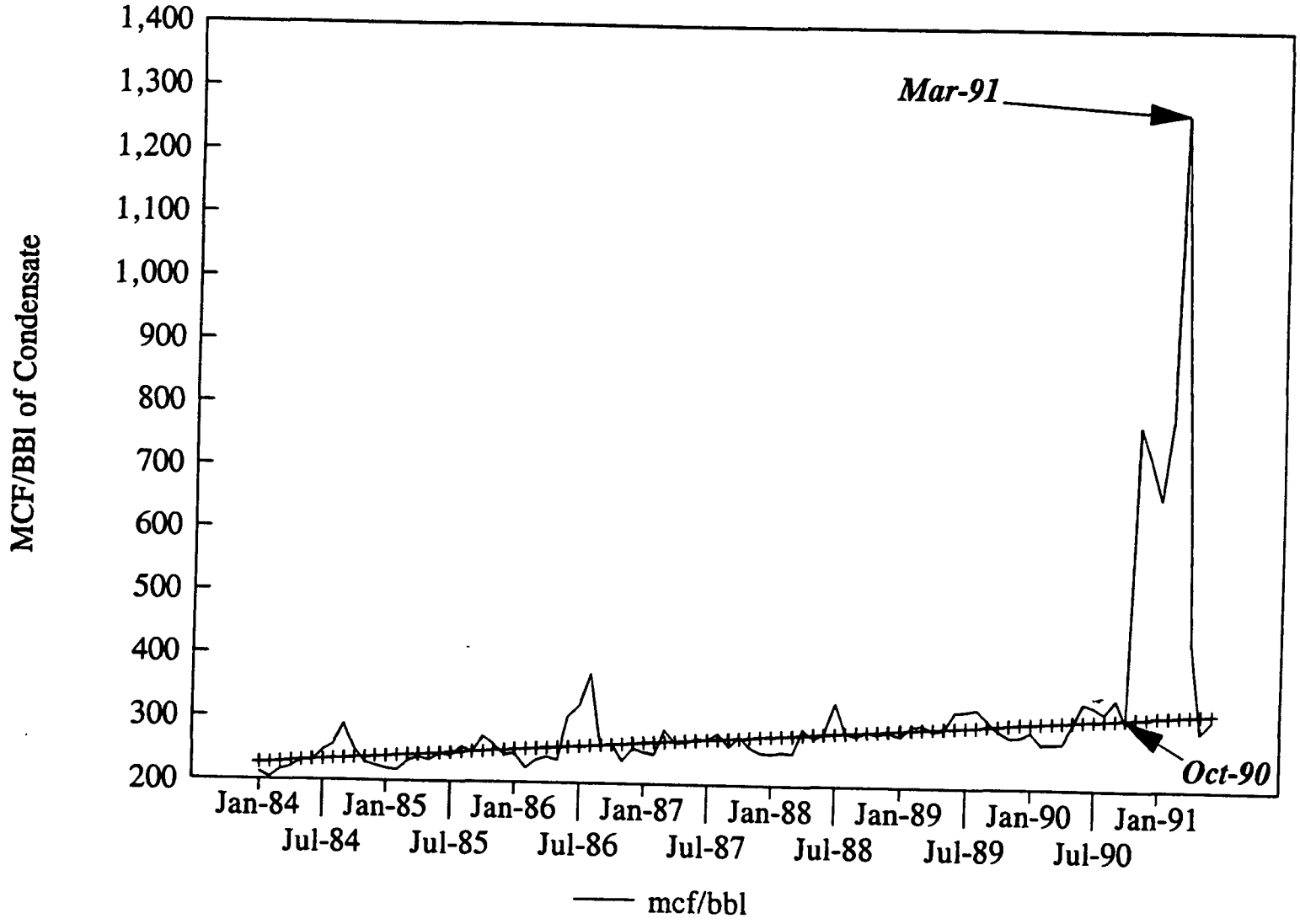
1987			
Jan.			
Feb.	1,300,158	5,276	1:246
Mar.	1,707,092	5,974	1:286
Apr.	1,431,773	5,388	1:266
May	2,180,422	8,187	1:266
June	1,644,451	6,026	1:273
July	1,933,676	7,142	1:271
Aug.	2,287,359	8,145	1:281
Sept.	2,549,247	9,811	1:260
Oct.	3,135,527	11,315	1:277
Nov.	3,250,908	12,493	1:260
Dec.	3,010,763	11,959	1:252
1988			
Jan.	2,959,549	11,815	1:250
Feb.	2,578,007	10,164	1:254
Mar.	1,769,747	7,050	1:251
Apr.	2,587,012	8,954	1:289
May	2,718,155	9,894	1:275
June	2,848,060	10,062	1:283
July	3,110,620	9,391	1:331
Aug.	3,195,795	11,206	1:285
Sept.	3,030,214	10,834	1:280
Oct.	3,223,288	11,229	1:287
Nov.	3,093,621	10,925	1:283
Dec.	3,248,310	11,308	1:287
1989			
Jan.	3,179,428	11,334	1:281
Feb.	2,999,988	10,145	1:296
Mar.	3,483,366	11,671	1:298
Apr.	3,317,637	11,435	1:290
May	3,254,475	11,143	1:292
June	2,761,299	8,645	1:319
July	2,779,983	8,661	1:321
Aug.	3,060,790	9,439	1:324
Sept.	3,071,146	10,014	1:307
Oct.	2,775,455	9,523	1:291
Nov.	3,258,708	11,581	1:281
Dec.	3,263,099	11,590	1:282
1990			
Jan.	3,156,128	10,900	1:290
Feb.	2,723,893	10,057	1:271
Mar.	3,352,458	12,352	1:271
Apr.	3,004,705	11,036	1:272
May	3,576,708	11,873	1:301
June	3,094,448	9,223	1:336
July	2,861,238	8,672	1:330
Aug.	3,330,080	10,423	1:319
Sept.	2,922,126	8,551	1:342
Oct.	3,549,495	11,591	1:306
Nov.	3,338,229	4,303	1:776
Dec.	3,206,413	4,436	1:723

1991			
Jan.	3,701,517	5,610	1:660
Feb.	2,957,938	3,774	1:784
Mar.	3,549,414	2,798	1:1268
Apr.	3,289,473	7,699	1:427
May	3,731,939	12,771	1:292
June	3,268,130	10,512	1:311

1. Data based on Marathon Oil Co. reports to OCD

2. This number includes a small percentage of off plant area take

Marathon Indian Basin Gas Plant



Mid-Continent Region
Production United States

Marathon Oil Company

P.O. Box 552
Midland, Texas 79702
Telephone 915/682-1626

April 22, 1991

Mr. M. B. Williams
Supervisor and Oil & Gas Inspector
New Mexico Oil Conservation Division
811 S. First Street
P. O. Drawer DD
Artesia, New Mexico 88210

Dear Mr. Williams:

In accordance with the applicable Rules and Regulations, the New Mexico Oil Conservation Division (NMOCD) was notified at 11:12 a.m. (MST) on April 12, 1991, of the discovery of a potential leak in a subsurface liquid gathering line which occurred directly south of the Marathon-operated Indian Basin Gas Plant.

Attached is a completed NMOCD report entitled "Notification Of Fire, Breaks, Spills, Leaks, and Blowouts". This completed written report is intended to fulfill the subsequent notification requirements as specified in Rule 116.

Should you have any questions, please direct your inquiries to me at the number indicated on the letterhead.

Sincerely,

R. F. Unger
Production Manager
Midland Operations

RFU/101/jmh

Attachment

OIL CONSERVATION DIVISION

NOTIFICATION OF FIRE, BREAKS, SPILLS, LEAKS, AND BLOWOUTS

NAME OF OPERATOR	MARATHON OIL COMPANY			ADDRESS	P. O. BOX 552, MIDLAND, TX 79702	
REPORT OF	FIRE	BREAK	SPILL	LEAK XX	BLOWOUT	OTHER*
TYPE OF FACILITY	DRLG WELL	PROD WELL	TANK BTTY	PIPE LINE XX	GASO PLNT	OIL RFY	OTHER*
NAME OF FACILITY	INDIAN BASIN GAS PLANT - GATHERING SYSTEM					
LOCATION OF FACILITY (QUARTER/QUARTER SECTION OR FOOTAGE DESCRIPTION)	NW/4 SE/4	SEC. 23	TWP. 21S	RGE. 23E	COUNTY EDDY	
DISTANCE AND DIRECTION FROM NEAREST TOWN OR PROMINENT LANDMARK	APPROXIMATELY 25 MILES NW OF CARLSBAD					
DATE AND HOUR OF OCCURENCE	ESTIMATED TO HAVE COMMENCED 11/90			DATE AND HOUR OF DISCOVERY	4/12/91 @ 10:30 A.M.	
WAS IMMEDIATE NOTICE GIVEN?	YES XX	NO	NOT REQUIRED	IF YES, TO WHOM	MIKE WILLIAMS; ARTESIA, NM	
BY WHOM	STEVE YORK, GAS PLANT SUPERINTENDENT			DATE AND HOUR	4/12/91 @ 11:12 A.M.	
TYPE OF FLUID LOST	CONDENSATE AND PRODUCED WATER			QUANTITY OF LOSS	SEE ATTACHMENT	VOLUME RECOVERED SEE ATTACHMENT
DID ANY FLUIDS REACH A WATERCOURSE?	YES	NO	QUANTITY SEE BELOW			

IF YES, DESCRIBE FULLY**

THE LEAK OCCURRED UNDER A DRY ARROYO THAT QUALIFIES AS A WATERCOURSE. THE ARROYO IS PRESENTLY DRY AND IT IS BELIEVED IT HAS NOT FLOWED WATER IN THIS AREA IN 5 YEARS.

DESCRIBE CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN**

SEE ATTACHMENT

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN**

SEE ATTACHMENT

DESCRIPTION OF AREA	FARMING	GRAZING XX	URBAN	OTHER* OILFIELD			
SURFACE CONDITIONS	SANDY	SANDY LOAM	CLAY	ROCKY XX	WET	DRY XX	STONY

DESCRIBE GENERAL CONDITIONS PREVAILING (TEMPERATURE, PRECIPITATION, ETC.)**

AT PRESENT VERY DRY AND WINDY

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

SIGNED R. F. UNGER TITLE PRODUCTION MANAGER, MIDLAND OPERATIONS DATE 4-22-91

*SPECIFY **ATTACH ADDITIONAL SHEETS IF NECESSARY

ATTACHMENT

QUANTITY OF LOSS:

Up to 35,000 barrels of condensate and 20,000 barrels of produced water.

VOLUME RECOVERED:

As of 4-21-91, 307 barrels condensate and 207 barrels water.

CAUSE OF PROBLEM AND REMEDIAL ACTION TAKEN:

The cause of the leak was determined to be a hole in a subsurface gathering line. Within one hour of discovery, Indian Basin Field employees had initiated shutting in the 23 wells supplying this gathering line and appropriate regulatory notifications (New Mexico Oil Conservation Division, Bureau of Land Management, and the National Response Center) were completed.

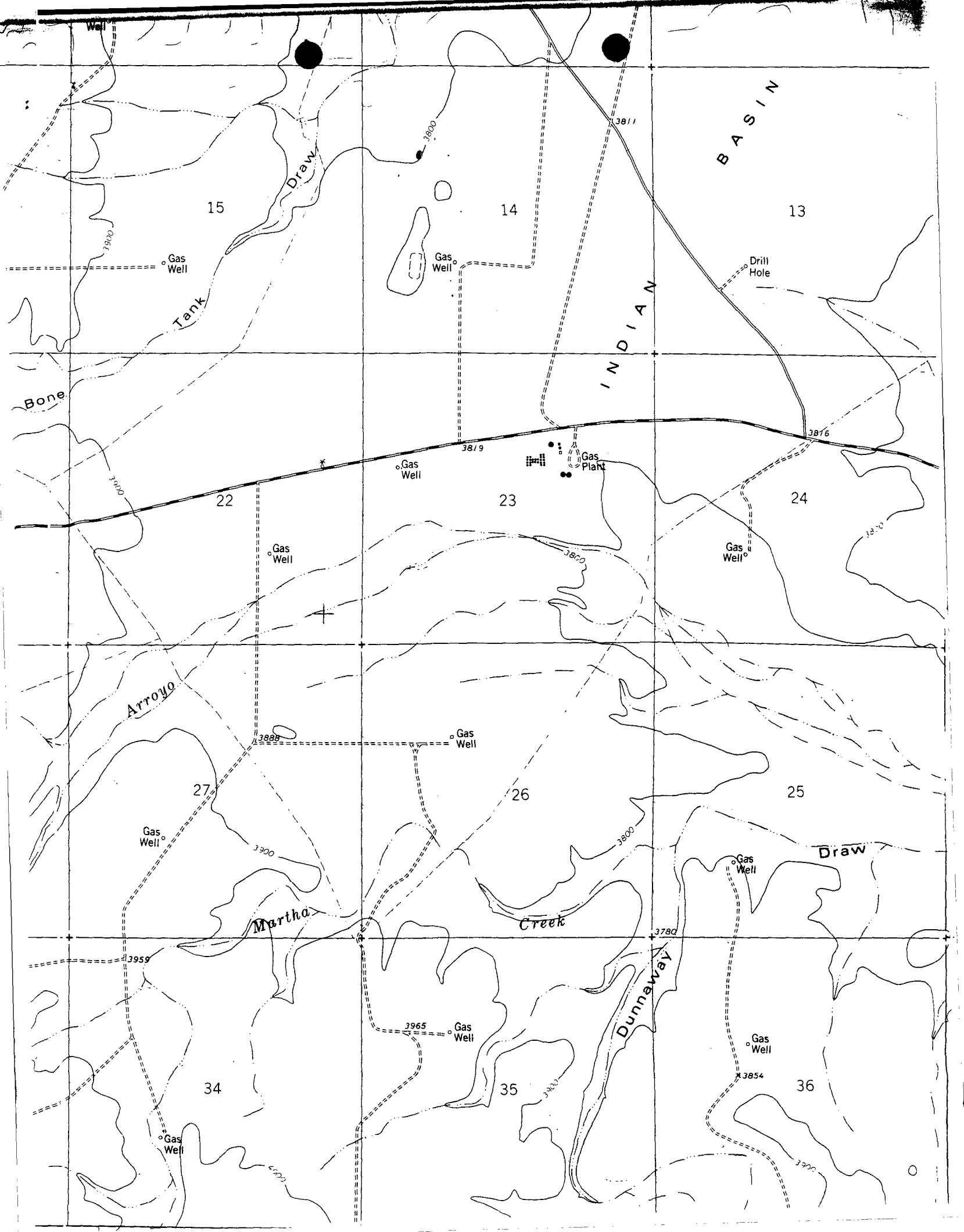
Once the shutting-in of the wells was complete, efforts were focused on relieving the residual pressure in the line. Subsequently, work was directed to physically isolating the section of pipeline containing the leak from the rest of the system. This work was complete within 28½ hours after the discovery of the first evidence of a leak.

Following positive isolation of this section of the pipeline, work was directed toward removing any residual fluid in the line. This was accomplished by flushing the line with water introduced at one end and recovering the fluids at the opposite end of this section of the pipeline had been isolated from the remainder of the gathering system. This was completed within 44½ hours after the discovery of the first evidence of a leak.

DESCRIBE AREA AFFECTED AND CLEANUP ACTION TAKEN:

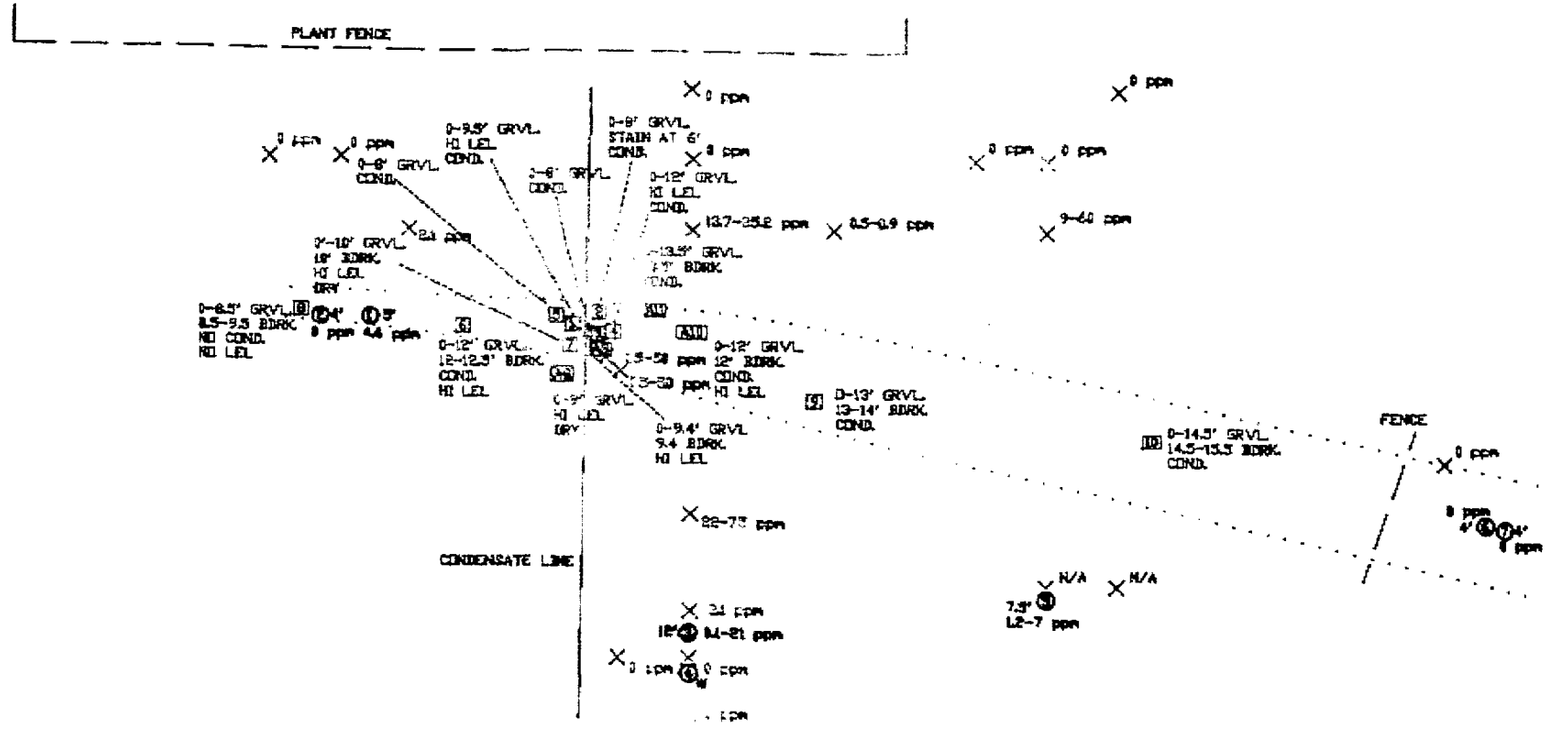
Since the leak in the line occurred subsurface, the affected area is not readily apparent. However, work has been undertaken to define the extent of the subsurface affected area. This work has already defined the primary extent of the affected area in three directions and is presently focussing on the eastern boundary. Of utmost importance in the cleanup efforts is the recovery of free liquids. Efforts in this regard were initiated within 5½ hours after discovery of the first evidence of the leak and have since been ongoing. The operation to recover free liquids has continued to expand as the extent of the affected area is defined. Efforts in this regard will be directed to maximize free liquid recovery. As of April 21, 11 recovery and monitoring wells were in place, with a total of approximately 514 barrels of fluid recovered. Recovery operations, as well as further characterization of the affected area are ongoing.

RFU/100/jmh


INDIAN BASIN
Bone Tank Draw
Arroyo
Martha Creek
Dunnaway Draw
15
14
13
22
23
24
27
26
25
34
35
36
Gas Well
Drill Hole
Gas Plant
3800
3811
3819
3816
3888
3959
3965
3780
3854
3900

INDIAN BASIN REMEDIATION

APRIL [illegible]



LEGEND

- X SOIL-GAS
- PIT
- FILLED PIT
- BORE HOLE

* POSTPONED TO EVALUATE EASTERN LBOTS. WILL COMPLETE AT LATER DATE.

APR-22-91 MON 14:06 505 748 9720 P.02

1989	Bbls/cons
Jun	10,262
July	7852
Apr	12,653
May	10,057
Mar	9,064
Aug	10,102
Feb	11,427
Sept	8,041
Oct	9,091
Nov	10,595
Dec	10,997

ave 10,067 for 11 mos

≅ 120,000 Bbls/yr

1988	
Feb	10469
Mar	7321
Apr	7304
May	10914
Jun	10914
Jul	9231
Aug	9936
Oct	10488
Nov	10694
Dec	13078

ave 10,039 for 10 mos

≅ 120,000 Bbls/yr

1991	Jan	5,610
	Feb	3,774
	Mar	2,798
	April	7,695
	MAY	12,777
1990	Jan	10,900
	Feb	10,057
	Mar	12,352
	Apr	11,036
	May	11,873
	June	9,223
	July	8,672
	Aug	10,423
	Sept	8,557
	Oct	11,591
	Nov	4,302
	Dec	4,435